Japan International Cooperation Agency (JICA)

Comision Ejecutiva Hidroelectrica del Rio Lempa (CEL)

FEASIBILITY STUDY
ON
THE HYDROELECTRIC COMPLEX
OVER
THE TOROLA RIVER
IN
THE REPUBLIC OF EL SALVADOR
(El Chaparral Project)

FINAL REPORT

APPENDIX

MARCH 2004

ELECTRIC POWER DEVELOPMENT CO.,LTD.
(J-POWER)
TOKYO JAPAN

Japan International Cooperation Agency (JICA)

Comisión Ejecutiva Hidroeléctrica del Río Lempa (CEL)

FEASIBILITY STUDY
ON
THE HYDROELECTRIC COMPLEX
OVER
THE TOROLA RIVER
IN
THE REPUBLIC OF EL SALVADOR
(El Chaparral Project)

FINAL REPORT

APPENDIX

MARCH 2004

ELECTRIC POWER DEVELOPMENT CO., LTD.
(J-POWER)
TOKYO-JAPAN

APPENDIX - Contents

Chapter 9: Development Plan

Appendix 9.1: Reservoir V-H, A-H Curve for El Chaparral and La Honda Site

Appendix 9.2: Comparison of Project Cost for Scale Examination Study (El Chaparral and La Honda Project)

Appendix 9.3: Comparison of Project Cost for Alternative (1) (La Honda Upstream Alternative)

Appendix 9.4: Comparison of Project Cost for Alternative (2) (El Chaparral Alternatives)

Appendix 9.5: Comparison of Project Cost for Joint Development (La Honda - El Chaparral)

Appendix 9.6: Energy Calculation for El Chaparral Project (E=220.6 GWh)

Appendix 9.7: Dynamic Programming (DP)

Chapter 11: Feasibility Study

Appendix 11.1: Calculation of Head Loss

Appendix 11.2: Calculation of Dam Height

Appendix 11.3: Reservoir Seepage Flow Analysis

Appendix 11.4: Dam Break Analysis

Appendix 11.5: Transportation Route to Project Site

Chapter 12: Construction Plan and Cost of Construction

Appendix 12.1: Construction Plan

Appendix 12.2: Cost of Construction

- Appendix 12.2.1: Summary of El Chaparral Project Cost
- Appendix 12.2.2: Details of Project Cost (Civil)
- Appendix 12.2.3: Details of Project Cost (Electric)
- Appendix 12.2.4: Disbursement Schedule

Appendix 12.3: Calculated Quantity

- Appendix 12.3.1: Summary of Quantity
- Appendix 12.3.2: Civil Works
- Appendix 12.3.3: Hydromechanical Equipment

Chapter 14: Economic and Financial Evaluation

Appendix 14.1: Economic / Financial Evaluation

Appendix 14.2: Cash Flow Analysis – Case A

Appendix 14.3: Cash Flow Analysis – Case B

Appendix 14.4: Cash Flow Analysis – Case C

Chapter 4: Situation of Power Sector

Appendix 4.1 : Generation Features of Existing Hydro Power Station

Appendix 4.2 : Operating Records of Existing Hydro Power Station

List

Appendix 4.1

Generation Features of Existing Hydro Power Station

Appendix 4.1 Generation Features of Existing Hydro Power Station 1/2

Name	:	15 de Septiembre Hydro Power Station	Guajoyo Hydro Power Station
Commenced Operation	:	Unit Nos. 1&2 : 1983	Unit No. 1 : 1963 (Renovation 2000)
Dam Type	:	Gravity Type Concrete / Rock-fill Compound Dam, Spillway : 8-gates	Gravity Type Concrete Dam, Spell way · 5-gates
Type of Power Station	:	Semi-under-ground, Directly Underneath Dam	Semi-under-ground, Directly Underneath Dam
Generating Method	:	Dam Type · Reservoir Type (Base Load)	Dam Type · Reservoir Type (Peak Load)
Installed Capacity	:	156.6 MW	15.0 MW
Switchyard	:	115kV One and Half Bus, Transmission Line : 5-circuits, 2-banks, 46kV Distribution Line: 6-banks	115kV One and Half Bus, Transmission Line : 1-circuit, 2-banks, 46kV Distribution Line : 5-banks
Turbine Type	:	1-unit, Vertical axis Frances (Voith)	1-unit, Vertical axis Kaplan (Original : Toshiba, Renovation : Va Tech E.W
Generator Type	:	3-phase, Synchronous type, Hitachi (Japan)	3-phase, Synchronous Type, Toshiba (Japan), ABB Alstom Power
Unit Number	:	2-units, (78.3 MW × 2)	1-unit (15 MW), After renovation (19.8 MW)
Reservoir Area	:	35.5 km^2	55 km^2
Reservoir Capacity	:	380 million m^3	645 million m^3
Effective Reservoir Capacity	:	37 million m^3	490 million m^3
Annual Average Discharge	:	366 m^3/sec-	26.3 m^3/sec, After renovation (32.5 m^3/sec)
Reservoir Water Level (El.)	:	Normal High Water Level : 49 m, Low Water Level : 30 m	Normal High Water Level : 430.30 m, Normal Water Level : 427.00m, Low Water Level . 418 m
Head	:	Maximum : 32 m Minimum : 19 m	Maximum : 54 m Minimum . 42 m
Maximum Plant Discharge	:	660 m^3/sec	42 m^3/sec After renovation (46 m^3/sec)
Annual Average Energy Generation	:	605.2 GWh	64.2 GWh

Appendix 4.1 Generation Features of Existing Power Station 2/2

Name	:	Cerron Grande Hydro Power Station5	5 de Noviembre Hydro Power Station
Commenced Operation	:	Unit No.1: 1976, Unit No. 2 : 1977	Unit No 1&2 : 1954, Unit No.3 : 1957, Unit No.4 . 1961, Unit No.5 : 1966, Renovation : 2000, 2001 and 2002
Dam Type	:	Rockfill dam, High : 90m, Spillway : 4-gates	Gravity type concrete dam, High : 65m, Spillway : 7-gates
Type of Power Station	:	Semi-underground, Directly Underneath Dam	Underground, Directly Underneath Dam
Generating Method	:	Dam Type · Reservoir Type (Base Load)	Dam Type · Reservoir Type (Base Load)
Installed Capacity	:	135 MW	84.4 MW
Switchyard	:	115kV Transmission Line : 4-circuits, 2-banks, 46kV Distribution Line: 1-bank	115kV Transmission Line : 2-circuits, 5-banks 115kV Shingle bus
Turbine Type	:	Unit Nos.1&2 : Vertical axis Francis, Aris Charmer	Unit Nos. 1,2,3&5 : Horizontal axis Francis, Bell, S A. Kriens (Switzerland) Unit No. 4 : Horizontal axis Frances, Hitachi (Japan)
Generator Type	:	Unit Nos.1&2 · 3-phase, Synchronous type, Brown Boveri and Co, (BBC) ,Baden	Unit Nos.1,2&3 : 3-phese, Synchrous type, BBC,. Baden Unit No.4 : 3-phese, Synchrous type, Hitachi (Japan) Unit No.5 : 3-phese, Synchrous type, ASEA(Switzerland)
Unit Number	:	2-units (67.5 MW)	5-units (19 MW × 4-units & 21.4 MW ×1-unit)
Reservoir Area	:	135 km^2	16 km^2
Reservoir Capacity	:	2,180 million m^3	87 million m^3
Effective Reservoir Capacity	:	1,430 million m^3	44 million m^3
Annual Average Discharge	:	197 m^3/sec	197 m^3/sec
Reservoir Water Level (El.)	:	Normal High Water Level : 243 m, Low Water Level : 228 m	Normal High Water Level : 180 m, Low Water Level . 172 m
Head	:	Maximum : 57 m Minimum : 42 m	Maximum : 56 m Minimum : 41 m
Maximum Plant Discharge	:	260 m^3/sec	Unit Nos. 1,2&3 (19 MW) 36.4 m^3/sec Unit No.4 (19 MW) 34.8 m^3/sec Unit No.5 (21.4 MW) 49.9 m^3/sec *(on El.180 m)
Annual Average Energy Generation	:	488 GWh	457.4 GWh

Appendix 4.2

Operating Records of Existing Hydro Power Station

GUAJOYO RESERVOIR

Table 4.2A-1 Operated Reservoir Water Level (1991~2000)

(Unit : El. m)

Year	Water Level	MONTH												Ave.
		Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	
91	Upp	426.3	424.2	421.7	419.5	419.5	420.0	420.5	420.1	421.1	423.2	422.6	422.2	421.7
92	Upp	421.2	420.2	419.2	418.6	417.9	420.4	423.3	426.4	428.4	429.7	427.9	425.9	423.3
93	Upp	423.9	422.5	421.2	420.2	419.3	420.7	422.5	424.2	428.9	429.9	428.6	426.6	424.0
94	Upp	425.0	423.3	421.4	419.7	419.6	421.6	421.8	424.2	425.7	427.3	425.9	424.2	423.3
95	Upp	422.6	421.9	421.2	420.9	420.0	420.3	422.4	426.5	430.2	429.9	428.9	427.4	424.4
96	Upp	426.0	424.4	421.9	420.3	419.8	422.0	426.1	428.8	429.9	430.1	428.9	426.8	425.4
97	Upp	425.0	423.2	421.7	420.2	418.4	422.0	424.3	424.7	426.8	428.7	428.3	427.7	424.2
98	Upp	426.9	425.5	423.6	421.6	420.0	420.6	422.9	425.1	425.7	430.2	429.6	427.7	424.9
99	Upp	425.7	424.0	422.2	420.6	420.5	421.5	423.2	428.9	429.7	430.1	427.9	421.2	424.6
00	Upp	419.7	420.1	420.3	420.4	421.5	426.2	426.3	427.7	429.9	429.7	428.6	427.5	424.8
Average		424.2	422.9	421.4	420.2	419.7	421.5	423.3	425.7	427.6	428.9	427.7	425.7	424.1

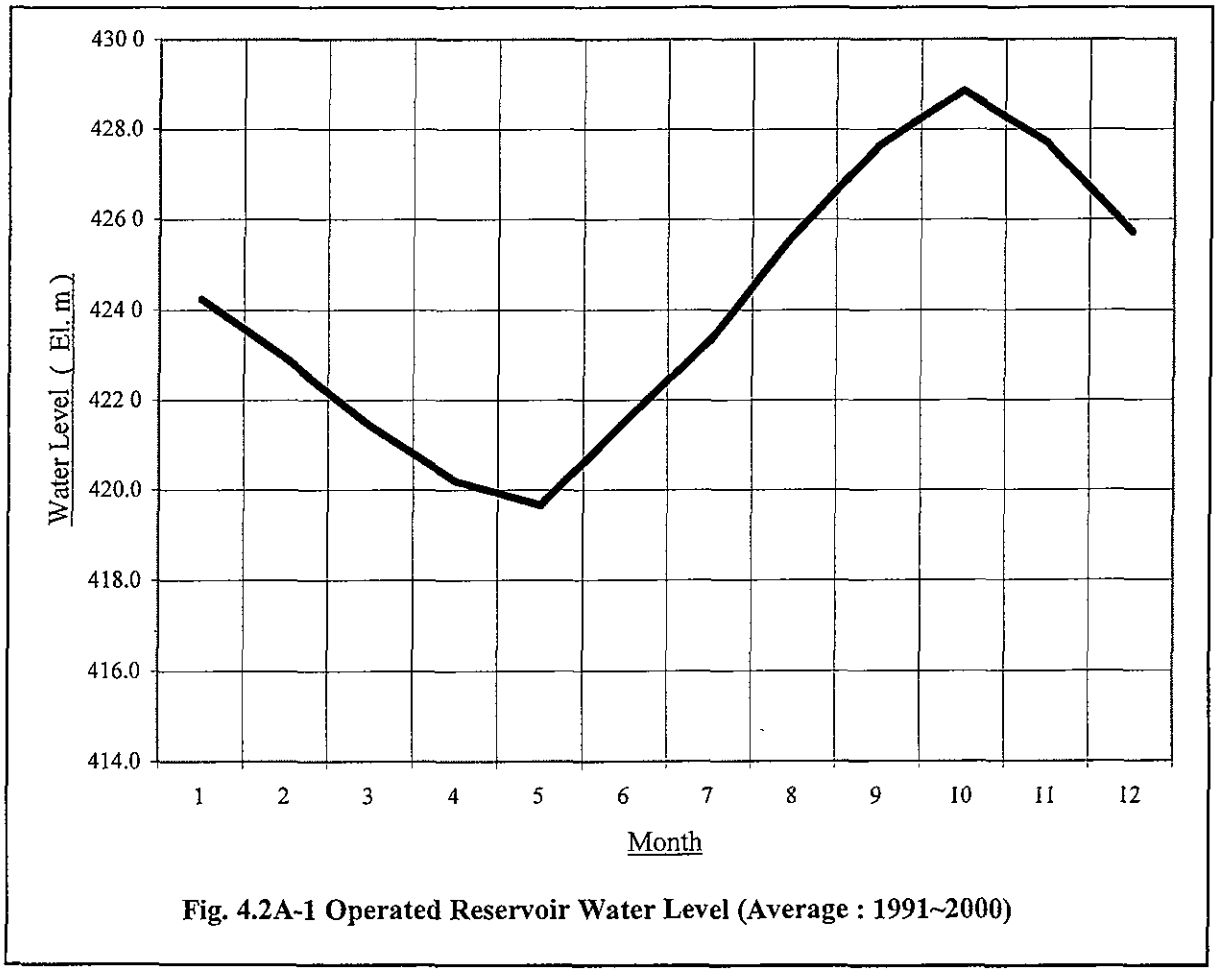


Fig. 4.2A-1 Operated Reservoir Water Level (Average : 1991~2000)

Note : H.W.L : El. 430 m, L.W.L : El 418 m

GUAJOYO RESERVOIR

Table 4.2A-2 Operated Generating Discharge (1991~2000)

(Unit : m^3/s)

Year	MONTH											
	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
91	24 60	35.60	37.60	32.30	10 30	14.80	8.00	17.60	9.20	3.00	10.80	11.10
92	13.60	14.10	10.90	6.60	0.60	0.00	1.90	3.70	8.80	9.00	30.40	31.70
93	30.50	21.50	16.90	14.40	16 10	0.10	16.30	5.40	6.30	8.90	21.50	30.50
94	26.40	29.00	28.20	24.20	11.70	10.80	3.10	0.50	0.20	2.00	26.90	24.50
95	24.60	9.00	6.60	5.60	18.30	16.40	1.50	2.30	18.90	28.40	22.80	20.20
96	20.80	26.90	37.60	35.50	19.00	11.70	3.00	9.20	22.30	28.80	36.40	28.50
97	31.50	31.70	23.70	22.10	16.40	5.80	0.10	0.00	0.00	2.00	0.00	0.00
98	5.10	23.50	28.40	30.10	21.90	19.40	22.50	15.00	9.10	22.50	33.90	33.70
99	35.90	34 20	29.40	24.60	8.60	23.10	22.40	23.00	22.40	27.20	32.80	35.40
00	12.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60	14.10	9.10
Ave.	22.55	22.55	21.93	19.54	12 29	10.21	7.88	7.67	9.72	13.24	22.96	22.47

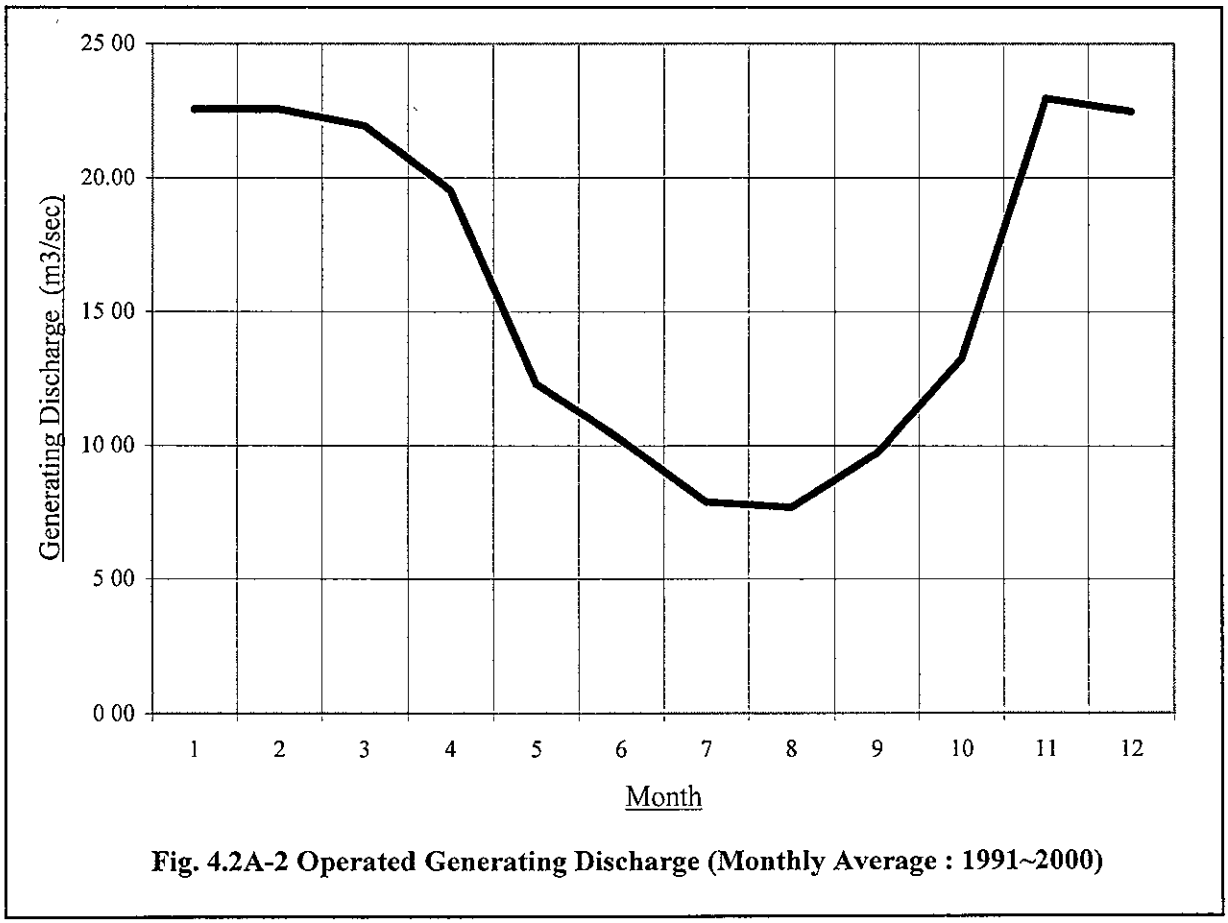


Fig. 4.2A-2 Operated Generating Discharge (Monthly Average : 1991~2000)

Note : Max. Generating Discharge . 42 m^3/s

GUAJOYO HYDRO POWER STATION

Table 4.2A-3 Number of Unit Start & Stop

Year		1996	1997	1998	1999	2000	Total	Average
Unit 1	Start	167	131	250	133	32	713	143
	Stop	168	126	238	133	32	697	139
	Total	335	257	488	266	64	1,410	282
	Average	168	129	244	133	32	705	141

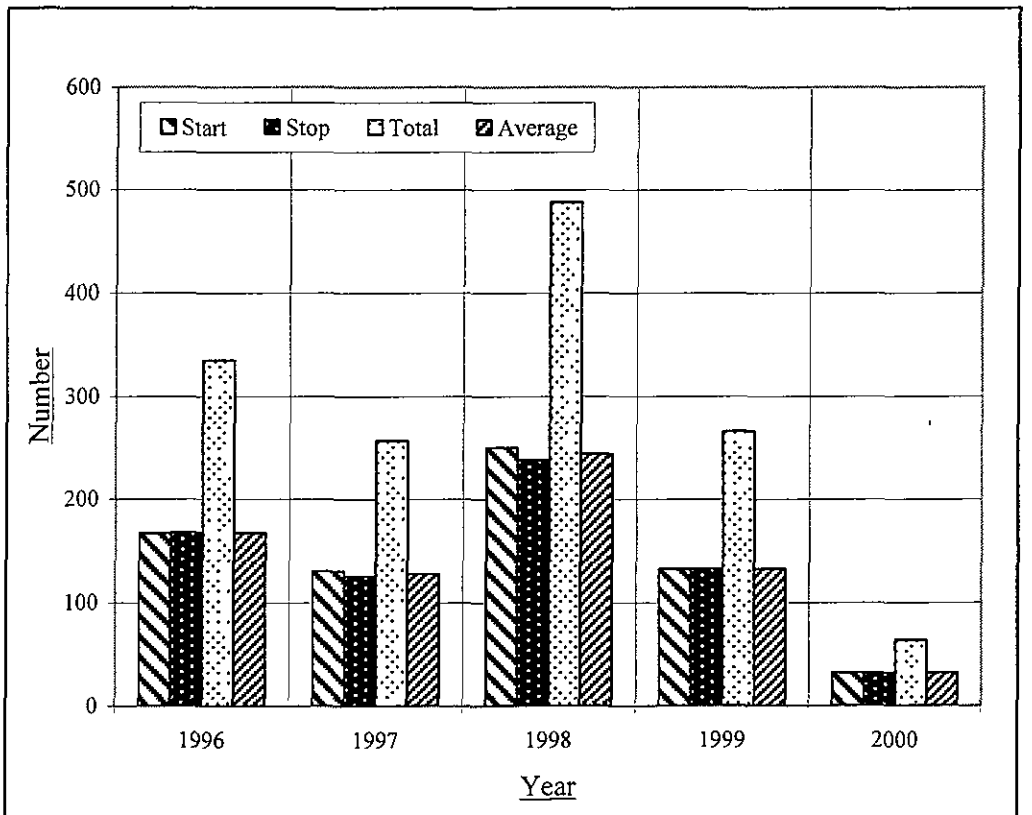


Fig.4.2A-3 Number of Unit Start & Stop

GUAJOYO HYDRO POWER STATION

Table 4.2A-4 Operation Hours of Generating Unit

(Unit : Hrs)

Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Total	Average
Unit 1	5,140	3,629	4,964	4,304	4,026	5,957	2,734	5,172	7,038	720	43,685	4,368

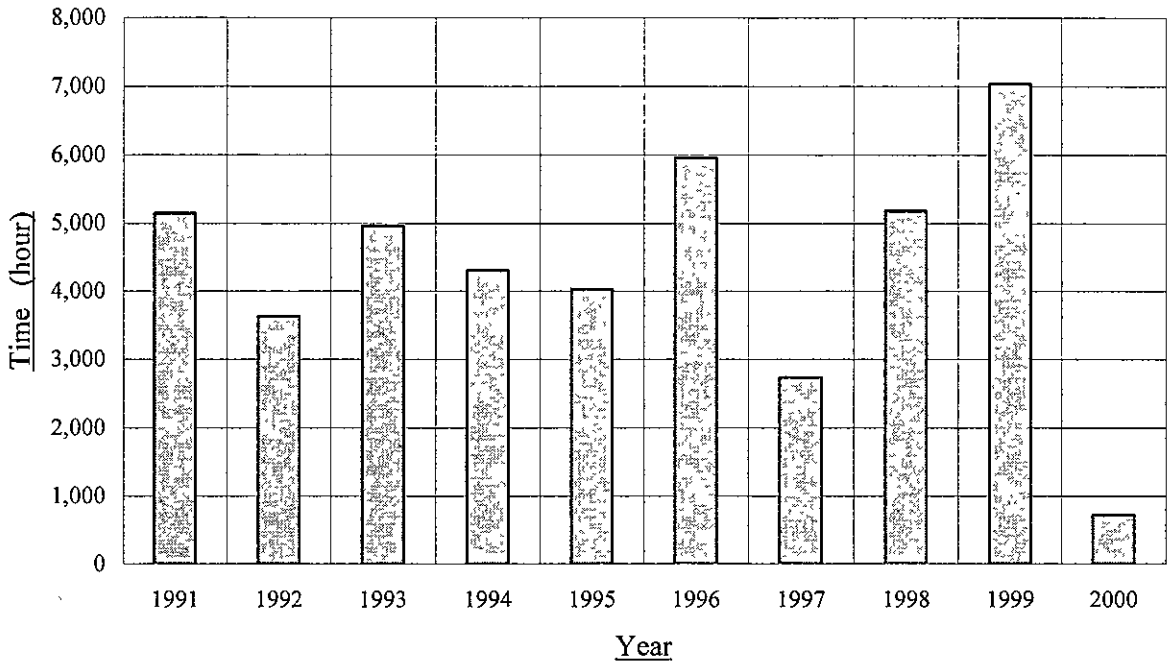


Fig.4.2A-4 Operation Hours of Generating Unit

GUAJOYO HYDRO POWER STATION

Table 4.2A-5 Daily Operation (Load) Pattern (2001)

(Unit . MW)

2001	Hour																							
date	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Jan 1	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	18	17	17	17
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Feb 1	0	0	0	0	0	5	9	12	17	17	17	17	17	17	17	17	17	17	17	17	17	16	17	11
15	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
Mar 1	0	0	12	17	14	12	17	17	17	17	17	17	17	17	17	17	17	17	19	19	17	17	17	17
15	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	16	17	17	16	14	17
Apr 1	7.7	4.6	0	4.2	1.1	0	0	14	17	17	17	17	17	17	17	17	17	15	16	17	17	17	12	7
15	0	0	0	0	0	0	0	0	0	0	8.1	8 1	8.2	8.2	8.2	8.2	8 2	6.2	12	12	8.4	7.8	8	8
May 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	8 4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	10	10	10	10	10	10	10	8.8	8.2	10	11	11	9.2	8 2	8
Jun 1	4	8.1	8.2	8.2	8.2	8.1	0	0	0	0	0	0	0	0	0	0	0	0	6.7	10	10	10	8	8
15	12	12	12	12	12	12	0	0	0	0	0	0	0	0	0	0	0	0	8.2	15	15	14	13	13
Ave.	7	7.1	7.7	8.5	8	8.1	7.2	8.6	9.3	9 5	10	10	10	10	10	10	10	9.6	12	13	12	12	11	10

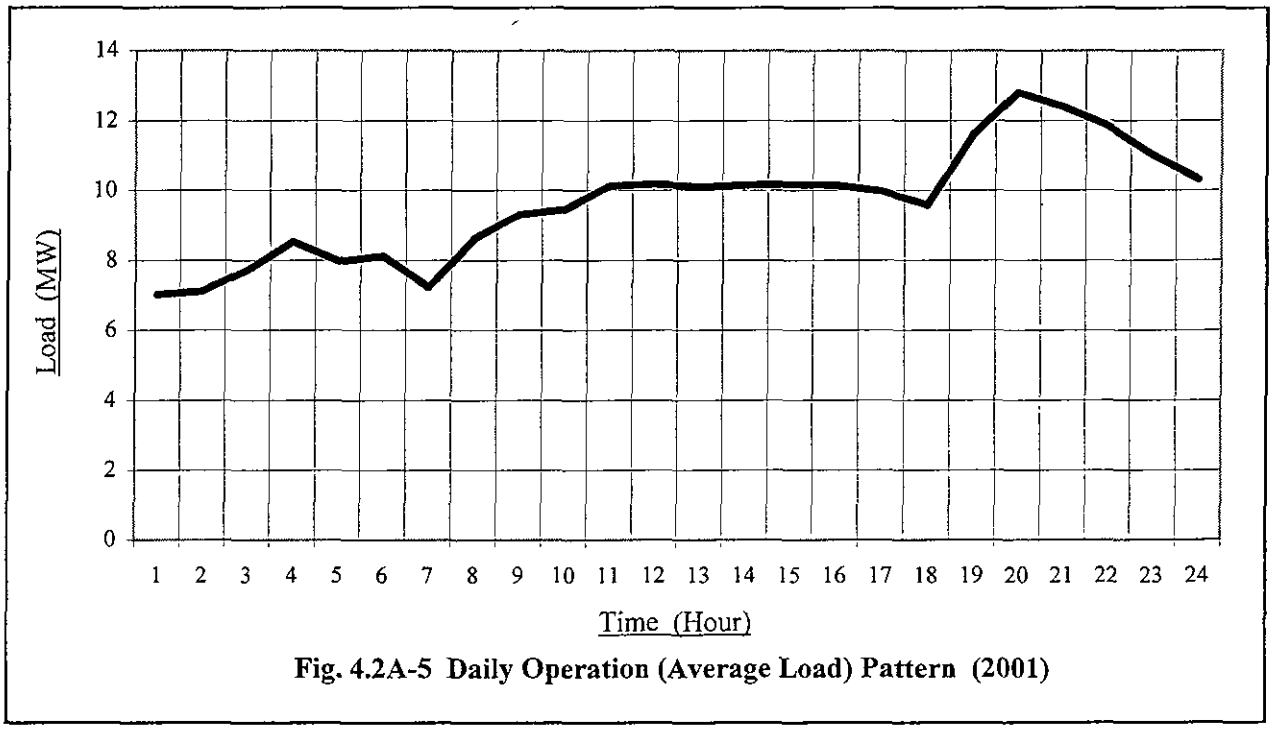


Fig. 4.2A-5 Daily Operation (Average Load) Pattern (2001)

