

## 4.5 Facility Plan

### 4.5.1 Summary

The proposed infrastructures are planned based on development presented in section 4.4. The major facilities proposed in this project are irrigation facilities, drainage facilities, roads, bank erosion control facilities and land consolidation facilities. These are summarized in Table 4-5-1 below.

Table 4-5-1 SUMMARY OF PROPOSED MAIN FACILITIES

Facilities		Descriptions
Intake facilities	Headworks	Type: Floating Type, Height of diversion weir: 3.0m Length of Headworks: 210m
Irrigation Facilities	Principal Canals	Line : 3 Length : 95 km
	Secondary Canal	Line : 29 Length : 113 km
Drainage Facilities	Principal Canals	Line : 1 Length : 5 km
Terminal Facilities	Irrigation Canal	Type : United Density: 25 m/ha
	Drainage Canal	Type : United Density: 20 m/ha
	Farm Road	Density: 15 m/ha
Revetment Facilities	Revetment Work	Site: 3 Length: 4 km
Road	Rehabilitation	Route : Trocha 4 Type : Asphalt pavement Length: 43 km
	Construction	Route : Service and Farm road Type : Gravel Pavement Length: 190 km

#### 4.5.2 Water Intake Facilities

(1) General

The headworks composed of diversion weir, intake, settling basin, etc. will be constructed.

(2) Location

The headworks will be constructed at a site about 4.6 km downstream from Lejanias (See ANNEX I).

(3) Type of Diversion Weir

The bedrock at the site of headworks is presumed to be deep, and it is composed of a gravel layer as the geotechnical survey has disclosed. For this reason, a floating type diversion weir has been selected.

(4) Intake System and its Capacity

At the proposed site of headworks, the water course is near to the left bank. To ensure a perennial stream along the right bank and a stable water intake, a dam-up system is adopted.

The capacity of the intake is 36.7 m<sup>3</sup> as designed in the irrigation plan.

(5) Dimensions of Headworks

The dimensions of the headworks is shown in Fig. 4-5-1 and Table 4-5-2.

Table 4-5-2 DIMENSIONS OF PROPOSED HEADWORKS

Facilities	Item	Dimensions
	Fixed Weir	Length: 187m, Width: 24m, Height: 3m
	Movable	Length: 10m, Width: 27m, 2 sites
	Riprap	Length: 15m, Width: 210m
	Intake	Width : 5m, Height: 2m, 5 sites
	Settling Basin	Length: 50m, Width : 45m

### 4.5.3 Irrigation Facilities

#### (1) General

Design criteria for the irrigation facilities such as principal and secondary canals have been determined based on the irrigation system.

#### (2) Design Discharge

The design discharges are established as follows:

Principal Canal No. 1 :  $Q = 36.7 - 2.2\text{m}^3/\text{s}$   
" No. 2 :  $Q = 17.0 - 1.8\text{m}^3/\text{s}$   
" No. 3 "  $Q = 3.0 - 1.2\text{m}^3/\text{s}$

#### (3) Dimensions of Irrigation Facilities

The dimensions of the principal and secondary irrigation canals, drops and diversion structures are as shown in Fig. 4-5-2 and Table 4-5-3.

Table 4-5-3 DIMENSIONS OF PROPOSED IRRIGATION FACILITIES

Facilities	Item	Dimensions
Principal Canal	Length	: 94.9 km (3 lines)
	Gradient	: 1/950 - 1/4,050
	Section	: refer to Fig. 4-5-2
	Lining	: Concrete lining and unlined
Secondary Canal	Length	: 113.0 km (29 lines)
	Gradient	: 1/700 - 1/3,400
	Section	: refer to Fig. 4-5-2
	Lining	: Concrete lining and unlined
Drop Structure	Place	: 356
	Head	: 1.0 - 2.0 m
	Type	: Water Cushion Type
Diversion Structure	Place	: 6
	Type	: Longitudinal Separation Type

(4) Related Facilities

Bridges will be installed where the irrigation canals cross roads, and inverted siphon works will be constructed where they cross canals. And considering the stability and the maintenance of the canals, wasteway works with spillway will be constructed at the site, where cross section changes, and at main inverted siphon works. At the terminals of the secondary canals, terminal wasteway will be constructed.

Table 4-5-4 DIMENSIONS OF PROPOSED ANCILLARY FACILITIES OF IRRIGATION NETWORK

Facility	Item	Dimension
Culvert	Place : 138 Span : 3.5 - 14.5 m	
Inverted Siphon	Place : 161 Type : Box Culvert, Pipe (RC) Culvert	
Wasteway	Place : 64 Type : with overflow spillway	

#### 4.5.4 Drainage Facilities

##### (1) General

Where caños lack draft capacity for drainage purpose, their cross section will be enlarged and these caños will be utilized as drainage canals.

##### (2) Dimensions of Structures

Typical cross-sections of proposed drainage canals are shown in Fig. 4-5-3, and their dimensions are shown in Table 4-5-5.

Table 4-5-5 DIMENSIONS OF PROPOSED DRAINAGE FACILITIES

Canal	Length (km)	B1 (m)	B2 (m)	H1 (m)	Gradient of Canal	Design Flood Discharge (m <sup>3</sup> /s)
Avichure	5.0	2.5	6.5	2.0	1/2,000	6.0

#### 4.5.5 Land Consolidation Facilities

##### (1) General

The tertiary irrigation canals to deviate water either from principal or secondary canals, terminal irrigation canals and drains, farm roads, etc. will be implemented by farmers.

##### (2) Dimensions of Structures

The dimensions of the terminal facilities are shown in Table 4-5-6.

Table 4-5-6 DIMENSIONS OF PROPOSED TERMINAL FACILITIES

Facility	Dimension	Length
Tertiary Canal	B: 0.5 m, H: 0.6 m	5 m/ha
Terminal Canal	B: 0.3 m, H: 0.5 m	20 m/ha
Terminal Drain	B: 0.5 m, H: 0.6 m	20 m/ha
Farm Road	T.W.: 4.0 m Type: Gravel Pavement	15 m/ha

4.5.6 Land Conservation and Disaster Prevention Plan

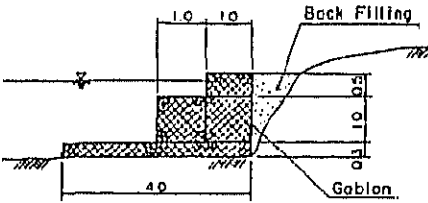
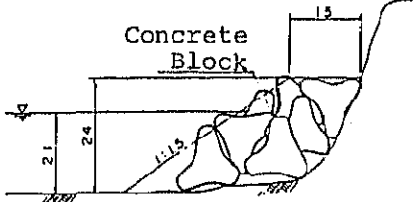
(1) General

The revetment works and foot protection works will be implemented for the three sections along the Ariari River which have been identified as the most urgent section in need of protection.

(2) Dimensions of Structures

The dimensions of the revetment works or foot protection works are as follows.

Table 4-5-7 DIMENSIONS OF PROPOSED REVETMENT WORK

Location	Item	Dimension	Remarks
Puerto Caldas	Length	L = 1,000m	
	Section		
Caño Venado and La Cooperativa	Length	L = 1,000m and L = 2,000m	
	Section		



#### 4.5.7 Road

##### (1) General

Rehabilitation of "Trocha 4" and construction of the service roads along the irrigation canals and farm roads are proposed.

##### (2) Cross-Section

The cross-section of proposed roads will be designed referring to existing farm roads. Their specific features are shown in Fig. 4-5-4 and Table 4-5-8.

Table 4-5-8 DIMENSIONS OF PROPOSED ROADS

Item	Trocha 4	Service Road		
		Type A	Type B	
Total Width	8.0	8.0	6.0	4.0
Effective Width (m)	6.0	6.0	4.5	3.0
Pavement	Asphalt	Gravel	Gravel	Gravel
Pavement Thin (cm)	7	20	20	20

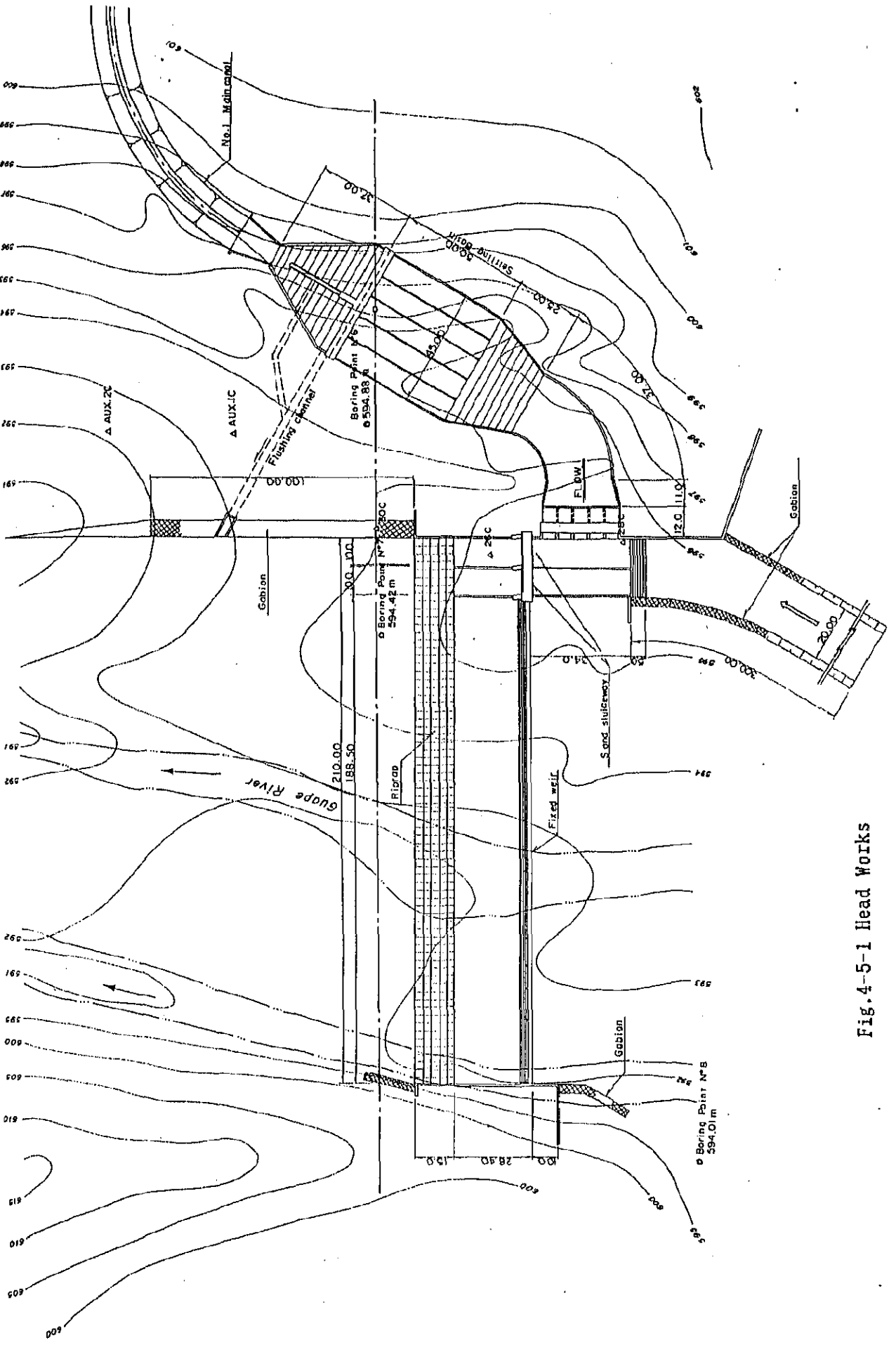
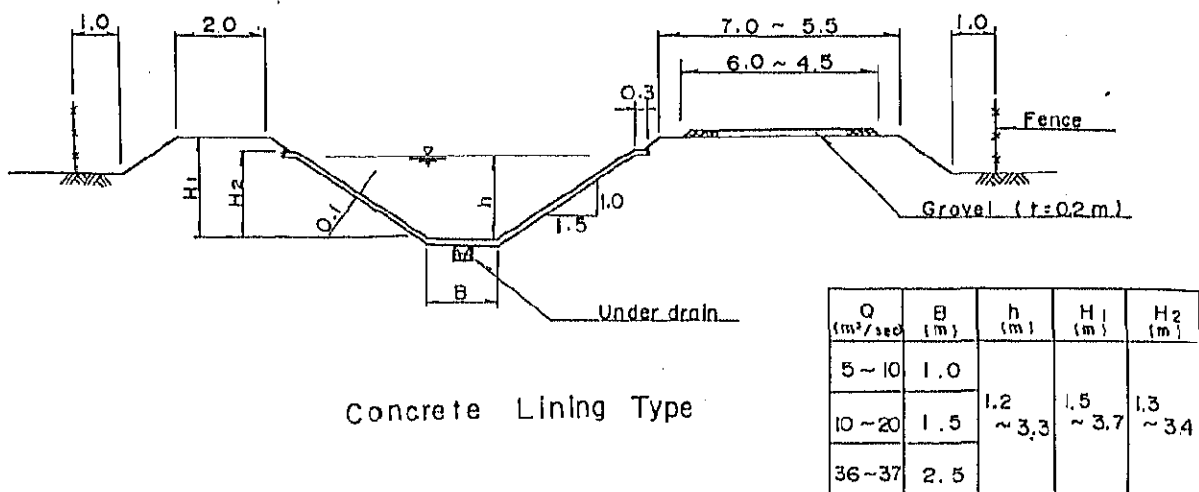
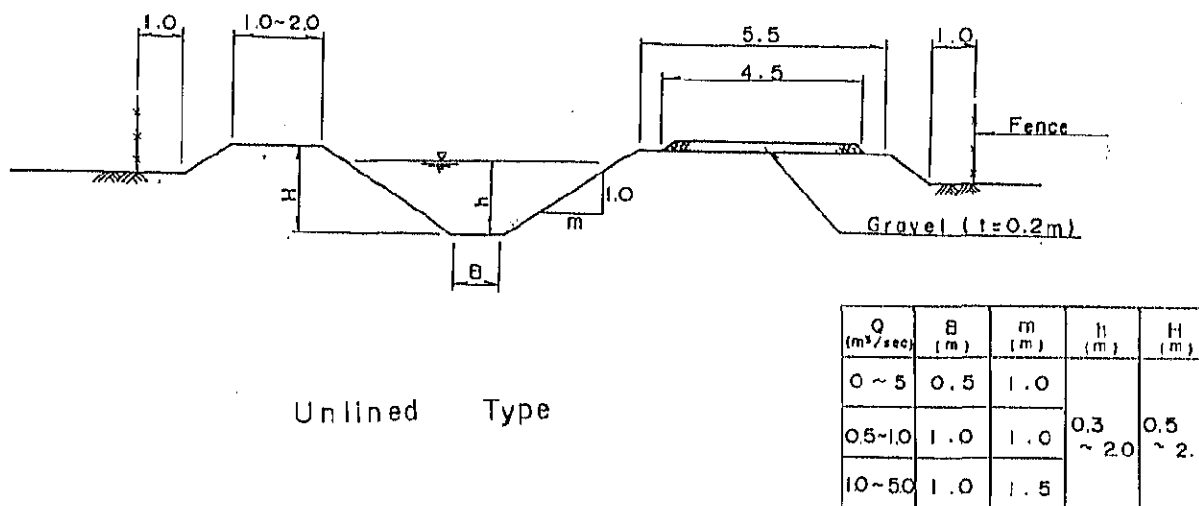


