- Long term continuous operation of a pumping station at its full capacity will be difficult due to possible fault in power supply or some mechanical trouble. In case Q_{Ep} = 12 m^3/s, a continuous operation of sixteen months is required, while in case Q_{Ep} = 16 m^3/s it is only five months. Also, in case Q_{Ep} = 14 m^3/s, full capacity operation of up to 10 months a year is required, while in case Q_{Ep} = 16 m^3/s it is only 9 months which can be obtained easier.

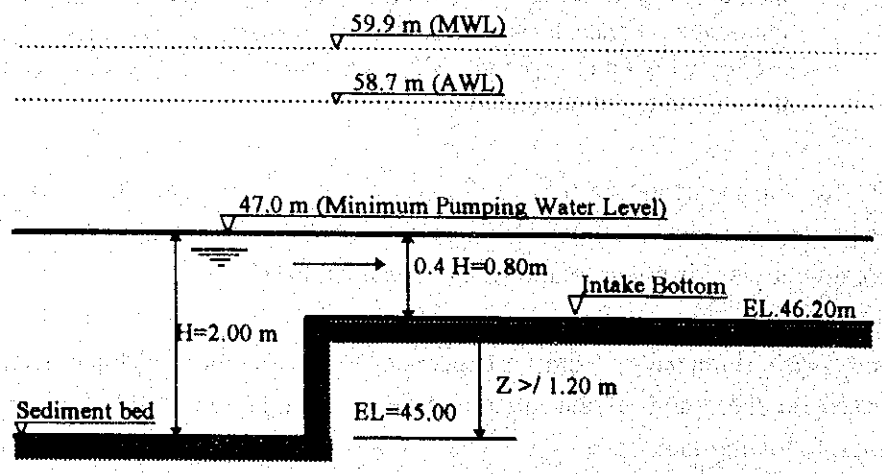
- A larger transbasin capacity will provide the whole transbasin schemes with more flexibility to cope with possible future changes in water demands.

The schematic water balance is shown in Fig. 27 for the proposed transbasin scheme with Q_{Ep} = 16 m^3/s. Proposed transbasin scheme is shown in Fig. 28.

6.4 Pumping Levels

In the next Table it is shown the different levels reached in each reservoir for the selected solution and defined as minimum (LWL), mean (MWL) (50%) and average water level (AWL). Based upon sediment level, elevation 45 m, it is recommended to fix the base elevation of the intake structure at EL. 46.2 m at La Esperanza reservoir in order to avoid sediment from getting into the suction sump and pumping at EL. 47 m, as indicated in the next figure.

Selected Transbasin scheme	Minimum Water Level (m) (LWL)		Mean Water Level (m) (MWL)		Average Water Level (m) (AWL)	
	La Esperanza	Poza Honda	La Esperanza	Poza Honda	La Esperanza	Poza Honda
Irrigation water demand 1/5 years drought and reservoir curves after sedimentation	39.8	88.3	59.9	103.2	58.7	102.2



6.5 Elevations for Coffering

For the purpose of the pumping station construction at La Esperanza reservoir, it is necessary to know the reservoir water levels in order to determine the coffering height. These calculations have been made by routing flood hydrographs through the reservoir with different return period as shown in table below.

Coffering Height at Severino Pumping Station Site

Tr (year)	Initial Elevation at La Esperanza Reservoir (m)	Final Elevation (m)	Minimum Coffering Height (m)
10	37	44.0	7.0
25	37	45.0	8.0
50	37	46.4	9.4
100	37	47.3	10.3
10	40	45.5	5.5
25	40	46.9	6.9
50	40	48.0	8.0
100	40	48.6	8.6
10	45	49.7	4.7
25	45	50.7	5.7
50	45	51.5	6.5
100	45	52.0	7.0
10	50	53.4	3.4
25	50	54.3	4.3
50	50	55.0	5.0
100	50	55.5	5.5

6.6 Conclusions

The main conclusions obtained from the reservoir operation study are the following.

(i) Capacities of the transbasin scheme proposed during the feasibility study have been confirmed and remain the same as follows: Daule-Peripa ~ La Esperanza Transbasin, Q = 18 m^3/s, La Esperanza ~ Poza Honda Transbasin, Q = 16 m^3/s and Poza Honda ~ Mancha Grande Transbasin, Q = 4 m^3/s

(ii) The optimum water level at La Esperanza and Poza Honda reservoir are 63.5 m and 102.5 m, respectively.

(iii) At the pumping station, minimum water level for pumping has been set at EL. 47 m due to the sediments height and the average water level.

Table 1 Maximum and Minimum elevation and volumes during Poza Honda Honda reservoir operation, 1979-1993 (*)

Year	Maximum Elevation (m)	Volume (MCM)	Minimum Elevation (m)	Volume (MCM)
1979	104.57	86.50	93.12	29.00
1980	103.05	78.38	92.97	28.42
1981	107.24	101.32	93.76	32.04
1982	102.85	77.36	95.23	44.15
1983	107.24	101.32	101.78	71.90
1984	107.23	101.27	101.94	72.70
1985	106.82	99.10	96.95	47.75
1986	107.26	101.43	96.95	47.75
1987	107.28	101.54	96.51	45.55
1988	107.12	100.60	96.65	46.25
1989	107.12	100.60	96.38	44.90
1990	105.69	92.55	95.21	39.05
1991	106.87	99.35	94.76	36.80
1992	107.15	100.83	96.00	43.00
1993	107.12	100.66	98.13	53.65

(*) The values from which table was made were gotten from CRM - Poza Honda Operation Department.

Table 2 Water Demand Guarantee. La Esperanza Reservoir Operation

BASIC DATA:			
- Reservoir useful volume	=	364.00	mcm
- Domestic water demand	=	19.90	"
- Irrigation demand	=	276.00	"
- Ecology	=	31.50	(1 m3/s)
- Evaporation loss	=	11.10	"
DEMAND DISCHARGES AND DEFICITS:			
- Annual average demand (potable water + irrigation)	=	9.38	m3/s
- Demand satisfied	=	7.52	"
- Deficit	=	1.86	"
- Ecology	=	1.00	"
- Demand satisfied	=	0.80	"
- Deficit	=	0.20	"
GUARANTEE OF WATER DEMAND:			
- No. of months failure:	=	69	
- No. of months with failures larger than 10% of demand:	=	66	
- Guarantee for the above second case:	=	81.7%	

Table 3 Results of Water Balance Simulation (*)
Irrigation Area: 20,500 ha

A. Maximum discharge diverted: 6 m3/s

Inlet Elevation (m)	Deficit of volume (%)			Time deficit (%)		
	Design case	Dilution case of 1.4	Dilution case of 1.8	Design case	Dilution case of 1.4	Dilution case of 1.8
69.0	10.6	8.5	9.9	13.3	12.0	13.7
67.0	9.5	7.4	9.6	12.5	10.8	13.3
66.0	8.9	6.8	9.0	11.7	10.8	13.3

B. Maximum discharge diverted: 12 m3/s

Inlet Elevation (m)	Deficit of volume (%)			Time deficit (%)		
	Design case	Dilution case of 1.4	Dilution case of 1.8	Design case	Dilution case of 1.4	Dilution case of 1.8
69.0	5.2	2.5	3.9	7.9	3.8	5.8
67.0	3.3	0.1	3.9	5.0	0.8	5.8
66.0	2.6	0.0	3.3	4.2	0.0	5.0

(*) Taken from Ecuadorian-Brazilian Consortium (1988)

Table 4 La Esperanza Reservoir Operation. Historic Total Simulation (1963-1982) (*)

- Reservoir average volume	%	84.00
- Reservoir average volume	mcm	330.02
- Discharge in the reservoir	mcm	6,891.00
- Diverted discharge	mcm	5,411.00
- Reservoir loss	mcm	-293.00
- Domestic water demand	mcm	205.00
- Irrigation water demand	mcm	8,676.00
- Reservoir overflow	mcm	3,755.00
- Irrigation deficit	mcm	-28.00
- Deficit/Irrigation water demand	%	0.32
- Deficits in percentage	%	0.83

(*) Volumes and Demands in million of cubic meters are accumulated during 1963-1982

Table 5 Summary of Results obtained for La Esperanza Dam Water Balance. Diverted discharge, 18 m3/s (*)

Year	Municipal Water Demand (m3/s)		Area to be irrigated (ha)		Deficit in Volume (%)	Deficit (%)
	Carrizal Valley	Portoviejo Valley	Carrizal Valley	Portoviejo Valley		
1992	0.14	1.28	10,300	12,700	0.00	0.00
1993	0.15	1.45	17,600	16,300	0.30	0.83
1995	0.18	1.84	20,500	17,000	3.40	3.75
1996	0.19	1.91	20,500	17,000	7.09	7.02
2005	0.25	2.80	20,500	17,000	7.88	9.17
2006	0.26	2.92	20,500	17,000	9.16	9.58
2010	0.29	3.46	20,500	17,000	9.91	10.42
2015	0.33	4.29	20,500	17,000	10.11	11.25

(*) Taken from Consortium Ecuatoriano-Brasileño (1988)

Table 6 Discharge curve of intake works transbasin from Daule-Peripa dam to La Esperanza dam

Elevation (masl)	Discharge (m3/s)
66.60	0.00
68.50	6.70
69.50	8.70
70.50	10.70
71.50	12.00
72.50	13.40
73.50	14.60
74.50	15.75
75.50	16.90
76.50	17.87
76.60	18.00
77.50	18.80
79.50	19.90
80.50	20.30
81.50	21.00
82.50	21.60
83.50	22.10
84.20	25.77
85.00	23.10

Table 7 Summary of deficit of Daule-Peripa reservoir for each serie

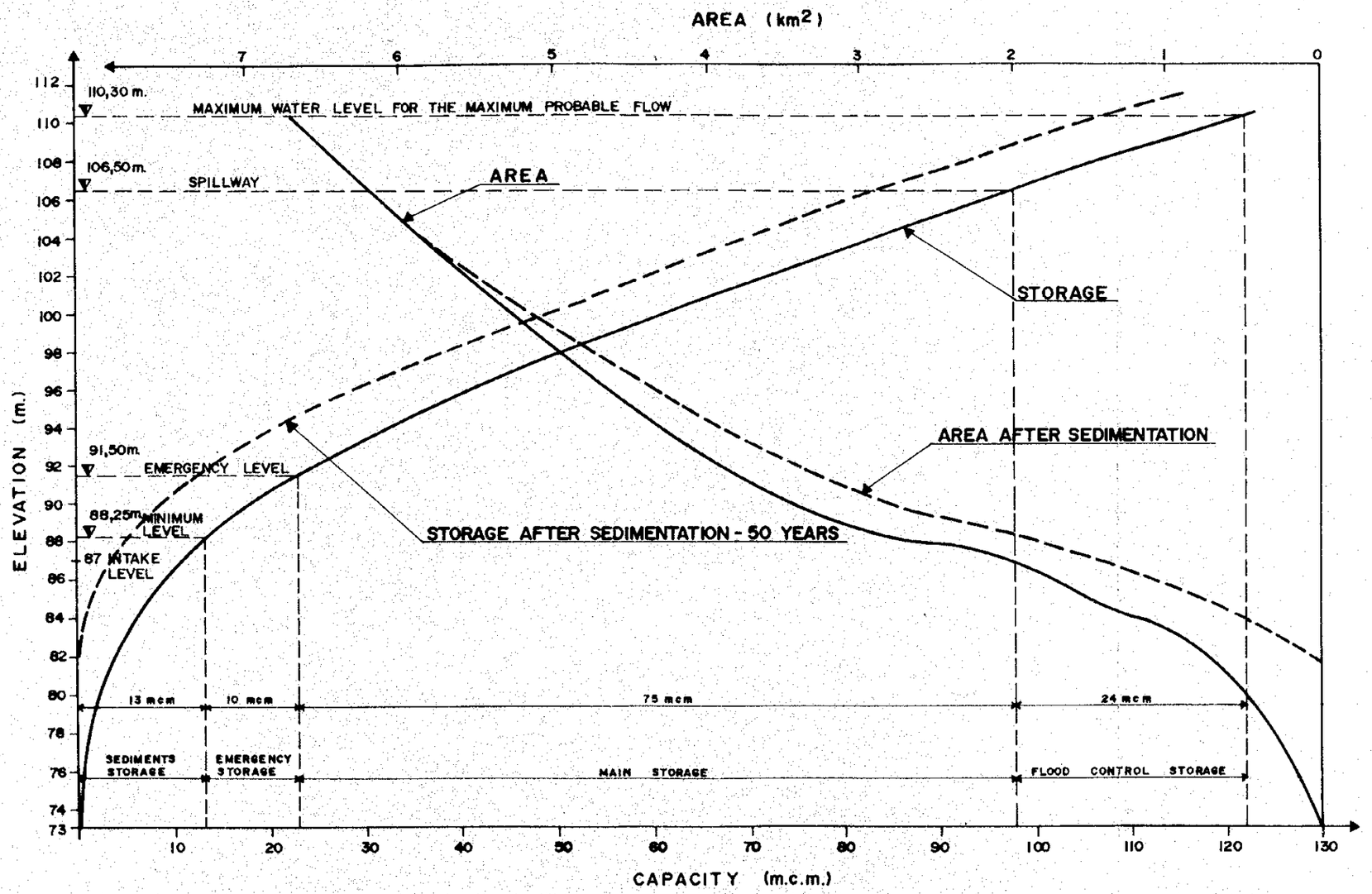
Serie No.	DEFICIT											
	Energy		Potable Water		Irrigation		Manabi Transbasin		Macul Transbasin		S.Elena Transbasin	
	No. month	%	No. month	%	No. month	%	No. month	%	No. month	%	No. month	%
1	0.00	0.00	0.00	0.00	0.00	0.00	4.00	1.11	0.00	0.00	0.00	0.00
2	9.00	2.50	0.00	0.00	0.00	0.00	45.00	12.50	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	9.00	2.50	0.00	0.00	0.00	0.00
4	7.00	1.94	0.00	0.00	1.00	0.28	27.00	7.50	1.00	0.28	1.00	0.28
5	0.00	0.00	0.00	0.00	0.00	0.00	22.00	6.11	0.00	0.00	0.00	0.00
6	9.00	2.50	0.00	0.00	1.00	0.28	48.00	13.33	1.00	0.28	1.00	0.28
7	5.00	1.39	0.00	0.00	0.00	0.00	39.00	10.83	0.00	0.00	0.00	0.00
8	4.00	1.11	0.00	0.00	0.00	0.00	41.00	11.39	0.00	0.00	0.00	0.00
9	22.00	6.11	3.00	0.83	6.00	1.67	45.00	12.50	6.00	1.67	6.00	1.67
10	4.00	1.11	0.00	0.00	0.00	0.00	30.00	8.33	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	14.00	3.89	0.00	0.00	0.00	0.00
12	4.00	1.11	0.00	0.00	0.00	0.00	64.00	17.78	0.00	0.00	0.00	0.00
13	10.00	2.78	0.00	0.00	0.00	0.00	44.00	12.22	0.00	0.00	0.00	0.00
14	13.00	3.61	0.00	0.00	0.00	0.00	47.00	13.06	0.00	0.00	0.00	0.00
15	5.00	1.39	0.00	0.00	0.00	0.00	44.00	12.22	0.00	0.00	0.00	0.00
16	5.00	1.39	0.00	0.00	0.00	0.00	29.00	8.06	0.00	0.00	0.00	0.00
17	11.00	3.06	0.00	0.00	0.00	0.00	57.00	15.83	0.00	0.00	0.00	0.00
18	2.00	0.56	0.00	0.00	0.00	0.00	34.00	9.44	0.00	0.00	0.00	0.00
19	7.00	1.94	0.00	0.00	0.00	0.00	41.00	11.39	0.00	0.00	0.00	0.00
20	5.00	1.39	0.00	0.00	0.00	0.00	33.00	9.17	0.00	0.00	0.00	0.00
21	4.00	1.11	0.00	0.00	0.00	0.00	52.00	14.44	0.00	0.00	0.00	0.00
22	3.00	0.83	0.00	0.00	0.00	0.00	30.00	8.33	0.00	0.00	0.00	0.00
23	7.00	1.94	0.00	0.00	0.00	0.00	45.00	12.50	0.00	0.00	0.00	0.00
24	3.00	0.83	0.00	0.00	0.00	0.00	32.00	8.89	0.00	0.00	0.00	0.00
25	22.00	6.11	4.00	1.11	5.00	1.39	45.00	12.50	7.00	1.94	7.00	1.94
26	0.00	0.00	0.00	0.00	0.00	0.00	10.00	2.78	0.00	0.00	0.00	0.00
27	14.00	3.89	2.00	0.56	3.00	0.83	42.00	11.67	4.00	1.11	4.00	1.11
28	0.00	0.00	0.00	0.00	0.00	0.00	17.00	4.72	0.00	0.00	0.00	0.00
29	2.00	0.56	0.00	0.00	0.00	0.00	40.00	11.11	0.00	0.00	0.00	0.00
30	8.00	2.22	0.00	0.00	0.00	0.00	34.00	9.44	0.00	0.00	0.00	0.00
Average	6.17	1.71	0.30	0.08	0.53	0.15	35.47	9.85	0.63	0.18	0.63	0.18

Table 8 Derivated Flow

	Flow m3/s				Average Volume to be derivated (mcm)	Adjusted Average Volume (mcm)	Derivated Flow (m3/s)
	Year 706	Year 707	Year 708	Average			
January	13.80	15.10	18.00	15.63	41.90	29.40	11.00
February	12.60	16.40	18.00	15.67	37.90	25.50	10.50
March	7.90	18.00	18.00	14.63	39.20	26.70	10.00
April	9.00	18.00	18.00	15.00	38.90	38.90	15.00
May	18.00	18.00	18.00	18.00	48.20	48.20	18.00
June	18.00	18.00	18.00	18.00	46.60	46.60	18.00
July	18.00	18.00	18.00	18.00	48.20	48.20	18.00
August	18.00	18.00	18.00	18.00	48.20	48.20	18.00
September	18.00	18.00	18.00	18.00	46.60	46.60	18.00
October	18.00	18.00	18.00	18.00	48.20	48.20	18.00
November	18.00	18.00	18.00	18.00	46.60	46.60	18.00
December	16.60	18.00	18.00	17.53	46.90	46.90	17.50
Total					537.40	500.00	

