

Fig. J.3.A2 Flood Water Level at the Payabo Block with Improved Flow Capacity (5/9)

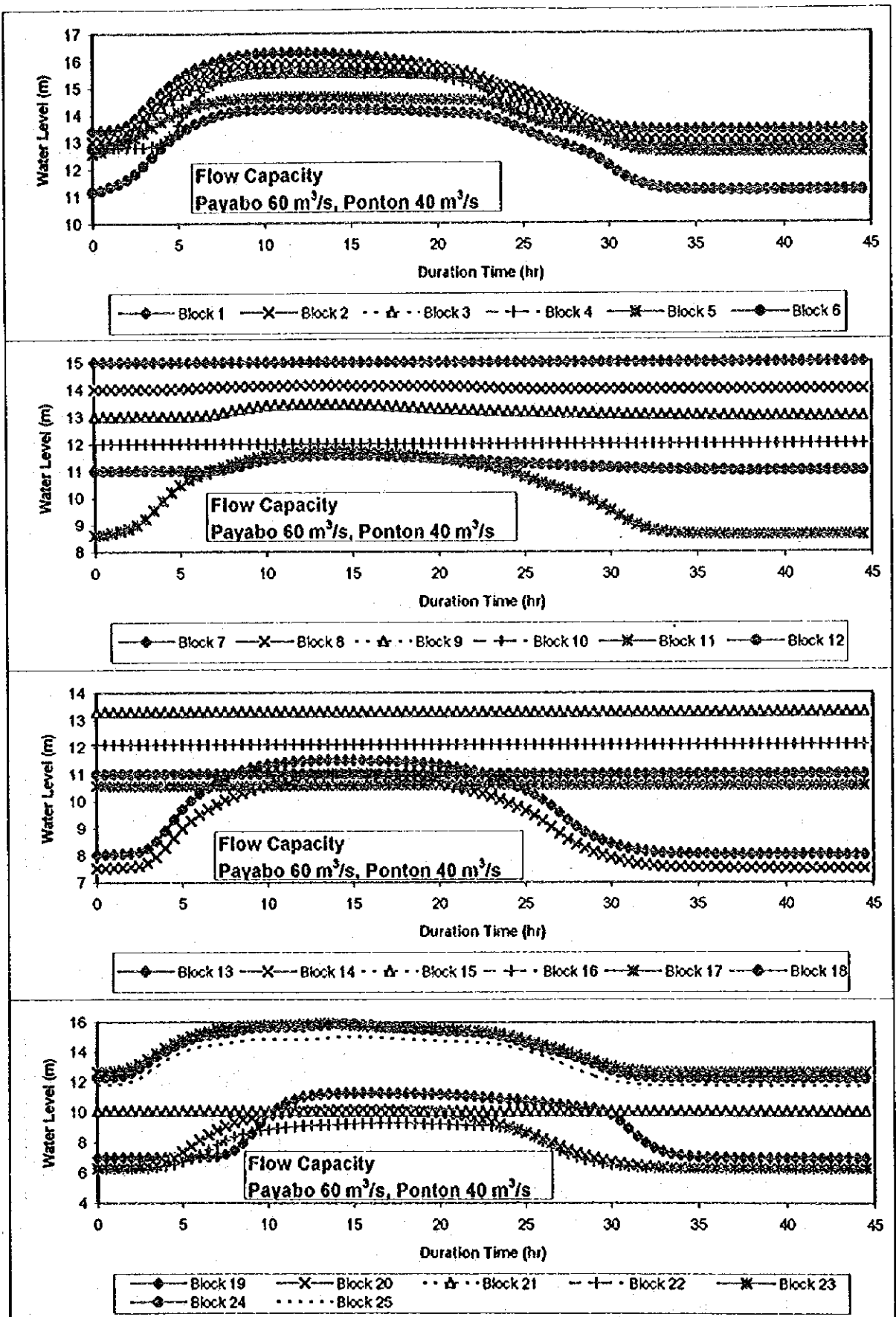


Fig. J.3.A2 Flood Water Level at the Payabo Block with Improved Flow Capacity (6/9)

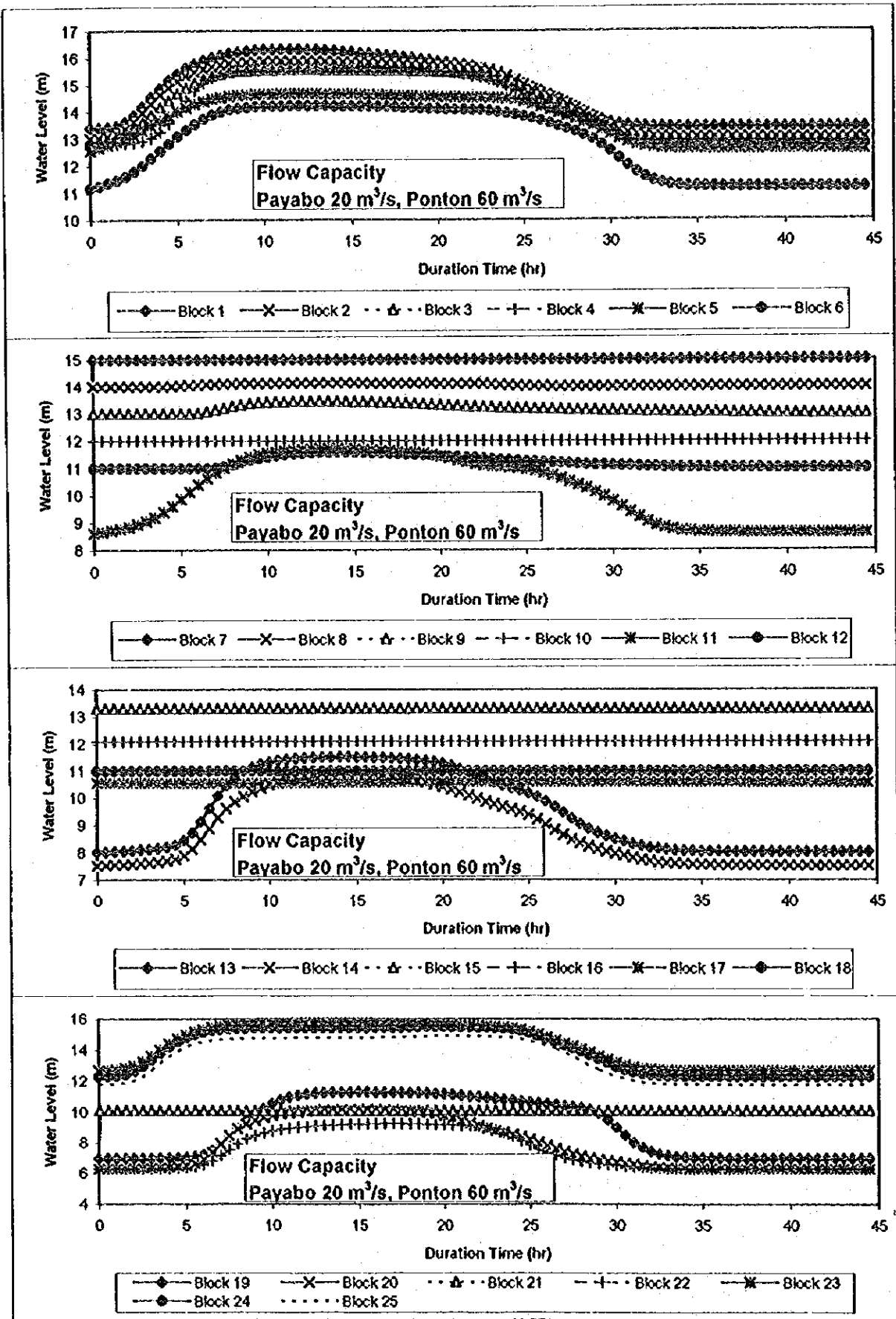


Fig. J.3.A2 Flood Water Level at the Payabo Block with Improved Flow Capacity (7/9)

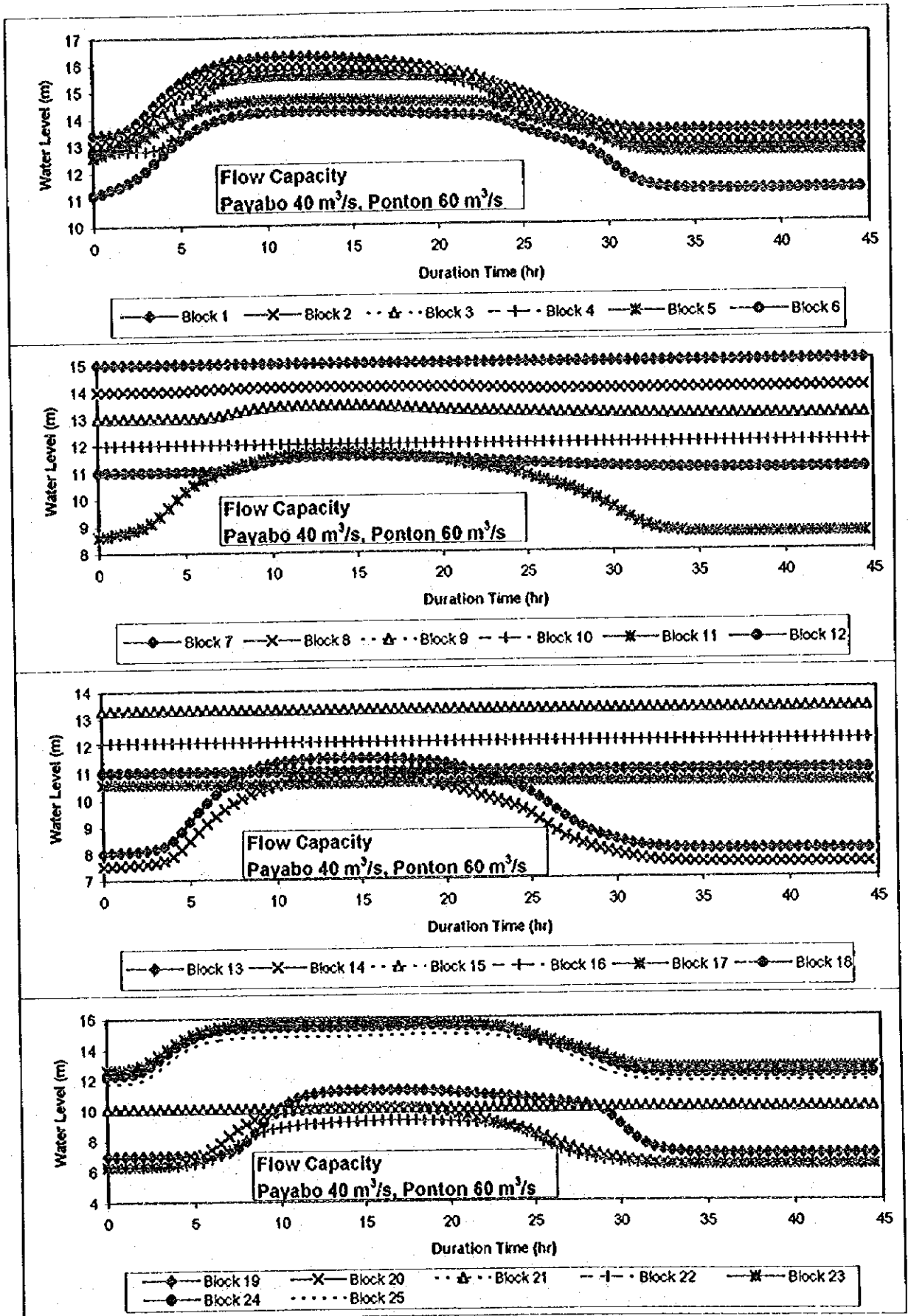


Fig. J.3.A2 Flood Water Level at the Payabo Block with Improved Flow Capacity (8/9)

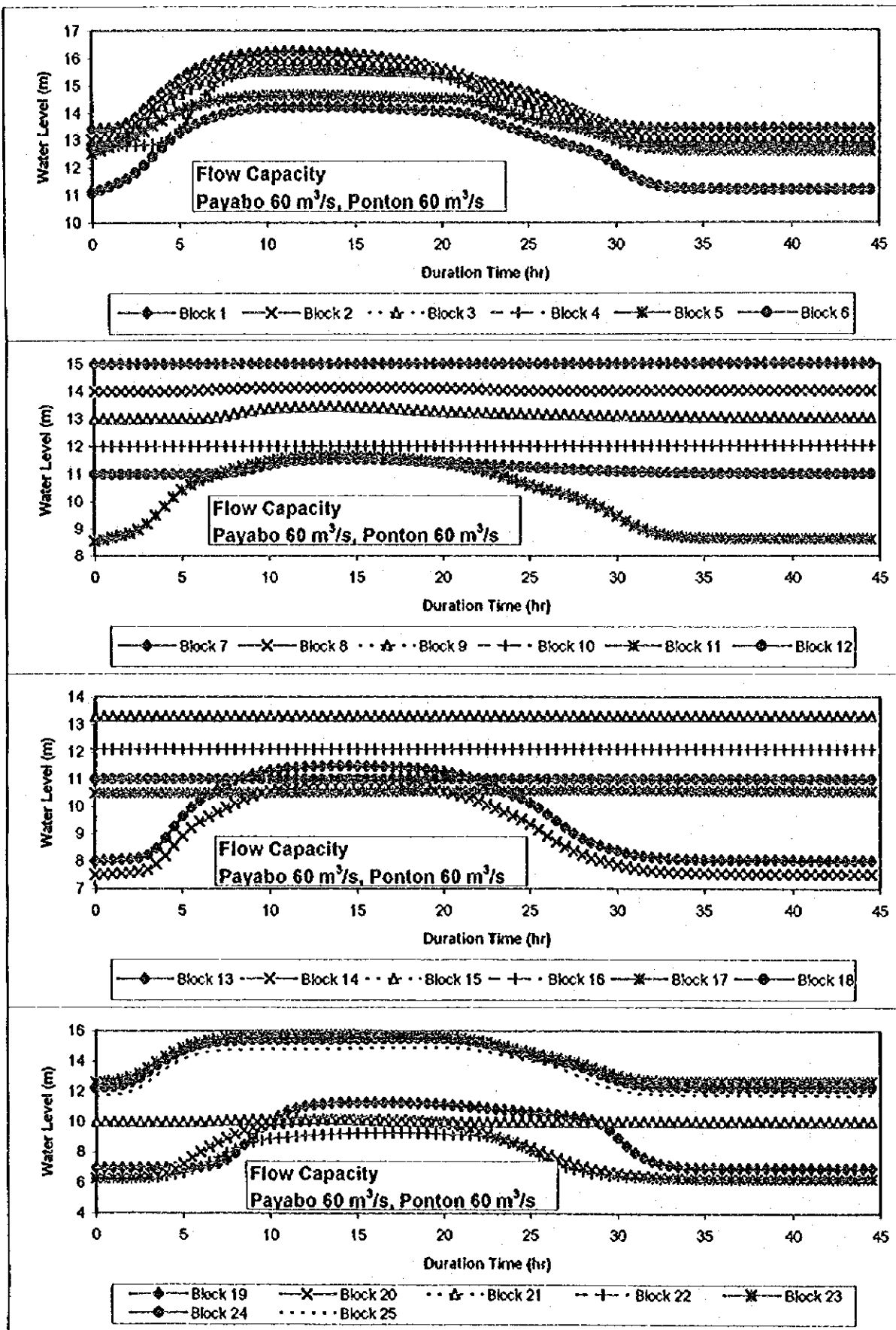


Fig. J.3.A2 Flood Water Level at the Payabo Block with Improved Flow Capacity (9/9)