CERRON GRANDE RESERVOIR

Table 4.2B-1 Operated Reservoir Water Level (1991~2000)

(Unit : El. m)

Year	Water Level	MONTH												Ave.
		Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	
91	Upp	238.4	235.8	232.9	231.0	228.6	231.4	229.5	229.4	232.4	237.5	237.2	236.1	233.4
92	Upp	234.1	231.6	230.3	229.3	228.3	234.8	239.6	242.6	242.9	242.3	240.7	238.8	236 3
93	Upp	236.2	234.7	232.9	231.1	229.1	231.9	235.5	240.1	243.0	243.0	241.9	240.7	236.7
94	Upp	238.8	236.9	234.7	232.3	228.9	229.8	229.0	237.5	239.5	241.6	241.0	239.7	235.8
95	Upp	238.4	236.4	233.8	231.5	228.6	230.5	234.6	237.9	243.0	243.1	242.4	241.2	236.8
96	Upp	239.7	237.8	235.5	233.0	231.4	234.7	239.9	242.6	242.8	243.1	242.7	241.5	238.7
97	Upp	240.2	238.4	235.6	231.5	228.7	231.6	232.5	234.4	240.1	242.4	241.7	239.8	236.4
98	Upp	237.6	235.9	234.0	231.7	229.7	230.2	233.0	238.7	239.1	243.2	242.9	241.7	236.5
99	Upp	237.6	235.9	234 0	231.7	229.7	230.2	233.0	238.7	239.1	243.2	242.9	241.7	236.5
00	Upp	240.6	237.6	233.0	231.3	230.5	232.6	230.6	234.7	240.8	242.1	241.2	240.1	236.3
Average		238.2	236.1	233.7	231.5	229.4	231.8	233.7	237.7	240.3	242.1	241.5	240.1	236 3

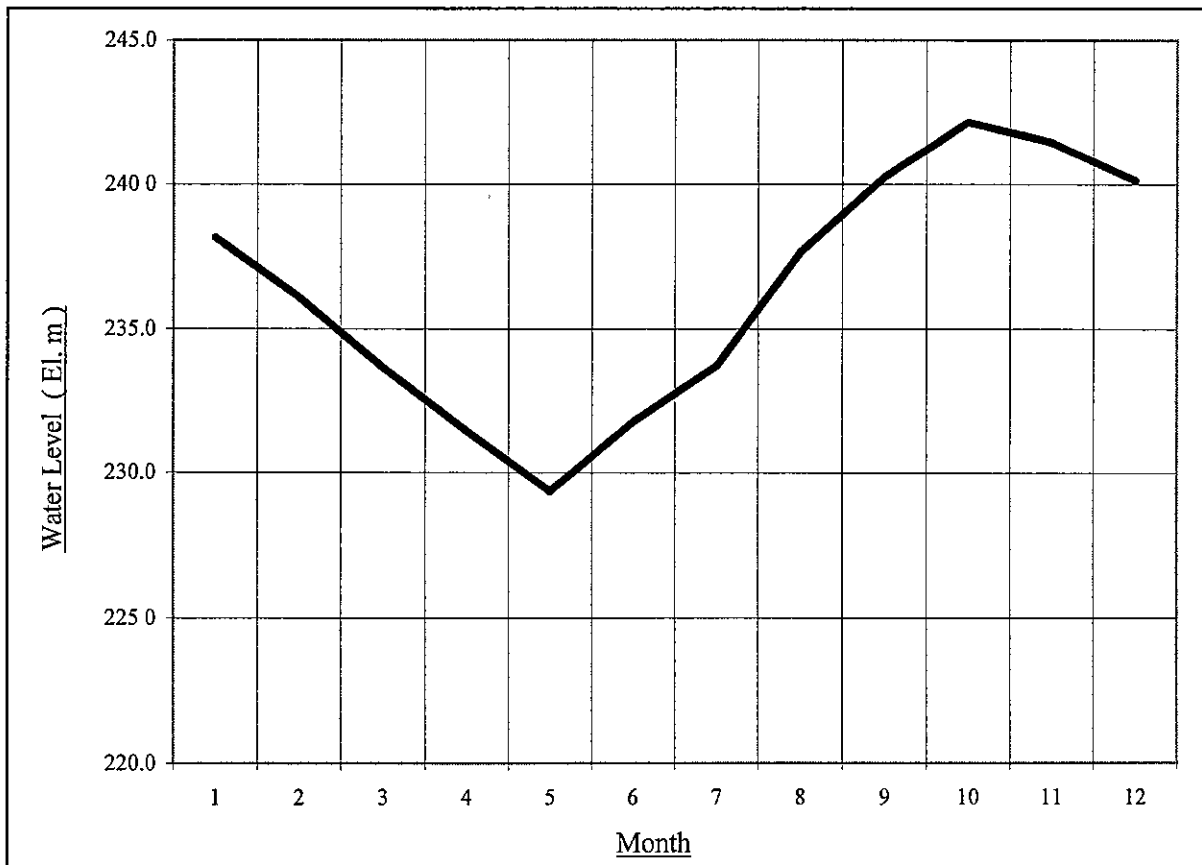


Fig. 4.2B-1 Operated Reservoir Water Level (Average. 1991~2000)

Note : H.W.L : El. 243 m, L.W.L : El. 228 m

CERRON GRANDE RESERVOIR

Table 4.2B-2 Operated Generating Discharge (1991~2000)

(Unit m^3/s)

Year	MONTH											
	Jan.	Feb.	Mar.	Apr.	May.	Jun	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
91	131.00	149.60	138.00	98.40	98.10	60 40	127.90	129.30	57.50	33.00	77.10	86.10
92	93.20	97.90	57.30	40.40	42.20	15.20	89.10	120 90	165.40	155.20	136.90	140.30
93	140.30	91.20	78.90	79.90	97.80	69.40	90.80	80.40	122.80	164.50	119.80	113 20
94	124.10	121.70	109.80	113 90	146.10	116 00	90.30	54.30	72.80	61.00	92.50	94.30
95	87 20	101.00	98.00	85.40	107.30	83 40	78.20	125.30	87.20	113.40	104.30	105.10
96	101 70	113.60	123.00	126.40	107.40	114.70	144.80	130.20	98.30	114.30	115.10	114.10
97	108.80	127.10	131 80	153.20	114.20	89.70	88.20	51.30	17.00	86.90	84.40	118.10
98	110.40	94.00	97.00	95.70	88 10	70 00	78 80	92.50	105.30	110.70	151 40	124 50
99	131.10	124.90	147.90	141.50	101.70	44.80	99.60	149.90	167 40	157.30	151.10	132.20
00	125.30	142.80	157.60	58.00	79.60	128.10	112.60	37.20	37.00	94.20	90.70	81.20
Ave.	115.31	116.38	113.93	99.28	98.25	79 17	100.03	97.13	93.07	109.05	112.33	110.91

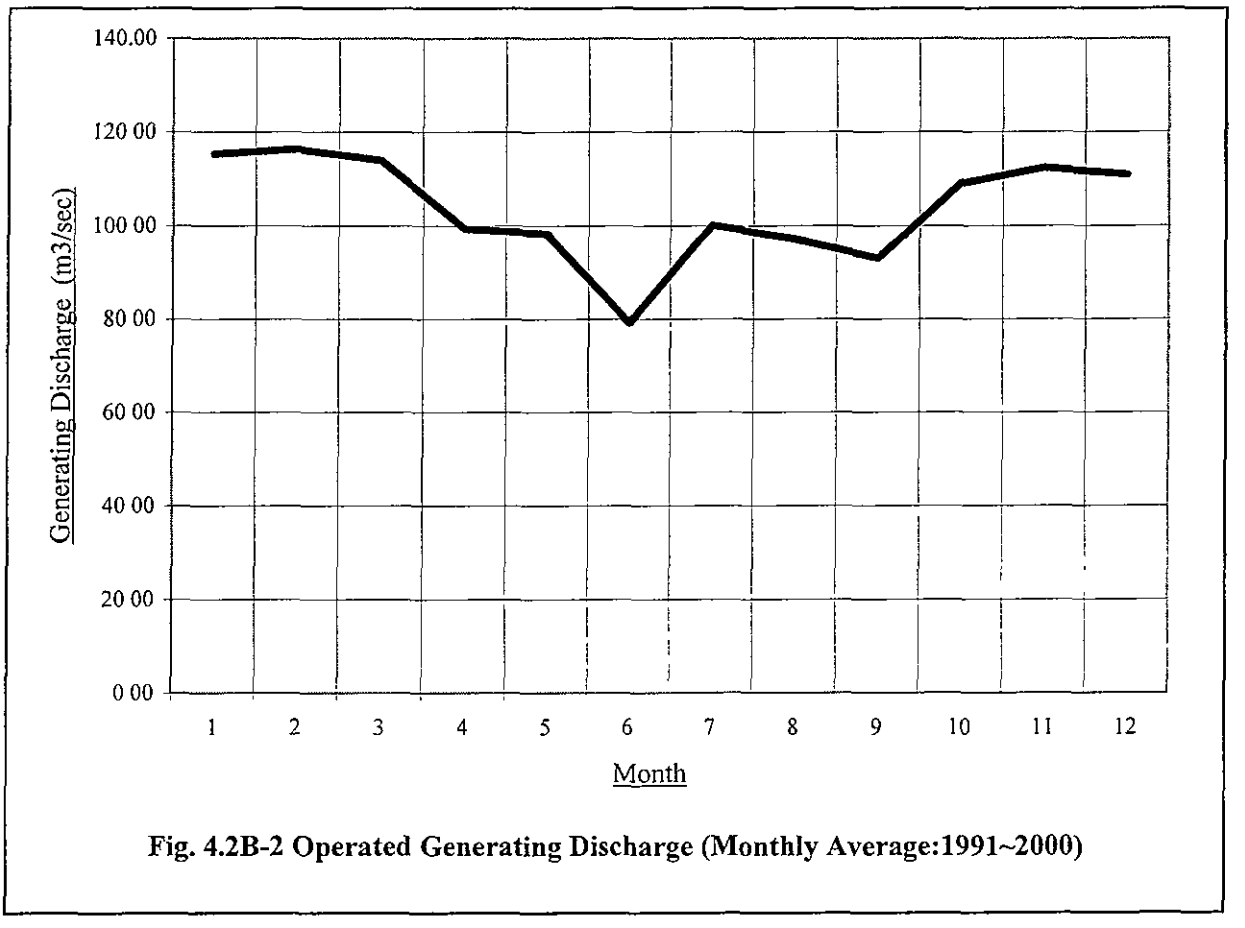


Fig. 4.2B-2 Operated Generating Discharge (Monthly Average:1991~2000)

Note Max. Generating Discharge : 260 m^3/s

Table 4.2B-3 Number of Unit Start & Stop

Year	Unit 1		Unit 2		Total		Average	
	Start	Stop	Start	Stop	Start	Stop	Start	Stop
1996	76	76	73	73	149	149	74.5	74.5
1997	273	273	261	261	534	534	267.0	267.0
1998	311	311	380	380	691	691	345.5	345.5
1999	164	164	237	237	401	401	200.5	200.5
2000	246	246	344	344	590	590	295.0	295.0
Total	1,070	1,070	1,295	1,295	2,365	2,365	---	---
Average	214.0	214.0	259.0	259.0	473.0	473.0	236.5	236.5

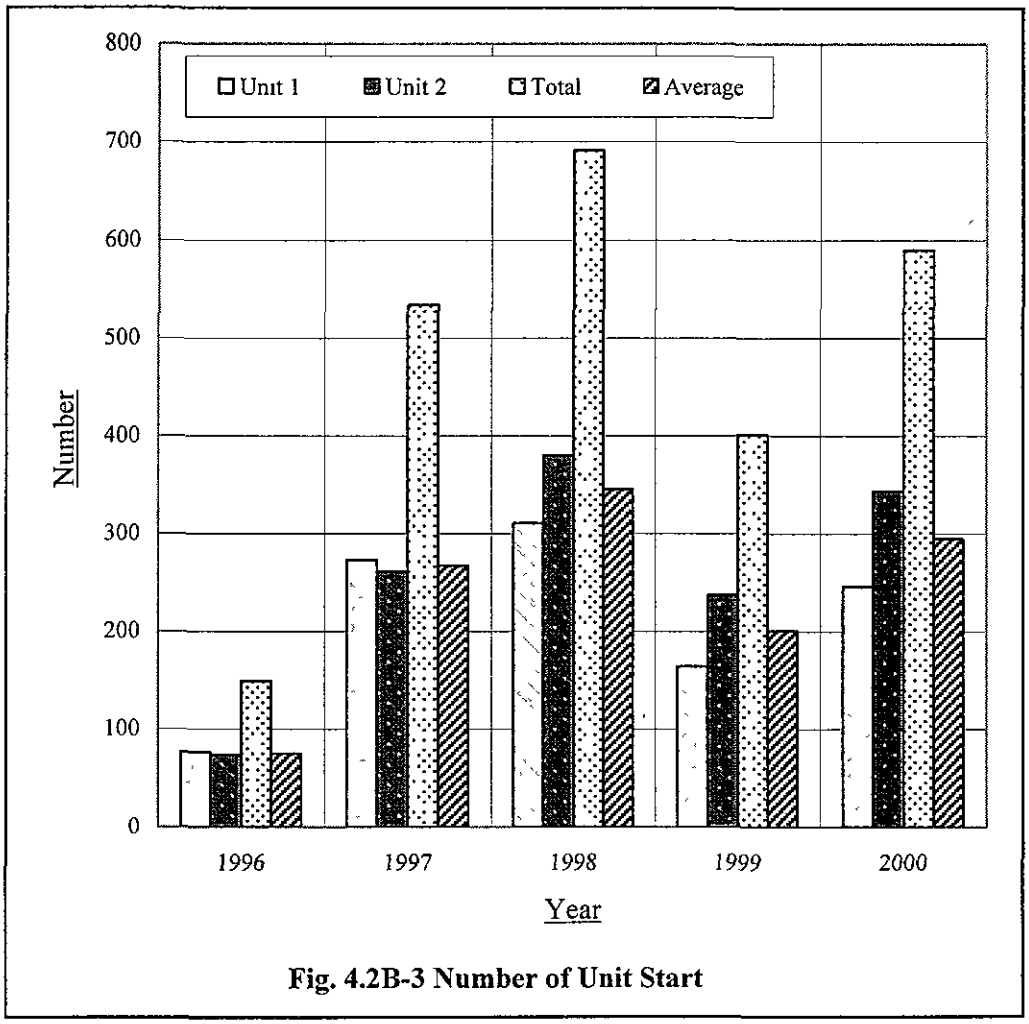


Fig. 4.2B-3 Number of Unit Start

CERRON GRANDE HYDRO POWER STATION

Table 4.2B-4 Operation Hours of Generating Unit

(Unit : Hrs)

Year	Unit 1	Unit 2	Total	Average
1991	4,303	4,363	8,666	4,333
1992	4,363	2,974	7,337	3,669
1993	5,013	4,837	9,850	4,925
1994	4,930	4,754	9,684	4,842
1995	3,316	5,314	8,631	4,315
1996	4,068	5,057	9,125	4,562
1997	5,300	3,414	8,713	4,357
1998	5,661	4,605	10,266	5,133
1999	7,525	5,439	12,964	6,482
2000	4,913	4,737	9,650	4,825
Total	49,391	45,494	94,885	47,442
Average	4,939	4,549	9,488	4,744

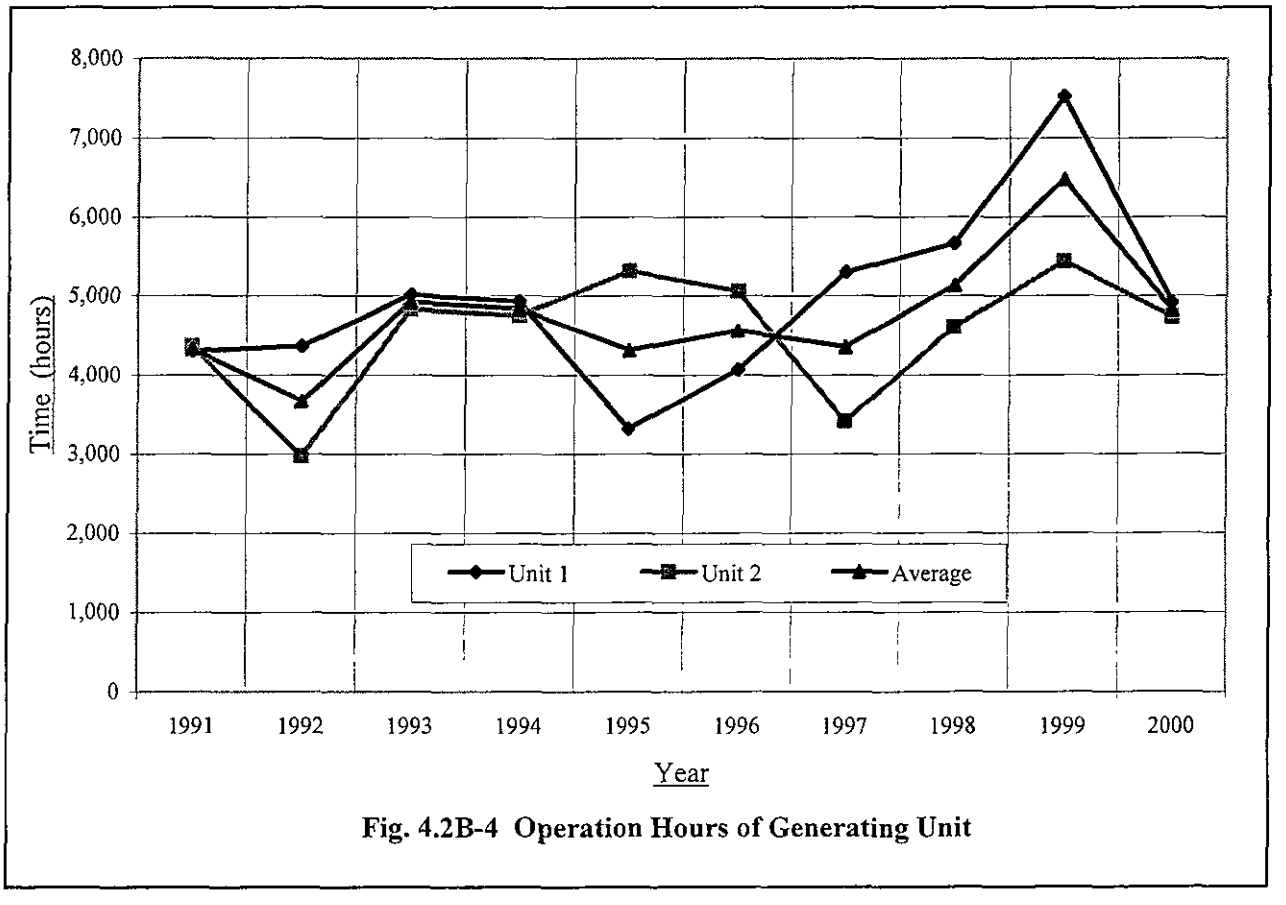


Fig. 4.2B-4 Operation Hours of Generating Unit

CERRON GRANDE HYDRO POWER STATION

Table 4.2B-5a Daily Operation(Load) Pattern (Unit No.1: 2001)

(Unit MW)

2000	Hour																							
date	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Jan.1	52	40	42	35	35	34	35	39	47	49	43	40	39	42	34	40	38	49	55	56	57	55	46	36
15	0	0	0	0	0	0	0	0	15	59	55	43	12	0	0	0	0	0	50	53	36	35	33	34
Feb 1	37	36	36	36	39	45	40	47	45	48	55	53	33	35	44	52	41	42	61	64	48	39	40	37
15	42	40	40	37	38	44	40	38	43	49	54	55	49	51	56	55	45	59	62	52	41	42	40	37
Mar 1	38	33	34	34	39	43	35	43	57	50	52	50	49	51	51	50	46	58	57	48	49	43	43	39
15	34	39	36	39	44	53	40	53	56	48	54	50	48	49	51	47	47	40	51	50	50	47	37	48
Apr 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7.2	30	40	34	32	32	32	32
15	0	0	0	0	0	0	0	4.2	29	31	31	31	32	32	31	31	31	31	37	36	31	32	0	0
May 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	37	39	33	32	0	0
15	0	0	0	0	0	0	32	39	40	40	40	42	44	42	39	40	40	34	40	39	39	13	0	0
Jun.1	0	0	0	0	0	0	17	35	41	43	42	42	37	39	45	44	42	36	46	50	41	37	19	0
15	32	42	40	40	42	46	47	48	41	46	48	50	46	44	46	46	47	47	46	47	44	39	40	38
Jul.1	40	43	48	45	41	41	42	44	47	46	51	50	45	43	42	44	43	44	51	53	46	39	42	40
15	0.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27	46	42	1	0	0
Aug 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep 1	0	0	0	0	0	0	0	0	17	37	34	38	34	36	44	43	33	31	44	40	30	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32	46	33	1	0	0
Oct.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	25	0	0	0	0
15	35	35	34	33	33	33	34	43	47	35	37	33	38	35	31	31	32	39	50	39	34	5	0	0
Nov 1	36	36	35	39	39	47	0	0	0	7	34	36	34	34	35	33	0	12	39	35	33	44	39	36
15	0.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	33	35	35
Dec 1	0	0	0	0	0	0	17	39	49	39	45	38	39	52	48	47	35	40	48	43	37	36	35	38
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	32	0	0	0	0	0
Ave.	15	14	14	14	15	16	16	20	24	26	28	27	24	24	25	25	22	25	39	37	32	25	20	19

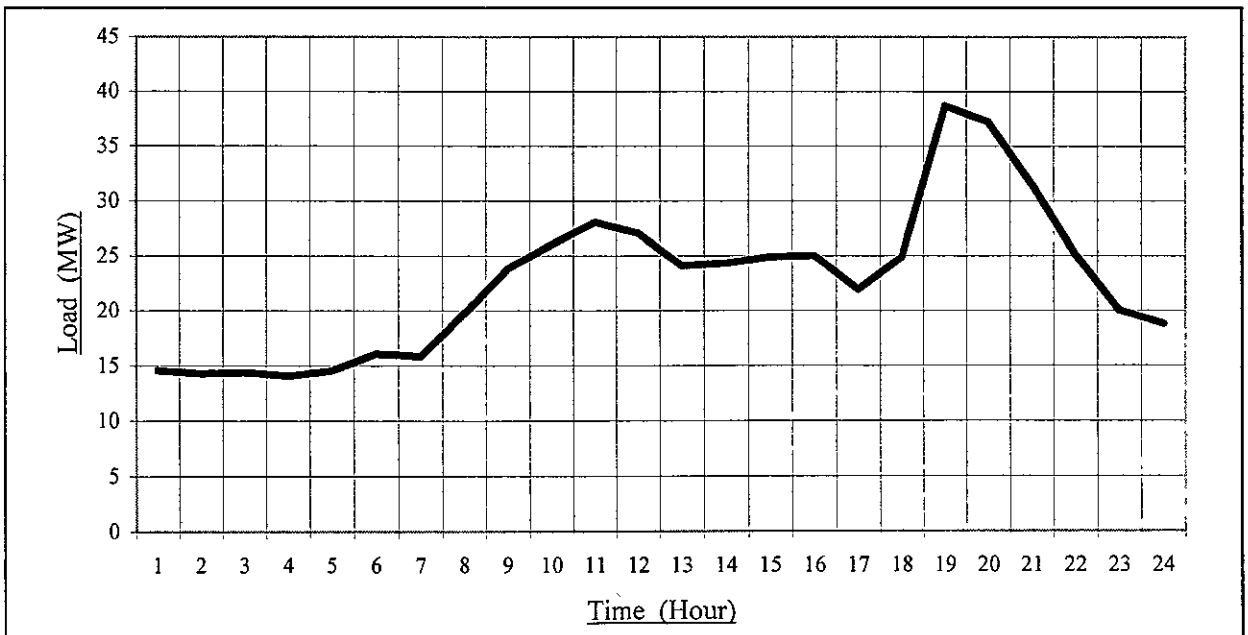


Fig. 4.2B-5a Daily Operation (Average Load) Pattern (Unit No.1: 2001)

CERRON GRANDE HYDRO POWER STATION

Table 4.2B-5b Daily Operation(Load) Pattern (Unit No.2 : 2001)

(Unit MW)

2000	Hour																							
date	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Jan 1	45	37	38	33	33	33	34	36	34	33	32	32	33	32	32	32	32	36	46	47	49	48	39	32
15	0	0	0	0	0	0	0	0	0	40	49	42	8	0	0	0	0	0	28	33	28	0	0	0
Feb.1	37	36	36	35	38	44	40	23	0	0	0	22	34	33	34	33	35	34	51	54	38	20	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	58	65	66	33	0	0
Mar 1	0	0	0	0	0	0	0	0	0	31	47	46	44	52	54	51	40	34	47	44	46	40	20	0
15	33	32	32	33	35	46	40	49	53	46	52	48	45	46	48	45	46	38	50	48	49	46	37	49
Apr 1	31	31	30	30	31	31	31	31	43	37	38	36	32	32	33	33	24	0	2.3	34	18	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29	34	26	0	0	0
May 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	33	30	25	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	39	39	39	0	0	0
Jun 1	0	0	0	0	0	0	0	0	0	19	32	34	29	31	34	30	30	30	39	50	37	2	0	0
15	5	0	0	0	0	7.6	45	47	41	46	43	42	38	37	40	39	40	45	46	47	43	35	33	4
Jul 1	2.2	0	0	0	5.9	32	34	37	40	39	44	42	34	31	30	29	30	37	45	49	46	44	36	32
15	31	32	32	29	30	30	37	44	40	41	44	44	37	35	41	36	38	38	45	45	42	39	30	38
Aug 1	0	0	0	0	0	0	0	0	19	30	32	34	31	31	34	32	33	28	35	38	36	19	0	0
15	0	0	0	0	0	0	13	38	37	38	39	40	35	33	34	33	32	34	37	37	34	33	33	0
Sep.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	31	30	18	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	49	48	40	22	0	0
Oct 1	32	34	33	32	1	0	0	0	0	0	0	0	0	0	0	0	0	2	37	33	11	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33	20	0	0	0	0
Nov.1	37	36	35	40	40	46	43	45	52	47	46	52	38	38	45	42	37	50	62	58	43	43	39	37
15	33	33	34	34	37	39	38	39	39	38	39	39	33	34	46	42	34	41	43	37	34	39	35	35
Dec 1	39	35	37	35	38	38	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	41	37	39	39	41	38	38	37	41	40	40	37	34	37	42	38	33	39	37	44	39	36	36	38
Ave	15	14	14	14	14	16	17	18	18	22	24	24	21	21	23	21	20	20	37	40	34	23	14	11

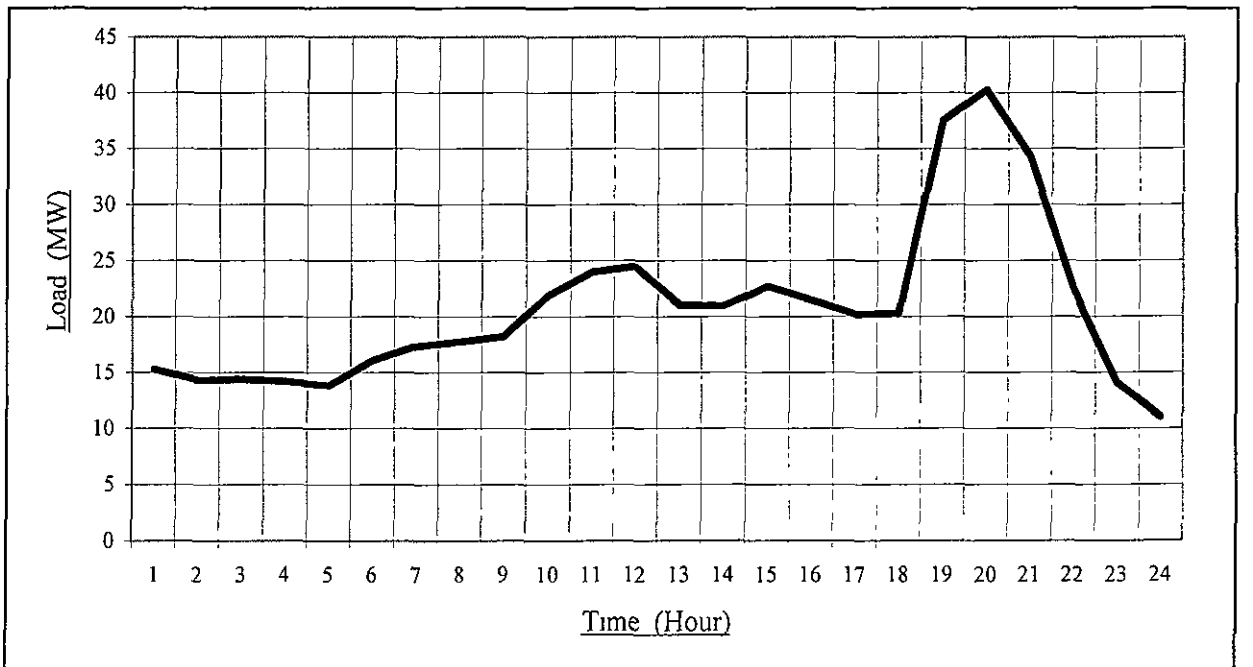


Fig. 4.2B-5b Daily Operation (Average Load) Pattern (Unit No.2 : 2001)