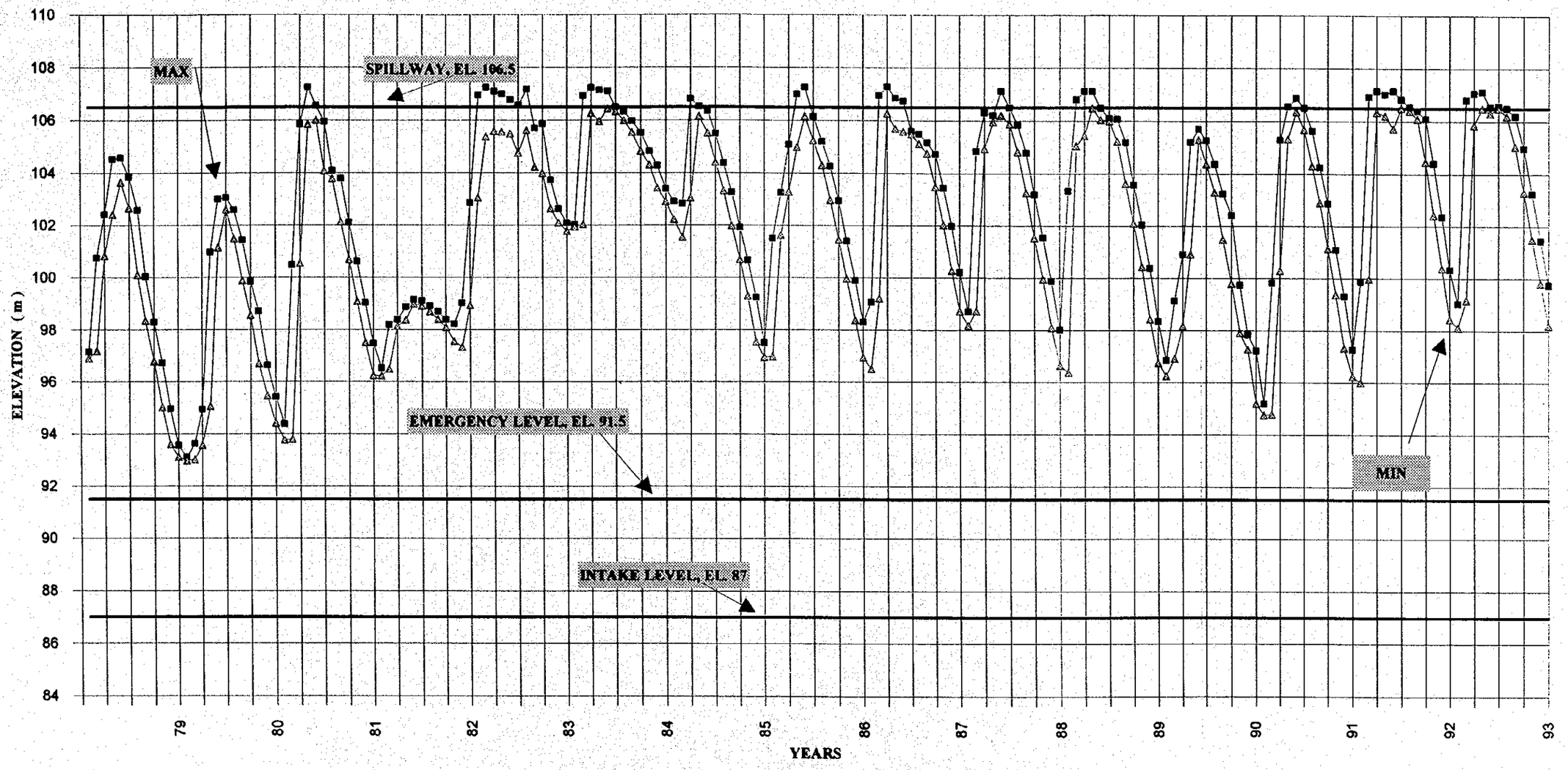
FIGURES

FIGURE 1



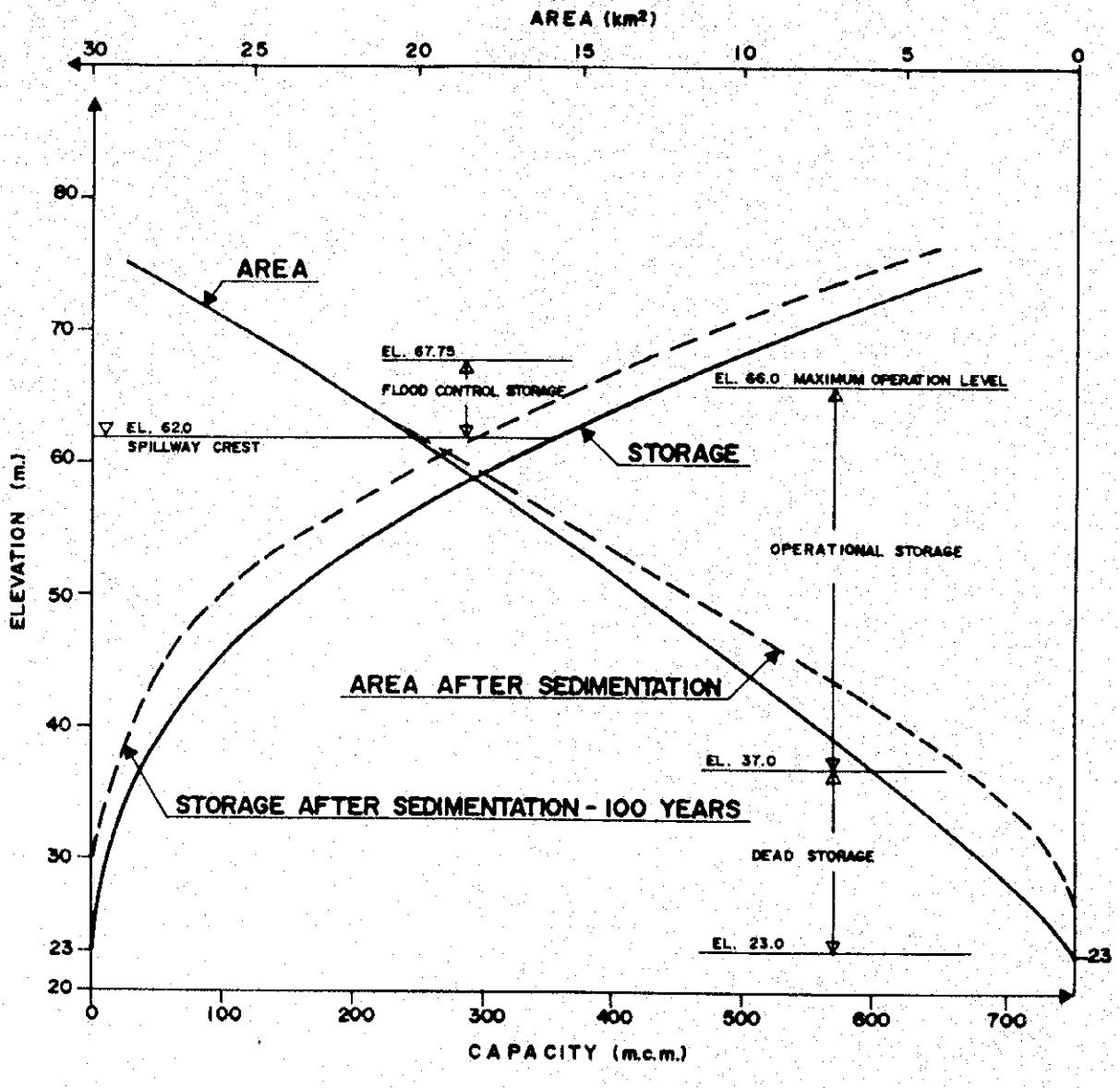
GOVERNMENT OF THE REPUBLIC OF ECUADOR CENTRO DE REHABILITACION DE MANABI (CRM) *THE DETAILED DESIGN STUDY ON THE WATER TRANSBASIN SCHEMES FOR CHONE-PORTOVIEJO RIVER BASINS* JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE AREA - STORAGE CAPACITY CURVES POZA HONDA RESERVOIR

FIGURE 2



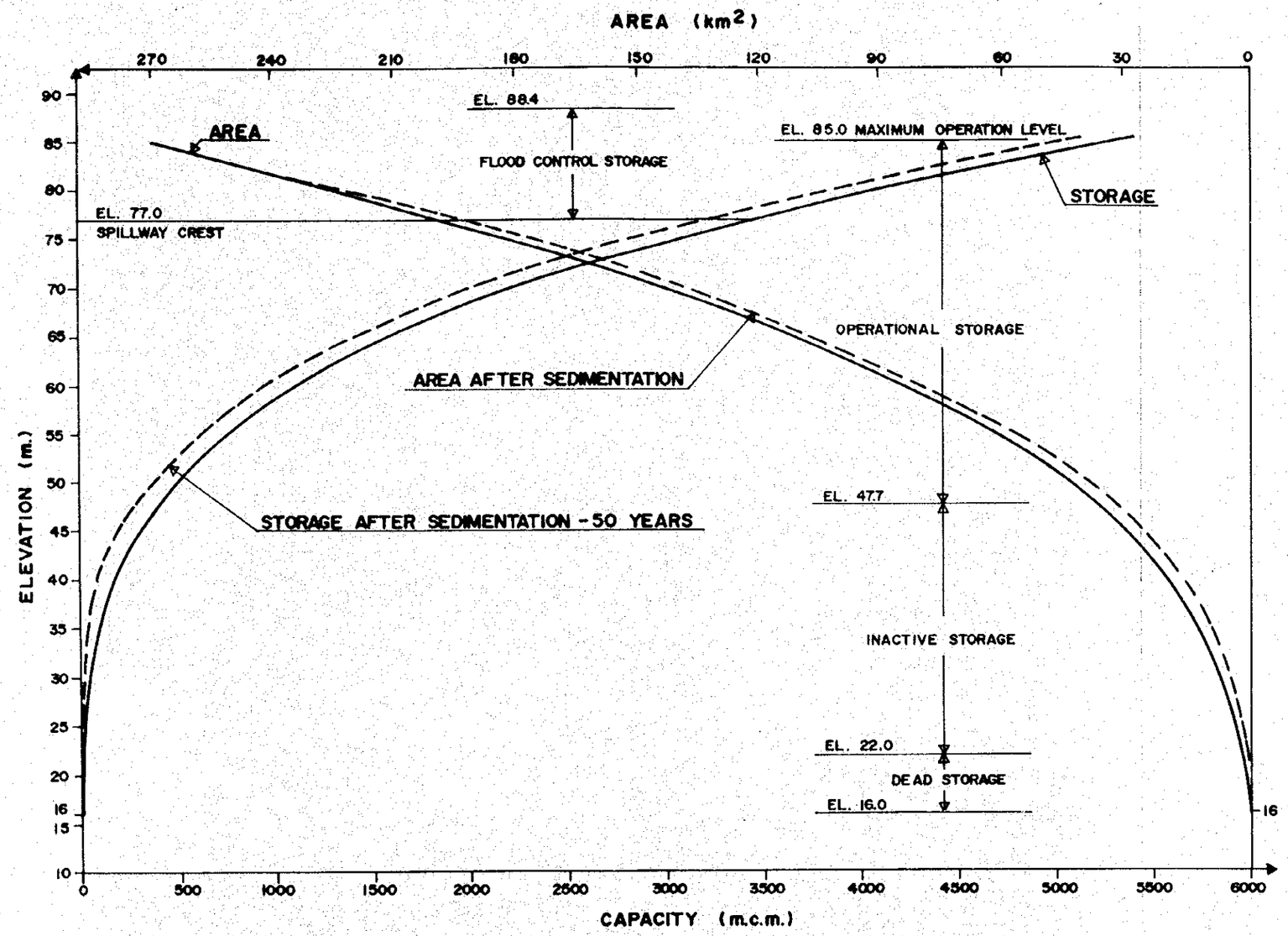
GOVERNMENT OF THE REPUBLIC OF ECUADOR CENTRO DE REHABILITACION DE MANABI (CRM) *THE DETAILED DESIGN STUDY ON THE WATER TRANSBASIN SCHEMES FOR CHONE-PORTOVIEJO RIVER BASINS* JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE PRESENT OPERATION OF POZA HONDA RESERVOIR (1979 - 1993)

FIGURE 3



GOVERNMENT OF THE REPUBLIC OF ECUADOR CENTRO DE REHABILITACION DE MANABI (CRM) THE DETAILED DESIGN STUDY ON THE WATER TRANSBASIN SCHEMES FOR CHONE-PORTOVIEJO RIVER BASINS JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE AREA-STORAGE CAPACITY CURVES LA ESPERANZA RESERVOIR

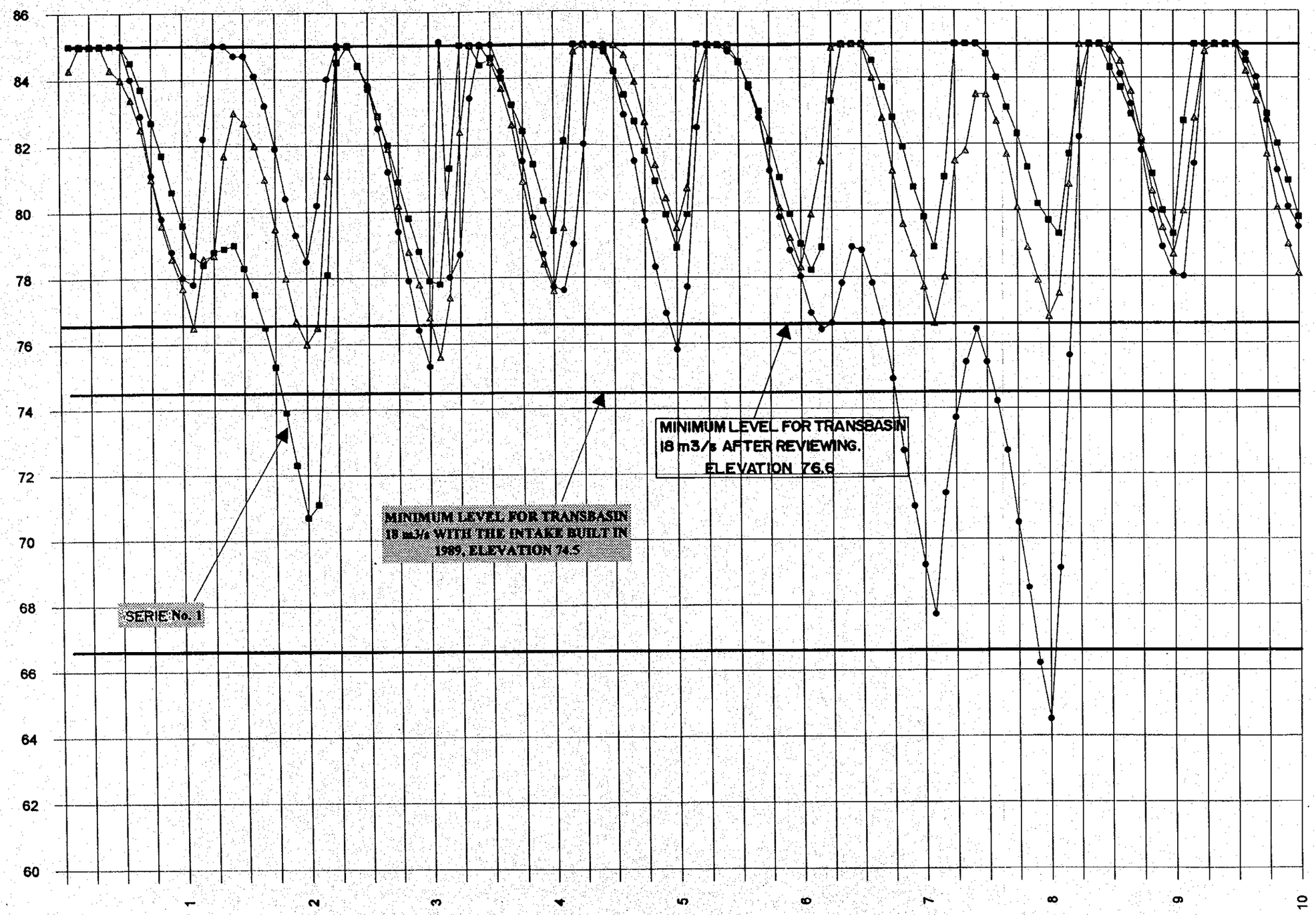
FIGURE 4



GOVERNMENT OF THE REPUBLIC OF ECUADOR
CENTRO DE REHABILITACION DE MANABI (CRM)
THE DETAILED DESIGN STUDY ON THE WATER TRANSBASIN SCHEMES FOR CHONE-PORTOVIEJO RIVER BASINS
JAPAN INTERNATIONAL COOPERATION AGENCY

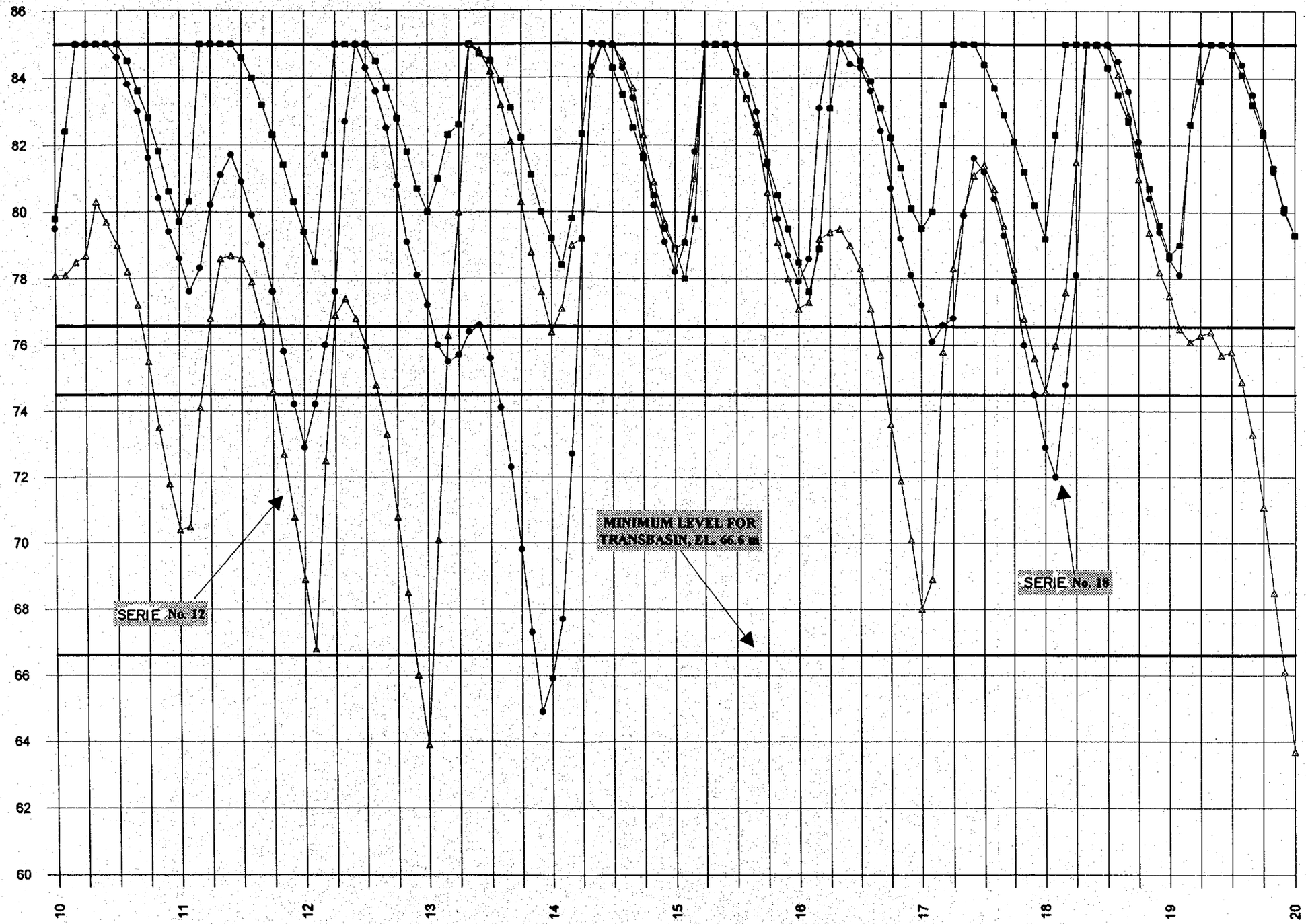
TITLE
AREA - STORAGE CAPACITY CURVES
DAULE - PERIPA RESERVOIR

FIGURE 5 (1/3)