Fig. 4-5-1 Head Works



Concrete Lining Type



Unlined Type

Fig. 4-5-2 STANDARD SECTION OF IRRIGATION CANAL

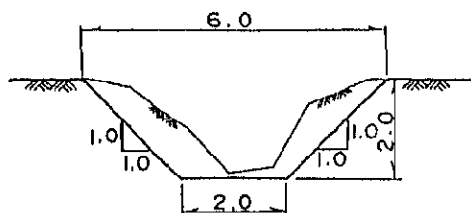
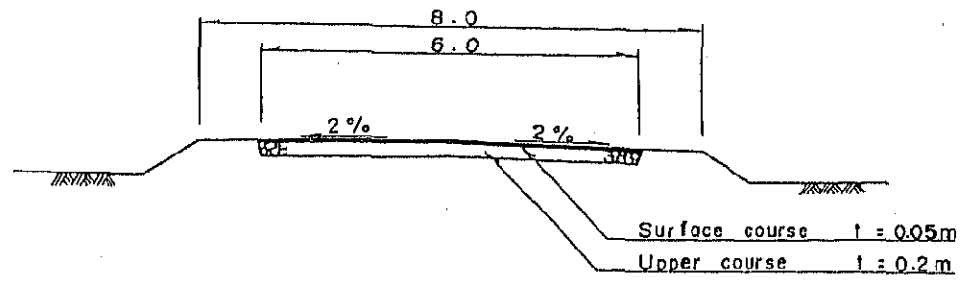
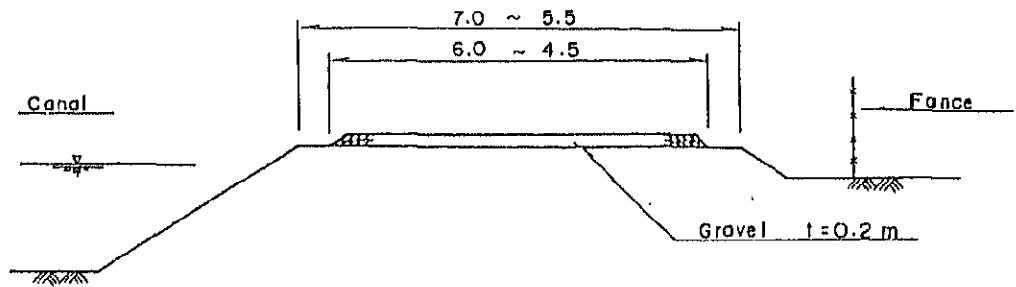


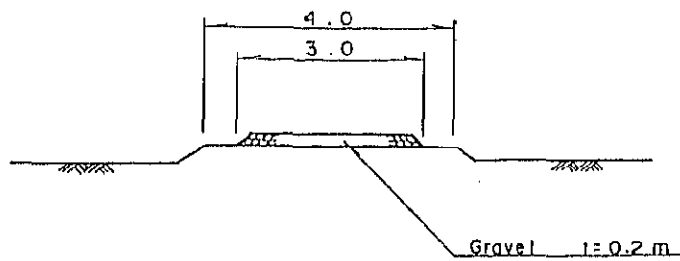
Fig. 4-5-3 STANDARD SECTION OF DRAINAGE CANAL



Trocha-4 Road (Asphalt Pavement)



Operation and Maintenance Road



On-Farm Road

Fig. 4-5-4 CROSS SECTION OF ROAD

#### 4.6 COMPONENTS OF THE PROJECT

In view that an integrated rural development including amelioration of living standard for rural population may come true, it is advisable that the Project should comprise not only irrigation and drainage sector but also such high-priority components in the social infrastructure sector as pavement of rural roads and rehabilitation of the banks in the Ariari river. Nevertheless, an obstacle to implement this integrated project is that any project under the responsibility of HIMAT should be covered all of its investment by its beneficiaries. Therefore, if road improvement and bank rehabilitation works, which are featured by high contribution to unclassified public interest, are included in the present Project, heavier burden will be imposed on farmers (in particular, small and medium farmers) within the Project area.

Bearing above consideration in mind, the Project to be implemented by HIMAT shall comprise exclusively irrigation and drainage sector, and road pavement and bank rehabilitation will be entrusted to other agencies concerned.

Information on project cost is given for irrigation and drainage sector as well as rural infrastructure sector.

#### 4.7 Project Cost

The project cost is composed of the construction cost, land acquisition cost, procurement cost of O/M equipment, administration cost, engineering fee and physical contingency allowance cost.

##### 4.7.1 Assumption of Cost Estimation

The project cost has been estimated on the following assumptions.

(1) Form of Contract

Civil engineering work will be executed by contractors on a contract basis. The machinery and equipment required for construction works will be provided by contractors. Accordingly, the required expenses on construction machinery and equipment will be included in the construction cost.

(2) Unit Price

Unit prices such as wages, materials and equipment applied for project cost estimation are market prices prevailing in the Republic of Colombia.

(3) Construction Amount

The construction amount are divided into foreign currency and local currency portions and include overhead charge of 30% in each amount.

(4) Foreign Exchange Rate

The foreign exchange rate is set at Col.\$332.56 for US\$1.00, which is the monthly average rate as of December 1988.

(5) Contingency Allowance

Physical contingency allowance is estimated to be 15% for civil engineering works and 5% for supporting services and O/M, respectively.

4.7.2 Project Cost

(1) Construction Cost

The major civil engineering works are headworks, irrigation and drainage works, farm roads, revetment works and field development works. The total construction cost required for these works is estimated at Col.\$17,040 million which will be divided into foreign and local currency components amounting to Col.\$9,382 million (55%) and Col.\$7,858 million (45%), respectively.

Table 4-7-1 CONSTRUCTION COST

Description	Cost	Remark
Agricultural Infrastructural		
Head Works	1,767,661	Undertaken by HIMAT
Irrigation Canal	11,262,336	"
Drainage Canal	99,807	"
Maintenance Road	279,118	* Undertaken by Farmers
Terminal Field Improvement	2,208,322	
Sub-Total	15,617,244	
Rural Infrastructure		
Road Improvement	932,580	**Pavement of
Revetment	489,805	"Trocha 4"
Sub-Total	1,422,385	
Total	17,039,629	

Note: \* Maintenance Road for Irrigation Canal  
\*\*Pavement of Trocha

(2) Land Acquisition Cost

The land acquisition costs required for constructing irrigation canals and their related facilities are estimated to be Col.\$205 million, totally represented by local currency.

(3) Cost for Procurement of O/M Equipment

The procurement cost of the equipment required for the operation and maintenance of headworks, farm roads, canals, etc. are estimated to be Col.\$694 million, totally represented by foreign currency. They will be procured by the executing agency in the final year of the project period.

(4) Administration Cost

The administration costs required for the project implementation such as preparation of office, procurement of office supplies, salaries and wages of personnel, miscellaneous expenses, etc. are estimated to be Col.\$90 million in total.

(5) Engineering Fee

Engineering fee including topographic and geotechnical surveys is estimated to be Col.\$642 million during the detailed design period, and to be Col.\$ 1,240 million during the construction period. The proportion of the foreign currency component is 62% of the total costs and that of the local component is 38%.

(6) Contingency Allowance

The physical contingency allowance for agricultural infrastructure undertaken by HIMAT is estimated to be Col.\$2,175 million, of which foreign currency portion is Col.\$1,182 million (about 54% of the total costs) and the local currency portion is Col.\$994 million (about 46%).



(7) Project Cost

The Project cost for agricultural infrastructure to be implemented by HIMAT is estimated to be Col.\$18,457 million, of which the foreign currency portion represents Col.\$10,425 million (56%) and the local currency portion is Col.\$8,032 million (44%).

Table 4-7-2 PROJECT COST

(Unit: Col.\$ 1,000)

Description	Foreign Currency Portion	Local Currency Portion	Total
<b>Agricultural Infrastructure</b>			
1. Construction	7,195,918 ( 21,638)	6,213,004 ( 18,682)	13,408,922 ( 40,320)
2. Land Aquisition	0	205,216 ( 617)	205,216 ( 617)
3. O/M Equipment	694,356 ( 2,088)	0	694,356 ( 2,088)
4. Administration Fee	0	90,063 ( 271)	90,063 ( 271)
5. Consulting Service Fee	1,353,357 ( 4,070)	529,581 ( 1,592)	1,882,938 ( 5,662)
Sub-Total (1-5)	9,243,631 ( 27,795)	7,037,864 ( 21,163)	16,281,495 ( 48,958)
6. Physical Contingency	1,181,773 ( 3,554)	993,716 ( 2,988)	2,175,489 ( 6,542)
Total (1-6)	10,425,404 ( 31,349)	8,031,580 ( 24,151)	18,456,984 ( 55,500)
<b>Tertiary Facilities</b>			
Rural Infrastructure	0	2,539,570 ( 7,636)	2,539,570 ( 7,636)
7. Construction	504,060 ( 1,516)	568,407 ( 1,709)	1,072,467 ( 3,225)
8. Physical contingency	165,574 ( 498)	397,702 ( 1,196)	563,276 ( 1,694)
Total (7-8)	669,634 ( 2,014)	966,109 ( 2,905)	1,635,743 ( 4,919)
Grand Total	11,095,038 ( 33,363)	11,537,260 ( 34,692)	22,632,297 ( 68,055)

Note: Figures in parentheses represent equivalent in US\$.

The disbursement of the Project cost will be made in seven (7) years and the annual disbursement schedule is shown in Table 4-7-3.

The Project is scheduled to start in 1990 and the annual disbursement schedule with price escalation contingency is as per Table 4-7-4. Price escalation ratio and exchange rate are in compliance with information prepared by HIMAT and the Central Bank.

Table 4-7-3 ANNUAL DISEBURSEMENT SCHEDULE

(Unit: Col\$ 1,000)

Description	Year	1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	Total
Land Acquisition	F/C								0
	L/C		205.210						205.210
	Total		205.210						205.210
Roadwork	F/C			047.830	047.830				1.295.072
	L/C			235.095	235.094				471.980
	Total			883.831	883.830				1.767.051
Irrigation Canal	F/C			1,413.935	1,413.935	1,413.935	1,413.934		6,055.739
	L/C			1,401.049	1,401.049	1,401.049	1,401.050		5,606.597
	Total			2,815.584	2,815.584	2,815.584	2,815.584		11,292.330
Drainage Canal	F/C			31.540	31.530				63.070
	L/C			18.304	18.304				36.728
	Total			49.904	49.903				99.807
Road (O/N Road)	F/C			45.857	45.957	45.857	45.350		181.427
	L/C			24.423	24.423	24.423	24.422		97.991
	Total			99.780	99.780	99.780	99.778		279.118
Sub-total	F/C			2,134.808	2,134.807	1,459.202	1,459.291		7,195.918
	L/C		205.210	1,680.431	1,680.430	1,420.972	1,420.971		6,418.220
	Total		205.210	3,819.000	3,819.007	2,885.804	2,885.802		13,614.138
Detailed Design	F/C	227.144	170.710						397.854
	L/C	130.704	105.040						244.804
	Total	306.908	275.750						642.658
Administration	F/C								0
	L/C		8.188	10.375	10.375	10.375	10.375	10.375	90.003
	Total		8.188	10.375	10.375	10.375	10.375	10.375	90.003
O/N Equipment	F/C							094.350	094.350
	L/C							0	0
	Total							094.350	094.350
Supervision	F/C			211.085	210.294	210.294	211.085	111.545	955.508
	L/C			93.090	62.070	62.070	63.090	33.245	264.777
	Total			274.775	272.970	272.970	274.775	144.790	1,240.280
Sub-total	F/C	227.144	170.710	211.085	210.294	210.294	211.085	805.901	2,047.718
	L/C	159.704	113.228	79.405	79.051	79.051	79.405	49.820	824.809
	Total	360.908	283.938	291.150	289.345	289.345	291.150	855.521	2,872.573
Physical Contingency	F/C	11.367	8.530	331.334	331.315	229.409	229.478	40.295	1,181.773
	L/C	6.988	30.444	250.038	250.017	217.803	217.803	2.481	993.715
	Total	18.345	44.980	587.422	587.332	447.272	447.302	42.770	2,175.488
Total	F/C	238.501	179.240	2,081.737	2,080.270	1,898.095	1,900.454	840.195	10,425.404
	L/C	146.702	364.888	2,015.934	2,015.498	1,722.980	1,723.420	52.101	8,931.579
	Total	385.203	534.124	4,097.671	4,095.774	3,621.081	3,623.874	898.297	18,456.984