5 DE NOVIEMBRE RESERVOIR

Table 4.2C-1 Operated Reservoir Water Level (1991~2000)

(Unit : El. m)

year	Water Level	MONTH												Ave.
		Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	
91	Upp	174.8	177.6	176.4	176.4	177.4	177.2	174.8	177.6	176.9	178 0	178.2	177.1	176.9
92	Upp	176.9	176.9	177.1	177.5	173.2	179.9	179.7	178.5	179.1	177.6	178.4	177:9	177.7
93	Upp	178.7	177.2	177.1	177.2	176.6	176.5	176.0	177.7	179.8	179.8	179.2	179.2	177 9
94	Upp	178.7	177.6	176.9	177.2	176.3	178.6	176.9	179.9	178.5	178.2	178.5	178.3	177.9
95	Upp	178.0	178.7	177.2	177.2	177.9	179.9	178.5	179.0	178.1	180.1	178.0	178.4	178.4
96	Upp	178.2	178.5	178.3	178.5	178.1	179.3	177.5	178.2	177.3	180.0	179.2	178.2	178.4
97	Upp	178.0	177.9	178.1	178.4	177.2	179.0	177.1	177.1	178.6	179.4	179.1	179.1	178.2
98	Upp	179.0	179.1	178.8	178.9	177.3	176.5	178.1	178.8	179.3	179.9	179.7	179.9	178.8
99	Upp	179.0	179.1	178.8	178.9	177.3	176.5	178.1	178.8	179.3	179.9	179.7	179.9	178.8
00	Upp	178.6	177.1	176.5	177.8	179.1	178.0	178.2	177.5	179.4	179.9	178.4	178.0	178.2
Average		178.0	178.0	177.5	177.8	177.0	178.1	177.5	178.3	178.6	179.3	178.8	178.6	178.1

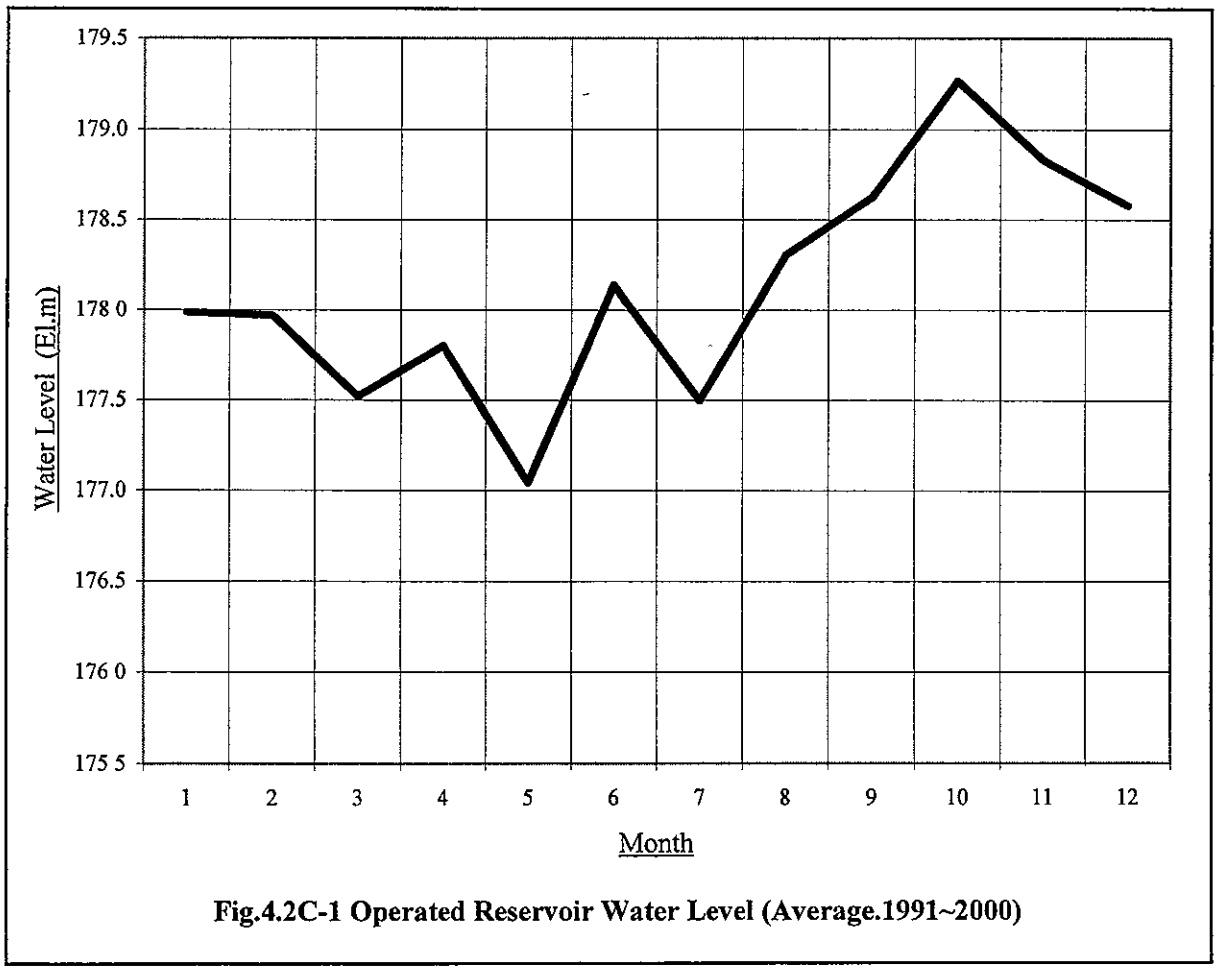


Fig.4.2C-1 Operated Reservoir Water Level (Average.1991~2000)

Note : H.W.L :El. 180m, L.W.L : El. 172m

5 DE NOVIEMBRE RESERVOIR

Table 4.2C-2 Operated Generating Discharge (1991~2000)

(Unit : m^3/s)

Year	MONTH											
	Jan.	Feb.	Mar.	Apr	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov	Dec.
91	130.50	92.80	71.60	69.80	61.70	77.10	82.70	79.50	80.40	89.90	90.10	99.30
92	97 40	99.60	57.30	41 00	55.50	50.70	141.50	146.90	145.20	152.90	148.70	125.30
93	125.10	101.30	77.60	84.60	107.00	100.00	139.30	118.30	149.20	148.40	134.20	117.50
94	129.40	129.50	114.50	113.80	146.10	140.30	108.10	113.10	117.90	119.10	101.10	97.40
95	88.30	98.10	105.30	89.80	110.90	118.60	134.10	139.20	126.30	136.60	126.30	106.30
96	109.20	114.90	127.40	141.70	147.90	163.20	154 70	145.20	118 20	120.70	134.50	131.70
97	113.10	132.50	136.00	150.40	126.90	131.60	98.60	73.20	90.20	129.20	103.00	129.40
98	119.40	111.30	107.60	102.70	102.80	139.80	99.10	127.90	105.30	110.70	151.40	124.50
99	139.50	137.40	145.40	150.70	124.30	76.80	124.40	124 80	126.70	142.90	135.00	127.40
00	110.50	92.40	64.30	51 20	70.10	62.40	68.30	64.70	55.40	56.20	80.10	89.30
Ave.	116.24	110.98	100.70	99.57	105.32	106 05	115.08	113.28	111.48	120.66	120.44	114.81

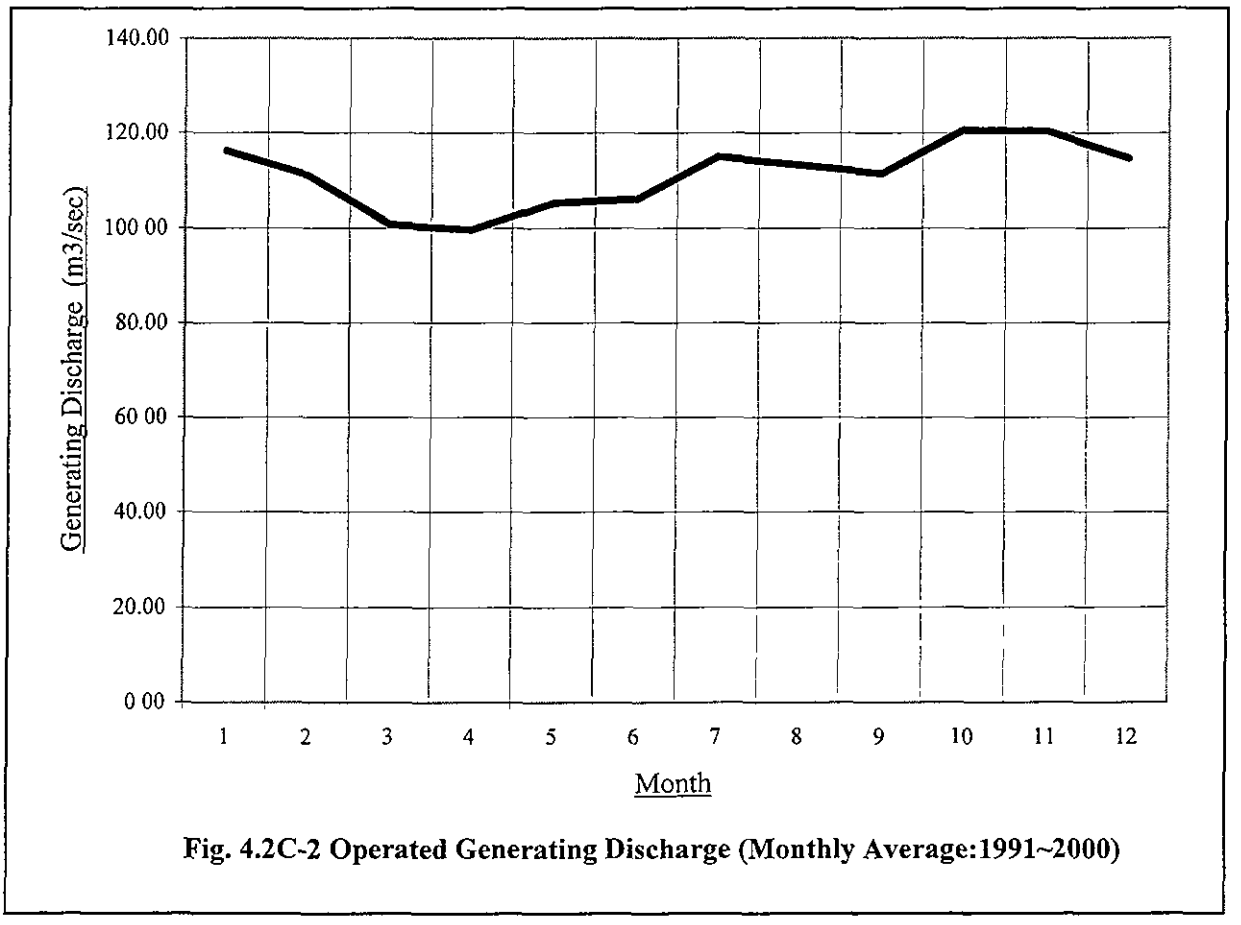


Fig. 4.2C-2 Operated Generating Discharge (Monthly Average:1991~2000)

Note : Max. Generating Discharge : 193.9 m^3/s

5 DE NOVIEMBRE HYDRO POWER STATION

Table 4.2C-3 Number of Unit Start & Stop

Year	Unit 1		Unit 2		Unit 3		Unit 4		Unit 5		Total		Average	
	Start	Stop	Start	Stop	Start	Stop	Start	Stop	Start	Stop	Start	Stop	Start	Stop
1996	59	59	67	67	103	103	86	86	28	28	343	343	125	125
1997	90	90	100	100	122	122	132	132	70	70	514	514	188	188
1998	90	90	93	93	144	144	125	125	35	35	487	487	177	177
1999	92	92	110	110	140	140	100	100	81	81	523	523	191	191
2000	237	237	196	196	338	338	66	66	27	27	864	864	298	298
Total	568	568	566	566	847	847	509	509	241	241	2,731	2,731	---	---
Average	114	114	113	113	169	169	102	102	48	48	546	546	196	196

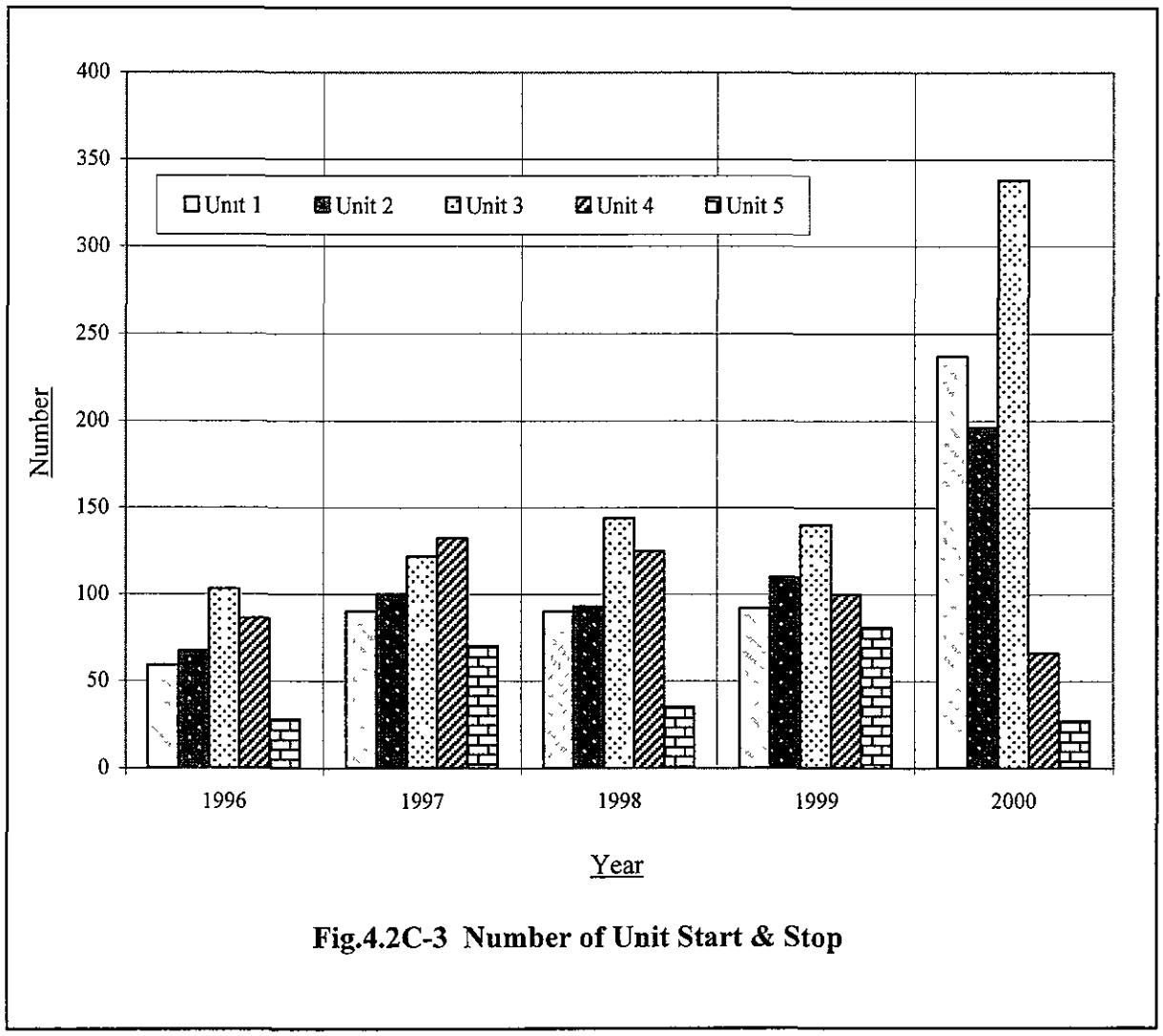


Fig.4.2C-3 Number of Unit Start & Stop

5 DE NOVIEMBRE HYDRO POWER STATION

Table 4.2C-4 Operation Hours of Generating Units

(Unit : Hrs)

Year	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Total	Average
1991	7,876	7,784	6,997	3,155	3,194	30,997	5,801
1992	6,056	6,951	5,955	6,178	7,453	34,585	6,519
1993	6,541	7,483	6,521	7,398	7,849	37,785	7,158
1994	7,477	7,642	6,746	7,429	7,622	38,910	7,383
1995	6,875	6,602	6,367	5,651	7,981	35,471	6,695
1996	7,968	7,926	7,647	7,942	7,692	41,171	7,835
1997	6,803	7,006	6,761	7,148	7,549	37,264	7,053
1998	7,819	7,803	7,364	7,811	7,889	40,684	7,737
1999	7,185	7,743	7,556	7,985	8,245	40,713	7,743
2000	7,137	7,593	6,466	1,871	1,587	26,654	4,931
Total	71,737	74,533	68,380	62,568	67,061	344,279	68,856
Average	7,174	7,453	6,838	6,257	6,706	36,423	6,886

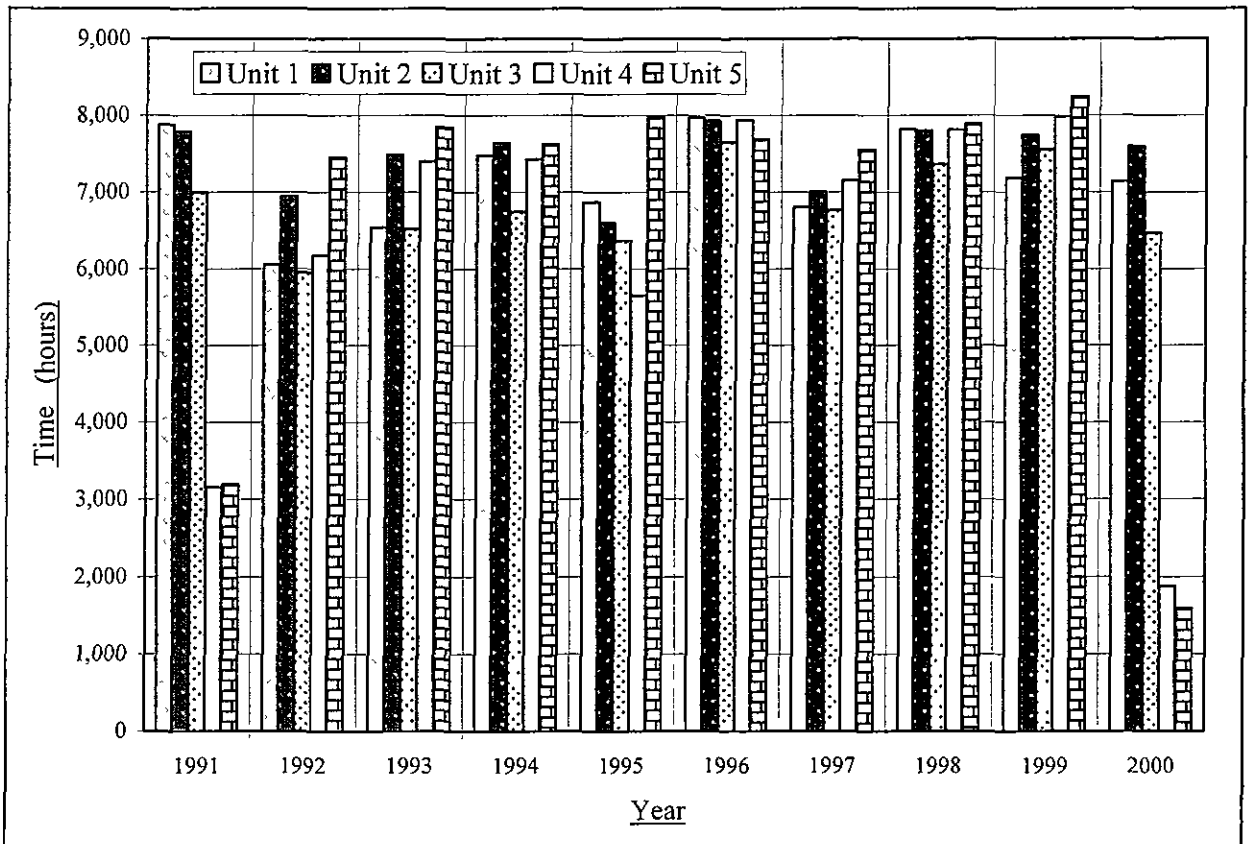


Fig.4.2C-4 Operation Hours of Generating Units

5 DE NOVIEMBRE HYDRO POWER STATION

Table 4.2C-5 Daily Operation (Load) Pattern (2000)

(Unit : MW)

2000	Hour																							
date	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Jan 1	70	70	56	46	31	23	7	13	15	32	55	65	67	59	65	61	70	70	70	70	70	70	70	55
15	20	17	26	27	31	54	62	59	70	70	69	67	61	61	57	40	31	31	69	70	70	66	41	16
Feb 1	70	68	68	61	68	70	69	66	70	70	70	70	71	71	70	69	70	70	70	70	70	69	69	68
15	70	68	68	61	68	70	69	66	70	70	70	70	71	71	70	69	70	70	70	70	70	69	69	68
Mar 1	15	0	0	0	0	0	0	5	34	36	36	36	36	36	36	36	36	36	36	36	36	36	36	35
15	31	18	10	10	12	22	22	32	36	36	36	36	36	36	36	36	36	36	36	36	36	24	32	10
Apr 1	9.1	8.9	9	9	8 7	9	9	16	35	36	36	36	36	36	36	34	32	36	36	36	36	36	32	13
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34	36	36	36	22	0
May 1	31	37	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	34	36	36	33	34	36
15	0	8.6	11	12	9.3	19	32	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	33	36
Jun.1	18	14	10	12	14	31	36	36	36	36	37	36	36	36	36	36	36	36	36	36	36	36	36	33
15	23	23	24	24	24	29	36	36	36	36	37	36	36	36	36	36	36	36	36	36	36	36	35	24
Jul 1	36	36	36	37	36	30	31	36	36	36	35	35	35	35	35	36	16	11	24	24	24	24	24	23
15	28	27	29	30	20	19	10	28	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	12
Aug.1	14	11	12	12	9.7	19	33	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	35	31
15	15	9	12	12	12	30	36	34	36	36	36	36	36	35	36	36	36	36	36	36	36	36	36	36
Sep.1	34	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	30	28	34	36	36	32	33	33
15	23	26	30	28	35	33	9	9	18	18	24	24	27	30	36	27	27	35	36	36	36	36	24	9
Oct 1	12	9	9	9	9	9	9	18	15	10	21	35	32	20	23	17	9	26	36	36	36	27	14	9
15	24	35	33	29	34	10	10	35	36	29	24	24	12	9	9	9	9	13	36	34	31	28	15	9
Nov.1	0	0	0	0	0	20	21	16	36	36	36	36	36	36	36	36	36	25	36	36	36	36	23	0
15	51	47	41	46	48	51	52	50	38	36	36	36	36	36	36	36	36	39	52	52	52	43	31	24
Dec.1	71	62	62	37	35	37	52	52	56	55	54	75	76	55	62	62	50	59	74	74	74	59	54	54
15	9.2	10	9	9	9	22	26	28	38	54	71	74	70	54	54	54	54	53	71	73	70	32	27	25
Ave	28	27	26	24	24	28	29	32	37	38	40	42	41	39	40	38	36	37	45	45	45	41	36	27

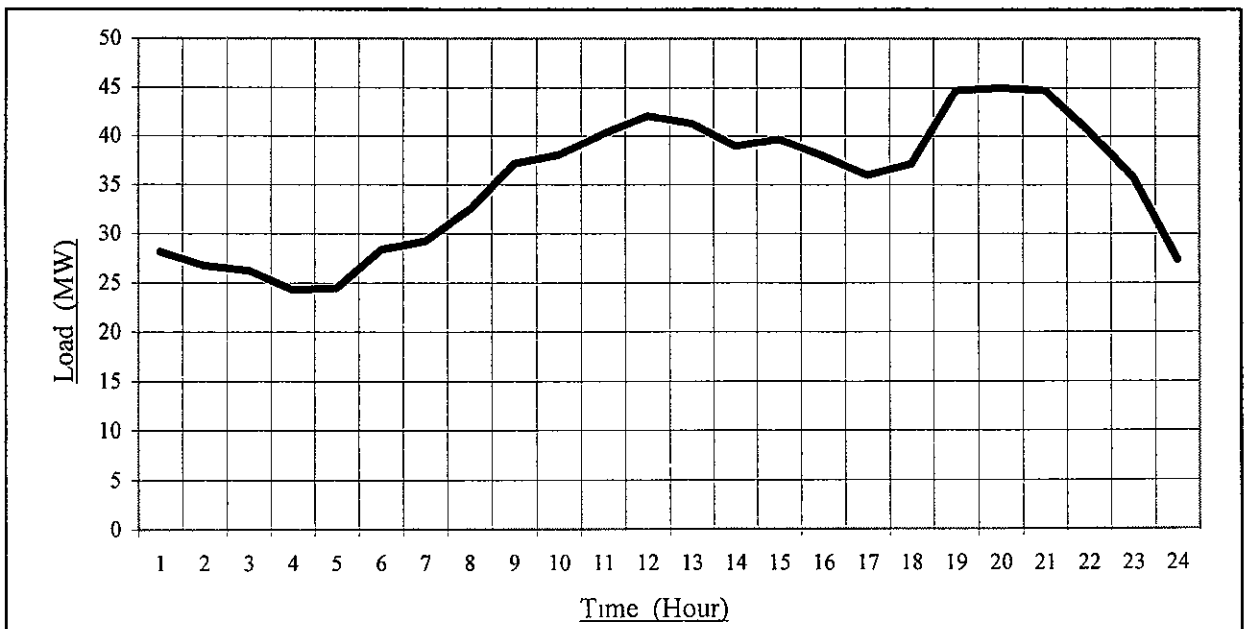


Fig.4.2C-5 Daily Operation (Average Load) Pattern (2000)

15 DE SEPTIEMBRE RESERVOIR

Table 4.2D-1 Operated Reservoir Water Level (1991~2000)

(Unit : El. m)

year	Water Level	MONTH												Ave.
		Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	
91	Upp	46.1	45.6	45.8	44.8	45.8	47.8	43.9	44.5	46.9	47.2	46.9	47.1	46.0
92	Upp.	46.8	46.9	46.9	46.9	45.5	46.7	44.9	46.0	47.2	46.9	47.3	47.1	46.6
93	Upp	46.4	47.3	46.7	46.9	46.8	45.7	45.7	47.7	48.7	47.4	48.0	48.0	47.1
94	Upp	45.7	47.0	45.7	47.4	46.4	46.0	45.1	46.3	47.9	45.1	45.1	45.1	46.1
95	Upp	45.2	44.9	44.8	45.0	44.7	47.9	48.7	47.5	47.7	48.4	48.0	48.3	46.8
96	Upp	48.2	47.9	48.0	47.5	47.1	48.3	47.0	46.0	46.7	48.1	48.2	48.2	47.6
97	Upp	48.3	48.1	48.4	47.1	47.1	47.8	46.0	46.2	47.0	48.0	48.3	48.0	47.5
98	Upp	48.7	48.0	47.6	47.8	47.5	47.5	46.3	47.8	46.7	49.4	48.2	47.6	47.8
99	Upp	48.7	48.0	47.6	47.8	47.5	47.5	46.3	47.8	46.7	49.4	48.2	47.6	47.8
00	Upp	46.9	46.8	45.7	45.0	48.2	46.9	46.9	47.3	48.0	47.1	47.3	46.7	46.9
Average		47.1	47.1	46.7	46.6	46.7	47.2	46.1	46.7	47.4	47.7	47.5	47.4	47.0