GOVERNMENT OF THE REPUBLIC OF ECUADOR CENTRO DE REHABILITACION DE MANABI (CRM) *THE DETAILED DESIGN STUDY ON THE WATER TRANSBASIN SCHEMES FOR CHONE-PORTOVIEJO RIVER BASINS* JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE FLUCTUATION LEVELS OF DAULE-PERIPA RESERVOIR FOR DILUTION OF 1.6

FIGURE 5 (2/3)



GOVERNMENT OF THE REPUBLIC OF ECUADOR CENTRO DE REHABILITACION DE MANABI (CRM) *THE DETAILED DESIGN STUDY ON THE WATER TRANSBASIN SCHEMES FOR CHONE-PORTOVIEJO RIVER BASINS* JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE FLUCTUATION LEVELS OF DAULE-PERIPA RESERVOIR FOR DILUTION OF 1.6

FIGURE 5 (3/3)

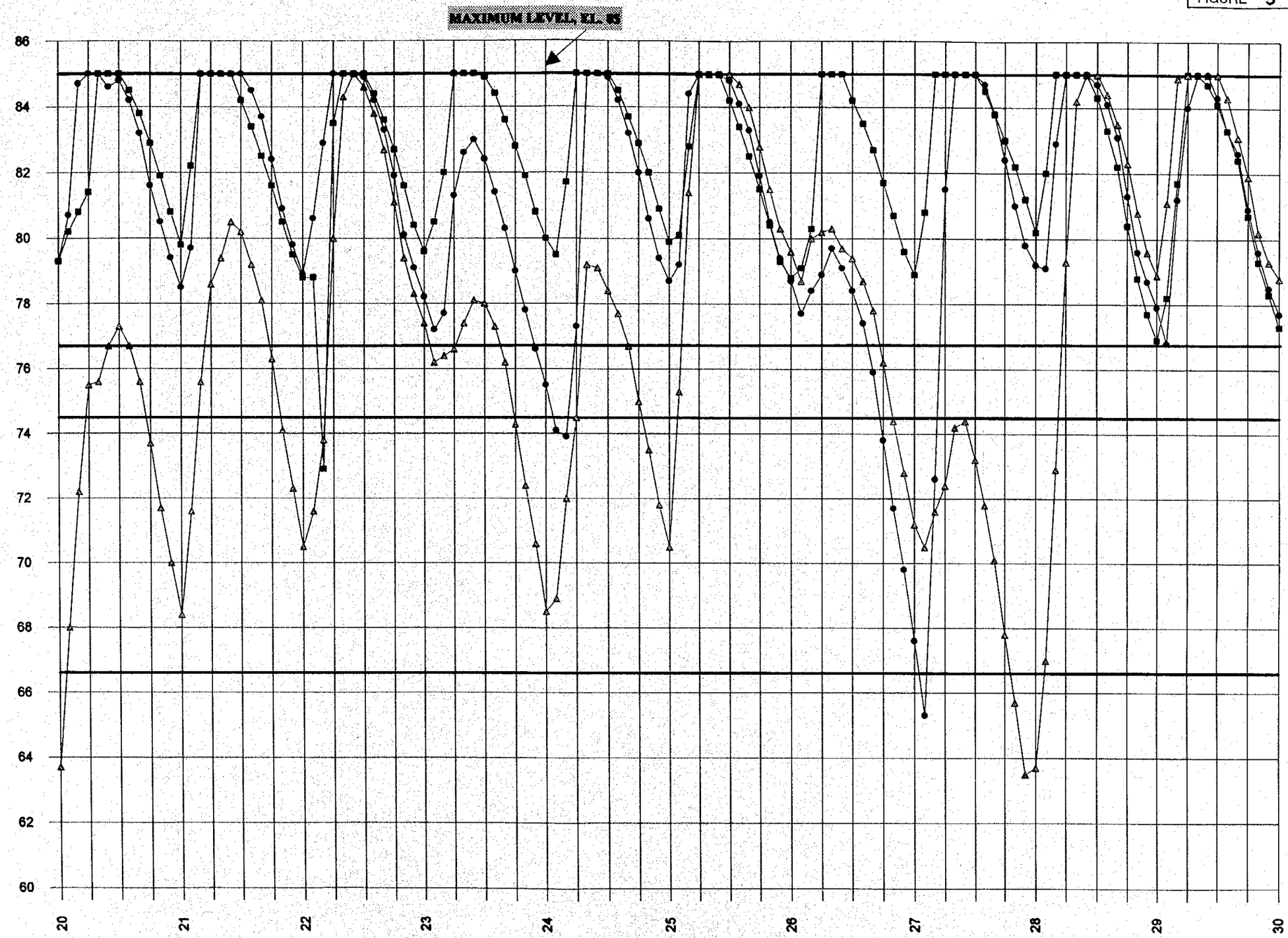


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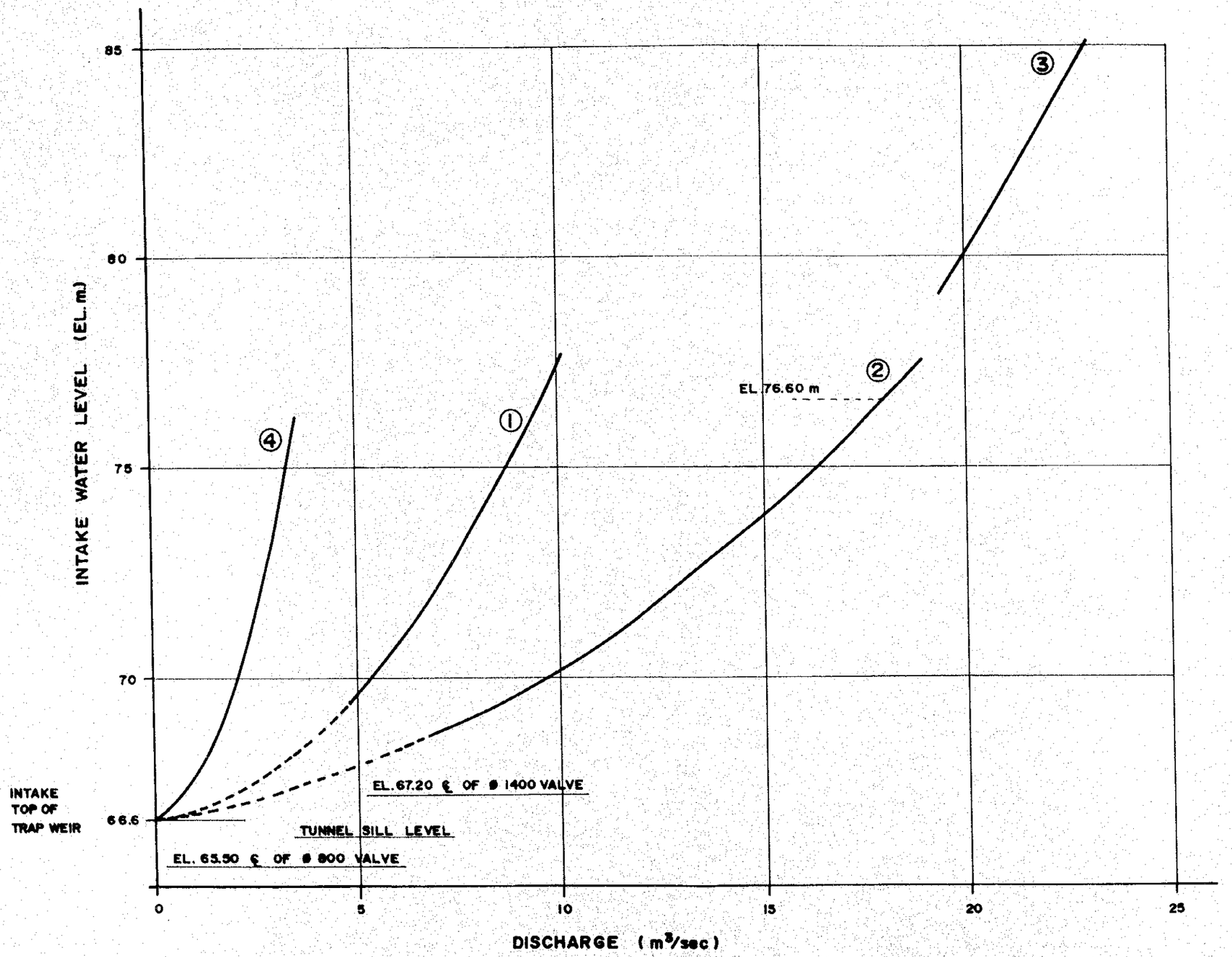
FIGURE 6



① ø 1400 x 1 no VALVE
(FREE FLOW IN TUNNEL)

② ø 1400 x 2 nos VALVES
(FREE FLOW IN TUNNEL

③ ø 1400 x 2 nos VALVES
(PRESSURE FLOW IN TUNNEL)

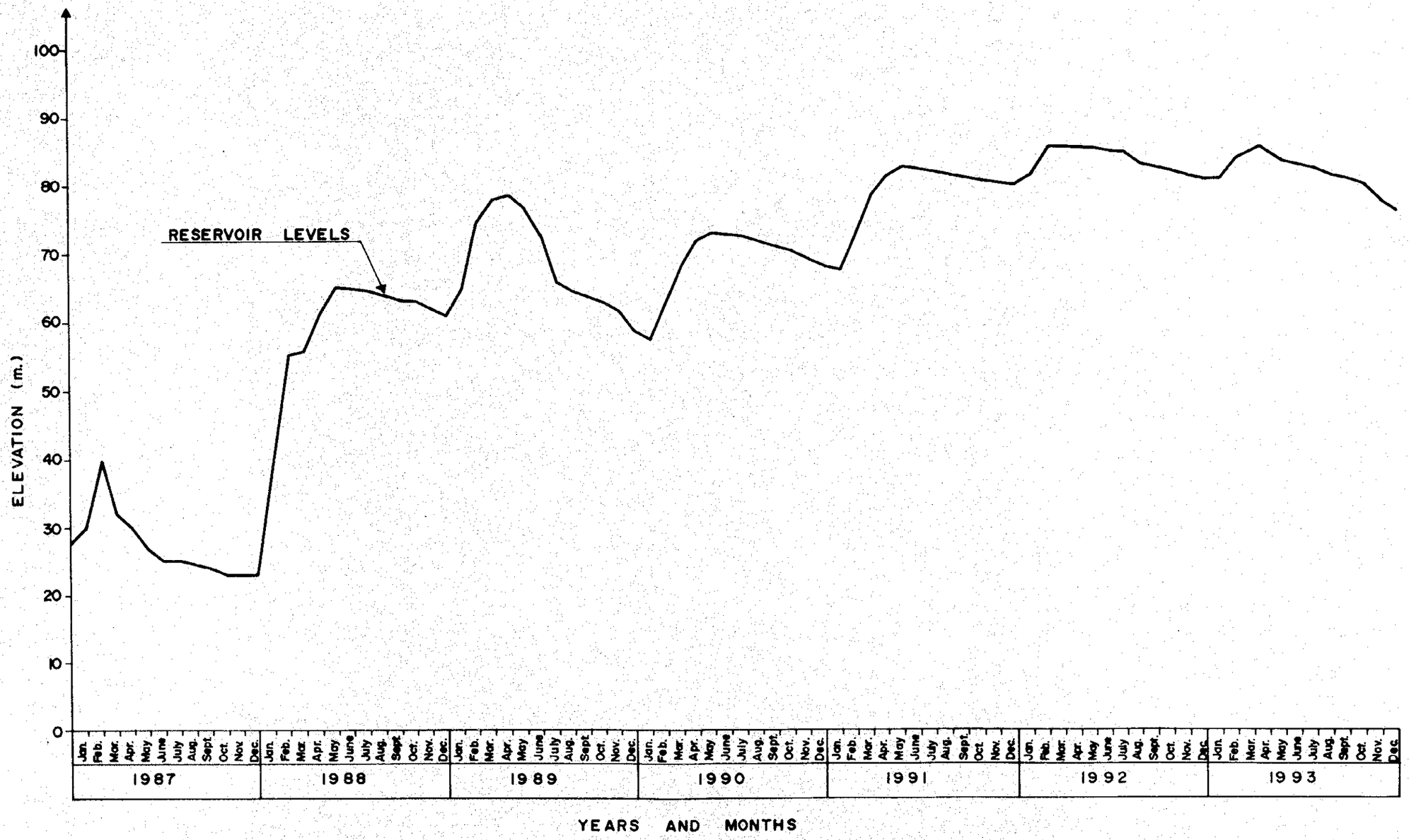
④ ø 800 x 1 no

NOTE:
----- OUT OF FLOW CONTROL
BY ø 1400 VALVE

GOVERNMENT OF THE REPUBLIC OF ECUADOR
CENTRO DE REHABILITACION DE MANABI (CRM)
THE DETAILED DESIGN STUDY ON THE WATER TRANSBASIN SCHEMES FOR CHONE-PORTOVIEJO RIVER BASINS
JAPAN INTERNATIONAL COOPERATION AGENCY

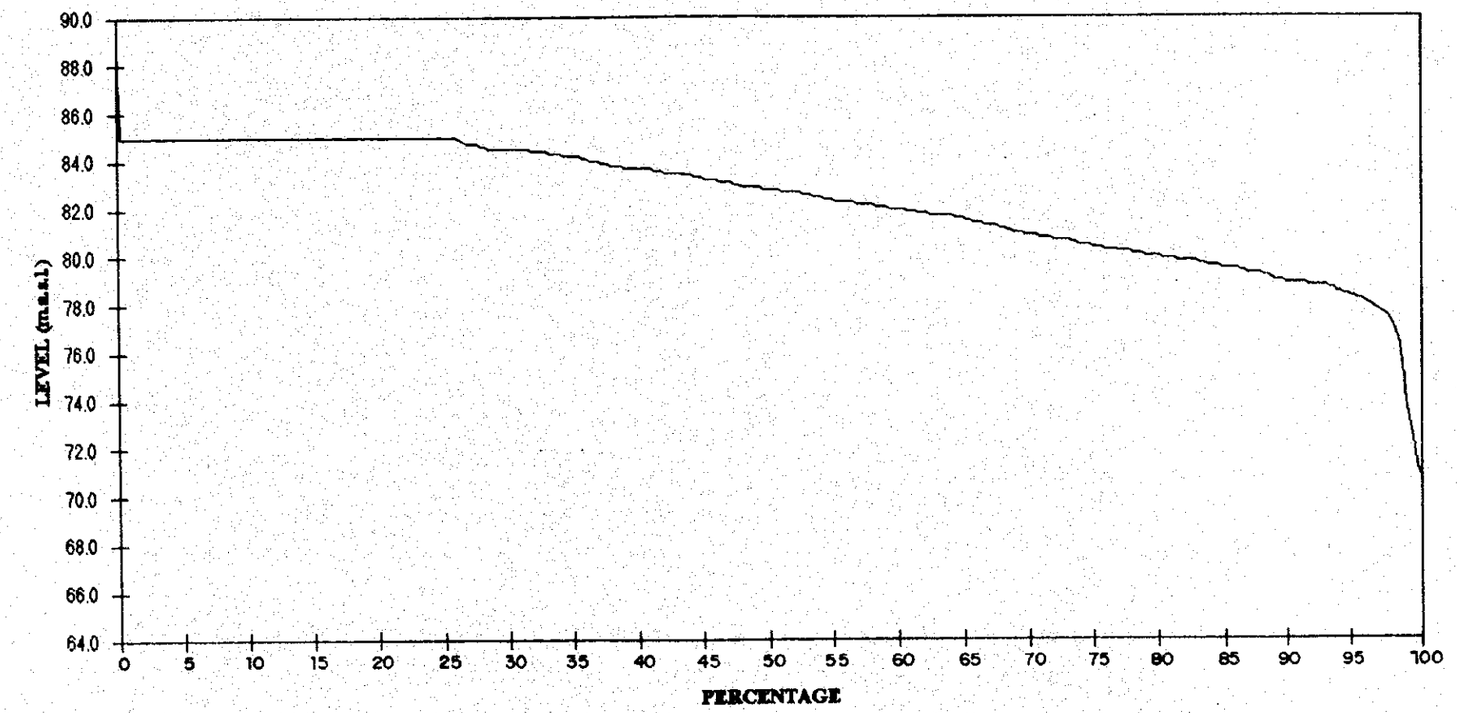
TITLE
DISCHARGE CURVE OF
CONGUILLO INLET

