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Philippines
Appraisal of the
Jalaur Irrigation Project

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East Asia and Pacific

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CURRENCY EQUIVALENTS

US$1.00	=	Pesos (₱) 7.50
₱ 1.00	=	US$0.133

WEIGHTS AND MEASURES - METRIC SYSTEM

1 hectare (ha)	=	2.47 acres
1 kilometer (km)	=	0.62 miles
1 square kilometer (km^2)	=	0.3886 square miles
1 meter (m)	=	39.37 inches
1 square meter (m^2)	=	10.76 square feet
1 cubic meter (m^3)	=	35.31 cubic feet
1 million cubic meters (Mm^3)	=	810.7 acre feet
1 millimeter (mm)	=	0.039 inches
1 kilogram (kg)	=	2.2 pounds
1 cavan (paddy)	=	50 kg
20 cavans	=	1 metric ton

ABBREVIATIONS

ACA	-	Agricultural Credit Administration
ADB	-	Asian Development Bank
ADCC	-	Agricultural Development Coordinating Council
AMIADP	-	Angat-Magat Integrated Agricultural Development Project
ARIS	-	Aganan River Irrigation System
BAE	-	Bureau of Agricultural Extension
BPI	-	Bureau of Plant Industry
DAR	-	Department of Agrarian Reform
DLGCD	-	Department of Local Government and Community Development
ECI	-	Engineering Consultants, Inc.
JRIS	-	Jalaur River Irrigation System
NGA	-	National Grains Authority
NIA	-	National Irrigation Administration
NISIS	-	National Irrigation Systems Improvement Study
RB	-	Rural Banks
SBIS	-	Santa Barbara Irrigation System
SRIS	-	Suague River Irrigation System
UPRP	-	Upper Pampanga River Project
WMT	-	Water Management Technologist

PHILIPPINES

APPRAISAL OF THE

JALAUR IRRIGATION PROJECT

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This report is based on the findings of an appraisal mission composed of Messrs. K. E. Ireland, A. N. Khan, J. van Holst Pellekaan, R. S. Baskett and M. Goldman. Mr. E. G. Giglioli also assisted in preparation of the report.

PHILIPPINES

APPRAISAL OF THE JALAUR IRRIGATION PROJECT

SUMMARY AND CONCLUSIONS

i. The Government of the Philippines has requested Bank assistance to carry out the Jalaur Irrigation Project located on Panay island in the Western Visayas. The project consists of the rehabilitation of four existing irrigation systems now serving a total area of 22,000 ha and the construction of new facilities on some 2,700 ha. The project also provides for a training program for water management staff and for technical assistance.

ii. Major Government objectives in the agricultural sector are to achieve self-sufficiency in basic foods and to correct regional economic and social imbalances. The project would help to meet both objectives by improving and expanding irrigation facilities for the rice crop in one of the poorer regions in the nation.

iii. The deficit in rice, the main staple crop, has been a persistent problem for the Philippines, and annual rice imports have averaged about 300,000 tons in recent years. With improved water control being a prerequisite to obtaining optimum results from the new high-yielding rice varieties, an annual total of about 50,000 ha of rice lands would have to be rehabilitated or provided with new irrigation facilities for the next decade to allow the country to achieve rice self-sufficiency. The proposed project would be the seventh Bank-assisted project aimed at helping the Government to achieve this goal. The Upper Pampanga (Loan 637-PH), Aurora-Penaranda (Loan/Credit 984/472-PH) and Tarlac projects are in Central Luzon; the Magat (Loan 1154-PH) and Chico (Loan 1227-PH) projects are in the Cagayan Valley of Northern Luzon; and the Rural Development Project (Loan 1102-PH) is on the island of Mindoro. The proposed project would be the first Bank-assisted irrigation project in the Visayas.

iv. Total cost of the project is estimated at ₱ 255.0 million (US$34.0 million), of which US$15.0 million, or approximately 44%, would be in foreign exchange. The Bank would finance the foreign exchange component. Equipment costing about US$4.5 million would be procured after international competitive bidding in accordance with Bank Group Guidelines. Civil works would not be suitable for international competitive bidding because of their nature and would be carried out by locally advertised contract (US$8.2 million) or by force account (US$5.5 million).

v. The National Irrigation Administration (NIA) would be the executing agency for the project. NIA's responsibilities would be carried out by the Special Projects Organization, which is in charge of all Bank-assisted irrigation projects. This body is well staffed with competent personnel and would be able to implement the project successfully.

vi. At full development of the project, nine years after commencement of work, annual paddy production from the project area is expected to reach 147,000 tons compared with a current level of production of 80,000 tons. The increased production would make a contribution to the national campaign for self-sufficiency by providing enough rice to feed nearly 425,000 persons per year.

vii. Under the Government's program of agrarian reform, sharecropping has been abolished and title to land in holdings over 7 ha is now being transferred to the cultivators. When the transfer is completed, tentatively by the end of 1977, about 54% of the land in the project area will be farmed by owner operators and the rest by leasehold tenants of small landlords. Some 12,000 farm families cultivate the project area, working an average unit of 2.1 ha. The project would increase the annual per capita income on a 1.5 ha farm from a current range of between US$45 and US$80 to between US$110 and US$220 at full agricultural development in 1985, depending on cropping intensity. For a 3 ha farm the per capita income at full development would range between US$200 and US$390. By comparison about 75% of the project's farm families are presently at or below the Bank's estimated absolute per capita poverty level of US$155. These comparisons indicate that the project would narrow the income gap between the project area and other parts of the country.

viii. The project would result in about a 19% increase in cropping intensity, which in turn would create an increase in farm labor employment opportunities equivalent to about 3,500 full time jobs. The economic rate of return of the project is expected to be about 20%. The rate of return is only moderately sensitive to a delay or a reduction in benefits. However, even under extremely adverse conditions, the rate of return would not fall below 15%.

ix. The proposed project is suitable for a Bank Loan of US$15.0 million for a period of 20 years, including a 4.5-year grace period. The borrower would be the Republic of the Philippines.

PHILIPPINES

APPRAISAL OF THE JALAUR IRRIGATION PROJECT

I. INTRODUCTION

1.01 The Government of the Philippines has requested Bank assistance in financing the Jalaur Irrigation Project in Iloilo province of Panay island. The project would provide a dependable water supply to irrigate about 24,700 ha of rice in the wet season and 12,000 ha in the dry season.

1.02 The National Irrigation Administration (NIA) prepared the feasibility report for the project with the assistance of Engineering Consultants, Inc. of Denver, Colorado (ECI). This report is based on the findings of a Bank appraisal mission, which visited the Philippines in June-July 1976, composed of Messrs. K.E. Ireland, A.N. Khan, J. van Holst Pellekaan, R.S. Baskett and M. Goldman. Mr. E.G. Giglioli also assisted in the preparation of the report.

II. BACKGROUND

General

2.01 The Philippines covers some 297,000 km^2 scattered over more than 7,000 islands between the Pacific Ocean and the China Sea. The 45 largest islands account for 98% of the area. The population is around 43 million (1975), growing at a rate of about 2.8% annually. Real GNP, which had a trend growth rate of 5 to 6% in the 1960s, grew by 10% in 1973 due to high prices for export commodities, but has grown at only about 6% in 1974-75 as some industries have been adversely affected by the recession in the economies of the Philippines' trading partners. Inflation related to high export prices and increased oil and food prices was a major problem in 1974, but abated markedly in 1975 and 1976. Unequal income distribution and underemployment remain major economic problems.

2.02 Out of a total land area of some 30 million ha, more than half is forest and about one-third under cultivation or in plantations. About 2.0 to 2.5 million ha of fairly level land is still available for growing crops, although some 1.0 million ha of this is cogon grassland which would be difficult to reclaim. Bringing this additional land under cultivation would be insufficient to meet increasing food needs or to improve rural income significantly. These goals also call for increasing production from currently cultivated areas through yield improvements and increased cropping intensity where water is available.

The Agricultural Sector

2.03 Agriculture accounts for about one-third of net domestic product, about 55% of total employment and 70% of export earnings. During the 1960s the rate of growth of agricultural output accelerated gradually and averaged 4.7% per year for the 1965-70 period, stimulated by the spread of improved rice varieties. During the next five years, the spread of new varieties decreased; typhoons in 1972 and high fertilizer prices in 1974 further affected agricultural output, which grew by only 3.2% a year on the average from 1970-75. The growth rate of rice production from 1970 to 1975 was only 1.4% a year. Although the early typhoon of 1976 had the heaviest rainfall in modern history, it occurred between rice growing seasons. The resulting damage to total production was estimated at less than 3%. The failure of food supply to keep pace with demand has caused the ratio of food prices to prices in general to increase over the 1970-75 period. This, combined with a short period of high world prices for sugar and coconut products, led to a substantial shift in the internal terms of trade in favor of agriculture, which has prevented a widening of the disparity between rural and urban incomes. In the face of sluggish growth of manufacturing employment, much of the growth of the labor force in recent years has therefore taken place in agriculture. Although value added per worker in agriculture has increased in current prices, it has declined in real terms, implying growing rural underemployment.

2.04 In the Philippines the population density is 131 people per km^2, compared with the Asian average of 86. The density in Iloilo province is about 250 per km^2. Migration is heavy from this overcrowded region (the Visayas) and Central Luzon to the Cagayan Valley in Northern Luzon and Mindanao in the south.

2.05 Agricultural sector performance will be crucial in determining whether the drive towards a rapid but more equitable income expansion succeeds. The major goals for the sector are self-sufficiency in cereals, particularly rice and corn; development of the livestock and fisheries sector; expansion of agricultural exports; intensification of agrarian reform; better conservation of natural resources; and strengthening of institutional support. Self-sufficiency in cereals is important not only to strengthen the balance of payments, but also to raise incomes for much of the rural population.

The Critical Role of Water Development

2.06 After allowance for increases in rainfed rice production, the Philippines cannot reach self-sufficiency in rice without substantial investment in irrigation expansion and improvement. Performance of

existing systems falls far short of their potential. The Sector Survey /1 estimates that, out of a total of 960,000 ha which could be served by existing systems, only 630,000 ha are served in the wet season and 254,000 ha in the dry season. Almost all the irrigated area is devoted to rice. The NIA's gravity systems are the main component. In addition, NIA has constructed and rehabilitated a substantial part of the small privately operated communal systems, averaging 250-300 ha. The Irrigation Services Unit, now under NIA's administrative supervision, is responsible for pump irrigation schemes. The 104 NIA gravity systems, varying in size from 130 ha to 83,000 ha, are usually run-of-the-river schemes with insufficient control structures in the canals, inadequate drainage and little provision for access. Even when the systems are new, water distribution is uneven during the wet season and limited during the dry season. Maintenance has been minimal due to shortages of staff and funds and the lack of access roads for maintenance machinery. A vicious circle has developed by which lack of maintenance discourages farmers from paying operation and maintenance charges, which in turn precludes further maintenance.

2.07 This unsatisfactory situation began to change in the late 1960s when the NIA was reorganized, more advanced irrigation designs were introduced and much higher levels of water management became a goal. Simultaneously, the need for intensified agricultural supporting services on irrigation projects was accepted. The Bank-assisted Upper Pampanga River Irrigation Project (UPRP) (Loan 637-PH) and the Asian Development Bank (ADB)-assisted Angat-Magat Integrated Agricultural Development Project (AMIADP) typify the new approach. The pattern of rehabilitation, new construction and operation exemplified by these projects is essential for large-scale rice production. To meet the growing domestic rice demand a program of rehabilitation and new construction in rice lands for some 50,000 ha per year will be needed over the next decade. The proposed project would thus be entirely compatible with Government objectives for water resources development.

Project Formulation

2.08 Since the late 1960s NIA, with assistance from the Bank and from the ADB, has been engaged in upgrading and extending large irrigation systems, mainly in Luzon and to a lesser extent in Mindanao. In addition to rehabilitation of existing canals and structures, the construction of new ones, the provision of better drainage and access and the introduction of water management and rotational irrigation practices, extra water supplies are being provided in some areas through the construction of storage or by trans-basin diversion. However, NIA has not neglected the need for rehabilitation and upgrading of the badly deteriorated, smaller systems scattered through the Philippines. The National Irrigation Systems Improvement Study (NISIS) was set up with Bank assistance (Loan 1080-PH)

/1 IBRD Agricultural Sector Survey, Philippines, May 2, 1974 (Report No. 39a-PH).

to inventory the smaller systems and to select a total of about 150,000 ha with the highest priority for improvement and allowing for a balanced regional distribution. The feasibility study for the first 50,000 ha of rehabilitation prepared under NISIS will be completed in late 1976.

2.09 The proposed Jalaur project, consisting of the rehabilitation and upgrading of 22,000 ha of land in four contiguous irrigation systems and the construction of irrigation facilities for an additional 2,700 ha of rainfed land, falls logically in place in terms of size between the large Luzon projects and the small scattered NISIS projects. The proposed project is located on Panay island in the Western Visayas and would meet the NIA objective of more balanced regional distribution of development. It has fertile soils, is a rice basket for the region and is relatively free of typhoons.

III. THE PROJECT AREA

General

3.01 The project is located in Iloilo province in the southeastern section of the island of Panay in the Western Visayas. The region contains about 12% of the area planted to rice annually in the Philippines and accounts for 12% of total national production. Iloilo province is responsible for 35% of the region's rice production and the project area accounts for about 40% of the provincial rice area and 60% of production. The mean rice yield in Iloilo is about 18% above the national average. This is due to the existence of irrigation systems, fertile soils well suited to rice production, good external drainage, rapid adoption of high yielding varieties and a fairly even rainfall distribution. Panay is a surplus rice producer and about 65% of Iloilo's production is exported to the nearby sugar growing island of Negros.

3.02 The project area includes 22,000 ha of rice land in the existing Jalaur River Irrigation System (JRIS), the Suague River Irrigation System (SRIS), the Aganan River Irrigation System (ARIS) and the Santa Barbara Irrigation System (SBIS). In addition, about 2,700 ha of currently rainfed rice land on the left bank of the Jalaur river would be irrigated and included in the JRIS (Map No. 12414).

3.03 There are a number of small towns with populations between 5,000 and 10,000 scattered throughout the area. The larger towns, including the provincial capital of Iloilo which lies on the southern edge of the project area, provide banking, storage and processing facilities as well as supplies of inputs to the surrounding agricultural area. The project area is connected to the capital city and port of Iloilo by a national highway and paved provincial roads. Daily air service and frequent interisland boat services connect Iloilo with Manila.

Climate

3.04 The climate in the project area is tropical and monsoonal. Warm temperatures throughout the year allow a twelve-month growing season with irrigation. About 85% of the average annual rainfall of 2,150 mm falls in the seven-month period of May through November with the heaviest rain in July. The rainfall, together with river flows in the wet season, is generally adequate for a single rice crop. Dry season cropping, however, entails a greater risk and irrigation is essential to ensure a crop. Panay island is hit by an average of one typhoon per year, with the highest frequency in November. The project area is less affected than the northern part of the island. Further climatic details are presented in Annex 1.

Topography, Drainage and Soils

3.05 The project area is located on the alluvial terrace fans of the Aganan, Tigum, Suague and Jalaur rivers. The Suague empties into the Jalaur river about 33 km northeast of Iloilo, while the Tigum and Aganan join 8 km north of Iloilo emptying into the ocean near the city. The slope of the land is from northwest to southeast. In the upper part of the project area, the slope is steeper with paddies sometimes terraced but it flattens out towards the sea with three-fourths of the area fairly level. Surface drainage is generally adequate, although there are drainage problems in a few scattered areas. Some of these are as large as 200 ha in size, but would be provided with the necessary drainage facilities under the project. In order to obviate possible drainage difficulties which could occur as a result of the belt of marine fish ponds lying between the project area and the ocean, additional drainage outlets would be built under the project.

3.06 Soils in the project area are predominantly of the Santa Rita series with Santa Rita clay covering about 65% of the area and Santa Rita clay loam about 30%. Recent alluvial deposits of fine sandy loam along the rivers make up the remainder. These soils are slightly acid with fair cation exchange capacity. Some phosphate is needed particularly if rice is to be double-cropped for a period of years. The soils of the project area are well supplied with potash for rice production, but additional amounts of this element should be added when planting sugarcane. The Santa Rita soils are fair in organic matter content. They have slow internal drainage and are well suited for rice, which has been grown in the project area for many years without difficulty. Sugarcane is planted on the fine sandy loam soils or the lighter textured portions of the Santa Rita soils where surface drainage is good and a high water table is not a problem in the wet season.

Land Tenure and Farm Size

3.07 Since 1972 the Government has pursued a program of agrarian reform aimed at the transfer of land ownership to tenant farmers on rice and corn lands. Presidential Decree No. 27 (PD 27), the basic legislation of the new program, provides for the transfer to the tenant, whether sharecropper or leaseholder, of the land he tills up to 3 ha in an irrigated area and 5 ha in a rainfed area. According to PD 27, the landlord may

retain up to 7 ha if he tills the land himself. Since there are some 2 million rice and corn farmers on about 4 million ha, of which less than 1 million ha are irrigated, there is little prospect of achieving the 5 ha rainfed and 3 ha irrigated family farms nationwide. Furthermore, some 85% of the landlords have holdings of less than 7 ha and there are no plans at present for transfer of lands in this category. The Department of Agrarian Reform (DAR) completed the issue of land transfer certificates to tenants for all land in holdings over 24 ha in 1975. In November 1974 the Government decided to proceed with the transfer of land in holdings between 24 and 7 ha.

3.08 DAR surveys show that some 12,000 farm families, averaging 5.8 members for a total of about 70,000 people, live in the project area. The average farm unit is about 2.1 ha. Average farm holdings are approximately 1.7 ha on rainfed rice areas, 2.0 ha on irrigated rice areas and about 13 ha on the 1,000 ha of sugarcane farms within the project area. The farm size distribution on the 23,700 ha of rice lands is as follows:

Farm Size (ha)	No. of Farms (%)	Area of Farms (%)
Less than 1	13	3
1-2	38	23
2-3	28	29
3-5	17	30
More than 5	4	15
Total	100	100

About 66% of the farms, covering 52% of the land, fall between 1 and 3 ha, while 96% of the farms covering 85% of the area are smaller than 5 ha. The figures vary somewhat between subproject areas. Survey and census data indicate that in addition to farm operating households, there are approximately 2,000 landless agricultural households.

3.09 According to DAR information the 23,700 ha of rice land in the project area are owned by some 8,100 people, 88% of whom hold less than 7 ha. This group accounts for 54% of the land. The remaining 12% of the owners account for 10,900 ha or 46% of the area. The actual number of farmers cultivating the land is somewhat different with about 9,000 tenants operating 17,600 ha and 3,000 owner operators farming 6,100 ha. After completion of land transfers under agrarian reform, there will be 7,100 owner operators and 4,900 farmers operating under a written lease agreement providing for payments of fixed rents cultivating 12,700 ha and 11,000 ha respectively (Annex 2).

Existing Irrigation Facilities

3.10 Approximately 22,000 ha of land in the project area fall within the existing four systems operated by NIA. The oldest system is the Santa Barbara, which was completed in 1922 to serve 4,600 ha from the Tigum river. The Aganan system was completed in 1925 to serve 5,500 ha from the Aganan river. The largest is the Jalaur system, completed in 1954, to serve 9,000 ha from the Jalaur river. The Suague river system was completed in 1958 to serve 2,900 ha. Irrigation in the dry season is limited to some 7,500 ha, partly because of inadequate river flows, but mostly because of reduced canal capacities due to siltation and a lack of on-farm distribution facilities. The systems have suffered from insufficient maintenance due to lack of funds and equipment. They also have poor distribution networks which make it impossible for the majority of the farmers to get water at the right time in the right amount. In addition, there is a general lack of access roads which renders movement of inputs and produce difficult. There are drainage deficiencies, particularly in portions of the area nearest the sea, due to insufficient collector drains and inadequate outlet conditions.

Agricultural Production

3.11 Rice grown by transplanting is by far the most important crop in the area. In the last two seasons about 12% of the rice area has been sown directly. Sugarcane is grown on less than 1,000 ha in the project area, although about 10% of the land area is suitable for the crop. Crops such as corn, mungbean, cowpea and melons are grown on a small part of the area as nonirrigated dry season crops for home use or local consumption. The majority of farmers in the irrigated areas use improved rice varieties, while in the rainfed areas farmers rely mainly on the lower yielding, but hardier local varieties. In the irrigated areas the average paddy yield is 2.7 ton/ha in the wet season and 2.4 ton/ha in the dry season, due to inadequate water supply and poor distribution facilities. The average yield of rainfed paddy is 1.8 ton/ha. Yields in the project area are slightly higher than in the Bank-assisted Central Luzon projects because of better soils, greater use of inputs, and more even rainfall distribution in the wet season.

3.12 In rainfed areas most farmers rely almost entirely on animal power for land preparation, while in the irrigated areas mechanical land preparation is practiced on about 45% of the crop area. Mechanical cultivation in the rice areas is done with small two-wheel tractors, while four-wheel tractors are used on sugar farms of 5 ha or more. Threshing of the rice crop is almost entirely manual, there being only a few small mechanical threshers in the area.

Transportation

3.13 A national highway connects the towns of Pototan, Barotac Nuevo and Leganes, within the Jalaur and Santa Barbara systems, with the port city of Iloilo. Paved provincial roads link the national highway with the towns of San Miguel, Santa Barbara and Mina, in the Aganan, Santa Barbara and Suague systems. The Department of Highways has a ten-year plan to upgrade some of the existing limited network of largely unpaved provincial and municipal roads serving the area. There is an

irregular railroad service connecting the eastern coastal city of Roxas with Iloilo. Under the project, farm and O&M roads for the irrigation facilities would also serve as feeder roads to handle increased production.

IV. THE PROJECT

4.01 The project proposed for Bank financing would upgrade four existing irrigation systems and extend irrigation service to currently rainfed rice lands, a total of 24,700 ha, to standards adopted for similar Bank projects in the Philippines. The project would include:

(a) rehabilitation of four existing NIA irrigation and drainage systems serving a total area of about 22,000 ha;

(b) construction of new irrigation and drainage facilities for about 2,700 ha of rainfed rice;

(c) construction of a project headquarters building and facilities for O&M; and

(d) procurement of vehicles and equipment.

The project would also provide for a water management training program and for a small amount of tehnical assistance, if required, for further studies on expansion of the project. A detailed description of the project works is given in Annex 3.

Project Works

4.02 NIA systems serving irrigable areas at Jalaur (9,000 ha), Suague (2,900 ha), Santa Barbara (4,600 ha) and Aganan (5,500 ha) would be rehabilitated and upgraded by repairing existing canals and structures as well as providing additional control structures, drains and turnouts to manage water deliveries effectively. New irrigation works would be constructed to serve about 2,700 ha of rainfed lands on the left bank of the Jalaur river. New outlet works would be constructed on the left abutment of the diversion dam.

4.03 Rice has been grown in the project area for many years and the land is reasonably level and well laid out with little fragmentation of land holdings. Consequently, no land leveling, boundary realignment, or consolidation would be required. The main farm ditches, serving units of approximately 50 ha, would have a turnout for each 10 ha block, from which supplementary farm ditches built as part of the project would provide direct delivery to about 80% of all the holdings. Each 10 ha block would also be served by a collector drain, except in steeper areas with slopes in excess of 0.4% where the farm drainage would be from field to field with a provision of collector drains for about 50% of the steep area. All canals would be unlined except in selected short portions, where the soils are erosive. Small buildings would be provided for Water Management Technologists operating 500 ha of irrigated land apiece (para. 5.03) and rice drying floors of 400 m^2 would be

provided near or adjacent to the buildings. About 20 km of new access roads would be built. Some 400 km of roads for operation and maintenance would be built along the major canals and laterals, as well as about 170 km of farm roads along some of the major farm ditches.

Water Supply, Demand and Quality

4.04 Each of the four systems gets its water from a separate unregulated river source, using its own diversion and conveyance facilities. Stream flow records at or near the points of diversion for each of the four streams are available for 10 to 20 years but not concurrently and in some cases the records are fragmentary. By correlation with other station records, stream flow data were built up at the four diversion points to cover the years 1949-1971, a period including exceptionally low dry season flows and considered representative of normal water supply flow conditions.

4.05 Water requirements for the project were based on two rice crops per year, except for about 1,000 ha under irrigated sugarcane. Taking into account the higher farm irrigation efficiencies expected after project development, anticipated conveyance and operational losses and effective rainfall, annual diversion requirements are estimated to total 2.1 m for rice, of which 1.6 m would be required in the dry season, and 1.2 m for sugarcane. The proposed cropping calendar would maximize the use of rainfall for both wet and dry season crops without exceeding local manpower constraints.

4.06 The size of the project area was determined from simulated operation studies using the 22 year period of synthesized discharge records at each diversion and the estimated seasonal water requirements for rice. The irrigable areas selected for the project and the currently irrigated areas are as follows:

	Irrigation System				
	JRIS	SRIS	ARIS	SBIS	TOTAL
Selected Irrigable Area (ha)					/a
Wet season	11,700	2,900	5,500	4,600	24,700
Dry season	10,100	1,300	100	500	12,000
Currently Irrigated Area (ha)					
Wet season	9,000	2,900	5,500	4,600	22,000
Dry season	5,600	1,300	100	500	7,500

/a Includes year-round irrigation of 1,000 ha of sugarcane.