Table 4-7-4 PRICE ESCALATION

(unit: Col\$ 1,000)

Item	Year	1989	1990	1991	1992	1993	1994	1995	1996	Total (%)
Total Cost	F/C		238.501 [717]	179.245 [539]	2,681.737 [8,064]	2,680,276 [8,050]	1,893,995 [5,710]	1,900,454 [5,715]	846,196 [2,544]	10,425,405(56) [31,349]
	L/C		146,752 [441]	354,888 [1,067]	2,015,984 [6,062]	2,015,498 [6,061]	1,722,986 [5,181]	1,723,420 [5,182]	52,101 [157]	8,531,579(44) [24,151]
	Total		385,253 [1,158]	534,134 [1,606]	4,697,721 [14,126]	4,695,774 [14,120]	3,621,981 [10,891]	3,623,874 [10,897]	898,297 [2,701]	18,456,984(100) [55,500]
Price Escaration Ratio (%)*	F/C		3.0	4.0	4.0	4.0	4.0	4.0	4.0	
	Accumulated Ratio		1.03	1.10	1.15	1.19	1.24	1.29	1.34	
Price Escaration Ratio (%)*	L/C		23.0	22.0	22.0	22.0	22.0	22.0	22.0	
	Accumulated Ratio		1.24	1.53	2.27	2.77	3.38	4.12	5.03	
Exchange Rate Valu (Col\$/US\$)			332.56	541.40	644.30	766.70	912.40	1038.00	1177.60	
	Exchange Rate Ratio ( /332.56)		1.00	1.63	1.94	2.31	2.74	3.12	3.54	
Grand Total	F/C		346,183 [781]	321,963 [595]	5,961,773 [9,253]	7,374,107 [9,618]	6,466,167 [7,087]	7,658,422 [7,376]	4,022,289 [3,416]	32,148,903(57) [38,105]
	L/C		223,826 [492]	660,356 [1,220]	4,576,387 [7,103]	5,581,985 [7,281]	5,821,674 [6,381]	7,104,231 [6,844]	262,018 [223]	24,230,477(43) [29,542]
	Total		570,009 [1,253]	982,318 [1,814]	10,538,160 [16,356]	12,956,092 [16,899]	12,287,840 [13,468]	14,760,653 [14,220]	4,284,307 [3,638]	56,379,380(100) [67,648]

Note : [1000 US\$] \*:Based on the data of DNP and HIMAT



CHAPTER 5

PROJECT  
MANAGEMENT PLAN



## CHAPTER 5: PROJECT MANAGEMENT PLAN

### 5.1 PROJECT IMPLEMENTATION PLAN

#### 5.1.1 Project Executing Organization

The project executing agency shall be HIMAT. Planning of the Project shall be under responsibility the Engineering Div. in collaboration with Planning Div., and arrangement for procurement of external loan shall be made by the Planning Div. through DNP. The Engineering Div. through its Designing Sec. and Construction Sec. shall also take charge of detailed design and construction supervision of civil works; for conducting these services, consulting firm(s) will be employed. The construction of civil works shall be on the contract basis and the contract shall be awarded to contractors by means of tendering. The project executive office will be established at the project site so as to manage and supervise construction works. An acquisition of proposed land for construction works shall be made by means of negotiation with land owners; in case that land owners do not agree to sell their land, an expropriation method may be taken.

Works to be constructed under responsibility of HIMAT shall be headworks and trunk and secondary canals, but shall not be included tertiary facilities which are to be developed by farmers.

Operation and maintenance of completed works shall be entrusted to beneficiaries of these works, but technical assistance by the Regional Office No. 6 and Conservation Sec. of HIMAT is indispensable.

The Project is formulated provided that irrigation farming is adequately diffused among farmers, so institutional supporting services are essential factor for attaining expected benefits of the Project. Furthermore, the development of the present Project to accord with the rural infrastructure is another important



factor. Thus, an intimate communication among relevant organization is expected.

This type of project can not succeed if farmers' intension is ignored. Therefore, farmer's participation in the Project at its planning stage is prerequisite so that proposed sites for construction works may be acquired smoothly and the objective of the Project and the necessity to form water users' association may be diffused effectively. Taking all of these factors into account, it is recommended the (Project Executing Committee) should be incorporated with the participation of the project executing organization and representatives of concerned agencies and bodies with the Project.

The proposed project management organization is illustrated in Fig. 5-1-1.

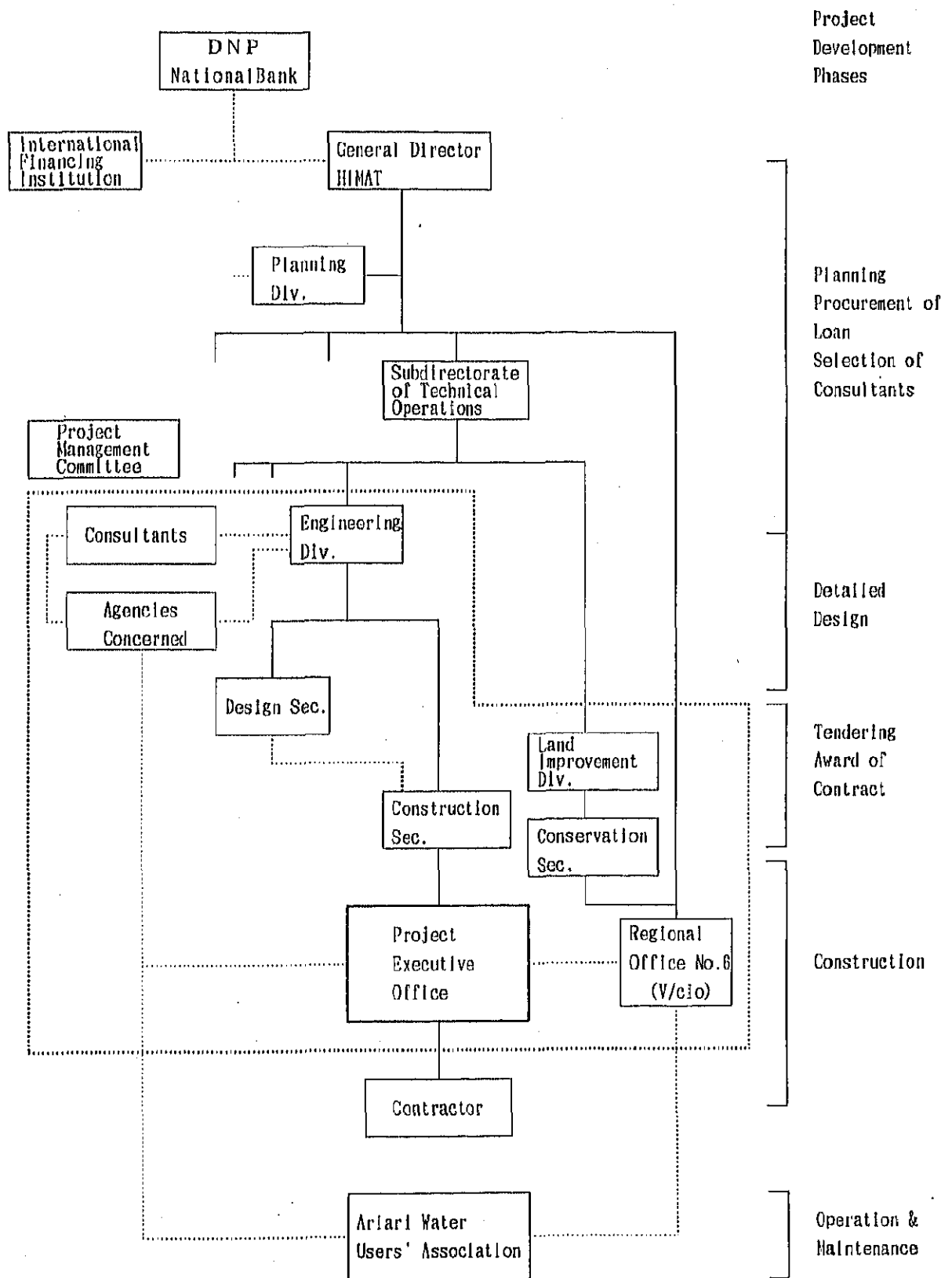


Fig.5-1-1 PROJECT MANAGEMENT ORGANIZATION

### 5.1.2 Project Implementation

#### (1) Budgetary Allocation

The project cost except for the amount that the Colombian Government can procure by within its budget will be financed by a foreign monetary institution.

#### (2) Contractor

The contractor will be employed through formal international competitive tendering.

#### (3) Project Executive Office

The executing agency will establish a Project Executive Office which will be responsible for the supervision of construction works. Assisted by the Consultants, the Project Executive Office will supervise the workmanship of the contractor and be acquainted with the up-to-date information on construction.

The the Project Executive Office will be constructed so that it might be used at the same time during the stage of the Operation and Maintenance after the completion of civil engineering works.

### 5.1.3 Project Implementation Schedule

The overall project period will cover a total of 84 months, which is composed of 18 months for detailed design period, 6 months for tendering and 60 months for civil engineering works. During the detailed design period, the detailed design including geotechnical and topographic survey of the right-of-way for the proposed major structures, the preparation of tender documents, etc. will be carried out. During the construction period, the land acquisition, tender evaluation, execution of construction works, procurement of equipment for operation and maintenance, etc. are envisaged (Fig. 5-1-2).

(1) Detailed Design

The detailed topographic survey of the right-of-way for the proposed major structures such as headworks, bridges, etc. and the route surveys including profile and cross-section of roads, canal and revetment works will be carried out.

On the basis of the above results, detailed design of the Project facilities, the estimation of construction costs and preparation of tender documents will be carried out.

(2) Land Acquisition

The land acquisition for construction of the facilities and structures such as headworks, irrigation canals, drainage canals, farm roads, etc. should be acquired by the Colombian Government before the commencement of the construction works.

(3) Contract

A contractor will be selected by means of international tendering for execution of the construction works. The construction machinery and materials are to be procured from domestic and/or international market under the responsibility of the contractor. Six months are allocated for tendering and tender evaluation.

(4) Construction Works

Construction works will start in the second year after the commencement of the Project. Works are to be performed in the following order unless otherwise specified.

- 1) Headworks construction
- 2) Farm roads and bridge construction
- 3) Irrigation canal construction
- 4) Siphon construction
- 5) Drainage canal works
- 6) Revetment construction

The construction of headworks should start in the first year of the construction period, because it can be carried out only in the dry season when the Guape river runs low. And farm roads and bridges should be constructed at the initial stage of the construction works, because these facilities may be used as access roads for the construction of the other structures.

The Project area covers a lengthy tract in the river basin, and the tertiary canals and terminal facilities are to be constructed by farmers themselves. Therefore, the construction works should be executed starting with the upper zone so that the benefits of the Project will be generated as early as possible.

Discription	Year	1st	2nd	3th	4th	5th	6th	7th
I. Detail Design								
1. Topographic Survey		█						
2. Geological Survey		█						
3. Detail Design and Preparation of Tender Documents		█	█					
4. Tendering			█					
II. Construction								
1. Land Acquisition			█					
2. Administration			█					
3. Head Works				█	█			
4. Irrigation Works				█	█			
5. Drainage Works				█	█			
6. Land Consolidation							█	
7. O/M Equipment							█	
8. Supervise							█	

Fig. 5-1-2 PROJECT IMPLEMENTATION SCHEDULE

## 5.2 OPERATION AND MAINTENANCE PLAN

### 5.2.1 Operation and Maintenance Organization

The task for operation and maintenance (O/M) of completed irrigation and drainage facilities shall, as the case of other irrigation districts of HIMAT, be entrusted to water users' association. Nonetheless, it is worth while to indicate that, of existing associations, only a couple of associations have attained financial independence, the rest of associations being provided financial support (subsidy) from public organizations. An association can not succeed in financial independence until expected benefits of the Project are attained and O/M of facilities are adequately conducted. In this regard, it is imperative that supporting services for both technical and managerial aspects be provided by concerned institutions.

Because farmers in the project area are scarce of experience in O/M of irrigation facilities, HIMAT through its regional office No. 6 will back the water users' association up until it gets underway; engineers of HIMAT will be stationed at the association and, if necessary, machinery will be provided. The managerial aspect of the association will be advised by SENA and technology of paddy cultivation by Fedearroz. These services are at the expense of the association and the association shall collect the expense from its members as a part of water charge.

In principal, the water users' association will have the following organization.

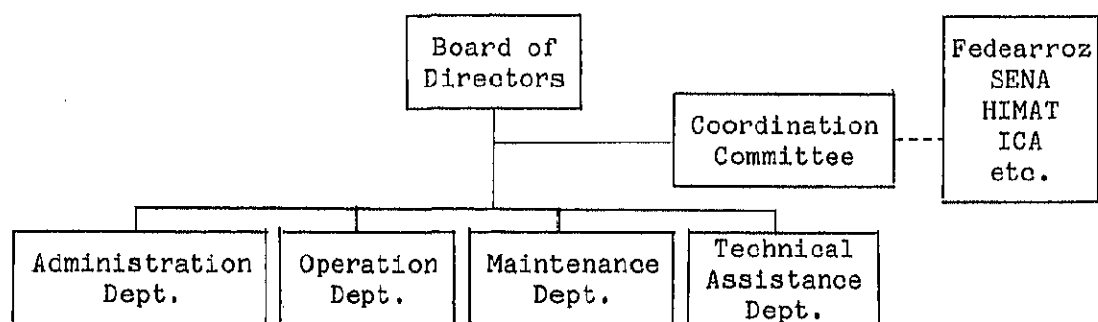


Fig. 5-2-1 ORGANIZATION OF WATER USERS' ASSOCIATION

Each section shall have the following functions:

Board of directors:	to make final decision on important matter of the association.
Administration dept.:	general affairs and accounting including collection of water charge.
Operation dept.:	operation of facilities and distribution of water.
Maintenance dept.:	maintenance of facilities and administration of machinery and vehicles.
Technical assistance dept.:	technical assistance and extension services of irrigation farming to farmers.
Coordination committee:	coordination with relevant organization.



