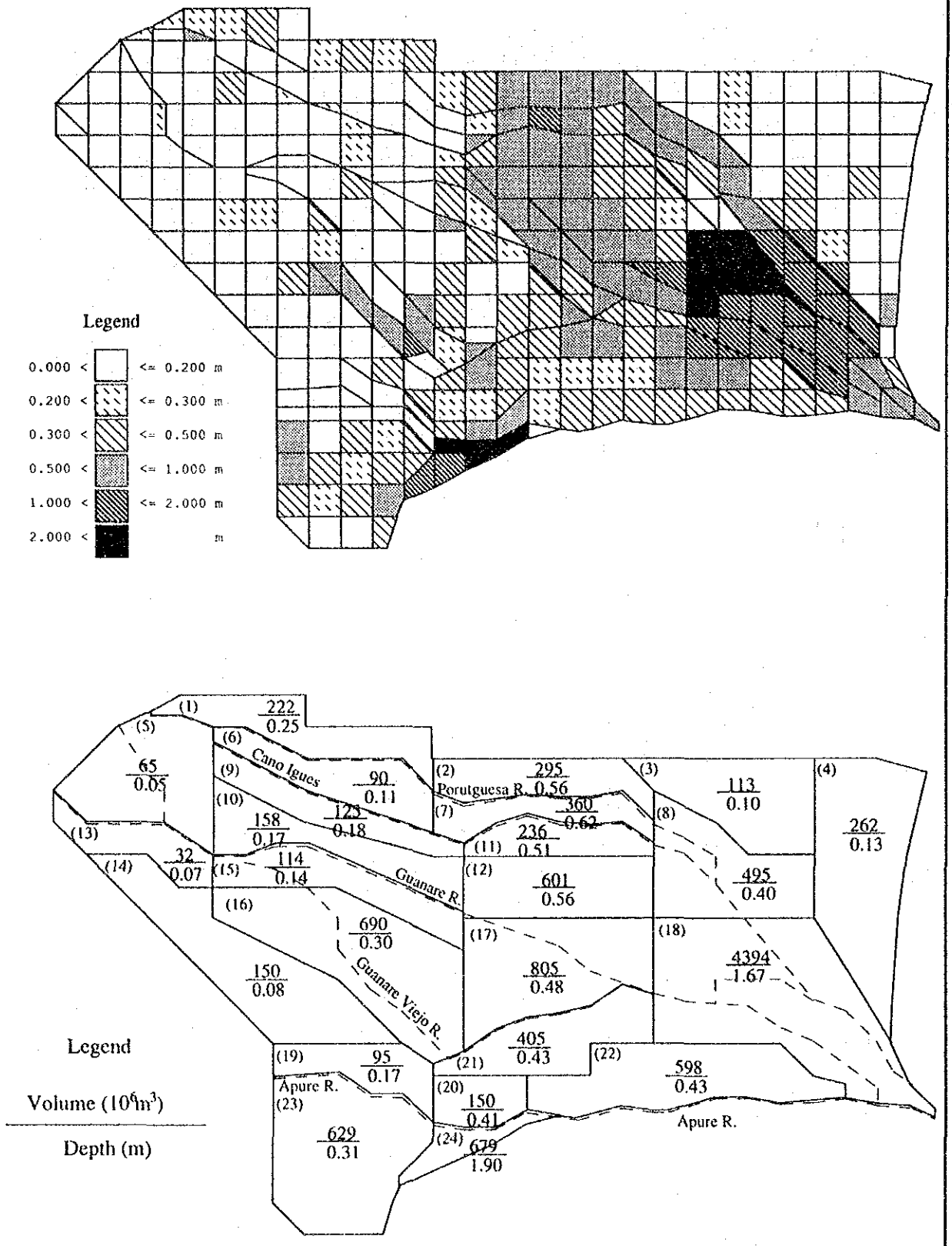


Fig. 4.3.10 Maximum Inundation (Plan D2 - 10-yr Return Period)

THE REPUBLIC OF VENEZUELA COMPREHENSIVE IMPROVEMENT OF THE APURE RIVER BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY

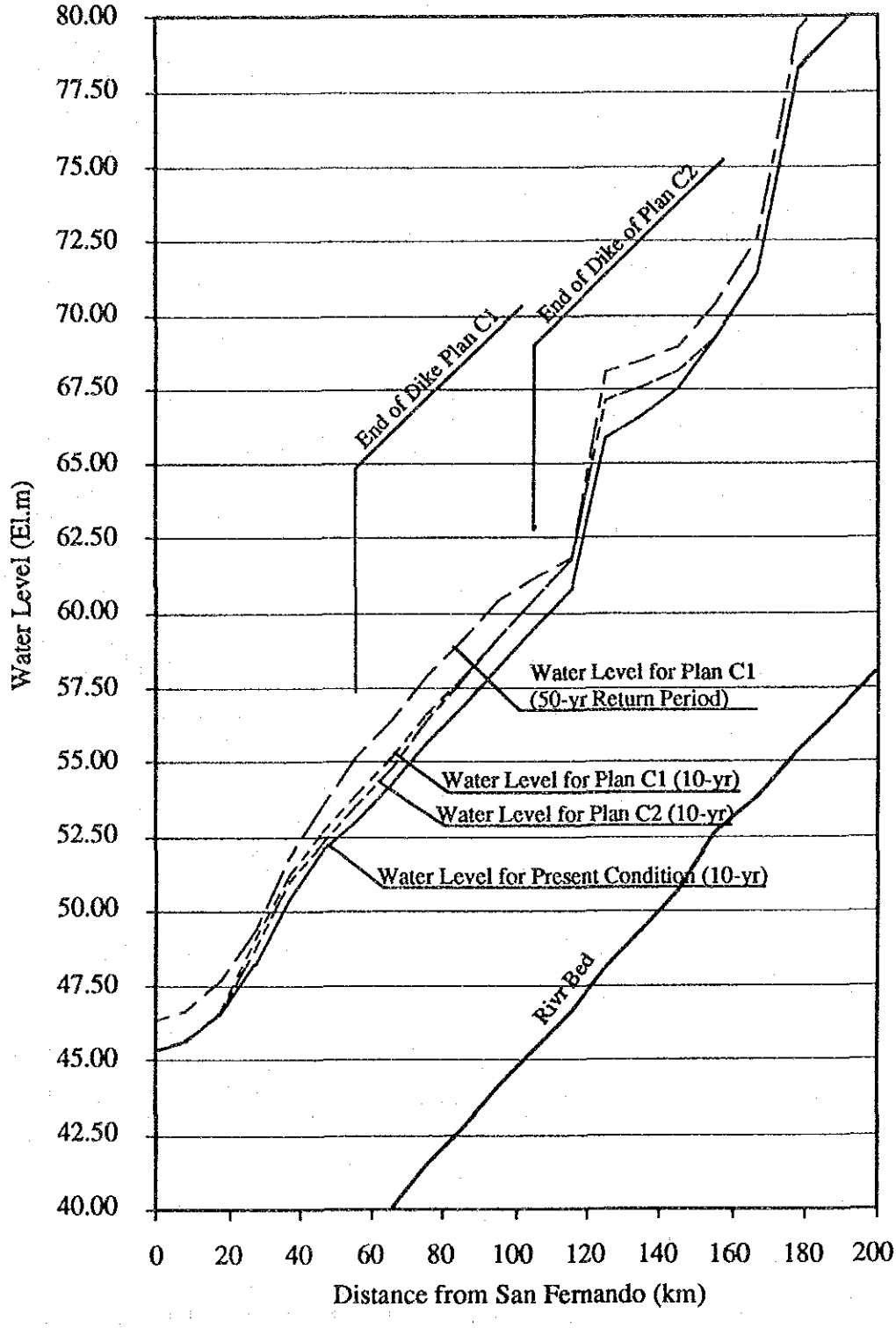
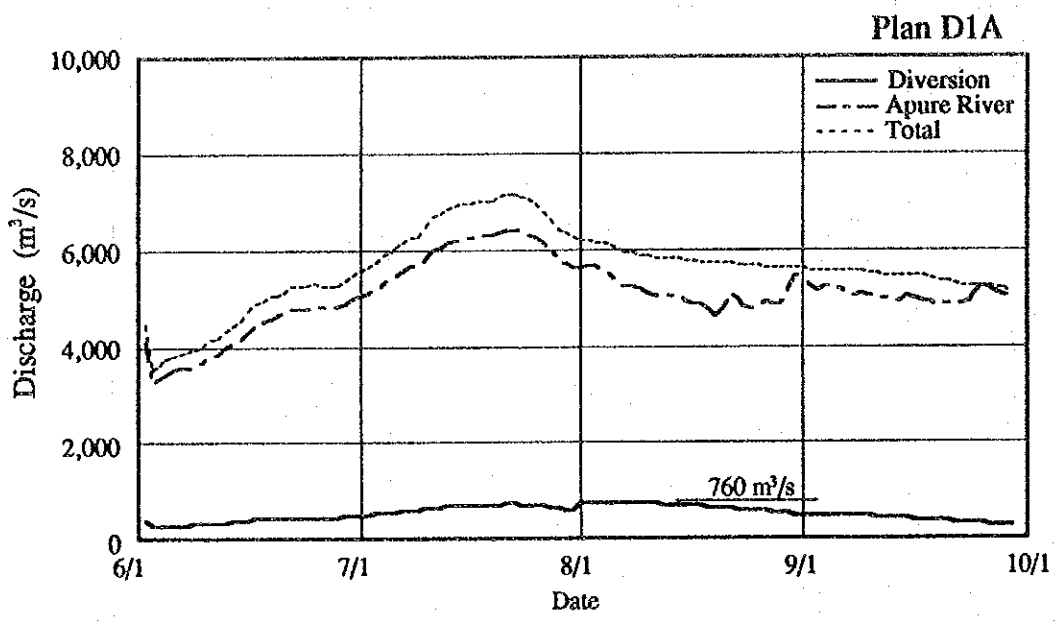


Fig. 4.3.11 Profile of Water Level of Apure River for Plans C1 and C2 (10- year Return Priod)

THE REPUBLIC OF VENEZUELA COMPREHENSIVE IMPROVEMENT OF THE APURE RIVER BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY



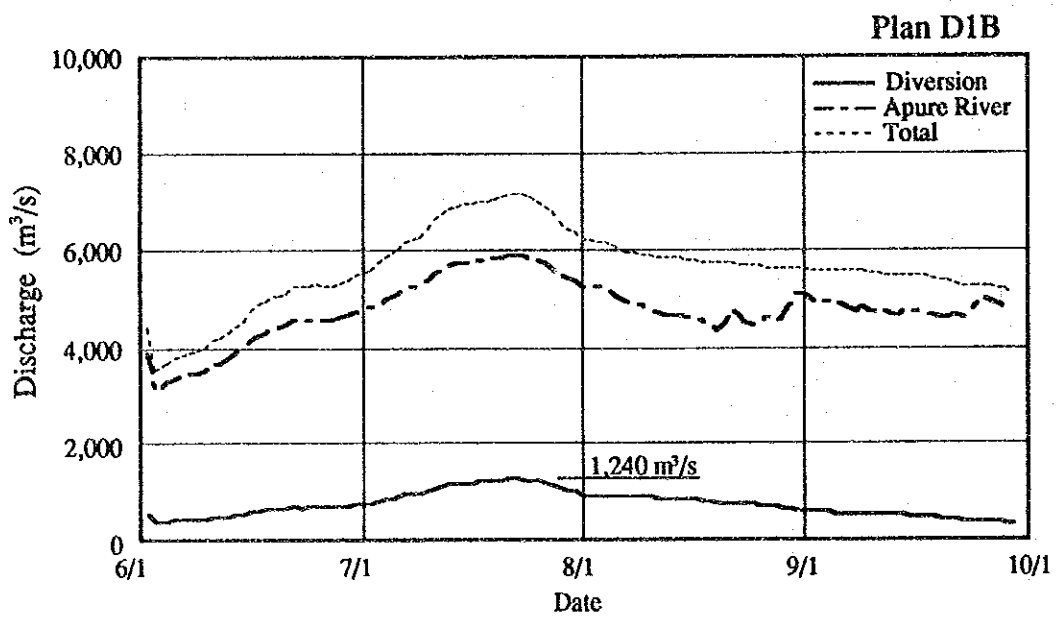


Fig. 4.3.12 Hydrographs of Outflows from Diversion Channels and Apure River

THE REPUBLIC OF VENEZUELA COMPREHENSIVE IMPROVEMENT OF THE APURE RIVER BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY

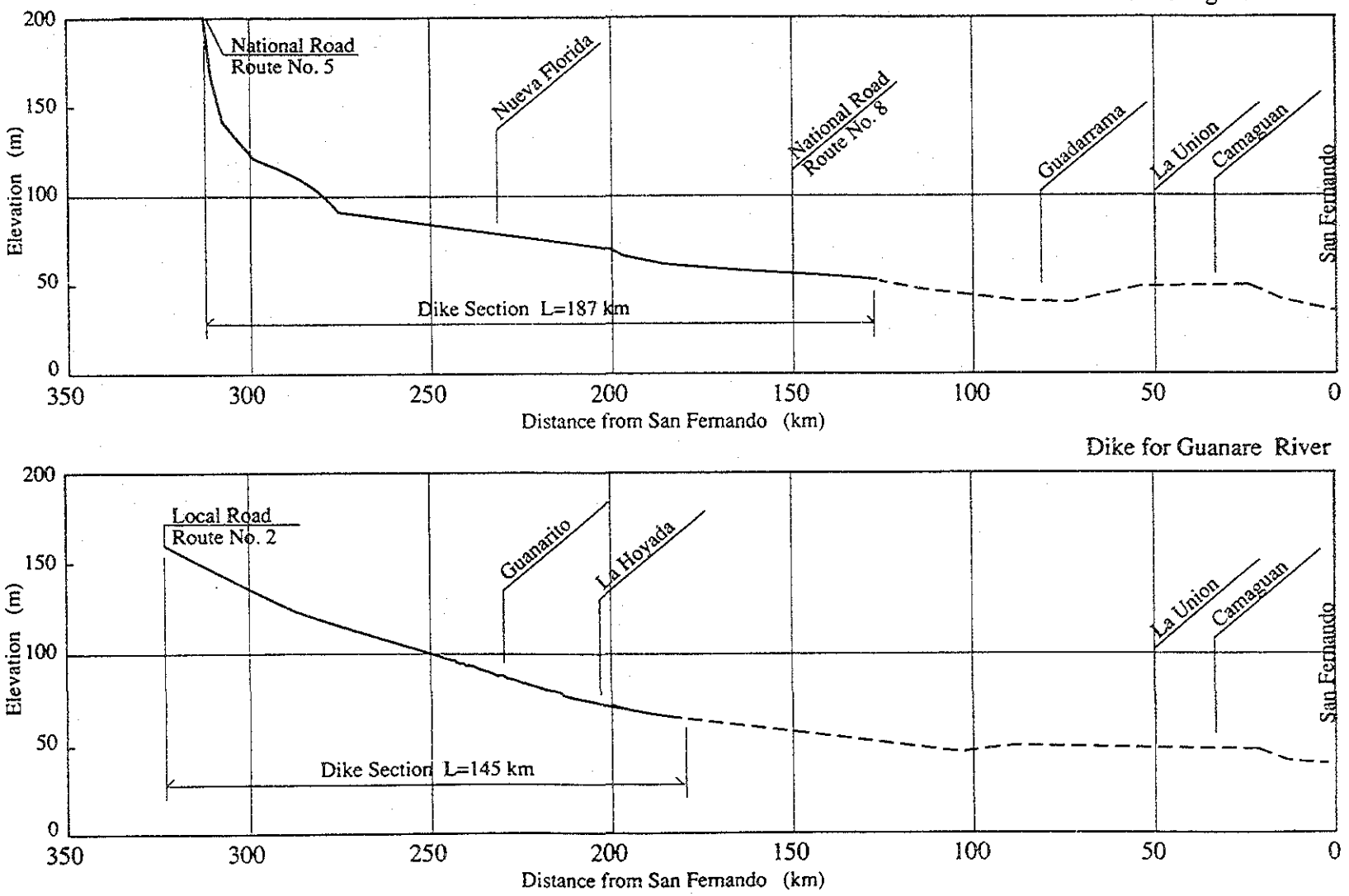


Fig. 4.3.13 Profiles along Dikes for Portuguesa and Guanare Rivers

THE REPUBLIC OF VENEZUELA
COMPREHENSIVE IMPROVEMENT
OF THE APURE RIVER BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY

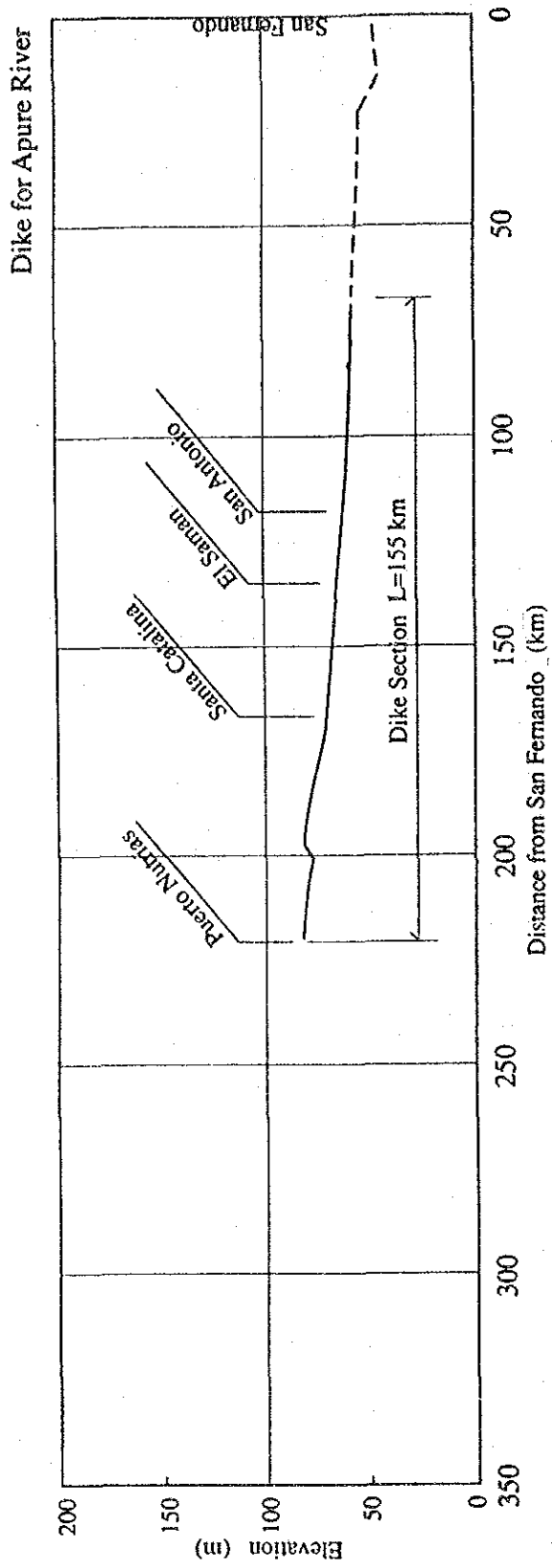


Fig. 4.3.14 Profiles along Dike for Apure River

THE REPUBLIC OF VENEZUELA COMPREHENSIVE IMPROVEMENT OF THE APURE RIVER BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY

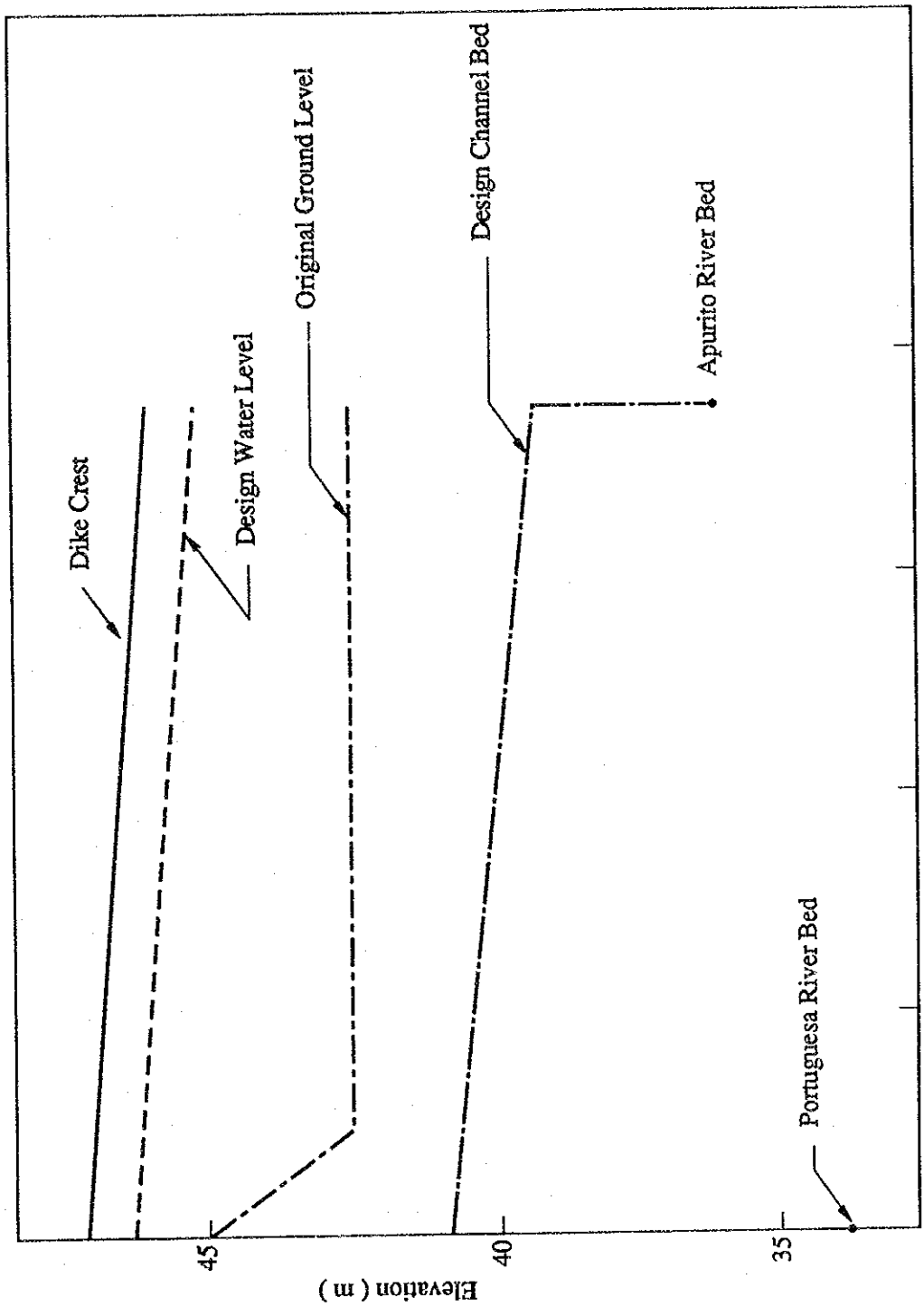


Fig. 4.3.15 Profiles of Diversion Channel Proposed by MARNR

THE REPUBLIC OF VENEZUELA COMPREHENSIVE IMPROVEMENT OF THE APURE RIVER BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY

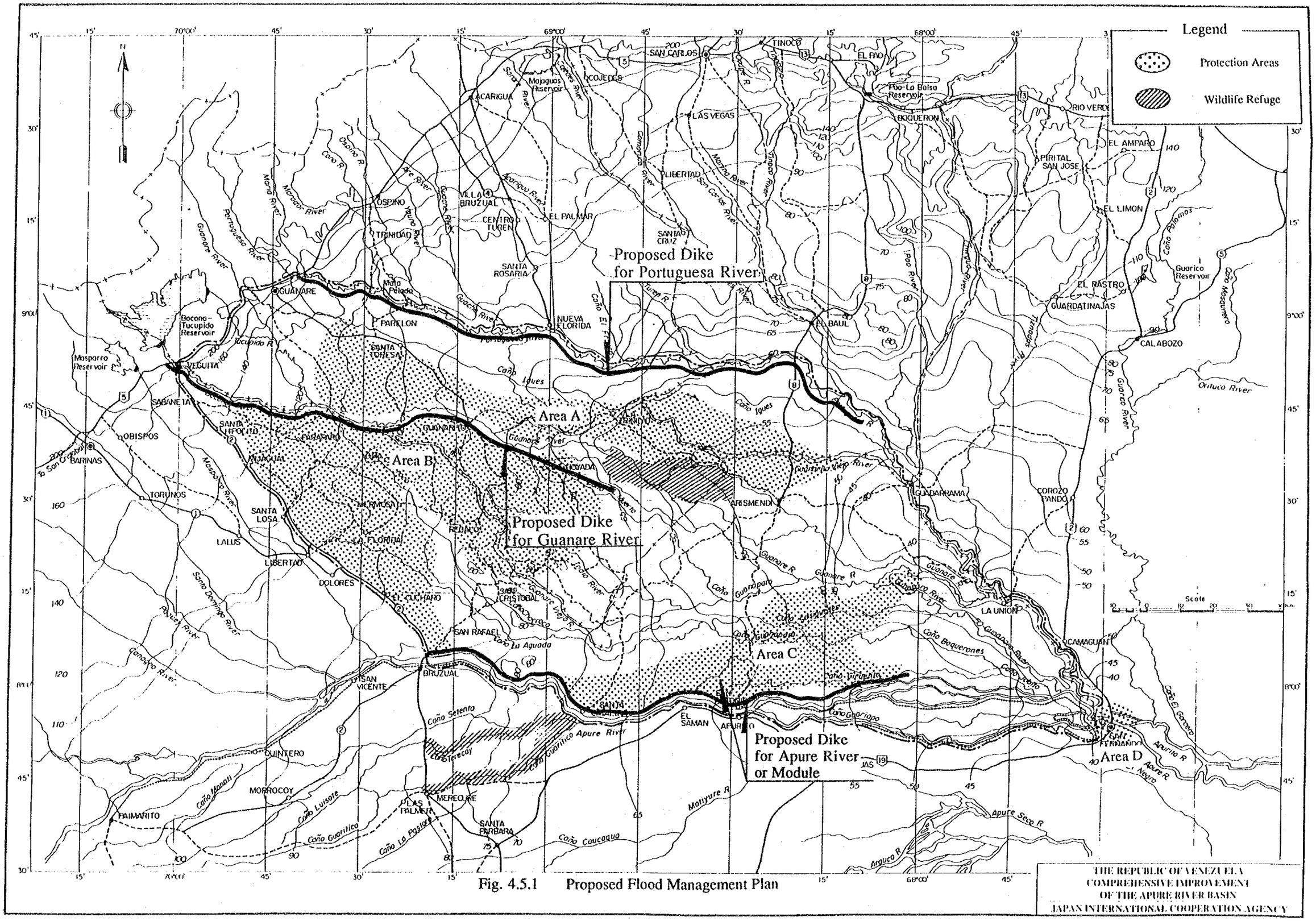


Fig. 4.5.1 Proposed Flood Management Plan

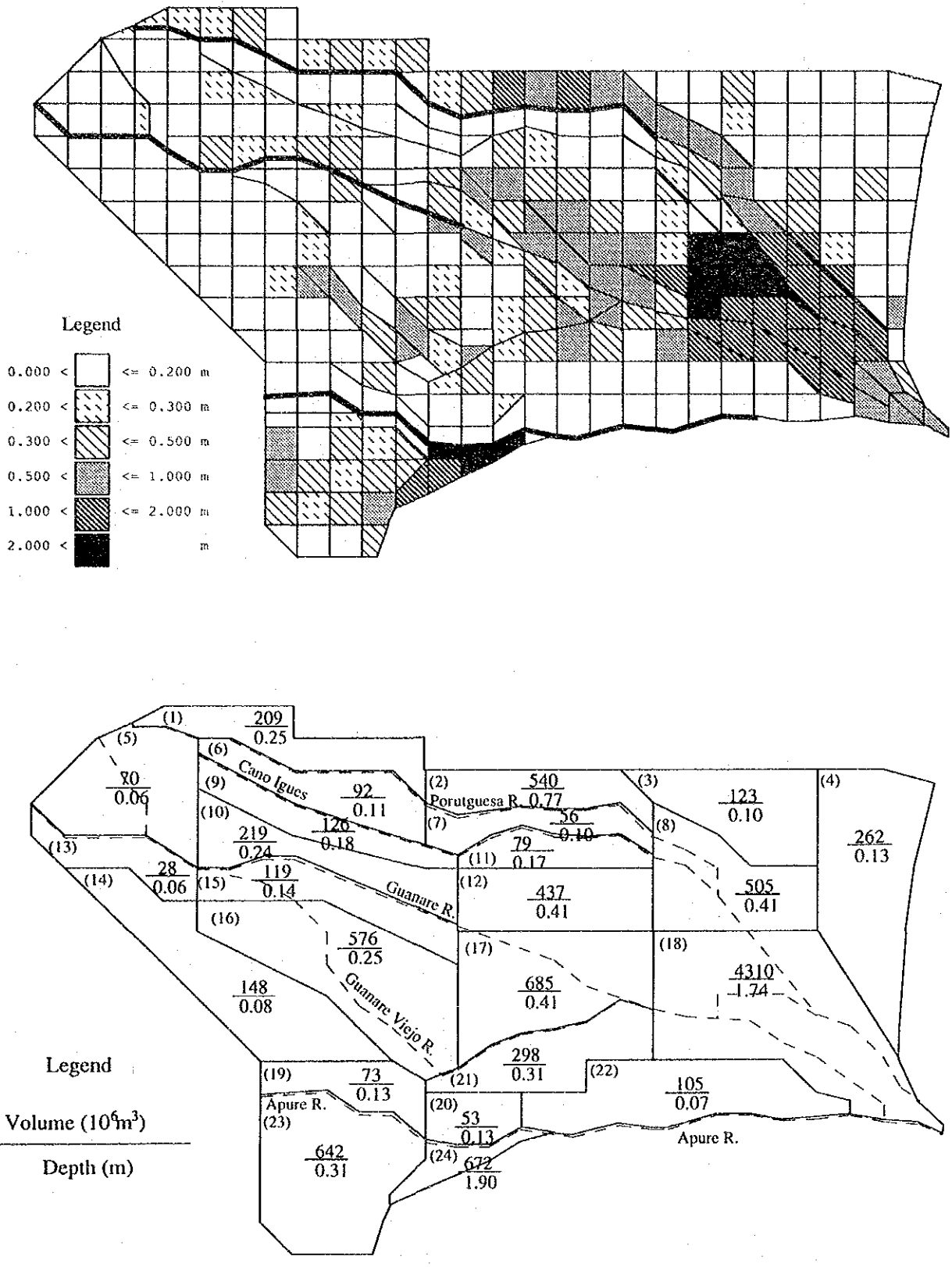


Fig. 4.5.2 Maximum Inundation for Proposed Flood Management Plan (10-yr Return Period)

THE REPUBLIC OF VENEZUELA
COMPREHENSIVE IMPROVEMENT
OF THE APURE RIVER BASIN

JAPAN INTERNATIONAL COOPERATION AGENCY

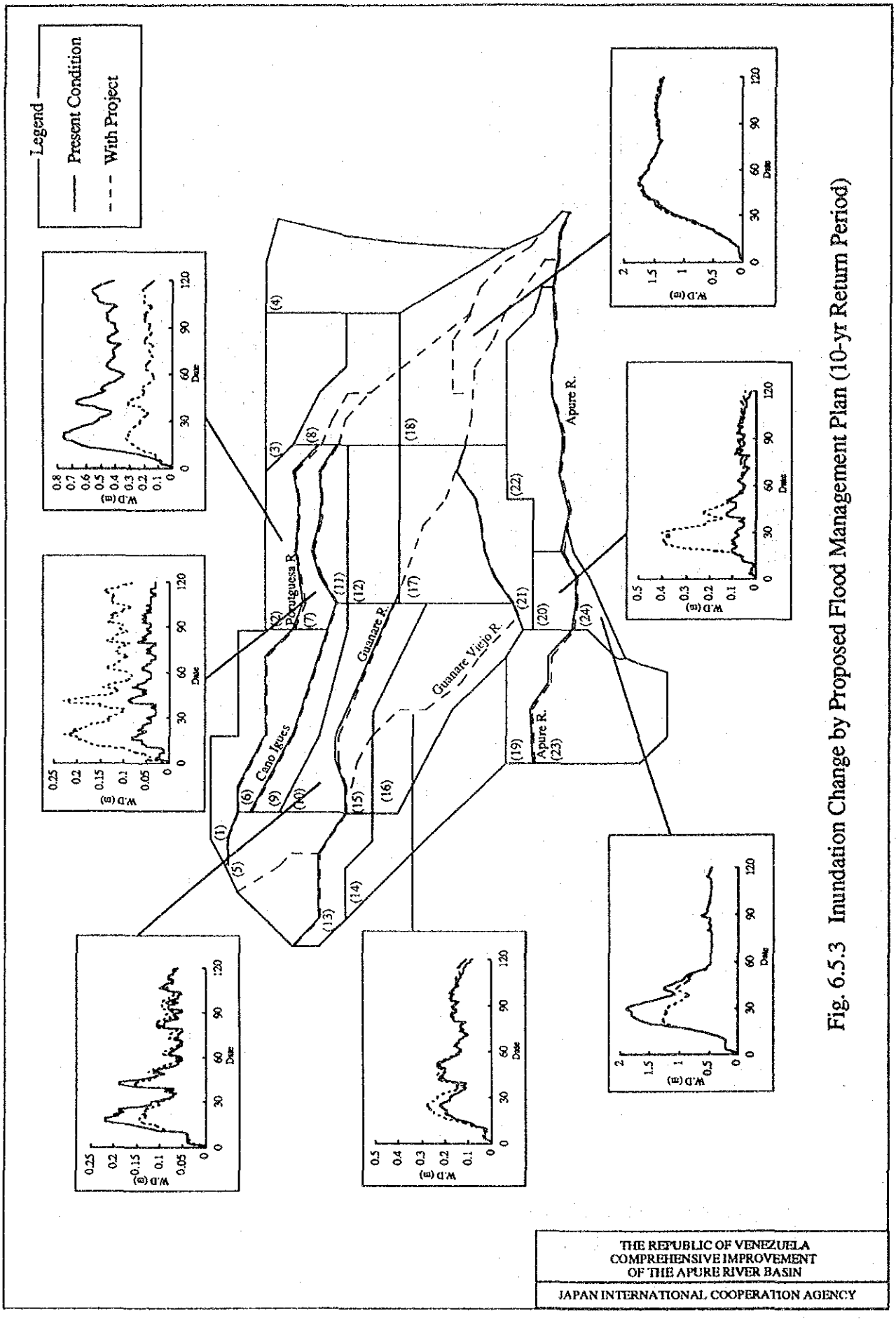
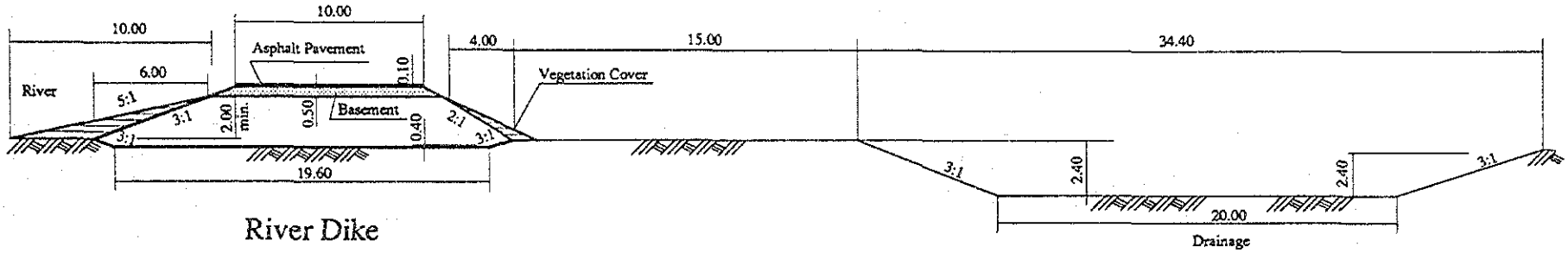
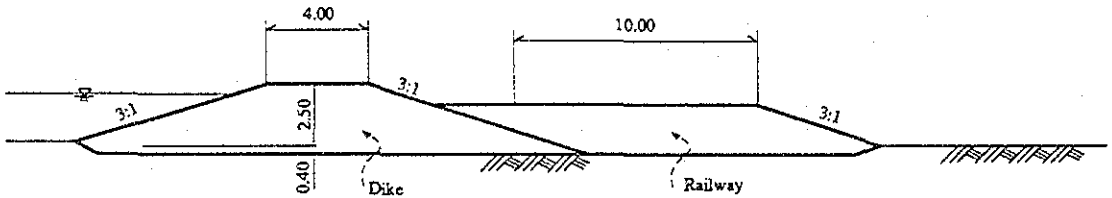


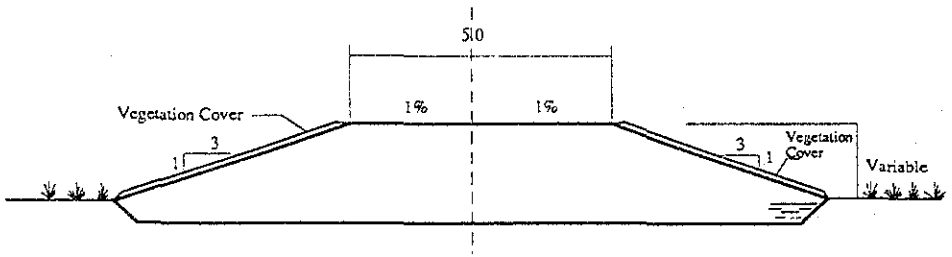
Fig. 6.5.3 Inundation Change by Proposed Flood Management Plan (10-yr Return Period)



River Dike



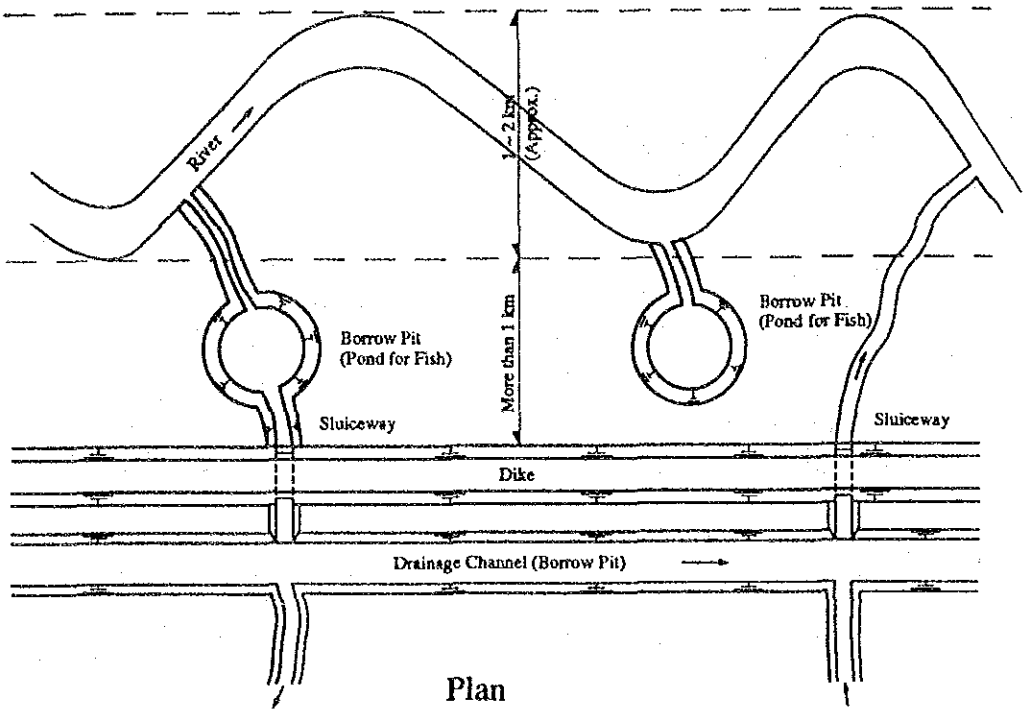
Dike for Railway



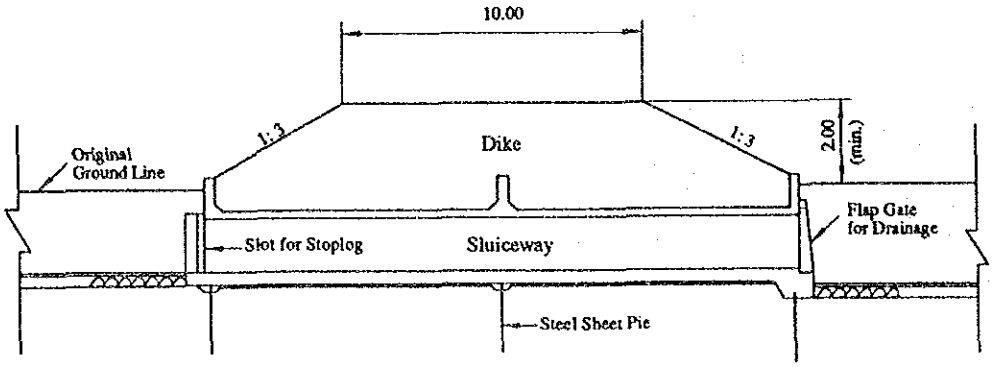
Dike for Apure Module

Fig. 4.5.4 Typical Cross Sections of Dikes

THE REPUBLIC OF VENEZUELA
COMPREHENSIVE IMPROVEMENT
OF THE APURE RIVER BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY



Plan



Longitudinal Section of Sluiceway

Fig. 4.5.5 Typical Arrangement of Dike, Borrow Pit and Sluiceway

THE REPUBLIC OF VENEZUELA COMPREHENSIVE IMPROVEMENT OF THE APURE RIVER BASIN
JAPAN INTERNATIONAL COOPERATION AGENCY

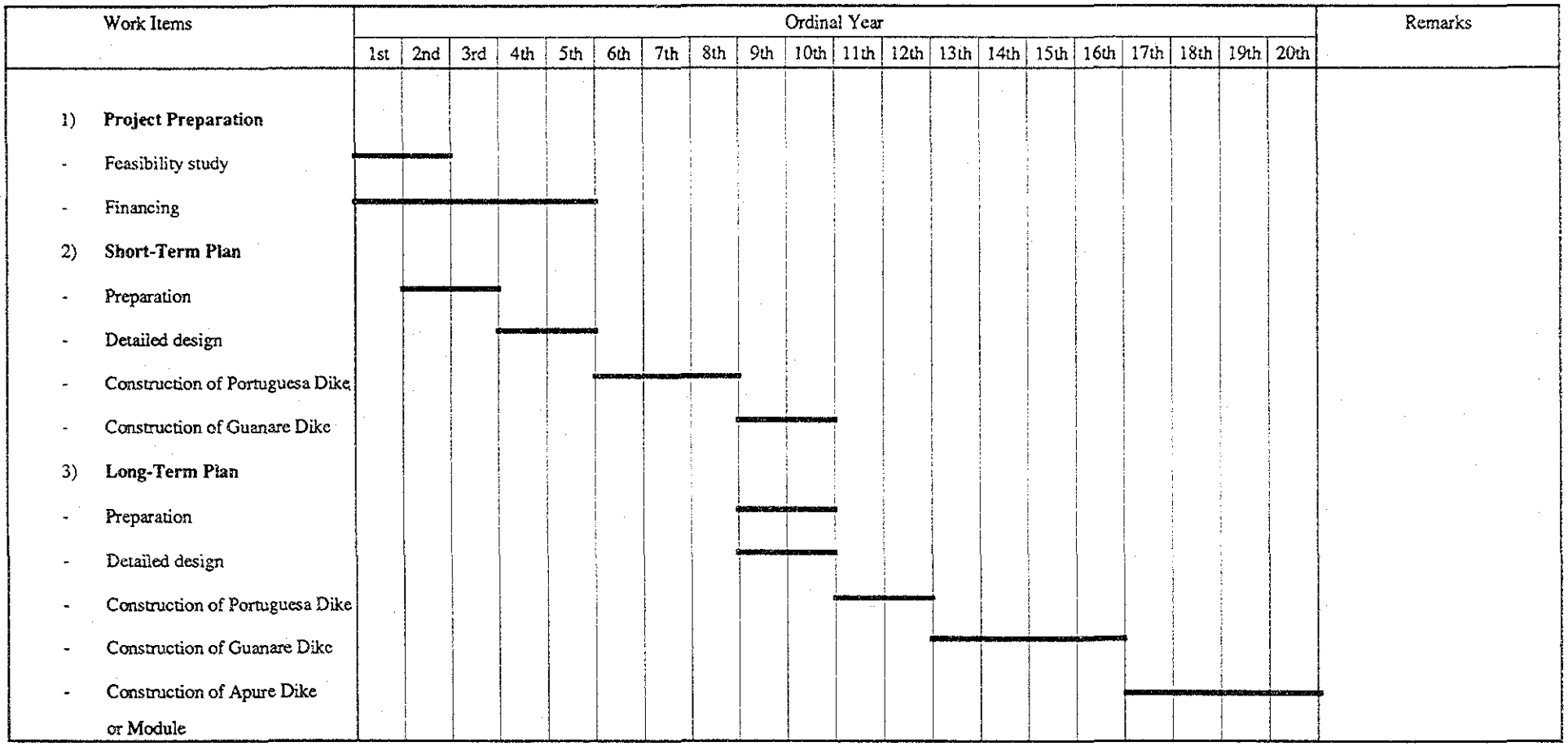


Fig. 5.3.1 Tentative Implementation Schedule of Flood Management Works

PART-G

CONSTRUCTION PLAN AND COST ESTIMATE

STUDY ON COMPREHENSIVE IMPROVEMENT OF THE APURE RIVER BASIN

FINAL REPORT

VOLUME III: SUPPORTING REPORT
PART-G : CONSTRUCTION PLAN ND COST ESTIMATE

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LIST OF TABLES

I. IMPLEMENTATION OF THE PROJECT

Based on the result of site reconnaisance and collected data with regard to the construction works, the proposed project is assumed to be implemented as follows :

(1) The government and/or government agency will become executing agency to take responsibility for all aspects necessary for the implementation including administration, financial and technical matters.

(2) Construction works of the project will be executed under a contract basis in accordance with the government regulation. Appropriate contractor will be selected through an international open tender with pre-qualification.

(3) For major construction works, contractor will apply a conventional and prevailing construction method using construction equipment, such as :

- Bulldozer, back hoe, tractor shovel and dump truck for earth moving works.
- Vibration roller, tanping roller and tire roller for compaction works.
- Concrete mixer, concrete bucket handled by crane, concrete pump, agitator truck, concrete vibrator and batching plant for concrete works.
- Diesel pile hammer and vibration hammer for piling works.
- Dredger for river channel excavation in water

II. CONSTRUCTION SCHEDULE AND METHOD

2.1 Preparatory Period

Prior to commencement of the construction works, it might be necessary to undertake financial arrangement, feasibility study, detailed design works including preparation of tender documents and tendering. Required periods for such events are estimated as follows:

Stage	Required period
(1) Feasibility study	1.5 years
(2) Financial arrangement based on feasibility study	1 years
(3) Detailed design	1.5 years
(4) Tendering	0.5 ~ 1 year
Total	about 5 years

2.2 Workable Day

After selecting contractor, the construction will be commenced. Considering the weather condition, the major construction works will be carried out during dry season from December to May. In rainy season from June to November, most of construction works, especially earth moving works and river works, will be suspended due to inferiority traffic ability of access road and high water level of river.

Annual workable day is assumed as follows:

1) Earth works and river works:

25 days/month x 6 months = 150 days/year

2) Concrete works and others:

Dry season : 20 days/month x 6 months = 120 days/year
Wet season : 15 days/month x 6 months = 90 days/year

Total 210 days /year

3) Dredging works:

20 days/month x 10 months = 200 days/year

2.3 Construction Period

Construction period required for the completion of the project depends on the scale of the project.

However, two (2) dry seasons may be required at least. One (1) dry season will be spent for preparatory works including access rood, temporary facilities etc. and another one (1) dry season will be for main construction works. In case of large scale construction, the construction period will spread over several years as corresponding to magnitude of the construction works.

Assuming that annual work quantity to be completed is 1,500,000 m^3 for dike embankment, the required construction periods for components plans of the proposed flood management project are estimated as follows :

1) Alternative plan A1 : 7.76 M cum ÷ 1.5 M cum/year = 5 year
2) Alternative plan B1 : 5.80 M cum ÷ 1.5 M cum/year = 4 year
3) Alternative plan C1 : 7.97 M cum ÷ 1.5 M cum/year = 5 year

In this case, major construction equipment required are as follows:

1) Required Capacity

Annual Capacity : 1,500,000 cum
Hourly Capacity : 1,500,000 cum ÷ (150 days x 8 hours/day)
= 1,250 cum/h.

2) Required construction equipment

a) Excavation and loading

Bulldozer, 30 t	:	1,250 cum/h ÷ 150 cum/h/no. = 9 nos.
Tractor shovel, 3 m^3	:	1,250 cum/h ÷ 150 cum/h/no. = 9 nos.

b) Hauling

Dump Truck 20 t	:	1,250 cum/h ÷ 30 cum/h/no. = 42 nos.

c) Spreading and compaction

Bulldozer 30 t	:	1,250 cum/h ÷ 300 cum/h/no. = 5 nos.
Tamping roller 20 t	:	1,250 cum/h ÷ 300 cum/h/no. = 5 nos.