The principal water rights on the four rivers are already vested in the four national irrigation systems. Although existing upstream uses of water are minor, assurances were obtained that the necessary water rights for the Jalaur extension would be granted to NIA and no other water rights except for domestic use would be granted which could adversely affect the project water supply.

4.07 Tests of samples from the Jalaur river show good water quality with total dissolved solids under 300 ppm. Water samples for the other three rivers have not been analyzed. However, water diverted from these rivers has been used to irrigate for more than 20 years without adverse effects on soils or crops in the project area (Annex 4).

Status of Engineering

4.08 Project planning studies, designs and estimates of the irrigation and drainage systems with associated works were carried out by NIA. For rehabilitation of the existing systems, surveys were made of the main canals, major creeks and drains, and within the sample area for secondary canals, by taking cross sections at 20 to 50 m intervals to determine excavation quantities. Rehabilitation costs of the remaining laterals, drainage and on-farm facilities were based on unit cost estimates obtained from a sample area for which designs were prepared. Canal structure requirements in the rehabilitation area were determined in the field by NIA inspectors and costs were estimated for repairs, replacements or additions. Operation and maintenance roads were based on canal capacity and needs within the service area and were checked in the field to ensure that adequate access to project works would be provided. Access roads were also provided as a link between service and existing major roads. Surveys were also made of the main canal in the Jalaur extension area to determine construction quantities. Existing 1:4,000 scale maps were used to determine lateral and drain locations, and costs were based on unit costs for a 1,600 ha sample area. Requirements for structures in the extension area were determined according to basic irrigation design practices. Repair work on river diversion structures was determined from field inspection of each structure. Sufficient investigations have been made to ensure that suitable materials are available for construction of canal embankments and maintenance roadways.

4.09 Aerial photographs of the project service area taken in 1966 at a scale of 1:15,000 were supplied by DAR and were used for preparation of the 1:4,000 scale topographic maps used in the sample area studies. These maps have been extended to cover the four systems to be rehabilitated, including the extension area, and would be used for final designs and estimates for construction. Where required the maps would be supplemented by additional topographic mapping at 20 to 25 cm contour intervals for on-farm facilities. The base maps for land classification were prepared by using these photographs enlarged to a scale of 1:10,000.

4.10 Construction of the irrigation and drainage system would begin at the end of 1977, with preconstruction activities starting in the early part of the year (see Chart No. 16409). All project works are expected to be completed by mid-1981. Water management training for the project personnel would be completed by 1980, but the training center would continue operating for other NIA projects within the Visayas region.

Water Management Training

4.11 Irrigation efficiencies on NIA's gravity systems are low due to lack of terminal facilities, poor maintenance and inadequate staff. NIA has recognized the need for more and better water management staff and is putting a Water Management Technologist (WMT) in charge of every 500 ha of irrigated land. The newly recruited staff is not well versed in water management, crop production aspects of irrigation or in methods of communication with farmers. In the Bank-assisted Central Luzon and Cagayan Valley projects, water management training programs have been established to train about 450 WMTs under the Tarlac and Magat projects (Loans 1080-PH and 1154-PH). About 50 WMTs and 150 ditch tenders would be required for the Jalaur project. The training center to be established under the project would serve the Visayas region covering about 170,000 ha of irrigation and with an ultimate requirement of about 350 WMTs. The training program would be based on three pilot water management units of 500 ha. Theoretical training would be reinforced by putting all trainees through a range of field situations on the pilot units where they could apply their new knowledge. NIA personnel with extensive technical knowledge and field experience would provide the training.

Cost Estimates

4.12 Total project costs are estimated at US$34.0 million, of which US$15.0 million or 44% is foreign exchange. Project costs are based on quantity estimates from feasibility designs and unit prices prevailing in Bank-assisted Luzon projects in mid-1976, adjusted to the conditions on Panay. Unit prices for equipment, materials and supplies are based on recent quotations received by NIA. NIA's costs for design and construction supervision are included under engineering. All costs were indexed to a common level, January 1977, and this is the base cost level for the project. A physical contingency factor based on the degree of investigations completed to date was applied. It amounts to 25% for the irrigation and drainage system, and 10% for the O&M facilities and the water management training program. A higher contingency of 25% for irrigation and drainage systems was used to allow for unforeseen works or repairs which would become apparent after dewatering the canals. Costs due to expected price increases over the implementation period amount to about 26% of total project costs, assuming the following annual inflation rates:

	Annual Inflation Rate (%)	
	1977-79	1980-81
Civil works	12	10
Equipment and services	8	7

4.13 Details of the project costs are presented in Annex 5 and are summarized below:

	Local	Foreign	Total	Local	Foreign	Total	Foreign Exchange
	(Pesos M)			(US$ M)			(%)
Irrigation systems	85.9	62.5	148.4	11.5	8.3	19.8	42
Water management training	2.4	1.9	4.3	0.3	0.3	0.6	50
O&M equipment	0.2	3.0	3.2	-	0.4	0.4	100
Technical assistance	0.2	0.6	0.8	-	0.1	0.1	80
Base cost estimate	88.7	68.0	156.7	11.8	9.1	20.9	43
Physical contingencies	17.3	15.7	33.0	2.3	2.1	4.4	48
Expected price increases	36.5	28.8	65.3	4.9	3.8	8.7	44
Total project cost	142.5	112.5	255.0	19.0	15.0	34.0	44

Financing

4.14 The proposed Bank loan of US$15.0 million would finance the full foreign exchange costs of the project. It would cover 44% of total project costs. The Government would provide the remaining ₱ 142.5 million (US$19.0 million) to NIA from annual budget appropriations. To ensure the continuous and timely flow of funds, assurances were obtained that the Government would cause NIA to set up a special account for the project which would be replenished by the Government at monthly intervals to a level equivalent to the estimated requirements for the next two months.

Procurement

4.15 Equipment and vehicles for force account construction, operation and maintenance and the water management training program, costing about US$4.5 million, would be procured after international competitive bidding in accordance with Bank Group Guidelines. A preference limited to 15% of the c.i.f. price of imported goods, or the customs duty, whichever is lower, would be extended to local manufacturers in the evaluation of bids. Local procurement practices are appropriate for off-the-shelf items costing less than US$10,000 each because the advantages of international competitive bidding would be clearly outweighed by the administrative costs involved. The total cost of such items would not exceed US$200,000. Bank staff have reviewed the local procedures and they are acceptable. There is adequate competition and foreign firms can participate. A detailed list of equipment requirements is given in Annex 6.

4.16 Works on the project service area (US$13.7 million) would be scattered over five separate areas and include rehabilitation of four systems with a total area of 22,000 ha and construction of a new system for 2,700 ha of rainfed rice lands. These have to be planned and executed to avoid as far as possible the growing season and bad weather. In the past,

NIA has experienced considerable difficulty in attracting bids for such works. Several steps have been taken on Bank-assisted projects to strengthen local contractors, including financing of reconditioned equipment and providing mobilization allowances, as a result of which there has been an encouraging response on the recent bids. However, it is doubtful that all civil works could be done by contract and some of them would therefore be carried out on force account. Nevertheless, in light of NIA's large work program in the years ahead, it would not be desirable to expand its force account work too rapidly. An assurance was obtained that NIA would ensure that the amount of work done by force account would not exceed 40% of the total cost of the work. Competitive bidding in accordance with local procedures is appropriate for the balance of the work. Bank staff have reviewed the local procedures and they are acceptable. There is potentially adequate competition and foreign firms can participate.

Disbursements

4.17 Disbursements would be made at the rate of 100% of the foreign exchange cost of directly imported equipment, 100% of the ex-factory price of locally manufactured equipment and 65% for imported equipment procured locally. Disbursements for civil works would be 25% of certified monthly progress payments or expenditures. For civil works contractors' mobilization and equipment, disbursements would be at 100% of foreign exchange cost. Disbursements would be at 100% of total cost for technical assistance for further studies on expansion of the project.

4.18 Disbursement of the Bank loan would be against import documentation, contracts and certified records of payment or expenditure. It is expected that disbursements would be completed by June 30, 1982, approximately one year after the end of construction. Upon completion of the project any undisbursed Bank funds would be cancelled. An estimated schedule of expenditures, a semi-annual disbursement schedule and a proposed allocation of loan proceeds are given in Annex 7.

Accounts and Audit

4.19 The NIA is a Government agency and its accounts are audited annually by the Government's Commission on Audit. Assurances were obtained that NIA would maintain separate accounts for the project and that after audit by the Commission on Audit, the project accounts, together with the auditor's comments, would be sent to the Bank within four months of the close of each financial year.

Environmental Effects

4.20 Schistosomiasis does not exist in the project area. Although a few cases are occasionally reported in the area, malaria is generally not a problem. Poor drainage in scattered areas would be corrected by the project. The incidence of the mosquito nuisance caused by poor drainage in low lying areas behind the belt of coastal fish ponds, would be reduced by improved project drainage. The principal health problems in the area are protein deficiences in preschool-age children, enteric diseases and tuberculosis. The proposed project would have little direct impact on these.

V. ORGANIZATION AND MANAGEMENT

Project Management

5.01 NIA was created in 1964 and given responsibility for developing, operating and maintaining all national irrigation systems in the Philippines. The Government finances NIA through the sale of bonds or from appropriations. A Board of Directors is responsible for the agency and the Administrator, who is appointed by the President of the Philippines, handles management. NIA has recently been reorganized to meet the requirements of the Government's policy of accelerated irrigation development. The integration of the major foreign-assisted projects under a Special Projects Organization office headed by an Assistant Administrator is one of the first results of the reorganization. Although this has been a step in the right direction, the number and complexity of projects presently under implementation has created certain administrative difficulties which are likely to increase as NIA continues to expand its activities. There is evidence that the senior management of NIA is already stretched considerably and has difficulty in maintaining tight control over the development and implementation of projects. To a large extent this is due to the heavy administrative burden on management which diverts scarce technical talent away from important engineering matters. To ease the situation NIA is proposing to engage two officers with broad experience in public and/or business administration to work directly under the Assistant Administrator.

5.02 The Special Projects Organization (Chart No. 9533-3R) would also be responsible for execution and operation of the Jalaur project. Day-to-day responsibility for construction would rest with the Assistant Project Manager stationed near Pavia, the proposed location of project headquarters. He would report on all matters concerning the project to the NIA's Regional Engineer stationed in Iloilo, who would be appointed Project Manager of the Jalaur project. The Project Manager and his assistant would report to the Assistant Administrator for Special Projects. NIA would provide all the additional support staff and facilities required to allow the Project Manager to carry out his responsibilities. There would be two construction divisions, the first located at Pototan for the rehabilitation works of the Jalaur and Suague systems and the Jalaur extension, and the second located at Pavia for the rehabilitation of the Santa Barbara and Aganan systems (Chart No. 16392). Selection of an Assistant Project Manager and arrangements for his appointment were confirmed at negotiations.

5.03 For O&M purposes NIA would establish four support divisions dealing with engineering and operation, administration, agriculture and equipment (Chart No. 16391R). The project area would be divided into two irrigation districts based on Pototan and Pavia. The Pototan district would serve a total area of 14,600 ha covering the existing Jalaur system and extension area, as well as the Suague system. The Pavia district

would cover the Santa Barbara and Aganan systems serving a total area of about 10,000 ha. The districts would be divided into 50 ha irrigation units with a ditch tender handling two such units (100 ha). A Water Management Technologist (WMT) would control five ditch tenders covering a 500 ha area, while a supervisor would be responsible for a water management division and five WMTs (2,500 ha). Details of the organization are given in Annex 8.

5.04 The Director appointed to supervise the Central Luzon and Magat water management training programs would also be in charge of the program proposed for the Jalaur project. A field supervisor would be attached to each of the two irrigation districts to be in day-to-day charge of the program. Training personnel would be drawn principally from well qualified and experienced O&M staff and from specialized NIA units.

Supporting Agricultural Services

5.05 An Agricultural Development Coordinating Council (ADCC) would be established in the project area to coordinate the work of the various agencies providing services to the farmers (Annex 9). The arrangement has been working well in the Central Luzon projects and a similar organization has been set up for the Cagayan Valley projects. Assurances were obtained that an ADCC based on Iloilo province would be established for the proposed project.

5.06 A total of 95 agricultural graduates from a number of government agencies provide extension services to farmers in the municipalities involved in the project area. The Bureau of Agricultural Extension and the Department of Agrarian Reform supply the majority. The ratio of extension workers to farmers is about 1:210. Under the project, the extension coverage would be strengthened by the addition of the water management staff (para. 5.03) and there would be better coordination through the ADCC (para. 5.05). At present the area is covered more intensively than most rice growing areas in the country because of extensive involvement in the Masagana program.

5.07 Current fertilizer consumption in the project area amounts to about 5,800 tons per year, with urea as the most frequently used product. At full development, the project area would require some 9,600 tons of fertilizer annually on the basis of 80 kg/ha nitrogen and 40 kg/ha phosphate per season. Existing supply channels would handle the increased demand without difficulty. The certified rice seed requirement at full development would total 450 tons per year and no problems are expected in obtaining the amount.

5.08 The increase in the irrigated area, higher cropping intensity and better farming practices resulting from the project would require

an increase in production credit. Under the agrarian reform and Masagana programs the Government has strengthened the credit institutions and eased credit to small farmers, previously dependent on the landlords and private lenders for their requirements. A system of "supervised credit" is used which includes the provision of technical services to the borrower to ensure that recommended practices, such as variety, fertilizer and agrochemical inputs, are adopted. Under the system no collateral is required. During 1974 wet season crop, agricultural loans granted to farmers in the project area by Rural Banks, the Philippine National Bank and the Agricultural Credit Administration amounted to P 9.5 million (US$1.3 million). At full project development, annual production credit requirements are estimated to be about P 34.2 million (US$4.6 million). The existing credit institutions are expected to be able to meet the requirement.

5.09 The Agricultural Department of the Special Projects Organization would be responsible for monitoring the deployment of extension and water management personnel, pace of land reform, preparation of farmers to receive irrigation, cropping patterns, use of inputs and credits, incidence of pests and diseases, etc. The Department already performs these functions in the Bank-assisted Luzon projects.

Cost and Rent Recovery

5.10 Republic Act No. 3601 establishing NIA gave it the authority to collect fees from users of irrigation systems to finance operations and to reimburse construction costs. Fees on the national irrigation systems were increased in July 1975, to the equivalent of 2.0 cavans of paddy per ha in the wet season and 3.0 cavans in the dry season, to be applied uniformly to all national irrigation systems. As an exception to the uniform rate policy, the Government has agreed to raise rates on Bank-assisted projects to the equivalent of 3.5 cavans of paddy/ha in the wet season and 4.4 cavans in the dry season. These rates would be reached gradually over a period of five years from completion of construction. Rates in the UPRP have already been raised to the equivalent of 2.5 and 3.5 cavans of paddy/ha in the wet and dry seasons respectively.

5.11 After a series of discussions with the Bank concerning the collection of water charges the NIA agreed to review the rate of collections for the national systems and to identify the factors affecting collection. The NIA completed a report in June 1976 which showed that for FY75 the total collection rate was about 59%, a small improvement on the collection rate in 1974. Preliminary FY76 information indicates that the national collection rate has fallen to less than 25% since the fourfold increase in water charges in July 1975. Collection rates in the region which includes the Jalaur project are amongst the better ones in the Philippines. The study also resulted in some preliminary findings on the factors affecting collection. NIA is making the necessary arrangements to study the factors in greater depth. The objective of the investigations will be to identify administrative and managerial obstacles to improved collection, as well as to determine the causes of farmers' resistance to payment. Assurances were obtained that NIA would prepare by October 31, 1978 a plan of action for improved collection of irrigation fees and after reviewing such plan of action with the Bank would proceed with its implementation.

5.12 In view of the problems encountered in collecting water fees and the negative effect on collections of the recent increase in fees, NIA should give priority to improved collection. Under the provisions of the Chico project (Loan 1227-PH) the Government has agreed to consult annually on the adequacy of water charges and the collection thereof. In the meantime NIA proposes to apply to the Jalaur project the same rates used on other Bank-assisted projects, i.e. the equivalent of 3.5 cavans of paddy/ha in the wet season and 4.4 cavans in the dry season.

5.13 Various indices are used to compute the proportion of cost recovered and the relationship of the proposed water charges to the ability of the farmers to pay. Definitions of the indices used and detailed computations are in Annex 14. In brief, the ratio of total water charges to total public sector outlays (total cost recovery index) is 35%, while the incremental cost recovery index is 15%. Total water charges are almost double O&M costs. The ratio of total water charges to total farm rent (farm rent recovery index) is 33% while the incremental project rent recovery index is 23%. The farm rent recovery index shows that one third of the farm's total surplus (after deducting returns for capital, labor, management and uncertainty) is paid in water charges. In view of this large contribution in relation to the income levels of project beneficiaries, the proposed water charges are acceptable.

5.14 To ensure sound operation and maintenance practices and an equitable contribution by beneficiaries toward recovery of project capital costs, assurances were obtained that:

(a) the NIA would make annual budgetary provisions to supply the funds necessary for operation and maintenance of the project;

(b) irrigation fees would be levied to provide NIA with sufficient funds to maintain and operate the project and to allow for the recovery of investment cost within a reasonable period, taking into account farmers' incentives and capacity to pay. A gradual increase in irrigation fees over a period of five years from completion of construction to a level equivalent to about 3.5 cavans of paddy per ha in the wet season and 4.4 cavans in the dry season would meet the requirement; and

(c) the NIA would take all necessary actions to ensure full and prompt collection of the irrigation fees.

VI. PRODUCTION, MARKET PROSPECTS, PRICES AND FARM INCOMES

Production

6.01 Upon completion of the project the irrigated area would increase to 24,700 ha, of which at present 22,000 ha are irrigated and 2,700 ha are rainfed during the wet season. The project would not increase the

dry season water supply, but the greatly improved distribution system and better water management would allow the present dry season irrigated area of 7,500 ha to be expanded to 12,000 ha. Annual cropping intensity would increase from 130% to 149%. Better water control, improved extension services and expanded credit facilities would encourage increased plantings of high-yielding rice varieties, heavier fertilizer applications and greater use of crop protection chemicals. The use of machinery for land preparation and threshing would increase to meet more exacting crop calendars. It is expected that at full agricultural development in 1985, about 50% of the threshing would be mechanical compared to 5% at present and most farmers would use a combination of machinery and animal-drawn implements for land preparation.

6.02 At full development, estimated paddy yields for the wet and dry season crops would average 4.0 ton/ha per crop. Farmers would achieve these yield levels five years after the introduction of water control. The expected yields would be about 30% above the estimated "without project" level. The greatly improved water control and distribution provided by the project, together with the strengthened water management staff, would allow farmers to take full advantage of inputs such as improved varieties, fertilizers, agrochemicals and credit. Total paddy production from the project area would be about 147,000 tons at full development compared with 80,000 tons at present and an estimated 91,000 tons in the future without the project (Annex 10).

Market Prospects

6.03 A major Government objective in the agricultural sector is self-sufficiency in basic foods, especially rice and corn. The deficit in rice, the main staple food crop, has been a persistent problem for the Philippines, and in recent years annual rice imports have averaged around 300,000 tons. The 1975 Basic Economic Report projects the 1985 Philippine demand for milled rice to be 5.0 million tons, equivalent to 8.5 million tons paddy, including seed requirements. To meet this demand local production would have to increase over the next decade by slightly more than 3.5% per year and the incremental paddy production from the project area would be marketed without difficulty. Traditionally Iloilo province has produced paddy surplus to its requirements, and has exported the bulk of the surplus to the neighboring sugar growing island of Negros. A small part of the province's production goes to the nearby provinces of Antique and Aklan and to Manila. The pattern would continue with the project.

Prices

6.04 In 1957 the Government introduced an annual farm gate support price for paddy to encourage production and to allow purchases of paddy by Government to build stocks. From 1965 to 1970 the support price was about 10% higher than the market price but since 1971 the market price has generally exceeded the support price. In December, 1975 the official farm gate support price for paddy was ₱ 1,000/ton, which was considerably lower than the corresponding price of imported rice (₱ 2,650/ton c.i.f. Philippines), which would correspond to a farm gate price for paddy of about ₱ 1,500/ton. The low farm gate price is maintained by Government sales of imported rice on the domestic market below cost. In 1974 this subsidy cost the Government about US$20 million. As of mid-1976 the price of imported rice had fallen

and the support price was raised to the point where the prices of domestic and imported rice were nearly the same. The latest Bank commodity price forecasts show the world market price in 1985 of Thai 25-35% broken rice to be about US$280, c.i.f. Philippines (in January 1977 constant dollars). The corresponding farm gate price (in January 1977 constant dollars) would be ₱ 1,285 (US$170) per ton (Annex 11). The use of a shadow exchange rate gives an economic farm gate price of ₱ 1,425 per ton. It is assumed that the actual farm gate price, on average, would correspond to the equivalent price for imported rice, namely ₱ 1,285 per ton.

6.05 The Government subsidizes fertilizers used to grow food crops for domestic consumption. With the recent fall in international prices for fertilizer, the farm gate fertilizer prices are nearly equivalent to the "subsidized" fertilizer prices. For sugar, coconut and other cash crop farmers the Government has maintained fertilizer prices substantially above international prices. At full development, the financial prices for nitrogen and phosphate based fertilizers are assumed to correspond to the Bank's forecasted world market prices for both food and cash crops. On this basis farm gate prices were estimated to be ₱ 1,905 (US$254) per ton for urea and ₱ 1,725 (US$230) per ton for triple super-phosphate. The use of a shadow exchange rate gives economic farm gate prices of about ₱ 2,100 and ₱ 1,900 per ton respectively.

Farm Incomes

6.06 Rice farm models have been prepared for four water supply situations, two typical farm sizes and two types of tenure. These are presented in detail in Annex 13. Estimated and projected incomes are summarized below for farm sizes of 1.5 and 3.0 ha, which would account for 80% of the project's area and over 90% of the farmers, for the JRIS and ARIS-SBIS systems covering 77% of the project area and for amortizing owners who would constitute 60% of the farmers.

Farm Size (ha)	Irrigation System /a	Cropping Intensity Present (%)	Cropping Intensity Future (%)	Farm Income /b Present (₱)	Farm Income /b Future (₱)	Farm Income /b Present (US$)	Farm Income /b Future (US$)
1.5	ARIS-SBIS	105	105	2,500	4,900	330	650
	JRIS	162	200	3,500	8,150	470	1,090
3.0	ARIS-SBIS	105	105	3,850	8,600	510	1,150
	JRIS	162	200	5,550	17,150	740	2,290

/a ARIS-SBIS = 41% of project area; JRIS = 36% of project area.

/b Rounded to nearest ₱ 50 and US$10.

6.07 Estimated present total net incomes for 1.5 to 3 ha farms vary between US$270 and US$770. Tenant farm families who do not doublecrop rely on employment on other farms and off-farm earnings for most of their income. According to NIA data, other income averages ₱ 1,000 in irrigated areas and nearly ₱ 1,200 per annum in the Jalaur rainfed area. Off-farm earnings estimated at 60% of "other income" rise with farm size, but constitute a smaller percentage of total income for larger or doublecropped farms. It was assumed that, except for farmers who would increase their cropping intensity and hence decrease significantly the time available for off-farm employment, "other income" would remain at present levels. At full development incomes are expected to double for 1.5 ha tenant farmers on the Aganan/Santa Barbara area, where cropping intensity would remain unchanged. The increase is likely to be about 300% to 400% for amortizing owners with land in the existing rainfed area. Farmers in the Jalaur area, where cropping intensities would rise to 200%, are expected in all types of tenancy situations to more than double their incomes with the project.

6.08 Assuming a household of 5.8 members, present per capita incomes in 1.5 ha farm households vary between US$45 and US$80, while those in 3 ha households range from US$65 to US$135. These figures correspond to between 12% and 35% of the national GNP per capita. About 75% of the project's farm families are presently at or below the Bank's estimated absolute per capita poverty level of US$155 (expressed in 1977 constant price levels). At full project development in 1985, the projected per capita incomes would range from US$110 to US$220 for a 1.5 ha farm to US$200 to US$390 for a 3 ha farm, depending on cropping intensity. Per capita incomes would be some 20-71% of the 1985 projected per capita GNP of US$550. These comparisons indicate that the project would help to narrow the income gap between the project area and other parts of the country.

