PN-AAD-272

UNITED STATES INTERNATIONAL DEVELOPMENT COOPERATION AGENCY
AGENCY FOR INTERNATIONAL DEVELOPMENT
Washington, D. C. 20523

DOMINICAN REPUBLIC

PROJECT PAPER

ON-FARM WATER MANAGEMENT

Loan Number: 517-T-042
Project Number: 517-0159

AID/LAC/P-139

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT DATA SHEET

1. TRANSACTION CODE: A (A = Add, C = Change, D = Delete) — Amendment Number: ____

DOCUMENT CODE: 3

COUNTRY/ENTITY: Dominican Republic

3. PROJECT NUMBER: 517-0159

4. BUREAU/OFFICE: Latin America and Caribbean, LAC — 05

5. PROJECT TITLE (maximum 40 characters): On-Farm Water Management

6. PROJECT ASSISTANCE COMPLETION DATE (PACD): MM 09 DD 30 YY 88

7. ESTIMATED DATE OF OBLIGATION (Under 'B.' below, enter 1, 2, 3, or 4)
A. Initial FY 83 B. Quarter 3 C. Final FY 84

8. COSTS ($000 OR EQUIVALENT $1 =)

A. FUNDING SOURCE	FIRST FY 83 B. FX	C. L/C	D. Total	LIFE OF PROJECT E. FX	F. L/C	G. Total
AID Appropriated Total	3891	802	4693	9464	2536	12,000
(Grant)	( )	( )	( )	( )	( )	( )
(Loan)	(3891)	(802)	(4693)	(9464)	(2536)	(12,000)
Other U.S. 1.						
Other U.S. 2.						
Host Country		366	366		7063	7,063
Other Donor(s)						
TOTALS	3891	1168	5059	9464	9599	19,063

9. SCHEDULE OF AID FUNDING ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	C. PRIMARY TECH. CODE 1. Grant	2. Loan	D. OBLIGATIONS TO DATE 1. Grant	2. Loan	E. AMOUNT APPROVED THIS ACTION 1. Grant	2. Loan	F. LIFE OF PROJECT 1. Grant	2. Loan
(1) FN	180		022				12,000		12,000
(2)									
(3)									
(4)									
TOTALS									

10. SECONDARY TECHNICAL CODES (maximum 6 codes of 3 positions each): 032, 004, 091

11. SECONDARY PURPOSE CODE: 140

12. SPECIAL CONCERNS CODES (maximum 7 codes of 4 positions each)

A. Code	181	182	183				
B. Amount	10%	57%	82%				

13. PROJECT PURPOSE (maximum 480 characters)

The project purpose is to strengthen GODR capability to: 1) effectively plan the development of its water resources for irrigation, 2) plan and operate irrigation systems, 3) support increased agricultural productivity under irrigation and 4) prevent and/or correct the deterioration of land resources already under irrigation.

14. SCHEDULED EVALUATIONS
Interim MM 01 YY 85 | MM 01 YY 87 | Final MM 06 YY 88

15. SOURCE/ORIGIN OF GOODS AND SERVICES
[X] 000 [X] 941 [X] Local [X] Other (Specify) 899

16. AMENDMENTS/NATURE OF CHANGE PROPOSED (This is page 1 of a ____ page PP Amendment)

17. APPROVED BY
Signature: [signature]
Philip R. Schwab
Title: Mission Director, USAID/DR
Date Signed: MM 06 DD 30 YY 85

18. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION
MM DD YY

PROJECT AUTHORIZATION

Name of Project: On-Farm Water Management

Number of Project: 517-0159

Number of Loan: 517-T-042

1. Pursuant to Section 103 of the Foreign Assistance Act of 1961, as amended, I hereby authorize the On-Farm Water Management project for the Dominican Republic (the "Cooperating Country") involving planned obligations of not to exceed Twelve Million United States Dollars ($12,000,000) over a five year period from date of authorization, subject to the availability of funds in accordance with the A.I.D. OYB/allotment process, to help in financing foreign exchange and local currency costs for the project.

2. The project ("Project") consists of assisting in a program to be implemented by the National Hydraulic Resources Institute to develop the institutional capacity within the Government of the Dominican Republic and assist it in undertaking action programs to develop the institutional framework needed to effectively manage the country's water resources for irrigation.

3. The Project Agreement, which may be negotiated and executed by the officer to whom such authority is delegated in accordance with A.I.D. Regulations and Delegations of Authority, shall be subject to the following essential terms and covenants and major conditions, together with such other terms and conditions as A.I.D. may deem appropriate.

a. Interest Rate and Terms of Payment

The Cooperating Country shall repay the Loan to A.I.D. in U.S. Dollars within twenty-five (25) years from the date of first disbursement of the Loan, including a grace period of not to exceed ten (10) years. The Cooperating Country shall pay to A.I.D. in U.S. Dollars interest from the date of first disbursement of the Loan at the rate of (i) two percent (2%) per annum during the first

ten (10) years; and (ii) three percent (3%) per annum thereafter, on the outstanding disbursed balance of the Loan and on any due and unpaid interest accrued thereon.

b. Source and Origin of Goods and Services

Goods and services, except for ocean shipping, financed by A.I.D. under the Loan shall have their source and origin in the Cooperating Country or countries included in A.I.D. Geographic Code 941, except as A.I.D. may otherwise agree in writing. Ocean shipping financed by A.I.D. under the Project shall, except as A.I.D. may otherwise agree in writing, be financed only on flag vessels of the Cooperating Country or of countries included in A.I.D. Geographic Code 941.

c. Conditions Precedent to Initial Disbursement

Prior to the first disbursement under the Loan, or to the issuance by A.I.D. of documentation pursuant to which disbursements will be made, the Cooperating Country, will, except as A.I.D. may otherwise agree in writing, furnish to A.I.D. in form and substance satisfactory to A.I.D.:

1) An opinion of the legal advisor to the Cooperating Country that this agreement has been duly authorized and/or ratified by, and executed on behalf of, the Cooperating Country, and that it constitutes a valid and legally binding obligation of the Cooperating Country in accordance with all of its terms;

2) A statement of the name of the person who will represent the Cooperating Country and of any additional representatives, together with a specimen signature of each person specified in such statement; and

3) The name of the Cooperating Country's project coordinator who will be able to contribute adequate time and effort for the successful implementation of the project.

d. Conditions Precedent to Disbursement for Equipment Procurement

Prior to any disbursement, or the issuance of any commitment documents under the Project Agreement to finance the procurement of equipment, the cooperating country shall, except as A.I.D. may otherwise agree in writing, furnish to A.I.D., in form and substance satisfactory to A.I.D.:

1) A plan for commodity procurement, delivery and distribution;

2) Specifications and required bidding documentation for specific commodity procurements.

e. Conditions Precedent to Initial Disbursement for Activities Other than Technical Assistance and Equipment

Prior to any disbursement, or the issuance of any commitment documents under the Project Agreement, to finance Project activities other than technical assistance and equipment, the Cooperating Country shall, except as A.I.D. may otherwise agree in writing, furnish to A.I.D. in form and substance satisfactory to A.I.D. evidence that adequate administrative arrangements have been made within the Cooperating Country to provide the necessary supporting staff, equipment and other resources to administer the Project.

f. Conditions Precedent to Disbursement for Field Activities

Prior to any disbursement, or the issuance of any commitment documents under the Project Agreement to finance the field activities in any pilot Project area, the Cooperating Country shall, except as A.I.D. may otherwise agree in writing, furnish to A.I.D., in form and substance satisfactory to A.I.D.:

1) A detailed development and management plan for the particular pilot Project area,

including evidence of the establishment of a pilot Project level office with adequate authority and staffing to administer the pilot Project;

2) Evidence that the Agricultural Bank has established an On-Farm Water Management Credit Fund, has programmed funds sufficient to accomplish the goals of farmer participation established under the Project, and will use and deposit all reflows generated under the Project for Agricultural Bank credit programs in support of water management activities under the Project.

g. Covenants

1) The cooperating Country shall establish an evaluation program as part of the Project. Except as A.I.D. may otherwise agree in writing, the program will include annual evaluations during the implementation of the Project and at least one more at the Project conclusion. the evaluation will include, but not be limited to: (i) evaluation of progress toward attainment of the objectives of the Project; (ii) identification and evaluation of problem areas or constraints which may inhibit such attainment; (iii) assessment of how such information may be used to help overcome such problems; and (iv) evaluation, to the degree feasible, of the overall development impact of the Project.

2) Except as A.I.D. may otherwise agree in writing, the Cooperating Country will prepare and submit to A.I.D. within 12 months of the signing of this Agreement a time phased plan for evaluation.

h. Waiver

Motorcycles financed by A.I.D. under the Project and having a value of approximately $10,000 may have their source and origin in countries included in A.I.D. Geographic Code 899. Exclusion of procurement from Free World countries other than the Cooperating Country and countries included in Code 941 would seriously impede

attainment of U.S. foreign policy objectives and objectives of the foreign assistance program.

Philip R. Schwab, Director
USAID Dominican Republic

6/30/83
Date

Drafted by: D. Carter
Regional Legal Advisor

Clearances:
ARDO:KCEllis
CRD:BHenriquez
CRD:LArmstrong
CRD:THammann
OPL:RVeith
OPE:JChang
CONT:SLiapis

DD:RVenezia

ON-FARM WATER MANAGEMENT PROJECT

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PARTICIPANTS IN PROJECT DEVELOPMENT

USAID/DR

- Dr. Kenneth Ellis, ARDO
- Dr. Joseph Kwiatkowski, ARD
- Dr. Roberto Castro, ARD
- Stephen Miller, ARD
- Timothy Hamman, CRD
- Eng. Betty Racey, CRD
- Agr. Eng. Emilio Martinez, ARD
- Dr. John Chang, OPE
- Steven Liapis, CONT

Project Paper Team

- Dr. Bruce Anderson (Team Leader, Consultant)
- Dr. Larry Bond (Utah State University)
- Dr. Melvin Burke (University of Maine)
- Dr. Helen Ingram (University of Arizona)
- Dr. Howard Peterson (Consultant)
- Dr. James Talbot (USAID/Haiti: REMS/C)
- Dr. Lyman Willardson (Utah State University)
- Dr. Douglas Merry (AID/W, S&T)

GODR Counterparts and Advisors

INDRHI:
- Ing. Gilberto Reynoso
- Ing. Vicente Gomez Nunez
- Ing. Felipe Victoro
- Lic. Moises Leonardo Rijo

SEA:
- Lic. Luisa Sanchez
- Ing. Agron. Julio Nova
- Lic. Federico Mejia
- Lic. Dionisio Alberto Mejia

CDESIA:
- Ing. Frank Caminc
- Agron. Alberto Figueroa

IAD:
- Leda Maria Jimenez
- Amada Castro

CIAZA:
- Ing. Agron. Cecilia Diaz de Santos

IICA:
- Roy Clifford
- Raul Pineda

GUIDE TO ACRONYMS

AID	=	Agency for International Development
ASPIRE	=	Asociacion para Inversion y Empleo, Inc.
AEA	=	Agente de Extension de Area
BAGRICOLA or Ag. Bank	=	Banco Agricola
CDE	=	Dominican Electric Corporation
CENDA Development	=	Northern Center for Agricultural
CEP	=	Country Environmental Profile
CIAZA	=	Centro de Investigaciones Aplicadas a Zonas Aridas
COCOPSA	=	Comite de Coordinacion de Planificacion Sectorial Agropecuaria
CONAPOFA	=	Consejo Nacional de Poblacion y Familia
CADR	=	Centro de Administracion del Desarrollo Rural (ISA)
CEDOPEX	=	Centro de Promocion de Exportaciones
EMESIRE	=	Estudio para el Mejoramiento de Sistemas de Riego Existentes
FAO	=	Food and Agriculture Organization of the United Nations
FEDA	=	Fondo Especial para el Desarrollo Agropecuario
GODR	=	Government of the Dominican Republic
IDB	=	Inter-American Development Bank
IICA	=	Inter-American Institute of Agriculture Sciences

INDRHI	=	National Hydraulic Resources Institute
ISA	=	Instituto Superior de Agricultura
IAD	=	Instituto Agrario Dominicano
IRR	=	Internal Rate of Return
INDESUR	=	Instituto para el Desarrollo del Suroeste
IDECOOP	=	Instituto de Desarrollo y Credito Cooperativo
INESPRE	=	Instituto de Estabilizacion de Precios
NARMA	=	Natural Resource Management Project
NPV	=	Net Present Value
ODESIA	=	Oficina para el Desarrollo Integral Agropecuario del Valle de Azua
ONAPLAN	=	Oficina Nacional de Planificacion (del Secretariado Tecnico de la Presidencia)
ONE	=	Oficina Nacional de Estadistica
ODC	=	Oficina de Desarrollo de la Comunidad
PRYN	=	Proyecto Riego Yaque del Norte
PROSLMA	=	Proyecto de Servicios y Maquinarias Agricolas
UNDP	=	United Nations Development Program
YSURA	=	Proyecto Yaque del Sur - Azua

1. INTRODUCTION

A. Summary of Problem

Over the past 15 years, the GODR has mounted several efforts to increase food production, including fairly extensive irrigation projects. More irrigation projects are under way. In the government's three-year plan for public investment for 1981-1983 of RD$1,255,067,000 budgeted for public institutions, RD$252,855,000 (20.64%) is programmed for the National Hydraulic Resources Institute (INDRHI). Additional funds for irrigation are budgeted through other government institutions. Despite this heavy investment, however, production on irrigated lands is only about one-half the yields normally achieved under similar soil and climate conditions in other countries. Further, because of improper water management, the salt content is increasing in many areas and valuable lands are being lost to production because of salinization.

The critical problem in the total irrigation system appears to be water management, in particular, its distribution through the system and its use on the farm. While the GODR and other donors are financing major irrigation projects, including dams and supporting infrastructure, actual water usage suffers from neglect and inefficiencies. Without an institutional mechanism and framework to effectively deal with the problem of managing water resources from the watershed to the farm, the benefits anticipated from these major infrastructure investments will never be realized.

There is a need to develop a strategy and mechanism for resolving problems of priority use of water and compatible sequential use of the water resources.

B. Recommendation

The project committee recommends the approval of the proposed US$19.1 million project (AID $12 million; GODR $7.1 million) to assist the GODR in developing the institutional framework needed to effectively deal with the problem of managing irrigation water. The loan project will be implemented over a period of five years. The loan will be repaid over twenty-five years, including a ten year grace period, with interest at 2 percent during the grace period and 3 percent thereafter.

C. Borrower and Implementing Agencies

The borrower will be the Government of the Dominican Republic (GODR). The National Hydraulic Resources Institute (INDRHI) will be the implementing agency for the GODR with cooperation from others Dominican organizations involved in irrigation water management.

D. Summary Project Description

The project includes a carefully designed set of both institution-building activities, primarily technical assistance and training at the national and field levels, and on-farm management activities involving water user groups. The project will also develop and test the procedures and methodologies necessary to carry out a nationwide water resource management program. The major focus of the project will be the establishment of two centers for water management (one near Santiago and the other in Azua). Through these centers the project will: carry out a series of technical field studies; demonstrate selected water management practices; develop water user associations; and train those involved in water delivery, management, and extension. In addition, the project will establish a credit program for financing land levelling, crop production, and marketing.

II. BACKGROUND

A. Irrigation Water Management: The Problem

The Dominican Republic is richly endowed with water resources, prticularly those river systems originating the Cordillera Central. The three important river basins, Yaque del Norte, Yuna, and Yaque del Sur, cover about 35% of the country. This renewable natural resource is only modestly developed to provide 15% of the nation's power and to irrigate less than 200,000 ha (4% of the country). Government projects are expected to substantially increase these values during the 1980's.

TABLE 1
SUMMARY COST ESTIMATE AND FINANCIAL PLAN
($000)
($ equiv. = RD$)

	A.I.D.		Total	GODR
	Dollars	Pesos	AID	Pesos
Technical Assistance	4,010	-	4,010	1,130
Administration	100	1,287	1,387	138
Training	1,251	30	1,281	898
Vehicles	692	-	692	-
Equipment	1,881	823	2,704	312
Construction	-	396	396	-
Credit	-	-	-	3,000
Total	7,934	2,536	10,470	5,478
Inflation			797	1,084
Contingency			733	501
GRAND TOTAL			12,000	7,063

As pointed out in the Country Environmental Profile (Hartshorn, et al. 1981), poor irrigation planning and practices, including over-irrigation, incomplete canal systems, lack of integrated irrigation and drainage systems, water-logged soils and salinization, have seriously contributed to a poor use of the country's water resources. Numerous examples exist: high salinity is a problem west of La Esperanza in the Yaque del Norte River Basin; in Villa Vasquez farmers dam drainage canals to divert saline water to their fields, accentuating their soil salinity problems; lack of maintenance allows the canals to fill with sediments and weeds, reducing irrigation potential and in some cases precluding the possibility of growing two crops per year; lack of proper drainage causes soil salinization and/or flooding.

An unfortunate situation has developed in the Azua Valley: a RD$33 million investment to irrigate 25,000 ha and benefit 10,000 families, which was intended to transform the valley into a garden, instead caused extensive damage by raising the water table by eight meters in the low lying areas. Large areas of the project are now inundated with water destroying their productive capacity. Due to indigenous soil conditions, impermeable layers located below the ground surfaces form an artesian basin, which is fed by water entering at higher elevations. Artesian pressures continue to build indicating lack of proper management in the upper reaches of the area. The lack of an understanding of proper management for water control has largely been assumed to be responsible for the area's deterioration. Farmers have not related cause to effect. A set of methods has not been available to the farmers that would enable them to establish practices to optimize production at the farms.

Improper water management practices caused by a lack of knowledge about losses in the delivery system as well as the efficient use of irrigation water at the farm level contribute to the overall problem. There are also problems caused by institutional overlap, lack of adequate credit to the producer, and the problems inherent in carrying out and enforcing government policies.

E. Some Causes of the Problem

There are at least sixteen agencies of government involved in some way with water management and use. Lack of clearly defined policies, procedures and responsibilities results in lack of adequate programs in managing water. There are uncertainties as to who is

responsible for ditch maintenance for agrarian reform lands and the needed work is not accomplished. There is ambiguity in water-use priorities power generation and agricultural use. A clear-cut line of authority has not been established to develop the priorities of water use for the common good.

There is a problem of financing, operation, and maintenance of the irrigation districts. The cost of operation and maintenance of irrigation systems in 1980 approximated RD$20/ha and rose to RD$44/ha in 1981. Water user fees collected in 1981 amounted to only 6% of operation and maintenance costs. The collection of water user fees or charges varied from 20-70%.

C. GODR Response to the Problem

To help solve the overall problems related to irrigation systems, the GODR established INDRHI in 1965 as an autonomous institution with broad powers and responsibilities in water resources development and management. It is responsible (1) for the operation and maintenance of publicly owned irrigation system, (2) for defining and evaluating water proposals and (3) for constructing irrigation systems. In terms of overall management of the water resources, INDRHI and the Dominican Eectric Corporation (CDE) are the two most important and interconnected. INDRHI has statutory authority to manage water from the watershed to the point of delivery on the farm; CDE operates the dams that generate electric power. INDRHI, therefore, is concerned with sedimentation rates of storage reservoirs, silting of canals, irrigation efficiencies, water quality problems such as high salinity levels, and ad hoc state corporations that use water.

The commitment of the GODR to improve the agricultural sector is illustrated by the steadily increasing allotment of funds to public sector institutions, such as INDRHI. In the last 10 years the Government has invested RD$493 million in the construction of dams and canals. This figure could easily pass the RD$1.0 billion mark in the next 10 years, if present construction plans are realized.

Despite these investments, the country is a net importer of food, and production has not kept pace with population, which will double in the next 26 years. In relation to gross national product, agriculture's share declined from the 1960-62 period. Agricultural production itself increased from 1961-67 at approximately one percent per year, then from 1968-73 rose to nearly 7% and, since

1973 declined again to the more modest rate of increase of one percent per annum.

While agricultural exports have grown at a rate of 4-6% since 1961 (with sugar being the most significant export crop), food imports have also increased. Between 1974-79 the Dominican Republic imported on the average 38,000 tons of rice 75,000 tons of corn and 125,000 tons of wheat valued at over RD$80 million. In 1980, these amounts increased substantially to nearly RD$120 million (Central Bank, 1981). At the same time, the output from irrigation is far below potential and could be doubled.

There is little hope for significant improvement in irrigated agriculture production, however, until well-conceive comprehensive programs backed by firm government resolve and support are implemented at all levels of the supply, distribution and use system. Even though there is an increasing awareness within the GODR agencies of the severity and magnitude of the problems of water management, the programs and activities that are necessary to mitigate or eliminate major constraints have not been developed.

The realization that infrastructure alone is not a guarantee of success in irrigated agriculture has been accepted by the key agriculture sector institutions, especialy SEA. All of the these institutions have begun to develop actions designed specifically for farmers using irrigation. However, they still lack adequate technical and financial resources to reduce the gap between the real and potential contribution of irrigated agriculture.

D. Other Donor Activities

Most other donor assistance directed at water resources management are connected to major investment programs for water development. At the end of 1981, the investment program including loans from foreign sources, totalled US$233 million for the four largest projects.

The Inter-American Development Bank (IDB) has supported various activities related to water management. Since 1974, approximately 30 irrigation district administrators have been trained in Mexico and the Dominican Republic. An operational study of the Yaque del Sur River basin, including some irrigation project design when found necessary, will be done with IDB financing for up to 75 percent of the total cost (US$2.9 million).

The Yaque del Norte Irrigation Project (PRYN), near Santiago, planned for a total cost of US$91 million, will have loans to cover 23 percent of this cost in two contracts, one with IDB and a second one with the World Bank. European Economic Community is also supporting land and rural development on part of the Bajos Yaque del Norte Irrigation Project, in Monte Cristi Province, which is being extended to include 20,000 ha of new lands and lands now irrigated by pumping from the river.

The Nizao Irrigation Project, planned mainly to rehabilitate the irrigation system and to increase the irrigated area to approximately 16,000 ha, is under construction. This project is supported by a loan from the World Bank to cover 53% of the total cost (of US$51 million).

Under a special agreement since 1979, IICA and INDRHI perform various activities directed towards institutional strengthening. The activities are jointly identified, programmed and financed for every calendar year. So far the various activities reported include strengthening the information system, the organizational structure and methodologies, the legislation and policy proposals, the irrigation districts' organization and the methods of procedure.

FAO, through a UNDP-financed project of US$200,000 (with $255,000 GODR contribution) will use the EMESIRE (Estudio para el Mejoramiento de Sistemas de Riego Existentes) methodology to prepare a comprehensive inventory of rehabilitation needs of infrastructure (canals, water control devices, etc.) of old irrigation systems. Eventually this will lead to additional rehabilitation projects. The project began in September 1982, and includes technical assistance for two years.

In sum, the other donor projects focus on the construction of the major infrastructure needed for water resource delivery. There is no other donor institutions providing assistance in the overall planning and management of these water resources. The AID program proposes to make this assistance available and to provide for the effective use and protection of these major investments.

E. The USAID Strategy

The USAID Agricultural Strategy addresses the management of a system. As stated in the Mission's Agriculture Sector Strategy Paper (reviewed in AID/W in July 1981), the key objective of USAID's strategy is to

increase agriculture production on land worked by small farmers. In structuring its strategy, USAID saw the small farmer and natural resource degradation as critical elements to the resolution of a number of the country's greatest social and economic problems.

Within this functional approach, the Mission considers that improved soil and water management by small farmers is the most important agricultural function to be addressed by USAID because it is crucial to two key objectives: intensification of production and slowing the degradation of the natural resource base. It is also that aspect of the agriculture strategy which contributes most importantly to the energy situation as soil and water management are essential to protection of hydro-electric investment, by far the most important factor in the GODR's energy strategy.

The USAID Agriculture Strategy, therefore, includes a major soil and water management program for which major loan projects are planned through 1985. The first loan, Natural Resource Management (NARMA), is designed to begin a rational program (primarily in the hillside or upper watershed areas) for the protection and exploitation of the potential of the soil base from which all farmers, small and large, derive their livelihood. This program initiated in August 1981 will build the institutional structures to deal with the hillside problems, develop necessary technology, initiate resource conservation programs on the ground, and expand the awareness of the need for rational resources management and utilization by Dominicans at all levels of society. A logical next step is to begin a program for more national planning and use of the water resources used for irrigation, whose source is the same upper watersheds.

F. Relationship of the Project to AID Policy

The On-Farm Water Management project is consistent with the Agency's Food and Agricultural Development Policy and the Regional Development Strategy. The project will focus on the four elements of AID's Food and Agricultural Development Policy.

1. Improved Country Policy:

   The project will provide technical assistance and training to improve the country's policies which relate to irrigation water use and planning.

2. Development of Human Resources and Institutional Capacity:

The project will develop the institutional capacity of INDRHI to plan the distribution of the nation's scarce water resources. At the same time, the institutional capacity of the Undersecretariat for Research and Extension will be strengthened to develop and adapt better water management techniques at the small producer's level. These objectives will be accomplished by providing technical assistance and training for national scientists and managers/planners.

3. Expanding the Role of Developing Country and U.S. Private Sectors:

The project will identify appropriate institutions either private or public through which funds can be channeled to small and medium sized producers to enable them to adopt more efficient water management techniques. The efficiency and timeliness of water deliveries by INDRHI will also be increased through an intensive program of training and technical assistance.

4. Providing Food Aid and Food Security:

This element, while not of the same magnitude as the previous three, is nonetheless an important aspect of the proposed project. The GODR has already indicated a willingness to program PL-480 Title I proceeds for activities in direct support of the project. These activities are support to research on irrigated crops, production of basic seed supplies and assistance to a program of land levelling and small canal repair or rehabilitation.

The Agency's experience with on-farm management activities in some Latin American countries (Ecuador and El Salvador) indicate highly favorable returns to participating farmers. In addition, the proposed project activities address directly the considerations for irrigation projects identified in the Agency's Program

Evaluation Discussion Paper No. 9 "THE IMPACT OF IRRIGATION ON DEVELOPMENT: ISSUES FOR A COMPREHENSIVE EVALUATION STUDY".

USAID/DR has depended heavily on the Science and Technology Bureau's Water Management Synthesis II project for assistance in developing the project. The worldwide experience of the technicians provided by S&T has been invaluable and has incorporated many of the lessons learned from other water management projects.

III. PROJECT DESCRIPTION

A. Project Goal and Purpose

The goal of the project is to increase the income and standard of living of Dominican farmers by increasing their productivity. The subgoal is to develop human resources and institutional conditions necessary for increased productivity in irrigated agriculture. The project purpose is to strengthen GODR capability to: (1) plan effectively the development of its water resources for irrigation, (2) plan and operate irrigation systems effectively and efficiently, (3) support increased agricultural productivity under irrigation, and (4) prevent and/or correct the deterioration of land resources presently under irrigation.

B. Project Activities

The activities proposed for financing under this project were selected after a careful examination of the water resource management problems and the capabilities of the existing GODR institutions. Much of this examination was done over the past six months by contract and Mission personnel. In addition, the Country Environmental Profile team provided a substantive study of the water resource problem. As a conclusion, the assumption is made that the cause of soil salinity, water logged soils and low crop production has resulted from improper management throughout the irrigation system.

Based upon this set of analysis, it became clear that a mixture of both institution-building activities, primarily technical assistance and training at the national and field levels, and on-farm water management activities, involving water user groups would be required. Furthermore, it would be essential to develop and test the

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procedures and methodologies necessary to carry out a nationwide water resource management program in the context of this project.

The major focus of the project will be to carry out activities through the two Centers for Water Management.

1. Centers for Water Management
(AID $2,897,000; GODR $1,388,000)

The Centers will conduct the following specific activities:

- Technical field studies and baseline data collection;
- Demonstration programs for land levelling and improved water management;
- Training programs for those involved in water delivery and management and extension programs;
- The formation of water user associations.

The project proposes that two Centers for Water Management be established. One will be in the PRY project near Santiago, representing the northern section of the country; the other will be in the YSURA project, near Azua in the southwest part of the country (see map, Annex J). The Centers will consist of a pilot project area to be selected, as well as the facilities of research stations, teaching and demonstration facilities and fields that can be used to accomplish the purposes of the project. The Centers will coordinate its activities with all the major agencies of government working in the irrigation district. The offices and facilities that may be used to house staff will represent only one segment of the overall locus of the Centers.

To assure that the specific irrigation system activities carried out by the project are kept within manageable limits, the two pilot irrigation systems will be restricted to one sub-lateral in each area. It will include the last farmer on the sub-lateral and proceed back up the lateral to the point of diversion to the main canal, then to the point of diversion from the river or from a storage reservoir.

To select the sub-lateral, a reconnaissance and diagnostic survey will be made by the project staff of

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several laterals in the district. This initial survey will highlight any unusual conditions and problems, as well as provide training and learning experience for the project staff. (For background and details on the pilot project sites, refer to Annex B.)

To provide the direction, leadership, coordination and management for the Centers, the following organization and structure will be used:

- Agency, Community, Coordinating Committee (ACCC)

This committee will be composed of the major govenment agencies involved with irrigation districts in the area, and representation from the community of farmers in the pilot area. Its function will be to review and make recommendations to the Directors of the Centers for Water Management (see Annex I). They will not control the funds, nor have the power to hire and fire Centers' personnel. They will provide direct linkages between their groups and the Center.

- Centers Directors

Each Center will be managed by a GODR Director. Each Director will be assisted by a long-term counterpart advisor funded by AID. Also, the project will provide a long-term farm manager consultant to assist in the operation of the demonstration training farm complex. Other basic staff will be assigned to the Centers from among the cooperating agencies.

The Centers Directors, with the assistance of the long-term consultants, will develop an annual plan of work outlining the Centers activities. This will, as indicated above, be reviewed by the ACCC prior to implementation. These plans will indicate how the Centers will maximize the interactions and coordination of the agencies and private sector available in the pilot areas. The Center-North, for example, will include CENDA (the research station), Instituto Superior de Agricultura (ISA), IAD, INDRHI, SEA, as well as private industry.

The Centers Directors and their staff, with the assistance of the long-term advisors, will be responsible for all field activities of the project and will give special attention to the collection, analyzing and utilization of bench mark data. They will develop an evaluation system to provide progress reports and evaluations over the life of the project. (Refer to the

Management Information Section, in Annex C.)

AID project funds will be used to establish the two Centers. The AID funds will finance the long-term consultants for three person-years, and 120 person-months of TDY technical assistance over the 5 year life of the project. AID funds will also finance office equipment and supplies and a portion of the operating funds. Vehicles for transportation and field studies, specific buildings and machine sheds, the technical equipment required for field studies, laboratory equipment and supplies for the cooperating research centers, farm machinery and equipment for the training and demonstration farms will also be financed by AID.

GODR funds will be used to offset personnel salaries, land costs, offices in the PRYN area, and other facilities used by the project. It will also assume a gradual increasing cost of project operations starting in the 4th year of the project.

2. Technical Field Studies
(AID $3,066,000; GODR $427,700)

Bench mark data collection will begin at the works for the irrigation delivery system, and on each pilot lateral and the farms and farm families it serves. The purpose of the data is to provide the basis for implementing the project activities and for carrying out the evaluation over the life of the project. Attention must be given to the data gathering process to prepare questionnaires and other instruments to assure reliable information. During initial contacts with the farmers on the pilot lateral, the purpose of the study must be explained and their cooperation obtained. A formal agreement signed between the farmer and the Centers will outline the work to be done on the farmers' field and what he will be expected to do. The demonstratin work in the pilot project, such as land levelling, water measurement and control done on the farmers' fields will be charged to the farmer, but the farmer will receive credit for the time spent with Centers' personnel providing information and permitting measurements to be made on the farmer's land, and a continuous monitoring of water management progress. Following the analysis of data, a decision will be made on the details of implementing the water management activities for each farmer and for the pilot system.

a. Irrigation Parameters
(AID $600,000; GODR $237,900)

A number of irrigation parameters will be intensively studied to improve on-farm water management. These include: irrigation efficiencies; evapotranspiration and replacement water needs; drainage coefficient; water quality; and pre-project irrigation methods. The information gained through this exercise will be used in the management of the irrigation water delivery system, especially at the farm level, and for training of personnel for systems management for extension and the farmers. Annex D contains a detailed discussion of each of the measurements indicating their relevance to improved water management.

AID funds will finance 4 person-months of TDY technical assistance during the life of the project; 2 scholarships for degree training; 7 scholarships for U.S. based short courses; technical equipment, such as neutron meters, access tubes, survey equipment, water flow recorders, water measuring devices, control gates, etc. A detailed equipment list is provided in Annex D under Irrigation Parameters. Transportation, office equipment and other facilities, as specified for each Center (see Annex H). GODR funds will provide staff support and office space.

b. Delivery System
(AID $1,435,000; GODR $109,400)

The delivery system already in place and the management of it are assumed to contribute significantly to poor crop production. Lack of timeliness in water delivery to the farmer, insufficient canal capacity to avoid night irrigation, spilling of excess water at night onto project lands causing inundation, water logging, high water tables and increased salinity, are some of the delivery problems. These are essentially planning, design, implementation and operational problems which at present are out of the perview of the farmer. The farmer is the victim of any defficiencies caused by the delivery system and its management.

The management of the delivery system that provides water from the headworks or main diversion to the last farmer on the pilot system will be reviewed under this activity. The review will begin in the pilot area and will include but not necessarily be restricted to the items singled out for special consideration below. The tasks of the project team will be to integrate the data collected into a management plan for each pilot system. This plan will be recommended to INDRH as a guide to use on the remainder of the total irrigation system, and then, countrywide. Recommendations will be forthcoming to

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influence the policy and procedures manual to improve water management at the national level and to suggest institutional changes where necessary. A number of factors will be studied in this context: canal efficiencies, particularly transmission and delivery; system capacity; available surface and sub-surface water supply; diversions; canals; control structures; and water measurement.

The project will also study alternative water user fee structures and approaches. Accordingly, within the project pilot areas users will be charged based upon volume of water used not area irrigated. During the third year of the project, the Management Centers, with the assistance of the project funded consultants, will evaluate the water user fee structure and make recommendations for application nationwide. This report will be the subject of a special joint GODR/AID evaluation.

The project will study sources of excess water so they can be intercepted and lands brought back to full production. The project will also review and identify the priorities of irrigation water in relation to other water uses, such as electric power generation. It will review the process used to resolve conflict during times of drought or when supply is not sufficient to meet demands. The communication system between decision-makers and users will be reviewed to assure that irrigation water users are better informed of decisions that affect them. Even though a new pricing policy for water has just been accepted by the GODR, its provisions will be reviewed with feed back from water users.

The AID funds will provide for 20 person-months of the time of the Chief of Party to oversee and direct the review of the operation and maintenance of the delivery systems. It will provide 7 person-months of TDY technical assistance; 2 scholarships for degree training; and 3 person-months of short course training. It will provide technical equipment for measuring water, for calibrating gates, equipment to clean and maintain delivery canals, gates and control structures and water stage recorders and gauges, and equipment for special studies described above. Detailed lists will be found in Annex B under Delivery Systems.

c. Water User Association Development
(AID $953,000; GODR $60,400)

A very important activity of this project will be the development of working models for water users' associations, the monitoring and evaluation of these models within the pilot project area, and the assessment of the institutional structure necessary to support and respond to water users' associations on the system level which can be replicated at the national level. Models developed will be based upon past and current experience in the Dominican Republic and elsewhere, with local social and cultural customs, land tenure patterns, and the farmers' need to be full participants in the improvement of water management as criteria. It has been the experience in other countries, that without effective associations of water users, management of irrigation systems will not approach optimal levels, either on-farm or system wide.

Both, the importance and the difficulty of this task, are --in many ways-- greater in the Dominican Republic because of the relative lack of experience with small farmer irrigation on the part of both the water users and the institutions involved in water resource development. Many of the farmers in new irrigation project areas have little exposure to irrigated agriculture and, in the case of IAD "asentados", many farmers have only recently resettled from areas with mainly dryland farming systems. Similarly, the principal water resource development institution, INDRHI, has dealt primarily with large scale producers and with "asentamientos colectivos" in rice growing areas which, from a water management perspective, are administered as large units rather than as individual small holdings.

As a result, many small farmers in the pilot project areas are currently adapting to new soil, climate and crops, new management responsibilities, and new neighbors, as well as to the technological change in irrigation and drainage systems. Even in established farming areas, new settlers have recently arrived and long time residents are farming different parcels of land as a result of redistribution under the "cuota parte" laws. ("Cuota parte" involves, among other things, the expropriation and redistribution of land from larger holdings and the rationalization and expansion of very small holdings as part of the development of irrigation systems.) Thus, in sections of the pilot project as elsewhere, the strong organizations necessary for successful water management are lacking. This is compounded further by a degree of ambiguity in the

relationship between water users' associations and INDRHI, and between IAD "asentados" and INDRHI, as established by legal and non-legal precedents.

With the realization that experimental knowledge in the Dominican Republic is limited and that there is wide variety within and between the pilot project areas, the Water Management Centers will coordinate closely with farmers, social scientists at IAD, SEA and INDRHI, and faculties of social science from Dominican universities to develop, apply and evaluate a strategy for effective water users' associations. This effort will involve the following: (a) a series of concise surveys at the farm, farmer organization, community and institutional levels; (b) analysis of survey results and past experience with directed and spontaneous farmer organizations to identify constraints to successful water users' associations; (c) development of models based on existing farmer organizations and/or new group formation, with eventual integration at the system and national levels in mind; (d) application, monitoring and evaluation of the models within the pilot project areas; and (e) recommendation, if any, resulting from the constraints analysis for reorganization, reform or restructuring of government agencies involved in water resource development and water management.

As part of the development of baseline social science data for the project, concise surveys will be used to query farmers about their experiences, attitudes and knowledge regarding farmer organiztions, as well as farmers' suggestions for organizing water users. A survey of farmer organizations currently functioning within the project areas will be carried out. The extensive work of IICA and SEA's Departmento de Organizacion Rural should guide this survey with useful background information. A key informant survey of communities within the project areas can contribute other organizational forms or methods which may work well in the local socio-cultural setting. Finally, a brief survey of government agency personnel involved in water resource development and water management will concentrate on their experience, attitudes and knowledge of farmer organizations, as well as their suggestion for water users' association formation.

All surveying of farmers, farmer organizations, communities and institution personnel will be completed soon after the project begins (estimated 6 months), as will the assessment of past experience with water users' associations based on INDRHI, SEA and other relevant documentation. An analysis of the survey data will then be completed to define successful organizations from the farmers' perspective and to identify

socio-cultural, institutional and other factors which promote or constrain successful farmer organization, particularly water users' associations.