In case of dredging works for river channel, annual production volume of dredging is estimated at 300,000 cum to 400,000 cum for one unit of cutter suction pumped dredger of 1,000 PS capacity.

Assuming that required work volume is five (5) million cum in total and two (2) units of dredgers are used, the construction period of dredging work is estimated at 6 years as follows :

5,000,000 cum ÷ (400,000 cum/year x 2 units) = 6 years

III. COST ESTIMATE

3.1 Conditions of Cost Estimate

Project cost is estimated at the price level in February 1993 since necessary data for cost estimate were collected during this period.

Currency of the project cost is expressed in US $ by using the prevailing exchange rate in February, 1993 as follows :

US $ 1 = Bs 82 = ¥ 119.72
Bs 1 = ¥ 1.46

The project cost to be required for implementation of the project consists of five (5) items and is estimated as follows :

1) Construction cost

The construction cost is estimated for each structure by maltiplying unit price by work quantity.

2) Land acquisition and compensation cost

Land and private properties to be acquired for the construction of permanent structure are estimated by using prevailing unit price in the project area.

3) Government administration cost

Government expenses for administration and supervision of the project are estimated at five (5) percent of total construction cost and land acquisition and compensation cost.

4) Engineering service cost

Engineering service cost to be required for further engineering study is estimated at seven (7) persent of the construction cost for detailed design and ten (10) percent for construction supervision.

5) Physical contingency

Physical contingency is estimated at ten (10) percent of total cost for unforeseen condition of the project.

3.2 Unit Price for Construction Cost

Unit prices applied for the estimate of construction cost are presented in Table 3.2.1.

Cost data were collected from the construction projects which have been executed in the project area by PROA recently, such as channel stabilization works, cut-off channel works and port construction works. Unit prices of construction works collected from these projects are summarized in Table 3.2.2 and labor cost, material cost and equipment cost were also collected from the field survey as presented in Tables 3.2.3, 3.2.4 and 3.2.5, respectively.

Most of applicable unit prices for the construction cost estimate were generally taken from the collected unit prices shown in Table 3.2.2 and several unit prices which were not collected from the field survey were taken from prevailing unit price in Japan and/or from similar works in other countries. They are gate, bridge, brushwood mattress, gabion mattress and piling works.

3.3 Project Cost

3.3.1 Channel Stabilization Project

The short-term plan (STP) and the mid-term plan (MTP) shall subject to cost estimation. These plans include following major works:

1) Derivation channel
   a) New channel works
   b) Diversion gate works
   c) Spillway works
2) Anabranch treatment
   a) Submerged dike works
   b) Closing dike works
3) Realignment works

4) Cut-off channel works
5) Section improvement works

Unit construction costs of the aforementioned works were estimated as presented in Tables 3.3.1 and 3.3.2, composing the unit prices presented in Table 3.2.1.

3.3.2 Flood Management Project

The alternative plans selected are subject to cost estimation. They include the following major works.

1) River Dike
   a) Foundation excavation
   b) Dike embankment
   c) Vegetation cover
   d) Sluiceway

2) Diversion Channel
   a) Channel excavation
   b) Dike embankment
   c) Bridge construction

3) Apure Type Module
   a) Dike embankment

The cost of each plan was estimated as presented in Tables 3.3.3 and 3.3.4.

IV. REFERENCE

The documents and data referred to the Study are listed below.

No.	Title
1.	Bnco De Datos De Costs De Construction Volume A
2.	Banco De Datos De Costos De Construction Volume B
3.	Manual De Costs Nivel Prefactibisidad
4.	Manual De Costos Nivel Preliminar
5.	Ley De Trabajo
6.	Ley Organica De Prevencion Conpiuonesysmedio Amdiente De Trabajo
7.	Ley De Exprodiacion Por Causa De Utilidad Publica O Social
8.	Ley De Impuesto Subre La Renta
9.	Ley De Transito Terrestre
10.	Ley De Politica Habitacional Y Ley De Deudor Hipgrelario Proteccion Al
11.	Ley Del Seguro Social
12.	Gaceta Oficial No. 1358
13.	Instituto Nacional De Canalizaciones
14.	Gaceta Oficial No. 34797
15.	Celeta Oficial No. 34830
16.	Lay De Licitaciones
17.	List Of Registered Contractors
18.	Organization Chart of Manr
19.	Priced Bill Of Quantities
20.	Cost Data of Channel Stabilization of the A Carigua River Project
21.	Cost Data of San Fernando Port Project
22.	Cost Data of El Baul Port Project
23.	Cost Data of La Muerte Cut Off Channel Project
24.	Cost Data of Cut Off in the Portuguesa River and Canaguan Protection Dike Project
25.	Cost Data of Vilches River Dam Project

TABLES

Table 3.2.1 APPLICABLE UNIT PRICE

Work Item	Unit	Unit Price (US $)	Equivalent in Bs.
1. Deforest and clearing			
(1) Deforest	ha	200	16,400
(2) Clearing and stripping	sq.m	0.3	20
2. Excavation works			
(1) Common	cu.m	1.0	82.0
(2) Channel	cu.m	1.8	147.6
(3) Structure	cu.m	5.0	410.0
3. Embankment works			
(1) Common	cu.m	2.5	205
(2) Sand and gravel	cu.m	15.0	1,230
4. Concrete works			
(1) Mass	cu.m	80.0	6500
(2) Structure	cu.m	120.0	10,000
(3) Reinforcement bar	ton	915.0	75,000
5. Piling works			
(1) PC pile, 380 mm Ø	m	60.0	5,000
450 mm Ø	m	97.0	8,000
(2) RC pile, 380 mm Ø	m	50.0	4,100
450 mm Ø	m	75.0	6,150
(3) Wooden pile, 150 mm Ø	m	8.0	650
(4) Steel pile, mm Ø	m		
mm Ø	m		
(5) Steel sheet pile	sq.m	125.0	10,250
6. Pavement			
(1) Gravel pavement	cu.m	30.0	2,500
(2) Asphalt pavement	sq.m	20.0	1,640
7. Protection works			
(1) Concrete block	sq.m	55.0	4,500
(2) Concrete sand bag	bag	4.0	328
(3) Gabion mattress	cu.m	40.0	3,280
(4) Brushwood mattress	sq.m	112.0	9,212
8. Dredging			
(1) River bed dredging	cu.m	2.5	200
9. Bridge			
(1) Concrete bridge, more than 50 m	sq.m	1,500.0	12,300
less than 50 m	sq.m	1,800.0	147,600
10. Gate			
(1) Sluice gate	ton	6,000.0	492,000
11. Others			
(1) Sodding	sq.m	0.6	50

Table 3.2.2 SUMMARY OF UNIT PRICES OF CONSTRUCTION WORKS

Description	Unit	Unit Price (Bs.) (1)*	(2)*	(3)*	(4)*	(5)*	(6)*
1. Earth Works							
(1) Excavation, common	cu.m				82.43	65.00	78.07
(2) Excavation, in water	cu.m	568.89			139.02		
(3) Excavation, by back hoe	cu.m	225.45	188.16	225.38			298.88
(4) Excavation, by hand	cu.m		701.67	982.60			
(5) Embankment	cu.m			265.00			363.67
(6) Compaction, dike	cu.m				28.89		
(7) Cofferdam embankment	cu.m	596.83					
(8) Deforest, medium	ha				14,703.92	14,092.65	20,885.24
(9) Deforest, light	ha					13,054.00	
(10) Land clearing	sq.m			19.48			
2. Concrete Works							
(1) Concrete, R = 150 kg/cm for base	cu.m		4,894.44				
(2) Concrete, R = 200 kg/cm for beam	cu.m			9,508.16			
(3) Concrete, R = 250 kg/cm for beam	cu.m		6,999.25	6,002.15			16,598.85
(4) Concrete, R = 250 kg/cm for colum	cu.m		7,710.92	6,002.15			
(5) Reinforcement steel bar	kg		69.61	75.17			68.98
3. Piling Works							
(1) Supply of pile							
- Ø = 45 cm, l = 14 m	m			4,857.77			
- Ø = 38 cm, l = 14 m	m			2,609.05			
(2) Pile driving							
- Ø = 45 cm	m			2,985.71			
- Ø = 38 cm	m			2,543.58			
(3) Cast in situs pile, P = 1.2 m	m		128,410.00				
4. Road Works							
(1) Leveling by grader	sq.m			20.30			
(2) Base course	cu.m			678.81			
(3) Sub base cause	cu.m	1,575.19					
(4) Transportation of material	cu.m	18.98		13.61			
(5) Quarry rock supply	cu.m	1,183.27					
5. Others							
(1) Concrete block wall	sq.m			447.77			
(2) Sand cement bag	cu.m		1,846.50				

Note ; * Data were obtained from the following projects.

Project Name	Commencement of Construction
(1) Channel Stabilizationof the Acarigua River	Feb. 1993
(2) San Fernand Port (Float Wharf)	Oct. 1992
(3) El Baul Port (Bank protection, Fix Whalf)	Sep. 1992
(4) La Muerte Cut Off Channel	Jan. 1993
(5) Cut Off in the Portuguesa River and Camaguan Protection Dike	Mar. 1993
(6) Vilches River Dam	1991

Table 3.2.3 LABOR WAGE

Description	Daily Basic Wage (US$)	Equivalent in Bs.
1. Foreman	4.49	368
2. Operator		
Heavy equipment	5.29	434
Light equipment	4.59	376
3. Assistant operator	4.34	356
4. Driver		
Dump truck	5.47	449
Truck	4.15	340
5. Mechanic	5.10	418
6. Assistant mechanic	4.34	356
7. Mason	4.93	404
8. Skilled labor	5.18	425
9. Semi skilled labor	4.49	368
10. Common labor	4.30	353

Table 3.2.4 BASIC PRICES OF MATERIALS

Description	Unit	Unit Price (US$)	Equivalent in Bs.
1. Fuel and lubricant			
Gasoline	l	0.07	6
Diesel	l	0.05	5
Engine oil	l	0.73	60
Hydraulic oil	l	0.85	70
Grease	kg	0.61	50
2. Cement, 40 kg bag	bag	3.41	280
3. Sand	cu.m	15.85	1,300
4. Gravel	cu.m	13.41	1,100
5. Boulder	cu.m	9.59	786
7. Asphalt	t	41.46	3,400
8. Reinforcement steel bar	kg	0.85	70
9. H steel	kg	1.22	100
10. Channel steel	kg	1.22	100
11. Steel pipe 10"	kg	2.44	200
12. Concrete block	pcs	0.46	38
13. Brick	pcs	0.27	22
14. Annealed iron wire	kg	0.29	24

Table 3.2.5 EQUIPMENT COSTS

Description	Daily Cost (US$)	Equivalent in Bs.
1. Tractor, D9h	411.76	34,588
2. Tractor, D9h with scarificator	470.59	39,530
3. Pay loader	236.65	19,879
4. Excavator Cat 235	373.71	31,392
5. Back hoe	144.00	12,096
6. Trench hoe, R-941	215.00	18,060
7. Tractor loader, C-950	185.80	15,607
8. Tractor shovel, C-955	193.54	16,257
9. Dump truck, 18 m3	110.84	9,311
10. Mack truck, R-600	119.27	10,019
11. Truck, 350	53.64	4,506
12. Plat form truck	127.85	10,739
13. Pick up truck	83.55	7,018
14. Light truck, F-150	70.20	5,897
15. Concrete pump truck	355.67	29,876
16. Concrete mixer	37.31	3,134
17. Concrete vibrator	8.46	711
18. Compressor	13.29	1,116
19. Vibro compactor	132.00	11,088
20. Compactor	12.08	1,015
21. Crawler crane, 50 t	437.14	36,720
22. Crauler crane, 30 t	253.30	21,277
23. Truck crane, 30 t	156.19	13,120
24. Submersible pump	13.44	1,129
25. Welder	15.43	1,296
26. Barge	287.86	24,180
27. Boat	114.94	9,655

Table 3.2.6 UNIT PRICE FOR LAND ACQUISITION AND COMPENSATION

Description	Unit	Unit Price (US$)	Equivalent in Bs.
1. Irrigated land			
Meiz	ha	123.31	10,111
Rice	ha	157.05	12,878
2. Non-irrigated land			
Meiz	ha	123.31	10,111
Rice	ha	157.05	12,878
3. Plantation			
Coffee	ha	108.35	8,885
Sugar cane	ha	242.93	19,920
4. Forest	ha	182.93 - 304.88	15,000 - 25,000
5. Pasture	ha	60.98	5,000
6. Residential land	ha	36.59	3,000
7. House, made of brick	sq.m	170.73	14,000

Table 3.3.1 PROJECT COST FOR PROPOSED CHANNEL STABILIZATION PROJECT (1/2) : SHORT-TERM PLAN

	Work item	Unit	Unit cost (US$)	Stretch-A1 Q'ty	Stretch-A1 Amoun ($1000)	Stretch-A2 Q'ty	Stretch-A2 Amoun ($1000)	Stretch-A3 Q'ty	Stretch-A3 Amoun ($1000)	Stretch-A4 Q'ty	Stretch-A4 Amoun ($1000)	Stretch-P1 Q'ty	Stretch-P1 Amoun ($1000)	Stretch-P2 Q'ty	Stretch-P2 Amoun ($1000)	Total Q'ty	Total Amoun ($1000)
I.	CONSTRUCTION COST				7,480		398		9,028		14,070		7,890		1,147		40,013
1.	Preparatory Works(10%)	Ls.			680		36		821		1,279		717		104		3,637
2.	Derivation Channel				0		0		0		3,020		0		0		3,020
21.	New channel works	m	337	-	0	-	0	-	0	7,000	2,359	-	0	-	0	7,000	2,359
22.	Diversion gate works	Ls.	308,300	-	0	-	0	-	0	1	308	-	0	-	0	1	308
23.	Spillway works	Ls.	352,900	-	0	-	0	-	0	1	353	-	0	-	0	1	353
3.	Anabranch Treatment				577		0		452		0		0		0		1,029
31.	Submerged dike works	m	2,800	206	577	-	0	92	258	-	0	-	0	-	0	298	835
32.	Closing dike works	m	1,020	-	0	-	0	190	194	-	0	-	0	-	0	190	194
4.	Alignment Normalization				5,674		0		2,797		5,081		6,964		425		20,941
41.	Realignment works																
	a) Apure R.	m	1,020	800	816	0	0	1,700	1,734	2,600	2,652	-	0	-	0	5,100	5,202
	b) Portuguesa R.	m	607	-	0	-	0	-	0	-	0	1,300	789	700	425	2,000	1,214
42.	Cut-off channel works																
	a) Apure R.	m	759	6,400	4,858	0	0	1,400	1,063	3,200	2,429	-	0	-	0	11,000	8,350
	b) Portuguesa R.	m	650	-	0	-	0	-	0	-	0	9,500	6,175	0	0	9,500	6,175
5.	Section Improvement				351		351		4,719		4,317		0		588		10,326
	a) Apure R.	m	502	700	351	700	351	9,400	4,719	8,600	4,317	-	0	-	0	19,400	9,738
	b) Portuguesa R.	m	111	-	0	-	0	-	0	-	0	0	0	5,300	588	5,300	588
6.	Miscellaneous works(3%)	Ls.			198		11		239		373		209		30		1,060
II.	LAND ACQUISITION	Ls.			1		0		0		2		2		0		5
1.	Derivation Channel	ha	13	-	0	-	0	-	0	60	1	-	0	-	0	60	1
2.	Cut-off channel works	ha	13	95	1	0	0	21	0	48	1	121	2	0	0	285	4
III.	ADMINISTRATION COST (5% of I+II)	Ls.			374		20		451		704		395		57		2,001
IV.	ENGINEERING SERVICES	Ls.			1,272		68		1,535		2,392		1,341		195		6,803
	(D/D: 7% of I)				524		28		632		985		552		80		2,801
	(C/S: 10% of I)				748		40		903		1,407		789		115		4,002
V.	PHYSICAL CONTINGENCY (10% of I to IV)	Ls.			913		49		1,101		1,717		963		140		4,883
	TOTAL				10,040		535		12,115		18,885		10,591		1,539		53,705

Table 3.3.1 PROJECT COST FOR PROPOSED CHANNEL STABILIZATION PROJECT (2/2) : MID-TERM PLAN

	Work item	Unit	Unit cost (US$)	Stretch-A1 Q'ty	Stretch-A1 Amoun ($1000)	Stretch-A2 Q'ty	Stretch-A2 Amoun ($1000)	Stretch-A3 Q'ty	Stretch-A3 Amoun ($1000)	Stretch-A4 Q'ty	Stretch-A4 Amoun ($1000)	Stretch-P1 Q'ty	Stretch-P1 Amoun ($1000)	Stretch-P2 Q'ty	Stretch-P2 Amoun ($1000)	Total Q'ty	Total Amoun ($1000)
I.	CONSTRUCTION COST				6,084		1,251		18,623		12,594		12,912		4,112		55,576
1.	Preparatory Works(10%)	Ls.			553		114		1,693		1,145		1,174		374		5,053
2.	Derivation Channel				0		0		0		0		0		0		0
21.	New channel works	m	337	-	0	-	0	-	0	-	0	-	0	-	0	0	0
22.	Diversion gate works	Ls.	308,300	-	0	-	0	-	0	-	0	-	0	-	0	0	0
23.	Spillway works	Ls.	352,900	-	0	-	0	-	0	-	0	-	0	-	0	0	0
3.	Anabranch Treatment				0		0		0		0		0		0		0
31.	Submerged dike works	m	2,800	-	0	-	0	-	0	-	0	-	0	-	0	0	0
32.	Closing dike works	m	1,020	-	0	-	0	-	0	-	0	-	0	-	0	0	0
4.	Alignment Normalization				5,019		0		7,752		4,590		8,532		1,920		27,813
41.	Realignment works																
	a) Apure R.	m	1,020	1,200	1,224	0	0	7,600	7,752	4,500	4,590	-	0	-	0	13,300	13,566
	b) Portuguesa R.	m	607	-	0	-	0	-	0	-	0	4,900	2,974	700	425	5,600	3,399
42.	Cut-off channel works																
	a) Apure R.	m	759	5,000	3,795	0	0	0	0	0	0	-	0	-	0	5,000	3,795
	b) Portuguesa R.	m	650	-	0	-	0	-	0	-	0	8,550	5,558	2,300	1,495	10,850	7,053
5.	Section Improvement				351		1,104		8,685		6,526		2,864		1,709		21,239
	a) Apure R.	m	502	700	351	2,200	1,104	17,300	8,685	13,000	6,526	-	0	-	0	33,200	16,666
	b) Portuguesa R.	m	111	-	0	-	0	-	0	-	0	25,800	2,864	15,400	1,709	41,200	4,573
6.	Miscellaneous works(3%)	Ls.			161		33		493		333		342		109		1,471
II.	LAND ACQUISITION	Ls.			1		0		0		0		1		0		2
1.	Derivation Channel	ha	13	-	0	-	0	-	0	-	0	-	0	-	0	0	0
2.	Cut-off channel works	ha	13	75	1	0	0	0	0	0	0	109	1	30	0	214	2
III.	ADMINISTRATION COST (5% of I+II)	Ls.			304		63		931		630		646		206		2,780
IV.	ENGINEERING SERVICES	Ls.			1,034		213		3,166		2,141		2,195		699		9,448
	(D/D: 7% of I)				426		88		1,304		882		904		288		3,892
	(C/S: 10% of I)				608		125		1,862		1,259		1,291		411		5,556
V.	PHYSICAL CONTINGENCY (10% of I to IV)	Ls.			742		153		2,272		1,537		1,575		502		6,781
	TOTAL				8,165		1,680		24,992		16,902		17,329		5,519		74,587

Table 3.3.2 PROJECT COST FOR PROPOSED FLOOD MANAGEMENT PROJECT

Cost Item	Unit	Unit price (US$)	Plan A1 Qty	Plan A1 Amount (US$)	Plan B1 Qty	Plan B1 Amount (US$)	Plan C1 Qty	Plan C1 Amount (US$)	Overall Plan Qty	Overall Plan Amount (US$)
I. CONSTRUCTION COST (DIKE CONSTRUCTION)										
(1) Preparatory works	L.S	10%	1	2,240,000	1	1,674,000	1	2,237,500	1	6,151,500
(2) Foundation excavation	cu.m	1.0	960,000	960,000	740,000	740,000	790,000	790,000	2,490,000	2,490,000
(3) Dike embankment	cu.m	2.5	7,760,000	19,400,000	5,800,000	14,500,000	7,970,000	19,925,000	21,530,000	53,825,000
(4) Vegetation Cover	cu.m	1.0	1,240,000	1,240,000	900,000	900,000	1,060,000	1,060,000	3,200,000	3,200,000
(5) Sluiceway	nos.	20,000	40	800,000	30	600,000	30	600,000	100	2,000,000
(5) Miscellaneous works	L.S	10%	1	672,000	1	502,200	1	671,250	1	1,845,450
Sub Total (I)				25,312,000		18,916,200		25,283,750		69,511,950
II. LAND ACQUISITION COST										
(1) Land aquisition	ha	100.0	1,870	187,000	1,450	145,000	1,550	155,000	4,870	487,000
Sub Total (II)				187,000		145,000		155,000		487,000
III. ADMINISTRATION COST (5% of I + II)	L.S			1,274,950		953,060		1,271,938		3,499,948
IV. ENGINEERING SERVICE COST	L.S			4,303,040		3,215,754		4,298,238		11,817,032
Detailed Design (7% of I)				1,771,840		1,324,134		1,769,863		4,865,837
Construction Supervision (10 % of I)				2,531,200		1,891,620		2,528,375		6,951,195
V. PHYSICAL CONTINGENCY (10 % of I + II + III + IV)	L.S			3,107,699		2,323,001		3,100,893		8,531,593
GRAND TOTAL				34,184,689		25,553,015		34,109,818		93,847,522

(3) Length of dike Plan A1 = 187 km, Plan B1 = 145 km, Plan C1 = 155 km

Note: (1) Currency exchange rate : US $ 1 = Bs 82 = ¥119.72
(2) Sluiceway isarranged at intervals of 5 km.

Table 3.3.3 PROJECT COSTS FOR ALTERNATIVE FLOOD MANAGEMENT PLANS (1/2)

Cost Item	Unit	Unit price (US$)	Plan B2A Qty	Plan B2A Amount (US$)	Plan B2B Qty	Plan B2B Amount (US$)	Plan C2 Qty	Plan C2 Amount (US$)
I. CONSTRUCTION COST								
(1) Preparatory works	L.S	10%	1	3,612,000	1	5,038,000	1	1,571,000
(2) Foundation excavation	cu.m	1.0	740,000	740,000	740,000	740,000	540,000	540,000
(3) Dike embankment	cu.m	2.5	5,800,000	14,500,000	5,800,000	14,500,000	5,600,000	14,000,000
(4) Vegitation Cover	cu.m	1.0	900,000	900,000	900,000	900,000	770,000	770,000
(5) Sluiceway	nos.	20,000	30	600,000	30	600,000	20	400,000
(7) Bridge	sq.m	1,500	0	0	0	0	0	0
(6) Channel excavation	cu.m	2	9,690,000	19,380,000	16,820,000	33,640,000	0	0
(7) Apure module	ha	200	0	0	0	0	0	0
(8) Miscellaneous works	L.S	3%	1	1,083,600	1	1,511,400	1	471,300
Sub Total (I)				40,815,600		56,929,400		17,752,300
II. LAND ACQUISITION COST	ha	100.0	1,925	192,500	2,400	240,000	1,050	105,000
III. ADMINISTRATION COST (5% of I + II)	L.S			2,040,780		2,846,470		887,615
IV. ENGINEERING SERVICE COST	L.S			6,938,652		5,692,940		1,775,230
Detailed Design (7% of I)				2,857,092		3,985,058		1,242,661
Construction Supervision				4,081,560		5,692,940		1,775,230
V. PHYSICAL CONTINGENCY (10 % of I + II + III + IV)	L.S			4,998,753		6,570,881		2,052,015
GRAND TOTAL				54,986,285		72,279,691		22,572,160

Note: (1) Currency exchange rate : US $ 1 = Bs 82 = ¥119.72

Table 3.3.3 PROJECT COSTS OF ALTERNATIVE FLOOD MANAGEMENT PLANS (2/2)

Cost Item	Unit	Unit price (US$)	Plan D1A		Plan D1B		Plan D2	
			Q'ty	Amount (US$)	Q'ty	Amount (US$)	Qty	Amount (US$)
I. CONSTRUCTION COST								
(1) Preparatory works	L.S	10%	1	960,000	1	1,702,000	1	10,400,000
(2) Foundation excavation	cu.m	1.0	0	0	0	0	0	0
(3) Dike embankment	cu.m	2.5	0	0	2,240,000	5,600,000	0	0
(4) Vegetation Cover	cu.m	1.0	0	0	0	0	0	0
(5) Sluiceway	nos.	20,000	0	0	0	0	0	0
(6) Bridge	sq.m	1,500	3,200	4,800,000	3,200	4,800,000	0	0
(7) Channel excavation	cu.m	2	2,400,000	4,800,000	3,310,000	6,620,000	0	0
(8) Apure module	ha	200	0	0	0	0	520,000	104,000,000
(9) Miscellaneous works	L.S	3%	1	288,000	1	510,600	1	3,120,000
Sub-total of I				10,848,000		19,232,600		117,520,000
II. LAND ACQUISITION COST	ha	100.0	0	0	900	90,000	0	0
III. ADMINISTRATION COST (5% of I + II)	L.S			542,400		966,130		5,876,000
IV. ENGINEERING SERVICE COST	L.S			1,844,160		3,269,542		19,978,400
Detailed Design (7 % of I)				759,360		1,346,282		8,226,400
Construction Supervision (10 % of I)				1,084,800		1,923,260		11,752,000
V. PHYSICAL CONTINGENCY (10 % of I + II + III + IV)	L.S			1,323,456		2,355,827		14,337,440
GRAND TOTAL				14,558,016		25,914,099		157,711,840

Note: (1) Currency exchange rate : US $ 1 = Bs 82 = ¥119.72

PART-H

SOCIO-ECONOMY AND PRELIMINARY PROJECT EVALUATION

STUDY ON COMPREHENSIVE IMPROVEMENT OF THE APURE RIVER BASIN

FINAL REPORT

VOLUME III : SUPPORTING REPORT
PART-H : SOCIO-ECONOMY AND PRELIMINARY PROJECT EVALUATION

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I. INTRODUCTION

The Apure river basin covers all of Barinas, Portuguesa and Cojedes provinces; a part of Tachira and Apure provinces; and small portion of Merida, Trujillo, Lara, Yaracuy, Carabobo and Guarico provinces as shown in Fig. 1.1.1.