### 5.2.2 Equipment and Machinery of Operation and Maintenance

The equipment and machinery required for the operation and maintenance after completion of the project are selected as follows.

Table 5-2-1 REQUIRED EQUIPMENT FOR OPERATION AND MAINTENANCE

Equipment	Capacity	Required Quantity	Purpose
Tractor shovel	1.14 m <sup>3</sup>	2	Exca. & loading
Backhoe (wheel)	0.4 m <sup>3</sup>	2	Dredging of canals
Backhoe (crawler)	0.4 m <sup>3</sup>	2	- ditto -
Bulldozer	105 Hp	2	Exca. & Spreading
Drag-line	0.58 m <sup>3</sup>	2	Dredging of canals
Truck crane	52 Hp	1	- ditto -
Motorgrader	100 Hp	2	Road repair
Vibrating compactor	48 Hp	2	Compaction
Dump truck	3.8 m <sup>3</sup>	5	Transport of earth sludge & materials

### 5.2.3 Operation and Maintenance Cost

The costs for operation and maintenance are estimated to be approximately Col.\$260 million per annual. The equipment and machinery will be replaced before the termination of their durable life, and the replacement cost will be borne totally by the beneficiaries.

### 5.3 TECHNICAL ASSISTANCE COST

As explained in 4.3.4, the following technical assistances shall be provided on a contract basis between water users' association and related organizations.

<u>Services</u>	<u>Responsible Organizations</u>
1. Rice cultivation in irrigated fields	Fedearroz
2. Cultivation of non-traditional crop and irrigation farming for upland crops	ICA
3. Operation and Maintenance of Agricultural Machinery	SENA

The disbursement of these costs is proposed as follows:

<u>Project Year</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>	<u>Total</u>
Fedearroz	21,000	3,000	3,000				27,000
ICA	7,000	1,000	1,000	1,000	1,000	1,000	12,000
SENA	5,000	2,000	2,000	2,000	2,000	2,000	15,000
Total	33,000	6,000	6,000	3,000	3,000	3,000	54,000

Note: Amounts are represented in thousand of Col\$.



CHAPTER 6

PROJECT EVALUATION



## CHAPTER 6 PROJECT EVALUATION

### 6.1 Evaluation Criteria

The Project has been evaluated in terms of economic and financial aspects. For the economic and financial evaluation, the following indicators have been used.

- Economic and financial internal rate of return (EIRR and FIRR)
- Benefit-Cost Ratio (B/C)

The economic and financial calculations are made on the basis of the following assumptions and data.

- (1) The period for which the economic and financial aspects of the Project are to be evaluated is 50 years from the start of the Project. The facilities and equipment whose service life will expire within this project will be replaced, and the replacement costs are naturally reckoned with for project evaluation.
- (2) The currency to be used for project evaluation is Colombian peso (Col.\$) and the monthly average exchange rate (Col.\$332.56 = US\$1.00) as of December 1988 is used. The shadow exchange price factor (1.2) which is used for project evaluation in Colombian has been employed.
- (3) For economic evaluation, construction cost will be calculated by applying the opportunity cost to the labor cost.
- (4) The target year for agricultural production is set at the third year for rice, 4th year for oil palm, and 5th year for other crops and fruits, all of which imply after completion of the Project.
- (5) In principle, farm-gate prices of agricultural products are used for computation. For economic prices, however, parity prices are applied.

1) Import parity prices

Maize, sorghum, soybean

2) Export parity prices

Rice, cotton, cacao, oilpalm, beef cattle

- (6) For the calculation of production costs, the price data on farm inputs, such as fertilizer, agrochemical, etc., supplied by agricultural authorities and organization based on the Commodity Price List for the second semester of 1988 are used.
- (7) In the economic evaluation, the appraised values of the farm inputs are multiplied by the shadow exchange prices factor specified in "Estimating Shadow Price in Colombia" prepared by the World Bank. For the evaluation of labor costs, the shadow price factor (0.7) which prevails in Colombia for project evaluation is used.
- (8) The same production cost as in the target year applies as effective from the year after the completion of the Project.

## **6.2 Economic Evaluation**

### **6.2.1 Project Benefits**

The project benefits are expressed by the difference between net profit "with" and "without" the Project, as well as by the benefits expected from utilization of service roads to be constructed under the Project.

#### **(1) Benefits of the Project**

The benefits of the Project is shown in Table 6-2-1.

#### **(2) Benefits expected from the utilization of service roads**

The benefits that the service roads will bring about in the target year are estimated at Col.\$143,289,000 per year.

### **6.2.2 Project Cost**

#### **(1) Project Cost**

Subject to the construction being carried out on schedule, an annual disbursement schedule is set as per given in Table 6-2-2 (See 4.5.2 "Project Cost").

#### **(2) Operation and Maintenance Cost**

The annual cost for operation and maintenance of the works after completion of the project is estimated at Col.\$290,860,000 (See 5.2.3 "Operation and Maintenance Cost").

#### **(3) Replacement Cost**

For the purpose of maintaining the performance of works and machinery, replacement and repairs are required. The replacement cost is estimated as in Table 6-2-3.



### 6.2.3 Economic Internal Rate of Return (EIRR), and B/C

The economic internal rate of return (EIRR) of the project has been calculated at 17.2% based on the above-mentioned benefits and costs. With the discount of 12%, B/C ratio becomes 1.11.

### 6.2.4 Sensitivity Analysis

A sensitivity analysis has been made for various cases of changes in prices of agricultural products, yields, construction costs, etc. The results are summarized in Table 6-2-4 (Changes in economic rate return obtained by sensitivity analysis of various factors).

Table 6-2-1 INCREASE OF AGRICULTURAL PRODUCTS IN TARGET YEAR  
(on Economic Valuation)

(Unit: Col.\$1,000)

	With Project	Without Project	Increase
Production Value	18,150,228	9,875,172	8,275,056
Production Cost	7,555,614	4,733,188	2,822,426
Net Return	10,594,614	5,141,984	5,452,630

Table 6-2-2 DISBURSEMENT SCHEDULE  
(on Economic Evaluation)

(Unit: Col.\$1,000)

Year	Disbursement
1st	431,483
2nd	598,230
3rd	5,893,467
4th	5,891,338
5th	4,688,690
6th	4,690,810
7th	1,322,129
Total	23,516,142

Table 6-2-3 REPLACEMENT COST  
(on Economic Evaluation)

Facilities & Machinery	Durable Life (year)	Costs (Col.\$1,000)
Machinery	8	816,563
Gates	30	1,832,807

Table 6-2-4 SENSITIVITY ANALYSIS  
(on Economic Evaluation)

Item	FIRR (%)
(0) Original Case	: 17.2%
(1) 10% increase of construction cost	: 15.9
(2) 10% resection of construction cost	: 18.7
(3) 15% increase in price of agricultural products and/or yield	: 20.5
(4) 15% reduction in price of agricultural products and/or yield	: 13.6
(5) 15% increase of production cost	: 15.9
(6) 15% increase of production cost	: 18.4
(7) Optimistic estimate (Combination of (2), (3) and (6))	: 23.4
(8) Conservative estimate (Combination of (1), (4) and (5))	: 11.3

## 6.3 Financial Evaluation

### 6.3.1 Project Benefits

The Project benefits have been calculated based on financial cost as follows.

#### (1) Benefits from agricultural production

Incremental agricultural products on financial terms are shown in Table 6-3-1.

#### (2) Benefits expected from the utilization of management roads

The annual benefits expected from the utilization of service roads are estimated to be Col.\$143,289,000 in the target year.

### 6.3.2 Project Cost

#### (1) Project Cost

The annual disbursement schedule on financial analysis is given in Table 6-3-2.

#### (2) Operation and maintenance cost

The annual financial cost of operation and maintenance is estimated at Col.\$259,696,000.

#### (3) Replacement cost

The financial cost for equipment replacement is estimated as shown in Table 6-3-3.

### 6.3.3 Financial Internal Rate of Return (FIRR) and Benefit-Cost Ratio

The financial internal rate of return (FIRR) is calculated at 23.5%. Assuming that the discount rate is 12%, the B/C ratio is calculated at 1.41.

### 6.3.4 Sensitivity Analysis

A sensitivity analysis has been made based on financial costs. The results are summarized in Table 6-3-4 (Changes in financial internal rate of return obtained by sensitivity analysis).

Table 6-3-1 INCREASE OF AGRICULTURAL PRODUCTS IN TARGET YEAR  
(on Financial Analysis)

(Unit: Col.\$1,000)

	With Project	Without Project	Increase
Production Value	19,415,425	9,433,735	9,981,690
Production Cost	8,003,004	5,053,457	2,949,547
Net Return	11,417,421	4,380,278	7,032,143

Table 6-3-2 DISBURSEMENT SCHEDULE  
(on Financial Analysis)

(Unit: Col.\$1,000)

Year	Disbursement
1st	385,253
2nd	535,134
3rd	5,262,020
4th	5,260,123
5th	4,186,330
6th	4,188,223
7th	1,180,472
Total	20,995,555

Table 6-3-3 REPLACEMENT COST  
(on Financial Analysis)

Facilities & Machinery	Durable Life (year)	Costs (Col.\$1,000)
Machinery	8	729,074
Gates	30	1,636,433

Table 6-3-4 SENSITIVITY ANALYSIS  
(on Financial Analysis)

Item	FIRR (%)
(0) Original Case	: 23.4%
(1) 10% increase of construction cost	: 21.8
(2) 10% resection of construction cost	: 25.3
(3) 15% increase in price of agricultural products and/or yield	: 27.2
(4) 15% reduction in price of agricultural products and/or yield	: 19.3
(5) 15% increase of production cost	: 22.1
(6) 15% increase of production cost	: 24.1
(7) Optimistic estimate (Combination of (2), (3) and (6))	: 30.7
(8) Conservative estimate (Combination of (1), (4) and (5))	: 16.5

## **6.4 Financial Analysis**

### **6.4.1 Project Financing Plan**

The Project cost (including physical contingency allowance) is composed of domestic and foreign currency portions. The annual disbursement schedule of the Project is as follows. The foreign currency portion of the project cost will be financed by loans from international financial institution, and the domestic currency portion by the Colombian Government.

### **6.4.2 Repayment of Investment**

The payment schedule of foreign loan is estimated based on the following conditions (Table 6-4-2).

Interest per annum :	7%
Grace period :	5 years
Loan period :	25 years (twice annual repayment with uniformly constant in capital)

The maximum annual repayment of foreign loans and related interest is US\$4,322 thousand.

The repayment schedule for foreign loans is shown in Table 6-4-2.

### **6.4.3 Financial Analysis on Selected Model Farms**

In order to justify financial viability of the Project at farm level, model farms have been selected and profit and loss analysis on these farms has been carried out. These model farms, nine farms, are selected from among interviewed farms totaling 135 considering farming pattern and features of the area. The cropping pattern "with" the project is established taking into account the introduction of irrigation schedule on the basis of the present farming pattern. The selected model farms are summarized in Table 6-4-2.



Table 6-4-1 DISBURSEMENT SCHEDULE  
(on Financial Analysis)

(Unit: 1,000 Col. \$)

Year	Total Cost [US\$ 1,000]	F/S [US\$ 1,000]	L/C
1	570,009 [ 1,253 ]	346,188 [ 761 ]	223,826
2	982,319 [ 1,814 ]	321,963 [ 595 ]	660,356
3	10,538,160 [ 16,356 ]	5,961,773 [ 9,253 ]	4,576,387
4	12,956,092 [ 16,899 ]	7,374,107 [ 9,618 ]	5,581,985
5	12,287,841 [ 13,468 ]	6,466,167 [ 7,087 ]	5,821,674
6	14,762,553 [ 14,220 ]	7,658,422 [ 7,376 ]	7,104,231
7	4,284,307 [ 3,838 ]	4,022,289 [ 3,416 ]	262,018
Total	56,381,381 [ 67,848 ]	32,150,904 [ 38,106 ]	24,230,477

Table 6-4-2 REPAYMENT SCHEDULE FOR FOREIGN CURRENCY BOND

(Unit: US\$1,000)

Year	Foreign Loan	Accumulated Foreign Loan	Interest Payment	Capital Payment	Total Payment
1	761	761	53	0	53
2	595	1,356	95	0	95
3	9,253	10,609	743	0	743
4	9,618	20,227	2,089	0	2,089
5	7,087	27,314	2,585	0	2,585
6	7,376	34,690	2,585	38	2,623
7	3,416	38,106	2,822	68	2,889
8			2,817	530	3,347
9			2,780	1,011	3,791
10			2,675	1,366	4,041
11			2,546	1,735	4,281
12			2,417	1,905	4,322
13			2,276	1,905	4,181
14			2,134	1,905	4,040
15			1,993	1,905	3,898
16			1,852	1,905	3,757
17			1,711	1,905	3,616
18			1,570	1,905	3,475
19			1,428	1,905	3,334
20			1,287	1,905	3,192
21			1,146	1,905	3,051
22			1,005	1,905	2,910
23			863	1,905	2,769
24			722	1,905	2,628
25			581	1,905	2,486
26			440	1,867	2,307
27			301	1,838	2,139
28			165	1,375	1,540
29			61	894	955
30			24	540	564
31			12	171	183

The balance of farm household economy of the model farms has been calculated as summarized in Table 6-4-4. For this calculation the following criteria were employed.

- (1) Gross farm income is calculated based on supporting prices of IDEMA, and the prices and yields reported by agricultural authorities concerned and farm survey.
- (2) The production cost is expressed in terms of financial cost.
- (3) The family labor is not included in the production cost.
- (4) The terms and conditions of farm credit of Caja Agraria are used for the calculation of the production cost; The credit terms are 6 months for general crops and 1 year for perennial crops.
- (5) Terms and conditions of loans for the construction of tertiary irrigation facilities by farmers are based on those offered by FFA (term: 3 years, grace period: 3 years; interest 24.6% per annum).
- (6) Repayment of interest does not comprise interest pertaining to project cost but that for farming credit.