Development of organizational models for water users' associations will be carried out jointly by the Water Management Centers, INDERHI, IAD, Departamento de Organizacion Rural, and university social scientists with assistance from farmers' group representatives. Where feasible, existing groups will be used as the basis for water users' organizations. No more than three models will be used per pilot project area. Optimization of farmer participation and responsiveness to water users' needs must be compatible with water management efficiency on-farm. The models must consider in the design integration or organization of water users' associations on the irrigation system and national levels.

Implementation of up to three models in each pilot project area will begin approximately 15 months after the first surveys are begun. In some cases, this will involve formalizing existing organizations. In other cases, farmers will be forming a new organization, which will require training of officers, legal procedures and farmer mobilization in advance of water management responsibilities. In both cases, the associations will be closely monitored for their ability to utilize water management training, settle disputes among members, deal effectively with government institutions, make requests for assistance when necessary, and manage funds, especially as the users' associations begin to collect water fees and pay the salaries of the "cabos de agua" (ditch riders) they select.

The role of the "cabo de agua" will be critical to the success of the water users' associations and the project and, therefore, will be the focal point of much of the water users' association business. The "cabo de agua" acts as a manager of the sub-lateral delivery system to the farmers' fields and as an advocate for the farmers' demands upon the systems, as well. Ideally, the person selected will be one of the community or the water users' association, who is technically proficient, respected by the association members, and responsive to the group. As much as possible, the arrangements for the management of the "cabo de agua" should be left to each association after its members are familiar with alternatives available to them. The "cabo de agua" may be paid by the association or, this position may be a rotational one within the water association if the members have confidence in one another's skills and integrity. Successful management of the "cabo de agua" by the

association will be a prime indicator of the association's health and capability.

By the end of the second year of the project, the farmers within the pilot project area will be members of water users' associations. To the greatest extent possible, the farmers themselves will have participated in the development of the association models, taken the lead in formation of their associations, established the responsibilities and goals of the associations, and become an active force in the improvement of on-farm water management practices. At the end of the fourth year of the project, the social science team of the Water Management Centers and the farmers of the associations will evaluate the models and make recommendations as to the replication of water users' groups nation-wide. Also, by this point in the project, the water users --with the help of the Water Management Centers, SEA and INDRHI-- will have formed a pilot project area users' organization to participate in irrigation system operations.

During years three, four and five of the project, the social science team of the Water Management Centers will concentrate its efforts on the following tasks, in addition to monitoring and assisting the water users' groups: (a) in cooperation with INDRHI, SEA, IAD and the water users' associations, conduct an in-depth institutional analysis of water management within the pilot project areas; and (b) develop a plan to make social scientists and water users full partners in the design and development of future irrigation systems in the Dominican Republic.

AID funds will provide 12 person-months of technical assistance over a three year period; 2 person-months of TDY technical assistance; 2 scholarships for degree programs; and finance 3-5 persons for special short-term training in the United States; transportation and basic office support services.

The GODR will provide the necessary counterpart assistance, office facilities, access to files documents, etc., to assist in data collection and user association organizational activities. It will also provide 10-15 Agency personnel for in-country training.

3. Demonstration and Training
(AID $4,419,000; GODR $661,800)

Part of the field activities of the Centers for water management will be the demonstration of selected water management practices and a comprehensive training program.

a. Demonstration
(AID $1,945,000; GODR $120,000)

Knowledge transfer, so essential in the training of all levels of personnel, is inseparably connected to both training and demonstration. An effective demonstration of the essential water management technique, strategies and practices will be coordinated with the agronomic knowledge, and preparation and cultivation practices to demonstrate optimum crop production. As new recommendations come from research stations or from other sources, they will be demonstrated prior to recommending them for general use.

Land levelling and water measurement and control will be singled out for a major demonstration effort at both the Centers and on the cooperating farms within the pilot Water Management projects. The project will work with all of the farms within the pilot project area, which is not to exceed 1,000 hectares of farm land on each pilot lateral. Schedules will be arranged to do the levelling according to the needs of the farm, and within the limits and constraints of the machine operators. Levelling by lasser control has been selected because it is faster, more accurate and the equipment can operate around the clock when necessary. Levelling must be scheduled in between crops so the down time on farming operations is minimal. A contract between the farmers in the pilot lateral area will be signed indicating the conditions under which land levelling and other water management practices will be carried out. The project machinery will be confined to demonstration purposes and not used commercially. Levelling will also be done on the demonstration and training farm.

The purpose of levelling land is to smooth out the high and low spots in the field so that water can be distributed over the land as uniformly as possible, and in the right amounts. Excess applications of water will wash out fertilizers that provide plant nutrients, contribute to high water table conditions and increase soil salinity, all of which contribute to poor yields. On the other hand, a shortage of water, or lack of uniform

coverage causes water deficits and the plants suffer stress and again yields are reduced. Land levelling contributes significantly to good water management practices.

In addition to land levelling to assist in uniform water application, water must be controlled and the right amount to meet crop needs stored in the soil profile. This requires good water control and using a known streamsize to supply the volume of water needed during the irrigation turn to a given area. The Centers will work with the farmers in the pilot area to control and measure water so that the water, soil, fertilizer relationships are optimum for the crops grown. The project will provide the control gates and measuring devices required to implement appropriate water management at the farm level. Such items will be covered in the farmers' contract. Most of these structures will be made locally to specifications at locations near the pilot lateral area.

As other types of practices are verified, these will also be recommended and special demonstrations developed with cooperating farmers. Through a continuing follow up by the extension personnel, farmers throughout all the pilot project will be encouraged to adapt the new practices. Finally, the initial effort to demonstrate improved practices in water management and related practices will spread to the entire irrigation district and also countrywide.

A second part of the demonstration program will be carried out at the demonstration-training farms. This will involve the growing of crops under improved management practices. Levelling of land, water management --together with appropriate agronomic practices-- will be tested and demonstrated at the farm. This process will provide a measure of safety for the farmers, in that a practice, first developed and tested at the experiment stations, can be further tested on a field basis at the demonstration farm, then, it can be recommended to the farmers for general use. Through appropriate extension techniques, and through the intervention and cooperation with water user groups and associations, field days can be held to demonstrate new practices to the farmers of the area.

AID funds will provide 36 person-months of long-term technical assistance and 5 person-months of TDY for each Center. The project will provide the equipment and machinery needed for land levelling demonstrations, and for water measurement and control, farm machinery and equipment for the demonstration farm, transportation repair shop facilities, and other items as detailed in Annex F, Demonstration Equipment.

b. Training
(AID $2,474,000; GODR $541,800)

1) In-Country Training

In-country training will provide training for up to 500 GODR personnel and fourteen special farmer training programs. The water user groups and water user associatons will be involved in the training process, in deciding on the kinds of training applicable to them and in structuring the program of training. The demonstration and training farms, successful farmers, and visits to other areas to see good water management practices are part of farmer training.

Training for local personnel in country will focus initially on the professionals and technical personnel of the GODR agencies assigned to work on the project. It should be noted that a great deal of informal training is accomplished by association, dialogue and participating in seminars, etc.

Since the extension agents will be the ones working directly with the farmers, farmer groups and farmer or water user associations, special attention will be given to their training. They will undergo repetative and refresher courses on an annual basis to continually upgrade their competence and capabilities to work with farmers in the technical and socio-economic areas.

Special farm training and experince is planned for extension personnel. Through a system of staggered planting dates trainees will receive field training experience in all the tasks a farmer must perform in growing a crop. Participants will learn by doing as well as through classroom training basic principles of crop production. This kind of hands-on experience will help extensionists gain the confidence of the farmers in the recommendations they bring them. It is planned to train twenty to twenty-five extension specialists in this program. Three courses will be held each year. Each course will last approximately 3 months and involve 8-10

trainees.

A second major focus of the three months extension training program will be oriented to extension techniques and the process of knowledge transfer. The agents must be conversant with the program for water user associations and learn how to assist the specialists involved in promoting these organizations. This portion of the course will be taught by the long-term sociologist advisor and the advisor's counterpart and by visiting TDY technical personnel and the sociologist assigned to work in the pilot lateral. The annual refresher course, one-two weeks, will provide opportunity to evaluate progress with farmer group organizations.

A stepwise refresher program is contemplated to reach the objective of farm extension of research results and the catalyzing of water user groups and associations. Following the initial training, and as data is generated from the research stations and from special studies, more sophisticated data collection and use will be introduced. Such an approach will include the agronomic packages and new information generated at the research centers. It will include consumptive use of water by crops, and the irrigation water required at the farm level, etc. Agronomic data, such as the interactions of fertilizer, soils, crops and the quantity of water to apply will be taught, explained, and demonstrated at the demonstration farm. Finally, the program will move out to the farmers' fields as the extension personnel complete their initial training and learn to work actively with farmers and farmer groups.

Farmer training is the major issue and the rationale behind the training of extension personnel. This project encourages innovation and should explore the several alternatives and experiences available. The search is for the catalyst that promotes change-knowledge transfer and, finally, implementation by the farmer.

The Centers will assist the extension agent develop farmer and farmer group training programs in the pilot lateral. Farmer groups and water user organizations will be encouraged to foster and promote training among its members. Such groups will be encouraged to assist in planning and organizing short courses, site visits to successful farmers or other areas, research station, and demonstration farm tours. An innovative tour program is outlined later to broaden the vision of a group of selected farmers to visit irrigation and drainage projects in Mexico and the United States.

One example of a farmer training program is provided here --there are many others. This approach to an understanding of soil, water, plant relationships has been used in many countries of the world with good success. It is based on using a soil auger, or a shovel, or a probe or even more sophisticated devices. For this example, a soil auger is used. Every farmer should have a soil auger or its equivalent in information gathering capability.

The short course, which can last for two hours or four, or more, depending on farmer time availability is divided into two sessions --a narrative session and a field session. In the narrative session, with approapriate visual aids, either sophisticated or primitive, a farmers group is walked through the basic concepts that the soil is essentially a reservoir in which to store water for crop use. Like any reservoir, the soil will only hold so much water per each unit of depth. If you add more water than the soil reservoir can hold, it leaks out and goes deeper into the soil or adds to the water table or runs off. When this occurs, the water carried with it, fertilizer and crop nutrients that are then lost for plant use and growth.

A second fundamental truth is explained in that the depth of the reservoir is defined as the depth of rooting of the crop. We now have a volumetric measure of what water the soil will hold, next is, how long will that reservoir last? Through a process of discussion the time between irrigations is correlated to the evapotranspiration of water by the plant at a given stage. The farmer is walked through this process through questions, answers, visual aids, etc., to the point of knowing the crop needs of a given quantity of water at given times and the irrigation practice and water management which must accomodate to that. A crop in stress, i.e., water deficit reduced potential yield. A crop with excess water reduces potential yield and losses nutrients.

Next, is a field verification of soil type, texture, water holding capacity and, by the "feel" method, how much is presently in each layer of soil, and how much the next irrigation should provide. Programs such as this, can be developed in those areas needing emphasis to bring about better water management.

The Centers will also have the responsibility to plan and carry out programs to train GODR professionals, through selected in-country courses. These will include: engineers, agricultural engineers,

hydrologists, drainage specialists, agronomists, sociologists, economists, planners, geographers, administrators, mid-management personnel, extensionists technicians, surveyors, machine and equipment operators, water masters, and operation and maintenance personnel.

The Centers will provide 1 course the first year and four courses per year thereafter for periods of from two to six weeks with each course having 10-25 participants. The following listing is illustrative of the types of courses that the Centers will provide. The strategy envisioned in each course offered by the Centers will be to stress and consider the interdisciplinary concepts and approach. This is vital in an irrigation project. Each discipline or area of expertise must learn about and appreciate the contribution that can be and must be made by the other. The bottom line is always the farmer who, in the final analysis, must integrate all of the technical factors, crop production factors, water management, etc., and still produce enough food for the family and for in-country use and export.

Listing of suggested courses:

- Irrigation Systems;
- Irrigation Scheduling;
- On-Farm Water Management;
- Operation and Management of Irrigation Districts or Irrigation Systems;
- Irrigation Water Production Functions;
- Administration and Management Training at a Given Level;
- Irrigation Water Production Functions;
- Plant-Water-Soil Relationships;
- Extension Techniques, Visual Aids, Video Use;
- Farmer Organizations, Necessary and Sufficient Sets of Conditions and Constraints, Experience in other Areas and if Transferable, Legal

Requirements; by Laws and Operating Procedures;

- Land Levelling and Machine Operation;
- Machine and Equipment Operators;
- Operation and Maintenance of Machinery and Equipment;
- Field Repair;
- Field Operation Techniques and Control.

The above listing is not intended to be all inclusive and many more courses can be added. It is illustrative, but based on previous short courses experience for irrigation districts.

The Centers will also plan, organize and carry out fourteen special farmer training courses in the seven major irrigation districts. The plan is to build up, within a two year period, a capability to hold three courses per year per district under the auspices of the Centers.

2) Academic Training

The program for training in the United States is outlined below. A suggested listing of subject areas needing well trained personnel follows:

- Academic Scholarships
  - 2 Irrigation Specialists (consumative use);
  - 2 Agricultural Engineer (irrigation methods);
  - 2 Agricultural Engineer (delivery systems, operation and maintenance);
  - 2 Agronomist (plant-water-soil relationships);
  - 2 Agricultural Economist (farm management);

2 Rural Sociologist
(farmer organizations);

2 Agricultural Engineer
(farm machinery and farm management);

2 Miscellaneous Specialties;

10 Researchers
(specialty areas to be specified).

- Short Course Training

Provision is made to send 31 persons to the United States for special short course training for periods of 2 weeks to 3 months.

A proposed breakdown would be to send 3 groups of 7 each for selected training and 10 persons possibly in groups of two for 2 weeks to 2 months. The needs for training must be identified by project staff prior to initiating this part of the training program.

- Special Considerations

As part of b. above, the suggestion is made to select a group of 6 farmers, 3 from each project area, including at least one from the pilot lateral to visit irrigation districts in Mexico and the United States. A technical interpretor would be included making a total of 7 persons. The purpose would be to allow farmers to catch the vision of a total irrigation and drainage district operation, and the kind of coordination that exists in other areas. Also, the farmers would see modern agricultural production processes and the management of resources required to achieve increased production. Even though at first thought the view of modern agriculture may be overwhelming --a proper orientation of the group and a wise selection of projects in Mexico and the United States will help alleviate any adverse reactions.

The returning farmers will be able to relate new agronomic recommendations and other practices positively by reason of their visit. The process of change will be accelerated since first hand experience transferred from farmer to farmer will mean more than from Extension Agent to farmer.

4. Credit
(AID $86,000; GODR $3,000,000)

The project will establish a credit program for use by farmers following the new views on agricultural credit, which are to make credit available at market rates of interest and expand services of formal financial institutions to farmers in the project areas.

The justification for this approach is found in the recommendations of the 1973 "Spring Review of Small Farmer Credit" and subsequent work by the rural finance group at Ohio State University and others. The findings show that in developing countries formal financial institutions provide few services to individuals living in rural areas. In the case of the Dominican Republic many larger towns do not have even one commercial bank office, and some do not even have a credit union or an agency of the Banco Agricola. In those areas where formal financial institutions do exist, many individuals may still not have access to financial services because they are not considered credit worthy. Individuals thus cut off from access to formal financial institutions are forced to rely on informal sources of financial services. Stories about the behavior of money lenders and the efficiency of their operations suggest that the opportunity cost of credit in the rural areas is quite high. Monthly lending rates of 10% to 20% are not uncommon as a recent informal survey has shown.

The lack of adequate formal financial services in the rural areas is recognized to be a serious problem that restricts production and diminishes the incomes of rural inhabitants. The traditional approach to this problem --infusion of cheap funds to be on lent at low, subsidized interest rates and targeted to specific productive activities-- has not helped and may even have made the situation worse. This approach has not worked because credit is fungible. Loans cannot be targeted to specific productive activities even with costly systems of credit supervision. In addition, financial institutions cannot remain viable if they continue to target low interest loans to small farmers because these are precisely the most expensive group to reach. High transaction costs are passed on to these borrowers and other rationing devices arise as financial institutions struggle to remain viable. Borrowers complain of these high transaction costs and poor service, which reduces repayment performance. In the case of Banco Agricola, attempts made to reach small farmers have resulted in high rates of loan delinquency and default, substantial operating losses, and a concentration

of credit into larger loans to fewer borrowers. Commercial banks are not interested in serving rural borrowers because the controlled low interest rates on agricultmural loans does not compensate for the risks and transaction costs. Credit unions have also failed to expand their services significantly in rural areas. Some have remained small and conservative, relying on capital contributions of members for resources and lending out only small amounts to each member in relation to his capital contribution and thereby turning the low stated interest rates on loans into very high effective rates. Other rural credit unions have sought cheap external resources through the Credit Union Federation (FEDOCOOP) or the Cooperativa Financiera (FICOOP) for on-lending to members at subsidized low rates of interest. These latter credit unions have almost without exception encountered the same problems as other financial institutions that rely heavily on cheap external resources: operating costs substantially in excess of interest income, severe repayment problems, and decreasing financial viability.

The credit program is intended to address two issues. First, how to make available credit for financing land levelling, crop production operations and marketing when necessary. Second, how to strengthen formal financial institutions in the project areas in order to make available increased credit not only for agricultural activities but business and personal services which support those activities. Business services includes activities such as input supply, transportation services and equipment rental. Personal services includes supply of family and household needs. Recognizing the main characteristic of credit, "fungibility", the funds will be lent at market rates or the maximum legal rates. Loans will be made in accordance with the normal lending criteria of the participating lenders, subject only to the following minimal restrictions: the loans may not be used for equity or land purchases, refinancing of existing debts, or exceed a given amount per borrower, which will be established for each project area. In addition, given the nature of the project, a borrower will have access to a line of credit for the above activities if he/she is committed to adopt land levelling practices as part of their routine activities.

The credit funds will be provided by the GODR in the amount of RD$3,000,000. The allocation of these funds among the project areas will be based on two criteria: perceived demand for credit and voluntary savings. the rationale for this last criteria is based on the commitment of the Banco Agricola's administration to initiate soon a savings mobilization program under the AID

funded Rural Savings Mobilization project (No. 517-0179).

Four branches of Banco Agricola will participate in a pilot effort to demonstrate that voluntary savings can be mobilized in rural areas. Banco Agricola's plans are to go from this effort to a nation-wide savings mobilization campaign by the end of this current year.

Quarterly reports for the first three quarters of each calendar year and an annual report at the close of the fourth semester shall be prepared by the participant lenders to monitor progress and evaluations of the credit program. These aspects will be sent to the Agency, Community, Coordinating Committee (ACCC) for information and adjustments in the program, if necessary. The reports shall address, among others, the following subjects:

a. New accounts opened under the program;

b. Total of new funds mobilized;

c. Actual balances of funds (savings and credit);

d. Loans made during reporting period;

e. Deliquency on loans made since start of the program;

f. Discussion of problems encountered;

g. Solution of problems.

The program shall be evaluated upon the completion of the first three calendar years' work. Participants in this evaluation process will include representation of the GODR, AID/W, USAID/DR and private consultants. Based on this evaluations, it shall be decided the appropriateness of adding on funds to the current program for further stages of project implementation.

TABLE 2

SUMMARY FINANCIAL REPORT

INPUT	YEAR I AID FX	YEAR I AID LC	YEAR I GOOR	YEAR II AID FX	YEAR II AID LC	YEAR II GOOR	YEAR III AID FX	YEAR III AID LC	YEAR III GOOR	YEAR IV AID FX	YEAR IV AID LC	YEAR IV GOOR	YEAR V AID FX	YEAR V AID LC	YEAR V GOOR	TOTAL AID FX	TOTAL AID LC	TOTAL GOOR
1. TECHNICAL ASSISTANCE																		
a) Long Term	960		226	960		226	960		226	235		226	235		226	3350		1130
b) TDY	195			120			150			90			105			660		
2. ADMINISTRATION		318			306			311			215	52		137	86		1287	138
				10			40			10			40			100		
3. TRAINING																		
a) Academic - USA	200		72	442		152	382		127	182		55				1206		407
b) In Country - DRL	5	6	68	10	6	131	10	6	89	10	6	99	10	6	104	45	30	491
4. VEHICLES	650						42									692		
5. EQUIPMENT																		
a) Off. Equip.	229	10			60			62			16	45		5	60	229	153	105
b) Project Equip.	1652															1652	670	
c) Operation-Maint.		72			245			240			73	67		40	140			207
6. CONSTRUCTION		396															396	
7. CREDIT									500			1000			1500			3000
SUB-TOTAL	3891	802	366	1542	617	509	1584	619	942	527	310	1544	390	188	2116	7934	2536	5478
Inflation																606	191	1084
Contingency																555	178	501
GRAND TOTAL	3891	802	366	1542	617	509	1584	619	942	527	310	1544	390	188	2116	9095	2905	7063

TABLE 3

SUMMARY OF PROJECTIONS OF EXPENDITURES BY FISCAL YEAR AND BY ACTIVITY
($000)

ACTIVITY	YEAR I AID	YEAR I GOOR	YEAR II AID	YEAR II GOOR	YEAR III AID	YEAR III GOOR	YEAR IV AID	YEAR IV GOOR	YEAR V AID	YEAR V GOOR	TOTAL AID	TOTAL GOOR
1. CENTERS FOR WATER MANAGEMENT												
(a) YSURA	927	116	211	116	238	116	121	166	63	191	1559	705
(b) PrON	754	116	197	116	218	116	110	158	58	177	1338	683
Sub-total Centers	1681	232	408	232	456	232	231	324	121	368	2897	1388
2. TECHNICAL FIELD STUDIES												
(a) Irrigation Parameters	337	68	195	89	74	27	44	27	29	27	680	238
(b) Delivery Systems	520	12	257	26	310	16	153	21	195	34	1435	109
(c) Water User Associations	330	12	288	24	224	12	77	20	35	12	953	81
Sub-total Technical Field Studies	1187	92	740	139	608	55	274	68	259	73	3068	428
3. TRAINING & DEMONSTRATION												
(a) Training	823	41	631	137	733	167	219	111	68	86	2474	542
(b) Demonstration	1007		396		396		83	40	63	80	1945	120
Sub-total Training & Demonstration	1830	40	1027	137	1129	167	302	152	131	166	4419	662
4. CREDIT			24		40	500	11	1000	11	1500	86	3000
TOTAL	4698	364	2199	508	2233	954	818	1544	522	2107	10470	5478
Inflation											797	1084
Contingency											733	501
Grand Total											12000	7063

IV. PROJECT ANALYSIS

A. Technical Analysis

1. General

The technical analysis was carried out by a design team consisting of an irrigation and drainge engineer, an agricultural engineer, an agronomist-social scientist with assistance from a water resources political scientist, an economist and an environmentalist. The team was also assisted in its analysis by engineers from INDRHI, Administrators of SEA and IAD, and personnel from AID Agriculture.

The analysis consisted of an intensive review of the PID, and the documents gathered in that process. Additional documents with data and information were assembled and reviewed for both the PRYN and YSURA irrigation districts. Discussions were held with key personnel from the following agencies of GODR: INDRHI, SEA, IAD and ISA. Also, dicussions were held with the staff of two research stations: CENDA, in Santiago; and CIAZA, near Azua.

Field visits were taken by the team to the proposed project sites, the PRYN project, near Santiago; and the YSURA project, near Azua. Discussions were held with field office staff. Maps, drawings and written material were presented to answer questions and to orient the team on the details of the project. Field trips were made to inspect the delivery system, including head works, main canals, laterals, sub-laterals, turnouts, gates, farmer laterals, and waste disposal and drain ditches. Every effort was made to ascertain the condition of the delivery system and its limitations and deficiencies in delivery water to the farmer.

The team visited field farmer training centers in use by INDRHI and discussed the kinds and depth of training being carried out, and the problems and success encountered. Facilities were inspected for adequacy and participant confort and acceptance.

The team carried out several farm visits and interviews with farmers to hear of their problems in relation to the operation of the district. Farm fields were examined, and some measurements taken. Crops were in various stages of development and harvest. Farm turn outs --farm ditches, and irrigation practices were observed and

discussed with farmers. Several farm laterals were followed to provide a cross section of the projects at the farm level.

2. Discussion

a. Pilot Water Management Site Selection

A major responsibility assigned to the design team by the GODR and the AID Mission during the intensive review was, to evaluate and recommend the site for the Water Manement pilot project. During the visits to the two projects under review, the team evaluated the following criteria --in addition to the basic consideration of facilities-- land, equipment, and the staff of the GODR in the areas:

- The types of farmer organizations, presently operating in the area and how they function.
- The types and kinds of crops grown.
- Farmer problems as perceived by random farmer interviews.
- Conditions at the farm level including: farm turnouts measuring devices procedures for requesting water; need for levelling and how they get it done; weed control both farm weeds and ditch bank weeds, and other farming practices.
- On site review of the existing delivery system to collect, divert and distribute water to the farm.
- Field visits to Finca 1, and Finca 2 on the PRYN project.
- The perceived importance of each area in the production of food and fiber for the country.

After the field visits and evaluations the recommendation of the design team was that a pilot Water Management project be established in each area, i.e., one in the PRYN project near Santiago, and another in the YSURA project near Azua. The reasons for the recommendation are the following:

- The projects are located in different parts of the country and are highly important production areas. The cropping patterns are quite different in that the PRYN project --which will be called the North Project-- is mainly a monocropping area with some variability but only to a minor degree. The YSURA --or South Project-- has a diversity of crops, many of which are grown for export to markets in the United States. The farmers in the North are primarily land owners. In contrast, those in the South are "Asentamientos" and, as such, do not own their own land. This diversity provides opportunity for a wide range of training and demonstration that reflects the real needs of the farmers in the two districts. The climate and basic soils are different and, thus, the techniques in handling or managing them are different; the impact of the pilot project on the entire area of the irrigation district will be more effective in that the positive effects will multiply throughout two districts rather than just one. This will also facilitate knowledge transfer service to other irrigation districts throughout the country.

- The infrastructure is in place and water is being delivered to the pilot projects selected. The size of the pilot projects will be limited to one sub-lateral in each district of approximately 1,000 hectares.

In the final selection of the sub-lateral for each area, the following criteria will be used:

- The lateral line will consist largely of small farmers. It is likely that there may be several large farms receiving water from the lateral but they must not dominate by numbers nor by total acreage.

- The hydraulic system that will form the pilot system will begin at the diversion point into the main canal system

on down to the last farmer on the sub-lateral.

- The farmers on the lateral must be visited and a determination made to see if they want to be a part of the Pilot Lateral Study and will cooperate in the activities outlined to them.

b. Selection of Research Stations, Facilities and Programs

During the field visits by the design team, considerable effort was devoted to determining if the research stations had adequate facilities and staff and were interested in cooperating with the water management project. Such factors as location, available land, equipment, staff and laboratory facilities were considered. After the visits and reviews, two research stations were selected for cooperation: CENDA, located in the Zona Norte; and CIAZA, in the YSURA area (see map, Annex K).

The staff and facilities at CENDA seem to be excellent. The laboratory and equipment are impressive. Nearby there are excellent instructional facilities at ISA and some land for field demonstrations.

The CIAZA (Research Center for Arid Zones) initiated its operation in 1979, in an area of 83 hectares located in the Azua valley, within the YSURA project, one of the Agrarian Reform's Centers.

The staff is composed mainly of "ingenieros agronomos", that is, university level technicians with no specialities. There are nine technicians supported by administrative personnel and numerous labor persons. Two major problems are visible regarding the personnel; one is that the Research Station urgently needs more highly trained personnel, since the actual research is being conducted by persons fairly inexperienced in research. Another problem is the lack of stability of the personnel. The Research Station lacks all kinds of facilities and incentives and some technicians are not willing to spend their professional careers working under existing conditions (see Annex G).

The laboratory building presently, serves as office space and needs to be made available and equipped for the intended purpose. There is a need of technical staff to operate the laboratory. The team suggested that individuals from CIAZA could be transferred to CENDA for training in the use of technical equipment. Other donors,

Israel and Holland, are aiding in the equipping of the laboratory for crop protection research. Some of that equipment can be utilized for other projects, such as the Water Management project. The staff seems eager to work but is hampered by lack of facilities. Some should receive additional training. In addition to more staff training, there is also a need for technical assistance specialists to periodically counsel and plan with the resident staff.

c. Facilities and Programs for Training and Demonstration

The design team also reviewed, with GODR personnel, the training and demonstration facilities available at the projects sites. As anticipated, the situation is different in each area.

The PRYN project area is near Santiago and has several sets of training facilities, including classrooms, dormitory space and research facilities. The research center, CENDA, is well established and has good facilities for both, laboratory and some field operations. At the same location is ISA, with excellent new facilities for short courses and formal class instruction. In addition to these two, there are other facilities such as CECARA, with dormitory space for 87 persons. The review team did not visualize any need for additional dormitory facilities, since those in the area are available.

At the field level, INDRHI is now operating two farmer training centers: Finca 1 and Finca 2. These fields are about 7 hectares each, and Finca 1 is presently in use. Approximately 1,200 farmers have attended courses at the farms. The needs for the training of technicians and extension agents would be better served with a large area of 50-100 hectares. SEA, apparently, has control of several hundred hectars of land located near the middle of the PRYN area, some of which may be available. In any event, field storage sheds will be needed together with repair facilities including tools, spare parts and fuel supplies.

The office space for the Center's staff, including the technical assistance personnel, both long-term and short-term and the personnel from the GODR,can apparently be povided. The project needs will require office space for 10-15 people with office equipment --computers and other office machines-- and, at least, one conference room (see Annexes D-H).

The AZUA project was also reviewed during a visit to the field, and through discussions with key

people. The facilities for field personnel, both at INDRHI and CIAZA, are very inadequate. The Center could not be housed at any of the existing facilities. The research Center does have offices for its personnel at the present time, but at the expense of laboratory space. The station must complete building offices to release needed laboratory space. The Research Station land area is only 83 hectares. This land is needed for research, and should not be used for other activities. Again, the Secretariat of Agriculture does have additional land close to the research station that hopefully can be used for training and demonstration activities.

It is imperative that good facilities be provided as an incentives for those who work at the field level. Central overhead fans will provide additional comfort for field personnel and those brought in for training and demonstration. The facility should be located close to the field or fields on which the demonstration and training activities will be conducted, as well as close to the pilot lateral on which the project will concentrate its efforts.

An office complex for the Center to be constructed at CIAZA, will precipitate good cooperation between the researchers at CIAZA and the Water Management team. The logistical problems will be lessened by having the two facilities close together (see Annexes D-H).

d. Hydraulic Systems

Water measurement at strategic points in the delivery system is the only basis upon which efficient use of water can be accomplished. Measurement is required at every point where water is divided. Such measurements assure the deliverers that the correct amount of water is given to the client. The receiver of water also has the assurance that the water paid for was delivered.

The project proposes that the first step in obtaining project-wide water measurement will be the calibration of delivery structures. Typical structures can be calibrated if they have critical flow sections or are functioning as submerged orifices. The structures are all in place and may eventually have to be calibrated individually, and it may be necessary to install critical depth measuring devices of the type developed by the U.S. Water Conservation Laboratory, in Phoenix, Arizona. These devices are relatively inexpensive and can be installed in existing lined canals without causing serious freeboard problems (see Annex D).

Latter during the last year of the project, when water measurement and management data are available in the projects, along with the known physical operating characteristics of the diversion and canal systems, a computer model for management of the system will be developed. Such a model would use real weather data to predict when water will be required on every field in the project. The delivery requests of the farmers can be anticipated and delivery service and efficiency maximized.

e. Training Needs

The personnel from the agencies reviewed consisted of a large percentage of relatively young persons. At the Research Station at CIAZA, the level of experience at the station ranges from 1-4 years. Many of the staff had graduated from college during the past 2 years. This lack of experience can only be corrected with time, but knowledge and modern technology can be acquired through training opportunities.

To meet the perceived project needs, training programs will be carefully designed using the following format:

- Short term training courses will be offered in a variety of subjects and at several training centers in the United States or elsewhere.

- Participants assigned to work on the project will receive training in designated areas in one to three months, then, return to work on the project.

- Attendance at a properly designed short course will also be used to screen candidates for degree training. Presurveying by attendance and performmance at a short course, will serve the participant as well as the country, by choosing the persons likely to succeed.

Participants are needed for academic degree training especially for research stations. As outlined above, the need for upgrading researchers is paramount. Also, the experience obtained by participating in and being a part of a mature research complex, is additionally worthwhile. The project will rely heavily

upon the agronomic packages that come from research and demonstration to provide that training. Professional improvement of selected research staff will greatly enhance the potential production possible in the Dominican Republic.

A third type of training is viewed as significant for success of the project. The extension agents are recruited with the high school level training. They need to be trained in the technology and the agronomic packages developed at the research stations. This can best be done by in-country training courses scheduled in a timely sequence throughout each year. The training must be oriented to field activities. Agents should be able to do all the operations that the farmer normally does. It is only in this way that farmers will have confidence in the ability of the agent to help them.

f. Technical Assistance

On the agency level, the analysis made by the design team with respect to the manpower and competence of personnel in the agencies who will be involved with this project, indicates there are many well educated professionals. The defficiencies were found in the experience levels and training in specialized areas such as water management and research. Also, it is apparent that there is a lack of depth in the available technical personnel within most agencies, again in specialized areas.

The experience that the well-educated professionals need can only be gained over time and under the observing eye of persons who have themselves gained their expertise through experience and special training. Since persons expert in water management are not readily available in the Dominican Republic, technical assistance in this area will be provided.

Specifically, assistance will be provided to the GODR in formulating policies to guide the future implementation of water management projects not yet completed by GODR. Additional assistance will be provided in the operation and maintenance of the distribution channels or delivery system that brings irrigation water to the individual farms.

Research is an important key to the development of basic agronomic information, and with good water management will produce optimum crops. It is recognized that it is very difficult for U.S. universities to send highly competent researchers abroad for long

periods of time. A methodology of using top researchers on a part-time basis will work well within the framework of field research. Thus, the design team recommended short-term technical assistance for the research stations in the Water Management project areas. During a short term visit, the technical assistants can work with local research personnel and provide the kind of help needed in research design, implementation and data analysis. The technical assistance can also provide help in planning trials and in the development of demonstration agronomic packages.

To assure that the project emphasis is on the increase of production at the farm level resulting in improving the life of the farm family, the operations in the field are of utmost importance. To this end, the project proposes that technical assistance be provided in the management and operation of each Center for Water Management.

Technical assistance will also be required to oversee the training and demonstration carried out at the Center. This will involve verifying that the agronomic packages are properly implemented with improved practices. As local technicians proceed through the training program and begin to demonstrate new practices to the farmers, they will undoubtedly call for some additional help from the trainers at the Center. It is not realistic to assume that a one time training course at the Center will provide all the training needed for technical personnel.

The evaluation procedure needed to monitor the progress of this project requires intensive measurements at the farm level. The local professionals and technicians will be trained to carry out needed measurements over the life of the project. During the early stage utside technical assistance will be needed to design and implement these studies. During the later stages of the project short-term technical assistance can provide help in the analysis of the data. Without this kind of supervision the validity of the data and the subsequent analysis can not be assured.

g. Credit Program

A credit fund is considered necessary for the success of the Water Management project. If the project is to impact beyond the pilot demonstration laterals and secure the benefits necessary to recover costs, credit must be made available to those producers who adopt the production package recommended. Loans will be needed to level the land, but also may be required for

drainage pipe, and accessories needed for proper water management at the farm level. While some practices such as land levelling will be granted to those farmers participating in the pilot projects, they will not be available to producers --especially small farmers-- beyond these areas unless they have access to a credit fund designated specifically for this purpose.

At present in the Dominican Republic, loanable funds are scare, costly, and typically unavailable to the small farmer. Government reports, including Banco Agricola, confirm this assertion. For example, less than 5% of the loans from private commercial banks are directed to agriculture. These loans, as well as those of the Banco Agricola, are extended predominately to the large commercial farms. Small producers obtain more than 50% of their loans from private lenders such as truck owners, businessmen, and "loan sharks". They usually borrow money to meet their living expenses between work and harvests.

In short, there exists no available funds in the Dominican Republic which would meet the credit needs of the small farmers who may want to participate in this project. Approximately 80% of the producers in the combined irrigation regions PRYN-YSURA, as well as in the nation as a whole, work farms of less than 5 hectares in area. In PRYN-YSJRA alone, there are approximately 6,000 of these small farmers who will require an estimated RD$50 per hectare to level their land. In none of the last three years has the Banco Agricola loaned RD$300 or less to this many agriculturalists throughout the entire nation.

Thus, a fund of RD$3 million is required by this project to enable these small producers to rent the necessary equipment to level their land and purchase fixed capital such as irrigation water measuring flumes, pipe and siphons, etc. These loans will average under RD$250 and be of about five years duration. The only guarantee will be the farmer's signature. However, loan defaulters will not be eligible for further loans, unless --of course-- the default is due to circumstances beyond his or her control such as hurricane crop destruction or the like. An additional reason why land cannot be used as collateral for loans is because the land worked cooperatively by the small farmers in the YSURA project, as well as elsewhere in the country, is publicly owned and unavailable for colateral. Because land needs resmoothing and because real capital equipment depreciates, the loan fund will be permanent, i.e., a revolving fund.

h. Land Levelling

The process of preparing farm land for irrigation is one of the more important considerations in on farm water management. There are many degrees of levelling that vary from a very precise levelling that may require large cuts and fills to a simple smoothing of the land with a minimum of cuts and fills. This project postulates that all irrigation land should be smoothed but that some must not be leveled. The reason is that the cuts and fills will be too great and the soil profile will not stand large cuts without destroying soil productivity. On such farms, levelling may cause a serious decrease in production.

The project proposes that levelling be confined to a smoothing operation with a minimum of cuts and fills. The detailed study of the farms in the pilot lateral area will identify what should be done on any given farm. Any exceptions to the above general criteria should be justified with physical data.

The project will provide laser-controlled land levelling equipment to demonstrate land levelling to the farms of those who participate in the program (see Annex F). This will be coordinated and conducted from each Water Management Center. A land levelling payment and cooperation payment schedule will be worked out prior to begining the program. It is anticipated that other farmers adjacent to the pilot lateral will see the advantages of levelling and look for ways and means to have their lands levelled. This need, when identified by the farmers, will result in one or two courses of action. One will be for the farmers to look for private companies and contractors who can do the work or, they may through a form of water user associations, work towards purchase of equipment that they will own and control.

The question of contractor availability was reviewed and the following situation found to exist. There are no contractors presently available in the irrigation district areas who are currently engaged in levelling land for farmers. The kinds of equipment required are not immediately available and would have to be imported or manufactured in the country. It is not possible to say at this time whether the costs involved would favor local construction or importation.

