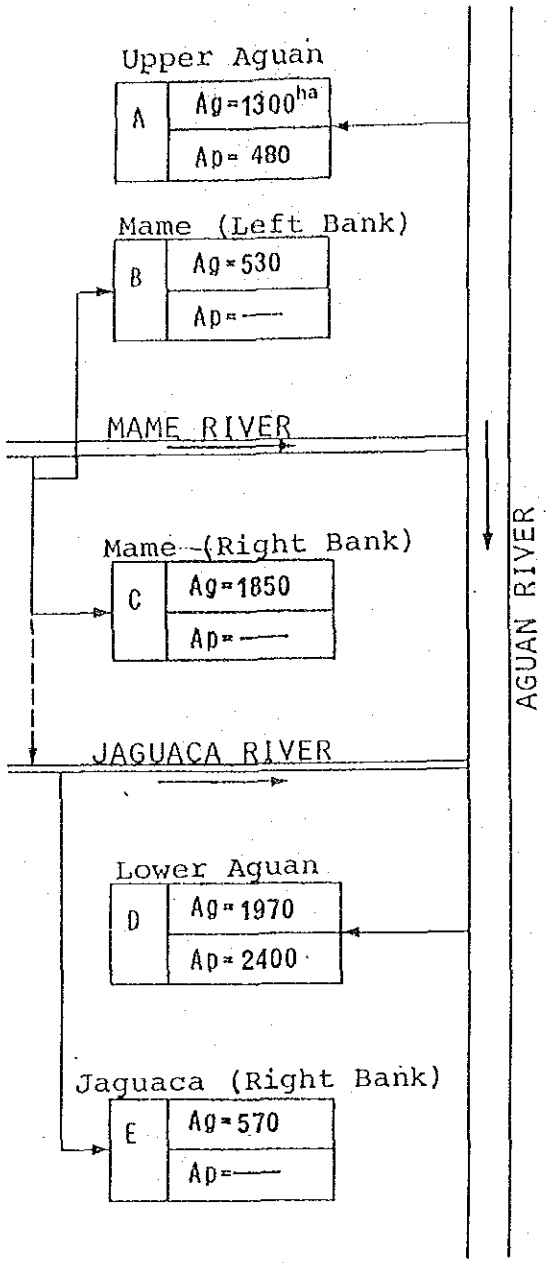


Fig. 4-9 Schematic Irrigation Area

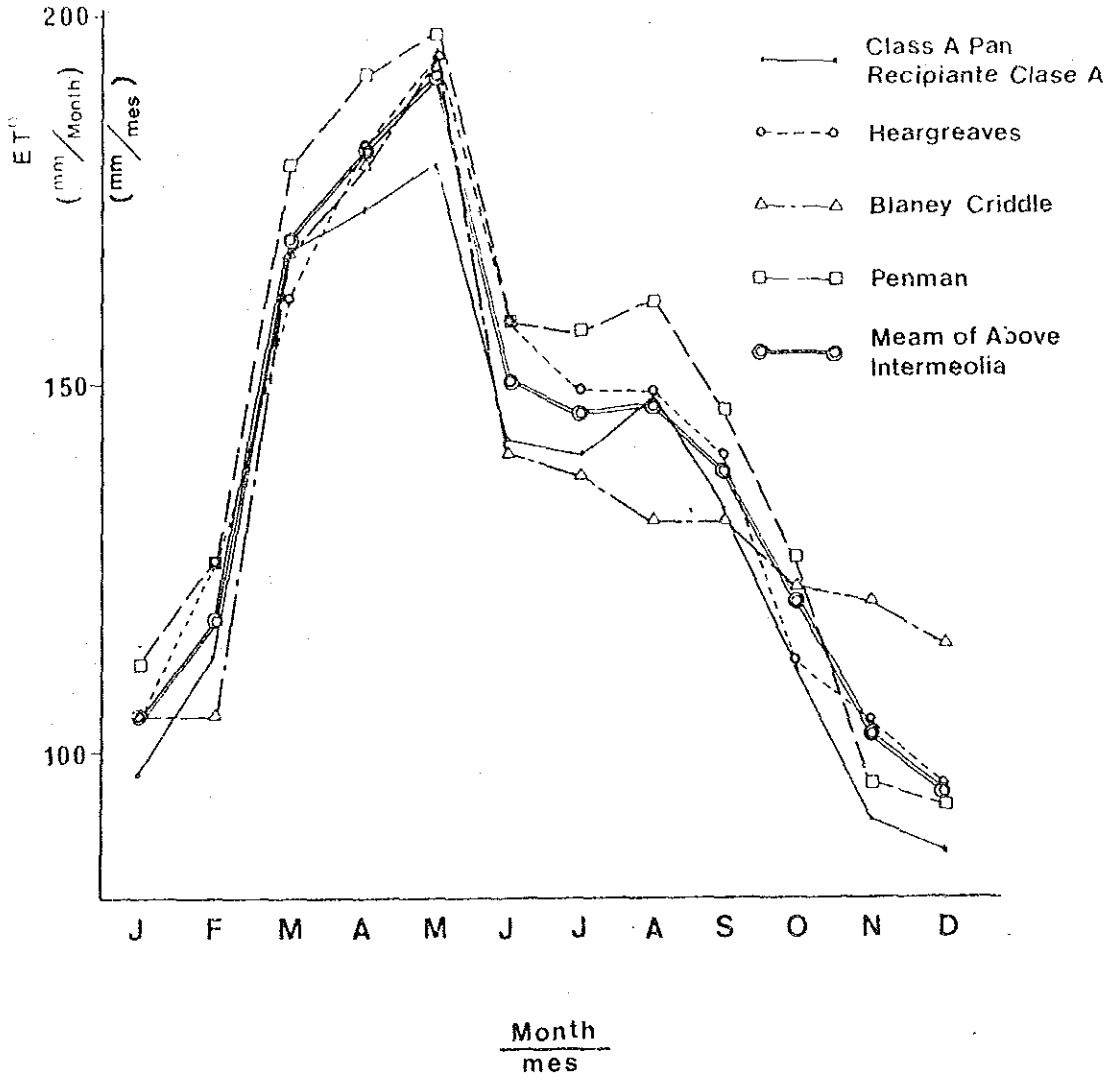


Fig. 4–10 POTENTIAL EVAPOTRANSPIRATION
EVAPOTRANSPIRACION POTENCIAL

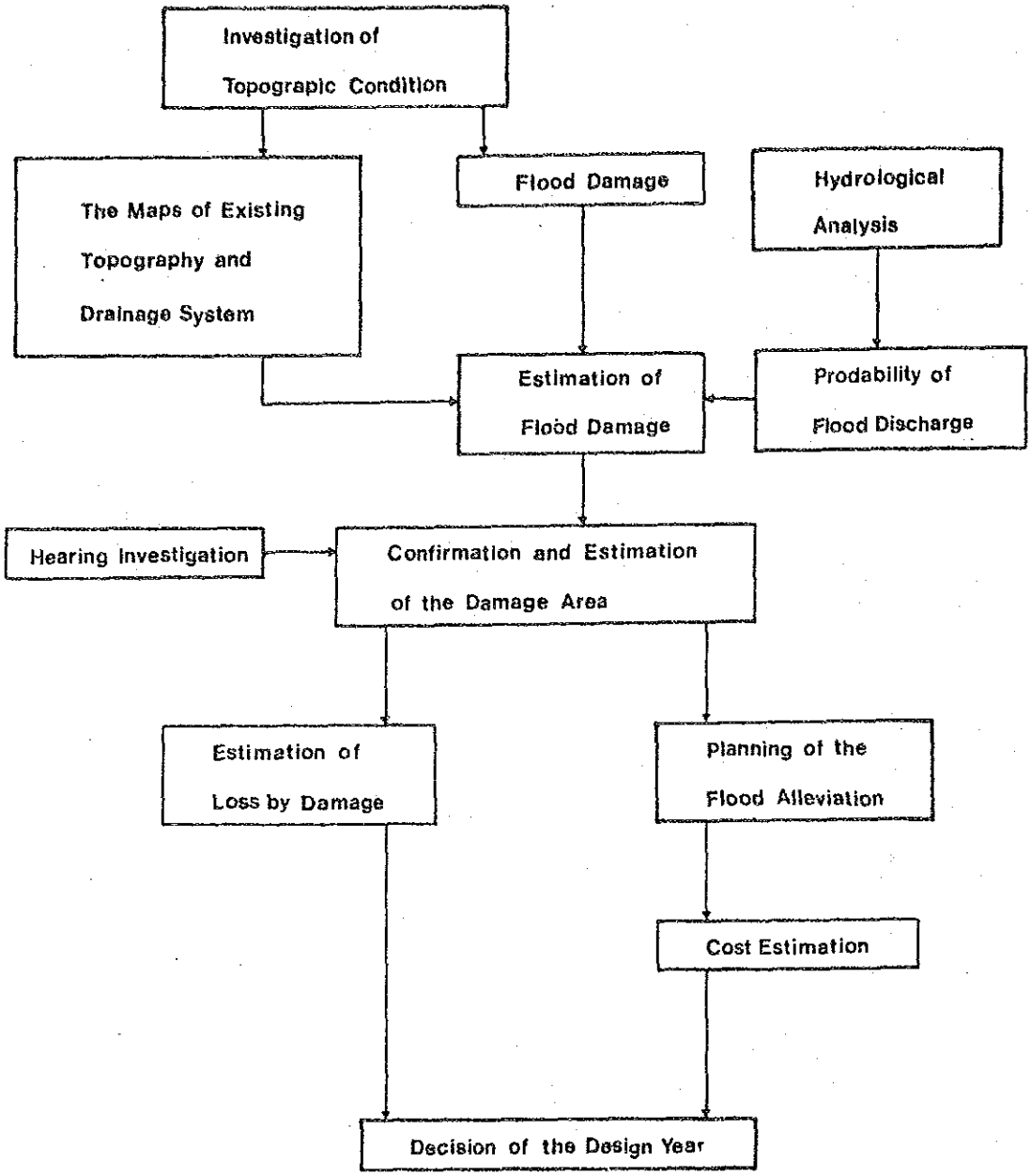


Fig. 4–11 FLOE CHART OF STUDY FOR DAINAGE

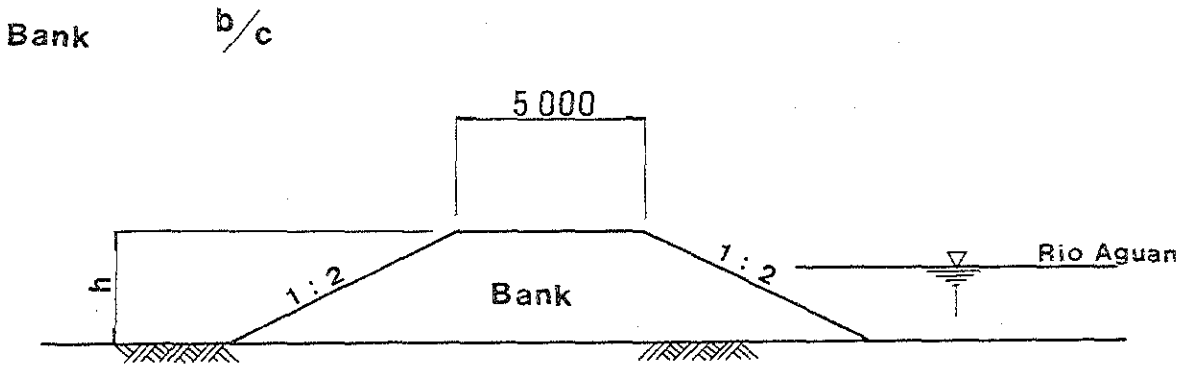


Fig. 4–12 Section of Dyke

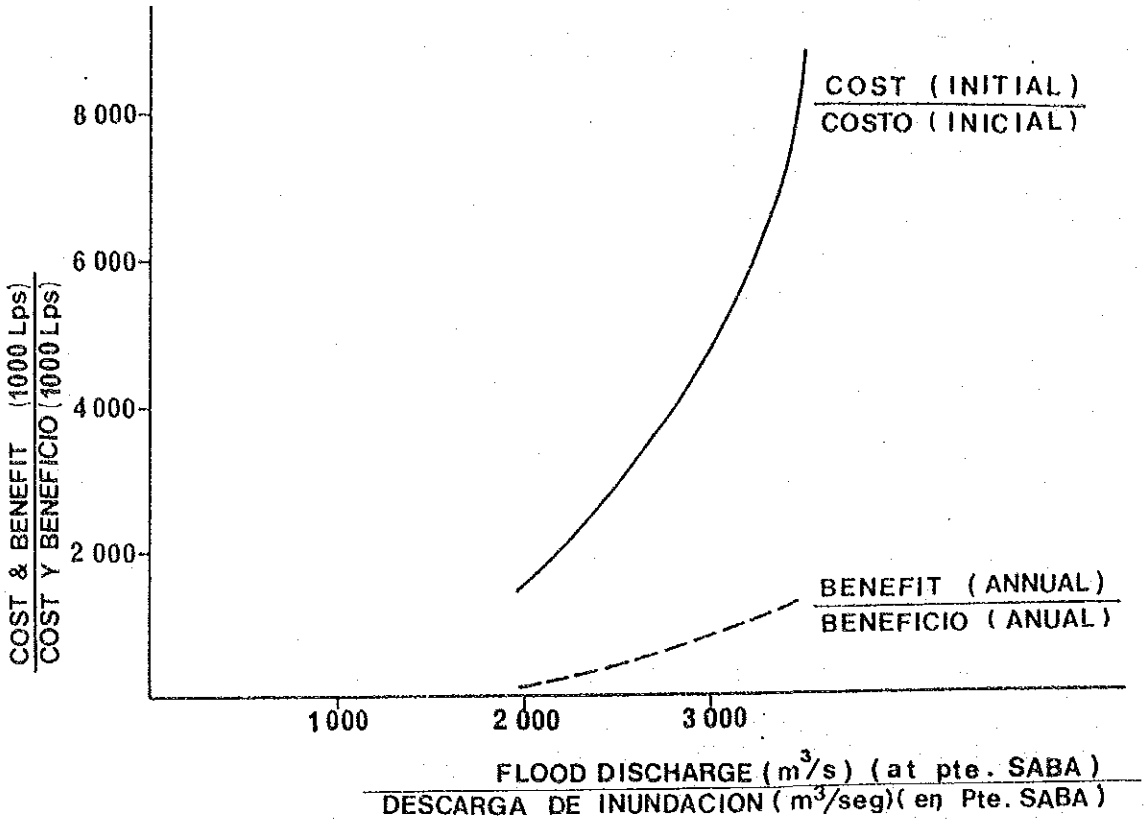


