THE REPUBLIC OF THE PHILIPPINES
NATIONAL IRRIGATION ADMINISTRATION

FEASIBILITY STUDY REPORT ON THE IMPROVEMENT PROJECT OF THE OPERATION & MAINTENANCE OF NATIONAL IRRIGATION SYSTEMS (UPRIIS)

MAIN REPORT

FEBRUARY 1984

JAPAN INTERNATIONAL COOPERATION AGENCY

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NATIONAL IRRIGATION ADMINISTRATION

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PREFACE

In response to the request of the Government of the Republic of the Philippines, the Japanese Government decided to conduct a feasibility study on the Improvement Project of the Operation and Maintenance of National Irrigation Systems and entrusted the study to the Japan International Cooperation Agency (JICA).

The JICA dispatched to the Philippines a study team headed by Mr. Tadashi SAKAMOTO from September 1982 to January 1983 and from June to September 1983. The team exchanged views with the officials concerned of the Government of the Philippines and conducted a survey in the Upper Pampanga river basin, Central Luzon. After the team returned to Japan, further studies were made and the present report has been prepared.

I hope that this report will serve for the improvement of the Upper Pampanga River Integrated Irrigation System and contribute to the promotion of friendly relations between our two countries.

I wish to express my deep appreciation to the officials concerned of the Government of the Republic of the Philippines for their close cooperation extended to the team.

February 1982

Keisuke ARITA
President
Japan International Cooperation Agency

February 1984

Mr. Keisuke ARITA
President
Japan International Cooperation Agency
Tokyo, Japan

LETTER OF TRANSMITTAL

Dear Sir,

We have the pleasure of submitting the feasibility study report on the Improvement Project of the Operation and Maintenance of National Irrigation Systems (UPRIIS), in accordance with the Implementing Arrangement of the technical cooperation between the Japan International Cooperation Agency and National Irrigation Administration.

The project is basically formulated for the improvement of overall operation and maintenance of the UPRIIS in order to upgrade the project efficiency.

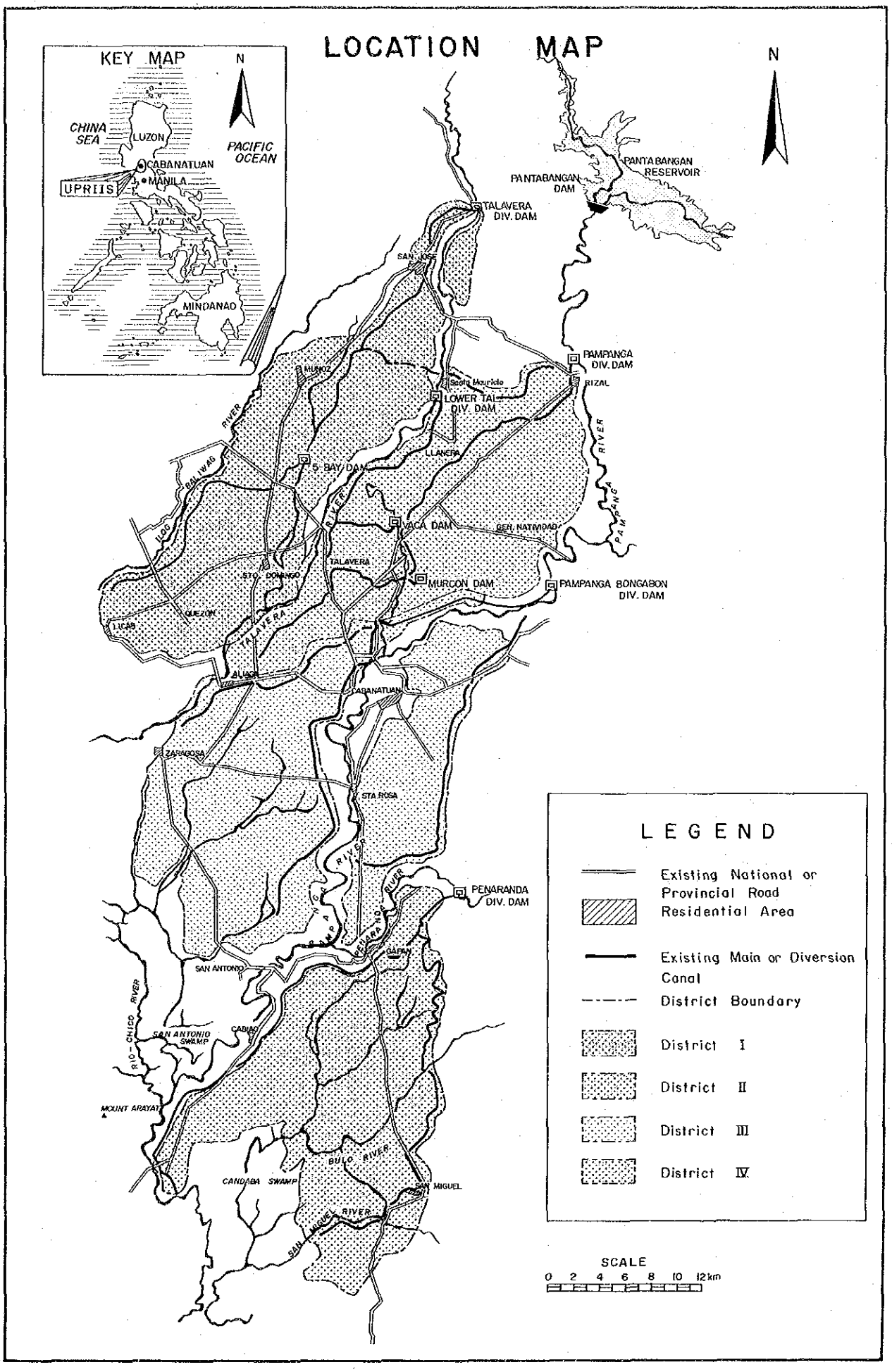
After implementation of the project, proper water distribution and operation and maintenance systems would be established in the UPRIIS. The productivity of land would be increased by the systems and the increased amount of agricultural products would substantially contribute to the national economy as well as the regional economy in the UPRIIS area. We would recommend that the project will be soon implemented in line with the conclusion presented in this report.

We wish to express our deep appreciation and gratitude to the personnel concerned of your Agency, Ministry of Foreign Affairs, Ministry of Agriculture Forestry and Fisheries, and the Authorities concerned of the Government of the Philippines and the Embassy of Japan in the Philippines for the courtesies and cooperation extended to us during our field survey and study period.

Sincerely yours,

T. Sakamoto

Tadashi SAKAMOTO
Leader of the Study Team
for the Improvement Project
of the Operation and Maintenance
of National Irrigation Systems
(UPRIIS)


LOCATION MAP
KEY MAP
N
CHINA SEA
LUZON
PACIFIC OCEAN
CABANATUAN
MANILA
UPRIIS
MINDANAO
PANTABANGAN RESERVOIR
PANTABANGAN DAM
TALAVERA DIV. DAM
SAN JOSE
MUNOZ
PAMPANGA DIV. DAM
RIZAL
Santa Maurida
LOWER TAL DIV. DAM
LLANERA
5 BAY DAM
BALIWAG
ILOG
VACA DAM
SAN NATIVIDAD
PAMPANGA RIVER
TALAVERA
STO. DOMINGO
MURCON DAM
PAMPANGA BONGABON DIV. DAM
QUEZON
LUCAB
ALIAGA
CABANATUAN
ZARAGOSA
STA ROSA
PENARANDA DIV. DAM
GAPAN
SAN ANTONIO
SAN ANTONIO SWAMP
CABIAO
RIO-CHICO RIVER
MOUNT ARAYAT
CANDABA SWAMP
BULO RIVER
SAN MIGUEL
SAN MIGUEL RIVER
LEGEND
Existing National or Provincial Road
Residential Area
Existing Main or Diversion Canal
District Boundary
District I
District II
District III
District IV
SCALE
0 2 4 6 8 10 12km

SUMMARY, CONCLUSION AND RECOMMENDATION

I. Introduction

1. This report presents the results of the feasibility study on the Improvement Project of the Operation and Maintenance of the Upper Pampanga River Integrated Irrigation System (UPRIIS).

   The studies have been made with a view to identify the present constraints for the project development and to envisage a prospective picture of the UPRIIS after the implementation of the project.

   This report is of a summary nature and is supported by eleven appendixes.

2. The Government of the Philippines have laid great emphasis on substantial increase in rice production in order to attain self-sufficiency of foodstuff since the four year development plan launched in 1967. In conformity with such circumstances the Government of the Philippines has made every endeavour to implemente national irrigation systems to a nationwide extent. However, these systems have become so deteriorated in recent years and operation and maintenance of these systems has not always been carried out sufficiently. For solving such problems the Government of the Philippines carried out to improve 76 national irrigation systems under assistance of ADB, IBRD, OECF, etc., as phase 1.

   As phase 2, the Government of the Philippines selected 21 national irrigation systems and made them the highest priority project from the remaining national irrigation systems and requested the technical assistance for the feasibility study on the 21 projects from the Government of Japan.

   In response to the request of the Government of the Philippines, the Government of Japan decided to undertake the feasibility study on the improvement project of operation and maintenance of the UPRIIS.

The implementing arrangement on the technical cooperation between NIA and JICA for the feasibility study on the Improvement Project of the Operation and Maintenance of National Irrigation Systems was signed on July 13, 1982.

3. The objective of the study is to formulate an improvement plan of the operation and maintenance of UPRIIS in order to upgrade the project efficiency and to verify the technical and economic feasibility of the project.

II. The Project Area and Constraints for the Project Development

1. The project area is located in Central Luzon, one of the largest rice producing regions in the Philippines. The project area is the vast flat alluvial plain in the upper reaches of the Pampanga river, about 150 km north of Metro Manila. It covers 157,000 ha. Farm land is estimated at 125,600 ha in which the potential irrigation service area served by the UPRIIS is demarcated at 116,900 ha.

2. In the potential irrigation service area, however, only 91,800 ha (79%) in the wet season and 84,900 ha (73%) in the dry season are irrigated under the UPRIIS. The remaining area is rainfed or fallow land. Major problems for lower irrigated ratio result from: i) the irrigation area is restricted due to shortage of water resources, ii) irrigation farming can not be practiced during the wet season due to inundation and iii) efficient use of irrigation water has been hindered because of low irrigation efficiency resulting from problems with the management of water delivery and control of system facilities and on deficiency of irrigation facilities.