Table 6-4-3 FEATURE OF SELECTED MODEL FARMS

Cropping Pattern	Case Model (Zone)	Extension (Size Level)	Cultivated Crop	Actual Situation		With Project		Unit: ha
				Semester I	Semester II	Semester I	Semester II	
				Rice as the Leading Crop	Case 1 (Middle Zone)	120 (Large)	Upland Rice Paddy Rice Sorghum Soybean Fallow	100 20
	Case 2 (Lower Zone)	30 (Medium)	Upland Rice Paddy Rice Sorghum	30	30	30	30	
	Case 3 (Middle Zone)	17 (Small)	Upland Rice Paddy Rice Sorghum Soybean Cotton	17	6 3 8	17	17	
Combination of Rice, Upland Crops and Perennial Crops	Case 4 (Upper Zone)	89 (Medium)	Paddy Rice Maize Sorghum Soybean Cacao Pasture Forest	27	9 43 10	25 25	25 25	9 20 10
	Case 5 (Lower Zone)	36 (Medium)	Upland Rice Paddy Rice Platain	26	26	26	26	
	Case 6 (Upper Zone)	16 (Small)	Paddy Rice Maize Papaya Pasture	5	5 5.5 5.5	10	10	6
	Case 7 (Middle Zone)	13 (Small)	Upland Rice Paddy Rice Fallow Maraouya	11	7 4	9	9	4
Combination of Rice, Upland Crops and Cattle Raising	Case 8 (Middle Zone)	100 (Large)	Upland Rice Paddy Rice Soybean Pasture	30	30	60	60	40
	Case 9 (Upper Zone)	43 (Medium)	Paddy Rice Maize Sorghum Soybean Fallow Platain Pasture	15	10 5	8 15	8 7.5 7.5	5 15

Note: \* Rotation Cultivation

Table 6-4-4 BALANCE OF AGRICULTURAL PRODUCTION  
FOR RESPECTIVE MODEL FARM

Model Farm		Gross Incom	Production Cost	Living Expense	Repayment of Interest for Credit	Superavit
case 1	Actual Situation	26,400	15,174	1,773	1,897	7,556
	With Project	96,280	41,388	1,773	5,174	47,945
Case 2	Actual Situation	12,834	7,692	1,196	962	2,984
	With Project	26,400	10,904	1,196	1,363	12,937
Case 3	Actual Situation	7,751	4,953	619	619	1,560
	With Project	14,960	6,179	619	772	7,390
Case 4	Actual Situation	9,542	5,997	1,773	871	901
	With Project	33,659	15,706	1,773	2,156	14,024
Case 5	Actual Situation	15,064	8,662	1,196	1,216	3,990
	With Project	27,880	10,927	1,196	1,551	14,206
Case 6	Actual Situation	2,419	1,403	619	249	148
	With Project	10,448	4,528	619	678	4,623
Case 7	Actual Situation	6,059	3,619	619	472	1,349
	With Project	10,640	5,507	619	968	3,546
Case 8	Actual Situation	17,738	9,332	1,773	1,238	5,395
	With Project	55,608	22,215	1,773	2,828	28,792
Case 9	Actual Situation	5,824	3,151	1,196	459	1,018
	With Project	15,379	6,928	1,196	977	6,278

The above calculation indicates that any farm will have substantial improvement in its farming activity.

#### 6.4.4 Water Charges and Share of the Project Cost

According to the law of Colombia, the benefited farmers in the project are required to bear the project cost, and operation and maintenance cost.

(1) Investment for Main Facilities

The amount to be born by beneficiaries will reach Col.\$18,456 million (Col.\$775 thousand per ha) which is equivalent to the total project cost excepting investments for pavement of Trocha 4, bank protection works of the Ariari River and tertiary works at field.

In accordance with the relevant law (Reglamento de Valorización) conditions to be incorporated for amortization of the Project cost are 7 years of amortization period (grace period: 3 years) and annual interest rate of 18%.

(2) Repayment of Investment for Tertiary Works at Fields

Required cost for development of tertiary works at fields which are to be constructed by farmers will be covered by loan under the FFA with the following conditions:

Period - 8 years (grace period: 3 years)

Interest - 24.6%/year

(3) Water Charge

The water charge calculated according to the operation and maintenance plan consists of a fixed rate per hectare and a volumetric rate. The fixed rate per hectare is Col.\$8,536 and the volumetric rate is Col.\$50 per 1,000 m<sup>3</sup>.

#### 6.4.5 Farmer's Capability to bear the Project Cost

Following premises explained before farmer's budget for each model farm has been estimated. As a result of this estimates, it is disclosed that initial funds (or separate credit) amounting in the range of Col.\$2,200 thousand and Col.\$6,500 thousand are required for model farms No. 4, 7 & 9 (Table 6-4-5). These model farms are featured by less coverage of paddy production. If cultivated area of paddy for these farms should be covered more or less two-thirds of the total cultivated area, no initial fund would not be required (Refer to ANNEX N).

The said estimate complies with conditions relevant to Colombian law and it is considered that these conditions are hard to small and medium farmers.

Under the circumstances if such small and medium scale farms can be obtained farm credit by the condition in the same level as loan from international banking agency, farmers' burden will be alleviated.

Table 6-4-5 ESTIMATION OF CASH FLOW OF MODEL FARM (1/3)

Case	Item	Year	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
Case 1	Initial Fund		0	10,797	33,646	66,484	74,291	86,721	103,774	125,451	175,000	226,768	278,536
	Farm Credito		24,497	11,899	0	0	0	0	0	0	0	0	0
	Farm Income		79,527	87,778	96,280	96,280	96,280	96,280	96,280	96,280	96,280	96,280	96,280
	Sub Total		104,024	110,474	129,926	162,764	170,571	183,001	200,054	221,731	271,280	323,048	374,816
	Production Cost		41,388	41,388	41,388	41,388	41,388	41,388	41,388	41,388	41,388	41,388	41,388
	Living Expenses		1,774	1,774	1,774	1,774	1,774	1,774	1,774	1,774	1,774	1,774	1,774
	Interest/Repayment		27,559	13,386	0	0	0	0	0	0	0	0	0
	Amortization		21,156	18,930	18,930	43,961	39,338	34,715	30,091	2,219			
	O/M Charge		1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350
	Sub Total		93,227	76,828	63,442	88,473	83,850	79,227	74,603	46,731	44,512	44,512	44,512
Case 2	Balance		10,797	33,646	66,484	74,291	86,721	103,774	125,451	175,000	226,768	278,536	330,304
	Initial Fund		0	2,928	9,352	18,566	21,521	25,633	30,900	37,323	50,714	64,660	78,606
	Farm Credito		7,434	3,122	0	0	0	0	0	0	0	0	0
	Farm Income		21,600	24,000	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400
	Sub Total		29,034	30,050	35,752	44,966	47,921	52,033	57,300	63,723	77,114	91,060	105,006
	Production Cost		10,904	10,904	10,904	10,904	10,904	10,904	10,904	10,904	10,904	10,904	10,904
	Living Expenses		1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196
	Interest/Repayment		8,364	3,512	0	0	0	0	0	0	0	0	0
	Amortization		5,288	4,732	4,732	10,991	9,834	8,679	7,523	555			
	O/M Charge		354	354	354	354	354	354	354	354	354	354	354
Sub Total		26,106	20,698	17,186	23,445	22,288	21,133	19,977	13,009	12,454	12,454	12,454	
Case 3	Balance		2,928	9,352	18,566	21,521	25,633	30,900	37,323	50,714	64,660	78,606	92,552
	Initial Fund		0	1,723	5,430	10,407	12,139	14,526	17,567	21,263	28,908	36,867	44,826
	Farm Credito		4,156	1,677	0	0	0	0	0	0	0	0	0
	Farm Income		12,240	13,600	14,960	14,960	14,960	14,960	14,960	14,960	14,960	14,960	14,960
	Sub Total		16,396	17,000	20,390	25,367	27,099	29,486	32,527	36,223	43,868	51,827	59,786
	Production Cost		6,180	6,180	6,180	6,180	6,180	6,180	6,180	6,180	6,180	6,180	6,180
	Living Expenses		620	620	620	620	620	620	620	620	620	620	620
	Interest/Repayment		4,675	1,887	0	0	0	0	0	0	0	0	0
	Amortization		2,997	2,682	2,982	6,227	5,572	4,918	4,263	314			
	O/M Charge		201	201	201	201	201	201	201	201	201	201	201
Sub Total		14,673	11,570	9,983	13,228	12,573	11,919	11,264	7,315	7,001	7,001	7,001	
Balance		1,723	5,430	10,407	12,139	14,526	17,567	21,263	28,908	36,867	44,826	52,785	

Table 6-4-5 ESTIMATION OF CASH FLOW OF MODEL FARM (2/3)

Case	Item	Year	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
Case 4	Initial Fund		6,500	4,549	7,184	13,165	7,140	3,082	695	26	12,977	28,566	44,155
	Farm Credito		3,634	4,657	2,022	0	2,066	6,124	10,160	10,829	0	0	0
	Farm Income		28,025	30,703	33,659	33,659	33,659	33,659	33,659	33,659	33,659	33,659	33,659
	Sub Total		38,159	39,909	42,865	46,824	42,865	42,865	44,514	44,514	46,636	62,225	77,814
	Production Cost		16,635	15,707	15,707	15,707	15,707	15,707	15,707	15,707	15,707	15,707	15,707
	Living Expenses		1,774	1,774	1,774	1,774	1,774	1,774	1,774	1,774	1,774	1,774	1,774
	Interest/Repayment		4,210	5,347	2,322	0	2,372	7,032	11,623	12,376	0	0	0
	Amortization		10,402	9,308	9,308	21,614	19,341	17,068	14,795	1,091	0	0	0
	O/M Charge		589	589	589	589	589	589	589	589	589	589	589
	Sub Total		33,610	32,725	29,700	39,684	39,783	42,170	44,488	31,537	18,070	18,070	18,070
Case 5	Balance		4,549	7,184	13,165	7,140	3,082	695	26	12,977	28,566	44,155	59,744
	Initial Fund		0	1,944	7,799	17,485	19,662	23,225	28,176	34,513	49,212	64,577	79,942
	Farm Credito		8,254	4,856	0	0	0	0	0	0	0	0	0
	Farm Income		22,220	24,800	27,880	27,880	27,880	27,880	27,880	27,880	27,880	27,880	27,880
	Sub Total		30,474	31,600	35,679	45,365	47,542	51,105	56,056	62,393	77,092	92,457	107,822
	Production Cost		11,102	10,927	10,927	10,927	10,927	10,927	10,927	10,927	10,927	10,927	10,927
	Living Expenses		1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196
	Interest/Repayment		9,493	5,607	0	0	0	0	0	0	0	0	0
	Amortization		6,347	5,679	5,679	13,188	11,802	10,414	9,028	666	0	0	0
	O/M Charge		392	392	392	392	392	392	392	392	392	392	392
Sub Total		28,530	23,801	18,194	25,703	24,317	22,929	21,543	13,181	12,515	12,515	12,515	
Case 6	Balance		1,944	7,799	17,485	19,662	23,225	28,176	34,513	49,212	64,577	79,942	95,307
	Initial Fund		0	2,619	7,331	13,216	15,764	18,928	22,708	27,105	35,218	43,627	52,036
	Farm Credito		4,234	756	0	0	0	0	0	0	0	0	0
	Farm Income		12,120	13,040	14,080	14,080	14,080	14,080	14,080	14,080	14,080	14,080	14,080
	Sub Total		16,354	16,415	21,411	27,296	29,844	33,008	36,788	41,185	49,298	57,707	66,116
	Production Cost		5,170	4,882	4,882	4,882	4,882	4,882	4,882	4,882	4,882	4,882	4,882
	Living Expenses		620	620	620	620	620	620	620	620	620	620	620
	Interest/Repayment		4,955	889	0	0	0	0	0	0	0	0	0
	Amortization		2,821	2,524	2,524	5,861	5,245	4,629	4,012	296	0	0	0
	O/M Charge		169	169	169	169	169	169	169	169	169	169	169
Sub Total		13,735	9,084	8,195	11,532	10,916	10,300	9,683	5,967	5,671	5,671	5,671	
Balance		2,619	7,331	13,216	15,764	18,928	22,708	27,105	35,218	43,627	52,036	60,445	



Table 6-4-5 ESTIMATION OF CASH FLOW OF MODEL FARM (3/3)