Fig. 4–13 RELATION BETWEEN FLOOD DISCHARGE AND COST & BENEFIT
RELACION ENTRE DESCARGA DE INUNDACION Y COSTO Y BENEFICIO

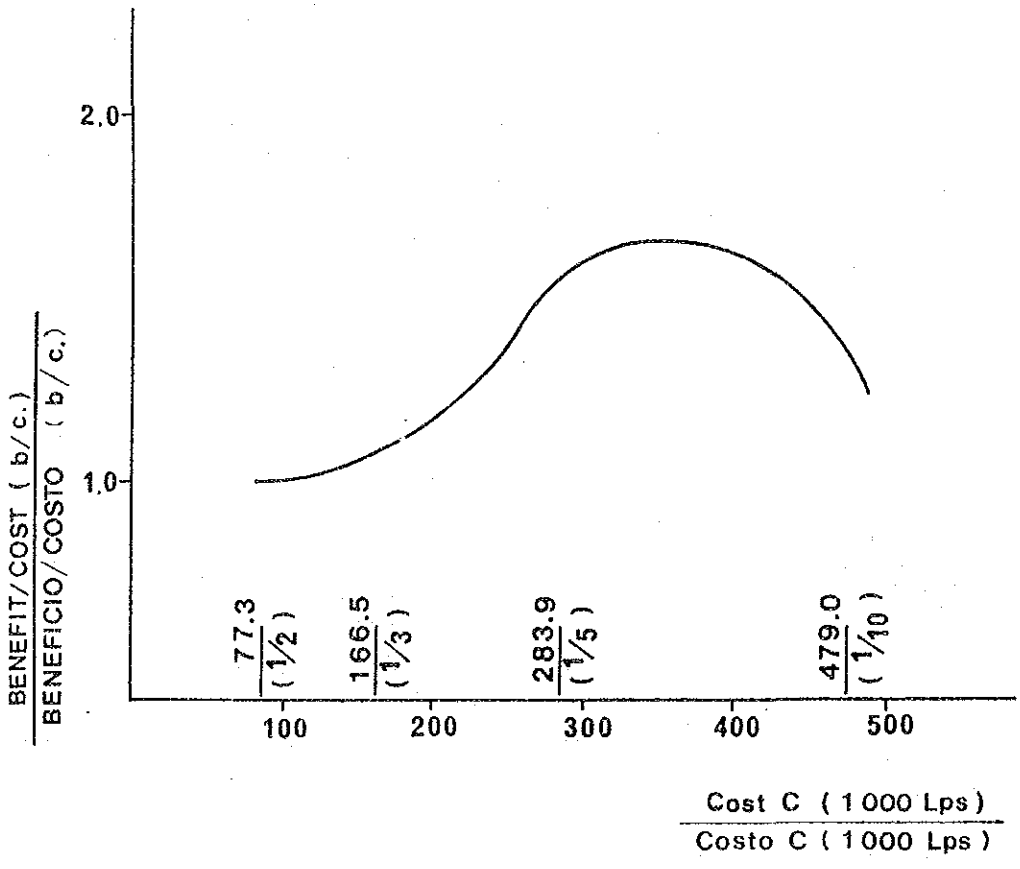
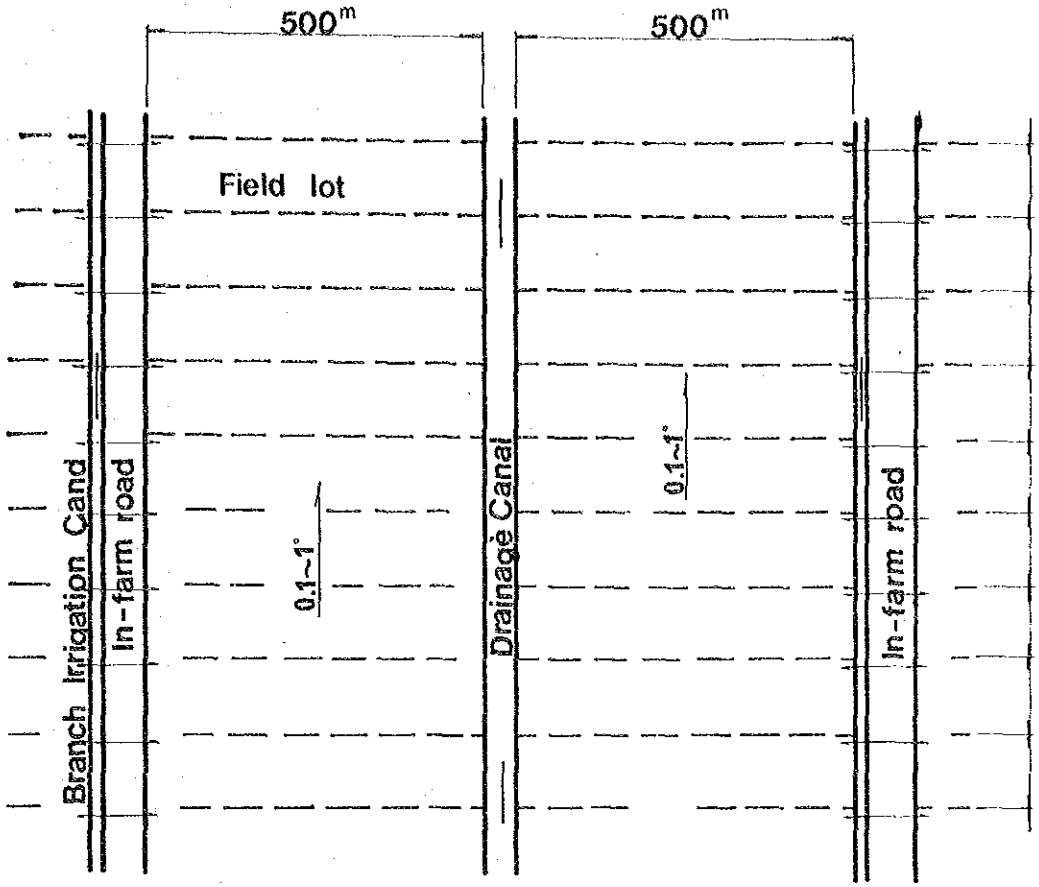
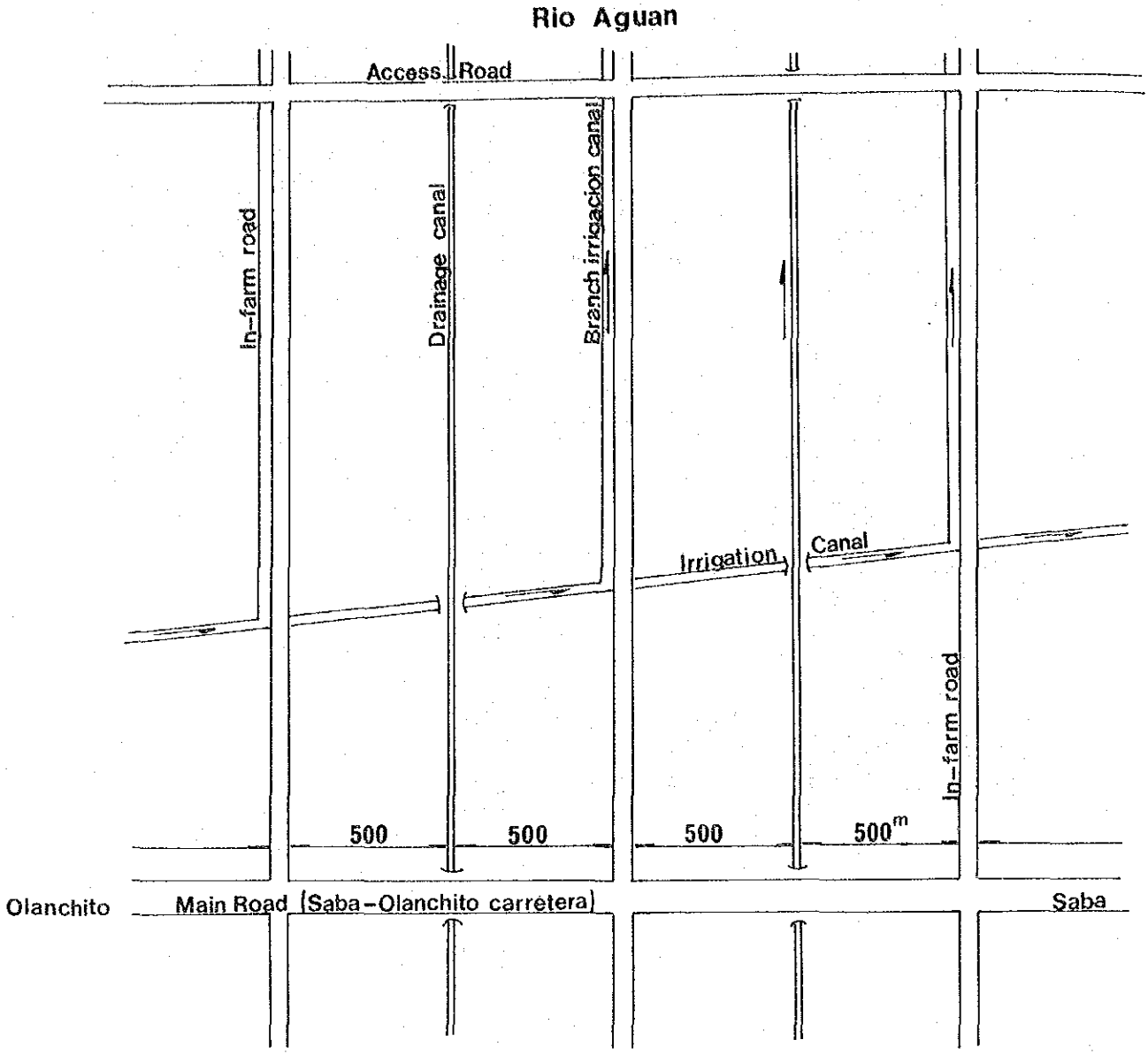


Fig. 4–14 COST AND B/C
COSTO Y B/C



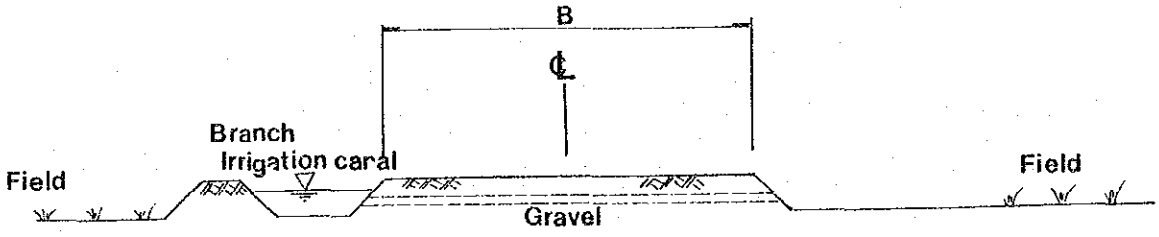
STANDARD FARM LOT

Fig. 4–15 Standard Farm Lot



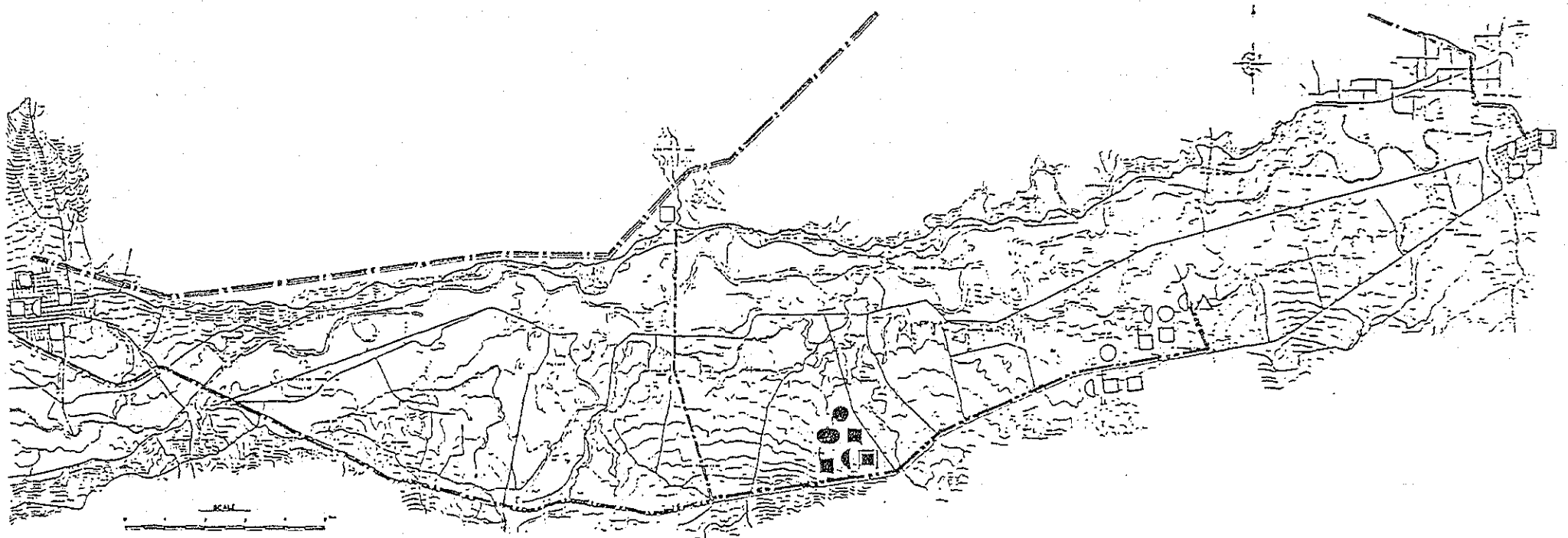
FARM ROAD NETWORK.