   Under these conditions the multi-cropping index is estimated at 1.73 for the potential irrigation service area. Unit yields of paddy is estimated at 3.6 ton of paddy per ha for irrigated land and 2.4 ton of paddy per ha for rainfed land in the wet season. The unit yield of the dry season paddy is 4.1 ton per ha.

3. In the potential irrigation service area, total farm households are estimated at 58,000. Most of the farmers are engaged in rice culture. The land tenure pattern is reported as follows: i) land owner 10%, ii) amortizing owner 26% and iii) lessee 64%.
An average farm size is 2 ha. Among the farmers, living conditions for amortizing owner operators with less than 1.0 ha and lessees with less than 2.0 ha still remain at the subsistence level. This fact indicates that those farmers or 28% of all farmers have insufficient capacity to pay for the irrigation service fee.

4. The irrigation facilities in the UPRIIS are composed of 8 diversion dams, 46.6 km of diversion canal, 236 km of main canal, 1,281 km of lateral canal and related structures. The present physical conditions of these facilities are considerably deficient. Major constraints noted are inoperable control structures, inaccurate or non-workable measuring structures and siltation and erosion of canals.

5. Principal and urgent drainage problems to be solved are habitual inundation near the San Antonio and North Candaba swamps. Inundation is caused by backwater from the swamp flood water level and insufficient carrying capacities of creeks.

6. Principal and urgent flood control problems to be solved in the project area exist in the downstream of the lower Talavera river from the Calipahan bridge to the confluence of the Talavera and the Rio Chico river. Floods occur due to the insufficient carrying capacity of the channel. The average carrying capacity of the channel is only 270 m^3/sec which corresponds to flood scale of about 2-year return period.

7. With regard to UPRIIS organization the responsibilities and functions of each supporting division and section under division are not clearly defined. The function of the Engineering and Operation division and WCCC overlap on the monitoring of the operations of four districts.

In comparison with work load of NIA standard and the national irrigation systems with higher irrigation service fee collection efficiency, work load of the UPRIIS staff is loose, especially for the field staff.

The operation and maintenance works have been carried out through a long channel of seven steps: from Operations Manager, District Chief, Operation Engineer, Zone Engineer, Water Management Technologist, Assistant Water Management Technician and Ditchtender. The long channel often hinders quick and accurate operational actions in O&M works.

8. Major problems in operation and control of irrigation water are in principle physical defects of control structures and measuring devices, and insufficient communication network.

   In addition, incomplete practice of field operation rule, insufficient and inaccurate information for operation and many supervision steps are some of the constraints for proper irrigation water delivery. Under these conditions the present overall irrigation efficiency in the UPRIIS is low: 30% during the wet season and 51% during the dry season.

   Major problems on recording and reporting systems for systems management are identified: i) large volume of paper processing, ii) inaccuracy of data, iii) unstandardized formats and iv) improper condition of filing and keeping data.

9. An average irrigation service fee collection efficiency rate is about 50% from 1979 to 1982 and annual collection amount is ₱15.5 million. The efficiency rate in the UPRIIS is lower than that in all national irrigation systems, about 60%. It is considered that the low efficiency of irrigation service fee collection rate of the UPRIIS is caused by i) insufficient supply and improper distribution of irrigation water, ii) inadequate record keeping and intricate procedure of billing and collection, iii) lack of dissemination, iv) low capacity to pay of farmers, v) farmers'

negative perception of the UPRIIS service and vi) no effective measures against nonpaying farmers by the UPRIIS office.

In 1982 total revenue was ₱17.3 million and total expenditure was ₱33.3 million. The financial status is red. The deficit of the UPRIIS gradually increases and is forecasted to be ₱50 million in ten years if this tendency continues.

10. There exist 98 farmers-irrigator associations (FIAs) and 3,082 farmers-irrigator groups (FIGs) instituted under the assistance of NIA and local authorities concerned. However these FIAs and FIGs hardly function due mainly to lack of funds and leadership.

III. The Project

1. Development plans for agriculture, irrigation, drainage, river improvement, management of operation and maintenance, UPRIIS organization and farmers associations set-up are formulated. These development plans aim to improve system efficiency of the UPRIIS through good system-wide irrigation management with principle emphasis on i) efficient and optimum use of water resources, ii) efficient supply of irrigation water and its equitable distribution, iii) realization of higher efficiency of irrigation service fee collection, iv) rationalization of management with balanced finances and v) improvement of living conditions of the farmers through increasing agricultural production.

2. The basic concept for agricultural development is to increase rice production by increasing the unit yield of paddy and expansion of irrigated land. Double cropping of paddy per annum will be practiced as far as irrigation water is available.

3. The irrigation plan was formulated through the studies of twelve (12) alternative plans taking into consideration: i) possibility of creation of new water resources, ii) effective use of present water resources by rehabilitation and improvement of the existing irrigation facilities, construction of farm pond, re-use of water and improvement of water management rule and iii) inundation area.

The optimum scale of irrigation service area is determined at 111,200 ha, comprising 108,000 ha in the dry season and 106,800 ha in the wet season with respect to cropping area.

For the area, rehabilitation and improvement works are proposed as follows: i) improvement of re-use points, ii) installation of control gates, iii) construction of spillway and wasteway, iv) rehabilitation of damaged and deteriorated structures and canals and v) rehabilitation & construction of discharge measuring devices.

The major proposed irrigation works are summarized below:

Item	Quantity
1) Diversion dam	8 nos.
2) Re-use structure	18 nos.
3) Irrigation canals	
- Diversion canal	46.6 km
- Main canal	236 km
- Lateral	1,281 km
4) Related structures	
- Headgate & turnout	1,556 nos.
- Checkgate	1,520 nos.
- Spillway and wasteway	35 nos.
- Syphon	12 nos.

4. The drainage plan is formulated to prevent overbank spills from creek adjacemt paddy field and to minimize the inundation area and duration in the area near the San Antinio and North Candaba swamps by means of widening, deepening and shortening the creeks.

   The design of the creeks is prepared to meet with the drainage requirement of 5-year probable rainfall. The area to be benefited by the drainage project is estimated at 5,550 ha consisting of 2,550 ha in the San Antonio swamp and 3,000 ha in the North Candaba swamp.

   The proposed works are summarized as follows:

Proposed Works	San Antonio Area	North Candaba Area
Total improvement length (km)	53	46
Structures		
Drainage inlet (nos.)	20	24
Bridge (nos.)	8	2

5. River improvement plan for the downstream of the lower Talavera river is examined by two alternative plans: i) method by widening the river width and excavation of the low water channel and ii) method by raising and strenghening of the existing dikes and minor excavation of the low water channel. Considering the present situation and possibility of realization of the works, the latter was accepted as the improvement plan for the lower Talavera river. Furthermore, improvement plans for alternative scales of 20-year, 10-year and 5-year design flood discharge were studied to determine the optimum scale of the project. As a result a river improvement plan for 10-year design flood discharge was accepted. The area to be benefited by the project is estimated at 5,890 ha.

The proposed works are outlined as follows:

Proposed Works	Talavera River	Tributary A	Tributary B	Total
Length to be improved (km)	26.5	9	8	43.5
Structures				
Bridge (nos.)	-	1	-	1
Gate (nos.)	-	2	2	4

6. Organizational modification of the existing UPRIIS office is proposed in order to improve organization efficiency: i) establishment of the strengthened Maintenance and Equipment Division which will integrate the maintenance functions shared by the existing Equipment Division and the Engineering & Operations Division, ii) creation of the Planning and Operations Division which will take over the present operation functions of WCCC and the Engineering & Operation Division and iii) transformation of Agriculture Division into the Farmer's Assistance Division.

Operational channel with five supervision steps consisting of Operations Manager, Irrigation Superintendent, Irrigation Engineer, Water Master and Ditchtender is proposed instead of the existing channel of seven steps for quick accurate operation of irrigation water distribution.

It is proposed that the staffing pattern of the field staff on operation function is composed of 4 Irrigation Superintendents (District Chief), 16 Irrigation Engineers, 50 Irrigation Association Organizers, 148 Water Master (AWMT), 47 Gatekeepers and 556 Ditchtenders. Based on this staffing pattern, the superfluous personnel in the UPRIIS office occurs and consists of 4 Operations Engineers, 12 Zone Engineers, 38 Water Management Technologists and 203 Ditchtenders. On the other hand new posts for 16 Irrigation Engineers, 20 Gatekeepers and 50 Irrigation Association Organizers will be created.

It is proposed that in the first place the superfluous personnel will be relocated as follows: i) All Operations Engineers and Zone Engineers will be transformed into Irrigation Engineers, ii) All superfluous Water Management Technologists and 12 among superfluous Ditchtenders will be incorporated in the Farmers' Assistance Division as Irrigation Association Organizers and iii) New post of Gatekeeper will be occupied by 20 Ditchtenders among the superfluous Ditchtenders.

The actual remaining superfluous 171 Ditchtenders will be discharged for 9 years as their age and/or service period requirements for retirement are satisfied. No new Ditchtenders will be appointed during the 9 years. Total numbers in the UPRIIS office will become 1,483 after 9 years from 1,654.

7. Establishment of the Centralized Monitoring System (CMS) is recommended for the purpose of accurate and quick operational action for management and control of irrigation water distribution. Through the CMS, collection of field data, data processing, planning of water distribution and monitoring of the field operation will be carried out in a short time. The CMS facilitated with mini-computer and related instruments comprises one central station at UPRIIS head office, five base stations at each District office and at the Pantabangan dam and 48 field stations.

   The following operation rule is proposed in order to attain higher irrigation efficiency, equitable distribution of irrigation water and same quality of control at each irrigation system: i) Unit operation period is one week, ii) If it is monitored that rainfall amount exceeds 30 mm/day, the irrigation supply will be stopped for the respective irrigation system from the next day until the end of week, iii) At the beginning of the week, irrigation water to be delivered is checked by the water balance calculation. Through this operation, overall irrigation efficiency will be expected to reach 54% in the wet season and 57% in the dry season.

The maintenance and repair activity will be reinforced through the improvement of organization and engineering. Minor maintenance and repair works within proposed farmer-irrigation associations (FIA) are to be transfered to FIA. The engineering support will be given by the UPRIIS office. The maintenance work by the UPRIIS office will be concentrated on the major irrigation facilities.