VII. BENEFITS, JUSTIFICATION AND RISKS

7.01 The proposed project would increase yields on about 24,700 ha currently dependent on run-of-the-river irrigation and rainfed cultivation by providing better water control, improved drainage and the necessary agricultural supporting services. Rice would be the main crop grown in the area. Approximately 12,000 farm families and 2,000 landless labor families, for a total of about 80,000 people, would benefit directly from the increased production and consequent employment. The project would also create a demand for an additional 840,000 man-days of farm labor per year, equivalent to some 3,500 full time jobs. It would also provide farmers with increased access to markets through an improved and denser network of roads to be constructed along the canals and drainage system. The project would meet the Government's objectives of increased food production and more balanced regional distribution of development at a capital cost of US$2,010 per benefited farm family. This would be at the low end of the cost range for irrigation projects in the Philippines, due to the high proportion of rehabilitation compared to new construction.

7.02 Assuming a 50-year project life, a five-year construction period full agricultural benefits being attained in 1985, farm gate prices for

rice and fertilizer based on the Bank's commodity price forecasts for 1985, a shadow price for foreign exchange, and a seasonably variable shadow wage rate for unskilled farm labor, the economic rate of return of the project would be 20%. Rates of return for rehabilitation of the individual irrigation systems ranged between 13% for the Santa Barbara system and 28% for the Jalaur system. The rate of return for the Jalaur extension was 13% (Annex 15).

7.03 The rate of return showed little sensitivity to the estimates of project costs. It showed most sensitivity to a reduction in the level of benefits, as well as to the timing of benefits. In none of the cases tested, however, did the rate of return fall below 15%. On the other hand, if the world market price of rice turns out to be 25% higher than forecast, the rate of return would be 25%.

7.04 At full agricultural development the project would result in rice imports savings of US$9.9 million per year at the forecast world market prices. After deducting the incremental cost of imported fertilizer, chemicals and fuel, the net foreign exchange savings would amount to about US$8.8 million.

7.05 There are no unusual risks associated with the project. The risks normally associated with irrigation projects have been accounted for in the estimates of yields and in the areas to be irrigated during the dry season.

VIII. AGREEMENTS REACHED AND RECOMMENDATION

8.01 During negotiations, agreement with the Government was reached on the following principal points:

(a) the necessary water rights for the Jalaur extension would be granted to the NIA and no other water rights which could adversely affect the project's water supply except for domestic use would be granted (para. 4.06);

(b) NIA would establish a special account for the project which would be replenished at monthly intervals to a level equivalent to the estimated requirements for the next two months (para. 4.14);

(c) NIA would ensure that the amount of civil works done by force account in the project's service area would not exceed 40% of the total cost of the work (para. 4.16);

(d) NIA would maintain separate accounts for the project and, after audit by the Commission on Audit, project accounts would be submitted to the Bank within four months of the close of each financial year (para. 4.19);

(e) an Agricultural Development Coordinating Council based on Iloilo province would be established for the proposed project (para. 5.05);

(f) NIA would prepare by October 31, 1978 a plan of action for improved collection of irrigation fees and after reviewing such plan of action with the Bank would proceed promptly with its implementation (para. 5.11); and

(g) NIA would make annual budgetary provisions to supply the funds necessary for operation and maintenance of the project; would take all necessary action to ensure full and prompt collection of irrigation fees; and would gradually increase irrigation fees over a period of five years from completion of construction to a level equivalent to about 3.5 cavans of paddy/ha in the wet season and 4.4 cavans in the dry season (para. 5.14).

8.02 The proposed project would be suitable for a Bank loan of US$15.0 million, with a 20 year maturity including a grace period of 4.5 years. The borrower would be the Republic of the Philippines.

PHILIPPINES

JALAUR IRRIGATION PROJECT

Climatological Data

Iloilo City	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Rainfall /1													
Average (mm)	57	32	31	43	156	254	383	354	281	250	202	109	2,152
Maximum (mm)	198	209	113	298	514	517	1,403	808	616	560	484	528	6,248
Minimum (mm)	1	0	0	0	0	87	57	73	31	32	3	10	294
Number of rainy days /2	8	6	6	5	12	18	19	20	19	17	15	12	157
Relative humidity (%) /3	82	81	77	74	77	82	84	84	84	84	85	85	
Temperature /4													
Mean (^{o}C)	25.7	26.0	26.8	28.1	28.6	27.9	27.4	27.2	27.3	27.2	26.9	26.2	
Mean Maximum (^{o}C)	28.5	29.1	30.0	31.5	32.0	30.9	30.1	29.9	30.9	30.3	29.8	28.9	
Mean Minimum (^{o}C)	22.9	22.9	23.5	24.7	25.1	24.8	24.6	24.5	24.5	24.2	24.0	23.5	
Evaporation (mm) /5	147	154	207	212	206	166	152	152	141	144	134	139	1,954
Prevailing wind direction /6	NE	NE	NE	NE	NE	SW	SW	SW	SW	NE	NE	NE	
Wind velocity (km/hr) /7	20.3	19.3	19.6	16.5	11.9	10.6	10.7	13.7	10.4	11.9	15.0	17.8	
Number of typhoons /8 (Panay Island, Northern area)	0	1	0	1	0	0	0	0	0	1	3	1	7

/1 Period of observation 1902-1940, 1947-1973
/2 Period of observation 1950-1970
/3 Period of observation 1949-1975
/4 Period of observation 1949-1973
/5 Period of observation 1957-1965 (Pototan, Iloilo)
/6 Period of observation 1956-1970
/7 Period of observation 1956-1960
/8 Period of observation 1964-1972

ANNEX 1
Table 1

PHILIPPINES

JALAUR IRRIGATION PROJECT

Land Tenure and Reform

Background

1. Since 1972, the Government has pursued an agrarian reform program aimed at the transfer of land ownership to tenant farmers on rice and corn lands. Presidential Decree No. 27 (PD 27), the basic legislation of the new program, provides for the transfer to the tenant, whether sharecropper or leaseholder, of the land he tills up to a total of 3 ha in an irrigated area and 5 ha in a rainfed area. The landlord is allowed to retain up to 7 ha providing he cultivates the land himself. The Decree lays down a system of valuing the land and provides for the tenant to pay for it in 15 equal annual installments at an interest rate of 6% per annum.

2. It is estimated that the total number of rice and corn tenants is about 1.0 million on some 1.5 million ha owned by about 430,000 landlords. Some 85% of these landlords have holdings of less than 7 ha. In addition, the total number of rice and corn farmers probably exceeds 2 million, while the total area of rice and corn lands is not much more than 4 million ha, of which less than 1 million ha are irrigated. There is, therefore, little prospect of achieving the objective of 5 ha rainfed or 3 ha irrigated family farms nationwide.

3. A recent survey by the Department of Agrarian Reform (DAR) reports that 55% of the tenants farming 45% of the tenanted area are under landlords with holdings smaller than 7 ha. The Government is anxious not to antagonize the small landowners, and is looking for a solution equitable to both tenants and landlords. For holdings under 7 ha the Government has announced its intention to enforce leasehold with security of tenure. To prevent abuses pending the issue of rules and regulations under the various decrees, the Government has forbidden evictions, and has declared sharecropping illegal. DAR is proceeding with the transfer of land in holdings over 24 ha, and by June 1976, had issued land transfer certificates to 218,000 tenants covering 381,000 ha in 64 provinces but valuation and payment has been slow. DAR reports that landlords and tenants have submitted to the DAR valuations of 61,000 ha, involving 1,370 landlords and 43,500 tenants in 42 provinces. The Land Bank has paid compensation to 1,065 landlords for 48,600 ha, involving 25,500 former tenants.

4. In November 1974, the Government decided to proceed with the transfer of land in holdings between 24 and 7 ha. This work began in January 1975 and is targeted to be finished by the end of 1977. To expedite land transfer and resolve land valuation disputes, barrio (hamlet) land valuation committees began functioning in April 1975. The committees consist of the barrio captain, four tenant farmers, two owner cultivators, two landowners, a representative from the DAR and one from the samahang nayon (precooperative organization).

Situation in the Project Area

5. DAR has identified nearly all of the rice holdings subject to land reform in the municipalities where the project is located. As of June 1976, land transfer certificates were issued to some 2,650 tenants on about 4,200 ha out of a total of about 6,870 tenants on holdings over 7 ha. Only 5,260 tenant farmers on holding below 7 ha have thus far been identified in the municipalities concerned. For Iloilo province as a whole as of June 1976, land transfer certificates have been issued to 10,680 tenants on 17,540 ha out of a total of about 17,000 tenants on holdings over 7 ha. About 21,000 tenants on holdings below 7 ha have been identified thus far.

6. According to DAR and NIA data, an estimated 8,075 people own the 23,660 ha of rice land in the project area. Some 88% of the owners have properties of less than 7 ha, and account for 54% of the area. The remaining 12% of holdings larger than 7 ha, the existing operational limit for land transfer, comprise 46% of the area (10,880 ha). The rice land ownership pattern in the project area by size of holding in January 1975 was as follows:

Size of Holdings /a (ha)	Owners %	Area Owned /b ha	Area Owned /b %
Less than 7	88	12,780	54
7 - 12	6	2,360	10
12 - 24	3	2,130	9
24 - 50	1	1,660	7
50 -100	2	1,890	8
More than 100		2,840	12
Total	100	23,660	100

/a Refers to owner's holding size, within and outside project area.

/b Refers to area within project area only.

7. The average rice farm unit in the project area is 2 ha. Most farms (96%) are between 1 and 5 ha, and cover 85% of the project area. The rice farm size distribution is as follows:

Farm Size (ha)	Farms No.	Farms %	Cultivated Area ha	Cultivated Area %
Less than 1	1,540	13	710	3
1 - 2	4,510	38	5,440	23
2 - 3	3,320	28	6,860	29
3 - 5	2,020	17	7,100	30
More than 5	470	4	3,550	15
Total	11,860	100	23,660	100

According to the NIA survey the size distribution varies between systems with the average rice farm in Jalaur somewhat smaller than in Suague and Santa Barbara which in turn are smaller than Aganan.

8. As of early 1975, the project area tenure situation for rice farms was as follows:

Tenure	Farms No.	Farms %	Area No.	Area %
Owner operated	2,965	25	6,150	26
Leasehold	6,760	57	14,195	60
Sharecropped	2,135	18	3,315	14
	11,860	100	23,660	100

The proportion of tenant farmers is 75% for the entire project area. In Aganan and Santa Barbara, the percentage was higher (78%) while in Jalaur and Suague, it was 74%. The average owner operator unit was about 2.07 ha compared to an average tenant unit of 1.97 ha.

9. The project area also contains about 1,040 ha of sugar farms not subject to land reform. Each of the areas contains some sugar land, but the bulk is located in the Jalaur and Suague systems. Jalaur contains 600 ha, Suague 230 ha, Santa Barbara 130 ha and Aganan 80 ha. While half of the farms are of 5 ha or less, the average farm size is 13 ha and there are 6 large farms. About 80 farmers cultivate the 1,040 ha. Six of the farms include 39% of the sugar area, while the 39 farms below 5 ha account for only 13% of the area. The information available suggests that most of the farms are owner operated. The largest farm includes a sizeable portion of land which is rented, while a number of the smallest farms include rented land.

10. The mean farm size of the project area is smaller than in the Cagayan valley, where the Magat and Chico projects are located, and comparable to some of the project areas in Central Luzon where the range is from 1.5 to 2 ha. With a high population density, Iloilo traditionally has supplied manpower to Negros and Manila. According to NEDA data, the annual migration rate from Iloilo was nearly 1% of the population until the 1970s. In recent years, the migration rate has slowed and the project is expected to assist in continuing that trend.

11. The transfer by DAR of landlord holdings larger than 7 ha would involve an estimated 6,600 ha and about 4,100 tenants. The transfer would result in owner operators comprising 60% of the farmers and cultivating some 12,750 ha or 54% of the project area. The 4,900 tenant farmers on holdings of less than 7 ha would operate under a leasehold contract.

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JALAUR IRRIGATION PROJECT

Project Works

1. The Jalaur Irrigation Project would provide irrigation service to 24,700 ha of rice land by improving four existing national systems with a total irrigable area of 22,000 ha and constructing new irrigation and drainage facilities in a presently rainfed area of 2,700 ha located on the left bank of the Jalaur river. The unregulated Jalaur river flow records of the last 20 years indicate that an additional area of 5,500 ha, of which 4,700 ha are presently in sugar cane, can be irrigated, so the intake works and main canal for the new area would be built to provide for future inclusion of this area. The project works would consist of:

(a) rehabilitation and upgrading of irrigation, drainage and road facilities on the following existing NIA irrigation systems:

(i) Jalaur River Irrigation System, 9,000 ha;

(ii) Suague River Irrigation System, 2,900 ha;

(iii) Santa Barbara Irrigation System, 4,600 ha; and

(iv) Aganan River Irrigation System, 5,500 ha.

(b) construction of new irrigation, drainage and access facilities, including intake works and main canal, on the left bank of the Jalaur river for 2,700 ha of currently rainfed rice lands.

Rehabilitation of Existing Systems

2. The layout of the irrigation systems and principal works are shown on Map 12414. Table 1 summarizes the main features of the project; the number of structures which would be modified, repaired or newly provided under the project are listed in Table 2. Costs per hectare and the density of on-farm facilities are given in Tables 3 and 4 respectively.

3. The improvements would include minor repairs to existing diversion structures and outlet works, the construction and/or enlargement of canals and drains, repairs and modification of existing and provision of new water regulating and delivery structures, and the construction of O&M, access and farm roads. General features of the improved irrigation systems would include additional canal structures

such as checks, control structures and turnouts and installation of gates on existing canal structures to more effectively control water deliveries and to provide water more efficiently to each field as needed. Constant head orifice turnouts to sublaterals would be provided for water deliveries to rotational areas of about 50 ha. Turnouts would be provided for each 10 ha unit from which farm ditches, constructed as part of the project, would convey water directly to most farms. Farm drains would convey excess water from each 10 ha unit to the main project outlet drains in flat areas. For more steeply sloping areas, where the land gradient in the direction of flow is in excess of 0.4%, the farms would drain from field to field, and consequently the intensity of farm and collector secondary drains would be somewhat lower. A few farms would still receive water through their neighbor's fields. Canals would be unlined except in selected portions of short length where the soils are erosive. Working stations for Water Management Technologists (WMT) would be provided for about each 500 ha of irrigated land. The stations would provide space for temporary storage and drying of paddy.

4. Gravel surfaced O&M roads would be constructed on the canal banks. Canals with a design flow greater than 5.0 m^3/sec, would be provided with a roadway 5 m wide on both banks if the service area is on both sides of the canal and one bank where the canal serves the area on one side. Canals with capacities between 2.0 and 5.0 m^3/sec, would be provided with a 3.5 m wide road on one bank. The roadway along waterways with capacities less than 2.0 m^3/sec, and along some of the major farm ditches would be a nongravel, 2.0 m wide, cycle or cart path. Access roads 5.0 m wide would also be provided as links between the existing major roads of the area and the canal O&M roads. These roads would also serve as farm-to-market roads. The surfacing of the roads would be 20 cm thick for 5.0 m wide roadways and 15 cm thick for 3.5 m roadways. To allow continuous passage along the O&M roads, bridges and/or culverts across the existing drainage waterways would be built. However, on major streams or rivers, the O&M roads would be connected to existing bridges by short access roads instead of constructing expensive, multi-span bridges.

5. The proposed level of on-farm distribution and drainage is similar to that being implemented in other Bank-assisted projects, and would be a substantial improvement on the present, practically non-existent system. Rice has been grown in the project area for many years and the land is reasonably level and well laid out with little fragmentation of land holdings. Therefore, no land leveling, boundary realignment or land consolidation would be required at this stage.

Extension Area

6. An intake structure for the Jalaur Extension would be built near the left abutment of the existing Jalaur diversion dam, to serve a new main canal 24 km long. Hydrological records indicate that the unregulated river flows would be adequate to serve an area on the left bank of 8,200 ha in the wet season and 6,800 ha in the dry season (Annex 4). The potential service area would include 3,500 ha of currently rainfed rice lands and 4,700 ha presently under medium to large sugar farms. The proposed main canal would provide irrigation to 2,700 ha of rice lands divided into four blocks, two of which are about 1,200 ha each, while the other two total 300 ha between them. The remaining 800 ha of rice land are distant from the canal and scattered among the sugar holdings which would not be provided with irrigation under the project. New irrigation, drainage and access facilities would be built on the four blocks comprising the 2,700 ha extension. The intake works and main canal would be sized for future inclusion of both the sugar area and the remaining rice area. This would be done to protect the safety of the water supply for the 2,700 ha extension from interference by sugar growers adjoining the canal and to avoid the unnecessary expense of duplicate facilities should it be decided to provide the sugar area with water at a future date.

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JALAUR IRRIGATION PROJECT

Principal Project Features

		Rehabilitation					
		Jalaur	Suague	Santa Barbara	Aganan	Jalaur Extension	Total
Net irrigable area	(ha)	9,000	2,900	4,600	5,500	2,700	24,700
Main canals	(km)	25	9	5	12	24	75
Laterals	(km)	121	39	66	90	34	350
Project drains:	(km)						
Rehabilitation		47	7	13	28	5	100
New construction		37	18	18	18	29	120
Farm ditches	(km)	420	140	210	250	130	1,150
Farm drains	(km)	230	80	120	130	80	640
Service roads:	(km)						
O&M roads							
- Along main canals (3.5-5 m)		25	9	5	12	24	75
- Along laterals (3.5 m wide)		113	35	60	82	30	320
Access roads	(3.5 m wide)	3	4	3	4	6	20
Farm roads	(2.0 m wide)	50	20	40	40	20	170

ANNEX 3
Table 1

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JALAUR IRRIGATION PROJECT

List of Structures

		Rehabilitation					
		Jalaur	Suague	Santa Barbara	Aganan	Jalaur Extension	Total
Diversion Dams							
Replace existing gates	(No.)	2	-	-	-	-	2
Mechanized gates operation	(No.)	8	-	-	-	-	8
New intake structure	(No.)	-	-	-	-	1	1
Main Canals							
Modification of existing structures:							
Install gates on checks, siphon & check drops	(No.)	20	5	5	10	-	40
Repair of existing structures	(No.)	10	8	4	28	-	50
Extension of existing drainage structures	(m)	50	20	20	30	-	120
Repairs to flumes	(No.)	2	-	-	-	-	2
New additional structures:							
Checks or check drops	(No.)	2	-	-	2	6	10
Bridges across canals		2	1	2	5	5	15
Operation road bridges	(No.)	3	1	2	2	2	10
Culverts or thresher crossings	(No.)	5	2	3	8	17	35
Drainage structures	(No.)	4	1	2	2	6	15
Secondary Canals							
Modification of existing structures:							
Install gates on checks, etc.	(No.)	14	5	5	6	-	30
Repair of existing structures	(No.)	80	25	35	60	-	200
Extension of existing drainage structures	(m)	60	20	70	80	-	330
New additional structures:							
Parshall flumes	(No)	14	5	3	4	4	30
New small checks without gates	(No)	30	10	10	25	15	90
New checks with gates	(No)	10	4	4	6	6	30
C.H.O. turnouts	(No)	22	8	20	30	10	90
Bridges across canals	(No)	9	3	4	4	20	40
Operation road bridges	(No)	4	1	2	4	4	15
Culverts or thresher crossings	(No)	30	10	10	10	15	75
Main and Secondary Drains							
New structures:							
Drops	(No)	35	20	15	55	15	140
Road crossings	(No)	15	6	21	8	10	60
Drainage inlets	(No)	180	50	80	110	50	470

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JALAUR IRRIGATION PROJECT

Irrigation Facilities Cost

	Irrigation Systems				
	Jalaur	Suague	Santa Barbara	Aganan	Average
	(US$/ha)/1				
I. Rehabilitation Area (ha)	9,000	2,900	4,600	5,500	22,000
(a) Canal system					
Diversion dam	15	2	1	9	9
Main canal	35	36	35	60	42
Secondary canals	116	116	66	73	95
Subtotal	166	154	102	142	146
(b) Drainage system	59	93	70	80	71
(c) Road system	184	234	120	144	162
(d) On-farm distribution and drainage /2	210	221	215	205	211
Subtotal	619	702	507	571	590
II. Extension Area (ha)	2,700				
(a) Canal system					
Intake works /3	152				
Main canal /3	511				
Secondary canals	226				
Subtotal	889				
(b) Drainage system	63				
(c) Road system	352				
(d) On-farm distribution and drainage /2	230				
Subtotal	1,534				
TOTAL					693

/1 Not including contingencies (25%) and engineering, supervision and administration (10%).

/2 Includes Water Management Technologist Stations.

/3 Capacity for a service area of 8,200 ha.

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JALAUR IRRIGATION PROJECT

Density of Terminal On-Farm Facilities on IBRD Projects

Project	On-Farm Facility		O&M
	Irrigation	Drainage	Roads
	(m/ha)		
UPRP	57	12	13
Tarlac	55	40	13
Magat	60	40	15
Chico	59	40	18
Jalaur	47 /1	24 /2	24 /3

/1 Lower than other projects due to higher density of secondary laterals.

/2 Lower than other projects due to steep areas in upper reaches covering about 70% of total area.

/3 Jalaur project includes 7 m/ha of farm roads.

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JALAUR IRRIGATION PROJECT

Water Supply, Demand and Quality

Water Supply

1. Each of the four systems gets its water supply from a separate river source using its own diversion and conveyance systems. The project would not develop new irrigation supplies, but would improve and expand the area covered by the existing irrigation systems. About 40% of the project area would be supplied with water during the dry season.

2. The Jalaur River Irrigation System (JRIS) is served through a diversion dam on the Jalaur river where the river drains an area of about 1,065 Km^2. Reliable discharge records are available for a gauging station originally located a few hundred meters upstream of the diversion dam from 1948 to 1956. After completion of the dam in 1956, the station was relocated to a site about 500 mm below the dam. The records for the period from 1957 to 1971 were adjusted by adding the amount of diversions for the Jalaur system.

3. The Suague river, a right bank tributary of the Jalaur, is the main source of supply for the Suague River Irrigation (SRIS) system. The catchment area at the diversion site is 181 Km^2. Reliable stream flow records for the period from 1949 to 1971 are available for a gauging station located below the diversion dam. As no diversion records are available, the stream flow was adjusted for the period after construction of the diversion dam in 1959 by correlation with nearby stations on the Ulian and Jalaur rivers for a concurrent period of records.

4. The Santa Barbara Irrigation System (SBIS) receives its water supply from the Tigum river through a diversion dam completed in 1923. At the diversion dam the drainage area of the river is at 193 Km^2. Continuous and reliable stream flow records are not available at the diversion point, so the long term discharge records were synthesized for the period from 1950 to 1971 by correlating the available record of the station with concurrent records of the nearby Suague and Ulian rivers.

5. The Aganan river, with a drainage area of 104 km^2 at the diversion dam completed in 1925, is the source of supply for the Aganan River Irrigation System (ARIS). A stream gauging station established in 1911 was

operated until 1923 with available records for six years for the period from 1911 to 1913 and 1919 to 1923. Development of a long-term record (1950-71) for the station was based on correlation with concurrent records of the Sibalom river at Leon.

Water Demand

6. An area of about 1,000 ha is currently under irrigated sugarcane cultivation with the remaining 23,700 ha under rice. It was assumed that transplanted rice using 120-day nonphotosensitive varities in both the wet and dry season would remain the dominant crop in the project. Water requirements for rice were based on the following cropping calendar:

Operation	Dates	
	Wet Season	Dry Season
Land preparation & nursery	Early May to mid-Sept.	Mid-Oct. to mid-Feb.
Transplanting	Late June to Late Sept.	Early Dec. to late Feb.
Harvesting	Late Sept. to late Dec.	Mid-Feb to mid-May.

7. Land preparation and nursery were estimated to take 30 days with requirements for saturation, evaporation and percolation of 310 mm in the wet season and 335 mm in the dry season. Flooding requirements to provide a minimum depth of water in the field for culitvation in each season were estimated to be 20 mm immediately after transplanting followed by an additional 50 mm about two weeks later. Subsequent water applications to compensate for evapotranspiration and deep percolation losses were based on a percolation loss of 2.0 mm/day and evapotranspiration rates estimated to be equal to the observed open-rim pan evaporation at Pototan, Iloilo between 1957 and 1965. The effective rainfall was determined from observed daily rainfall records at Pototan, between 1950 and 1971, allowing water depths to fluctuate with the growth of the rice plants and limiting depth to 150 mm.

8. The overall irrigation efficiency was estimated to be 43% in the wet season and 50% in the dry season at full development, based on farm irrigation wastes of 40% in the wet season and 30% in the dry season, system operation losses of 10% and conveyance losses of 20%.

9. The consumptive use of sugarcane was assumed to be a ratio of observed monthly evaporation at Pototan. The following crop coefficients were used to obtain the consumptive use for sugar cane:

State of Growth	Crop Coefficient
Planting - 3 months	0.50
3-4 months	0.80
4-7 months	1.00
7-9 months	0.75

10. The effective rainfall was computed on the basis of daily rainfall records at Pototan and soil moisture capacity assumed as 30 mm for the first two months after planting and 50 mm for the remaining period. An overall irrigation efficiency of 50% was used to derive diversion requirements for the sugarcane.