Case	Item	Year	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	
Case 7	Initial Fund		3,100	1,607	1,260	2,045	753	187	34	369	3,750	8,037	12,409	
	Farm Credito		1,082	2,575	2,922	2,137	3,429	3,872	3,975	3,813	492	0	0	
	Farm Income		7,280	8,480	9,680	10,160	10,640	10,640	10,640	10,640	10,640	10,640	10,640	
	Sub Total		11,462	12,652	13,862	14,342	14,822	14,699	14,649	14,822	14,822	18,677	23,049	
	Production Cost		5,508	5,508	5,508	5,508	5,508	5,508	5,508	5,508	5,508	5,508	5,508	
	Living Expenses		620	620	620	620	620	620	620	620	620	620	620	
	Interest/Repayment		1,295	3,083	3,498	2,559	4,105	4,636	4,752	4,752	4,564	517	0	0
	Amortization		2,292	2,051	2,051	4,762	4,262	3,761	3,260	2,40	240			
	O/M Charge		140	140	140	140	140	140	140	140	140	140	140	
	Sub Total		9,855	11,402	11,817	13,589	14,635	14,665	14,280	14,280	11,072	6,785	6,268	6,268
Balance		1,607	1,260	2,045	753	187	34	369	369	3,750	8,037	12,409	16,781	
Case 8	Initial Fund		0	6,207	22,078	43,525	52,457	63,700	77,255	93,121	122,924	153,836	184,748	
	Farm Credito		16,511	5,990	0	0	0	0	0	0	0	0	0	
	Farm Income		45,684	50,808	55,608	55,608	55,608	55,608	55,608	55,608	55,608	55,608	55,608	
	Sub Total		62,195	63,005	77,686	99,133	108,065	119,308	132,863	148,729	178,532	209,444	240,356	
	Production Cost		24,070	22,214	22,214	22,214	22,214	22,214	22,214	22,214	22,214	22,214	22,214	
	Living Expenses		1,774	1,774	1,774	1,774	1,774	1,774	1,774	1,774	1,774	1,774	1,774	
	Interest/Repayment		18,858	6,766	0	0	0	0	0	0	0	0	0	
	Amortization		10,578	9,465	9,465	21,980	19,669	17,357	15,046	1,109	708	708	708	
	O/M Charge		708	708	708	708	708	708	708	708	708	708	708	
	Sub Total		55,988	40,927	34,161	46,676	44,365	42,053	39,742	25,805	24,696	24,696	24,696	
Balance		6,207	22,078	43,525	52,457	63,700	77,255	93,121	122,924	153,836	184,748	215,660		
Case 9	Initial Fund		4,500	3,204	4,334	7,078	3,982	1,964	740	274	6,189	13,350	20,511	
	Farm Credito		66	578	0	0	0	1,841	4,109	4,974	0	0	0	
	Farm Income		12,923	14,125	15,649	15,649	15,649	15,649	15,649	15,649	15,649	15,649	15,649	
	Sub Total		17,489	17,907	19,983	22,727	19,631	19,454	20,498	20,897	21,838	28,999	36,160	
	Production Cost		7,812	7,028	7,028	7,028	7,028	7,028	7,028	7,028	7,028	7,028	7,028	
	Living Expenses		1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	
	Interest/Repayment		77	668	0	0	0	2,126	4,714	5,702	0	0	0	
	Amortization		4,936	4,417	4,417	10,257	9,179	8,100	7,022	518	264	264	264	
	O/M Charge		264	264	264	264	264	264	264	264	264	264	264	
	Sub Total		14,285	13,573	12,905	18,745	17,667	18,714	20,224	14,708	8,488	8,488	8,488	
Balance		3,204	4,334	7,078	3,982	1,964	740	274	6,189	13,350	20,511	27,672		

## 6.5 EVALUATION OF SOCIO-ECONOMIC IMPACT

The Project, when completed, will increase agricultural production, save transportation costs, produce employment opportunities for construction and agricultural operations, and also bring about spin-off benefits as enumerated below.

- Increase of employment opportunities by construction work
- Vitalization of processing and distribution industries with increase in agricultural output and capital investment. It is to be noted here that the rice output is expected to increase about 114,000 tons from the current level.
- Increase of employment opportunities due to increase in the area of cropland. It is expected that the Project will produce employment opportunities of 9,887 man-month.
- Stable farming operations supported by well-developed agricultural infrastructure. Even a small farm household is expected to earn about Col.\$4,500,000 more than now (on the average for model cases).

The Project will accelerate the vitalization to regional economy, through the improvement of living standard by stabilization of farm household economy and increase in the quantity of distribution of the agricultural relevant materials. This pioneering project will be lead the way in opening up the future of the Llanos Plains, and will be richly contribute to the development of Colombia.

## 6.6 ENVIRONMENTAL ASSESSMENT

So far, in regional development the environmental management is indispensable, because of possible obstacle for continuous development of the project, which may arise by environmental problems in the project area. Therefore, it is quite important to maintain the supporting capacity of environment in order to obtain the maximum benefit of the Project.

### 6.6.1 Environmental Impact

#### (1) Prevailing Constraints

Prevailing constraints of environmental aspect in the Area are as follows:

- Intensive land use and amplification of agricultural land change the ecological system causing diminution or extinction of fauna and flora;
- Excessive spraying of insecticides deteriorate water quality and air resulting in decrease of fauna and flora, and destruct the health condition;
- Forest exploration reduce the storage effect of water and mitigation of rapid run-off causing soil lose, sedimentation and flooding;
- Advanced fluvial erosion causes loss of agricultural and around the Guape and Ariari rivers;

#### (2) Environmental Effects of the Project Implementation

The Project increases the agricultural productivity and activate regional economy. On the other hand, some negative effects may arise in relation to local environment. Principal environmental changes by development component are shown in Table 6-6-1.

Table 6-6-1 Environmental Change

Environmental item Development component	Soil erosion	Air contamination	Noises	Order	Change of river system	Deter. of water qualit.	Effects for ecolog. system
Head works	0				0	0	0
Enlargement of irrigated land	0				0	0	0
Material gathering	0	0	0				0
Road rehabilit.	0		0				0
Canal	0		0		0		0
Work implem.		0	0	0		0	0
Spraying of insecticide		0	0	0		0	0

(3) Countermeasures for Environmental Conservation

The Project introduces the following countermeasures with regard to existing constraints and environmental effects which may arise because of the Project implementation.

- The present project does not cause significant negative effects for water quality, air, soils, etc., because of agricultural development project engaging in construction works.
- Considering the topography and soil mechanics, large scaled topographical change is not planned for form and structure of facilities such as head works, canals, etc. Therefore, soil erosion and sedimentation can be reduced by means of appropriate operation and maintenance of facilities.
- Exploration of present forest remains out of the project area and therefore deterioration of natural environment will not occur.

- It is expected to reduce the soil loss and flooding due to the storing effects caused by the increase of irrigated paddy field.
- Irrigation plan is set up separately from caños to prevent the deterioration of portable water quality.
- Deterioration of water quality of the project works will be shown only for short period, but this problem can be controlled by appropriate construction supervision.
- Odor arising from construction works does not cause negative impact on life environment because the principal work places are located far away from the residential zone.

#### **6.6.2 Subjects for Environmental Conservation**

In order to promote the regional economic development and simultaneously to conserve natural/social environment, it is prerequisite to dispose the following subjects.

- Establish and popularize the environmental standards to prove the Project from social and environmental viewpoints;
- Set up a monitoring system during the project implementation in order to study environmental impact of the Project;
- Program the integrated management of the Guape - Ariari River basin to be initiated by HIMAT. Moreover, it is indispensable to give extension service and education to the local inhabitant about the environmental conservation techniques, for example, afforestation program by means of related organizations;
- Considering welfare, security, conservation and protection for ecological system, facilities structure and condition of location should be examined in detailed design phase;
- Establish the regulation for spraying of insecticide to prevent the deterioration of soil and water resources; and

- As soon as possible the social infrastructures should be improved quantitatively and qualitatively by the related organizations.

## 6.7 COMPREHENSIVE EVALUATION

The Project will bring an increase of agricultural production associated with expansion of cultivated area, elevating cropping intensity and increase of unit yield, consistent supply of food, and generation of more job opportunity and elevation of income level, and these factors combined will contribute for the enhancement of living standard of the people living within and adjacent to the Project area. The implementation of the Project will have positive impact on improvement of public welfare and productive activity, and on the national economy accordingly.

The above consideration leads to the conclusion that the implementation of the Project is justified from economic and financial evaluations for which tangible benefits were employed. In addition, enough socio-economic effects are also expected.

A T T A C H M E N T — 1  
S c o p e o f W o r k

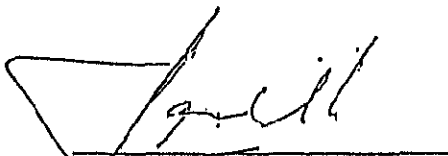




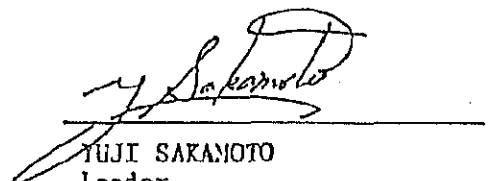
SCOPE OF WORK  
FOR  
THE FEASIBILITY STUDY  
ON  
THE ARIARI RIVER BASIN INTEGRATED AGRICULTURAL DEVELOPMENT PROJECT  
IN  
THE REPUBLIC OF COLOMBIA

AGREED UPON BETWEEN  
JAPAN INTERNATIONAL COOPERATION AGENCY  
AND  
INSTITUTO COLOMBIANO DE HIDROLOGIA,  
METEOROLOGIA Y ADECUACION DE TIERRAS

Bogotá, February 10 1988



ENRIQUE SANDOVAL  
Director General  
Instituto Colombiano de Hidrología,  
Meteorología y Adecuación de Tierras,  
"IIMAT"



YUJI SAKANOTO  
Leader  
Preliminary Survey Mission  
Japan International Cooperation  
Agency "JICA"



MARTA E. LASPRILLA MICHAELS  
Jefe de la División de  
Cooperación Técnica Internacional  
DEPARTAMENTO NACIONAL DE PLANEACION  
"D.N.P."

## I. INTRODUCTION

In response to the request of the Government of the Republic of Colombia, the Government of Japan decided to conduct the Feasibility Study on the Ariari River Basin Integrated Agricultural Development Project (hereinafter referred to as "the Study"), in accordance with the Agreement on Technical Cooperation between the Government of Japan and the Government of the Republic of Colombia, signed on 22 December, 1976 (hereinafter referred to as "the Agreement").

Accordingly, the Japan International Cooperation Agency (hereinafter referred to as "JICA") official agency responsible for the implementation of the technical cooperation programme of the Government of Japan, will undertake the Study in close cooperation with the authorities of the Republic of Colombia.

Instituto Colombiano de Hidrología, Meteorología y Adecuación de Tierras (hereinafter referred to as "IHIMAT") shall act as the counterpart agency to the Japanese Study Team and also as the coordinating body in relation to other governmental and non-governmental organizations concerned for the smooth conduct of the Study.

The present document sets forth the Scope of Work for the Study.

## II. OBJETIVES OF THE STUDY

The objectives of the Study are:

- 1) to formulate the optimum agricultural development plan in the study area.
- 2) to verify technical and economic feasibility of the selected project in the study area.
- 3) to transfer the relevant technology to Colombian counterparts in the course of the Study.

### III. SCOPE OF THE STUDY

#### 1. Study Area

The study area covers the right bank of Guape and Ariari river about 43,000 ha.

The project area for the feasibility study will be selected within the study area.

#### 2. Scope of the Study

The contents of the Study are as follows:

- (1) To collect and review the existing data and informations relevant to the Study on the following items:
  - (a) Topography,
  - (b) Meteorology and hydrology,
  - (c) Geology and soil mechanics,
  - (d) Soils,
  - (e) Natural environment,
  - (f) Agriculture (including stockbreeding),
  - (g) Agro-economy and institutions including marketing,
  - (h) Land use,
  - (i) Irrigation and drainage conditions,
  - (j) Infrastructure,
  - (k) Regional and national economy, and
  - (l) Regional and national development plans relevant to the agricultural sector.
- (2) To carry out field survey and investigation on the following items:
  - (a) Geology and soil mechanics,
  - (b) Meteo-hydrology,
  - (c) Soil, land use and land suitability,
  - (d) Topographic survey of proposed major structures,
  - (e) Present farming practices and production,
  - (f) Agro-economy and institutions,
  - (g) Irrigation and drainage systems,
  - (h) Regional economy and marketing, and
  - (i) Construction materials and its cost.

- (3) To establish basic concepts for the project,
  - (a) Delineation of the project area,
  - (b) Outline of the proposed agricultural development plan,
  - (c) Basic plan of major structures, and
  - (d) Strategy for implementation.
- (4) To formulate an appropriate development plan of the selected project,
  - (a) Final delineation of the project area,
  - (b) Land use planning,
  - (c) Formulation of agricultural development plan including:
    - i) Establishment of most promising cropping pattern and farming plan,
    - ii) Irrigation and drainage system planning,
    - iii) Farm road planning,
    - iv) Protection from inundation,
    - v) Agroindustry, marketing and other supporting services,
    - vi) others
  - (d) Layout of the agricultural facilities and preliminary design of major structures,
  - (e) Establishment of implementation plan and schedule,
  - (f) Cost and benefit estimation,
  - (g) Socio-economic evaluation, and
  - (h) Environmental evaluation

#### IV. STUDY SCHEDULE

The Study will be executed in accordance with the attached tentative schedule.

#### V. REPORTS

JICA shall prepare and submit the following reports in English to the Government of Colombia.

- (1) Inception Report  
Twenty (20) copies at the commencement of the Study.
- (2) Progress Report (1)  
Twenty (20) copies at the end of the field survey in Phase I.

- (3) Interim Report  
Twenty (20) copies at the end of Phase I.
- (4) Progress Report (2)  
Twenty (20) copies at the end of the field survey in Phase II.
- (5) Draft Final Report  
Twenty (20) copies at the end of the home office work in Phase II.  
The Government of Colombia will provide JICA with its comments on the Draft Final Report through JICA office in Bogota within one (1) month after receipt of this Report.
- (6) Final Report  
Fifty (50) copies within two (2) months after receipt of the comments from the Government of Colombia on the Draft Final Report.

VI. UNDERTAKING OF THE GOVERNMENT OF COLOMBIA

- 1. To facilitate smooth conduct of the Study, the Government of Colombia shall accord to the Japanese Study Team and its members such privileges and immunities as provided for in articles V.2 (b), VI (excluding 2 (c)), VII and IX of the Agreement.
- 2. HIMAT shall take necessary measures in cooperation with other relevant organizations:
  - 1) To secure the safety of the Japanese Study Team,
  - 2) To secure permission for entry into private properties or restricted areas for the conduct of the Study,
  - 3) To secure permission for the Japanese Study Team to take all data and documents (including Aero-photo - graphs and Maps) related to the Study out of Colombia to Japan.

3. HINAT shall, at its own expense, provide the Study Team with the following in cooperation with other relevant organizations:
- 1) Available data and information related to the Study,
  - 2) Additional survey related to the Study if necessary,
  - 3) Counterpart personnel,
  - 4) Suitable office space with necessary equipment,
  - 5) Appropriate number of vehicles with drivers in the study area.
  - 6) Credentials or identification cards.