In the YSURA district, the Proyecto de Servicios y Maquinarias Agricolas (PROSEMA) presently has 17 tractors which they claim are underutilized. It is not consired useful to have land levelling done by government institutions, but rather by farmers themselves or by private contractors. In the PRYN district, private

contractors are appropriate. However, only existing earth movers in the Dominican Republic should be contracted to do the land levelling, drainage work, etc. Moreover, periodic audits will be undertaken to ensure that the work was done and the money lent and repaid in accordance with the objectives of the Water Management project. The project will encourage prospective land levelling contractors by encouraging them to participate in farmer field days and other demonstration activities.

Care will be exercised with land levelling the PRYN irrigation area, as well as elsewhere in the nation, so as not to improve land which has an ambiguous legal status as regards the nation's agrarian reform laws. The Instituto Agrario Dominicano will be consulted prior to to the disbursement of any loan for land levelling and no loans should be granted if land ownership is questionable.

There are contractors available in both project areas that have road grading equipment. At times, such equipment has been used by farmers. A very skilled operator with experience in levelling farm land would be required to use such equipment. An unskilled operator can very quickly do considerable damage to a farmers field. Specialized equipment such as laser-controlled scraper and land plane is best to accomplish adequate land smoothing. The latest technology now in use extensively in the United States uses laser beams to control the levelling operation. It is fast and very accurate and will work effectively.

i. Water Use Charges and Collections

INDRHI is faced with the problem of poor collection of water charges from farmers. The problem is prevalent in all the irrigation districts varying from as low as 6% up to 70-80% collection rate. Some farmers take the attitude that since God sends the rain, there should be no charge for the collected water. Also, previously farmers could divert water from the rivers, now the irrigation district does it for them. Much of the problem dates back to the planning and design stages of the irrigation district. Little, if any farmer involvement occurred, thus no foundation or basis was established in which farmers had any voice in what took place. Since they are the ones who must pay the costs of administering, operating and maintaining the districts, they should be involved in such matters either individually or collectively through water user associations.

Historically, the GODR has used a flat rate charge per hectare for irrigation water for all crops, except rice. This rate structure, in place for the past 20

years, was changed in December 1982 by Presidential Decree. (Full details of the decree are available in the Mission file.)

The new rate structure to be implemented in a district by district basis provides a formula to recapture the budgeted costs for administration, operation and maintenance of the irrigation districts.

The schedule differentiates between common crops and rice. Rice is given a higher charge than other crops which is similar to the schedule previously in use. A major difference is the escalation of charges as the area irrigated increases. Ten hectares is used as the point at which rates will change. The decree also mandates that users will pay for water whether they use it or not.

Prior to the passage of the new decree, several studies were made by ILACO on the alternative ways of charging for water. The advantages and disadvantages of the flat rate system and the volumetric system were discussed in the paper "Proyecto de Riego Yaque del Norte, Cobrar el Servicio de Riego: Como y Cuando", ILACO, Mayo 1977.

Also, a discussion of water costs and charges and project costs is found in a paper "Proyecto de Riego de Tavera, Costo de Riego y Regimen de Tarifas", ILACO, enero 1976.

Charging for water that is not used is seen by the design team as a weakness in the decree. No mention is made about relief from payments if water is not delivered as needed. The penalties seem to be exclusive to the farmer who apparently had very little if any voice in establishing the new formula. A farmers' ability to pay is dependent on supplying the water needs of the crops without undue stress to the plant. Timely deliveries are not guaranteed. Nor is much said about how the water will be delivered, will potential evapotranspiration be the criteria or just how will the decision be made.

Finding the right combinations of services and charges comes with experience and accountability on the part of irrigation districts and on the part of farmers who are expected to pay the costs. This experience will be provided in the two pilot project areas.

Within the pilot project areas the GODR has agreed that the price of water will be based on an actual volume delivered basis. A farmer will be expected to pay only for the water actually received. The

allocation of water will be determined to meet potential evapotranspiration needs of the crops, and will be prorated to the farmer on a rotation basis according to his soil and growing period needs. To do this, water measurement will be mandatory. Steps will be taken within the pilot project areas to calibrate all turnouts so that all water delivered to individual farms can be measured. Every effort will be made to measure water at the farmer turnouts or within a given area where a measured stream can be rotated equitably among the farms. If extra water is requested and used by a farmer over and above potential evapotranspiration needs, the charge per unit volume will be escalated. This policy will tend to discourage overirrigation and help to increase good water management. Such a policy will also tend to spread water onto more lands thus increasing the efficient use of water. Such a pricing structure should encourage optimum water use. Further the system should be operated 24 hours/day when operating. This will involve night irrigation and again provide better water management and better use of the water supply.

The price of water charged to the farmer within the pilot project areas will be set high enough to cover costs of delivery and maintenance of the canal system. The farmers will be given records of the water they receive and should be able to verify the volume received within the limits of accuracy of the calibrated turnout structures. The farmer can then be legitimately expected to pay for the water he acknowledges that he receives.

The delivery system operation within the pilot project areas will be refined so that it is absolutely dependable in delivering water to the farmer at the appointed rotation time and in the proper amounts. The farmer will willingly pay for dependable service and value received. This project offers an excellent opportunity to monitor the effects of the newly established policy for water user charges and compare results with the pricing structure in the pilot project areas. Based on this analysis recommendations will be developed from water user associations, project staff and appropriate changes can be made nationwide.

3. Conclusions

a. The design team concluded that there were sufficient differences in types of crops, the types of farmers, and the influence of IAD in each of the project sites reviewed that two pilot project sites should be chosen; one in PRYN --near Santiago, the other in YSURA --near Azua. The fact that one project was in the North and the other in the Southwest also was considered.

b. There are apparently enough facilities for offices, training facilities and minimum demonstration and training fields already in place in the PRYN project to meet project needs. A machine shed, a small field shop, a field classroom with restroom facilities, will be required. INDRHI officials indicated additional land area for demonstration and training can be provided.

c. The YSURA site will require major office facilities, machine shed and repair shop. These should be located near CIAZA, the research station where power and water are available.

d. Although INDRHI, SEA, and IAD have well trained personnel in many areas, there is a severe lack in areas of interest to water management. Also, there is very little depth of personnel, in such disciplines. Intensive training in selected areas is needed.

e. Technical assistance will be required to help initiate the Water Management project and to provide decreasing support over the 5 years.

f. Credit to farmers and farmer groups is required, especially to assist in land levelling as a necessary condition to good water management.

g. Very little base data is available on either project and this must be collected to provide monitoring and evaluation of the progress and success of the project.

h. The price of water within the pilot project areas should be based on volume used and the recently established GODR water pricing schedule should then be given a fair trial before any changes are recommended. Water user associations should discuss and assess the effects of the new decree and contribute to recommendations.

In sum, based on the technical analyses performed during the development of the project, all the proposed technologies appear to be feasible. The cost estimates for equipment and materials are based on the most reliable data available. The cost estimate for the construction of the training facility is based upon GODR experience from on-going similar construction activities. Thus, the Mission believes that the project as designed is technically feasible and that it is a cost-effective approach to solving the problem. The Mission also considers that the requirements of Section 611 (a) of the Foreign Assistance Act of 1961, as amended, have been met.

B. Social Soundness Analysis

1. General

The prospect of improved water management in the areas designated raises two sets of social questions, one related to social impacts of water management and the other to the institutionalization of water user groups. It is necessary first to evaluate whether the achievement of the project goals will improve the lives of the people in the area. It is also necessary to evaluate the extent to which social mechanisms exist, or can be created, which are necessary to the establishment of successful water management.

These issues will be discussed as follows: social impacts of water management; social feasibility of irrigation water groups; farmer perceptions of irrigation bureaucracy; function and roles of user groups. It should be noted from the onset that the decision to promote irrigation has been made and that infrastructure is built or near completion. The aim of the proposed project is to raise the capacity of the small --and medium-- scale farmer to deal with complexities of modern irrigation and associated agronomic technology.

2. Discussion

a. Social Impacts of Water Management

Techniques of irrigated agriculture have become enormously sophisticated (i.e., high level of technology, greater efficiency, more capital intensive, greater management skills required, better monitoring/measuring devices, etc.). This sophistication biases the system against those without clear access to the technology. The role of the social sciences in the

proposed project, therefore, is twofold:

- Facilitate the transfer of this technology to the small farmer; and
- Mitigate the impacts of social change fostered by such technology advancement.

1) Greater Work Loads

If this project is successful, it will improve the level of income of farmers in the project area. This is an undeniably positive economic consequence. However, good irrigation practices will involve changes, not all of which may be positive to everyone. More intensive farming with the addition of a supplemental crop requires more work and translates into more work for farm laborers. It may also mean more work for certain family members. We know that many of the changes in agriculture have resulted in worsening the position of the marginal farmer and of women in agriculture. Where higher levels of technical expertise and more sophisticated equipment become a requisite to success, poor farmers who have neither often are likely to suffer on the contrary, land levelling should greatly reduce the amount of labor required to irrigate and particularly at night.

2) Incentives to Technology Transfer

Farmers must have incentives to change their irrigation practices. Rewards may include higher production, but this will be effective only if farmers profit in some way from higher crop yields. Other equally effective incentives may be a reduction in labor, the substitution of more satisfying work, or an improvement in family life. An additional incentive may be greater certainty, that is, if farmers could be sure of regular deliveries of water, they might be willing to change practices. Better water management by some will result in more water for others and make the supply more reliable. Another incentive may be a greater amount of control over their own life. If changed irrigation practices were to result in a greater amount of autonomy from supervision or bureaucratic rules, the farmer might be quite willing to experiment. Literature suggests the farmers are willing to innovate, but that farmers are justifiably skeptical of outsiders with new ideas. In the past many ideas and innovations have not improved farmer's lives and have made them more vulnerable to outside forces.

Training and technical assistance is a necessary condition, but by itself is not an incentive to change irrigation practices. Research in information transfer has demonstrated that information does not produce its own market. Overwhelming a farmer with new information is probably counterproductive. The existence of a demand for knowledge must come before any training programs begin.

3) Status of Women

Unfortunately, agricultural work has all too often not improved the status or condition of women. The stereotype of women's work in the Dominican Republic, as in many Latin American countries, is housework. Unchanged stereotypes may create double burdens on women as their farmwork increases. The project must carefully monitor the impact of such changes as introduction of double cropping upon the work of women.

The technological sophistication of irrigation gives advantages to those with training. Women do not ordinarily have access to the training, that is regularly open to men (f.n. interview). Irrigation technology may introduce other particular problems. For instance, good water management may require irrigation at night. This may be particularly burdensome on some families and workers. The project will need to monitor such effects of irrigation and the family adjustments that ensue.

Women seldom participate in groups that include men, and --when they do-- they do not have much influence. The project must attend to the rights of women farmers to have a voice in the water users associations that are formed.

4) Resettlement and Reorientation of Fields

The implementation of water development projects already promises to have a very large impact upon farmers. In the PRYN area, in particular, the application of agrarian reform "cuota parte" law will require large farmers to relinquish part of their land. Further, optimal irrigation from an irrigation standpoint suggests the reorientation of fields. INDRHI has developed a plan for reorienting the placement of fields to facilitate irrigation and other farm operations, (Lora Lara, 1981). This plan has not received detailed analysis from lawyers who understand the complexities of land tenure. It has been developed without clear indication of participation by farmers themselves. It seems unlikely

that resettlement could succeed without the support of farmers. Farmers have a great deal at stake in gaining a voice in planning and implementing such land reorientation.

5) Improved Farmer Participation

The implementation of an irrigation management system based on farmer participation places risks and demands as well as opportunities upon the farmer. Some farmers may profit from the system that now exists. They may irrigate more land than they declare to INDRHI to lie under irrigation. Particular friends of the ditch rider (cabo de agua) may fare better than others in the allocation of water. There is a burden involved in the participation in groups which are time consuming and take farmers away from their work. Also, groups may become dominated by a few large farmers or by the governmental agency. While all of these risks are real, the benefits of improved irrigation practice can not be realized without farmer participation. On the whole the benefits of higher farm income should outweigh these costs. Further, there are benefits associated with farmers gaining greater control over the external influences on their lives such as an irrigation agency can exert.

b. Social Feasibility of Irrigation User Groups

1) General Principles

Farmer participation through organization is a precondition for improved irrigation practices. Experience worldwide suggests that unless farmers participate in irrigation projects, the projects fail. The most successful projects are ones in which indigenous farmer groups participate in the initial design of the project, and where such groups control water allocation, the settlement of disputes, and the maintenance and repair of the canals leading directly to farms (Coward, 1980).

In a number of examples of large scale construction of irrigation works, the construction agency is not very responsive to users. Its mission becomes defined in terms of dams, diversions, and miles of canals. Getting authority for further construction becomes more important than the ultimate agronomic production of the farms to which water is provided through irrigation works. When there is little sensitivity to farmers needs, the delivery of water becomes irregular and undependable. The challenge becomes changing the system so that it is

responsive to the farmer.

2) Role of INDRHI

INDRHI is an autonomous public sector institution responsible for all hydraulic development, except urban water supply. Since 1969 this agency has moved very rapidly to construct a number of large scale water projects. This construction has been the product of centralized planning with limited participation of local users. It has only been in recent years that the gap between what was projected to happen before projects were built and the actual results have become obvious. There is increasing concern with INDRHI to improve water management. INDRHI has established a Department of Irrigation that is focusing upon management problems. However, the social service capability of this office is limited, and much of the sociological expertise has come on loan from Agriculture (SEA) since on the field level, personnel lack training.

The delivery of water by INDRHI tends to break down at the level of the ditch rider (cabo de agua). These officials play a key role in the irrigation system because they stand at the interface between the irrigation bureaucracy and water users. Ideally, they should be able to communicate to the water agency the experience and needs of the users. They also must have the respect of the farmers, be able to explain authoritatively the capacity and limits of the water system, and enforce the rules fairly. In actuality, the "cabo de agua" are poorly paid, lack technological skills in measurement, and are sometimes corrupted. Some farmers interviewed in Azua complained that "cabos de agua" acted capriciously, highhandedly and unfairly.

In many irrigation systems, ditch riders are directly responsible to irrigation users. In Northern New Mexico, ditch riders, or "mayordomos" as they are called, are elected from among farmers. INDRHI has accepted the need to organize water users associations, but resists the idea of giving them real power such as some control over "cabos de agua". There are also some real problems in organizing effective irrigation groups.

3) Operational Aspects

Unlike irrigation structures, water user groups cannot be simply designed and constructed. Effective organizations must evolve through experience of mutual community trust and accomplishment. Experience suggests that the most effective organizations are based

upon longstanding indigenous relationships. For instance, studies of irrigation in the ILICO's region of the Philippines (ZANJERA DANUM) indicate that a complex system has developed among users over time to organize water allocation, maintain the physical structure of canals, and manage conflict among users (Coward, 1979). It took time and experimentation for ZANJERA DANUM to devise an elaborate form of human organization that fits the natural and cultural situation and the engineering system. There are many other examples of successful indigenous community irrigation systems. The challenge of creating viable user groups under circumstances where none have existed or have participated in the design of the water projects is very great.

It must be noted that farmer organizations are not automatically attractive to or beneficial for the farmer. Participation takes time. Farmers may fear that organization may simply provide outside forces with additional avenues for inroads into their private lives. For the weaker farmers, organization may simply appear a means whereby they may be dominated and controlled by their neighbors. It is probably a precondition that farmers be offered incentive benefits to defray the costs and risks of organization. Credit, land leveling and other project components may provide some incentives. Costs can be lessened by allowing already existing farmer groups to take on new tasks, thereby lessening the need to participate in two or more organizations. Risks can be lessened by guarantees that the farmers themselves will control the decisions of the group and that the existence of the organization will guarantee to the farmer greater collective access to outside decisions that affect his or her life.

c. Institutionalization Tasks

Without indigenous community irrigation associations to build upon, it is important to at least connect this institution-building task within the country to experience in community organization that has taken place. The Department of Rural Organization (DOR) within SEA, has as its mission the organization of rural associations. There is some evidence to suggest it has been somewhat successful.

Most of the rural organizations in the country are of recent origin and were initiated through programs in SEA. The DOR has personnel with organizing skills and sociological training.

As a general rule, established organizations that take on new tasks are likely to be more successful than organizations newly founded. It takes time for an organization to become stable and to gain the trust of water-user group members. At the beginning, new organizations tend to be controlled by the government agency that promoted them. Over time organizations gain independence when they have effective leadership. From the perspective of social soundness, every effort should be made to work through existing rural associations in setting up user groups. This can be done by establishing special water subcommittees of existing associations. Water sub-committees could have members for the purpose of obtaining irrigation water who may not be members for other purposes. It may be that specialized water associations will need to be established in the pilot areas in order to gain experience. However, once this experience is attained, attention needs to be given to the diffusion of this experience through already existing organizations and channels.

In order to realistically assess the capability of existing rural associations to serve as a basis of user groups, it is important to be cognizant of their limitations. It is important to note that most of the associations have been established since 1975, and are not well institutionalized. A socio-economic study of associations in the Barahona concluded that these organizations had not yet reached a level where they could act as pressure groups or compete effectively in the policy arena to protect and advance their interests. Further, in some cases, these groups had become politicized through the influence of political parties. Internal conflicts, polarization of membership, and fragmentation of groups have resulted.

d. Farmer Perceptions of Irrigation Bureaucracy

Farmers' perceptions of problems in irrigation systems are very often quite different from those of personnel in water or other agency bureaucracy. A review of available literature, and brief conversations with farmers encountered on field trips to projects sites in PRYN and Azua suggest that farmers see INDRHI as an arbitrary agency that does not serve their interests. They volunteer stories of "cabos de agua" who act upon whim, or favor friends in the distribution of water.

A survey of 287 farmers in the Barahona area revealed that a number of problems exist between INDRHI and agricultural producers, at least in that area

(INDRHI). While care must be taken in extrapolating these findings to PRYN or Azua, information gathered in the field suggests problems are similar. According to the study, INDRHI's failure to deliver water has caused INDRHI to lose credibility in the field. Its image has deteriorated, and some farmers perceive INDRHI as an institution that is not interested in their problems, postpones actions, and systematically breaks its promises.

Evidence suggests that the cause of some water scarcity resides with the farmers themselves. The study of Barahona found that farmers were underestimating the amount of land area they actually irrigated in official reports to INDRHI; such estimates are the basis upon which water needs and charges are calculated. When they irrigated more land with highly water-intensive crops like tomatoes, the allotment was inadequate. This caused difficulties with the "cabo de agua" and among water users.

Farmers express real interest in the formation of water users' associations for several reasons. First, they believe they will have more power collectively than they do individually. Second, they also see user groups as a means to discipline farmers who acted against majority interests. Yet, farmers encountered in Azua were concerned about the structure of whatever user group might be formed. They wanted to be sure that the organization would be their instrument and not under the control of others.

e. Functions of User Groups

As has already been suggested, an irrigation system can be conceived of as a series of roles. The role of the water agency bureaucracy is to deliver the water to a sub-lateral in agreed upon amounts at agreed upon time and with appropriate quality. Another set of roles that begin at the level of the sub-lateral must be taken over by farmers if irrigation water management is to succeed. Possible roles to be performed by a user association are:

- Allocation of water by quantity and timing among farmers sharing the same ditch. Optimaly, this group should not be more than 30 or 40 farmers.

- Settlement of farmer disputes. Such disputes may be about actual water use, such as the size of area being irrigated. Or, the dispute may be

among individual farmers.

- Maintaining and cleaning the ditches that lead from the main lateral and serve a number of farmers in common.

If an association is to perform these roles successfully, it must have real leadership authority and influence. Some influence will spring from the election of its representatives by the farmer. There are other mechanisms to strengthen user associations that need to be seriously considered, and some mechanism to lend power to associations must be adopted. Associations must be able to sanction:

- Members who break rules by means such as cutting off water supply; and

- INDRHI by withholding payments or necessary authorization if water is not delivered as agreed.

The role of the cabo de agua is essential in linking water users to water managers. In many water systems, the ditch rider is actually an employee of water users. In Northern New Mexico, the "mayordomos" (ditch rider) who allocate water along the acequia madres (main irrigation canals) are actual farmers who are elected to the position by other farmers (Jacobs, 1978). The "mayordomos'" power is temporary and accountable, and is therefore not abused. "Cabos de agua" might be made accountable to farmers as well as to INDRHI if farmers paid 50% of their salaries. This money could be raised by assessing a water association fee collected by the association. It may be that associations could collect all water fees, and use a portion of fees to pay the "cabos" and turn the rest over to INDRHI. Perhaps it may be sufficient to require both the "Cabo" and the representative of the farm organization to sign off on all water deliveries, and keep receipts as a basis of collecting fees.

The relationships that presently exist between ditch riders and farmers require some improvement. Ditch riders are not highly qualified. In the communities studied in the Barahona report, their salaries were between 97 and 125 pesos (RD$) a month. There was a great deal of turn over in ditch riders, partly because of low salary and partly because of the difficulties of the job. The theft of water was fairly common in the communities studied and the ditch rider was unable to take action to stop it. Conflicts between ditch riders and water users were

frequent, as were conflicts among users. The situations in Azua and PRYN are probably different, but it is likely that ditch riders in these areas face many of the same problems as in Barahona.

3. Conclusion

The introduction of irrigation into the Azua Valley and PRYN brings to the small and medium-sized farmer some new-opportunities, but also some challenging problems. Irrigation, if it is to be effective, is highly technical, requiring investments and training. The farmers who do not have access to capital and training are likely to fare poorly. Women, in particular, who seldom have access to resources important to commercial farming, are apt not to succeed in irrigated agriculture. Moreover, irrigation is likely to erode further the autonomy of the farmer and their control over the factors of production. Water comes or does not come at the command of the irrigation bureaucracy over which farmers may have little power. Irrigation can benefit the small-and medium-sized farmer only if they organize to represent their own interests. Training is a necessary precondition for increasing income from irrigation. However, insuring timely delivery of water in appropriate quantities requires agency sensitivity to users. This sensitivity is not likely to develop unless farmers exert influence. Farmers collectively have much greater power than they do individually.

Groups are not likely to represent farmers true interests if they are instigated or designed by irrigation agencies. Ideally, the formation of groups occurs indigenously and spontaneously, among members on the basis of shared perceptions of common interests. While there is general agreement among agencies that farmers should organize into water users associations, there is resistance to the idea that these groups should be organized from the bottom up and that they should have real power. Some important roles must be given to farmers user groups, or a project can not succeed.

Above all, the social soundness analysis suggests that a great deal of information must be gathered by a social scientist at the outset of the water management project. The project directors must begin with a clear understanding of the best avenue to approach farmer training. It must understand the interests around which farmers combine in groups. It also must understand the risks of irrigation to special populations, such as landless and women, so that impacts can be mitigated.

C. Institutional Analysis

1. Introduction

The analysis in this section describes the basic organization of the project, the GODR agencies most likely to interface with and implement the activities proposed, and the major assets and liabilities associated with such local institutions in implementation of the project. Two aspects of GODR institutions will be emphasized, apart from their basic organization, namely: (1) the rationale for selection of the implementing agencies and (2) their relevant experience with similar projects or activities, as proposed herein.

2. Description of GODR Institutions

Because of the scope and nature of this project, a large number of public sector agencies and private institutions or groups will be involved in selected actitivities, some more so than others. For successful implementation of the project, however, three agencies are considered of primary importance, namely, INDRHI, SEA, and IAD; of secondary importance, CDE, BAGRICOLA, ODESIA and INDESUR. Also, two research centers of SEA are proposed as primary locations for demonstration, experimentation and training activities: CENDA (North) and CIAZA (Southwest). All of the above institutions are briefly described and constraints to their effective operation with water delivery systems are highlighted.

a. Instituto Nacional de Recursos Hidraulicos (INDRHI)

INDRHI is an autonomous public sector institution created in 1965 with responsibility for all hydraulic development except for urban water supply. (Bell, 1982). The Executive Chief of INDRHI must be a trained civil engineer, with major emphasis in either hydrology or hydroelectricity. The built-in bias of the Chief, is therefore toward construction.

Its organic act, Law 6, invests INDRHI with the following principle functions (Hartshorn, et al, 1981):

- Serve as the authority for surface and groundwaters and regulate their use;

- Study, protect, and program all the energy and hydraulic works necessary for the integral development of the hydrographic watersheds in coordination with national development plans.

- Organize and manage the utilization and conservation of national irrigation systems.

- Administer use of watersheds, reservoirs, springs, and national waters.

- Organize, direct, and regulate works involving water use with the Corporation of Industrial Development, with the Dominican Electricity Corporation (CDE) concerning energy aspects, and with the National Water and Sewage Institute (INAPA) for water supply.

- Organize, direct and regulate works concerning watershed hydrology, springs, and national waters, both superficial and underground.

- Participate in the conservation of stream flows, lakes, lagoons and watershed protection, including environmental and erosion control.

Of all these legal functions, INDRHI has taken most seriously the planning and construction of water projects. The following projects have been, or are near completion: Tavera Dam project began in 1969 and completed in 1975; Yaque del Sur program began at Sabana Yegua in 1975; small dam at Rincon finished in 1978; Sabaneta reservoir began construction in 1979. Much of the subsidiary work on these projects remains to be done, and there are other projects still on the drawing board (Bell, 1982). The projected INDRHI investment in water projects for 1980-82 period were RD$37.5 million for energy and RD$189.6 in agriculture (Hartshorn et al., 1981).

INDRHI tends to be a centralized organization, with much of the power over budget, supplies, and other matters concentrated in Santo Domingo. The Planning Office sets policy for INDRHI, and it is staffed primarily by civil engineers who are oriented toward construction. The Department of Irrigation is a relatively new organizational unit. Within it are divisions of

conservation and improvement, operations, and irrigation and drainage. This Department will have a key role to play in the proposed project through assistance to farmers in irrigation water management and farm drainage evaluations.

Irrigation districts have been established to deliver water out through the system (Hargreaves and Furlong, 1982).

At the present time there are seven major irrigation districts within INDRHI: Bani, Azua, Barahona, San Juan de la Maguana, La Vega, Santiago, and Province Maria Trinidad Sanchez (Nagua). But, INDRHI personnel have considerably more skill and experience in engineering than in water management for agriculture. For example, the Directors of both the Yaque del Norte and Azua irrigation districts in March, 1983 were civil engineers without agronomic experience (Hartshorn et al., 1981).

In 1979 INDRHI had some 1,650 employees, few of whom had formal training in irrigation water management. Only recently have significant numbers of agronomists and irrigation specialists been trained and placed in major positions of authority even in the irrigation section of the organization (Hartshorn et al., 1981). Some observers have concluded that the small number of INDRHI personnel with graduate studies or degrees are a real limiting factor. Certainly, INDRHI lacks personnel with the necessary agricultural and social science background at the irrigation district level to provide expertise in effective water management. At present, many such positions are filled with people or interagency agreement with SEA. The proposed project will be providing funds for upgrading INDRHI's capability in this area.

The role of the ditch rider (Cabo de Agua) in INDRHI reflects the low priority placed upon water management in INDRHI. These officials stand at the interface between the irrigation agency and users. In 1983, they are poorly paid, corruptable, and lack technical skills or skills at relating to farmers. INDRHI's attitude toward water users associations also reflects a lack of concern with management.

INDRHI has long had authority to organize users, but as of 1983, there were no such associations. Currently INDRHI has begun to pursue the idea of associations seriously (INDRHI, 1982). Yet, officials in INDRHI are resisting the idea of associations having power to collect user fees or pay part of the salary of the "Cabos de Agua". Unless user associations have some such

authority, they are not likely to be effective.

b. The Secretariat of State for Agriculture (SEA)

The lead agency for the development of the agricultural sector in the Dominican Republic is SEA. Its overall responsibilities encompass formulation and direction of agricultural development policy; monitoring agricultural distribution and production; managing the use of renewable natural resources; promotion of agricultural production; and coordinating the various activities of all the institutions within the country's agricultural sector. SEA's organization (see Table 4) consists of two support subsecretaries for agricultural sector planning and for administration. In addition, there are four technical subsecretariats (i.e., natural resources; agricultural production and marketing; animal resources development; and research, extension and training).

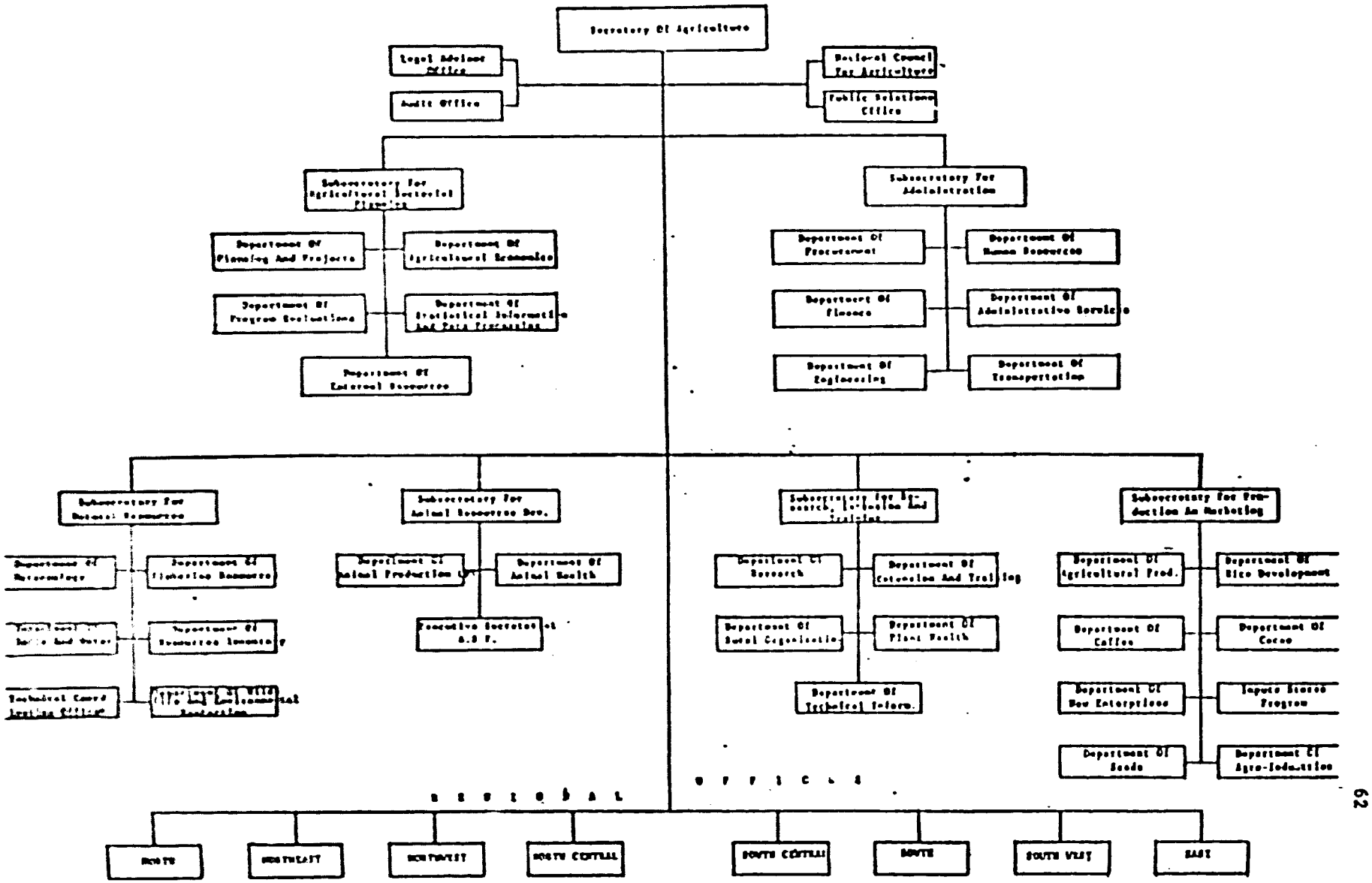
SEA has a number of activities that relate directly or indirectly to water management. For SEA, agricultural use of irrigation water has been an understandably secondary concern. SEA has had to focus upon other transcendant but sometimes conflicting goals, including: (1) meeting important agricultural production targets aimed toward self-sufficiency for the Dominican Republic in some agricultural commodities such as rice; (2) improving the balance of payments situation; and fostering agrarian land reform and improvement of the situation for small farmers.

Within the Subsecretariat for Research, Extension and Training (SEIECA), the Department of Research operates four research centers: (1) CENDA, located in Santiago, conducts research in the northern part of the country; (2) RICE, located in Bonao, deals strictly with rice investigation; (3) CESDA, located in San Cristobal, conducts research in the southern part of the country; and (4) CIAZA, located in Azua Valley, deals with arid lands research.

SEIECA contains a number of departments directly and indirectly related to water development. The land and water department (Departamento de Tierras y Aguas, or DTA) and its section of soil conservation has concentrated upon the loss of soil in higher elevations (Hargreaves and Furlong, 1982). There are irrigation specialists within DTA who train farmers in the mountains to use small irrigation systems. There are about twenty-eight technicians in the field working with this program. There is neither conflict with INDRHI in this

TABLE 4

ORGANIZATIONAL CHART OF THE SECRETARIAT OF STATE FOR AGRICULTURE



program, nor any close coordination.

The Research and Extension Departments are also important to irrigation. Some research is done at four of the experiment stations with irrigation impacts on agriculture, but there is a general lack of analysis and publication and distribution of the findings. Agriculture has approximately 600 extension agents working throughout the country. There are plans to increase this number to 1,000 in the near future. These technicians, however, have little or no training in teaching irrigation techniques or water management to the farmer. In May 1981, an agreement was made between INDRHI and SEA to train extension agents in correct and modern irrigation practices. Two main problems continue to exist, however: (1) there are few people at INDRHI who can conduct training programs at the nature desired; and (2) the program has yet to be implemented, so it is impossible to evaluate. There are communication problems in the relationships between SEA extension agents and researchers and INDRHI. Also, since farmers have at most a high school education, they have difficulty of status and communication with professionals.

c. Centro de Investigaciones Aplicadas a Zonas Aridas (CIAZA)

CIAZA began, in 1977, as project of a joint Dominican-Isreali committee in the Azua Valley to address agricultural production needs in an area characterized by low rainfall (42-year average annual of 701.6 mm) and potentially saline soils, and by the existence of a large "asentamiento" movement, Proyecto YSURA, and by a developing irrigation system encompassing an area of about 12,000 ha. CIAZA began applied studies in 1979 in the following areas: plant improvement, vegetable production, edible oils, musaceae, roots and tubers, cropping systems, pasture and forage, orchards, plant protection, plant pest control, phytopathology, and soil and water management. Apart from research, a portion of the center's 83 ha is used for production of vegetables; proceeds from their sale are used to support the administration of the center. Also, some inter-institutional cooperative studies and extension work have been initiated.

The core staff consists of four agronomic engineers, two supported jointly by SEA-IAD, two by SEA alone, and roughly 8-10 investigators from SEA who work on their various research programs (SEA, 1981). A recent visit to CIAZA and interview with the Director Ing. Agron. Cecilia Diaz indicated that, apart from need to improve the

capacity of their technical staff and facilities, some limitations to use of land existed due to a high water table.

d. Centro de Desarrollo Agropecuario, Zona Norte (CENDA)

CENDA is a regional research center formed in 1974 under SEA whose main goals are: to increase farm productivity through research and technology transfer; to support development program in areas of agriculture and livestock; to foster improvements in economic and social condition of the rural family; and to contribute to improvement of quality and yield of agricultural and animal products. Ten experimental areas have been established throughout the northern part of the country to study: plant sciences; plant protection; irrigation and drainage; soils; agricultural economics; and technical information transfer.

Since a more detailed description of CENDA is provided in the Technical Analysis, it will not be repeated here except to indicate that CENDA has good facilities and is apparently a capably run research station.

e. The Department of Rural Organization (DOR, SEIECA)

This Department of SEIECA performs functions that are enormously important for water management. Currently, personnel in the Department have been engaged in performing social-economic analysis in various irrigation districts for INDRHI. Their skills have not yet been utilized in the organization of associations of water users.

The policy and philosophy of the DOR is oriented toward the development and strengthening of organizations of small farmers to better represent their own interests. Their aim is to develop in these associations the effective participation and representation of members. Their orientation is organizational rather than technical. That is, DOR aims to model organizations to fit various purposes, such as commercialization, credit, and, conceivably the delivery of irrigation water.

The DOR is organized at both the national and the regional levels. At the national level, there are sections that deal with organization of producers, women and youth. This structure has a counterpart in the organization in the regions.

A closer look and possible cooperation with this organization should be considered by project implementers.

f. Dominican Agrarian Institute (IAD)

The IAD is a semi-autonomous body under the Secretariat of Agriculture established in 1962 with the aim of redistributing land and improving the standard of living of the rural poor. Over time IAD has changed its operations several times in response to changing political administrations and economic problems. Most recently, it has reoriented its programs toward collective "asentamientos" or farms. One aim of collective farming has been to increase production. IAD has been somewhat successful in achieving this aim, at least in growing rice. However, as discussed elsewhere, IAD has had difficulties gaining acceptance of the collective concept among farmers (A. Castro, pers. comm., 1983).

Among IAD's difficulties have been the establishment of mechanisms for farmer training, and farmer participation. For example, IAD itself has few personnel with expertise in water management. It is unable on its own to train farm managers and farmers in water management. The access to training of persons, who do much of the work on farms, is poor. Very few women are "parceleras" or actual members of "asentamientos" with rights of representation, since most women are connected through their husbands and families. Opportunities to paticipate in training, therefore, go mostly to men. Further, benefits are distributed to male heads of households. There are centers established to improve the status of women within IAD, but those centers though active and effective are quite new and poorly funded.

Most of the decisions on "asentamientos", in fact, are made by specially-appointed people ("encargados") who are technicians hired by IAD. It is the duty of these "encargados" to arrange credit, marketing of products, and technical assistance. The numbers and variety of their duties prohibit particular concentration upon water management.

g. Dominican Electricity Corporation (CDE)

CDE was created as an autonomous institution by Law 4115 (1955) to provide for the production, transmission and distribution of electrical energy. A section of Article 8 of the CDE enabling legislation explicitly assigns responsibility to CDE for national electrification. CDE's autonomous status and

financial independence allow it to plan on a longer term basis and with more stability than institutions such as INDRHI (Hargreaves and Furlong, 1982).

Most CDE hydroelectric projects are contracted to foreign or private consultants for feasibility and design studies. CDE then, forms a specific corporation to construct a dam. Upon completion of the construction project, the corporation is dissolved.

Although it may have administrative and financial advantages, CDE's creation of a separate corporation for each dam construction has had some serious consequences. CDE has traditionally ignored the condition of the watershed and any interest or effort in watershed management. The construction corporation is only interested in completing the dam, thus puts no money into studies or actions in the watershed above the hydroelectric project. The creation of a separate construction corporation for each project effectively excludes CDE engineers from substantive involvement in a hydroelectric project.