11. Monthly project water requirements for the rice and sugarcane crops are shown in Table 1 and seasonal and total annual diversion requirements are developed in Table 2. Monthly project water requirements and average river flows for each irrigation system are shown in Table 3.

12. The size of the project area was determined from simulated operation studies using synthesized discharge records for each of the four systems for the 22-year period, 1949-1971, and the estimated seasonal water requirements for rice. The cropping calendar was chosen to maximize the use of rainfall without exceeding local manpower constraints. No use of return flows was assumed. About 1,900 ha can be irrigated during the dry season in the Suague, Santa Barbara and Aganan systems. During the wet season there would be some risk of shortage in the month of October in the Aganan system. River flows in the Jalaur system are sufficient for wet season cropping of 9,000 ha under the existing system and another 8,200 ha in the extension located on the left bank of the river. The extension area consists of 4,700 ha under sugarcane and 3,500 ha under rice. Due to the relatively large size of holdings under sugarcane, present development in this area would be limited to about 2,700 ha of rice land located in four blocks, the remaining 800 ha of rice are scattered amongst the sugar areas. However, the diversion intake works and main canal of the extension area would be sized to include future addition of the remaining 5,500 ha (4,700 ha sugarcane and 800 ha rice). Dry season cropping in the rehabilitated area of Jalaur on the right bank of the river would be carried out on 9,000 ha for a cropping intensity of 200%, while on the left bank extension 1,100 ha would be cultivated in the dry season for a cropping intensity of 141%.

13. The irrigable areas selected for development under the project and the currently irrigated areas are as follows:

	Irrigation System				
	JRIS	SRIS	SBIS	ARIS	Total
Selected Irrigable Area (ha)					
Wet season	11,700	2,900	4,600	5,500	24,700
Dry season	10,100	1,300	500	100	12,000
Currently Irrigated Area (ha)					
Wet season	9,000	2,900	4,600	5,500	22,000
Dry season	5,600	1,300	500	100	7,500

Water Quality

14. Tests of water samples from the Jalaur river indicate good water quality with total dissolved solids under 300 ppm. The waters are of low salinity, slightly alkaline (pH 7-9) and are free of toxic elements. Water samples from the other three rivers have not been taken for analysis. However, no adverse effects have been noted on the soils or crops irrigated with these waters for periods ranging from 20 to 50 years.

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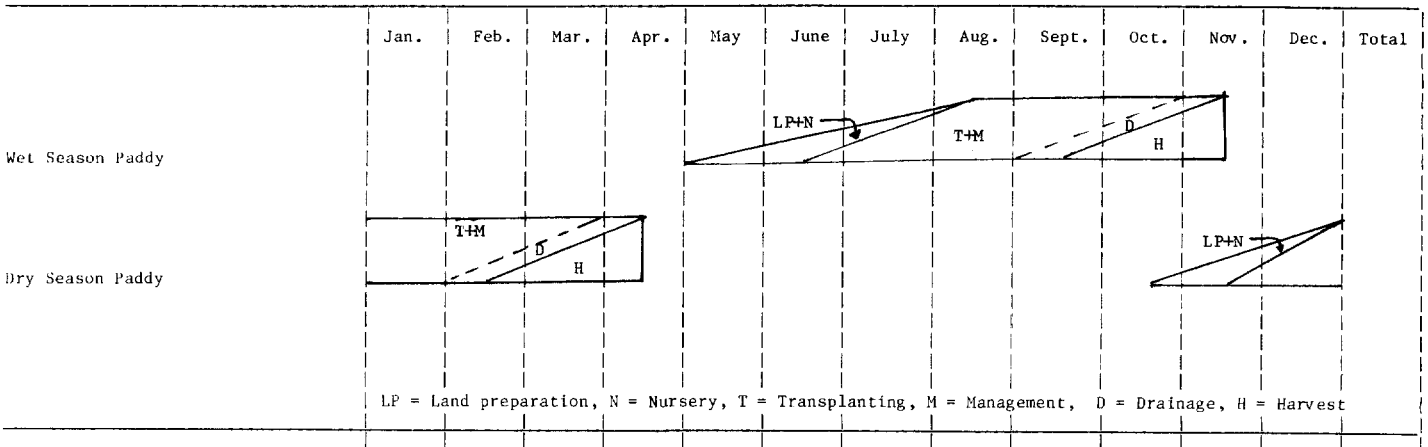
JALAUR IRRIGATION PROJECT

Estimated Water Requirements



LP = Land preparation, N = Nursery, T = Transplanting, M = Management, D = Drainage, H = Harvest

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Paddy Water Requirements (mm)													
Land preparation and nursery					80	140	90			100	125	110	645
Flooding for cultivation	20					20	30	20			20	30	140
Evapotranspiration	139	139	104				76	151	146	72	16	55	898
Deep percolation	60	55	30			6	30	60	58	30	15	25	369
Field requirement	219	194	134		80	166	226	231	204	202	176	220	2,052
Effective rainfall /1	23	14	10	-	66	131	181	191	179	72	110	64	1,041
Net farm requirement	196	180	124	0	14	35	45	40	25	130	66	156	1,011
Overall efficiency	50	50	50	-	43	43	43	43	43	49	50	50	
Diversion requirement	392	360	248	0	33	79	103	91	56	265	132	312	2,071
Sugarcane Water Requirements (mm) /2													
Evapotranspiration	103	108	104	106	124	133	152	152	127	122	107	104	1,442
Effective rainfall /1	25	17	10	13	54	79	90	121	127	122	107	77	842
Net farm requirement	78	91	94	93	70	54	62	31	-	-	-	27	600
Diversion requirement /3	156	182	188	186	140	108	124	62	-	-	-	54	1,200

/1 Effective rainfall exceeded in 4 out of 5 years (1949-1971) computed separately for paddy and sugarcane.

/2 March Planting.

/3 Based on 50% overall efficiency.

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JALAUR IRRIGATION PROJECT

Project Water Requirements Summary

	Wet Season	Dry Season	Annual
	(mm)		
Paddy			
Land preparation			
Saturation	75	50	
Evaporation	175	225	
Percolation	60	60	
Subtotal	310	335	645
Flooding for cultivation	70	70	140
Crop water requirements			
Evapotranspiration	445	453	898
Deep percolation	184	185	369
Subtotal	629	638	1,267
Total field water requirement	1,009	1,043	2,052
Less effective rainfall	820	221	1,041
Net farm irrigation requirement	189	822	1,011
Farm irrigation efficiency (%)	60	70	
Farm requirement (turnout)	315	1,174	1,489
Conveyance efficiency (%)	80	80	
System operation efficiency (%)	90	90	
Diversion requirement (headworks)	432	1,639	2,071
Overall irrigation efficiency	43	50	49
Sugarcane			
Evapotranspiration			1,442
Less effective rainfall			842
Net farm irrigation requirement			600
Overall irrigation efficiency (%) /1			50
Diversion requirement (headworks)			1,200

/1 Estimated efficiencies - farm 70%, conveyance 80% and system operation 90%.

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JALAUR IRRIGATION PROJECT

Estimated Water Requirement and Supply

		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Irrigation Diversion Requirement													
	Rice: early planting (mm)	392	360	248	0	33	79	103	91	56	265	132	312
	late planting (mm)	454	426	328	298	-	-	-	81	98	291	200	244
	Sugarcane (mm)	156	182	188	186	140	108	124	62	-	-	-	54
Jalaur System	Cropped area												
	Rice: wet season (ha)					←		10,900				→	
	dry season (ha)	←	9,300	→								←	9,300 →
	Sugarcane (ha)	←			800								→
	Diversion requirement (Mm^3)												
	Rice	36.5	33.5	23.1	-	3.6	8.6	11.2	9.9	6.1	28.9	12.3	29.0
	Sugarcane	1.3	1.5	1.5	1.5	1.1	0.9	1.0	0.5	-	-	-	0.4
	Total	37.8	35.0	24.6	1.5	4.7	9.5	12.2	10.4	6.1	28.9	12.3	29.4
	Water supply (Mm^3)												
	critical year /1	53.6	38.3	26.3	14.8	34.3	70.5	97.8	80.3	84.8	141.7	99.8	85.7
Suague System	Cropped area												
	Rice: wet season (ha)					←		2,700				→	
	dry season (ha)	←	1,100	→								←	1,100 →
	Sugarcane (ha)	←						200					→
	Diversion requirement (Mm^3)												
	Rice	4.3	4.0	2.7	-	0.9	2.1	2.8	2.5	1.5	7.2	1.5	3.4
	Sugarcane	0.4	0.4	0.5	0,5	0.2	-	-	-	-	-	0.1	0.2
	Total	4.7	4.4	3.2	0.5	1.1	2.1	2.8	2.5	1.5	7.2	1.6	3.6
	Water supply (Mm^3)												
	critical year /1	9.1	4.4	3.3	1.9	2.1	6.1	16.2	13.3	14.9	22.5	15.8	10.8
Santa Barbara	Cropped area												
	Rice: wet season (ha)						←		4,600				→
	dry season (ha)	←		500	→							←	
	Diversion requirement (Mm^3)												
	Rice	2.3	2.1	1.6	1.5	-	-	-	3.7	4.5	13.4	1.0	1.2
	Water supply (Mm^3)												
	critical year /1	5.3	3.1	1.6	1.6	1.8	5.4	8.4	7.3	11.2	15.8	10.8	7.4
Aganan System	Cropped area												
	Rice: early planting: wet season (ha)					←		3,000				→	
	late planting: wet season (ha)						←		2,500				→
	dry season (ha)	←		100	→							←	100 →
	Diversion requirement (Mm^3)												
	Rice: early planting: wet season	-	-	-	-	1.0	2.4	3.1	2.7	1.7	2.1 /2	-	-
	late planting: wet season	-	-	-	-	-	-	-	2.0	2.5	7.3	-	-
	dry season	0.5	0.4	0.3	0.3	-	-	-	-	-	-	0.2	0.3
	Total	0.5	0.4	0.3	0.3	1.0	2.4	3.1	4.7	4.2	9.4	0.2	0.3
	Water supply (Mm^3)												
	critical year /1	0.6	0.6	0.3	0.4	1.0	3.5	4.3	8.9	7.9	7.6	2.7	2.6

/1 Monthly flows with 80% probability of occurrence (four out of five years).

/2 Irrigation diversion requirement for wet season rice (early planting) is 70 mm.

PHILIPPINES

JALAUR IRRIGATION PROJECT

Cost Estimate

	Local	Foreign	Total	Local	Foreign	Total	Foreign Exchange
		(Pesos '000)			(US$ '000)		(%)
1. Irrigation Systems							
Diversion dam & intake works	2,320	2,330	4,650	310	310	620	50
Main canal	6,900	10,270	17,170	920	1,370	2,290	60
Secondary distribution system	10,120	10,050	20,170	1,350	1,340	2,690	50
Main & secondary drainage system	6,530	6,450	12,980	870	860	1,730	50
Service, access & farm roads	16,880	16,870	33,750	2,250	2,250	4,500	50
On-farm ditches & drains	20,770	13,730	34,500	2,770	1,830	4,600	40
Water management stations	3,450	1,500	4,950	460	200	660	30
Subtotal	66,970	61,200	128,170	8,930	8,160	17,090	48
Contingencies 25%	16,730	15,300	32,030	2,230	2,040	4,270	48
Engineering, supervision & admin. 10%	16,050	-	16,050	2,140	-	2,140	-
Subtotal	99,750	76,500	176,250	13,300	10,200	23,500	43
2. O&M Buildings							
Project headquarters	1,650	750	2,400	220	100	320	30
Field offices	1,270	530	1,800	170	70	240	30
Subtotal	2,920	1,280	4,200	390	170	560	30
Contingencies 10%	300	150	450	40	20	60	-
Subtotal	3,220	1,430	4,650	430	190	620	30
3. Water Management Training							
Project personnel	1,650	450	2,100	220	60	280	20
Equipment and supplies	750	1,430	2,180	100	190	290	66
Subtotal	2,400	1,880	4,280	320	250	570	44
Contingencies 10%	230	220	450	30	30	60	50
Subtotal	2,630	2,100	4,730	350	280	630	44
4. O&M Equipment	150	3,070	3,220	20	410	430	95
5. Technical Assistance	150	600	750	20	80	100	80
Subtotal Project Costs (Items 1-5)	105,900	83,700	189,600	14,120	11,160	25,280	44
Expected Price Increases /1	36,600	28,800	65,400	4,880	3,840	8,720	44
TOTAL PROJECT COSTS	142,500	112,500	255,000	19,000	15,000	34,000	44

/1 Based on Annex 5, Table 7.

PHILIPPINES

JALAUR IRRIGATION PROJECT

PROJECT SERVICE AREA

Cost Estimate

	Irrigation System					Total		
	Jalaur	Suague	Santa Barbara	Aganan	Jalaur Extension	Cost	Local	Foreign
	(US$'000)							
1. Irrigation and Drainage Facilities								
Diversion dam and intake works	140	10	10	50	410	620	310	310
Main canal	320	100	160	330	1,380	2,290	920	1,370
Secondary distribution system	1,040	340	300	400	610	2,690	1,350	1,340
Main and secondary drainage system	530	270	320	440	170	1,730	870	860
Service, access and farm roads	1,530	680	550	790	950	4,500	2,250	2,250
On-farm ditches and drains	1,650	560	870	980	540	4,600	2,770	1,830
Water management stations	240	80	120	140	80	660	460	200
Subtotal	5,450	2,040	2,330	3,130	4,140	17,090	8,930	8,160
Contingencies 25%	1,360	510	580	780	1,040	4,270	2,230	2,040
Engineering, supervision and administration 10%	680	260	290	390	520	2,140	2,140	-
Subtotal	7,490	2,810	3,200	4,300	5,700	23,500	13,300	10,200
2. O&M Buildings	-	-	-	-	-	560	390	170
Contingencies 10%	-	-	-	-	-	60	40	20
Subtotal	-	-	-	-	-	620	430	190
3. O&M Equipment	-	-	-	-	-	430	20	410
TOTAL	7,490	2,810	3,200	4,300	5,700	24,550	13,750	10,800

ANNEX 5
Table 2

PHILIPPINES

JALAUR IRRIGATION PROJECT

Quantities and Cost Estimates of Irrigation & Drainage Works

Items	Unit	Unit Price /1 (Pesos)	Quantity /2 Rehabilitation Jalaur	Rehabilitation Suague	Rehabilitation Santa Barbara	Rehabilitation Aganan	Jalaur Extension	Total	Cost (Pesos '000) Rehabilitation Jalaur	Rehabilitation Suague	Rehabilitation Santa Barbara	Rehabilitation Aganan	Jalaur Extension	Total
DIVERSION DAM & INTAKE WORKS														
Class A concrete	m^3	1,000	40	-	-	300	2,000	2,340	40	-	-	300	2,000	2,340
Grouted riprap	m^3	150	60	-	-	300	160	520	9	-	-	45	24	78
Gravel filter below riprap	m^3	50	20	-	-	100	60	180	1	-	-	5	3	9
Demolition of reinforced concrete and/or riprap	m^3	50	20	-	-	240	300	560	1	-	-	12	15	28
Gates with hoisting & installation	ton	30,000	25	-	-	-	8	33	750	-	-	-	240	990
Motors & mechanism for gates	each	15,000	8	-	-	-	2	10	120	-	-	-	30	150
Excavation and backfill	m^3	6.50	-	-	-	-	20,000	20,000	-	-	-	-	130	130
Rock excavation	m^3	35	-	-	-	-	40,000	40,000	-	-	-	-	140	140
Coffer dam and/or other diversion facilities	lump sum	-	-	-	-	-	-	-	90	-	-	8	300	398
Foundation treatment	lump sum	-	-	-	-	-	-	-	-	-	-	-	100	100
Miscellaneous	lump sum	-	-	-	-	-	-	-	39	70	80	-	98	287
Subtotal									1,050	70	80	370	3,080	4,650
MAIN CANAL														
Right of way	ha	17,000	7	2	2	2	50	63	119	34	34	34	850	1,071
Ordinary excavation	m^3	6.50	10,000	6,000	34,000	38,000	240,000	328,000	65	39	221	247	1,560	2,132
Rock excavation	m^3	40	-	-	-	-	15,000	15,000	-	-	-	-	600	600
Compacted fill using excavation material	m^3	3.50	10,000	4,000	10,000	20,000	22,000	66,000	35	14	35	70	77	231
Compacted fill using borrowed material with 300 m overhauling	m^3	15	5,000	10,000	8,000	12,000	90,000	125,000	75	150	120	180	1,350	1,875
Concrete lining including trimming and joints	m^3	400	1,500	-	300	600	800	3,200	600	-	120	240	320	1,280
Class A concrete	m^3	1,000	600	120	300	1,000	3,200	5,220	600	120	300	1,000	3,200	5,220
Grouted riprap	m^3	130	900	300	400	1,400	3,000	6,000	117	39	52	182	390	780
Sand & gravel bedding below riprap	m^3	35	400	200	200	400	1,000	2,200	14	7	7	14	35	77
Gates with hoisting & installation	ton	30,000	7	10	2	12	15	46	210	300	60	360	450	1,380
Miscellaneous metalwork	ton	16,000	2	1	1	2	10	16	32	16	16	32	160	256
Railings for bridges and other structures	m	75	200	80	200	240	400	1,120	15	6	15	18	30	84
Precast slabs for bridges	m	900	450	-	200	-	800	1,450	405	-	180	-	720	1,305
Concrete pipe work (36" to 54" dia. pipes)	m	400	100	50	75	75	1,250	1,550	40	20	30	30	500	620
Miscellaneous	lump sum	-	-	-	-	-	-	-	73	5	10	63	108	259
Subtotal									2,400	750	1,200	2,470	10,350	17,170
SECONDARY DISTRIBUTION SYSTEM														
Right of way	ha	17,000	10	-	2	2	45	59	170	-	34	34	765	1,003
Ordinary excavation	m^3	6.50	220,000	70,000	70,000	90,000	60,000	510,000	1,430	455	455	585	390	3,315
Compacted fill using excavation material	m^3	3.50	80,000	30,000	10,000	20,000	50,000	190,000	280	105	35	70	175	665
Compacted fill using borrowed material with 300 m overhauling	m^3	15	120,000	36,000	20,000	16,000	30,000	222,000	1,800	540	300	240	450	3,330
Concrete lining including trimming and joints	m^3	400	3,800	1,200	1,100	1,200	1,200	8,500	1,520	480	440	480	480	3,400
Class A concrete	m^3	1,000	1,100	400	500	800	1,600	4,400	1,100	400	500	800	1,600	4,400
Grouted riprap	m^3	130	900	400	400	1,600	700	4,000	117	52	52	208	91	520
Sand & gravel bedding below riprap	m^3	35	400	200	200	600	200	1,600	14	7	7	21	7	56
Gates with hoisting & installation	ton	30,000	32	10	8	11	10	71	960	300	240	330	300	2,130
Miscellaneous metalwork	ton	16,000	7	2	1	1	4	15	112	32	16	16	64	240
Railings for bridges and other structures	m	75	800	400	200	200	400	2,000	60	30	15	15	30	150
Pipework (18" to 36" dia. pipes)	m	250	300	200	400	500	700	2,100	75	50	100	125	175	525
Concrete and/or riprap demolition	m^3	50	300	100	200	200	-	800	15	5	10	10	-	40
Miscellaneous	lump sum	-	-	-	-	-	-	-	147	94	46	66	43	396
Subtotal									7,800	2,550	2,250	3,000	4,570	20,170
MAIN & SECONDARY DRAINAGE SYSTEM														
Right of way	ha	17,000	56	27	27	27	17	154	952	459	459	459	289	2,618
Ordinary excavation	m^3	5	330,000	160,000	170,000	180,000	100,000	940,000	1,650	800	850	900	500	4,700
Class A concrete	m^3	1,000	900	500	700	1,300	300	3,700	900	500	700	1,300	300	3,700
Mass concrete	m^3	600	400	200	300	600	100	1,600	240	120	180	360	60	960
Grouted riprap	m^3	130	1,000	600	1,000	1,600	400	4,600	130	78	130	208	52	598
Sand & gravel bedding below riprap	m^3	35	400	200	400	600	200	1,800	14	7	14	21	7	63
Drainage inlets (complete)	each	340	200	50	100	100	50	500	68	17	34	34	17	170
Miscellaneous	lump sum	-	-	-	-	-	-	-	26	39	33	18	55	171
Subtotal									3,980	2,020	2,400	3,300	1,280	12,980

Item	Unit	Unit Price /1 (Pesos)	Quantity /2 Rehabilitation Jalaur	Suague	Santa Barbara	Aganan	Jalaur Extension	Total	Cost (Pesos '000) Rehabilitation Jalaur	Suague	Santa Barbara	Aganan	Jalaur Extension	Total
SERVICE, ACCESS & FARM ROADS														
Right of way	ha	17,000	49	21	28	33	27	158	825	355	475	568	452	2,675
Ordinary excavation	m^3	6.50	20,000	12,600	20,300	29,400	29,200	111,500	130	82	132	191	190	725
Compacted fill using borrowed material with 300 m overhauling	m^3	15	310,000	160,000	70,000	100,000	250,000	890,000	4,650	2,400	1,050	1,500	3,750	13,350
Gravel and/or selected material for surfacing including compaction	m^3	25	130,000	60,000	50,000	56,000	85,000	381,000	3,250	1,500	1,250	1,400	2,125	9,525
Class A concrete	m^3	1,000	1,800	400	400	1,400	300	4,300	1,800	400	400	1,400	300	4,300
Grouted riprap	m^3	130	500	200	300	1,200	200	2,400	65	26	39	156	26	312
Sand and gravel bedding below riprap	m^3	35	200	100	100	400	100	900	7	4	4	14	4	33
Precast concrete slabs for bridges	m	900	-	40	230	50	-	320	-	36	207	45	-	288
Pipe railings for bridges	m	75	600	300	600	1,200	200	2,900	45	23	45	90	15	218
Miscellaneous metalwork	ton	16,000	6	2	3	6	1	18	96	32	48	96	16	288
Farm roads 2.0 m wide, earthwork and compaction	km	10,000	50	20	40	40	20	170	500	200	400	400	200	1,700
Pipework (18" to 24" dia. pipes)	m	140	800	300	500	500	300	2,400	112	42	70	70	42	336
Subtotal									11,480	5,100	4,120	5,930	7,120	33,750
ON-FARM DITCHES & DRAINS														
Right of way	ha	17,000	150	50	80	90	50	420	2,550	850	1,360	1,530	850	7,140
Earthwork for main farm ditch	km	14,000	170	60	90	100	50	470	2,380	840	1,260	1,400	700	6,580
Earthwork for supplementary field ditch	km	11,000	250	80	130	150	80	690	2,750	880	1,430	1,650	880	7,590
Earthwork for farm drain	km	8,000	230	80	120	130	80	640	1,840	640	960	1,040	640	5,120
Compacted fill in concrete lining parts of ditch	m^3	10,000	6	2	3	4	2	17	60	20	30	40	20	170
Concrete lining	m^3	400	500	180	250	300	180	1,410	200	72	100	120	72	564
Class A concrete	m^3	1,000	700	250	350	420	250	1,970	700	250	350	420	250	1,970
Miscellaneous metalwork	ton	16,000	2	1	1	2	1	7	32	16	16	32	16	112
Gates with installation	ton	30,000	14	5	6	7	5	37	420	150	180	210	150	1,110
Pipe work (18" to 24" dia. pipes)	m	140	2,000	700	1,000	1,200	700	5,600	280	98	140	168	98	784
Farm turnouts with stop-plank grooves	each	180	3,500	1,200	1,900	2,200	1,100	9,900	630	216	342	396	198	1,782
Precast check structures for main farm ditch	each	200	500	180	270	300	150	1,400	100	36	54	60	30	280
Precast check structures for supplementary field ditch and end structures	each	190	1,000	320	520	600	320	2,760	190	61	99	114	61	525
Miscellaneous	lump sum	-	-	-	-	-	-	-	248	71	199	170	85	773
Subtotal									12,380	4,200	6,520	7,350	4,050	34,500
WATER MANAGEMENT STATIONS														
Right of way	ha	17,000	15	5	7	9	5	41	255	85	119	153	85	697
Water master working station	m^2	350	720	240	360	440	240	2,000	252	84	126	154	84	700
Storage area	m^2	200	450	150	230	280	150	1,260	90	30	46	56	30	252
Covered drying floor (nipa & bamboo roofing)	m^2	100	5,550	1,800	2,850	3,050	1,800	15,050	555	180	285	305	180	1,505
Open drying floor	m^2	60	10,800	3,600	5,400	6,370	3,600	29,770	648	221	324	382	221	1,796
Subtotal									1,800	600	900	1,050	600	4,950
TOTAL COST									40,890	15,290	17,470	23,470	31,050	128,170

/1 Unit cost indexed to January 1977 levels.

/2 Quantities revised from feasibility estimates by 5 to 15% during mission review.