Fig. 4–16 Farm Road Network



SECTION OF IN-FARM ROAD

Fig. 4–17 Section of In-Farm Road



LEGEND (Proposed Facilities)
LEYENDA (Facilidades Propuestas)

34.5/19.5KVA Power Line
Linea de Electricidad 34.5/19.5KVA

Processing & Packing Plant of Agro-products
Planta Procesadora de Producto Agricola

Healthy Center with Doctor (CESAMO)
Centro de Salud con Medico (CESAMO)

Primary School
Escuela Primera

Well
Pozo

Church
Iglesia

Community Center
Centro Comun

LEGEND (Existing Facilities)
LEYENDA (Facilidades Actuales)

Main Transmission Power Line (138 KVA)
Linea Principal de Electricidad (138KVA)

34.5/19.5KVA Power Line
Linea de Electricidad 34.5/19.5KVA

Healthy Center with Doctor (CESAMO)
Centro de Salud con Medico (CESAMO)

Rural Healthy Center (CESAR)
Centro de Salud Rural (CESAR)

Primary School
Escuela Primera

Well
Pozo

Church
Iglesia

Community Center
Centro Comun

Fig. 4–18 LOCATION OF SOCIAL INFRASTRUCTURES
UBICACION DE INFRASTRUCTURAS SOCIALES

Table 4-1 Future Land Use Plan in Arable Area

(1) Irrigated Area

Crop	Net return/ha (Lps.)	Case 1		Case 2		Case 3		Case 4	
		Area (ha)	Net return (Lps.)	Area (ha)	Net return (Lps.)	Area (ha)	Net return (Lps.)	Area (ha)	Net return (Lps.)
Maize:									
Primavera	1,005	5,350	5,376,750	3,800	3,819,000	1,890	1,899,450	1,890	1,899,450
(Pastrera)	(1,005)	(6,227)	(6,258,135)	(3,800)	(3,819,000)	(2,714)	(2,727,570)	(2,714)	(2,727,570)
Rice	1 280	2,200	2,816,000	1,800	2,304,000	1,577	2,018,560	1,577	2,018,560
Beans									
Primavera	810	1,377	1,115,370	900	729,000	1,210	980,100	910	737,100
(Pastrera)	(810)	(2,700)	(2,187,000)	(2,700)	(2,187,000)	(1,963)	(1,590,030)	(1,663)	(1,347,000)
Soy beans									
Primavera	720.5	-	-	-	-	600	432,300	600	432,300
(Pastrera)	(720.5)	-	-	-	-	(600)	(432,300)	(600)	(432,300)
Cassava	1,007	21	21,147	320	322,240	421	423,947	221	222,547
Taro	2,336	-	-	200	467,200	300	700,800	200	467,200
Plantain	3,563	7	24,941	200	712,600	207	737,541	207	737,541
Orange (Agria)	3,799	130	493,870	130	493,870	130	493,870	130	493,870
Orange (Valencia)	3,799	-	-	-	-	-	-	-	-
Cocoa	3,389.5	-	-	1,100	3,728,450	2,500	8,473,750	2,300	7,795,850
Mango	3,698	-	-	100	369,800	-	-	300	1,109,400
Papaya	2,770	-	-	50	138,500	-	-	50	138,500
Other fruit tree	945	15	14,175	15	14,175	15	14,175	15	14,175
Pineapple	6,955	-	-	300	2,086,500	-	-	400	2,782,000
Tomato									
Primavera	1,738	-	-	185	321,530	250	434,500	300	521,400
(Pastrera)	(1,738)	-	-	(185)	(321,530)	(250)	(434,500)	(300)	(521,400)
Primavera		9,100	9,862,253	9,100	15,506,865	9,100	16,608,993	9,100	19,369,893
(Pastrera)		(8,927)	(8,445,135)	(6,685)	(6,327,530)	(5,527)	(5,184,400)	(5,277)	(5,028,300)
Total		18,027	18,307,388	15,785	21,834,395	14,627	21,793,393	14,377	24,398,193

(2) Non-Irrigated Area

Crop	Net return/ha (Lps.)	Case 1		Case 2		Case 3		Case 4	
		Area (ha)	Net return (Lps.)	Area (ha)	Net return (Lps.)	Area (ha)	Net return (Lps.)	Area (ha)	Net return (Lps.)
Maize									
Primavera	379	300	113,700	300	113,700	300	113,700	300	113,700
(Postrera)	379	(300)	(113,700)	(300)	(113,700)	(300)	(113,700)	(300)	(113,700)
Cassava	640	400	256,000	400	256,000	400	256,000	400	256,000
Taro	1,380	400	552,000	400	552,000	400	522,000	400	552,000
Cocoa	1,478	300	443,400	300	443,400	300	443,400	300	443,400
Mango	1,450	200	290,000	200	290,000	200	290,000	200	290,000
Orange (Valencia)	1,850	2,800	5,180,000	2,800	5,180,000	2,800	5,180,000	2,800	5,180,000
Pasture (Improved)	121	2,300	278,300	2,300	278,300	2,300	278,300	2,300	278,300
Total primavera		6,700	7,113,400	6,700	7,113,400	6,700	7,113,400	6,700	7,113,400
Total postrera		(300)	(113,700)	(300)	(113,700)	(300)	(113,700)	(300)	(113,700)
Total		7,000	7,227,100	7,000	7,227,100	7,000	7,227,100	7,000	7,227,100

(3) Total of Arable Area

Crop Season	Case 1		Case 2		Case 3		Case 4	
	Area (ha)	Net return (Lps.)	Area (ha)	Net return (Lps.)	Area (ha)	Net return (Lps.)	Area (ha)	Net return (Lps.)
Primavera	15,800	16,775,153	15,800	22,620,265	15,800	23,722,393	15,800	26,483,293
Postrera	(9,227)	(8,558,835)	(6,985)	(6,441,230)	(5,829)	(5,298,100)	(5,579)	(5,142,000)
Total	25,027	25,534,488	22,785	29,061,495	21,629	29,020,493	21,377	31,625,293

Table 4–2 Summary of Crop Net Return/ha

Crop	Yield ton/ha		Cost Lps.			Net return Lps.	
	Actual	Future	Price Lps.	Present	Future	Present	Future
Maize	2.5	5.0	350	657	745	218	1,005
Rice	2.6	5.0	460	800	1,020	396	1,280
Beans	1.1	1.5	920	500	570	512	810
Soy beans	-	2.5	555	-	667	-	720.5
Cassava	9 9	20	160	800	2,193	640	1,007
Taros	18	35	160	1,200	3,264	1,680	2,336
Plantain	15	35	150	1,087	1,687	1,163	3,563
Oranges	25	35	110	900	1,701	1,850	3,799
Cocoa	0.9	1.5	3,245	900	1,478	2,020	3,389.5
Mango	20	30	160	750	1,102	2,450	3,698
Papaya	-	25	160	-	1,230	-	2,770
Other Fruits	10	12	80	10	15	790	945
Pineapple	-	25	360	-	2,045	-	6,955
Tomato	-	40	110	-	2,662	-	1,738

* Irrigation cost is not included.

Table 4–3 Staged Introduction of New Crops in Case 4

Crop	Present (ha)	First stage (ha)	Second stage (ha)	Third stage (ha)
I. Maize: Primavera	1,694	1,694	1,890	1,890
Postrera	(2,018)	(2,018)	(2,614)	(2,714)
Rice	302	302	1,277	1,577
Beans: Primavera	80	200	800	910
Postrera	(178)	(178)	(1,263)	(1,663)
Soy beans: Primavera		200	600	600
Postrera		(200)	(600)	(600)
Cassava	21	221	221	221
Taros		100	200	200
Plantain	7	207	207	207
Orange (Agria)	130	130	130	130
Orange (Valencia)		-	-	-
Cocoa		400	1,400	2,300
Mango		50	300	300
Papaya		50	50	50
Other fruit trees	15	15	15	15
Pineapple			300	400
Tamato: Primavera			24	300
Postrera			0	(300)
Total of irrigated area		3,569	7,414	9,100
II. Maize: Primavera		300	300	300
Postrera		(300)	(300)	(300)
Cassava		200	300	400
Taros		200	300	400
Cocoa		100	200	300
Mango		100	100	200
Orange (Valencia)		800	1,800	2,800
Total of non-irrigated area		1,700	3,000	4,400
III. Pasture (Cooperative)	1,394	394	0	0
Improved pasture	3,600	3,600	3,600	2,300
Pasture (Independent)	2,718	2,718	1,786	0
Uncleared land (cooperative)	4,191	2,171	0	0
Non-arable land	1,648	1,648	0	0
Total of Development Area	15,800	15,800	15,800	15,800

Table 4-4 Intake Rate Test

Soil Classification	C	N	K	M	Ib	No. of Sampling
Fine	16.2	0.58	528.9	-0.42	47.0	3
Medium	21.4	0.56	716.9	-0.44	61.2	5
Coarse	21.7	0.58	733.4	-0.42	68.5	3

N.B. 1) $D = CT^N$

where; D: Accumulated Intake (mm)
T: Time (minute)
C,N: Coefficient

2) $I = KT^M$

where; I: Intake Rate (mm/hr)
T: Time (minute)
K,M: Coefficient

3) Ib: Basic Intake Rate (mm/hr)

4) In accordance with the value for Ib, the following irrigation method can be proposed.

Ib Value (mm/hr.)	Irrigation Method
<50	Furrow and Other Surface Irrigation
50 - 75	Furrow and Sprinkler
>75	Sprinkler

Table 4–5 Maximum Gross Water Requirement

BLOCK		Irrigation Area (ha)	Maximum Water Requirements (m^3/S)			
			1/2 q=77.81	1/3 q=83.41	1/5 q=87.86	1/10 q=92.48 (mm/Mon)
A Upper Aguan	Gravity	1,300	1.027	1.101	1.160	1.221
	Pumping	480	0.379	0.407	0.428	0.451
	Total	1,780	1.406	1.508	1.588	1.672
B Left Mame	Gravity	530	0.419	0.449	0.473	0.498
	Pumping	-	-	-	-	-
	Total	530	0.419	0.449	0.473	0.498
C Right Mame	Gravity	1,850	1.462	1.567	1.650	1.737
	Pumping	-	-	-	-	-
	Total	1,850	1.462	1.567	1.650	1.737
D Middle Aguan	Gravity	1,970	1.556	1.669	1.757	1.850
	Pumping	2,400	1.896	2.033	2.141	2.254
	Total	4,370	3.452	3.701	3.898	4.104
E Right Jaguaca	Gravity	570	0.450	0.483	0.508	0.535
	Pumping	-	-	-	-	-
	Total	570	0.450	0.483	0.508	0.535
Total	Gravity	6,220	4.974	5.269	5.548	5.841
	Pumping	2,880	2.275	2.440	2.569	2.705
	Total	9,100	7.189	7.709	8.117	8.546
						(l/sec)
Unit water requirement (1.0ha)			0.790	0.847	0.892	0.939

Table 4--6 River Discharge at Intake Point (in Drought)

(m^3/S)

Month / Intake		Jan.	Feb.	Mar.	Apr.	May	Jun	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Upper Aguan	1/2	31.9	22.1	17.2	12.3	16.5	52.0	47.7	50.2	80.8	96.4	88.5	66.3
	1/3	24.8	17.3	13.4	9.6	12.9	39.1	35.7	37.7	62.0	74.3	68.1	50.5
	1/5	19.9	13.8	10.8	7.7	10.3	30.1	27.9	29.2	48.2	58.4	53.4	39.1
	1/10	15.3	10.6	8.3	5.9	7.9	23.2	21.5	22.5	35.6	43.4	39.5	28.9
Mame (Both Banks)	1/2	16.1	11.5	9.1	6.6	8.7	25.3	22.7	24.2	42.3	51.5	46.9	33.7
	1/3	12.8	9.1	7.2	5.3	6.9	18.8	17.5	18.3	31.2	38.5	34.8	24.4
	1/5	10.4	7.4	5.9	4.3	5.6	15.3	14.3	14.9	23.2	29.1	26.1	18.8
	1/10	8.1	5.8	4.6	3.3	4.4	12.0	11.1	11.6	17.5	20.5	19.0	14.7
Lower Aguan	1/2	74.8	53.3	42.2	30.8	40.6	110.4	102.8	107.3	161.5	189.1	175.2	135.8
	1/3	59.3	42.3	33.5	24.4	32.2	87.6	81.5	85.2	128.2	150.0	139.0	107.7
	1/5	48.2	34.3	27.2	19.8	26.2	71.2	66.2	69.2	104.1	121.8	112.9	87.5
	1/10	37.7	26.9	21.3	15.5	20.5	55.7	51.8	54.1	81.4	95.3	83.3	68.5
Jaguaca	1/2	1.6	1.1	0.9	0.7	0.9	2.3	2.2	2.3	3.4	4.0	3.7	2.9
	1/3	1.3	0.9	0.7	0.5	0.7	1.9	1.7	1.8	2.7	3.2	2.9	2.3
	1/5	1.0	0.7	0.6	0.4	0.6	1.5	1.4	1.5	2.2	2.6	2.4	1.9
	1/10	0.8	0.6	0.5	0.3	0.4	1.2	1.1	1.1	1.7	2.0	1.9	1.4

Table 4–7 Expected Benefit by Dyke

	Return Period			
	1/2	1/3	1/5	1/10
High Peak Discharge				
Pte. Sabá (m^3/S)	2,050	2,480	2,950	3,500
Pte. Olanchito	1,600	1,900	2,250	2,700
Flooded Area (ha)				
Present	3,900	5,300	7,000	7,300
After Construction of Dyke	2,700	3,100	3,400	3,600
Alleviated Area	1,200	2,200	3,600	3,700
Probability of Alleviation of Damage (Lps)				
0 - 50%	145,200	145,200	145,200	145,200
50 - 66.7		185,937	185,937	185,937
66.7 - 80			365,581	365,581
80 - 90%				383,332
Expected Benefit (Lps/Year)	145,200	331,137	696,718	1,080,050

* Crop is assumed to be rice as estimated 2,420 Lps/ha
* Percentage of Damage for each return period are assumed as follow:
  1/2:20% 1/3:31% 1/5:44% 1/10:44%

Table 4–8 Benefit and Cost for the Construction of Dyke

Length 32.3 km Durable Period 50 Years

Unit cost 4.0 Lps/m^3 Interest i = 5%

	Return Period			
	1/2	1/3	1/5	1/10
Height (m)	1.4	2.4	3.4	4.7
Section (m^2)	10.92	23.52	40.12	67.68
Volume (m^3)	352.7	749.7	1,295.9	2,186.1
Initial cost I. (Lps)	1,410,860	3,038,780	5,183,500	8,744,260
$C=I\cdot(i+\frac{i}{(1+1)^n-1})$	77,283	166,455	283,936	478,982
Benefit (Lps)	145,200	331,137	696,718	1,080,050
Maintenance Cost (Lps)	70,543	151,939	259,179	437,213
b = B-M	74,657	179,198	437,539	642,837
b/c Ratio	0.97	1.08	1.54	1.34

CHAPTER 5 : PROJECT IMPLEMENTATION PLAN

CHAPTER 5 PROJECT IMPLEMENTATION PLAN

5.1 Construction Program

The construction stage of the Project consists of two phases: preparatory phase and construction phase. In the preparatory phase, the topographic survey of main structures (head works, pump station, canal and road), detailed design of these structures, preparation of tender document, evaluation of tender and acquisition of land will be carried out.