Friction between INDRHI and CDE and lack of communication seem to exist. Apparent mutual distrust for the quality of work and policies of each institution is demonstrated in two instances: lack of knowledge and indifference at the technical level regarding the activities in which each institution is involved, and the maps of locations of future dams being considered separately by each institution that do not show the projected dams of the other (Hargreaves and Furlong, 1982).

Some conflict exists concerning releases of water from storage reservoirs. Although hydropower production is only 15% of the total reservoir water capacity, reservoirs are used to generate additional power to meet peak demands and during power outages of other plants. Power production and associated water releases from the resevoir at times conflict with storage needs for irrigation. The interagency agreement between CDE and INDRHI, signed in August 1980, attempted to maximize both agricultural and energy benefits from water development. However, INDRHI is sometimes at a disadvantage in its negotiations with CDE. INDRHI's lack of actual control over water management means INDRHI has little data on how much water is supplied through its systems, or how much is needed. CDE's data on energy needs are much more exact.

h. Oficina para el Desarrollo Integral Agropecuario (ODESIA)

ODESIA was formed in 1979 to coordinate the activities and direct the policy of the agriculture and livestock sector of the Azua Valley. Their main support, as a quasi-governmental organization attached to SEA, comes from U.S. PL-480 funds, SEA and FEDA. ODESIA attempts to coordinate the activities of 10 GODR institutions, civil and local governments, the private sector, agricultural cooperatives, and individual farmers in the agriculture sector. Their role when compared to Instituto para el Desarrollo del Suroeste (INDESUR) becomes problematic in concept and in action (Johnson et al., 1972). Perhaps, their greatest achievement is the running of the Valley Directive Council (see organigram, Table 3), which meets once a week to discuss and solve local problemns.

i. Instituto para el Desarrollo del Suroeste (INDESUR)

As part of ONAPLAN, INDESUR's job is to assist in establishment of a cohesive plan for implementation of projects in the Southwest and coordinate projects of other organizations of the public sector, including SEA. There are about 17 employees and 108 projects currently under INDESUR. In general, it is believed that INDESUR gives good technical advise, but lacks authority to coordinate the diverse array of projects on-going in the region (Johnson et al., 1982).

j. Agricultural Bank (Banco Agricola)

After the Secretariat of Agriculture, the official GODR institution that reaches the largest number of small farmers is the Banco Agricola. It is the main source of credit for crop production and can lend money to individuals and/or groups of people. They lend considerable amounts to "asentamientos" and to other farmers with irrigated lands. When lands are irrigated, the Bank collects the water fees for INDRHI by subtracting them from the loan.

3. Technical/Administrative Requirements for Project Implementation

Water management implies a number of changes in agency behavior. Agencies must pay a great deal more attention to the more direct and indirect social and environmental consequences of their actions in the field. The lines of communication must flow more strongly from the bottom-up in agency administration. Agency personnel in the field must become more conscious of, and adjust to, the activities and capabilities of other agencies. A great deal more focus must be placed upon the target population, in this case the water users, and their perceptions and capabilities. While difficult to accomplish, there is experience that demonstrates that water development agencies can and do change. The U.S. Army Corps of Engineers has become a great deal more sensitive to public participation and the environmental consequences of construction in the last 15 years (Magmanian, 1980). The National Irrigation Administration of the Phillipines is having some success in strengthening its work in support of communal irrigation associations (Korten, 1980).

There are signs that suggest that water resources policy in the Dominican Republic is undergoing a transition to water management. The forces behind this change are several. The pace of large dam and diversion construction is slowing. Difficulties in the actual operation of irrigation projects are becoming evident. There are physical manifestations of poor management, such as uncertin water delivery, water-logging and drainage problems, soil salinity, and less production than anticipated.

INDRHI has been subjected to negative political consequences of dissatisfied farmers. Conflicts between users and water managers that are not settled in the field become politiced. Farmers write and phone the office of the President or the offices of the Secretariat or Subsecretariat of Agriculture (SEA). The Director of INDRHI is then put under pressure, which he passes on down the line to irrigation districts, to begin to seriously pursue the formation of user groups.

Interagency conflict has also become costly, especially in the field where failure to integrate the activities of different agencies become clearly evident in terms of mixed signals to irrigators. INDRHI and other agencies have begun to develop mechanisms for interagency cooperation in the field. A coordinating committee called ODESIA was established in Azua to integrate the development

of the valley. The membership is comprehensive, cutting across a variety of interests. Membership includes:

a. Agriculture

- Secretaria de Estado de Agricultura (SEA)

- Instituto Agrario Dominicano (IAD)

b. Institute of Cooperative Credit and Development

- Instituto de Desarrollo y Credito Cooperativo (IDECOOP)

c. Institute of Price Stabilization

- Instituto Nacional de Estabilizacion de Precios (INESPRE)

d. INDRHI

- Instituto Dominicano de Recursos Hidraulicos (INDRHI)

e. Institute for Southwest Development

- Instituto para el Desarrollo del Suroeste (INDESUR)

- Banco Agricola (BAGRICOLA)

f. Agricultural Machinery Project

- Proyecto de Servicios y Maquinarias Agricolas (PROSEMA)

g. Center for Promotion and Export

- Centro Dominicano de Promocion de las Exportaciones (CEDOPEX)

h. Private Sector Representatives

- Representante(s) del Sector Privado

i. Representatives of the Province

- Representante(s) de la Autoridad Civil de la Provincia

The ODESIA office has a permanent Director, a position now held by Ing. Frank Camino, and an office staff of 8 people. ODESIA has already begun a project to improve water management.

Signs of institutional change toward more coordination on the national level are also becoming evident. INDRHI and SEA have come to an agreement to provide technical assistance for irrigation and drainage. Further, an interagency committee has been formed at the Subsecretariat level to deal with some of the problems of agricultural production including water management. At this writing, the committee (Comite de Coordinacion para la Planificacion Sectorial Agropecuaria) COCOPSA has met but four times, has no permanent staff, and has an uncertain future. At the same time, it must be noted that the existence of the committee is a signal that agencies are recognizing the need to coordinate a response to problems developing in the field.

This project intends to facilitate the growth and development of these trends toward water resource management through the Water Management Implementation Process.

4. Constraints to Irrigation Water Management

The above description of agencies involved in water development reveals a number of characteristics of the institutional structure that has prevailed during the water development era in the Dominican Republic.

- Water development has taken precedence over water management

- Water planning has taken place without considering resource constraints, particularly the constraints of farmers technical ability, lack of organization, and the persistence of traditional farming practices.

- The governmental organization that delivers water has been only loosely linked with other organizations that intend to help irrigation farmers. Each organization has in large part operated independent of the other, often assuming that other organizations will perform tasks that, in fact, they lack will or resources to perform.

- The flow of resources (money, expertise, equipment, etc.) to the operational level has been insufficient and uneven. The national level of organizations has been insufficiently responsive to problems that arise in the irrigation district.

- The water user has not been the focus of organizational concern. Agency officials that serve them directly have not been sensitive to their needs. Users have not been effectively organized to pursue and protect their own interests.

For the Azua region, a number of institutional constraints to improvements in agricultural productivity were identified (Johnson et al., 1982). A short list is provided to indicate some obstacles to successful irrigation water management in context of this project:

- Extensive movement of technicians from one position or location to another.

- Party-related agro-politics to prevent improved project coordination.

- Little central GODR support.

- Poor administration of resources at the national level.

- Few mechanisms to resolve problems because of mobility of members of Directive Council of ODESIA, that is, no constancy of people in position where problems can be resolved.

- Little cooperation between INDRHI-IAD on control of irrigation water.

5. Project Management Structure

The analysis clearly indicates that INDRHI, SEA and IAD are heavily involved in the irrigation districts of the country. The Agricultural Bank also is involved but not at the management and operational level. There is also evidence of INDRHI's increasing awareness that there must be an interdisciplinary approach to managing the districts from the headworks of the system to the use of water at the farm level. This necessitates full cooperation with SEA, IAD, and the farmers. Cooperation

now exists in many field offices.

The following management structure is therefore proposed:

- That INDRHI undertake overall responsibility for the Irrigation Water Management project. A high level person in the decision making process be charged with overseeing the project as project leader. The Chief of Party of the contractor will have direct access to the the project leader in all activities of the project.

- To assure the needed cooperation and coordination of resource availability and use from other agencies a coordinating committee be assigned to advise and work with the project leaders. Annual plans of work will be discussed and areas of responsibility and coordination established. Each committee representative will be charged to provide direct contacts within and for that agency.

- At the field level Directors will be established for each Center for Water Management. The project will provide for one Counterpart from the contractor's staff and the GODR will provide the Directors from INDRHI-SEA or IAD. A coordinating committee is suggested at the field level to assure agency-community farmer participation.

6. Agency Experience in Project Management

The analysis of agency experience in carrying out projects of this kind reflects some concerns. Although the list of construction works accomplished is impressive, the construction of Phase II of PRYN has run into trouble. There is evidence to suggest that most agencies of government have been a part of fairly straight forward and easily managed project activities. But there is little evidence of experience or ability to coordinate the activities of a project as complex as the one proposed in this Project Paper.

The project recognizes the complexity of an integrated water management system from the point of

collecting controlling and diverting water through a delivery system for use on a farmers fields. Accordingly, the following actions will be taken:

- A project monitor experienced in the administration of irrigation agriculture will be contracted to interface with the GODR and the contractor for the project.

- That the contract for implementation will be an AID rather than a host country contract.

- That INDRHI will be the primary agency to implement project working within the management structure cited above.

- That close monitoring procedures and performance will be reported at regular intervals so that changes, if required, can be made in the plans of work.

7. Conclusion

The implementation, operation and maintenance of an irrigation district to properly service the needs of the water users is a complex task. It requires a degree of sophistication that is seldom obtained without years of experience and a working out of solutions to problems on a continuous basis. It is only after agency personnel have worked their way through the many levels and operations involved that they are ready to address the decisions of operation and maintenance of the system. Ideally personnel who have advanced through the planning, design and implementation stage of a project are best suited to continue on as system managers and administrators at the policy-making level. This experience is hard to come by necessitating many short cuts to fill positions with inexperienced personnel.

The analysis of the institutions discussed in this section indicates that working relationships are really just beginning to evolve in relation to water management. There is a transition taking place in INDRHI expanding its traditional role to include more direct involvement with the water users and an increasing recognition among INDRHI personnel that the primary purpose of the irrigation district is to serve the water user. These trends bode well for the future and this project will help accelerate the rate of change.

A great deal of coordination is needed to coalesce the expertise available within the GODR institutions in water management. Steps must be taken to reduce unneeded overlap and government costs for administration. As this is done, agencies must then clarify their mandated responsibilities and assume fully their roles of leadership. A set of policies and procedures is needed to guide this needed change.

Since conflict over water is inevitable, especially in periods of short supply, policies and procedures are also needed to establish priorities in water use for the common good.

The analysis concludes finally, that the removal of all the constraints outlined in this analysis must be undertaken over a period of time. A strengthening of present institutional structure should be used rather than create new entities. Government resources to implement, operate and maintain present projects should be a priority with the GODR.

D. Economic Analysis

1. Introduction

a. Purpose

This analysis demonstrates the WITH-WITHOUT economic and financial feasibility of the Water Management project at three levels: hectare (farmer); region (PRYN and YSURA); and national (Dominican Republic irrigated land area).

The purpose is to estimate the project's probable benefits and costs to the farmer, the pilot regions, and the nation. Net present values and internal rates of return, along with benefit cost ratios are the measures estimated which will provide the managers and directors of AID and the GODR with additional information upon which to make loan and investment decisions.

b. Scope

In this analysis, project benefits and costs were treated quantitatively and qualitatively. While the qualitative differences may well be the most significant ones, most attention is focused on the quantitative estimates, as is usual in such analyses. Below are listed the various costs and benefits treated in

this analysis:

1) Qualitative

- Decrease in environmental destruction caused by poor water management.

- Increase in number of hectares irrigated due to proper management and pricing of water.

- Decrease in underemployment of landless rural laborers, and rural to urban migration occasioned by the increased yield on existing irrigated land.

- Decrease in malnutrition on the small farms in the areas influenced by the project.

- A potential decrease in food imports and an increase in agricultural exports.

2) Quantitative

- On-Farm, Regional and National-increased agricultural yields, outputs and incomes.

Project benefits were estimated by comparing the situation expected WITH the project to that expected WITHOUT the project. An attempt was made to identify the overall return attributable to the water management project, i.e., to estimate the impact WITH and WITHOUT the project. The difference is assumed to be the expected net additional benefit arising from the project. Every attempt was made to provide credible and useful information within the time and resource limitations given. In the final analysis, of course, every project must ultimately be accepted or rejected on the basis of a subjective judgement. The intent of this economic and financial analysis is to contribute to this judgement, but not to replace it.

2. Methods and Data

a. WITH and WITHOUT Concept

Project analyses are often done using a WITH and WITHOUT approach as distinguished between a BEFORE and AFTER approach. The distinction is largely one of semantics. The BEFORE approach implies that productivity is constant before the project but increases afterward. The WITHOUT concept suggests that productivity could decline over time if the project is not implemented. Hence, under the WITH and WITHOUT concept net benefits over time are due to increasing productivity as well as a reversal or slowing of declining productivity.

There are suggestions of a possible decline in soil productivity on some irrigated farm land due to a buildup of salts in the soil. Furthermore, water management could result in reclamation of some abandoned land (Table A-1). In the absence of reliable estimates, the analysis reflects only increases in productivity. However, the terms WITH and WITHOUT will be used in the analyses, even though no losses WITHOUT the project are added in as benefits WITH the project.

The WITH and WITHOUT approach, to reiterate, defines benefits and costs in terms of the situation expected in the presence and in the absence of the project over time. Added benefits and reduced costs resulting from the project were summed, then benefit reductions and cost increases were subtracted out to arrive at a net incremental project benefit on an annual basis throughout the expected life of the project.

b. Hectare-Farm Level

To begin with, at the micro level, a "representative" hectare (and tarea) of the target region PRYN-YSURA was constructed as the base unit reflecting costs, revenues, and yields. That is, costs and revenues were weighted on the basis of the number of hectares planted to each crop to arrive at weighted average costs and returns. The net benefits WITH and WITHOUT the project are weighted averages (Table A-8).

c. Data Sources and Assumptions

Secondary data from various published sources, which were judged to be reasonably reliable, were used in the financial and economic analyses. Much of the data and other information available were for the 1981 crop year. Weighted average crop revenues and production costs were calculated using these data sources. Prices on the cost side as well as the benefit side were assumed to rise uniformly by the same proportion over the life of the project. It is recognized that some crops may be subject

to price controls. Therefore, sensitivity analyses were conducted. One in which prices of farm products were held constant over the life of the project and another assuming a 3 percent increase in prices received.

d. Regional Level

In order that these hectares be "representative", of the irrigated regions where the two pilot projects would be located, it was necessary to collect data such as hectares devoted to each crop, yields, costs, prices, etc., on the major agricultural crops grown in the area. This information is summarized in Tables 5 and 6. Virtually all variables, upon which the anlysis was done were extrapolitated from this basic information. For additional statistics on the PRYN-YSURA irrigation areas, see Annex, Tables A-2, A-3 and maps. These combined regional irrigation areas comprise a total area of approximately 30,000 hectares, of which about 26,000 is in irrigated production for which data were available.

e. National Level

The potential hectares for development at the national level, revelant to the water management project, is the total irrigated area of the Dominican Republic, currently estimated at about 200,000 hectares, including pasture land. However, it is estimated that if all potentially irrigable land were developed it would approximate 500,000 hectares. Although, the crop mix for the nation's irrigated land differs from the combined PRYN-YSURA area, as seen in Table 7 below, the similarities far outweigh the differences. Both the national and the regional areas produce the same crops on 99 percent of their respective areas. Even more remarkable is the fact that the average weighted costs and revenues for both areas are nearly equal despite the different crop mix. Based upon these figures, it appears that the 26,147 regional hectares are quite representative of the 146,744 total hectares currently under irrigated crop production in the nation. Hence, price figures for the region were assumed to approximate those of the nation in this analysis. That is to say, weighted estimates of yields, costs, revenues, etc., computed from regional information, were assumed to reflect national variables. For additional information on agricultural land, irrigated land, production, land tenure, etc., at the national level, see tables A-4, A-5,and A-6 of the Annex.

f. Life of Project and Project Area Impact Assumptions

The water management project was estimated to have a life of 20 years by the irrigation engineers working on the project paper. In addition, land levelling and improved water management practices were estimated by the engineers to occur at the following rate:

* Hectares = $5.11 \times 10^{-4} \times \text{Yrs}^{2.53} \times$ 151,120 has. Farmers, especially those with small holdings, are reluctant to forego production in order to level land, and will schedule leveling either before the crop season or after harvest so as to not interfer with production.

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* The rate of adoption of this technology occurs at a geometric rate, although it expected to slow down and level off after about 17 years. This is to be expected for several reasons. First, the terrain is relatively level and no major cuts or fills are required. Hence, costs are minimal. The payoff is sufficient to encourage adoption of this technology. This formula was modified to reflect a slowdown after 17 years.

Secondly, there is the ripple effect. Studies, including one by Zvi Griliches on the adoption of hybrid corn, have demonstrated that the adoption of technology does in fact often occur at a geometic rate. The majority wait to see what the outcome of new technology is on their neighbor's farm. If is profitable then a percentage of those will adopt the practice. Each of these has others who are also observing and waiting. This results in a geometric rate of adoption up to some point where it levels off.

The project calls for extension agents who will not only train cooperating producers, but will make contacts with other farmers, inviting them to field days, etc, so they can get first hand knowledge of the benefits of leveling. Morecver, agents in areas outside the project will also be extending this technology to their clientele.

All of th[illegible] effects combined are expected to result in a geometric [illegible]e of adoption, which will probably start to decrease towards the end of the project.

Table 5: YIELDS, COSTS, REVENUES PER TAREA (1981) - PRYN

	YIELD QQ*/TA	PRICE DR$/QQ*	TOTAL REVENUE DR$/TA	LABOR COST DR$	MACHINE RENTAL DR$	OTHER INPUTS DR$	TOTAL COST DR$/TA	NET REV DR$/TA	TOTAL AREA HECTARES	TOTAL AREA $ TOTAL
Tobacco	2.50	40.00	100.00	46.75	5.25	10.00	62.00	38.00	4,018	16
Bananas	4240	.05	217.00	45.75	5.50	25.75	77.00	135.00	3,850	15
Rice	8.00	12.31	98.48	29.35	11.00	22.15	62.50	35.98	6,764	27
Pasture (Cattle)			16.50	2.50	.50	5.00	8.00	8.50	4,524	18
Not Cultivated									1,847	7
Sugar Cane	5.75	14.00	80.50	13.00	6.25	12.50	31.75	53.75	2,152	9
Tomatoe (Industrial)	35.00	2.65	92.75	36.50	5.50	14.75	56.75	36.00	822	3
Red Beans	1.75	35.00	61.25	16.00	5.25	12.50	33.75	37.50	500	2
Corn	4.50	7.25	32.63	9.20	4.50	6.30	20.00	12.63	750	3

* Except for Sugar Cane which is in Metric Tons (1000 kilograms)

Wages Average DR$4.00 for 8-Hour Day.

SOURCES: Diagnóstico Proyecto de Riego Yaque del Norte (PRYN), Secretaría de Estado de Agricultura, 1980.
Proyecto de Desarrollo Agropecuario del Alto Yaque del Norte, Secretaría de Estado de Agricultura, 1982.
Costos de Producción y Rentabilidad de los Cultivos, Centro de Desarrollo Agropecuario, 1981.
Costos de Producción de Cultivos Temporeros, Secretaría de Estado de Agricultura, 1982.
Costos de Producción de los Cultivos Permanentes y Temporeros: La República Dominicana, Banco Agrícola, 1981

Table 6: YIELDS, COSTS, REVENUES PER TAREA (1981) - YSURA

	YIELD QQ*/TA	PRICE DR$/QQ*	TOTAL REVENUE DR$/TA	LABOR COST DR$	MACHINE RENTAL DR$	OTHER INPUTS DR$	TOTAL COST DR$/TA	NET REV DR$/TA	TOTAL AREA HECTARES	TOTAL AREA $ TOTAL
Tomatoes (Industrial)	36.33	2.65	96.28	20.96	6.50	18.13	5' 60	40.68	755	28
Yargua	5.50	7.91	43.50	5.75	9.15	12.10	17.00	16.50	546	20
Melons	2.50	86.00	215.00	21.85	5.80	6.60	37.25	177.50	113	4
Bananas (Large)	4,000	.05	200.00	43.10	5.00	46.90	95.00	105.00	379	14
Red Beans	1.36	44.94	61.12	13.15	5.20	8.20	26.55	34.57	230	8
Guineo (Small bananas)	75**	1.50**	112.50	45.30	6.00	32.70	84.00	28.00	396	14
Corn	3.00	9.17	27.50	9.90	4.00	5.10	19.00	8.50	137	5
Peanuts	2.01	10.00	40.17	9.80	3.50	8.70	22.00	18.17	146	5
Red Peppers	12.28	12.90	158.41	59.10	6.50	24.75	90.35	68.06	65	2
								TOTAL	2,756	100%

Wages Average DR$4.00 for 8-Hour Day

* Except for guineo-bunches
** Estimate

SOURCES: Unidad Regional de Programación y Estadística del Proyecto YSURA, Instituto Agrario Dominicano, 1983.
Proyecto Yaque del Sur-Arua, Instituto Agrario Dominicano, 1977
Investigación Social Proyecto Yaura-Arua, Instituto Agrario Dominicano, 1980.
Boletín Informativo Anual, Instituto Agrario Dominicano, 1981
Costos de Producción de Cultivos Temporeros, Secretaría de Estado de Agricultura, 1982
Costos de Producción de los Cultivos Permanentes y Temporeros: La República Dominicana, Banco Agrícola, 1981

TABLE 7

PRYN-YSURA IRRIGATION REGIONS AS COMPARED WITH NATIONAL IRRIGATED TERRITORY WITH RESPECT TO CROPS, HECTARES, REVENUE

	PRYN-YSURA			NATIONAL		
Crops	Has.	Has. as % Total	Revenue ($DR 000) From Sales	Has.	Has. as % Total	Revenue ($DR 000) From Sales
Tobacco	4,018	15	6,429	2,114	1	3,367
Bananas	4,229	16	14,272	11,265	8	19,561
Rice	6,764	26	10,660	95,314	63	142,681
Sugar cane	2,152	8	2,772	5,918	4	7,539
Tomatoes	1,577	6	2,383	3,895	3	38,031
Beans	730	3	715	11,844	8	13,058
Corn	887	3	452	4,256	3	1,682
Sorgum	546	2	380	1,890	1	1,204
Guineo	396	2	713	3,012	2	3,597
Peanuts	146	1	94	2,055	2	1,309
Peppers	65	1	165	697	1	1,243
Melons	113	-	389	32		347
Pasture	4,524	17	1,194	4,452	3	71
Total	26,147	99	40,616	146,744	99	233,690

YSURA-PRYN WEIGHTED AVERAGE REVENUE FROM SALES PER HECTARE $\frac{40,616}{26,147}$ = $DR 1,554

NATIONAL IRRIGATED TERRITORY WEIGHTED AVERAGE REVENUE FROM SALES PER HECTARE $\frac{233,690}{146,744}$ = $DR 1,592

Source: Estadistica Agricola, Año 1981, #9 INDRI, Santo Domingo, Junio, 1981

The formula used to describe the rate of adoption of this technology is of the form $Y = a X^b$. Establishing the geometric rate to provide the equation $Y = (5.11 \times 10^{-4}) (X^{2.53})$ which, when multiplied by total number irrigated hectares in the irrigation districts (151,120) has gives the number of hectares (Y) that can be levelled for any number of years up to 20, was based upon the personal experience of the engineers involved. Thus, the decision was made that when X = 5 years Y = 0.03 hectares that are expected to be levelled. This, then establishes the formula shown above. When X = 0, Y = 0, X = 5.Y = 0.03, X = 20 y = 1, which indicates all lands should be leveled in 20 years.

Benefits on half the land leveled in a given year are assumed to be received in the year in which development occurs.

g. WITHOUT Project Financial and Economic Benefit

Information from Tables 5, 6 and 7 above, was used to compute WITHOUT project expected weighted financial benefits and costs from production per hectare, as well as the expected number of hectares to be influenced by the project over the expected 20 year life span of the project. Table A-7 of the Annex shows the computation of these weighted financial benefits and costs for the PRYN and YSURA regions. Thus, in the absence of the water management project, a "representative" of land could be expected to produce an average annual net financial benefit of RD$758. This figure multiplied by the hectares to be influenced by the project, constitutes the WITHOUT project financial situation. Keep in mind that no benefit from reversing or slowing of alleged declines in soil productivity were included in the benefit stream.

The estimated WITHOUT project economic benefit from production is similar in composition to the financial one described above except that certain market prices were adjusted for implicit and explicit subsidies and distortions. The adjusted market prices, referred to as shadow prices, are assumed to compensate for these distortions and more correctly reflect "true" market prices from a social (national) perspective. Below are listed the assumptions used in the computations of the revenues, costs and net benefits for the economic analysis.

NO SHADOW PRICES

I. Prices of agricultural products in the Dominican Republic do not differ substantially from international prices. (See Natural resource Management project paper, page 85.)

II. The difference between the official foreign exchange rate of RD$ 1 = US$ 1 is RD$ .47, this increase is assumed to be passed on to producers as higher prices for imported inputs into the production function.

SHADOW PRICES

III. The following shadow prices were substituted for market prices based upon the rational offered:

Variable	Official or Market Price	Price	Rationale
wage	RD$ 4 man -day	RD$2	AID estimate
water	RD$ 2.5 - 11.50	RD$44	INDRHI estimate

In Table A-8 an estimate of the computed economic benefit per hectare is provided for the WITHOUT project case. While revenues remained the same as in the financial case, economic costs were less and, therefore the weighted average net economic benefit per hectare of RD$939 was greater than the WITHOUT financial benefit. Multiplying this figure times the expected number of hectares expected to be influenced by the project constitutes the WITHOUT economic benefit in year 1 of the project.

h. Project Benefit and Cost Assumptions

This analysis assumes a 30 percent increase in yields with proper water management (USAID/DR, 1981). This rate of increase is considered conservative since personal experience of members of the design team in diferent areas of the world have seen rates of increase from 50 to more than 100%. Part of these increases in yield is attributed to land levelling and the balance is assumed to be a direct result of training, improved timing of irrigation-agronomic inputs with proper water management, improved drainage and other aspects of water management.

An increase in yield is expected to result in increased harvest costs, but not by the same proportion due to increased efficiencies of harvest operations. An increase of 20 percent in harvest costs was assumed, while labor efficiency in water management was estimated at 15 percent*. Using weighted averages, it was estimated that the net effect in total costs was an increase of just over one percent (Table A-9 of the Annex). Therefore, without additional studies and information, labor increases and decreases due to the project are assumed to balance out.

Machine rental for land preparation is also assumed not to be affected by the project, except for land planing or floating and possibly for crops harvested mechanically. Land leveling is considered a capital investment and not an increase in production cost. It is recommended that leveled land be planed or floated each year to keep it as level as possible. The cost of this operation is estimated to be 30 percent of the original cost of leveling or about RD$37 in year 1 of the project. While it is not certain to what extent "other inputs" such as fertilizer, insecticide, transportation, etc., will be affected. It is assumed that all "other" inputs in Tables 5 and 6 are increased in proportion to the yield increase, namely by 30 percent.

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* In the absence of data on efficiency of farm operations, several of the design team members, all of whom have operated farms, agreed on this figure as a "best" estimate.

For both the financial and economic analyses, average revenue from sales of production is assumed to increase by 30 percent on all land (hectares) influenced by the water management project, reflecting yield increases of 30 percent. Likewise the "other" input component of average costs of production was also assumed to increase proportionately in both the financial and economic analyses.

It is recognized that in later years of the project, large numbers of hectares are projected to be leveled. With yield increases projected at 30 percent, this represents a substantial increase in supply. This could seriously depress prices unless market development and shifts in production to scarce or exportable crops occur concurrently.

Attempts were made to obtain price and income elasticities for the crops in question, along with import-export statistics. However, what little work has been done in this area is not very reliable, and suggest that it be assumed that the market and production adjustments would occur over time so as to absorb the increased production. It is hoped that such will be the case. The rate of growth in population is projected at 2.5 percent per cent. This may create sufficient demand during the early years of the project to keep prices from falling, but not during the later years. Even with a price support policy, upward adjustments in prices occur periodically. holding prices constant, while incomes are increasing, could increase demand. The sensitivity analyses, in which prices received are held constant while costs are allowed to rise, may partially compensate for this deficiency.

As land is leveled and supplies increase to the point of depressing prices, there could be shifts in production to those crops that are imported. This would have a favorable effect on the balance of payments postion of the Dominican Republic. In addition, export markets could be developed which would give support to prices as well as bring in additional dollars. It is beyond the scope of this analysis to conduct the necessary studies to examine the effects of all these possibilities.

As pointed out earlier, for the economic analysis, water costs per hectare were shadow priced at RD$44 for reasons elaborated upon in Table A-10 of the Annex. From Table A-8 we see all these assumptions manifested in estimates of a net financial benefit per hectare with project of RD$389 and a net economic benefit per hectare with project of RD$348.

i. Results - Financial and Economic

The results of the initial analyses are presented in Tables A-11, A-12 and A-13 of the Annex. The financial analysis yielded a net present value (NPV) of RD$106 million when discounted at 13 percent, with an internal rate of return (IRR) was 36 percent. The economic analysis was done in terms of real values and was therefore discounted at 5 percent. The real NPV was calculated to be RD$ 84.8 million and the real IRR was 21 percent, with a benefit-cost of 5. All of these figures suggest a high payoff for the project.

A cash flow financial analysis for a representative hectare was done on a WITH and WITHOUT basis (Annex Table A-13). The first land leveling to any major degree, paid for by farmers, is not expected to occur much before the fifth year of the project. By then the estimated cost of RD$123 for leveling is projected to inflate to RD$181 at an assumed 8 percent rate of inflation. Other costs and prices are assumed to increase by the same percentage rate. The cash flow is sufficient to pay off a loan for land leveling. Furthermore, the cash flow with the project is substantially greater than WITHOUT the project, indicating that it is profitable to level farm land.

During the first five years of the project, net cash flow benefits were negative as was to be expected, since substantial project costs were disbursed. However, benefits become positive immediately thereafter and continue throughout the remaining life of the project. It is assumed here that operation, maintenance, training and extension costs after the initial five year period of the project are the normal ones incurred by the GODR and are therefore not attributable to the water management project.

j. Results - Sensitivity Analysis

The results of the sensitivity analyses suggest that the project is financially sound when prices fail to increase as much as costs. A financial analysis of the worst possible case was done. That is, prices received were held constant while costs were allowed to increase at a rate of 6 percent. The result was an NPV of RD$9.78 million with an IRR of 19 percent (Annex Table A-14). This is still above the opportunity cost of capital. Due to the unavailibility of a computer, an economic analysis

with constant prices was not done. When foreign exchange was shadow priced at RD$2 to US$1, the real IRR dropped to 18 percent (Annex Table A-15).

A sensitivity analysis of financial cash flow for a single hectare was done to determine if there would be sufficient cash flow to pay for leveling land. The results indicated that even at a zero rate of increase in prices received, in face of an 8 percent increase is costs, there was sufficient cash generated to pay off land leveling loans (Annex Table A-16). Moreover, the results showed a NPV substantially higher WITH the project than WITHOUT. Holding prices received constant over time did result in negative cash balances, but this occured about midway in the project and were much smaller that WITHOUT the project.

TABLE 8

Summary of overall project feasibility under alternative assumptions and analysis

	Internal Rate of Return	
	Financial	Economic
Full on-farm benefits	36	21
Constant prices and 8% inflation for costs	19	-
Shadow price for foreign exchange at RD$2 to US$1	-	18

A cash flow analysis of this fund was done to determine if there would be sufficient to meet credit demands (Annex Table A-17). The sum of payments expected in each year is actually the cost of land leveling as used in the financial and economic analysis (Tables A-11, A-12, A-13).

Credit is to be extended at an interest rate of 12 percent for five years with a two year grace period. That is, only interest will be paid the first two years, beginning the year following loan acquisition. Loans are to be amortized over three years commencing with the third year. Credit is assumed to be dispersed evenly throughout the year. Hence, interest receivable by the lending institution will be equal to one half the amount of first time loans times an interest rate of 12 percent.

As can be seen in Table A-17 of the Annex, the credit fund is depleted during the ninth year, assuming that no other institutions are lending credit for land leveling. However, it may be that other sources of credit will be available at that time. Moreover, this analysis assumes that every farmer who levels land will do so on borrowed money. This may not be the case. Additional funds may have to be supplied unless the lending institution is willing to operate on their own money, or other sources of credit are available.

3. Conclusions

The results of the analyses demonstrate the economic and financial feasibility of the project for the hectare (farmer), the region (PRYN-YSURA) and the nation (total irrigated area). The internal rates of return were above the opportuntiy cost of capital in all cases, including the sensitivity analyses. The cash flow position of the producer was demonstrated to be substantially improved as a result of the project.

The analyses were only computed using estimated quantificable variables. There are other potential benefits that will no doubt occur but estimates by scientists were lacking. Resident soil scientist were reluctant to estimate productivity decreases in the absence of the project but insisted that land that was once productive could be reclaimed. Neither were national multipliers of output and income applied to expected increases. All of these benefits are real, but not easily quantifiable. Were they quantifiable, the expected benefits would be substantially larger. All this should be seriously taken into consideration by AID and GODR decision makers.

Finally, it should be noted that after 20 years not all the irrigated area of the Dominican Republic was assumed to be affected nor is the area irrigated a constant, but, rather an increasing dynamic realty. "An auditional 100,000 hectares are expected to be irrigated by 1985, and it is estimated (depending upon soil studies)

that the total potential irrigated land could be as much as 500,000 hectares." (Reynoso and Encarnacion 1980, as cited in Country Environmental Profile, DR, A Field Study, 1981, p. 37). Thus, there is every reason to expect that the stream of benefits will continue into the future and influence much more land than estimated in this analysis if the per hectare net benefits approximate those calculated and if the farmers adopt the new water management techniques and practices.

It can be concluded, therefore, that the project represents a major advance toward implementing the GoDR and AID Mission agricultural strategy objectives and goals of increasing yields, income, and employment of the targeted small and medium farmers. The estimated net benefits of the project, based only on quantifiable variables alone, are adequate to justify an investment in the water management project. Indeed, when all expected benefits are considered, this investment may well warrant priority status.

E. Environmental Considerations

1. Impact of Irrigation and Mitigative Measures.

Bringing land under irrigation does create environmental problems. This is particularly true during construction of dams, canals, drains and other structures where erosion may be serious. The Irrigation Water Management project will not be involved in irrigation system construction, nor in activities which will increase turbidity. The project is to manage water for purposes of irrigation and in so doing will more likely reduce the negative environmental impacts. Although irrigation may be accompanied by more disease problems, better management of water will aid in disease control. Water carrying suspended solids, disease organisms, and agri-chemicals when applied to the soil, filter out the sediments and many water-borne organisms will be filtered out and/or decomposed. Many pesticides are degraded or absorbed onto sediments so the process of irrigation has a purification component.

As part of the project training and demonstration programs, ways of minimizing the undesirable environmental aspects can be taught. Another component of the proposed project is the monitoring of water used and the salinity and certain chemical constituents in the drainage waters. An excellent preliminary examination of the proposed project is appended, Initial Evironmental

Examination.

2. Irrigation and Public Health Problems.

When irrigation is introduced into tropical or semitropical climates it is likely to increase some health hazards to the rural inhabitants. The irrigation ditches and canals bring water to the people and they commonly not only use it for their crops and livestock but as a source of the domestic supply. They wash themselves and their clothes and many swim and play in these streams and thus are subject to multiple exposures.

During the team's visit to the field, members observed where raw sewage and wastes form the city are being discharged into the river above an irrigation canal diversion.

From experience it is known that fertilizers and pesticides are sometimes carried by rain or irrigation water into irrigation ditches and canals. Pesticide residues are dumped into the water and sometimes the containers rinsed in the streams. The team was informed that some of the pesticides banned from use in the United States are obtained from other sources and used on the farms (this was not verified). In many ways the river and irrigation water serve as a sewer.

Stagnant waters in canals and low spots in the fields, wastes land, etc., from irrigation can serve as a place for Malaria-carrying Anophales mosquitoes to breed. They also are a habitat for snailes Biomphalaria glabrata, which are an essential in the life cycle of schistomes.

Through better water management these conditions can be improved. The quality of contaminated irrigation is improved in several ways when applying it to the land. Suspended particles are filtered or settled out of the water. Many organisms and chemicals are absorbed by soil particles and organic matter. While some disease organisms are retained in the soil there is an adequate "death time" for them so if they are leached out or returned to the water system by erosion they are no longer infectious. Some oxidizable pollutants are decomposed while being carried along through the distribution system.

By the proper design and construction of the canal and drainage systems together with good management, the incidences of some diseases can be reduced and the toxicity of other pollutants reduced. There should be a program to monitor the quality of water for irrigation as well as the quality of the water in drains being used or

discharged into the river system.

It is not the intent to have the water management project involved with monitoring the health hazards throughout the irrigation district but salinity monitoring and control is a concern of the project. Consideration to the health hazards associated with irrigation however, should be a component of the teaching and training program.

3. Linkages of Proposed Project with USAID Health Programs.

Linkages with existing and/or planned USAID/DR programs in public health is neccesary to address the concern over environmental health and disease vectors associated with irrigation systems. Such linkages are feasible given the level of support provided by the Basic Health Services Program financed through Health Sector I and II loans and forthcoming Health Sector III loan. Existing or planned AID activities will cover the following areas:

- health services to campesinos through health promotors
- Expanded programs in malaria and schistosomiasis aimed at preventive measures and control of disease and vectors (malaria surveillance and snail control)
- Technology transfer in new methods for control of malaria and schistosomiasis
- Strengthening of in-country training capabilities in environmental health and disease control, among other activities.

These programs offer the possibility of outreach to those involved in irrigation water management. Short seminars for extensionists, agency officials, and farmers in YSURA and PRYA areas can be employed to teach environmental health as related to water management on farms, or arrangements can be made to allow key persons to attend those courses offered in locations other than the irrigation district.

V. PROJECT IMPLEMENTATION

A. GODR Project Administration

The project will be managed and administered within the existing GODR institutional structures. INDRHI will have the responsibility for managing project activities. Within INDRHI, the Department of Planning will actually coordinate the various project activities.