ANNEX 5
Table 4

PHILIPPINES

JALAUR IRRIGATION PROJECT

O&M BUILDINGS

Quantities and Cost Estimates

Item	Unit	Quantity	Unit Price (₱)	Amount (₱ '000)
1. Project Headquarters				
Land with landscaping & fencing, etc.	Ha	3	60,000	180
Roads, sewage & water supply, etc.	LS	-	-	300
Buildings:				
Offices, infirmary & staff quarters	m^2	1,450	800	1,160
Laboratory facilities	m^2	80	750	60
Warehouse, workshop & powerhouse, etc.	m^2	850	600	510
Car garage	m^2	150	400	60
Sport courts, etc.	LS	-	-	130
Subtotal				2,400
2. Field Offices				
Land with landscaping & fencing, etc.	Ha	2	60,000	120
Roads, sewage & water supply, etc.	LS	-	-	200
Buildings:				
Offices & staff quarters	m^2	1,000	800	800
Warehouse, workshop & security force barracks, etc.	m^2	850	600	510
Car garage	m^2	100	400	40
Sport courts, etc.	LS	-	-	130
Subtotal				1,800

ANNEX 5
Table 5

PHILIPPINES

JALAUR IRRIGATION PROJECT

O&M BUILDINGS

Cost Estimate

		Local	Foreign	Total
			(US$'000)	
1.	Project headquarters	220	100	320
2.	Field offices	170	70	240
	Subtotal	390	170	560
	Contingencies (10%)	40	20	60
	TOTAL	430	190	620

PHILIPPINES

JALAUR IRRIGATION PROJECT

WATER MANAGEMENT TRAINING

Cost Estimate

		Local	Foreign	Total
		(US$'000)		
1.	Project personnel	220	60	280
2.	Equipment, supplies and materials			
	(a) Office supplies, materials and furniture	15	15	30
	(b) Farm equipment	8	16	24
	(c) Vehicles	-	70	70
	(d) Hydromet. equipment	-	10	10
	(e) Fuel, oil, spares	-	30	30
	(f) Field supplies and materials	-	40	40
	(g) Sundries	77	9	86
	Subtotal	100	190	290
	Subtotal Items 1 & 2	320	250	570
	Contingencies (10%)	30	30	60
	TOTAL	350	280	630

PHILIPPINES

JALAUR IRRIGATION PROJECT

Expected Price Increases

	Calendar Year					
	1977	1978	1979	1980	1981	Total
	(US$ '000)					
1. Civil Works						
Irrigation and drainage facilities	2,200	6,700	7,000	4,800	2,800	23,500
O&M buildings	120	300	200	-	-	620
Subtotal	2,320	7,000	7,200	4,800	2,800	24,120
Annual inflation rate (%) /1	12	12	12	10	10	-
Expected price increases	160	1,500	2,600	2,440	1,820	8,520
2. Equipment and Services						
Technical assistance	100	-	-	-	-	100
O&M equipment	-	300	130	-	-	430
Water management training	60	200	150	150	70	630
Subtotal	160	500	280	150	70	1,160
Annual inflation rate (%) /1	8	8	8	7	7	-
Expected price increases	10	60	60	40	30	200
Total without price increases	2,480	7,550	7,480	4,900	2,870	25,280
Expected price increases	170	1,560	2,660	2,480	1,850	8,720
Total with price increases	2,650	9,110	10,140	7,380	4,720	34,000

/1 Calculated by compounding the estimated rate of price increases in prior year and one-half the rate of increase in the year concerned.

PHILIPPINES

JALAUR IRRIGATION PROJECT

Equipment for Force Account Work

Item	Quantity	Unit Cost	Total Cost
		----(US$'000)----	
Tractor, crawler 140 hp	3	70	210
Tractor, crawler 90 hp	5	48	240
Crane, crawler, dragline 3/4 cu. yd.	4	85	340
Hydraulic backhoe, crawler 0.4 cu. yd.	7	35	245
Tractor, industrial w/backhoe loader	15	30	450
Front end loader, wheeled 1.5 cu. yd.	5	34	510
Farm tractor with blade attachment 75 hp	5	15	75
Truck, tractor w/25 ton trailer	1	50	50
Motor grader, 125 hp	3	50	150
Roller, 3-wheel steel 12 ton	1	30	30
Roller 5 ton	3	15	45
Roller 1.0 m wide	6	10	60
Mixer, concrete 1/2 cu. yd.	13	12	156
Compactor 19 x 24 in. plate w/generator	13	6	78
Water pumps 2 to 6 in. size	16	1	16
Truck, dump 6-8 cu. yd.	13	25	325
Truck, flatbed 6 ton	7	20	140
Truck, water	1	20	20
Truck, forklift	1	20	20
Truck, fuel and lubrication service	1	40	40
Truck, pickup 3/4 ton 4 x 4	8	10	80
Mobile repair shop, truck mtd.	1	70	70
Station wagons 4 x 4	6	10	60
Jeep, utility vehicle 4 x 4	10	9	90
Miscellaneous tools & equipment			40
Subtotal			3,540
Spare parts 10%			360
TOTAL			3,900

PHILIPPINES

JALAUR IRRIGATION PROJECT

Equipment for Operation and Maintenance

Item	Quantity	Unit Cost	Total Cost
		----(US$'000)----	
Water pumps 2 to 4 in. size	8	1	8
Station wagon 4 x 4	4	10	40
Jeep, utility vehicle 4 x 4	8	9	72
Truck, pickup 3/4 ton 4 x 4	6	10	60
Motor bike 100 cc	70	1	70
Weed cutter	250	0.3	75
Radio transceiver (single Sb)	6	4	24
Miscellaneous tools & equipment (lump sum)			41
Subtotal			390
Spare parts (10%)			40
TOTAL			430

PHILIPPINES

JALAUR IRRIGATION PROJECT

WATER MANAGEMENT TRAINING

List of Equipment and Vehicles

Item	Quantity	Unit Cost (US $)	Total Cost
1. Office and Training Equipment			
Typewriters	4	500	2,000
Mimeo machines	4	1,000	4,000
Desk calculators	8	100	800
Slide projectors w/screens	4	250	1,000
Cameras	3	300	900
Movie projector	1	2,400	2,400
Public address systems	5	1,600	8,000
Tape recorders w/cassettes	4	200	800
Moisture meters	3	500	1,500
Miscellaneous office furniture	-	-	8,600
Subtotal			30,000
2. Farm Equipment			
Row seeders	3	300	900
Transplanters	3	300	900
Rotary weeders	30	50	1,500
Power tillers w/attachments	3	1,200	3,600
Boom sprayers	3	400	1,200
Threshers	3	2,500	7,500
Farm tractor w/attachments 45 hp	1	8,400	8,400
Subtotal			24,000
3. Vehicles			
Bicycles	12	100	1,200
Motorcycles 100 cc	6	1,000	6,000
Truck, pickup 1/2 ton	3	8,000	24,000
Jeep, wagon 4 x 4	2	9,000	18,000
Bus, 40 seat	1	20,800	20,800
Subtotal			70,000
4. Hydromet Equipment			
Portable Parshall flumes	3	600	1,800
Water level recorders	3	500	1,500
Raingauges	3	200	600
Evaporation pans	3	300	900
Miscellaneous			5,200
Subtotal			10,000
5. Miscellaneous Equipment			
Provision for unlisted items of equipment, apparatus and instruments.			16,000
TOTAL			150,000

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JALAUR IRRIGATION PROJECT

Estimated Schedule of Expenditures

Item	Total Cost	FY78 /1	FY79	FY80	FY81	FY82
			(US$'000)			
Project service area	24,120	5,820	7,100	6,000	3,800	1,400
O&M equipment	430	150	210	70	-	-
Water management training	630	160	180	150	110	30
Subtotal	25,180	6,130	7,490	6,220	3,910	1,430
Expected price increases	8,820	960	2,130	2,600	2,190	940
Total Project Cost	34,000	7,090	9,620	8,820	6,100	2,370

/1 IBRD Fiscal years.

ANNEX 7
Table 2

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JALAUR IRRIGATION PROJECT

Estimated Schedule of Disbursements

IBRD Fiscal Year and Semester	Accumulated Disbursements US$'000 Equivalent
Fiscal Year 1978	
1st	1,300
2nd	3,100
Fiscal Year 1979	
1st	5,100
2nd	7,600
Fiscal Year 1980	
1st	9,800
2nd	11,500
Fiscal Year 1981	
1st	12,600
2nd	13,500
Fiscal Year 1982	
1st	14,200
2nd	14,700
Fiscal Year 1983	
1st	15,000

ANNEX 7
Table 3

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JALAUR IRRIGATION PROJECT

Proposed Allocation of Proceeds of Loan

Category	Costs		Proposed Loan
	Total	Foreign	
	(US$ million)		
I. Civil Works:			
Project service area /1	13.80	4.43	6.8*
Water management training /2	0.40	0.10	
Expected price increases	6.80	2.12	
Subtotal	21.00	6.65	
II. Equipment: /3	4.50	4.30	6.4
Expected price increases	1.90	1.87	
Subtotal	6.40	6.17	
III. Technical Assistance	0.10	0.08	0.1
IV. Unallocated: /4			
Physical contingencies	4.40	2.10	1.7
(Administrative & engineering)	(2.10)	-	
Total	34.00	15.00	15.0

* Of which (a) US$2.0 million for mobilization and contractors' equipment and (b) US$4.8 million for other civil works. Disbursement for (a) will be 100% of foreign expenditure up to 20% of the value of each contract and for (b) 25% of total expenditure.

Disbursement will be 100% of foreign expenditure for directly imported equipment, 100% of expenditure (ex-factory) for locally manufactured equipment and 65% of total expenditure for imported equipment procured locally.

Disbursement will be 100% of total expenditure.

/1 Force account equipment (US$3.9 million) excluded and transferred to Category II; Annex 6, Table 1.
/2 Excludes cost of equipment (US$150,000); Annex 6, Table 3.
/3 Includes equipment for force account (US$3.9 million), O&M (US$430,000), and water management training (US$150,000).
/4 See Annex 5, Table 1.

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JALAUR IRRIGATION PROJECT

Organization & Management

1. Since 1964 overall responsibility for the national irrigation systems in the Philippines has been vested in the National Irrigation Administration (NIA). The NIA was set up under Republic Act No. 3601 to investigate, study, improve, construct and administer all national irrigation systems. It was given the power to investigate all available water resources in the country in order to utilize them for irrigation and to collect water rates from the beneficiaries of the national irrigation systems. Presidential Decree No. 552 of September 11, 1974 has further widened NIA's scope by giving it ".... broader powers and authority to undertake concomitant projects such as flood control, drainage, land reclamation, hydraulic power development, domestic water supply, road or highway construction, reforestation and projects to maintain ecological balance, in coordination with the agencies concerned." The NIA is financed by the Government through the sale of bonds or from appropriations.

2. The governing body of the NIA is the Board of Directors, composed of a Chairman and five members, who are all ex-officio except for one member appointed by the President of the Philippines on the recommendation of rice and corn growers. Management of the NIA is the responsibility of an Administrator appointed by the President. The Administrator is also Vice-Chairman of the Board. Directly below the Administrator there are three Assistant Administrators, respectively responsible for Special Projects, Engineering and Operation, and Finance and Administration. Field services are managed by eight regional and two subregional offices, together with a number of special project offices.

3. The NIA has recently been reorganized and expanded to meet the wider responsibilities imposed on it by Presidential Decree No. 552 and by the Government's policy of accelerating irrigation development. As a result of this reorganization all of the major foreign-assisted projects have been integrated under the Special Projects Organization office, thus avoiding duplication and increasing transfer of experience between projects. The Special Projects Organization would also be responsible for executing and operating the Jalaur project.

4. NIA would appoint the Regional Engineer (Region V) stationed in Iloilo as Jalaur Project Manager; he would be responsible to the Assistant Administrator for Special Projects. Day-to-day responsibility for construction would rest with an Assistant Project Manager to be stationed near Pavia, the proposed location of project headquarters. NIA expects to meet the staff requirements by transfer from the Angat-Magat Integrated Agricultural Development Project, which is nearing completion. The Special Projects Engineering Department would design plans and prepare estimates for the Project works, except for on-farm facilities (para. 5), and would also undertake contract administration work.

5. The proposed organization for construction is shown in Chart No. 16392. The Project Engineering Division would be responsible for the preparation of plans, programs, design and estimates of on-farm facilities as well as revisions dictated by field conditions of those works designed in the central office. The Administrative Division would be responsible for personnel and records management, accounting, property, procurement and other services. The agricultural phase of the project would be handled by the Agricultural Division and the Equipment Division would provide maintenance and services for construction equipment and vehicles to be used on force account construction. There would be two construction divisions: the first, located at Pototan would be responsible for the rehabilitation of the Suague system and the rehabilitation and extension of the Jalaur system; the second, located at Pavia, would be responsible for work on the Santa Barbara and Aganan systems.

6. The proposed organization for operation and maintenance is shown in Chart No. 16391(R). The headquarters staff under the project Manager would consist of four support divisions: an Engineering and Operation Division, an Agriculture Division, an Equipment Division and an Administrative Division. The Equipment Division would handle the equipment of the project, and the Agriculture Division would be responsible for the water management training center, introducing new water management techniques and farming methods as well as ensuring that necessary agricultural support services are established in the area. The Engineering and Operation Division would be responsible for day-to-day maintenance activities and operation of the system including water scheduling, while the Administrative Division would handle personnel and records management, accounting and other services. For operation and maintenance purposes, the project area would be divided into two irrigation districts based in Pototan and Pavia. The Pototan district would serve a total area of 14,600 ha covering the Jalaur and Suague systems. The Pavia district would cover the Santa Barbara and Aganan systems serving a total area of about 10,000 ha. Each district would be further subdivided into divisions of about 2,500 ha each controlled by a supervisor and would be subdivided into 500 ha units, each under a Water Management Technologist (WMT). A ditch tender would be employed for every 100 ha, two of the basic 50 ha units. Each WMT therefore would be responsible for about five ditch tenders. The estimated annual cost of operation and maintenance is ₱ 180 (US$24) per ha as shown below:

Cost of Irrigation Operation and Maintenance /1

	Annual Cost (P/ha)	Annual Cost (US$/ha)
Salaries and wages	110	14.60
Equipment operation	35	4.10
Materials and supplies	5	0.70
Administrative & general expenses	30	4.00
Total	180	24.00

/1 From detailed NIA estimates of personnel and equipment requirements, based on experience in UPRP.

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JALAUR IRRIGATION PROJECT

Supporting Agricultural Services

1. Many Government organizations currently have dealings with the farmers, the principal agencies are:

(a) Bureau of Agricultural Extension (BAE);

(b) Bureau of Plant Industry (BPI);

(c) Department of Agrarian Reform (DAR);

(d) Agricultural Credit Administration (ACA);

(e) Department of Local Government and Community Development (DLGCD);

(f) National Grains Authority (NGA); and

(g) National Irrigation Administration (NIA).

In addition, there are the non-Government Rural Banks (RB).

2. In the Upper Pampanga River Project (UPRP) the need for coordinating the various agencies providing services to the farmers was clearly felt. An Agricultural Development Coordinating Council (ADCC) was established for the project to provide day-to-day control and coordination of the activities of the various agencies within the project area. The ADDC consisted of the Provincial Heads of all the participating agencies. The arrangement is working well in UPRP and similar organizations are being set up for the Tarlac Irrigation Systems Improvement Project, the Rural Development Project on Mindoro and the Magat project. An ADCC based on Iloilo Province would be established for the proposed project.

3. The BAE is mainly responsible for agricultural extension, with technical back-up provided by the BPI. Under the Masagana 99 program aimed at increasing rice production, a total of 95 agricultural technicians was used in the project area. The technicians, all graduates, came mainly from BAE and DAR. This worked out to a ratio of one extension worker to about 210 farmers.

4. The project would be organized on the basis of irrigation units of 50 ha in the same manner as the Pampanga, Tarlac, Magat and Chico projects. The 20 to 25 farmers in such a unit would be given every incentive to work together as a group. The NIA would schedule irrigation on a rotational

basis thus promoting a uniformity of operations within each unit at any given time. The rotational area would also be the basic unit for the provision of credit and the building block for the eventual organization of irrigation associations and cooperatives. In the Bank-assisted irrigation projects, the NIA is assigning a Water Management Technologist to every ten units. The same staffing pattern would be applied to the Jalaur project (see Annex 8). The water management staff would supplement the existing extension personnel provided by the various Government agencies and would help to increase extension coverage in the project area.

5. New extension work items to be emphasized would include improved irrigation and drainage practices, the importance of scheduling operations, the use of good quality seed and even planting, proper fertilizer application, weed and pest control, and the use of tillage and threshing machinery.

Research

6. The Visayas Rice Experiment Station at Leganes in the project area is operated by the BPI. Research work includes varietal screening, fertilizer rates, direct seeding methods with the attendant weed, insect and rodent control, and multiple cropping plus some minor projects. Some 42 ha of the station are used to produce foundation seed for the certified seed program of the province. A water management pilot project was set up at Potatan in 1974 by the NIA in cooperation with the Philippine Council for Agricultural Research (PCAR). The research undertaken at this station includes water use studies of rice and the use of effective rainfall as a guide for timing of irrigation in relation to HYV and different fertilizer rates. The work would be valuable to the project in developing information for making maximum use of limited water supplies. The BAE conducts trials and demonstrations in cooperation with the Agricultural College of the University of the Philippines and the International Rice Research Institute. The Bureau of soils has a unit in the province. NIA has good working relations with these agencies and the project would be able to draw on research back-up from all these sources.

Fertilizer

7. Annual consumption of fertilizer in the project area currently amounts to 5,800 tons, of which about 30% is in the form of urea and ammonium sulphate and the balance is evenly divided between ammonium phosphate and compound formulations like 15-15-15. Application rates run at fairly high levels, the average being 55, 17 and 6 kg/ha for nitrogen, phosphate and potash respectively. At full development the project would require some 9,600 tons of fertilizer annually of which 68% would be urea and the balance triple super-phosphate. In terms of nutrients the average rate of application per crop season would be 80 kg/ha nitrogen and 40 kg/ha phosphoric acid. There are four dealers and 28 subdealers of fertilizer and agro-chemicals in the project area who would handle the increased demand without difficulty.

Seed

8. About 2,000 tons of rice seed per annum are presently used in the project area. The requirement that Masagana program farmers use certified seed has promoted the development of a large seed growing capability. There are currently about 100 registered growers of certified seed on just under 2,500 ha under BPI supervision. Production from this area already exceeds local demand. At full development the annual seed requirement for the project area would total about 1,840 tons, of which not more than about 450 tons would be certified. There would be no difficulty in obtaining this amount.

Farmers' Organizations

9. As part of the Agrarian Reform program, the Government, through the DLGCD, is promoting the formation of precooperative farmers' organizations, based on the barrio or hamlet. The organizations would serve as channels for the inflow of technical services, credit and inputs and as assembly points for produce intended for market. There are 255 precooperatives with 10,000 members in the project area, with 34 assigned field workers and 216 volunteer barrio workers. It is hoped that these organizations will grow into fully-fledged, formally constituted cooperatives. This approach to cooperative organization fits in well with the 50 ha irrigation unit approach by NIA on Bank-assisted irrigation projects.

10. The NIA is committed to the creation of irrigation associations among the farmers which would eventually assume a large part of the responsibility for the operation and maintenance of the national irrigation systems. Without losing sight of the ultimate objective, the main thrust of NIA's efforts in the Bank-assisted projects has been to organize the farmers within the 50-ha units, primarily for production and water management. The immediate aim is to demonstrate to the farmers that working together and using water efficiently is possible and profitable. Once this has been established, a realistic framework for setting up irrigation associations would exist. The project area would be expected to follow the pattern and gain from the experience of the earlier Luzon projects.

Credit

11. Some 40% of the farmers in the project area finance their requirements of farm inputs and hired labor from their own resources. The remainder use some form of credit. The principal sources are:

(a) banks, notably the Rural Banks (RB), the Philippine National Bank (PNB), the Development Bank of the Philippines (DBP) and private banks;

(b) the Agricultural Credit Administration (ACA);

(c) input dealers, marketing organizations and millers; and

(d) money lenders.

Fifteen of the 26 RBs in Iloilo province are within reach of the project area farmers.

12. To ensure the success of the Agrarian Reform program, the Government has proceeded to strengthen the credit institutions and to facilitate the granting of production credit to small farmers who previously depended on the landlord and private money lenders for their requirements. RBs have been authorized rediscounting privileges of 100%, Government guarantees of up to 85% of the loans made and low-cost money is available from the Central Bank. The easier credit thus made available is employed under a system of "supervised credit", which includes the provision of technical services to the borrower to ensure that recommended practices, including variety, fertilizer and agro-chemical inputs, are adopted. Loans granted under supervised credit are not secured by collateral, but are covered by a Government guarantee; the interest is at 12% per annum and the loan is for a period of six months. During the 1974 wet season crop, a total of about ₱ 40.7 million (US$5.4 million) was issued as production credit to rice farmers in the Masagana program in Iloilo province. The PNB accounted for about 48% of the total, the RBs for 47% and the ACA for the balance. The area covered by the credit amounted to 53,000 ha. It is estimated that about 11,000 ha in the project area, or 45% of the total, received ₱ 9.5 million (US$1.3 million) under the program.

13. Under the Masagana program, production credit was given up to ₱ 800/ha, consisting of ₱ 430 for inputs and ₱ 370 for labor and subsistence. The Government has since raised the rate to ₱ 1,200/ha, made up of ₱ 680 for the inputs and ₱ 520 for labor and subsistence. The increased rate is a little below the production costs estimated at full development. Assuming that at full project development about 20% of the farmers in the project area would find their requirements of inputs and hired labor from their own resources, some 9,600 farmers would need credit from institutional sources. At a loan level of ₱ 1,200/ha the total annual credit requirement at full development would amount to ₱ 34.2 million (US$4.6 million). The existing credit institutions would be able to meet the requirement.

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Present and Projected Cropping Patterns and Production

Present Cropping Pattern

1. All but a small portion /1 of the 24,700 ha in the project are cultivated to rice in the wet season. Of these about 22,000 ha are irrigated and the remaining 2,700 are rainfed. The irrigated land is located in four gravity systems operated by NIA. In the irrigated area approximately 7,500 ha are cultivated during the dry season for a cropping intensity of 134%. However, for the project area as a whole the present cropping intensity is 130%. Rice is by far the most important crop in the area. Small areas of corn, mung beans, cowpea, melons and vegetables are grown without irrigation in the dry season. Annual paddy production is estimated at about 80,000 tons.

2. Wet season irrigated rice is grown between June and December. Transplanting time in this area is about eight weeks, which is shorter than other areas in the Philippines; any use of direct seeding would reduce it further. About 10% of the farmers own small tractors and about half of the farmers utilize these tractors for land preparation in combination with animal power. There is an ample supply of agricultural labor in the area and much of the field work is still done manually. On about 85% of the area rice is transplanted from field nurseries onto previously puddled land, while on the balance of the land it is direct seeded with soaked seed and broadcast into fully drained puddled fields. The dry season crop is planted in January and February and harvested by traditional, manual methods between mid-April and mid-May. Only a few mechanical threshers are in use in the area.

3. On the presently irrigated land 85% of the area is planted to improved varieties. The average paddy yield in the rainfed areas is about 1.8 ton/ha, on the irrigated areas the yield in the wet season is about 2.7 ton/ha and 2.4 ton/ha in the dry season./2 Higher yields are expected in the dry season due to better growing conditions, but water supply and distribution are unsatisfactory in the project area in the dry season. The rice yields in Iloilo are better than in Central Luzon.

/1 Less than 1,000 ha of sugarcane are scattered in patches along the rivers.

/2 Yields in the Aganan system are about 20% lower because of higher risks of water shortage.

Future Cropping Pattern

4. In the absence of the project the rate of increase in yield in the rainfed area is estimated at about 1.4% per annum and would probably be due to a slow increase in the area under high yielding varieties. In the irrigated areas the yields in both wet and dry season crops are estimated to increase about 1.5% per annum as a result of gradual improvement of crop management. The use of inputs would be expected to increase with the availability of greater supplies of credit and further extension efforts as part of the Government's campaign for national rice self-sufficiency. Existing cropping intensities would remain unchanged in the absence of additional water supplies and improvement of the systems.

5. The expected changes in the cropping pattern and production under the project are shown in Table 1. Some 24,700 ha would be provided with wet season irrigation, of which 2,700 ha are currently rainfed. Improved facilities in the four irrigation systems and better water management would allow dry season cropping to increase from the current 7,500 ha to 12,000 ha. Overall cropping intensity in the project area would rise from the present 130% to 149%. The proposed cropping pattern based solely on rice is consistent with soils and topography and the customs of the local people.

Future Yields

6. With good water control, adequate supplies of credit and inputs and increased extension service support, future paddy yields under irrigation are expected to be 4.0 ton/ha in both the wet and dry seasons. The projected yields would be reached five years after the rehabilitation of the present facilities and the completion of the Jalaur extension. The improved yields would be obtained from the use of high yielding varieties throughout the project area, better land preparation through greater use of machinery, certified seed, heavier fertilizer inputs and greater expenditures on crop protection and weed control. The improved road network envisaged under the project would improve access to the farms, thus facilitating the inflow of inputs and outflow of produce.