Tachira province is located in the southwest of Venezuela on the Andes region. It is bounded by the Zulia province on the north, Merida province on the west, Barinas and Apure provinces on the south and Colombia on the east. Its surface area is 11,100 km^2 with a population of 807,700 persons in 1990. The capital is San Cristobal. The major agricultural products are coffee, cattle, potatoes, vegetables, fruits and beans. The main mining product is carbon. It has an attractive tourist scenery.

Barinas province is located in the southwest of Venezuela, in the west of Los Llanos. It is bounded by the Apure river on the south, provinces of Portuguesa, Cojedes and Trujillo on the north, Tachira and Merida on the west and Guarico on the east. Its surface area is 35,200 km^2 with a population of 424,500 persons in 1990. The capital is Barinas. The main agricultural products are cotton, maize, timber, cattle, pork rice and sesame. Crude oil is produced on the northwest of San Silvestre.

Cojedes province is located in the western center of Venezuela. It is bounded by the provinces of Lara, Yaracuy and Carabobo on the north Barinas on the south, Guarico on the east, and Portuguesa and Lara on the west. Its surface area is 14,800 km^2 with a population of 182,100 persons in 1990. The capital is San Carlos. The main agricultural products are cattle, rice, sorghum and maize.

Portuguesa province is in the west of Venezuela. It is bounded by the provinces of Lara and Trujillo on the north Barinas on the south, Cojedes on the east, and Barinas and Trujillo on the west. Its surface area is 15,200 km^2 with a population of 576,400 persons in 1990. The capital is Guanare. The major agricultural products are rice, sorghum, sesame, cotton, maize and beans.

Apure province is located in the southeast of Los Llanos. It is bounded by the Apure river on the north, the Orinoco river on the east and Colombia on the south and west. The area of this province is 76,500 km^2 and the population is 285,400 persons in 1990. The capital is San Fernando de Apure. The major agricultural products are cattle, kidney beans, rice pork, banana, maize, cotton and timber. The central part of the province is protected by the right dike of the Apure river. The Modulos de Apure Project for flood management is located there, of which objectives are to evacuate cattle on dikes in rainy season and to supply water as ditch water for cattle in dry season. Recently, crude oil was discovered in the Arauca river on the border to Colombia.

II. SOCIO-ECONOMY

2.1 Population and Labor Force

(1) Population

According to the 1990 census by La Oficina Central de Estadistica e Informatica (OCEI), Venezuela had a population of 18,105,265. This population increased by 7.4 million as compared with the 1971 census as shown in Table 2.1.1. During the 70's, the average annual growth rate of the population was 3.08 %. During the 80's, the growth rate slowed down to 2.48 %. This rate, however, indicates that the population may double in about 30 years.

Average annual growth rate of population in Barinas, Cojedes and Portuguesa provinces which are major provinces in the Project area, was about 0.5 % higher than the national average both during the 70's and the 80's.

Population by provinces and its average annual growth rate are shown in Table 2.1.2 and population by municipality related to the Project is shown in Table 2.1.3.

(2) Labor Force

The economically active population defined as persons aged 15 years and over increased almost twice from 5.9 million in 1971 to 11.4 million in 1990. The average annual growth rate was 3.99 % in the 70's and 2.98 % in the 80's as shown in Table 2.1.1. The ratio of the economically active population to the total population has gradually increased from 51.1 % in 1971, 53.2 % in 1981, and 55.4 % in 1990.

On the other hand, Venezuela's labor force grew from 3.0 million in 1971 to 6.2 million in 1990. Labor participation rate defined as the rate of the labor force to the economically active population gradually increased as 51.1 % in 1971, 53.2 % in 1981, and 55.4 % in 1990.

Venezuela's unemployment has been increasing rapidly from 185,978 in 1971 to 863,489 in 1990 as shown in Table 2.1.1. Unemployment rate is rising as 6.2 % in 1971, 9.9 % in 1981 and 14.0 % in 1990.

2.2 Economic Indices

(1) Gross Domestic Product

Gross domestic product (GDP) in 1991 was about Bs.3,036 billion (approximately US$53.4 billion) and GDP per capita in 1991 was Bs.153,452 as shown in Table 2.2.1. Annual growth rate of GDP in these five (5) years is large at about 44 % on current price basis. However, this is due to price escalation. Taking a look at substantial growth rate of the GDP and GDP per capita in 1984 constant price, the annual growth rate in these five (5) years falls down to 3.6 % and 1.1 %, respectively.

In 1989, GDP and GDP per capita in 1984 constant price recorded negative growth at -8.6 % and -10.7 %, respectively. However, the growth rates of the GDP and GDP per capita are increasing gradually since then.

GDP by industrial origin in 1984 constant price is shown in Table 2.2.2. The table shows that the GDP fell off in 1989 for almost all the sectors. However, it is recovering in these years.

(2) Prices

Movement of the consumer price in Metropolitan of Caracas continued with its upward trend as shown in Table 2.2.3. The average inflation rates in the Metropolitan from 1981 to 1991 and that from 1988 to 1991 are 25.1 % and 51.6 %, respectively.

Construction price index is derived from wholesale price index of construction industry sector, which reflects the public construction cost. The price index shows the same upward trend as the consumer price index. The index is almost always lower than the consumer price index.

(3) Foreign Exchange Rate

Table 2.2.4 shows foreign exchange rate between local currency and US dollar since 1981. The foreign exchange rate of Bs.4.30 to US$1.00 in 1982 was rapidly devaluated to Bs.81.97 to US$1.00 at February 1993.

III. INSTITUTIONS

Executive branch of the Government of Venezuela at the time of the study is shown in Fig. 3.1.1. The Ministry of Environment and Natural Resources (MARNR) is the executing agency for implementation of the Project.

Organization chart of MARNR and its agencies related to the Study is shown in Fig. 3.1.2. Functions of counterpart agencies of MARNR are outlined below.

1) Direccion General Sectorial de Investigacion y Conservacion de Agua, Suelo y Vegetacion (Sectorial General Directorate of Investigation and Conservation of Water, Soil and Vegetation) : To research, study and update the inventory of the water, soil and vegetation resources according to the guidelines of the national plan and environmental improvement plan.

   a) Direccion de Hidrologia y Meteorologia (DHM)
      - Research and study on hydrology, hydrometeorology and agrometerology
      - Preparation of land use map
      - Collection and management of data and information on hydrology

2) Direccion General Sectorial de Planificacion y Ordenacion del Ambiente (Sectorial General Directorate of Planning and Ordering of the Environment) : To formulate policies, strategies to develop country, zone planning of all the territorial spaces and to achieve the sustained utilization of the water, soil, vegetation and animal resources.

   a) Direccion de Planificacion de los Recursos Hidraulicos Suelos Vegetacion y Fauna (DPRH)
      - Appraisement and approval of water and land use for development project

3) Direccion General Sectorial de Infraestructura : (Sectorial General Directorate of Infrastructure)

   a) Direccion de Estudios y Proyectos (DEP)
      - Study and project formulation

4) Direccion General Programa Orinoco - Apure (General Directorate of Orinoco - Apure Program: PROA) : To prepare plan and conduct investigation for development of middle and southern part of the country that has enormous potential in mining, agriculture, livestock farming, fishery, forestry, tourism

and fluvial navigation with development of the Orinoco and the Apure rivers and their tributaries.

5) Direccion General Sectorial de Conservacion de Cuencas (Sectorial General Directorate of Basin Conservation) : To control sedimentation and erosion by reforest and environmental program for river basin

   a) Direccion de Planes Conservacionistas (DPC)

6) Laboratorio Nacional de Hidraulica (National Hydraulic Laboratory : LNH)

7) Corporacion Venezolana de Suroesta (Southwest Venezuelan Corporation : CVS)

IV. PRELIMINARY PROJECT EVALUATION FOR FLOOD MANAGEMENT PLAN

4.1 General

The Apure river basin has been suffering from floods every year during rainy season. Serious floods occurred in 1976 and 1981. Floods cause troubles to resident people of the basin and give damages to private and public properties and agricultural products. The long period of inundation due to floods has constrained the sound development of this vast plain lands.

The flood management plan aims to mitigate the flood damages in the study area and enhance land use there. The following flood management plans were proposed and subject to the evaluation:

1) Plan A1 : dike on the right bank side of the Portuguesa river
2) Plan B1 : dike on the right bank side of the Guanare river
3) Plan C1 : dike on the left bank side of the Apure river
4) Overall Plan : combination of above three dikes

Other than main objectives mentioned above, the dikes planed for the flood management will be utilized as public roads. They will enable to access to farm lands from cities and to carry out products from there.

For the present study on evaluation of the flood management plans, flood reduction benefit and land enhancement benefit were taken into account.

4.2 Methodology

Preliminary project evaluation was made at the price level of February 1993 and applied foreign exchange rate is US$1 equivalent to Bs.82.

The following properties in the flood prone area were considered for the evaluation:

1) General assets
   a) Houses and other buildings for retail, warehouse, private and public services and manufacturing
   b) Household effects, indoor movables of buildings specified above

2) Agricultural properties
   a) Various kind of crops on farm land
   b) Livestock

3) Infrastructure such as roads, bridges and public utilities related to water and electricity supply

Distribution of these properties in the study area is based on the statistic data on general properties and study results of land use which are presented in Supporting Report; Part C.

The study area was divided into numerous blocks of about 100 sq.km for flood simulation analysis as shown in Fig. 4.2.1. The same block division was used for the project evaluation. The blocks are the units for estimating assets in the study area.

4.2.1 Damageable Properties

(1) General Assets

Houses

Unit value of the house in the study area was estimated with the following equation.

$$Vh = Af \times Ccon \times Rdep$$
$$= 65\ m^2 \times Bs.3,460 \times 0.50 = Bs.112,450\ (= US\$1,372)/house$$

where,

Vh : unit value of house
Af : average floor area
Ccon : unit area building cost
Rdep : Depreciation rate

Average floor area and unit area building cost of a house is estimated based on site reconnaissance and data collected at Direction General de Saneamiento Sanitario Ambiental, Barinas province. Depreciation rate of house was assumed to be 0.5 considering the average lifetime of house and period of use.

Table 4.2.1 shows population projection in the study area in 1993 based on Proyeccion de la Poblacion de Venezuela, Entidades Federales y Municipios 1990-1995 (OCEI). Based on the population projection, the number of houses in the study area was projected on the assumption that family size in 1993 would be same as that in 1990.

Household Effects

Value of household effects was assumed at Bs.61,248 (= US$747)/house based on the information during site reconnaissance. The household effects were estimated from the market prices depreciating by the assumed average lifetime and period of use.

Buildings other than Residences

Other than houses discussed above, there are buildings such as public offices, church, hospitals, business offices, and factories in the study area. These general assets were also taken into account. Unit value of these buildings was estimated with the following equation.

$$Vb = Af \times Ccon \times Rdep$$
$$= 120\ m^2 \times Bs.16{,}000 \times 0.50 = Bs.960{,}000\ (= US\$11{,}707)/bldg.$$

where,

Vb : unit value of building
Af : average floor area
Ccon : unit area building cost
Rdep : Depreciation rate

Average floor area and unit area building cost were estimated based on site reconnaissance and interview in Portuguesa province. Depreciation rate of a building is same as that of a house.

Numbers of such buildings were assumed at 1 % of numbers of houses based on the site reconnaissance, since no such data were available.

Properties inside Buildings

Value of properties inside the buildings is assumed at Bs.500,000 (= US$6,098)/bldg. based on the interview survey in the study area.

(2) Agricultural Crops and Livestock

For the purpose of the project evaluation, potential land use was introduced. The potential land use was assumed based on average inundation depth, soil characteristics, climate and environment for whole study area as presented in the Supporting Report; Part-C. According to the study, the potential land use is as follows:

1) Crop : The land is suitable for the crops . It is possible to plant rice and other upland crops even without the flood management.

2) Livestock : The land is suitable for livestock farming. Extensive and semi-intensive livestock farming will be performed even without the flood management.

Area of each land use under the potential land use is summarized in Table 4.2.2.

Damageable value of crops is estimated as expected net income plus accumulated production cost spent by the time of a flood occurrence. Considering nature of the flooding in the area, flooding is assumed to occur from the end of June and lasts 4 months for estimation of the flood damages to the agricultural crops and livestock.

According to the information from livestock farmers in Portuguesa province, their livestock are often drowned or usually lose their weight during rainy season because of shortage of pastures due to flooding. Thus, unit damageable value of livestock farming is estimated as reduction of production of meat.

(3) Public Facilities

Damages to public facilities such as roads, railway, channels, and irrigation facilities were assumed at 15 % of damages to general asset and agriculture based on the information on restoration cost of roads damaged by floods from Ministerio de Transporte y Comunicaciones, Barinas province.

(4) Other Direct Damages

Ten (10) percent of total damages to general assets, agriculture, and public facilities were assumed as other direct damages which may include the following:

1) Injury to human lives
2) Cost of emergency measures made by the central and/or rural government
3) Interest on a loan for restoration
4) Termination of public services such as transportation, communication, electricity, water and gas supply.

(5) Indirect Damage

Indirect damage was assumed at 10 % of the direct damages. The indirect flood damage are the net economic losses of goods and services to the nation due to interruption of economic activities in the study area.

4.2.2 Damage Rate

(1) Flood Condition

As a result of flood simulation analysis average inundation depth were obtained. The depth, however, is an average over the unit block of about 100 km^2, actual inundated area and depth are by far different from the calculated average depth depending on the topography of the block.

With the following equations, the inundated depth and area were estimated from the calculated average inundation depth for each block by the following relations:

$$hi = (2h \times Ho)^{0.5} = 2.83h^{0.5}$$
$$Ai = (2h / Ho)^{0.5} = 0.707h^{0.5}$$

where,

hi : maximum inundation depth in a block
Ai : percentage of area inundated in a block
h : calculated average inundation depth of a block
Ho : maximum height of land undulation (4.0 m)

The above relations were derived based on the assumption of inclined flat block area with the maximum height of four (4) meters. The height was assumed based on point elevations in sample blocks along the Apure river by the topographic map of 1/10,000 prepared as shown in Fig. 4.2.2.

As to the duration of inundation, flooding is assumed to occur at the end of June and lasts 4 months considering characteristics of the flooding in the area.

(2) Damage Rate

Damage rate of direct flood damages was assumed as follows

1) With respect to house/building, household effects and indoor movables, basically standard rate developed by Ministry of Construction, Japan was applied, since no such data were available in Venezuela.

2) Damage rate of crops was assumed to be 100 % because no crop survives under four month inundation during rainy season even in case inundation depth is not deep.

3) Damage rate of livestock was assumed to be one third or 33 %. Livestock usually lose their weight during rainy season since, they don't have enough pastures due to four months of inundation every year.

Damage rate by inundation depth was estimated based on inundation area and depth calculated from the average inundation depth considering the land undulation. Table 4.2.3 shows estimated flood damage rate.

4.2.3 Flood Damages

Probable flood damages were estimated from the damageable properties in inundated area multiplied by the flood damage rate corresponding to inundation conditions under various magnitude of flood events.

Annual mean flood damages were estimated as accumulation of flood damage segments derived from various magnitude of probable flood damages multiplied by the corresponding probability of occurrence, from non-damageable flood up to design probable flood.

4.2.4 Flood Reduction Benefit

Difference of the annual mean flood damages between those with and without project are counted as annual flood reduction benefit.

4.2.5 Land Enhancement Benefit

Implementation of the flood management in the study area enable further enhancement of the potential land use. On the land protected from flooding it becomes possible to plant rain fed rice or manage livestock farming by Apure type module. Such condition was defined as proposed land use. The area of the proposed land use in the whole study area is summarized in Table 4.2.2.

The land enhancement benefit was worked out as an increase of the net income borne from the proposed land use with the flood management plan comparing with that from the potential land use without the plan.

4.3 Benefit

(1) Flood Reduction Benefit

Agricultural properties are estimated under the conditions of potential land use. Table 4.3.1 shows productivity, production cost, net income and damageable value under potential land use without project. The probable flood damages for whole the flood management study area by deferent magnitude of floods is summarized in Table 4.3.2. Based on the probable flood damages by different magnitude of floods, the annual mean flood damages were calculated as shown in Table 4.3.3. Table 4.3.5 shows flood reduction benefit by each alternative.

(Unit: US$1,000)

Plan	Flood reduction Benefit
Plan A1, Portuguesa dike	426
Plan B1, Guanare dike	297
Plan C1, Apure dike	423
Overall Plan	435

The flood reduction benefit of overall plan has no significant difference against that of each plan. This is because some negative benefits are caused in the river side areas by dike construction as well as positive benefits and also average change of inundation condition is generally small.

(2) Land Enhancement

Difference of net income between those with and without project is counted as land enhancement benefit. Table. 4.3.4 shows total production and net income in the flood management study area under the proposed land use by each plan for the flood management. Increase of the net income borne from the proposed land use with the flood management is considered land enhancement benefit. Result of calculation by each alternative is shown in Table 4.3.5.

(Unit: US$1,000)

Plan	Land Enhancement Benefit
Plan A1, Portuguesa dike	4,482
Plan B1, Guanare dike	3,473
Plan C1, Apure dike	4,042
Overall Plan	11,106

The crown of dike will be paved with gravel and used as inspection road. In addition the dike will be used as important rural road to access farm lands and to transport agricultural products. Especially right side dike of the Portuguesa river under the Plan A1 will connect the national highway No. 5 and No. 8. The road would play a important roll for development of the regional economy with extra investment for asphalt pavement in the future. Guanare dike under Plan B1 and Apure dike under Plan C1 also will contribute to development of the area.

These favorable effects as dike road were considered to be incorporated to the increase of net income with project.

4.4 Economic Cost

(1) Project Cost

Economic costs of the project are the amounts duly reflect true economic value of goods and services involved. The economic costs are used only for economic evaluation of the project.

Transfer items such as taxes and duties imposed on construction materials and equipment, including government subsidy and contractor's profit, should be excluded from the elements of financial cost. Based on a similar study conducted in Venezuela, the cost for transfer items were assumed to be 16 % of the financial construction cost.

The financial and economic project costs for each plan are shown in Table 4.4.1 and Table 4.4.2, respectively.

(Unit: US$1,000)

Plan	Economic Project Cost
Plan A1, Portuguesa dike	28,750
Plan B1, Guanare dike	21,492
Plan C1, Apure dike	28,683
Overall Plan	78,922

(2) Annual Operation and Maintenance Cost

Annual operation and maintenance costs for flood control facilities and facilities for the Apure type module are assumed at 0.5 % of the total economic costs of both the facilities. The costs are estimated as shown below.

(Unit: US$1,000/yr)

Plan	Flood Control Facilities	Facilities for Apure Module	Total
Plan A1, Portuguesa dike	144	22	166
Plan B1, Guanare dike	107	-	107
Plan C1, Apure dike	143	68	211
Overall Plan	395	90	485

(3) Annual Economic Cost

Annual economic costs are estimated as shown in Table 4.4.3 based on construction time schedule. Overall plan is assumed to be executed in the order of Plan A1, Plan B1 and Plan C1.

4.5 Evaluation

Economic viability of each alternative for the flood management was assessed using three indicators: internal rate of return (IRR), cost-benefit ratio (B/C) and net benefit (B-C). Calculations were made in consideration of the annual cash flow prepared from the economic project cost and annual mean benefit discussed in previous section. The economic viability of each plan is summarized below and its annual cash flow is shown in Table 4.5.1.

Plan	IRR (%)	B/C	B-C (US$1,000)
Plan A1, Portuguesa dike	11.0	1.39	9,124
Plan B1, Guanare dike	11.0	1.45	7,295
Plan C1, Apure dike	6.6	0.82	- 5,212
Overall Plan	9.2	1.15	7,614

Remarks: Discount rate of 8 % were assumed for the calculations of B/C and B-C.

V. PRELIMINARY PROJECT EVALUATION FOR CHANNEL STABILIZATION PLAN

5.1 General

Study on channel stabilization aims to formulate channel improvement plan for fluvial navigation. Short-term plan (STP) and mid-term plan (MTP) were proposed finally. Preliminary project evaluation was made on these two plans.

Navigable period of the Apure and Portuguesa rivers will be extended by the channel stabilization. Cargo being transported by land like trucks would change to fluvial navigation, if it is economically beneficial. Preliminary project evaluation on the channel stabilization was made by the comparison of transportation costs by fluvial navigation and truck.

Since the navigation master plan has not been prepared yet, the evaluation were made based on the cargo data and transportation cost data prepared provisionally by PROA. The result of evaluation is therefore rather preliminary and needs review after preparation of the master plan.

5.2 Methodology

(1) Basic Data

The evaluation was made based on the data and information provided by PROA. The data provided by PROA are as follows:

1) Major items to be transported based on present production and consumption in the study area
2) Origin of item
3) Port of origin
4) Destination port
5) Final destination
6) Monthly transportation volume
7) Route and distance of fluvial navigation for each item
8) Route and distance of land transportation (by trucks)
9) Unit transportation cost by fluvial navigation (ton/km)
10) Unit transportation cost by truck (ton/km)
11) Unit cost of transshipment (ton)

(2) Direct Benefit

Reduction in Transportation Costs of Major Cargos

For the evaluation of the channel stabilization plans, the following kinds of cargos were considered based on the information provided by PROA.

1) Oil product
2) Iron product
3) Wood (pine)
4) Construction material
5) Urea
6) Scoria of steel
7) Phosphates
8) Coal
9) Coke
10) Cement
11) Vehicle
12) Agricultural product

Reduction in transportation cost by fluvial navigation during the extended navigable period by the channel stabilization was considered a major part of direct benefit. The benefit was worked out with the following equation for respective cargos and their destination:

$$Brcs = (Clt - Cfn) \times Vt \times Pn$$

where,

Brcs : benefit of channel stabilization

Clt : unit cost of land transportation (by truck)

Cfn : unit cost of transportation by fluvial navigation

Vt : monthly transportation volume

Pn : navigable period to be extended by channel stabilization

Most practical transportation route was selected both for the fluvial navigation and the truck transportation. No truck transportation was considered for urea and scoria of steel, since the truck transportation was not practically used according to the information from PROA.

Other Direct Benefit

Other than transportation discussed above, navigation of other cargos and local goods also enjoys the benefit of channel stabilization. These direct benefit was assumed at 10% of that of the major cargos.

(3) Indirect Benefit

Indirect benefit was assued at 20 % of the total direct benefits. Following effects could be taken into account as the indirect benefit:

1) Conservation of land (agricultural land and villages)
2) Rural development by fluvial navigation as public transportation
3) Agricultural development by local transportation of agricultural products
4) Tourism by fluvial navigation
5) Reclamation of low land with dredging sand

5.3 Benefit

Monthly transportation costs of each item by truck and fluvial navigation were calculated based on data provided by PROA and shown in Tables 5.3.1 and 5.3.2. Schematic location of origin and destination is shown in Fig. 5.3.1.