In the construction phase, construction of civil works, procurement of O/M machineries and equipments, provision of facilities for the agricultural extension and supporting services and supervision of construction works will be undertaken. The overall implementation schedule for the whole-in-one development plan and the phased development plan is shown in Fig. 5-1. The comparison between the whole-in-one development plan and the phased development plan is described in Chapter 7 and for the purpose of phased development concept, the project area has been tentatively divided into the following two categories

Case I: Between Saba and the Jaguaca River
Case II: Between Olanchito and the Jaguaca River

5.1.1 Implementation of Construction Stage

(1) Detailed Design

Based on the topographic map of the scale 1/5,000 prepared by JICA, the following works will be done.

1) Topographic and soils surveying on road, canal and farmland.

2) Topographic mapping of proposed sites for the construction of head works, pump station, canal etc. on a scale of 1/1,000.

3) Supplemental geological investigation of proposed sites for the construction of head works and pump station.

4) Investigation on construction materials, particularly, for banking works.

5) Preparation of tender documents including specifications

(2) Construction of Civil Works

Selection of contractor for construction is to be made by means of international tender practice. Construction works will be commenced in the third year of the construction stage and will be completed within sixty (60) months.

Structures are to be constructed in the following order:

1) Main in-farm road to be utilized also as a access road for construction works

2) Main drainage and irrigation canals

3) Head works and pump station

4) Lateral drainage and irrigation canals

5) Secondary drainage canals

In the planning of construction schedule, emphasis should be given to the diagnosis of actual conditions of the project area and interrelationship of each work so as to minimize the construction cost as much as possible.

(3) Procurement of O/M machineries and equipments

Machineries and equipments to be used for the operation and maintenance of the project will be procured starting the fifth year of the construction stage.

(4) Supervision of Construction Works

Supervision of construction works is to be undertaken by the consulting engineering firms with sufficient experience and capability in similar type of international tendering projects. Major fields to be supervised are schedule, quality and safety controls of construction works.

(5) Technology Transfer

The technology transfer to the Honduran government officers concerned with the Project will be undertaken by the consultants during the Detailed Design and Construction Supervision periods. It is advisable that the technology transfer program will be set up in Water Management, Quality Control of Construction Works and Rural Development.

5.2 Project Cost

5.2.1 Construction Cost

Estimated construction cost is summarized in Table 5-1. Breakdown of this cost estimation is set out in Appendix G.

The construction cost has been estimated based on the following assumptions:

(1) Exchange rate is fixed as follows:

US$1 = Lps. 2 = Yen 240

(2) Construction is to be undertaken by a selected contractor with the necessary construction machineries.

(3) Estimated purchase price of construction machineries for depreciation includes the sum of CIF San Lorenzo.

(4) Price of construction materials which will be imported are estimated based on CIF San Lorenzo.

(5) Price of labor and local materials are based on market prices in October, 1984.

(6) Administration cost is estimated as 25% - 30% of the total construction cost.

(7) Physical contingency is estimated at 10% of construction cost and administration cost. Price contingency for the local portion is estimated at 6% per annum and for the foreign portion at 5% per annum.

The summary of disbursement schedule is shown in Table 5-2.

5.2.2 Operation and Maintenance Cost

The operation and maintenance cost has been estimated as shown in table below.

Annual Operation and Maintenance Cost

Unit: x 1000 Lps.

Item	Area I	Area II	Total
Maintenance cost for civil work	109.7	111.1	220.8
Operation & Maintenance Cost of Equipments	511.0	512.5	1,023.5
Running Cost of Pumps	161.2	13.4	174.6
Total	781.9	637.0	1,418.9

Replacement Cost

Unit: x 1000 Lps.

Item	Area I	Area II	Total	Remarks
Pump	1,840.2	731.9	2,572.1	20 years
Gates	435.8	378.1	813.9	30 years
Total	2,276.0	1,110.0	3,386.0	

5.3 Project Executing and Management Organization

5.3.1 Executing Organization

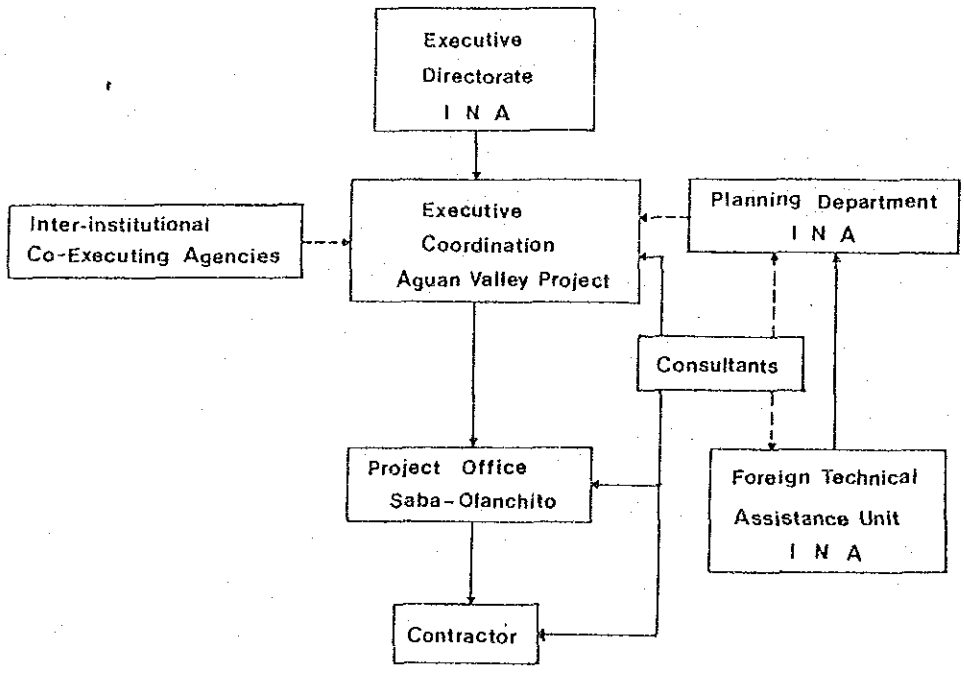
With the introduction of irrigation and drainage facilities, the agricultural production of the project area will be increased and the efficient utilization of farm land will be promoted. In order to attain the project purposes, it is indispensable to prepare necessary budgets for the agency which will be responsible for the execution and management of the Project.

INA will be the executing agency of the Project. For the better implementation of the Project, it is advised that the existing organization of INA should be consolidated.

5.3.2 Project Implementation Operation and Maintenance Organization

(1) Project Implementation Organization

Project implementation is divided into two phases: detailed design and construction phases. In the course of project execution close coordination among INA, Consultants and Inter-institutional Co-Executing Agencies will be required. Proposed executing organization is illustrated below.



The Inter-institutional Co-Executing Agency will consist of: INA, CONSUPLANE, MRN and SECOPT. The Project Office will be located its headquarter in Tegucigalpa and site office in Olanchito and will be operated in close liaison with Consultants. The site office will be advised by the Consultants for the supervision of

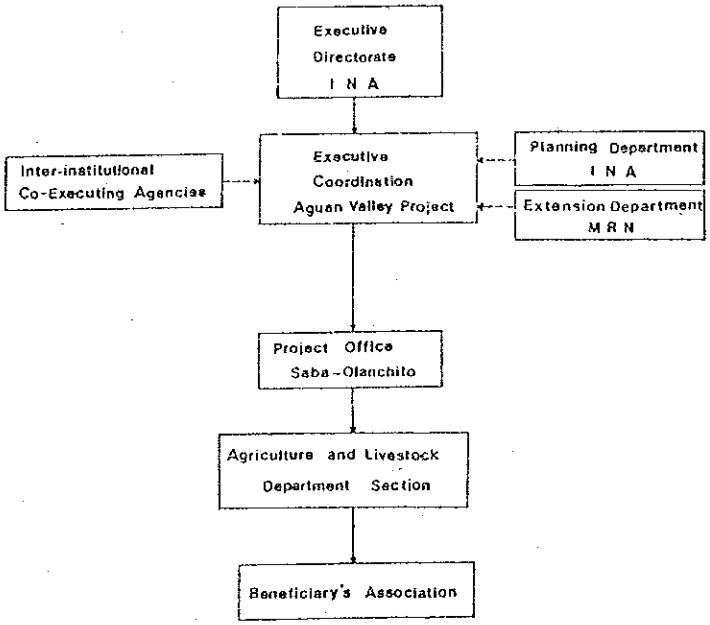
construction works and prepare up-to dating site information to the headquarter. The Office of Execution Coordination for Aguan Valley Project will directly evaluate the tendering of contractors. Two janitor's office (with wireless radio) will be constructed for the operation and maintenance of irrigation facilities.

(2) Farmer's Settlement

Farmers will be newly settled or re-settled from the area where construction works for land reclamation, irrigation and drainage canals and road will have been completed. Some parts of construction works will be carried out in areas where farmers are already settled or where land ownership belongs to private sector. The project executing agency has to undertake to prepare substituting land in respect to these lands. INA will be responsible for the farmer's settlement program.

(3) Operation and Maintenance Organization

Without the appropriate organization for the operation and maintenance, the expected benefit from the construction of irrigation and drainage facilities will not be attained. The project life for these facilities will be determined by the proper operation and maintenance of facilities. With poor technology for operation and incomplete organization for maintenance the durable period of machineries will be reduced, even if excellent machineries will be procured. The function for operation and maintenance in this project includes: operation and maintenance for pump station and gate and maintenance for irrigation and drainage canals and road network. The proposed organization is illustrated as below.



the project will be as follows:

Personnel

Personnel	Number
Officer in Charge	1
Civil Engineer	3
Assistant Engineer	5
Secretary	3
Water Controller	4
Drivers	6
Operators	10
Assistant Operators	6
TOTAL	38

Machinery

Machinery	Capacity	Required Quantity	Purpose
Bulldozer	15 t 141 HP	1	Road repair Removal of dredged earth
Back Hoe	0.6 m^3	2	Dredging, loading earth
Motor Garder	3.7 m 130 HP	1	Road repair
Drag Line	0.6 - 0.8 m^3 105 HP	1	Dredging of main canal Earth loading
Dump Truck	8.0 t	6	Transport of earth and material

5.3.3 Supporting Service for Agriculture

(1) Agricultural Credits

When the project is implemented, agricultural credit for cooperative members and small - and medium-scale independent farmers will be granted by INA and BANADESA. With the implementation of the project, the cultivated area will be expanded and, as a result, demand for agricultural credits will be increased. INA in cooperation with the related institutions will have to make necessary arrangements to meet the future demand for the principal credit.

(2) Extension Services

It is necessary to provide farmers with extension services to obtain successful project results. The agriculture and livestock development section in the Middle Aguan Development Project Office will coordinate with related public institutions like agricultural and livestock experimental and promotion centers for promotion and extension services.

For the introduction of agricultural mechanization, it will be necessary that INA will provide famers with training and education necessary for mechnization.

For successful marketing of agricultural products, INA is requested to provide the project with the ncessary services for transport and marketing of products.

(3) Farmer's Cooperative

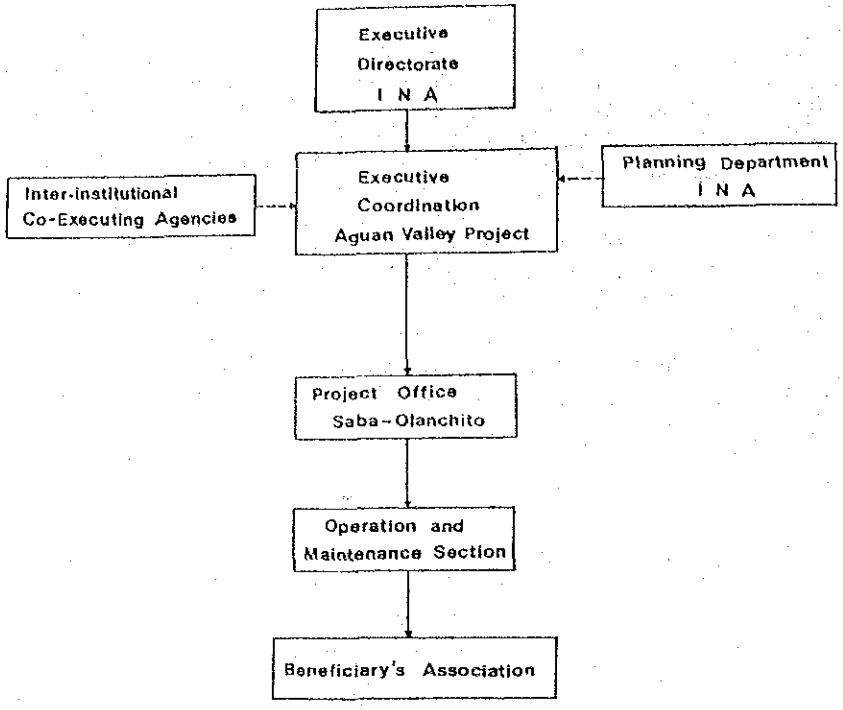
The project area is classified into five zones (four on the right bank of the Aguan River and one on the left bank) according to the irrigation system. It is necessary to establish the cropping patterns and to promote efficient utilization of agricultural machineries and irrigation water within the same zone.