Development Constraints

7. The project would add 4,500 ha of dry season cropping resulting in an 28% increase in labor requirement, a greater degree of mechanization of both land preparation and harvesting, and a demand for additional drying and storage facilities. The most important issues are examined briefly.

8. Cropping Calendar. Chart No. 16408 shows the existing cropping calendar which would remain unchanged under the project. The cropping calendar minimizes weather hazards by harvesting in November and December

for the wet season crop and in April and May for the dry season crop. Typhoons are infrequent, particularly in the wet season harvest period. The calendar allows for a 30-day closure period for system maintenance in April for the Jalaur-Suage river systems and in May for the Santa Barbara-Aganan systems.

9. Labor Availability. The supply of and demand for labor with and without the project are examined in detail in Annex 13.

10. Mechanization. Mechanization has not progressed in the project area to the same degree that it has in Central Luzon. At present, 10% of the farmers own small tractors which are used on about half of the project area for the basic cultivation, with animal-drawn equipment doing the subsequent harrowing and smoothing operations. On the remainder of the land all operations are done with animal-drawn implements. With improved water management, better access to fields, tighter operating schedules to maximize water use, increased cropping intensities, and use of earlier maturing varieties, it is estimated that about 70% of land preparation would be mechanical. It is anticipated that the machinery, mostly two-wheel tractors and rotary tillers, would be owned by farmers and contracted out to their neighbors, as is currently the practice.

11. Harvesting. A sickle is used for harvesting and threshing is done manually. There are no large threshers in the project area. Under project conditions of better access to the fields, it is assumed that some 50% of the cropped area would be threshed mechanically. The small drum-loop type thresher is manufactured in Iloilo and the area could easily be supplied with the machines.

12. Drying and Storage. Threshed paddy is currently sun-dried or air-dried on whatever suitable surfaces are available. Some of the rice mills and farmers' cooperatives have concrete drying floors. In addition, the NGA operates three grain driers in the area with a capacity of 15 tons per 8-hour day. Existing arrangements appear to be adequate for the present paddy crop of 80,000 tons. At full development the annual production from the project would total 147,000 tons. Production from the wet season crop would increase by 60%. Production from the dry season crop harvest should not present problems as it would take place mainly between February and April, at the driest time of the year. Some expansion in drying facilities, both solar and mechanical, would be needed to deal with the increased output of the wet season crop harvested in the relatively wetter October-November period. The DLGCD is currently engaged in a program to provide every barrio with a paved area to be used for recreation and crop drying. The project would provide additional solar drying facilities attached to the WMT stations. Millers and farmers' cooperatives are aware of the need for drying and can be expected to provide whatever additional facilities are required. Storage capacity in the project area and at the nearby port of Iloilo is ample for existing requirements, but would need some expansion to meet increased yields. The NGA plans to build additional storage and the private sector is expected to follow suit to accommodate rising paddy production from the project area.

12. Processing. There are 400 privately owned rice mills and hullers in the project area, many of the hullers are portable and move along the main roads to barrios and municipalities. Assuming a 12 hour working day and a 200-day milling season, the mills have a capacity of 135,000 tons of paddy per year. In addition, the NGA owns a mill with a capacity of 5 tons of paddy per 12-hours operation or 1,000 tons per year. The existing annual capacity of 136,000 tons is greatly in excess of present needs but some expansion would be required to handle production from the project at full development. No difficulties are anticipated in providing the required extra milling capacity as the private sector is enterprising and has access to capital.

Marketing

13. The farmer may sell his surplus paddy to a middleman, store it in a private or Government-owned warehouse in the hope of obtaining a better price, have it milled and sell the rice to a trader, or sell the paddy to the NGA at the Government support price. While the Government is involved in the marketing sector, there is no authority with specific responsibility for marketing. The part played by Government agencies and farmers' marketing cooperatives is remarkably small. With the emphasis currently being placed on the development of cooperatives as an essential support to agrarian reform, it is likely that at full project development, cooperatives would play a larger role in marketing paddy.

Table 1

Summary of Rice Cropping Pattern and Production

	Cropped Area		Paddy Production	
	Present	Future	Present	Future /1
	------(ha)------		--('000 tons)---	
Wet Season				
Irrigated rice	22,000	24,700	55.6	98.8
Rainfed rice	2,700	-	4.9	-
Subtotal	24,700	24,700	61.5	98.8
Dry Season				
Irrigated rice	7,500	12,000	18.0	48.8
Total	32,200	36,700	79.5	146.8
Cropping Intensity	130%	149%		

/1 At full development 1985.

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Market Prospects and Prices

Market Prospects

1. One of the Philippines Government's main policy goals is self-sufficiency in basic foods, especially rice and corn. A deficit in rice, the main staple food crop, has been a persistent problem. Official figures show that for 1963-1967 the Philippines imported an average of about 300,000 tons of rice annually. Although the Government did not import rice in 1969 or 1970, stocks declined in those years. Rice imports were again over 300,000 tons in 1971, 1972 and 1973, reaching 456,000 tons in 1972 because of disastrous floods that year. Good domestic crops allowed smaller rice imports of 170,000 tons in 1974, and about 150,000 tons in 1975. Due to an exceptionally good 1975/76 harvest, there have been no imports thus far in 1976.

2. For the second year running, the Philippines produced a record rice crop in 1975. For the crop year ending June 30, 1975, paddy production officially was 5.7 million tons harvested from 3.5 million ha, yielding some 1.6 ton/ha. This was slightly larger (by 1%) than the record 1973/74 crop. Despite good harvests the last two years, rice self-sufficiency is not imminent. With a population of 42 million, converting paddy to milled rice at a 63% recovery rate, and adding 200,000 tons consumed from imports, per capita consumption of milled rice in 1974/75 was 90 kg. Based on a population forecast of 55 million in 1985 (Philippines Basic Economic Report, 1975), and assuming that the annual per capita consumption of milled rice remains at 90 kg, total Philippine rice demand in 1985 would be some 5.0 million tons. At a 63% recovery rate, this is equivalent to 7.9 million tons of paddy. To meet this demand, paddy output would have to increase by 4% yearly between 1975 and 1985. This rough demand computation is in line with the Basic Economic Report, 1975, which suggests rice production will have to expand by 4% per year if domestic demand is to be met and imports eliminated. Comparing the 3 year averages of 1965 to 1967 and 1973 to 1975, paddy production increased by an average of 3.4% per annum. This increase was due in large part to the spread of high yielding varieties (HYVs), especially in irrigated areas. With the use of HYVs fairly widespread where applicable, other sources of growth will have to be sought to maintain the previous decade's 3.4% growth rate let alone increase that rate to 4%. The project would help maintain the country's growth rate in rice production, and farmers should have no difficulties in marketing the additional rice from the project area. The project area has traditionally supplied rice for consumption in Iloilo, Negros Occidental, and Aklan and Antique provinces on Panay island. With the project, this pattern would mainly continue, with buyers from Negros purchasing most of the additional rice.

Prices

3. Since 1957 the Government has set an annual farm gate support price for paddy to encourage production and allow some purchases of paddy by Government to build stabilization stocks. Responsibility for operating the system rested with an independent body, the Rice and Corn Administration, which operated unsatisfactorily. On September 28, 1972, the responsibility for rice and corn was transferred to a statutory body, the National Grains Authority (NGA).

4. During the late 1950s and early 1960s the support price remained virtually unchanged and was ₱ 9.5 per cavan /1 (₱ 216/ton) in 1961. Thereafter, it was gradually increased and by 1971 it reached ₱ 20.0 per cavan (₱ 454/ton). Although no precise figures are available to compare the annual average market and support prices for paddy before 1965, the Sector Survey /2 shows the market price about 10% higher in 1965, and the support price about 10% higher from 1966 to 1970. Since 1971 the market price has generally exceeded the support price, except in areas where the NGA has not operated. The NGA only commenced buying in the project area in crop year 1974/75. Before then, unofficial figures suggest the market price was considerably below the support price in the project area.

5. The behavior of market prices in relation to the support price is consistent with the record of domestic paddy output during the past decade. In the early 1960s, domestic production was unable to meet the growing demand for rice and this tended to raise market prices above the support price. After the mid-1960s, increased production as a result of the spread of high yielding varieties improved the balance between domestic production and consumption and tended to depress market prices. During the last three to four years the trend has reversed and the market and support prices are practically the same. As a result of continuing inflation and to encourage farmers to increase paddy production, the Government has continued to raise the official support price for paddy, which in June 1976 was ₱ 55 per cavan (₱ 1,100/ton). In the project area, the market farm gate price was ₱ 52 per cavan (₱ 1050/ton).

6. Through 1972, the farm gate support price for paddy and the domestic consumer price for rice kept pace with changes in the world market price for rice. Between 1972 and 1975, however, to keep domestic prices down in the face of record high world market prices for rice, the Government has subsidized consumers by maintaining a low official ceiling price for rice and a correspondingly low farm gate price for paddy by sales of imported rice on the domestic market below cost. This subsidy cost the Government about US$20 million in 1974.

/1 Before 1974 a "cavan" or sack of paddy was equivalent to 44 kg. Since 1974 the official weight of a cavan of paddy is set at 50 kg.

/2 IBRD Agricultural Sector Survey, Philippines, May 2, 1973 (Report No. 391-PH). Annex 10, Table 13.

7. The Bank projects the world market price of Thai 25%-35% broken rice to rise (at constant January 1977 prices) from US$220 per ton f.o.b. Bangkok in 1976 to around US$260 per ton in 1985. These projections have been used to estimate the present and future farm gate prices of paddy for the farm budgets and the economic analysis. In the farm budgets, using the official exchange rate (US$1.00 = ₱ 7.50), the corresponding farm gate prices rise from ₱ 1,050 per ton (₱ 52 per cavan) in 1976 to ₱ 1,285 per ton (₱ 65 per cavan) in 1985. For the economic analysis, using a shadow priced foreign exchange rate (US$1.00 = ₱ 8.33), farm gate paddy prices rise from ₱ 1,225 per ton (₱ 61 per cavan) to ₱ 1,425 per ton (₱ 71 per cavan). Over the same period the current paddy support price of ₱ 55 per cavan is assumed to rise to ₱ 65 per cavan at constant January 1977 prices. This implies that by 1985 the subsidy to consumers would fall to zero, and the market farm gate price and the support price for paddy on average would be equal.

8. Table 1 shows the present and projected price structure for rice as used in the economic analysis. In the project area, rice ex-mill has been valued at the c.i.f. price Bacolod, Negros of imported rice. Based on unofficial data from the project area, the value of by-products was found to be equal to the costs of milling plus transport from farm to mill.

9. Table 2 shows the price of fertilizer, based on the most economic sources of nitrogen and phosphate. Since the Philippines is not expected to be self-sufficient in fertilizer in the foreseeable future, the cost of imported fertilizer was used for the analysis. Urea is the predominant source of nitrogen in the project area, while ammonium phosphate is the major source of phosphate. The future price is based on the cheapest source of phosphoric acid, triple-super-phosphate.

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Rice Price Structure, 1977 and 1985 /1

	1977		1985	
	₱/ton	US$/ton	₱/ton	US$/ton
Export price of Thai 25-35% brokens, f.o.b. Bangkok	1,850	222	2,165	260
Ocean freight and insurance	190	23	190	23
Import price, c.i.f. Bacolod, Negros	2,040	245	2,355	283
Less freight and insurance, Iloilo to Negros	25	3	25	3
Less transport mill to Iloilo port	75	9	75	9
Rice price, ex-mill project area	1,940	233	2,255	271
Paddy equivalent price (63% recovery)	1,225	147	1,425	171
Value of by-products less milling cost less transport and handling farm to mill	-	-	-	-
Farm gate paddy price (Financial farm gate price) /2	1,225 (1,050)	147	1,425 (1,285)	171
	₱/cavan		₱/cavan	
Economic (Financial) /2	61 (52)		71 (65)	

/1 ₱ or US$/ton at constant January 1977 prices. ₱ at shadow-priced exchange rate of US$1.00 = ₱ 8.33. ₱ figures per ton rounded to nearest 5 pesos.

/2 At official exchange rate of US$1.00 = ₱ 7.50.

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Fertilizer Price Structure /1

	1977		1985	
	₱/ton	US$/ton	₱/ton	US$/ton
Urea				
Export price, f.o.b. Europe, bagged	1,315	158	1,480	178
Ocean freight and insurance	335	40	335	40
Handling and distribution	250	30	250	30
Retail price project area	1,900	228	2,065	248
Transport to farm gate	50	6	50	6
Urea farm gate price	1,950	234	2,115	254
(Financial farm gate price) /2			(1,905)	
	₱/kg N		₱/kg N	
Nitrogen, farm gate price	4.2		4.6	
(Financial) /2	(4.0)		(4.1)	
Triple Super-phosphate				
Export price, f.o.b. US, bagged	1,060	127	1,325	159
Ocean freight and insurance	290	35	290	35
Handling and distribution	250	30	250	30
Retail price, project area	1,600	192	1,865	224
Transport to farm gate	50	6	50	6
TSP, farm gate price	1,650	198	1,915	230
(Financial) /2, /3			(1,725)	
	₱/kg P		₱/kg P	
Phosphate, farm gate price	3.7		4.3	
(Financial) /2	(3.8)		(3.75)	

/1 ₱ or US$/ton at constant January 1977 prices. ₱ at shadow-priced exchange rate of US$1.00 = ₱ 8.33. ₱ figures per ton rounded to nearest 5 pesos.

/2 At official exchange rate of US$1.00 = ₱ 7.50.

/3 The present financial price for phosphate is based on the phosphate fertilizer which is currently available to farmers, namely Ammonium phosphate (16-20-0).

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JALAUR IRRIGATION PROJECT

Crop and Farm Budgets

1. Present and proposed cropping patterns and agricultural practices are given in Annex 10. This Annex gives the basis for the economic and financial calculation of production costs and examines the impact of the project on individual farms.

2. Per hectare production costs and labor requirements for irrigated and rainfed rice at present and in future with and without the project are presented in Table 1. Present costs are based on the results of a survey conducted in the project area by NIA and of interviews in the area during appraisal. In the future without the project, input levels would change marginally in rainfed areas, but crop husbandry would improve in the irrigated areas. Future input levels for "with project" conditions are based on consultations with various Government agencies and expected increases in mechanized cultivation and threshing. Physical input assumptions and unit prices are presented in Table 2.

3. Monthly labor requirements for the wet and dry season crops per hectare, based on present and proposed cropping calendars are presented in Table 3. Under project conditions, the labor requirements for land preparation and threshing would be reduced by the use of machinery, while the labor requirements would increase for crop management including such activities as weeding, fertilizer and pesticide application and irrigation, and for harvesting and hauling.

4. Table 3 presents a per hectare budget for rice farms. This table uses present and projected market prices and is the basis for the farm budget included in Table 4.

5. Farm budgets for 1.5 and 3 ha (the average farm size for the project area is 2 ha) family farms are presented in Table 5. The sizes were chosen to represent the 50% of the farms (25% of the area) of less than 2 ha and the 45% of the farms (60% of the area) of between 2 and 5 ha. For each farm size, budgets are included for four different areas with different present and future cropping intensities. For each area, budgets are presented for a tenant farm and an amortizing owner operated farm, which are estimated to comprise 40% and 35% of the farms, respectively, in the future. The budgets are presented in terms of cash flows and therefore include an estimate of hired labor costs, though not of family labor. Budgets for conditions with the project refer to those at full agricultural development. The basis for each calculation is detailed in the footnotes.

6. Table 6 presents an income summary for the families whose farm budgets are given in Table 5. Other income, including income earned from earnings on other farms and off-farm income, is based primarily on the survey conducted by NIA in the project area. According to the survey, other income averages ₱ 1,000 per annum in irrigated areas and ₱ 1,200 per annum in rainfed areas. With the exception of farmers who would increase their cropping intensity significantly and therefore reduce the time available for off-farm employment in the future, it was assumed that other income would, in constant 1977 prices, remain at present levels.

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Rice Crop Production Costs /1

	Present			Future Without Project			Future With Project	
	Wet Season		Dry Season	Wet Season		Dry Season	Wet Season	Dry Season
	Rainfed	Irrigated	Irrigated	Rainfed	Irrigated	Irrigated	Irrigated	Irrigated
Cash Input (₱/ha) /2								
Cultivation	150	195	195	200	210	210	240	240
Seeds	130 (110)	135 (115)	130 (110)	120 (110)	135 (120)	130 (115)	135 (120)	135 (120)
Fertilizers	230 (215)	315 (295)	300 (280)	300 (270)	445 (400)	415 (375)	540 (480)	540 (480)
Chemicals	160 (145)	165 (150)	160 (145)	180 (160)	285 (260)	190 (175)	285 (260)	285 (260)
Harvesting	5 (5)	10 (10)	10 (10)	20 (20)	155 (140)	140 (125)	200 (180)	200 (180)
Other /3	20	35	30	30	45	40	55	55
Interest /4	(65)	(50)	(50)	(30)	(50)	(45)	(60)	(60)
Total cash inputs	695 (710)	855 (850)	825 (820)	850 (820)	1,275 (1,225)	1,125 (1,085)	1,455 (1,395)	1,455 (1,395)
Labor Inputs (man-days/ha) /5								
Land preparation	20	19	16	17	19	15	21	19
Planting	27	26	27	27	24	26	23	23
Crop management	17	21	20	19	22	22	28	30
Harvesting	26	29	27	27	30	27	33	33
Total labor inputs	90	95	90	90	95	90	105	105

/1 Prices based on world market rice and fertilizer prices (see Annex 12), are used in the economic analysis. Figures in parentheses indicate financial costs only when they differ from economic costs. Financial costs are used in the farm budgets, Table 4.

/2 Physical inputs and unit cost assumptions are given in Table 2.

/3 1% of gross value of production.

/4 Present is based on combination of institutional and noninstitutional borrowing derived from survey data; future is based on 80% of farmers borrowing 90% of cash inputs for 6 months @ 12%/year.

/5 Excludes labor handling farm machinery, the cost of which is included under cash inputs.

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JALAUR IRRIGATION PROJECT

Crop Production Costs: Physical Inputs and Unit Prices

Inputs	Units	Wet Season Rainfed	Wet Season Irrigated	Dry Season Irrigated	Units	Unit Price/Input /1
Present						
Cultivation - Mechanical	(%)	25	45	45	P/ha	320
- Animal	(%)	75	55	55	P/ha	95
Seed - Transplanted	(%)	90	85	90	kg/ha /2	60
Fertilizer - N	(nutrient kg)	40	55	52	P/kg	4.2 (4.0)
- P	(nutrient kg)	13	18	17	P/kg	3.7 (3.8)
- K	(nutrient kg)	6	9	8	P/kg	1.8 (0.9)
Threshing - Mechanical /3	(%)	2	5	5		
- Manual	(%)	98	95	95		
Future Without Project						
Cultivation - Mechanical	(%)	50	55	55	P/ha	300
- Animal	(%)	50	45	45	P/ha /2	95
Seed - Transplanted	(%)	90	80	85	kg/ha	50
Fertilizer - N	(nutrient kg)	47	70	65	P/kg	4.6 (4.1)
- P	(nutrient kg)	20	30	30	P/kg	4.2 (3.8)
- K	(nutrient kg)	-	-	-		
Threshing - Mechanical /3	(%)	10	50	50		
- Manual	(%)	90	50	50		
Future with Project						
Cultivation - Mechanical	(%)		70	70	P/ha	300
- Animal	(%)		30	30	P/ha /2	95
Seed - Transplanted	(%)		80	80	kg/ha	50
Fertilizer - N	(nutrient kg)		80	80	P/kg	4.6 (4.1)
- P	(nutrient kg)		40	40	P/kg	4.2 (3.8)
- K	(nutrient kg)		-	-		
Threshing - Mechanical /3	(%)		50	50		
- Manual	(%)		50	50		

/1 Figures in parenthesis are financial unit prices where they differ from economic unit prices.

/2 Figures given are for transplanted seed. Direct seeded rice is estimated to require 100 kg.

/3 Unit cost for mechanical threshing is calculated at 7% of yield.

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JALAUR IRRIGATION PROJECT

Monthly Labor Requirements for Rice Crop /1

(man-days/ha)

Crop /2		Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Wet Season														
Irrigated														
	P					3	14	22	19	5	10	14	8	95
	W					3	14	22	17	6	10	15	8	95
	W					4	15	22	18	10	11	16	9	105
Rainfed														
	P						18	25	15	7	14	11		90
	W						15	25	15	8	15	12		90
Dry Season														
Irrigated														
	P	21	8	14	11						2	9	25	90
	W	22	9	14	11						2	8	24	90
	W	25	13	15	15						3	10	24	105

/1 Excludes labor handling farm machinery.

/2 P = present.
W = future without project.
W = future with project.

ANNEX 12
Table 3

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JALAUR IRRIGATION PROJECT

Rice Crop Budgets /1

	Present			Future Without Project			Future With Project	
	Wet Season		Dry Season	Wet Season		Dry Season	Wet Season	Dry Season
	Rainfed	Irrigated	Irrigated	Rainfed	Irrigated /2	Irrigated	Irrigated /2	Irrigated
Yield (ton/ha)	1.8	2.7	2.4	2.1	3.1	2.8	4.0	4.0
Farm gate price (₱/ton)	1,050	1,050	1,050	1,285	1,285	1,285	1,285	1,285
Gross value of production (₱/ton)	1,890	2,835	2,520	2,700	3,980	3,600	5,140	5,140
Production costs, excluding labor (₱/ha)	710	850	820	820	1,225	1,085	1,395	1,395
Net value of production without accounting for labor (₱/ha)	1,180	1,985	1,700	1,880	2,755	2,515	3,745	3,745
Labor requirement (man-days/ha)	90	95	90	90	95	90	105	105

/1 Financial costs and prices are used, based on Table 1.

/2 Wet season yields in the Aganan system area are estimated to be 20% less at present and in the future without the project. Total labor requirements and production costs are assumed to be the same as in other systems.

ANNEX 12
Table 4

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JALAUR IRRIGATION PROJECT

Farm Budgets

A. 1.5 ha Farm

	Jalaur Extension		Aganan-Santa Barbara		Jalaur		Suague	
	Present	Future w/Proj.	Present	Future w/Proj.	Present	Future w/Proj.	Present	Future w/Proj.
Total paddy cropped area (ha)	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Cropping intensity (%)	100	141	105	105	162	200	145	145
Total paddy production (ton)	2.7	8.4	3.8	6.3	6.3	12.0	5.7	8.7
Gross value of production (₱) /1	2,835	10,800	3,990	8,095	6,615	15,420	5,985	11,180
Production costs (excluding labor) (₱)	1,065	2,930	1,335	2,195	2,040	4,185	1,830	3,035
Cost of hired farm labor (₱) /2	-	-	-	-	-	-	-	-
Net value of production (before water charges) (₱)	1,770	7,870	2,655	5,900	4,575	11,235	4,155	8,145
Water charges /3	-	510	170	365	300	765	260	530
Net crop income	1,770	7,360	2,485	5,535	4,275	10,470	3,895	7,615
(a) Annual payment for land /4	730	730	1,010	1,010	1,620	1,620	1,465	1,465
Net crop income (owner-operator who received a land transfer)	1,040	6,630	1,475	4,525	2,655	8,850	2,430	6,150
(b) Annual payment to landlord /5	670	2,060	895	1,550	1,480	2,940	1,345	2,160
Net crop income (tenant farmer)	1,100	5,300	1,590	3,985	2,795	7,530	2,550	5,455

/1 Based on Tables 1 and 4.

/2 Based on maximum of 40 man-days/month and a total of 480 man-days/year of family labor; hired labor priced at wage of ₱ 7/man-day.

/3 Based on present charges of approximately ₱ 104/ha in the wet season and ₱ 156/ha in the dry season and on future charges of ₱ 225/ha in the wet season and ₱ 285/ha in the dry season.

/4 Based on amortizing owner with annual payments over 15 years at 6% in the unpaid balance; based on price of land of 2.5 times present gross value of production.

/5 Based on 30% for present and 25% for future of gross value of production minus seed, harvesting, and water costs.

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JALAUR IRRIGATION PROJECT

Farm Budgets

B. 3.0 ha Farm /1

	Jalaur Extension		Aganan - Santa Barbara		Jalaur		Suague	
	Present	Future w/Proj.	Present	Future w/Proj.	Present	Future w/Proj.	Present	Future w/Proj.
Total paddy cropped area (ha)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Cropping intensity (%)	100	141	105	105	162	200	145	145
Total production (tons)	5.4	16.9	7.6	12.6	12.6	24.0	11.4	17.4
Gross value of production (₱)	5,670	21,715	7,950	16,190	13,230	30,840	11,970	22,360
Production costs, excluding labor (₱)	2,135	5,860	2,670	4,395	4,080	8,370	3,660	6,070
Cost of hired farm labor (₱)	390	575	335	385	665	1,325	540	600
Net value of production	3,145	15,280	4,945	11,410	8,485	21,145	7,770	15,690
Water charges	-	1,025	340	725	600	1,530	520	1,060
Net crop income	3,145	14,255	4,605	10,685	7,885	19,615	7,250	14,630
(a) Annual payment for land	1,460	1,460	2,015	2,015	3,245	3,245	2,935	2,935
Net crop income (for owner-operator who received land transfer certificate)	1,685	12,795	2,590	8,670	4,640	16,370	4,315	11,695
(b) Annual payment to landlord	1,345	4,120	1,780	3,095	2,960	5,880	2,690	4,320
Net crop income (for tenant farmer)	1,800	10,020	2,825	7,590	4,925	13,735	4,560	10,310

/1 See footnotes on page 1.