According to the channel stabilization plan, the navigable period will be extended by short term plan and mid term plan as shown in Table 5.3.3. Based on the above, reduction of transportation cost by fluvial navigation was estimated as described in Table 5.3.3. Annual benefit of the respective channel stabilization plans were as follows:

(Unit: US$1,000)

Plans	Direct benefit			Indirect benefit	Total
	Reduction of transp.cost (a)	Other direct benefit (b=a*10%)	Sub-total (c=a+b)	(d=c*20%)	(e=c+d)
Short-Term Plan	8,327	833	9,160	1,832	10,992
Mid-Term Plan (STP+MTP)	15,806	1,581	17,387	3,477	20,864

5.4 Economic Cost

(1) Project Cost

Transfer items such as taxes and duties imposed on construction materials and equipment, including government subsidy and contractor's profit, should be excluded from the elements of financial cost. The amount of 16 % of the financial construction cost is assumed to be the transfer cost in the same way as that of the flood management plan.

The financial and economic project costs are shown in Table 5.4.1.

Plan	Financial cost (US$1,000)	Economic cost (US$1,000)
Short-Term Plan	53,705	45,111
Mid-Term Plan (STP+MTP)	128,292	107,765

(2) Annual Operation and Maintenance Cost

Annual operation and maintenance costs for facilities for the channel stabilization are assumed to be 20 % of the annual benefit and 5 % of the total economic costs of the project considering the difficulties in operation and maintenance activities in the wild rivers.

(3) Annual Economic Cost

Annual disbursement schedule were prepared as shown in Table 5.4.2 based on construction time schedule.

5.5 Evaluation

Economic viability of each alternative for the river channel stabilization was assessed using three indicators: internal rate of return (IRR), cost-benefit ratio (B/C) and net benefit (B-C). Calculations were made in consideration of the annual cash flow prepared from the economic project cost and annual benefit. The economic viability of the each plan is summarized below and its annual cash flow is shown in Table 5.5.1.

Plan	IRR (%)	B/C	B-C (US$1,000)
Short term plan	17.7	1.72	38,677
Mid term plan (STP+MTP)	13.7	1.46	46,666

Remarks: Discount rate of 8% were assumed for the calculation of B/C and B-C.

TABLES

Table 2.1.1 POPULATION BY SEX, URBAN/RURAL RESIDENT AND LABOR FORCE

	Item	Number of Persons			Percentage Distribution (%)			Average Annual Growth Rate (%)		
		1971	1981	1990	1971	1981	1990	'71-81	'81-90	'71-90
1.	Population	10,721,522	14,516,735	18,105,265	100.0	100.0	100.0	3.08	2.48	2.80
2.	Male	5,349,711	7,259,812	9,004,717	49.9	50.0	49.7	3.10	2.42	2.78
3.	Female	5,371,811	7,256,923	9,100,548	50.1	50.0	50.3	3.05	2.55	2.81
4.	Urban	7,808,650	11,655,332	15,227,740	72.8	80.3	84.1	4.09	3.02	3.58
5.	Rural	2,912,872	2,861,403	2,877,525	27.2	19.7	15.9	-0.18	0.06	-0.06
6.	15 year or over	5,897,240	8,719,466	11,361,414	55.0	60.1	62.8	3.99	2.98	3.51
	Male	2,912,066	4,322,715	5,591,072	27.2	29.8	30.9	4.03	2.90	3.49
	Female	2,985,174	4,396,751	5,770,342	27.8	30.3	31.9	3.95	3.07	3.53
7.	Lobor force	3,014,674	4,634,500	6,155,513	28.1	31.9	34.0	4.39	3.20	3.83
	(No declaration)	-	-	244,054	-	-	-	-	-	-
8.	Labor Participation Rate/1	51.1%	53.2%	55.4%	-	-	-	-	-	-
9.	Gainful Worker	2,828,696	4,177,718	5,292,024	26.4	28.8	29.2	3.98	2.66	3.35
10.	Employment Rate	93.8%	90.1%	86.0%	-	-	-	-	-	-
11.	Unemployment	185,978	456,782	863,489	1.7	3.1	4.8	9.40	7.33	8.42
12.	Unemployment Rate	6.2%	9.9%	14.0%	-	-	-	-	-	-

Remarks: Source ; Oficina Central de Estadistica e Informatica

/1 ; calculated based on number of labor force and population of 15 years or over excluding number of no declaration.

Table 2.1.2 POPULATION BY PROVINCES

Provinces	Number of Persons			Percentage Distribution (%)			Average Annual Growth Rate (%)		
	1971	1981	1990	1971	1981	1990	'71-81	'81-90	'71-90
Total	10,721,522	14,516,735	18,105,265	100.0	100.0	100.0	3.08	2.48	2.80
Distrito Federal	1,860,637	2,070,742	2,103,661	17.4	14.3	11.6	1.08	0.18	0.65
Anzoategui	506,297	683,717	859,758	4.7	4.7	4.7	3.05	2.58	2.83
Apure	164,705	188,187	285,412	1.5	1.3	1.6	1.34	4.74	2.94
Aragua	543,170	891,623	1,120,132	5.1	6.1	6.2	5.08	2.57	3.88
Barinas	231,046	326,166	424,491	2.2	2.2	2.3	3.51	2.97	3.25
Bolivar	391,665	668,340	900,310	3.7	4.6	5.0	5.49	3.37	4.48
Carabobo	659,339	1,062,268	1,453,232	6.1	7.3	8.0	4.88	3.54	4.25
Cojedes	94,351	133,991	182,066	0.9	0.9	1.0	3.57	3.47	3.52
Delta Amacuro	48,139	56,720	84,564	0.4	0.4	0.5	1.65	4.54	3.01
Falcon	407,957	503,896	599,185	3.8	3.5	3.3	2.13	1.94	2.04
Guarico	318,905	393,467	488,623	3.0	2.7	2.7	2.12	2.44	2.27
Lara	671,410	945,064	1,193,161	6.3	6.5	6.6	3.48	2.62	3.07
Merida	347,095	459,361	570,215	3.2	3.2	3.1	2.84	2.43	2.65
Miranda	856,272	1,421,442	1,871,093	8.0	9.8	10.3	5.20	3.10	4.20
Monagas	298,239	388,536	470.157	2.8	2.7	2.6	2.68	2.14	2.42
Nueve Esparta	118,830	197,198	263,748	1.1	1.4	1.5	5.20	3.28	4.29
Portuguesa	297,047	424,984	576,435	2.8	2.9	3.2	3.65	3.44	3.55
Sucre	469,004	585,698	679,595	4.4	4.0	3.8	2.25	1.67	1.97
Tachira	511,346	660,234	807,712	4.8	4.5	4.5	2.59	2.27	2.44
Trujillo	381,334	433,735	493,912	3.6	3.0	2.7	1.30	1.45	1.37
Yaracuy	223,545	300,597	384,536	2.1	2.1	2.1	3.01	2.77	2.90
Zulia	1,299,030	1,674,252	2,235,305	12.1	11.5	12.3	2.57	3.26	2.90
T.F. Amazonas	21,696	45,667	55,717	0.2	0.3	0.3	7.73	2.23	5.09
Dependecias Federales	463	850	2,245	0.0	0.0	0.0	6.26	11.40	8.66

Remark: Populations mentioned here are based on Population Censuses 1971, 1981 and 1990 made by Oficina Central de Estadistica e Informatica (OCEI)

Table 2.1.3 POPULATION BY MUNICIPALITY IN THE PROJECT AREA (1/7)

Province/Municipality	Number of Persons			Percentage Distribution (%)			Average Annual Growth Rate (%)		
	1971	1981	1990	1971	1981	1990	'71-81	'81-90	'71-90
Apure	164,705	188,187	285,412	100.0	100.0	100.0	1.34	4.74	2.94
Achaguas	26,443	28,523	43,373	16.1	15.2	15.2	0.76	4.77	2.64
Biruaca	12,940	13,148	26,018	7.9	7.0	9.1	0.16	7.88	3.74
Munoz	10,422	14,934	20,952	6.3	7.9	7.3	3.66	3.83	3.74
Paez	34,915	36,608	63,267	21.2	19.5	22.2	0.47	6.27	3.18
Pedro Camejo	13,567	11,435	19,717	8.2	6.1	6.9	-1.70	6.24	1.99
Romulo Gallegos	10,242	10,582	15,240	6.2	5.6	5.3	0.33	4.14	2.11
San Fernando	56,176	72,957	96,845	34.1	38.8	33.9	2.65	3.20	2.91
Barinas	231,046	326,166	424,491	100.0	100.0	100.0	3.51	2.97	3.25
Alberto Arvelo Torrealba	15,332	20,648	25,798	6.6	6.3	6.1	3.02	2.51	2.78
Antonio Jose de Sucre	-	22,912	34,201	0.0	7.0	8.1	-	4.55	-
Arismendi	15,192	9,856	16,995	6.6	3.0	4.0	-4.23	6.24	0.59
Barinas	69,705	129,028	176,178	30.2	39.6	41.5	6.35	3.52	5.00
Bolivar	23,755	25,622	32,026	10.3	7.9	7.5	0.76	2.51	1.58
Ezequiel Zamora	30,609	33,844	37,139	13.2	10.4	8.7	1.01	1.04	1.02
Obispos	21,421	24,299	31,030	9.3	7.4	7.3	1.27	2.75	1.97
Pedraza	27,555	29,550	34,383	11.9	9.1	8.1	0.70	1.70	1.17
Rojas	17,829	18,850	24,957	7.7	5.8	5.9	0.56	3.17	1.79
Sosa	9,648	11,557	11,784	4.2	3.5	2.8	1.82	0.22	1.06

Remark: Populations based on Population Censuses 1971, 1981 and 1990 made by Oficina Central de Estadistica e Informatica (OCEI)

Table 2.1.3 POPULATION BY MUNICIPALITY IN THE PROJECT AREA (2/7)

Province/Municipality	Number of Persons			Percentage Distribution (%)			Average Annual Growth Rate (%)		
	1971	1981	1990	1971	1981	1990	'71-81	'81-90	'71-90
Carabobo	659,339	1,062,268	1,453,232	100.0	100.0	100.0	4.88	3.54	4.25
Bejuma	18,603	25,555	30,624	2.8	2.4	2.1	3.23	2.03	2.66
Carlos Arvelo	44,503	65,418	81,935	6.7	6.2	5.6	3.93	2.53	3.26
Diego Ibarra	25,023	51,447	70,261	3.8	4.8	4.8	7.47	3.52	5.58
Guacara	40,371	74,143	98,576	6.1	7.0	6.8	6.27	3.22	4.81
Juan Jose Mora	34,394	41,060	47,097	5.2	3.9	3.2	1.79	1.54	1.67
Miranda	10,327	13,501	16,790	1.6	1.3	1.2	2.72	2.45	2.59
Montalban	9,087	11,895	15,430	1.4	1.1	1.1	2.73	2.93	2.83
Puerto Cabello	74,726	114,021	145,759	11.3	10.7	10.0	4.32	2.77	3.58
San Joaquin	10,885	19,490	31,235	1.7	1.8	2.1	6.00	5.38	5.70
Valencia	391,420	645,738	915,525	59.4	60.8	63.0	5.13	3.96	4.57
Cojedes	94,351	133,991	182,066	100.0	100.0	100.0	3.57	3.47	3.52
Anzoategui	6,561	7,733	10,948	7.0	5.8	6.0	1.66	3.94	2.73
Falcon	18,552	32,343	47,816	19.7	24.1	26.3	5.72	4.44	5.11
Girardot	5,458	5,839	9,467	5.8	4.4	5.2	0.68	5.52	2.94
Pao	9,625	9,042	9,679	10.2	6.7	5.3	-0.62	0.76	0.03
Ricaurte	5,552	4,749	8,458	5.9	3.5	4.6	-1.55	6.62	2.24
San Carlos	34,616	56,108	70,276	36.7	41.9	38.6	4.95	2.53	3.80
Tinaco	13,987	18,177	25,422	14.8	13.6	14.0	2.65	3.80	3.19

Remark: Populations based on Population Censuses 1971, 1981 and 1990 made by Oficina Central de Estadistica e Informatica (OCEI)

Table 2.1.3 POPULATION BY MUNICIPALITY IN THE PROJECT AREA (3/7)

Province/Municipality	Number of Persons			Percentage Distribution (%)			Average Annual Growth Rate (%)		
	1971	1981	1990	1971	1981	1990	'71-81	'81-90	'71-90
Guarico	318,905	393,467	488,623	100.0	100.0	100.0	2.12	2.44	2.27
Camaguan	18,767	19,582	21,118	5.9	5.0	4.3	0.43	0.84	0.62
Chaguaramas	5,660	5,555	7,863	1.8	1.4	1.6	-0.19	3.94	1.75
El Socorro	8,644	8,096	11,453	2.7	2.1	2.3	-0.65	3.93	1.49
Infante	56,061	64,895	80,000	17.6	16.5	16.4	1.47	2.35	1.89
Las Mercedes	8,856	14,704	19,745	2.8	3.7	4.0	5.20	3.33	4.31
Mellado	11,588	13,626	19,365	3.6	3.5	4.0	1.63	3.98	2.74
Miranda	49,052	73,292	92,634	15.4	18.6	19.0	4.10	2.64	3.40
Monagas	38,374	50,615	53,435	12.0	12.9	10.9	2.81	0.60	1.76
Ortiz	8,942	9,342	13,377	2.8	2.4	2.7	0.44	4.07	2.14
Ribas	23,629	22,028	28,784	7.4	5.6	5.9	-0.70	3.02	1.04
Roscio	42,692	62,414	74,556	13.4	15.9	15.3	3.87	1.99	2.98
San Jose de Guaribe	6,465	7,014	10,569	2.0	1.8	2.2	0.82	4.66	2.62
Santa Maria de Ipire	8,813	7,971	11,482	2.8	2.0	2.3	-1.00	4.14	1.40
Zaraza	31,362	34,333	44,242	9.8	8.7	9.1	0.91	2.86	1.83
Lara	671,410	945,064	1,193,161	100.0	100.0	100.0	3.48	2.62	3.07
Andres E. Blanco	-	23,258	31,207	0.0	2.5	2.6	-	3.32	-
Crespo	20,152	26,417	31,549	3.0	2.8	2.6	2.74	1.99	2.39
Iribarren	366,120	548,315	688,229	54.5	58.0	57.7	4.12	2.56	3.38
Jimenez	52,498	47,458	59,148	7.8	5.0	5.0	-1.00	2.48	0.63
Moran	65,633	77,624	89,814	9.8	8.2	7.5	1.69	1.63	1.66
Palavecino	36,314	59,096	106,820	5.4	6.3	9.0	4.99	6.80	5.84
Torres	95,195	120,926	140,374	14.2	12.8	11.8	2.42	1.67	2.07
Urdaneta	35,498	41,970	46,020	5.3	4.4	3.9	1.69	1.03	1.38

Remark: Populations based on Population Censuses 1971, 1981 and 1990 made by Oficina Central de Estadistica e Informatica (OCEI)

Table 2.1.3 POPULATION BY MUNICIPALITY IN THE PROJECT AREA (4/7)

Province/Municipality	Number of Persons			Percentage Distribution (%)			Average Annual Growth Rate (%)		
	1971	1981	1990	1971	1981	1990	'71-81	'81-90	'71-90
Merida	347,095	459,361	570,215	100.0	100.0	100.0	2.84	2.43	2.65
Alberto Adriani	32,130	57,674	76,014	9.3	12.6	13.3	6.02	3.12	4.64
Andres Bello	7,805	9,501	8,816	2.2	2.1	1.5	1.99	-0.83	0.64
Antonio Pinto Salinas	17,257	17,318	20,550	5.0	3.8	3.6	0.04	1.92	0.92
Aricagua	4,392	3,648	4,195	1.3	0.8	0.7	-1.84	1.56	-0.24
Arzobispo Chacon	14,960	12,800	13,305	4.3	2.8	2.3	-1.55	0.43	-0.62
Campo Elias	31,615	33,844	59,415	9.1	7.4	10.4	0.68	6.45	3.38
Caracciolo Parra Olmedo	6,140	8,458	16,492	1.8	1.8	2.9	3.25	7.70	5.34
Cardenal Quintero	5,334	5,268	6,131	1.5	1.1	1.1	-0.12	1.70	0.74
Guaraque	7,463	6,640	7,563	2.2	1.4	1.3	-1.16	1.46	0.07
Julio Cesar Salas	4,306	5,830	8,373	1.2	1.3	1.5	3.08	4.10	3.56
Justo Briceno	8,298	3,195	4,175	2.4	0.7	0.7	-9.10	3.02	-3.55
Libertador	94,239	156,956	178,290	27.2	34.2	31.3	5.23	1.43	3.41
Miranda	11,024	14,530	17,555	3.2	3.2	3.1	2.80	2.12	2.48
Obispo Ramos de Lora	12,425	13,686	16,058	3.6	3.0	2.8	0.97	1.79	1.36
Padre Noguera	1,654	1,394	2,069	0.5	0.3	0.4	-1.70	4.49	1.19
Pueblo Llano	4,161	5,616	7,022	1.2	1.2	1.2	3.04	2.51	2.79
Rangel	9,961	12,898	13,337	2.9	2.8	2.3	2.62	0.37	1.55
Rivas Davila	8,637	10,318	13,412	2.5	2.2	2.4	1.79	2.96	2.34
Santos Marquina	4,990	6,721	9,209	1.4	1.5	1.6	3.02	3.56	3.28
Sucre	21,659	26,752	32,978	6.2	5.8	5.8	2.13	2.35	2.24
Tovar	25,795	30,092	36,416	7.4	6.6	6.4	1.55	2.14	1.83
Tulio Febres Cordero	12,850	16,222	18,840	3.7	3.5	3.3	2.36	1.68	2.03

Remark: Populations based on Population Censuses 1971, 1981 and 1990 made by Oficina Central de Estadistica e Informatica (OCEI)

Table 2.1.3 POPULATION BY MUNICIPALITY IN THE PROJECT AREA (5/7)

Province/Municipality	Number of Persons			Percentage Distribution (%)			Average Annual Growth Rate (%)		
	1971	1981	1990	1971	1981	1990	'71-81	'81-90	'71-90
Portuguesa	297,047	424,984	576,435	100.0	100.0	100.0	3.65	3.44	3.55
Agua Blanca	7,489	11,649	13,972	2.5	2.7	2.4	4.52	2.04	3.34
Araure	33,673	52,470	75,315	11.3	12.3	13.1	4.54	4.10	4.33
Esteller	19,204	24,652	32,341	6.5	5.8	5.6	2.53	3.06	2.78
Guanare	53,203	84,820	119,155	17.9	20.0	20.7	4.77	3.85	4.34
Guanarito	11,011	14,348	24,187	3.7	3.4	4.2	2.68	5.97	4.23
Mons. Jose V. de Unda	12,171	14,545	17,850	4.1	3.4	3.1	1.80	2.30	2.04
Ospino	13,822	17,946	30,041	4.7	4.2	5.2	2.65	5.89	4.17
Paez	66,596	103,117	131,485	22.4	24.3	22.8	4.47	2.74	3.65
Papelon	5,097	6,153	10,726	1.7	1.4	1.9	1.90	6.37	3.99
San Genaro de Boconoito	5,120	11,867	14,512	1.7	2.8	2.5	8.77	2.26	5.64
San Rafael de Onoto	7,023	8,029	10,659	2.4	1.9	1.8	1.35	3.20	2.22
Santa Rosalia	9,483	10,507	16,867	3.2	2.5	2.9	1.03	5.40	3.08
Sucre	23,913	26,198	32,179	8.1	6.2	5.6	0.92	2.31	1.57
Turen	29,242	38,683	47,146	9.8	9.1	8.2	2.84	2.22	2.55

Remark: Populations based on Population Censuses 1971, 1981 and 1990 made by Oficina Central de Estadistica e Informatica (OCEI)

Table 2.1.3 POPULATION BY MUNICIPALITY IN THE PROJECT AREA (6/7)

Province/Municipality	Number of Persons			Percentage Distribution (%)			Average Annual Growth Rate (%)		
	1971	1981	1990	1971	1981	1990	'71-81	'81-90	'71-90
Tachira	511,346	660,234	807,712	100.0	100.0	100.0	2.59	2.27	2.44
Andres Bello	5,484	8,487	12,341	1.1	1.3	1.5	4.46	4.25	4.36
Ayacucho	29,794	36,622	41,225	5.8	5.5	5.1	2.08	1.32	1.72
Bolivar	25,738	33,404	39,990	5.0	5.1	5.0	2.64	2.02	2.35
Capacho	10,800	16,736	23,079	2.1	2.5	2.9	4.48	3.64	4.08
Cardenas	30,061	42,738	61,879	5.9	6.5	7.7	3.58	4.20	3.87
Cordova	11,122	14,209	21,555	2.2	2.2	2.7	2.48	4.74	3.54
Fernandez Feo	-	15,856	24,305	0.0	2.4	3.0	-	4.86	-
Garcia de Hevia	18,827	25,558	31,786	3.7	3.9	3.9	3.10	2.45	2.79
Guasimos	11,909	13,122	19,963	2.3	2.0	2.5	0.97	4.77	2.76
Jauregui	32,867	37,170	39,457	6.4	5.6	4.9	1.24	0.67	0.97
Junin	38,187	51,414	59,915	7.5	7.8	7.4	3.02	1.71	2.40
Libertad	10,441	11,410	14,826	2.0	1.7	1.8	0.89	2.95	1.86
Libertador	12,432	11,353	16,869	2.4	1.7	2.1	-0.90	4.50	1.62
Lobatera	8,039	8,341	10,425	1.6	1.3	1.3	0.37	2.51	1.38
Michelena	8,444	10,409	12,610	1.7	1.6	1.6	2.11	2.15	2.13
Panamericano	22,656	25,039	31,810	4.4	3.8	3.9	1.01	2.70	1.80
Pedro Maria Urena	10,536	17,206	25,267	2.1	2.6	3.1	5.03	4.36	4.71
Samuel Dario Maldonado	7,251	12,623	15,238	1.4	1.9	1.9	5.70	2.11	3.99
San Cristobal	170,569	222,283	257,595	33.4	33.7	31.9	2.68	1.65	2.19
Seboruco	9,773	11,217	13,802	1.9	1.7	1.7	1.39	2.33	1.83
Sucre	8,835	11,383	11,482	1.7	1.7	1.4	2.57	0.10	1.39
Uribante	27,581	23,654	22,293	5.4	3.6	2.8	-1.52	-0.66	-1.11

Remark: Populations based on Population Censuses 1971, 1981 and 1990 made by Oficina Central de Estadistica e Informatica (OCEI)

Table 2.1.3 POPULATION BY MUNICIPALITY IN THE PROJECT AREA (7/7)

Province/Municipality	Number of Persons			Percentage Distribution (%)			Average Annual Growth Rate (%)		
	1971	1981	1990	1971	1981	1990	'71-81	'81-90	'71-90
Trujillo	381,334	433,735	493,912	100.0	100.0	100.0	1.30	1.45	1.37
Bocono	68,315	67,598	74,898	17.9	15.6	15.2	-0.11	1.15	0.49
Candelaria	19,676	23,047	23,487	5.2	5.3	4.8	1.59	0.21	0.94
Carache	25,569	24,869	26,069	6.7	5.7	5.3	-0.28	0.52	0.10
Escuque	10,885	12,924	15,090	2.9	3.0	3.1	1.73	1.74	1.73
Miranda	16,873	18,698	24,058	4.4	4.3	4.9	1.03	2.84	1.88
Monte Carmelo	11,365	9,180	11,092	3.0	2.1	2.2	-2.11	2.12	-0.13
Motatan	7,262	9,529	11,225	1.9	2.2	2.3	2.75	1.84	2.32
Pampan	22,280	26,439	30,461	5.8	6.1	6.2	1.73	1.59	1.66
Rafael Rangel	16,000	19,478	23,251	4.2	4.5	4.7	1.99	1.99	1.99
San rafael de Carvajal	19,694	26,210	31,782	5.2	6.0	6.4	2.90	2.16	2.55
Sucre	20,277	25,081	28,850	5.3	5.8	5.8	2.15	1.57	1.87
Trujillo	46,219	50,969	57,846	12.1	11.8	11.7	0.98	1.42	1.19
Urdaneta	20,109	21,985	24,689	5.3	5.1	5.0	0.90	1.30	1.09
Valera	76,810	97,728	111,114	20.1	22.5	22.5	2.44	1.44	1.96
Yaracuy	223,545	300,597	384,536	100.0	100.0	100.0	3.01	2.77	2.90
Bolivar	24,616	22,318	28,939	11.0	7.4	7.5	-0.98	2.93	0.86
Bruzual	28,518	39,685	48,178	12.8	13.2	12.5	3.36	2.18	2.80
Jose Antonio Paez	4,498	7,929	10,647	2.0	2.6	2.8	5.83	3.33	4.64
Nirgua	28,744	32,850	37,966	12.9	10.9	9.9	1.34	1.62	1.48
Pena	29,806	44,707	68,830	13.3	14.9	17.9	4.14	4.91	4.50
San Felipe	79,301	114,897	141,135	35.5	38.2	36.7	3.78	2.31	3.08
Sucre	20,184	27,647	35,005	9.0	9.2	9.1	3.20	2.66	2.94
Urachiche	7,878	10,564	13,836	3.5	3.5	3.6	2.98	3.04	3.01

Remark: Populations based on Population Censuses 1971, 1981 and 1990 made by Oficina Central de Estadistica e Informatica (OCEI)

Table 2.2.1 GROSS DOMESTIC PRODUCT

Year	At Current Price				At 1984 Constant Price			
	GDP		GDP Per Capita/1		GDP		GDP Per Capita/1	
	Amount (Bs.million)	Growth Rate(%)	Amount (Bs.)	Growth Rate(%)	Amount (Bs.million)	Growth Rate(%)	Amount (Bs.)	Growth Rate(%)
1981	285,208	-	19,647	-	-	-	-	-
1982	291,268	2.1	18,500	-5.8	439,811	-	27,935	-
1983	290,492	-0.3	17,949	-3.0	415,107	-5.6	25,649	-8.2
1984	409,487	41.0	24,624	37.2	409,487	-1.4	24,624	-4.0
1985	464,620	13.5	27,208	10.5	414,750	1.3	24,288	-1.4
1986	493,765	6.3	28,173	3.5	443,093	6.8	25,282	4.1
1987	696,421	41.0	38,747	37.5	464,341	4.8	25,834	2.2
1988	873,283	25.4	47,404	22.3	491,372	5.8	26,673	3.2
1989	1,510,361	73.0	80,032	68.8	449,262	-8.6	23,806	-10.7
1990	2,279,261	50.9	117,942	47.4	478,320	6.5	24,751	4.0
1991	3,036,275	33.2	153,452	30.1	527,927	10.4	26,681	7.8

Remarks: Source: Banco Central de Venezuela

Note/1 : Population used for calculation of GDP Per Capita is based on population projection made by Oficina Central de Estadistica e Informatica.