It is, therefore, proposed to organize a farmer's cooperative for each classified zone in addition to the beneficiaries' association of the project.

The farmer's cooperative will function in two areas with close cooperation of related public institutes: promotion technical extension services and agricultural mechanization.

The promotion of technical extension services will be made for supply of material and equipment for agricultural production, assistance for farming, improvement of farm level infrastructure, agricultural mechanization includes assistance for farmers to purchase agricultural machinery as well as repair and rental services for agricultural machinery. Close coordination will also be necessry between the farmers' cooperative and the agriculture and livestock development section of the INA Project office.

In addition, farmer's attitude toward improvement of agricultural system is another important factor for the project to consider. The inter-relationship of these organizations and public institution in the project is illustrated as follows:

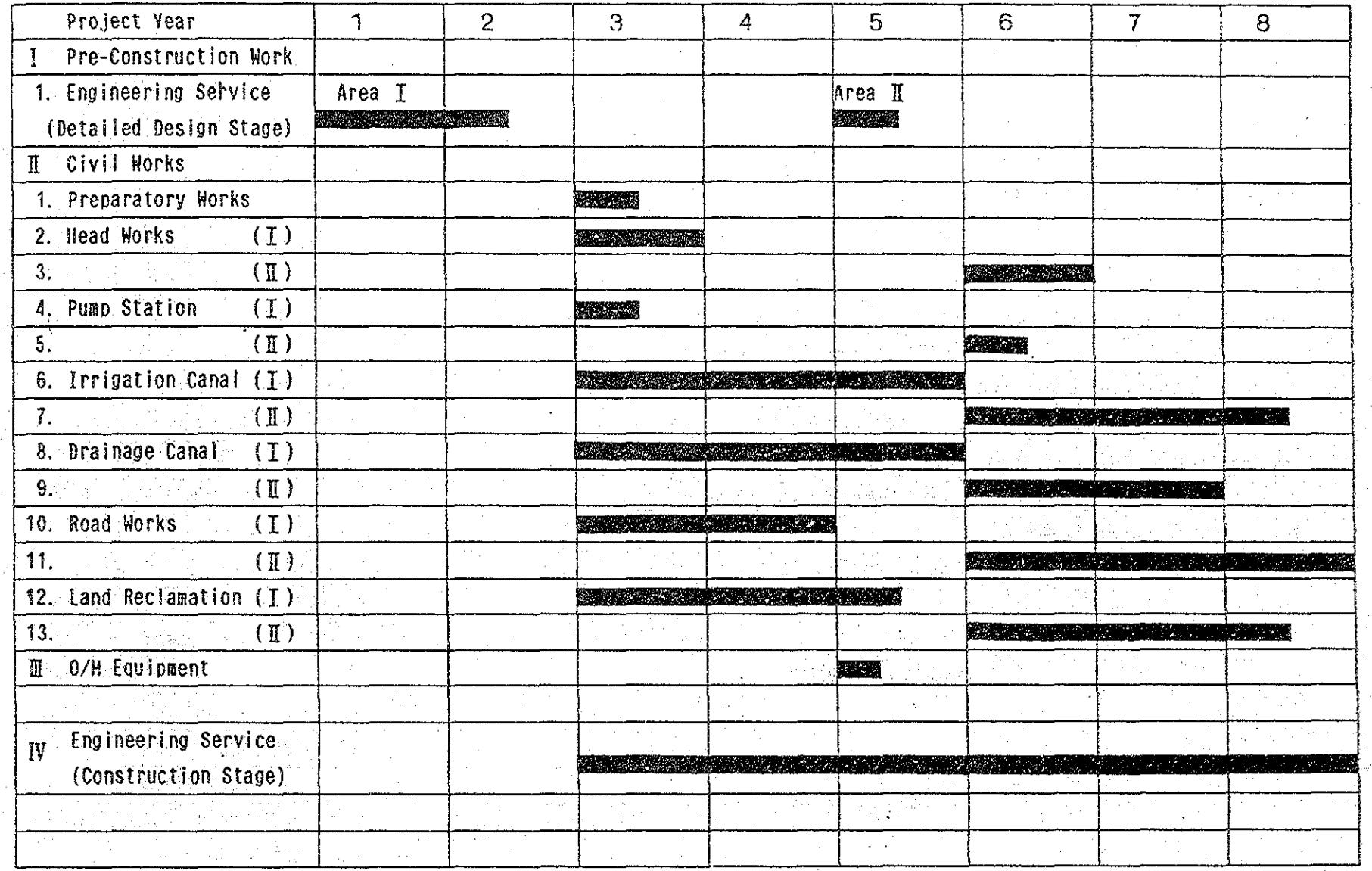

Executive
Directorate
I N A
Inter-institutional
Co-Executing Agencies
Executive
Coordination
Aguan Valley Project
Planning Department
I N A
Project Office
Saba-Olanchito
Operation and
Maintenance Section
Beneficiary's Association

Project Year	1	2	3	4	5	6	7	
Ⅰ Pre-Construction Work								
1. Engineering Service (Detailed Design Stage)								
Ⅱ Civil Works								
1. Preparatory Works								
2. Head Works (Ⅰ)								
3. (Ⅱ)								
4. Pump Station (Ⅰ)								
5. (Ⅱ)								
6. Irrigation Canal (Ⅰ)								
7. (Ⅱ)								
8. Drainage Canal (Ⅰ)								
9. (Ⅱ)								
10. Road Works (Ⅰ)								
11. (Ⅱ)								
12. Land Reclamation (Ⅰ)								
13. (Ⅱ)								
Ⅲ O/H Equipment								
Ⅳ Engineering Service (Construction Stage)								

1) (Ⅰ) → Area Ⅰ

2) (Ⅱ) → Area Ⅱ

Fig. 5-1 (1) PROJECT IMPLEMENTATION SCHEDULE FOR WHOLE-IN-ONE DEVELOPMENT PLAN



1) (I) → Area I

2) (II) → Area II

Fig. 5–1 (2) PROJECT IMPLEMENTATION SCHEDULE FOR PHASED DEVELOPMENT PLAN

Table 5–1 SUMMARY OF COST ESTIMATION (CASE 1)

(Cost Unit : 1000Lps)

Description	Area I			Area II			Total		
	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total
1. Preparatory Works	0.0	282.0	282.0				0.0	282.0	282.0
2. Head Works (Middle Aguan)	2,452.3	1,801.7	4,254.0				2,452.3	1,801.7	4,254.0
3. Head Works (Upper Aguan)				1,461.9	1,179.9	2,641.8	1,461.9	1,179.9	2,641.8
4. Head Works (Jaguaca)	273.9	163.3	437.2				273.9	163.3	437.2
5. Head Works (Mame)				582.7	387.9	970.6	582.7	387.9	970.6
6. Siphon (Pte.Mame)				283.3	204.3	487.6	283.3	204.3	487.6
Sub-Total [2.-6.]	2,726.2	1,965.0	4,691.2	2,327.9	1,772.1	4,100.0	5,054.1	3,737.1	8,791.2
7. Pump Station No.1	2,426.8	245.9	2,672.7				2,426.8	245.9	2,672.7
8. Pump Station No.2				895.7	120.8	1,016.5	895.7	120.8	1,016.5
Sub-Total [7.-8.]	2,426.8	245.9	2,672.7	895.7	120.8	1,016.5	3,322.5	366.7	3,689.2
9. Main Canal	3,942.0	2,370.0	6,312.0	3,362.7	1,567.5	4,930.2	7,304.7	3,937.5	11,242.2
10. Secondary Canal	789.0	749.1	1,538.1	597.0	577.0	1,174.0	1,386.0	1,326.1	2,712.1
Sub-Total [9.-10.]	4,731.0	3,119.1	7,850.1	3,959.7	2,144.5	6,104.2	8,690.7	5,263.6	13,954.3
Sub-Total [2.-10.]	9,884.0	5,330.0	15,214.0	7,183.3	4,037.4	11,220.7	17,067.3	9,367.4	26,434.7
11. Drainage Canal	1,583.1	1,288.5	2,871.6	596.4	485.4	1,081.8	2,179.5	1,773.9	3,953.4
12. Road Works (I) Right Aguan	7,371.9	4,653.1	12,025.0	9,972.0	6,085.9	16,057.9	17,343.9	10,739.0	28,082.9
13. Road Works (II) Left Aguan				739.1	413.2	1,152.3	739.1	413.2	1,152.3
Sub-Total [12.-13.]	7,371.9	4,653.1	12,025.0	10,711.1	6,499.1	17,210.2	18,083.0	11,152.2	29,235.2
14. Land Reclamation	5,391.4	3,102.4	8,493.8	5,178.6	2,971.7	8,150.3	10,570.0	6,074.1	16,644.1
Sub-Total [2.-14.]	24,230.4	14,374.0	38,604.4	23,669.4	13,993.6	37,663.0	47,899.8	28,367.6	76,267.4
Sub-Total [1.-14.]	24,230.4	14,656.0	38,886.4	23,669.4	13,993.6	37,663.0	47,899.8	28,649.6	76,549.4
15. O/M Equipment	1,195.8	0.0	1,195.8				1,195.8	0.0	1,195.8
16. Administration Cost	0.0	1,660.0	1,660.0				0.0	1,660.0	1,660.0
17. Engineering Service	11,590.0	1,160.0	12,750.0				11,590.0	1,160.0	12,750.0
Sub-Total [1.-17.]	37,016.2	17,476.0	54,492.2	23,669.4	13,993.6	37,663.0	60,685.6	31,469.6	92,155.2
18. Physical Contingency	3,701.6	1,747.6	5,449.2	2,366.9	1,399.4	3,766.3	6,068.6	3,147.0	9,215.5
Sub-Total [1.-18.]	40,717.8	19,223.6	59,941.4	26,036.3	15,393.0	41,429.3	66,754.2	34,616.6	101,370.7
19. Price Escalation	8,113.9	4,651.1	12,765.0	8,517.0	6,198.5	14,715.5	16,630.9	10,849.6	27,480.5
Total	48,831.7	23,874.7	72,706.4	34,553.4	21,591.5	56,144.8	83,385.1	45,466.2	128,851.3

Table 5-1 SUMMARY OF COST ESTIMATION (CASE 2)

(Cost Unit : 1000Lps)

Description	Area I			Area II			Total		
	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total
1. Preparatory Works	0.0	282.0	282.0				0.0	282.0	282.0
2. Head Works (Middle Aguan)	2,452.3	1,801.7	4,254.0				2,452.3	1,801.7	4,254.0
3. Head Works (Upper Aguan)				1,461.9	1,179.9	2,641.8	1,461.9	1,179.9	2,641.8
4. Head Works (Jaguaca)	273.9	163.3	437.2				273.9	163.3	437.2
5. Head Works (Mame)				582.7	387.9	970.6	582.7	387.9	970.6
6. Siphon (Pte.Mame)				283.3	204.3	487.6	283.3	204.3	487.6
Sub-Total [2.-6.]	2,726.2	1,965.0	4,691.2	2,327.9	1,772.1	4,100.0	5,054.1	3,737.1	8,791.2
7. Pump Station No.1	2,426.8	245.9	2,672.7				2,426.8	245.9	2,672.7
8. Pump Station No.2				895.7	120.8	1,016.5	895.7	120.8	1,016.5
Sub-Total [7.-8.]	2,426.8	245.9	2,672.7	895.7	120.8	1,016.5	3,322.5	366.7	3,689.2
9. Main Canal	3,942.0	2,370.0	6,312.0	3,362.7	1,567.5	4,930.2	7,304.7	3,937.5	11,242.2
10. Secondary Canal	789.0	749.1	1,538.1	597.0	577.0	1,174.0	1,386.0	1,326.1	2,712.1
Sub-Total [9.-10.]	4,731.0	3,119.1	7,850.1	3,959.7	2,144.5	6,104.2	8,690.7	5,263.6	13,954.3
Sub-Total [2.-10.]	9,884.0	5,330.0	15,214.0	7,183.3	4,037.4	11,220.7	17,067.3	9,367.4	26,434.7
11. Drainage Canal	1,583.1	1,288.5	2,871.6	596.4	485.4	1,081.8	2,179.5	1,773.9	3,953.4
12. Road Works (I) Right Aguan	7,371.9	4,653.1	12,025.0	9,972.0	6,085.9	16,057.9	17,343.9	10,739.0	28,082.9
13. Road Works (II) Left Aguan				739.1	413.2	1,152.3	739.1	413.2	1,152.3
Sub-Total [12.-13.]	7,371.9	4,653.1	12,025.0	10,711.1	6,499.1	17,210.2	18,083.0	11,152.2	29,235.2
14. Land Reclamation	5,391.4	3,102.4	8,493.8	5,178.6	2,971.7	8,150.3	10,570.0	6,074.1	16,644.1
Sub-Total [2.-14.]	24,230.4	14,374.0	38,604.4	23,669.4	13,993.6	37,663.0	47,899.8	28,367.6	76,267.4
Sub-Total [1.-14.]	24,230.4	14,656.0	38,886.4	23,669.4	13,993.6	37,663.0	47,899.8	28,649.6	76,549.4
15. O/M Equipment	1,195.8	0.0	1,195.8				1,195.8	0.0	1,195.8
16. Administration Cost	0.0	1,180.0	1,180.0	0.0	730.0	730.0	0.0	1,910.0	1,910.0
17. Engineering Service	7,800.0	730.0	8,530.0	4,348.0	452.0	4,800.0	12,148.0	1,182.0	13,330.0
Sub-Total [1.-17.]	33,226.2	16,566.0	49,792.2	28,017.4	15,175.6	43,193.0	61,243.6	31,741.6	92,985.2
18. Physical Contingency	3,322.6	1,656.6	4,979.2	2,801.7	1,517.6	4,319.3	6,124.4	3,174.2	9,298.5
Sub-Total [1.-18.]	36,548.8	18,222.6	54,771.4	30,819.1	16,693.2	47,512.3	67,368.0	34,915.8	102,283.7
19. Price Escalation	6,806.2	4,215.0	11,021.1	12,023.6	8,071.6	20,095.1	18,829.7	12,286.5	31,116.3
Total	43,355.0	22,437.6	65,792.6	42,842.7	24,764.7	67,607.4	86,197.7	47,202.3	133,400.0