8. At present, the irrigation service fee (ISFs) is collected directly from individual farmers by bill collectors or deputized collectors. But, to alleviate the burden on the UPRIIS, it is recommended that Farmer-Irrigation Associations collect irrigation service fees by themselves and remit them to the UPRIIS office.

   It is assessed that an allowance of six (6) kg per cavan collected in payment of ISFs in kind is not enough to cover all expenses incurred in collecting the paddy. It would be advantageous to abolish the option to pay ISFs in kind or to increase the allowance the more than ten (10) kg to recoup such losses.

   Considering the current interest rate on loans and penalties imposed in tax payments, the present penalty charge of 1% per month for non-payment of the irrigation service fee seems too low to discharge effectively the delinquency. It is recommended that a heavier penalty is imposed in the case of willful neglect.

9. Farmer irrigation association is formulated on the basis of irrigation water delivery systems. Farmer Irrigation Group (FIG) will be established in each irrigation rotation area on the basis of 3,008 blocks in the irrigation service area. FIG will later be federated into the Farmer-Irrigation Association. One FIA will be established in each irrigation block controlled by a sub-lateral canal or approximately less than 200 ha and 865 FIAs will be instituted in total.

FIA will be formed as non-stock corporation. The major activities of FIA are: i) operation and minor maintenance and repairs for irrigation facilities within the area of FIA, ii) scheduling of water delivery within the FIA area, iii) check of collection bills for all FIA members and iv) collection of the irrigation service fees and their remittance to the UPRIIS office.

10. After implementation of the project, crop yield of rice will be expected to reach 4.5 ton of paddy per ha in the wet season and 5.2 ton of paddy per ha in the dry season. The total production of paddy is expected to be one million ton in the irrigation service area of 111,200 ha. Further the expected decrease in the annual amount of flood damage will amount to about ₱7 million. Under such situations farmer's income will be expected to improve considerably. Net reserve or capacity to pay for typical farmers will increase 1.3 to 3 times that of the net reserve under without project condition.

11. The Assistant Administrator for Operations will be responsible for the overall execution of the proposed project in cooperation with the Assistant Administrator for Project Development and Implementation. The new project execution office in the field will not be established. The UPRIIS office will execute the project through reinforcing its function by establishment of Design & Construction Supervision division.

12. The construction works including preparatory works are planned to be carried out over 10 years from 1985 to 1994.

IV. Evaluation

1. The project cost is estimated at ₱916.2 million comprising ₱554.1 million equivalent of foreign currency and ₱362.1 million of peso currency. Fund requirement for the project or financial cost amounts to ₱1,446.0 million consisting of ₱752.5 million equivalent of foreign currency and ₱693.5 million of peso currency. Economic project cost is estimated at ₱855.19 million. Annual operation and maintenance costs at the full stage of the project are estimated at ₱32.68 million.

2. The total benefits to be expected from the project at the full stage are expected to be ₱409.94 million consisting of ₱400.37 million for irrigation & drainage, ₱7.08 million for river improvement and ₱2.49 million for reduction of personnel expenses.

3. The internal rate of return for the project is 19.3%. The rate of return is sensitive to decrease of benefit and increase of project cost, but the internal rate of return is 15.3% even if construction cost increases by 20% and benefit decreases by 20%.

4. After the implementation of the project, drastic increase of farm income will be expected for farmers. The farm budget analysis for typical farmers indicates that all typical farmers will be able to have net reserve for paying irrigation service fee.

5. The UPRIIS office would financially manage the project under the condition which efficiency of irrigation service fee collection exceeds 75% with rice at a price of ₱1.7 per kg.

V. Conclusion and Recommendation

The project will be expected to provide greater benefits and effects to the peoples in and around the project area.

The project has been proved to be technically sound and economically feasible. Further the project is financially justifiable.

It is therefore recommended to implement the Improvement Project of Operation and Maintenance of the UPRIIS as soon as possible.

PRINCIPAL FEATURES OF THE PROJECT

I. PROJECT FEATURES

1.	Project area	:	157,000 ha
2.	Irrigation service area	:	112,000 ha
3.	Cropping area : wet season	:	106,800 ha
	dry season	:	108,000 ha
4.	Irrigation practices	:	Year-round irrigation by gravity
5.	Cropping pattern	:	Double cropping of paddy per annum
6.	Rehabilitation & improvement works		
	i) Diversion dam	:	8 nos.
	ii) Re-use structure	:	18 nos.
	iii) Irrigation canal		
	Diversion canal	:	46.6 km
	Main canal	:	236 km
	Lateral canal	:	1,281 km
	iv) Related structures		
	Headgates & turnout	:	1,556 nos.
	Check gates	:	1,520 nos.
	Spillway	:	35 nos.
	Syphon	:	12 nos.
	v) Drainage creek		
	San. Antonio area	:	53 km
	Candaba area	:	46 km
	vi) River improvement		
	The Talavera river	:	26.5 km
	Tributaries of the Talavera	:	17 km
7.	Centralized monitoring system		
	i) Central station	:	1 no.
	ii) Base station	:	5 nos.
	iii) Field station	:	48 nos.
8.	Implementation period	:	10 years
9.	Irrigation association set-up		
	Farmer-Irrigation Association	:	865 nos.
	Farmer-Irrigation Group	:	3,006 nos.

II. PROJECT COST, BENEFIT AND EVALUATION

1.	Economic cost	:	₱855.19 x 10^6
2.	Project cost		
	Foreign currency portion	:	₱554.1 x 10^6
	Local currency portion	:	₱362.1 x 10^6
	Total	:	₱916.2 x 10^6
3.	Fund requirement		
	Foreign currency portion	:	₱752.5 x 10^6
	Local currency portion	:	₱693.5 x 10^6
	Total	:	₱1,446.0 x 10^6
4.	Operation and maintenance cost	:	₱32.68 x 10^6
5.	Annual project benefit	:	₱409.94 x 10^6
6.	Internal rate of return	:	19.3%

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ON
THE IMPROVEMENT PROJECT
OF
THE OPERATION & MAINTENANCE
OF
NATIONAL IRRIGATION SYSTEMS (UPRIIS)

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ABBREVIATIONS

Abbreviations used in this report are listed below:

1. Length and Height

mm : millimeter
cm : centimeter
m : meter
km : kilometer
MSL : mean sea level
EL : elevation

2. Area

cm^2 : square centimeter
m^2 : square meter
km^2 : square kilometer
ha : hectare
MSM : million square meter

3. Volume

lit, ℓ : liter (= 1,000 cm^3)
m^3 : cubic meter
MCM : million cubic meter

4. Weight

mg : milligram
g : gram
kg : kilogram
t (ton) = 1,000 kg

5. Time

sec : second
min : minute
hr : hour
yr : year

6. Electric Measures

kV : kilovolt
kW : kilowatt
kWh : kilowatt-hour
MW : megawatt
MWh : megawatt-hour
GWh : gigawatt-hour

7. Other Measures

% : percent
PS : horse power
°C : centigrade
m^3/sec, m^3/s : cubic meter per second
lit/sec/ha, lit/s/ha : liter per second per hectare
cm/sec, cm/s : centimeter per second
t/ha : ton per hectare
ppm : part per million
No(s), no(s) : number(s)
SpT : standard penetration test

8. Currency

US$: US Dollar
₱ : Philippine Peso
(US$1.00 = ₱11.0 = ¥240)

9. Other Abbreviations

(A)

AD	-	Agriculture Division
ADB	-	Asian Development Bank
APIP	-	Aurora Peñaranda Irrigation Project
ARBA	-	Agrarian Reform Beneficiaries Association
AW	-	Association Worker
AWMT	-	Assistant Water Management Technician

(B)

BAEcon	-	Bureau of Agricultural Economic
BAEx	-	Bureau of Agricultural Extension
BAI	-	Bureau of Animal Industry
BC	-	Billing Clerk
BCD	-	Bureau of Cooperative Development
BFAR	-	Bureau of Fisheries and Aquatic Resources
BFCD	-	Bureau of Flood Control and Drainage
BPI	-	Bureau of Plant Industry
BPW	-	Bureau of Public Works
BS	-	Bureau of Soils

(C)

CBP	-	Central Bank of the Philippines
CDLF	-	Cooperatives Development Loan Fund
CIA	-	Communal Irrigators Association
CISP	-	Cooperative Insurance System of the Philippines
CLSU	-	Central Luzon State University
CMSP	-	Cooperative Marketing System of the Philippines
COA	-	Commission of Audit
CRB	-	Cooperative Rural Bank

(D)

DPB	-	Development Bank of the Philippines
DT	-	Ditchtender

(E)

EOD	-	Engineering and Operations Division

(F)

FACOMA	-	Farmers' Cooperative Marketing Association
FAD	-	Farmers' Assistance Division
FAO	-	Food and Agricultural Organization
FBC	-	Farmers' Barrio Cooperative
FIA	-	Farmer-Irrigators' Association or Farmer-Irrigation Association
FIG	-	Farmer-Irrigators' Group or Farmer-Irrigation Group
FL	-	Farmers' Leader
FSDC	-	Farm Systems Development Corporation

(G)

GK	-	Gatekeeper
GOP	-	Government of the Philippines

(I)

IA	-	Irrigation Association
IAO	-	Irrigation Association Organizer
IBRD	-	International Bank for Reconstruction and Development
IGL	-	Irrigators' Group Leader
IOMP	-	Input and Output Monitoring Program
IRRI	-	International Rice Research Institute
ISA	-	Integrated Services Association
ISF	-	Irrigation Service Fee

(J)

JICA	-	Japan International Cooperation Agency

(K)

KAISA	-	Kalipunan Ng Mga Integrated Service Association
KKK	-	Kilusang Kabuhayan at Kaunlaran

(L)

LBP	-	Land Bank of the Philippines

(M)

MA	-	Ministry of Agriculture
MAR	-	Ministry of Agrarian Reform
MEC	-	Ministry of Education and Culture
MF	-	Ministry of Finance
MHS	-	Ministry of Human Settlements
MITI	-	Ministry of Industry, Trade and Investment
MLG	-	Ministry of Local Government
M-99	-	Masagana 99 Program
MPWH	-	Ministry of Public Works and Highways
MRRTC	-	Maligaya Rice Research and Training Center

(N)