To accomplish this, all plans to carry out project activities and all project disbursement requests will require prior approval by INDRHI's Department of Planning. They will also assure that adequate technical standards are maintained in all project documentation. INDRHI will receive disbursement requests from project implementing agencies and assure that such requests are in conformance with approved workplans, and will then forward such requests to the appropriate Center in the case of activities actually implemented within the pilot project site. The Center will certify that the proposed disbursement is consistent with field level workplans and return it to INDRHI's Department of Planning for certification and disbursement to the requesting agency.

The Department of Planning within INDRHI, will act as the administrative office for coordinating documentation between AID and the implementing unit. This department will prepare all project quarterly and annual financial reports. This department will also coordinate regular borrower/grantee correspondence.

B. AID Project Administration

1. Implementation Monitoring

Given the complexity of the project, the Mission believes that it will be necessary to draw upon the talents of many Mission staff to effectively monitor and support the project. To accomplish this in a systematic fashion, the Mission will form a project team. The Mission's Agricultural Development Office (ARDO) will have primary responsibility for monitoring the project. One ARDO staff member will be designated the USAID project manager. This person will coordinate the Mission's monitoring activities and represent AID at the working level. Members of the other Mission offices will be designated as project team members. In particular, personnel from the Mission's Controller, Management,

Capital Development/Engineering, Health, and Education offices will be assigned to the team to provide regular staff support for the project. Additional members of the ARDO staff will supplement the project team from time to time to assist in carrying out field monitoring activities. An increase in the Mission's current staffing level is not viewed as necessary to adequately support the project.

2. Procurement and Contracting Plans

The Mission has determined that the procurement of all technical assistance and the services of a private procurement agent to purchase the equipment will be undertaken by AID directly. The Mission bases this determination on the conclusion that use of the host country contracting made for these procurements would unnecessarily delay project implementation. In addition, direct contracting by AID would not materially increase expenditure of Mission staff time.

Under the project, large amounts of technical assitance and training are needed to help the GODR in the planing and organization of project activities. To be effective, much of this training and assistance are needed during the first year. As identified during project development, Title XII universities can best provide this training and assistance.

Given the wide range of technical assistance services needed, the need for a strong agriculture research support capability, and the need for an institution that has field experience on farm water management training, it seems apparent that only a university can provide all the assistance needed in one package. In audition, a U.S. land-grant university would probably offer the best possible source of this assistance given the need for a strong agriculture institutional background. Thus, the Title XII mechanism seems to offer the most effective way to procure the needed assistance. The BIRAD group could assist the Mission in pre-selecting a list of qualified universities. The Mission could then issue RFTP's to all qualified universities.

Contracting with a U.S. university would prove to be an unnecessarily difficult task for INDRHI. The contracting process would require the use of procurement procedures with which INDRHI is not familiar and much of the documentation and negotiations would need to be in English. Contracting of this assistance would, therefore, prove difficult for INDRHI. A procurement of this type can best be handled by AID which has more experience and capability in this type of procurement and can, therefore,

minimize possible procurement delay. INDRHI's contracting capability, while good in terms of other developing countries, would probably not be able to obtain the needed assistance on schedule. Thus, serious delays in project implementation could result.

Adding to the GODR contracting weakness, is that contracting of the technical assistance could give rise to special difficulties in the host country/contractor relationships. The GODR in the past has been reluctant to contract advisors at salary levels that greatly exceed those of their host country counterparts. Contracting of the advisors by AID will minimize such friction by avoiding situations where GODR officials must make salary payments to advisors, provide customs privileges, etc.

The procurement of the equipment to support the field activities will also be unusually complex and technically oriented. The development of the specifications will require the inputs of the project advisors in the field to assure that the equipment meet the particular needs of the pilot site. It is therefore anticipated that the project funded advisors will prepare a detailed procurement plan along with the necessary specifications.

Relying on the existing INDRHI contracting facilities to complete such a demanding, equipment procurement probably would prove unwise. It is almost certain that they will be unable to meet the required procurement schedule. AID, on the other hand, can better meet the requirements. AID can more easily obtain the assistance needed to develop the contracting documentation and procure the services.

The Mission, therefore, proposes to contract the above technical services and the services of a procurement agent through AID direct contracts. It is believed the RCO can provide the necessary assistance to develop the RFTP, evaluate the proposals, and negotiate a contract. In all cases, AID standard procurement procedures will apply.

Except for motorcycles goods and services procured under the grant will have both their source and origin in the United States or the Dominican Republic. Goods and services procured under the loan will have both their source and origin in countries included in Code 941 of the Geographic Code Book or, for those materials purchased under shelf procurement regulations described in AID Handbook 11, from countries in Code 935.

A source/origin waiver is requested in this document from Code 000 to Code 899 for the purchase with loan funds of four 3 wheel motorbikes and four 70cc motorcycles to be used by the Water Management Center personnel. This is necessary to carry out the project. The motorcycles will cost approximately $10,000. the required motorcycles are not manufactured in the United States. Although they are available from suppliers in two of the 941 Code countries, country-wide maintenance and service from those suppliers in the Dominican Republic is considered to be inadequate for purposes of the project and, therefore, not available within the meaning of AID Handbook 1, Supp. B, Section 4C2d. A waiver is, therefore, requested to Code 899 to allow for adequate maintenance and service country-wide of purchased motorcycles. The procurement will otherwise be conducted in accordance with AID's established procedures.

C. Evaluation Plan

1. General Points

This project is designed as a "process" project, rather than a "blueprint" project. Therefore, flexibility is essential in its management. As the project proceeds, there must be continuous learning of lessons, and an ability to make changes as needed to achieve the overall project goals. The annual work plans will be an essential management tool. The first work plan should be based upon the findings of detailed baseline studies (discussed below); the second will be based largely on the results of an evaluation of what was achieved during the previous year, and so on: work plans plus evaluations will be cumulative over the life of the project.

The evaluations themselves will have to use a combination of quantified and qualitative data. Many of the changes sought --in policy, institutional capacity to do planning and management, inter-agency and government-water user relationships-- cannot be satisfactorily measured by quantifiable means.

The evaluations will cover three basic parameters:

- Impact of project on GODR institutions (government and water users) and economy (production, employment, etc.);

- Substantive impact (quality, relevance of research; quality and relevance of training; management of irrigation water, etc.);

- Performance of consultants and AID management. This latter is an important parameter, but not discussed further below. It should be based on such things as their relationships with GODR counterparts; technical quality and realism of work plans, etc.; and the overall impact of the project.

2. Baseline Studies

Objective evaluation of the impact of the project requires an adequate basis against which to measure change. Since the project aims to have an impact on government institutions, water users' behavior, and productivity, studies of all three of these will be needed.

a. Institutional Analysis

The project subgoal is to develop the human resources and institutional conditions for increasing productivity of irrigated agriculture. The project purpose is to strengthen the capacity of the GODR to plan effectively to develop water resources; plan and operate irrigation systems effectively; support increased agricultural production; prevent and/or correct the deterioration in the present area under irrigation. In order both to plan for achieving these goals/purposes, and evaluate whether progress is being made to their achievement, more detailed information is needed on the present institutional capacity and weaknesses.

The following general areas/topics should be the focus of this institutional analysis:

- Present manpower level in terms of numbers and training;

- Present agency functions, statutory and "de facto", and interrelations among the various agencies involved in irrigated agriculture and water resource planning and use;

- Goals, philosophies, orientations, and general procedures (e.g., communication only top to bottom consensus versus autocratic decision-making, role of

users, etc.);

- Budgetary priorities and levels (adequacy to do the job entrusted to organization; which parts are protected when cuts are necessary, etc.);

- Incentive structure for employees;

- Effectiveness of implementation: management capacity;

- Planning capacity;

- Relationship with/attitudes toward water users.

b. Water Users

In order to plan effective interventions, considerable intensive research is needed in the pilot areas on farmers' culture and social organization. Specifically, data is needed on farmers' cultural understandings/perceptions on cooperation with neighbors; kinship and "compadrazgo" relationships and their possible effect on farmer cooperation/organization; informal patterns of cooperation at present; and their real goals, objectives, etc., in cultivation (for example, assess the assumption that all farmers wish to increase production).

In order both to plan interventions and evaluate impacts, socio-economic surveys among farmers using replicable questions and sampling is needed. Surveys are needed in three areas: the pilot area in which intensive work will be done; control areas in the same project and, if possible, one or two control populations in other (but similar) projects. The following are the general topic areas on which data are needed:

- Agronomic practices, knowledge, and constraints (including specifically irrigation practices, knowledge, and constraints);

- Employment and income levels (including costs and profits involved in cultivation);

- Present forms of cooperation and conflict in irrigation, agriculture more generally, and other spheres of life

within community;

- Attitudes to/relationships with government officials and departments;

- Present types and level of contribution to irrigation system operation and maintenance (e.g., irrigation fees, labor, time);

- Present role of and relationships with "cabo de agua".

c. Technical/Environmental

In order to measure potential productivity and changes in productivity, data are required on present cropping patterns, crop yields, area irrigated, and intensity of cultivation. These data should be gathered for the pilot and control areas discussed in b. above, as well as for the two irrigation systems more generally.

In order to evaluate the magnitude of the problem, and impact of the project, detailed measures are needed on the extent and intensity of waterlogging and salinity. Finally, in order to plan improvements in irrigation system management, as well as evaluate progress, many measures are required of delivery efficiency, irrigation efficiency, system operation, and system maintenance levels and needs. Many of these are discussed in more detail in other sections of the Project Paper.

3. Uses of Baseline Studies

It is important to note that the rather comprehensive baseline data gathering activities suggested here are needed for effective detailed project planning as well as a base for measuring project impact. They will be used for estimating problems, gaps, weaknesses and strengths in GODR institutions; planning appropriate training plans; developing a general strategy for achieving necessary institutional changes (training is only one --though central-- part of such a strategy); identifying research priorities and developing a research plan; and planning intervention strategies (both organizational at the local level, and technical).

4. Evaluations

a. Schedule

The project will undergo annual internal evaluations; the results will then provide the basis for annual work plans. Assuming the baseline studies are substantially completed by about March 1984, the first annual evaluation would be held about January 1985. This would be a simple managerial evaluation, since no substantial impact on Dominican institutions, water users' institutions, or management of water is expected in the first year. The second, third, and fourth evaluations will be more detailed (the extent of detail, and focus to be decided by the project management) and include re-surveys of pilot and control areas, and GODR institutions involved in the project. The Water Management Synthesis II project (WMS II) will assist the evaluations to the extent possible; for example, WMS II personnel can help develop survey instruments, develop scopes of work and assist in the selection of evaluation teams. The third evaluation (approximately January 1987) will be a mid-project external evaluation; the fourth internal annual evaluation will take place six months before the project completion date, in order to ascertain whether the project should be extended. The end of project evaluation in about June 1988 will use the data gathered in the fourth internal evaluation as a basis for its report.

b. Impact on GODR Institutions

The Project Paper emphasizes the centrality of achieving institutional change. This is not conceived as a passive process, in which the GODR institutions receive "wisdom" from outside. Rather, it is conceived of as a complex collaborative process, in which the project provides GODR officials with alternative approaches and concepts, which these officials will then consider integrating, modifying, and adapting to achieve specific goals. Some changes (for example, number of people trained) are easily quantified; others --some of the most important-- are qualitative in nature. The baseline institutional analysis provides a basis for measuring changes in such parameters as:

- Manpower levels;
- Number of people trained in various specialties;
- Use of trained people in appropriate positions;
- Changes in inter-agency levels of cooperation;

- Changes in bureaucratic structures (e.g., decentralization);
- Changes in incentive structures;
- Changes in investment/budget priorities;
- Changes in water use, water planning, water management policies;
- Changes in planning capabilities;
- Implementation of new programs;
- Management effectiveness (e.g., in operation and management of irrigation systems);
- Changes in government-water user relationships.

Evaluations will include more specific examinations of changes in the institutions with which the project works most closely; not only the larger entities such as INDRHI (implied by the above generalized list), but the smaller ones such as the Centers for Water Management. Here, detailed examination will be possible of changes in staffing (numbers, level of expertise); management; demonstration activities (relevance, cost-effectiveness for farmers); and training programs (appropriateness, use of research results, effectiveness, ability to evaluate modify and continue training activities). Finally, it should be noted that much of the data required can be developed through an internal, periodic reporting procedure; formal resurveys are not required.

c. Impact on Water Users' Institutions and Behavior

The topic areas listed in B.2. above, provide guidelines for analyzing the impact of efforts to organize water users, get them involved more actively in irrigation water management, and improve communication with officials. In addition to those parameters, it will be necessary to evaluate carefully the particular strategies used for working with farmers to identify which ones work best and why, what problems arise, and whether the methods developed can be replicated on a larger scale.

d. Technical/Environmental Impact

It is expected that in the pilot areas there will be considerable impact on productivity, crop patterns, and at least some impact on waterlogging and salinity problems. In addition, before the end of the project improvements should begin to be observed on other parts of the two systems where work will be concentrated, and there should be potential for similar improvements elsewhere as GODR institutions develop greater water management capacity.

The studies of crop yields and intensities, and the detailed studies of irrigation system efficiency, system operation, etc., will provide a strong basis for measuring impact of various improvement measures during the life of the project, and evaluating which are most important for wider adoption.

5. Implementation Plan for Baseline Studies and Evaluation

The baseline surveys of water users, and periodic surveys to measure changes, will be done by a local institution not part of the participating agencies. A university would be most appropriate. Technical assistance will be provided either through the project contractor, or the WMS II project, or both, to insure these surveys are done at the standard required. This exercise would be an institution-building activity: the university or other institution that takes on this task will be assisted to develop a continuing capacity for such work.

The institutional analysis of GODR organizations is best done by an independent outsider, with the assistance of the GODR institutions involved. This should not be conceived as an activity that leads to "criticism" of the GODR organizations; it will be carried out in a collaborative manner so that these institutions themselves get an objective picture of the present situation.

The technical/environmental studies will form part of the project itself. The data generated will provide the base from which to measure the impact of interventions.

D. Negotiating Status, Conditions and Covenants

1. Negotiating Status

Representatives of INDRHI, SEA, and the Technical Secretariat of the Presidency (STP) have worked closely with the Mission staff on all aspects of the project design. The GODR will be the borrower and INDRHI will be the executing agency. There are no remaining issues which will require substantive negotiation. Once the project is authorized, the project agreement and project description will be developed and negotiated with the GODR (principally INDRHI and STP). The agreement will, then, be reviewed and approved by the Legal Advisor to the President and signed shortly after. No unusual delays are expected in this process.

2. Conditions Precedent

a. Initial Conditions

Initial conditions precedent to any disbursement under the project will include the usual AID legal requirements, including a statement by a recognized legal entity that the project is legally binding, and that the recipients of the loan are responsible and legally bound to all requirements under the Project Agreement. In addition, the GODR will be required to name a project coordinator, acceptable to AID, who can devote adequate time and effort necessary for the successful implementation of this project. Once these conditions are met, the procurement of technical assistance and off-shore training may begin.

This is necessary since most of the technical assistance is needed early on to carry out the planning aspects of various project activities and in some cases to help develop plans needed to meet subsequent Conditions Precedent. In addition, as discussed in the Procurement section of the Project Paper, the technical assistance will be contracted from a Title XII university and that the off-shore training under the project will be handled by this same university. A clause will be included in the technical assistance contract which requires the university to obtain AID clearance on the off-shore training prior to initiating any participant training. The university contractor will also be required to submit to AID a work plan within 90 days after the signing of the contract which describes the detailed plans for the provision of the technical assistance, indicating the

anticipated detailed work assignments, tasks and their timing and the plans for the purchase, delivery, and warehousing of the equipment to be procured under the project and the plans for the selection and placement of the off-shore training participants.

b. Conditions Precedent to Initial Disbursement for Equipment Procurement

This Condition Precedent will require the development of the necessary plans to procure all the equipment. Even though a procurement agent will be contracted by AID to handle the individual procurement transactions, it is still necessary for the GODR to plan the overall implementation. This Condition Precedent will include: (1) A plan for commodity procurement, delivery and distribution; and (2) Specifications and required binding documentation.

It is anticipated, as indicated in paragraph a. above, that the university contractor will assist the GODR in the development of the required plans.

c. Conditions Precedent to Initial Disbursement for Activities Other Than Technical Assistance and Equipment

In effect, this Condition Precedent will require the formalization of the administrative arrangements for carrying out the project at each level prior to initiation of any loan funded project activity by a particular management unit (e.g., national office and pilot project sites).

This will include the following Condition Precedent documentation:

1) A general description of the operation procedures for the management, fiscal control and reporting of project activities. This document should also define the administrative functions, responsibilities and authorities of the various entities involved in the project at the national and pilot project levels.

2) A general staffing plan which sets forth the timing for hiring additional personnel for the national and field level project management offices.

3) A description of the mechanism for interagency coordination and a description of the proposed system for distribution of the information generated under

the activity within INDRHI and within other Dominican institutions.

4) A plan for the off-shore training contemplated under the project, identifying the participants/institutions, level of training, academic areas, timing of training and plans for returned participants.

d. Condition Precedent to Disbursement for Field Activities

This Condition Precedent to disbursement for the field activities applies to each pilot project area separately. All the activities within a pilot project area are seen as an integrated set. All of the basic conditions for initiating the various field activities within the particular pilot project area must, therefore, be in place before disbursement of loan funds.

The required Condition Precedent documentation will include:

1) A detailed development and management plan for the particular pilot project area. This plan should include: detailed descriptions of each sub-project activity scheduled for each quarter of the first year and annually for the remaining four years of the project, including the nature, magnitude, and timing of each activity; staffing and training plans to support each activity; the identification and description of the pilot project laterals and the basis for their selection; the procedures for working with the farmers on the project lateral; procurement plans for obtaining the required goods and services; and a detailed budget to support each activity.

2) The sub-lending policies, procedures, and eligibility criteria to be followed under the program for lending to individuals and farmer groups and the administrative order establishing the On-Farm Water Management credit fund in the Agricultural Bank.

3) A plan of the anticipated sub-lending activities within the particular pilot project area, including the number, timing, and types of such activities.

4) A cash flow plan for the credit program, indicating the sub-lending needs for small and medium size farmers and a projected disbursement and recuperation schedule and sources of all funds by year.

5) A plan showing the number, functions

and responsibilities of technical personnel of INDRHI, IAD, and SEA that will provide assistance to small farmer sub-borrowers under the project, their place of assignment and scheduled work starting dates.

6) A plan showing the anticipated Agricultural Bank staff participation in the project. This plan should indicate projected staffing and locations of field offices and mobile credit brigades that will support the project.

7) A copy of the official document signed by the Director of INDRHI establishing the pilot project level office, designating their staffs, and defining their relationships to national level entities including their responsibilities and authorities with regard to implementation of the project.

8) A copy of the official document signed by the Director of INDRHI appointing the pilot project director, defining his authority and appointing a staff to manage the pilot project level activities for a particular pilot project area.

9) Detailed engineering/construction plans as appropriate (including evidence of legal title to the land on which construction will take place).

3. Covenants

As indicated in the DAEC guidance cable, the project evaluations will be a particularly important component of this project. The GODR will, therefore, covenant to establish an evaluation program as part of the project and to submit an evaluation plan within one year after obligation of the project. (It is expected that the project funded technical assistance advisors and consultants from S&T/AGR will assist in developing the evaluation methodology to be applied to this project.) One important topic for the periodic evaluations will be a review by the GODR of the price ceilings, on a crop specific basis, and recommendations for revision as necessary for project success (STATE 061196, Para. 2A).

TABLE 9

IMPLEMENTATION SCHEDULE

Country agreement signed	Year 1				Year 2				Year 3				Year 4				Year 5			
Major Events	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1. Contract signed →																				
2. Project Leader for GODR assigned	X																			
3. Technical Assistance in place F.T.		X																		
(a) Plan of Work developed		X																		
(b) TDY		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4. National Coordinating Committee appointed																				
5. Procurement of Equipment																				
vehicles	X																			
furniture	X																			
farm machinery	X	X																		
land levelling	X																			
drainage major	X																			
computers		X																		
office equipment		X																		
tools for repair shop, etc.		X																		
6. Building Constructor																				
Office Bldg. YSURA	X																			
field shops & machine sheds		X																		
7. Centers for Water Management																				
Co-Directors in place		X																		
(a) Work Plan		X																		
(b) demonstration areas selected		X																		
(c) initial survey irrigation diestricts		X																		
(d) pilot laterals selected		X																		
(e) data collection at farm level		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
(f) review at delivery systems		X	X			X	X			X	X			X	X			X	X	

	1				2				3				4				5			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
8. U.S. Training																				
(a) academic	X	X			X				X				X							
(b) short course			X			X				X			X							
9. In Country Training																				
(a) C.W.M. staff		X																		
(b) extension			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
(c) INDRHI specialists					X				X				X				X			
(d) technicians & operators				X			X			X				X				X		
10. Water User Associations																				
(a) legal status			X	X																
(b) data collection				X			X				X			X			X			
(c) specialist training				X			X			X			X							
(d) formation of user associations					X		X		X		X				X		X		X	
11. Land Levelling - Pilot Laterals					X		X		X		X		X				X			
12. National Water Implementation Plan																				
(a) policies & procedures		X	X	X	X	X	X	X	Implementation →											
(b) review of systems		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
13. Monitoring	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
14. Evaluation						X						X				X				X

GODR Actions	1				2				3				4				5			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
(a) Appointment of Major Responsibility to GODR Agency - INDRHI	X																			
(b) Appoint Proj. Leader	X																			
(c) Appointment of Coordinating Committee	X																			
(d) Selection and Presentation of Scholarship Candidates	X	X	X	X																
(e) Selection and Approval of Lands for																				
1) demonstration areas		X																		
2) lands for buildings	X																			
(f) Appointment of Co-Directors for D.R.	X																			
(g) Assignment of staff for C.W.M. (AZUA & PRYM)		X	X	X																
(h) Initial Credit Allocation and Build-up									X				X				X			
(i) Increased Cost of Operating Project														X						
(j) Full Operating Costs																	X			

ANNEX A - ECONOMIC ANALYSIS

TABLE A-1

Statistical Estimates of Irrigated Land Damaged by Poor Water Management (i.e., salination and flooding)(1)

	PRYN	YSURA	National(2)
Area Damaged(3)	2,000	1,200	25,670
	=60%	=58%	=17%
Estimated Total Land (Has)	4,000	2,000	151,120
Estimated Decreased Yield on Damaged Irrigated Land	20%	20%	20%
Estimated Increased Damaged Land Due to Poor Drainage and Water Management General(4)	400	200	2,500
Estimated Cost of Rehabilitating One Hectare of Damaged Land	RD$110	1,200	--

(1) Supplied by Ing. Agron. Roberto Reinoso, INDRHI, March 1983.

(2) National estimates on based upon regional PRYN-YSURA statistical ratios.

(3) Hectars with yield reductions greater than 20 percent.

(4) Assumes a straight line (%) increase per year over 10 year period.

TABLE A-2

Various Statistics on Social and Economic Variables:
PRYN Irrigation Region

Total Land Area:
25,035 hectares. (See map Phase I, Contract 1= app. 4,000)

Irrigated Land Area:
21,930 hectares. (Contract 2= app. 21,000)

Estimated Land Area Damaged by Water:
4,000 hectares

Approximately 6,500 head of milk and beef cattle*

LAND TENURE

		No. Families	Hectares
Non-Private			
Landless Workers	App.	4,000	0
Renters		956	0
Agrarian Reform Cooperatives		328	952
State		0	2,150
Private			
Smallest (0.01 - 3.8 Has)		1,734	2,917
Medium (3.81 - 31.5 Has)		5,892	5,400
Large (31.6 - above Has)		144	9,995

Approximate Number of Rural Families: 13,000
Estimated Annual Income: 75% families receive less than RD$1,200 per year
Estimated Illiteracy Rate: 25%

* 80% cattle are in farms larger than 50 hectares owned by 24 families.

TABLE A-3

Various Statistics on Social and Econmic Variables:
YSURA Irrigation Region

Total Land Areas:
12,000 hectares. (See map V, A-1)

Irrigated Land Areas:
Approximately 8,000

Estimated Land Area Damaged by Water:
Approximately 2,000 hectares

LAND TENURE

		No. Families	Hectares
Agrarian Reform Cooperatives:			
- Formed Collectively	App.		
- Formed Individually		1,720	6,075
Private Small Farms:		960	1,250
Approximate Number of Rural Families:			
- Cooperatives		1,720	
- Private		960	
Total		2,680	

Estimated Annual Income:
Approximately RD$1,500

Estimated Illiteracy Rate:
50%

TABLE A-4

Agricultural Land Statistics: The Dominican Republic, 1981

	Hectareas	Number of Farm Units	(%)	Area in Hectares	(%)
Small	0.01 - 5.00	314,665	82	325,680	12
Medium	5.01 - 50.00	63,358	16	871,028	33
Large	50.01 - Above	7,037	02	1,476,037	55
		385,060	100		

Total Agricultural Land:	2,672,745
Total Irrigated Land:*	151,120
Total Land in Agrarian Reform Cooperatives:	365,800

* Estimates range from 140,515 hectares to 192,000 hectares for irrigated land area. INDRHI's estimate for 1980 was 170,000 hectares. Country Environmental Profile, AID, 1981.

Sources:
- Censo Nacional Agropecuario, 1981.
- Oficina Nacional de Estadistica, 1982.
- Estadisticas Agricola Ano 1981.
- Informe Estadistico No. 9, INDRHI.
- Boletin Informativo Anual #7, 1981.
- Instituto Agrario Dominicano, 1982.

TABLE A-5

National Production, Hectares, Gross Revenue Per Unit on Irrigated Land - 1981.

	Hectares	Value Prod. (000 RD$)	RD$ Unit*	Units Other Than QQ
Rice Flour	80,334	125,005	24.70	-
Rice Return	14,980	17,676	24.70	-
Corn	4,256	1,682	10.23	-
Beans	11,844	13,058	46.00	-
Yuca	2,476	2,819	7.70	-
Sweet Potatoe	2,084	1,556	5.86	-
Peanuts	2,055	1,309	20.00	-
Tomatoes	3,895	38,031	22.65	-
Onions	2,356	6,597	30.55	-
Tobacco	2,114	3,367	40.00	-
Egg plant	330	644	9.70	-
Hot Peppers	697	1,243	16.00	-
Big Bananas	11,265	19,561	36.35	(000)
Little Bananas	3,012	3,597	1.50	(Bunches)
Rulos	354	282	1.00	(Bunches)
Sugar Cane	5,918	7,539	10.00	(Tons.)
Papaya	524	1,115	5.35	(12)
Sorgum	1,890	1,204	8.00	-
Guandul	545	744	17.30	-
Auyama	60	84	8.78	-
Coconut	375	440	75.00	-
Ceboilin	526	2,009	30.00	-
Potatoes	480	1,293	16.00	-
Citric Fruit	95	122	20.00	(000)
Molondron	375	304	8.50	-
Oranges	299	381	20.00	(000)
Yams	237	478	12.70	-
Pineapple	41	221	37.56	-
Cabbage	180	1,754	202.90	(000)
Vainita	70	30	18.00	-
Carrots	96	309	13.50	-
Remolacha	116	517	18.70	-
Mellons	32	347	85.00	-
Cucumber	55	6	1.00	-
Garlic	667	6,056	95.00	-
Natural Pasture	4,452	71	1.00	-
Guinea	1,113	26,573	1.50	-
Pangola	3,965	94,707	1.50	-

Grapes	141	336	30.00	-
Lettuce	17	11	2.75	(Heads)
Watermelons	13	5	17.00	-
Soybean	318	-	-	-

Total Hectares	151,120			

* All units in quintales (100 lbs.) unless otherwise specified.

Sources:
- Estadisticas Agricola, Ano 1981.
- Informe Estadistico No. 9, INDRHI.

TABLE A-6

NUMERO DE EXPLOTACIONES, SUPERFICIE Y USO DE LA TIERRA, SEGUN TAMAÑO DE LAS EXPLOTACIONES (CENSO NACIONAL AGROPECUARIO 1981)

TAMAÑO DE LA EXPLOTACION (Tareas)	EXPLOTACIONES (Número)	SUPERFICIE TOTAL (Tareas)	USO DE LA TIERRA							MONTES, BOSQUES Y OTRAS CLASES DE TIERRAS (Tareas)
			SUPERFICIE DE LAS TIERRAS DE LABRANZA (TAREA)				SUPERFICIE BAJO PASTOS (TAREA)			
			TOTAL	BAJO CULTIVO	EN BARBECHO	EN DESCANSO	TOTAL	CULTIVADO	NO CULTIVADO	
Total del País	385 060	42 559 639	20 957 642	16 039 269	2 843 267	2 075 106	19 035 892	9 531 545	9 504 347	2 566 105
De menos de 8 tareas	61 670	199 440	185 994	163 542	16 814	5 638	7 387	3 091	4 296	6 059
De 8 a 79 "	252 995	4 986 559	4 175 710	3 093 548	771 741	310 421	639 273	265 296	373 977	171 576
De 80 a 159 "	32 543	3 686 128	2 478 420	1 855 913	352 943	269 564	1 012 660	419 631	593 029	195 048
De 160 a 799 "	30 815	10 183 748	4 583 301	3 347 949	615 380	619 972	4 904 943	2 256 095	2 648 848	695 504
De 800 a 1 599 "	4 081	4 322 463	1 512 780	1 106 565	204 656	201 559	2 504 595	1 256 418	1 248 177	305 0[illegible]
De 1 600 a 3 199 "	1 825	3 994 062	1 318 399	1 027 406	138 588	152 405	2 368 293	1 373 635	994 658	307 370
De 3 200 a 7 999 "	786	3 682 805	1 200 470	968 266	130 158	102 046	2 154 724	1 401 618	753 106	327 611
De 8 000 a 15 999 "	184	1 929 199	666 124	551 503	63 901	50 720	1 167 231	700 596	466 635	95 844
De 16 000 y más tareas	161	9 575 235	4 836 444	3 924 577	549 086	362 781	4 276 786	1 855 165	2 421 621	462 005

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TABLE A-7

Weighted Average Financial Revenue from Sales of Products Per Hectare YSURA-PRYN Without Project

Crops	RD$/Ha	×	Total Has	=	Total Revenue
YSURA:					
- Tomatoes	1,540		755		1,162,700
- Sorghum	696		546		380,016
- Melons	3,440		113		388,720
- Bananas	3,200		379		1,212,800
- Beans	978		230		224,940
- Guineo	1,800		396		712,8[illegible]1
- Corn	440		137		60,280
- Peanuts	643		146		93,878
- Peppers	2,535		65		164,775
			2,767		4,400,909

Weighted Average Revenue from Sales Per Hectare - YSURA:

$$\frac{4,400,909}{2,767} = \text{RD\$}1,590$$

PRYN:					
- Tobacco	1,600		4,018		6,428,800
- Bananas	3,392		3,850		13,059,200
- Rice	1,576		6,764		10,660,064
- Sugar Cane	1,288		2,152		2,771,776
- Tomatoes	1,484		822		1,219,848
- Beans	980		500		490,000
- Corn	522		750		391,500
- Pasture	264		4,524		1,194,336
			23,380		36,215,524

Weighted Average Revenue from Sales per Hectare - PRYN:

$$\frac{36,215,524}{23,380} = \text{RD\$}1,549$$

Combined YSURA-PRYN Weighed Average Revenue from Sales per Hectare:

$$\frac{40,616,433}{26,147} = \text{RD\$}1,555$$

TABLE A-8

NET FINANCIAL AND ECONOMIC BENEFITS ESTIMATES
PRYN + YSURA

FINANCIAL

WITHOUT PROJECT:

- Weighted average financial revenue from sales of production	=	RD$1,555
- Weighted average financial costs of production per hectare	=	RD$ 797
- Weighted net financial benefit from production per hectare	=	RD$ 758

(See Table A-6 above for computations.)

WITH PROJECT:

- Weighted average financial revenue from sales of production per hectare	=	RD$2,019
- Weighted average financial costs of production per hectare	=	RD$ 872
- Weighted net financial benefit from production per hectare	=	RD$1,147

(Assumes a 30% increase in other inputs production costs other than labor and machine land preparation and a 30% increase in production and revenue from sales over WITHOUT PROJECT estimates above.)

- Net financial benefit per hectare WITH PROJECT	=	RD$ 389

ECONOMIC

WITHOUT PROJECT:

- Weighted average economic revenue from sales of production per hectare	=	RD$1,555
- Weighted average economic costs of production per hectare	=	RD$ 616
- Weighted net economic benefit from production per hectare	=	RD$ 939

WITH PROJECT:

- Weighted average economic revenue from sales of production per hectare	=	RD$2,019
- Weighted average economic costs of production per hectare	=	RD$ 732
- Weighted net economic benefit from production per hectare	=	RD$1,287

(Same assumptions used as in computation of financial revenue, costs, net benefits above.)

- Net economic benefit per hectare WITH PROJECT = RD$ 348

Table A-9: Net Effect of Increased Harvest Costs and Reduced Irrigation Costs on Total Production Costs. PRYN

Crop	Total Hectares	Harvest Cost/Ha	Total Harvest Cost	Total Harvest Cost+30%	Irrig. Cost/Ha	Total Irrig. Cost	Total Irrig. Cost-30%
Tobacco	4018	21.91	88034	105641	5.00	20090	17077
Bananas	3850	1.25	4813	5776	11.25	43313	36816
Rice	6764	6.00	40584	48701	3.00	20292	17246
Tomatoes	822	10.32	8483	10180	6.56	5392	4583
Red Beans	500	4.00	2000	2400	4.00	2000	1700
Corn	750	2.00	1500	1800	2.00	1500	1275
Total	16704		145414	174498		92587	78699
% of Total	13						

$$\text{Change in Total Cost} = \frac{174498 \quad 64510}{145414 \quad 92587} = \quad 1\% \text{ Increase}$$

Net Effect of Increased Harvest Costs and Reduced Irrigation Costs on Total Production Costs. YSURA

Crop *	Total Hectares	Harvest Cost/Ha	Total Harvest Cost	Total Harvest Cost-30%	Irrig. Cost/Ha	Total Irrig. Cost	Total Irrig. Cost-30%
Bananas	379	2.50	948	1138	4.50	1706	1450
Guinea	396	3.80	1505	1806	4.50	1782	1515
Farmers	65	22.67	1491	[illegible]	0.31	[illegible]	345
Sorghum	546	3.90	2129	2555	2.00	1092	928
Tomatoes	785	11.00	9060	10872	2.40	1884	1602
Red Beans	230	4.53	1042	1250	0.96	225	191
Corn	137	3.37	462	554	1.50	206	175
Total	2538		17137	20564		7234	6.48
% of Total	87						

$$\text{Change in Total Cost} = \frac{20279 \quad 5063}{17137 \quad 7234} = \quad 5\% \text{ Increase}$$

Weighted Average Increase = (1.3 X 5) + (.87 X 1) = 1.52

* Some crops were and costs where no event information was missing.

TABLE A-10

ANNUAL WATER CHARGES

Regular Irrigation		Rice	
Area (ha.)	Charge (RD$/ha.)	Area (ha.)	Charge (RD$/ha.
1-10	2.50	1-10	5.00
Greater than	5.50	Greater than 10	11.50

Source: Diagnóstico Proyecto de Riego Yaque del Norte (PRYN) Secretaría Agricultura 1980

Cost estimates for maintenance and management of the system is estimated to be $44 a hectare in 1981 according to INDRHI.

Approximately RD$7.5 million is required to maintain the irrigation system in the Dominican Republic, but less than RD$0.5 million is collected annually from water users in fees.

Source: AID Memorandum on Water Management Report by Kenneth C. Ellis.

Table A-11 : Financial Rate of Return and Net Present Value.

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Project Costs	-4775600	-3435041	-3813417	-3242566	-3233376															3000000
Cumulative Hectares Leveled		77	446	1244	2576	4530	7185	10613	14878	20043	26166	33301	41502	50818	61298	72988	85934	97227	107248	116217
Hectares Leveled each Year		77	369	798	1778	1954	2655	3428	4265	5165	6123	7135	8201	9316	10480	11690	12946	11293	10021	8969
Leveling Costs of Farmers (Princ. + Interest)						-8371	-50403	-172325	-316077	-442117	-595992	-781401	-1002592	-1264305	-1571691	-1931126	-48940	-2745817	-3039615	-3403439
Net Incremental Benefits Per Hectare	389	420	454	490	529	572	617	667	720	778	840	90	980	1058	1143	1234	1333	1439	1554	1679
Net Incremental Benefit		16170	118720	414049	392422	2032315	3614077	5935632	9176759	13584268	19407779	26968284	36653469	48837279	64074293	82854461	1 21512	131784339	158877074	187598867
Net Benefits	-4775600	-1418871	-3694697	-2828517	-2340954	2023944	3563674	5763307	8860682	13142151	18811787	26186883	35650877	47572974	62502602	80923335	1 72572	129038522	155837459	187195428
Discount Rate	11%																			
NPV	106065358																			
IRR	36																			
NPV @ 18%	24[illegible]																			

1. All values [illegible] with a reflected inflation rate of 8%.
2. Assume half the land leveled in a given year is done after harvest so benefit is realized for that portion.

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Table A-12 : Economic Benefit-cost Ratio, Real Internal Rate of Return and Real Net Present Value.

YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Dis. Project Costs	-6844164	-4402535.	-4116199.	-3099534.	-2647698.												(Credit Fund Salvage)			3000000
Cumulative Hectares Leveled		77	446	1244	2576	4530	7185	10613	14878	20043	26166	33301	41502	50818	61298	72988	85934	97227	107248	116217
Hectares Leveled Each Year		77	369	798	1778	1954	2655	3428	4265	5165	6123	7135	8201	9316	10480	11690	12946	11293	10021	8969
Leveling Costs of Farmers (Princ. + interest)						-8371	-50403	-172325	-316077	-442117	-595992	-781401	-1002592	-1264305	-1571691	-1931126	-2348940	-2765817	-3039615	-3403439
Net Incremental Benefits Per Hectare	348	348	348	348	348	348	348	348	348	348	348	348	348	348	348	348	348	348	348	348
Net Incremental Benefit		13398	91001	294059	587075	1236443	2038409	3096851	4435433	6076253	8040365	10347257	13015721	16063679	19508163	23365763	27652427	31870013	35578649	38882909
Discounted Net Inc. Benefit		12152	78610	241923	459989	922653	1448659	2096071	2859120	3730292	4701035	5761740	6902515	8113249	9383770	10704125	12064662	13242649	14079680	14654559
Discounted Costs	-6844164	-4192890	-3914520	-2677494	-2178267	-6559	-37611	-122468	-213933	-284993	-365887	-456869	-558791	-670488	-793811	-928905	-1076076	-1197991	-1263023	-1346856
Net Benefits	-6844164	-4389137	-4225198	-2805475	-2060623	1228072	1988006	2924526	4119356	5634136	7444373	9565856	12013129	14799374	17936492	21434637	25303487	29124196	32539034	38479470
Benefit-cost Ratio	5.08																			
Real Discount Rate	5%																			
Real NPV	8484348																			
Real IRR	21																			
Real NPV @ 13%	10405529																			

1. Project costs deflated by 8 Percent to get real values. All other discounting at 5 percent.
2. Assumes half the land leveled in a given year is done after harvest so no benefit is realized on that portion.
3. Shadow price for foreign exchange is RD51.47 to US$1.
4. Shadow price for labor is RD52 per man day.
5. Shadow price for water is RD544 per hectare.