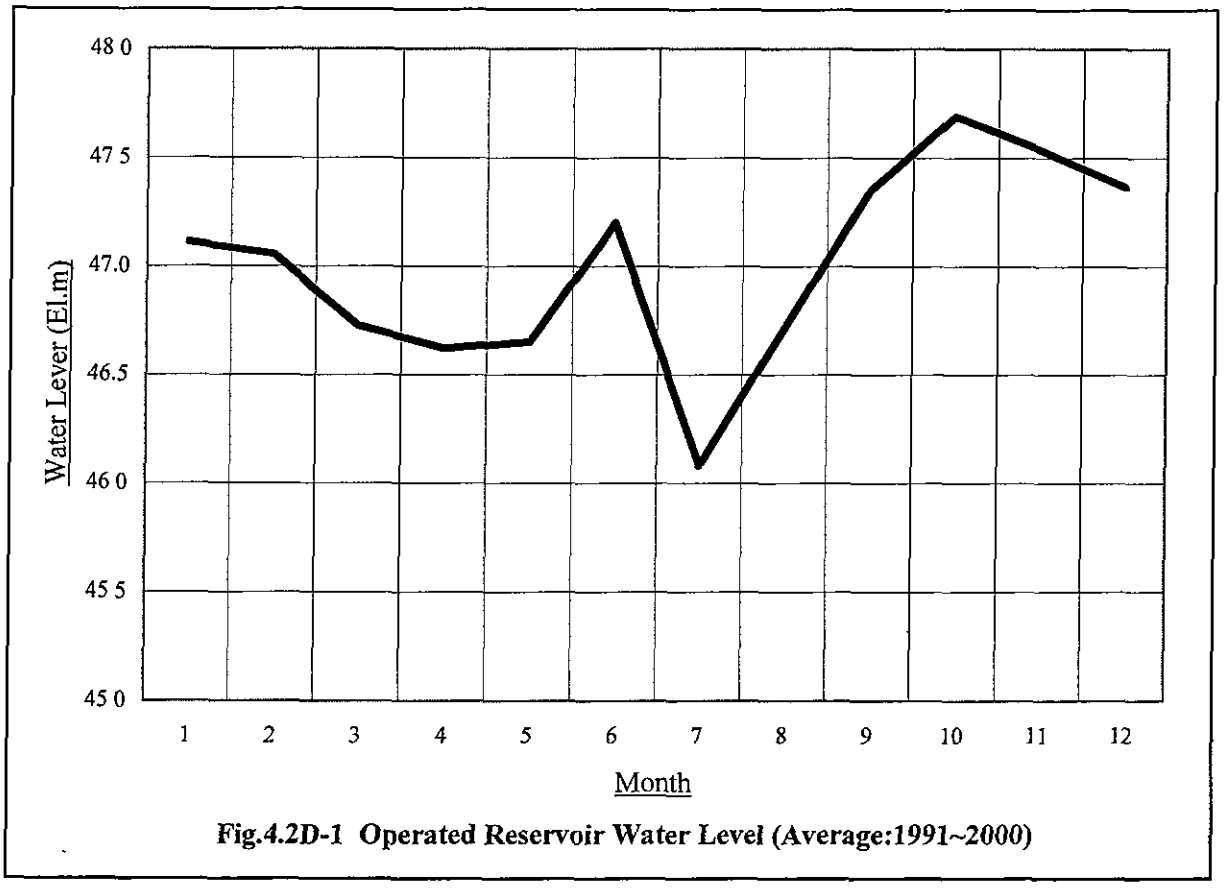


Fig.4.2D-1 Operated Reservoir Water Level (Average:1991~2000)

Note : H.W.L : El. 49 m, L.W.L : El. 30 m

15 DE SEPTIEMBRE RESERVOIR

Table 4.2D-2 Operated Generating Discharge (1991~2000)

(Unit : m^3/s)

Year	MONTH											
	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
91	174.90	157.80	147.70	122 30	169.30	286.40	313.60	208.60	237.90	392.70	149.10	146.60
92	115.60	109.90	67.10	58.10	106.60	317.70	396.50	363.80	428 00	386.60	196.20	162.00
93	155.70	98.00	95.20	98.90	207.60	325.10	295.60	301.30	529.80	410.30	162.80	132.70
94	154.70	117.90	133.00	108.60	242.60	317.90	160.70	341.90	364.60	408.80	144.30	113.80
95	97.40	108.30	110.10	106.70	163.70	246.00	282.80	352.60	541.30	406.50	198.10	130.00
96	125.00	131.90	133.30	178.60	301.00	430.20	539.50	496.60	571.30	481.00	208.10	155.40
97	131.50	148.50	139.90	176.20	146.80	354.50	252.60	154.90	411.20	368.00	133.60	148.00
98	125.90	105.40	113.00	99.70	139.00	236.60	235.30	380.80	362.50	529.60	341.00	182.90
99	171.30	149.60	150.60	171.00	177.50	236.70	402.50	412.10	497.60	515.70	226.80	165.10
00	152.80	155.60	170.80	65.90	215.40	381.00	171.90	218.10	327.70	301.80	134.80	108.40
Ave.	140.48	128.29	126.07	118.60	186.95	313.21	305.10	323.07	427.19	420.10	189.48	144.49

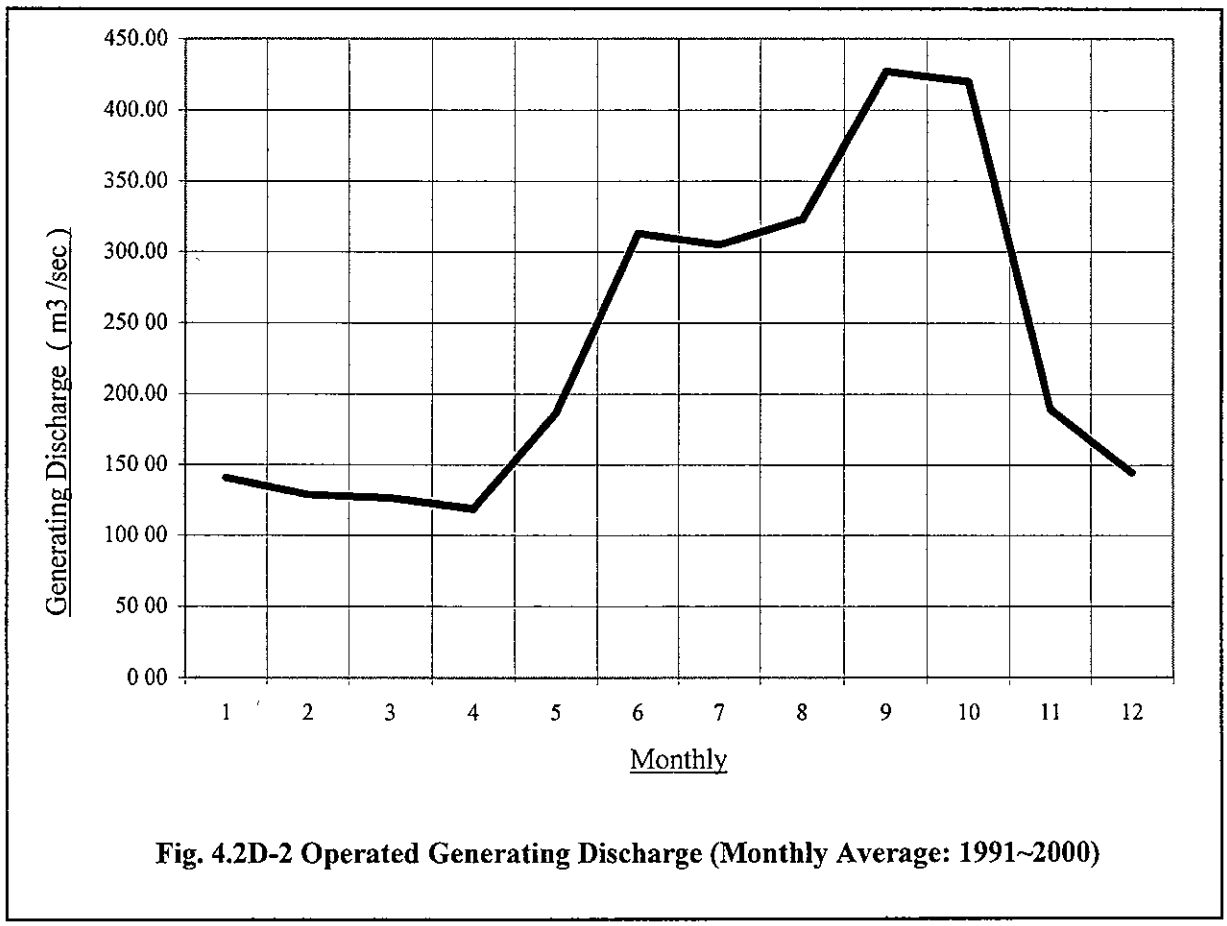


Fig. 4.2D-2 Operated Generating Discharge (Monthly Average: 1991~2000)

Note : Max. Generating Discharge : 660 m^3/s

15 DE SEPTIEMBRE HYDRO POWER STATION

Table 4.2D-3 Number of Unit Start & Stop

Year	Month													Total	Ave.
	Unit No	Jan.	Feb.	Mar	Apr.	May	Jun.	Jul.	Agu.	Sep.	Oct.	Nov.	Dec.		
1996	1	34	31	36	32	18	11	5	4	1	0	29	20	221	18
	2	32	35	38	32	14	10	7	11	2	6	37	34	258	22
1997	1	0	0	0	0	0	37	23	35	17	18	35	38	203	17
	2	35	27	32	25	34	12	25	30	26	23	27	13	309	26
1998	1	34	30	40	34	37	25	19	6	7	5	10	31	278	23
	2	36	0	46	26	34	37	41	26	22	7	6	31	312	26
1999	1	22	28	35	31	34	28	23	23	27	28	36	37	352	29
	2	11	32	34	40	36	26	15	29	15	20	29	28	315	26
2000	1	12	34	34	26	20	22	32	27	10	23	15	12	267	22
	2	25	27	32	29	30	12	32	32	16	24	27	27	313	26
Ave.		241	244	327	275	257	220	222	223	143	154	251	271	2,828	236

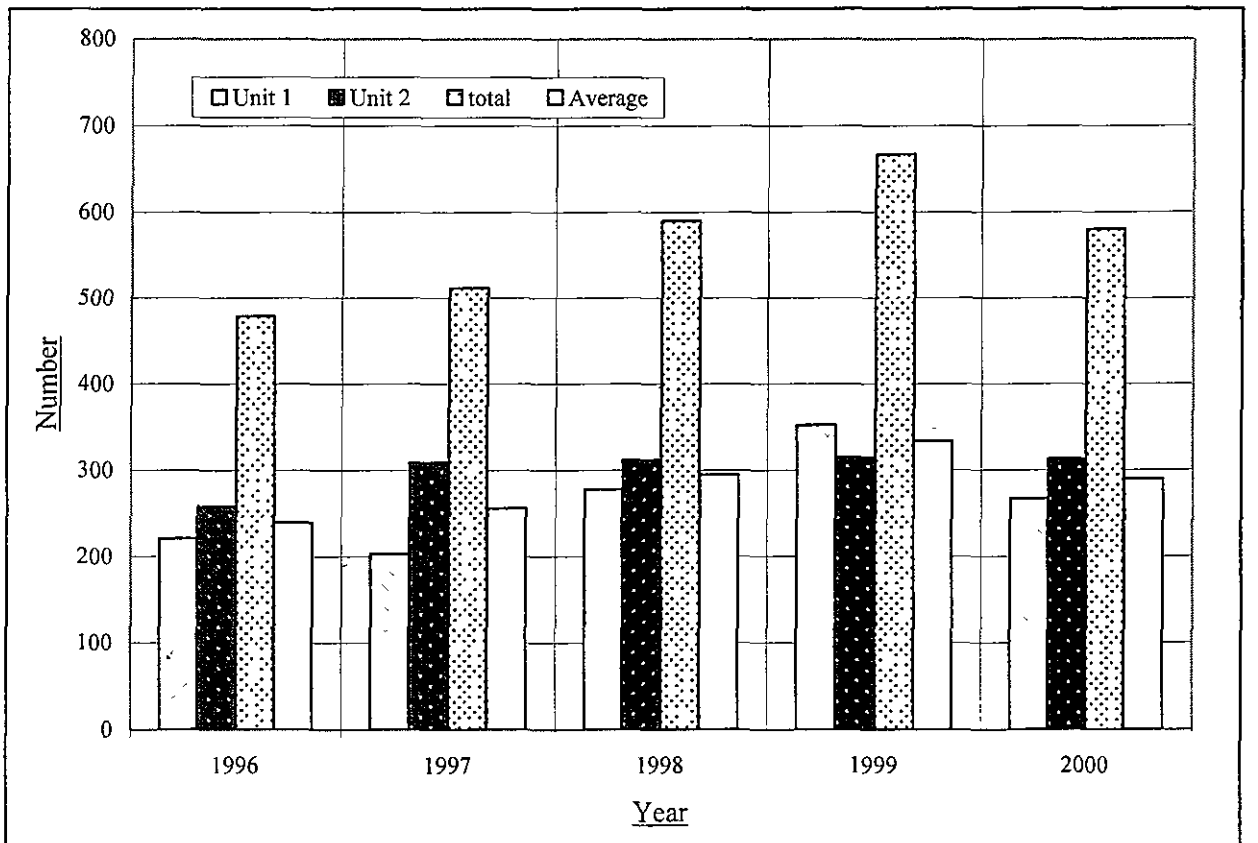


Fig.4.2D-3 Number of Unit Start & Stop

33

15 DE SEPTIEMBRE HYDRO POWER STATION

Table 4.2D-4 Operation Hours of Generating Unit

(Unit : Hrs)

	Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Total	Ave
Unit	1	4,023	2,648	4,621	3,193	5,644	5,417	3,065	5,879	4,804	3,255	42,549	4,255
	2	4,862	5,012	4,681	5,710	2,312	6,141	5,163	3,545	5,446	5,284	48,156	4,816
	Total	8,885	7,660	9,302	8,903	7,956	11,558	8,228	9,424	10,250	8,539	90,705	9,071
	Ave.	4,443	3,830	4,651	4,452	3,978	5,779	4,114	4,712	5,125	4,270	45,353	4,535

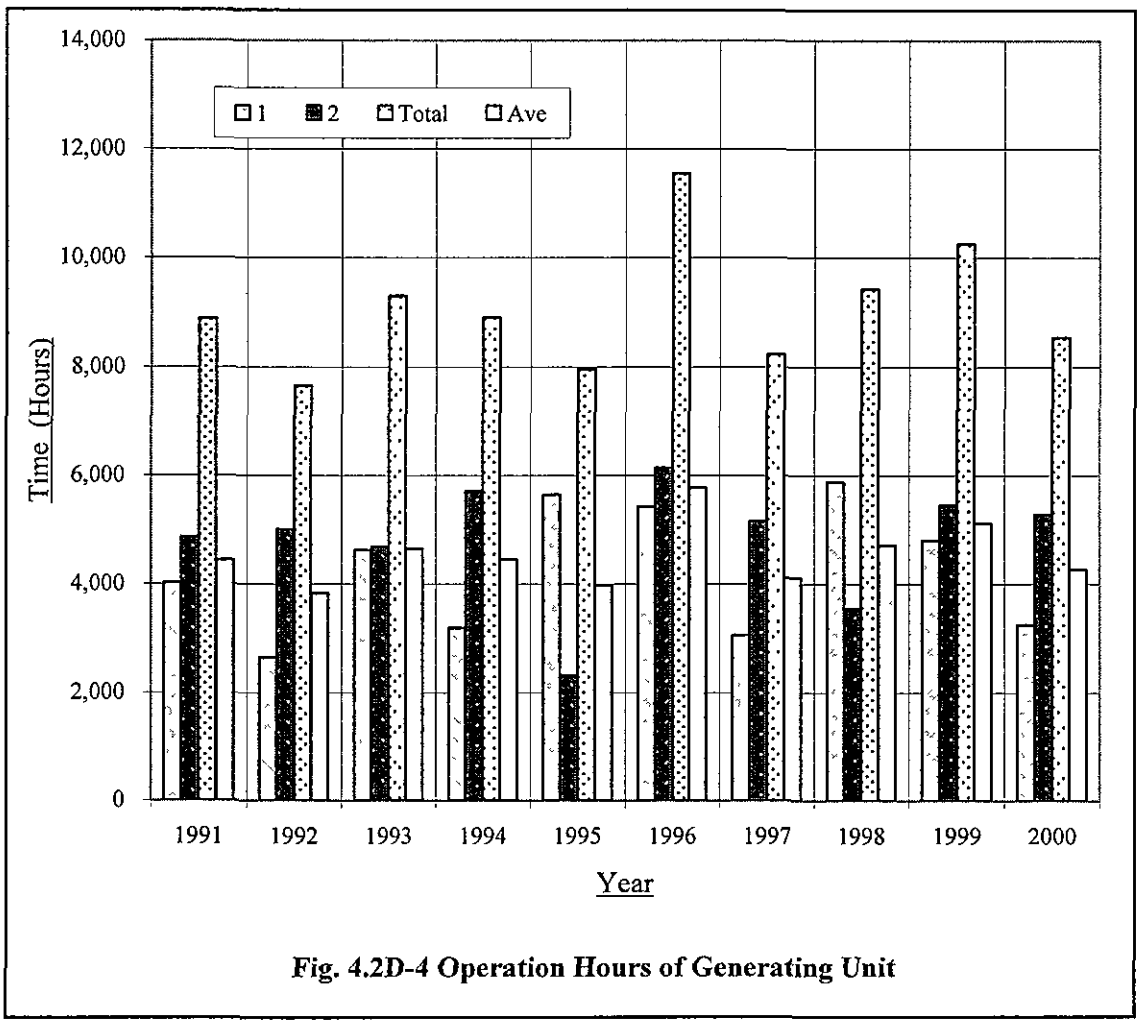


Fig. 4.2D-4 Operation Hours of Generating Unit

15 DE SEPTIEMBRE HYDRO POWER STATION

Table 4.2D-5a Daily Operation(Load) Pattern (Unit No.1: 2000)

(Unit . MW)

2000	Hour																							
date	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Jan 1	71	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38	41	41	19	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Feb.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38	50	35	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	47	75	57	20	0	0
Mar.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	70	76	69	18	0	0
15	0	0	0	0	0	0	0	0	3	62	67	76	55	73	75	69	72	59	75	79	79	69	0	0
Apr 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	75	75	75	0	0	0
May 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	41	41	34	0	0
15	0	0	0	0	0	0	0	2.3	54	76	76	77	78	74	76	77	76	72	51	51	51	45	25	0
Jun.1	51	43	49	52	49	56	59	56	61	63	68	77	72	73	77	74	68	52	84	86	86	73	62	49
15	5	0	0	0	0	7 6	45	47	41	46	43	42	38	37	40	39	40	45	46	47	43	35	33	4
Jul.1	59	48	54	53	67	49	50	52	59	46	56	64	60	59	49	45	53	56	68	70	66	63	57	47
15	43	45	45	41	43	42	50	59	57	61	73	75	61	49	54	50	46	43	54	75	72	47	40	40
Aug 1	0	0	0	0	0	0	0	0	19	30	32	34	31	31	34	32	33	28	35	38	36	19	0	0
15	0	0	0	0	0	0	0	0	55	74	78	72	67	73	74	71	73	80	74	68	67	61	20	0
Sep 1	0	0	0	0	0	3.8	51	45	59	52	47	50	47	47	58	56	43	42	69	58	53	2	0	0
15	46	48	45	45	46	45	41	46	43	41	44	49	49	48	43	46	46	55	73	70	59	55	41	45
Oct 1	36	43	41	45	44	47	46	53	46	46	47	45	42	46	45	46	54	55	65	63	66	47	44	44
15	56	49	46	49	46	47	49	66	57	44	50	63	53	48	50	52	55	58	66	48	52	45	49	48
Nov.1	0	0	0	0	0	2	44	43	58	63	57	59	47	46	53	51	61	60	79	72	60	36	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	62	56	16	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ave.	15	12	12	12	12	12	18	20	25	29	31	33	29	29	30	29	30	30	50	52	47	29	15	12

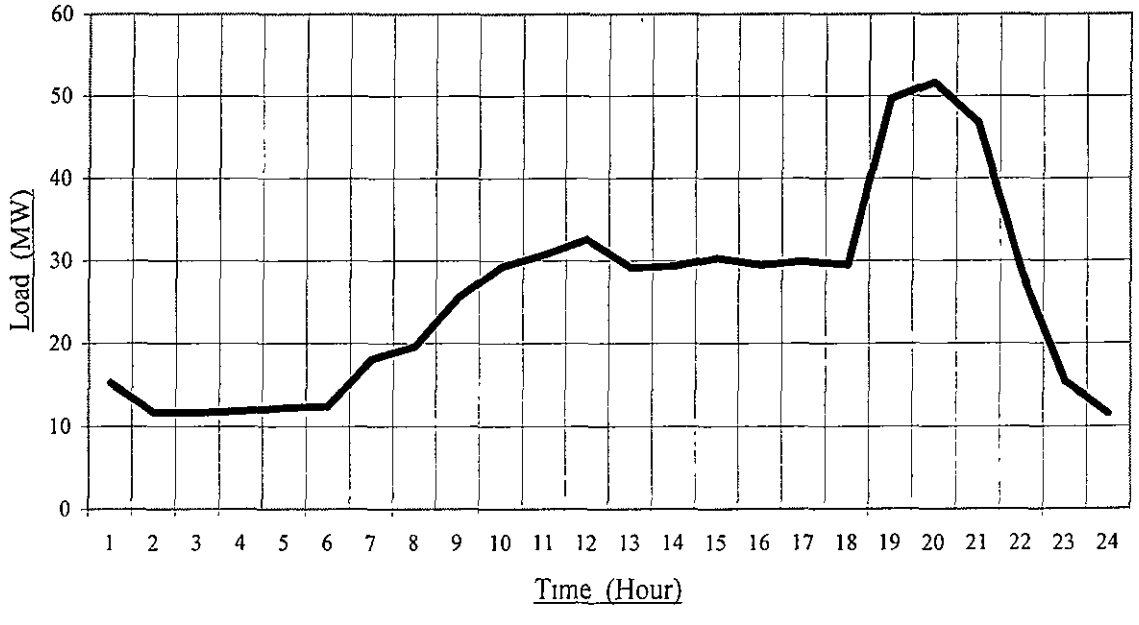


Table 4.2D-5a Daily Operation (Average Load) Pattern (Unit No.1 : 2000)

35

15 DE SEPTIEMBRE HYDRO POWER STATION

Table 4.2D-5b Daily Operation(Load) Pattern (Unit No.2 : 2000)

(Unit MW)

2000	Hour																							
date	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Jan 1	75	47	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	42	44	73	41	3	0
15	63	64	55	55	63	56	49	53	64	83	58	59	53	52	44	43	46	49	72	79	67	55	41	39
Feb.1	0	0	0	0	0	0	28	47	44	43	49	47	39	41	52	59	48	54	74	79	73	48	44	39
15	44	48	48	44	46	52	48	45	51	56	61	61	56	58	65	64	55	58	67	61	60	46	41	40
Mar.1	41	40	40	39	39	42	41	41	44	54	50	54	53	50	51	56	58	59	75	75	69	42	51	41
15	0	0	0	0	0	0	0	2	53	39	42	48	40	40	61	67	40	39	65	78	78	26	0	0
Apr 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.5	58	76	69	53	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	75	75	75	0	0	0
May 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.4	39	39	40	38	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	47	50	50	42	7	0
Jun 1	41	40	42	42	43	46	55	55	61	63	68	76	72	74	77	74	68	52	71	85	85	57	44	41
15	45	52	48	47	50	67	70	73	68	74	73	78	71	77	77	75	77	71	78	80	80	80	69	45
Jul.1	0	0	0	0	0	0	0	0	21	40	40	39	28	0	0	0	0	0	42	79	78	72	24	0
15	0	0	0	0	0	0	0	0	30	39	40	40	38	23	0	0	0	0	14	64	55	0	0	0
Aug.1	0	0	0	0	0	0	0.5	43	52	63	72	75	67	70	76	73	59	47	62	67	53	32	21	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	60	69	66	38	0	0
Sep.1	0	0	0	0	0	0	0	0	0	0	32	39	2.3	0	0	0	0	0	56	75	51	43	16	0
15	46	48	45	45	46	46	42	46	43	42	45	50	50	48	43	46	46	55	74	71	60	57	44	46
Oct.1	8.6	0	0	0	42	47	48	47	43	46	47	46	42	47	45	47	55	56	66	63	66	48	45	44
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	53	44	45	40	40	41
Nov 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	52	57	44	13	0	0
15	0	0	0	0	0	0	2	44	49	48	48	49	42	43	55	52	43	50	56	49	40	0	0	0
Dec.1	0	0	0	0	0	1	44	48	56	49	54	47	47	57	57	54	45	50	67	62	52	44	0	0
15	0	0	0	0	2	47	49	47	53	52	52	49	45	49	54	48	42	44	47	51	49	47	27	0
Ave.	15	14	12	11	14	17	20	25	30	33	35	36	31	30	32	31	28	30	59	65	62	40	21	16

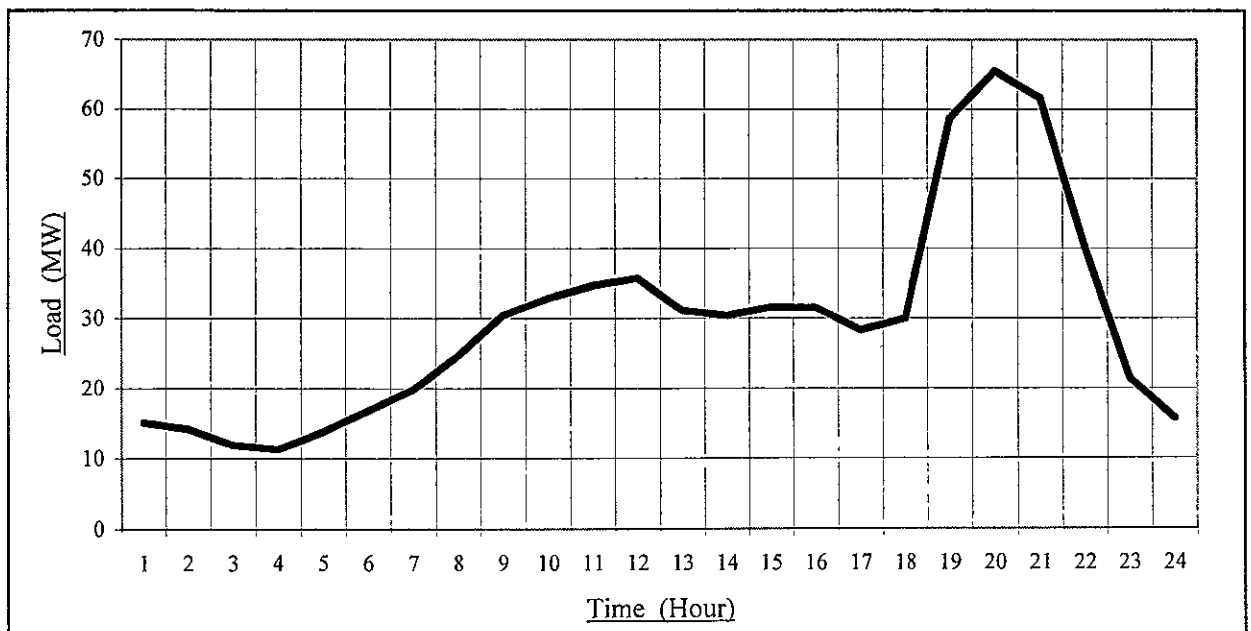


Fig.4.2D-5b Daily Operation(Average Load) Pattern (Unit No.2 : 2000)

Chapter 5: Power Forecast and Supply Plan

Appendix 5.1 : Primary Regressive Predication Method Using Correlation with GDP

Appendix 5.1

Primary Regressive Predication Method

Using Correlation with GDP

APPENX 5.1 Primary Regressive Prediction Method using Correlation with GDP

It is generally seen that since a strong correlation between the income levels of a consumer and the growth of electricity demand which are expressed with GDP, then, an electric power demand can be estimated paying attention to this relation. Now, in the El Salvador, the relation between the electricity demand for the past six (6) years and GDP presupposes that it was almost linear as shown below.