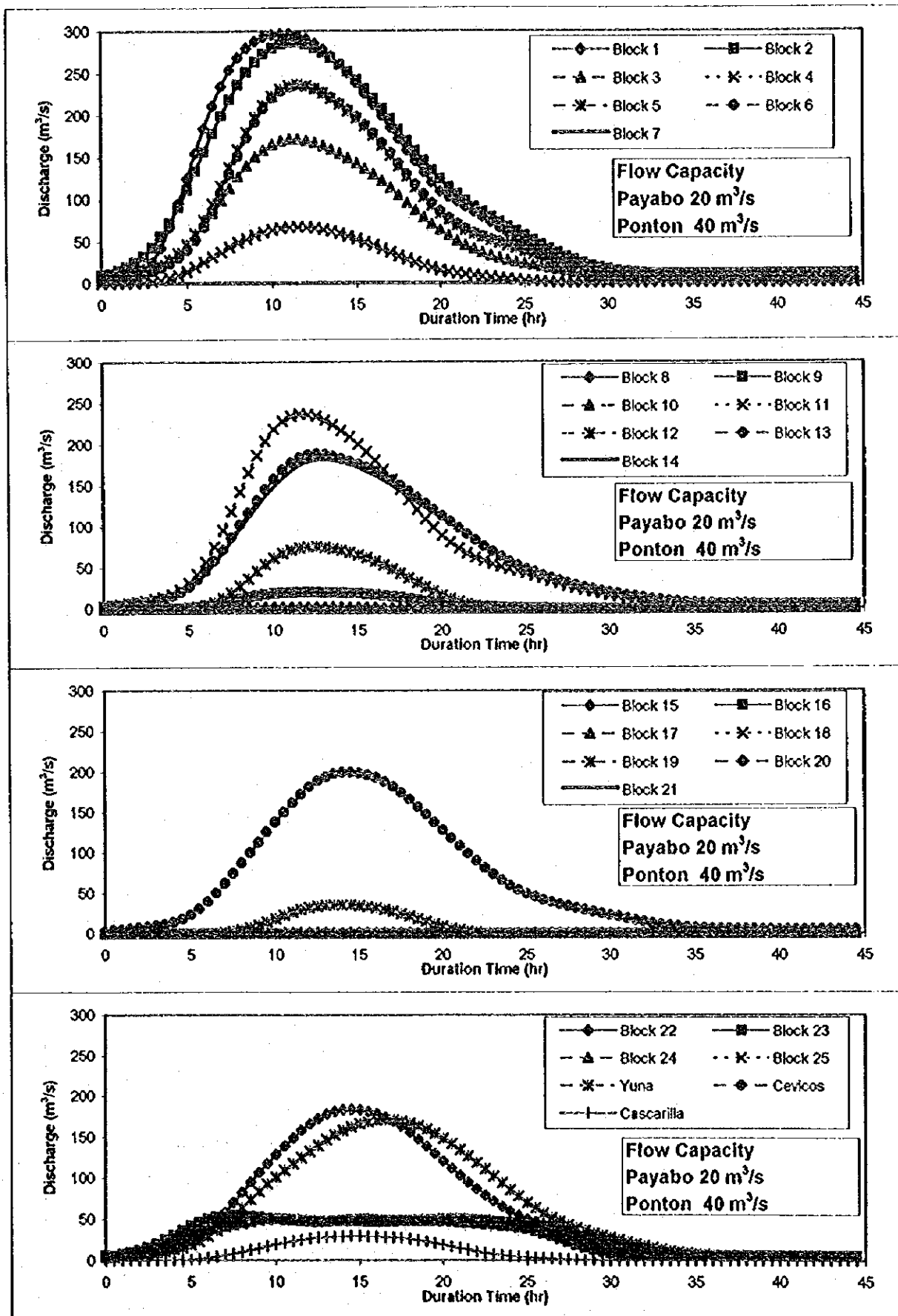


Fig. J.3.B1 Flood Discharge at the Payabo Block with Improved Flow Capacity and By-path to Cascarilla (1/2)

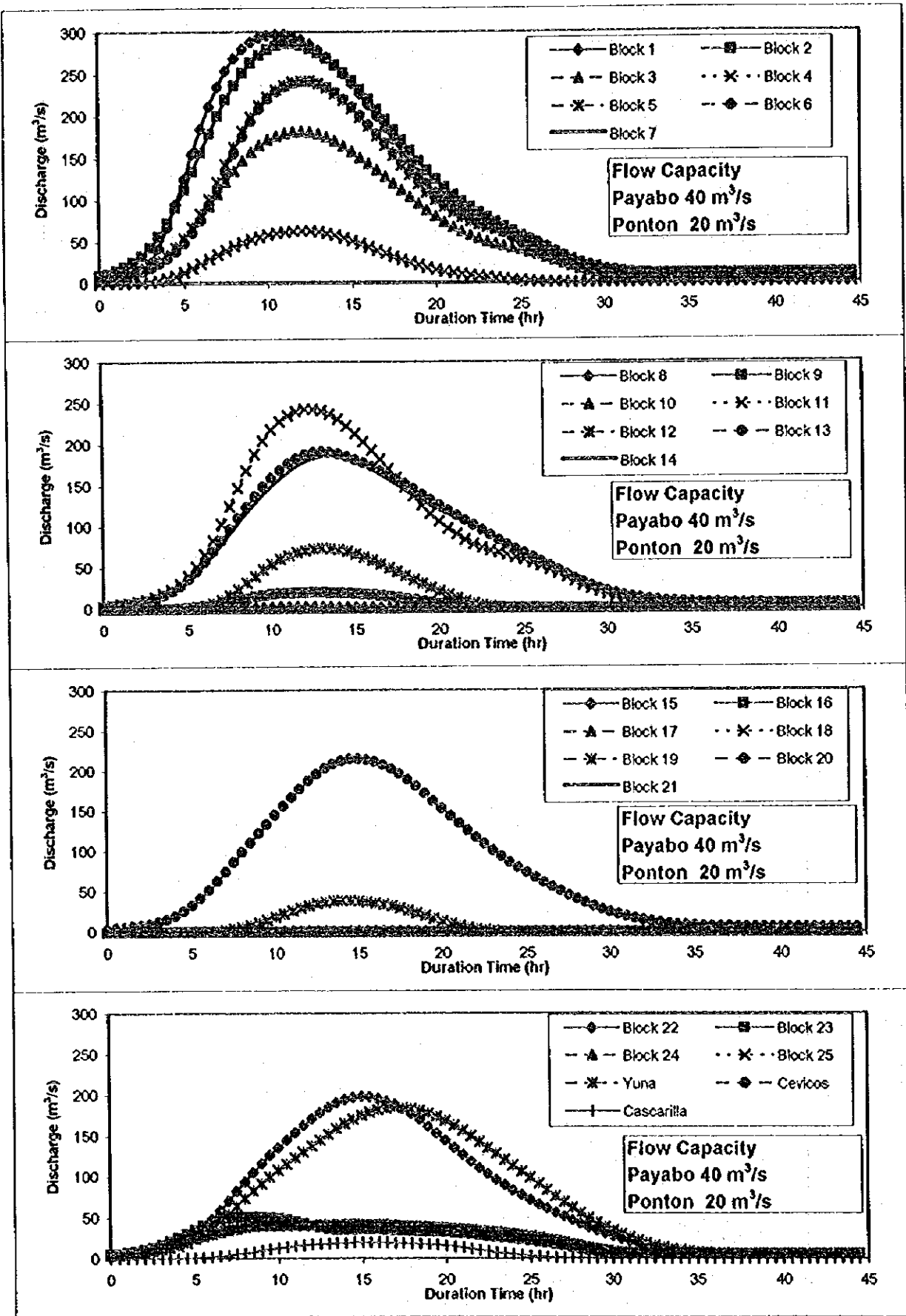


Fig. J.3.B1 Flood Discharge at the Payabo Block with Improved Flow Capacity and By-path to Cascarilla (2/2)

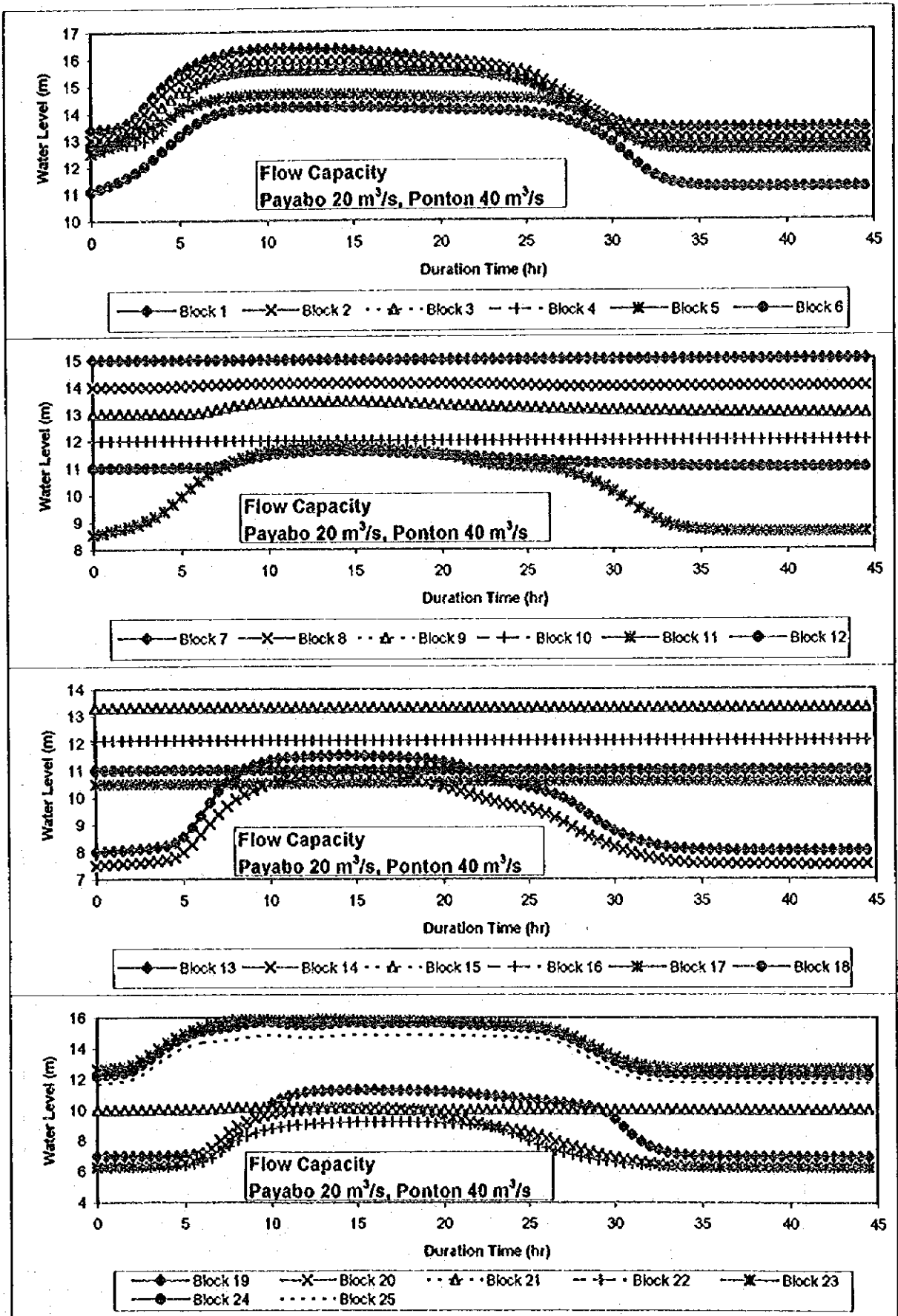


Fig. J.3.B2 Flood Water Level at the Payabo Block with Improved Flow Capacity and By-path to Cascarilla (1/2)