Table 5-2 SUMMARY OF ANNUAL DISBURSEMENT SCHEDULE (CASE 1)

(Unidad : 1000Lps)

Ano	Area I				Area II				Total			
	Divisas	Locales	Total	%	Divisas	Locales	Total	%	Divisas	Locales	Total	%
1 (1985)	3,078.9	601.4	3,680.3	5.1	0.0	0.0	0.0	0.0	3,078.9	601.4	3,680.3	2.9
2 (1986)	1,686.7	377.2	2,063.9	2.8	0.0	0.0	0.0	0.0	1,686.7	377.2	2,063.9	1.6
3 (1987)	18,231.1	10,125.3	28,356.4	39.0	564.7	324.8	889.5	1.6	18,795.8	10,450.1	29,245.9	22.7
4 (1988)	13,203.2	7,957.9	21,161.1	29.1	3,547.5	2,035.8	5,583.4	9.9	16,750.8	9,993.7	26,744.5	20.8
5 (1989)	8,078.7	3,527.8	11,606.4	16.0	8,437.4	5,500.0	13,937.4	24.8	16,516.1	9,027.8	25,543.8	19.8
6 (1990)	2,221.0	623.8	2,844.9	3.9	10,733.5	6,665.4	17,399.0	31.0	12,954.6	7,289.3	20,243.8	15.7
7 (1991)	2,332.1	661.3	2,993.4	4.1	11,270.2	7,065.4	18,335.6	32.7	13,602.3	7,726.6	21,328.9	16.6
Total	48,831.7	23,874.7	72,706.4	100.0	34,553.4	21,591.5	56,144.8	100.0	83,385.1	45,466.2	128,851.3	100.0

Table 5–2 SUMMARY OF ANNUAL DISBURSEMENT SCHEDULE (CASE 2)

(Cost Unit : 1000Lps)

Project Year	Area I Foreign Currency	Area I Local Currency	Area I Total	Area I %	Area II Foreign Currency	Area II Local Currency	Area II Total	Area II %	Total Foreign Currency	Total Local Currency	Total Total	Total %
1st. (1985)	2,702.7	558.0	3,260.7	5.0	0.0	0.0	0.0	0.0	2,702.7	558.0	3,260.7	2.4
2nd. (1986)	945.9	265.2	1,211.2	1.8	0.0	0.0	0.0	0.0	945.9	265.2	1,211.2	.9
3rd. (1987)	18,500.6	10,301.7	28,802.3	43.8	0.0	0.0	0.0	0.0	18,500.6	10,301.7	28,802.3	21.6
4th. (1988)	13,274.5	7,965.9	21,240.4	32.3	0.0	0.0	0.0	0.0	13,274.5	7,965.9	21,240.4	15.9
5th. (1989)	7,931.3	3,346.6	11,277.9	17.1	610.4	66.5	677.0	1.0	8,541.7	3,413.2	11,954.8	9.0
6th. (1990)	0.0	0.0	0.0	0.0	17,644.4	10,278.0	27,922.4	41.3	17,644.4	10,278.0	27,922.4	20.9
7th. (1991)	0.0	0.0	0.0	0.0	15,728.7	9,309.6	25,038.3	37.0	15,728.7	9,309.6	25,038.3	18.8
8th. (1992)	0.0	0.0	0.0	0.0	8,859.2	5,110.6	13,969.7	20.7	8,859.2	5,110.6	13,969.7	10.5
Total	43,355.0	22,437.6	65,792.6	100.0	42,842.7	24,764.7	67,607.4	100.0	86,197.7	47,202.3	133,400.0	100.0

CHAPTER 6 : PROJECT EVALUATION

CHAPTER 6 PROJECT EVALUATION

6.1 Benefits

First of all, the project would directly give benefit to more than one thousand eight hundred members of the co-operatives which are located in the irrigated section of the project area. The benefit would be derived from the incremental return of the various agricultural products which would be cultivated within the irrigated section with higher productivity due to introduction of double crop system and improvement in flood control and drainage.

In the marginal section of the project area on the right bank, where no crops but grasses are cultivated, new settlers will be able to grow various crops with the improvement of drainage and access roads.

On the left bank of the project area, improvement of through-road along the river with three submerged bridges will be carried out. Though there would be positive effect on every aspect of the socio-economic life of the residents on the left bank, both agricultural and animal husbandry sectors, we shall refrain from counting as incremental benefit between "with project" condition and "without project" condition.

More yield can be expected with proper and energetic programmes for education and extension services to the member farmers of the co-operatives in the project area, but expected additional benefit shall be awarded to those who will provide these services, as our project does not allocate any funds for the services. Likewise, the project does not make any provision for the post harvest facilities such as efficient mills and rodent- and insect-free storages, those who will invest for the facilities would deserve to reap the harvest of expected benefit.

Firstly, we shall describe the present situation of the project area. Present land use of the project area in terms of agricultural production is under the mercy of natural climatic condition, thus the area is sparsely used for the major cereal cultivation, and the rest is covered by grasses. Table 6-1 gives the breakdown of the area cultivated. In the more favorable part of the area, about 1,800 hectres, is under double crop system. Agricultural income of the project area in 1984 is shown in Table 6-2. Unit net profit per hectare for the total project area is about 185 lempiras. The tables also tell that the unit net profit of the Area II (between Olanchito and Jaguaca River) is less than half of that of the Area I (between Saba and Jaguaca River). This is the original level of production, from which possible course of development, whether they are planned or natural, will start.

The scenario for the "without project" situation is given in Table 6-3. What is presumed in it is that the unit profitability won't change and that numbers of additional settlers to the project area is around fifty families. Total cultivable area in broad sense

will be 13,129 hectres (15,800-2,671-13,129). If each new settlers is allocated five hectres according to the INA's direction, the area can accommodate 2,626 more families (13,129/5=2,626). So with fifty families a year, it will take 53 more years to fill up the area. As is shown in Table 6-3, with given unit net profit described in Table 6-2, incremental net profit per year to be added to the 1984 level will be about 32 thousand lempiras for the Area I, and about 18 thousand lempiras for the Area II.

The program for the "with project" situation is given in Table H-1 of Appendix. The plan is tabulated crop-wise and section-wise. Reasons to chose this combination is given in Chapter 4. As tree crops need some years before they reach full production level, Table H-2 of Appendix presents the figures of net profits of each tree crops in their initial stages after planted. They are expressed in financial prices. Annual crops which grow in the irrigated area outside the dyke are more susceptible to the flood than those inside the dike. The probable damage is calculated and reduced. The assumption is given in the appendix H.

6.2 Economic Evaluation

Economic Internal Rate of Return (EIRR) is calculated as 13.00 perent. Project life is set to be forty years. In the case one (whole-in-one development plan), two years of preparatory period and five years of construction period are included; in the case two (phased development plan), construction period lasts six years. Table 6-4 shows how the economic cost is calculated and Table 6-5 EIRR. EIRR of case two is 12.83 percent.

Factors used to get benefit and cost in economic term are explained in the appendix, and all the processes through which the EIRR are calculated are given in the tables in Appendix H.

The EIRR of this project suggests that proposed capital investment to this project is worthwhile in the context of national economy, as the figure is above the higher range of opportunity cost of the capital to be used in this type of agricultural project. Incidentally, EIRR for the development of Area I only is 12.6 percent.

A sensitibity analysis is carried out and expreseed in sets of matrix form which is shown in Table 6-6. Two variables are used, one is ten percent increase in the cost and the other is ten percent decrease in the net profit. Both are identical in character, opposite in direction. So another element, time is brought in. The case 2 deals with a risk of delay in completion of the construction of facilities due to some unforseeable factors. An year's delay in completion is far less sensitive than ten percent fluctuation of either in cost or in benefit.

6.3 Financial Evaluation

6.3.1 Financial Internal Rate of Return (FIRR)

FIRR to all resources engagd is estimated to be 13.18 percent over a project lift of 40 years, which includes two years of preparatory period and five years of construction period in the case one.

Benefit in financial term is given in Table 6-7, in which the revenue from "with project" situation is reduced by that of "without project" situation. Th cost includes physical contingencies.

The case two is one of the example of sensitibity analysis, where the fund for Area I and Area II is separately procured, though they come in succession. FIRR of the case 2 is 13.04. Subsequent sensitive analysis is given in two sets of matrix in Table 6-8. An year's postponement in construction period is one seventh sensitive to either ten percent increase in cost or ten percent decrease in benefit.

prices are expressed in 1984 lempiras, if not mentioned otherwise.

6.3.2 Economic Backround of the co-operatives. (Farm Economy)

Our field study at the project area has found outsome indication that the better the economic basis of each member, the broader the basis of activities of the co-operative. Less sound economy of the member families leads to less effective economic activities in the part of the co-operative. Then members start loosing their identity to their cooperatives, which will result in the inertia of the cooperative. But without co-operative, single farmer is not likely to negotiate the rough sea successfully. So here you will find a vicious cycle. This project will provide the member farmers, present and future, with basic irrigation and drainage facilities, so that they can produce more foodstuffs to sell on the field which is more secured from natural disaster than before. 9100 hectares of irrigated section of the project area will produce 24,311 thousand lempiras' net worth of agro-products (family labour is included in the cost, but water charges is not), according to the cropping patterns proposed in Chapter 4. If each family is allocated five hectares, a family can earn 13,358 lempiras in average as it's share of net profit. On the other hand, maintenance and operation cost shall be shared by the farmers in the irrigated area, then the beneficiary rate will be 780 lempiras a family. This amount consists only 6 percent of the net profit. Thus, the income before tax per family is 12,578 lempiras after tree crops give their full grown yield. Besides, 1.5 man-day of family labour force in average earn 2,700 lempiras a year (300 days), if daily wage is set to 6 lempiras. This amount naturally goes directly into household account.

It requires some size of initial investment to start orchards. But, thanks to the income from annual crops, co-operatives of the project area, if taken as a whole, will be able to overcome the situation with reasonable amount of long term loan provided by the government for several years.

The argument given above is based on the average income of the household of the irrigated section in the project area, when all the tree crops reach their full grown stage. But, a little more close examination of the project implementation aspect is felt to be required because of the fact that the irrigated area will be planted with various crops, perennial as well as annual. So the principle of efficiency of production may dictate to each co-operative to specialize its each crop, at the same time, the other principle of the self-sufficiency will do to every household to produce its own basic food. Though an example of farmer's income with reference to the existing co-operative is given in 4.3.4, here a financial analysis is given of initial stage of two imaginative co-operatives which will grow oranges and cacaos in their respective orchard. Cacao is chosen here because more than a thousand hectares are allocated for growing it in the cropping plan, and oranges are chosen because growing oranges requires more initial investment than growing cacao.

Table H-27-(i), H-27-(ii) (Appendix H) give an example of cash flow of a member farmer of organge grower's co-operative and cacao growers' co-operative. A share of the holding of the cacao plantation per unit family is set to 3.9 hectares, as unit net income from cacao is more than average net income of the irrigated land. (5 ha x 2,515.6/3,233 = 3.89 ha). And a family share of orange orchard is 3.4 hectares. (5 ha x 2,515.6/3,643 = 3.45 ha)

Each family is allocated 10ha of land to satisfy its need in basic grain. Input and labour requirement for this piece of land is calculated from the assumption that maize and paddy are gorwn. 500 kg of maize and 330 kg of husked rice can sustain a family of 5.5 members.

A family can provide 450 man-day labour force a year. In the initial year for the orange growing, it has to pay wages for hire hands because more labour is required than its own available work force. But from the second year to the sixth, it will have to earn wages outside, using remining man-day after using it within its family's share in the orchard and its grain growing plot, in order to offset the financial burden incurred by the repayment of the debt made in the first year. For the same reason, intercrop is also cultivated during the same period.

Long-term credit must be drawn for the initial investment of making orange orchard. The amount for a family is set to 7,000 lempiras, interest rate 15 percent and repayment period of 11 years with grace period of five years. Though they will have to endure several years of shortage of cash (basic grain for home consumption is secured), soon the strenuous effort will be rewarded with the increase of yeield from orchard. Co-operative is responsible for the arrangement of credit with the lending institutions. Then, from seventh year onward, it will be able to

concentrate its effort to increase efficiency in management of the orchard, as the amount of saving, that is, its own fund, will broaden the base of its financial maneuvability.

Co-operatives engaging in cacao and other crops require less financial burden at the initial stage, and the co-opertives in the non-irrigated section of the project area require larger unit area for cultivation acording to the productivity of the land and variety of crop they decide to choose.

6.3.3 Investment and Its Repayment

Now let us look at the project from the aspect of financing. The total amount of investment with physical contingency in 1984 price is 101,371 thousand lempiras. If the amount is procured, both by foreign loans and through government financing, at the interest rate of three percent, the amount of interest cost per year will be 3,041 thousand lempiras. If depreciation charges are paid evenly over 40 years of project life, the yearly amount will become 2,534 thousand lempiras. Then if these amounts are equally shared by the beneficiaries of irrigation facilities, each member of the co-operatives is to share the responsibility of paying 3,063 lempiras per year. This amount is 24.4 percent to the amount of its income before tax. This is within its capacity. Following is an example of levying. If the income tax is levied at the rate of 15 percent to the income, which include the cost of family labour, the amount of tax will be 2,292 lempiras. If the land tax is collected at the rate of 0.5 percent to the value of land, which is calculated as 25,156 lempiras per hectare (Income before tax is devided by socially admitted interest rate, which is set to be ten prcent in this case), the land tax to a member family will be 629 lempiras. The total of these two types of taxes will become 2,921 lempiras. Table 6-9 gives a cash flow of the project financing. Loans wll be assumed to be granted by an international lending institution or to be arranged bilaterally with three percent interest rate. The period of amortization is set to 30 years with grace period of ten years. With the local portion of the project fund, the total required amount shall be provided through the channel of public capital investment. In recent years agricultural sector has been receiving only around 5 percent of total public investment to fixed assets. In 1980, the amount was 25 million lempiras. On the one hand, the broad principles of fiscal austerity should be observed, on the other hand, agricultural sector ought to get priority in the investment policy to boost the agricultural production. But, judging from the level of investment of this project, the fund for the project can easily be accommodated in the total framework of public investment to the fixed assets in agricultural sector.