Basic Data

n	year	Energy Consumption (GWh)	GDP (million US$)		
			Current Price	Deflator (2000 = 100)	Cost in 2000
		(yi)	(Y : nominal GDP)	(Pt)	(xi : real GDP)
1	1995	2,830	9,500	83.4	11,391
2	1996	2,926	10,358	89.0	11,638
3	1997	3,184	11,192	92.1	12,152
4	1998	3,113	11,989	95.8	12,515
5	1999	3,206	12,467	96.2	12,959
6	2000	3,626	13,217	100.0	13,217
Total		18,885			73,217
Average		y = 3,148			x = 12,312

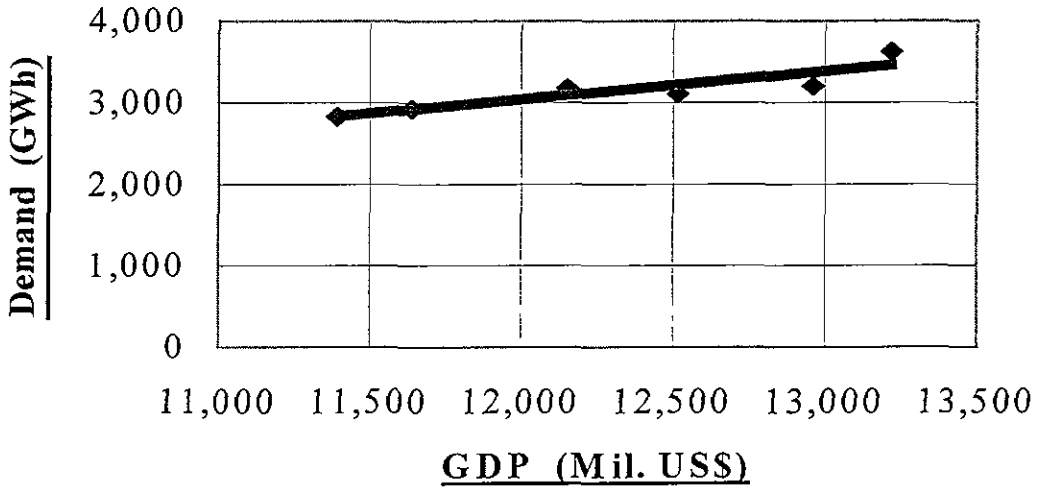


Fig. A5.1.1 GDP and Demand

41

Thus, when both relation is linear, the following relational expression is materialized.

$$yi = a + bxi + ei$$

Where,

yi : Energy Consumption (GWh)

xi : GDP (million US$)

a, b : Regression Coefficient

ei : Deviation value from Regression

If it asks for regression coefficients a and b by the method of least square so that ei may become small as a whole now, and sigma (yi-a-bxi) 2 may become the minimum,

$$b = \frac{S(xy)}{S(xx)} = \frac{\Sigma(xi-x)(yi-y)}{\Sigma(xi-x)^2} = \frac{\Sigma xiyi - (\Sigma x)(\Sigma yi)/n}{\Sigma xi^2 - (\Sigma xi)^2/n} \quad (n : number\ of\ data)$$

$$a = y - bx$$

So, last formula becomes as follows,

$$y = y + b(x-x) = a + bx$$

Moreover, correlation coefficient(r) is,

$$r = \frac{S(xy)}{\sqrt{S(xx)S(yy)}}$$

$$Where,\ S(yy) = \Sigma(yi-y)^2 = \Sigma yi^2 = \Sigma yi^2 - (\Sigma yi)^2/n$$

Regression coefficients a and b and correlation coefficient r follows the model included into a computer. If x and y are inputted, it can ask easily, but if the calculation process of a manual is shown, it will become as follows.

Calculate of S(xy)

n	Year	xi	yi	xi yi
1	1995	11,391	2,830	32,236,211
2	1996	11,638	2,926	34,053,380
3	1997	12,152	3,184	38,691,996
4	1998	12,515	3,113	38,957,993
5	1999	12,959	3,206	41,548,027
6	2000	13,217	3,626	47,924,842
Total		73,872	18,885	233,412,448

$S(xy) = 233,412,448 - (73,872 \times 18,885) / 6 = 899,789$

Calculate of S(xx)

n	Year	xi	xi^2
1	1995	11,391	129,752,313
2	1996	11,638	135,447,752
3	1997	12,152	147,671,315
4	1998	12,515	156,615,558
5	1999	12,959	167,947,789
6	2000	13,217	174,689,089
Total		73,872	912,123,616

$S(xx) = 912,123,616 - (73,872)^2 / 6 = 2,607,330$

Calculate of S(yy)

n	Year	yi	yi^2
1	1995	2,830	8,008,900
2	1996	2,926	8,561,476
3	1997	3,184	10,137,856
4	1998	3,113	9,690,769
5	1999	3,206	10,278,436
6	2000	3,626	13,147,876
Total		18,885	59,825,313

$S(yy) = 59,825,313 - (18,885)^2 / 6 = 384,776$

From a result of the above calculation, regression coefficient a, b, are as follows

$$b = \frac{S(xy)}{S(xx)} = \frac{899,789}{2,607,330} = 0.3451$$

$$a = y - bx = 3,148 - (0.3451 \times 12,312) = -1,101$$

Therefore, searching regression equation is as follows.

$$y = -1,101 + (0\ 3451)x$$

Where, y : Energy Consumption (GWh)

X : GDP (Million US$)

Moreover, correlation coefficient (r) is as follows.、

$$r = \frac{S(xy)}{\sqrt{S(xx)S(yy)}} = \frac{899,789}{\sqrt{2,607,330 \times 384,776}} = 0.898$$

At present, the GDP growth rate (2000 year's cost) after ten (10) years in El Salvador are planned an annual average 4.2% and 5.0% in 2001~2005 years and 2006~2011 year, respectively. And then, the both values for about 13% and 60% of actual loss factor of transmission & distribution lines and load factor of power system, respectively, are estimated that they are not modified during estimation. In this case, the power demands estimated by using the above-mentioned primary regression equation are as follows.

Year	GDP2000 Cost	Energy at Demand Terminal	Energy at Transmission End	Peak Demand
	(million US$)	(GWh)	(GWh)	(MW)
2001	13,772	3,652	4,197	737.2
2002	14,351	3,851	4,427	777.5
2003	14,953	4,059	4,666	819.4
2004	15,581	4,276	4,915	863.2
2005	16,236	4,502	5,175	908.8
2006	17,048	4,782	5,497	965.3
2007	17,900	5,076	5,835	1,024.7
2008	18,795	5,385	6,190	1,087.1
2009	19,735	5,709	6,563	1,152.5
2010	20,721	6,050	6,954	1,221.3
2011	21,757	6,407	7,365	1,293.5

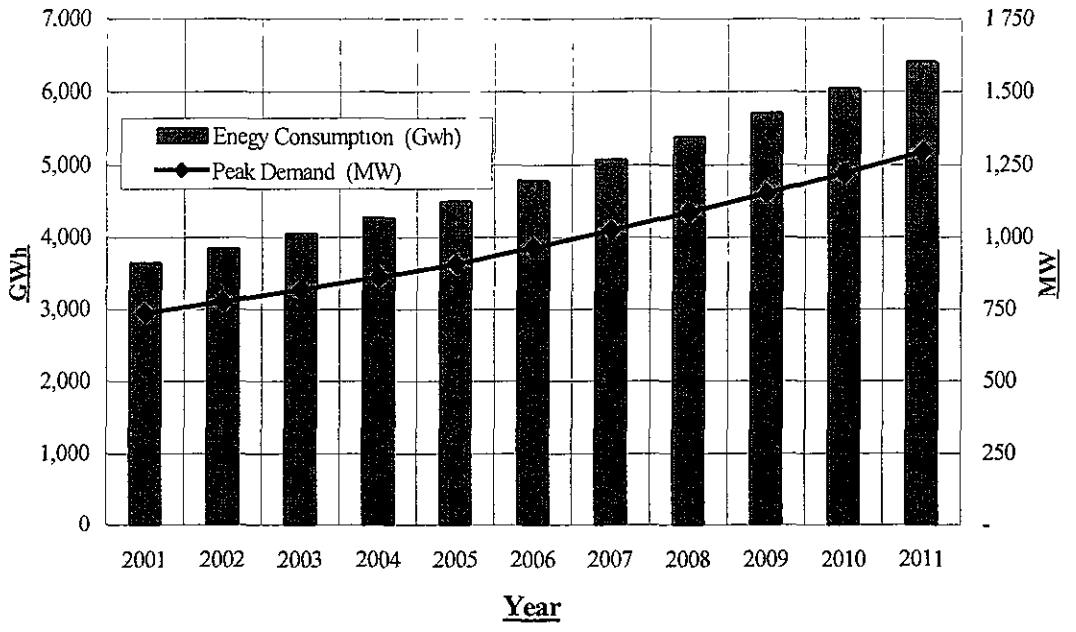


Fig. A5.1.2 Power Demand Forecast

45
(96)

Chapter 6: Meteorology and Hydrology

Appendix 6.1: Historical Data of Rainfall at Meteorological Stations

Appendix 6.2: Historical Data of Discharge at Hydrological Gauging Station (Osicala)

Appendix 6.3: Historical Data of Sediment Sampling at Hydrological Gauging Station (Osicala)

Appendix 6.4: Extended Rainfall at Meteorological Stations

Appendix 6.5: Extended Discharge at Hydrological Gauging Station (Osicala)

Appendix 6.6: Extended Discharge at El Chaparral, La Honda, La Honda Upstream Alternative Sites

Appendix 6.7: Hydrological Data for Tank Model Calculation

Appendix 6.8: Rainfall and Discharge Data of Hurricane FIFI

Appendix 6.9: PMP Calculation

Appendix 6.10: Simulation of Sedimentation in El Chaparral Reservoir

Appendix 6.1

Historical Data of Rainfall

at Meteorological Stations

Station SAN FRANCISCO GOTERA/MORAZAN
Code Z02
Basin G SAN MIGUEL

Latitude 13-41-48 N
Longitude 88-06-24 W
Elevation 250 m

HISTORICAL DATA

Rainfall (mm)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1942													
1943													
1944													
1945													
1946													
1947													
1948													
1949													
1950													
1951													
1952													
1953													
1954													
1955													
1956	12	23	0	39	265	246	195	287	433	400	10	0	
1957	0	0	0	113	188	308	297	269	465	370	32	0	
1958	4	0	0	37	311	666	486	283	693	257	73	0	
1959	0	0	0	27	211	283	195	280	431	243	32	0	
1960	5	7	16	50	497	441	236	231	291	498	42	2	
1961													
1962													
1963													
1964													
1965													
1966													
1967													
1968													
1969													
1970													
1971													
1972													
1973							272 3	627 6	544 5	674 2	25 4	0	
1974	0	0	23 2	0	147 5	783 8	307 7	227 1	654 2	156 7	0	0	2300 2
1975	0	0	0	0	289 6	211 5	203 7	470 5	843 9	324 9	249 1	0	2593 2
1976	0	0	0	136 8	113 3	514 8	43 6	105 1	307	159	55 5	0	1435 1
1977	0	0	0	101 6	220 6	438 1	13 2	192 7	214 4	65 6	79	6	1331 2
1978	0	19 5	51 5	85 7	232 9	209 5	204 1	230 6	383 7	114 9	13 7	26 3	1572 4
1979	0	0	0	149 5	46 7	310 6	193 9	210 5	329 7	255 1	37 8	0	1533 8
1980	20	0		14 6	468	265 1	143 1	283 1	185 3	291 5	0	0	
1981	0	0	16 5	17 5	173,8	359 8	195 7	245 1	278 6	161 5	0	0	1448 5
1982	3 9	0	0	69 7	421 6	264 2	76 2		124 1	70 8	4 2	7 6	
1983	0	0	7	2 2	40 3	320 3	112 6	155	285 2	198 7	46 5	1 3	1169 1
1984	0	0	0	84 9	185.7	339 8	264 9	184 6	509 6	216 5	14 4	0	1800 4
1985	0	0	0	144 7	221	75 3	318 9	226 7	293 2	236 8	90	0	1606 6
1986	0	0	0	2 4	301 1	194 9	55 2	144	296 1	197 8	14 4	4 6	1210 5
1987	3 3	0	11 6	0	103 3	201 8	196	117	298 4		28 6	0	
1988	0	0	0	78 1	202 9	353 5	157 7	531 3	617 9	250 4	35 7	0	2227 5
1989	0	0	0	12 4	311 9	202 5	298 3	317 2	590 8	77 1	100 9	15 8	1926 9
1990	0	0	20 8	104 8	191 7	318 5	171 6	215 4	413 5	463 5	33	14 5	1947 3
1991													
1992													
1993													
1994													
1995													
1996													
1997													
1998					266 1	347 9	224 1	464 4	282 7	535 2			
1999					205 8	407 3	517 6	347 5	460 6	234 2			
2000					293 2	302 5	116 2	434 4	594 7	178 3			
Avearage	2 2	2 3	7 0	57 8	236 4	334 6	211 4	283 2	416 2	265 2	44 2	3 4	1,863 8
Max.	20 0	23 0	51 5	149 5	497 0	783 8	517 6	627 6	843 9	674 2	249 1	26 3	2,593 2
Min.	0 0	0 0	0 0	0 0	40 3	75 3	13 2	105 1	124 1	65 6	0 0	0 0	1,169 1
Dev.	4 8	6 2	12 6	50 0	111 1	148 1	116 3	128 5	171 2	149 4	51 9	6 6	413 7

Station PERQUIN/MORAZAN
Code Z03
Basin LEMPA

Latitude 13-57-30 N
Longitude 88-09-42 W
Elevation 1225 m

HISTORICAL DATA

Rainfall (mm)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1942													
1943													
1944													
1945													
1946													
1947													
1948													
1949													
1950													
1951													
1952													
1953													
1954													
1955													
1956													
1957													
1958													
1959													
1960													
1961													
1962				72	256	684		224	629	504			
1963													
1964							518	405	613	211	54	15	
1965	0	43	0	12	241	446	206	342	507	350	2	0	2149
1966	8	2	22	168	271	535	650	480	319	284	13	0	2752
1967	25	75	45	277	13	518	215	233	401	387	72	33	2294
1968	0	0	0	29	413	543	180	260	491	568	189	3	2676
1969	13	24	24	126	340	599	307	611	598	547	35	5	3229
1970	10	2	15	58	235	340	391	492	707	501	4	0	2755
1971	0	0	0	0	264	365	182	613	343	578	81	10	2436
1972	0	6	5	157	322	512	144	157	273	232	182	0	1990
1973	0	3	0	55	592	458	325	512	552	673	94	16	3280
1974	3	0	36	0	281	463	182	262	655	135	22	0	2039
1975	4	1	12	51	318	306	198	301	644	463	228	0	2526
1976	0	0	0	139	234	716	163	273	297	247	134	2	2205
1977	0	0	0	75	308	587		410	362	230	140	4	
1978	0	1	45	54	158	433	408	234	602	400	36	52	2423
1979	1	0	64	282	189	554	520	319	651	291	27	5	2903
1980	24	0	3	64	384	422	391	355	597	335	54	7	2636
1981	0	2	55	2	292	493	389	220	449	360	25	81	2368
1982	30	44	7	81	493		109	110	630		0	0	
1983													
1984													
1985													
1986													
1987													
1988													
1989													
1990													
1991													
1992													
1993													
1994													
1995													
1996													
1997													
1998													
1999					316 3	518 7	461 5	577 9	753	575 7			
2000					582 3	358 1	179 5	245 3	558 9	421			
Avearage	6 6	11 3	18 5	89 6	294 9	498 6	304 3	340 6	516 0	384 0	73 3	12 3	2,549 9
Max.	30 0	75 0	64 0	282 0	592 0	716 0	650 0	613 0	707 0	673 0	228 0	81 0	3,280 0
Min.	0 0	0 0	0 0	0 0	13 0	306 0	109 0	110 0	273 0	135 0	0 0	0 0	1,990 0
Dev.	10 0	21 4	21 4	83 7	123 8	109 1	154 0	142 4	138 7	148 4	69 7	21 4	383 5

Station LA GALERA/MORAZAN
Code Z04
Basin LEMPA

Latitude 14-02-36 N
Longitude 88-05-12 W
Elevation 1900 m

HISTORICAL DATA

Rainfall (mm)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1942													
1943													
1944													
1945													
1946													
1947													
1948													
1949													
1950													
1951													
1952													
1953													
1954													
1955													
1956													
1957													
1958													
1959													
1960													
1961													
1962	0	0	5	31	176	457	220	411	575	341	53	7	2276
1963	4	5	40	13	228	280	388	240	408	35	110	7	1758
1964	2	0	0	5	228	626	411	358	383	98	11	12	2134
1965	7	18	0	37	197	353	156	242	416	206	5	5	1642
1966	4	16	42	29	362	397	335	250	439	231	10	35	2150
1967	42	19	42	122	9	342	115	318	285	273	124	9	1700
1968	1	5	0	66	301	581	97	308	374	416	140	19	2308
1969	3	1	25	84	193	458	297	636	571	295	14	2	2579
1970	10	8	6	34	186	291	378	310	454	142	3	8	1830
1971	3	17	0	60	289	270	199	485	403	317	75	0	2118
1972	2	18	5	48	144	447	256	143	125	52	66	0	1306
1973	0	0	0	63	224	383	227	492	379	426	35	16	2245
1974	3	8	40	3	218	425	235	316	643	99	0	5	1995
1975	10	1	1	0	275	155	109	244	433	307	90	10	1635
1976	9	2	0	50	189	634	111	295	222	137	56	17	1722
1977	0	1	2	61	324	353		377	305	912	108	14	
1978	11	4	90	10	242	288	259	188	591	120	15	47	1865
1979	6	11	107	225	79	336	335	249	470	220	13	16	2067
1980	17	5	76	66	219	323	187	305	333	190	94	17	1832
1981	4	12	86	2	299	418	345	315	286	261	4	36	2068
1982	26	49	7	31	303	353			406	217	18	21	
1983	9	21	67	44	89	317	131	282	306	157	168	49	1640
1984	8	23	14	6									
1985													
1986													
1987													
1988													
1989													
1990													
1991													
1992													
1993													
1994													
1995													
1996													
1997													
1998													
1999													
2000													
Avearage	7 9	10 6	28 5	47 4	217 0	385 8	239 6	322 1	400 3	247 8	55 1	16 0	1,978 0
Max.	42 0	49 0	107 0	225 0	362 0	634 0	411 0	636 0	643 0	912 0	168 0	49 0	2,579 0
Min.	0 0	0 0	0 0	0 0	9 0	155 0	97 0	143 0	125 0	35 0	0 0	0 0	1,306 0
Dev.	9 6	11 3	34 5	49 2	84 9	116 9	101 8	111 6	124 1	183 2	51 4	14 0	302 6

Station CORINTO/MORAZAN
Code Z05
Basin LEMPA

Latitude 13-48-18 N
Longitude 87-58-06 W
Elevation 820 m

HISTORICAL DATA

Rainfall (mm)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1942													
1943													
1944													
1945													
1946													
1947													
1948													
1949													
1950													
1951													
1952													
1953													
1954													
1955													
1956													
1957													
1958													
1959													
1960													
1961													
1962											51	1	
1963	0	16	4	74	185	337	409	148	140	183	204	0	1700
1964	0	0	0	40	234	595	430	645	373	220	20	3	2560
1965	0	0	0	68	288	277	375	501	415	182	3	0	2109
1966	0	0	45	165	267	526	436	274	237	194	0	4	2148
1967	23	9	28	59		424	97	268	221	227	24	2	
1968	0	9	0	0	286	620	73	99	264	383	27	15	1776
1969	4	1	23	71	366	548	240	516	848	512	41	0	3170
1970	3	0	0	129	317	419	477	482	527	267	10	8	2639
1971	10	2	0	13	323	294	130	408	287	394	53	2	1916
1972	0	0	0	117	364	317	78	224	213	218	62	0	1593
1973	0	0	0	226	277	502	243	537	465	622	41	6	2919
1974	4	0	44	0	248	445	159	245	469	117	1	0	1732
1975	1	0	0	3	423	222	193	466	362	251	126	0	2047
1976	0	0	0	83	160	433		112	196	189	62	0	
1977	0	0	0	40	182	489		175	102	42	66	6	
1978	0	5	95	98	322	193	454	120	372	271	0	0	1930
1979	0	0	1	186	160	267	185	421	439	322	34	0	2015
1980	18	0	0	44	386	545	184	302	348	251	61	4	2143
1981	0	2	124	20	284	758	305	463	514	323	4	3	2800
1982	9	24	0	76	410	636	130	94	588	163	0	0	2130
1983													
1984	7	22	14	73	391	317	312	135	510	208	12	0	2001
1985	0	0	7	64	201	295	382	452	235	371	118	8	2133
1986	0	2	0		432				368	274	10	0	
1987	0	0	50	6	81	325	329	217	294	29	2	5	1338
1988	0	0	3	67	330	581	311	693	577	299	71	0	2932
1989	0	0	13	76	249	276	419	531	634	284	137	54	2673
1990													
1991													
1992													
1993													
1994													
1995													
1996													
1997													
1998					236 6	310 1	350	599 9	236	731 4			
1999					160 2	286 3	288 1						
2000													
Avearage	3 0	3 5	17 3	71 9	286 6	425 6	276 1	341 1	384 5	261 4	45 9	4 5	2,121 7
Max.	23 0	24 0	124 0	226 0	432 0	758 0	477 0	693 0	848 0	622 0	204 0	54 0	3,170 0
Min.	0 0	0 0	0 0	0 0	81 0	193 0	73 0	94 0	102 0	29 0	0 0	0 0	1,338 0
Dev.	5 9	6 9	31 5	57 8	91 9	149 5	131 7	182 4	171 6	128 0	50 4	10 5	484 7

Station JOCORO/MORAZAN
Code Z06
Basin G SAN MIGUEL

Latitude 13-36-42 N
Longitude 88-01-30 W
Elevation 250 m

HISTORICAL DATA

Rainfall (mm)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1942													
1943													
1944													
1945													
1946													
1947													
1948													
1949													
1950													
1951													
1952													
1953													
1954													
1955													
1956													
1957													
1958													
1959													
1960													
1961													
1962													
1963													
1964													
1965													
1966													
1967													
1968													
1969	0	0	11		234	321	190	282	548	334	130	0	
1970	0	0	0	77					298	262	81	4	
1971	0	0	0	14	172	150	174	513	342	294	6	0	1665
1972	0	0	0	148	223	143	95	138	148	182	0	0	1077
1973	0	0	0	53	325	502	206	462	289	377	48	0	2262
1974	0	0	31	0	88	404	171	203	544	148	2	0	1591
1975	0	0	0	0	170	101	172	340	422	287	140	0	1632
1976	0	0	0	82	132	611	81	185	194	192	17	0	1494
1977	0	0	0	60	305	442	110	235	241	131	76	15	1615
1978	0	0	33	74	193	132	215	303	455	263	48	21	1737
1979	0	0	0	189	78	450	119	281	328	367	0	0	1812
1980													
1981													
1982							169	84	399	0	0	0	
1983													
1984	0	0	0	29	58	230	230	135	420	103	0	0	1205
1985													
1986													
1987													
1988													
1989													
1990													
1991													
1992													
1993													
1994													
1995													
1996													
1997													
1998													
1999													
2000													
Avearage	0 0	0 0	6 3	66 0	179 8	316 9	161 0	263 4	356 0	226 2	42 2	3 1	1,620 8
Max.	0 0	0 0	33 0	189 0	325 0	611 0	230 0	513 0	548 0	377 0	140 0	21 0	2,262 0
Min.	0 0	0 0	0 0	0 0	58 0	101 0	81 0	84 0	148 0	0 0	0 0	0 0	1,077 0
Dev.	0 0	0 0	12 4	59 4	88 2	175 5	48 7	129 6	123 8	111 7	50 6	6 8	324 5

Station MEANGUERA/MORAZAN
Code Z07
Basin LEMPA

Latitude 13-36-42 N
Longitude 88-01-30 W
Elevation 250 m

HISTORICAL DATA

Rainfall (mm)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1942													
1943													
1944													
1945													
1946													
1947													
1948													
1949													
1950													
1951													
1952													
1953													
1954													
1955													
1956													
1957													
1958													
1959													
1960													
1961													
1962													
1963													
1964													
1965													
1966													
1967													
1968													
1969	8	3	42	132	674	632	427	332			0	0	
1970	0	0	10	15	565	754	510	582	482	181	14	5	3118
1971	0	0	3	26	197	360	182	576	249	386	20	0	1999
1972	0	0	0	186	320	281		156	358	230	92	0	
1973	0	0	0	5	172	497	239	378	406	569	42	0	2308
1974	0	0	3	1		382		233	422	122	0	0	
1975	0	0	0	0	433	310	188	339	373	279	145	0	2067
1976	0	0	0	115	248	566	210	252	311	89	49	0	1840
1977	0	0	0	27	411	430		247	291	224	61	5	
1978	0	0	36	102	220	290	400	175	450	219	33	20	1945
1979	0	0	23	121	130	284	418	291	198	264	84	0	1813
1980	16												
1981													
1982													
1983													
1984													
1985													
1986													
1987													
1988													
1989													
1990													
1991													
1992													
1993													
1994													
1995													
1996													
1997													
1998													
1999													
2000													
Avearage	2 0	0 3	10 6	66 4	337 0	435 1	321 8	323 7	354 0	256 3	49 1	2 7	2,159 0
Max.	16 0	3 0	42 0	186 0	674 0	754 0	510 0	582 0	482 0	569 0	145 0	20 0	3,118 0
Min.	0 0	0 0	0 0	0 0	130 0	281 0	182 0	156 0	198 0	89 0	0 0	0 0	1,813 0
Dev.	5 0	0 9	15 7	66 0	180 1	159 1	130 2	142 9	91 0	137 4	44 3	6 1	455 2

Station OSICALA/MORAZAN
Code Z08
Basin LEMPA

Latitude 13-53-36 N
Longitude 88-02-36 W
Elevation 820 m

HISTORICAL DATA

Rainfall (mm)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1942													
1943													
1944													
1945													
1946													
1947													
1948													
1949													
1950													
1951													
1952													
1953													
1954													
1955	0	0	0	13	73	319	724	398	728	580	37	4	2876
1956	11	13	5	81	315	286	275	101	384	702	0	2	2175
1957	0	2	2	73	243	293	314	297	555	476	56	0	2311
1958	0	0	0	6	413	796	469	301	647	210	75	0	2917
1959	0	6	0	34	260	269	225	320	512	522	32	0	2180
1960	8	10	27	36	527	419	236	207	273	518	32	2	2295
1961	0	13	92	24	206	307	393	173	338	332	111	18	2007
1962	0	0	0	58	355	513	226	262	584	421	34	0	2453
1963	0	7	46	11	245	259	344	163	414	307	14	2	1812
1964	0	6	14	41	287	382	433	389	235	86	16	33	1922
1965	0	0	0	17	298	318	183	221	409	321	5	0	1772
1966	0	0	20	134	448	533	332	317	315	260	12	0	2371
1967	0	32	0	112	74	407	136	278	421	403	11	7	1881
1968	0	1	0	10	110	290			352	772	15	3	
1969	0	0	0	2	88	510	510	277	235	332	338	29	2321
1970	0	6	8	29	420	346	390	259	298	339	20	5	2120
1971	0	0	0	10		246	185	489	461	350	26	0	
1972	0	0	0	50	406	184	154	161	284			0	
1973	0	0	0	47	199	441	236	286	471	452	13	0	2145
1974	0	0	28	0	300	364	183	200	383	155	0	0	1613
1975	0	0	0	0	538	143	173	343	650	150	238	0	2235
1976	0	0	0	0	150	503	146	283		94		0	
1977	0	0	0	42	527	436		224	161	117	4	0	
1978	0	0	28				365		553	198	62	21	
1979	0	0	0	31	67	164	452	393	438	421	0	0	1966
1980	0	0	31	21	284		284	273					
1981													
1982													
1983													
1984													
1985													
1986													
1987													
1988													
1989													
1990													
1991													
1992													
1993													
1994													
1995													
1996													
1997													
1998					194 3	374 9	209	375 8	192 6				
1999						206 6	203 5	329	453	275			
2000													
Avearage	0 7	3 7	11 6	35 3	284 7	363 7	307 0	275 6	420 9	354 9	50 0	5 0	2,113 2
Max.	11 0	32 0	92 0	134 0	538 0	796 0	724 0	489 0	728 0	772 0	338 0	33 0	2,917 0
Min.	0 0	0 0	0 0	0 0	67 0	143 0	136 0	101 0	161 0	86 0	0 0	0 0	1,613 0
Dev.	2 6	7 1	21 0	34 7	148 2	143 5	142 2	88 5	146 1	183 3	81 2	9 5	337 6