FIGURE 7



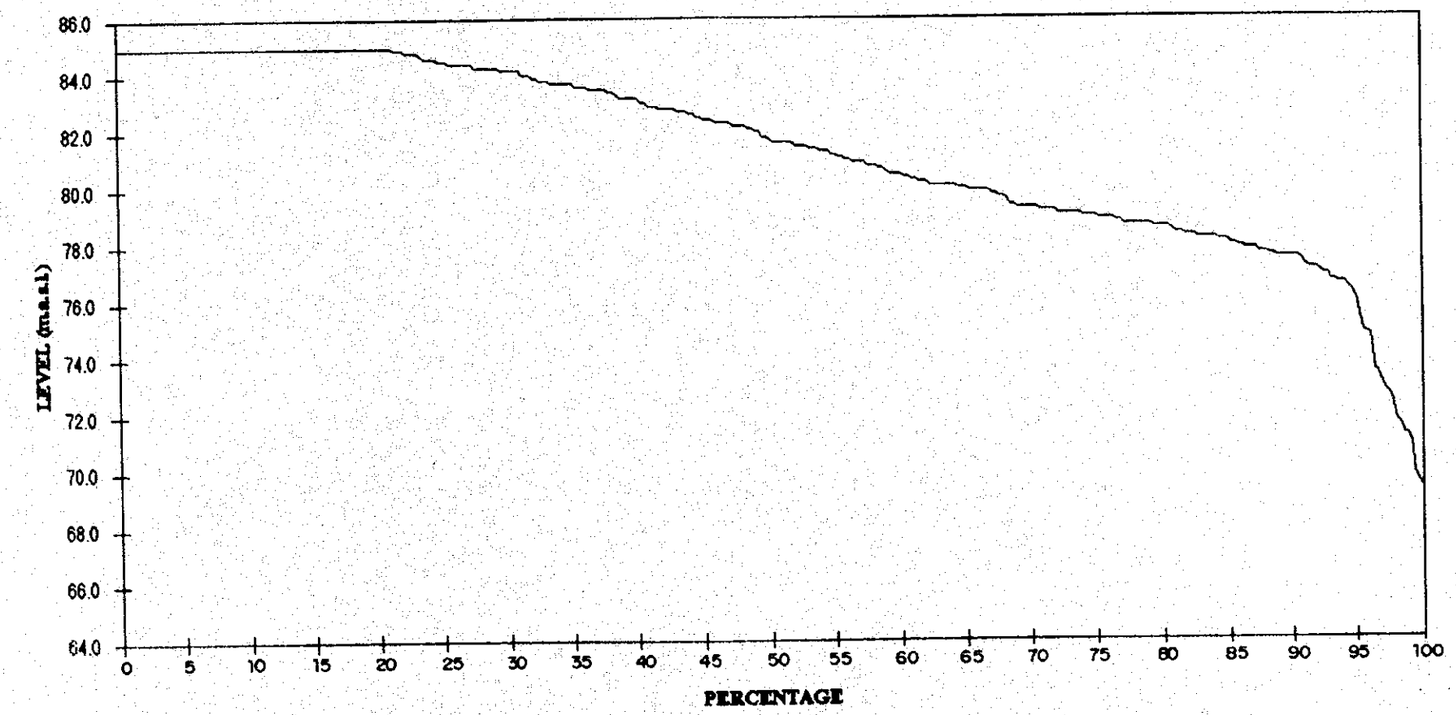
GOVERNMENT OF THE REPUBLIC OF ECUADOR CENTRO DE REHABILITACION DE MANABI (CRM) *THE DETAILED DESIGN STUDY ON THE WATER TRANSBASIN SCHEMES FOR CHONE-PORTOVIEJO RIVER BASINS* JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE DAULE-PERIPA RESERVOIR LEVELS

FIGURE 8



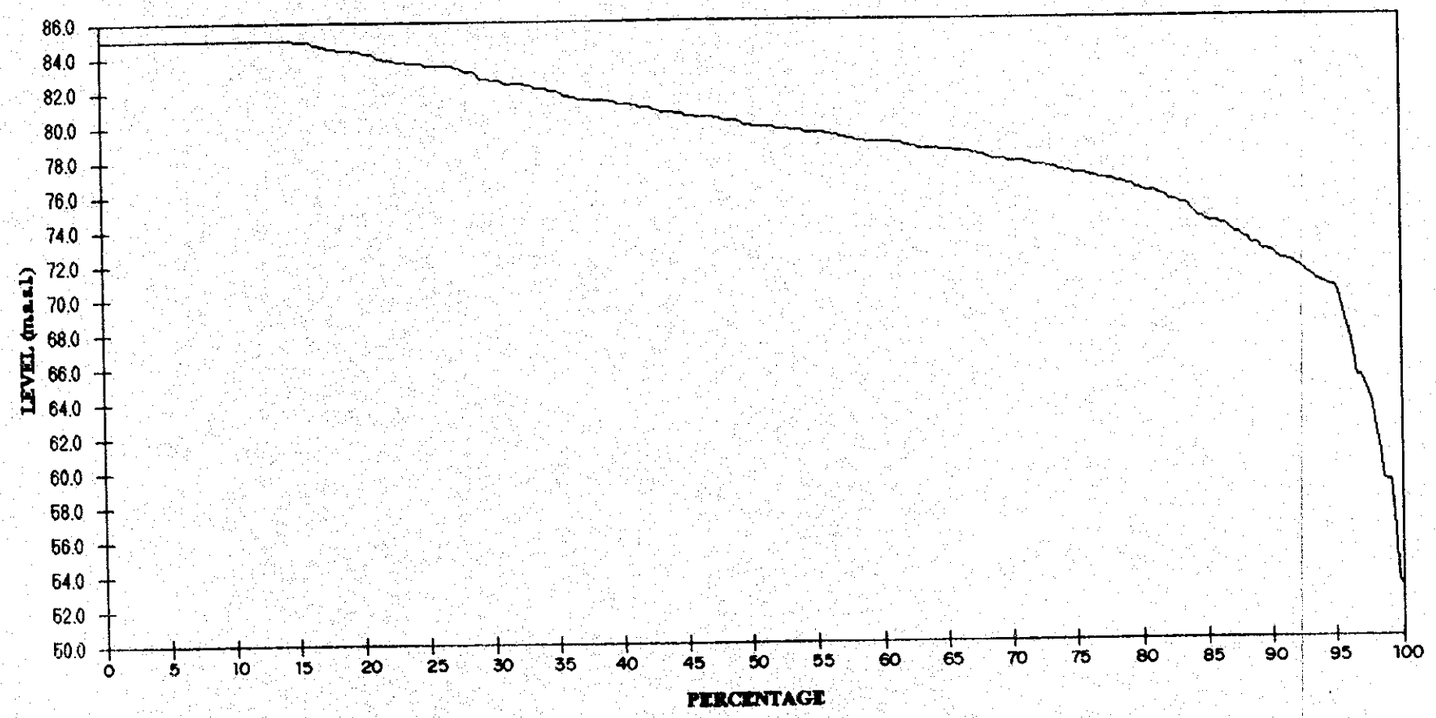
GOVERNMENT OF THE REPUBLIC OF ECUADOR CENTRO DE REHABILITACION DE MANABI (CRM) *THE DETAILED DESIGN STUDY ON THE WATER TRANSBASIN SCHEMES FOR CHONE-PORTOVIEJO RIVER BASINS* JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE DAULE - PERIPA AVERAGE DURATION LEVELS CURVE FOR SERIE I

FIGURE 9



GOVERNMENT OF THE REPUBLIC OF ECUADOR CENTRO DE REHABILITACION DE MANABI (CRM) *THE DETAILED DESIGN STUDY ON THE WATER TRANSBASIN SCHEMES FOR CHONE-PORTOVIEJO RIVER BASINS* JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE DAULE - PERIPA AVERAGE DURATION LEVELS CURVE FOR SERIE 12

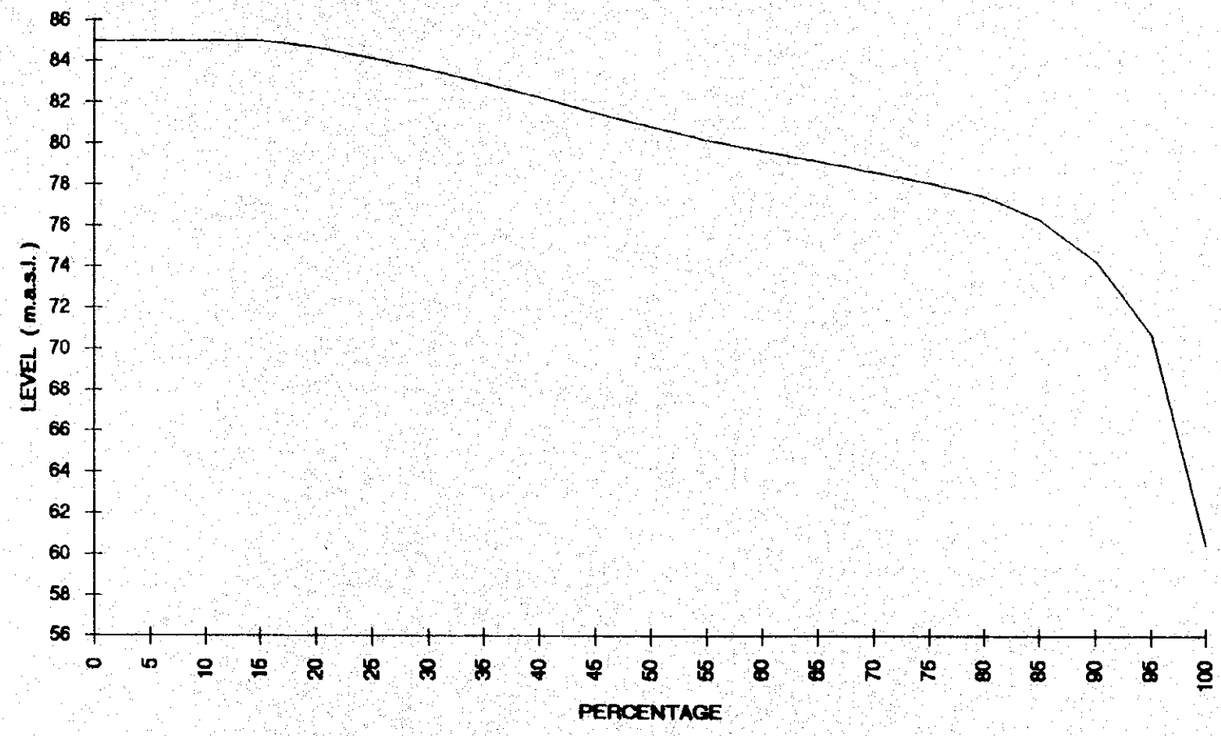
FIGURE 10



GOVERNMENT OF THE REPUBLIC OF ECUADOR CENTRO DE REHABILITACION DE MANABI (CRM) *THE DETAILED DESIGN STUDY ON THE WATER TRANSBASIN SCHEMES FOR CHONE-PORTOVIEJO RIVER BASINS* JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE DAULE - PERIPA AVERAGE DURATION LEVELS CURVE FOR SERIE 18

FIGURE 11

DAULE PERIPA DAM DURATION LEVELS CURVE

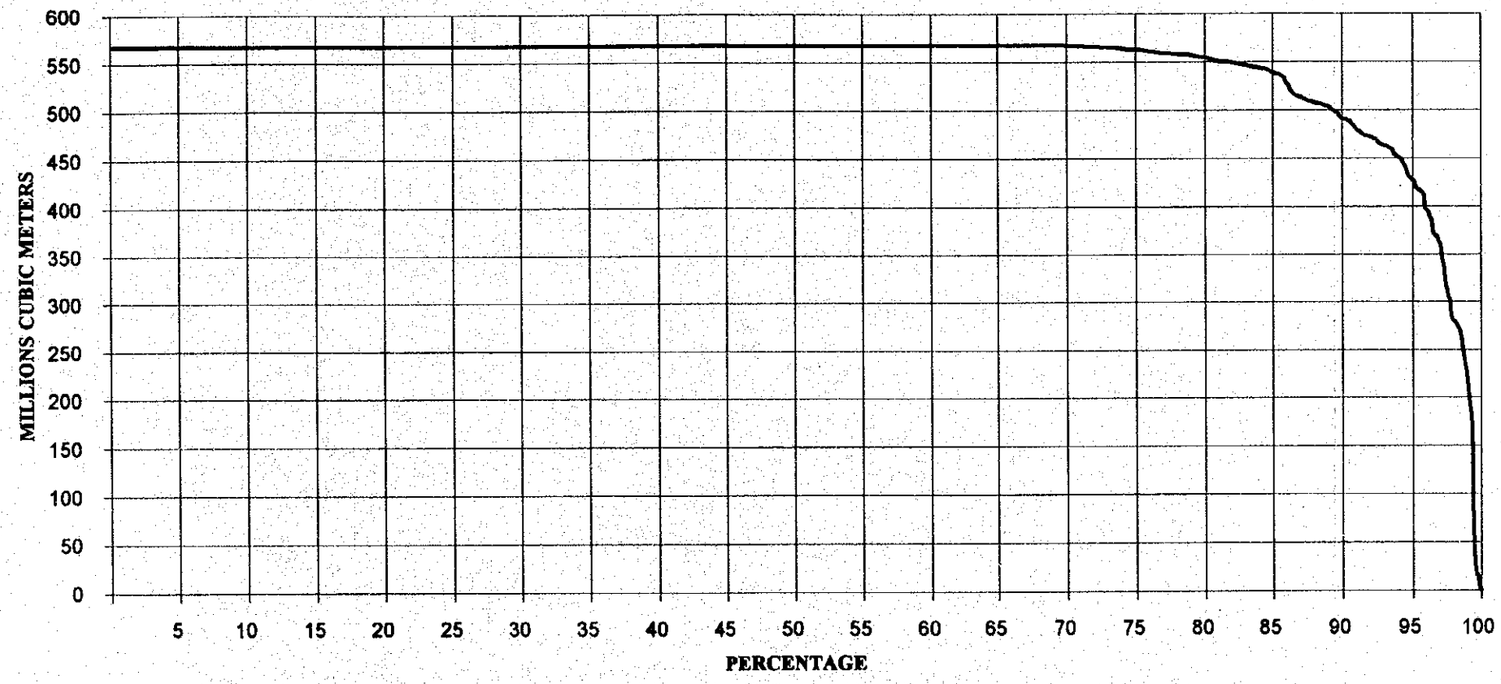


%	LEVELS
0.00	85.00
5.00	85.00
10.00	85.00
15.00	85.00
20.00	84.60
25.00	84.20
30.00	83.60
35.00	82.90
40.00	82.20
45.00	81.50
50.00	80.80
55.00	80.20
60.00	79.60
65.00	79.20
70.00	78.70
75.00	78.10
80.00	77.50
85.00	76.30
90.00	74.30
95.00	70.70
100.00	60.50

GOVERNMENT OF THE REPUBLIC OF ECUADOR
CENTRO DE REHABILITACION DE MANABI (CRM)
THE DETAILED DESIGN STUDY ON THE WATER TRANSBASIN SCHEMES FOR CHONE-PORTOVIEJO RIVER BASINS
JAPAN INTERNATIONAL COOPERATION AGENCY

TITLE
DAULE - PERIPA AVERAGE DURATION LEVELS CURVE

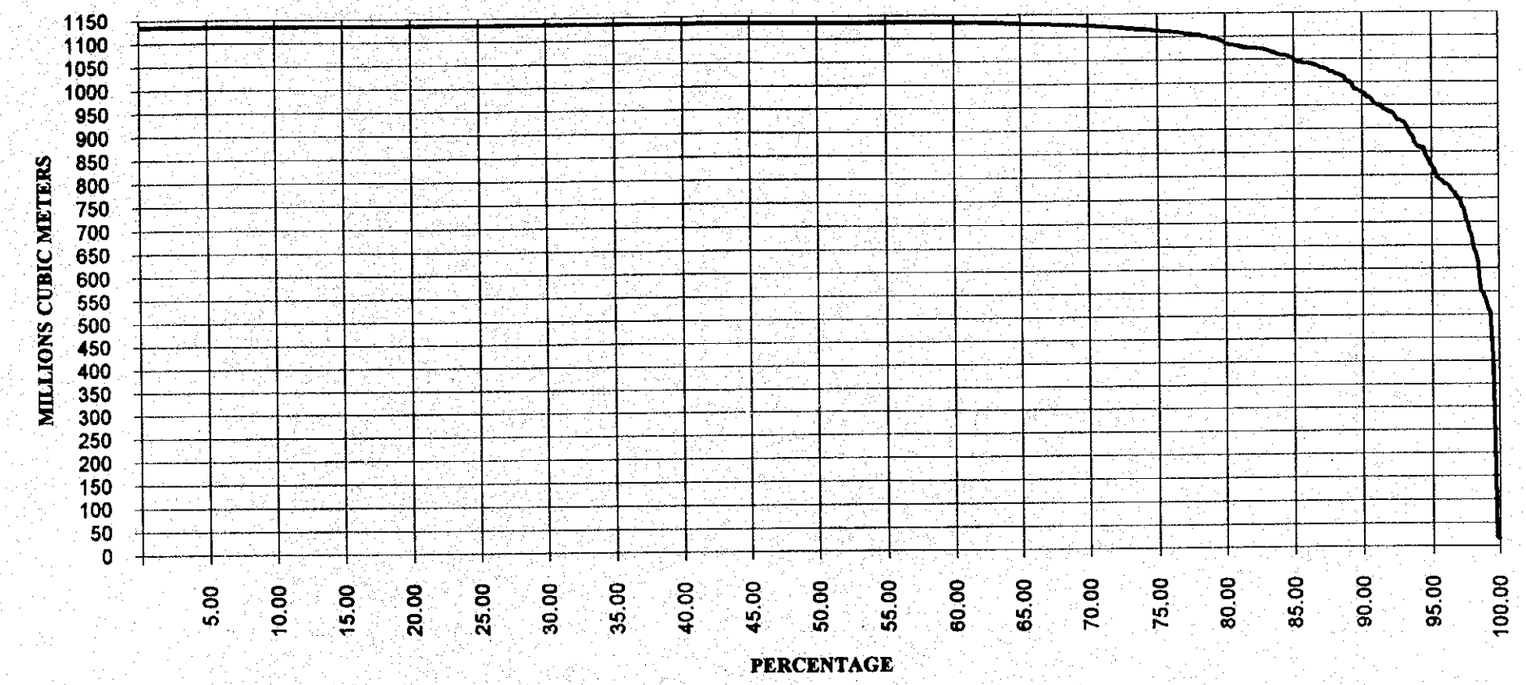
FIGURE 12



GOVERNMENT OF THE REPUBLIC OF ECUADOR
CENTRO DE REHABILITACION DE MANABI (CRM)
THE DETAILED DESIGN STUDY ON THE WATER TRANSBASIN SCHEMES FOR CHONE-PORTOVIEJO RIVER BASINS
JAPAN INTERNATIONAL COOPERATION AGENCY