NCSO	-	National Census and Statistics Office
NEDA	-	National Economic and Development Authority
NFA	-	National Food Authority
NFAC	-	National Food and AGriculture Council
NIA	-	National Irrigation Administration
NIS	-	National Irrigation System
NPC	-	National Power Corporation
NSDB	-	National Science Development Board
NWRC	-	National Water Resources Council

(O)

OECF	-	Overseas Economic Cooperative Fund

(P)

PAGASA	-	Philippine Atmospheric, Geophysical and Astronomical Services Administration
PATC	-	Philippine Agricultural Training Council
PCARR	-	Philippine Council for Agricultural Research Resources
PCIC	-	Philippine Crop Insurance Corporation
PDC-ADCC	-	Provincial Development Committee - Agricultural Development Coordinating Council
PIS	-	Pump Irrigation System
PNB	-	Philippine National Bank

(R)

RIS	-	River Irrigation System
RP	-	Republic of the Philippines
RUG	-	Rotation Unit Group

(S)

SEC	-	Securities and Exchange Commission

(U)

UNDP	-	United Nations Development Program
UPCA	-	University of the Philippines College of Agriculture at Los Baños
UPRIIS	-	Upper Pampanga River Integrated Irrigation System
USAID	-	United States Agency for International Development
USBR	-	United States Bureau of Reclamation

(W)

WCCC	-	Water Control Coordinating Center
WM	-	Watermaster
WMT	-	Water Management Technologist
WMTC	-	Water Management Training Center

(Z)

ZE	-	Zone Engineer

10. Abbreviations on the Upper Pampanga River Integrated Irrigation Systems

LTRIS	-	Lower Talavera River Irrigation System
MCIS	-	Murcon Creek Irrigation System
PBRIS	-	Pampanga Bongabon River Irrigation System
PCCA	-	Pamaldan Cinco Cinco Area
PENRIS	-	Peñaranda River Irrigation System
PRIS	-	Pampanga River Irrigation System
RMA	-	Rizal Munic Area
SAE	-	San Agustin Extension
SDA	-	Sto. Domingo Area
TRIS	-	Talavera River Irrigation System
VCIS	-	Vaca Creek Irrigation Sytem

CHAPTER 1 INTRODUCTION

1.1 Purpose of Report

This is a final report for feasibility study on the Improvement Project of the Operation and Maintenance of the UPRIIS.

The report describes the project area, presents constraints for development which the UPRIIS encountered, proposes solutions, examines institutional aspect of the UPRIIS and farmer's organizations, sets forth proposed development programs on agriculture, irrigation, drainage, river improvement, management of operation and maintenance and farmer's organization set-up and presents an assessment of these programs. This report is of a summary nature and is supported by the eleven appendixes listed below.

Appendix I	Meteorology and Hydrology
Appendix II	Irrigation
Appendix III	Drainage
Appendix IV	River Improvement
Appendix V	Agriculture and Agro-economy
Appendix VI	Management of Operation and Maintenance
Appendix VII	UPRIIS Organization
Appendix VIII	UPRIIS Farmers
Appendix IX	Farmer's Organizations
Appendix X	Implementation Schedule and Cost Estimate
Appendix XI	Evaluation

1.2 Authority to Report

This report was prepared in accordance with Implementing Arrangement of the technical cooperation between National Irrigation Administration (NIA) and Japan International Cooperation Agency (JICA) dated on July 13, 1982.

1.3 Project History

Since the four year development plan launched in 1967, the Government of the Philippines has laid great emphasis on substantially increasing rice production in order to attain self-sufficiency of foodstuff.

In conformity with this the Government of the Philippines has made every effort to implement national irrigation systems to a nationwide extent. At present 117 national irrigation systems exist in the Philippines. However, these systems have become so deteriorated in recent years and operation and maintenance of these systems has not always been sufficiently. For solving such problems the Government of the Philippines carried out to improve 76 national irrigation systems of the 117 systems with assistance from ADB, IBRD, OECF, etc., as phase 1. Through improvement of these systems the Government of the Philippines attained good results in increasing rice production. However, 41 national irrigation systems still remain to be improved.

As phase 2, the Government of the Philippines selected 21 national irrigation systems as a highest priority project from the remaining 41 systems and requested the technical assistance for a feasibility study on the 21 projects from the Government of Japan.

In response to the request of the Government of the Philippines, the Government of Japan decided to undertake the feasibility study on the improvement project of operation and maintenance of the UPRIIS and the Angat and Maasim River Irrigation Systems (AMRIS) and to give technical assistance on the feasibility study on the remaining 18 irrigation systems to NIA. The implementing arrangement on the technical cooperation between NIA and JICA for the feasibility study on the improvement project of the operation and maintenance of national irrigation systems was signed on July 13, 1982.

According to the Implementing Arrangement, the feasibility study was begun in September 1982 and finished in February 1984.

1.4 Personnel Assigned and Transfer of Knowledge

The Advisory Committee, the JICA Survey Team and the Philippine Counterpart Group who have taken part in the survey and study are listed in Table 1. Transfer of knowledge to the Philippine counterpart personnel was executed throughout the survey and the study in both the Philippines and Japan.

CHAPTER 2 THE PROJECT AREA AND CONSTRAINTS FOR PROJECT DEVELOPMENT

2.1 General Description of the Project Area

2.1.1 Location

The project area is defined as a gross area of the UPRIIS. It is located in Central Luzon, one of the largest rice producing regions in the Philippines (see general map). The project area lies in the vast flat alluvial plain in the upper reaches of the Pampanga river, about 150 km north of Manila. The project area is bounded on the west by the Rio Chico river, on the south by the Maasim river, on the east by the Sierra Madre mountain range and on the north by the Caraballo mountain range. It covers about 157,000 ha of land. Administratively the project area extends over the area in the provinces of Nueva Ecija, Bulacan and Pampanga, out of which over 80% is in Nueva Ecija province.

2.1.2 Climate

The climatic conditions in the project area are dominated by the monsoons. An average annual rainfall is about 1,900 mm, of which 87% is concentrated on the wet season extending from May to October. However, there exists a considerable yearly variation. It is observed that a seasonal distribution pattern of rainfall in the project area shows no great difference on location. The annual average temperature is 27°C with little variation throughout the year. The difference between maximum and minimum daily temperature is about 10°C throughout the year. Sunshine duration ranges from 3.9 hr/day in August to 8.8 hr/day in April. Average annual relative humidity is 77%, ranging from 91% in August to 62% in April. Average daily evaporation is about 5 mm. From an agro-climatical viewpoint, these climatic conditions favour higher agricultural production with the project area. However, typhoons sometimes hit and cause serious damage to the area. Climatic conditions in the project area are as shown in Table 2.

2.1.3 Hydrology

Rainfall in the project area is brought mainly by the combination of tropical typhoons and monsoons. Average annual rainfall is about 1,900 mm at Cabanatuan in the central part of the project area. The rainfall increases with elevation and reaches about 2,800 mm in the mountain areas. About 90% of the total annual rainfall is concentrated on the wet season and August is generally the month of heaviest rainfall.

Major streamflows in the project area are the Pampanga river and its tributaries such as the Talavera river, the Peñaranda river and the Coronel river.

The mean annual discharge of the Pampanga river is about 46 m^3/sec at the Pantabangan dam. The discharge fluctuates throughout the year ranging from about 102.5 m^3/sec in August to 7.0 m^3/sec in April. Estimated mean annual discharges at the PRIS and PBRIS dams are 2.4 m^3/sec and 52 m^3/sec, respectively. The mean annual discharges of the Talavera river at the Talavera diversion dam and of the Peñaranda river at the Peñaranda diversion dam are about 12 m^3/sec and 19 m^3/sec, respectively. The mean annual discharge of the Coronel river is about 21 m^3/sec at Bangkerohan.

The seasonal patterns of the streamflows of the above rivers are as follows:

Mean Monthly Discharge

(Unit: m^3/sec)

River	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Mean Annual
Pampanga													
- Pantabangan	11.6	9.7	10.0	7.0	59.4	42.3	71.6	102.5	90.7	64.3	66.9	14.3	45.9
- PRIS	0.9	0.8	0.7	0.7	1.6	2.9	3.9	5.2	5.0	3.2	2.2	1.2	2.4
- PBRIS	19.5	17.8	16.6	17.1	36.7	63.3	85.3	113.4	108.2	69.4	49.2	27.1	52.0
Talavera	5.3	6.2	7.6	6.0	8.7	13.2	9.9	17.1	16.8	20.8	18.8	8.8	11.6
Peñaranda	9.7	8.2	8.9	9.5	10.9	11.8	19.7	17.7	18.8	21.4	50.3	16.0	16.9
Coronel	14.7	12.2	10.1	8.1	10.8	17.7	26.6	29.9	27.1	29.2	47.3	19.8	21.1

2.1.4 Topography and Soil

Topographically the area slopes from north to south and from east to west. The gradient is about 1/500 in the upper part of the project area and 1/1,000 to 1/2,000 in the lower part of the project area adjacent to the Candaba and San Antonio Swamps. There exist many creeks and considerable microreliefs, which often hinder proper surface drainage.

Ten (10) soil series established by the Bureau of Soils are found; Prensa, Quingua, Maligaya, Umingan, Bantog, Zaragoza, Annam, Candaba, Bigaa and Buenavista. Most of them are formed by recent alluvium, having relatively deep effective solum depth with medium to fine soil textures. These soils are suitable for irrigation farming especially for rice. Under proper irrigation farming these soils promise to realize full exploitation of their higher productive potentials.

2.1.5 Land Use and Agricultural Product

(1) Land Use

The land use in the project area is summarized as follows:

Item	Area (ha)	Proportional Extent (%)
1. Paddy Field	125,600	80.0
Rainfed paddy field	8,700	5.5
Paddy field with irrigation facilities	116,900	74.5
- Irrigated double cropping of paddy	(84,900)	(54.1)
- Irrigated wet season paddy only	(6,900)	(4.4)
- Rainfed wet season paddy only	(25,100)	(16.0)
2. Village/Road/River/Canal	31,400	20.0
Total	157,000	100.0

As shown in above table, most of the project area is paddy field. Among 116,900 ha of paddy field with irrigation facilities, about 91,800 ha in wet season and 84,900 ha in dry season are irrigated. The remaining area is cultivated under rainfed condition or fallow land due to lack of irrigation water in the dry season, inundation and some other constraints.