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Table A-10 : Financial Rate of Return and Net Present Value, Constant Prices Assumed.

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
																	(Credit Fund Salvage)			3000000
Project Costs	-4775630	-3435841	-3813417	-3242566	-2211175															
Cumulative Hectares Leveled		77	666	1244	2576	4530	7185	10613	14878	20043	26166	33301	41502	50818	61299	72988	85934	97227	107248	116217
Hectares Leveled		77	589	790	1370	1954	2655	3428	4265	5165	6123	7135	8201	9316	10480	11690	12946	11293	10021	8969
Land Rent						-4371	-58453	-172325	-316877	-442117	-595992	-781401	-1002592	-1264305	-1571691	-1931126	-2348940	-2745817	-3039615	-3403439
Levelling Costs of Farmers Drive + Interest)																				
Net Incremental Benefits Per Hectare	389	383	377	370	362	354	345	336	325	313	301	289	275	260	244	226	207	187	164	141
Net Incremental Benefit		18746	98586	112650	772186	1257762	2020020	2990064	4162288	5485137	6954455	8592982	10285413	12081600	13878152	15174318	16448427	17125554	16716950	15754283
Net Benefits	-4775630	-3428295	-3716831	-2929916	-2461230	-1249391	-1930435	-2817739	-3826211	-5023020	-6358463	-7811581	-9282821	-10737295	-12186461	-13213192	-14099487	-14379737	-13727335	-15350844

Discount Rate 12%
NPV
IRR
NPV @ 12%

1. All values scaled with a reflected inflation rate of 8% for costs and prices received held constant.
2. Because half the land leveled in a given year is done after harvest no benefit is realized on that portion.

Table A-15 : Economic Benefit-cost Ratio, Real Internal Rate of Return and Real Net Present Value. Foreign Echange at RDS2 to US1.

YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
																	(Credit Fund Salvage)			3000000
Dis. Project Costs	-9176800	-5790469.	-5496644.	-3692097.	-2953372.															
Cumulative Hectares Leveled		77	446	1244	2576	4530	7185	10613	14878	20043	26166	33301	41502	50818	61298	72988	85934	97227	107248	116217
Hectares Leveled		77	369	798	1778	1954	2655	3428	4265	5165	6123	7135	8201	9316	10480	11690	12946	11293	10021	8969
Exc. Tax						-8371	-50403	-172325	-316077	-442117	-595992	-781401	-1002592	-1264305	-1571691	-1931126	-2348940	-2745817	-3039615	-3403439
Leveling Costs of Farmers (Princ. + Interest)																				
Net Incremental Benefits Per Hectare	348	348	348	348	348	348	348	348	348	348	348	348	348	348	348	348	348	348	348	348
Net Incremental Benefit		13398	51001	294059	587075	1236443.	2038409	3096851	4435433	6076253	8040365	10347257	13015721	16063679	19508183	23365763	27652427	31870013	35578649	38882909
Discounted Net Inc. Benefit		12152	78610	241923	459989	922653	1448659	2096071	2859120.	3730252	4701035	5761740	6902515	8113249	9383770	10704125	12064662	13242649	14079680	14654559
Discounted Costs	-9176800	-5505208	-4985618	-3189372	-2429746	-6559	-37611	-122468	-213933	-284993	-365887	-456869	-558281	-670488	-793811	-928505	-1076076	-1197991	-1263023	-1346856
Net Benefits	-9176800	-5767071	-5405643	-3390038	-2366297	1228072	1688006	2924526	4119356	5634136	7444373	9565856	12013129	14799374	17936492	21434637	25303487	29124196	32539034	38479470
Benefit-cost Ratio	4.45																			
Real Discount Rate	5%																			
Real NPV	79625744																			
Real IRR	18																			
Real NPV @ 13%	13914581																			

1. Project costs deflated by 8 Percent to get real values. All other discounting at 5 percent.
2. Assumes half the land leveled in a given year is done after harvest so no benefit is realized on that portion.
3. Shadow price for foreign exchange is RDS2 to US$1.
4. Shadow price for labor is RDS2 per man day.
5. Shadow price for water is RDS44 per hectare.

Exh. - 9-16: Cash flow for average hectare with and without project.

Item	Inflation Rate	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
WITH PROJECT																	
Cash Inflows																	
Crop Sales	0	2219	2219	2219	2219	2219	2219	2219	2219	2219	2219	2219	2219	2219	2219	2219	2219
Crop Insur.		16.															
Cash Inflows		2207	2219	2219	2219	2219	2219	2219	2219	2219	2219	2219	2219	2219	2219	2219	2219
Cash Outflows																	
Project Costs	.08	1251	1384	1494	1614	1743	1883	2032	2196	2371	2561	2766	2987	3226	3485	3763	-4064
Op. Costs	.08		72	77	81	86	92	99	106	114	122	131	141	152	163	176	189
Cash Outflows		1251	1456	1571	1695	1829	1975	2131	2302	2485	2683	2897	3128	3378	3648	3939	4253
Cash Balance before Debt Service		956	563	448	324	192	44	-112	-261	-466	-662	-873	-1123	-1351	-1602	-1929	-2032
Debt Service																	
Principal				53	62	67											
Interest		22	22	22	15	8											
Subtotal		22	22	75	77	75											
Cash Balance after Debt Service		697	541	373	249	115	44	-112	-261	-466	-662	-873	-1123	-1351	-1602	-1929	-2032
Discount Rate	13%																
NPV	-120																
WITHOUT PROJECT																	
Cash Inflows																	
Crop Sales	0	1555	1555	1555	1555	1555	1555	1555	1555	1555	1555	1555	1555	1555	1555	1555	1555
Cash Outflows																	
Project Costs	.08	1171	1265	1366	1475	1593	1721	1858	2007	2168	2341	2528	2732	2949	3185	3440	3715
Cash Balance		384	290	189	80	-38	-166	-303	-452	-613	-786	-973	-1173	-1394	-1632	-1885	-2162
Discount Rate	13%																
NPV	-1253																

Assumptions:

1. Assume 8% inflation for sales and 5% for costs.
2. [illegible] and planing each year beginning first year after [illegible] and it [illegible].
3. Interest rate of 12 percent with a two year grace period in which [illegible] interest is paid then a three year amortization.
4. Assume [illegible] will produce a crop the year it is leveled.

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ANNEX B

BACKGROUND ON PILOT PROJECT SITES

A number of factors were favorable to the selection of two proposed sites. Baseline information on soil exists, operational irrigation system are in-place, and several GODR agencies are presently implementing projects there to increase farm productivity. The problem of water management however, especially at the farm level, is in the area needing the urgent attention.

1. Baseline of Soil Information

Considerable information is available about the soils of the study areas. The soils of the Yaque del Norte and the Azua project areas have been surveyed and classified. The surveys are semidetailed. For classification, the GODR uses the U.S. Soil Conservation system; and for classifying the soils on the basis of suitability for irrigation, the U.S. Bureau of Reclamation system is utilized.

The information on prepared maps and in reports will be useful to anyone starting investigations in the pilot areas. However, there is not enough detail to be adequate when individual farms are being considered for such studies as suitability for land levelling. In such instances, a very detailed investigation will need to be made on the individual farms.

There is competence in the country to direct and conduct any type of soil classification needed. INDRHI has soil maps and reports of the classification studies made in the PRYN and Azua project areas.

2. Description of PRYN and Azua

Two locations are proposed for the Irrigation Water Management project: Phase I of Proyecto Riego del Norte (PRYN) near Santiago; and the YSURA (Azua) project in San Juan de la Maguana valley. The unique features and diversity of cropping patterns and geographical locations of the irrigation projects, justify using the two areas.

PRYN: This project encompasses a total area of 45,000 ha along the margin of the Yaque del Norte River,

west from Santiago de los Caballeros. The right margin is between Rio Yaque del Norte and the Cordillera Septentrional, beginning from the head work of Santiago continuing west up to the stream Agua de Palma near Villa Elisa (Guayubin) --the left margin is from the same head works to the Rio Amina in the south of Esperanza. The PRYN project is divided into two stages: Phase I, completed first and covering nearly the total right margin; Phase II, now in progress, and covering all the left margin and an amplification of the right margin. It is in Phase I where the project will be located.

Phase I of PRYN serves approximately 5,000 ha agricultural land with good access to markets, input supplies and agricultural technology. Nevertheless, the ecological situation is delicate due to salinization and water-logging and there are many problems yet to be solved to achieve better agricultural production. The main canal and major laterals, funded by IDB have been completed. INDRHI is in the process of finishing the farm delivery systems using GODR funds. The second phase, Navarrete and Monte Cristi, is also under construction. Parts of the old system are still functioning and some farmers receive water from that system. The pressure is building to complete the system so that farmers can receive water for new lands not previously irrigated. An additional 1,200 ha are to be developed under Phase II.

In order to realize its objective and coordinate activities, PRYN has formed a Directive Council of the following institutions: FEDA, INDRHI, SEA, CDE, BAGRICOLA, IAD, INTABACO and the private sector. Day-to-day operation of the irrigation system is facilitated by the following units: Advisory; Technical Publications; Administration; Design; Irrigation and Drainage; Land Units; Farm Units. The latter two entities deal with land reform, resettlement, agronomic practice, credit and markets and the like.

Azua: This project is an older project with different and unique problems. At the end of the 1950s and beginning of the 1960s there were two large agricultural companies in the Azua valley: Dominican Sisal, C. x A., and the Dominican Fruit Company. Their activities provided most of the employment for the people of the valley. These two companies disappeared for various reasons in the 1960s, and this aggravated the problem of unemployment and low income in the valley.

By the end of the 1960s an Israeli group, directed by Alexander Dotnan (an advisor), began to develop a vegetable production project in the area around Puerto

Viejo using well water. In this zone, where before the Sisal Company worked, IAD began in 1969 three "asentamientos" under a project entitled "Alexander Dothan", in honor of the contributions of the Israeli advisor. In spite of the fact that there was high productivity, particularly in the tomato industry, the project had problems with salinization of the soil. In the early 1970s, the valley still was underdeveloped.

By the mid-1970s, the GODR understood the need to build an irrigation infrastructure for agricultural development at the national level. The lack of water in the Azua valley was, at that time, the bottleneck to development of the zone. The GODR began --through INDRHI-- the irrigation project Yaque del Sur-Azua. That project included the dam Sanaga Yegua, a feeder canal from the dam to the Tabara River, the dam/impoundment at Tabara, the principal canal and a network of canals for irrigation and drainage. First, the canals were constructed, but when the technicians realized that, there was not enough water for the canals, they began to construct the dam. The project allowed about 12,000 ha to be irrigated, which laid the foundation for the development of the valley.

In 1977 the GODR, realizing that the availability of water opened up numerous development possibilities for the valley, formulated, through IAD, the agrarian reform project YSURA. At the same time, in order to establish the infrastructure for the development of the valley, the GODR established new offices or increased existing offices of institutions that could participate in development of the zone. By August 1982, those organizations involved in the valley were the following: SEA and its three dependencies, namely ODESIA, CIAZA, and PROSEMA; INDESUR; IAD; INDRHI; BAGRICOLA; ODC; IDECOOP; SEEBAC; INESPRE; and CEDOPEX. Each GODR organization had its own area of responsibility in the valley and reported directly or indirectly to their home offices in Santo Domingo. Finally, each office was responsible to the President of the Dominican Republic. Since 1970, the GODR has invested more than RD$150 million in the development of the Azua valley.

ANNEX C

MANAGEMENT INFORMATION SECTIONS

Included in each integrated Center for Water Management at PRYN and YSURA will be a Management Information Section (MIS). This division will be responsible for all data collection and processing, as well as much of the analysis. Its functions will include the design and implementation of basic social, economic, and engineering studies to provide information and direction for all those responsible for project implementation.

Moreover, the MIS will primarily be responsible for sub-project identification, as well as overall project monitoring and evaluation. Finally, the MIS will be the identifiable section and group of technicians charged with the task of measuring many of the "objectively verifiable indicators" of the project in order to ascertain whether or not the "outputs" and "goals" of the logical framework matrix are being achieved, especially the foremost goal of an "increase in the income and standard of living of Dominican farmers by increasing their productivity".

As pointed out in the PID, there is a dearth of information on agricultural production and irrigation in the Dominican Republic. One kind of information which needs particular attention is socio-economic data from individual farm field surveys. This flow of information from down-up will render the up-down technical recommendations more practical and, therefore, more effective. In all projects, including this Water Management project, one must examine individual farms to see if new practices will fit into existing cultivation patterns. One must know whether the credit the farmers themselves must invest will be profitable enough to induce them to act. In short, project managers must know the socio-economic reality of the farmer and it is the task of the management information sections to obtain, process, and analyze this information.

There is also an obvious and continuing need for engineering data collection and analysis on soil, water, weather, and similar variables. Engineering studies of existing irrigation systems, water balance studies, groundwater and soil studies, etc., are the technical counterparts to the socio-economic studies referred to above. Engineers in the project must also know the

technical reality of the farm, of the area, and of the irrigation system before they can make recommendations, undertake experiments, or set up demonstrations.

The philosophy of the management information sections should be that all dimensions of economic development are capable of being measured and they are not some mysterious phenomena beyond comprehension, measurement or control. Moreover, an expenditure or undertaking is socially efficient if it contributes more to increasing the income and output of the farmer than alternative expenditures and activities which were not undertaken. "Something is lacking" is no justification for an expenditure or activity where resources are limited. Likewise, confusion can be avoided if the MIS maintains a clear distinction between inputs, outputs, and goals. Land, labor, and capital are inputs, improved water management and education are outputs, and increased yields, production and income of the Dominican farmers are the goals.

Because there is often disagreement on this issues and because engineering efficiency differs from economic efficiency, care must taken to ensure that these management information sections are supported by the project manages, properly staffed, adequately equipped, and provided with appropriate methodology. Unless this is accomplished, outputs will be confused with inputs, assumptions will be substituted for reality, laboratory results will be mistaken for field results, and the goals of the project will simply be ignored.

Appropriate methodology recommended for these MIS's is comparative field investigations, one of the very few practical scientific methods. Both "before and after" (time series) comparative studies and "with and without" (cross-sections) comparative studies are recommended. When properly executed, these investigations are simple, practical, inexpensive, and scientifically valid. In all the field investigations only a small random sample need be selected to obtain statistically sampling who still believe that samples must be large, expensive, and related in size to the population being investigated, the following quotes are offered in guidance:

"Newcomers to the field sometimes advance the common sense hypothesis that sampling error depends primarily on the proportion of the sample to the total population... while this argument may seem plausible, it is erroneous." Donald Warwick and Charles Lininger, The Sample Survey: Theory and Practice, McGraw Hill Book Co., New York, 1975, pp. 82 and 92.

"While there is no simple answer to this question which will work for all situations regardless of the variation present in the population, it is possible to suggest a minimum size below which reliable estimates are not likely to occur. Than minimum jis around thrirty; that is, for any region, or sub-type within a sample, it is necessary to have at least thirty observations (samples households, farms, etc.), before the sample error is reduced to acceptable levels." Samuel R. Daines, An Overview of Economic and Data Analysis Techniques for Project Design and Evaluation, Agency for International Development, Washington, D.C. 1977, p. 34.

To begin with, a coordinated effort must be undertaken by a number of socio-economic and engineering studies in the PRYN and YSURA districts and in the respective pilot laterals. These "lines of intervention" investigations will not only furnish the micro data for a statistical profile of the target areas and farms, it will also provide the project managers and technicians with guidelines for the selection of activities designed to meet the goals of the project. By way of example, let us assume that the field investigations revealed that the wealthier farmers had not more water per hectare but received the water on a regular basis and that his land was level. The middle group of prosperous farmers also received no more water than the others, received it on a regular basis, but his land was not level. The poorest farmers on the other hand received the same amount of water as the others but not on a regular basis and his land was not level. Were these the major findings, then the lines of intervention would be clear. First, ensure that the water is received on a regular basis and second, level the land. Ideally, all activities should be comparatively investigated three times: before the activity was put into operation, at least once during the life of the activity, and again after the activity is terminated. The first time is to identify the lines of intervention and to obtain parameters on the "before" situation. The second or subsequent investigations are to evaluate the progress of the activity and to modify, expand, contract, or eliminate it based on the information obtained from the field investigations. The final evaluation, of course, is to determine the success of the activity, i.e., whether or not it achieved its goal. If done properly, evaluations of existing activities will reveal further lines of intervention.

From all these comparative field investigations and pilot sub-projects will come the selection of those activities which have demonstrated a practice social efficiency towards the objective of achieving overall project goals. This "production package" of methods,

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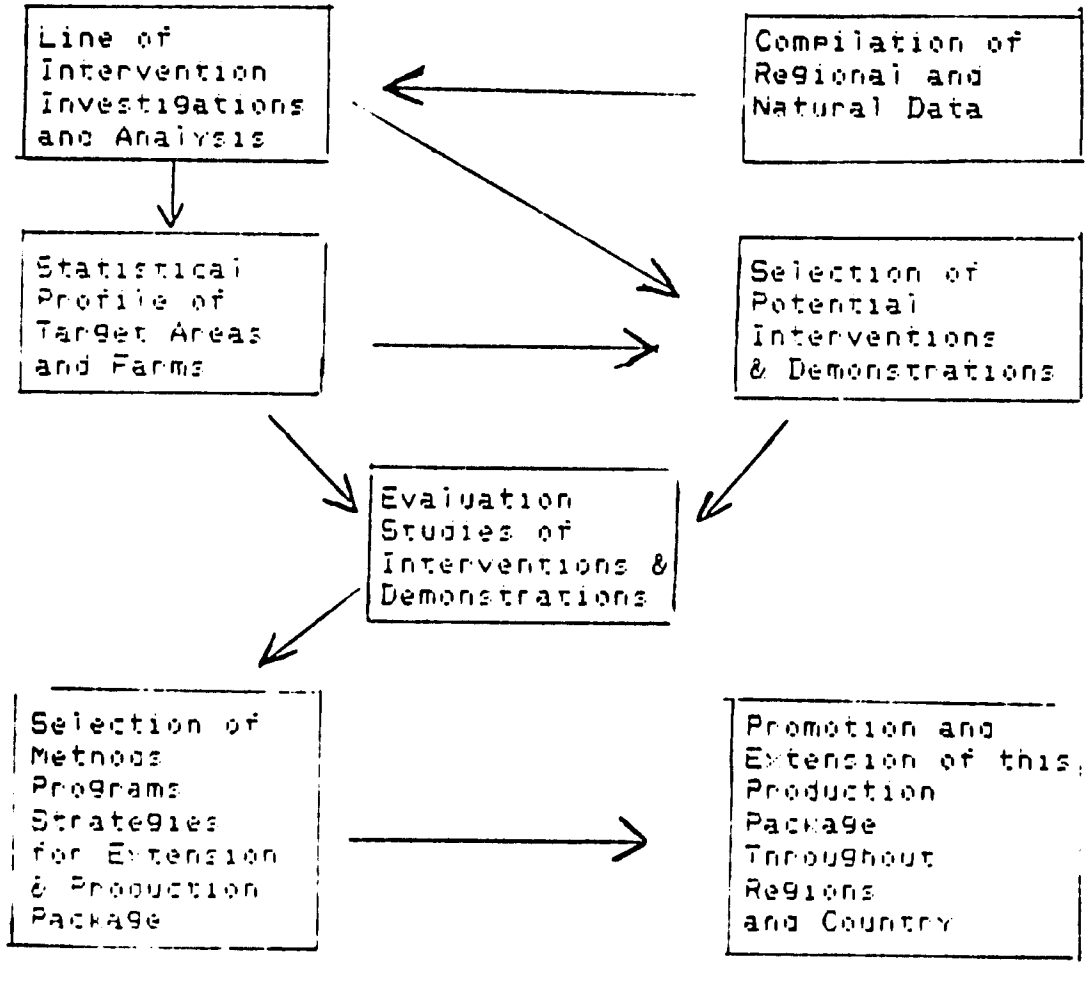
techniques, activities, strategies, etc., will then be permanently demonstrated and extended throughout the PRYN-YSURA districts and the other irrigated regions of the country.

The scheme outlined above is shown in the diagram below:

RECOMMENDED SCHEME



The measurement information sections will obviously require resources to accomplish these tasks. For those who believe that the cost is too high, let them reflect upon the fact that there is probably no more false economy than to spend millions of dollars on project implementation and little or nothing on scientifically valid procedures of control and evaluation. At the minimum, each Water Management Center will require the following resources to

accomplish its objectives:

1. One full time economist (with a background in statistics, field investigations, and engineering, if possible);

2. Two full time interviewers (with farming backgrounds and family roots in the area);

3. One full time secretary;

4. One Jeep;

5. One small Word Processor-computer;

6. Adequate funds for operating the MIS and conducting the field investigations.

Just as the sample size of these investigations should be minimized, so should the size of the questionnaire. The questions should be few, the interview short, the information sought practical, the responses clear, etc. If the sample size and the questionnaire are both small and economical, it will be possible to continue to sample the same population over and over again without ever interviewing the same farmer twice. While questions will differ depending upon the area being investigated and the information sought, below is a partial list of the variables needed for social, economic, and engineering investigations of the type described above:

Social: Population, Family, Division of Labor, Education, Health, Community Facilities, Organizations, Attitudes, Opinions, Preferences.

Economic: Resources (especially water), Production, Income (including off-farm), Crops, Animals, Input Prices, Output (product) Prices, Markets, Transportation, Land Tenure, Technology.

Engineering: Rainfall, Rainoff, Hydrological Data, Climate, Soil, Irrigation System, Hydrolic Data, Canal Leepage, Silting, Water Flow, Drainage.

ANNEX D

IRRIGATION PARAMETERS

The following discussion details the types of irrigation parameters that will be measured on the farms of the pilot laterals to provide baseline data for evaluation of the project progress over the 5 year period.

- Irrigation Efficiencies

Team will select a minimum of 10 farms in each pilot lateral area and determine the irrigation efficiencies on each farm. These efficiency measurements will be continued over a five-year period to provide a measure of progress. When the initial measurements are taken, changes, as required, will be recommended to the farmer. The changes may include land smoothing, irrigation methods, water control and cropping pattern. Subsequent efficiency measurements will indicate the progress made on each farm. All changes in irrigation practice will be recorded. The project will provide the technical staff, the field equipment, water measurement devices, and land levelling service as required.

Since the project is fundamentally based on the assumption that poor management of irrigation water is one of the underlying causes of poor production and the misuse of water, it is important to determine the efficiencies of irrigation at the farm level. In terms of the farmers themselves, the irrigation efficiency of importance is the efficiency of application. Application efficiency measures the proportion of the water applied that is stored in the rootzone. Other efficiencies can be determined for other purposes.

Application efficiency is determined by measuring the water in the soil just prior to irrigation, measuring the amount of water delivered to the field, and then measuring the amount of water in the root zone following irrigation. The soil water measurements can most easily be made with a neutron meter. It has the advantage that it can measure in exactly the same location a second time and measurement is not delayed by the wetness of the soil following irrigation.

Deep percolation losses will also be evaluated. It is necessary to measure the volume of surface runoff and deep percolation is obtained by subtraction of the other data factors since it cannot be measured directly.

Semi-permanent neutron meter access tubes will be installed, so that the irrigation efficiency can be measured on the same field for different irrigations.

Irrigation application efficiency should be measured on at least 10 farms in each lateral, to get a cross-section of irrigation practices over time. Measurement of stored water on at least three locations within the field will give information on a real distribution of water and the degree of non-uniformity of application. It is possible to apply the precise amount of water necessary to fill the rootzone and still have a low irrigation efficiency due to poor distribution of water over the field.

Leaching requirements for salinity control must be considered in the computation of irrigation requirements and irrigation efficiency. A low irrigation efficiency cannot be justified on the basis that the lost water is leaching salt.

Runoff water, which reduces water application efficiency, may be recaptured and reused. Low farm water application efficiencies may not mean low project water application efficiencies if the water is reused in the project or downstream.

Low irrigation efficiencies that result on excess seepage may reduce water quality if excess leaching occurs.

- Evapotranspiration and Replacement Irrigation Water Needs

Evapotraspiration needs will be computed for every important crop grown in each pilot area for the season in which it is normally grown. The computation method used will depend on the availability of climatic data. By using data from the irrigation efficiency studies of the amount of water consumed by the plants between irrigations, the evapotranspiration calculations can be verified. Measurements of soil water after one irrigation and before the next one can be used to determine the actual water use by crops. The weather data for the same period will be used to compute the expected evapotranspiration for comparison and the most appropriate method of calculation selected.

Data developed for the evapotranspiration needs of crops will be converted into irrigation water needs using the canal efficiencies and irrigation efficiencies that are determined in other components of the data collection program.

Evapotranspiration measurements will also be measured in 10 fields that are not over-irrigated and which do not have a shallow water table. A shallow water table will allow the plants to take their water from the watertable instead of the soil. Over-irrigation will appear in the measurement of changes in soil water as a water loss from the soil since the excess water will be lost from the rootzone as deep percolation rather than as evapotranspiration as would be assumed from the soil profile water measurements.

Irrigation water needs cannot be known until the true evaportranspiration is known. The project will provide special TDY help to make the evapotranspiration calculations specified above, and to establish the field criteria for the evapotranspiration measurements in the field. Staff from the Center will be trained to continue measurements as needed. Data obtained will be stored in the computer at the Centers and used in future training and development programs.

- Drainage Coefficients

Since drainage and saline soils are major problem in both irrigation districts, the project will evaluate drainage coefficients on five selected farms in or closely associated with the pilot project area. Technical assistance will be provided to train professionals from INDRHI in such techniques. This will enable INDRHI to continue to evaluate on-farm drainage needs for the total irrigation district.

Six months of TDY technical assistance is envisioned, 2 months in year one and 1 month in each of years 2, 3, 4, 5 of the project.

To design on-farm drainage systems in areas where it is needed, an evaluation of the drainage coefficient is needed. The drainage coefficient is that amount of water that passes through the rootzone as deep percolation. In saline areas or areas that are irrigated with saline water, the leaching fraction of irrigation water becomes part of the drainage coefficient. All the water that infiltrates into the soil from irrigation or rainfall that is not consumed as evapotranspiration becomes the drainage

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coefficient.

The determination of drainage coefficient is based on studies of the irrigation application efficiency and the evapotranspiration of the crops being grown. The total amount of water to be removed by the drainage system includes: deep seepage water from irrigation, the seepage from canals, and excess rainfall, and artesian contributions.

- Water Quality

A system for monitoring the quality of the irrigation water will be established and carried out by the project. The project will provide the technical equipment necessary to equip the laboratories in the area to make the analysis. Laboratory costs will be defrayed by the project.

The data provided will be analyzed and incorporated into the agronomic packages and the irrigation requirements of the pilot area. It will then, be very easy to compile data for total district use.

In determining irrigation needs, an important factor is the quality of the irrigation water. In irrigation projects where groundwater or return flows are used for irrigation, the quality becomes important in the determination of the leaching fraction and the drainage coefficient. The quality of the irrigation water also affects the kinds of crops that can be grown. The quality of the irrigation water from every source will be determined at least once each month for a year and as needed after that initial period. Electrical conductivity will be measured unless sodium problems are suspected, and in those cases, a more complete analysis will be made. Sources of irrigation water include wells and seepings in addition to the water entering irrigation canals.

If seepage from higher lands is entering irrigation canals, measurements should be made of the canal water quality above and below the section to determine whether steps should be taken to protect the quality of water in the canal.

- Pre-Project Irrigation Methods

The project will determine the extent of various types of surface irrigation in the area and level of irrigation experience available among the farmers. The Center will provide demonstrations of methods applicable to local conditions and train extension personnel how to

demonstrate such methods at the farm level.

A survey of the current irrigation methods will be made to determine to what extent such methods might be changed to increase the efficiency of water use. Current irrigation methods may be a result of a lack of land preparation or canal maintenance. The project proposes to provide land levelling in part of the pilot area as a means of increasing the efficiency of water management.

With good land preparation, there may be an opportnity to raise the level of irrigation technology through the use of portable irrigation structures and siphon tubes, for example. Also, the introduction of the new surface irrigation technology of "Surge Flow" has the potential of increasing surface irrigation efficiency to levels at or above those attainable with the more energy intensive methods, such as sprinkle or trickle irrigation.

Equipment and Supplies for Bench Mark Data and Initial Studies and Monitoring, and Evaluation of Irrigation Parameters for Both Centers for Water Management, North and South

4	PH meters type 40 portable (forestry supplies).	$ 600
2	PH accumeter lab. 140-A (Fisher).	590
4	Conductivity salinity meters, model 33 sct (Fisher).	1,160
2	Colorimeter electrophotometer, 33 sct. (Fisher).	1,190
-	Accessories (Fisher).	240
4	Potentiometer portable (Fisher).	2,700
2	Stereoscope ST-wild-4 mirror (for supplies).	1,400
-	Accessories (for supplies).	2,000
2	Mapping equipment, layline 5 drawers, map files (for supplies).	960
2	Map projector & accessories (for supplies).	8,200
2	Vertical sketchmaster (for supplies).	4,200
8	Drawing light tables (for supplies).	2,848
4	Drafting machines (for supplies).	860
8	Soil sampling professionak kit (for supplies).	1,800
12	Bucket augers (for supplies).	960
12	Soil thermometers (for supplies).	480
2	Sample pa kits at $1,000 (for supplies).	160
12	Hip chains, metric (for supplies).	1,284

-	Miscellaneous tags, brusheds, etc. (for supplies).	500
2	Neutron meters and access tubes.	5,250
5000	Sypnon tubes assorted sizes.	5,000
100	Cut throat flumes (to be fabricated locally).	100
100	Soil augers (to be made locally).	100
100	Weirs.	7,500
100	Control gates.	10,000
10	Parameters, VWR Sc.	2,000
6	Pysmy WC meter (forestry supplies).	6,900
12	Hydrologic recorder, Stevens type F metric.	6,192
12	Accessories.	5,316
4	Optical planimeter Lietz (for supplies).	2,220
4	Surveying compass transit (for supplies).	2,320
4	Altimeter, micro.	3,860
4	Automatic level, 360 degrees, circle with tripod wild NAZ.	10,000
4	PH meters.	1,200
2	Balances, electronic top loading VWR.	3,400
2	Drying ovens gravity convertion.	620
2	Mechanical auger, model 330, General, (SHP 4 cycle, 2 man).	1,300
-	Miscellaneous repair and maintenance.	20,790
	Total	$137,000

ANNEX E

DELIVERY SYSTEM

The operation of the delivery system is of utmost concern to the farmer. It must be able to convey water to the farm quantity and in time to meet crop needs. Poorly operated systems mitigate against the farmer, and his ability to optimize crop production. The following discusses several aspects of the delivery system that directly and indirectly affect water management.

- Canal Efficiencies

Canal seepage losses will be estimated by computing water balances between diversion points or by making flow measurements at appropriate locations. Determinations will be made for representative sections of main canals as well as secondary and tertiary canals. The losses in farmer distribution systems will also be estimated from water delivery measurements and on-farm water application measurements. The project will provide the technical expertise and the measuring devices (e.g., current meters) to measure canal losses due to seepage, and management. The data collected will be used to assist management to improve overall operation and reduce canal losses.

It is important to get an estimate of canal seepage and canal operation losses to evaluate the overall efficiency of the irrigation water delivery system. Losses from canals reduces the amount of water that can be delivered and also contributes to the drainage problem. In many cases, canal seepage is minimum because of lining or natural sealing due to canal water sediments. It cannot be assumed to be negligible. Water losses from canals do not reduce the water supply of the basin unless the water is consumed by phreatophytes, but losses may create groundwater problems.

An important canal efficiency that depends on the operation of the canal as well as the physical conditions, i.e., size, slope, free-board, and condition of the structures, is the efficiency of delivery. This the proportion of the water introduced into the canal that is delivered to the farmers field. Since it includes water lost due to operation of the canal, seepage losses must be

accounted for separately. The water that cannot be removed from the canal by the last irrigator is an operation loss. The amount of the loss is important and the disposal of the water is also important. The water should be quickly directed to an outlet system so that it will be returned to the downstream supply and also so that it will not contribute to the seepage and groundwater problems. The proportion of water delivered to the lateral that is lost in operation will be determined for the different types of laterals so that efficient operation procedures can be developed.

Every canal should be examined to make certain that the excess water can be safely discharge without causing erosion or leaving standing water that will breed mosquitoes, and so that a surface drainage problem will not be created.

- System Capacity

The design capacity of each section of the canal system will be determined in the pilot area. The purpose for the capacity determination is to find out whether irrigation water can be delivered on demand or whether it is necessary to deliver water on rotation. The delivery method will affect the response time to water requests by farmers. It will also affect the efficiency of delivery of the canal.

Another factor of system capacity is the availability of water in all seasons of the year. It may be that the canals have sufficient capacity but that there is inadequate water supply to meet the needs of the irrigated area. This information is important for the farmers in making decisions to leave land fallow at certain times to avoid crop losses. The project will compile the data and make it available to water user groups and INDRHI for improving systems operations.

- Available Water Supply

The review and analysis of the delivery system by the project team will include an analysis of the surface water supply. This data will be used in analyzing the adequacy of the existing systems and recognizing their limitation. Farmers will be alerted to periods of short water supply as early as possible to assist them in the decision on types of crops to grow and how many hectares.

The principal water supply in the irrigation projects is from surface sources. In some cases, storage reservoirs are available and can be used to advantage. It

is assumed that the differing needs for power generation and irrigation can be resolved in a way that will cause maximum efficiency in the use of the available water supply.

The historical records will be examined to update them from the time when the projects were designed. The probability and dependability of runoff will be determined for short periods so that the available water supply can be compared with the irrigation water needs.

The surface water supply is affected by the irrigation system. The water not consumed by the irrigated crops is eventually returned to the river and the water supply for re-use. The time delay induced by irrigation will affect the quality, quantity and timing of the downstream water supply. By analysis of the available water in various parts of the system, the effect of the irrigation system will be considered.

Local surface runoff is usually of little use in the irrigation system. Where local surface runoff is intercepted and collected by canals, facilities must be provided for safe disposal of the water to prevent damage to the canals and flooding of the farms.

The surface water supply characteristics will determine the possible extent of cropping in all seasons and needs to be carefully determined.

The project will demonstrate techniques to monitor the depth to the groundwater in the pilot project. Observation wells, and piezometer tubes will be installed in the pilot areas to monitor ground water depth fluctuations. The quality of groundwater will also be determined in high water table areas to determine its use if needed for supplemental use by pumping or further down stream. These determinations will be integrated with other data and used in the total management of the system.

Before the development of the irrigation projects, part of the local irrigation water was supplied form wells. This source of water has the advantage that it was available on demand, it is expensive to obtain, and it removed subsurface water and effectively lowered the water table. The introduction of irrigation on higher lands results in an increase in the recharge rate and exceeds the natural drainage capacity of the soil profile. When this occurs, the water table rises to the soil surface and causes salinity and drainage problems. Seepage from canals also contributes to the increased recharge of the groundwater. One of the partial solutions to the

groundwater problem is to use the groundwater as part of the irrigation supply. Such a procedure will release surface water in the streams for downstream or alternative uses. It will also tend to lower the water table in the areas of groundwater extraction.

The quality of groundwater sometimes is too low to be useful for re-use as irrigation water. In that case, it can be returned to the river where it is diluted by the natural streamflow. It may also reduce the downstream water quality to an unacceptable level. Low quality groundwaters can be disposed of in separate drainage channels or by evaporation.

Wherever possible, full use should be made of the available water in an area to minimize the drainage problem.

Groundwater problems can also be controlled in some cases by on-farm relief drains. Subsurface drainage water is sometimes of sufficient quality to be returned to the river and the water supply for reuse. Under new irrigation projects, the water quality initially removed by the drains may be very low until leaching has occurred and equilibrium established with the irrigation operations.

- Diversions

The diversion structures of the projects are reasonably well designed and functional for the most part. Problems may develop in the future, if proper operation and maintenance procedures are not followed pending on the silt problems in the rivers. Heavy silt deposition has destroyed the effectiveness of the major divis on on the river. Such problems will be reviewed by the project in the review and analysis of the delivery system.

- Canals

The canals are lined down to the level of the farms. Within the farms below the lined canals, control structures and drops made of prefabricated concrete have been installed and tested by filling the farm ditches once. There is some problem with the structures in that some have failed because of lack of compaction of backfill and some of the metal control gates have disappeared. The farmers who are receiving water have resorted to sticks and leaves and odd pieces of concrete and metal to control the water and to divert it in different directions.

Some canals are filling with silt and trash. A regular program of cleaning is necessary. The ditch riders

the person assigned to control water releases along one segment of the canal, could be assigned this responsibility during the time he is not changing water from one farmer to another. The initial cleaning will have to be done with a project force. Inspection of the cleaning work will help in the future. Cleaning is important for a number of reasons, trash and silt interfere with accurate water measurement and control, and people in the area are using the water for culinary purposes and recreational purposes and should at least be able to get it from clean canals. Every effort should be made to assure positive gate closures since slow leakage into canals not in use provides maximum seepages to the groundwater system.

- Control Structure

The control structure located within the delivery system are in good condition. The control structures in the farmers' distribution system are subject to failure because they are subject to soil related failures. The farmers should be educated to maintain the soil around the structures in good condition as part of the training they receive. A source of prefabricated structures suitable for farm use should be made available through the project or privately according to project approved designs. The farmers should be encouraged to develop water controls that are applicable to their conditions. When water is delivered in larger streams for shorter times, the farmers will need functional control devices to be able to handle the water efficiently.

- Water Measurement

There can be no orderly water management in the project without water measurement. The PRYN project does not have water measurement although it may be possible to calibrate the turnouts. The YSURA project was installed with double gates that are supposedly precalibrated. The calibration can be checked by a hydrographer and then water can be delivered by volume. The farmer should be taught to interpret the amount of water he is receiving so that he can be assured of the amount he is getting. He will not understand the measuring process, but he can learn to watch his inlet so that he knows when he has been given less water than he is entitled to.