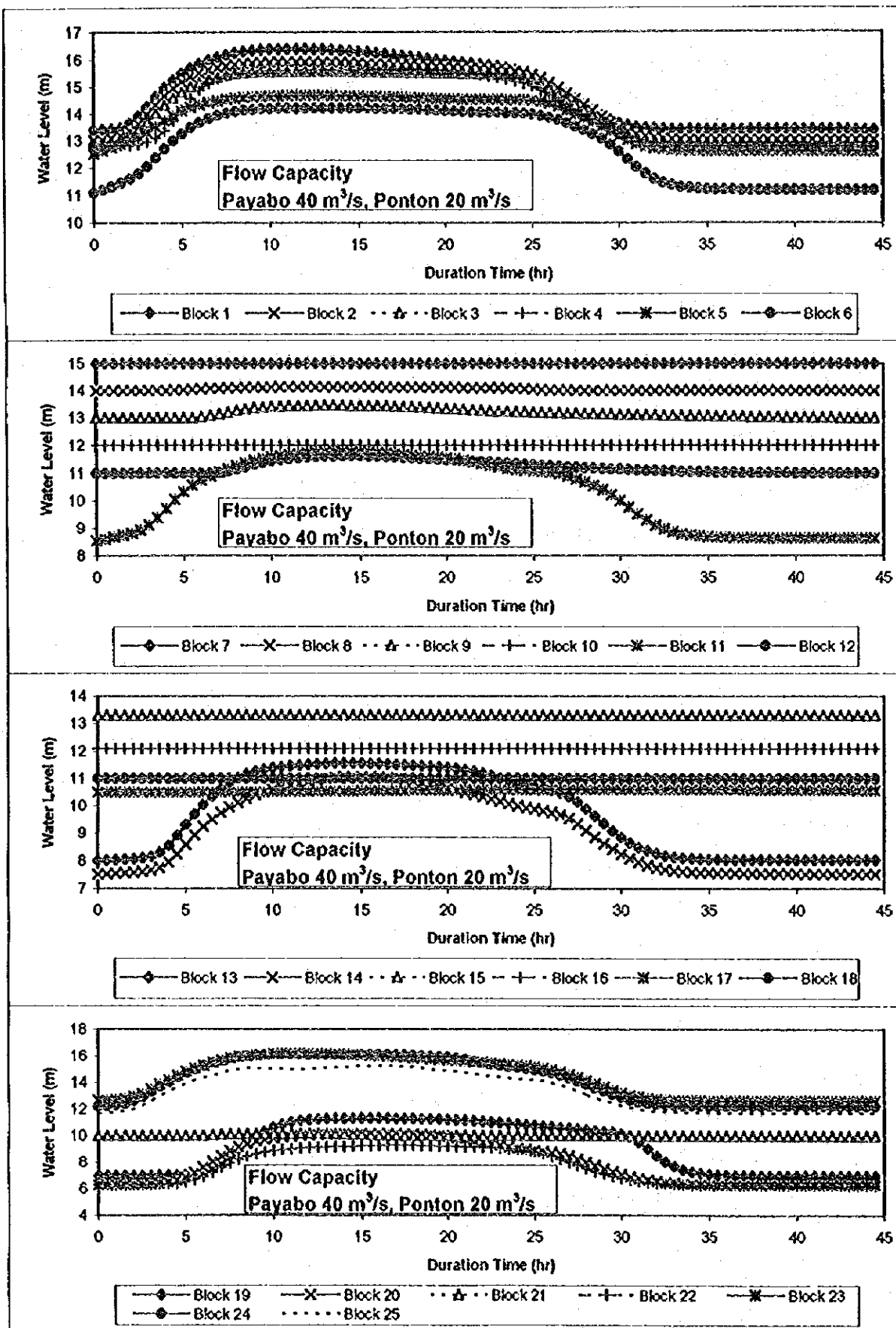


Fig. J.3.B2 Flood Water Level at the Payabo Block with Improved Flow Capacity and By-path to Cascarilla (2/2)

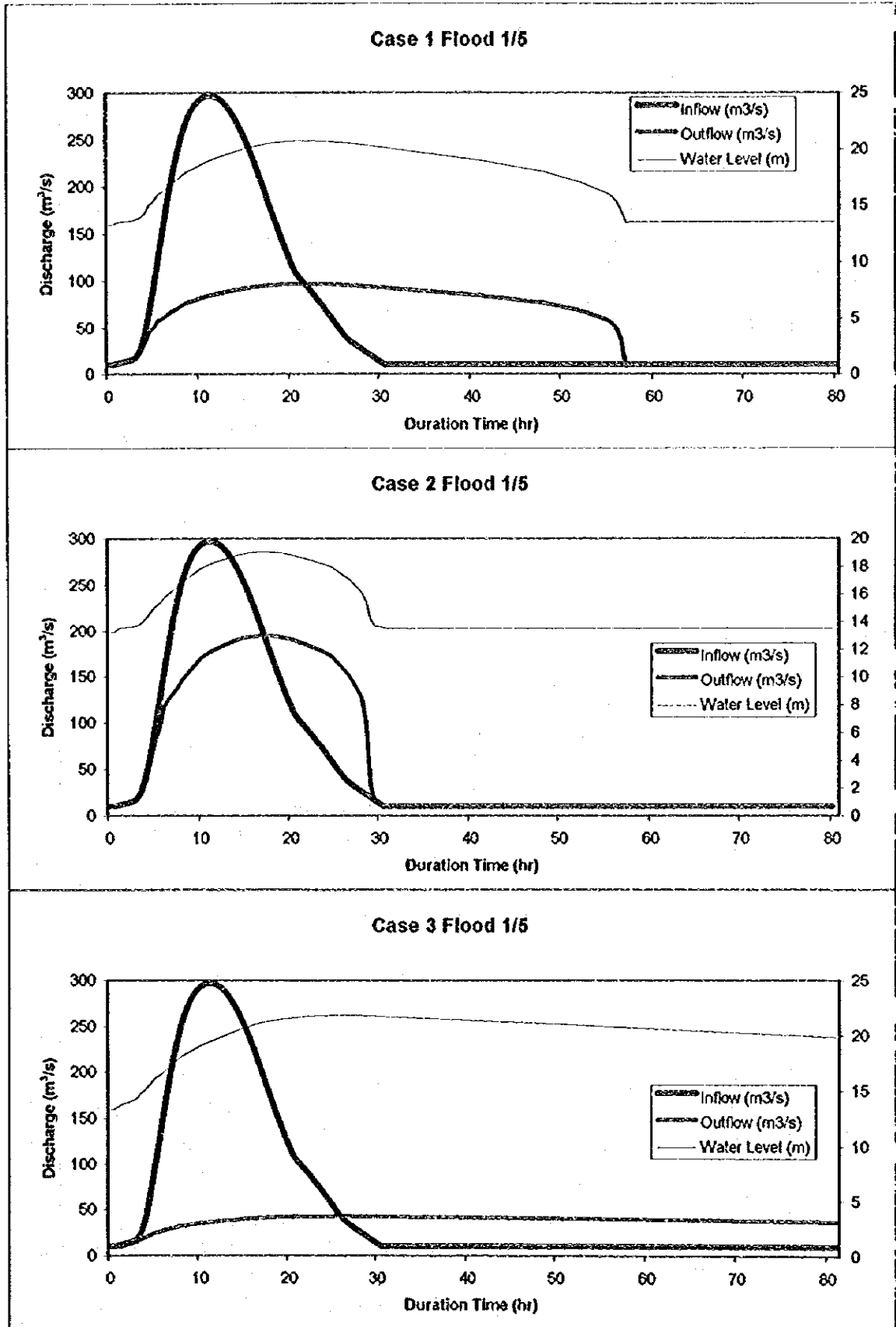


Fig J.3.C0 Water Level and Discharge at the Payabo Reservoir (1/2)

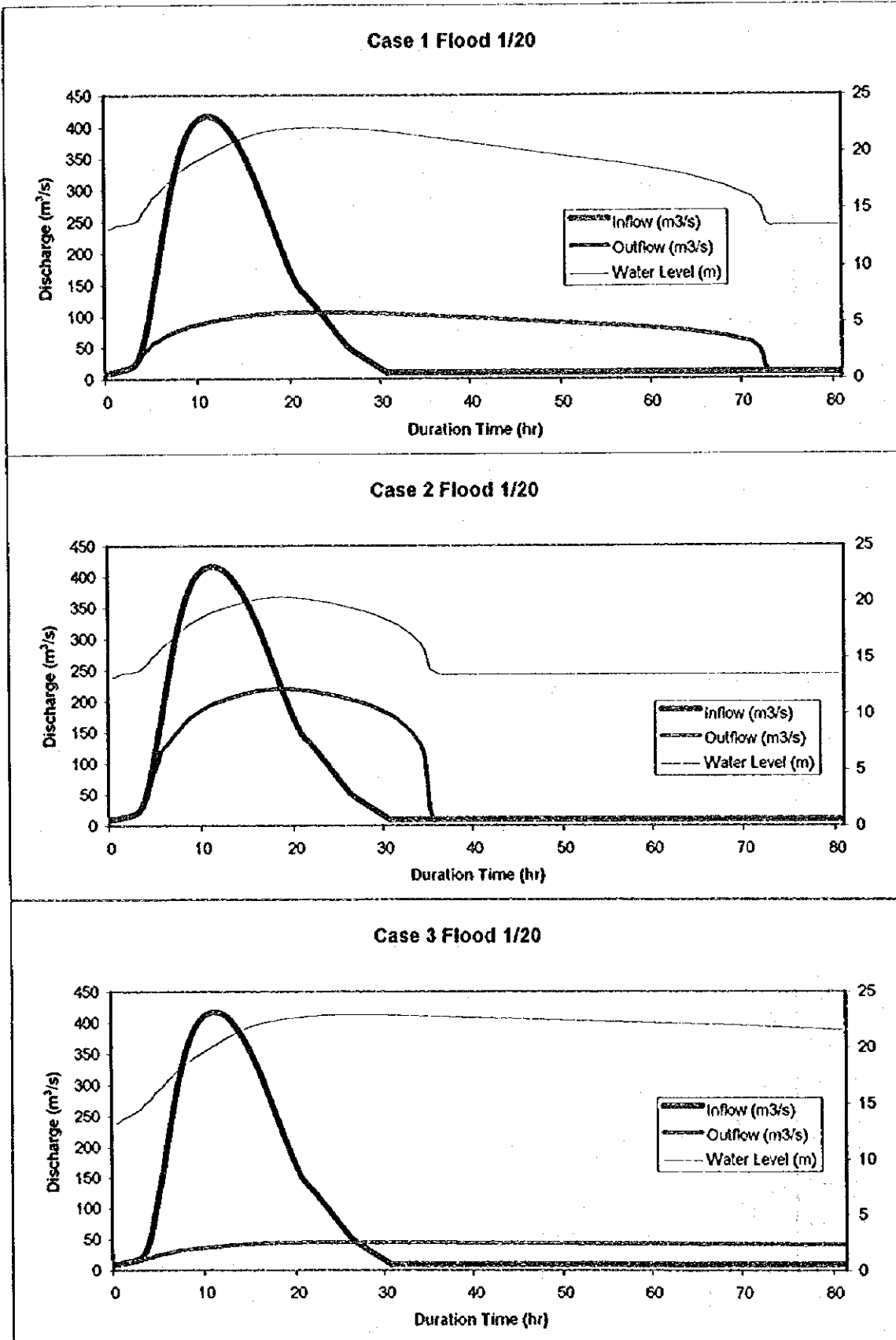


Fig J.3.C0 Water Level and Discharge at the Payabo Reservoir (2/2)

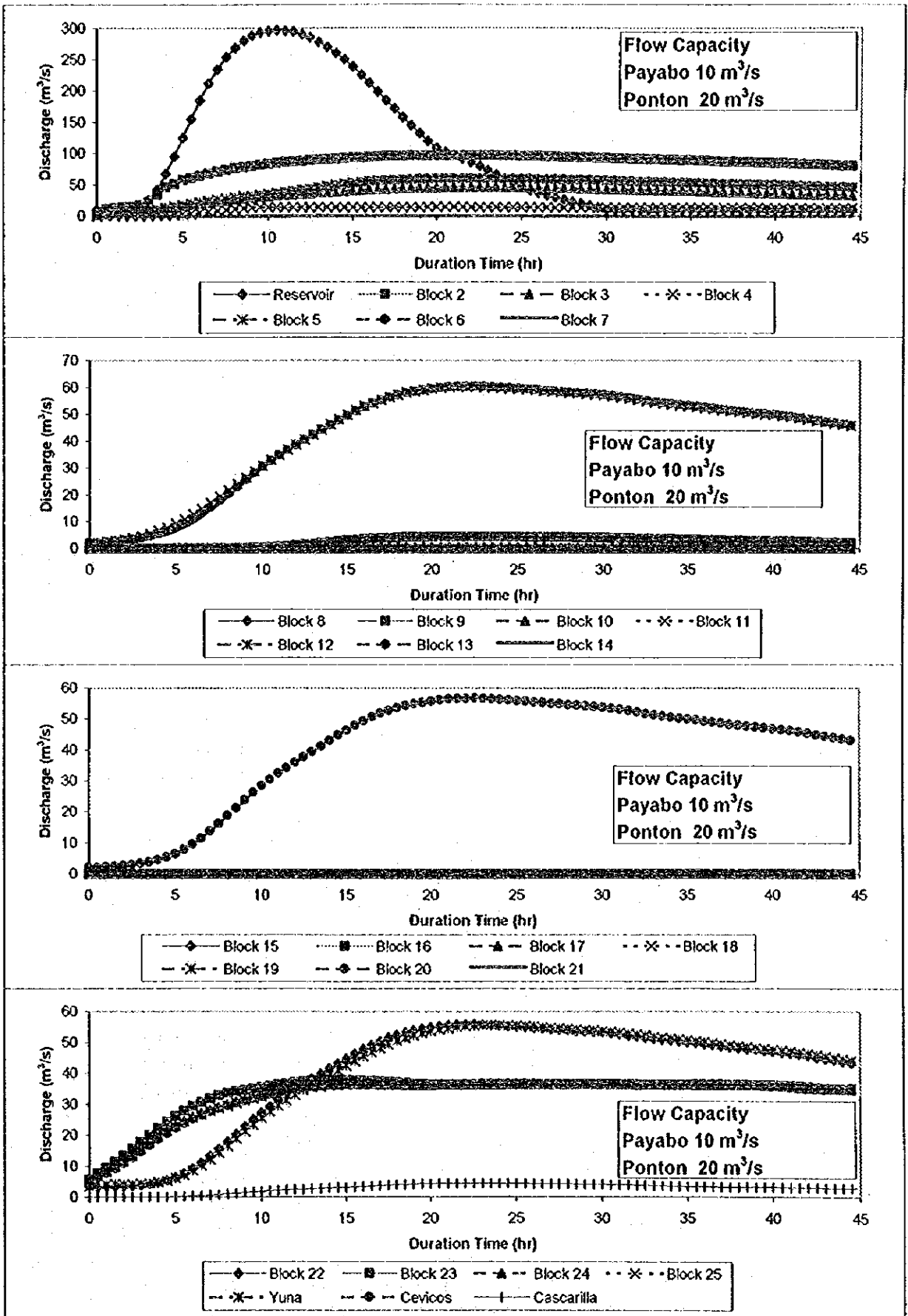


Fig. J.3.C1 Flood Discharge at the Payabo Block with Reservoir (1/3 : case 1)