The multi-cropping index is estimated at 1.68 for the project area and 1.73 for potential irrigation service area of UPRIIS.

(2) Cropping Pattern and Farming Practice

The present cropping pattern prevailing in the project area is that the wet season paddy is planted on the onset of the monsoon, generally June to September, and harvested from October to December. The dry season paddy is planted at the period of December to February in normal cases.

The most predominant rice varieties are IR 36, 42, 46, 48 and 50. About 140 kg of seed is applied per ha.

Application of fertilizer and agro-chemicals is common practice. The estimated dosages of fertilizer per ha range from 57 kg to 78 kg on N, about 15 kg of P and about 7 kg of K. With regard to agro-chemicals, less than 4 kg of pesticides and insecticides are applied in spite of considerable damage done by stem borer, sheath blight, tungro, grassy stunt, etc. In addition, herbicides are also applied.

As far as farming is concerned, most of the land preparation work and most of the threshing work is done by farm machinery. Other farming practices are done by manpowers. About 70% of total manpower is dependent on hired labor. Especially more than 90% of farming work on transplanting and harvesting is carried out by hired laborer. Details are explained in Appendix V.

(3) Unit Yield and Production

The unit yield of the wet season paddy is estimated at 3.6 ton of paddy per ha for irrigated land and 2.4 ton of paddy per ha for rainfed land. An average yield of the dry season paddy is estimated at 4.1 ton per ha. The unit yield of paddy is significantly different depending on location in the project area. It is also noticeable that there exists a significant difference in unit yield between the wet season and the dry season paddy. These unit yields are considerably higher than the notional level of 2.1 ton per ha. However the unit yield of paddy is still low in comparison with the target yield of the UPRIIS and its full potential has not been realized. Limiting factors which hinder the increase of rice yield are supposed to be accrued from the following major constraints encountered in the area: i) Flood damage due to typhoons, ii) Poor drainage conditions, iii) Improper irrigation water supply in volume and in time and iv) Limited extent of proper farming. Details are explained in Appendix V.

The total production of paddy in the project area is estimated at about 760,000 ton.

2.2 Irrigation Systsms

2.2.1 General

The UPRIIS consists of the following sixteen irrigation systems. These systems are operated by the four district offices under the UPRIIS head office.

System	Water Resources	
	Main	Supplementary
District I		
1) San Agustin Extension (SAE)	Talavera River	-
2) Talavera River Irrigation System - Upper Area (TRIS upper)	"	-
3) Talavera River Irrigation System - Lower Area (TRIS lower)	Pampanga River	-
4) Santo Domingo Area (SDA)	De Babuyan Creek	Pampanga River
District II		
5) Rizal Munic Area (RMA)	Pampanga River	-
6) Pampanga River Irrigation System (PRIS)	"	-
7) Lower Talavera River Irriation System (LTRIS)	Talavera River	Pampanga River
8) Vaca Creek Irrigation System (VCIS)	Vaca Creek	"
9) Murcon Creek Irrigation System (MCIS)	Murcon Creek	"
District III		
10) Pampanga Bongabon River Irrigation System - Proper (PBRIS proper)	Pampanga River	-
11) Pampanga Bongabon River Irrigation System - Extension (PBRIS ext'n)	"	-
12) Aliaga Area (ALIAGA)	"	-
13) Platero Area (PLATERO)	"	-
14) Pamaldan Cinco-Cinco Area (PCCA)	"	-
District IV		
15) Peñaranda River Irrigation System - Proper (PEÑRIS proper)	Peñaranda River	Pampanga River
16) Peñaranda River Irrigation System - Extension (PEÑRIS ext'n)	"	"

The general layout of the irrigation systems in each District is shown in Fig. 1(1) - (4).

2.2.2 Water Resources

The water resources in the UPRIIS are i) the Pampanga river with reservoir function provided by the Pantabangan dam, ii) the Talavera river, iii) the Peñaranda river and iv) major creeks in the project area.

The Pampanga river is the largest water resources in the UPRIIS. The mean annual runoff of the Pampanga river is about 1,450 MCM at the Pantabangan dam. The maximum monthly runoff is about 275 MCM in August and the minimum about 18 MCM in April. The effective storage capacity of the Pantatangan dam is 2,800 MCM which is allocated for irrigation in UPRIIS, generation of hydro electric power and flood control. The water released from the Pantabangan dam is intaked at the Pampanga diversion dam (PRIS dam) and the Pampanga Bongabon diversion dam (PBRIS dam) located in about 21.5 km and 56 km downstreams from the Pantabangan dam, respectively.

The drainage area is about 52 km^2 at the PRIS dam excluding the drainage area at the Pantabangan dam. As the mean annual runoff from the drainage area is about 76 MCM, most of the irrigation area served by the PRIS dam depends on the water from the Pantabangan dam.

The drainage area at the PBRIS dam is about 1,043 km^2 excluding the drainage area at the Pantabangan dam and the PRIS dam. There are major tributaries such as the Coronel and Digmala rivers. The mean annual runoff at the PBRIS dam is about 1,640 MCM. The mean monthly runoff fluctuates from 280 MCM in September to 44 MCM in March. The area served by the PBRIS dam is irrigated by the above uncontrolled stream flow and water from the Pantabangan dam.

The mean annual runoff of the Talavera river is about 380 MCM at the Talavera diversion dam (TRIS dam). The maximum monthly runoff is about 56 MCM in October and the minimum is about 16 MCM in April. The TRIS upper and SAE depend on the river flow of the Talavera and the irrigation area in the dry season is restricted due to the shortage of water. The discharge record of the Talavera river is not available at the Lower

Talavera diversion dam (LTRIS dam). The LTRIS area served by the LTRIS dam receives the supplementary water from the Pantabangan dam.

The mean annual runoff of the Peñaranda river is about 600 MCM at the Peñaranda diversion dam (PEÑRIS dam). The maximum monthly runoff is about 130 MCM in November and the minimum is about 20 MCM in February. The irrigation area served by the PEÑRIS dam is so large compared with the river flow. The water shortage also occurs in the dry season. So additional water is supplied by the PBRIS dam through the PBRIS proper main canal and lateral G-2 extension.

There is no available discharge record of the major creeks such as the De Babuyan, Vaca and Murcon. The drainage areas of the De Babuyan creek at 5-Bay, the Vaca creek at the Vaca dam and the Murcon creek at the Murcon dam are about 35 km^2, 48 km^2 and 79 km^2, respectively. The available discharges of these creeks are expected to be small. These systems are supplied by the supplementary water from the Pantabangan dam.

2.2.3 Irrigation Service Area

For the purpose of operation, the UPRIIS office delineates the potential irrigation service area of 103,600 ha. The area may represent the practical existing condition of the UPRIIS excluding such area as affected by inundation or by flood damage. It is essential for the formulation of an irrigation plan to define the physical potential area of the system and to clarify the practical irrigation service area.

The physical potential irrigation service area was identified by using the map of the "Irrigation Networks" on a scale of 1/4,000, the topographic map of 1/4,000 and the data of land classification.

The physical potential irrigation service area is obtained at 116,900 ha. The breakdown of the area by each irrigation system is summarized in Table 3.

2.2.4 Irrigation Facilities

The irrigation facilities in the UPRIIS are composed of eight diversion dams, 46.6 km of diversion canal, 236 km of main canal, 1,281 km of lateral and related canal structures. Construction of the on-farm level water distribution system was carried out based on the design criteria which provided one turnout structure with every 50 ha and one farm ditch with every 10 ha. The inventory of irrigation facilities is summarized in Table 4.

The remarkable problems in the irrigation facilities are described as follows:

(1) Diversion Dam

Major problems found at diversion dams are difficulties in operation of sluice gates and intake gates caused by siltation in front of the gates, damage on the lifting mechanism and from lack of proper maintenance such as lubrication, painting and periodical cleaning. Major on minor rehabilitation works are necessary for the all diversion dams.

(2) Canals

Major problems noted on canals are siltation, bank erosion and sloughing and scouring at downstream of structures and siltation problems.

(3) Related Structures

An noticeable problem is the lack of operable gate at most structures such as headgate, turnouts and checks. Stop logs often made of banana logs are commonly used for control. Smooth and accurate operation and control of water distribution is not possible using a stop log.

Spillways and wasteways to control excess water and to flush off all water in case of emergency and repairing canals have been very neglected in the present system.

(4) Farm Road

Service roads along main canals and laterals are the major farm transportation networks within the UPRIIS in addition to the national roads connecting major cities. The condition of service roads along main canals and major laterals is generally good. Near the tail portion of canals and along smaller laterals, however the conditions becomes bad.

2.2.5 Irrigated Ratio in the Existing Irrigation Systems

An average irrigated area in the UPRIIS during the period of four years from 1979 to 1982 was 84,900 ha in the dry season, 73% of the potential area and 91,800 ha in the wet season, 78% of the potential area.

It is considered that such low irrigated ratio seems to result from the following causes.

1) Since irrigation development has been executed without assessment of water resources, the potential irrigation service area has contained the area where irrigation water could not be provided inherently due to a shortage of water resources.

2) The potential irrigation service area contains the area where irrigation farming can not be practised during the wet season due to inundation and overbank spills.

3) The potential area contains the area in which irrigation water can not be supplied due to the deficiencies of irrigation facilities as mentioned in the previous section.

4) Efficient use of irrigation water has been hindered because of low irrigation efficiency resulting from problems on management of water delivery and control of system facilities.

2.2.6 Irrigation Efficiency and Dam Operation

The actual irrigation efficiency is expressed by the ratio between calculated diversion water requirement and recorded diversion amount.

The actual irrigation efficiency by major diversion dam system was estimated as follows. Theoretical overall irrigation efficiency is calculated based on the criteria of UPRIIS.

Diversion Dam System	Irrigation Efficiency (%)	
	Dry Season	Wet Season
TRIS	-	20
PRIS	51	29
PBRIS	51	30
PEÑRIS	87	32
Theoretical Efficiency	54	51

There is a clear difference in the irrigation efficiency between the dry season and the wet season. The dry season efficiency gains more than 50% in most of the irrigation systems. Very high efficiency attained in the dry season at the PEÑRIS diversion dam is explained by the use of supplemental pump irrigation from ground water and by the use of return flow which are disregarded in the calculation.