Station EL ROSARIO/MORAZAN
Code Z09
Basin LEMPA

Latitude 13-51-54 N
Longitude 88-12-42 W
Elevation 465 m

HISTORICAL DATA

Rainfall (mm)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1942													
1943													
1944													
1945													
1946													
1947													
1948													
1949													
1950													
1951													
1952													
1953													
1954													
1955													
1956													
1957													
1958													
1959													
1960													
1961													
1962													
1963													
1964													
1965													
1966													
1967													
1968													
1969													
1970													
1971			6	44	142	323	466	447	486	244	10	2	
1972	0	0	0	154	263	210		164	365	182	117	0	
1973	0	1	0	137	315	373	231	344	420	459	62	18	2360
1974	0	0	136	19	405	304	166	144	369	124	2	0	1669
1975	5	0	0	41	466	184	141	319	409	264	65	0	1894
1976	0	0	0	159	243	488	220	274	213	166	48	4	1815
1977	0	0	0	60	402	409		437	345	204	144	2	
1978	0	1	18	104	182	315	337	152	382	332	2	57	1882
1979	0	0	84	151	111	311	245	322	309	223	58	10	1824
1980	32	0	5	30	339	304							
1981													
1982													
1983													
1984													
1985													
1986													
1987													
1988													
1989													
1990													
1991													
1992													
1993													
1994													
1995													
1996													
1997													
1998													
1999													
2000													
Avearage	4 1	0 2	24 9	89 9	286 8	322 1	258 0	289 2	366 4	244 2	56 4	10 3	1,952 7
Max.	32 0	1 0	136 0	159 0	466 0	488 0	466 0	447 0	486 0	459 0	144 0	57 0	2,360 0
Min.	0 0	0 0	0 0	19 0	111 0	184 0	141 0	144 0	213 0	124 0	2 0	0 0	1,669 0
Dev.	10 6	0 4	46 8	56 8	119 4	88 3	111 1	115 9	76 3	100 5	49 5	18 5	235 8

Station HACIENDA NOMBRE DE JESÚS/MORAZAN
Code Z10
Basin G SAN MIGUEL

Latitude 13-38-12 N
Longitude 88-02-42 W
Elevation 220 m

HISTORICAL DATA

Rainfall (mm)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1942													
1943													
1944													
1945													
1946													
1947													
1948													
1949													
1950													
1951													
1952													
1953													
1954													
1955													
1956													
1957													
1958													
1959													
1960													
1961													
1962													
1963													
1964													
1965													
1966													
1967													
1968													
1969													
1970													
1971													
1972	0	0	0	81	344	156	156		213	269	87	0	
1973	0	0	0	19		619	242	297	406	593	35	0	
1974	0	1	66	0	92	290		89	396	152	0	0	
1975	0	0	2	0	53	153	193	278	371	300	143	0	1493
1976	0	0	0	276	484	516	66	364	430	38	7	0	2181
1977	0	0	0	24	343	223	32	230	382	109	60	0	1403
1978	0	0	61	93	201	132	277	248	427	423	78	0	1940
1979	0	0	10	197	221	439	481	264	323	593	45	0	2573
1980													
1981													
1982													
1983													
1984													
1985													
1986													
1987													
1988													
1989													
1990													
1991													
1992													
1993													
1994													
1995													
1996													
1997													
1998													
1999													
2000													
Avearage	0 0	0 1	17 4	86 3	248 3	316 0	206 7	252 9	368 5	309 6	56 9	0 0	1,862 6
Max.	0 0	1 0	66 0	276 0	484 0	619 0	481 0	364 0	430 0	593 0	143 0	0 0	2,573 0
Min.	0 0	0 0	0 0	0 0	53 0	132 0	32 0	89 0	213 0	38 0	0 0	0 0	1,403 0
Dev.	0 0	0 4	28 7	101 2	152 3	186 0	149 7	84 1	71 5	211 8	46 5	0 0	485 9

Station TOROLA/MORAZAN
Code Z11
Basin LEMPA

Latitude 13-54-48 N
Longitude 88-14-00 W
Elevation 730 m

HISTORICAL DATA

Rainfall (mm)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1942													
1943													
1944													
1945													
1946													
1947													
1948													
1949													
1950													
1951													
1952													
1953													
1954													
1955													
1956													
1957													
1958													
1959													
1960													
1961													
1962													
1963													
1964													
1965													
1966													
1967													
1968													
1969													
1970													
1971									3	333	57	1	
1972	0	0	0	123	421	409	167	164	284	252	135	0	1955
1973	0	0	0	71	445	381	398	416	401	487	70	5	2674
1974	5	0	103	12	447	358	145	228	260	149	0	0	1707
1975	4	0	4	31	367	370	258	232	535	446	66	0	2313
1976	0	0	0	167	170	314	162	256	276	194	53	0	1592
1977	0	0	0	71	548	434	26	382			136	0	
1978	0	0	111	90	193	322	358	245	421	277	335	0	2352
1979	0	0	127	150	253	390	414	294	351	266	5	3	2253
1980	11	0	0		243	401			420	331	92	0	
1981	0	0	89	34	223	276							
1982													
1983													
1984													
1985													
1986													
1987													
1988													
1989													
1990													
1991													
1992													
1993													
1994													
1995													
1996													
1997													
1998													
1999													
2000													
Avearage	2 0	0 0	43 4	83 2	331 0	365 5	241 0	277 1	327 9	303 9	94 9	0 9	2,070 8
Max.	11 0	0 0	127 0	167 0	548 0	434 0	414 0	416 0	535 0	487 0	335 0	5 0	2,674 0
Min.	0 0	0 0	0 0	12 0	170 0	276 0	26 0	164 0	3 0	149 0	0 0	0 0	1,592 0
Dev.	3 7	0 0	55 9	54 3	130 6	48 7	139 2	83 9	150 3	109 7	95 9	1 7	385 6

Station CERRO OCOTEPEQUE (EL TABLON)/MORAZAN
Code Z12
Basin G SAN MIGUEL

Latitude 13-44-00 N
Longitude 88-00-30 W
Elevation 770 m

HISTORICAL DATA

Rainfall (mm)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1942													
1943													
1944													
1945													
1946													
1947													
1948													
1949													
1950													
1951													
1952													
1953													
1954													
1955													
1956													
1957													
1958													
1959													
1960													
1961													
1962													
1963													
1964													
1965													
1966													
1967													
1968													
1969													
1970													
1971													
1972		0	2	118	331	353	174	273	303	167	0	0	
1973	0	0	0	28	539	912	795	553	531	208	42	0	3608
1974	0	0	92	0	152	559		221	555	142	0	0	
1975	0	0	0	2	317	130	204	407	522	290	75	0	1947
1976	0	0	0	162	179	720	60	102	300	378	39	0	1940
1977	0	0	0	74	249	355	65	360	534	91	79	0	1807
1978	0	0	87	172		436		255	581	294	2	36	
1979	0	0	0	131	92	567	442	297	898	869			
1980	21	0	0	79									
1981													
1982													
1983													
1984													
1985													
1986													
1987													
1988													
1989													
1990													
1991													
1992													
1993													
1994													
1995													
1996													
1997													
1998					34 2	35 5		216 7	347 1	533 2			
1999					125 4	518 1	281 1	426 2	796 9	704 8			
2000					554 6	325 1	168 7	534 5	875 7				
Avearage	2 6	0 0	20 1	85 1	265 6	504 0	290 0	308 5	528 0	304 9	33 9	5 1	2,347 8
Max.	21 0	0 0	92 0	172 0	539 0	912 0	795 0	553 0	898 0	869 0	79 0	36 0	3,608 0
Min.	0 0	0 0	0 0	0 0	92 0	130 0	60 0	102 0	300 0	91 0	0 0	0 0	1,807 0
Dev.	7 4	0 0	39 4	65 4	148 6	241 9	283 7	134 5	186 4	246 3	34 5	13 6	857 4

Station JOATECA/MORAZAN
Code Z13
Basin LEMPA

Latitude 13-53-48 N
Longitude 88-02-48 W
Elevation 820 m

HISTORICAL DATA

Rainfall (mm)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1942													
1943													
1944													
1945													
1946													
1947													
1948													
1949													
1950													
1951													
1952													
1953													
1954													
1955													
1956													
1957													
1958													
1959													
1960													
1961													
1962													
1963													
1964													
1965													
1966													
1967													
1968													
1969													
1970													
1971													
1972		0	0	165	336	314	150	130	264	324	44	0	
1973	0	0	0	80	351	298	358	505	440	634	11	0	2677
1974	0	0	187	4	425	308	48	183	505	153	0	0	1813
1975	0	0	0	5	384	225	221	307	531	394	238	1	2306
1976	0	0	0	199	345	732	76	108	280	180	90	0	2010
1977	0	0	0	29	256	386	21	163	505	270	70	0	1700
1978	0	0	67	87	227	309	252	132	517				
1979	0	26		150	190								
1980													
1981													
1982													
1983													
1984													
1985													
1986													
1987													
1988													
1989													
1990													
1991													
1992													
1993													
1994													
1995													
1996													
1997													
1998					222 9	243 3	279 3	358 6	476 1	581 4			
1999					210 5	461 4	403 1	559 3	524 5	675 5			
2000					586 1	309	185 9	278 4	546 3	205			
Avearage	0 0	3 3	36 3	89 9	314 3	367 4	160 9	218 3	434 6	325 8	75 5	0 2	2,026 3
Max.	0 0	26 0	187 0	199 0	425 0	732 0	358 0	505 0	531 0	634 0	238 0	1 0	2,677 0
Min.	0 0	0 0	0 0	4 0	190 0	225 0	21 0	108 0	264 0	153 0	0 0	0 0	1,700 0
Dev.	0 0	9 2	71 0	75 2	81 4	167 4	122 7	142 5	114 8	175 4	86 6	0 4	395 5

Station CERRO CACAHUATIQUE/MORAZAN
Code Z14
Basin LEMPA

Latitude 13-46-06 N
Longitude 88-13-18 W
Elevation 1400 m

HISTORICAL DATA

Rainfall (mm)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1942													
1943													
1944													
1945													
1946													
1947													
1948													
1949													
1950													
1951													
1952													
1953													
1954													
1955													
1956													
1957													
1958													
1959													
1960													
1961													
1962													
1963													
1964													
1965													
1966													
1967													
1968													
1969													
1970													
1971													
1972													
1973									406	706	32	0	
1974	0	0	51	0	246	358	203	397	592	210	0	0	2057
1975	0	0	0	0	403	148	184	344	535	340	18	0	1972
1976	0	0	0	27	210	699	176	278	291	269	31	1	1982
1977	0	0	0	90	451	459	87	274	550	218	96	8	2233
1978	0	0	33	204	222	291	471	372	452	290	51	25	2411
1979	0	0	31	185	263	273	408	342	393	234	103	0	2232
1980	5	0	6	52	367	382	235	328	341	308	68	9	2101
1981	0	8	25	63									
1982													
1983													
1984													
1985													
1986													
1987													
1988													
1989													
1990													
1991													
1992													
1993													
1994													
1995													
1996													
1997													
1998													
1999													
2000													
Avearage	0 6	1 0	18 3	77 6	308 9	372 9	252 0	333 6	445 0	321 9	49 9	5 4	2,186 9
Max.	5 0	8 0	51 0	204 0	451 0	699 0	471 0	397 0	592 0	706 0	103 0	25 0	2,411 0
Min.	0 0	0 0	0 0	0 0	210 0	148 0	87 0	274 0	291 0	210 0	0 0	0 0	1,972 0
Dev.	1 8	2 8	19 4	78 5	96 5	173 8	137 0	45 4	106 6	161 6	36 8	8 8	159 2

Station CANTON LAS QUEBRADAS/MORAZAN
Code Z15
Basin LEMPA

Latitude 13-48-30 N
Longitude 88-13-48 W
Elevation 870 m

HISTORICAL DATA

Rainfall (mm)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1942													
1943													
1944													
1945													
1946													
1947													
1948													
1949													
1950													
1951													
1952													
1953													
1954													
1955													
1956													
1957													
1958													
1959													
1960													
1961													
1962													
1963													
1964													
1965													
1966													
1967													
1968													
1969													
1970													
1971													
1972													
1973													
1974													
1975	6	0	19	4	407	244	226	410	512	309	130	0	2267
1976	0	0	0	196	235	650	151	271					
1977	0	0	0	96	486	418	54	261	366	268	106	11	2066
1978	0	0	49	139	149	316	476	261	434	262	26	66	2178
1979	0	0	18	200	116	281	370	259	323	432	80	0	2079
1980													
1981													
1982													
1983													
1984													
1985													
1986													
1987													
1988													
1989													
1990													
1991													
1992													
1993													
1994													
1995													
1996													
1997													
1998													
1999													
2000													
Avearage	1 2	0 0	17 2	127 0	278 6	381 8	255 4	292 4	408 8	317 8	85 5	19 3	2,184 9
Max.	6 0	0 0	49 0	200 0	486 0	650 0	476 0	410 0	512 0	432 0	130 0	66 0	2,267 0
Min.	0 0	0 0	0 0	4 0	116 0	244 0	54 0	259 0	323 0	262 0	26 0	0 0	2,066 0
Dev.	2 7	0 0	20 0	81 1	161 7	163 3	168 9	65 9	82 6	79 0	44 6	31 6	94 1

Station CIUDAD BARRIOS/MORAZAN
Code M05
Basin LEMPA

Latitude 13-45-54 N
Longitude 88-16-18 W
Elevation 860 m

HISTORICAL DATA

Rainfall (mm)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1942													
1943													
1944													
1945													
1946													
1947													
1948													
1949													
1950													
1951													
1952													
1953													
1954													
1955													
1956	0	0	0	15	320	186	349	251	892	418	29	0	2460
1957	0	0	0	138	227	342	267	279	460	251	48	0	2012
1958	0	10	34	4	484	530	350	241	471	230	77	0	2431
1959	0	10	0	47	325	309	253	339	414	351	68	4	2120
1960	1	31	0	177	334	391	330	323	234	461	18	0	2300
1961	0	92	98	47	114	243	407	174	424	165	26	0	1790
1962	0	0	0	38	284	358	281	294	468	323	38	3	2087
1963	0	21	2	20	218	398	305	294	468	323	38	0	2087
1964	0	0	0	13	221	255	416	302	426	195	33	21	1882
1965	0	0	0	19	192	304	156	173	532	235	11	0	1622
1966	0	0	10	134	450	574	349	425	421	463	4	15	2845
1967	9	10	82	117	161	393	192	214	388	317	85	0	1968
1968	0	28	3	34	277	386	148	311	542	405	63	2	2199
1969	1	1	3	204	268	302	265	341	478	258	29	0	2150
1970	5	16	9	24	321	396	324	382	562	336	3	3	2381
1971	0	0	42	44	356	318	199	364	306	450	22	16	2117
1972	0	0	5	100	466	300	158	167	317	244	89	0	1846
1973	0	0	0	12	27	418	228	480	486	754	39	3	2447
1974	0	0	25	0	254	321	211	363	465	194	0	0	1833
1975	0	0	0	0	446	160	202	439	678	375	183	0	2483
1976	0	0	0	186	237	502	170	278	236	269	35	0	1913
1977	0	0	0	91	315	346		320	409	220	88	4	
1978	0	0	35	152	133	248	433	383	428	292	20	17	2141
1979	0	0	11	198	299	339	281	308	427	522	0	0	2385
1980	6	0	7	50	582	398	283			316	0	0	
1981	0	0	46	22	207	575	400	444	527	486	11	20	2738
1982	0	18	21		480		132	107					
1983	0	0	13	44	138	372	208			366	79	15	
1984	5	31	5	9	311	283	377	287					
1985													
1986													
1987													
1988													
1989													
1990													
1991													
1992													
1993													
1994													
1995													
1996													
1997													
1998					389 6	250 2	388 2	546 9	231 3	653 1			
1999					177 6	500 3	284 3	680 5	558 3	489 2			
2000					309 5	274 2	100	369 8	590 3	290 3			
Avearage	0 9	9 2	15 6	69 3	291 3	355 3	274 1	306 8	458 4	341 4	42 1	4 6	2,168 8
Max.	9 0	92 0	98 0	204 0	582 0	575 0	433 0	480 0	892 0	754 0	183 0	21 0	2,845 0
Min.	0 0	0 0	0 0	0 0	27 0	160 0	132 0	107.0	234 0	165 0	0 0	0 0	1,622 0
Dev.	2 3	18 9	24 8	66 8	126 8	102 1	89 5	90 8	132 8	127 6	40 3	7 2	303 0

Station SESORI/SAN MIGUEL
Code M18
Basin LEMPA

Latitude 13-42-48 N
Longitude 88-21-48 W
Elevation 195 m

HISTORICAL DATA

Rainfall (mm)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1942													
1943													
1944													
1945													
1946													
1947													
1948													
1949													
1950													
1951													
1952													
1953													
1954													
1955													
1956													
1957													
1958													
1959													
1960													
1961													
1962													
1963													
1964													
1965													
1966													
1967													
1968													
1969													
1970													
1971		0	0	44	238	310	182	152	246	395	44	0	
1972	14	5	2	111	354	250	277	170	308	209	114	0	1814
1973	0	1	2	124	146	286	232	332	266	438	26	14	1867
1974	0	0	70	1	182	278	132	294	355	225	14	0	1551
1975	1	4	19	0	302	117	206	384	496	335	88	0	1952
1976	0	0	1	84	212	444	136	225	250	116	16	0	1484
1977	0	0	0	44	149	244		236	201	117	88	7	
1978	0	0	33	69	89	292	374	292	377	181	23	43	1773
1979	0	0	5	157	90	247	469	255	228	266	112	1	1830
1980	5	0	0	86	292	308	220	340	314	299	43	3	1910
1981													
1982													
1983													
1984													
1985													
1986													
1987													
1988													
1989													
1990													
1991													
1992													
1993													
1994													
1995													
1996													
1997													
1998					70 7	189 6	271 6	532 6	91 5				
1999					250 3	458 4	223 5	361 8		295 4			
2000					311 7	238 3	117 2	323	377 3	198 8			
Avearage	2 2	1 0	13 2	72 0	205 4	277 6	247 6	268 0	304 1	258 1	56 8	6 8	1,712 8
Max.	14 0	5 0	70 0	157 0	354 0	444 0	469 0	384 0	496 0	438 0	114 0	43 0	1,952 0
Min.	0 0	0 0	0 0	0 0	89 0	117 0	132 0	152 0	201 0	116 0	14 0	0 0	1,484 0
Dev.	4 7	1 9	22 7	51 2	90 8	80 7	111 1	74 6	87 6	109 7	39 7	13 5	167 9

Station CAROLINA/SAN MIGUEL
Code M21
Basin LEMPA

Latitude 13-51-06 N
Longitude 88-18-24 W
Elevation 275 m

HISTORICAL DATA

Rainfall (mm)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1942													
1943													
1944													
1945													
1946													
1947													
1948													
1949													
1950													
1951													
1952													
1953													
1954													
1955													
1956													
1957													
1958													
1959													
1960													
1961													
1962													
1963													
1964													
1965													
1966													
1967													
1968													
1969													
1970													
1971									201	266		2	
1972			14	112	258								
1973			0	157	351	476	251	508	319	615	18	0	
1974	0	0	68	0	174	328	117	310	316	113	0	0	1426
1975	5	4	20	7	508	146	185	291	497	273	56	0	1992
1976	0	0	0	127	232	534	157	225	278	247	74	2	1876
1977	0	0	0	112	277	413	63	314	497	117	122	26	1941
1978	0	0	59	57	212	293	348	149	409	314	12	31	1884
1979	0	0	53	139	79	166	338	260	237	404	7	4	1687
1980	21	0	1	121	354	446	244	337	215	158	13	0	1910
1981	0	1	71	0	201	317	286	384	297	355	15	105	2032
1982	23	40	0	0	327	363		142	431		47	9	
1983													
1984													
1985													
1986													
1987													
1988													
1989													
1990													
1991													
1992													
1993													
1994													
1995													
1996													
1997													
1998													
1999													
2000													
Avearage	5 4	5 0	26 0	75 6	270 3	348 2	221 0	292 0	336 1	286 2	36 4	16 3	1,918 5
Max.	23 0	40 0	71 0	157 0	508 0	534 0	348 0	508 0	497 0	615 0	122 0	105 0	2,032 0
Min.	0 0	0 0	0 0	0 0	79 0	146 0	63 0	142 0	201 0	113 0	0 0	0 0	1,426 0
Dev.	9 5	13 2	30 2	63 4	113 6	126 2	97 9	108 7	107 0	150 8	38 5	31 4	197 5

Station SAN GERARDO/SAN MIGUEL
Code M22
Basin LEMPA

Latitude 13-48-42 N
Longitude 88-24-30 W
Elevation 200 m

HISTORICAL DATA

Rainfall (mm)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1942													
1943													
1944													
1945													
1946													
1947													
1948													
1949													
1950													
1951													
1952													
1953													
1954													
1955													
1956													
1957													
1958													
1959													
1960													
1961													
1962													
1963													
1964													
1965													
1966													
1967													
1968													
1969													
1970													
1971								447	398	367	21	0	
1972	0	0	0	89	298	237	128	160	385	117			
1973	0	0	18	79	230	321	366	386	332	493	65	0	2290
1974	0	0	130	0	172	403	214	233	309	64	19	0	1544
1975	15	0	0	7	342	256	193	392		195	160	0	
1976	0	0	0	214	109	632	194	231	193	97	6	0	1676
1977	0	0	0	22	108	350	198	561	413	329	234	2	2217
1978	0	0	119	195	351	774	639	540	760	366	33	73	3850
1979	3	0	44	58	58	182	696	644	770	607	55	30	3147
1980	8	2	7	7	280	252							
1981													
1982													
1983													
1984													
1985													
1986													
1987													
1988													
1989													
1990													
1991													
1992													
1993													
1994													
1995													
1996													
1997													
1998													
1999													
2000													
Avearage	2 9	0 2	35 3	74 6	216 4	378 6	328 5	399 3	445 0	292 8	74 1	13 1	2,260 9
Max.	15 0	2 0	130 0	214 0	351 0	774 0	696 0	644 0	770 0	607 0	234 0	73 0	3,850 0
Min.	0 0	0 0	0 0	0 0	58 0	182 0	128 0	160 0	193 0	64 0	6 0	0 0	1,544 0
Dev.	5 3	0 7	52 6	80 5	109 0	198 4	220 3	166 4	209 2	187 8	80 7	26 3	888 3

Station MARCALA/GUARALAPE
Code U070
Basin (25) ULUA

Latitude 14-09-32 N
Longitude 88-02-25 W
Elevation 1340 m

HISTORICAL DATA

Rainfall (mm)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1942													
1943													
1944													
1945													
1946													
1947													
1948													
1949													
1950													
1951	0	0	0	20 4	160 8	296 1	429	148	330 4	167 2	0	18	1569 9
1952	1 4	2 6	39 9	123 9	126 1	420	222 2	283	377	137 1	22 9	1 1	1757 2
1953	3	0	0	70 6	124	325 6	400	270 8	469 8	94	49 6	50 8	1858 2
1954	0	3 3	0	53 1	379 5	445 3	233 9	261	543 5	175 5	0	1 3	2096 4
1955	16 5	0	1 3	20	30 1	96 8	405 7	306 1	383 4	336 6	30 4	10 1	1637
1956	17 8	0		0	307 5	200 3	246 4	264 4	427 1		0	0	
1957	0	0	0	0	73 2	226 1	279 4	286	448 8	118 1	0	0	1431 6
1958											5 6	0	
1959	0	0	0	0	14 5						0 5	0	
1960													
1961												7 4	
1962	16 8	3 6	0	29 2	116 8	407 7	165 1	177	255	365	57 7	12 2	1606 1
1963	0	7 6	12 7	52 6	133 9	183 4	263 1	195 3	390 7		0	0	
1964													
1965													
1966													
1967													
1968													
1969													
1970													
1971		16 9	41 1	4 6	124 5		151 1		254 5	177 1	80 8	33 3	
1972	1 8	4 7	0	64	202 7	223 2	174 5	144 7	251 1	167	24 9	3 7	1262 3
1973	1 5	0 2	0 9	79 4	187 3	274 8	206 7	292 7	215 2	273 6	24 6	4 1	1561
1974	4 3	0 8	9 9	2	220 9	377 1	127 4	293 2	253 6	134 5	6 6	5	1435 3
1975	19 3	0	0	0	128 5	89 4		293 8	364 2	245 7	77 7	3 5	
1976	11 3	1 4	0	124 6	144 2	367 9		137 2	134	101 8	14 1	10 6	
1977	0	0	2 1	100 8	291 6	133 4	116 7	139 1	187 3	79 5	75 8	16 1	1142 4
1978	10 4	0	39 2	62 2	186 8	203 6	254 7	284 1	268 6				
1979			42	49 7	179 1	221	211 5	280 1	219 5	119	8	19 9	
1980	1 8	0		12 4	144 6	269 6	244 9	173 6	155 7	79 9	2 5	2 2	
1981	0 9	6 1	21 8	17	159 2	188 4	163 1	224 2	154 6	125 2	1 2	2 1	1063 8
1982	17 7	51 9	30 9	24 3	251.9	341 2	192 3	130 8	193 2	111 2	7 5	7 1	1360
1983	14 3	41 1	35 4	137 4	104 2	153 5	182 4	214 4	396 8	107 2	128 2	14 4	1529 3
1984	6 9	5 7	5 3	9 4	226 4	227	294 2	300 6	282 9	150 4	37 1	11 3	1557 2
1985	7 7	0	39 1	53 2	154 9	146 7	187 5	299 7	302	126	52 6	20 5	1389 9
1986	4 4	16 7	0 2	13 5	149 8	192	59 7	219 8	272 5	263 4	43 7	1 3	1237
1987	1 5	9 9	18 7	15 1	81 2	414 2	195 3	229	269 6		15 1	4 9	
1988	7 4	21 9	0 1	43 5	168 4	361 5	203 3	398 6	255 6	85 5	1 2	0 1	1547 1
1989	13 3	1 3	1 1	140	117 7	189 8	145 9	465 5	362 6	202 5	59 8	9	1708 5
1990	7 7	3 4	9 3	38 3	172 7	349 3	183 1	169 4	312 2	162 6	91 5	7 6	1507 1
1991	8 7	0	1 7	10	271 6	198 3	122 8	194 7	171 7	252 8	48	10 4	1290 7
1992													
1993													
1994													
1995													
1996													
1997													
1998													
1999													
2000													
Avearage	6 8	6 6	12 2	44 2	165 6	259 4	216 5	244 0	296 8	167 6	31 2	9 0	1,460 0
Max.	19 3	51 9	42 0	140 0	379 5	445 3	429 0	465 5	543 5	365 0	128 2	50 8	2,096 4
Min.	0 0	0 0	0 0	0 0	14 5	89 4	59 7	130 8	134 0	79 5	0 0	0 0	1,063 8
Dev.	6 6	12 3	16 1	43 1	78 3	102 4	86 6	78 9	102 2	78 0	33 6	10 9	241 5

Station GOASCORAN/GOASCORAN
Code 5204
Basin (25) GOASCORAN

Latitude 13-56-30 N
Longitude 87-45-15 W
Elevation 50 m

HISTORICAL DATA

Rainfall (mm)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1942													
1943													
1944													
1945													
1946													
1947													
1948													
1949													
1950													
1951													
1952													
1953													
1954													
1955													
1956													
1957													
1958													
1959													
1960													
1961													
1962													
1963													
1964													
1965													
1966													
1967													
1968													
1969													
1970													
1971													
1972													
1973							272 3	627 6	544 5	674 2	25 4	0	
1974	0	0	23 2	0	147 5	783 8	307 7	227 1	654 2	156 7	0	0	2300 2
1975	0	0	0	0	289 6	211 5	203 7	470 5	843 9	324 9	249 1	0	2593 2
1976	0	0	0	136 8	113 3	514 8	43 6	105 1	307	159	55 5	0	1435 1
1977	0	0	0	101 6	220 6	438 1	13 2	192 7	214 4	65 6	79	6	1331 2
1978	0	19 5	51 5	85 7	232 9	209 5	204 1	230 6	383 7	114 9	13 7	26 3	1572 4
1979	0	0	0	149 5	46 7	310 6	193 9	210 5	329 7	255 1	37 8	0	1533 8
1980	20	0		14 6	468	265 1	143 1	283 1	185 3	291 5	0	0	
1981	0	0	16 5	17 5	173 8	359 8	195 7	245 1	278 6	161 5	0	0	1448 5
1982	3 9	0	0	69 7	421 6	264 2	76 2		124 1	70 8	4 2	7 6	
1983	0	0	7	2 2	40 3	320 3	112 6	155	285 2	198 7	46 5	1 3	1169 1
1984	0	0	0	84 9	185 7	339 8	264 9	184 6	509 6	216 5	14 4	0	1800 4
1985	0	0	0	144 7	221	75 3	318 9	226 7	293 2	236 8	90	0	1606 6
1986	0	0	0	2 4	301 1	194 9	55 2	144	296 1	197 8	14 4	4 6	1210 5
1987	3 3	0	11 6	0	103 3	201 8	196	117	298 4		28 6	0	
1988	0	0	0	78 1	202 9	353 5	157 7	531 3	617 9	250 4	35 7	0	2227 5
1989	0	0	0	12 4	311 9	202 5	298 3	317 2	590 8	77 1	100 9	15 8	1926 9
1990	0	0	20 8	104 8	191 7	318 5	171 6	215 4	413 5	463 5	33	14 5	1947 3
1991													
1992													
1993													
1994													
1995													
1996													
1997													
1998													
1999													
2000													
Avearage	1 6	1 1	8 2	59 1	216 0	315 5	179 4	263 7	398 3	230 3	46 0	4 2	1,723 5
Max.	20 0	19 5	51 5	149 5	468 0	783 8	318 9	627 6	843 9	674 2	249 1	26 3	2,593 2
Min.	0 0	0 0	0 0	0 0	40 3	75 3	13 2	105 1	124 1	65 6	0 0	0 0	1,169 1
Dev.	4 9	4 7	14 2	56 0	117 0	158 8	92 8	146 5	189 4	152 5	59 2	7 5	429 3