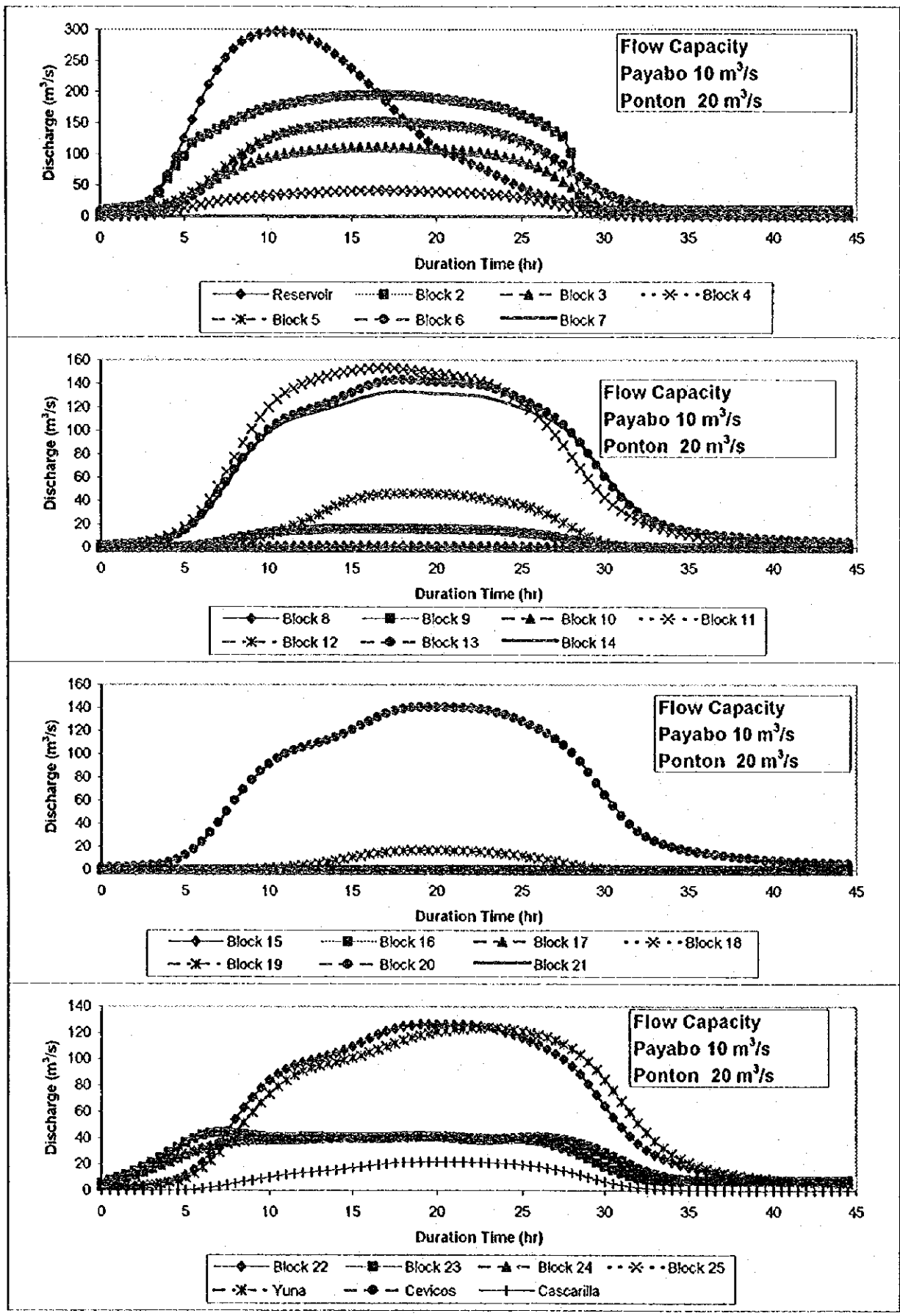


Fig. J.3.C1 Flood Discharge at the Payabo Block with Reservoir (2/3 : case 2)

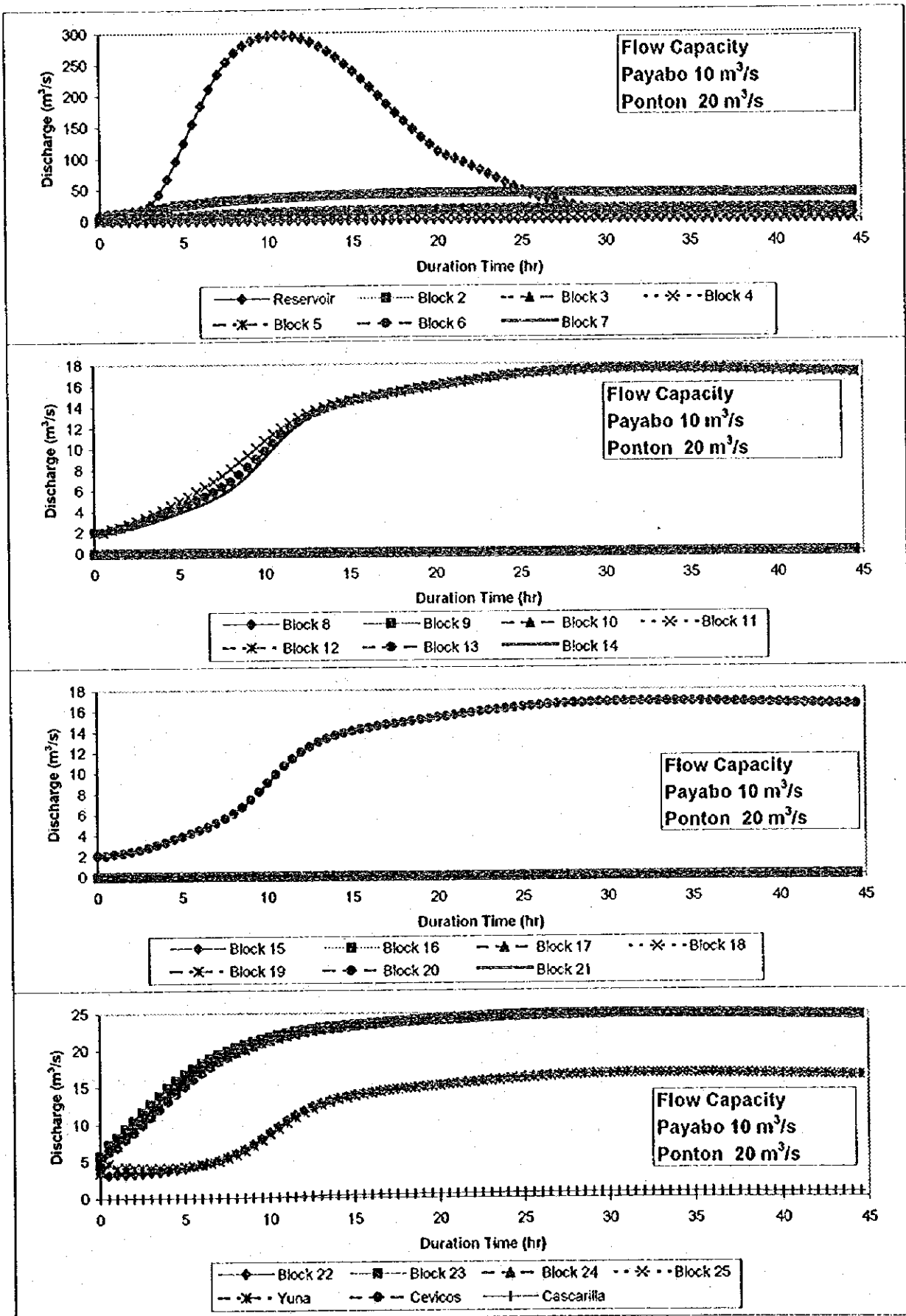


Fig. J.3.C1 Flood Discharge at the Payabo Block with Reservoir (3/3 : case 3)

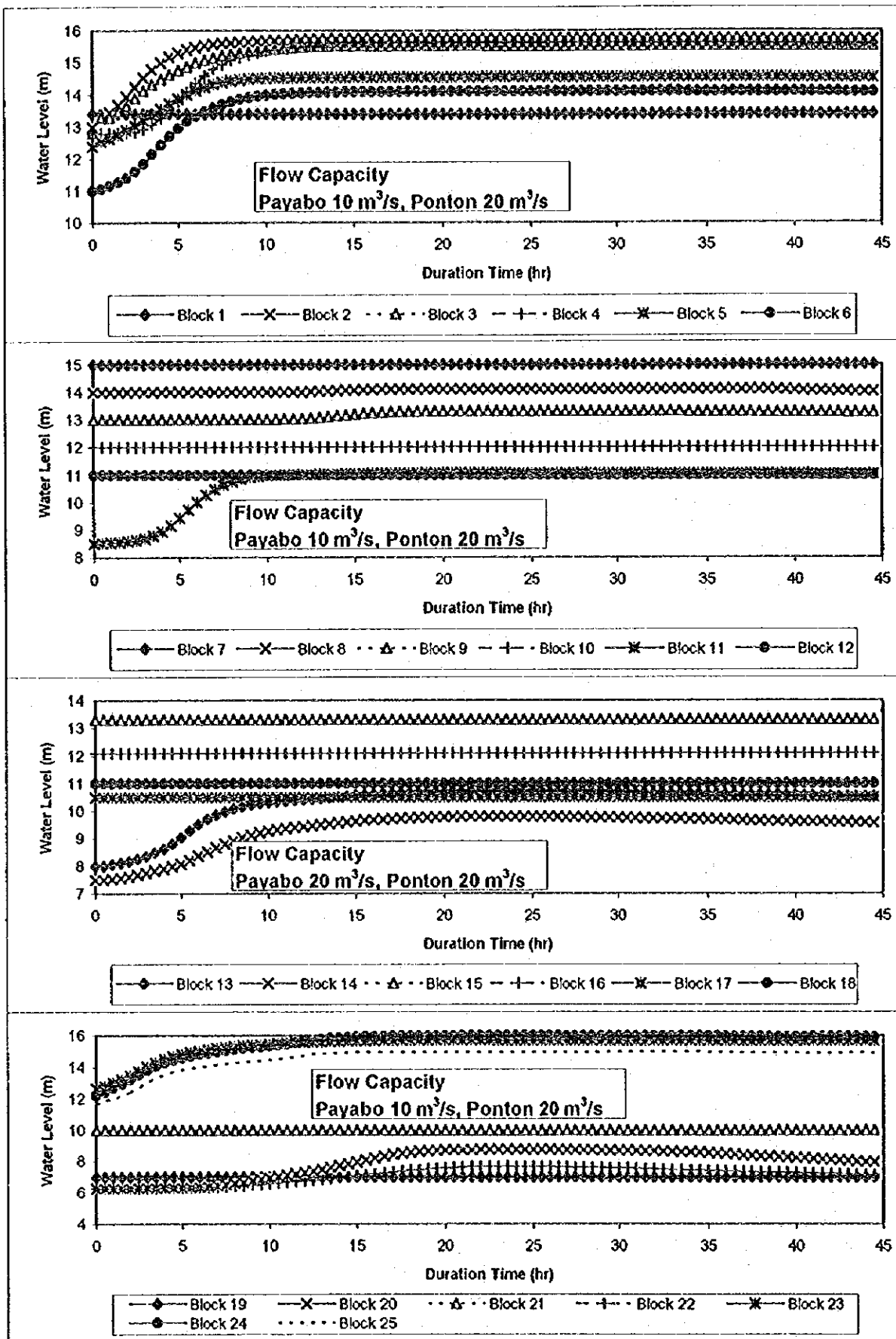


Fig. J.3.C2 Flood Water Level at the Payabo Block with Reservoir (1/3 : case 1)

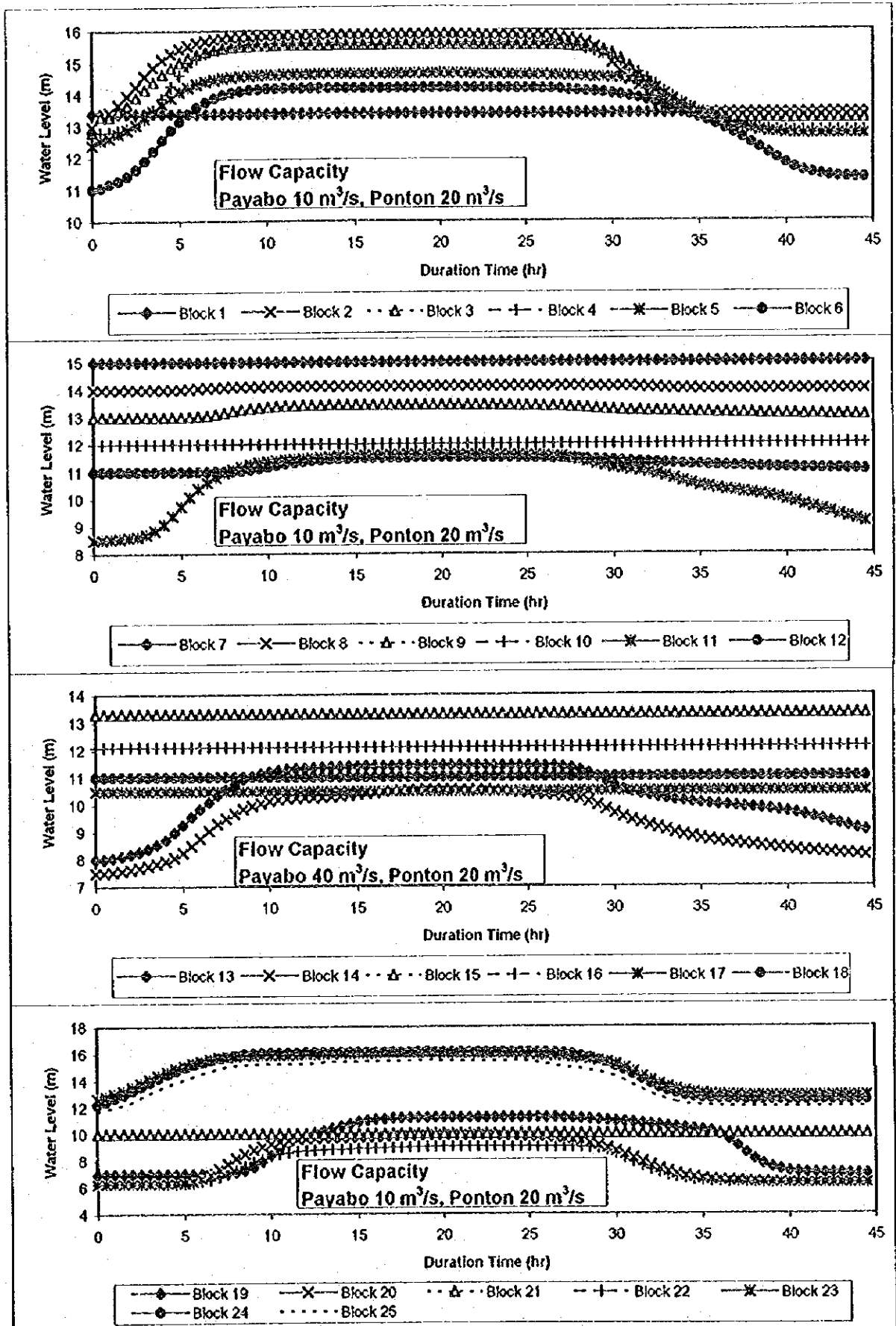


Fig. J.3.C2 Flood Water Level at the Payabo Block with Reservoir (2/3 : case 2)