The ditch rider (cabo de agua) should be given sufficient training that he can teach the farmer what is happening in water delivery. The delivery gates are calibrated for gate opening and head difference and this simple concept can be easily understood by farmers.

ANNEX F

EQUIPMENT LIST FOR DEMONSTRATION ACTIVITIES

Demonstration: Equipment and Machinery for Both Centers for Water Management

Land Leveling

2	120 HP (John Deere type) model 4250 2 wheel drive, cab-digital touch, PS transmission, dual hydraulic, 3pt hitch category 2 96" axle, heavy cost wheels 184-38-8 ply rear, 100-16 6 ply front; #12700 at $52,260.	$104,520
-	20% spare parts.	20,904
2	Hydraulic scrapers 10' model 2F 2.5 cuyds. Eversman.	41,978
2	Land plane - 3pt hitch model 1200. Eversman.	10,000
2	behind land plane #329 32', 9' blade.	4,000
2	Sets laser equipment per attached quotes and specifications.	59,994
2	Pick up trucks Ford Ranger.	18,000
2	Automatic level control survey levels and tripod-rods and accessories, Wild NA2.	5,100
2	Transit - wild.	5,100

- Operation and maintenance of equipment and miscellaneous spare parts, factory recommended.	189,404
Total	$460,000

Demonstration Farms - Machinery and Equipment

2	100 HP (John Deere type) model 4050 2 wheel drive cab-digital touch, PS transmission, dual hydraulic 3pt hitch cat. 2, 96" axle, heavy cost wheels, 184-38 8 ply rear, 100-16 6 ply front. #11540.	$ 98,864
2	55HP (John Deere type) model 2350, 2 wheel drive No roll bar, Hi lo., transmission PTU, one hydraulic outlet, large pump rack opinion-wide front axle, #13638.	40,352
2	14" two bottom, 2 way plough.	8,800
2	3 pt. cultivator.	4,800
2	3 pt. discs.	3,000
2	Sets 3pt. 3 sec harrow.	1,320
2	Danish diggers 12'.	3,300
2	Draw bars.	320
2	Tool bars.	800
2	Tilt trailers.	9,400
2	Spray rigs, 200-300 gal.	700
2	Ditchers V type, 3 pt. 4' spread, Model H4.	1,250
2	Fertilizer spreader, draw type.	500
2	Corrugators, 3 row 30" centers.	1,450
2	Farrowers, 5 row 30" centers.	5,680
2	Border makers.	1,500
2	Drills general purpose, 12', Fertilizer attachment, fluted feed box-large, double ribbed tires, double disc.-zig zag, hydraulic cylinders, John Deere	

	model 8300, 6" spacing, #2883.	18,316
2	Weigh scales, metric field type.	1,648
-	20% spare parts.	40,000
2	Fuel storage tanks, Diesel, 1000 gal. storage cap., stand and shelter pump.	10,000
-	Operation and maintenance.	200,000
-	Field day and demonstration material.	30,000
-	Bulletins and supplies.	30,000
-	Travel and transportation of farmers.	30,000
-	Audio visual, etc.	10,000
-	Seeds, fertilizers for demonstration; including farmer fields.	50,000
	Total	$602,000

Demonstration Farm - Repair Shop. Tools and Equipment for Both Centers of Water Management - North and South

Shop Tools:

2	Welders two stage Oxy-Acetylene with tanks and other accesories at $600	$ 1,200
2	Drill press, heavy duty at $2,400	4,800
2	Bench vice machinits swivel base & combo.	1,640
2	Hoists manual 8' lift 6000 lbs.	930
2	Cleaning tank manual soak and brush pts.	230
2	Mobile rinse tank 12 gal.	203
2	Hydraulic Jack crane 1.5 tons.	1,670
2	Service Jacks 2 tons.	996
2	Hydraulic Jacks 12" 1.5 tons.	42
2	Hydraulic Jacks 14" 5 tons.	96
2	Miscellaneous hand tools 251 piece master set.	2,546
2	Miscellaneous tools and chests.	5,000
2	Engine rebuilding equip. and tools.	900
2	Valve seat grinder set.	1,900
2	Tire service equipment & tools & impact.	716
2	Drill press parts, etc.	3,000
-	Miscellaneous nuts bolts washers all sizes.	5,000
-	Supplies welding rods solvents, etc.	3,000
-	Miscellaneous grease guns and supplies.	5,000

2	Heavy duty grease ramps.	4,200
2	Air compressors.	5,600
-	Operation and maintenance.	1,6331
	Total	$65,000

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Training Farms - Equipment - Machinery and Supplies for Both Centers for Water Management - North and South

2	45 HP (John Deere) model 2150, 8 position, steel wheel, 2 wheel drive, no roll bar, Hi Lo transmission, large pump, rock and pinion wide front axle.	$36,046
2	12" 2 way - 2 bottom plow.	8,800
2	3 pt. cultivator and attachments.	4,800
2	Discs, 3 pt.	3,000
2	3 pt., 3 section narrows.	1,320
2	V ditchers, pull behind, model D5.	4,000
2	V ditchers, tripod assembly, model H5-3.	2,550
25	Hand augers, locally built.	250
25	Abney hand levels.	2,500
-	Miscellaneous gates and measuring devices, made locally.	2,500
	Sub-Total	$65,766

Special Drainage Studies and Training Program:

2,000' -	3/8" piezometer pipe, 8' lengths, threaded with couplers.	3,000
1 -	Piezometer hamer, locally built.	100
2,000' -	3/4" observation wells, 8' lengths threaded with couplers.	4,000
2 -	Drainage tile and tubing laying machines, e.g., ditch-with-hoes, etc., usually made to specifications.	250,000

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	- Accessories and spare parts.	50,000
	- Drainage tubing - 10,000'.	10,000
2	- Tractor-Dozer blade for back fill bucket-gravel fill, Ford Series 7610, 86 HP.	36,000
	Sub-Total	$353,100
	- Operation and maintenance to support courses.	200,137
	Total	$619,000

Field Equipment, National Office, System Review, Implementation and Maintenance

5	Current meters for other districts at $1,150.	$ 5,750
5	Water stage recorders. at $516.	2,580
-	Accessories	2,000
-	Miscellaneous staff gauges, chairs, etc.	2,000
2	Back hoes drainage ditch cleaning and channel cleaning.	64,540
-	O & M.	20,000
	Total	$96,870

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CMD TLX NO> 49
APRIL 14, 1983

TO: UNIVERSITY OF UTAH
FM: SPECTRA-PHYSICS

ATTN: DR. BRUCE ANDERSON

CC: JIM DILLON

RE: QUOTATION FOR DOMINICAN REPUBLIC L.S.A.I.D.

SORRY WE HAVEN'T BEEN ABLE TO GET TOGETHER BUT TRAVEL SCHEDULES WILL DO THAT SOMETIMES. LISTED BELOW IS THE QUOTATION REQUESTED:

A. COMMAND POST SET INCLUDING: 1 EACH DOL. 3,375
- 445000-01 LASER TRANSMITTER
- 444250-01 CARRYING CASE
- 321300-01 POWER CABLE
- 403700-04 ELEVATING BASE
- 302612-06 TRIPOD LEG SET

B. SURVEY SET INCLUDING: 1 EACH DOL. 1,455
- 402722-03 5M SURVEY ROD
- 303003-03 ROD BAG
- 402771-01 MARK II DETECTOR
- 302612-02 TRIPOD LEG SET
- 301373 TRIPOD BAG

C. MACHINE MOUNTED EQUIPMENT INCLUDING: 1 EACH DOL. 12,125
- 430000-04 RECEIVER MAST
- 430200-04 CONTROL BOX
- 000009 INST. KIT FORD TRACTOR W DRAG SCRAPER

D. 10 PERCENT SPARE PARTS DOL. 2,322

TOTAL COMPONENT PRICE DOL. 24,177

COMMISSIONING OF SYSTEMS

SPECTRA PHYSICS WILL MAKE AVAILABLE THE SERVICES OF ITS TECHNICIANS ON THE CUSTOMER'S WORK SITE IN THE DOMINICAN REPUBLIC FOR A FULL COMMISSIONING WORK PROGRAM COMPRISING:

1) INSTALLATION OF THE LASER CONTROL SYSTEMS ONTO THE EARTH-MOVING MACHINERY.
2) TRAINING THE CUSTOMER'S ENGINEERS AND MACHINE OPERATORS IN THE USE OF THE LASER SYSTEMS FOR MACHINE CONTROL OPERATIONS.

DOL. 3,140

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PAYMENT TERMS

CONFIRMED IN REVOCABLE LETTER OF CREDIT [illegible] TO SPECIFIED PRICES, CONDITIONS AND AS INSTRUCTED, [illegible] CELLENTRUCKI ROAD, DAYTON, OHIO 45424 USA, [illegible] TRANSFER FUNDS TO THE FOLLOWING BANK:

WINTERS NATIONAL BANK AND TRUST CO. (ACCOUNT NO. [illegible])
WINTERS BANK TOWER
DAYTON, OHIO 45401

WARRANTY

THESE PRODUCTS ARE GUARANTEED AGAINST DEFECTS IN MATERIALS AND WORKMANSHIP BOTH PARTS AND LABOR, UNDER NORMAL WORKING CONDITIONS, FOR ONE YEAR FROM THE DATE OF DISPATCH TO THE CUSTOMER, EXCEPT AS NOTED HEREIN.

SPECTRA PHYSICS' LIABILITY UNDER THIS WARRANTY IS LIMITED TO REPAIRING OR REPLACING ANY PRODUCT RETURNED TO ITS AUTHORIZED SERVICE CENTER FOR THAT PURPOSE. ANY EVIDENCE OF ATTEMPTS TO REPAIR THESE UNITS BY OTHER THAN FACTORY AUTHORIZED PERSONNEL AUTOMATICALLY VOIDS THIS WARRANTY.

THE FOREGOING STATES THE ENTIRE LIABILITY OF SPECTRA PHYSICS AND IT SHALL NOT BE HELD RESPONSIBLE FOR CONSEQUENTIAL DAMAGES OF ANY KIND. THE FOREGOING IS IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED.

VALIDITY

THIS QUOTATION IS VALID UNTIL SEPTEMBER 1, 1983.

FREIGHT

CIF (AIR FREIGHT) SANTO DOMINGO, DOMINICAN REPUBLIC [illegible]

REGARDS,
JOHN [illegible]
INTERNATIONAL COORDINATOR
TELEX [illegible]

JT4HSTATE LOGN

Best Available Document

ANNEX G

LIST OF LABORATORY EQUIPMENT

Laboratory and Field Equipment for Research Stations and for Centers for Water Management - North and South

Laboratory Equipment Center, South - CIAZA

1	Drying over 200 degrees Thomas; 1787-C20.	$ 360
1	Mill grinding Thomas; 3371-J05.	600
1	PH meter; 4135-C10.	620
1	Shaker mechanical Thomas; 8289-B10.	450
1	Distilling apparatus; 3911-F05.	800
1	Analytical balance; 1339-F52.	3,000
1	Mettler electronic balance; 1344-L50.	2,400
1	Vacuum pump; 1052-E10.	300
1	Conductivity bridge; 3239-F11.	600
1	Flame photometer; 8395-D15.	3,500
1	Spectrophotometer; 8420-H65.	1,200
1	Dessicator; 3750-M30.	200
1	Pressure plate moisture app.	360

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1	Magnetic stirer; 8605-D10.	180
1	Electric hot plate.	120
1	Automatic pipet; 7733-J20.	100
1	Distallator alcohol.	250
1	Barnstead water still Fisher;09026-2.	2,850
8	Voltage stabilizers; 09521-22.	960

Glassware

-	Miscellaneous small equipment, burners berets filtering stands, etc. Fisher.	2,500
-	Chemical reagents filter papers, etc.	4,500
1	Wiley mill; 08336-10.	3,400
1	Soil crusher; 08415.	690
1	Soil sampling equipment, augers, aluminum cans scales, etc.	650
1	Micro Kjeldahl Digester Thomas; 7053-S10.	562
1	Micro Kjeldahl Digester Thomas; 7051-N10.	750
-	Chemical cabinets, local construction.	2,000
-	Glassware & supply storage construction.	2,500
1	Standby generator 6.5 KVA 65,000 watts.	1,995
1	Copy machine, such as Minolta EP 300 RE.	2,550
1	Neutron meter access tubes and augers.	5,250
1	Copy machine, such as Minolta EP 300 RE.	2,550
	Sub-Total	$48,747

Laboratory Equipment Center - North, CENDA

8	Voltage stabilizers Thomas; 09521-22.	$ 960

1	Neutron meter and access tubes & augers.	5,250
-	Soil sampling equipment, such as balance, augers, aluminum cans, etc.	750
-	Replacement parts, expendable supplies and chemicals.	3,100
1	Copy machine, such as Minolta EP300 RE.	2,550
	Sub-Total	$12,610

Field Equipment

1,500'	Gated pipe, 30' lengths, 6" diam.	4,500
1	Wheel move sprinkler system, 10 ha area (North).	25,000
4	Hydrologic recorder, Stevens type, F metric.	1,200
2	Tractor for field preparation, John Deere, model 2150 Hi Lo transmission, one hydraulic output.	31,046
2	14" two bottom plow, two way.	1,760
2	3 pt. cultivator.	4,800
2	Sets harrows.	1,320
2	V ditchers, 3 pt. hitch.	1,250
2	Land plane #329.	7,647
-	Spare parts.	10,120
	Total	$150,000

ANNEX H

CENTERS FOR WATER MANAGEMENT

The proposed Centers for Water Management are located in different irrigation districts, one in the PRYN project near Santiago or Center-North. The other is located in the YSURA project near Azua, Center-South. A brief description of each Center is provided.

- Center for Water Management --North

The Center-North will be physically housed in offices and facilities to be provided by INDRHI in Santiago. It will also have access to and use lands and facilities already developed by INDRHI, such as Finca 1 and Finca 2, for training and demonstration purposes. A large tract of land has been requested for a major demonstration area and when designated will also be part of the Center-North operation. A machinery storage shed and a farm shop will be constructed at the demonstration site to house and care for project machinery and equipment. Also, a small building will be built to provide toilet and wash up facilities, and a small conference or classroom for field instruction.

The Center concept envisions the total locus of the facilities and staff that are available in the project area. This will include, in addition to the facilities described above, the facilities, data and information available through CENDA, the Research Station serving the PRYN project area, ISA --with its teaching facilities and staff capability, IAD with its housing and dormitory facilities, and other agencies and private sector programs that may be of value in carrying out the programs of the Center.

To carry out specific work in Water Management Center will designate a particular lateral or sub-lateral in the PRYN project for intensive study and demonstration activities. On this lateral, in cooperation with the cooperating farmers, specific programs such as land levelling, water control and management will be conducted. The agronomic packages developed through CENDA will be tested and demonstrated. The water delivery systems will be reviewed and their operation checked to assure proper service to the farmer. Based upon common needs and

problems as identified, water users will be provided opportunities to organize and work toward the solution of their problems.

The lateral chosen will actually be one complete system in that it will start at the main diversion into the main delivery canal; then, the lateral turnout and finally to the farmer's fields. The system model will be studied in detail to provide the data needed to implement operational changes in the main irrigation district of PRYN.

Farm machinery to operate the demonstration and training farm will be provided by the project. Also, land levelling equipment for levelling demonstrations will be located at the Center --vehicles, office equipment, laboratory equipment and field study equipment will all be part of the Center provided by project funds.

- Center for Water Management --South

The Center-South will be in the YSURA project near Azua. This Center will require the building of an office building to be located at the research station CIAZA. This location has a power source and several buildings belonging to CIAZA. The Center will also construct a machinery shed and a small shop for field repairs on land to be designated by the GODR as a demonstration and training farm.

The concept is to use all available facilities possible and helpful to carry out project activities. The research station CIAZA, the facilities of IAD, are considered as part of the locus of facilities and activities of value to the Centers program.

As discussed above, the Center will select a pilot lateral or sub-lateral on which to carry out the detailed studies of the project. Again, the lateral will serve as a sub-system, which can be used to analyze the problems of water distribution and on-farm water management. Land levelling demonstrations will be conducted along with water control and management for optimum returns.

Recommended Staffing Pattern for Each Center for Water Management

Director

- GODR (INDRHI, SEA, IAD)
- Project Funded Counterpart - US Contractor

Technical Staff

- Farm Manager, Project Funded - US Contractor
- Agronomist, Assistant Farm Manager - GODR
- Agricultural Economist - GODR
- Rural Sociologist - GODR
- Irrigation Engineer - GODR
- Agricultural Engineer - GODR
- Soils Specialist - GODR
- Drainage and Salinity - GODR

Administrative Staff

3 Secretaries;
1 Bookkeeper;
1 Administrative Assistant;
2 Drivers.

Total Transportation Required for the Two Centers for Water Management (North and South)

	4 3 wheel bike, e.g., Honda Act 110 at $1,050	$ 3,150
4	Motorcycles 70cc Honda at $700	2,800
4	Buses 12 to 15 passengers at $1,500	60,000
	6 4x4 wagons, such as Ford Bronco II at $16,000	96,000
8	Shells for pickups at $250	2,000
2	Two ton trucks at $20,000	40,000
2	Dumptruck Drainage	50,000
	8 Pick ups small, such as Ford Ranger at $9,000	72,000
-	Factory spare parts	59,000
-	Replacement - 4th years	27,000
-	Operation and maintenance	574,000
	- Freight and miscellaneous handling charges	57,050
	Total	$1,286,000

To be divided equally between the two Centers.

Office Equipment and Supplies for Both Centers for Water Management - North and South

2	Copy machines, such as Canon NP 400F		$ 3,500
6	Electric typewriters Selectric type at $1,800		10,800
2	Water coolers at $500		1,000
2	Sets of visitor lounge furniture (chairs, couch and tables) at $1,500		3,000
2	Mini-computers (see description attached, Annex A-3.1)		10,000
-	Individual office furniture for 20 offices:		
	- 1 desk No. 33080	$ 447.84	
	- 1 chair GB27	233.40	
	- 4 office chairs W52 at $59.04	240.00	
	- 2 file cabinets 5412 4 drawer legal at $1,007	2,015.00	
	- 1 fluorescent light 4324 weighted base	79.95	
	- Miscellaneous (waste basket, trays, etc.)	150.00	
	- 1 tape record calculator	175.00	
	- Paper, envelopes and miscellaneous supplies	1,880.00	
	Sub-Total	$ 4,341.19	
	Estimating 20 offices for a total		86,820
			$116,000
-	Communication system for field personnel (CUS system portable)		38,000
			$154,000
-	Office operation and maintenance (5 years)		140,000
	Grand Total		$294,000

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Computer Systems for Dominican Republic Water Management Project

Criteria for Computer Selection.

Hardware

I would recommend that the same type of computer be used in the head office as will be used in the two project areas. This would assure that all software purchased initially, as well as that which may be developed in one or more of the offices, will be useful in the other offices.

It is difficult to determine at this stage the extent to which the computers will be used. What is being recommended below would be minimum specifications for usage.

1. 64k RAM memory expandable;
2. Two disk drives;
3. Monitor capable of supporting 80 column display;
4. Dot matrix printer for field offices. Letter quality printer for head office.

Possible Choices

1. Computer:
   - IBMP ;
   - Victor 9000;
   - Apple IIE with the Z80 card for CPM;
   - Radio Shack Model III;
   - Apple III.

A very important factor in the choice of a computer is service. Also important is the availability of specific types of software.

2. Software:

- Good Word Processor, such as WORDSTAR. This requires a CPM operating system which is available on Apple computers with the addition of a Z80 card.

- Electronic Spreadsheet such as Visicalc, Supercalc, Victorcalc.

- Statistical Analysis package.

- Database Management such as dBASE II.

- An accounting package for the head office.

- Specialized software, such as that developed and used by Bob Hill and Dick Griffin.

3. Printers:
   - Epson MX80 100 (dot matrix).
   - Texas Instruments 810 or 820 (dot matrix).
   - Diablo 630 (letter quality).
   - Radio Shack (dot matrix and letter quality).

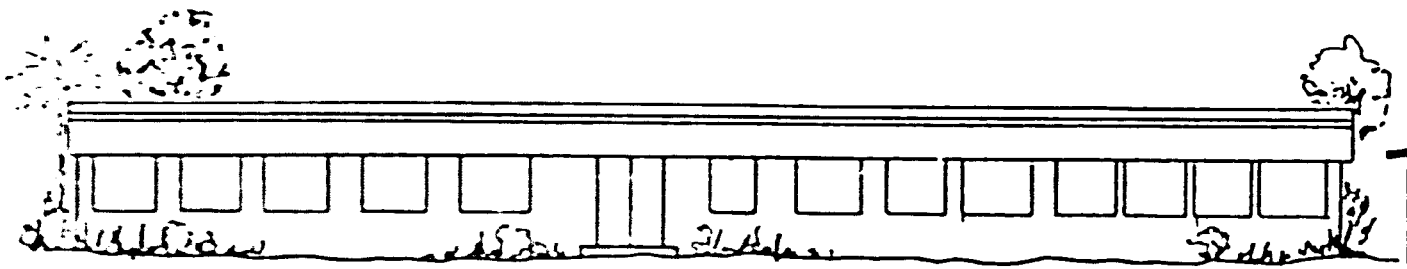
Here again, the choice of a printer would largely depend on service. There are other good ones but we've had real good luck with the first three on the list. Have not used the Radio Shack printer enough to know how reliable they are.

Office Equipment, Supplies, Furniture for National Office Chief of Party

1	Copy machine, such as Canon NP 400 F	3,500
1	Electric typewriter (Selectric type)	1,800
-	Office chairs, desks, cabinets, lights, etc.	3,500
-	Paper supplies, etc.	2,700
1	Water cooler	500
1	Computer (refer to A-3.1)	5,000
-	Operation and maintenance	3,000
-	Replacement and miscellaneous equipment and maintenance	10,000
-	Transportation national office:	
	- 1 station wagon and replacement	30,000
	- O&M (5 years), extra computer time large system as needed.	56,700
	Total	$115,000

Teaching Training Materials

2	Overhead projectors.	$ 880
2	Movie projectors for movies.	2,500
6	Recorders field.	610
2	Portable video communication system.	38,000
2	Audio visual materials.	2,000
-	Transport of farmers to meetings.	10,000
-	Materials, books for water users, file cases, etc.	1,010
-	Miscellaneous fund.	5,000
	Total	$60,000



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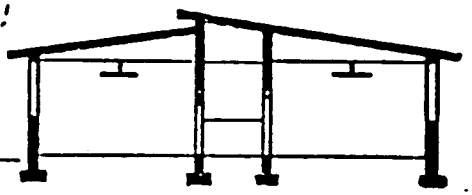

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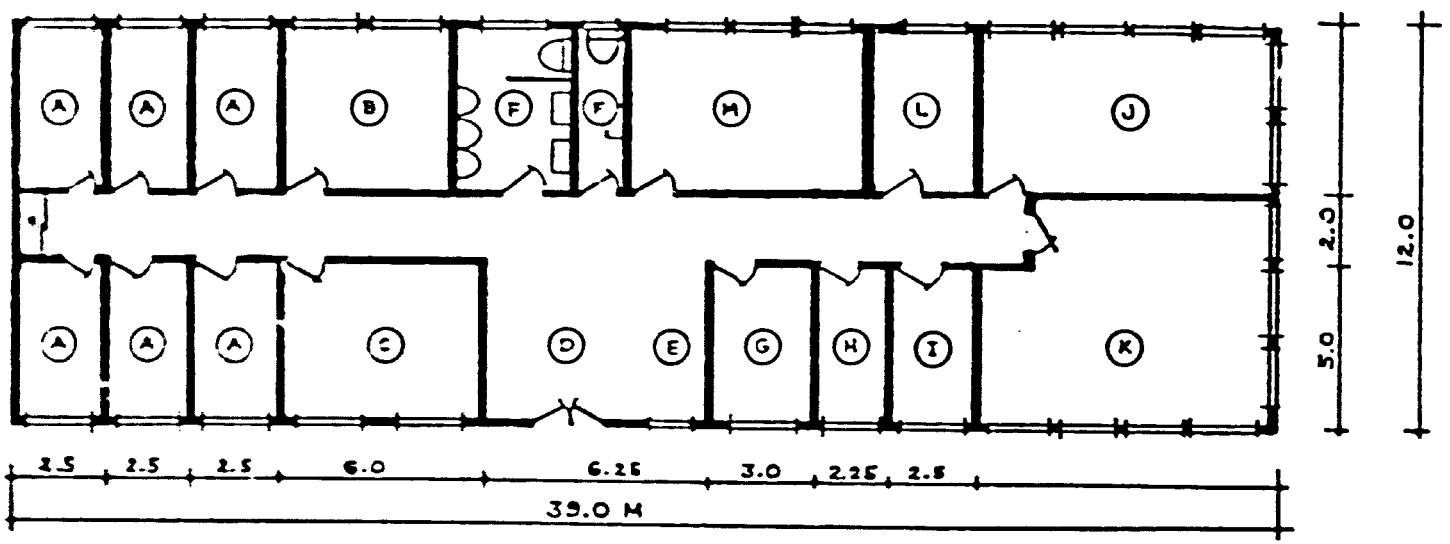


PLANTA

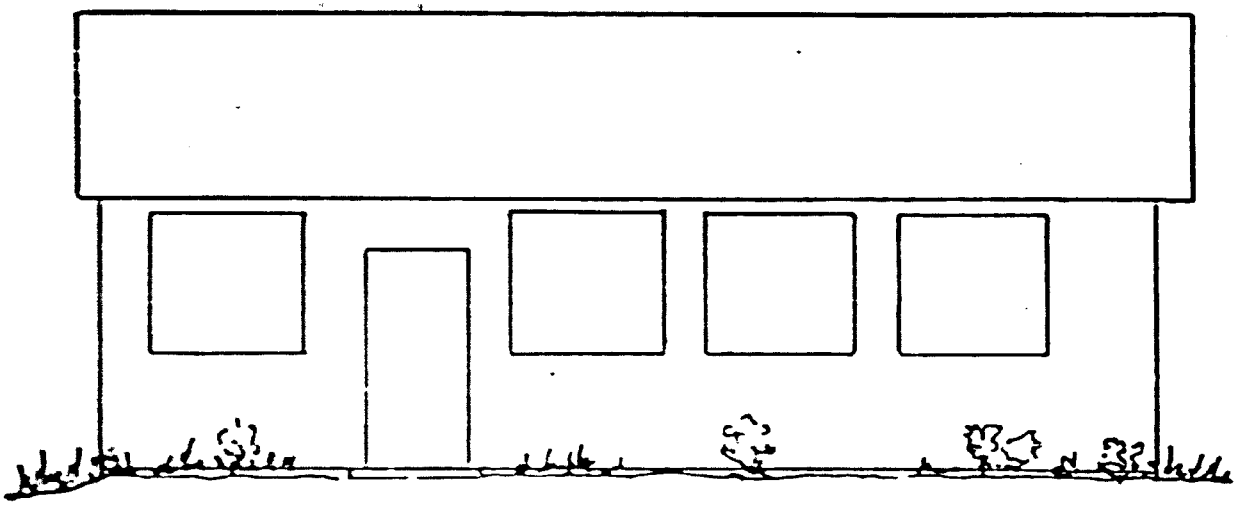
LEYENDA

A. Oficinas (2.5 m x 5 m)
B. Oficina del director (5 m x 5 m)
C. Salón de conferencias (6 m x 5m)
D. Area de recibo (5 m x 5 m)
E. Oficina de secretarias (3.5 m x 5 m)
F. Sanitarios para damas y para caballeros
G. Cuarto de utilidad (copiadora, computadora, mesa de trabajo)
H. Cuarto de abasto (2.5 m x 5 m)
I. Oficina (2.5 m x 5 m)
J. Comedor (9 m x 5 m)
K. Laboratorio de Instruccion (9 m x 7 m)
L. Biblioteca (4.25 x 5 m)
M. Aula de clase y/o conferencias (7.25 m x 5 m)

NOTAS

I. Ventanas de vidrio
II. Blocks de cemento de 8" (20 cm) y 6" (15 cm)
III. Pañete o juntas cojidas pintadas con pintura exterior a prueba de agua
IV. Piso de mosaicos de 25 cm x 25 cm
V. Meseta y fregaderos en marmolite o en marmolit
VI. Divisoria en oficina secretarias sera una barandilla de madera
VII. Plafond atérmico y acústico
VIII. Plomería a construirse e instalarse de acuerdo a las normas estandares
IX. Instalación electrica, lámparas fluorescentes en techo con interruptor en la pared. Tambien toma corriente de pared, corriente 110v
X. Pintura acrílica interior
XI. Portaje exterior de caoba
XII. Portaje interior de plywood estandard o de pin apanelado con llavín de seguridad
XIII. Herraje de calidad aceptable
XIV. La madera para tijerillas sera bruta y tratada contra termitas, hongos, etc.
XV. Asbestos será usado para techar
XVI. Abanicos de techo en cada cuarto

WATER MANAGEMENT CENTER - SOUTH (YSURA)



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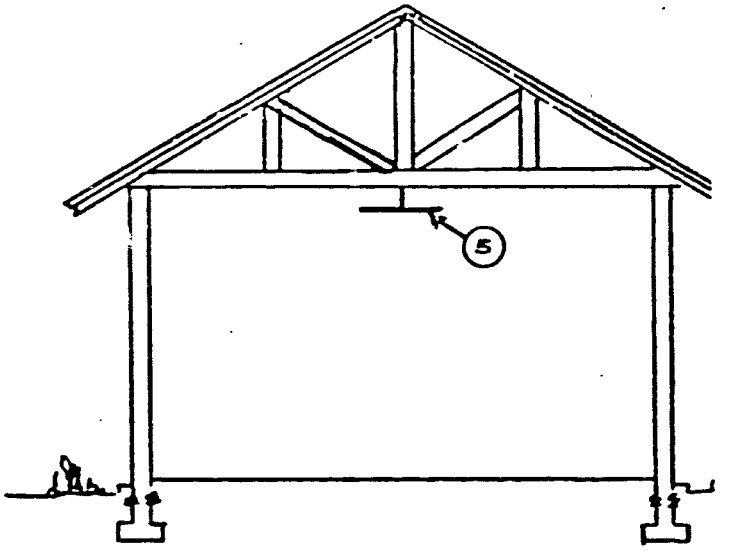

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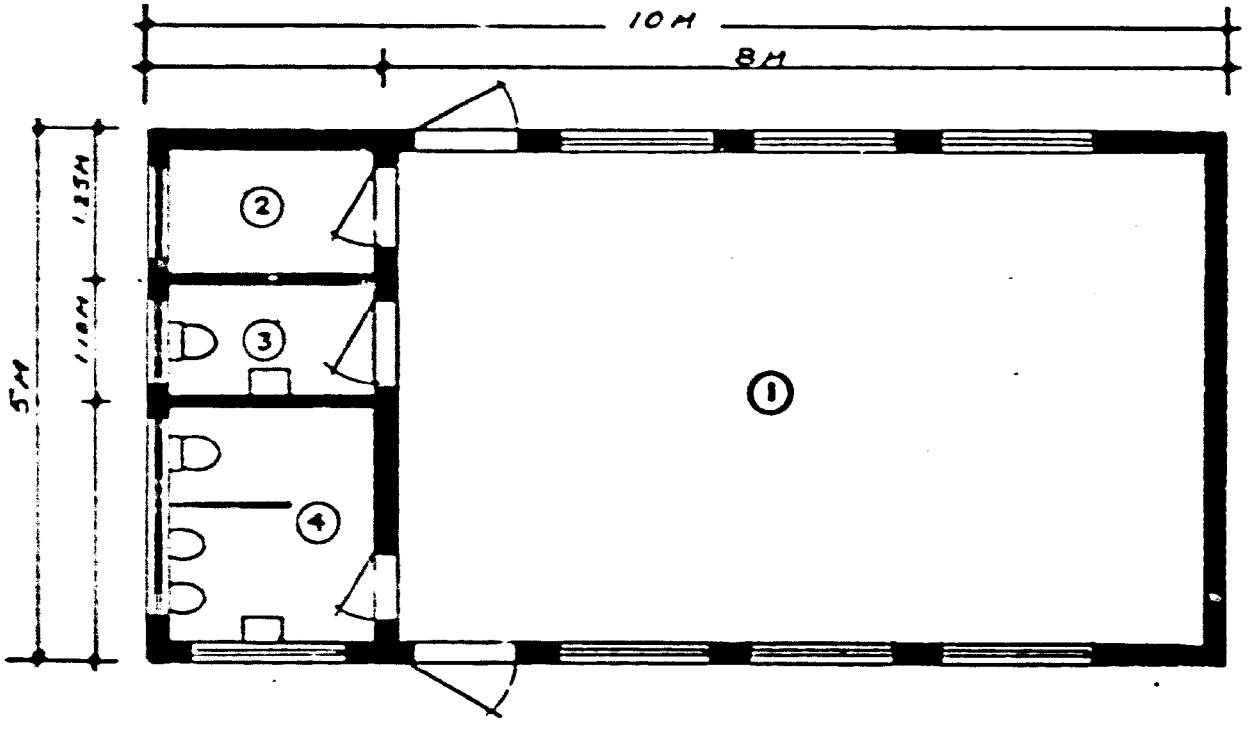


PLANTA

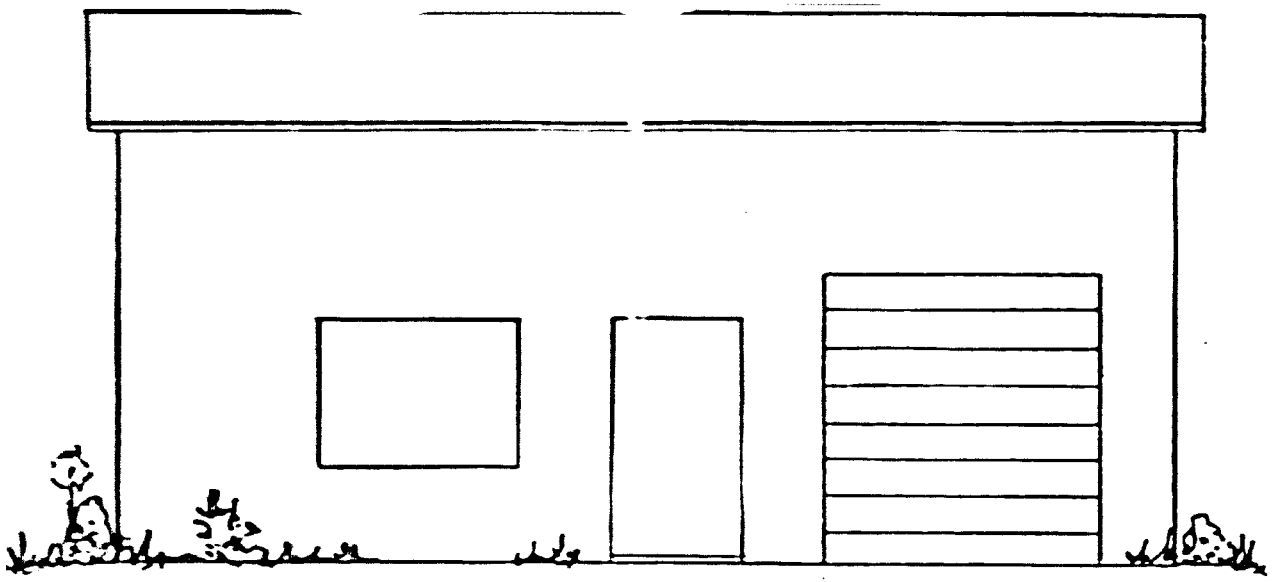
LEYENDA

1. Salón de Clases y Conferencias
2. Area de Almacenamiento
3. Servicio de Damas
4. Servicio de Caballeros
5. Abanico de Techo

NOTAS

I. Ventanas de aluminio esmaltadas
II. Blocks de cemento de 8" (20 cm) y 6" (15 cm)
III. Piso de mosaicos de 25 cm x 25 cm
IV. Pañete o juntas cogidas pintadas con pintura exterior a prueba de agua
V. Plafond atérmico y acústico
VI. Plomería e instalaciones eléctricas a instalarse de acuerdo a normas aceptables, corriente 110V y 220V
VII. Pintura acrílica interior
VIII. Portaje de pino para exterior con llavín y de plywood para las demás
IX. La madera para tijerillas será bruta y tratada contra termitas, hongos, etc.
X. Asbestos será usado para techar
XI. Herraje de calidad aceptable

CONFERENCE AND CLASSROOM (PRYN)



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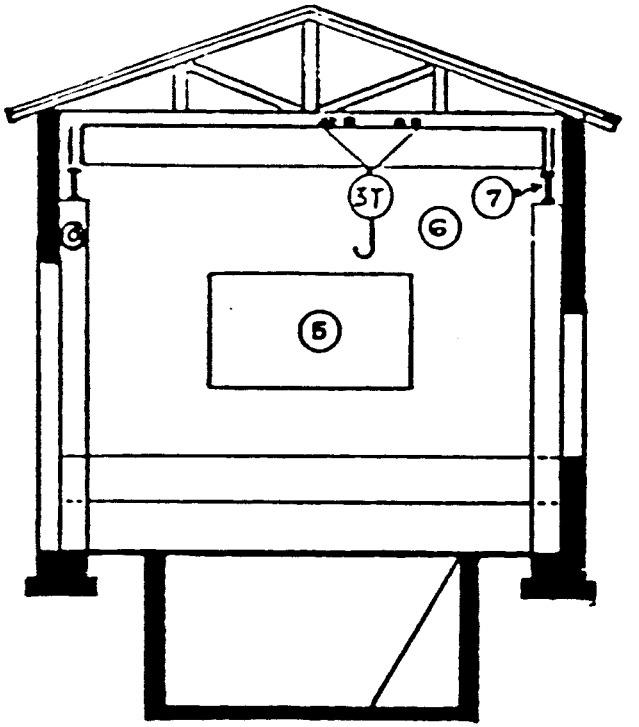

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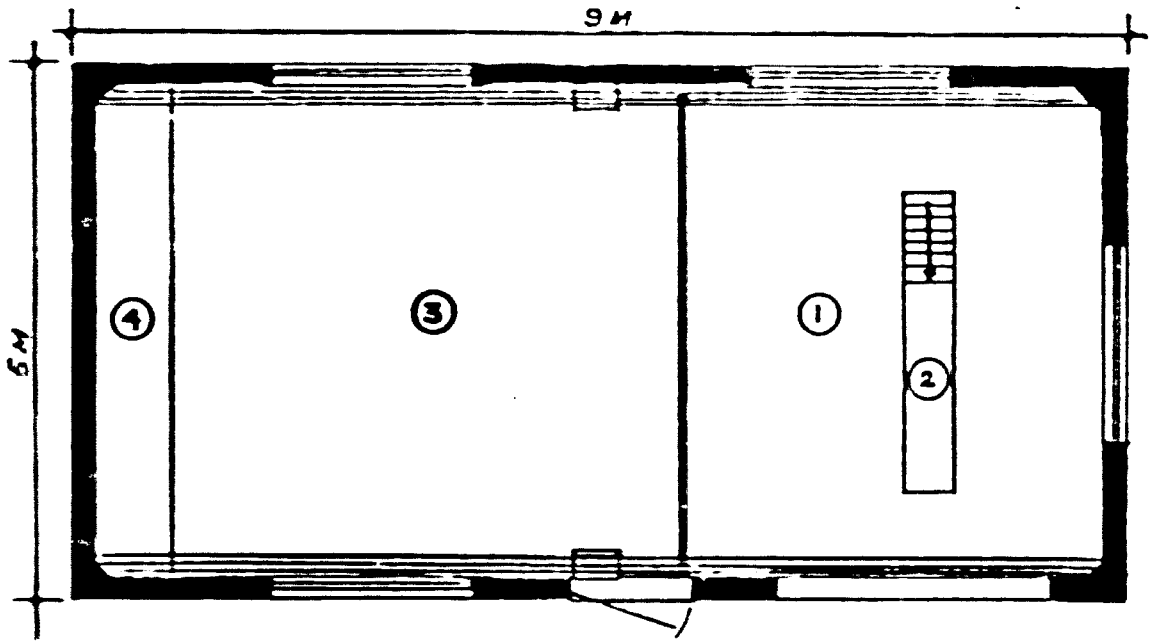

PLANTA

DEMONSTRATION FARM REPAIR SHOP - PRYN AND YSUPA

LEYENDA

1. Area para trabajar a los tractores y vehiculos al servicio del proyecto
2. Foso de trabajo
3. Area de trabajos de mecanica
4. Mesa de trabajo fabricada en madera cepillada de 2" x 6" y con dos tramos
5. Tablero para colocar las herramientas mecanicas
6. Grua viajera (aparejo) de hasta 3 toneladas de capacidad para desmontar motores de tractores con fines de reparacion
7. Viga I para correr la grua viajera (aparejo) con los rieles

NOTAS

I. Ventanas de aluminio esmaltadas
II. Blocks de cemento de 6" (15 cm)
III. Pañetes o juntas cojidas pintadas con pintura exterior a prueba de agua
IV. Columnas y vigas en hormigon armado
V. Piso de hormigon armado capaz de resistir golpes de herramientas
VI. Instalaciones electricas, lámparas fluorescentes, etc. a instalarse de acuerdo a normas aceptables. Corriente 110V y 220V
VII. Pintura aceite para el interior
VIII. Puerta arrovable metal galvanizado
IX. Puerta madera pino con llavín de seguridad
X. Asbesto será usado para techar
XI. La madera para tijerillas sera bruta y tratada contra termitas, hongos, etc.