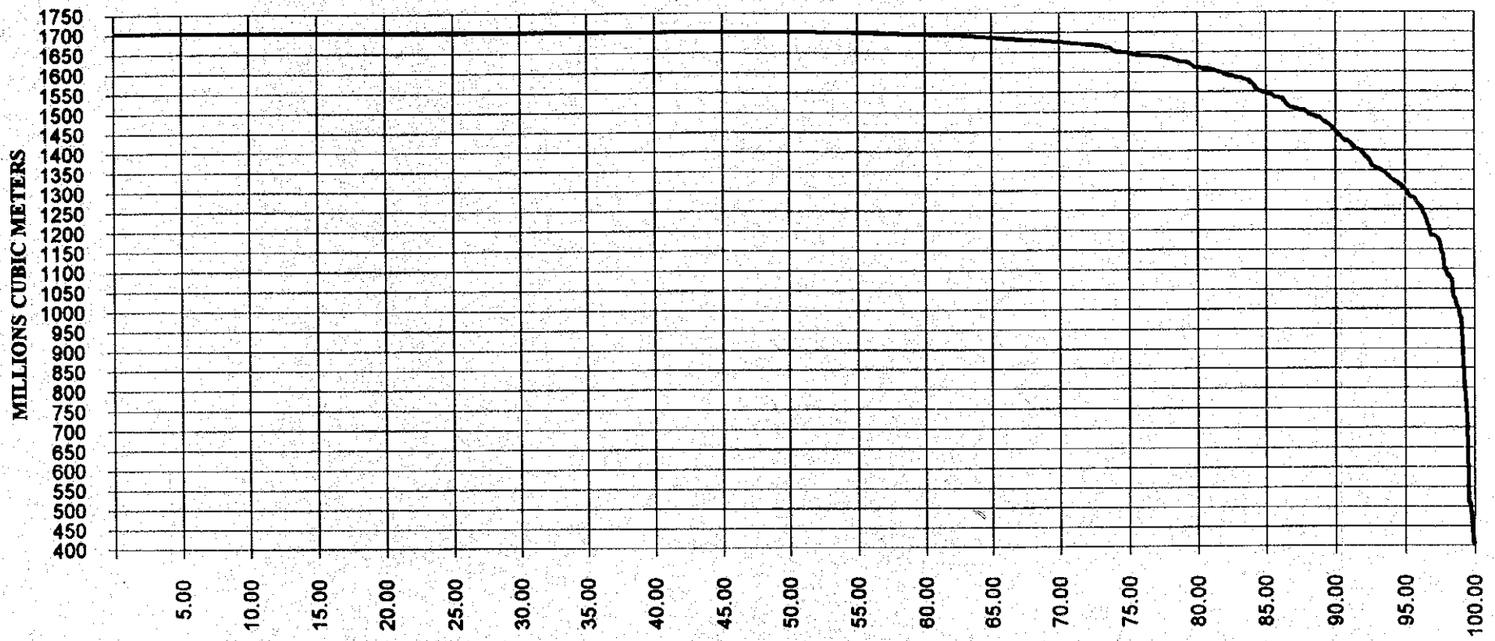
TITLE
TOTAL ANNUAL WATER VOLUME TRANSBASED FROM DAULE - PERIPA DAM TO LA ESPERANZA DAM.

FIGURE 13



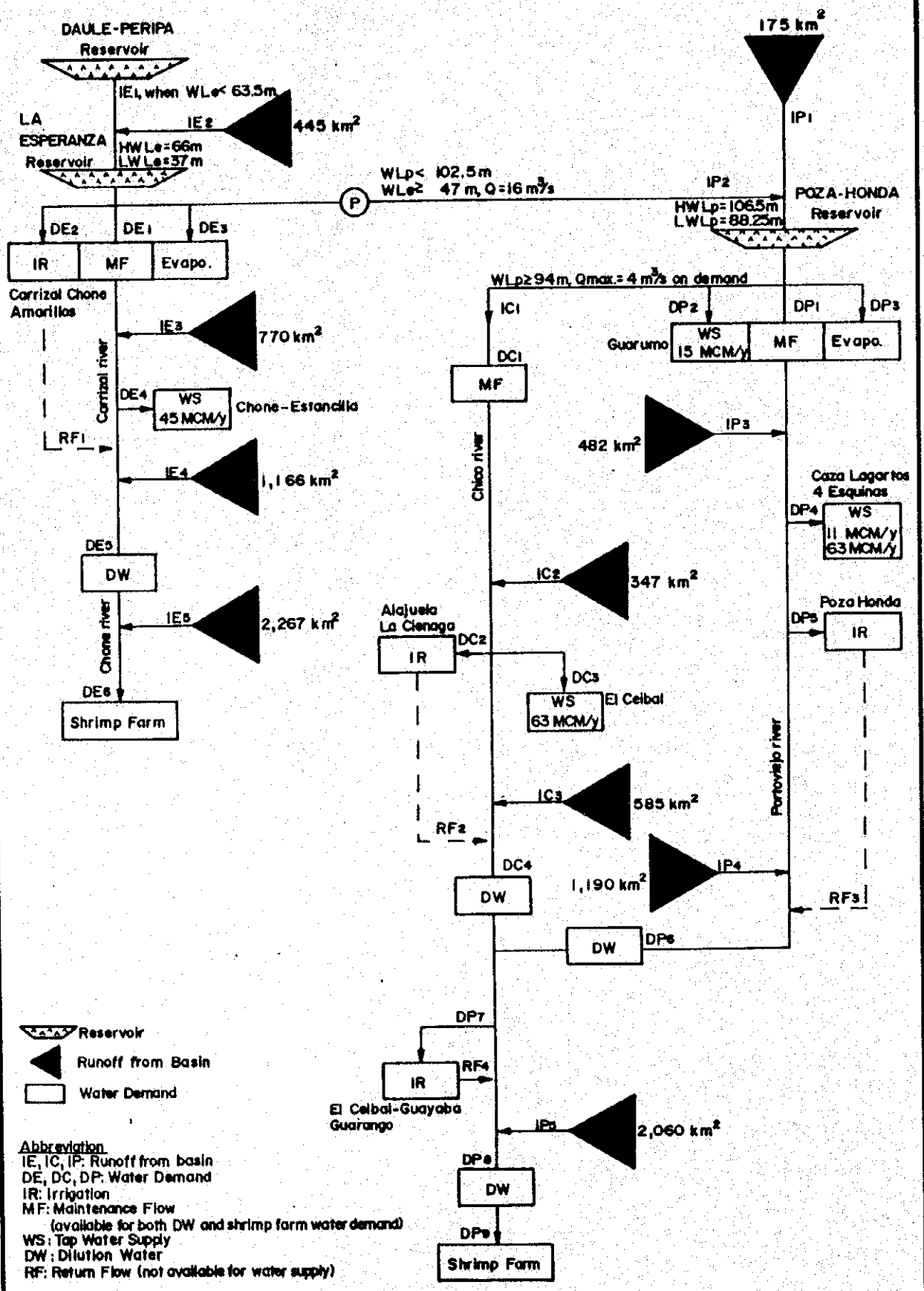
GOVERNMENT OF THE REPUBLIC OF ECUADOR CENTRO DE REHABILITACION DE MANABI (CRM) ***THE DETAILED DESIGN STUDY ON THE WATER TRANSBASIN SCHEMES FOR CHONE-PORTOVIEJO RIVER BASINS*** JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE TOTAL BI-ANNUAL WATER VOLUME TRANSBASED FROM DAULE - PERIPA DAM TO LA ESPERANZA DAM.

FIGURE 14



GOVERNMENT OF THE REPUBLIC OF ECUADOR CENTRO DE REHABILITACION DE MANABI (CRM) *THE DETAILED DESIGN STUDY ON THE WATER TRANSBASIN SCHEMES FOR CHONE-PORTOVIEJO RIVER BASINS* JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE TOTAL TRI-ANNUAL WATER VOLUME TRANSBASED FROM DAULE - PERIPA DAM TO LA ESPERANZA DAM.

FIGURE 15 a



GOVERNMENT OF THE REPUBLIC OF ECUADOR
CENTRO DE REHABILITACION DE MANABI (CRM)

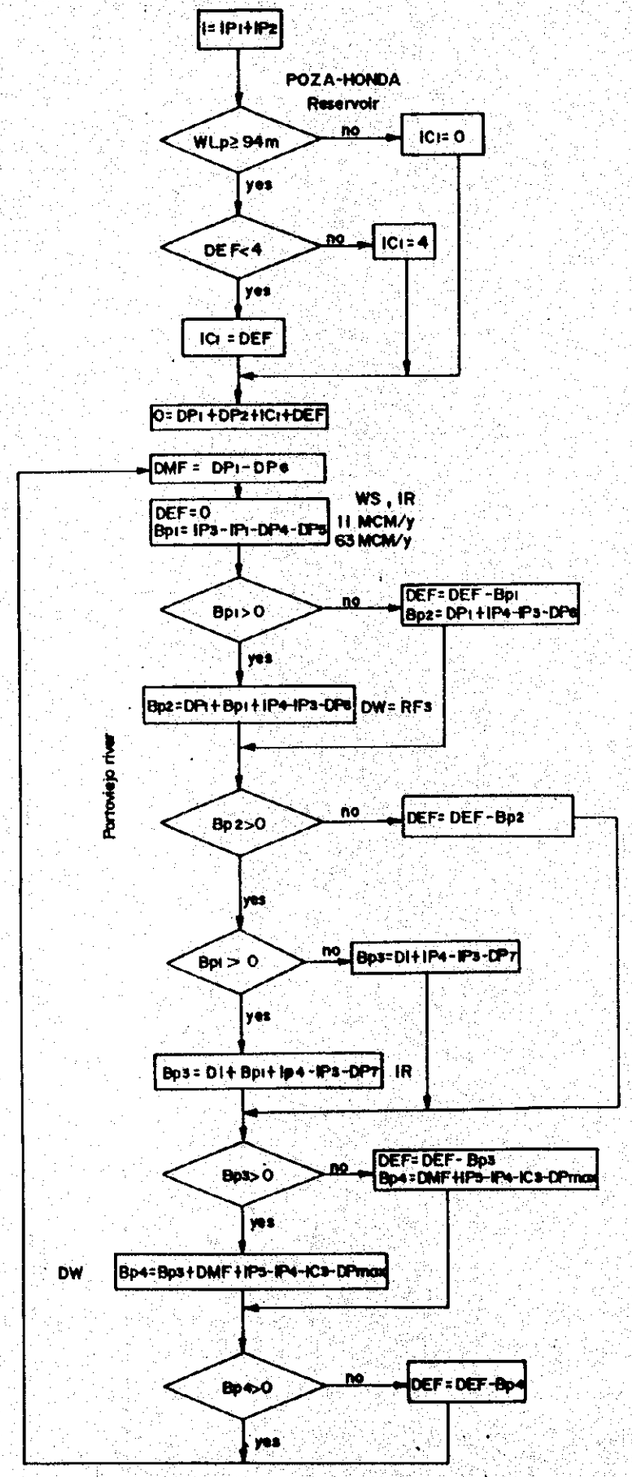
THE DETAILED DESIGN STUDY ON THE WATER TRANSBASIN SCHEMES FOR CHONE-PORTOVIEJO RIVER BASINS

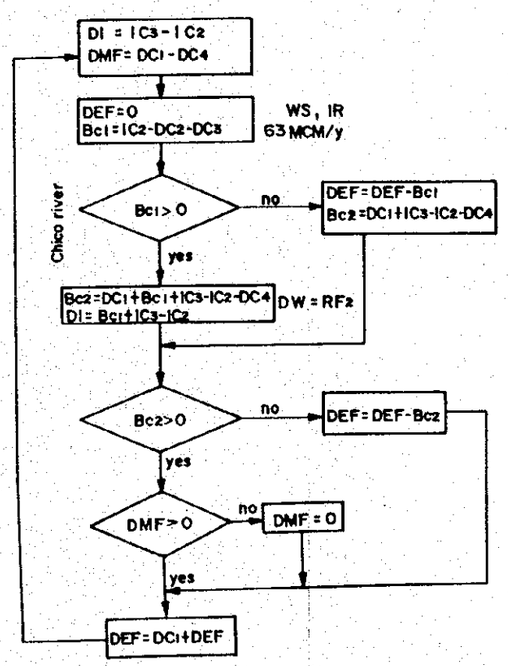
JAPAN INTERNATIONAL COOPERATION AGENCY

TITLE

FLOW DIAGRAM OF WATER DEMAND AND SUPPLY

FIGURE 15 b



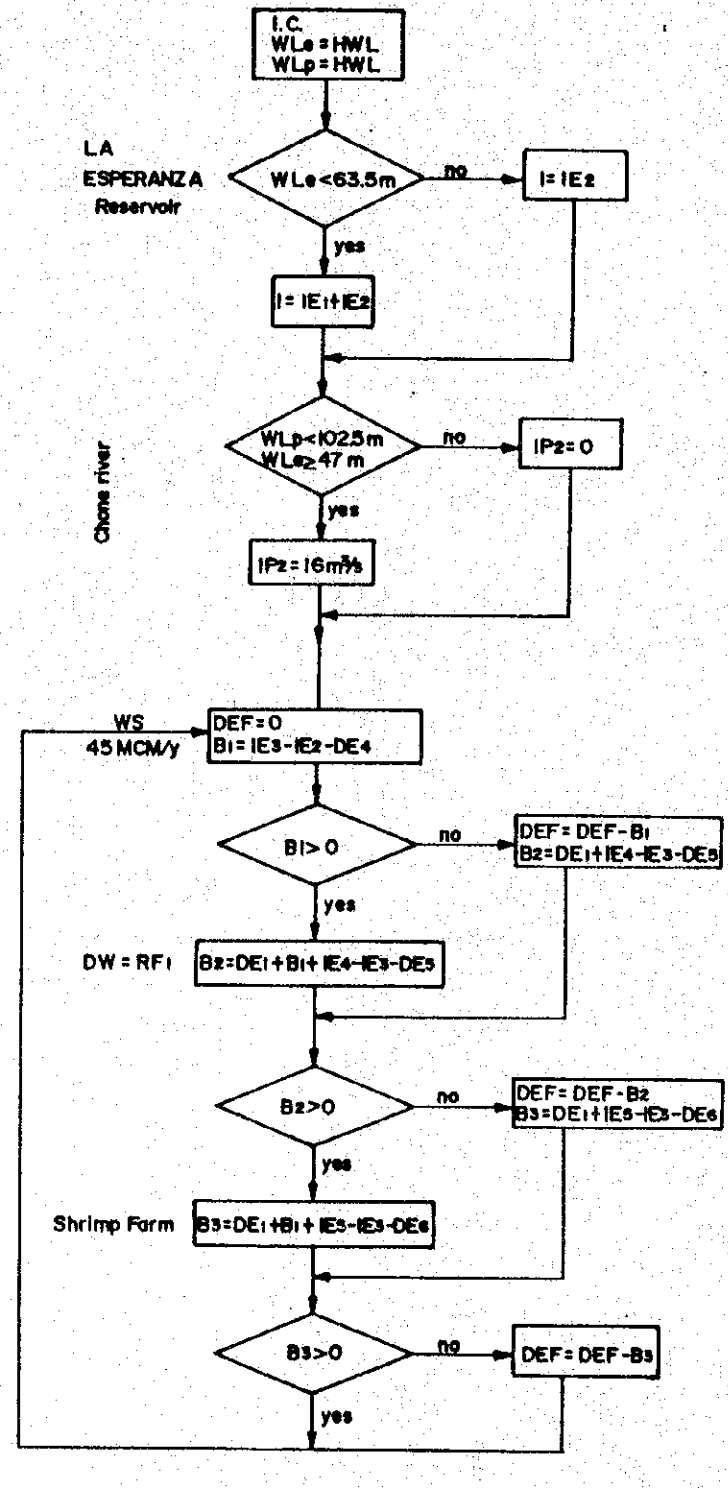


Abbreviation

IE, IC, IP:
DE, DC, DP:
IR: Irrigation Demand
MF: Maintenance Flow
(available for DW and shrimp farm water demand)
WS: Tap Water Supply
DW: Dilution Water
RF: Return Flow (not available for water supply)

GOVERNMENT OF THE REPUBLIC OF ECUADOR CENTRO DE REHABILITACION DE MANABI (CRM) *THE DETAILED DESIGN STUDY ON THE WATER TRANSBASIN SCHEMES FOR CHONE-PORTOVIEJO RIVER BASINS* JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE FLOWSHEET OF WATER BALANCE PORTOVIEJO AND CHICO RIVERS

FIGURE 15 c



Abbreviation
IE, IC, IP:
DE, DC, DP:
IR: Irrigation Demand
MF: Maintenance Flow
(available for DW and shrimp farm water demand)
WS: Tap Water Supply
DW: Dilution Water
RF: Return Flow (not available for water supply)

GOVERNMENT OF THE REPUBLIC OF ECUADOR
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JAPAN INTERNATIONAL COOPERATION AGENCY

TITLE
FLOWSHEET OF WATER BALANCE CHONE RIVER

FIGURE 16

Dilution Water Demand (54)

0.67	0.23	0.87	1.54	2.16	1.58
1.79	0.56	2.33	3.99	5.79	4.09
1.89	2.29	3.03	2.72	2.23	1.40
4.89	6.14	7.85	7.29	5.77	3.75

Carrizal River Maintenance (16)

J	F	M	A	M	J	J	A	S	O	N	D
0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
1.34	1.21	1.34	1.30	1.34	1.30	1.34	1.34	1.30	1.34	1.30	1.34

Chone-Estancilla Water Demand (45)

1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42
3.80	3.40	3.80	3.70	3.80	3.70	3.80	3.80	3.70	3.80	3.70	3.80

Carrizal-Chone & Amarillos Irrigation (272)

3.34	1.17	4.36	7.70	10.78	7.90	9.44	11.43	15.13	13.62	11.13	7.02
8.95	2.83	11.68	19.94	28.89	20.46	25.29	30.63	39.19	36.50	28.83	18.81

Chone Estuary Shrimp Farm (99)

J	F	M	A	M	J
0	0	0	0	0	0
0	0	0	0	0	0
J	A	S	O	N	D
1.45	1.47	1.52	10.94	11.35	10.82
3.89	3.94	3.94	29.32	29.40	29.00

La Cienaga Irrigation (15)

0.19	0.12	0.31	0.42	0.63	0.38
0.51	0.29	0.83	1.09	1.69	0.98
0.53	0.65	0.87	0.77	0.63	0.36
1.42	1.74	2.33	2.06	1.63	0.96

Alajuela Irrigation (16)

0.20	0.13	0.31	0.44	0.64	0.39
0.54	0.31	0.83	1.14	1.72	1.01
0.55	0.67	0.86	0.80	0.64	0.38
1.47	1.80	2.28	2.14	1.66	1.02

LA ESPERANZA RESERVOIR
391 MCM
HWL. EL. 66.00 m.
LWL. EL. 37.00 m.