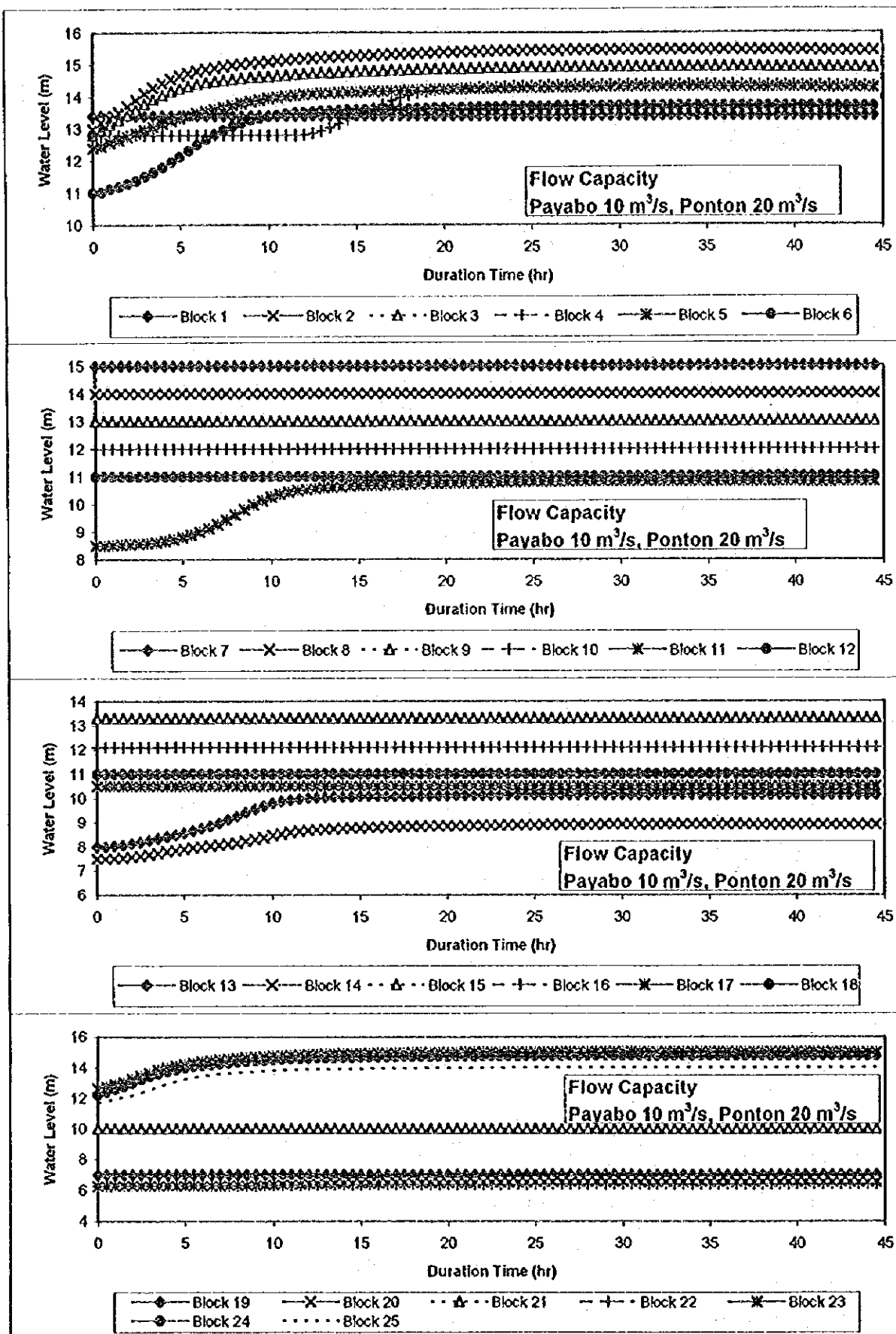


Fig. J.3.C2 Flood Water Level at the Payabo Block with Reservoir (3/3 : case 3)

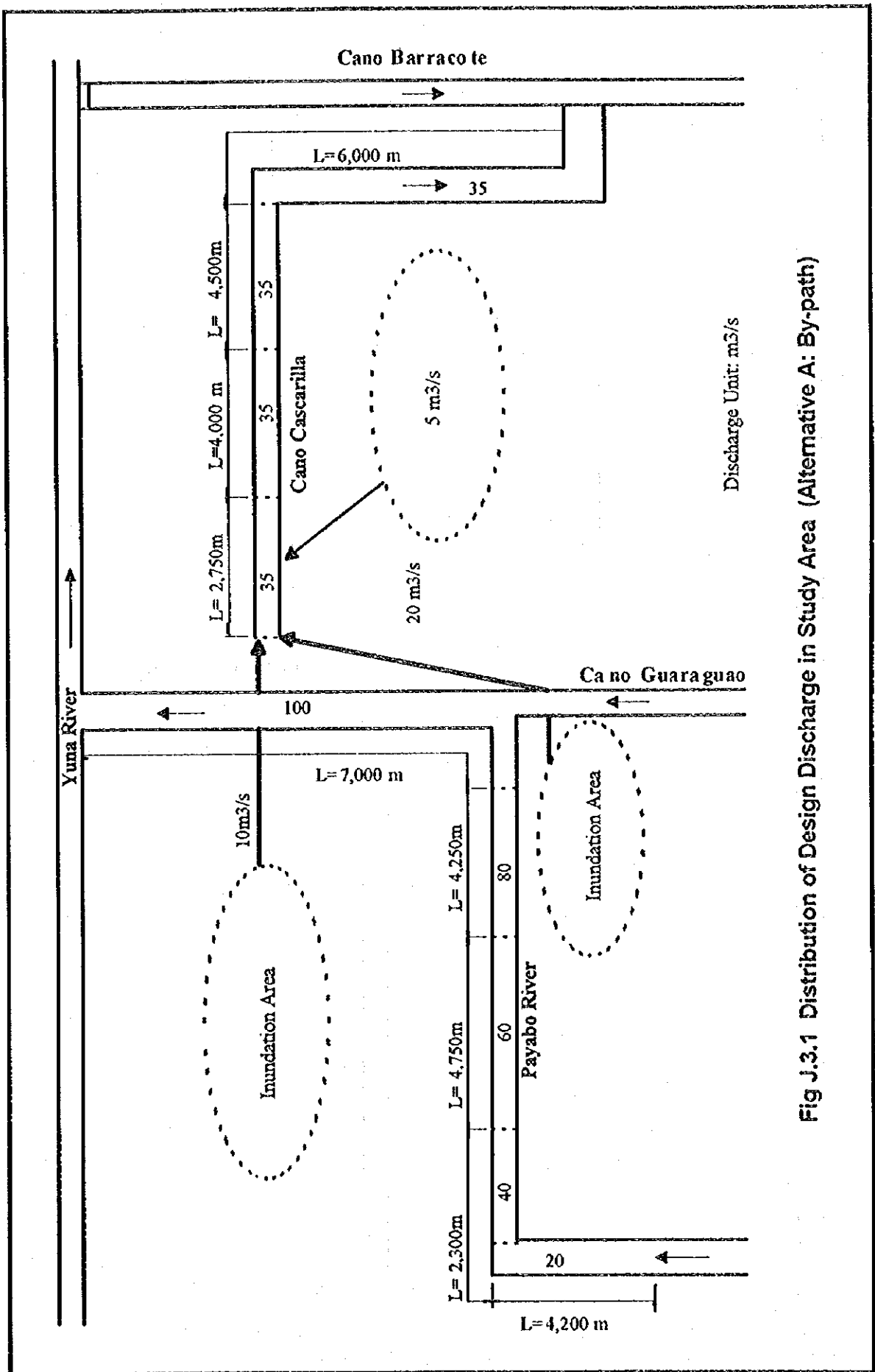


Fig J.3.1 Distribution of Design Discharge in Study Area (Alternative A: By-path)

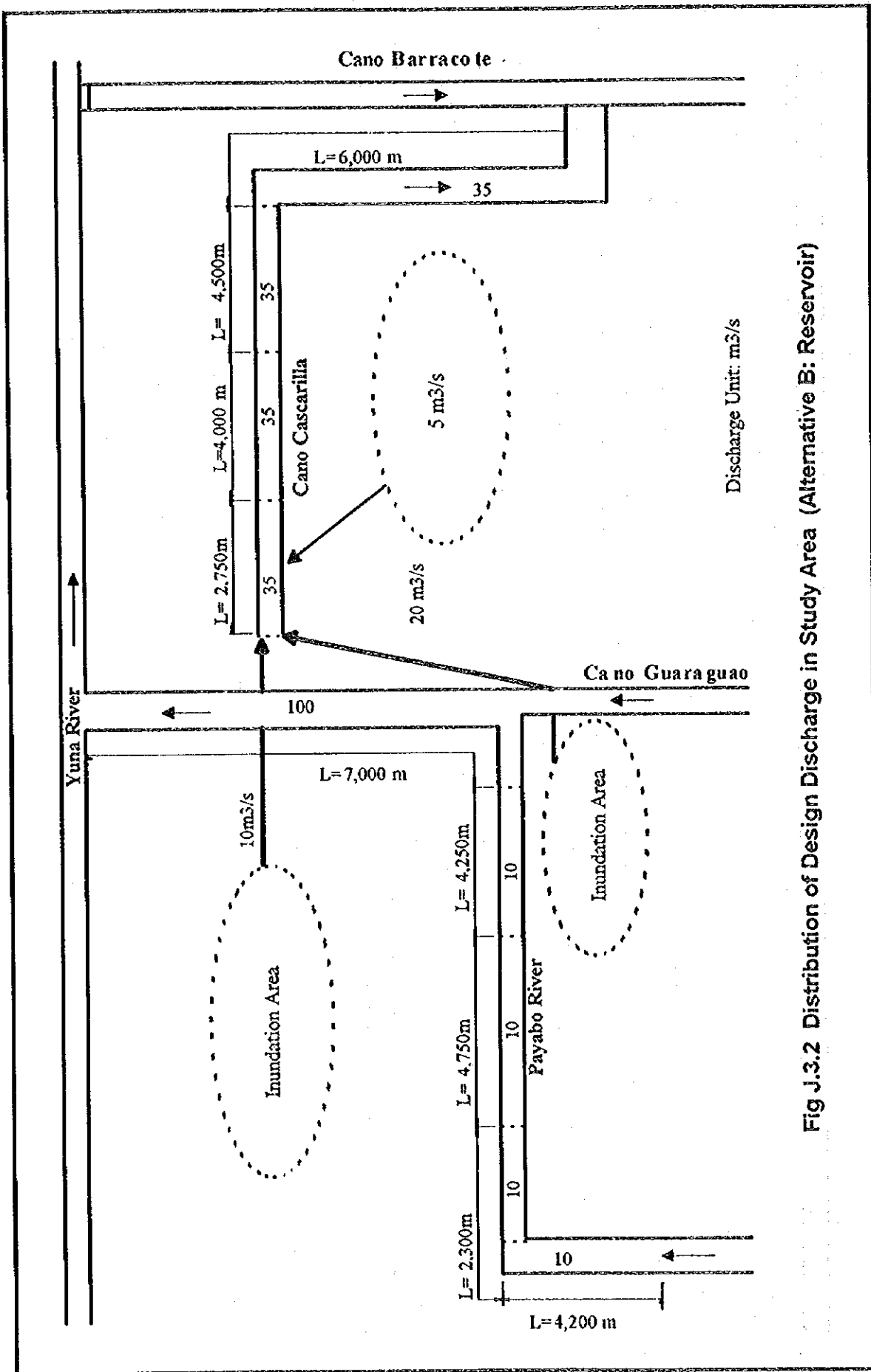


Fig J.3.2 Distribution of Design Discharge in Study Area (Alternative B: Reservoir)

**ANNEX K : DESIGN AND
COST ESTIMATE**

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ANNEX K : DESIGN AND COST ESTIMATE

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ANNEX K : DESIGN AND COST ESTIMATION

K.1 Design

K.1.1 Design Standard

In Dominican Republic, DESIGN OF SMALL CANAL STRUCTURES, which was published by the bureau of reclamation of the united states in 1978, and revised in 1986, is used as design standard of irrigation facilities. It was also useful for the project, because there was no large structures.

K.1.2 Design

Facilities Plan deals with infrastructures necessary for development of:

- 1) Irrigation system;
- 2) Drainage improvement;
- 3) Flood Mitigation measures;

Designed facilities are as follows:

- 1). **Irrigation System**
 - (1) Intake facilities
 - 1) Reservoir
 - 2) Springs
 - a. Improvement of levees
 - c. Construction of spillway (Caño Ponton)
 - 3) Diversion weir
 - a Payabo River (2 sites)
 - b Cascarilla Canal
 - c Cevicos river
 - d Pumping station
 - 3) Tertiary canals
 - 4) Canal network intensity
 - 5) Diversion Works
 - 6) Road intersection works
 - 7) River intersection works (siphon)
 - 8) Intake of return flow
- 2). **Drainage System**
 - (1) Drainage canal
 - 1) Main and secondary canals
 - 2) Tertiary canals
 - 3) Canal network intensity

- (2) Drainage gate
- (3) Wasteway
- (4) Road intersection works
- (5) River intersection works

3). Flood Mitigation Works

- (1) Improvement works of the Payabo river
- (2) Improvement works of the Cascarrilla canal

K.1.3 Alternative Study for the Disaster Prevention Dam on Rio Payabo

1. Purpose

As for the flood control planning on the Project, the Disaster Prevention Dam should be designed comparing with other flood control methods.

2. Dam Site

2.1 Comparison between Upper stream Plan and Down stream Plan

The calculation of water balance study planned two alternative dam locations in upper stream and downstream. The upper stream plan was too costly comparing with the downstream one due to the long dam body length and big flood sluice way size.

2.2 Axis of Dam

The Dam axis shall be placed considering a good response of the counter force from both sides of abutments and an acceptable foundation condition of the Dam base. In order to a flood control planning, the Dam should be planned on an alluvium swamp field near a river mouth of the Rio Payabo at Rio Yuna. The abutments of the Dam are consisted of high quality hard limestone rock that are suitable for dam planning, but 12m soft soil are spread under the Dam foundation. Geological condition for the Dam foundation should be consider as for structural stability.

3. Dam Type

According to the geological condition of the Dam foundation, earth fill type dam is feasible. Materials for the dam body can be obtained from the nearest borrow pits and excavated material from flood sluice way works.