#### VII. UNDERTAKINGS OF JICA

For the implementation of the Study, JICA shall take the following measures:

1. To dispatch, at its own expense, the Study Team to Colombia.
2. To pursue technology transfer to Colombian counterparts in the course of the Study.







#### VIII. CONSULTATION

JICA and HINAT shall consult with each other in respect of any matter that may arise from or in connection with the Study.

#### IX. TRANSLATION

The Scope of Work is made both in English and in Spanish. In case any discrepancy of translation arises between two languages, the English version shall prevail.

TENTATIVE SCHEDULE

		MONTH IN ORDER														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		← Phase I →					← Phase II →									
Work in Colombia																
Work in Japan																
Reports		△ Inc/R		△ P/R(1)		△ Inc/R		△ P/R(2)		△ D.F.R.		⊙ COMMENTS		△ F.R.		

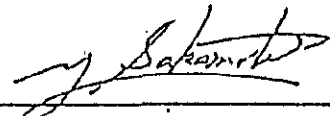


MINUTES OF MEETING  
FOR  
THE FEASIBILITY STUDY  
ON  
THE ARIARI RIVER BASIN INTEGRATED AGRICULTURAL DEVELOPMENT PROJECT  
IN  
THE REPUBLIC OF COLOMBIA.

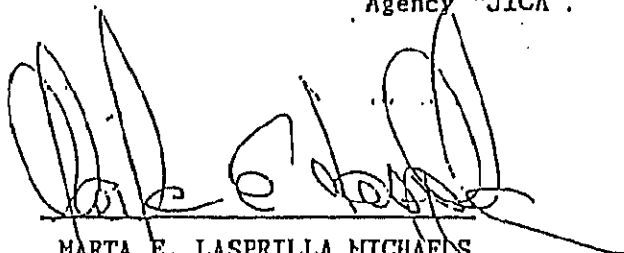
Bogotá, February 10 1988



ENRIQUE SANDOVAL  
Director General  
Instituto Colombiano de Hidrología,  
Meteorología y Adecuación de Tierras,  
"INMAT"



YUJI SAKAMOTO  
Leader  
Preliminary Survey Mission  
Japan International Cooperation  
Agency "JICA".



MARTA E. LASPRILLA MICHAEDS  
Jefe de la División de  
Cooperación Técnica Internacional  
DEPARTAMENTO NACIONAL DE PLANEACION  
"D.N.P."

The preliminary survey mission for the Ariari River Basin integrated Agricultural Development Project sent by JICA had a series of discussions on the above mentioned project with the relevant officials of HIMAT from 2 to 10 February 1988. The followings are summarized conclusions of the discussions.

1. HIMAT requested the preliminary survey Mission to carry out, at its own expenses, the following studies in relation to the Scope of Work VI, 3, 2).
  - 1) Preparation of topographic maps.
  - 2) Soil survey.
  - 3) Geotechnical survey.
2. HIMAT confirmed to the Mission in respect of the Scope of Work, VI, 3, 5), that this Institute will assure the availability of one vehicle for the Study Team. However, if more vehicles will be necessary, HIMAT expects JICA to arrange them. In this case, HIMAT will provide at its own expenses drivers and fuels.
3. Both the Mission and HIMAT confirmed the necessity to install strategically 4 pluviographs and 1 Water-level recorder, to complete the hidro-metereological analysis of the project. HIMAT requested JICA to provide the above-mentioned equipment for this analysis, thus complementing it with the other equipment such as anemometer, wind vane and heliograph. HIMAT will be fully responsible for the installation, operation and maintenance of the equipment.
4. The Mission permits HIMAT to present the following reports in Spanish in the course of the Feasibility Study, together with those promised in the Scope of Work.

- 1) Inception Report, twenty copies;
- 2) Summary of Interim Report, twenty copies;
- 3) Draft Final Report (main volume), twenty copies,  
and
- 4) Final Report (main volume,, fifty copies.

HIMAT requested the Mission to include also the Spanish version of the Progress Report and the main volume of the Interim Report.

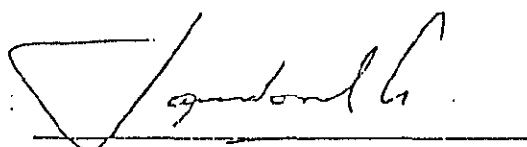
A T T A C H M E N T — 2

M i n u t e s o f M e e t i n g  
o n  
T h e I n c e p t i o n R e p o r t

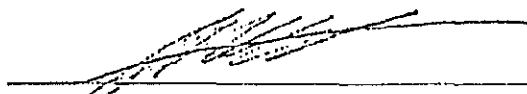


MINUTES OF MEETING  
FOR  
THE FEASIBILITY STUDY  
ON  
THE ARIARI RIVER BASIN INTEGRATED  
AGRICULTURAL DEVELOPMENT PROJECT  
AGREED UPON  
BETWEEN  
JAPAN INTERNATIONAL COOPERATION AGENCY  
AND  
INSTITUTO COLOMBIANO DE HIDROLOGIA, METEOROLOGIA Y ADECUACION DE TIERRAS

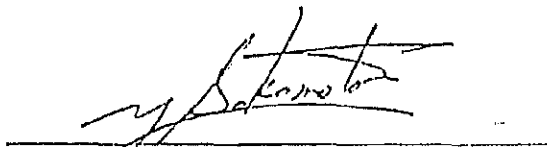
Dogotá, August 26.1988



Enrique SANDOVAL GARCIA  
Director General,  
Instituto Colombiano  
de Hidrología, Meteorología  
y Adecuación de Tierras  
(IIRCAT)



Shoji KANATSU  
Leader of the Feasibility  
Study Team, Japan International  
Cooperation Agency (JICA)



Yuji SAKAMOTO  
Leader of the Advisory Team, JICA

In accordance with the Scope of Work for the Feasibility Study on the Ariari River Basin Integrated Agricultural Development Project (hereinafter referred to as "the Study"), the Government of Japan dispatched through Japan International Cooperation Agency (JICA) the Advisory Team headed by Mr. Yuji Sakamoto and the Study Team headed by Mr. Shoji Kanatsu for the implementation of the Study to the Republic of Colombia. At the commencement of the Study, the Study Team presented officially twenty (20) copies of the Inception Report and explained the basic consideration and study methodology of the Report at the presence of Colombian organization represented by Instituto Colombiano de Hidrologia, Meteorologia y Adecuación de Tierras (INIMAT) on August 23, 1988. As a result of explanation and exchange of opinions on the Report, the following has been agreed upon by the Colombian side and Japanese side.

1. The Colombian side has agreed upon the contents of the Inception Report which had been prepared in due compliance with the conditions as stipulated in the Scope of Work.
2. Both sides will collaborate for the efficient development of the Study so that the objective of the Study would be attained as described in the Inception Report.
3. Present Minutes of Meeting is made both in English and in Spanish. If any discrepancy on interpretation arises between both languages, the English expression shall be employed.

Attachment : List of attendants for the Meeting.



ANNEX

Participants of HIMAT

Name	Charge
Dr.Enrique SANDOVAL GARCIA	General Director
Dr.Carlos RANIREZ	Dupty Director of operation and Maintenance
Dr.Jaime H.LAMO J.	Chief of Planning Department
Dr.Francisco RUEDA	Chief of Study Division
Dr.Hermenégildo ORTIZ	Chief of Feasibility Study Section
Dr.Juan F. GALINDO	Adviser to Director General
Dr.Alvaro LUNA	Chief of Project Identification Section
Dr.Fernando VELASCO	Professional Specialist
Dr.Luis Eduardo BETANCOURT	Professional Specialist
Dr.Myriam Eugenia CASTILLO	Professional Specialist
Dr.Alvaro LANCHEROS	Professional Specialist
Dr.Luis Enrique CORTES	Professional Specialist
Dr.Martha L. CASTAÑEDA	Professional Specialist
Dr.Martha L. QUINTERO	Professional Specialist

Participants of the Study Team

Hr.Shoji KANATSU	Team Leader/General Coordination
Hr.Gunjiro OZAWA	Dupty Team Leader/Irrigation and Drainage
Hr.Yujiro ITAKURA	Meteorology and Hydrology
Hr.Katsuhito YOSHIDA	Topography and Geology/Mapping Supervision

Participants of the Advisory Team

Mr.Yuji SAKAMOTO	Team Leader
Mr.Akihide ENOKI	Coordination







A T T A C H M E N T — 3

M i n u t e s o f M e e t i n g  
o n  
T h e P r o g r e s s R e p o r t  
( 1 )

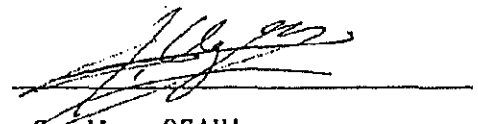


MINUTES OF MEETING  
FOR  
THE FEASIBILITY STUDY  
ON  
THE ARIARI RIVER BASIN INTEGRATED AGRICULTURAL DEVELOPMENT PROJECT  
AGREED UPON BETWEEN  
JAPAN INTERNATIONAL COOPERATION AGENCY  
AND  
INSTITUTO COLOMBIANO DE HIDROLOGIA, METEOROLOGIA Y ADECUACION DE TIERRAS


Bogotá, October 28, 1988



Carlos RAMIREZ  
Deputy Director of  
Technical Operation,  
Instituto Colombiano de  
Hidrología, Meteorología y  
Adecuación de Tierras  
(HIMAT)



Gunjiro OZAWA  
Deputy Team Leader of  
Feasibility Study Team,  
Japan International  
Cooperation Agency  
(JICA)



Francisco RUEDA  
Chief of Integrated  
Study Division,  
HIMAT

The phase I field work for Feasibility Study on The Ariari River Basin Integrated Agricultural Development Project ( hereinafter referred to "the Study") has been conducted starting on August 21,1988 in the Republic of Colombia and the result of the said work has been compiled in the Progress Report (I). On October 25, 1988 the Study Team submitted 20 copies of the Progress Report (I) to HIMAT and explained its contents. Subsequently, an exchange of opinions has been made between HIMAT and the Study Team and the both parties agreed on as follows:

1. The Progress Report (I) has been prepared in due compliance with the methodology and program of the Study presented in the Inception Report.
2. The basic development concepts proposed in the said Report have been established as a result of an appropriate analysis and diagnosis of the study area as well as taking account of the objectives of the Study.
3. The development plan to be established in the course of the home office work of the phase I in Japan shall be made on the basis of the basic development concepts.
4. The subsequent work of the Study shall be conducted in close communication between HIMAT and the Study Team so that the objectives of the Study may be accomplished as stipulated in the Scope of the Work for the Study.

Attachment : List of attendants for the Meeting.

### Participants of HIMAT

Name	Charge
Dr. Francisco Rueda	Chief of Integrated Study Division
Dr. Hermenegildo ORTIZ	Chief of Feasibility Study Section
Dr. Fernando VELASCO	Professional Specialist
Dr. Augusto ACOSTA	Professional Specialist
Dr. Myriam E. CASTILLO	Professional Specialist
Dr. Martha L. CASTAÑEDA	Professional Specialist
Dr. Luis E. ORTIZ	Professional Specialist

### Participants of the Study Team

Name	Charge
Mr. Gunjiro OZAWA	Deputy Team Leader/Irrigation and Drainage
Mr. Yujiro ITAKURA	Meteorology and Hydrology
Mr. Nobuharu MORITA	Agriculture and Crop Production
Mr. Tamio OHTA	Agro-economy
Mr. Katsuhito YOSHIDA	Topography and Geology/Mapping Supervision





A T T A C H M E N T — 4

M i n u t e s o f M e e t i n g  
o n

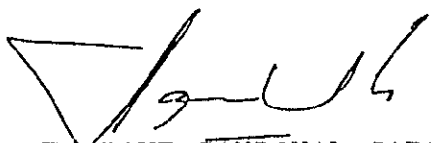
T h e I n t e r i m R e p o r t



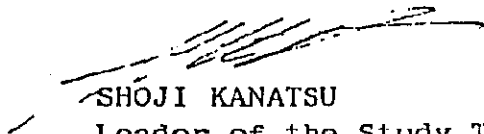


MINUTES OF MEETING  
FOR  
THE FEASIBILITY STUDY  
ON  
THE ARIARI RIVER BASIN INTEGRATED AGRICULTURAL DEVELOPMENT PROJECT  
AGREED UPON BETWEEN  
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)  
AND  
INSTITUTO COLOMBIANO DE HIDROLOGIA, METEOROLOGIA  
Y ADECUACION DE TIERRAS (HIMAT)

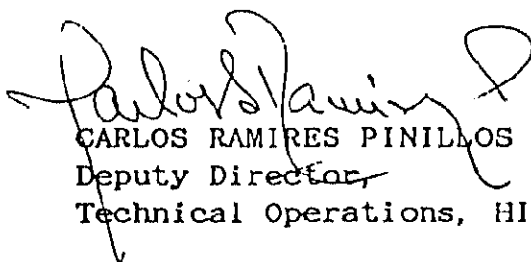
BOGOTA, FEBRUARY 9, 1989



ENRIQUE SANDOVAL GARCIA  
General Director  
HIMAT



SHOJI KANATSU  
Leader of the Study Team  
JICA



CARLOS RAMIRES PINILLOS  
Deputy Director  
Technical Operations, HIMAT

The phase I feasibility study for the Ariari River Basin Integrated Agricultural Development Project (hereinafter referred to as "the Study") was conducted between August, 1988 and January, 1989 and the result of the said study was presented in the Interim Report.

On February 1, 1989, the Study Team submitted 20 copies of the Interim Report, both English and Spanish versions, to HIMAT and explained its content on the same and the next days in Bogota and on February 3 in Villavivencio at the presence of counterpart personnel of HIMAT and representatives of other public organizations related to the Study. Subsequently, an exchange of opinions had been made between the Colombian side and the Study Team followed by an agreement as given below.