Appendix 6.2

Historical Data of Discharge

at Hydrological Gauging Station (Osicala)

Station OSICALA
Code 5701
Basin (46) LEMPA

Latitude 13-50-24 N
Longitude 88-08-42 W
Catchment 908 km²
Elevation 277 m
Discharge (m³/s)

HISTORICL DATA

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1942													
1943													
1944													
1945													
1946													
1947													
1948													
1949													
1950													
1951													
1952													
1953													
1954													
1955													
1956													
1957													
1958													
1959													
1960													
1961													
1962		7 80	6 50	6 20	18 40	159 60	60 60	62 60	189 60	131 70	12 60	9 40	
1963	6 80	6 80	6 50	7 80	12 90		119 70	37 60	100 60	27 30	33 50	8 40	
1964	8 80	8 00	7 20	8 30	14 10	75 20	111 20	74 10	120 70	65 70	12 60	11 00	43 20
1965	9 30	7 40	4 80	3 20		46 30		34 60	142 10	85 70	8 20	4 10	
1966	6 20		5 10	11 70	54 00	112 60		45 20	146 20	95 10	13 60	10 00	
1967	6 80	6 20	5 60	20 70	5 80	51 10	18 30	27 80	63 10	108 60	24 50	8 00	28 90
1968	6 20	5 60	4 80	5 00	37 20	59 90		11 90	71 80	107 30	26 50	10 80	
1969	8 70	6 50	5 90	11 20					184 00	157 00	25 40	7 50	
1970	4 50	3 30	2 70	4 40	13 10	30 60	49 80	90 20	148 80	97 50	14 40	5 70	38 90
1971	3 10	2 30	1 80	2 30	14 80	31 80	9 80	90 70	79 10	108 20	17 30	6 50	30 80
1972	3 30	1 90	1 40	2 80	24 20	81 80	11 90	9 40	23 30	28 50	12 20	3 60	17 00
1973	2 00	1 40	0 90	1 80	22 80	38 90	20 00	104 50	121 40	152 40	16 70	5 60	41 00
1974	3 20	2 00	3 30	1 40	31 60	94 50	39 70	15 10	200 10	39 30	6 10	3 10	36 50
1975	1 90	1 50	1 30	1 00	24 80	33 00	8 50	29 70	133 80	101 00	95 00	6 10	36 40
1976	3 00	2 00	1 50	3 00	10 70			11 20	20 10		7 60	3 70	
1977	2 30	1 50	1 00	1 60	12 00	48 30	2 40	10 10	43 70	30 30	10 90	3 70	13 90
1978	2 40	1 50	2 00	2 20	11 10	21 00	32 20	12 00	103 40	51 90	7 40	4 10	21 00
1979	2 30	1 60	1 80	7 70	18 40	65 90	57 60	50 40	128 70	78 90	18 80	4 90	36 50
1980	3 00	2 10	1 50	2 90									
1981													
1982													
1983													
1984													
1985													
1986													
1987													
1988													
1989													
1990													
1991													
1992													
1993													
1994													
1995													
1996													
1997													
1998									51 50	130 70	66 60	6 95	
1999	3 72	2 41	1 63	1 46	13 90	50 97	43 73	67 87	140 24	130 93	12 07	5 48	
2000	3 18	2 17	1 66	1 35	31 73	55 66	8 33	32 45	135 20	59 13	7 48	3 92	
PROM.	4 6	3 9	3 5	5 5	20 4	63 4	41 7	42 2	112 2	86 3	20 2	6 4	34 2
MÁX.	9 3	8 0	7 2	20 7	54 0	159 6	119 7	104 5	200 1	157 0	95 0	11 0	43 2
MÍN.	1 9	1 4	0 9	1 0	5 8	21 0	2 4	9 4	20 1	27 3	6 1	3 1	13 9
DEV.TI	2 6	2 6	2 2	4 9	12 2	37 0	37 9	31 7	54 0	41 1	20 1	2 6	10 0

Appendix 6.3

Historical Data of Sediment Sampling

at Hydrological Gauging Station

(Osicala)

Station: Osicala
Code 07-01
Basin: Torola

Latitude
Longitude.
Elevation

Sediment Sampling Data (1/4)

MONTH	DAY	HOUR	YEAR	Discharge (m3/sec)	C m (gf/m3)	Suspended L Q (gf/sec)	Solido (Tf/day)	Water Level (m)
6	12	10	1969	95 97		5,730 40	494 00	1 70
6	24	10	1969	37 50		555 64	47 90	1 27
8	27	10	1969	86.60		2,401.20	207.00	1 62
9	10	11	1969	84 28		2,262 00	195.00	1 69
6	3	14	1970	15 40	58 40	901.32	77 70	1 05
2	26	11	1976	1 62	1 82	2 90	0.25	0 92
3	10	11	1976	1 60	3 10	4 99	0 43	0 92
3	30	11	1976	1 29	3 25	4.19	0 36	0 90
5	5	9	1976	2 40	34 91	83 83	7 24	1 02
5	27	10	1976	18.78	98 28	1,844 33	159 35	1 31
6	10	8	1976	160.29	358.93	57,532 30	4,970 79	2 10
7	1	10	1976	46 41	16.54	767 78	66 28	1 54
7	14	10	1976	17 05	12.25	208 97	18.05	1 30
8	10	9	1976	4 79	4 44	21.30	1 84	1 09
8	24	10	1976	12 60	59 17	769 03	66 44	1.23
10	7	9	1976	90 63	174 53	15,817 24	1,366 61	1 78
10	28	9	1976	8 61	10 01	96 18	8 31	1 18
11	9	9	1976	6 41	5 69	36.50	3 15	1 12
11	24	9	1976	5 08	3 04	25 62	2 21	1 10
12	9	9	1976	4 28	4 82	20.63	1 78	1 06
1	11	9	1977	2 78	2 40	6.73	0 58	1 01
1	25	10	1977	2 06	3 40	7 08	0 61	1 00
2	16	9	1977	1 26	2 21	2.78	0 24	0 90
3	3	9	1977	1.56	3 53	5 57	0 48	0 98
3	29	10	1977	1 48	4 83	7.19	0 62	0 96
4	21	9	1977	1 65	13 12	21.63	1.87	1.00
5	4	9	1977	6.42	85 06	546.16	47 19	1 14
5	17	9	1977	11.47	26 90	997.06	86 15	1 25
6	7	11	1977	83.78	84 83	7,107.33	614 07	1 90
6	28	10	1977	9.59	14 79	103.54	8 95	1 20
7	14	9	1977	3.68	5 54	20.42	1 76	1 10
7	28	9	1977	2.73	3 52	9.60	0 83	0 99
8	17	11	1977	3.73	21 60	80.60	6 96	1 02
9	8	9	1977	8.01	33 59	268.79	23 22	1 13
9	20	10	1977	23 88	40 67	971 01	83 90	1 38
10	10	17	1977	16.68	26 03	434.17	37 51	1 32
10	25	9	1977	21 60	34 79	751 50	64 93	1 37
11	24	9	1977	6.66	8 49	56.55	4 89	1 09
12	7	9	1977	4 34	10 26	44 53	3 85	1 12
1	11	11	1978	2 06	4 69	9 74	0 84	0 97
1	26	9	1978	1 82	7 68	14 01	1.21	0.96
2	8	8	1978	1 84	7 55	13 89	1 20	0 94
2	23	10	1978	1 23	6.93	8 58	0 74	0 95
3	9	10	1978	1 59	5.70	9 08	0.78	0 93
3	29	9	1978	2 34	23 61	55 29	4.78	0 96
4	20	9	1978	1.50	10 05	15 05	1 30	0.93

Station Osicala
Code. 07-01
Basin Torola

Latitude
Longitude
Elevation:

Sediment Sampling Data (2/4)

MONTH	DAY	HOUR	YEAR	Discharge (m3/sec)	C m (gf/m3)	Suspended L (gf/sec)	Q.Solido (Tf/day)	Water Level (m)
5	3	8	1978	1 63	16 58	26 98	2 33	0 95
6	8	10	1978	131 98	1,362 78	166,657 52	14,399 20	2 00
6	21	9	1978	12.65	63 64	805 05	69 60	1 20
7	6	9	1978	12 57	66 15	831 37	71 86	1 20
7	18	10	1978	86 68	292 21	25,328 54	2,188 39	1 78
8	17	9	1978	5 74	20 62	118 27	10 22	1 09
8	30	10	1978	55 82	213 75	11,932 10	1,030 93	1 65
9	13	10	1978	41.27	128 31	5,299 87	457.56	1 52
9	28	9	1978	157 06	83 52	13,118 06	1,133 40	2 30
10	11	9	1978	40 40	138 65	5,601 47	483.97	1 51
10	25	9	1978	23.41	12 22	286 13	24 72	1 32
11	8	10	1978	8 94	14 32	128 06	11.04	1 12
11	22	10	1978	6 03	108 10	655 86	56 54	1 08
12	12	10	1978	4 90	9 03	44 21	3 82	1 01
1	18	9	1979	1 85	13 70	25 38	2.19	0.94
1	30	11	1979	1 70	7 11	12 06	1.04	0 93
2	15	9	1979	1 77	7 99	14 12	1 22	0.92
2	28	11	1979	1 50	29 08	43 64	3 77	0 91
3	14	9	1979	1 24	7 80	9 74	0 84	0 90
4	24	16	1979	24.68	226 62	5,593 75	483.30	1 34
5	17	9	1979	5 61	13 90	77 95	6.73	1 04
5	30	9	1979	6 34	59 71	378 29	32.68	1 06
6	20	15	1979	16 71	6 81	113 80	9.83	1 22
7	3	10	1979	77 87	182 38	14,202 15	1,227.07	1 79
8	21	16	1979	37 30	57 35	2,139 04	184 81	1 51
8	30	15	1979	86 71	37 54	3,254 95	281 23	1 79
9	19	10	1979	86 07	15 97	1,374 30	118 74	1 91
10	3	9	1979	28 00	11.93	334 03	28 86	1.40
10	17	10	1979	51 06	23.23	1,180 91	102 03	1.55
11	15	8	1979	10.88	3 18	34 65	2 99	1.16
11	27	15	1979	7.37	6 59	48 55	4 20	1.08
12	12	8	1979	4.96	1 67	8 35	0 72	1.03
2	7	9	1980	1 98	2 92	5 80	0.50	0.94
2	20	9	1980	2.07	3 21	6 63	0 57	0.93
4	24	12	1980	1 55	7.21	11 25	0 97	0 99
5	6	8	1980	1 73	9.94	17 24	1 49	1 03
5	21	8	1980	2.35	16.37	38 54	3 33	0 95
6	4	7	1980	27 90	29.54	824 04	71 20	1 40
6	7	9	1980	45 45	19 40	881 58	76.17	1 54
7	1	8	1980	11 80	5 88	69 41	6.00	1 17
7	15	8	1980	5 42	10 01	54 26	4.69	1 03
7	29	8	1980	21 36	20 27	433 01	37 41	0.94
8	27	9	1980	19 69	5 13	101.01	8.73	1.27
9	9	15	1980	31 19	102 76	3,204 98	276 91	1.42
9	23	9	1980	47.55	14 23	677 16	58 51	1.55

Station Osicala
Code 07-01
Basin. Torola

Latitude
Longitude
Elevation:

Sediment Sampling Data (3/4)

MONTH	DAY	HOUR	YEAR	Discharge (m3/sec)	C m (gf/m3)	Suspended L Q (gf/sec)	Solido (Tf/day)	Water Level (m)
8	27	13	1998	99 77	65 56	6,540 92	565 14	1 28
9	3	13	1998	69 67	46 17	3,216 66	277 92	1 10
9	10	13	1998	39 92	15 17	605 59	52 32	0 89
9	17	12	1998	41 48	23 76	985 57	85 15	0 89
9	24	11	1998	77 85	91 88	7,152 86	618 01	1 14
10	1	12	1998	38 26	19 16	733 06	63 34	0 86
10	8	12	1998	49 90	25 65	1,279 94	110 59	0 96
10	15	11	1998	260 48	349 49	91,035 16	7,865 44	1 99
10	22	12	1998	80 79	223 07	18,021 83	1,557 09	1 16
10	29	11	1998	76 82	31 54	2,422 90	209 34	1.15
11	5	11	1998	97 15	16 79	1,631 15	140 93	1 37
11	12	12	1998	30 21	9.42	284 58	24 59	0 85
11	26	14	1998	13 92	11.11	154 65	13 36	0 62
12	10	11	1998	8.11	11 01	89 29	7 71	0 52
12	22	11	1998	6.16	4 67	28 77	2 49	0 46
1	7	11	1999	4 80	1 80	8 64	0 75	0.41
1	14	12	1999	3 50	4 54	15 89	1 37	0 49
1	21	10	1999	3 10	5 19	16.01	1 38	0 38
1	28	10	1999	3 21	4 18	13.42	1 16	0 36
2	4	10	1999	2 64	2 18	5.76	0 50	0 34
2	12	10	1999	2 47	5 95	14.70	1 27	0 33
2	19	10	1999	2 34	2 27	5.31	0 46	0 32
2	25	10	1999	2 20	2.50	5.50	0 48	0 31
3	4	10	1999	2 12	2 50	5.30	0 46	0 31
3	11	11	1999	1 51	1 40	2 11	0 18	0 28
3	18	10	1999	1 49	8 02	11.95	1 03	0 28
3	25	10	1999	1 40	3 99	5.59	0 48	0 27
3	31	10	1999	1 64	4 32	7.08	0 61	0 29
4	8	10	1999	1 24	3 65	4.53	0 39	0 26
4	15	10	1999	1 13	2 32	2.62	0 23	0 25
4	22	10	1999	1 11	3 40	3.77	0.33	0 25
4	29	10	1999	2 07	2 54	5.26	0 45	0 31
5	7	11	1999	3 77	17 55	66.16	5 72	0 39
5	13	10	1999	5 33	35 83	190.97	16.50	0 45
5	20	12	1999	37 60	201 99	7,594.82	656 19	0 88
5	27	11	1999	9 62	15 47	148 82	12 86	0 52
6	3	10	1999	17 43	146 29	2,549 83	220 31	0.67
6	10	10	1999	28 88	72 38	2,090 33	180 60	0 81
7	8	10	1999	36 68	22 78	835 57	72 19	0.92
7	15	10	1999	35 75	20 80	743 60	64 25	0.90
7	22	10	1999	17 28	7 41	128 04	11 06	0 66
7	29	11	1999	8 66	5 95	51 53	4 45	0.52
8	12	11	1999	25 59	14 11	361 07	31 20	0 78
8	20	11	1999	76 66	253 46	19,430 24	1,678 77	1 20
8	27	11	1999	81 81	29 83	2,440 39	210 85	1 19
9	2	11	1999	101 79	130 79	13,313 11	1,150 25	1 29

Station Osicala
Code 07-01
Basin Torola

Latitude
Longitude
Elevation

Sediment Sampling Data (4/4)

MONTH	DAY	HOUR	YEAR	Discharge (m3/sec)	C m (gf/m3)	Suspended L (gf/sec)	Q Solido (Tf/day)	Water Level (m)
10	28	11	1999	31 79	2 79	88 69	7.66	0 82
11	12	11	1999	14 95	4 47	66.83	5 77	0 60
11	26	11	1999	9 00	2 28	25.92	2 24	0 52
12	9	11	1999	6 04	2 21	13 35	1 15	0 44
12	22	10	1999	5 80	1 13	6.55	0 57	0 43
1	27	10	2000	2 91	0 95	2.76	0 24	0 32
2	23	10	2000	2 01	0 79	1.59	0 14	0 28
3	23	11	2000	1 55	2 85	4.42	0 38	0 26
4	13	11	2000	1 35	6 10	8 24	0 71	0 24
5	18	11	2000	16 33	32 59	532.19	45 98	0 66
6	10	13	2000	108 25	83 19	9,005 32	778 06	1 30
7	27	12	2000	4.21	10 94	46 04	3 98	0 38
8	17	13	2000	18 32	10 52	192 73	16 65	0 65
8	30	12	2000	25 08	19 28	483 54	41 78	0 72
9	13	12	2000	78 66	75 22	5,916.81	511 21	1 15
9	27	12	2000	89 85	41 71	3,747.64	323 80	1.21
10	25	11	2000	14 65	7 99	117 05	10 11	0.60
11	15	10	2000	6 90	9.22	63.62	5 50	0.46
3	15	10	2001	1 55	9 44	14.63	1 26	0.25
4	4	11	2001	1 49	12.35	18 44	1 59	0 25
4	24	12	2001	1 14	12 19	13 90	1 20	0 23
5	9	9	2001	1.36	12 20	16 59	1 43	0 24
5	25	9	2001	15.23	91 07	1,387 00	119 84	0 68
6	5	11	2001	26 60	20 02	532 49	46 01	0 75
6	20	10	2001	3 12	12 70	39 62	3 42	0 34

Appendix 6.4

Extended Rainfall

at Meteorological Stations

Station SAN FRANCISCO GOTERA/MORAZAN
Code Z02
Basin G SAN MIGUEL

Latitude 13-41-48N
Longitude 88-06-24W
Elevation 250 m
Rainfall (mm)

EXTENDED RAINFALL

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1942	0	0	7	105	513	238	390	338	333	222	68	76	2290
1943	2	0	7	43	236	376	124	308	490	395	73	1	2055
1944	0	0	40	31	246	293	178	274	337	199	3	0	1601
1945	0	0	54	11	230	250	187	314	537	236	30	11	1860
1946	0	0	0	46	313	229	181	195	406	152	65	0	1587
1947	16	4	14	44	167	493	310	373	423	366	190	46	2446
1948	0	0	0	39	176	283	287	282	346	403	121	0	1937
1949	0	0	0	44	140	242	176	343	301	402	120	0	1768
1950	1	0	12	3	213	468	259	295	333	486	41	0	2111
1951	2	1	0	26	169	444	234	274	542	214	29	0	1935
1952	0	0	1	125	282	663	335	382	385	215	62	4	2454
1953	1	0	0	42	390	237	218	306	643	313	3	18	2171
1954	0	5	3	163	295	371	278	323	454	393	0	0	2285
1955	0	2	3	27	61	271	475	362	581	606	55	6	2449
1956	12	23	0	39	265	246	195	287	433	400	10	0	1910
1957	0	0	0	113	188	308	297	269	465	370	32	0	2042
1958	4	0	0	37	311	666	486	283	693	257	73	0	2810
1959	0	0	0	27	211	283	195	280	431	243	32	0	1702
1960	5	7	16	50	497	441	236	231	291	498	42	2	2316
1961	0	9	54	34	194	323	393	193	360	319	148	21	2048
1962	0	0	1	38	335	540	241	213	456	493	46	0	2363
1963	0	6	27	16	231	273	344	182	441	295	197	6	2018
1964	1	4	8	57	271	402	370	448	410	290	23	33	2317
1965	0	0	0	17	246	335	183	247	436	309	7	0	1780
1966	0	0	0	88	440	502	430	285	438	302	2	8	2495
1967	0	10	5	182	75	428	172	166	448	370	15	9	1880
1968	0	2	0	37	236	340	143	306	491	302	33	4	1894
1969	0	0	11	75	252	485	211	263	354	373	39	0	2063
1970	0	4	5	40	319	364	390	289	505	312	27	6	2261
1971	0	0	0	14	244	312	176	608	265	407	60	0	2086
1972	0	0	0	81	265	225	128	191	303	162	79	0	1434
1973	0	2	0	141	290	572	254	441	591	580	14	0	2885
1974	0	0	38	2	134	297	169	182	419	178	0	0	1419
1975	0	0	5	0	210	156	264	392	492	331	138	0	1988
1976	0	0	0	125	270	598	111	126	250	166	40	0	1686
1977	0	0	0	42	239	393	41	293	299	140	92	21	1560
1978	0	12	13	92	181	129	428	345	547	265	15	34	2061
1979	0	0	12	332	181	387	398	370	386	325	33	3	2427
1980	6	0	0	26	401	478	245	417	550	335	24	0	2482
1981	0	2	24	48	178	321	225	232	396	392	7	38	1863
1982	13	12	0	9	530	457	178	83	412	196	39	40	1969
1983	0	1	10	19	77	310	157	173	420	513	86	13	1779
1984	7	39	8	17	110	362	399	252	396	171	38	0	1799
1985	0	0	3	101	242	287	295	483	478	235	135	12	2271
1986	0	1	0	29	196	240	141	279	349	259	23	0	1517
1987	1	0	49	21	119	405	196	172	187	21	2	1	1174
1988	0	0	26	18	113	518	272	620	538	186	148	0	2439
1989	0	0	0	16	339	269	423	557	491	256	117	14	2482
1990	0	1	4	118	278	378	260	294	513	496	162	15	2519
1991	0	0	12	9	320	284	87	312	381	283	5	88	1781
1992	0	0	23	54	70	368	188	250	459	206	63	8	1689
1993	4	0	20	101	332	233	151	138	383	268	6	0	1636
1994	0	5	0	35	188	148	146	409	432	345	33	0	1741
1995	0	0	40	112	206	368	205	502	377	205	24	0	2039
1996	2	0	10	129	308	304	313	306	320	331	36	0	2059
1997	5	2	7	17	131	316	140	286	474	258	65	10	1711
1998					266	348	224	464	283	535			
1999					206	407	518	348	461	234			
2000					293	303	116	434	595	178			
Average	1	3	10	59	244	356	248	304	426	308	55	10	2024
Max.	16	39	54	332	530	666	486	620	693	606	197	88	2885
Min.	0	0	0	0	61	129	41	83	187	21	0	0	1174
Dev.	3	6	15	58	106	121	104	112	98	116	51	18	358

82

Station PERQUÍN/MORAZAN
Code Z03
Basin LEMPA

Latitude 13-57-30N
Longitude 88-09-42W
Elevation 1225 m
Rainfall (mm)

EXTENDED RAINFALL

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1942	0	0	13	179	607	330	467	385	391	259	89	73	2793
1943	6	0	13	73	280	521	149	351	576	461	96	1	2527
1944	0	0	75	54	291	406	213	312	396	233	4	0	1984
1945	0	0	102	18	273	347	223	358	631	276	40	10	2278
1946	0	0	0	79	370	318	216	222	477	177	85	0	1944
1947	60	18	26	75	198	682	371	425	497	428	248	44	3072
1948	1	0	0	66	209	392	344	322	407	471	158	0	2370
1949	0	0	0	75	166	335	210	391	353	470	156	0	2156
1950	4	0	23	5	252	647	309	337	391	569	54	0	2591
1951	8	6	0	45	200	615	279	313	636	250	37	0	2389
1952	0	0	2	215	333	918	400	436	452	251	81	3	3091
1953	5	0	0	73	462	328	260	349	755	366	4	18	2620
1954	0	26	6	278	349	514	333	368	533	459	0	0	2866
1955	0	4	3	41	74	409	646	455	776	652	63	7	3130
1956	52	77	4	149	319	369	254	228	484	598	7	2	2543
1957	0	4	1	198	237	416	333	339	605	462	62	0	2657
1958	7	0	0	39	397	1013	522	350	794	257	103	0	3482
1959	0	12	0	71	259	382	228	360	559	414	45	0	2330
1960	31	36	36	93	566	595	258	261	334	557	51	3	2821
1961	0	47	122	63	221	436	429	218	414	357	179	28	2514
1962	0	0	2	72	256	684	264	224	629	504	79	3	2717
1963	1	41	12	73	229	383	459	185	297	185	272	2	2139
1964	1	0	0	38	262	733	518	405	613	211	54	15	2850
1965	0	43	0	12	241	446	206	342	507	350	2	0	2149
1966	8	2	22	168	271	535	650	480	319	284	13	0	2752
1967	25	75	45	277	13	518	215	233	401	387	72	33	2294
1968	0	0	0	29	413	543	180	260	491	568	189	3	2676
1969	13	24	24	126	340	599	307	611	598	547	35	5	3229
1970	10	2	15	58	235	340	391	492	707	501	4	0	2755
1971	0	0	0	0	264	365	182	613	343	578	81	10	2436
1972	0	6	5	157	322	512	144	157	273	232	182	0	1990
1973	0	3	0	55	592	458	325	512	552	673	94	16	3280
1974	3	0	36	0	281	463	182	262	655	135	22	0	2039
1975	4	1	12	51	318	306	198	301	644	463	228	0	2526
1976	0	0	0	139	234	716	163	273	297	247	134	2	2205
1977	0	0	0	75	308	587	42	410	362	230	140	4	2158
1978	0	1	45	54	158	433	408	234	602	400	36	52	2423
1979	1	0	64	282	189	554	520	319	651	291	27	5	2903
1980	24	0	3	64	384	422	391	355	597	335	54	7	2636
1981	0	2	55	2	292	493	389	220	449	360	25	81	2368
1982	30	44	7	81	493	538	109	110	630	226	0	0	2268
1983	2	9	26	40	89	448	179	232	418	392	138	18	1991
1984	6	35	8	80	325	452	383	187	662	323	22	0	2483
1985	0	0	4	156	252	231	465	376	343	452	174	10	2463
1986	0	4	0	27	424	319	129	252	431	353	21	7	1967
1987	6	0	41	4	111	348	337	186	384	40	26	6	1489
1988	0	0	2	105	306	617	296	694	775	414	89	0	3298
1989	0	0	7	59	338	320	468	474	795	259	199	89	3008
1990	0	2	28	184	294	512	295	306	568	678	134	28	3029
1991	0	0	23	15	379	393	104	356	448	331	7	85	2141
1992	0	1	36	76	87	505	244	275	563	260	101	12	2160
1993	0	1	32	142	413	331	196	152	470	338	10	0	2085
1994	0	1	0	49	234	211	189	450	530	435	53	0	2152
1995	0	1	63	157	256	505	266	552	462	259	38	0	2559
1996	0	1	16	181	383	432	406	337	392	417	58	0	2623
1997	0	1	11	24	163	449	182	315	581	325	104	14	2169
1998	0	0	96	6	210	346	272	489	362	658	389	20	2848
1999	1	0	29	49	316	519	462	578	753	576	29	9	3321
2000	0	0	3	27	582	358	180	245	559	421	68	3	2446
Average	5	9	20	86	294	473	301	343	518	383	84	12	2529
Max.	60	77	122	282	607	1013	650	694	795	678	389	89	3482
Min.	0	0	0	0	13	211	42	110	273	40	0	0	1489
Dev.	12	18	28	71	124	150	133	124	140	144	78	22	417

Station LA GALERA/MORAZAN
Code Z04
Basin LEMPA

Latitude 14-02-36N
Longitude 88-05-12W
Elevation 1900 m
Rainfall (mm)