4. Dam Design

4.1 Height of Dam

According to the water balance calculation, proposed high water levels were given. The ground level of the Dam is 16m and cut off basement level after foundation treatment is 11.5m from sea level. 1.4m water depth of flood sluice way were calculated in section 5. And 1.6m freeboard and 0.3m extra banking were given according to the Japanese " Small Dam Standard ".

$$\text{Type A } 22.19 - 11.5 + 1.4 + 1.6 + 0.3 = 13.99\text{m}$$

$$\text{Type B } 20.42 - 11.5 + 1.4 + 1.6 + 0.3 = 12.22\text{m}$$

$$\text{Type C } 22.97 - 11.5 + 1.4 + 1.6 + 0.3 = 14.77\text{m}$$

4.2 Foundation Treatment

The Dam foundation soil is consisted of 12m thickness of alluvium Clay soil on the hard sandy clay soil stratum that can suffer consolidation phenomenon by the Dam body load. The 1.5m thickness top soil should be taken off for the dam foundation treating works and 3m thickness soft clay and loose sand should be cleaned by the center cut off of the Dam. A countermeasure the consolidation phenomenon shall be taken by extra banking on the Dam body.

4.3 Dam Type

Alternative study needs the smallest dam figure and the easiest construction for economical feasibility. The homogeneous embankment type dam with toe drain is recommendable for this study. The material for the Dam body should be chosen as follows:

for dam body : sandy clay or silty clay
for toe drain : sand or gravel
for stone facing : stone

4.4 Slope Gradient

The Dam shapes for each type shall be decided after a careful structural considerations. The upper part slope is 1:3 with stone facing, and lower part slope is 1:2.5.

4.5 Width of Crest

According to the "design of Small Dam" that was prepared by USDR, the width of the crest should be calculated by the following regulation.

$$W > 0.2H + 3.0 \text{ (m)}$$

where, W : width of crest

H : height of Dam

Type A $0.2 \times 13.99 + 3.0 = 5.8\text{m}$

Type B $0.2 \times 12.22 + 3.0 = 5.4\text{m}$

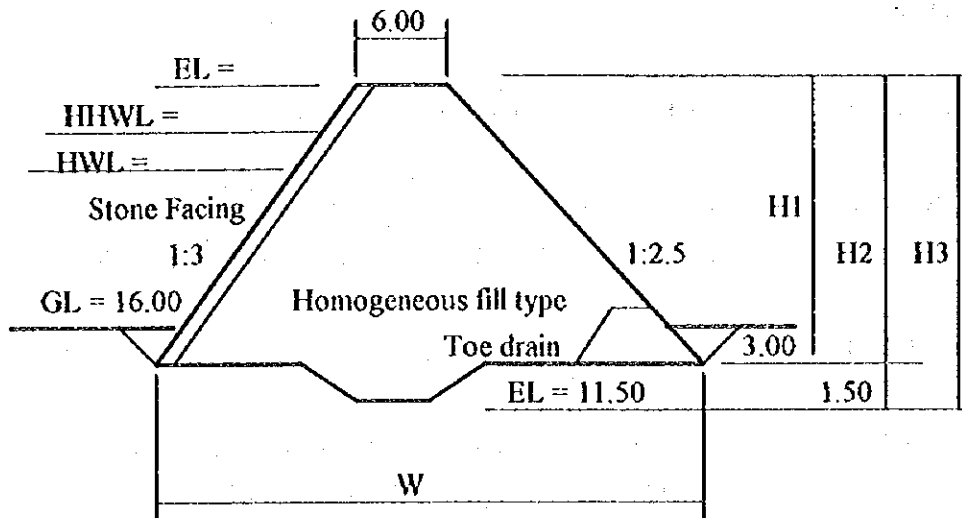
Type C $0.2 \times 14.77 + 3.0 = 6.0\text{m}$

The calculation showed the 6.0m width for crest to be the best choice.

4.6 Typical Cross Section

Typical standard cross section of the Dam is shown below.

Crest Length = 550 m



	Type A	Type B	Type C
EL	25.49	23.42	26.27
HHWL	23.59	21.82	24.37
HWL	22.19	20.42	22.97
W	75.00	65.00	79.00
H1	9.49	7.72	10.27
H2	12.49	10.72	13.27
H3	13.99	12.22	14.77

5. Flood Sluiceway

The Flood Sluice Way should be put on the left abutment of the Dam. By the morphological condition, a canal type overflow chute is suitable. The water balance study showed $546 \text{ m}^3/\text{s}$ as design flood discharge.

5.1 Maximum Allowable Velocity

Concrete lining	$V_{\text{max}} = 4.5 \text{ m/s}$
Soft rock	$V_{\text{max}} = 3.0 \text{ m/s}$

5.2 Canal Depth

For stable flow condition, The Freud number should be kept under 1.2.

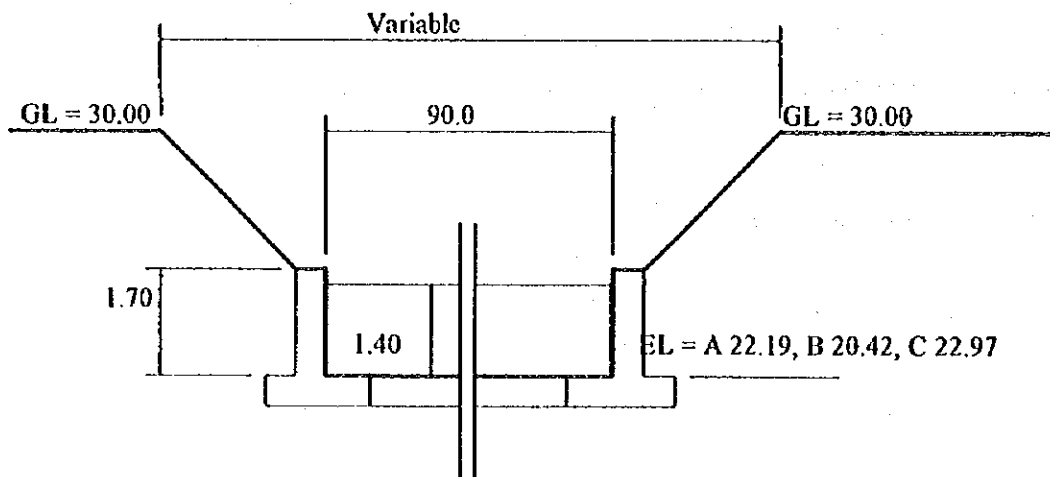
Concrete lining	$Fr. = 1.2 = V / (g h)^{0.5} = 4.5 / (9.8 \times h)^{0.5}$	$h = 1.4 \text{ m}$
Soft rock	$Fr. = 1.2 = V / (g h)^{0.5} = 3.0 / (9.8 \times h)^{0.5}$	$h = 0.6 \text{ m}$

5.3 Width of Canal

Concrete lining	$q1 = 1.4\text{m} \times 1.0\text{m} \times 4.5\text{m/s} = 6.3 \text{ m}^3/\text{s}$
	$B1 = Q / q1 = 546 / 6.3 = 86.6 \text{ m}$ YES
Soft rock	$q2 = 0.6\text{m} \times 1.0\text{m} \times 3.0\text{m/s} = 1.8 \text{ m}^3/\text{s}$
	$B2 = Q / q2 = 546 / 1.8 = 303.3 \text{ m}$ NO

The specification of the Flood Sluice Way is as below.

Maximum velocity	4.5 m/s
Canal depth	1.4 m
Width of canal	90 m
Canal slope	1/200
Length	300 m



Construction Planning and Quantities

TYPE		Unit	A	B	C
1 Temporally Works					
Construction Road		km	5	5	5
2 Foundation Treatment for Dam					
Excavation	Bulldozer	m ³	123,750	107,250	130,350
Loading	Loader	m ³	123,750	107,250	130,350
Transport	Dumptrack	m ³	123,750	107,250	130,350
Embankment	Spoiled yard	m ³	123,750	107,250	130,350
Dewatering		day	300	300	300
3 Spillway					
Excavation	Backhoe	m ³	6,000	5,200	6,320
Backfill	Bulldozer	m ³	60	52	63
Concrete Works		m ³	300	260	316
4 Dam					
Excavation	Power shovel	m ³	278,215	209,308	310,186
Loading	Loader	m ³	278,215	209,308	310,186
Transport	Dumptrack	m ³	278,215	209,308	310,186
Embankment		m ³	278,215	209,308	310,186
5 Flood sluice way					
Excavation	Bulldozer	m ³	229,169	286,193	204,636
Loading	Loader	m ³	229,169	286,193	204,636
Concrete Works		m ³	18,680	18,680	18,680
6 Stone facing					
Transportation	Power shovel	m ³	10,854	9,316	11,532
Stone covering		m ³	10,854	9,316	11,532

K.2 Cost Estimation

K.2.1 Unit Cost

Labor rates and unit cost of the typical construction materials are shown at Table K.1, K.2 and K.3. Major materials necessary for the construction, except special gate and pump, can be procured in the Dominican Republic, as explained below:

(a) Soil :

Soil for the embankment of the road and canal construction can be procured at the borrow pit near the Study area.

(b) Sand and gravel :

Sand and gravel can be procured from the Yuna river at Platanal, where is about 20 km above the boundary of the Study area.

(c) Stone :

It is impossible to get a large amount of stone for gabion or wet masonry lining canal in and around the Study area. However, a small amount of stone can be procured at the Yuna river, where is about 10 km westward of Villa Riva.

(d) Other construction materials :

Construction materials such as cement, reinforcing bar, concrete pipe, concrete pile, timber and so on can be freely procured through the wholesale store, or specialty store or factory.

(e) Construction Equipment :

In Dominican Republic, general construction equipment can be procured through parches or lease.

K.2.2 Quantity of Main Materials

Quantity of the main materials used for the construction is shown as below:

Description	Unit	Quantity			Remarks
		A	B-1	B-2	
Reinforcement Concrete	m3	7,133	7,243	7,181	
Concrete	m3	90,250	98,460	98,091	
Reinforcing Bar	ton	497	515	508	
Gravel Stone	m3	50,242	56,180	55,980	
Embanking Material for Road	m3	990,143	1,080,110	1,045,547	Caliche
Embankment	m3	544,818	534,094	521,107	
Excavation	m3	1,063,590	1,238,671	1,209,194	
Gabion	m3	1,614	1,522	1,522	

K.2.3 Construction Cost

Construction costs of the three alternatives are shown at Table K.4, K.5 and K.6.

K.2.4 Work Schedule

Work schedule is shown at Table K.7. Before beginning the detailed design, two years will be necessary for the Loan arrangement and procurement of consultant. About three years will be necessary for the construction work and at the final stage of it, the operation and maintenance training will be executed for mainly Funta de Regantes.

K.2.5 Consulting Services

Man-months necessary for the consulting services of the detailed design and the construction supervision are shown at Table K.9 and K.10.

K.2.6 Disbursement Schedule

Disbursement schedules of the three alternatives are shown at Table K.11, K.12, and K.13.

K.2.7 Costs of Similar Projects in Dominican Republic

Costs of Similar Projects in Dominican Republic are shown at Table K.13. Number of data is too few to characterize it.

ANNEX K : TABLES

Table K.1 LABOR COST (1/2)

Unit : RDS

Description	Unit	Local Currency	Foreign Currency	Total	Remark
Labor	M/Day	90		90	
Special labor	"	100		100	
Foremen	"	260		260	
Carpenter	"	120		120	
Senior Carpenter	"	230		230	
Form Carpenter	"	230		230	
Head Carpenter	"	270		270	
Senior Mason	"	230		230	
Assistant Mason	"	120		120	
Head Mason	"	270		270	
Reinforcement Welder	"	230		230	
Welder	"	230		230	
Driver (Light Equipment)	"	180		180	
Driver (Heavy Equipment)	"	200		200	
Driver (General)	"	150		150	
Mechanic	"	250		250	
Assistant Mechanic	"	120		120	
Senior Mechanic	"	300		300	
Electrician	"	250		250	
Driller	"	250		250	
Blaster	"	300		300	
Plumber	"	230		230	
Watchman	"	140		140	
Surveyor	"	275		275	
Operator (Mixing Plant)	"	200		200	

Table K.1 LABOR COST (2/2)

Unit : RDS

Description	Unit	Local Currency	Foreign Currency	Total	Remark
Assistant Operator	M/Day	150		150	
Chief of Project Office	M/Month	2,800		2,800	
Irrigation & Drainage Engineer	"	2,300		2,300	
Clark	"	1,440		1,440	
Secretary	"	940		940	
Assistant	"	780		780	
Operator	"	2,340		2,340	
Staff of Office	"	1,250		1,250	
Bill Collector	"	1,500		1,500	
Radio Operator	"	1,010		1,010	
Canal Supervisor	"	940		940	
Pump Operator	"	940		940	
Canal Operator	"	780		780	
Gate Operator	"	780		780	
Dredging Operator	"	1,500		1,500	
Assistant Dredging Operator	"	940		940	
Mechanic (Heavy Machine)	"	2,340		2,340	
Assistant Mec. (Heavy Machine)	"	1,100		1,100	
Mechanic (Light Machine)	"	1,720		1,720	

Table. K.2 MATERIAL COST (1/2)

Unit : RDS

Description	Unit	Local Currency	Foreign Currency	Total	Remark
Cement	ton	1,300.00	-	1,300.00	
Gravel	m ³	200.00	-	200.00	
Crushed Stone	m ³	140.00	-	140.00	
Sand	m ³	190.00	-	190.00	
Boulder(Foundation)	m ³	180.00	-	180.00	
Boulder	m ³	200.00	-	200.00	
Reinforcing Bar	ton	5,600.00	2,400.00	8,000.00	
Deformed Bar	ton	5,600.00	2,400.00	8,000.00	
Wooden Form	m ²				
Steel Wire	kg	8.40	3.60	12.00	
Galvanized Steel Wire	kg	10.50	4.50	15.00	
Nail	kg	12.60	5.40	18.00	
Ply Wood	Sheet	-	660.00	660.00	4' x 8' x 19 mm
Square Lumber	ft ²	-	14.00	14.00	
Gasoline	GL	-	24.00	24.00	
Light Oil (Diesel Oil)	"	-	13.70	13.70	
Lubrication Oil	"	-	35.00	35.00	
Motor Oil	"	-	88.00	88.00	
Concrete Pipe D=10"	m				
" D=12"	"	150.00	-	150.00	
" D=15"	"	200.00	-	200.00	
" D=18"	"	270.00	-	270.00	
" D=21"	"	486.00	54.00	540.00	Reinforced
" D=24"	"	675.00	75.00	750.00	"

Table. K.2 MATERIAL COST (2/2)