The figures for the amount of amortization and interest costs exceeed combined total of interest and depreciation cost calculated above, because of the difference in amortization period and depreciation period. The discrepancy can be filled theoritically, if we consider to levy five percent indirect tax to the agricultural commodities produced from the project area.

6.4 Socio-Economic Evaluation

(i) With the provision of dyke and drainage canal, the major part of the project area will be protected from all the flood, the scale of which is less than five year return period. Members of the co-operatives in the project area will be able to rely on far more stable flow of income from their crops than before the project is introduced.

(ii) The construction work of the project will create about 210 thousand man-days of work for un-skilled labourers.

(iii) The volume of manual labour required by the farm management system in the irrigated sect ion of the project area described in Chapter 4 is 1,151 thousand man-daysof work per year. 1,820 member families can create 819 thousand man-daysof work a year, as each five member family can provide 1.5 man-days of work a day and they can work 300 days a year in the field. So the program requires 332 thousand more man-days of work. This means that the irrigated area will create 1,100 regular jobs, and additional seasonal labour for planting and harvesting times. Some can be filled from the adjacent non-irrigation section of the project area, some from neighbouring mono-culture areas.

(iv) It will be easier for INA to induce new settlers to come to the project area because the project will give foundation for further development of the area, and the area's potential will be materialized by the supply of human resources. If INA is able to provide the settlers with jobs in the construction work, then transform them into the farmers, so much the better.

6.5 Evaluation of the Project

The project will transform the middle Aguan region, where major filled part of the potential agricultural land is left untouched, into wealtheir and manageable farm land. The facilities the project will provide is not huge, and the system is conventional. The river water is brought into the area by gravity flow as far as possible to minimize the cost. The structures are also easy to handle. The area has been a corridor to connect the upper Aguan and the lower geographically. When the co-operatives of the area start producing balanced combination of cereals, fruits and vegetables, they will feed the people of the upper and the lower region, where mono-culture is predominant, with staple food and vegetables, so people of both area need not rely on the basic foodstuffs to outside the valley basin. This gives the basis of forming Aguan Valley Economic Region, which should form itself as a hinterland of newly built Puerto Castilla. Production of such cash crops like fruits will augment the agro-product of the same kind of two other areas, which will facilitate the introduction of agro-processing industry and some of better qualities goods will be forwarded to port to increase, at least, the varieties of agro-commodities to be exported. Then, as La Ceiba has been functioning as the frotnier port town to the Aguan, Puerto Castilla, an out-port of the histric town of Trujillo, will act as a frontier town to the valleys to be developed, which are located east to the Aguan.

6.6 Conclusion

The economic and financial evaluation made in this study has concluded that the implementation of the Project is feasible for the agricultural development of the Aguan Valley between Saba and Olanchito.

Table 6--1 Present Situation of Cultivated Area

(ha)

	Fruit	Field	Pasture	Total
Area I	0	(2200) 3750	1372	5122
Area II	152	(319) 543	6340	7035
Total	152	*(2519) 4293	7712	12157

* 1774 ha is under double crop system

Table 6–2 (i) Agricultural Income in 1984 (Area I)

	Product t/h	Unit Price Lp/t	Unit Cost Lp/ha	Area ha	(Area I) Gross Inc. Lp	(Area I) T. Cost Lp	New Profit Lp
Maize	2.5	350	657	3,242	3,544,449	2,129,994	706,756
Friholes	1.1	920	500	225	227,700	112,500	115,200
Up-L Rice	2.6	460	800	263	314,548	210,400	104,148
Cassava	9	160	800	20	28,800	16,000	12,800
Plantain	15	150	1,087	0	0	0	0
Orange	25	110	1,100	0	0	0	0
Others	10	80	10	0	0	0	0
Pasture	6	16.6	20	1,372	136,651	27,440	109,211
Total				5,122	3,544,449	2,496,334	1,048,115

Cultivated Area = 3,572 ha Unit Net Profit = Lp. 293.4/ha

Table 6–2 (ii) Agricultural Income in 1984 (Area II)

	Product t/h	Unit Price Lp/t	Unit Cost Lp/ha	Area ha	(Area II) Gross Inc. Lp	(Area II) T. Cost Lp	New Profit Lp
Maize	2.5	350	657	470	411,250	308,790	102,460
Friholes	1.1	920	500	33	33,396	16,500	16,896
Up-L Rice	2.6	460	800	39	46,644	31,200	15,444
Cassava	9	160	800	1	1,440	800	640
Plantain	15	150	1,087	7	15,750	7,609	8,141
Orange	25	110	1,100	130	357,500	143,000	214,500
Others	10	80	10	15	12,000	150	11,850
Pasture	6	16.6	20	6,340	631,464	126,800	504,664
Total				7,035	1,509,444	634,849	874,595

Cultivated Area = 6,811 ha Unit Net Profit = Lp. 128.4/ha

Table 6–2 (iii) Agricultural Income in 1984 (Total)

	Product t/h	Unit Price Lp/t	Unit Cost Lp/ha	Area ha	(Total Area) Gross Inc. Lp	(Total Area) T. Cost Lp	New Profit Lp
Maize	2.5	350	657	3,712	3,248,000	2,438,784	809,216
Friholes	1.1	920	500	258	261,096	129,000	132,096
Up-L Rice	2.6	460	800	302	361,192	241,600	119,592
Cassava	9	160	800	21	30,240	16,800	13,440
Plantain	15	150	1,087	7	15,750	7,609	8,141
Orange	25	110	1,100	130	357,500	143,000	214,500
Others	10	80	10	15	12,000	150	11,850
Pasture	6	16.6	20	7,712	768,115	154,240	613,875
Total				12,157	5,053,893	3,131,183	1,922,710

Cultivated Area = 10,383 ha. Unit Net Profit = Lp. 185.18/ha

Table 6–3 Without Project Situation

	Area under cultivation (ha)	Cultivable area (ha)	%	Inflow of family/ year	Allocated area (ha)	Unit net profit Lps/ha	Increased net profit/ year (Lps)
Area I	2,200	6,944	44	22	110	293.4	32,274
Area II	471	8,856	56	28	140	128.4	17,976
Total	2,671	15,800	100	50	250	201.0	50,250

Table 6–4 (1) ECONOMIC COST (CASE 1)

(1000 Lempira in 1984 price)

YEAR	FINANCIAL COST(*1) FOREIGN	LOCAL	TOTAL	ECONOMIC COST FOREIGN(*2)	LOACL(*3)	TOTAL	OPERATION & MAINTENANCE FINANCIAL(*4)	ECONOMIC(*5)	GRAND TOTAL
1985	2932.27	567.38	3499.65	3665	556	4221	0	0	4221
1986	1529.88	335.72	1865.60	1912	329	2241	0	0	2241
1987	16236.55	8774.15	25010.70	20295	8595	28895	0	0	28895
1988	13780.91	7915.93	21696.84	17226	7758	24984	0	0	24984
1989	12940.73	5746.08	19686.81	16176	6611	22787	0	0	22787
1990	9666.91	5138.65	14805.56	12084	5036	17120	782	979	18099
1991	9666.91	5138.65	14805.56	12084	5036	17120	782	979	18099
1992-2024	0.00	0.00	0.00	0	0	0	1419	1776	1776
2010	1472.00	368.00	1840.00	1840	361	2201	1419	1776	3977
2012	585.60	146.40	732.00	732	143	875	1419	1776	2651
2020	348.80	87.20	436.00	436	85	521	1419	1776	2297
2022	302.40	75.60	378.00	378	74	452	1419	1776	2228

Table 6-4 (ii) Economic Cost (CASE 2)

(1000 Lempira in 1984 price)

YEAR	FINANCIAL COST(*1) FOREIGN	LOCAL	TOTAL	ECONOMIC COST FOREIGN(*2)	LOACL(*3)	TOTAL	OPERATION & MAINTENANCE FINANCIAL(*4)	ECONOMIC(*5)	GRAND TOTAL
1985	2574.00	526.46	3100.46	3217	516	3733	0	0	3733
1986	858.00	236.06	1094.06	1072	231	1303	0	0	1303
1987	15981.46	8649.52	24630.98	19977	8477	28454	0	0	28454
1988	10920.91	6309.82	17230.73	13651	6184	19835	0	0	19835
1989	6692.62	2550.46	9243.08	8366	2499	10865	0	0	10865
1990	13166.45	7245.59	20412.04	16458	7101	23559	782	979	24538
1991	11178.09	6191.46	17369.55	13973	6068	20041	782	979	21020
1992	5996.21	3206.39	9202.60	7495	3142	10637	782	979	11616
1993-2024	0.00	0.00	0.00	0	0	0	1419	1776	1776
2010	1472.00	368.00	1840.00	1840	361	2201	1419	1776	3977
2013	585.60	146.40	732.00	732	143	875	1419	1776	2651
2020	348.80	87.20	436.00	436	85	521	1419	1776	2297
2023	302.40	75.60	378.00	378	74	452	1419	1776	2228

NOTE

(*1) including physical contingencies
shadow exchange rate : Lps. 2.50 =US$ 1.00
shadow wage rate : 0.5
cost of un-skilled labor consists of 4 percent of labor cost

(*2) FIN-FORIGN 2.5/2

(*3) FIN-LOCAL x(1-.04x.5)

(*4) O/M cost (financial)

	Area I	Area II	Total
(a) maintenance cost for civil work	109.7	111.1	220.8
(b) O/M cost of equipments	511.0	512.5	1023.5
(c) running cost of pumps	161.2	13.4	174.6
total	781.9	637.0	1418.9

(*5) O/M cost (economic)

	Forign	Local	Area I	Total Area
(a) maintenance cost for civil work				
Area I	68.0x1.1x2.5/2=94	41.7x(1-.04x.5)x1.1=45	139	
Total	132.2x1.1x2.5/2=182	88.6x(1-.04x.5)x1.1=96		278
(b) O/M cost of equipments and running cost of pumps				
Area I (511.0+161.2)x2.5/2=840 , Total Area (1023.5+174.6)*2.5/2=1498			840	1498
		total	979	1776

Table 6–5 EIRR

(1000 Lempira in 1984 price)

No.	YEAR	CASE 1 CAPITAL	CASE 1 M/O	CASE 1 T.COST	CASE 1 T.BENEFIT	CASE 1 B-C	CASE 2 CAPITAL	CASE 2 M/O	CASE 2 T.COST	CASE 2 T.BENEFIT	CASE 2 B-C
0	1984										
1	1985	4221		4221		-4221	3733		3733		-3733
2	1986	2241		2241		-2241	1304		1304		-1304
3	1987	28895		28895		-28895	28454		28454		-28454
4	1988	24984		24984		-24984	19835		19835		-19835
5	1989	22787		22787		-22787	10865		10865		-10865
6	1990	17120	979	18099	-1108	-19207	23559	979	24538	-1108	-25646
7	1991	17120	979	18099	4188	-13911	20041	979	21020	4188	-16832
8	1992		1776	1776	6875	5099	10637	979	11616	6786	-4830
9	1993		1776	1776	13002	11226		1776	1776	7692	5916
10	1994		1776	1776	17037	15261		1776	1776	15160	13384
11	1995		1776	1776	18988	17212		1776	1776	18267	16491
12	1996		1776	1776	22299	20523		1776	1776	20176	18400
13	1997		1776	1776	24969	23193		1776	1776	23239	21463
14	1998		1776	1776	26710	24934		1776	1776	24955	23179
15	1999		1776	1776	29454	27678		1776	1776	27095	25319
16	2000		1776	1776	29239	27463		1776	1776	29771	27995
17	2001		1776	1776	30785	29009		1776	1776	29458	27682
18	2002		1776	1776	31987	30211		1776	1776	30970	29194
19	2003		1776	1776	32571	30795		1776	1776	32021	30245
20	2004		1776	1776	33003	31227		1776	1776	32605	30829
21	2005		1776	1776	32997	31221		1776	1776	32953	31177
22	2006		1776	1776	32991	31215		1776	1776	32947	31171
23	2007		1776	1776	32941	31165		1776	1776	32941	31165
24	2008		1776	1776	32891	31115		1776	1776	32891	31115
25	2009		1776	1776	32841	31065		1776	1776	32841	31065
26	2010	2421	1776	4197	32791	28594	2421	1776	4197	32791	28594
27	2011		1776	1776	32741	30965		1776	1776	32741	30965
28	2012	963	1776	2739	32691	29952		1776	1776	32691	30915
29	2013		1776	1776	32641	30865	963	1776	2739	32641	29902
30	2014		1776	1776	32591	30815		1776	1776	32591	30815
31	2015		1776	1776	32541	30765		1776	1776	32541	30765
32	2016		1776	1776	32491	30715		1776	1776	32491	30715
33	2017		1776	1776	32441	30665		1776	1776	32441	30665
34	2018		1776	1776	32391	30615		1776	1776	32391	30615
35	2019		1776	1776	32341	30565		1776	1776	32341	30565
36	2020	574	1776	2350	32291	29941	574	1776	2350	32291	29941
37	2021		1776	1776	32241	30465		1776	1776	32241	30465
38	2022	497	1776	2273	32191	29918		1776	1776	32191	30415
39	2023		1776	1776	32141	30365	497	1776	2273	32141	29868
40	2024		1776	1776	32091	30315		1776	1776	32091	30315
		EIRR=13.00%					EIRR=12.83%				

Table 6-6 (i) SENSITIVITY ANALYSIS (EIRR) (CASE 1)

	Base Case	-10% Benefit
Base Case	13.00	12.02
+10% Cost	12.11	11.16

Table 6-6 (ii) SENSITIVITY ANALYSIS (EIRR) (CASE 2)

	Base Case	-10% Benefit
Base Case	12.83	11.86
+10% Cost	11.95	11.00

Table 6-7 FIRR

(1000 Lempira in 1984 price)