Table 2.2.2 GROSS DOMESTIC PRODUCT BY INDUSTRIAL ORIGIN

(AT 1984 CONSTANT PRICE)

Industrial Group	Gross Domestic Product (in Bs.million)							Annual Growth Rate (%)					
	1985	1986	1987	1988	1989	1990	1991	'85 -'86	'86 -'87	'87 -'88	'88 -'89	'89 -'90	'90 -'91
Total	414,750	443,093	464,341	491,372	449,262	478,320	527,927	6.83	4.80	5.82	-8.57	6.47	10.37
Agriculture, Hunting, Forestry and Fishery	23,299	25,224	26,126	27,338	25,937	25,483	26,303	8.26	3.58	4.64	-5.12	-1.75	3.22
Crude Petroleum and Natural Gas	62,553	67,110	67,459	70,216	70,224	82,766	90,514	7.29	0.52	4.09	0.01	17.86	9.36
Mining	2,096	2,485	3,116	3,939	3,771	3,971	3,830	18.56	25.39	26.41	-4.27	5.30	-3.55
Industry	82,219	87,969	103,645	110,755	97,654	103,614	115,476	6.99	17.82	6.86	-11.83	6.10	11.45
- Manufacturing	59,986	65,577	84,159	87,047	74,317	79,816	88,449	9.32	28.34	3.43	-14.62	7.40	10.82
- Refinery of Petroleum	22,233	22,392	19,486	23,708	23,337	23,798	27,027	0.72	-12.98	21.67	-1.56	1.98	13.57
Electricity and Water Supply	6,596	6,860	7,086	7,612	7,726	8,123	8,854	4.00	3.29	7.42	1.50	5.14	9.00
Construction	18,532	20,346	27,822	30,019	21,884	23,576	30,826	9.79	36.74	7.90	-27.10	7.73	30.75
Commerce, Restaurant and Hotel	58,771	64,051	71,644	75,525	63,581	66,013	70,931	8.98	11.85	5.42	-15.81	3.83	7.45
Transportation, Warehouse and Communication	26,558	29,046	24,980	27,015	25,297	25,233	27,215	9.37	-14.00	8.15	-6.36	-0.25	7.85
Bank, Insurance, Real Estate and Other Services for Firms	58,101	61,229	64,912	69,203	64,854	66,020	69,283	5.38	6.02	6.61	-6.28	1.80	4.94
Community, Social and Personal Services	30,247	33,302	21,135	22,681	22,551	24,025	26,048	10.10	-36.54	7.31	-0.57	6.54	8.42
Products and Services for Public Office	35,450	35,301	37,365	39,095	40,682	43,781	47,313	-0.42	5.85	4.63	4.06	7.62	8.07
Products and Services for Individual without Benefit	4,891	5,071	6,094	6,306	6,227	7,024	7,591	3.68	20.17	3.48	-1.25	12.80	8.07
Banking Service (Minus)	-10,785	-12,478	-8,577	-9,023	-6,559	-6,675	-7,484	15.70	-31.26	5.20	-27.31	1.77	12.12
Sub-total	398,528	425,516	452,807	480,681	443,829	472,954	516,700	6.77	6.41	6.16	-7.67	6.56	9.25
Import Right and Adjustment due to Variation of Foreign Exchange	16,222	17,577	11,534	10,691	5,433	5,366	11,227	8.35	-34.38	-7.31	-49.18	-1.23	109.22

Source: Banco Central de Venezuela

Table 2.2.3 PRICE INDEX : 1981 - 1991

Year	Consumer Price	Wholesale Price			
	Metropolitan of Caracas	General	Agriculture	Manufacturing	Construction
1981	76.5	-	-	-	67.5
1982	83.9	-	-	-	78.6
1983	89.2	-	-	-	84.0
1984	100.0	100.0	100.0	100.0	100.0
1985	111.4	115.2	117.0	115.0	111.4
1986	124.3	134.7	149.5	133.6	122.2
1987	159.2	196.2	223.3	194.1	156.6
1988	206.1	234.0	276.7	230.8	188.8
1989	380.2	462.2	390.2	467.7	393.4
1990	534.8	588.0	613.7	586.2	472.7
1991	717.7	718.9	828.4	710.7	579.6
Inflation Rate:					
1981-1991 (10 years)	25.1%	-	-	-	24.0%
1988-1991 (3 years)	51.6%	45.4%	44.1%	45.5%	45.3%

Remarks: Source; Anuario de Estadisticas, Precios y Mercado Laboral, Banco Central de Venezuela

Note ; 1984 Price = 100

Table 2.2.4 FOREIGN EXCHANGE RATE

Year	Average Price	Year/Month	Average Price
1981	4.30	1993	
1982	4.30	January	80.34
1983	8.62	February	81.97
1984	12.51		
1985	13.73		
1986	19.85		
1987	27.85		
1988	33.61		
1989	38.91		
1990	47.13		
1991	56.89		
1992	68.40		

Remarks: Source; Estadisticas Sobre El Tipo de Cambio Promedio Diario del Bolivar Frente Al Dolar
Banco Central de Venezuela
Unit ; Bs./US$1.00

Table 4.2.1 POPULATION AND HOUSES IN THE FLOOD MANAGEMENT STUDY AREA

Province/District	Number of Persons			Annual Growth Rate (%)		Number of Houses			Family Size (person/house)				
	1990	1993	1995	'71-'90	'90-'95	1990	1993	1995	1971	1981	1990	1993	1995
Barinas													
Alberto Arvelo Torrealba													
- Sabaneta	20,211	23,042	23,988	2.78	3.49	4,300	4,903	5,104	5.6	5.3	4.7	4.7	4.7
Arismendi													
- Arismendi	7,434	9,327	10,423	0.59	6.99	1,403	1,760	1,967	5.8	5.0	5.3	5.3	5.3
- Guadarrama	2,539	3,185	3,560	0.59	6.99	479	601	672	5.8	5.0	5.3	5.3	5.3
- La Union	5,217	6,545	7,315	0.59	6.99	984	1,235	1,380	5.8	5.0	5.3	5.3	5.3
- San Antonio	2,011	2,523	2,820	0.59	6.99	379	476	532	5.8	5.0	5.3	5.3	5.3
Sosa													
- Ciudad de Nutrias	8,080	8,709	8,712	1.06	1.52	1,683	1,814	1,815	5.7	4.8	4.8	4.8	4.8
- El Regalo	1,103	1,189	1,189	1.06	1.52	230	248	248	5.7	4.8	4.8	4.8	4.8
- Puerto de Nutrias	1,328	1,431	1,432	1.06	1.52	277	298	298	5.7	4.8	4.8	4.8	4.8
- Santa Catalina	1,355	1,461	1,461	1.06	1.52	282	304	304	5.7	4.8	4.8	4.8	4.8
Portuguesa													
Guanarito													
- Capital Guanarito	20,938	26,402	29,178	4.23	6.86	4,362	5,500	6,079	5.3	5.1	4.8	4.8	4.8
- Trinidad de la Capilla	3,201	4,036	4,461	4.23	6.86	667	841	929	5.3	5.1	4.8	4.8	4.8
Papelon													
- Capital Papelon	4,292	5,469	6,092	3.99	7.26	825	1,052	1,172	5.1	6.3	5.2	5.2	5.2
- Cano Delgadito	6,181	7,876	8,774	3.99	7.26	1,189	1,515	1,687	5.1	6.3	5.2	5.2	5.2
Guanare													
- Capital Guanare (North)	49,299	58,879	62,503	4.34	4.86	10,489	12,527	13,299	5.3	4.4	4.7	4.7	4.7
- Capital Guanare (South)	49,299	58,879	62,503	4.34	4.86	10,489	12,527	13,299	5.3	4.4	4.7	4.7	4.7
- Virgen de la Coromoto	5,725	6,838	7,258	4.34	4.86	1,218	1,455	1,544	5.3	4.4	4.7	4.7	4.7
San Genaro de Boconoito													
- Antolin Tovar	8,976	10,262	10,547	5.64	3.28	2,040	2,332	2,397	4.6	5.6	4.4	4.4	4.4
TOTAL	197,188	236,053	252,216	-	-	41,296	49,388	52,726					

Remark 1. Populations in 1993 and 1995 based on population projection stated in Proyeccion de la Poblacion de Venezuela, Entidades Federales y Municipios 1990-1995 (OCEI).

2. Number of houses in 1993 and 1995 is estimated with same family size as 1990 and population projection for 1993 and 1995.

Table 4.2.2 POTENTIAL AND PROPOSED LAND USE

((Whole Flood Management Study Area))

Alternative	Crops					Livestock				Total
	1	2.1	2.2	3	Sub-total	1	2	3	Sub-total	
Without Project (Potential land use)	-	1,036	1,360	487	2,883	-	1,373	6,078	7,451	10,334
Plan A1, Portuguesa dike	542	1,022	1,360	463	3,387	218	1,198	5,711	7,127	10,514
Plan B1, Guanare dike	806	901	1,322	445	3,474	-	1,192	5,772	6,964	10,438
Plan C1, Apure dike	-	1,036	1,360	487	2,883	682	1,035	5,852	7,569	10,452
Overall Plan, Portuguesa, Guanare and Apure dikes	1,348	887	1,322	421	3,978	900	679	5,023	6,602	10,580

Remarks: Unit: sq.km

Crop 1: Rain fed rice under proposed land use with Project
2.1: Rain fed rice under potential land use condition
2.2: Other crops under potential land use condition
3: Crops under present condition

Livestock 1: Apure Type Module
2: Semi-intensive
3: Extensive

Table 4.2.3 ESTIMATION OF FLOOD DAMAGE RATE

1. Base Condition

Range of Inundation Depth(m)	0 - 0.030	0.031 - 0.124	0.125 - 0.499	0.500 - 1.124	1.125 - 1.999	2.000 -
Average Depth (m)	0.015	0.078	0.313	0.812	1.562	2.000
Maximum Depth (m)	0.347	0.790	1.583	2.550	3.537	4.002
Inundation Area	8.7%	19.7%	39.6%	63.7%	88.4%	100.0%

2. Estimation of Damage Rate

Inundation Depth	Damage Rate by MOC Japan a	Area to be inundated b	Applied Damage Rate c = a x b	Area to be inundated d	Applied Damage Rate e = a x d	Area to be inundated f	Applied Damage Rate g = a x f	Area to be inundated h	Applied Damage Rate i = a x h	Area to be inundated j	Applied Damage Rate k = a x j	Area to be inundated l	Applied Damage Rate m = a x l
(1) House/Building													
0 cm	0	91.34%	-	80.25%	-	60.45%	-	36.29%	-	11.64%	-	0.02%	-
0 - 49 cm	0.053	8.66%	0.005	12.50%	0.007	12.50%	0.007	12.50%	0.007	12.50%	0.007	12.50%	0.007
50 - 99 cm	0.072	-	-	7.25%	0.005	12.50%	0.009	12.50%	0.009	12.50%	0.009	12.50%	0.009
100 - 199 cm	0.109	-	-	-	-	14.57%	0.016	25.00%	0.027	25.00%	0.027	25.00%	0.027
200 - 299 cm	0.152	-	-	-	-	-	-	13.74%	0.021	25.00%	0.038	25.00%	0.038
300 - cm	0.220	-	-	-	-	-	-	-	-	13.41%	0.030	25.00%	0.055
Total damage rate:			0.005		0.012		0.032		0.064		0.110		0.136
(2) Household Effects													
0 cm	0	91.34%	-	80.25%	-	60.45%	-	36.29%	-	11.64%	-	0.02%	-
0 - 49 cm	0.086	8.66%	0.007	12.50%	0.011	12.50%	0.011	12.50%	0.011	12.50%	0.011	12.50%	0.011
50 - 99 cm	0.191	-	-	7.25%	0.014	12.50%	0.024	12.50%	0.024	12.50%	0.024	12.50%	0.024
100 - 199 cm	0.331	-	-	-	-	14.57%	0.048	25.00%	0.083	25.00%	0.083	25.00%	0.083
200 - 299 cm	0.499	-	-	-	-	-	-	13.74%	0.069	25.00%	0.125	25.00%	0.125
300 - cm	0.690	-	-	-	-	-	-	-	-	13.41%	0.093	25.00%	0.173
Total damage rate:			0.007		0.025		0.083		0.186		0.335		0.415
(3) Stored Goods													
0 cm	0	91.34%	-	80.25%	-	60.45%	-	36.29%	-	11.64%	-	0.02%	-
0 - 49 cm	0.127	8.66%	0.011	12.50%	0.016	12.50%	0.016	12.50%	0.016	12.50%	0.016	12.50%	0.016
50 - 99 cm	0.276	-	-	7.25%	0.020	12.50%	0.035	12.50%	0.035	12.50%	0.035	12.50%	0.035
100 - 199 cm	0.379	-	-	-	-	14.57%	0.055	25.00%	0.095	25.00%	0.095	25.00%	0.095
200 - 299 cm	0.479	-	-	-	-	-	-	13.74%	0.066	25.00%	0.120	25.00%	0.120
300 - cm	0.562	-	-	-	-	-	-	-	-	13.41%	0.075	25.00%	0.141
Total damage rate:			0.011		0.036		0.106		0.211		0.340		0.405
(4) Agricultural Crops			0.087		0.197		0.396		0.637		0.884		1.000
(5) Livestock			0.029		0.066		0.132		0.212		0.295		0.333

Table 4.3.1 PRODUCTION COST, NET INCOME AND DAMAGABLE VALUE

((Whole Project Area, Without Project))

Crop		Yield (ton/ha)	Planted Area (ha)	Production Cost (US$/ha)	Farmgate Price (US$/ton)	Total Production Cost (US$1000)	Total Farmgate Price (US$1000)	Net Income (US$1000)	Production Cost to be Spent until when Flood Attacks (End of June)		Damageable Value (US$1000)	Damageable Value per sq.km (US$)
									(%)	(US$1000)		
a		b	c	d	e	f=c x d	g=exbxc	h=g-f	i	j	k=h+j	l=k/c
With Flood Management and Irrigation and Drainage Development												
Crop-1	Rice	2.5	-	301.85	147.3	0	0	0	38%	0	0	-
Potential Land Use without Flood Management nor Irrigation and Drainage Development												
Crop-2.1	Rice	2.5	103,600	301.85	147.3	31,272	38,151	6,879	38%	11,883	18,762	18,110
Crop-2.2	Other Crops											
	a. Corn	2.5	45,300	222.6	113.7	10,084	12,877	2,793	43%	4,336	7,129	
	b. Sorghum	2.0	45,300	222.6	101.4	10,084	9,187	-	36%	3,630	3,630	
	c. Cotton	1.4	45,400	304.9	331.5	13,842	21,070	7,228	0%	0	0	
	Sub-total		136,000			34,010	43,134	10,021		7,966	10,759	7,911
Land Remains as Present Land Use												
Crop-3	a. Rice (7.3%)	3.8	3,555	431.1	147.3	1,533	1,990	457	38%	583	1,040	
	b. Corn (37.6%)	2.5	18,311	222.6	113.7	4,076	5,205	1,129	43%	1,753	2,882	
	c. Sorghum (9.1%)	2.0	4,432	222.6	101.4	987	899	-	36%	355	355	
	d. Cotton (7.1%)	1.4	3,458	304.9	331.5	1,054	1,605	551	-	0	551	
	e. Sugarcane (13.5%)	40.0	6,575	487.8	12.7	3,207	3,340	133	24%	770	903	
	f. Sunflower (20.8%)	0.75	10,130	164.6	178.0	1,667	1,352	-	-	0	0	
	g. Sesame (4.6%)	0.6	2,239	164.6	287.2	369	386	17	-	0	0	
	Sub-total		48,700			11,360	12,787	1,830		2,878	4,691	9,632
Total of Crop			288,300			76,642	94,072	18,730		22,727	34,212	35,653

Livestock		Yield (kg/ha/ year)	Area (ha)	Management Cost (US$/ha)	Farmgate Price (US$/kg)	Total Management Cost (US$1000)	Total Farmgate Price (US$1000)	Net Income (US$1000)	Production Cost to be Spent until when Flood Attacks (End of June)		Damageable Value (US$1000)	Damageable Value per sq.km (US$)
									(%)	(US$1000)		
a		b	c	d	e	f=c x d	g=exbxc	h=g-f	i	j	k = g	l=k/c
With Flood Management and Apure Type Module												
Livestock-1	Meat	70	-	25.5	1.36	0	0	0	-	-	0	-
Semi-intensive Livestock Farming												
Livestock-2	Meat	30	137,300	15.0	1.36	2,060	5,602	3,542	-	-	5,602	4,080
Extensive Livestock Farming												
Livestock-3	Meat	15	607,800	8.78	1.36	5,336	12,399	7,063	-	-	12,399	2,040
Total of Livestock			745,100			7,396	18,001	10,605	-	-	18,001	6,120
TOTAL (Crop + Livestock)			1,033,400			84,038	112,073	29,335	-	-	-	-

Table 4.3.2 PROBABLE FLOOD DAMAGES

((Whole Flood Management Study Area)) Unit: US$1,000

Alternatives	Return Period (Year)	Probable Flood Damage										
		Housing Asset		Other General Asset								
		House	Household Effects	Building	Indoor Movable	Crops	Livestock	Sub-total	Public Facilities	Other Direct Damage	Indirect Damage	Total
Without Project	2	1,353	1,835	115	191	7,060	1,821	12,375	1,860	1,438	3,141	18,814
	5	1,441	1,986	122	202	7,345	1,988	13,084	1,965	1,517	3,322	19,888
	10	1,472	2,035	125	207	7,616	2,112	13,567	2,040	1,571	3,445	20,623
Plan A1, Portuguesa dike	2	1,219	1,623	103	170	6,856	1,808	11,779	1,768	1,371	2,988	17,906
	5	1,447	1,998	123	204	7,195	1,948	12,915	1,937	1,498	3,280	19,630
	10	1,455	2,011	124	205	7,583	2,046	13,424	2,015	1,554	3,407	20,400
Plan B1, Guanare dike	2	1,353	1,835	115	191	6,577	1,780	11,851	1,778	1,380	3,006	18,015
	5	1,455	2,005	123	204	7,460	1,967	13,214	1,984	1,536	3,357	20,091
	10	1,465	2,025	124	206	7,523	1,984	13,327	2,002	1,546	3,383	20,258
Plan C1, Apure dike	2	1,203	1,597	102	167	6,898	1,797	11,764	1,767	1,370	2,986	17,887
	5	1,441	1,986	122	202	7,151	1,942	12,844	1,929	1,492	3,264	19,529
	10	1,457	2,012	123	205	7,433	1,990	13,220	1,987	1,532	3,357	20,096
Overall Plan	2	1,369	1,861	116	194	6,484	1,719	11,743	1,760	1,369	2,976	17,848
Portuguesa+Guanare	5	1,447	1,998	123	204	7,350	1,883	13,005	1,951	1,510	3,302	19,768
+Apure dikes	10	1,447	1,998	123	204	7,523	1,947	13,242	1,987	1,535	3,360	20,124

Remarks: Land use condition: Potential land use

Table 4.3.3 ANNUAL MEAN FLOOD DAMAGES

(Under Potential Land Use Condition)

((Whole Flood Management Study Area))

Alternatives	Return Period	Exceedance	Difference of Exceedance	Flood Damages (US$1000) Amount	Flood Damages (US$1000) Mean	Annual Damage (US$1000) Segment	Annual Damage (US$1000) Cummulative
Without Project	-	1.000	-	0	0	0	0
	2	0.500	0.500	18,814	9,407	4,704	4,704
	5	0.200	0.300	19,888	19,351	5,805	10,509
	10	0.100	0.100	20,623	20,256	2,026	12,534
Plan A1, Portuguesa dike	-	1.000	-	0	0	0	0
	2	0.500	0.500	17,906	8,953	4,477	4,477
	5	0.200	0.300	19,630	18,768	5,630	10,107
	10	0.100	0.100	20,400	20,015	2,002	12,108
Plan B1, Guanare dike	-	1.000	-	0	0	0	0
	2	0.500	0.500	18,015	9,008	4,504	4,504
	5	0.200	0.300	20,091	19,053	5,716	10,220
	10	0.100	0.100	20,258	20,175	2,018	12,237
Plan C1, Apure dike	-	1.000	-	0	0	0	0
	2	0.500	0.500	17,887	8,944	4,472	4,472
	5	0.200	0.300	19,529	18,708	5,612	10,084
	10	0.100	0.100	20,096	19,813	1,981	12,111
Overall Plan, Portuguesa,	-	1.000	-	0	0	0	0
Guanare and Apure dikes	2	0.500	0.500	17,848	8,924	4,462	4,462
	5	0.200	0.300	19,768	18,808	5,642	10,104
	10	0.100	0.100	20,124	19,946	1,995	12,099

Table 4.3.4 PRODUCTION COST AND NET INCOME (1/4)

((Whole Project Area, Plan A1, Portuguesa Dike))

Crop		Yield (ton/ha)	Planted Area (ha)	Production Cost (US$/ha)	Farmgate Price (US$/ton)	Total Production Cost (US$1000)	Total Farmgate Price (US$1000)	Net Income (US$1000)
a		b	c	d	e	f=c x d	g=exbxc	h=g-f
Proposed Land Use with Flood Management								
Crop-1	Rice	2.5	54,180	301.85	147.3	16,354	19,952	3,598
Potential Land Use without Flood Management								
Crop-2.1	Rice	2.5	102,200	301.85	147.3	30,849	37,635	6,786
Crop-2.2	Other Crops							
	a. Corn	2.5	45,300	222.6	113.7	10,084	12,877	2,793
	b. Sorghum	2.0	45,300	222.6	101.4	10,084	9,187	-
	c. Cotton	1.4	45,400	304.9	331.5	13,842	21,070	7,228
	Sub-total		136,000			34,010	43,134	10,021
Land Remains as Present Land Use								
Crop-3	a. Rice (7.3%)	3.8	3,380	431.1	147.3	1,457	1,892	435
	b. Corn (37.6%)	2.5	17,409	222.6	113.7	3,875	4,949	1,074
	c. Sorghum (9.1%)	2.0	4,213	222.6	101.4	938	854	-
	d. Cotton (7.1%)	1.4	3,287	304.9	331.5	1,002	1,525	523
	e. Sugarcane (13.5%)	40.0	6,251	487.8	12.7	3,049	3,176	127
	f. Sunflower (20.8%)	0.75	9,630	164.6	178.0	1,585	1,286	-
	g. Sesame (4.6%)	0.6	2,130	164.6	287.2	351	367	16
	Sub-total		46,300			10,800	12,157	1,740
Total of Crop			338,680			92,013	112,878	22,145
Livestock		Yield (kg/ha/ year)	Area (ha)	Management Cost (US$/ha)	Farmgate Price (US$/kg)	Total Management Cost (US$1000)	Total Farmgate Price (US$1000)	Net Income (US$1000)
a		b	c	d	e	f=c x d	g=exbxc	h=g-f
With Flood Management and Apure Type Module								
Livestock-1	Meat	70	21,788	25.5	1.36	556	2,074	1,518
Semi-intensive Livestock Farming								
Livestock-2	Meat	30	119,800	15.0	1.36	1,797	4,888	3,091
Extensive Livestock Farming								
Livestock-3	Meat	15	571,122	8.78	1.36	5,014	11,651	6,637
Total of Livestock			712,710			7,367	18,613	11,246
TOTAL (Crop + Livestock)			1,051,390			99,380	131,491	33,391