(500)

J	F	M	A	M	J
11.00	10.50	10.00	15.00	18.00	18.00
29.40	25.50	26.70	38.90	48.20	46.60
J	A	S	O	N	D
18.00	18.00	18.00	18.00	18.00	18.00
48.20	48.20	46.60	48.20	46.60	46.90

DAULE-PERIPA RESERVOIR
4000 MCM
HWL. EL. 85.00 m.
LWL. EL. 60.00 m.

Own Basin (391)

J	F	M	A	M	J
12.20	26.90	33.80	30.90	19.70	10.80
32.80	65.70	90.40	80.00	52.70	28.10
J	A	S	O	N	D
6.40	3.60	2.10	0.90	1.00	1.80
17.20	9.70	5.30	2.40	2.50	4.70

(P)

Dilution Water Demand (54)

1.01	1.11	1.86	1.91	1.94	1.35
2.71	2.69	4.98	4.95	5.20	3.49
1.51	1.84	2.49	2.26	1.84	1.22
4.05	4.93	6.45	6.06	4.76	3.27

El Ceibal & Guarango Irrigation (121)

2.25	2.66	4.43	4.15	4.35	3.10
6.03	6.44	11.87	10.75	11.66	8.31
3.41	4.03	5.53	5.08	4.14	2.73
9.14	10.80	14.32	13.61	10.72	7.32

Chico River Maintenance (8)

0.25	0.25	0.25	0.25	0.25	0.25
0.67	0.61	0.67	0.65	0.67	0.65
0.25	0.25	0.25	0.25	0.25	0.25
0.67	0.67	0.65	0.67	0.65	0.67

El Ceibal Water Supply (63)

1.99	1.99	1.99	1.99	1.99	1.99
5.33	4.82	5.33	5.15	5.33	5.15
1.99	1.99	1.99	1.99	1.99	1.99
5.33	5.33	5.15	5.33	5.15	5.33

Chico River Own Basin (110)

3.88	7.05	7.83	6.84	4.39	2.87
10.40	17.23	20.96	17.74	11.75	7.44
2.13	1.76	1.62	1.24	1.15	1.26
5.71	4.21	4.19	3.32	2.99	3.38

J	F	M	A	M	J
0	0	0	0	0	0
0	0	0	0	0	0
J	A	S	O	N	D
0.17	0.17	0.18	0.17	0.18	0.17
0.45	0.45	0.46	0.45	0.46	0.45

(3)

Guarumo Water Supply (14)

0.45	0.45	0.45	0.45	0.45	0.45
1.21	1.09	1.21	1.17	1.21	1.17
0.45	0.45	0.45	0.45	0.45	0.45
1.21	1.21	1.17	1.21	1.17	1.21

Dilution Water Demand (6)

0.08	0.05	0.12	0.17	0.25	0.15
0.21	0.12	0.32	0.44	0.67	0.39
0.22	0.26	0.35	0.31	0.25	0.15
0.59	0.69	0.91	0.83	0.65	0.40

POZA HONDA RESERVOIR
85 MCM
HWL. EL. 108.50 (106.50) m.
LWL. EL. 90.25 (88.25) m.

Poza Honda Own Basin (102)

3.61	6.55	7.27	6.36	4.07	2.67
9.66	16.00	19.47	16.46	10.91	6.91
1.98	1.63	1.50	1.15	1.07	1.17
5.30	4.37	3.90	3.09	2.77	3.14

Poza Honda Irrigation (6.500ha) (147)

2.82	2.89	4.88	5.42	5.35	3.63
7.56	6.99	13.08	14.04	14.34	9.40
4.13	5.18	6.93	6.23	5.05	3.35
11.07	13.88	17.95	16.70	13.08	8.98

4 Esquinas Water Supply (70)

2.21	2.21	2.21	2.21	2.21	2.21
5.92	5.35	5.92	5.72	5.92	5.72
2.21	2.21	2.21	2.21	2.21	2.21
5.92	5.92	5.72	5.92	5.72	5.92

Caza Lagarto Water Supply (5)

0.16	0.16	0.16	0.16	0.16	0.16
0.43	0.39	0.43	0.41	0.43	0.41
0.16	0.16	0.16	0.16	0.16	0.16
0.43	0.43	0.41	0.43	0.41	0.43

Portoviejo River Maintenance (8)

0.25	0.25	0.25	0.25	0.25	0.25
0.67	0.61	0.67	0.65	0.67	0.65
0.25	0.25	0.25	0.25	0.25	0.25
0.67	0.67	0.65	0.67	0.65	0.67

LEGEND

J	F	M	
2.25	2.66	4.43	m^3/s
6.03	6.44	11.87	MCM

(391) ——— Annual in MCM

GOVERNMENT OF THE REPUBLIC OF ECUADOR
CENTRO DE REHABILITACION DE MANABI (CRIM)
THE DETAILED DESIGN STUDY ON THE WATER TRANSBASIN SCHEMES FOR CHONE-PORTOVIEJO RIVER BASINS
JAPAN INTERNATIONAL COOPERATION AGENCY

TITLE
WATER DEMAND IN(m^3/s) and MCM BASED ON IRRIGATION WATER DEMAND 1/5 YEAR

FIGURE 17

Dilution Water Demand → (37)

0	0	0.03	0.30	1.32	0.87
0	0	0.08	0.78	3.54	2.25
1.21	2.14	2.78	2.58	2.01	0.77
3.24	5.73	7.20	6.91	5.21	2.06

Carrizal River Maintenance → (16)

J	F	M	A	M	J	J	A	S	O	N	D
0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
1.34	1.21	1.34	1.30	1.34	1.30	1.34	1.34	1.30	1.34	1.30	1.34

Chone - Estancilla Water Supply → (45)

1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42
3.80	3.40	3.80	3.70	3.80	3.70	3.80	3.80	3.70	3.80	3.70	3.80

Carrizal - Chone & Amarillos Irrigation → (185)

0	0	0.16	1.49	6.61	4.34	6.07	10.70	13.90	12.88	10.04	3.83
0	0	0.43	3.86	17.71	11.24	16.27	28.68	36.00	34.52	26.00	10.26

Chone Estuary Shrimp Farm → (99)

J	F	M	A	M	J
0	0	0	0	0	0
0	0	0	0	0	0
J	A	S	O	N	D
1.45	1.47	1.52	10.94	11.35	10.82
3.89	3.94	3.94	29.32	29.40	29.00

La Clenaga Irrigation → (11)

0	0	0.09	0.18	0.42	0.25
0	0	0.24	0.47	1.13	0.65
0.40	0.62	0.83	0.73	0.58	0.21
1.07	1.66	2.15	1.96	1.50	0.56

Alajuela Irrigation → (12)

0	0	0.09	0.18	0.42	0.25
0	0	0.24	0.47	1.13	0.65
0.40	0.63	0.84	0.74	0.60	0.22
1.07	1.69	2.18	1.98	1.55	0.59

LA ESPERANZA RESERVOIR
391 MCM
HWL. EL. 66.00 m.
LWL. EL. 37.00 m.

(500)

J	F	M	A	M	J
11.00	10.50	10.00	15.00	18.00	18.00
29.40	25.50	26.70	38.90	48.20	46.60
J	A	S	O	N	D
18.00	18.00	18.00	18.00	18.00	18.00
48.20	48.20	46.60	48.20	46.60	46.90

DAULE - PERIPA RESERVOIR
4000 MCM
HWL. EL. 85.00 m.
LWL. EL. 60.00 m.

Own Basin → (391)

J	F	M	A	M	J
12.20	26.90	33.80	30.90	19.70	10.80
32.80	65.70	90.40	80.00	52.20	28.10
J	A	S	O	N	D
6.40	3.60	2.10	0.90	1.00	1.80
17.20	9.70	5.30	2.40	2.50	4.70

Dilution Water Demand → (44)

0.40	0.39	1.16	1.44	1.57	1.09
1.07	0.94	3.11	3.73	4.21	2.82
1.32	1.86	2.44	2.17	1.84	1.01
3.54	4.98	6.32	5.81	4.76	2.71

El Ceibal & Guarango Irrigation → (100)

0.98	0.92	2.85	3.19	3.60	2.71
2.63	2.23	7.64	8.26	9.65	7.02
3.06	4.17	5.46	4.76	4.10	2.33
8.20	11.17	14.14	12.76	10.62	6.24

El Ceibal Water Supply → (63)

1.99	1.99	1.99	1.99	1.99	1.99
5.33	4.82	5.33	5.15	5.33	5.15
1.99	1.99	1.99	1.99	1.99	1.99
5.33	5.33	5.15	5.33	5.15	5.33

Chico River Maintenance → (8)

0.25	0.25	0.25	0.25	0.25	0.25
0.67	0.61	0.67	0.65	0.67	0.65
0.25	0.25	0.25	0.25	0.25	0.25
0.67	0.67	0.65	0.67	0.65	0.67

Chico River Own Basin → (110)

3.88	7.05	7.83	6.84	4.39	2.87
10.40	17.23	20.96	17.74	11.75	7.44
2.13	1.76	1.62	1.24	1.15	1.26
5.71	4.21	4.19	3.32	2.99	3.38

Guarumo Water Supply → (14)

0.45	0.45	0.45	0.45	0.45	0.45
1.21	1.09	1.21	1.17	1.21	1.17
0.45	0.45	0.45	0.45	0.45	0.45
1.21	1.21	1.17	1.21	1.17	1.21

Poza Honda Own Basin → (102)

3.61	6.55	7.27	6.36	4.07	2.67
9.66	16.00	19.47	16.48	10.91	6.91
1.98	1.63	1.50	1.15	1.07	1.17
5.30	4.37	3.90	3.09	2.77	3.14

POZA HONDA RESERVOIR
85 MCM
HWL. EL. 108.50 (106.50) m.
LWL. EL. 90.25 (88.25) m.

Dilution Water Demand → (5)

0	0	0.04	0.07	0.17	0.10
0	0	0.11	0.18	0.45	0.26
0.16	0.25	0.33	0.29	0.24	0.09
0.43	0.67	0.85	0.78	0.62	0.24

Poza Honda Irrigation (6,500ha) → (120)

1.03	1.02	2.96	4.00	4.26	2.76
2.76	2.47	7.93	10.36	11.42	7.15
3.54	5.12	6.76	6.09	5.12	2.73
9.49	13.72	17.51	16.32	13.26	7.32

4 Esquinas Water Supply → (70)

2.21	2.21	2.21	2.21	2.21	2.21
5.92	5.35	5.92	5.72	5.92	5.72
2.21	2.21	2.21	2.21	2.21	2.21
5.92	5.92	5.92	5.92	5.92	5.92

Portoviejo River Maintenance → (8)

0.25	0.25	0.25	0.25	0.25	0.25
0.67	0.61	0.67	0.65	0.67	0.65
0.25	0.25	0.25	0.25	0.25	0.25
0.67	0.67	0.65	0.67	0.65	0.67

Caza Lagarto Water Supply → (5)

0.16	0.16	0.16	0.16	0.16	0.16
0.43	0.39	0.43	0.41	0.43	0.41
0.16	0.16	0.16	0.16	0.16	0.16
0.43	0.43	0.41	0.43	0.41	0.43

LEGEND

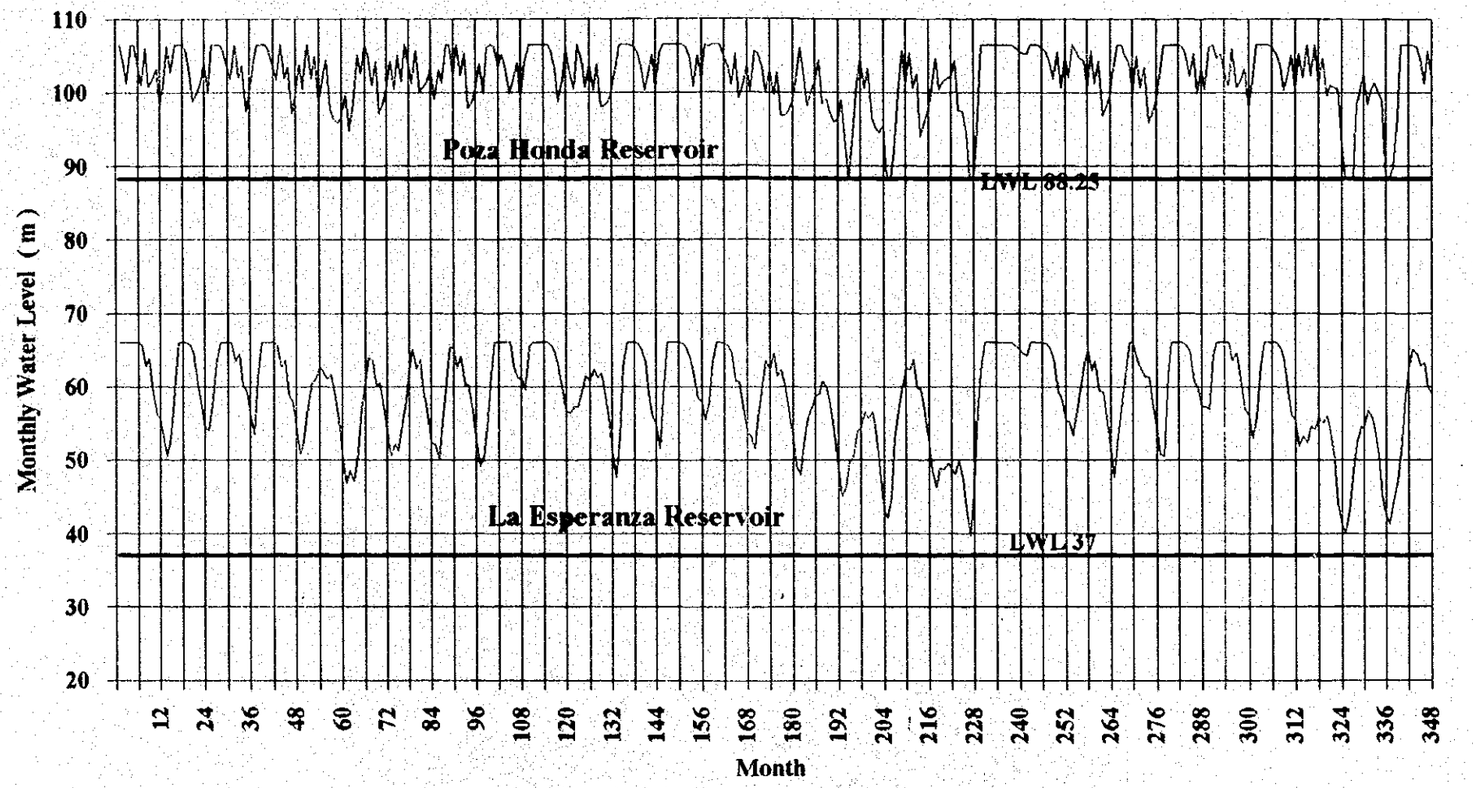
J	F	M .....
2.25	2.66	4.43 .... m³/s
6.03	6.44	11.87 .... MCM

(391) —— Annual in MCM

GOVERNMENT OF THE REPUBLIC OF ECUADOR
CENTRO DE REHABILITACION DE MANABI (CRM)
THE DETAILED DESIGN STUDY ON THE WATER TRANSBASIN SCHEMES FOR CHONE-PORTOVIEJO RIVER BASINS
JAPAN INTERNATIONAL COOPERATION AGENCY

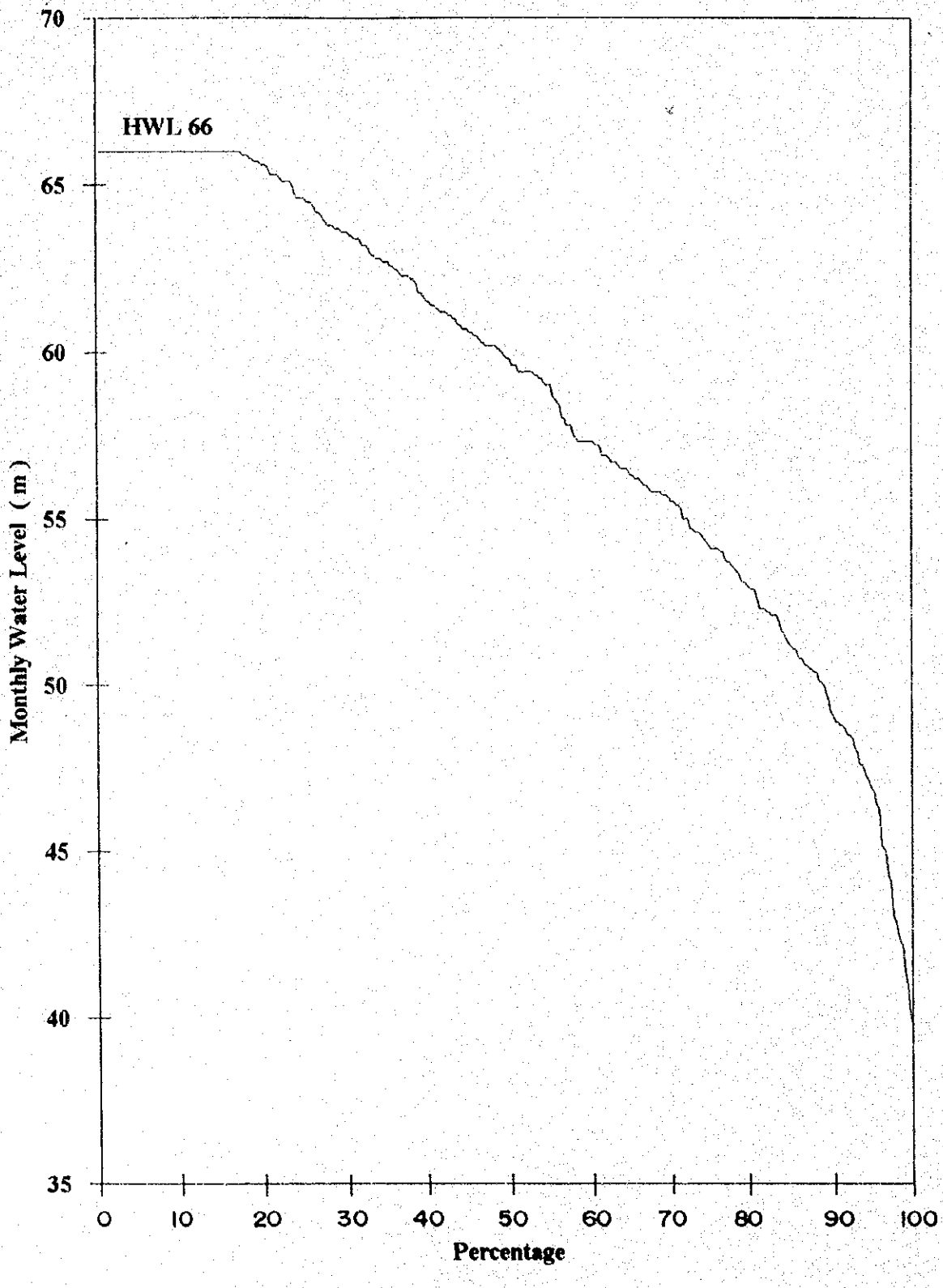
TITLE
WATER DEMAND IN (m³/s) and MCM BASED ON AVERAGE IRRIGATION WATER DEMAND