COST ESTIMATES - CONSTRUCTION

Demonstration Farm Repair Shops - PRYN and YSURA

Site preparation	-	RD$ 500	
Parking area Leveling and Gravel	-	2,000	
Fencing, 100 L.M. 35 L.M.	-	3,500	
45 M^2 Construction 200/M^2	-	9,000	
Overhead Crane & Beams	-	5,000	
Water and Electrical Connection	-	2,000	
Sewage	-	1,500	
Access	-	5,000	
		28,500 x 2 Centers	RD$ 57,000

Conference/Classroom Building - PRYN

Site Preparation	-	750	
Parking Area Leveling and Gravel	-	2,500	
Sidewalks	-	750	
Fencing - 120 L.M. at 35/L.M.	-	4,200	
50 M^2 Construction - 280/M^2	-	14,000	
Water and Electrical Connection	-	2,000	
Sewage	-	1,500	
Access	-	5,000	
		30,700	30,700

Water Management Center South - YSURA

Site Preparation	-	1,000	
Parking Area Leveling and Gravel	-	3,000	
Parking Shelter 36 M^2 x 50	-	1,800	
Sidewalks	-	1,000	
Fencing - 162 L.M. at 35 L.M.	-	5,670	
468 M^2 Construction - 300/M^2	-	140,400	
Water and Electrical Connection	-	2,500	
Sewage	-	3,000	
14 KW Emergency Generator	-	20,000	
Access	-	5,000	
		183,370	183,370
			271,070
		10% Contingencies	27,107
		TOTAL	RD$298,177

CENTER'S FURNISHINGS

Professors'Desks (2) at 350	RD$ 700
Professors' Chairs (2) at 150	300
Bookshelves (2 sets)	400
Student Chairs (60) at 50	3,000
Secretarial Desks (5) at 250	1,250
Secretarial Chairs (5) at 100	500
File Cabinets (4) at 160	640
Conference Table for 12	800
Conference Chairs (12) at 100	1,200
Storage Area Shelving	700
Computer Table, Chairs, etc.	1,500
Library Shelves	3,000
Library Tables (2) and 12 Chairs	2,400
Dining Tables (6) at 125	750
Dining Chairs (24) at 75	1,800
Laboratory Tables (4) at 300	1,200
Lab Stools (12) at 125	1,500
Miscellaneous	5,000
	26,640
Contingencies	2,664
TOTAL	RD$29,304

ANNEX I

FUNCTIONS OF AGENCY, COMMUNITY COORDINATING COMMITTEE

This committee must be carefully organized so it can bring together the resources of government, with the private sector. It shall be composed of representatives from the following:

1. INDRHI;
2. SEA (Extension or Regional officer);
3. IAD;
4. ISA;
5. CENDA;
6. Farmers representative chosen from the pilot sub-lateral.

A chairman shall be elected by the members to serve a one year term --this position shall then, be rotated among the group until all have participated.

The committee functions shall be:

1. To review the plan of work for the Center as developed by the Co-Directors and their staff.

2. To meet every 2 months (or as needed) to hear progress reports from the Co-Directors and to discuss ways to assist the development of the project. This will include providing basic staff support from their respective agencies for work on the project.

3. When the committee finds problems that are delaying the project or they do not think the project is progressing as it should, they can file a report with the project leaders and request a review. This will pertain to complaints, etc.

4. After the 1st. year the committee should review their actions and determine how effective they have been, and restructure the working of the committee by establishing its own by laws.

ANNEX J

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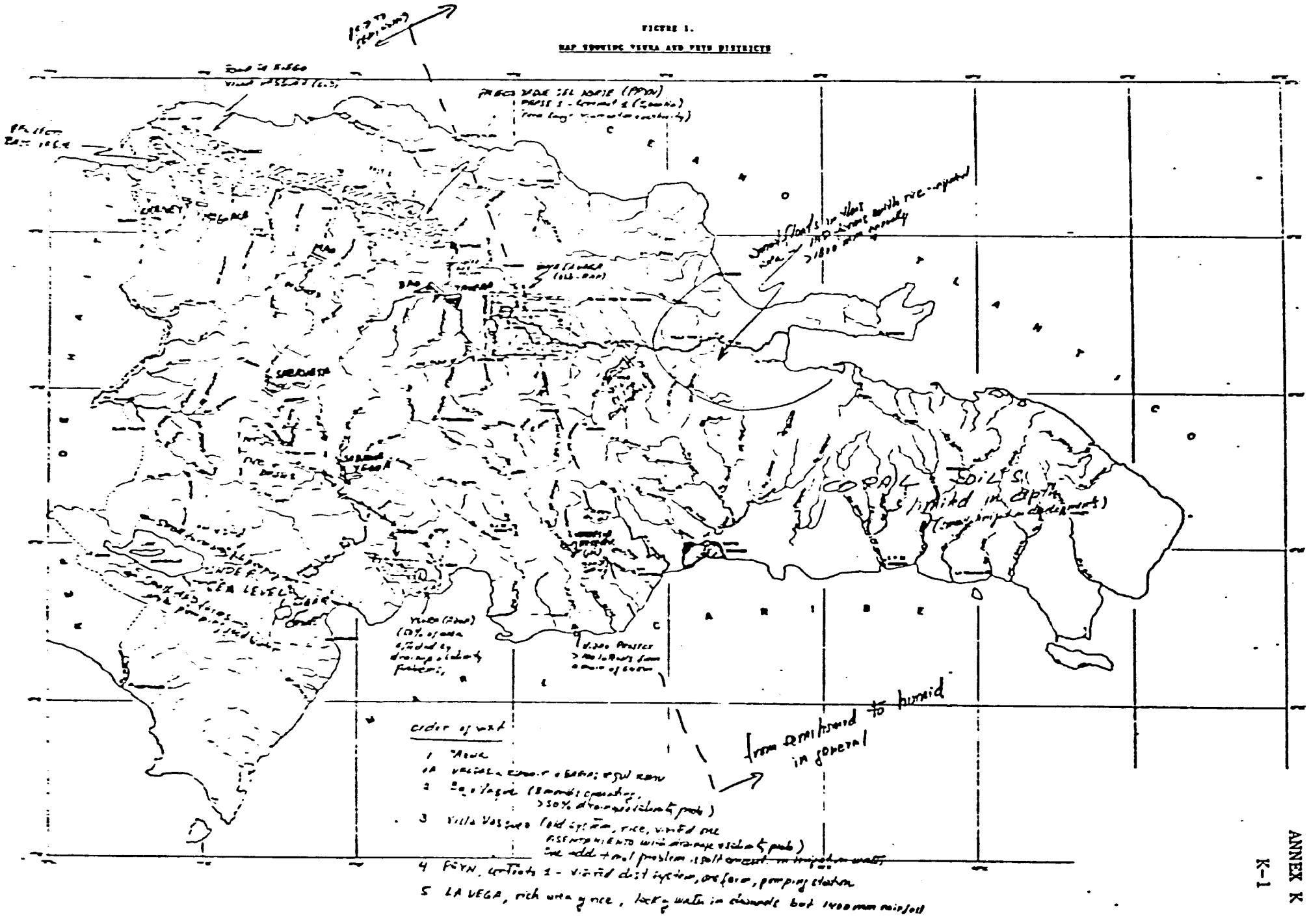
Best Available Document

FIGURE 1.

MAP SHOWING VEGA AND PEYN DISTRICTS



5C(2) - PROJECT CHECKLIST

Listed below are statutory criteria applicable generally to projects. This section is divided into two parts. Part A. includes criteria applicable to all projects. Part B. applies to project funded from specific sources only: B.1. applies to all projects funded with Development Assistance Funds, B.2. applies to projects funded with Development Assistance Loans, and B.3. applies to projects funded from ESP.

CROSS REFERENCES:
IS COUNTRY CHECKLIST UP TO DATE? Yes.
HAS STANDARD ITEM CHECKLIST BEEN REVIEWED FOR THIS PROJECT? Yes.

A. GENERAL CRITERIA FOR PROJECT

1. FY 82 Appropriation Act Sec. 523; FAA Sec. 634A; Sec. 653(b).

   (a) Describe how authorizing and appropriations Committees of Senate and House have been or will be notified concerning the project; (b) is assistance within (Operational Year Budget) country or international organization allocation reported to Congress (or not more than $1 million over that amount)?

   (a) The project was included in the FY 83 Congressional Presentation as an FY 83 project. A Congressional Notification is required.

   (b) An Advice of Program Change will be submitted for the change in funding.

2. FAA Sec. 611(a)(1). Prior to obligation in excess of $100,000, will there be (a) engineering, financial, other plans necessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?

   (a) Yes.

   (b) Yes.

3. FAA Sec. 611(a)(2). If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance?

   The loan agreement will need to be ratified by the GODR Congress. This is a standard GODR procedure and should not present any problems.

4.	FAA Sec. 611 (b); FY 1982 Appropriation Act Sec. 501. If for water or water-related land resource construction, has project met the standards and criteria as set forth in the Principles and Standards for Planning Water and Related Land Resources dated October 25, 1973? (See AID Handbook 3 for new guidelines.)	Not Applicable.
5.	FAA Sec. 611(e). If project is capital assistance (e.g., construction), and all U.S. assistance for it will exceed $1 million, has Mission Director certified and Regional Assistant Administrator taken into consideration the country's capability effectively to maintain and utilize the project?	Yes. See Mission Director's certification in the Project Paper.
6.	FAA Sec. 209. Is project susceptible of execution as part of regional or multilateral project? If so why is project not so executed? Information and conclusion whether assistance will encourage regional development programs.	The Project cannot be executed as part of a regional project.
7.	FAA Sec. 601(a). Information and conclusions whether project will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; (c) encourage development and use of cooperatives, credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture and commerce; and (f) strengthen free labor unions.	This project will indirectly increase the flow of international trade by encouraging increased agricultural production. The project will encourage private small farmer initiatives in water management and increased agriculture production. It will improve the technical efficiency of agriculture through improved farming, and water management practices. Further, the project will discourage monopolistic practices, and will encourage community action with respect to irrigation water management. The project will encourage water user associations and will not have any direct effect on free labor unions.

8.	FAA Sec. 601 (b). Information and conclusion on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).	It is anticipated that the technical assistance and equipment for the project will be procured from U.S. private sector sources.
9.	FAA Sec. 612(b); Sec. 636(h); FY 1982 Appropriation Act Sec. 508. Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized in lieu of dollars.	The loan agreement will require that counterpart contribution will be used.
10.	FAA Sec. 612(d). Does the U.S. own excess foreign currency of the country and, if so, what arrangements have been made for its release?	There is no excess, U.S. owned local currency available for this program.
11.	FAA Sec. 601(e). Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise?	Yes.
12.	FY 1982 Appropriation Act Sec. 522. If assistance is for the production of any commodity for export, is the commodity likely to be in surplus on world markets at the time the resulting productive capacity becomes operative, and is such assistance likely to cause substantial injury to U.S. producers of the same, similar, or competing commodity?	No.

13.	FAA 118(c) and (d). Does the project comply with the environmental procedures set forth in AID Regulation 16? Does the project or program take into consideration the problem of the destruction of tropical forests?	Yes.
14.	FAA 121(d). If a Sahel project, has a determination been made that the host government has an adequate system for accounting for and controlling receipt and expenditure of project funds (dollars or local currency generated therefrom)?	N/A

B. FUNDING CRITERIA FOR PROJECT

1. Development Assistance Project Criteria

a. FAA Sec. 102(b); Sec. 111; 113; 281 (a). Extent to which activity will (a) effectively involve the poor in development, by extending access to economy at local level, increasing labor-intensive production and the use of appropriate technology, spreading investment out from cities to small towns and rural areas, and insuring wide participation of the poor in the benefits of development on a sustained basis, using the appropriate U.S. institutions; (b) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and otherwise encourage democratic private and local governmental institutions; (c) support the self-help efforts of developing countries; (d) promote the participation of women in the national economies of developing countries and the improvement of women's status; and (e) utilize and encourage regional cooperation by developing countries?

This project is directed to the promotion of the participation of the rural poor in the benefits of development. This will be accomplished through the planning and implementation of farm level water management activities in two pilot areas. The resulting gain from this improved water management will include increased income from agricultural production and increased employment; the reliance of this project on community and/or local private groups and governmental institutions for planning and implementation will encourage rural poor participation at the individual, group and community level. This program is designed to reinforce the concept of community participation. This project will also promote the participation of women in cooperative type units and educational programs. This project will indirectlypromote regional cooperation by increasing the flow of interregional trade and by fostering cooperative efforts to tackle similar problems within the region through the interchange of experience and information.

b. FAA Sec. 103, 103A, 104, 105, 106. Does the project fit the criteria for the type of funds (functional account) being used?
(103) for agriculture, rural development or nutrition; if so, extent to which activity is specifically designed to increase productivity and income of rural poor; (103) A) if for agricultural research, is full account taken of needs of small farmers?

The proposed loan program directly addresses the problem of income, productivity and quality of life for the poor in rural areas. Through improved water management at the farm level this project will increase the productivity and income of the small farm families living in the project areas.

c. FAA Sec. 107. Is appropriate emphasis on use of appropriate technology? (relatively smaller, cost-saving, labor-using technologies that are generally most appropriate for the small farms, small businesses, and small incomes of the poor)?	Yes
d. FAA Sec. 110(a). Will the recipient country provide at least 25% of the costs of the program, project, or activity with respect to which the assistance is to be furnished (or is the latter cost-sharing requirement been waived for "relatively least-developed" country)?	Yes
e. FAA Sec. 110(b). Will grant capital assistance be disbursed for project over more than 3 years? If so, has justification satisfactory to Congress been made, and efforts for other financing, or is the recipient country "relatively least-developed?" (M.O. 1232.1 defined a capital project as "the construction, expansion, equipping or alteration of a physical facility or facilities financed by AID dollar assistance of not less than $100,000, including related advisory, managerial and training services, and not undertaken as part of a project of a predominantly technical assistance character.	N/A

f. FAA Sec. 122(b). Does the activity give reasonable promise of contributing to the development of economic resources, or to the increase of productive capacities and self-sustaining economic growth?	The project directly recognizes and utilizes the needs, desires and capabilities of the population and of the implementing agencies.
g. FAA Sec. 281(b). Describe extent to which program recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage institutional development; and supports civil education and training in skills required for effective participation in governmental processes essential to self-government.	Yes. The project should contribute directly to the development of economic resources and to increasing the productive capacity of the Dominican Republic.
2. Development Assistance Project Criteria (Loans Only)	
a. FAA Sec. 122(b). Information and conclusion on capacity of the country to repay the loan, at a reasonable rate of interest.	The Dominican Government and the Central Bank are not in default on any AID loans and appear capable to repay the proposed loan.
b. FAA Sec. 620(d). If assistance is for any productive enterprise which will compete with U.S. enterprises, is there an agreement by the recipient country to prevent export to the U.S. of more than 20% of the enterprise's annual production during the life of the loan?	Not applicable.

3. Economic Support Fund Project Criteria

a. FAA Sec. 531(a). Will this assistance promote economic or political stability? To the extent possible, does it reflect the policy directions of section 102?	Not applicable.
b. FAA Sec. 531 (c). Will assistance under this chapter be used for military, or paramilitary activities?	No.
c. FAA Sec. 534. Will ESP funds be used to finance the construction of the operation or maintenance of, or the supplying of fuel for, a nuclear facility? If so, has the President certified that such use of funds is indispensable to nonproliferation objectives.	N/A
d. FAA Sec. 609. If commodities are to be granted so that sale proceeds will accrue to the recipient country, have Special Account (counterpart) arrangements be made?	N/A

CERTIFICATION PURSUANT TO

Section 611 (e) of the

FOREIGN ASSISTANCE ACT

As Amended

I, Philip R. Schwab, the principal officer of the Agency for International Development in the Dominican Republic, do herewith certify that in my judgment, the Dominican Republic has both the financial capability and human resources to maintain and utilize effectively goods and services procured under the capital assistance project entitled On-Farm Water Management.

This judgment is based upon the record of implementation of AID financed projects in the Dominican Republic and the results of the consultations undertaken during intensive review of this new project.

Philip R. Schwab
Director, USAID Dominican Republic

6/30/83
Date

Department of State
INCOMING TELEGRAM
American Embassy Santo Domingo

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SUBJECT: DOMINICAN REPUBLIC ON-FARM WATER MANAGEMENT PID GUIDANCE CABLE

1. THE DAEC REVIEW OF THE SUBJECT PID WAS HELDE ON FEBRUARY 15, 1983. THE PID WAS APPROVED AND, SUBJECT TO THE FOLLOWING CONDITIONS AND GUIDANCE (PARTICULARLY PARA. 3 BELOW), THE MISSION MAY PROCEED WITH INTENSIVE REVIEW, AND APPROVE AND AUTHORIZE THE PROJECT IN THE FIELD.

2. CONSTRAINTS ANALYSIS: THE PP SHOULD INCLUDE AN ANALYSIS OF THE CONSTRAINTS TO: (1) INCREASING AGRICULTURAL PRODUCTION IN THE DOMINICAN REPUBLIC (DR), IN GENERAL AND (2) IMPROVING WATER MANAGEMENT ON IRRIGATED LANDS, SPECIFICALLY. IN PARTICULAR, THIS ANALYSIS SHOULD EXAMINE THE EFFECTS OF THE FOLLOWING TWO FACTORS ON THE ABOVE OBJECTIVES:

-- A) AGRICULTURAL PRICING POLICIES- THE EXTENT TO WHICH GOVERNMENT OF DOMINICAN REPUBLIC (GODR) AGRICULTURAL PRICING POLICIES, PARTICULARLY AS THEY APPLY TO RICE, SERVE AS DISINCENTIVES TO INCREASED PRODUCTION SHOULD BE EXAMINED AND CLARIFIED IN THE PP. THE EFFECT OF GOVERNMENT SET AGRICULTURAL PRICES OVER THE LIFE OF THE PROJECT SHOULD BE ANALYZED IN TERMS OF COSTS OF PRODUCTION INPUTS TO THE FARMER RELATIVE TO THE PRICES RECEIVED FOR HIS OUTPUT. PREPARATION OF FARM BUDGETS FOR REPRESENTATIVE FARMS SHOULD INDICATE THE EFFECTS OF THESE PRICING POLICIESS ON PRODUCTION PATTERNS AND FAMILY INCOMES. IF THE CONCLUSION IS REACHED THAT GODR PRICING POLICIES ARE OR COULD BE A MAJOR CONSTRAINT TO INCREASED AGRICULTURAL PRODUCTION IN THE PROJECT AREA AT ANY TIME DURING THE LIFE OF THIS PROJECT, A COMMITMENT SHOULD BE OBTAINED FROM THE GODR THAT PRICE CEILINGS WILL BE REVIEWED AND REVISED, ON A CROP SPECIFIC BASIS, AS NECESSARY FOR PROJECT SUCCESS. THE PROJECT AGREEMENT SHOULD INCLUDE A COVENANT REFLECTING SUCH A COMMITMENT BY THE GODR.

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----B) ADEQUACY OF WATER USER CHARGES AND COLLECTION PRACTICES: THE PP SHOULD DISCUSSS THE CONSEQUENCES OF BOTH THE LOW RATES SET FOR WATER USER FEES AND LOW LEVEL OF COLLECTION CITED IN THE PIEAND INDICATE HOW THE PROJECT WILL IMPROVE THIS SITUATION. THE EEXTENT TO WH USER FEE LEVELS SHOULD BE INCREASED AND COLLECTION PRACTICES UPGRADED TO PROVIDE ADEQUATE INCENTIVES TO THE FARMER TO PRACTICE IMPROVED WATER MANAGEMENT SHOULD BE ANALYZED DURING THE INTENSIVE REVIEW. IN ADDITION, THE PP SHOULD EXPLAIN HOW THE REVENUES COLLECTED B THE GODR WILL BY DISTRIBUTED FOR USE (I.E., AT THE WATER USER ASSOCIATION LEVEL, REGIONAL LEVEL, OR NATIONAL LEVEL). COORDINATION AND COLLABORATION TH OTHER DONORS INVOLVED IN FINANCING THE GODR'S MAJOR IRRIGATION PROGRAMS SHOULD ALSO BE EXPLORED AS A MEANS OF EFFECTING CHANGE IN WATER USER V ARGES AND COLLECTION RATES.

3. ESTABLISHMENT OF A SPECIAL CREDIT FUND: MAJOR QUESTIONS WERE RAISED AT THE DAEC REVIEW ABOU THE INCLUSON OF THIS COMPONENT IN THE PROJECT AND A DECISION WAS MADE THAT IT SHOULD BE EXCLUDED FROM A.I.D. FINANCING, IF POSSIBLE. IT IS RECOMMENDED THAT OTHER SOURCES OF FINANCING, EITHER DOMINICAN OR FROM OTHER DONOR AGENCIES, BE SOUGHT TO PROVIDE NECESSARY CREDIT RESOURCES. IF, DURING THE INTENSIVE REVIEW, IT IS DECIDED THAT A.I.D. FUNDS ARE REQUIRED FOR ACREDIT COMPONENT TO THIS PROJECT, THE MISSION SHOULD SEND AN INTERIM CABLE TO THE BUREAU JUSTIFYING ITS INCLUSION AND PROVIDING INFORMATION REGARDING THE FOLLOWING: (1) THE TYPES OF INVESTMENTS THAT WILL BE ELIGIBLE FOR FINANCING BY THE CREDIT FUND; (2) THEE SUBLENDING INTEREST RATE AN CRITERIA THAT WILL BE APPLIED; (3) AN INSTITUTIONAL ANALYSIS OF THE ENTITY THAT WILL MANAGE THE CREDIT FUND (STRONG PREFERENCE SHOULD BE GIVEN TO A PRIVATE FINANCIAL INSTITUTIOND; AND (4) IF ESTABLISHED WITHIN THE GODR AGRICULTURAL DEVELOPMENT BANK, THE RECURRENT COST IMPLICATIONS FOR THE GODR OF MAINTAINING THE VALUE OF THIS CREDIT FUND BEYOND THE IFE OF THE PROJECT.

4. INTRODUCTION OF WATER USER ASSOCIATIONS: THE POTENTIALLY NEGATIVE CONSEQUENCES OF OVERTAXING THE CAPACITY OF THESE NEW ORGANIZATIONS SHOULD BE TAKEN INTO CONSIDERATION WHEN DEFINING THEIR RESPONSIBILITIES BEYOND THEIR PRIMARY FUNCTION OF COORDINATING AND SCHEDULING WATER USAGE AMONG COMPETING USERS (E.G., THEIR LEVEL OF INVOLVEMENT IN LAND LEVELING ACTIVITIES). IN ADDITION, SINCE WATER USER ASSOCIATIONS REPRESENT A NEW FORM OF SOCIAL INTERACTION FOR PROJECT BENEFICIARIES, THEIR SOCIAL ACCEPTABILITY BY DOMINICAN FARMERS SHOULD BE ANALYZED. INFORMATION ON EXPERIENCES OF WATER USER ASSOCIATIONS IN OTHER COUNTRIES, PARTICULARLY THE PHILIPPINES, SRI LANKA AND EGYPT, IS BEING FORWARDED TO THE MISSION FROM ST/AGR.

5. LAND LEVELING ACTIVITIES: A.I.D. EXPERIENCES ELSEWHERE, PARTICULARLY IN ASIA, OF CARRYING OUT LAND LEVELING ACTIVITIES THROUGH PUBLIC SECTOR INSTITUTIONS HAVE BEEN GENERALLY UNSUCCESSFUL. THEREFORE, THE MISSION SHOULD ANALYZE FULLY THE ALTERNATIVES OFFERED BY THE PRIVATE SECTOR TO DO LAND LEVELING IN THE DR. THE PROJECT SHOULD NOT FINANCE THE ESTABLISHMENT OF GODR EQUIPMENT POOLS WHICH, BASED ON PREVIOUS WORLD-WIDE EXPERIENCES, ARE GENERALLY POORLY MAINTAINED AND IMPROPERLY USED.

6. PROJECT HEALTH CONSIDERATIONS: SINCE HEALTH CONSIDERATIONS ARE NOT A DIRECT CONCERN OF THIS PROJECT, IN THE INTEREST OF MINIMIZING THE COMPLEXITY OF PROJECT DESIGN AND IMPLEMENTATION, A SPECIFIC PROJECT HEALTH COMPONENT SHOULD NOT BE ADDED. INSTEAD, PUBLIC HEALTH ASPECTS SHOULD BE ADDRESSED THROUGH ONGOING GODR HEALTH ACTIVITIES AND/OR THE HEALTH SECTOR III PROJECT CURRENTLY IN DESIGN. THE MISSION, HOWEVER, SHOULD ASSESS THE IMPACT OF THIS PROJECT ON HEALTH CONDITIONS (SCHISTO, MALARIA, OTHER WATER BORNE DISEASES) IN THE PROJECT AREA AND BRING IDENTIFIED HEALTH CONCERNS TO THE ATTENTION OF THE GODR SO THAT IT CAN PROVIDE INFORMATION TO THE TARGET POPULATIONS ON PREVENTIVE HEALTH MEASURES RELATED TO PROPER USES OF IRRIGATION WATERS. THE ON-FARM WATER MANAGEMENT PP SHOULD CLARIFY THROUGH WHAT PROJECTS AND ACTIVITIES HEALTH CONCERNS WILL BE ADDRESSED.

7. PROJECT EVALUATION: EVALUATION WILL BE A PARTICULARLY IMPORTANT COMPONENT OF THIS PROJECT GIVEN ITS DIAGNOSTIC ORIENTATION AND THE ANTICIPATED COMPLEXITY OF PROJECT IMPLEMENTATION. THUS, BUDGETING OF SUFFICIENT RESOURCES FOR CARRYING OUT EVALUATIONS SHOULD BE ENSURED. THROUGH THE WATER MANAGEMENT SYNTHESIS II PROJECT, S&T/AGR WOULD BE AVAILABLE TO ASSIST THE MISSION IN DEVELOPING AN EVALUATION METHODOLOGY TO BE APPLIED TO THIS PROJECT.

8. THE MISSION APPEARS TO BE GETTING FURTHER INVOLVED WITH ENVIRONMENTALLY-RELATED ACTIVITIES THROUGH THE PROPOSED PROJECT, THE ONGOING NATURAL RESOURCE MANAGEMENT PROJECT, AND ANOTHER PLANNED FOR 1984. REQUEST MISSION ASSESS THE NEED FOR ACQUIRING A NATURAL RESOURCES ADVISOR (TO BE FINANCED THROUGH ONE OF THE FY 1984 PROJECTS) TO OVERSEE THESE ACTIVITIES AS THE HONDURAS, ECUADOR, AND PERU MISSIONS HAVE DONE.

9. IF POSSIBLE, THE MISSION IS ENCOURAGED TO ACCELERATE SIGNING OF PROJECT AGREEMENT, CURRENTLY SCHEDULED FOR JULY 1983, TO JUNE 1983. PLEASE ADVISE IF MISSION UNABLE TO MEET JUNE OBLIGATION TARGET DATE.

10. FYI: ALL LAC MISSION PID APPROVALS ARE SUBJECT TO BUREAU REVALIDATION IF POST-PID PROJECT DEVELOPMENT PROCESS EXTENDS BEYOND ONE YEAR. END FYI. DAM

ANNEX O

SUMMARY OF HOW DAEC CONCERNS WERE DEALT WITH DURING INTENSIVE REVIEW

1. Agricultural Pricing Policies

As indicated in the Economic Analysis section of the Project Paper (section IV.D.2.j.), the extent to which GODR agricultural pricing policies serve as a disincentive to increased production was tested through the economic sensitivity analysis at the farm level when prices were assumed not to increase as much as costs. Even when prices were held constant while costs were allowed to increase at 8% and yields were assumed to increase by only 30%, the result was an IRR of 19%. Thus, the Mission concluded that GODR pricing policies would probably not be a major constraint to increased production in the project area during the life of the project. Nevertheless, as indicated in the Project Paper, an important topic for the periodic evaluation will be a review by the GODR of the price ceilings on a crop specific basis.

2. Adequacy of Water User Charges

The Technical Analysis (section IV.A.a.1. of the Project Paper) discusses this concern. The GODR has agreed to charge for water on a volume basis within the pilot project areas. By the end of the third project year the GODR, with the assistance of the technical advisors, will evaluate the water user fee structure and make recommendations for application nationwide.

3. Establishment of a Special Credit Fund

This activity is described in section III.B.4. of the Project Paper. As recommended by the DAEC, this activity will be entirely funded with GODR resources.

4. Introduction of Water User Associations

The project design team recognized the potentially negative consequences of overtaxing the capacity of these

new organizations (see Social Soundness Analysis, section IV.B.2.e.). Accordingly the project design provides for extensive surveying and analysis of farmers experiences and based on this data the development of up to three organizational models in each pilot area.

5. Land Levelling Activities

Land levelling on the pilot laterals will be carried out by the Center with project funded equipment. Land levelling funded under the credit fund will be carried out by private contractors.

6. Project Health Considertions

This concern is discussed in section IV.E. of the Project Paper.

7. Project Evaluation

The project budget includes $100,000 for evaluations. The Water Management Syntnesis II project (S&T/AGR) assisted in developing the evaluation methodology to be applied to this project and it is anticipated they will participate in carrying out the evaluations.

Department of State INCOMING TELEGRAM

American Embassy Santo Domingo

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ACTION: AID-8

INFO: AMB X, DCM X, POL, BIO, ECON, FCS, CONS, AC X, BMO, CPU, GSO, PER, RSO, RMO, NCOIC, AGATT, DAO, MAAG, USICA, PC, IAGS, DIR ✓, AD ✓, PRG, CRD, CONT ✓, AGR, MGT ✓, HAN, EDU, UDD, A/RF ✓, CHRON ✓

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ANNEX Q

ON-FARM WATER MANAGEMENT PID

LOGICAL FRAMEWORK MATRIX

SUMMARY	OBJETIVELY VERIFIABLE INDICATORS	IMPORTANT ASSUMPTIONS
A.1 Goal Increase the income and standard of living of Dominican farmers by increasing their productivity.	A.2 Measurement of Goal Achievement Agriculture production and yields increase faster than total rural population; incomes of lower income farmers rise faster than the average.	A.3 (as related to goal) - No devastating natural disasters. - Continuing economic, poiitical and social stability - Continued GODR support for effective agricultural development programs.
Sub Goal Develop human resources and generate institutional conditions necessary for increased productivity in irrigated agriculture.	Adoption of irrigation practices and techniques at the farm level to increase water use efficiency and agricultural productivity.	
B.1 Purpose Strengthen GODR capability to: 1) effectively plan the development of its water resources for irrigation, 2) plan and operate irrigation system, 3) support increased agricultural productivity under irrigation and 4) prevent and/or correct the deterioration of land resources already under irrigation.	B.2 End of Project Status Improved capability for management of the irrigation water systems in the DR through strengthening of the human and institutional resources	B.3 (as related to purpose) - There will be a close working and collaborative relationship with the agencies involved in the project. - Dominican farmers will participate in the project activities.

SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	IMPORTANT ASSUMPTIONS
C.1 Outputs	C.2 Outputs Indicators	C.3 (as related to outputs)
1. Improved capacity of GODR for water resources planning and management	1a. National water plan developed 1b. Policies, procedures for water delivery and use developed with INDRHI 1c. National irrigation systems reviewed and evaluated.	1. Inputs provided in a timely manner 2. Professionals, technicians trained will continue to work in water resource management, irrigation systems development and implementation.
2. Improved data collection and analysis of water and soil resources	2a. Published analyzed data available for use in planning, design operation of irrigation projects. 2b. Data utilized by appropriate agencies.	
3. Irrigation system in pilot area operating efficiently.	3a. Farmers receiving adequate quantities of water on a timely basis 3b. Yield of farms in pilot area doubled. 3c. Absence of water-logging and salinity in pilot area.	
4. Centers of excellence in place and operational	4a. 30 courses for professionals and technicians held.	
5. Credit system for land development	5a. 2000 loans covering 6000 ha. of land leveling.	
6. Water user associations.	6a. Up to 3 water user associations models formed in each pilot area (approximately 5000 farmers)	
7. Trained professionals, technicians	7a. 26 professionals trained at Master's level.	

SUMMARY	OBJETIVELY VERIFIABLE INDICATORS	IMPORTANT ASSUMPTIONS
C.1 Outputs	C.2 Outputs Indicators	
	7b. 31 professionals upgraded through U.S. short-course training	
	7c. 500 professionals upgraded through in-country short courses	
	7d. 25 extension agents trained in farm irrigation water management	
	7e. 75 technicians trained.	
8. Farmers trained in on-farm water management.	8a. 1001 farmers trained in short courses.	

SUMMARY	OBJETIVELY VERIFIABLE INDICATORS			IMPORTANT ASSUMPTIONS
D.1 Inputs	D.2 Budget (US$000)			D.3 (as related to inputs)
	AID	GODR	TOTAL	
1. Technical assistance	4,010	1,130	5,140	1. Appropriate technical assistance available
2. Administration	1,387	138	1,525	2. AID and counterpart funding is made available.
3. Training	1,281	898	2,179	3. Dominican Congress approves loan
4. Vehicles	692	-	692	
5. Equipment	2,704	312	3,016	
6. Construction	396	-	396	
7. Credit	-	3,000	3,000	
SUBTOTAL	10,470	5,478	15,948	
Inflation	797	1,084	1,881	
Contingency	733	501	1,234	
GRAND TOTAL	12,000	7,063	19,063	

REPUBLICA DOMINICANA

Secretariado Técnico de la Presidencia

SANTO DOMINGO, D. N.

"AÑO DE LA REFORESTACION"

2072

28 JUN. 1983

Señor
Philip R. Schwab,
Director Agencia Internacional
para el Desarrollo (AID)
SU DESPACHO

Ref. : Préstamo por US$12.0 millones para irrigación y manejo de agua; en negociación.

istinguido señor Director:

Cumpliendo instrucciones impartidas por el Ciudadano residente, Dr. Salvador Jorge Blanco, procedemos a tramitar ante esa gencia esta solicitud de préstamo, según se indica en la referencia, n correspondencia con los lineamientos establecidos por el Superior obierno para el sector Agropecuario, dirigidos a mejorar la condición e vida del campesino a través de un aumento en la productividad de las tierras bajo irrigación, así como mejorando el aspecto institucional de los programas y actividades encaminadas a satisfacer estos requerimientos.

En términos generales, los elementos básicos del proyecto a ejecutarse, y de conformidad con los planes que viene desarrollando el Instituto Nacional de Recursos Hidráulicos (INDRHI), pueden resumirse de la siguiente manera:

- Planificar eficientemente el desarrollo de los recursos de agua para riego;
- Operar los sistemas de riego con efectividad y eficiencia;
- Respaldar los esfuerzos destinados al incremento de la productividad agrícola mediante la utilización de los sistemas de riego;
- Prevenir y corregir el deterioro de las tierras actualmente bajo riego.

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Sr. Philip R. Schwab
Director Agencia Internacional
para el Desarrollo (AID)

Se estima que el costo total del proyecto ascienda a un monto equivalente a RD$19,063,000.00 (Diecinueve millones sesenta y tres mil con 00/100), de los cuales el Gobierno Dominicano participaría con una contrapartida ascendente a RD$7,063,000.00 (Siete millones sesenta y tres mil con 00/100).

La institución ejecutora será el Instituto Nacional de Recursos Hidráulicos (INDRHI), la cual se comprometerá a controlar y administrar con rigurosidad los recursos y, por otra parte, dotará del apoyo técnico que sea requerido para la buena y exitosa ejecución del proyecto.

Con mis mayores sentimientos de consideración y estima, le saluda,

Muy atentamente,

Ing. Ramón Alburquerque Ramírez
Secretario Técnico de la Presidencia

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