Table 4.3.4 PRODUCTION COST AND NET INCOME (2/4)

((Whole Project Area, Plan B1, Guanare Dike))

Crop		Yield (ton/ha)	Planted Area (ha)	Production Cost (US$/ha)	Farmgate Price (US$/ton)	Total Production Cost (US$1000)	Total Farmgate Price (US$1000)	Net Income (US$1000)
a		b	c	d	e	f=c x d	g=exbxc	h=g-f
Proposed Land Use with Flood Management								
Crop-1	Rice	2.5	80,640	301.85	147.3	24,341	29,696	5,355
Potential Land Use without Flood Management								
Crop-2.1	Rice	2.5	90,100	301.85	147.3	27,197	33,179	5,982
Crop-2.2	Other Crops							
	a. Corn	2.5	44,100	222.6	113.7	9,817	12,535	2,718
	b. Sorghum	2.0	44,100	222.6	101.4	9,817	8,943	-
	c. Cotton	1.4	44,000	304.9	331.5	13,416	20,420	7,004
	Sub-total		132,200			33,050	41,898	9,722
Land Remains as Present Land Use								
Crop-3	a. Rice (7.3%)	3.8	3,249	431.1	147.3	1,401	1,819	418
	b. Corn (37.6%)	2.5	16,732	222.6	113.7	3,725	4,756	1,031
	c. Sorghum (9.1%)	2.0	4,050	222.6	101.4	902	821	-
	d. Cotton (7.1%)	1.4	3,159	304.9	331.5	963	1,466	503
	e. Sugarcane (13.5%)	40.0	6,008	487.8	12.7	2,931	3,052	121
	f. Sunflower (20.8%)	0.75	9,256	164.6	178.0	1,524	1,236	-
	g. Sesame (4.6%)	0.6	2,046	164.6	287.2	337	353	16
	Sub-total		44,500			10,382	11,684	1,671
Total of Crop			347,440			94,970	116,457	22,730
Livestock		Yield (kg/ha/ year)	Area (ha)	Management Cost (US$/ha)	Farmgate Price (US$/kg)	Total Management Cost (US$1000)	Total Farmgate Price (US$1000)	Net Income (US$1000)
a		b	c	d	e	f=c x d	g=exbxc	h=g-f
With Flood Management and Apure Type Module								
Livestock-1	Meat	70	-	25.5	1.36	0	0	0
Semi-intensive Livestock Farming								
Livestock-2	Meat	30	119,200	15.0	1.36	1,788	4,863	3,075
Extensive Livestock Farming								
Livestock-3	Meat	15	577,180	8.78	1.36	5,068	11,774	6,706
Total of Livestock			696,380			6,856	16,637	9,781
TOTAL (Crop + Livestock)			1,043,820			101,826	133,094	32,511

Table 4.3.4 PRODUCTION COST AND NET INCOME (3/4)

((Whole Project Area, Plan C1, Apure Dike))

Crop		Yield (ton/ha)	Planted Area (ha)	Production Cost (US$/ha)	Farmgate Price (US$/ton)	Total Production Cost (US$1000)	Total Farmgate Price (US$1000)	Net Income (US$1000)
a		b	c	d	e	f=c x d	g=exbxc	h=g-f
Proposed Land Use with Flood Management								
Crop-1	Rice	2.5	-	301.85	147.3	0	0	0
Potential Land Use without Flood Management								
Crop-2.1	Rice	2.5	103,600	301.85	147.3	31,272	38,151	6,879
Crop-2.2	Other Crops							
	a. Corn	2.5	45,300	222.6	113.7	10,084	12,877	2,793
	b. Sorghum	2.0	45,300	222.6	101.4	10,084	9,187	-
	c. Cotton	1.4	45,400	304.9	331.5	13,842	21,070	7,228
	Sub-total		136,000			34,010	43,134	10,021
Land Remains as Present Land Use								
Crop-3	a. Rice (7.3%)	3.8	3,555	431.1	147.3	1,533	1,990	457
	b. Corn (37.6%)	2.5	18,311	222.6	113.7	4,076	5,205	1,129
	c. Sorghum (9.1%)	2.0	4,432	222.6	101.4	987	899	-
	d. Cotton (7.1%)	1.4	3,458	304.9	331.5	1,054	1,605	551
	e. Sugarcane (13.5%)	40.0	6,575	487.8	12.7	3,207	3,340	133
	f. Sunflower (20.8%)	0.75	10,130	164.6	178.0	1,667	1,352	-
	g. Sesame (4.6%)	0.6	2,239	164.6	287.2	369	386	17
	Sub-total		48,700			11,360	12,787	1,830
Total of Crop			288,300			76,642	94,072	18,730
Livestock		Yield (kg/ha/ year)	Area (ha)	Management Cost (US$/ha)	Farmgate Price (US$/kg)	Total Management Cost *(US$1000)*	Total Farmgate Price *(US$1000)*	Net Income (US$1000)
a		b	c	d	e	f=c x d	g=exbxc	h=g-f
With Flood Management and Apure Type Module								
Livestock-1	Meat	70	68,198	25.5	1.36	1,739	6,492	4,753
Semi-intensive Livestock Farming								
Livestock-2	Meat	30	103,500	15.0	1.36	1,553	4,223	2,670
Extensive Livestock Farming								
Livestock-3	Meat	15	585,232	8.78	1.36	5,138	11,939	6,801
Total of Livestock			756,930			8,430	22,654	14,224
TOTAL (Crop + Livestock)			1,045,230			85,072	116,726	32,954

Table 4.3.4 PRODUCTION COST AND NET INCOME (4/4)

((Whole Project Area, Overall Plan))

Crop		Yield (ton/ha)	Planted Area (ha)	Production Cost (US$/ha)	Farmgate Price (US$/ton)	Total Production Cost (US$1000)	Total Farmgate Price (US$1000)	Net Income (US$1000)
a		b	c	d	e	f=c x d	g=exbxc	h=g-f
Proposed Land Use with Flood Management								
Crop-1	Rice	2.5	134,820	301.85	147.3	40,695	49,647	8,952
Potential Land Use without Flood Management								
Crop-2.1	Rice	2.5	88,700	301.85	147.3	26,774	32,664	5,890
Crop-2.2	Other Crops							
	a. Corn	2.5	44,100	222.6	113.7	9,817	12,535	2,718
	b. Sorghum	2.0	44,100	222.6	101.4	9,817	8,943	-
	c. Cotton	1.4	44,000	304.9	331.5	13,416	20,420	7,004
	Sub-total		132,200			33,050	41,898	9,722
Land Remains as Present Land Use								
Crop-3	a. Rice (7.3%)	3.8	3,073	431.1	147.3	1,325	1,720	395
	b. Corn (37.6%)	2.5	15,830	222.6	113.7	3,524	4,500	976
	c. Sorghum (9.1%)	2.0	3,831	222.6	101.4	853	777	-
	d. Cotton (7.1%)	1.4	2,989	304.9	331.5	911	1,387	476
	e. Sugarcane (13.5%)	40.0	5,684	487.8	12.7	2,773	2,887	114
	f. Sunflower (20.8%)	0.75	8,757	164.6	178.0	1,441	1,169	-
	g. Sesame (4.6%)	0.6	1,936	164.6	287.2	319	334	15
	Sub-total		42,100			9,821	11,054	1,581
Total of Crop			397,820			110,340	135,263	26,145
Livestock		Yield (kg/ha/ year)	Area (ha)	Management Cost (US$/ha)	Farmgate Price (US$/kg)	Total Management Cost (US$1000)	Total Farmgate Price (US$1000)	Net Income (US$1000)
a		b	c	d	e	f=c x d	g=exbxc	h=g-f
With Flood Management and Apure Type Module								
Livestock-1	Meat	70	89,986	25.5	1.36	2,295	8,567	6,272
Semi-intensive Livestock Farming								
Livestock-2	Meat	30	67,900	15.0	1.36	1,019	2,770	1,751
Extensive Livestock Farming								
Livestock-3	Meat	15	502,334	8.78	1.36	4,410	10,248	5,838
Total of Livestock			660,220			7,724	21,585	13,861
TOTAL (Crop + Livestock)			1,058,040			118,064	156,848	40,006

Table 4.3.5 FLOOD DAMAGE REDUCTION AND LAND ENHANCEMENT BENEFIT BY ALTERNATIVE

((Whole Flood Management Study Area)) Unit: US$1000

Alternative	Flood Reduction Benefit (under Potential Land Use)		Land Enhancement Benefit (under Proposed Land Use)		Total Benefit
	Annual Ave. Flood Damages	Mitigation of Damages	Net Income	Benefit	
Without Project	12,534	-	29,335		-
Plan A1, Portuguesa dike	12,108	426	33,391	4,056	4,482
Plan B1, Guanare dike	12,237	297	32,511	3,176	3,473
Plan C1, Apure dike	12,111	423	32,954	3,619	4,042
Overall Plan, Portuguesa, Guanare and Apure dikes	12,099	435	40,006	10,671	11,106

Table 4.4.1 FINANCIAL PROJECT COST FOR FLOOD MANAGEMENT PROJECT

No.	Work Item	Unit	Unit price (US$)	Plan A1, Portuguesa dike Qty	Plan A1, Portuguesa dike Amount (US$)	Plan B1, Guanare dike Qty	Plan B1, Guanare dike Amount (US$)	Plan C1, Apure dike Qty	Plan C1, Apure dike Amount (US$)	Overall Plan Qty	Overall Plan Amount (US$)
I.	Construction Cost (Dike construction)										
	(1) Preparatory works	L.S	10%	1	2,240,000	1	1,674,000	1	2,237,500	1	6,151,500
	(2) Foundation excavation	cu.m	1.0	960,000	960,000	740,000	740,000	790,000	790,000	2,490,000	2,490,000
	(3) Dike embankment	cu.m	2.5	7,760,000	19,400,000	5,800,000	14,500,000	7,970,000	19,925,000	21,530,000	53,825,000
	(4) Vegitation Cover	cu.m	1.0	1,240,000	1,240,000	900,000	900,000	1,060,000	1,060,000	3,200,000	3,200,000
	(5) Sluiceway	nos.	20,000	40	800,000	30	600,000	30	600,000	100	2,000,000
	(6) Miscellaneous works	L.S	3%	1	672,000	1	502,200	1	671,250	1	1,845,450
	Sub-total of I				25,312,000		18,916,200		25,283,750		69,511,950
II.	Land Acquisition Cost	ha	100.0	1,870	187,000	1,450	145,000	1,550	155,000	4,870	487,000
III.	Administration Cost (5% of I+II)	L.S			1,274,950		953,060		1,271,938		3,499,948
IV.	Engineering Service Cost	L.S			4,303,040		3,215,754		4,298,238		11,817,032
	D/D (7% of I) :				1,771,840		1,324,134		1,769,863		4,865,837
	C/S (10% of I) :				2,531,200		1,891,620		2,528,375		6,951,195
V.	Physical Contingency (10% of I+II+III+IV)	L.S			3,107,699		2,323,001		3,100,893		8,531,593
	Total				34,184,689		25,553,015		34,109,818		93,847,522

Note: (1) Currency exchange rate: US$1 = Bs.82 = JPY119.72
(2) Sluiceway is arranged at intervals of 5 km.
(3) Length of dike: Plan A1 = 187 km, Plan B1 = 145 km, Plan C1 = 155 km

Table 4.4.2 CALCULATION OF ECONOMIC PROJECT COST FOR EACH ALTERNATIVE

No.	Work Item	Plan A1, Portuguesa dike			Plan B1, Guanare dike			Plan C1, Apure dike			Overall Plan		
		Financial Cost (US$1000)	Conversion Rate	Economic Cost (US$1000)	Financial Cost (US$1000)	Conversion Rate	Economic Cost (US$1000)	Financial Cost (US$1000)	Conversion Rate	Economic Cost (US$1000)	Financial Cost (US$1000)	Conversion Rate	Economic Cost (US$1000)
I.	Construction Cost (Dike construction)												
	(1) Preparatory works	2,240	-	1,882	1,674	-	1,406	2,238	-	1,880	6,152	-	5,167
	(2) Foundation excavation	960	0.84	806	740	0.84	622	790	0.84	664	2,490	0.84	2,092
	(3) Dike embankment	19,400	0.84	16,296	14,500	0.84	12,180	19,925	0.84	16,737	53,825	0.84	45,213
	(4) Vegitation Cover	1,240	0.84	1,042	900	0.84	756	1,060	0.84	890	3,200	0.84	2,688
	(5) Sluiceway	800	0.84	672	600	0.84	504	600	0.84	504	2,000	0.84	1,680
	(6) Miscellaneous works	672	-	564	502	-	422	671	-	564	1,845	-	1,550
	Sub-total of I	25,312		21,262	18,916		15,890	25,284		21,239	69,512		58,390
II.	Land Acquisition Cost	187	1.00	187	145	1.00	145	155	1.00	155	487	1.00	487
III.	Administration Cost (5% of I+II)	1,275	-	1,072	953	-	802	1,272	-	1,070	3,500	-	2,944
IV.	Engineering Service Cost	4,303		3,615	3,216		2,701	4,298		3,611	11,817		9,926
	D/D (7% of I) :	1,772	-	1,488	1,324	-	1,112	1,770	-	1,487	4,866	-	4,087
	C/S (10% of I) :	2,531	-	2,127	1,892	-	1,589	2,528	-	2,124	6,951	-	5,839
V.	Physical Contingency (10% of I+II+III+IV)	3,108	-	2,614	2,323	-	1,954	3,101	-	2,608	8,532	-	7,175
	Total	34,185		28,750	25,553		21,492	34,110		28,683	93,848		78,922

Table 4.4.3 BREAKDOWN OF ANNUAL ECONOMIC COST

Unit: US$1000

	Item	Year 1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th	15th	Total
I.	Plan A1, Portuguesa dike																
	1. Direct Construction Cost	-	-	4,252	4,252	4,252	4,252	4,254	-	-	-	-	-	-	-	-	21,262
	2. Land Acquisition Cost	93	94	-	-	-	-	-	-	-	-	-	-	-	-	-	187
	3. Administration Cost	5	5	213	213	213	213	210	-	-	-	-	-	-	-	-	1,072
	4. Engineering Service Cost	744	744	425	425	425	425	427	-	-	-	-	-	-	-	-	3,615
	5. Phisical Contingency	84	84	489	489	489	489	490	-	-	-	-	-	-	-	-	2,614
	Total	926	927	5,379	5,379	5,379	5,379	5,381	-	-	-	-	-	-	-	-	28,750
II.	Plan B1, Guanare dike																
	1. Direct Construction Cost	-	-	3,973	3,973	3,973	3,971	-	-	-	-	-	-	-	-	-	15,890
	2. Land Acquisition Cost	72	73	-	-	-	-	-	-	-	-	-	-	-	-	-	145
	3. Administration Cost	4	4	199	199	199	197	-	-	-	-	-	-	-	-	-	802
	4. Engineering Service Cost	556	556	398	397	397	397	-	-	-	-	-	-	-	-	-	2,701
	5. Phisical Contingency	63	63	457	457	457	457	-	-	-	-	-	-	-	-	-	1,954
	Total	695	696	5,027	5,026	5,026	5,022	-	-	-	-	-	-	-	-	-	21,492
III.	Plan C1, Apure dike																
	1. Direct Construction Cost	-	-	5,310	5,310	5,310	5,309	-	-	-	-	-	-	-	-	-	21,239
	2. Land Acquisition Cost	77	78	-	-	-	-	-	-	-	-	-	-	-	-	-	155
	3. Administration Cost	4	4	266	266	266	264	-	-	-	-	-	-	-	-	-	1,070
	4. Engineering Service Cost	743	744	531	531	531	531	-	-	-	-	-	-	-	-	-	3,611
	5. Phisical Contingency	82	83	611	611	611	610	-	-	-	-	-	-	-	-	-	2,608
	Total	906	909	6,718	6,718	6,718	6,714	-	-	-	-	-	-	-	-	-	28,683
IV.	Overall Plan																
	1. Direct Construction Cost	-	-	4,252	4,252	4,252	4,252	4,253	3,973	3,973	3,973	3,971	5,310	5,310	5,310	5,309	58,390
	2. Land Acquisition Cost	93	94	-	-	-	72	73	-	-	77	78	-	-	-	-	487
	3. Administration Cost	5	5	213	213	213	216	216	199	199	203	202	265	265	265	265	2,944
	4. Engineering Service Cost	2,043	2,044	425	425	425	425	427	397	397	397	397	531	531	531	531	9,926
	5. Phisical Contingency	213	213	489	489	489	497	497	457	457	465	465	611	611	611	611	7,175
	Total	2,354	2,356	5,379	5,379	5,379	5,462	5,466	5,026	5,026	5,115	5,113	6,717	6,717	6,717	6,716	78,922

Table 4.5.1 BENEFIT/COST ANALYSIS (1/4)

(Plan A1, Portuguesa Dike)

Unit: US$1000

Year	Benefit			Cost				Net Cash Flow
	Flood Reduction	Land Enhancement	Total	Dike	Module	O & M	Total	
	a	b	c=a+b	d	e	f	g=d+e+f	h=c - g
1	-	0	0	926			926	-926
2	-	0	0	927			927	-927
3	-	0	0	5,379			5,379	-5,379
4	-	0	0	5,379			5,379	-5,379
5	-	569	569	5,379			5,379	-4,810
6		1,138	1,138	5,379			5,379	-4,241
7		1,708	1,708	5,381			5,381	-3,673
8	426	2,277	2,703		1,453	144	1,597	1,106
9	426	3,060	3,486		1,453	151	1,604	1,882
10	426	3,842	4,268		1,452	159	1,611	2,657
11	426	4,056	4,482			166	166	4,316
12	426	4,056	4,482			166	166	4,316
13	426	4,056	4,482			166	166	4,316
14	426	4,056	4,482			166	166	4,316
15	426	4,056	4,482			166	166	4,316
16	426	4,056	4,482			166	166	4,316
17	426	4,056	4,482			166	166	4,316
18	426	4,056	4,482			166	166	4,316
19	426	4,056	4,482			166	166	4,316
20	426	4,056	4,482			166	166	4,316
21	426	4,056	4,482			166	166	4,316
22	426	4,056	4,482			166	166	4,316
23	426	4,056	4,482			166	166	4,316
24	426	4,056	4,482			166	166	4,316
25	426	4,056	4,482			166	166	4,316
26	426	4,056	4,482			166	166	4,316
27	426	4,056	4,482			166	166	4,316
28	426	4,056	4,482			166	166	4,316
29	426	4,056	4,482			166	166	4,316
30	426	4,056	4,482			166	166	4,316
31	426	4,056	4,482			166	166	4,316
32	426	4,056	4,482			166	166	4,316
33	426	4,056	4,482			166	166	4,316
34	426	4,056	4,482			166	166	4,316
35	426	4,056	4,482			166	166	4,316
36	426	4,056	4,482			166	166	4,316
37	426	4,056	4,482			166	166	4,316
38	426	4,056	4,482			166	166	4,316
39	426	4,056	4,482			166	166	4,316
40	426	4,056	4,482			166	166	4,316
41	426	4,056	4,482			166	166	4,316
42	426	4,056	4,482			166	166	4,316
43	426	4,056	4,482			166	166	4,316
44	426	4,056	4,482			166	166	4,316
45	426	4,056	4,482			166	166	4,316
46	426	4,056	4,482			166	166	4,316
47	426	4,056	4,482			166	166	4,316
48	426	4,056	4,482			166	166	4,316
49	426	4,056	4,482			166	166	4,316
50	426	4,056	4,482			166	166	4,316
51	426	4,056	4,482			166	166	4,316
52	426	4,056	4,482			166	166	4,316
53	426	4,056	4,482			166	166	4,316
54	426	4,056	4,482			166	166	4,316
55	426	4,056	4,482			166	166	4,316
56	426	4,056	4,482			166	166	4,316
57	426	4,056	4,482			166	166	4,316
					IRR (%) =	11.0		
					B/C =	1.39	(at discount rate: 8%)	
					B - C =	9,124	(at discount rate: 8%)	

Table 4.5.1 BENEFIT/COST ANALYSIS (2/4)

(Plan B1, Guanare Dike)

Unit: US$1000

Year	Benefit			Cost				Net Cash Flow
	Flood Reduction	Land Enhancement	Total	Dike	Module	O & M	Total	
	a	b	c=a+b	d	e	f	g=d+e+f	h=c - g
1	-	0	0	695			695	-695
2	-	0	0	696			696	-696
3	-	0	0	5,027			5,027	-5,027
4	-	0	0	5,026			5,026	-5,026
5	-	352	352	5,026			5,026	-4,674
6	-	706	706	5,022			5,022	-4,316
7	297	1,058	1,355			107	107	1,248
8	297	1,412	1,709			107	107	1,602
9	297	1,764	2,061			107	107	1,954
10	297	2,118	2,415			107	107	2,308
11	297	2,470	2,767			107	107	2,660
12	297	2,824	3,121			107	107	3,014
13	297	3,176	3,473			107	107	3,366
14	297	3,176	3,473			107	107	3,366
15	297	3,176	3,473			107	107	3,366
16	297	3,176	3,473			107	107	3,366
17	297	3,176	3,473			107	107	3,366
18	297	3,176	3,473			107	107	3,366
19	297	3,176	3,473			107	107	3,366
20	297	3,176	3,473			107	107	3,366
21	297	3,176	3,473			107	107	3,366
22	297	3,176	3,473			107	107	3,366
23	297	3,176	3,473			107	107	3,366
24	297	3,176	3,473			107	107	3,366
25	297	3,176	3,473			107	107	3,366
26	297	3,176	3,473			107	107	3,366
27	297	3,176	3,473			107	107	3,366
28	297	3,176	3,473			107	107	3,366
29	297	3,176	3,473			107	107	3,366
30	297	3,176	3,473			107	107	3,366
31	297	3,176	3,473			107	107	3,366
32	297	3,176	3,473			107	107	3,366
33	297	3,176	3,473			107	107	3,366
34	297	3,176	3,473			107	107	3,366
35	297	3,176	3,473			107	107	3,366
36	297	3,176	3,473			107	107	3,366
37	297	3,176	3,473			107	107	3,366
38	297	3,176	3,473			107	107	3,366
39	297	3,176	3,473			107	107	3,366
40	297	3,176	3,473			107	107	3,366
41	297	3,176	3,473			107	107	3,366
42	297	3,176	3,473			107	107	3,366
43	297	3,176	3,473			107	107	3,366
44	297	3,176	3,473			107	107	3,366
45	297	3,176	3,473			107	107	3,366
46	297	3,176	3,473			107	107	3,366
47	297	3,176	3,473			107	107	3,366
48	297	3,176	3,473			107	107	3,366
49	297	3,176	3,473			107	107	3,366
50	297	3,176	3,473			107	107	3,366
51	297	3,176	3,473			107	107	3,366
52	297	3,176	3,473			107	107	3,366
53	297	3,176	3,473			107	107	3,366
54	297	3,176	3,473			107	107	3,366
55	297	3,176	3,473			107	107	3,366
56	297	3,176	3,473			107	107	3,366

IRR (%)	=	11.0	
B/C	=	1.45	(at discount rate: 8%)
B-C	=	7,295	(at discount rate: 8%)

Table 4.5.1 BENEFIT/COST ANALYSIS (3/4)

(Plan C1, Apure Dike)