1. The Interim Report has been prepared in due compliance of stipulations set forth in the Scope of the Work and the methodology and work program of the Study agreed between the Japanese Study Team and HIMAT.
2. The basic development concepts and the basic development plan have been established as a result of an appropriate analysis and diagnosis of the study area as well as taking account of the objectives of the Study and are accepted by the Colombian side as criteria for formulating the development plan of the Study.
3. In the phase II of the Study, supplementary and detailed studies shall be carried out on the basis of the basic development plan included in the Interim Report which was presented by the Study Team.
4. The present phase of the Study shall be conducted in close collaboration between the Study Team and counterpart personnel so that the objectives of the Study stipulated in the "Scope of the Work for the Study" may be attained.
5. The major comments and observations expressed by the Colombian side in relation with the Interim Report are summarized in the ANNEX I.

Participants of the meeting are given in the ANNEX II.

ANNEX I

COMMENTS AND OBSERVATIONS TO THE INTERIM REPORT

The Regional Bureau of INCORA made the following recommendations:

- a). To formulate a development plan that will contribute to the enhancement of living conditions of small farmers through an increase of their income level.
- b). To take, within the context of the development plan, account of existing processing facilities of agro-products in the departmental level.

The counterpart personnel of HIMAT recommended that:

- a), For introducing pepper, which constitute non-traditional crop for farmers in the study area, in the cropping plan, an analysis of actual and potential marketing would be made.
- b). The number of beneficiaries together with generated new employment with the Project shall be estimated.
- c). Pertaining to the land conservation and disaster prevention plan, the influence of the Ariari river on the right margin of the river near "Guillermo Leon Valencia" bridge and on the Trochà 5 (at the confluence of the Cano Venado with the Ariari river) would be analyzed.
- d). One copy for each land use plan and general plan with a scale of 1/50,000 or 1/25,000 would be attached to the Draft Final Report.

Representatives of ICA and Agricultural Bureau of the Departmental Office of Meta manifested that they would submit their comments or observations in writing later.

ANEXO Nº 2  
PARTICIPANTES DEL HIMAT

NOMBRE	CARGO
Dr. ENRIQUE SANDOVAL GARCIA	Director General
Dr. CARLOS RAMIREZ PINILLOS	Subdirector Operaciones Técnicas
Dr. FRANCISCO RUEDA PARDO	Jefe División Estudios Integrales
Dr. HERMENEGILDO ORTIZ T.	Jefe Sección Estudios Factibilidad
Dr. LUIS EDUARDO ORTIZ	Jefe Sección Identificación Proyectos
Dr. FERNANDO VELASCO	Profesional Especializado
Dr. LUIS E. BETANCOURT	Profesional Especializado
Dr. AUGUSTO ACOSTA	Profesional Especializado
Dra. MYRIAM E. CASTILLO	Profesional Universitario
Dr. ALVARO LANCHEROS	Profesional Especializado
Dra. MARTHA PRADA	Profesional Especializado
Dr. LUIS E. CORTES	Profesional Especializado
Dra. MARTHA L. CASTAÑEDA	Profesional Universitario
Dra. MARTHA L. QUINTERO	Profesional Especializado
Dr. ALFREDO SIERRA	Profesional Especializado

PARTICIPANTES DEL EQUIPO DE ESTUDIO

Mr. SHOJI KANATSU	Jefe Equipo/Coordinación General
Mr. GUNJIRO OZAWA	Jefe Equipo/Riego y Drenaje
Mr. TAMIO OHTA	Agro-economía
Mr. KATSUHITO YOSHIDA	Topografía y Geología/Supervisión de Levantamiento Cartográfico

A T T A C H M E N T - 5

M i n u t e s o f M e e t i n g  
o n  
T h e p r o g r e s s R e p o r t  
( I I )



MINUTES OF MEETING  
ON  
THE PROGRESS REPORT (II)  
FOR  
THE FEASIBILITY STUDY  
ON  
THE ARIARI RIVER BASIN INTEGRATED AGRICULTURAL DEVELOPMENT PROJECT  
AGREED UPON BETWEEN  
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)  
AND  
INSTITUTO COLOMBIANO DE HIDROLOGIA, METEOROLOGIA  
Y ADECUACION DE TIERRAS (HIMAT)

BOGOTA, MARCH 27, 1989



ENRIQUE SANDOVAL GARCIA  
GENERAL DIRECTOR  
HIMAT



SHOJI KANATSU  
LEADER FOR THE STUDY TEAM  
JICA



CARLOS RAMIRES PINILLOS  
DEPUTY DIRECTOR,  
TECHNICAL OPERATIONS, HIMAT



Having completed the work in Colombia corresponding the Phase II of the Feasibility Study on the Ariari Basin Integrated Agricultural Development Project (hereinafter referred to as "the Study"), the Study Team presented twenty (20) copies of the Progress Report (II) on March 21 and explained an essential portion of the same for the consideration of the Colombian side represented by HIMAT. As a result of an explanation and exchange of opinions on the Report realized on March 21 and 22, both Colombian side and Japanese Study Team have entered into an agreement as given below:

(1)-. The Progress Report (II) was prepared in due compliance of both the conditions stipulated in the Scope of the Work and methodology and program of the Study agreed upon between the Study Team and HIMAT, and consequently, it is acceptable to the Colombian side.

(2)-. The description on features of the study area as well as basic concepts and development plan, proposed project plan, methodology on economic and financial evaluation and the methodology for the Phase II home office work in Japan has been made and established as a result of an appropriate analysis of the study area together with bearing objectives of the Study in mind.

(3)-. The define development plan shall be formulated in the course of the Phase II home office work in Japan on the basis of the concepts and methodology in the Progress Report (II) which have been established in mutual consensus of the Study Team and HIMAT.

(4)-. Following an exchange of opinions between the members of the Study Team and counterpart personnel of HIMAT, the following aspects have been confirmed.

1. The irrigation plan (the size of irrigation canals) shall be incorporated after making a cost-benefit analysis on the basis of available discharge for the respective return period of 2, 5 and 10 years.
2. The four alternatives of the proposed land use plan presented additionally in the meeting will be analyzed for

the selection of the optimum one employing such parameters as: irrigation water requirement, available discharge, net returns and marketing conditions of crops, availability of labor force and machinery, farmers' cropping technology, etc.

3. Regarding the location of the diversion weir, the third plan (the lowest site) is considered to be the most adequate. At the same, in the facilities planning, it is recommended to analyze one alternative with "temporary" weir.
4. As soon as information on "valorization", which is being requested to INCORA by HIMAT, is obtained, it will be send to the Study Team in Japan.
5. HIMAT presented a report on environmental impact.
6. In view that an electric inter-connection is projected in the region by other organizations (ISA, ICEL), the generation of mini-hydroelectric power shall be excluded from the development plan of the Study.
7. The leader of the Study Team requested to take an advantageous measures for small farmers of the Ariari Project in relation to period and interest rate for the payment of "valorization".
8. The evaluation of the Project will be conducted in two manners: an agricultural development portion and other portion (rural infrastructure and land conservation and disaster prevention). The economic evaluation for the latter will be presented in the annex of the Final Report as a reference.

## PARTICIPANTS OF THE MEETING

### JAPANESE STUDY TEAM

Shoji KANATSU (Team Leader)  
Gunjiro OZAWA (Deputy Team Leader, Irrigation and Drainage)  
Yujiro ITAKURA (Meteorology & Hydrology)  
Yasuhisa ENAKA (Soils and Land Use)  
Nobuharu MORITA (Agricultural Technology and Crop Production)  
Tamio OTA (Agro-economy)  
Kazunari NAGATA (Facilities Planning)  
Masashi ISHII (Facilities Design and Cost Estimates)  
Yoshihisa UCHIDA (Project Evaluation)

### COUNTERPART PERSONNEL OF HIMAT

DR. CARLOS RAMIREZ PINILLOS (Deputy Director, Technical Operations)  
DR. FRANCISCO RUEDA PARDO (Manager, Integrated Study Div.)  
DR. HERMENEGILDO ORTIZ T. (Chief, Feasibility Study Section)  
DR. LUIS EDUARDO ORTIZ (Chief, Projects Identification Section)  
DR. FERNANDO VELASCO (Specialist-Land Use)  
DR. LUIS. E BETANCOUR (Specialist-Agro-economy and Marketing)  
DR. AGUSTO ACOSTA (Specialist-Agricultural Planning)  
DRA. MYRIAM E. CASTILLO (Specialist-Agricultural Planning & Land Use)  
DR. ALVARO LANCHEROS (Specialist-Hydrology & Meteorology)  
DRA. MARTHA PRADA (Specialist-Facilities Planning)  
DRA. MARTHA L. QUINTERO (Specialist-Project Evaluation)

Actual Land Use	Unit:ha	
	1st Semester	2nd Semester
Rice *	15,000	3,800
Upland Crops	2,400	8,700
Perennial Crops	4,500	4,500
Grass Land	13,000	13,000
Fallow Land	---	4,900
Sub Total	34,900	34,900
Othes	6,200	6,200
Total	41,100	41,100

\* Include up-land rice

CS

Land Use Plan I-1 : Maximize the Paddy

	1st Semester	2nd Semester
Paddy	19,000	19,000
Upland Crops	1,200	1,200
Perennial Crops	4,500	4,500
Grass Land	10,200	10,200
Fallow Land	---	---
Sub Total	34,900	34,900
Othes	6,200	6,200
Total	41,100	41,100

Upland Crop 1st Semester: Maize 1,200 ha

2nd Semester: Soybeen 600 ha  
Sorgum --- ha  
\* Others 600 ha

\* Maize, Sunflower,  
Kidney been etc.

Land Use Plan I-2 : Decrease Paddy in 2nd semester in Plan I-1

	1st Semester	2nd Semester
Paddy	19,000	15,000
Upland Crops	1,200	5,200
Perennial Crops	4,500	4,500
Grass Land	10,200	10,200
Fallow Land	---	---
Sub Total	34,900	34,900
Othes	6,200	6,200
Total	41,100	41,100

Upland Crop 1st Semester: Maize 1,200 ha

2nd Semester: Soybeen 2,600 ha  
Sorgum 1,200 ha  
\* Others 1,400 ha

\* Maize, Sunflower,  
Kidney been etc.

*CP*

*[Signature]*

*[Signature]*

Land Use Plan II-1: Keep the existing rice field area

	1st Semester	2nd Semester
Paddy	15,000	15,000
Upland Crops	4,900	4,900
Perennial Crops	4,800	4,800
Grass Land	10,200	10,200
Fallow Land	---	---
Sub Total	34,900	34,900
Othes	6,200	6,200
Total	41,100	41,100

Upland Crop 1st Semester: Maize 4,900 ha

2nd Semester: Soybeen 2,400 ha  
Sorgum 1,200 ha  
\* Others 1,900 ha

\* Maize, Sunflower,  
Kidney been etc.

Land Use Plan II-2: Decrease Paddy in 2nd semester in Plan II-1

	1st Semester	2nd Semester
Paddy	15,000	10,000
Upland Crops	4,900	9,900
Perennial Crops	4,800	4,800
Grass Land	10,200	10,200
Fallow Land	---	---
Sub Total	34,900	34,900
Othes	6,200	6,200
Total	41,100	41,100

Upland Crop 1st Semester: Maize 4,900 ha

2nd Semester: Soybeen 5,000 ha  
Sorgum 3,000 ha  
\* Others 1,900 ha

\* Maize, Sunflower,  
Kidney been etc.

088






ATTACHMENT — 6

LIST OF MEMBERS OF  
MISSION AND  
COUNTERPART  
PERSONNEL





SUPERVISORY GROUP MEMBERS

Assignment	Name	Position
Chairman	Mr. Yuji SAKAMOTO	Director, Shinano River Land Improvement Survey and Management Office, Hokuriku Regional Agricultural Administration Office, Ministry of Agriculture, Forestry and Fisheries (MAFF)
Water Use and Irrigation/Drainage	Mr. Mitsuo SUGIURA	Survey and Planning Specialist, Survey Division, Kiso River Land Improvement Survey and Management Office, Tokai Regional Agricultural Administration Office, MAFF
Agriculture	Mr. Wataru UNNO	Deputy Chief, Agricultural Production and Extension Division, Tokai Regional Agricultural Administration Office, MAFF
Project Evaluation	Mr. Hiroshi HARUTA	Director, Loan Department III, 3rd Division, The Overseas Economic Cooperation Fund (OECF) (up to Jan. 1989)
Project Evaluation	Mr. Mitsuo SAKAMOTO	Manager, Loan Department III, 3rd Division, OECF (From February 1989 on)

STUDY TEAM MEMBERS AND COUNTERPART PERSONNEL

Assignment	Name	Colombian Counterpart
Team Leader/ Coordination	Dr. Shoji KANATSU	Dr. Carlos RAMIREZ P.
Deputy Leader/Irrigation and Drainage	Mr. Gunjiro OZAWA	Dr. Francisco RUEDA P. Dr. Heimenegildo ORTIZ T.
Meteorology and Hydrology	Mr. Yujiro ITAKURA	Dr. Alvaro LANCHEROS
Soil and Land Use	Mr. Yasuhisa ENAKA	Dr. Fernando VELASCO
Agricultural Management and Cultivation	Mr. Nobuharu MORITA	Dr. Augusto ACOSTA Dra. Myriam E. CASTILLO
Agro-economy	Mr. Tamio OHTA	Dr. Luis E. BETANCOURT Dra. Marta L. CASTAÑEDA
Structure & Construction Plan	Mr. Kazunari NAGATA	Dra. Marta PRADA
Design & Cost Estimates	Mr. Masashi ISHII	Dr. Alfredo SIERRA
Project Evaluation	Mr. Yoshihiro UCHIDA	Dra. Marta L. QUINTERO
Topography & Geology/Mapping Management	Dr. Katsuhito YOSHIDA	Dr. Luis E. CORTES Dr. Luis Eduardo ORTIZ Dra. Gaby VEGA





JICA