FIGURE 18



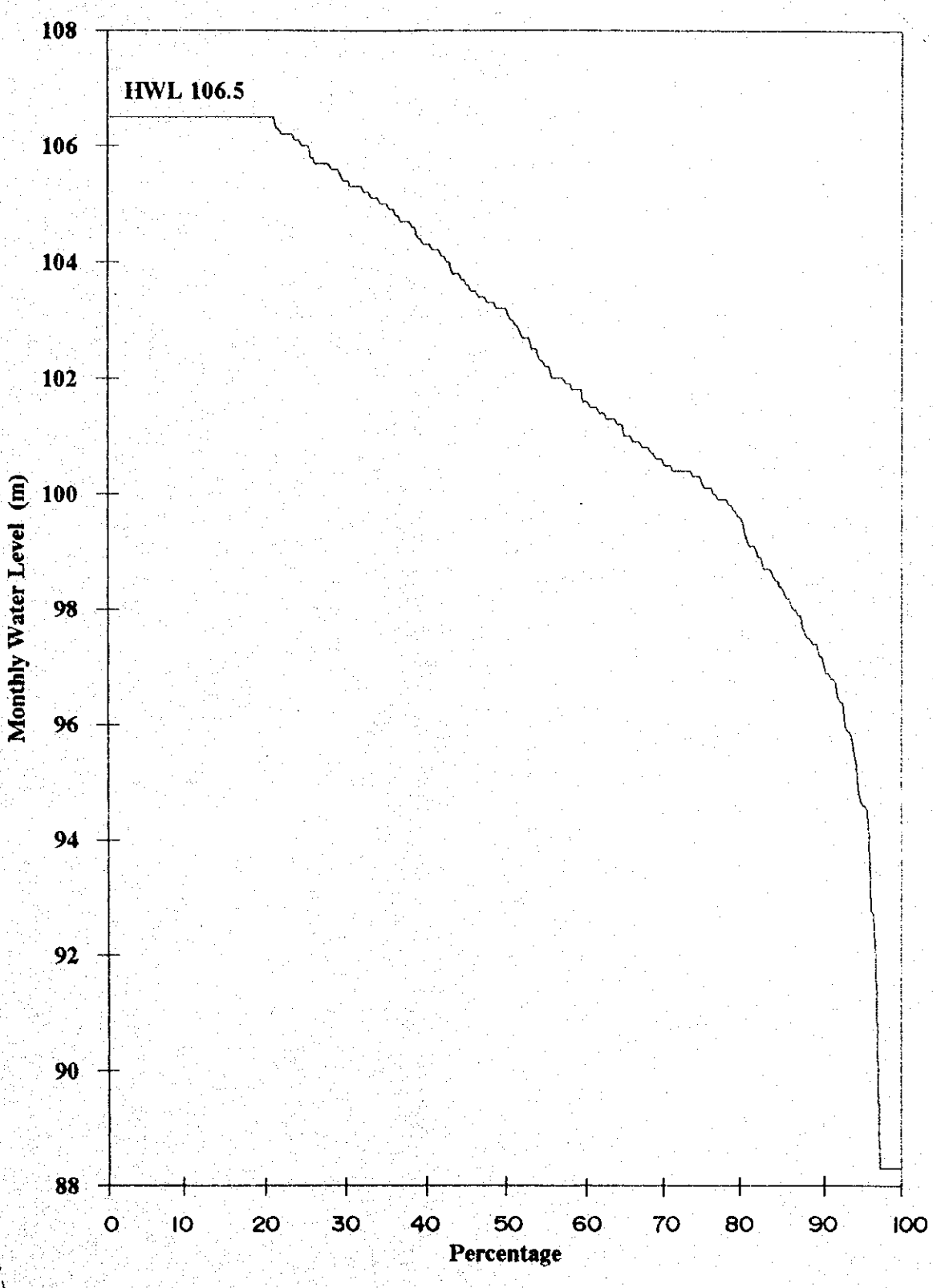
GOVERNMENT OF THE REPUBLIC OF ECUADOR CENTRO DE REHABILITACION DE MANABI (CRM) *THE DETAILED DESIGN STUDY ON THE WATER TRANSBASIN SCHEMES FOR CHONE-PORTOVIEJO RIVER BASINS* JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE RESERVOIR OPERATION CURVES, LA ESPERANZA AND POZA HONDA RESERVOIRS TRANSBASIN DISCHARGE, Q = 16 m³/s

FIGURE 19



GOVERNMENT OF THE REPUBLIC OF ECUADOR CENTRO DE REHABILITACION DE MANABI (CRIM) *THE DETAILED DESIGN STUDY ON THE WATER TRANSBASIN SCHEMES FOR CHONE-PORTOVIEJO RIVER BASINS* JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE DURATION CURVE OF RWL (LA ESPERANZA) TRANSBASIN DISCHARGE, Q = 16 m³/s

FIGURE 20



GOVERNMENT OF THE REPUBLIC OF ECUADOR
CENTRO DE REHABILITACION DE MANABI (CRM)

THE DETAILED DESIGN STUDY ON THE WATER TRANSBASIN SCHEMES FOR CHONE-PORTOVIEJO RIVER BASINS

JAPAN INTERNATIONAL COOPERATION AGENCY

TITLE

DURATION CURVE OF RWL (POZA HONDA)
TRANSBASIN DISCHARGE, Q = 16 m^3/s

FIGURE 21

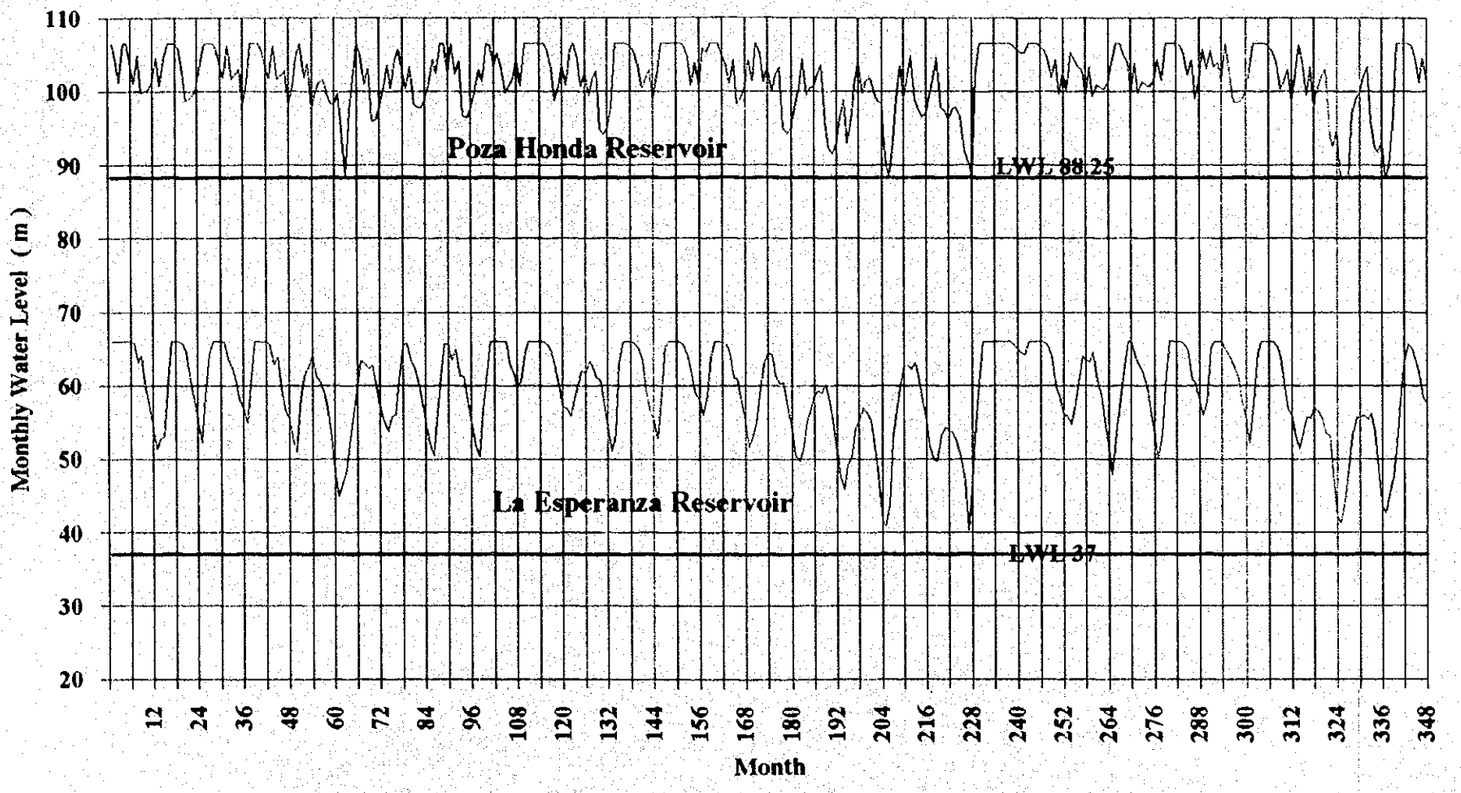


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FIGURE 22

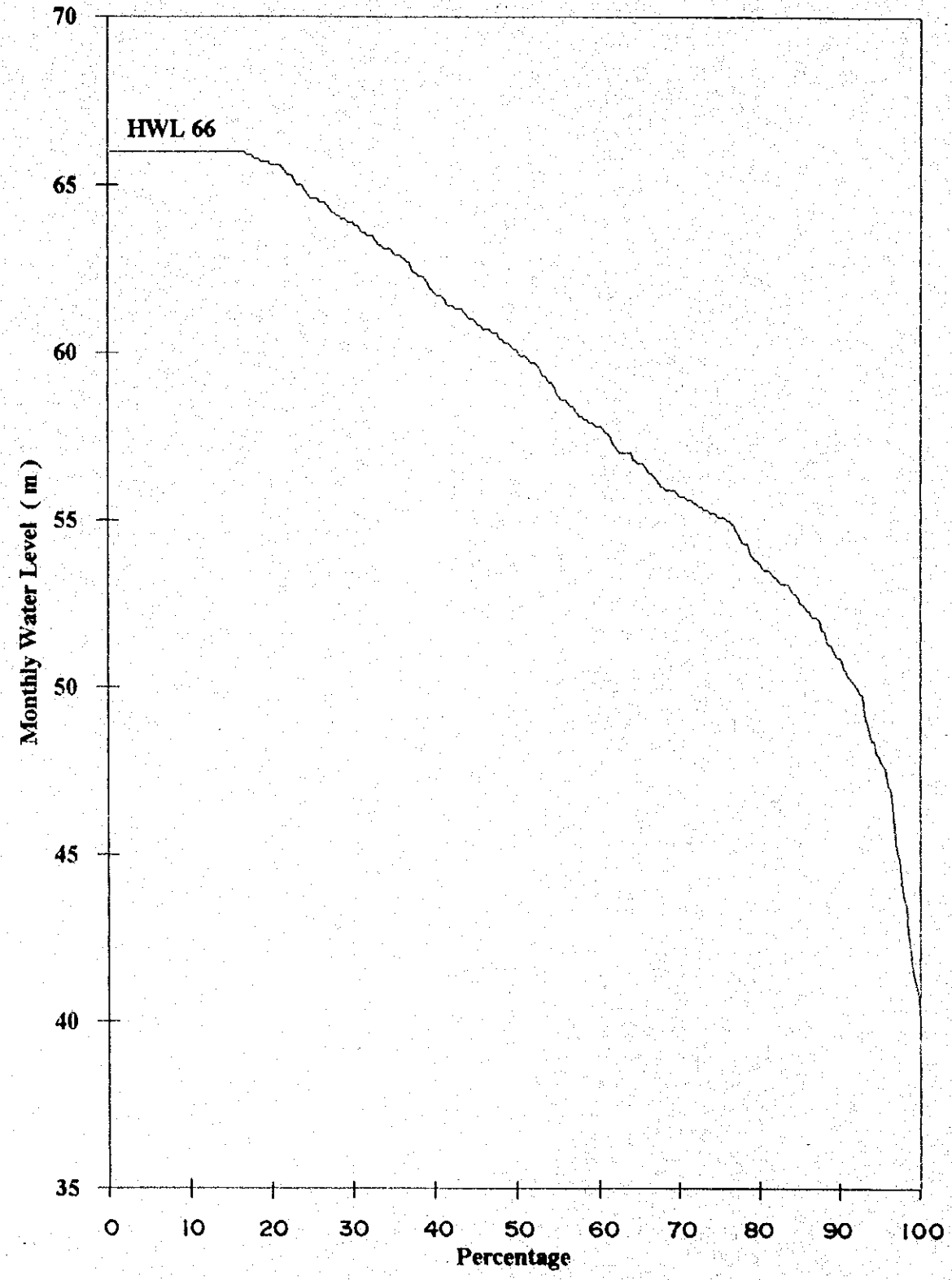

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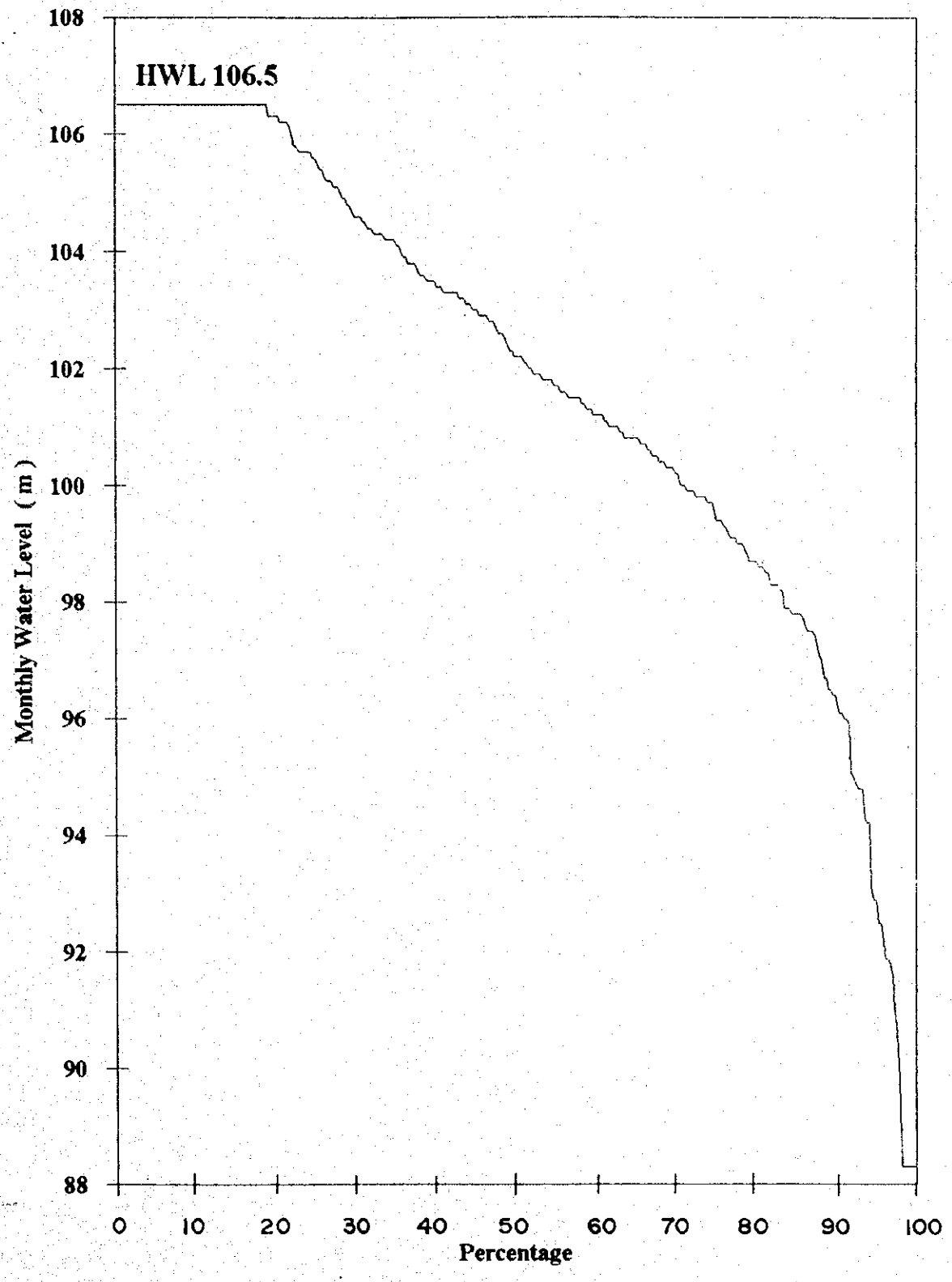
FIGURE 23



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JAPAN INTERNATIONAL COOPERATION AGENCY