Unit : RDS

Description	Unit	Local Currency	Foreign Currency	Total	Remark
Concrete Pipe D=36"	"	1,440.00	160.00	1,600.00	Reinforced
" D=48"	"	1,935.00	215.00	2,150.00	"
" D=60"	"	3,600.00	400.00	4,000.00	"
PC Pile 30*30cm	m	1,800.00	200.00	2,000.00	
" 35*35cm	"	2,070.00	230.00	2,300.00	
Sluice Gate 0.5*0.5m	Unit	2,610.00	290.00	2,900.00	Manual Operated
" 1.0*1.0m	"	7,965.00	885.00	8,850.00	"
" 1.5*1.5m	"	33,300.00	3,700.00	37,000.00	"
" 2.0*2.0m	"	38,700.00	4,300.00	43,000.00	"
" 2.5*2.5m	"	50,400.00	5,600.00	56,000.00	"
" 3.0*3.0m	"	58,500.00	6,500.00	65,000.00	"

Table K.3 UNIT PRICE COST (1/3)

Unit:RDS

No.	Description	Specification	Unit	Local Currency	Foreign Currency	Total	Remarks
101	Bush Cutting	Labor	m ²	0.35	0.11	0.46	
102	Surface soil removing	Bulldozer 21 ton	m ³	0.79	12.99	13.78	
103	Stumping	Bulldozer	ha	143.00	2,357.00	2,500.00	
104	Spreading	Bulldozer 21ton	m ³	0.46	7.46	7.92	
105	Clearing		m ²	0.73	6.25	6.98	
106	Land Clearing		ha	460.00	7,460.00	7,920.00	
107	Excavation	Labor	m ³	42.30		42.30	
108	"	Bulldozer 21ton	m ³	0.90	14.74	15.64	
109	"	Bach hoe 0.6m3	m ³	1.14	10.93	12.07	
110	Backfill	Labor	m ³	36.88	0.00	36.88	
111	"	Bulldozer 21ton	m ³	0.40	6.55	6.95	
112	"	Bach hoe 0.6m3	m ³	0.52	4.98	5.50	
113	Embankment	Labor	m ³	27.16	0.00	27.16	
114	Compaction	Compactor	m ²	3.31	0.00	3.31	
115	Banking	Bulldozer	m ³	0.99	14.11	15.10	
116	Slope Finishing	Labor	m ²	9.25	2.00	11.25	
117	Slope Finishing	Labor	m ²	9.25	2.00	11.25	
118	Removal of Surplus Soil		m3	5.00	25.00	30.00	
201	Reinforcement Concrete	ck= 180 kgf/cm2	m ³	447.77	447.77	895.54	
202	Reinforcing Bar		t	6,734.85	2,491.20	9,226.05	
203	Concrete	ck= 180 kgf/cm2	m ³	399.70	399.70	799.39	
204	Plain Concrete	ck= 120 kgf/cm2	m ³	320.00	320.00	640.00	
205	Concrete Lining		m ³	459.00	459.00	917.99	
206	Wooden Form	Canal Work	m ²	23.79	31.27	55.06	
207	Wooden Form	General Construction	m ²	55.92	37.52	93.44	

Table. K.3 UNIT PRICE COST (2/3)

Unit:RDS

No.	Description	Specification	Unit	Local Currency	Foreign Currency	Total	Remarks
208	Metal Form		m ²				
209	Base Gravel	Labor	m ³			229.08	
210	Sand Bed		m ³			225.40	
301	P.C. Pile	30cm X 30cm	m	1,800.00	200.00	2,000.00	
302	"	35cm X 35cm	m	2,070.00	230.00	2,300.00	
303	Concrete Pipe	D= 24inch	m	373.00	373.00	746.00	
304	"	D= 36inch	m	800.00	800.00	1,600.00	
305	"	D= 10inch	m	65.00	65.00	130.00	
306	Wet Masonry		m ³			116.80	
307	Wire Cylinder		m3	450.00	90.00	540.00	
308	Flap Gate	D=1,000 mm	Unit	10,000.00	62,000.00	72,000.00	
309	"	D=2,000 mm	Unit	10,000.00	440,000.00	450,000.00	
310	Bar Screen		Unit	7,500.00	7,500.00	15,000.00	
311	Sluice Gate (Metal)	0.5m X 0.5m	Unit	1,437.00	1,437.00	2,874.00	Manual Operated
312	"	0.6m X 0.6m	Unit	2,000.00	2,000.00	4,000.00	"
313	"	1.0m X 1.0m	Unit	4,425.00	4,425.00	8,850.00	"
314	"	1.0m X 1.5m	Unit	10,000.00	10,000.00	20,000.00	"
315	"	1.0m X 2.0m	Unit	15,000.00	15,000.00	30,000.00	"
316	"	1.5m X 2.0m	Unit	20,000.00	20,000.00	40,000.00	"
317	"	3.0m X 3.0m	Unit	36,000.00	36,000.00	72,000.00	"
318	Stop Log (Metal)	0.3m X 0.3m	Unit	750.00	750.00	1,500.00	
319	"	0.5m X 0.5m	Unit	1,500.00	1,500.00	3,000.00	
320	"	0.5m X 0.6m	Unit	1,750.00	1,750.00	3,500.00	

Table. K.3 UNIT PRICE COST (3/3)

No.	Description	Specification	Unit	Local Currency	Foreign Currency	Total	Remarks
401	Embankment for Road	Machine	m ³	12.34	76.18	88.52	
402	Farm Land Consolidation	Bulldozer 15 ton	ha	2,820.99	24,180.56	27,001.55	
403	Embankment for Reservoir	Bulldozer 21 ton	m ³	14.81	91.42	106.23	
501	Bulldozer 32ton	CAT D8N	hr	44.91	913.71	958.62	Operation Cost
502	Bulldozer 21ton	CAT D7G	hr	42.04	687.50	729.54	"
503	Bulldozer 15ton	CAT D6D	hr	38.22	443.68	481.90	"
504	Back hoe 0.6m3	CAT320L	hr	38.22	366.05	404.27	"
505	Wheel Loader	CAT 930T	hr	38.22	284.40	322.62	"
506	"	CAT 950F	hr	40.13	503.45	543.58	"
507	Motor Greder	CAT 12G	hr	42.04	463.53	505.57	"
508	"	CAT 120G	hr	38.22	376.66	414.88	"
509	Road Roller	CAT 815B	hr	38.22	711.74	749.96	"
510	"	CAT 825C	hr	40.11	1,023.90	1,064.01	"

Table.K.4 CONSTRUCTION COST (1/3)

Unit:RDS

Description	Unit	Alternative A						Alternative B-1						Alternative B-2					
		Local		Foreign		Total	Qty	Local		Foreign		Total	Qty	Local		Foreign		Total	
		Currency	Qty	Currency	Qty			Currency	Qty	Currency	Qty			Currency	Qty	Currency	Qty		
1.Preparation Works	LS	1	3,274,525	5,729,076	9,003,601	1	3,623,441	7,169,813	10,793,254	1	3,566,486	7,038,061	10,604,547						
2.Water Source Facilities																			
1).Head Works																			
a.Payabo River No.I	Set	1	1,328,983	680,076	2,009,059	1	1,344,371	702,608	2,046,979	1	1,344,371	702,608	2,046,979						
b.Payabo River No.II	"	1	397,784	323,072	720,856	1	402,391	333,776	736,167	1	402,391	333,776	736,167						
c.Cevicos River	"	1	912,158	388,718	1,300,876	1	922,719	401,597	1,324,316	1	922,719	401,597	1,324,316						
d.Canal Cascañilla	"	1	577,111	449,553	1,026,664	1	583,792	464,447	1,048,239	1	583,792	464,447	1,048,239						
2).Intake Works (Spring)																			
a.Cano Ponton	Set	2	351,713	95,772	447,485	2	355,785	98,945	454,730	2	355,785	98,945	454,730						
b.Guaragua	"	2	75,481	50,077	125,558	2	76,355	51,736	128,091	2	76,355	51,736	128,091						
c.La Cueva	"	1	29,531	24,369	53,900	1	29,873	25,176	55,049	1	29,873	25,176	55,049						
d.El Cercado	"	1	130,931	101,760	232,691	1	132,447	105,132	237,579	1	132,447	105,132	237,579						
e.Lagunita Cristal	"	2	75,481	50,077	125,558	2	76,355	51,736	128,091	2	76,355	51,736	128,091						
3).Spring Levee	LS	1	381,362	2,480,776	2,862,138	1	385,778	2,562,968	2,948,746	1	385,778	2,562,968	2,948,746						
4).Spillway (at Cano Ponton)	Set	1	531,236	375,192	906,428	1	537,387	387,623	925,010	1	537,387	387,623	925,010						
5).Reservoir (Guaragua)	LS	1	1,024,581	5,885,396	6,909,977	0	0	0	0	0	0	0	0						
6).Pumping Station																			
a.No.1 Pumping Station	LS	0	0	0	0	1	536,553	6,347,828	6,884,381	1	536,553	6,347,828	6,884,381						
b.No.2 Pumping Station	"	0	0	0	0	1	694,336	8,931,954	9,626,290	1	694,336	8,931,954	9,626,290						
c.No.3 Pumping Station	"	1	190,931	1,253,620	1,444,551	1	193,141	1,295,155	1,488,296	1	193,141	1,295,155	1,488,296						
d.No.4 Pumping Station	"	1	114,471	965,881	1,080,352	1	115,796	997,883	1,113,679	1	115,796	997,883	1,113,679						
e.No.5 Pumping Station	"	1	190,931	1,253,620	1,444,551	1	193,141	1,295,155	1,488,296	1	193,141	1,295,155	1,488,296						
Sub-total			6,312,685	14,377,959	20,690,644		6,580,220	24,053,719	30,633,939		6,580,220	24,053,719	30,633,939						
3.Irrigation Facilities																			
1).Irrigation Canal																			
a.Main Canal	LS	1	45,120,898	41,571,241	86,692,139	1	47,127,693	47,941,037	95,068,730	1	46,928,630	47,743,196	94,671,826						

Table.K.4 CONSTRUCTION COST (2/3)

Description.	Unit	Alternative A						Alternative B-1						Alternative B-2										
		Local		Foreign		Total	Qty	Local		Foreign		Total	Qty	Local		Foreign		Total	Qty	Local		Foreign		Total
		Currency		Currency				Currency		Currency				Currency		Currency				Currency		Currency		
b.Secondary Canal	LS	1	13,603,784	11,808,137	25,411,921	1	15,559,867	14,830,388	30,390,255	1	15,223,102	14,500,763	29,723,865											
c.Tertiary Canal	"	1	2,033,072	89,464	2,122,536	1	2,249,527	98,562	2,348,089	1	2,222,270	98,562	2,320,832											
2).Division Works																								
a.Type-I	Set	59	1,195,306	992,376	2,187,682	74	1,499,197	1,362,743	2,861,940	71	1,438,419	1,307,497	2,745,916											
b.Type-II	"	37	950,906	795,058	1,745,964	41	1,053,706	964,582	2,018,288	41	1,053,706	964,582	2,018,288											
c.Type-III	"	175	782,887	651,335	1,434,222	200	894,728	814,994	1,709,722	189	845,518	770,169	1,615,687											
3).Road Crossing Work	Set	59	1,589,792	1,282,692	2,872,484	67	1,805,357	1,594,790	3,400,147	64	1,724,520	1,523,381	3,247,901											
4).Syphon (River Cross)	Set	1	307,991	188,846	496,837	1	307,991	206,759	514,750	1	307,991	206,759	514,750											
5).Intake Works (for Return Flow)	Set	7	152,076	111,110	263,186	7	152,076	121,650	273,726	7	152,076	121,650	273,726											
Sub-total			65,736,712	57,490,259	123,226,971		70,650,142	67,935,505	138,585,647		69,896,232	67,236,559	137,132,791											
4.Drainage Facilities																								
1).Drainage Canal																								
a.Main Canal	LS	1	1,170,696	2,216,104	3,386,800	1	1,695,773	3,703,673	5,399,446	1	1,405,549	3,045,722	4,451,271											
b.Secondary Canal	"	1	4,641,257	3,829,029	8,470,286	1	5,820,155	6,181,606	12,001,761	1	5,660,222	5,977,857	11,638,079											
c.Tertiary Canal	"	1	6,878,849	4,735,364	11,614,213	1	8,204,989	5,832,057	14,037,046	1	8,032,523	5,733,806	13,766,329											
2).Sluiceway	Set	2	369,674	1,941,179	2,310,853	2	370,212	1,944,142	2,314,354	2	370,212	1,944,142	2,314,354											
2).Outlet Works	Set	8	462,622	846,829	1,309,451	10	579,119	1,060,152	1,639,271	10	579,119	1,060,152	1,639,271											
3).Road Crossing Work	Set	53	1,269,265	1,318,607	2,587,872	59	1,415,012	1,470,124	2,885,136	57	1,367,045	1,420,290	2,787,335											
4).Syphon (River Cross)	Set	1	1,684,452	1,437,708	3,122,160	1	1,686,904	1,439,902	3,126,806	1	1,686,904	1,439,902	3,126,806											
Sub-total			16,476,815	16,324,820	32,801,635		19,772,164	21,631,656	41,403,820		19,101,574	20,621,871	39,723,445											
5.Flood Control Works																								
1).Payabo River	LS	1	1,186,551	14,292,620	15,479,171	1	1,186,551	14,292,620	15,479,171	1	1,186,551	14,292,620	15,479,171											
2).Canal Cascarilla	"	1	592,439	5,941,972	6,534,411	1	592,439	5,941,972	6,534,411	1	592,439	5,941,972	6,534,411											
Sub-total			1,778,990	20,234,592	22,013,582		1,778,990	20,234,592	22,013,582		1,778,990	20,234,592	22,013,582											

Table.K.4 CONSTRUCTION COST (3/3)