Unit: US$1000

Year	Benefit			Cost				Net Cash Flow
	Flood Reduction	Land Enhancement	Total	Dike	Module	O & M	Total	
	a	b	c=a+b	d	e	f	g=d+e+f	h=c - g
1	-	0	0	906			906	-906
2	-	0	0	909			909	-909
3	-	0	0	6,718			6,718	-6,718
4	-	0	0	6,718			6,718	-6,718
5	-	0	0	6,718			6,718	-6,718
6		0	0	6,714			6,714	-6,714
7	423	0	423		1,705	143	1,848	-1,425
8	423	452	875		1,705	152	1,857	-982
9	423	905	1,328		1,705	160	1,865	-537
10	423	1,357	1,780		1,705	169	1,874	-94
11	423	1,810	2,233		1,705	177	1,882	351
12	423	2,262	2,685		1,705	186	1,891	794
13	423	2,714	3,137		1,705	194	1,899	1,238
14	423	3,167	3,590		1,705	203	1,908	1,682
15	423	3,619	4,042			211	211	3,831
16	423	3,619	4,042			211	211	3,831
17	423	3,619	4,042			211	211	3,831
18	423	3,619	4,042			211	211	3,831
19	423	3,619	4,042			211	211	3,831
20	423	3,619	4,042			211	211	3,831
21	423	3,619	4,042			211	211	3,831
22	423	3,619	4,042			211	211	3,831
23	423	3,619	4,042			211	211	3,831
24	423	3,619	4,042			211	211	3,831
25	423	3,619	4,042			211	211	3,831
26	423	3,619	4,042			211	211	3,831
27	423	3,619	4,042			211	211	3,831
28	423	3,619	4,042			211	211	3,831
29	423	3,619	4,042			211	211	3,831
30	423	3,619	4,042			211	211	3,831
31	423	3,619	4,042			211	211	3,831
32	423	3,619	4,042			211	211	3,831
33	423	3,619	4,042			211	211	3,831
34	423	3,619	4,042			211	211	3,831
35	423	3,619	4,042			211	211	3,831
36	423	3,619	4,042			211	211	3,831
37	423	3,619	4,042			211	211	3,831
38	423	3,619	4,042			211	211	3,831
39	423	3,619	4,042			211	211	3,831
40	423	3,619	4,042			211	211	3,831
41	423	3,619	4,042			211	211	3,831
42	423	3,619	4,042			211	211	3,831
43	423	3,619	4,042			211	211	3,831
44	423	3,619	4,042			211	211	3,831
45	423	3,619	4,042			211	211	3,831
46	423	3,619	4,042			211	211	3,831
47	423	3,619	4,042			211	211	3,831
48	423	3,619	4,042			211	211	3,831
49	423	3,619	4,042			211	211	3,831
50	423	3,619	4,042			211	211	3,831
51	423	3,619	4,042			211	211	3,831
52	423	3,619	4,042			211	211	3,831
53	423	3,619	4,042			211	211	3,831
54	423	3,619	4,042			211	211	3,831
55	423	3,619	4,042			211	211	3,831
56	423	3,619	4,042			211	211	3,831

IRR (%)	=	6.6	
B/C	=	0.82	(at discount rate: 8%)
B-C	=	-5,212	(at discount rate: 8%)

Table 4.5.1 BENEFIT/COST ANALYSIS (4/4)

(Overall Plan)

Unit: US$1000

Year	Benefit			Cost				Net Cash Flow
	Flood Reduction	Land Enhancement	Total	Dike	Module	O & M	Total	
	a	b	c=a+b	d	e	f	g=d+e+f	h=c - g
1	-	0	0	2,354			2,354	-2,354
2	-	0	0	2,356			2,356	-2,356
3	-	0	0	5,379			5,379	-5,379
4	-	0	0	5,379			5,379	-5,379
5	-	569	569	5,379			5,379	-4,810
6		1,138	1,138	5,462			5,462	-4,324
7		1,708	1,708	5,466			5,466	-3,758
8	426	2,277	2,703	5,026	1,453	159	6,638	-3,935
9	426	3,060	3,486	5,026	1,453	166	6,645	-3,159
10	426	4,194	4,620	5,115	1,452	174	6,741	-2,121
11	426	4,762	5,188	5,113		181	5,294	-106
12	431	5,114	5,545	6,717		282	6,999	-1,454
13	431	5,468	5,899	6,717		282	6,999	-1,100
14	431	5,820	6,251	6,717		282	6,999	-748
15	431	6,174	6,605	6,716		282	6,998	-393
16	435	6,526	6,961		1,705	417	2,122	4,839
17	435	7,332	7,767		1,705	425	2,130	5,637
18	435	8,137	8,572		1,705	434	2,139	6,433
19	435	8,589	9,024		1,705	442	2,147	6,877
20	435	9,042	9,477		1,705	451	2,156	7,321
21	435	9,494	9,929		1,705	459	2,164	7,765
22	435	9,946	10,381		1,705	468	2,173	8,208
23	435	10,399	10,834		1,705	476	2,181	8,653
24	435	10,851	11,286			485	485	10,801
25	435	10,851	11,286			485	485	10,801
26	435	10,851	11,286			485	485	10,801
27	435	10,851	11,286			485	485	10,801
28	435	10,851	11,286			485	485	10,801
29	435	10,851	11,286			485	485	10,801
30	435	10,851	11,286			485	485	10,801
31	435	10,851	11,286			485	485	10,801
32	435	10,851	11,286			485	485	10,801
33	435	10,851	11,286			485	485	10,801
34	435	10,851	11,286			485	485	10,801
35	435	10,851	11,286			485	485	10,801
36	435	10,851	11,286			485	485	10,801
37	435	10,851	11,286			485	485	10,801
38	435	10,851	11,286			485	485	10,801
39	435	10,851	11,286			485	485	10,801
40	435	10,851	11,286			485	485	10,801
41	435	10,851	11,286			485	485	10,801
42	435	10,851	11,286			485	485	10,801
43	435	10,851	11,286			485	485	10,801
44	435	10,851	11,286			485	485	10,801
45	435	10,851	11,286			485	485	10,801
46	435	10,851	11,286			485	485	10,801
47	435	10,851	11,286			485	485	10,801
48	435	10,851	11,286			485	485	10,801
49	435	10,851	11,286			485	485	10,801
50	435	10,851	11,286			485	485	10,801
51	435	10,851	11,286			485	485	10,801
52	435	10,851	11,286			485	485	10,801
53	435	10,851	11,286			485	485	10,801
54	435	10,851	11,286			485	485	10,801
55	435	10,851	11,286			485	485	10,801
56	435	10,851	11,286			485	485	10,801
57	435	10,851	11,286			485	485	10,801
58	435	10,851	11,286			485	485	10,801
59	435	10,851	11,286			485	485	10,801
60	435	10,851	11,286			485	485	10,801
61	435	10,851	11,286			485	485	10,801
62	435	10,851	11,286			485	485	10,801
63	435	10,851	11,286			485	485	10,801
64	435	10,851	11,286			485	485	10,801
65	435	10,851	11,286			485	485	10,801

IRR (%) =	9.2		
B/C =	1.15	(at discount rate: 8%)	
B - C =	7,614	(at discount rate: 8%)	

Table 5.3.1 MONTHLY TRANSPORTATION COST BY TRUCK (1/2)

Item \ Cargo	Oil Products	Iron Products	Wood (Pine)	Construction Material	Urea	Scoria of Steel
a. Origin	Valencia	Ciudad Guayana	Los Barrancos	Calabozo	Moron - Valencia	Matanzas
b. Final Destination	San Fernando	Valencia	Valencia	San Fernando	Villavicencio (Colombia)	San Fernando
c. Transportation Route	Valencia - Cagua - San Juan de Los Morros - Dos Caminos - Calabozo - San Fernando	Ciudad Guayana - Ciudad Bolivar - El Tigre - Valle de La Pascua - Dos Caminos - San Juan de Los Morros - Cagua - Valencia	Los Barrancos - Ciudad Bolivar - El Tigre - Valle de La Pascua - Dos Caminos - San Juan de Los Morros - Cagua - Valencia	Calabozo - San Fernando	No truck transportation considered.	No truck transportation considered.
d. Monthly Transportation Valume (ton)	62,500	150,000	18,000	3,750	-	-
e. Distance between a. and b.(km)	419	787	817	183	-	-
f. Land Transportation Tariff (Bs./ton/km)	3.60	3.60	3.60	4.50	-	-
g. Monthly Transportation Cost (Bs.) (e x {(f + h) x j + g x i + k})	94,275,000	424,980,000	52,941,600	3,088,125	-	-
Equivalent (US$)	$1,149,695	$5,182,683	$645,629	$37,660	-	-

Remarks: Source ; Direccion General Programa Orinoco - Apure

Note 1 ; Cargo, route and transportation volume are assumed based on present production and consumption.

Note 2 ; Tariffs are estimated as of 1992

Foreign Exchange Rate: US$1 = Bs.82

Table 5.3.1 MONTHLY TRANSPORTATION COST BY TRUCK (2/2)

Item \ Cargo	Phosphates	Coal	Coke	Cement	Vehicle	Agricultural Products
a. Origin	Region Surdeste (Colon-Lobatera)	Region Surdeste (Colombia)	Region Surdeste (Colombia)	San Juan de Los Morros	Valencia	Apure river basin
b. Final Destination	Estado Bolivar	Matanzas	Matanzas	San Fernando	Puerto Ordaz	Puerto Ordaz
c. Trasportation Route	Lobatera - San Cristobal - Barinas - Acarigua - San Carlos - Tinaco - Dos Caminos - Valle de La Pascua - El Tigre - Ciudad Bolivar - Ciudad Guayana	Lobatera - San Cristobal - Barinas - Acarigua - San Carlos - Tinaco - Dos Caminos - Valle de La Pascua - El Tigre - Ciudad Bolivar - Matanzas	Lobatera - San Cristobal - Barinas - Acarigua - San Carlos - Tinaco - Dos Caminos - Valle de La Pascua - El Tigre - Ciudad Bolivar - Matanzas	San Juan de Los Morros - Dos Caminos - Calabozo - San Fernando	Valencia - Cagua - San Juan de Los Morros - Dos Caminos - Valle de La Pascua - El Tigre - Ciudad Bolivar - Puerto Ordaz	Acarigua - San Carlos - Tinaco - Dos Caminos - Valle de La Pascua - El Tigre - Ciudad Bolivar - Puerto Ordaz
d. Monthly Transportation Valume (ton)	3,750	37,500	15,000	3,315	1,250	75,000
e. Distance between a. and b.(km)	1,245	1,245	1,245	307	787	866
f. Land Transportation Tariff (Bs./ton/km)	3.60	3.60	3.60	3.60	5.20	3.60
g. Monthly Transportation Cost (Bs.) (e x {(f + h) x j + g x i + k})	16,807,500	168,075,000	67,230,000	3,663,738	5,115,500	233,820,000
Equivalent (US$)	$204,970	$2,049,695	$819,878	$44,680	$62,384	$2,851,463

Remarks: Source ; Direccion General Programa Orinoco - Apure

Note 1 ; Cargo, route and transportation volume are assumed based on present production and consumption.

Note 2 ; Tariffs are estimated as of 1992

Foreign Exchange Rate: US$1 = Bs.82

Table 5.3.2 MONTHLY TRANSPORTATION COST BY FLUVIAL NAVIGATION (1/2)

Item \ Cargo	Oil Products	Iron Products	Wood (Pine)	Construction Material	Urea	Scoria of Steel
a. Origin	Monagas	Matanzas	Uveritos	El Baul	Moron-Valencia	Matanzas
b. Port of Origin	Puerto Ciudad Bolivar	Matanzas	Los Barrancos	Puerto El Baul	Puerto El Baul	Puerto Ordaz
c. Port of Destination	Puerto San Fernando	Puerto El Baul	Puerto El Baul	Puerto San Fernando	Puerto Lopez (Colombia)	Puerto San Fernando
d. Final Destination	San Fernando	Valencia	Valencia	San Fernando	Villavicencio (Colombia)	San Fernando
e. Monthly Transportation Valume (ton)	62,500	150,000	18,000	3,750	37,500	25,000
f. Distance between a. and b.(km)	-	-	30	12	258	4
g. Distance between b. and c.(km)	588	938	948	248	1,746	690
h. Distance between c. and d.(km)	10	205	205	10	-	10
i. Fluvial Navigation Tariff (Bs./ton/km)	0.55	0.80	0.55	0.55	0.55	0.50
j. Land Transportation Tariff (Bs./ton/km)	3.60	3.60	3.60	4.50	3.60	7.00
k. Transshipment Cost (Bs./ton)	100	100	200	100	100	200
l. Monthly Transportation Cost (Bs.) (e x {(f + h) x j + g x i + k})	28,712,500	238,260,000	28,213,200	1,257,750	74,591,250	16,075,000
Equivalent (US$)	$350,152	$2,905,610	$344,063	$15,338	$909,649	$196,037

Remarks: Source ; Direccion General Programa Orinoco - Apure

Note 1 ; Cargo, route and transportation volume are assumed based on present production and consumption.

Note 2 ; Tariffs are estimated as of 1992

Foreign Exchange Rate: US$1 = Bs.82

Table 5.3.2 MONTHLY TRANSPORTATION COST BY FLUVIAL NAVIGATION (2/2)

Item \ Cargo	Phosphates	Coal	Coke	Cement	Vehicle	Agricultural Products
a. Origin	Region Surdeste (Colon-Lobatera)	Region Surdeste (Colombia)	Region Surdeste (Colombia)	Matanzas	Valencia	Apure river basin
b. Port of Origin	Puerto Santos Luzardo	Puerto Santos Luzardo	Puerto Santos Luzardo	Puerto Ordaz	Puerto El Baul	Puerto San Fernando
c. Port of Destination	Puerto Ciudad Bolivar	Puerto Ordaz	Puerto Ordaz	Puerto San Fernando	Matanzas	Matanzas
d. Final Destination	Estado Bolivar	Matanzas	Matanzas	San Fernando	Puerto Ordaz	Puerto Ordaz
e. Monthly Transportation Valume (ton)	3,750	37,500	15,000	3,315	1,250	75,000
f. Distance between a. and b.(km)	240	240	300	-	205	unknown
g. Distance between b. and c.(km)	1,064	1,160	1,160	690	938	688
h. Distance between c. and d.(km)	2	5	-	10	14	10
i. Fluvial Navigation Tariff (Bs./ton/km)	0.50	0.50	0.50	0.55	1.60	0.80
j. Land Transportation Tariff (Bs./ton/km)	3.60	3.60	3.60	3.60	5.20	3.60
k. Transshipment Cost (Bs./ton)	200	200	200	100	200	200
l. Monthly Transportation Cost (Bs.) (e x {(f + h) x j + g x i + k})	6,012,000	62,325,000	27,900,000	1,708,883	3,549,500	58,980,000
Equivalent (US$)	$73,317	$760,061	$340,244	$20,840	$43,287	$719,268

Remarks: Source ; Direccion General Programa Orinoco - Apure

Note 1 ; Cargo, route and transportation volume are assumed based on present production and consumption.

Note 2 ; Tariffs are estimated as of 1992

Foreign Exchange Rate: US$1 = Bs.82

Table 5.3.3 EXTENSION OF NAVIGATION PERIOD AND REDUCTION OF TRANSPORTATION COST (1/2)

(Short Term Plan)

Item	Navigation Route			Navigable Period (Month)			Monthly Transportation Cost			Reduction of Transportation Cost per Year
	Port of Origin		Port of Destination	Without Project	With Project	Extended Period	by Truck (US$1000)	by Fluvial Navigation (US$1000)	Difference of Monthly Cost (US$1000)	(US$1000)
Oil Products	P. Ciudad Bolivar	--->	P. San Fernando	8	8	0	1,150	350	800	0
Iron Products	Matanzas	--->	P. El Baul	7	8	1	5,183	2,906	2,277	2,277
Wood (Pine)	Los Barrancos	--->	P. El Baul	7	8	1	646	344	302	302
Construction Material	P. El Baul	--->	P. San Fernando	7	8	1	38	15	23	23
Urea	P. El Baul	--->	P. Lopez (Colombia)	-	-	0	N.A.	910	-	-
Scoria of Steel	P. Ordaz	--->	P. San Fernando	-	-	0	N.A.	196	-	-
Phosphates	P. Santos Luzardo	--->	P. Ciudad Bolivar	4	7	3	205	73	132	396
Coal	P. Santos Luzardo	--->	P. Ordaz	4	7	3	2,050	760	1,290	3,870
Coke	P. Santos Luzardo	--->	P. Ordaz	4	7	3	820	340	480	1,440
Cement	P. Ordaz	--->	P. San Fernando	8	8	0	45	21	24	0
Vehicle	P. El Baul	--->	Matanzas	7	8	1	62	43	19	19
Agricultural Products	P. San Fernando	--->	Matanzas	8	8	0	2,851	719	2,132	0
Total										8,327

Table 5.3.3 EXTENSION OF NAVIGATION PERIOD AND REDUCTION OF TRANSPORTATION COST (2/2)

(Mid Term Plan)

Item	Navigation Route			Navigable Period (Month)			Monthly Transportation Cost			Reduction of Transportation Cost per Year
	Port of Origin		Port of Destination	Without Project	With Project	Extended Period	by Truck (US$1000)	by Fluvial Navigation (US$1000)	Difference of Monthly Cost (US$1000)	(US$1000)
Oil Products	P. Ciudad Bolivar	--->	P. San Fernando	8	9	1	1,150	350	800	800
Iron Products	Matanzas	--->	P. El Baul	7	9	2	5,183	2,906	2,277	4,554
Wood (Pine)	Los Barrancos	--->	P. El Baul	7	9	2	646	344	302	604
Construction Material	P. El Baul	--->	P. San Fernando	7	9	2	38	15	23	46
Urea	P. El Baul	--->	P. Lopez (Colombia)	-	-	0	N.A.	910	-	-
Scoria of Steel	P. Ordaz	--->	P. San Fernando	-	-	0	N.A.	196	-	-
Phosphates	P. Santos Luzardo	--->	P. Ciudad Bolivar	4	8	4	205	73	132	528
Coal	P. Santos Luzardo	--->	P. Ordaz	4	8	4	2,050	760	1,290	5,160
Coke	P. Santos Luzardo	--->	P. Ordaz	4	8	4	820	340	480	1,920
Cement	P. Ordaz	--->	P. San Fernando	8	9	1	45	21	24	24
Vehicle	P. El Baul	--->	Matanzas	7	9	2	62	43	19	38
Agricultural Products	P. San Fernando	--->	Matanzas	8	9	1	2,851	719	2,132	2,132
Total										15,806

Table 5.4.1 PROJECT COSTS FOR CHANNEL STABILIZATION PLAN

No.	Work items	Ratio (FC/EC)	Short-Term Plan FC (US$1000)	Short-Term Plan EC (US$1000)	Mid-Term Plan FC (US$1000)	Mid-Term Plan EC (US$1000)	STP+MTP FC (US$1000)	STP+MTP EC (US$1000)
1	Construction Cost							
	(1 Preparatory works	0.84	3,637	3,055	5,053	4,245	8,690	7,300
	(2 Derivation channel	0.84	3,020	2,537	0	0	3,020	2,537
	(3 Anabranch treatment	0.84	1,029	864	0	0	1,029	864
	(4 Alignment normalization	0.84	20,941	17,590	27,813	23,363	48,754	40,953
	(5 Section improvement	0.84	10,326	8,674	21,239	17,841	31,565	26,515
	(6 Miscellaneous works	0.84	1,060	890	1,471	1,236	2,531	2,126
	Sub-total of I		40,013	33,610	55,576	46,685	95,589	80,295
2	Land Acquisition Cost	1.00	5	5	2	2	7	7
3	Administration Cost (5% of I+II)		2,001	1,681	2,780	2,334	4,781	4,015
4	Engineering Service Cost		6,803	5,714	9,448	7,937	16,251	13,651
	D/ (7% of I) :		2,801	2,353	3,892	3,268	6,693	5,621
	C/S (10% of I) :		4,002	3,361	5,556	4,669	9,558	8,030
5	Physical Contingency (10% of I+II+III+IV)		4,883	4,101	6,781	5,696	11,664	9,797
	Total		53,705	45,111	74,587	62,654	128,292	107,765

Remarks: FC and EC stand for financial and economic costs.

Table 5.4.2 ANNUAL ECONOMIC COST FOR CHANNEL STABILIZATION

(Unit: US$1000)

Item	Year 1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	Total
Short-Term Plan (STP)													
1. Direct Construction Cost	-	-	6,722	6,722	6,722	6,722	6,722	-	-	-	-	-	33,610
2. Land Acquisition Cost	-	5	-	-	-	-	-	-	-	-	-	-	5
3. Administration Cost	0	0	336	336	336	336	337	-	-	-	-	-	1,681
4. Engineering Service Cost	1,176	1,177	672	672	672	672	673	-	-	-	-	-	5,714
5. Phisical Contingency	118	118	773	773	773	773	773	-	-	-	-	-	4,101
Total	1,294	1,300	8,503	8,503	8,503	8,503	8,505	-	-	-	-	-	45,111
Mid-Term Plan (MTP)													
1. Direct Construction Cost	-	-	4,669	4,669	4,669	4,669	4,669	4,669	4,669	4,669	4,669	4,664	46,685
2. Land Acquisition Cost	-	2	-	-	-	-	-	-	-	-	-	-	2
3. Administration Cost	0	0	233	233	233	233	233	233	233	233	233	237	2,334
4. Engineering Service Cost	1,634	1,634	467	467	467	467	467	467	467	467	467	466	7,937
5. Phisical Contingency	163	164	537	537	537	537	537	537	537	537	537	536	5,696
Total	1,797	1,800	5,906	5,906	5,906	5,906	5,906	5,906	5,906	5,906	5,906	5,903	62,654
STP + MTP													
1. Direct Construction Cost	-	-	8,030	8,030	8,030	8,030	8,030	8,030	8,030	8,030	8,030	8,025	80,295
2. Land Acquisition Cost	-	7	-	-	-	-	-	-	-	-	-	-	7
3. Administration Cost	0	0	402	402	402	402	402	402	402	402	402	397	4,015
4. Engineering Service Cost	2,810	2,811	803	803	803	803	803	803	803	803	803	803	13,651
5. Phisical Contingency	281	282	924	924	924	924	924	924	924	924	924	918	9,797
Total	3,091	3,100	10,159	10,159	10,159	10,159	10,159	10,159	10,159	10,159	10,159	10,143	107,765

Table 5.5.1 BENEFIT/COST ANALYSIS FOR CHANNEL STABILIZATION (1/2)

- Short-Term Plan -

Unit: US$1000

Year	Benefit	Cost				Net Cash Flow
		Project	Operation	M & R	Total	
	a	b	c	d	e=b+c+d	f=a-e
1	-	1,294	-	-	1,294	(1,294)
2	-	1,300	-	-	1,300	(1,300)
3	-	8,503	-	-	8,503	(8,503)
4	2,198	8,503	440	90	9,033	(6,834)
5	4,397	8,503	879	180	9,563	(5,166)
6	6,595	8,503	1,319	271	10,093	(3,497)
7	8,794	8,503	1,759	361	10,623	(1,829)
8	10,992		2,198	451	2,649	8,343
9	10,992		2,198	451	2,649	8,343
10	10,992		2,198	451	2,649	8,343
11	10,992		2,198	451	2,649	8,343
12	10,992		2,198	451	2,649	8,343
13	10,992		2,198	451	2,649	8,343
14	10,992		2,198	451	2,649	8,343
15	10,992		2,198	451	2,649	8,343
16	10,992		2,198	451	2,649	8,343
17	10,992		2,198	451	2,649	8,343
18	10,992		2,198	451	2,649	8,343
19	10,992		2,198	451	2,649	8,343
20	10,992		2,198	451	2,649	8,343
21	10,992		2,198	451	2,649	8,343
22	10,992		2,198	451	2,649	8,343
23	10,992		2,198	451	2,649	8,343
24	10,992		2,198	451	2,649	8,343
25	10,992		2,198	451	2,649	8,343
26	10,992		2,198	451	2,649	8,343
27	10,992		2,198	451	2,649	8,343
28	10,992		2,198	451	2,649	8,343
29	10,992		2,198	451	2,649	8,343
30	10,992		2,198	451	2,649	8,343
31	10,992		2,198	451	2,649	8,343
32	10,992		2,198	451	2,649	8,343
33	10,992		2,198	451	2,649	8,343
34	10,992		2,198	451	2,649	8,343
35	10,992		2,198	451	2,649	8,343
36	10,992		2,198	451	2,649	8,343
37	10,992		2,198	451	2,649	8,343
38	10,992		2,198	451	2,649	8,343
39	10,992		2,198	451	2,649	8,343
40	10,992		2,198	451	2,649	8,343
41	10,992		2,198	451	2,649	8,343
42	10,992		2,198	451	2,649	8,343
43	10,992		2,198	451	2,649	8,343
44	10,992		2,198	451	2,649	8,343
45	10,992		2,198	451	2,649	8,343
46	10,992		2,198	451	2,649	8,343
47	10,992		2,198	451	2,649	8,343
48	10,992		2,198	451	2,649	8,343
49	10,992		2,198	451	2,649	8,343
50	10,992		2,198	451	2,649	8,343
51	10,992		2,198	451	2,649	8,343
52	10,992		2,198	451	2,649	8,343
53	10,992		2,198	451	2,649	8,343
54	10,992		2,198	451	2,649	8,343
55	10,992		2,198	451	2,649	8,343
56	10,992		2,198	451	2,649	8,343
57	10,992		2,198	451	2,649	8,343

IRR (%) =	17.7		
B/C =	1.72	(at discount rate: 8%)	
B - C =	38,677	(at discount rate: 8%)	