The irrigation efficiency in the wet season is significantly as low as 30%. The reason for the low efficiency in the wet season is not imputed only to the physical defect of structures as far as higher efficiency is attained in the dry season. It will be derived from the low efficiency of utilizing the effective rainfall.

Further excessive water release from the Pantabangan dam is also one of the constraints from the standpoint of effective use of water resource particularly, as shown in Fig. 2.

2.2.7 Time-lag Analysis

Time-lag between the diversion point and each turnout of canal is one of the constraining factors in the distribution of water in such a run-of-river system type which has a long conveyance line without storage facilities on the way.

The time-lag between the Pantabangan dam and the end point of the major irrigation canals was calculated using on the result of field experiment and the unsteady flow simulation method.

The results of this simulation are summarized in Fig. 3. The longest time-lag of 65 hours or about 3 days equivalent to the average velocity of 0.54 m/sec is found between the Pantabangan dam and the terminal of the Peñaranda main canal.

2.3 Drainage Systems

2.3.1 Drainage Systems

The major drainage systems in the project area consist of rivers and natural drainage creeks. No artificial drainage systems exist except for some irrigation canals working to intercept the surface runoff from the adjacent area. The San Antonio swamp and the North Candaba swamp are located functioning as natural retarding basin of the Pampanga river.

2.3.2 Drainage Facilities

There are no farm drainage networks such as main and secondary drainage canals in the area. Drainage water flows from paddy field to paddy field and finally reaches the natural drainage creeks.

Small to medium scale check structures are located on the creeks to re-use the irrigation return flow. Small earth dams are temporarily built by farmers in the creeks especially in the downstream area far from the turnouts. All these structures block the stream flow and cause flooding or drainage deficiencies at upstream. Heavy growth of aquatic vegetation reduces the creek flow capacity and chokes up the check structures.

2.3.3 Inundation Area

Drainage problems caused by the lack of farm drainage ditches and by excessive irrigation water release are noticeable during the wet season. However, principal and urgent drainage problems are the habitual inundation near the San Antonio and the North Candaba swamps and the overbanked flood from the Talavera river.

In order to analyse hydrological features in the inundation area, drainage simulation study is conducted by adopting the method developed by Japan Institute of Irrigation and Drainage.

The results of the study are as follows:

(1) San Antonio Swamp Area

For the probable rainfall scale of 2-year return period, overflow from creek or inundation does not occur at present physical conditions of creeks. For the scales of 5-year and 10-year return periods, overflow and inundation were clearly reproduced by simulation model.

The inundation area within the sample area is almost same for both cases of 5-year and 10-year floods, only the duration for overflow and inundation is different. The inundation reaches almost up to the ground elevation of EL. 13.0 m. Applying this result, the inundation area at present condition with 5-year probability was estimated at about 4,300 ha around San Antonio swamp within the boundary of about 15,000 ha of potential irrigation service area for PBRIS Extension.

Inundation is caused by the overflow from the creek to the adjacent paddy field. Overflow from the creek is caused by small carrying capacity of the creek section, the irregular alignment of creek bed gradient and by the swamp backwater.

(2) North Candaba Swamp Area

The backwater effect of swamp flood water level is more significant and duration of overflow or submergence is longer than those at the San Antonio swamp. The inundation water level reaches up to the ground elevations of about EL. 7 - 7.2 m, EL. 8.0 - 9.0 m and EL. 10.0 m for probable rainfall scales of 2-year, 5-year and 10-year, respectively.

Based on these results, the present total inundation area by 5-year probability scale was estimated at about 100 km^2 or 10,000 ha (PEÑRIS Proper area 66.5 km^2, PEÑRIS Extension area 33.6 km^2) within the boundary of potential irrigation service area of about 29,800 ha.

Details are explained in Appendix III.

2.4 Flood and Sedimentation

2.4.1 River Systems

The Pampanga river having catchment area of approximately 10,500 km^2 and the river length of 260 km is the principal drainage way of the basin. Major tributaries of the upper Pampanga basin are Digmala, Coronel and Peñaranda on the left side, and the Rio Chico and Talavera on the right side. The project area is drained mainly by the Talavera and Rio Chico rivers to the main Pampanga and by the Bulo and Malimba rivers to the Candaba swamp.

2.4.2 Carrying Capacity of Existing Channel and Flooded Area

The carrying capacities of the major existing channels in the project area were estimated by using non-uniform flow methods. The following table shows the bankful carrying capacity and corresponding flood scale.

River/Reach	Capacity (m^3/sec)	Scale (yr)
Pampanga river		
From conf. of Peñaranda to conf. of Coronel	2,500	1/10
Talavera river		
From conf. of Rio Chico to Calipahan bridge	200 to 500	1/2
From Calipahan bridge to TRIS dam	1,500 to 3,000	more than 1/20
Rio Chico river		
Downstream from conf. of Talavera	more than 1,300	more than 1/15
Upstream from conf. of Talavera	250 to 2,000	1/3 to 1/20
Peñaranda river		
Downstream from PEÑRIS dam	1,000	1/20

The table indicates that principal and urgent flood control problems in the Project area exist in the downstream of the lower Talavera river from the Calipahan bridge. Within this reach, the average carrying capacity of the channel was calculated at only 270 m^3/sec which corresponds to a flood scale of about 2-year return period.

The flood water often overflows at such reaches around the Aliaga diversion dam and the upstream of the confluence of the Rio Chico river.

The flood water causes severe damage for the towns of Aliaga and Zaragoza. Overflow flood from the left bank of the Talavera river spreads toward downstream and reaches the San Antonio swamp. Flood from the right bank of the Talavera river occurs in the area along the Talavera river because of topographic features and effect of back water from the confluence of the Talavera and the Rio Chico rivers.

The inundation areas were estimated by the storage balance calculation between the overbanked flood inflow and outflow from the area as follows:

Flood Scale	Inundation Area (ha)	
	Right Side	Left Side
1/5	640	1,500
1/10	830	5,500
1/20	960	6,100

2.4.3 Sedimentation

The sampling and physical analysis of river bed materials was conducted at 34 sites in the 5 major rivers by the UPRIIS staff in order to estimate the sediment transport capacity of the existing channels. Using the sampling data, grain size distribution and specific gravity were analyzed. Sediment discharges of the present river channels were estimated at major points by applying the Brown formula and sediment discharge rating curves were prepared. Based on the sediment discharge curves and daily discharges of the river, the annual sediment transport capacities of the present river channels were estimated.

Evaluating from the results of these analyses, it is concluded that the sediment transport capacity of the present river channel exceeds the expected sediment discharge except in the lower reaches of the Rio Chico and the Pampanga where these rivers flow into the San Antonio swamp. In the Talavera river, the transport capacity falls down to the sediment discharge at the Talavera and the Lower Talavera diversion dams because of the dam structures. However, the capacity and discharge are about balanced and serious problems against the ordinary operation and maintenance are not expected, providing proper execution of sluice gate operation of diversion dams during flood.

2.5 Management of the UPRIIS

2.5.1 Organizational Structure

(1) Structure

The existing organizational structure of the UPRIIS is presented in Fig. 4. The Assistant Administrator for Operations, National Irrigation Administration has an overall responsibility over the UPRIIS. The UPRIIS is headed by an Operations Manager who undertakes overall supervision and direction of operation and management of the system. Under the Operations Manager there are five (5) support Divisions, Water Control Coordinating Center (WCCC) and four (4) District Offices.

As for implementation and coordination of matters related to the development of irrigated agriculture in the Province, there exist the Provincial Development Committee (PDC) and Agricultural Development Coordinating Council (ADCC) composed of representatives from the government agencies concerned.

As for support Divisions, three (3) support Divisions (Administrative, Engineering & Operations and Equipment) are based in the headquarters at Cabanatuan, one (Agriculture) at Muñoz and one (Dam & Reservoir) at the Pantabangan dam site. These support Divisions provide, in principle, the Operations Manager with necessary supports with regard to general administration, engineering, training, research and extension, operation of the Pantabangan dam, equipment, etc.

Upon reviewing the O&M organization, it was found that the responsibilities and functions of each Division and Section under Division are not clearly defined. In the actual organization, maintenance of the systems is being performed by two sections: Operations Section and Field Services & Repair Section.

To ensure continuity and adequacy of maintenance works, it is advisable from the viewpoints of efficiency and economy to separate maintenance works from operation works. It is also observed that the functions of the Engineering and Operations Division and the WCCC are overlapping on the monitoring of the operations of the four (4) Districts.

The WCCC functions as a centralized control and monitoring center in which the valuable data of operation and hydrology are accumulated.

The four (4) District Offices are located respectively in Muñoz, Talavera, Cabanatuan and Gapan. Each Office is headed by a District Chief who is responsible for operation, maintenance, improvement and rehabilitation of the irrigation and drainage systems in the District. The District Office consists, in principle, of three (3) sections: administrative, operation and maintenance. Some Districts have furthermore collection section as shown in Fig. 5.

The operation and maintenance of the irrigation service area are carried out through administrative irrigation block ranging from District, Zone, Division to Section as shown in the following table.

Administrative Irrigation Block	Number of Blocks				
	District				Whole UPRIIS
District	I	II	III	IV	4
Zone	3	3	3	3	12
Division	8	11	12	11	42
Section	40	47	51	48	186

The irrigation service area in each District is divided into twelve (12) Zones having about 10,000 ha each. A Zone is under the supervision of a Zone Engineer who reports directly to the Operations Engineer. Likewise, the Zone is further divided into 42 Divisions with about 2,500 ha each, being managed by one Water Management Technologist (WMT). Then, each Division is subdivided into 186 Sections; where one Assistant Water Management Technician (AWMT) supervises 500 - 750 ha at the working station. Below Section level, irrigation rotational areas are controlled by Ditchtenders (DT). This means that the operation & maintenance of the UPRIIS as a whole is carried out through as many as seven (7) steps in total, ranging from Operations Manager, District Chief, Operation Engineer, Zone Engineer, WMT, AWMT (or Watermaster) to DT. The presence of

multi-posts in the middle of the system often complicates communication among them and negatively affects operation and maintenance activities.

(2) Staff and Staffing Pattern

The UPRIIS is now going through a transition period on institutional aspects. In pursuance of the Memorandum Circular MC #2, 1982, the coverage of the duties and responsibilities for field staff was amended. Following this circular, a large-scale reorganization including personnel reduction and resectioning is under way.