TITLE
DURATION CURVE OF RWL (POZA HONDA)
TRANSBASIN DISCHARGE, Q = 14 m^3/s

FIGURE 24

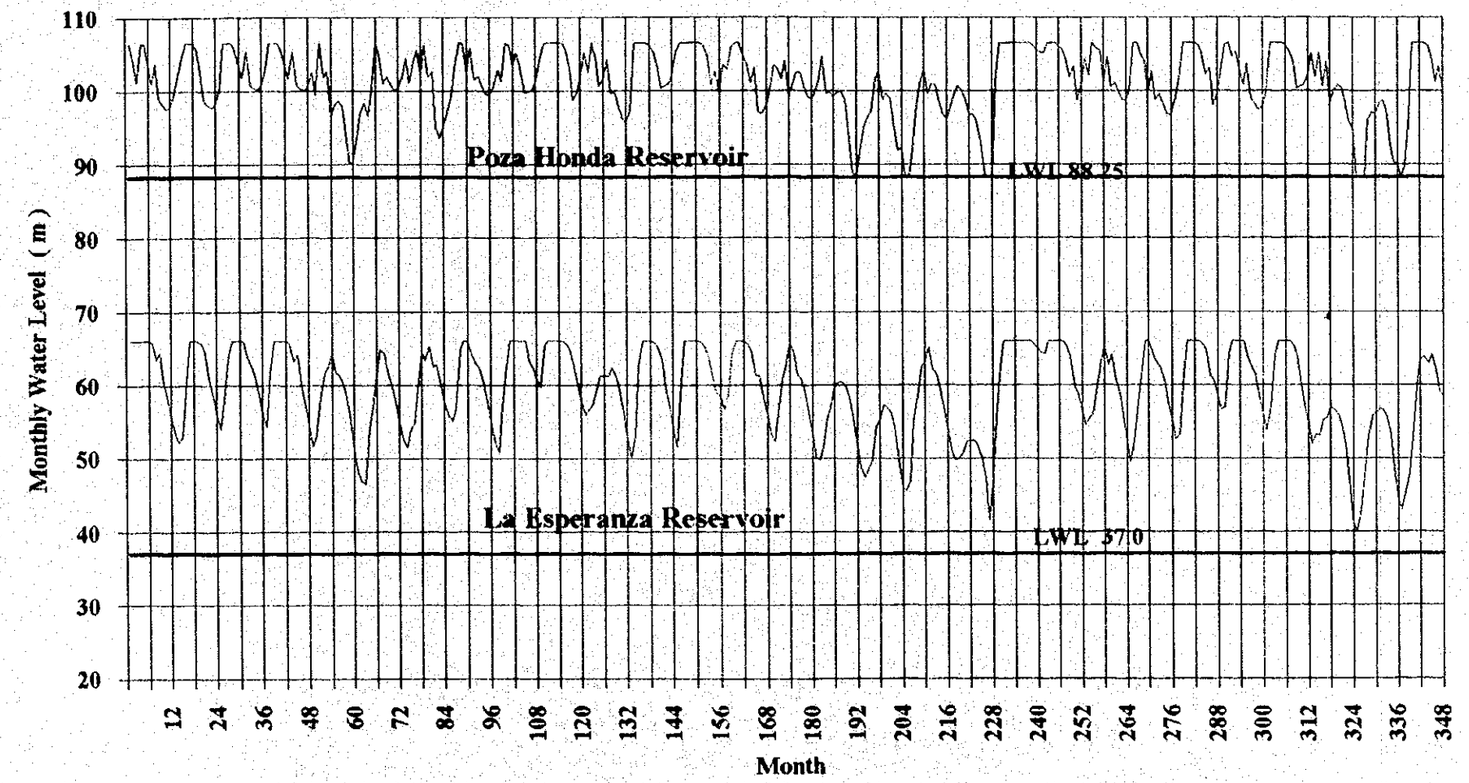

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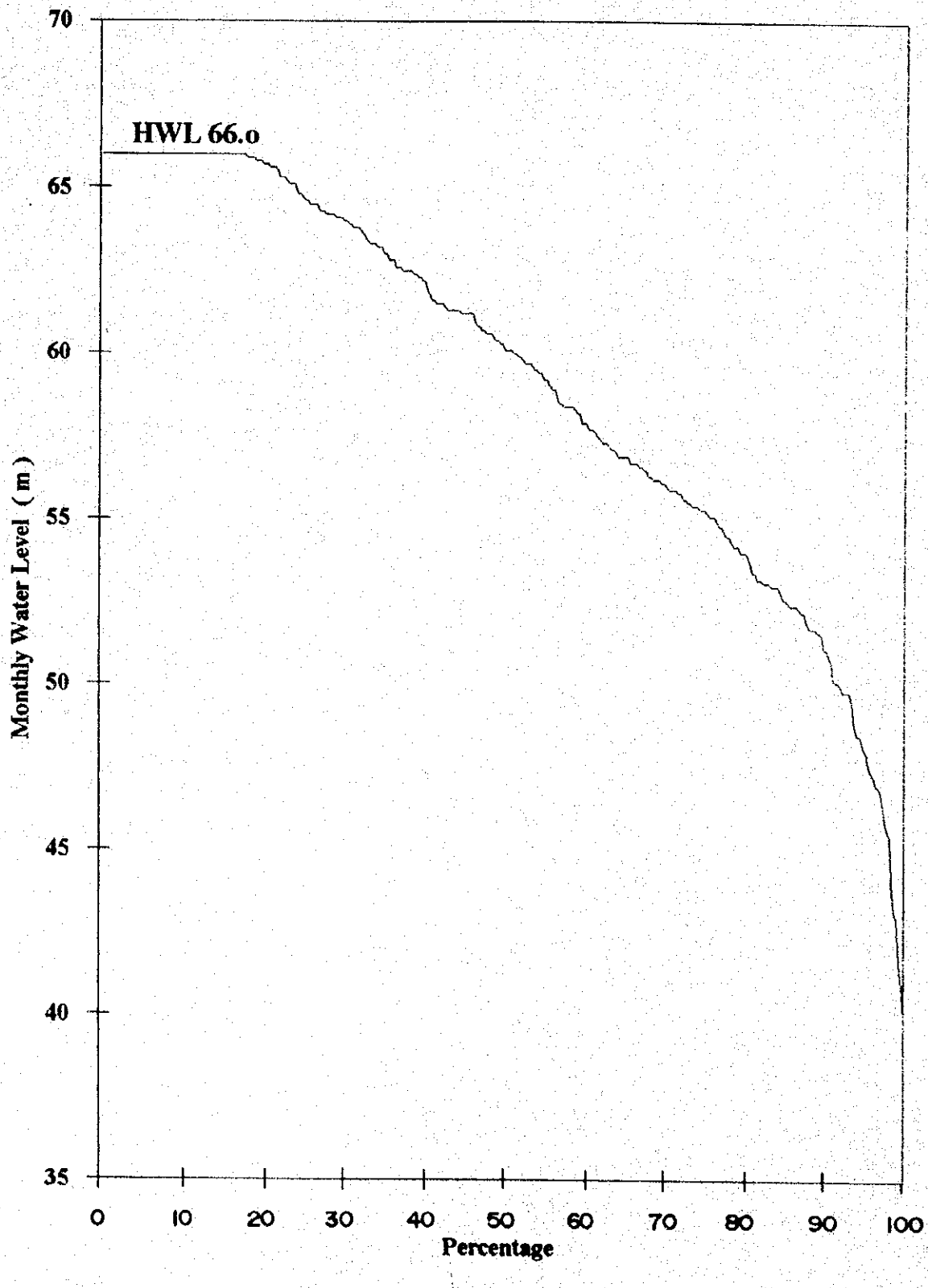
FIGURE 25



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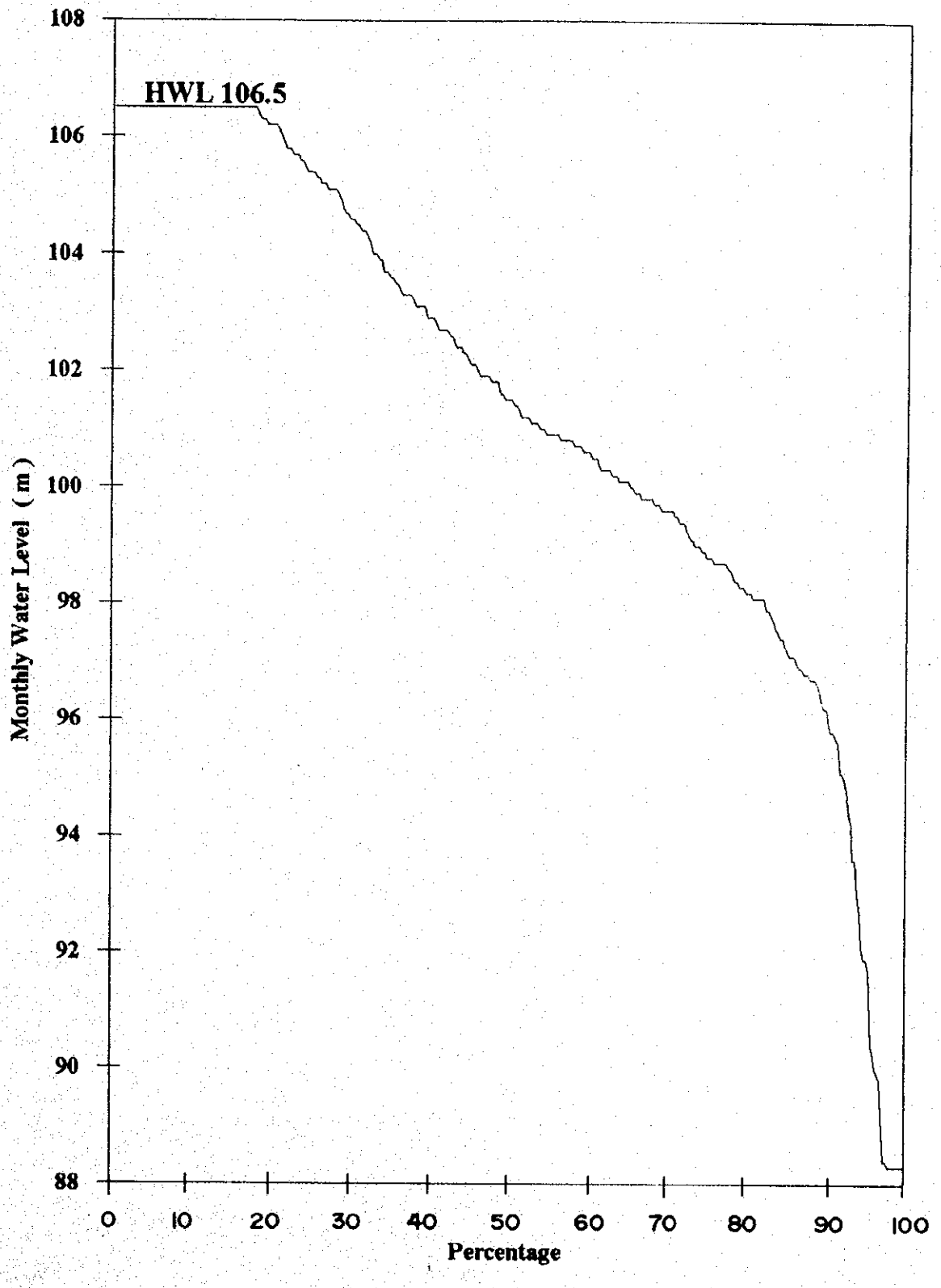
DURATION CURVE OF RWL (LA ESPERANZA)
TRANSBASIN DISCHARGE, Q = 12 m^3/s

FIGURE 26



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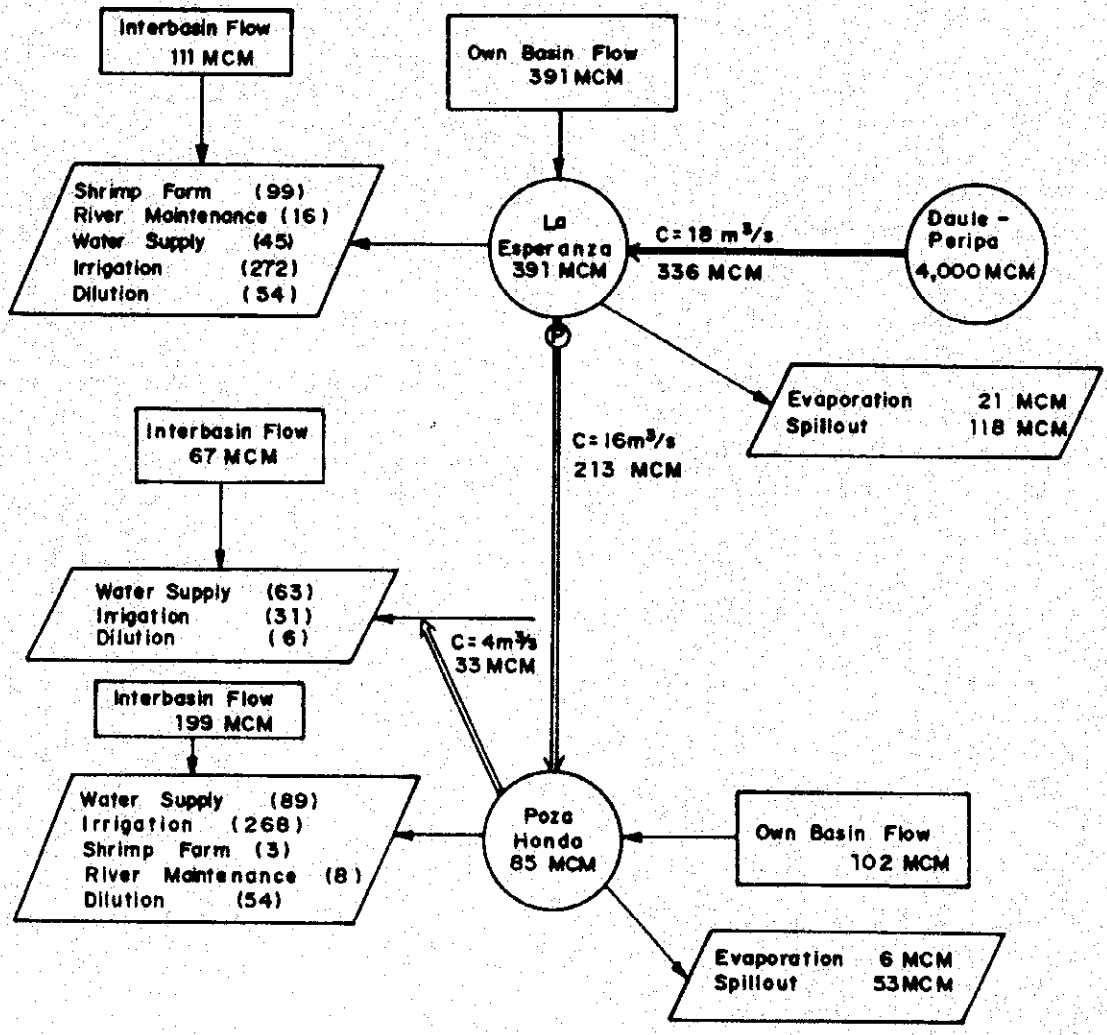
THE DETAILED DESIGN STUDY ON THE WATER TRANSBASIN SCHEMES FOR CHONE-PORTOVIEJO RIVER BASINS

JAPAN INTERNATIONAL COOPERATION AGENCY

TITLE

DURATION CURVE OF RWL (POZA HONDA)
TRANSBASIN DISCHARGE, Q = 12 m^3/s

FIGURE 27



Legend :

- Reservoir / Effective reservoir capacity
- Own basin flow and interbasin flow
- Transbasin
- Movement of water
- Water demand or loss
- Ⓟ Pumping station
- Figures in parenthesis : Water demand in MCM/year
- C : Transbasin capacity

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THE DETAILED DESIGN STUDY ON THE WATER TRANSBASIN SCHEMES FOR CHONE-PORTOVIEJO RIVER BASINS

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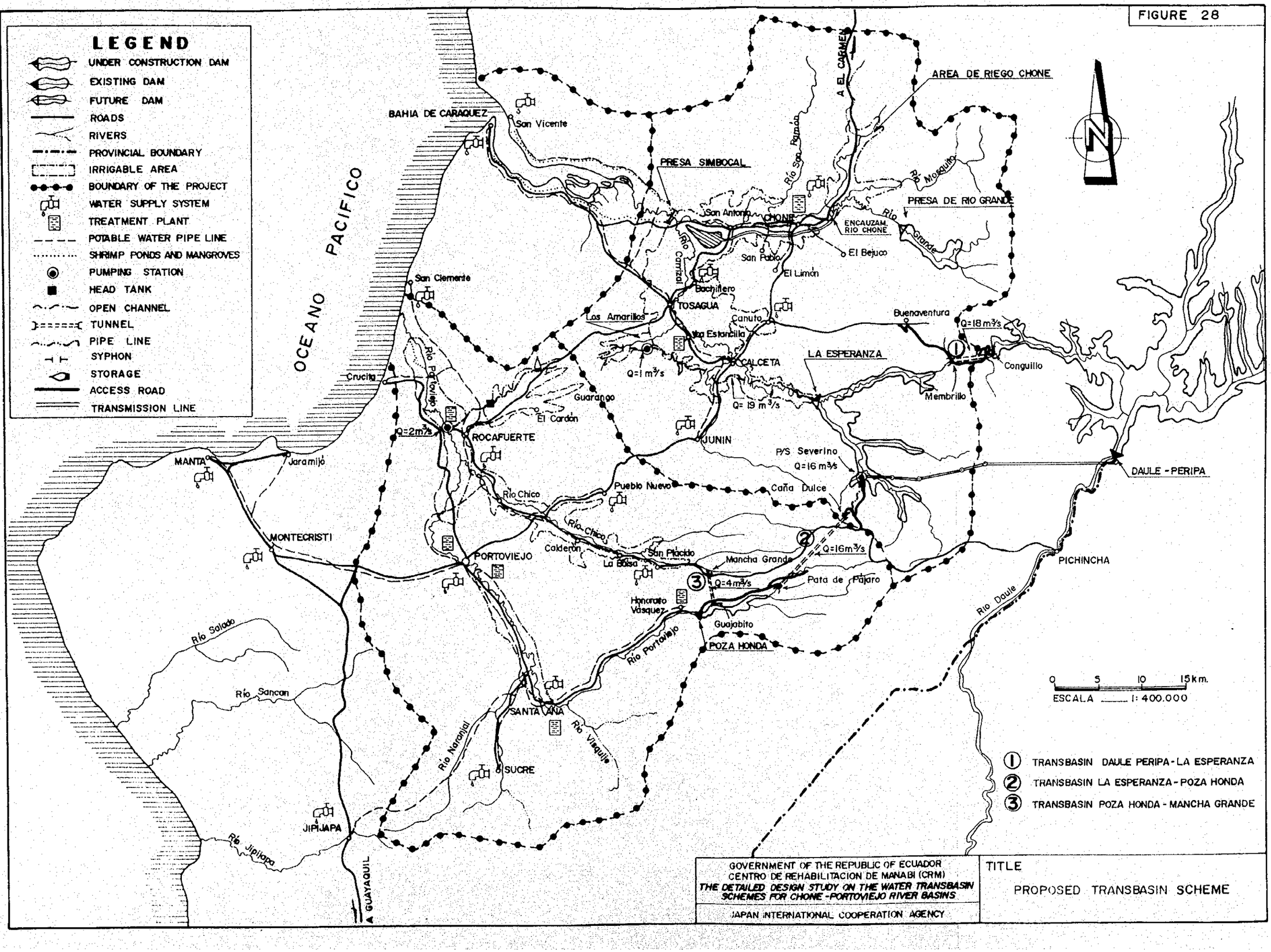
TITLE

SCHEMATIC WATER BALANCE

FIGURE 28



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THE DETAILED DESIGN STUDY ON THE WATER TRANSBASIN SCHEMES FOR CHONE - PORTOVIEJO RIVER BASINS
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PROPOSED TRANSBASIN SCHEME