Unit:RDS

Description	Unit	Alternative A			Alternative B-1			Alternative B-2					
		Qty	Local Currency	Foreign Currency	Total	Qty	Local Currency	Foreign Currency	Total	Qty	Local Currency	Foreign Currency	Total
6. Road Works													
1). Road													
a. Main Road	LS	1	4,159,554	25,654,221	29,813,775	1	4,196,162	25,882,607	30,078,769	1	4,196,162	25,882,607	30,078,769
b. Farm Road	"	1	7,537,385	46,249,843	53,787,228	1	8,594,529	52,665,094	61,249,623	1	8,167,497	50,113,839	58,281,336
c. Village Road	LS	1	204,864	1,263,328	1,468,192	1	321,264	1,981,128	2,302,392	1	321,264	1,981,128	2,302,392
2). Bridge													
a. Payabo River	Set	1	1,620,459	1,498,669	3,119,128	1	1,620,459	1,498,669	3,119,128	1	1,620,459	1,498,669	3,119,128
b. Canal Cascanilla	"	1	640,397	561,940	1,202,337	1	640,397	561,940	1,202,337	1	640,397	561,940	1,202,337
Sub-total			14,162,659	75,228,001	89,390,660		15,362,811	82,589,438	97,952,249		14,945,779	80,038,183	94,983,962
7. Farm Land Consolidation													
1). Payabo Area	LS	0	0	0	0	1	1,452,284	12,480,796	13,933,080	1	1,452,284	12,480,796	13,933,080
2). Ponton Area	"	0	0	0	0	1	610,700	5,248,300	5,859,000	1	152,872	1,313,768	1,466,640
Sub-total			0	0	0		2,062,984	17,729,096	19,792,080		1,605,156	13,794,564	15,399,720
7. O/M Office	LS	1	1,408,440	1,584,495	2,992,935	1	1,408,440	1,584,495	2,992,935	1	1,408,440	1,584,495	2,992,935
Total			109,150,826	190,969,202	300,120,028		121,239,192	242,928,314	364,167,506		118,882,877	234,602,044	353,484,921

Table. K.5 Work Schedule

Project Year	1st year		2nd year		3rd year		4th year		5th year		6th year		7th year																												
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82
Work Item																																									
Loan Arrangement																																									
Application of Loan																																									
Exchange of Notes between Government																																									
Appraisal Mission																																									
Loan Agreement																																									
Detailed Design Phase																																									
Formalities in Dominican Republic Government																																									
Procurement of Consultants																																									
Detailed Design																																									
Construction Phase																																									
Tendering																																									
Construction																																									
Operation and Maintenance																																									

Table. K.6 Staffing Schedule (Stage I : Detailed Design)

No.	Assignment													M/M				Int. Trp		
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	F	L		T	
1.	Project Director																2		2	3
2.	Team Leader (A)																14		14	1
3.	Irigation Planning Engineer																3		3	1
4.	irigation Engineer (A)																4		4	1
5.	irigation Engineer (B) (Local)																14		14	
6.	Junior Irigation Engineer (A)																3		3	1
7.	Junior Irigation Engineer (B) (Local)																	3	3	
8.	Structure Design Engineer (A)																5		5	1
9.	Structure Design Engineer (B) (Local)																	5	5	
10.	Hydrologist																1		1	1
11.	Soil Mech/Foundation Engineer																5		5	1
12.	Topographic Surveyor(A)																6		6	1
14.	Topographic Surveyor(C) (Local)																	6	6	
16.	Construction Planning Engineer																2		2	1
17.	Mechanical Engineer																1		1	1
18.	O & M Expert																2		2	1
19.	Project Economist																2		2	1
20.	Agronomist																1		1	1
21.	Technical Specification Specialist																2		2	1
22.																				
24.	Total																53	28	81	17

Table. K.7 Staffing Schedule (Stage II : Construction Supervision)

No.	Assignment	1st year												2nd year												3rd year												4th year				M/M		Int								
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42		A	B	Total	Trip				
1.	Project Director																																											2			2	4				
2.	Team Leader																																													37			37	3		
3.	Construction Engineer (A)																																												12			12	1			
4.	Construction Engineer (B)																																												0			0	0			
5.	Construction Engineer (C) (Local)																																														37			37		
6.	Construction Engineer (D) (Local)																																															12			12	
7.	Construction Engineer (E) (Local)																																														0			0	0	
8.	O/M Expert (B)																																													4			4	1		
Total																																															55	49	104	9		

Table K.8 Disbursement Schedule (Alternative A)

Description	1st year		2nd year		3rd year		4th year		5th year		TOTAL			
	F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C	Total	
1. CONSTRUCTION														
Preparatory Works		5,729.0	3,274.0									5,729.0	3,274.0	9,003.0
Road Work		7,522.8	1,416.3	45,136.8	8,497.8	22,568.4	4,248.9	0.0	0.0	75,228.0	14,163.0	75,228.0	14,163.0	89,391.0
Irrigation Works				28,747.2	28,819.6	35,934.0	36,024.5	7,186.8	7,204.9	71,868.0	72,049.0	71,868.0	72,049.0	143,917.0
Drainage Works		3,656.0	1,925.6	21,936.0	10,968.0	5,476.8				36,560.0	18,256.0	36,560.0	18,256.0	54,816.0
O/M Office				1,585.0	1,408.0					1,585.0	1,408.0	1,585.0	1,408.0	2,993.0
Sub-total	0.0	16,907.8	6,515.9	97,405.0	49,679.0	69,470.4	45,750.2	7,186.8	7,204.9	190,970.0	109,150.0	190,970.0	109,150.0	300,120.0
2. INDIRECT COST														
O & M Equipment									18,673.0			18,673.0	0.0	18,673.0
Land Acquisition			1,500.0			1,500.0				500.0		0.0	5,000.0	5,000.0
Consulting Services	18,122.8	3,802.4	4,530.7	950.6	9,061.4	1,901.2	1,901.2	9,061.4	4,530.7	950.6	45,307.0	9,506.0	9,506.0	54,813.0
Administration Cost		1,000.0		1,000.0		1,000.0				1,000.0		0.0	5,000.0	5,000.0
Sub-total	18,122.8	4,802.4	4,530.7	3,450.6	9,061.4	4,401.2	4,401.2	9,061.4	23,203.7	2,450.6	63,980.0	19,506.0	19,506.0	83,486.0
3. PHYSICAL CONTINGENCY														
	1,812.3	480.2	2,143.9	996.7	10,646.6	5,408.0	7,853.2	5,015.1	3,039.1	965.6	25,495.0	12,865.6	12,865.6	38,360.6
4. TOTAL														
	19,935.1	5,282.6	23,582.4	10,963.2	117,113.0	59,488.2	86,385.0	55,166.5	33,429.6	10,621.1	280,445.0	141,521.6	141,521.6	421,966.6
5. PRICE ESCALATION														
			966.9	449.5	9,800.1	4,978.0	11,066.9	7,067.5	5,828.9	1,851.9	27,662.9	14,346.9	14,346.9	42,009.8
6. GRAND TOTAL	19,935.1	5,282.6	24,549.2	11,412.6	126,913.2	64,466.3	97,451.9	62,234.0	39,258.5	12,473.0	308,107.9	155,868.5	155,868.5	463,976.4

Table K.9 Disbursement Schedule (Alternative B-1)

Description	1st year		2nd year		3rd year		4th year		5th year		TOTAL		
	F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C	Total
1. CONSTRUCTION													
Preparatory Works			7,170.0	3,623.0									
Road Work			8,258.9	1,536.3	49,553.4	9,217.8	24,776.7	4,608.9	0.0	0.0	82,589.0	15,363.0	97,952.0
Irrigation Works					36,795.6	30,892.0	45,994.5	38,615.0	9,198.9	7,723.0	91,989.0	77,230.0	169,219.0
Drainage Works			4,186.7	2,155.1	25,120.2	12,930.6	12,560.1	6,465.3			41,867.0	21,551.0	63,418.0
Land Reclamation					3,545.8	412.6	12,410.3	1,444.1	1,772.9	206.3	17,729.0	2,063.0	19,792.0
O/M Office					1,585.0	1,408.0					1,585.0	1,408.0	2,993.0
Sub-total	0.0	0.0	19,615.6	7,314.4	116,600.0	54,861.0	95,741.6	51,133.3	10,971.8	7,929.3	242,929.0	121,238.0	364,167.0
2. INDIRECT COST													
O & M Equipment									18,673.0		18,673.0	0.0	18,673.0
Land Acquisition				1,500.0		1,500.0		1,500.0		500.0	0.0	5,000.0	5,000.0
Consulting Services	18,122.8	3,802.4	4,530.7	950.6	9,061.4	1,901.2	9,061.4	1,901.2	4,530.7	950.6	45,307.0	9,506.0	54,813.0
Administration Cost		1,000.0		1,000.0		1,000.0		1,000.0		1,000.0	0.0	5,000.0	5,000.0
Sub-total	18,122.8	4,802.4	4,530.7	3,450.6	9,061.4	4,401.2	9,061.4	4,401.2	23,203.7	2,450.6	63,980.0	19,506.0	83,486.0
3. PHYSICAL CONTINGENCY													
	1,812.3	480.2	2,414.6	1,076.5	12,566.1	5,926.2	10,480.3	5,553.5	3,417.6	1,038.0	30,690.9	14,074.4	44,765.3
4. TOTAL	19,935.1	5,282.6	26,560.9	11,841.5	138,227.5	65,188.4	115,283.3	61,088.0	37,593.1	11,417.9	337,599.9	154,818.4	492,418.3
5. PRICE ESCALATION													
			1,089.0	485.5	11,567.0	5,455.0	14,769.2	7,826.1	6,554.9	1,990.9	33,980.1	15,757.5	49,737.6
6. GRAND TOTAL	19,935.1	5,282.6	27,649.9	12,327.0	149,794.6	70,643.5	130,052.5	68,914.0	44,147.9	13,408.8	371,580.0	170,575.9	542,155.9

Table. K.10 Disbursement Schedule (Alternative B-2)

Description	1st year		2nd year		3rd year		4th year		5th year		TOTAL		
	F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C	Total
1. CONSTRUCTION													
Preparatory Works			7,038.0	3,566.0							7,038.0	3,566.0	10,604.0
Road Work			8,003.8	1,494.6	48,022.8	8,967.6	24,011.4	4,483.8	0.0	0.0	80,038.0	14,946.0	94,984.0
Irrigation Works					36,516.0	30,590.4	45,645.0	38,238.0	9,129.0	7,647.6	91,290.0	76,476.0	167,766.0
Drainage Works			4,085.7	2,088.1	24,514.2	12,528.6	12,257.1	6,264.3			40,857.0	20,881.0	61,738.0
Land Reclamation					2,759.0	321.0	9,656.5	1,123.5	1,379.5	160.5	13,795.0	1,605.0	15,400.0
O/M Office					1,585.0	1,408.0					1,585.0	1,408.0	2,993.0
Sub-total	0.0	0.0	19,127.5	7,148.7	113,397.0	53,815.6	91,570.0	50,109.6	10,508.5	7,808.1	234,603.0	118,882.0	353,485.0
2. INDIRECT COST													
O & M Equipment									18,673.0		18,673.0	0.0	18,673.0
Land Acquisition				1,500.0		1,500.0		1,500.0		500.0	0.0	5,000.0	5,000.0
Consulting Services	18,122.8	3,802.4	4,530.7	950.6	9,061.4	1,901.2	9,061.4	1,901.2	4,530.7	950.6	45,307.0	9,506.0	54,813.0
Administration Cost		1,000.0		1,000.0		1,000.0		1,000.0		1,000.0	0.0	5,000.0	5,000.0
Sub-total	18,122.8	4,802.4	4,530.7	3,450.6	9,061.4	4,401.2	9,061.4	4,401.2	23,203.7	2,450.6	63,980.0	19,506.0	83,486.0
3. PHYSICAL CONTINGENCY													
	1,812.3	480.2	2,365.8	1,059.9	12,245.8	5,821.7	10,063.1	5,451.1	3,371.2	1,025.9	29,858.3	13,838.8	43,697.1
4. TOTAL													
	19,935.1	5,282.6	26,024.0	11,659.2	134,704.2	64,038.5	110,694.5	59,961.9	37,083.4	11,284.6	328,441.3	152,226.8	480,668.1
5. PRICE ESCALATION													
			1,067.0	478.0	11,272.2	5,358.8	14,181.3	7,681.8	6,466.0	1,967.6	32,986.5	15,486.3	48,472.8
6. GRAND TOTAL	19,935.1	5,282.6	27,091.0	12,137.3	145,976.4	69,397.3	124,875.8	67,643.7	43,549.5	13,252.2	361,427.8	167,713.1	529,140.9

Table. K.11 Cost of Similar Project in Dominican Republic

Construction Period	Fond	Local Cost (RD\$1000)	Foreign Cost (US\$1000)	Benefited Area (ha) (A)	Length of Principal Irrigation Canal (km)	Length of Principal Drainage Canal (km)	Length of Principal Road (km)	Length of Secondary Canals (km)
MAIMON (Provincia de Higüey)								
1989 - 1993	BID	7,147.24	280.85	566.00	2.75	5.00	6.00	2.10
per (A)		1.549	0.496		4.86	8.83	10.60	3.71
Total		(US\$1=RD8.15)	2.046					28.00
SABANA DE NISIBON (El Seybo)								
1989 - 1993	BID	18,636.09	576.26	1,200.00	1.45	22.50	10.65	5.74
per (A)		1.906	0.480		1.21	18.75	8.88	4.78
Total		(US\$1=RD8.15)	2.386					33.62
EL CEDRO (El Seybo)								
1989 - 1993	BID	11,472.59	278.36	943.00	2.60	17.00	4.30	1.30
per (A)		0.973	0.295		2.76	18.03	4.56	1.38
Total		(US\$1=RD8.15)	1.268					26.72
SABANETA Damo Basin Area Irrigation Project								
1987 - 1993	BID	269,831.50	22,926.20	20,680.00	178.50	77.40	175.70	229.50
per (A)		1.488	1.109		8.63	3.74	8.50	11.10
Total		(US\$1=RD8.77)	2.596					31.97
AGLIPO (El Pozo) Agricultural Development Project								
1977 - 1988	OECF	59,000.00	34,066.67	7,500.00	32.00	73.70	257.00	186.00
per (A)		1.449	4.542		4.27	9.83	34.27	24.80
Total		(US\$1=RD5.43)	5.991					73.16
YAQUE DEL NORTE Project								
1986 - 1990	World Bank	150,000.00	56,000.00	14,590.00	35.00	225.00	98.00	538.00
per (A)	BID	5.469	3.838		2.40	15.42	6.72	36.87
Total	Mexico	(US\$1=RD1.83)	9.307					61.41
FIDA III Project								
Panzo - Las Marias System								
1993	FIDA	12,100.00	0.00	970.00	42.00		11.20	
per (A)		0.998	0.000		43.30		11.55	
Total		(US\$1=RD12.5)	0.998					54.85
Cambronal System								
1992	FIDA	12,500.00	125.00	700.00	25.00			
per (A)		1.429	0.179		35.71			
Total		(US\$1=RD12.5)	1.607					35.71
Los Lapitos, Plaza Cacique y La Desubierta System								
1992	FIDA	20,000.00		2,040.00	47.00			
per (A)		0.817	0.000		23.04			
Total		(US\$1=RD12.5)	0.817					23.04