Since October 1982, more than 400 temporary workers have been tapered and the total number of employees in the UPRIIS amounts to 1,654 as of July 31, 1983. Its workforce is comprised of 402 key staff and 1,252 skilled & unskilled workers. The staff conducting field operation in the four District offices accounts for 78% of the total number of employees.

Major staff for operation and maintenance work in the UPRIIS is comprised of 4 Division Managers, 15 Irrigation Engineers including Operation Engineers and Zone Engineers, 38 WMT, 126 AWMT, 22 WM, 759 DT, 27 Gatekeepers (GK), 23 Billing Clerks (BC) and 5 Cashiers. The work load of the main field staff is shown in Table 5. The table indicates that work load for the staff varied in the four Districts. The length of canal controlled by one DT is estimated at 2.1 km on an average ranging from 1.6 km to 3.3 km. The irrigation service area supervised by one WMT and one AWMT or WM ranges from 1,600 ha to 3,300 ha and from 500 ha to 1,200 ha, respectively. Work load of DT varies from 110 ha/person to 160 ha/person.

To evaluate the work load of the UPRIIS staff, 13 national irrigation systems having an irrigation fee collection efficiency rate of more than 70% were selected from all national irrigation systems in the Philippines. The work load of staff in these systems was studied. The work load of UPRIIS staff was further examined in comparison with NIA work standard. The results in both cases are as follows:

Work Load per Person

Main Field Staff	UPRIIS (Average)	NIA Work Standard	National Irrigation Systems with High Collection Efficiency
WMT	2,400 ha	1,000 to 3,000 ha	-
AWMT/WM	620 ha	At least 750 ha	1,040 ha
DT	120 ha 2.1km of canal	At least 3.5km of canal plus all gates	170 ha 2.8km of canal
GK	3,400 ha	2 major gates plus 1.5km of canal	1,460 ha 9km of canal

It is noticed from the above that the UPRIIS has a thick density of field staff assignment with the exception of GK.

(3) General Profile of UPRIIS Staff

To identify the characteristics of UPRIIS staff, surveys on age, service period, employment status, training experience and working willingness, etc. were carried out.

As far as age is concerned the thirties occupy about 40.3% of the total staff of UPRIIS followed respectively by the forties (28.7%), the fifties (15.8%), the twenties (13.5%) and the sixties (1.8%). As for DTs who account for 78% of the field O&M personnel, it is characterized that their age distribution is wide-spread. This means that their share in old ages is large on the whole.

With regard to the period of water management services, most of the main field staff have experience of over five (5) years in water management. About 37% of the main field staff have experience of over 10 years in water management.

With regard to the status of employment, 79% of the total number of employees in the UPRIIS are in permanent status. The remainder are temporary staff, comprising 12% employed on a monthly and 9% on a daily basis.

For the purpose of improving and upgrading the quality of this staff, UPRIIS has executed several kinds of general or annual training programs. 99% of AWMTs and 97% of DTs respondents have already attended such training programs. The strengthening of such training programs is vital for the improvement of operation and maintenance of the UPRIIS.

Apart from the level of the skill, 97% of AWMTs and DTs are eager to work.

2.5.2 Management of Operation and Maintenance

(1) General

The UPRIIS Office owns all the irrigation facilities in the area and is responsible for the maintenance and repair of the facilities. With regard to operation, the UPRIIS Office has responsibility for the area above irrigation rotational area and water users are in charge of operation work within the irrigation rotational area in principle.

To ensure the efficient system management, the UPRIIS Office is responsible for the operation and maintenance and other services as follows:

1) Operation and maintenance of following irrigation facilities to distribute irrigation water properly to the service area
   - Pantabangan dam reservoir
   - Diversion dams (8 nos.)
   - Diversion canal (47 km)
   - Main canal (236 km)
   - Lateral canal (1,281 km)
   - Headgate & turnout (3,230 nos.)
   - Check structures (353 nos.)
   - Syphon (131 nos.)
   - Drainage culvert (213 nos.)
2) Collection of irrigation service fees
3) Data processing and recording

In principle, these works are carried out by the hierarchical system from Operations Manager, District Chief, Operation Engineer, Zone Engineer, WMT, AWMT (or WM) and DT.

(2) Planning of Irrigation Schedule

The WCCC takes responsibility for the preparation of the irrigation water delivery operation plan, monitoring and evaluation of delivery and of coordinating the activities of the District offices in matters pertaining to water delivery.

The plan of irrigation schedule prepared by the WCCC is approved by the PDC and ADCC. The general procedure of planning in the present system is as follows: i) The WCCC solicits from the four District office the area they expect to be irrigated for the next cropping season about 2 months prior to the start of irrigation. The report from the every District office will indicate information concerning the area to be irrigated by the system, kind of crop to be planted and the possible start date of water delivery, ii) Based on the reports, the WCCC will prepare a tentative plan of water allocation for the whole area considering the available storage in the Pantabangan reservoir and other water resources, iii) The tentative plan will be reviewed and checked by the District offices, iv) The reviewed plan will be finalized by the WCCC and submitted to the PDC & ADCC for approval and v) The final approved water delivery schedule program will be provided to all District offices, office of Dam and Reservoir Division and to the other government and private agencies, several weeks or possibly a month before the start of irrigation delivery.

However the actual irrigation practices were different from the irrigation schedule program due to the following reasons.

1) The irrigation schedule program was not announced to each farm sufficiently.

2) The actual irrigation practices are restricted by the weather conditions rather than the schedule. It is very difficult to plan the irrigation schedule taking into consideration of effective rainfall.

3) The control facilities for irrigation water delivery are not functioned well because of their defects, insufficient communication network and so on.

(3) Control of Irrigation Water Delivery

For the control and monitoring of the irrigation water delivery, the guidelines were set-up by the WCCC through the detailed operational rule of daily, weekly and monthly basis.

At the WCCC level, the decisions for irrigation water release from the reservoir and for control of diversion points under the WCCC, are made daily based on the following informations submitted by the District offices: i) Weekly progress of farming activity report containing the hectarage under land soaking, land preparation, normal irrigation, terminal drainage and the area harvested, ii) A daily record of discharges at major diversion points and rainfall and iii) A daily camp site report including the daily release from the reservoir, inflow to the reservoir and daily weather condition. All these data are to be sent through radio communication network in a corded form.

At District level, the same procedures are practiced daily based on the weekly farming activity report, submitted by the Zone Engineer to the district Operations Engineer, and daily discharge records obtained through the radio network.

However the operation and control of irrigation water delivery does not always function in the UPRIIS inspite that the procedures mentioned above exist.

The major problems in the operation and control of irrigation water are the physical defects of control structures and measurement devices and insufficient communication network. In addition to this, quick and accurate operational action is hindered by so many steps of operational supervisions from DT to Operations Manager.

It should also be noted that the operation relating to drainage is mostly neglected as present. Excessive irrigation water is noticeable from field observation especially in the wet season. There is no measurement of waste water from the tail of the system.

Constraints in the management and control of irrigation water delivery are summarized in Fig. 6.

(4) Monitoring and Radio Network

1) Meteo-hydrological Measurement

There exist 35 meteorological stations and 209 measurement stations for canal discharge in the UPRIIS. However 20% of the meteorological stations and 30% of the measurement stations are out of order as shown in the following table. Further considerable amounts of measuring devices do not function due to a lack of substantial and positive maintenance. Such lack of workable control structures and measuring devices seriously affects proper operation of irrigation water delivery.

Meteorological Stations

District	Station		Existing Instruments	
	Functional	Abandoned	Functional	Non-functional
I	11/*	0	13 (11)	10 (5)
II	13	1	16 (12)	19 (10)
III	2	6	3 (2)	3 (2)
IV	9	0	16 (9)	0 (0)
Total	35	7 (20%)	48 (34)	32 (17)

( ): Nos. of raingate

/* : Two stations under supervision of PAGASA and MRRTC

Discharge Measurement Stations

District	No. of Station		Functional Devices	
	Functional	Non-functional	Staff Gate	Parshall Flume
I	47	8	29	19
II	46	26	2	44
III	12	24	4	8
IV	104	2	80	24
Total	209	60 (29%)	115	95

2) Radio Network

Fig. 7 shows the existing communication radio network in UPRIIS. The micro wave tele-communication system connects UPRIIS Office in Cabanatuan with the NIA Head Office at Quezon City and the Pantabangan/Canili dam sites. Also, a VHF radio network is established among four base stations at Districts I, II, III & IV offices, nineteen field base stations located in the main structure points such as diversion dams, radial gates and diversion points of canals and seven mobile stations mounted in car or jeep. Communication between field base station and portable station, is by the handy-VHF system consisting of walkie-talkie. Details are explained in Appendix VI.

However the communication through radio network is not always functional because the radio network apparatus are not well maintained. It is desired to rehabilitate these apparatus and to reconsider the location of radio network so as to achieve a more smooth and efficient operation.

(5) System of Irrigation Service Fee Collection

Fee collection is made from each individual water user. Bills for irrigation service fee collection are prepared by billing clerks during about 3 months from the end of land preparation to the beginning of terminal drainage. Distribution of these bills is carried

out during about 40 days from the beginning to the end of terminal drainage. Collection of fee starts at the middle of the period of terminal drainage. For evaluation of fee exemption, cancellation of bills on lots with total crop failure is conducted during about 40 days from about half a month before start of terminal drainage to the middle of the terminal drainage period.

Though procedure and formats necessary for irrigation service fee collection are well prescribed and almost complete, the said procedure is very intricate and many formats should be filled up within a short time. Then each District Office partly modifies the format prescribed in the billing and collection manual for irrigation service fee, moreover collection work is very hard for UPRIIS staff. Delayed presentation and inaccuracy of bills sometimes occurs.

As for the exemption from payment of the irrigation service fee, the procedure is quite complex and it seems very difficult to evaluate the size of crop failure on time. Besides, with the abolition of government subsidies for irrigation activities in 1980, the UPRIIS Office can no longer afford to give exemptions from payment of irrigation fee on account of farmers' unsuccessful harvests. The exemption is rarely applied in UPRIIS.