		CASE 1					CASE 2				
No.	YEAR	CAPITAL	M/O	T.COST	T.BENEFIT	B-C	CAPITAL	M/O	T.COST	T.BENEFIT	B-C
0	1984										
1	1985	3500		3500		-3500	3100		3100		-3100
2	1986	1866		1866		-1866	1094		1094		-1094
3	1987	25011		25011		-25011	24631		24631		-24631
4	1988	21697		21697		-21697	17231		17231		-17231
5	1989	19687		19687		-19687	9243		9243		-9243
6	1990	14806	782	15588	-488	-16076	20412	782	21194	-488	-21682
7	1991	14806	782	15588	4973	-10615	17370	782	18152	4973	-13179
8	1992		1419	1419	5597	4178	9203	782	9985	6683	-3302
9	1993		1419	1419	12101	10682		1419	1419	6377	4958
10	1994		1419	1419	14564	13145		1419	1419	13280	11861
11	1995		1419	1419	16400	14981		1419	1419	15764	14345
12	1996		1419	1419	18766	17347		1419	1419	17503	16084
13	1997		1419	1419	21349	19930		1419	1419	19647	18228
14	1998		1419	1419	22922	21503		1419	1419	21336	19917
15	1999		1419	1419	25371	23952		1419	1419	23261	21842
16	2000		1419	1419	25200	23781		1419	1419	25652	24233
17	2001		1419	1419	26560	25141		1419	1419	25391	23972
18	2002		1419	1419	27622	26203		1419	1419	26724	25305
19	2003		1419	1419	28141	26722		1419	1419	27649	26230
20	2004		1419	1419	28526	27107		1419	1419	28168	26749
21	2005		1419	1419	28520	27101		1419	1419	28476	27057
22	2006		1419	1419	28514	27095		1419	1419	28470	27051
23	2007		1419	1419	28464	27045		1419	1419	28464	27045
24	2008		1419	1419	28414	26995		1419	1419	28414	26995
25	2009		1419	1419	28364	26945		1419	1419	28364	26945
26	2010	1840	1419	3259	28314	25055	1840	1419	3259	28314	25055
27	2011		1419	1419	28264	26845		1419	1419	28264	26845
28	2012	732	1419	2151	28214	26063		1419	1419	28214	26795
29	2013		1419	1419	28164	26745	732	1419	2151	28164	26013
30	2014		1419	1419	28114	26695		1419	1419	28114	26695
31	2015		1419	1419	28064	26645		1419	1419	28064	26645
32	2016		1419	1419	28014	26595		1419	1419	28014	26595
33	2017		1419	1419	27964	26545		1419	1419	27964	26545
34	2018		1419	1419	27914	26495		1419	1419	27914	26495
35	2019		1419	1419	27864	26445		1419	1419	27864	26445
36	2020	436	1419	1855	27814	25959	436	1419	1855	27814	25959
37	2021		1419	1419	27764	26345		1419	1419	27764	26345
38	2022	378	1419	1797	27714	25917		1419	1419	27714	26295
39	2023		1419	1419	27664	26245	378	1419	1797	27664	25867
40	2024		1419	1419	27614	26195		1419	1419	27614	26195
		FIRR=13.18%					FIRR=13.04%				

Table 6-8 (i) SENSITIVITY ANALYSIS (FIRR) (CASE 1)

	Base Case	-10% Benefit
Base Case	13.18	12.19
+10% Cost	12.18	11.22

Table 6-8 (ii) SENSITIVITY ANALYSIS (FIRR) (CASE 2)

	Base Case	-10% Benefit
Base Case	13.04	12.05
+10% Cost	12.15	11.19

Table 6–9 CASH FLOW CASE

(1000 Lempira in 1984 price)

YEAR	1 (1985)	2 (1986)	3 (1987)	4 (1988)	5 (1989)	6 (1990)	7 (1991)	8 (1992)	9 (1993)	10 (1994)	11 (1995)	12 (1996)	13 (1997)	14 (1998)	15 (1999)
(1)FRN LOAN	2932	1530	16237	13781	12941	9667	9667	0	0	0	0	0	0	0	0
(2)GV FINANCE	568	336	8774	7916	6746	5139	5139	0	0	0	0	0	0	0	0
(3)TTL INFLOW	3500	1866	25011	21697	19687	14806	14806	0	0	0	0	0	0	0	0
(4)CONST COST	3500	1866	25011	21697	19687	14806	14806	0	0	0	0	0	0	0	0
(5)ACCM FR LN	2932	4462	20699	34480	47421	57088	66755	66755	66755	66755	63417	60079	56741	53403	50065
(6)AMORT-20Y	0	0	0	0	0	0	0	0	0	3338	3338	3338	3338	3338	3338
(7)INT-3%	88	134	621	1034	1423	1713	2003	2003	2003	2003	1903	1802	1702	1602	1502
(8)AMOR+INT	88	134	621	1034	1423	1713	2003	2003	2003	5341	5241	5140	5040	4940	4840

YEAR	16 (2000)	17 (2001)	18 (2002)	19 (2003)	20 (2004)	21 (2005)	22 (2006)	23 (2007)	24 (2008)	25 (2009)	26 (2010)	27 (2011)	28 (2012)	29 (2013)	30 (2014)
(1)FRN LOAN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(2)GV FINANCE	0	0	0	0	0	0	0	0	0	0	(*1840)	0	(* 732)	0	0
(3)TTL INFLOW	0	0	0	0	0	0	0	0	0	0	(*1840)	0	(* 732)	0	0
(4)CONST COST	0	0	0	0	0	0	0	0	0	0	(*1840)	0	(* 732)	0	0
(5)ACCM FR LN	46727	43389	40051	36713	33375	30037	26699	23361	20023	16685	13347	10009	6671	3333	0
(6)AMORT-20Y	3338	3338	3338	3338	3338	3338	3338	3338	3338	3338	3338	3338	3338	3338	3333
(7)INT-3%	1402	1302	1202	1101	1001	901	801	701	601	501	400	300	200	100	0
(8)AMOR+INT	4740	4640	4540	4439	4339	4239	4139	4039	3939	3839	3738	3638	3538	3438	3333

(1) Foreign Loan (including physical contingecies)
(2) Goverment Finace (including physical contingecies)
(3) Total Inflow
(4) Construction Cost
(5) Accumulated Foreign Loan
(6) Amortization (30 years with 10 year grace period)
(7) Interest (3.00 %)
(8) Amortization and Interest
(*) The amount is supposed to be provided by budgetal arrangement.

CHAPTER 7 : PHASED DEVELOPMENT CONCEPTS

CHAPTER 7 PHASED DEVELOPMENT CONCEPT

7.1 General Considerations

From the viewpoint for land ownership, the total project area can be divided into the following three categories:

(1) Upper Aguan Basin ..... Most land is privately owned and cultivated for pasture

(2) Middle Aguan Basin ..... National and private lands combined.

(3) Lower Aguan Basin ..... Mostly are national land, some of which are distributed to cooperative members

The drainage density and the road network system have been set out at intervals of 1 km/ha. On the other hand, in view of the efficient utilization of the existing topographical conditions, water intake points have been located at four sites, two on the Aguan River, one on the Mame and one on the Jaguaca. Given the location of the water intake site and distribution canal, the irrigated zone within the project area could be categorized in the upper basin and lower basin of the Aguan River divided by the Jaguaca River.

7.2 Amount of Construction Works in Phased Development Concepts

The phased development of the construction works has been tentatively proposed dividing the project area into the following two areas.

Area I : The development of the area between Saba and the Jaguaca River

Area II: The development of the area between Olanchito and the Jaguaca River

The phased development is summarized as below:

Benefiting Area (ha)	Area I	Area II	Total
Irrigation	4,940	4,160	9,100
Drainage	8,070	12,590	20,660
Roads	8,070	12,590	20,660

The phased construction works can be summarized as follows:

(ha)	Area I	Area II	Total
Head Works (No.)	2	2	4
Pump Station (No.)	1	1	2
Main Irrigation Canal (km)	39.75	33.9	73.65
Lateral Irrigation Canal (km)	42.5	38.5	81.0
Drainage Canal (km)	36.65	27.95	64.60
Main In-farm Road (km)	16.8	30.7	47.5
Lateral In-farm Road (km)	49.95	70.7	120.65

7.3 Comparison of Proposals for Whole-in-one Development Plan and Phased Developmt Plan

7.3.1 Whole-in-one Development Plan (Case 1)

In terms of the duration of the construction period, there is one year's difference between the whole-in-one development plan and phased development plan. The former being 5 years and the latter 6 years.

It is recommended that the construction of critical parts for head works and pump stations be carried out, to the extent possible in the dry season with efficient utilization of construction machinery. In order to accomplish this goal as well as to reduce construction costs, the construction order of head works is proposed as: 1) Middle Stream of the Aguan River, 2) the Jaguaca River, 3) Upper Stream of the Aguan River and the Mame River.

The same considerations should be made for the construction of the pump station.

7.3.2 Phased Development Plan (Case 2)

The phased development plan would be proposed in the following cases:

(1) Earlier generation of benefits from the implementation of the Project will be pressed.

(2) Due to insufficient availability of financial resources the budget is not enough to cover the whole construction works at the same time.

Considering the work volume for irrigation and drainage system and in-farm road network, it will be feasible to carry out the construction works divided into two blocks by the Jaguaca River. For the purpose of easy acquisition of sites for the construction work and in order to accelerate the progress of the Project, it is recommended that the Project be started from Area I. Furthermore, the first phase of development will present an example of development to the succeeding phases.

The comparison of project cost between the whole-in-one development plan and the phased development plan is hereinunder summarized.

Project Cost for Whole-in-one Development Plan and Phased Development Plan

Year	Whole-in-one Development Plan		Phased Development Plan		Remarks
	Amount	%	Amount	%	
1 (1985)	3,680	2.9	3,261	2.4	Detailed Design Stage
2 (1986)	2,064	1.6	1,211	0.9	
3 (1987)	29,246	22.7	28,802	21.6	
4 (1988)	26,744	20.7	21,240	15.9	Construction Stage
5 (1989)	25,544	19.8	11,955	9.0	
6 (1990)	20,244	15.7	27,923	20.9	
7 (1991)	21,329	16.6	25,038	18.8	
8 (1992)	-	-	13,970	10.5	
Total	128,851	100.0	133,400	100.0	

CHAPTER 8 : INTEGRATION WITH THE MASTER PLAN

CHAPTER 8 INTEGRATION WITH THE MASTER PLAN

8.1 The Master Plan

Based on studies carried out between May 1982 and December 1983, four alternative Master Plan Strategies for the hydraulic development of the Aguan River Basin have been presented.

Each strategy has been drawn up with regard to national and regional development aims, technical feasibility and compatibility with available financial resources. Each plan is designed for phased implementation and is adaptable to changing conditions. The principal features of the four alternatives are summarized in Table 8-1. The final choice among these alternatives have been left to the Government of Honduras because Master Plans presented have financial, social and political implication which involve questions of public policy.

8.2 The Integration of the Feasibility Study with the Master Plan

In the Master Plan it is analyzed that the principal physical constraints on development of the potential of the Aguan River are soil erosion in the Upper Aguan and flooding and poor drainage in the Valley.

It is also suggested that the need for irrigation in the Middle Aguan is an important constraint in that area.

As one of the countermeasures for these constraints, the Master Plan proposes the construction of storage dams. After the topographical investigations, six potential reservoir sites have been identified as locations to provide substantial reservoir storage. These sites are located each two on the Aguan, the Yaguala and the Mame. The potential of each site has been examined with respect to the benefits potentially available to flood alleviation, the supply of water irrigation and for the generation of hydro-electric power. As a result, a reservoir at Cerro de la Puerta or at Loma Zope had been considered to be more effective and had been selected for more detailed study of cost estimation.

In the Feasibility Study, because it covers only approximately 21,000 ha of the middle Aguan area, the construction of reservoirs on the upstream of the Aguan River and its tributaries has been taken away for the development of the area. The irrigation works have been depending only on the utilization of river surface water by gravity and by pumping and flood alleviation on the construction of a dyke.

The need for irrigation in the middle Aguan and construction of dyke as means for flood alleviation are proposed in the Master Plan and, in this sense, the Feasibility Study is integrated with the Master Plan.

Table 8–1 Summary of Master Plan

Phase	Capital Works	Internal Rate of Return (%)	Investment Required (Lps million)	New Jobs Created ('000)
Master Plan 1				
I	Catchment conservation-hardwood areas Dykes and land drainage in Upper Wet Zone Durango Floodway	16%	153	3.5
II	Catchment conservation-pine savannah areas Relocation of settlements & raising of roads in Moist Zone Land Drainage in the Moist Zone and Transitional Zone	16%	242	4.0
III	Land drainage in the Dry Zone	27%	51	5.5
IV	Dykes and land drainage in the Lower Wet Zone	11%	217	3.5
			663	16.5
Master Plan 2				
I	Catchment conservation hardwood areas Dykes and land drainage in Upper Wet Zone Durango Floodway	16%	153	3.5
II	Catchment conservation - pine savannah areas Re-location of settlements and raising of roads in Moist Zone Dykes in Transitional zone and tributaries Land drainage in Moist and Transitional Zones Macora Irrigation Scheme	14%	302	6.0
III	Land drainage in Dry Zone Sabana Larga Irrigation Scheme Dam at Cerro de la Puérta	11%	401	11.5
IV	Dykes and land drainage in Lower Wet Zone	11%	217	3.5
			1,073	24.5

Table 8–1 Summary of Master Plan (Cont'd)

Phase	Capital Works	Internal Rate of Return (%)	Investment Required (Lps million)	New Jobs Created ('000)
Master Plan 3				
I	Catchment Conservation in hardwood areas Dykes and land drainage in Upper Wet Zone Durango Floodway	16%	153	3.5
II	Catchment Conservation in pine savannah areas Dykes in Moist Zone incl. tributaries Land drainage in Moist Zone	11%	265	1.0
III	Land draiange in Dry and Transitional Zones Dam at Cerro de la Puerta	11%	255	6.0
IV	Dykes and land drainage in Lower Wet Zone Macora Irrigation scheme	11%	339	8.5
			1,012	19.0
Master Plan 4				
I	Catchment Conservation in hardwood areas Dykes and land draiange in Upper Wet Zone Durango Floodway	16%	153	3.5
II	Catchment Conservation in pine savannah areas Dykes in Moist Zone incl. tributaries Land drainage in Moist Zone	11%	265	1.0
III	Dykes and land drainage and irrigation in Lower Wet Zone Dykes and Land draianges in Transitional Zone Macora Irrigation Scheme	9%	337	7.5
IV	Dam at Cerro de la Puerta Land drainage in Dry Zone Sabana Larga Irrigation Scheme	11%	401	11.5
			1,156	23.5

JICA