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Estimated Farm Family Income in Project Area /1

Farm Size and Location	Cropping Intensity Present	Cropping Intensity Future	Status of Tenure /2	On Farm Income /3 Present	On Farm Income /3 Future	Other Income /4 Present	Other Income /4 Future	Total Income Present	Total Income Future
	------(%)------			----- ₱ -----		----- ₱ -----		------ ₱ -----	
1.5 ha									
Jalaur Extension	100	141	T	1,100	5,300	1,000	700	2,100	6,000
			O/A	1,050	6,650	1,000	700	2,050	7,350
Aganan/Santa Barbara	105	105	T	1,600	4,000	900	900	2,500	4,900
			O/A	1,450	4,500	900	900	2,350	5,400
Jalaur	162	200	T	2,800	7,550	700	600	3,500	8,150
			O/A	2,650	8,850	700	600	3,350	9,450
Suague	145	145	T	2,550	5,450	700	700	3,250	6,150
			O/A	2,450	6,150	700	700	3,150	6,850
3.0 ha									
Jalaur Extension	100	141	T	1,800	10,000	1,100	900	2,900	10,900
			O/A	1,700	12,800	1,100	900	2,800	13,700
Aganan/Santa Barbara	105	105	T	2,850	7,600	1,000	1,000	3,850	8,600
			O/A	2,600	8,650	1,000	1,000	3,600	9,650
Jalaur	162	200	T	4,900	13,750	900	800	5,800	14,550
			O/A	4,650	16,350	900	800	5,550	17,150
Suague	145	145	T	4,550	10,300	900	900	5,450	11,200
			O/A	4,300	11,700	900	900	5,200	12,600

/1 Figures are rounded to the nearest ₱ 50.

/2 T - tenant farmer; O/A - owner paying amortization for land transfer payments.

/3 From Annex 12, Table 4.

/4 Based largely on NIA survey.

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Farm Labor Analysis

Labor Supply

1. According to an NIA survey, data from the 1970 Census of Population and Housing, the 1971 Agricultural Census and the National Economic Development Authority, the 1976 rural population of the project area is about 80,000. This consists of about 12,000 farm families, and some 1,950 landless families occupied principally or entirely in agricultural production. The average farm family is 5.8 persons, of which two full-time workers are available for farm work, giving a total family labor supply of about 24,000 workers. Assuming each of the other 1,950 families also supply two workers, the total estimated rural labor force in the project area is 27,900. On the basis of 240 days per worker per year, a monthly average of 20 days, the total annual labor supply is 6.7 million man-days, or 0.56 million man-days per month.

2. From 1960 to 1970, while the total Philippine population grew 3.0% per year, the population in the project area municipalities grew at 1.6% per annum due to migration to Manila and elsewhere in the Philippines. Since 1970, however, migration has slowed and the population has grown at more than 2.5% per annum. Assuming that some migration continues in the future, and the rural work force in the project area grows at 2.5% per year (versus the 1975 Basic Economic Report's average 3.0% growth projection for the Philippine work force over the same period), rural labor would total some 34,000 at full project development in 1985. This would give a total annual labor supply of 8.16 million man-days, and a monthly average supply of 0.68 million man-days.

Labor Demand

3. Annex 12, Table 3 gives estimates of average monthly and annual labor requirements per ha for different rice crops. Mechanization of land preparation is already widespread, particularly on land with some existing irrigation. In future without the project, some additional mechanization of land preparation and threshing is assumed, thereby slightly reducing labor requirements per ha. The timing of cropping operations throughout the project area varies widely. This diversity contributes to the difficulties of water management in present irrigated areas, and of scheduling inputs and support services. With the project, strict scheduling of operations would be essential to permit adequate irrigation of the whole area. This in turn would require further mechanization of land preparation, particularly for the dry season crop. At the same time it is expected that the high cost of manual threshing will result in substantial increases in the hiring of mechanical threshers. Notwithstanding this additional

mechanization, average labor requirements per ha at full project development are estimated to be slightly higher than present levels because of higher crop management and harvesting and hauling requirements.

4. Table 2 gives estimates of total monthly labor requirements in the project area. The present annual requirement is some 3.0 million man-days, or 45% of the estimated rural labor supply. Yearly labor demand has a pronounced seasonal pattern. Peak monthly demand occurs in July and nearly half of total yearly labor is needed during the three-month period, June through August. Present dry season labor demand is much less than that of the wet season, requiring only 23% of total yearly labor demand. In future without the project, it is estimated that increased mechanization would be balanced by increased labor for crop management and harvesting and annual labor requirements would remain at present levels. Except for small monthly variations, the seasonal employment pattern would remain as now. At full development with the project, annual labor requirements would be 3.9 million man-days, 0.8 million man-days (28%) greater than without the project. Most of the additional labor requirements would be for the dry season crop and hence would increase demand in periods of low labor requirements. NIA would maintain the system during the dry conditions of April and May and farmers would grow their dry season crop from November through April. At 1.3 million man-days, total dry season labor demand would be 49% of the total wet season labor demand of 2.6 million man-days.

Economic Cost of Farm Labor

5. Detailed information on wages actually paid in the project area is limited. Most work is done by unpaid family labor and traditional "exchange" labor. Information on off-farm employment is even less reliable. The wage for hired labor in peak agricultural seasons is around ₱ 7 per man-day, which is assumed to reflect the opportunity cost of labor to the economy at such times. In months of high rural unemployment, which characterize most of the year, the opportunity cost of labor would be much lower. The economic cost of farm labor in the project area was, therefore, estimated by taking account of the generally prevailing rural unemployment and extreme seasonal fluctuations in labor demand.

6. The economic cost of labor at different times of the year for the project area was determined by the use of a technique developed in the Thailand Phitsanulok Irrigation Project (Report No. 2486-TH) and used recently in the Philipppines Chico River Irrigation Project (Report No. 1009a-TH). It is postulated that the marginal opportunity cost of farm labor in the project area can be approximated by an S-shaped curve. The marginal opportunity cost is positive at all levels of labor demand and increases as more labor is employed in farm work. The increase is slow initially, reflecting the scarcity of alternative productive employment, but becomes more rapid as the labor supply is more fully used. At full employment in the project area, the opportunity cost is assumed equal to market wage of ₱ 7 per man-day during periods of heavy labor demand.

As labor demand increases beyond this point, the market wage rate continues to rise until it reaches the observed maximum of ₱ 8.5 per man-day, at which level it remains constant for subsequent demand increases. With the mobility of the Philippines rural labor force, large numbers of laborers would be attracted to the project area from surrounding areas at a wage of ₱ 8.5 which is in fact the prevailing contract wage rate for migrant sugarcane labor from the neighboring provinces of Antique and Aklan.

7. In practice, the S-shaped curve can be approximated by three straight line segments. Figure 1 gives the curve of approximate shadow wage rates used in the analysis. The curve shows the estimated marginal opportunity cost of labor as a function of demand (expressed as a proportion of supply). The shape of the curve is determined by points A, B, C and D. Point A represents the minimum opportunity cost of farm labor which is estimated to be ₱ 2 per man-day, equal to ₱ 1.5 as the economic value of alternative employment (casual nonfarm labor, fishing, house repairs, etc.) plus ₱ 0.5 to supply the additional food requirements of more strenuous farm work with the project. Point B represents the opportunity cost of farm labor when the demand for labor begins to exceed the supply of family labor and the hiring of landless and very small farmers is required. The opportunity cost at B is approximated by the minimum market rate of ₱ 4. Point C indicates that at full employment of rural labor the opportunity cost would equal the market wage of ₱ 7 per man-day. The horizontal segment to the right of Point D indicates that at ₱ 8.5 per man-day as many laborers as needed would be available for farm work in the project area.

8. The monthly marginal opportunity cost may be read directly from the curve at the corresponding level of labor demand. With the project, it varies from ₱ 2.8 per man-day in months of high unemployment to ₱ 5.0 per man-day in the month of July. The total economic cost of farm labor is then the area under the curve up to the level of employment. Computed this way, the future economic cost of farm labor would be ₱ 11.1 million with the project at full development and ₱ 8.4 million without the project, or an incremental cost of ₱ 2.7 million. This would be equivalent to pricing the incremental employment of 0.8 million man-days per year at a shadow wage rate of ₱ 3.2 per man-day. The corresponding shadow wage rate for the total labor demand of 3.9 million man-days at full development would be ₱ 2.9 per man-day.

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Total Monthly Labor Requirements /1

('000 man-days)

		Area (ha)	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Wet Season															
Irrigated rice															
	P	22,000					66	308	484	418	110	220	308	176	2,090
	W	22,000					66	308	484	374	132	220	330	176	2,090
	W	24,700					99	371	543	445	247	272	395	222	2,594
Rainfed rice															
	P	2,700						49	68	41	19	38	30		245
	W	2,700						41	68	41	22	41	32		245
Dry Season															
Irrigated rice															
	P	7,500	158	60	105	83						15	68	188	677
	W	7,500	165	68	105	83						15	60	180	677
	W	12,000	300	156	180	180						36	120	288	1,260
Total															
	P	32,200	158	60	105	83	66	357	552	459	129	273	406	364	3,012
	W	32,200	165	68	105	83	66	349	552	415	154	276	422	356	3,012
	W	36,700	300	156	180	180	99	371	543	445	247	308	515	510	3,854

/1 P = Present.
W = Future without project.
W = Future with project.

ANNEX 13
Table 1

PHILIPPINES

JALAUR IRRIGATION PROJECT

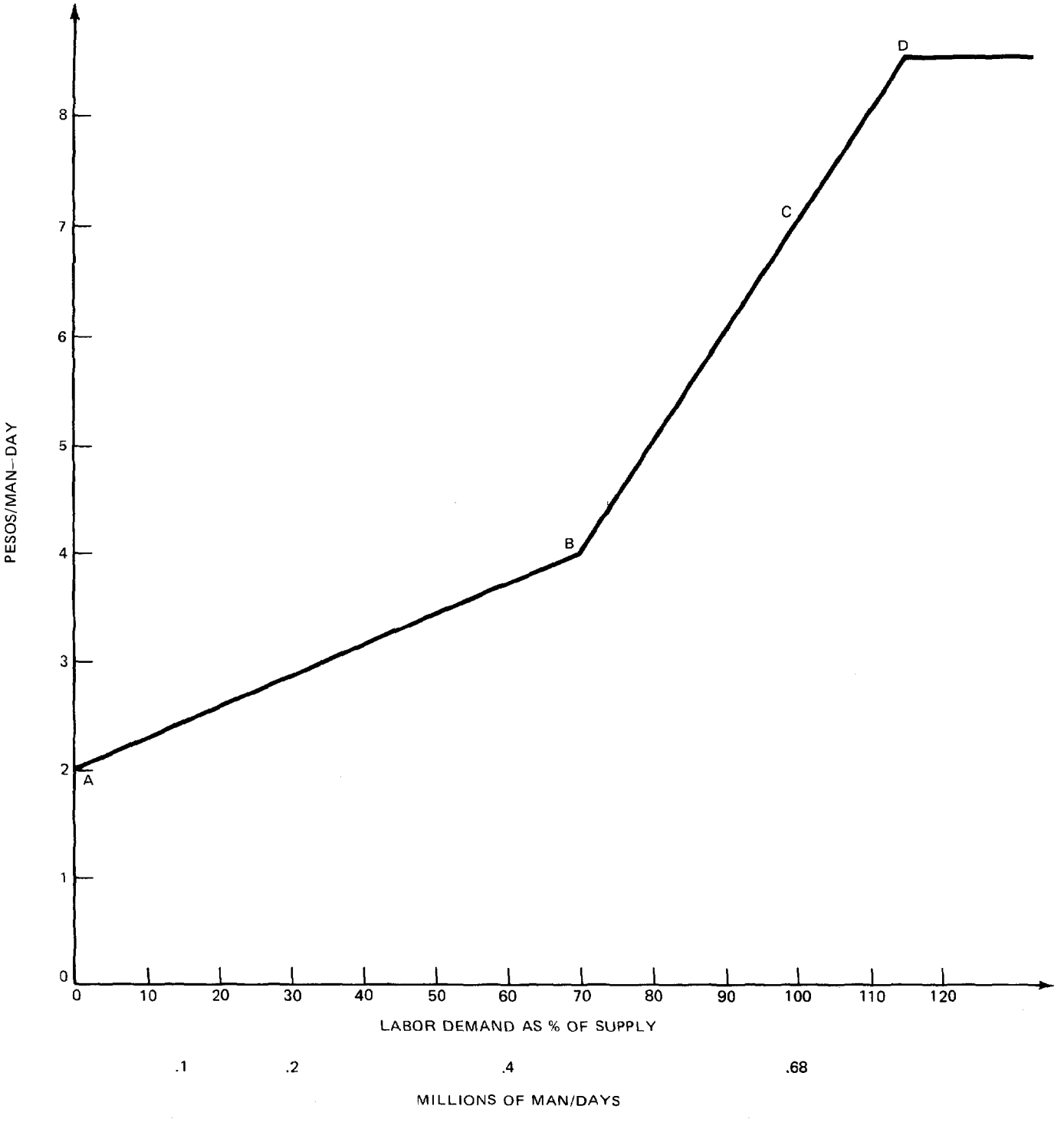
Economic Cost of Farm Labor in 1985 /1

		Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Labor requirement (million man-days)	W	.30	.16	.18	.18	.10	.37	.54	.45	.25	.31	.52	.51	3.86
	$\overline{W}$	.17	.07	.11	.08	.07	.35	.55	.42	.15	.28	.42	.36	3.03
Marginal opportunity cost (₱/man-day)	W	3.3	2.8	2.8	2.8	2.5	3.6	5.0	3.9	3.1	3.3	5.0	5.0	
	$\overline{W}$	2.8	2.3	2.5	2.4	2.3	3.5	5.1	3.8	2.7	3.2	3.8	3.6	
Average economic cost of farm labor (₱/man-day)	W	2.7	2.4	2.4	2.4	2.3	2.8	3.2	3.0	2.6	2.7	3.1	3.1	2.9
	$\overline{W}$	2.4	2.2	2.3	2.2	2.2	2.8	3.2	2.9	2.4	2.6	2.9	2.8	2.8
Economic cost of farm labor (₱ million)	W	.81	.38	.43	.43	.23	1.04	1.73	1.35	.65	.84	1.61	1.58	11.08
	$\overline{W}$	.41	.15	.25	.18	.15	.98	1.76	1.22	.36	.73	1.22	1.01	8.42
Incremental economic cost of farm labor (₱ million)	W - $\overline{W}$	.40	.23	.18	.25	.08	.06	-.03	.13	.29	.11	.39	.57	2.66

/1 W = Future with project.
$\overline{W}$ = Future without project.

ANNEX 13
Table 2

PHILIPPINES
JALAUR IRRIGATION PROJECT
Marginal Economic Cost of Farm Labor



World Bank–16428

PHILIPPINES

JALAUR IRRIGATION PROJECT

Cost and Rent Recovery

1. This Annex examines the implications for public revenues and project beneficiary incomes of proposed water charges for the project. In determining the extent of cost recovery and the relation of water charges to benefits, four indices have been used which are defined as follows for the present project:

(a) Cost Recovery Index: the ratio of revenues from incremental water charges paid by all project beneficiaries to project construction and incremental operation and maintenance costs.

(b) Total Cost Recovery Index: the ratio of revenue from total water charges paid by all project beneficiaries to project construction costs and total operation and maintenance costs.

(c) Project Rent Recovery Index: the ratio of incremental water charges to "project rent" before paying water charges, where "project rent" is defined as incremental farm income less the value of incremental family labor, management costs and allowances for uncertainty.

(d) Farm Rent Recovery Index: the ratio of total water charges to total "farm rent", where "farm rent" is defined as total farm income less the value of family labor, management costs and allowances for uncertainty.

2. Table 1 presents the cost and rent recovery indices and the bases of their calculations. All figures are in terms of January 1977 constant prices and except where otherwise labelled are incremental values ("with" less "without" the project). The rate of discount applied is 10%. It is assumed that there would be no incremental payments of general taxes due to the project.

Cost Recovery

3. In the cost recovery analysis, the present value of construction costs amounts to ₱ 158 million. The present value of the incremental O&M costs is ₱ 22 million. Water charges would be the equivalent of 3.5 cavans of paddy/ha in the wet season and 4.4 cavans in the dry season as in other Bank-assisted projects in the Philippines. This would be equivalent in 1985 to ₱ 225 and ₱ 285/ha (in January 1977 constant prices) in the wet and dry

seasons, respectively, at the forecast farm gate price for paddy (Annex 11). Such rates would be reached gradually over a period of five years from completion of construction. Without the project, lands already irrigated are assumed to be charged at the present prevailing rate of 2.0 cavans (₱ 130) in the wet season and 3.0 cavans (₱ 195) in the dry season. The present value of incremental charges on the entire project area over the 50-year life of the project would be ₱ 27 million, indicating a cost recovery index of about 15%. The low cost recovery rate reflects the fact that this project is a rehabilitation project, with water charges which are already high compared to other countries in the Region, and incremental charges which are consequently small relative to total water charges. As a better measure of how much beneficiaries would actually be expected to pay, the ratio of total water charges to total public sector outlays (Total Cost Recovery Index) would be 35%.

Rent Recovery

4. Of the farms examined in the farm budgets (Annex 12), four were selected for analysis of rent recovery (see Table 1). Farm A, a 1.5 ha farm in the Aganan-Santa Barbara systems would have a per capita income of ₱ 950 at full project development. This income is below the estimated cut-off level where a peso of private consumption would have the same social value as a peso of public saving (Critical Consumption Level or CCL). Farm B, a 1.5 ha farm in the extension area, would benefit the most from the project and would have an income significantly above the CCL. A 3.0 ha Farm C in the Aganan-Santa Barbara systems would have a per capita income at full project development slightly above the CCL. A relatively well-off owner-operated farm D, of 3 ha in the Jalaur area, currently however has a per capita income only slightly above the CCL and would have an income of more than triple the CCL at full production.

5. While the project rent recovery index is somewhat low, less than 20% for rehabilitated areas, where cropping intensity remains unchanged as a result of the project, it is higher at 35% for the area with new irrigation facilities. Overall, the project rent recovery index is estimated to be 23%. The farm rent recovery index (see para. 1d), however, is a better indicator of what the farmer must pay for irrigation. Of the farms examined, between 29% and 44% of total farm rent would have to be paid in water charges. Since water charges are fixed in terms of paddy, the rate of inflation would not affect the cost and rent recovery calculations.

Water Charge Policy

6. The Government increased the water charges on all national irrigation systems by five times in July 1975 and has agreed to a further increase in water charges for all Bank-assisted projects. It has also built in a form of "indexing" by setting the rates in terms of paddy rather than pesos. Considering that:

(a) farmers in the project area are paying on average 33% of their total farm rent in water charges; and

(b) 15% of the project beneficiaries would be below the CCL at full development and 85% would be at or below the national average per capita personal income;

further increases in water charges are judged to be unwarranted.

Collections

7. The Government is also faced with the important issue of collecting water charges. Between the late 1960s until 1975, NIA efforts resulted in noticeable improvement with total collections (current plus back collections) averaging about 50% to over 60% of current charges. During the past year, however, with the five-fold increase in water rates, collections dropped precipitously to below 25% (based on preliminary information). Any additional increases in water charges before NIA learns more about farmers' willingness to pay would therefore likely be counter-productive.

8. At the suggestion of the Bank, NIA is conducting a study to identify the factors affecting payment and collection of water charges, with an aim to devise policies and actions to deal with collections. The Bank would continue to consult with NIA on this study and on formulating actions to improve water charge collections. Once the combination of factors affecting collections are clearly delineated by the study and further experience is gathered with the new levels of water charges, appropriate actions to improve collections would be taken.

PHILIPPINES

JALAUR IRRIGATION PROJECT

Rent and Cost Recovery /1

	A /2	B /2	C /2	D /2	Total Project Million of ₱	Total Project Indices
	(₱)					
1. Incremental gross value of production	2,455	6,750	4,915	12,200	70.9	
2. Less incremental - production costs (including hired labor)	275	1,700	605	3,330	13.9	
3. payments to landlord	-	-	950	-	)	
4. imputed return on capital /3	490	1,350	20	2,420	) 13.9	
5. imputed value for family labor /4	65	520	45	510	5.2	
6. imputed value for management /5	245	675	735	1,830	8.5	
7. allowance for risk /6	370	1,015	735	1,220	9.2	
8. Equals project rent	1,010	1,490	1,825	2,890	20.2(119) /7	
9. Incremental water charges /8	155	510	310	790	4.7(27)	
10. Project rent recovery index (%) /9	15	34	17	27		23
11. Net public sector outlays (net present value)					181	
12. Cost recovery index (%) /11						15
13. Total water charges	365	510	725	1,540	9.1(61)	
14. Total farm rent	1,260	1,695	1,665	4,640	29 (184)	
15. Farm rent recovery index (%) /10	29	30	44	33		33
16. Gross public sector outlays					193	
17. Total cost recovery index (%) /12						35
18. Farmer's income per capita at full development /13	950	1,250	1,500	3,500		
19. Estimated critical consumption level						₱1,160
20. Estimated per capita personal income, 1985						₱3,300
21. Estimated per capita GDP, 1985						₱4,400

/1 All peso values are in January, 1977 constant pesos; items 1 through 12 are incremental values for 1985 at full production.

/2 Farm A is a 1.5 ha owner operated farm with amortization payments for land transfer in the Aganan-Santa Barbara systems, with a cropping intensity of 105%.
B is a 1.5 ha owner operated farm with amortization payments for land transfer in the Jalaur extension with a cropping intensity with the project of 141%.
C is a 3.0 ha tenant farm in the Aganan-Santa Barbara systems with a cropping intensity of 105%.
D is a 3.0 ha owner operated farm in the Jalaur system with a cropping intensity of 200%.

/3 Imputed return on land and 10% on incremental cash investment; incremental cash investment estimated at 28% of production costs.

/4 Incremental labor requirements less incremental hired labor valued at average market wage of ₱ 6.00/man-day

/5 10% of incremental gross value of production for 1.5 ha farms, 15% for 3.0 ha farms.

/6 15% of incremental gross value of production for tenant farms and for 1.5 ha owner-operated farms and 10% for 3 ha owner-operated farms.

/7 Figure in parenthesis is the net present value of project rent over the life of the project.

/8 Figure in parenthesis is the net present value of total project incremental water charges for the life of the project.

/9 Incremental water charges as a percent of project rent, each discounted over the life of the project.

/10 Gross water charges as a percent of project rent, each discounted over the life of the project.

/11 Incremental water charges as a percent of capital and O&M costs, each discounted over the life of the project.

/12 Gross water charges as a percent of capital and O&M costs, each discounted over the life of the project.

/13 Income per capita figures include off farm income (rounded to nearest ₱50).

PHILIPPINES

JALAUR IRRIGATION PROJECT

Economic Analysis

1. The following assumptions were made in evaluating the economic rate of return:

(a) Benefits - The expected paddy yields, prices, gross returns, production costs, net returns (without accounting for labor costs) and labor requirements per ha are given in Annex 12. Chart 16408(R) shows the proposed cropping calendar. Annex 11 gives the calculations for the farm gate prices of paddy, which are based on the Bank's world market price projections for milled rice. Table 1 gives the expected project benefits at full agricultural development for the entire project area.

(b) Foreign Exchange - Because of import taxes and quantitative restrictions, the official exchange rate understates the value to the economy of foreign exchange used in carrying out the project and saved by reducing rice imports. In the absence of detailed information needed to compute specific conversion factors and using the Squire-van der Tak approach /1, the estimated standard conversion factor (SCF) for the Philippines was about 0.9 for the three years 1972-74. This ratio implies a shadow exchange rate of US$1.00 = ₱ 8.33, which was used in the economic analysis.

(c) Investment Costs - The total investment cost, expressed in January 1977 prices, is US$23.7 million, and includes the cost of training Water Management Technologists. Annual incremental O&M costs of US$22 per ha on the newly irrigated area and US$13 per ha on the rehabilitated area include the incremental cost of the Water Management Technologists. All costs include physical contingencies but exclude costs due to price increases.