As a result of a promulgation (May 1st, 1976) of the option to pay irrigation fees either in kind or in cash, a slight increase in the collection efficiency has been noted. In spite of its small ratio (about 5%) to total collection, it is significant to note that the collection in kind creates various constraints to the UPRIIS Office. Six (6) kg of allowance per cavan collected for the payment of the irrigation fee in kind is not enough to cover the substantial hauling and storage costs, losses and spoilage and selling expenses for the collected paddy. In addition to the quality of paddy, the UPRIIS Office faces the difficulties in drying, classifying, storing and selling.

It is necessary for present irrigation fee collection system: i) to simplify forms necessary for fee collection, ii) to introduce a computer system and iii) to examine a method of collection not from the individual user but from the group.

(6) Recording

In UPRIIS, many kinds of reports are prepared daily, weekly, monthly, quarterly, semi-annually, annually and occasionally.

Prescribed reports from the District offices to the Operations Manager and from Operations Manager to NIA head office in Quezon City, amount to about one hundred reports to be prepared throughout the year.

In connection with recording and reporting systems for systems management, the following problems are identified: i) Large volume of paper processing, ii) Inaccuracy of data and iii) Unstandardized formats.

To solve such problems, it is necessary to rationalize data processing by taking the following counter-measures: i) Standardization of processing formats, ii) Simplification of data system and iii) Introduction of computer system.

The conditions of filing and keeping data are not always good. This is mainly due to the shortage of equipment and instruments necessary for filing/keeping systems and also because there is no proper operational rule for the said systems. Therefore the introduction of micro-computer system will be essential for proper filing and keeping data.

(7) Communication System

Communication within the UPRIIS can be broadly divided into: i) internal communication and ii) external communication with irrigation water users.

Internal communication in the UPRIIS is made by means of: i) meeting/conference, ii) official written memorandum circular, iii) bulletin board, iv) public address, v) newsletter such as "Pananaw", vi) micro wave/radio systems and vii) others.

External communication with the irrigation water users is carried out through: i) personal exchange of ideas in the field, ii) programs such as live-in seminar-workshop for irrigators' group leaders (IGL) and one-day echo seminar, iii) mass media such as broadcasting station of DWNE, iv) printed/written matters and v) others.

Among internal communication methods, meeting and conference are most important for communication among the field staff. The meeting systems in the UPRIIS are illustrated in Fig. 8. Fifteen kinds of regular and/or occasional meetings except staff, ADCC and PDC meetings are held among UPRIIS staffs from the top "Operations Manager" to the subordinate "Ditchtenders". As indicated in Fig. 8, many meetings are held and meeting systems are quite different in each district office. Though these meetings promote good internal communication from subordinates to superiors, simplification and standardization of these systems are required for efficient mutual understanding of the UPRIIS staffs.

As one of the most important ways of external communication, the build-up of face to face communication with farmers is now being advocated by various sociologists and its importance is recognized by the authorities concerned. However, this kind of communication is not so developed as the UPRIIS staff expected. As one of the reasons, poor comprehension between the UPRIIS field staff and farmers is pointed out. And lack of effective transportation means also contributes to the wider gap in such communication.

With regard to training, the UPRIIS is conducting the training program for leading farmers (IGLs). Mainly due to shortage of fund, training period and the contents of such live-in seminar-workshop for IGLs and one-day echo seminars are not always sufficient.

The dissemination of information on irrigation farming, campaign of fee collection, etc. is scarcely carried out through printed/written matters in the UPRIIS.

(8) Maintenance and Repair

Maintenance and repair works for irrigation facilities are classified into two (2) categories. One is the rehabilitation or improvement of facilities. This requires construction work and is usually undertaken during non-irrigation period. The other is daily routine works to keep facilities in good operating conditions and to prevent excessive wear and tear.

The rehabilitation works have not been carried out sufficiently due to lack of budget. In the present status, there are any number of structures to be rehabilitated. Some of these require urgent rehabilitation.

Problems noted in daily routine works are deficiency of the daily maintenance and minor repairs. Most of the operable gates have no lubricating oil. This will cause difficulties in operation, inexpedient load on the lifting mechanism. Vegetation control is not satisfactorily practiced in the lower reach of laterals and sublaterals. Vegetation will disturb the flow capacity and accelerate siltation.

(9) O & M Facilities

Number of O & M equipments and their condition as of 1983 are listed in Table 6.

Out of 59 service vehicles such as jeep, wagon, tamaraw excluding motorcycle, 12 have need of repair in the whole UPRIIS. As for trucks including light and dump trucks, 54 are workable out of 72. Utilization of service vehicles and trucks is efficient.

As for heavy equipments, about 50% of them needs repair. The number of workable bulldozers is not sufficient. Compaction machinery is non except 3 compactors which need repair. The list of heavy

equipments indicates that the major works of construction and rehabilitation were excavation and hauling. Less attention was paid to solid compaction of canal embankment and slope.

2.5.3 Administrative Work and Other Works

The Administrative Division in the UPRIIS - Head Office deals in principle with the general affairs including personnel & records, accounting, cash general services and property and procurement.

In addition to operation & maintenance and administrative works, UPRIIS executes construction works, organizational set-up of farmers and training and research works.

Construction work includes rehabilitation of the facilities damaged by typhoon, improvement of irrigation facilities and structures, expansion of the irrigation systems in the Aurora Peñaranda Irrigation Project (APIP), project systems development and other small works. Among these activities, the expansion of irrigation systems in APIP was the largest work, and accounted for 61% of total construction work in monetary value in 1982.

With regard to the set-up of farmers' organization, it is reported that except in the extension area of District IV, Farmer-Irrigators' Groups (FIGs) are fully organized. Under the guidance of the UPRIIS and also with the assistance of farmers organization specialists of the Agriculture Division, FIGs are being federated at the section level.

With respect to training, the Agriculture Division (AD) conducts: i) Live-in training for irrigators group leaders (IGLs), ii) One day echo-seminar for FIG farmer-members and iii) FIA officers training. And AD carriers out various works through application and demonstration to increase agricultural productivity.

2.5.4 Financial Status of the UPRIIS

(1) Irrigation Service Fee Collection

In principle, the rates of irrigation service fees are to be fixed at the level that will provide for: i) total repayment of public investment in irrigation facilities without interest, ii) operation and maintenance cost of the system and iii) marginal costs such as incentives/bonus to be paid to the personnel participating in irrigation service fee collection.

For the UPRIIS, special rates of irrigation service fee are applied as follows:

- 2.5 cavans of paddy per ha for the wet season crop and
- 3.5 cavans of paddy per ha for the dry season crop and the third crop

The total amount of irrigation fee collected and fee collection efficiency rates from 1979 to 1982 in the UPRIIS are shown in Table 7.

An average collection efficiency rate is about 50% and annual collection amount is ₱15.5 million. The irrigation fee collection efficiency rate in the UPRIIS is lower than the average collection efficiency rate of about 60% in the national irrigation systems in the Philippines.

The low efficiency rate of irrigation service fee collection in the UPRIIS is supposed to be due to the following major factors: i) Insufficient supply and improper distribution of irrigation water, ii) Inadequate record keeping and procedures of billing and collection, iii) Inadequacy of transportation facilities, iv) Lack of information dissemination, v) Low capacity-to-pay of farmers, vi) Farmers' perception of NIA services and vii) Inaction of the UPRIIS Office against deliquent farmers. Details are explained in Appendix VII.

(2) UPRIIS Expenditure

The total expenditure of the UPRIIS Office from 1978 to 1982 is shown in Table 8. The expenditure decreases gradually from ₱191.6 million in 1978 to ₱44.9 million in 1982 in line with the progress of construction works under the Aurora-Peñaranda Irrigation Project. The expenditure is divided into four categories: operation and maintenance work, construction works, erosion control and reforestation project, and project systems development. In 1982, operation and maintenance work accounted for 74.3% of total expenditure, followed by construction works (25.6%) and project systems development (0.1%). The operation and maintenance cost increases annually at the rate of 10 to 20%.

In order to clarify personnel expenses for UPRIIS Head Office including 5 support Divisions and four (4) District Offices, estimation was made on the basis of the number of employees as of July 1983 and their basic salaries. About 26% of the total amount of salaries are paid to the staff of the Head Office and the balance thereof to the District Offices. It is significant that personnel expenses for the UPRIIS Head Office accounted for around 30% of total personnel expenditure, if several allowances are added to the salaries of its staff.

In the case of the District Offices, it can be considered that they comprise four functions: supervision, operation, repair & maintenance and administration. Salary distribution by these functions is estimated as follows: 2% for supervision, 77.8% for operation, 7.4% for repair & maintenance and 12.8% for administration.

(3) O&M Cost and Personnel Expenses

In 1982, operation and maintenance (O&M) cost allocated to the UPRIIS amounted to ₱33.34 million, equivalent to 74.3% of the total expenditure.

The O&M cost of the UPRIIS can be classified into two items: personnel expenses and other expenses, as indicated in Table 9.

Personnel expenses consisting of salaries, government share, wages, allowances and pag-ibig fund account for about 83% (1982) of the total O&M cost. Personnel expenses of the UPRIIS are increasing annually from ₱16.3 million in 1978 to ₱27.6 million in 1982, as a result of the increases in personnel and salaries and wages. However, this tendency has slowed in recent years, as shown in Table 9. In 1983, personnel expenses of the UPRIIS are expected to be about ₱22.0 million or a 20% reduction of the budget in 1982. The total amount is proposed to be reduced by around 35%. It is anticipated that reduction of maintenance and operation expenses by reducing the number of vehicles, and therefore gasoline and oil cost, may adversely affect the efficiency of the system management. Details are explained in Appendix VII.

(4) Budget Analysis

The irrigation service fees (ISF) collected from water-users are the major source of revenue of the UPRIIS. Based on the ISF collected and O&M expenditure of the UPRIIS, the financial status was analysed as summarized in the following table:

(Unit: ₱10^3)

	1979	1980	1981	1982
Revenue	15,920	13,467	15,419	17,334
Expenditure	21,715	26,661	30,240	33,341
Balance	-5,795	-13,194	-14,821	-16,007

The deficit of the UPRIIS is gradually increasing and is expected to be ₱50 million in 10 years if this tendency continues. This deficit will become a huge burden for the government.

In addition to the above-mentioned O&M expenditure, it is noticed that the UPRIIS is bound to repay the loan borrowed from the IBRD for the implementation of the Upper Pampanga Irrigation Project including its commitment charge and interest in accordance with the repayment schedule and a further ₱45 to ₱60 million will be required annually thereafter for the rehabilitation and extension works.