(d) Development Period - According to the project implementation schedule, all works would be completed by mid-1981 in time for the 1981 wet season crop. Main and secondary canals

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/1 L. Squire and H. G. van der Tak; Economic Analysis of Projects; Baltimore and London, The Johns Hopkins University Press, 1975.

and on-farm facilities would be completed for approximately two thirds of the project area in time for the 1980 wet season crop. In each sub-area sufficient land would be irrigable under improved conditions for the full 1981 dry season crop. Beginning with the first crop grown under upgraded conditions, farmers would achieve the projected yield levels over five years in equal installments. The project would reach full development in 1985.

(e) Labor Pricing - Farm labor was evaluated at a shadow wage rate, which varies seasonally and averages ₱ 2.9 per man-day over the year "with" project conditions at full development, compared to a full employment market wage of ₱ 7.0 per man-day. Annex 13 presents a detailed analysis. The use of unskilled labor in construction and development works is limited and all labor employed in such works is valued at the market wage rate.

2. Using the foregoing assumptions and discounting benefits and costs over 50 years, the economic rate of return is 20% (Table 2). Rates of return for the individual sub-project areas vary between 13% and 28% and are given along with the respective cost and benefit streams in Table 2.

Sensitivity Analysis

3. Sensitivity of the rate of return was tested to cost overruns, reduction and delays in benefits, and a 25% increase in the world market rice price. The effects of these changes in assumptions were as follows:

	Alternative	Rate of Return %
(a)	A two-year delay in reaching full project benefits	17
(b)	A 20% increase in construction costs	17
(c)	A combination of a two-year delay in reaching full project benefits and a 20% cost overrun	15
(d)	A 25% decrease in project benefits because farmers failed to attain projected yields and/or cropping intensity	16
(e)	A 25% increase in the world market price of rice.	25

PHILIPPINES

JALAUR IRRIGATION PROJECT

Economic Analysis - Net Value of Production - Total Project Area

		Area /1	Paddy Yield /1	Farm Gate Price /2	Gross Value of Production	Production Costs /3	Net Value of Production	Net Value of Production in Project Area
		(ha)	(ton/ha)	(₱/ton)	----------(₱/ha)----------			(₱ million)
Wet Season								
Irrigated Rice	$\bar{W}$ /4	16,500	3.1	1,425	4,420	1,275	3,145	51.8
	$\bar{W}$	5,500	2.5	1,425	3,565	1,275	2,290	12.6
	W	24,700	4.0	1,425	5,700	1,455	4,245	104.8
Rainfed Rice	$\bar{W}$	2,700	2.1	1,425	2,995	850	2,145	5.8
	W	—	—	—	—	—	—	—
Dry Season								
Irrigated Rice	$\bar{W}$	7,500	2.8	1,425	3,990	1,125	2,865	21.5
	W	12,000	4.0	1,425	5,700	1,455	4,245	50.9
Total	$\bar{W}$	32,200						
	W	36,700						

/1 From Annex 10, Table 1.
/2 From Annex 11, Table 1.
/3 From Annex 12, Table 1.
/4 $\bar{W}$ = Future without project.
W = Future with project.
/5 From Annex 13, Table 2.

	$\bar{W}$	W
	-------(₱ million)------	
Total net value of production (before costing labor)	91.7	155.7
Less imputed labor cost /5	8.4	11.1
Total net value of production	83.3	144.6
Net incremental value of production at full project development		61.3

ANNEX 15
Table 1

PHILIPPINES

JALAUR IRRIGATION PROJECT

Economic Costs and Returns

(US$ million)

Year	Project Costs Capital	Project Costs O&M	Incremental Project Benefits
Total Project			
1	2.3	0	0
2	7.1	0	0
3	7.0	0	0
4	4.6	.24	1.2
5	2.7	.35	3.0
6	0	.35	4.4
7	0	.35	6.1
8	0	.35	6.9
9 to 50	0	.35	7.4
Economic Rate of Return			20%
Aganan System Rehabilitation			
1	.4	0	0
2	1.3	0	0
3	1.3	0	0
4	.8	.04	.17
5	.5	.07	.36
6	0	.07	.72
7	0	.07	.90
8	0	.07	1.08
9 to 50	0	.07	1.26
Economic Rate of Return			18%
Jalaur Extension			
1	.5	0	0
2	1.7	0	0
3	1.7	0	0
4	1.1	.04	.08
5	.6	.06	.23
6	0	.06	.46
7	0	.06	.77
8	0	.06	1.00
9 to 50	0	.06	1.15
Economic Rate of Return			13%

Year	Project Costs Capital	Project Costs O&M	Incremental Project Benefits
Suague System Rehabilitation			
1	.3	0	0
2	.9	0	0
3	.9	0	0
4	.5	.03	.1
5	.3	.04	.2
6	0	.04	.4
7	0	.04	.4
8	0	.04	.5
9 to 50	0	.04	.6
Economic Rate of Return			14%
Santa Barbara System Rehabilitation			
1	.3	0	0
2	1.0	0	0
3	1.0	0	0
4	.7	.04	.1
5	.4	.06	.3
6	0	.06	.4
7	0	.06	.5
8	0	.06	.6
9 to 50	0	.06	.7
Economic Rate of Return			13%
Jalaur System Rehabilitation			
1	.8	0	0
2	2.3	0	0
3	2.2	0	0
4	1.5	.08	.67
5	.8	.12	1.52
6	0	.12	2.40
7	0	.12	3.00
8	0	.12	3.51
9 to 50	0	.12	3.70
Economic Rate of Return			28%

ANNEX 16
Table 1

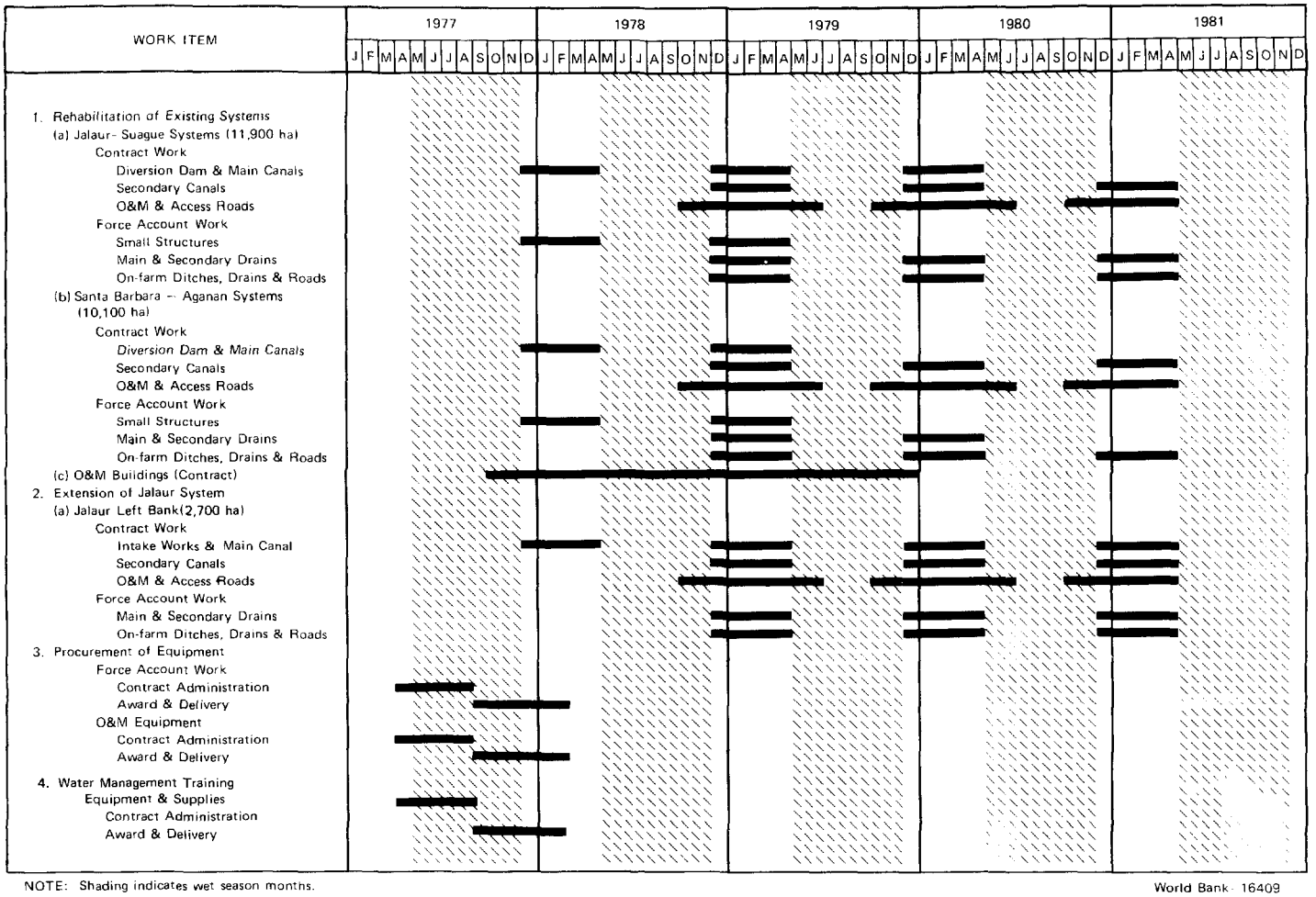
PHILIPPINES

JALAUR IRRIGATION PROJECT

Schedule of Early Events

	Activity	Target Date
1.	First Civil Works Contract	
(a)	Complete detailed engineering design tender documents and advertise	June 1977
(b)	Preparation and submission of bids	July-August 1977
(c)	Evaluate bids and award contract	October 1977
(d)	Start construction	December 1977
2.	Procurement of Force Account Construction Equipment	
(a)	Complete tender documents for force account equipment and advertise (ICB)	June 1977
(b)	Evaluate bids and award contracts	August 1977
(c)	Receive construction equipment	March 1978
3.	First Force Account Construction	
(a)	Complete detailed engineering design for initial year's construction	October 1977
(b)	Start construction of small structures and features requiring none of the earthmoving equipment	December 1977
(c)	Start construction with equipment	December 1978

PHILIPPINES
JALAUR IRRIGATION PROJECT
Implementation Schedule



NOTE: Shading indicates wet season months.

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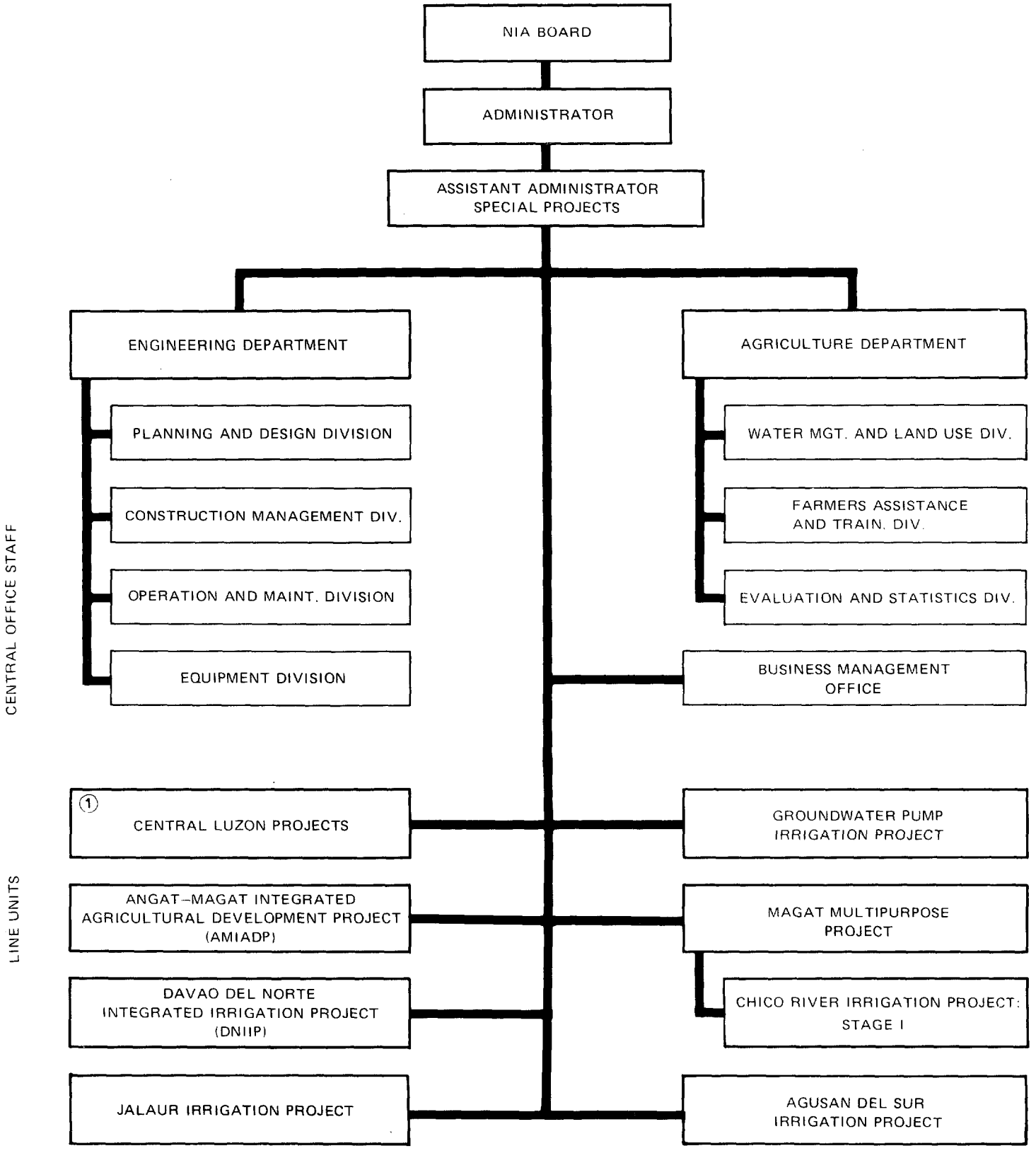
JALAUR IRRIGATION PROJECT
NIA Organization for Special Projects



(1) Includes Upper Pampanga, Aurora–Penaranda & Tarlac Projects

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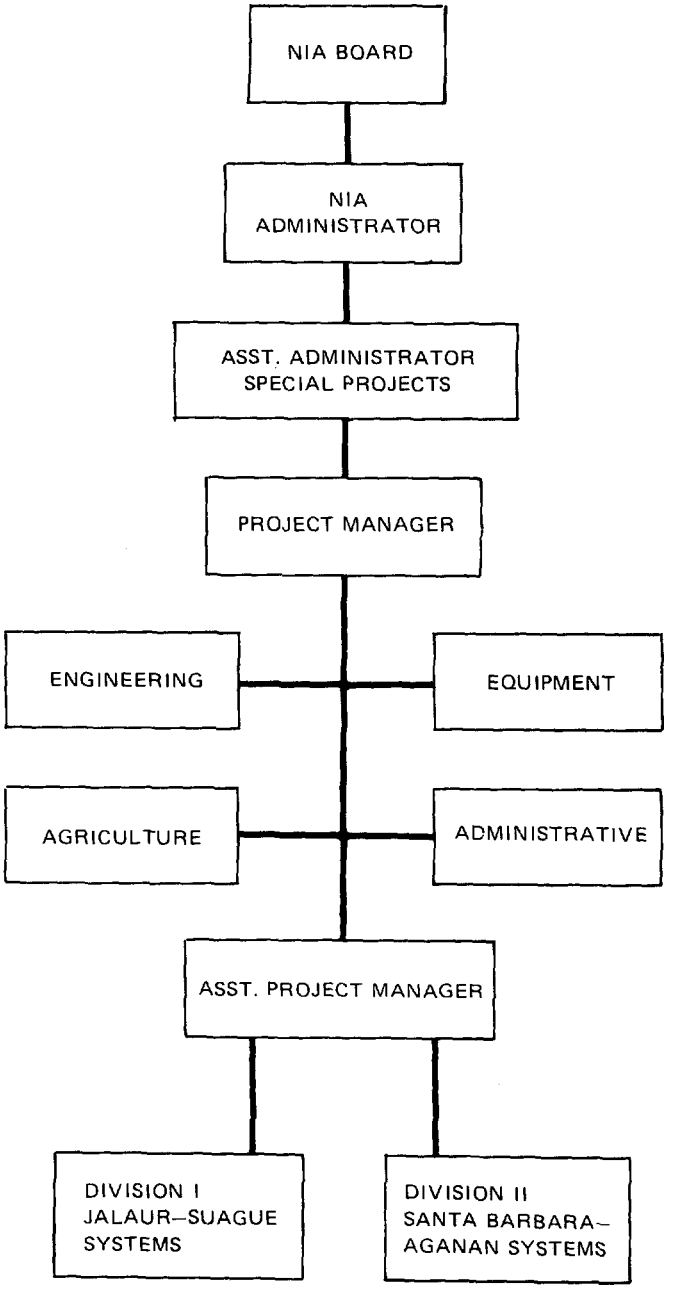
JALAUR IRRIGATION PROJECT
Proposed Organization for Project Construction



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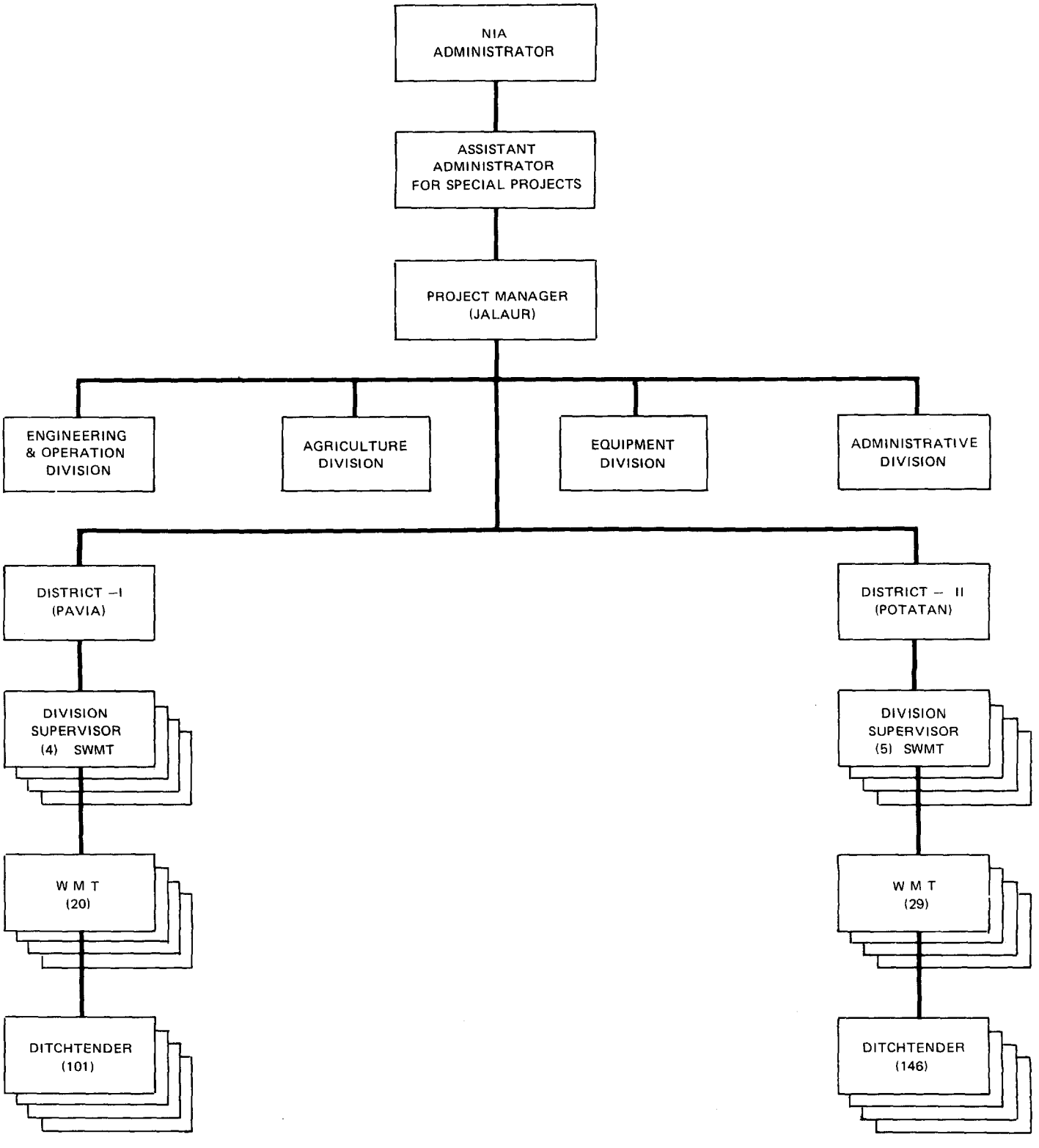
JALAUR IRRIGATION PROJECT
Proposed Organization for Operation and Maintenance

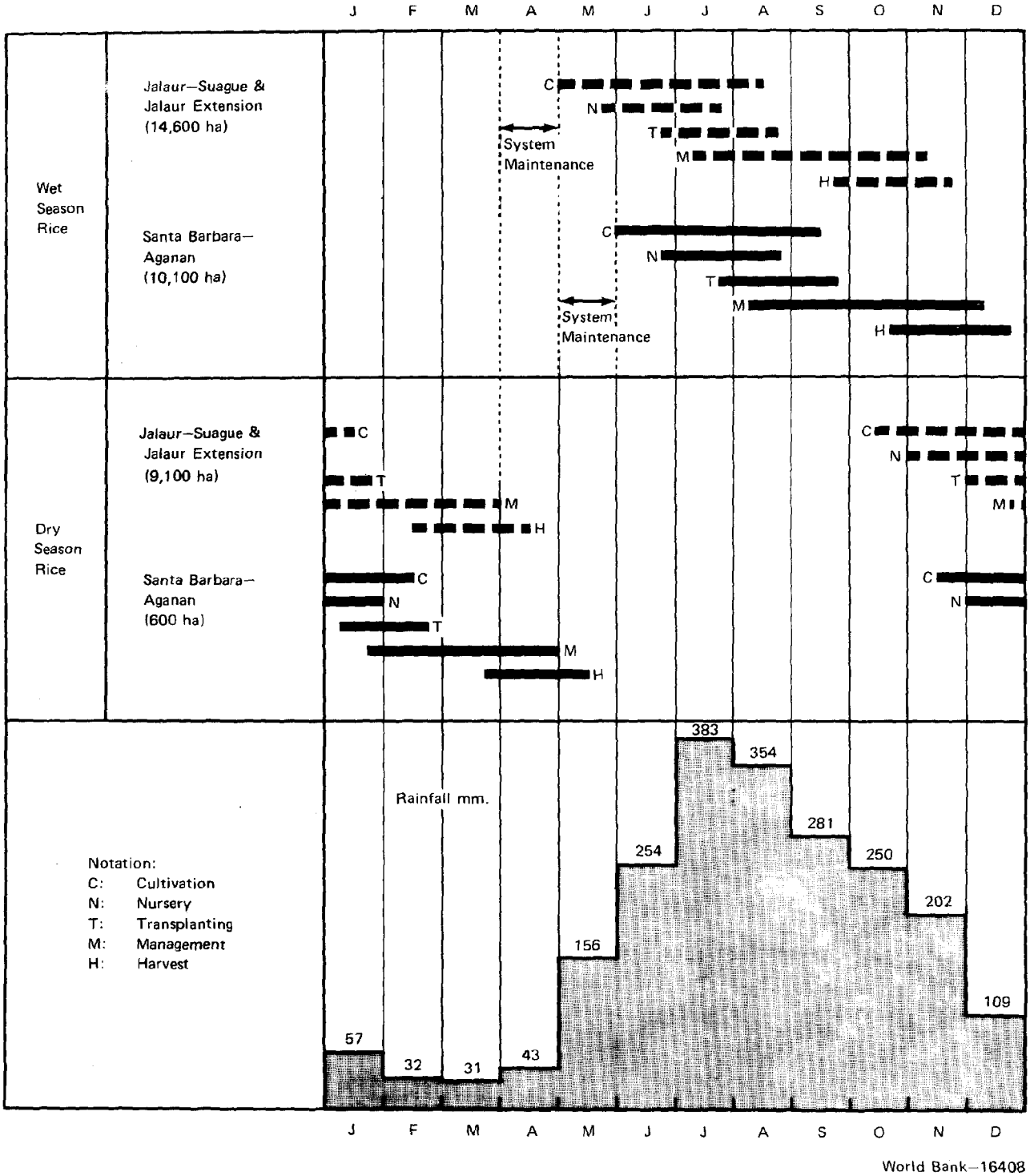


NOTE:

ONE SUPERVISING WATER MANAGEMENT TECHNOLOGIST (SWMT) – 2,500 HAS.
ONE WATER MANAGEMENT TECHNOLOGIST (WMT) – 500 HAS.
ONE DITCHTENDER – 100 HAS.
DISTRICT I – STA. BARBARA – AGAÑAN IRRIG. SYSTEMS
DISTRICT II – JALAUR – SUAGUE IRRIG. SYSTEMS

World Bank–16391 (R)

PHILIPPINES
JALAUR IRRIGATION PROJECT
Proposed Cropping Calendar



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