EXTENDED RAINFALL

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1942	0	0	19	95	447	255	367	364	303	167	67	95	2179
1943	7	0	20	39	206	403	117	332	447	298	72	2	1943
1944	0	0	116	28	214	314	168	295	307	150	3	0	1595
1945	0	0	157	10	201	268	176	339	489	178	30	13	1861
1946	0	0	0	42	272	246	170	210	370	114	64	0	1488
1947	73	17	40	40	146	528	292	402	385	276	187	58	2444
1948	2	0	0	35	154	303	271	304	316	304	119	0	1808
1949	0	0	0	39	122	259	166	370	274	304	118	0	1652
1950	5	0	36	3	185	501	243	319	303	367	40	0	2002
1951	9	6	0	24	147	476	220	296	494	161	28	0	1861
1952	0	0	3	114	245	710	315	412	351	162	61	5	2378
1953	6	0	0	38	340	254	205	330	586	236	3	23	2021
1954	0	25	9	147	257	398	262	348	413	296	0	0	2155
1955	0	3	4	22	54	316	508	431	602	421	48	9	2418
1956	62	73	6	79	235	285	200	215	375	386	5	2	1923
1957	0	4	2	105	174	322	262	321	469	298	47	0	2004
1958	9	0	0	21	292	784	411	331	616	166	78	0	2708
1959	0	12	0	38	191	296	180	340	434	267	34	0	1792
1960	37	34	55	49	417	461	203	247	259	360	39	4	2165
1961	0	44	187	33	163	337	338	207	321	230	135	36	2031
1962	0	0	5	31	176	457	220	411	575	341	, 53	7	2276
1963	4	5	40	13	228	280	388	240	408	35	110	7	1758
1964	2	0	0	5	228	626	411	358	383	98	11	12	2134
1965	7	18	0	37	197	353	156	242	416	206	5	5	1642
1966	4	16	42	29	362	397	335	250	439	231	10	35	2150
1967	42	19	42	122	9	342	115	318	285	273	124	9	1700
1968	1	5	0	66	301	581	97	308	374	416	140	19	2308
1969	3	1	25	84	193	458	297	636	571	295	14	2	2579
1970	10	8	6	34	186	291	378	310	454	142	3	8	1830
1971	3	17	0	60	289	270	199	485	403	317	75	0	2118
1972	2	18	5	48	144	447	256	143	125	52	66	0	1306
1973	0	0	0	63	224	383	227	492	379	426	35	16	2245
1974	3	8	40	3	218	425	235	316	643	99	0	5	1995
1975	10	1	1	0	275	155	109	244	433	307	90	10	1635
1976	9	2	0	50	189	634	111	295	222	137	56	17	1722
1977	0	1	2	61	324	353	33	377	305	912	108	14	2490
1978	11	4	90	10	242	288	259	188	591	120	15	47	1865
1979	6	11	107	225	79	336	335	249	470	220	13	16	2067
1980	17	5	76	66	219	323	187	305	333	190	94	17	1832
1981	4	12	86	2	299	418	345	315	286	261	4	36	2068
1982	26	49	7	31	303	353	98	95	406	217	18	21	1624
1983	9	21	67	44	89	317	131	282	306	157	168	49	1640
1984	8	23	14	6	239	350	302	177	513	209	17	0	1858
1985	0	0	6	82	186	179	366	355	266	292	131	13	1876
1986	0	3	0	14	312	247	102	238	335	228	15	8	1502
1987	8	0	62	2	82	270	265	176	298	26	20	8	1217
1988	0	0	2	56	225	477	233	657	601	267	67	0	2585
1989	0	0	11	31	249	248	369	448	617	167	150	116	2406
1990	0	2	44	97	217	396	232	290	441	438	101	36	2294
1991	0	0	35	8	279	304	82	337	347	214	5	111	1722
1992	0	1	59	41	65	385	189	259	446	173	72	17	1707
1993	0	1	51	76	309	253	152	143	372	225	7	0	1589
1994	0	1	0	26	175	161	147	423	419	290	38	0	1680
1995	0	1	102	85	191	385	206	520	366	172	27	0	2055
1996	0	1	26	98	286	330	315	317	311	278	41	0	2003
1997	0	1	18	13	122	343	141	296	460	217	74	20	1705
1998	1	0	54	11	109	257	205	362	339	504	244	7	2093
1999	2	0	0	76	162	459	355	423	645	447	18	16	2603
2000	1	0	0	43	294	318	132	196	493	340	43	7	1867
Average	7	8	30	48	216	366	234	320	410	256	59	16	1969
Max.	73	73	187	225	447	784	508	657	645	912	244	116	2708
Min.	0	0	0	0	9	155	33	95	125	26	0	0	1217
Dev.	14	14	41	41	86	125	100	108	115	136	54	25	330

Station CORINTO/MORAZAN
Code Z05
Basin LEMPA

Latitude 13-48-18N
Longitude 87-58-06W
Elevation 820 m
Rainfall (mm)

EXTENDED RAINFALL

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1942	0	0	12	137	596	283	433	378	299	190	54	30	2412
1943	4	0	12	56	274	446	138	345	441	337	58	1	2112
1944	0	0	70	41	285	348	197	307	303	170	2	0	1723
1945	0	0	95	14	268	297	207	352	483	202	24	4	1946
1946	0	0	0	61	363	272	201	218	365	130	52	0	1662
1947	34	5	24	57	194	584	344	418	380	313	151	18	2522
1948	1	0	0	51	205	336	318	316	312	345	96	0	1980
1949	0	0	0	57	163	287	195	384	271	344	95	0	1796
1950	2	0	22	4	247	555	286	331	299	416	33	0	2195
1951	4	2	0	34	196	526	259	307	487	183	23	0	2021
1952	0	0	2	165	327	786	371	428	346	184	50	1	2660
1953	3	0	0	56	453	281	241	343	578	268	2	7	2232
1954	0	7	6	213	342	440	308	361	408	336	0	0	2421
1955	0	1	3	31	72	350	599	447	594	477	38	3	2615
1956	29	21	3	114	313	316	235	224	370	437	4	1	2067
1957	0	1	1	152	232	356	309	333	463	338	38	0	2223
1958	4	0	0	30	390	868	484	344	608	188	63	0	2979
1959	0	3	0	55	254	327	212	353	428	303	27	0	1962
1960	17	10	33	71	555	510	239	257	256	408	31	1	2388
1961	0	13	113	48	217	374	398	215	317	261	109	11	2076
1962	0	0	1	88	374	624	237	280	473	368	51	1	2497
1963	0	16	4	74	185	337	409	148	140	183	204	0	1700
1964	0	0	0	40	234	595	430	645	373	220	20	3	2560
1965	0	0	0	68	288	277	375	501	415	182	3	0	2109
1966	0	0	45	165	267	526	436	274	237	194	0	4	2148
1967	23	9	28	59	81	424	97	268	221	227	24	2	1463
1968	0	9	0	0	286	620	73	99	264	383	27	15	1776
1969	4	1	23	71	366	548	240	516	848	512	41	0	3170
1970	3	0	0	129	317	419	477	482	527	267	10	8	2639
1971	10	2	0	13	323	294	130	408	287	394	53	2	1916
1972	0	0	0	117	364	317	78	224	213	218	62	0	1593
1973	0	0	0	226	277	502	243	537	465	622	41	6	2919
1974	4	0	44	0	248	445	159	245	469	117	1	0	1732
1975	1	0	0	3	423	222	193	466	362	251	126	0	2047
1976	0	0	0	83	160	433	146	112	196	189	62	0	1381
1977	0	0	0	40	182	489	70	175	102	42	66	6	1172
1978	0	5	95	98	322	193	454	120	372	271	0	0	1930
1979	0	0	1	186	160	267	185	421	439	322	34	0	2015
1980	18	0	0	44	386	545	184	302	348	251	61	4	2143
1981	0	2	124	20	284	758	305	463	514	323	4	3	2800
1982	9	24	0	76	410	636	130	94	588	163	0	0	2130
1983	0	1	18	25	89	368	174	194	378	439	68	5	1759
1984	7	22	14	73	391	317	312	135	510	208	12	0	2001
1985	0	0	7	64	201	295	382	452	235	371	118	8	2133
1986	0	2	0	38	432	285	156	313	368	274	10	0	1878
1987	0	0	50	6	81	325	329	217	294	29	2	5	1338
1988	0	0	3	67	330	581	311	693	577	299	71	0	2932
1989	0	0	13	76	249	276	419	531	634	284	137	54	2673
1990	0	1	7	155	323	449	288	329	461	424	129	6	2572
1991	0	0	21	12	372	337	96	350	343	242	4	34	1811
1992	0	0	38	63	84	434	210	273	425	191	57	4	1779
1993	0	0	33	119	398	285	168	151	355	249	5	0	1763
1994	0	0	0	41	225	181	163	446	400	320	30	0	1806
1995	0	0	66	132	247	434	228	548	349	190	22	0	2216
1996	0	0	16	151	369	372	349	334	297	307	32	0	2227
1997	0	0	11	20	157	386	156	312	439	239	59	5	1784
1998	0	0	42	8	237	310	350	600	236	731	206	0	2720
1999	0	0	1	50	160	286	288	816	469	586	20	71	2747
2000	0	0	1	8	515	364	291	415	486	178	40	0	2298
Average	3	3	19	70	284	412	266	348	392	290	49	5	2140
Max.	34	24	124	226	596	868	599	816	848	731	206	71	3170
Min.	0	0	0	0	72	181	70	94	102	29	0	0	1172
Dev.	7	6	30	55	115	147	118	150	133	131	48	13	437

Station MEANGUERA/MORAZAN
Code Z07
Basin LEMPA

Latitude 13-51-00N
Longitude 88-09-12W
Elevation 250 m
Rainfall (mm)

EXTENDED RAINFALL

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1942	0	0	7	127	700	289	504	359	276	186	58	18	2524
1943	2	0	7	52	323	456	161	327	406	331	62	0	2127
1944	0	0	43	38	335	355	230	291	279	167	2	0	1740
1945	0	0	58	13	314	303	241	334	444	198	26	3	1934
1946	0	0	0	56	427	278	234	207	336	127	55	0	1720
1947	23	1	15	53	228	597	401	396	350	307	161	11	2543
1948	1	0	0	47	241	343	371	300	287	338	103	0	2031
1949	0	0	0	53	191	293	227	364	249	337	102	0	1816
1950	2	0	13	3	290	567	334	314	276	408	35	0	2242
1951	3	0	0	32	231	538	302	292	449	179	24	0	2050
1952	0	0	1	152	384	804	432	406	319	180	53	1	2732
1953	2	0	0	51	532	287	281	325	532	262	2	4	2278
1954	0	2	3	197	402	450	359	343	376	329	0	0	2461
1955	0	0	2	29	85	358	697	425	547	467	41	2	2653
1956	19	6	2	105	368	323	274	212	341	429	4	0	2083
1957	0	0	1	140	273	364	360	316	426	331	40	0	2251
1958	3	0	0	28	458	887	564	326	559	185	67	0	3077
1959	0	1	0	50	299	335	247	335	394	297	29	0	1987
1960	11	3	20	66	653	521	278	244	236	400	33	1	2466
1961	0	4	69	44	255	382	464	204	291	256	117	7	2093
1962	0	0	1	81	440	638	276	266	435	361	42	0	2540
1963	0	3	24	36	275	330	429	175	281	218	134	1	1906
1964	0	1	7	62	329	520	481	514	294	173	19	9	2409
1965	0	0	0	39	343	358	290	332	363	225	5	0	1955
1966	0	0	15	176	483	598	472	311	282	211	4	1	2553
1967	5	5	8	165	95	482	160	252	310	277	16	2	1777
1968	0	1	0	21	263	466	151	248	315	402	24	4	1895
1969	8	3	42	132	674	632	427	332	424	353	0	0	3027
1970	0	0	10	15	565	754	510	582	482	181	14	5	3118
1971	0	0	3	26	197	360	182	576	249	386	20	0	1999
1972	0	0	0	186	320	281	141	156	358	230	92	0	1764
1973	0	0	0	5	172	497	239	378	406	569	42	0	2308
1974	0	0	3	1	278	382	200	233	422	122	0	0	1641
1975	0	0	0	0	433	310	188	339	373	279	145	0	2067
1976	0	0	0	115	248	566	210	252	311	89	49	0	1840
1977	0	0	0	27	411	430	82	247	291	224	61	5	1778
1978	0	0	36	102	220	290	400	175	450	219	33	20	1945
1979	0	0	23	121	130	284	418	291	198	264	84	0	1813
1980	16	0	9	38	446	572	278	350	410	269	35	1	2424
1981	0	1	43	45	273	518	312	311	376	325	5	7	2216
1982	14	5	0	31	643	586	224	91	417	135	17	5	2168
1983	0	0	11	23	105	376	203	184	348	430	73	3	1756
1984	6	9	7	38	247	381	457	204	390	160	21	0	1920
1985	0	0	4	101	299	333	402	485	336	253	119	4	2336
1986	0	0	0	35	348	291	182	297	306	234	17	0	1710
1987	1	0	46	19	140	438	297	191	193	21	2	1	1349
1988	0	0	19	35	232	617	355	659	474	202	109	0	2702
1989	0	0	3	36	406	312	527	563	466	236	115	13	2677
1990	0	0	4	143	379	458	336	313	425	416	138	4	2616
1991	0	0	13	11	437	344	112	332	315	237	4	21	1826
1992	0	0	23	57	99	457	254	260	394	186	58	2	1790
1993	3	0	20	107	469	300	204	143	329	242	5	0	1822
1994	0	1	0	37	266	191	197	425	371	312	30	0	1830
1995	0	0	40	119	291	457	277	522	324	185	22	0	2237
1996	2	0	10	137	435	392	423	318	275	299	33	0	2324
1997	4	0	7	18	185	407	189	297	407	233	59	3	1809
1998	0	0	55	12	239	322	287	445	286	470	215	0	2331
1999	1	0	17	40	227	530	453	519	474	544	20	37	2862
2000	0	0	3	26	611	385	206	243	381	174	41	0	2070
Average	2	1	13	64	333	433	312	324	361	272	50	3	2168
Max.	23	9	69	197	700	887	697	659	559	569	215	37	3118
Min.	0	0	0	0	85	191	82	91	193	21	0	0	1349
Dev.	5	2	17	52	148	141	127	118	82	110	47	7	391

86

Station OSICALA/MORAZAN
Code Z08
Basin LEMPA

Latitude 13-53-36N
Longitude 88-02-36W
Elevation 820 m
Rainfall (mm)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1942	0	0	12	47	499	225	464	279	351	226	52	22	2177
1943	2	0	13	39	266	418	173	294	498	413	66	1	2183
1944	0	0	52	16	229	260	250	207	349	239	1	0	1603
1945	0	0	50	6	233	229	234	329	555	268	23	6	1933
1946	0	0	0	37	408	301	204	178	421	182	60	0	1791
1947	10	3	26	36	188	469	359	331	404	427	125	16	2394
1948	0	0	0	22	251	256	330	250	279	460	94	0	1942
1949	0	0	0	21	206	253	220	345	303	505	108	0	1961
1950	1	0	13	1	258	488	282	239	313	531	22	0	2148
1951	2	2	0	20	170	475	295	227	505	282	17	0	1995
1952	0	0	2	74	274	665	384	353	401	216	61	1	2431
1953	1	0	0	25	463	254	275	313	682	340	3	14	2370
1954	0	5	2	83	353	368	348	323	412	472	0	0	2366
1955	0	0	0	13	73	319	724	398	728	580	37	4	2876
1956	11	13	5	81	315	286	275	101	384	702	0	2	2175
1957	0	2	2	73	243	293	314	297	555	476	56	0	2311
1958	0	0	0	6	413	796	469	301	647	210	75	0	2917
1959	0	6	0	34	260	269	225	320	512	522	32	0	2180
1960	8	10	27	36	527	419	236	207	273	518	32	2	2295
1961	0	13	92	24	206	307	393	173	338	332	11	18	1907
1962	0	0	0	58	355	513	226	262	584	421	34	0	2453
1963	0	7	46	11	245	259	344	163	414	307	14	2	1812
1964	0	6	14	41	287	382	433	389	235	86	16	33	1922
1965	0	0	0	17	298	318	183	221	409	321	5	0	1772
1966	0	0	20	134	448	533	332	317	315	260	12	0	2371
1967	0	32	0	112	74	407	136	278	421	403	11	7	1881
1968	0	1	0	10	110	290	179	274	352	772	15	3	2006
1969	0	0	0	2	88	510	510	277	235	332	338	29	2321
1970	0	6	8	29	420	346	390	259	298	339	20	5	2120
1971	0	0	0	10	316	246	185	489	461	350	26	0	2083
1972	0	0	0	50	406	184	154	161	284	239	79	0	1557
1973	0	0	0	47	199	441	236	286	471	452	13	0	2145
1974	0	0	28	0	300	364	183	200	383	155	0	0	1613
1975	0	0	0	0	538	143	173	343	650	150	238	0	2235
1976	0	0	0	0	150	503	146	283	262	94	31	0	1469
1977	0	0	0	42	527	436	74	224	161	117	4	0	1585
1978	0	0	28	62	190	239	365	290	553	198	62	21	2008
1979	0	0	0	31	67	164	452	393	438	421	0	0	1966
1980	0	0	31	21	284	431	284	273	433	366	41	4	2168
1981	0	14	22	29	213	405	350	289	410	486	10	23	2251
1982	6	17	5	13	518	455	196	100	474	195	38	17	2034
1983	0	1	10	19	126	340	211	236	402	490	75	11	1921
1984	4	33	7	9	212	345	444	235	334	272	36	2	1933
1985	0	0	2	72	296	249	355	331	413	259	92	5	2074
1986	0	6	2	20	248	256	252	272	372	318	28	0	1774
1987	0	1	37	23	165	482	347	196	253	18	12	1	1535
1988	0	0	31	45	162	520	319	453	404	304	82	0	2320
1989	0	0	0	25	393	309	435	442	504	258	114	4	2484
1990	0	1	5	48	433	391	327	256	612	454	101	7	2635
1991	0	0	7	20	361	316	138	275	357	360	12	37	1883
1992	0	0	26	32	82	364	232	227	453	237	53	4	1710
1993	3	0	23	60	388	239	187	125	378	309	5	0	1717
1994	0	7	0	21	220	152	181	371	427	398	28	0	1805
1995	0	0	45	67	241	364	253	455	372	236	20	0	2053
1996	1	0	11	77	360	311	387	278	316	382	30	0	2153
1997	3	3	8	10	153	324	173	259	468	297	54	5	1757
1998	0	0	34	4	194	375	209	376	193	592	170	0	2147
1999	0	0	0	30	133	518	204	329	453	275	14	64	2020
2000	0	0	0	4	501	323	106	445	638	188	19	0	2224
Average	1	3	13	34	280	358	284	285	415	339	48	6	2066
Max.	11	33	92	134	538	796	724	489	728	772	338	64	2917
Min.	0	0	0	0	67	143	74	100	161	18	0	0	1469
Dev.	2	7	18	28	129	123	118	86	123	149	59	12	307

Station CANTÓN EL TABLON/MORAZAN
Code Z12
Basin TOROLA

Latitude 13-44-00N
Longitude 88-00-30W
Elevation 770 m
Rainfall (mm)

EXTENDED RAINFALL

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1942	0	0	12	165	563	338	472	343	401	213	37	37	2581
1943	2	0	12	67	259	533	150	312	591	379	40	1	2346
1944	0	0	72	50	269	415	216	278	406	191	2	0	1899
1945	0	0	97	17	253	355	226	319	647	227	16	5	2162
1946	0	0	0	73	343	325	219	198	490	146	35	0	1829
1947	21	2	25	69	184	698	376	378	510	352	103	23	2741
1948	0	0	0	61	194	401	348	286	418	388	66	0	2162
1949	0	0	0	69	154	343	213	348	363	387	65	0	1942
1950	2	0	22	5	233	663	313	300	401	468	22	0	2429
1951	3	1	0	41	186	629	283	278	653	206	16	0	2296
1952	0	0	2	198	309	939	405	388	464	207	34	2	2948
1953	2	0	0	67	428	336	264	311	775	301	1	9	2494
1954	0	2	6	257	324	526	337	327	547	378	0	0	2704
1955	0	0	4	39	68	407	628	393	764	552	27	3	2885
1956	17	8	2	114	294	368	250	232	505	455	4	1	2250
1957	0	0	1	181	215	429	345	292	601	372	23	0	2459
1958	4	0	0	43	359	1006	548	303	822	224	42	0	3351
1959	0	1	0	58	237	394	233	308	556	303	18	0	2108
1960	9	3	32	84	532	614	269	233	346	465	22	1	2610
1961	0	4	110	56	208	450	448	195	428	298	77	13	2287
1962	0	0	1	92	358	752	270	241	605	435	31	1	2786
1963	0	5	5	66	171	399	430	134	192	213	150	0	1765
1964	0	0	0	35	217	705	452	583	512	257	15	3	2779
1965	0	0	0	89	267	328	394	453	570	212	2	0	2315
1966	0	0	52	146	247	623	458	248	325	226	0	5	2330
1967	20	3	32	52	266	502	102	242	303	265	18	2	1807
1968	0	3	0	0	265	734	77	90	363	447	20	17	2016
1969	3	0	27	63	339	649	252	467	1164	597	30	0	3591
1970	3	0	0	115	294	496	501	436	724	311	7	9	2896
1971	9	1	0	12	299	348	137	369	394	460	39	2	2070
1972	0	0	2	118	331	353	174	273	303	167	0	0	1721
1973	0	0	0	28	539	912	795	553	531	208	42	0	3608
1974	0	0	92	0	152	559	250	221	555	142	0	0	1971
1975	0	0	0	2	317	130	204	407	522	290	75	0	1947
1976	0	0	0	162	179	720	60	102	300	378	39	0	1940
1977	0	0	0	74	249	355	65	360	534	91	79	0	1807
1978	0	0	87	172	259	436	420	255	581	294	2	36	2542
1979	0	0	0	131	92	567	442	297	898	869	26	0	3322
1980	21	0	0	79	467	534	212	302	362	339	22	2	2340
1981	0	0	92	21	238	736	318	353	538	295	1	2	2594
1982	7	3	0	84	449	588	130	85	486	142	2	5	1981
1983	0	0	17	3	50	512	182	181	378	263	34	2	1622
1984	3	3	8	94	295	459	378	169	688	265	10	0	2372
1985	0	0	4	133	229	235	458	337	356	373	77	5	2207
1986	0	0	0	3	385	311	89	168	449	291	9	3	1708
1987	3	0	43	3	101	354	331	167	400	34	11	3	1450
1988	0	0	2	86	278	626	291	624	806	340	39	0	3092
1989	0	0	8	43	307	325	461	426	827	217	88	41	2743
1990	0	0	51	151	236	509	277	252	548	614	24	18	2680
1991	3	1	20	85	266	504	290	309	528	305	34	5	2350
1992	0	0	39	78	79	520	233	250	565	209	37	5	2015
1993	0	0	34	146	373	337	187	138	472	272	4	0	1963
1994	0	0	0	50	211	214	181	409	532	350	19	0	1966
1995	0	0	68	161	232	520	254	502	464	208	14	0	2423
1996	0	0	17	186	346	440	387	306	394	336	21	0	2433
1997	0	0	12	24	147	457	173	286	584	262	38	6	1989
1998	0	0	30	0	34	36	324	217	347	533	158	0	1679
1999	0	0	0	15	125	518	281	426	797	705	10	66	2943
2000	0	0	0	0	555	325	169	535	876	224	0	0	2684
Average	2	1	19	77	269	488	299	308	533	321	32	6	2355
Max.	21	8	110	257	563	1006	795	624	1164	869	158	66	3608
Min.	0	0	0	0	34	36	60	85	192	34	0	0	1450
Dev.	5	2	29	60	120	186	143	119	180	149	34	12	489

Station JOATECA/MORAZAN
Code Z13
Basin LEMPA

Latitude 13-53-48N
Longitude 88-02-48W
Elevation 820 m
Rainfall (mm)

EXTENDED RAINFALL

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1942	0	0	24	173	652	245	258	248	331	219	85	6	2241
1943	1	0	24	71	300	386	82	226	487	390	92	0	2059
1944	0	0	142	52	312	301	118	201	335	197	4	0	1662
1945	0	0	193	18	293	257	123	231	534	234	38	1	1922
1946	0	0	0	77	397	235	120	143	404	150	82	0	1608
1947	10	5	49	72	213	505	205	274	420	362	238	4	2357
1948	0	0	0	64	224	290	190	207	344	398	151	0	1868
1949	0	0	0	72	178	248	116	252	299	398	150	0	1713
1950	1	0	44	5	270	480	171	217	331	481	52	0	2052
1951	1	2	0	43	215	455	154	201	539	211	36	0	1857
1952	0	0	4	208	358	680	221	281	382	212	78	0	2424
1953	1	0	0	70	496	243	144	225	639	309	3	1	2131
1954	0	7	11	269	375	381	184	237	451	388	0	0	2303
1955	0	1	5	40	79	303	357	293	657	551	61	1	2348
1956	8	22	7	144	343	273	140	147	409	506	6	0	2005
1957	0	1	3	192	254	308	184	218	512	391	60	0	2123
1958	1	0	0	38	427	751	289	225	672	218	99	0	2720
1959	0	4	0	69	278	283	126	232	473	350	43	0	1858
1960	5	10	68	90	608	441	142	168	283	471	49	0	2335
1961	0	13	230	60	238	323	237	141	350	302	172	2	2068
1962	0	0	2	111	410	540	141	184	522	426	81	0	2417
1963	0	16	8	93	203	291	244	97	155	212	322	0	1641
1964	0	0	0	50	256	515	256	423	412	254	32	1	2199
1965	0	0	0	86	315	240	224	328	459	210	5	0	1867
1966	0	0	91	208	292	455	260	180	262	224	0	1	1973
1967	6	9	57	74	89	367	58	176	244	262	38	0	1380
1968	0	9	0	0	313	536	44	65	292	443	43	3	1748
1969	1	1	47	90	401	474	143	338	937	592	65	0	3089
1970	1	0	0	163	347	362	284	316	583	309	16	2	2383
1971	3	2	4	30	255	311	184	302	447	391	49	0	1978
1972	0	0	0	165	336	314	150	130	264	324	44	0	1727
1973	0	0	0	80	351	298	358	505	440	634	11	0	2677
1974	0	0	187	4	425	308	48	183	505	153	0	0	1813
1975	0	0	0	5	384	225	221	307	531	394	238	1	2306
1976	0	0	0	199	345	732	76	108	280	180	90	0	2010
1977	0	0	0	29	256	386	21	163	505	270	70	0	1700
1978	0	0	67	87	227	309	252	132	517	306	8	4	1909
1979	0	26	41	150	190	316	146	231	404	344	64	0	1912
1980	8	0	4	36	492	376	119	216	293	351	48	0	1943
1981	0	1	163	26	282	537	179	253	436	301	3	0	2181
1982	2	12	0	101	531	429	73	62	393	144	3	1	1751
1983	0	1	34	17	78	346	102	128	364	394	92	1	1557
1984	1	11	14	111	349	335	212	121	560	273	21	0	2008
1985	0	0	7	150	271	171	257	242	290	382	167	1	1938
1986	0	1	0	26	456	237	71	162	365	298	20	1	1637
1987	1	0	77	4	120	258	186	120	325	34	25	1	1151
1988	0	0	3	102	328	457	163	447	656	350	85	0	2591
1989	0	0	13	57	363	237	259	305	673	219	191	7	2324
1990	0	1	53	177	316	379	163	197	481	573	129	2	2471
1991	0	0	43	15	407	291	57	229	379	280	275	7	1983
1992	0	0	73	76	93	376	132	180	472	221	89	1	1713
1993	0	0	63	142	440	247	106	100	394	287	8	0	1787
1994	0	0	0	49	249	157	103	295	444	369	47	0	1713
1995	0	0	126	158	273	376	144	362	388	220	34	0	2081
1996	0	0	32	182	409	322	220	221	329	354	51	0	2120
1997	0	0	22	24	174	335	98	206	488	276	92	1	1716
1998	0	0	84	0	223	243	279	359	476	581	342	0	2587
1999	0	0	0	56	211	461	403	559	525	676	16	14	2921
2000	0	0	0	0	586	309	186	278	546	205	30	0	2140
Average	1	3	36	84	315	360	173	230	439	330	75	1	2046
Max.	10	26	230	269	652	751	403	559	937	676	342	14	3089
Min.	0	0	0	0	78	157	21	62	155	34	0	0	1151
Dev.	2	6	54	65	125	126	82	100	133	131	79	2	367

Station MARCALA/MORAZAN
Code U070
Basin ULUA
LLUVIA (mm)

Latitude 14-09-32N
Longitude 88-02-25W
Elevation 1340 m
Rainfall (mm)

EXTENDED RAINFALL

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1942	1	1	9	81	322	186	323	272	234	120	36	49	1633
1943	7	1	9	36	158	276	119	251	328	199	39	2	1424
1944	1	1	44	28	164	221	160	226	236	110	5	1	1197
1945	1	1	60	12	155	193	167	255	356	127	18	8	1353
1946	1	1	1	39	203	180	163	169	278	88	35	1	1158
1947	57	11	16	37	117	352	262	298	288	186	95	30	1749
1948	2	1	1	33	123	215	244	232	242	203	61	1	1358
1949	1	1	1	36	101	188	159	276	214	203	61	1	1243
1950	5	1	15	7	144	336	222	242	234	241	24	1	1470
1951	0	0	0	20	161	296	429	148	330	167	0	18	1570
1952	1	3	40	124	126	420	222	283	377	137	23	1	1757
1953	3	0	0	71	124	326	400	271	470	94	50	51	1858
1954	0	3	0	53	380	445	234	261	544	176	0	1	2096
1955	17	0	1	20	30	97	406	306	383	337	30	10	1637
1956	18	0	4	0	308	200	246	264	427	253	0	0	1720
1957	0	0	0	0	73	226	279	286	449	118	0	0	1432
1958	8	1	1	21	217	508	358	250	439	120	6	0	1929
1959	0	0	0	0	15	210	170	256	320	181	1	0	1152
1960	30	22	22	44	301	311	189	194	205	237	23	3	1579
1961	1	28	71	31	129	236	299	166	245	159	69	7	1442
1962	17	4	0	29	117	408	165	177	255	365	58	12	1606
1963	0	8	13	53	134	183	263	195	391	83	0	0	1322
1964	1	0	0	17	147	390	348	403	283	112	11	6	1718
1965	2	4	0	66	161	196	243	304	312	121	2	1	1411
1966	1	4	27	74	194	309	329	196	227	131	2	11	1504
1967	43	19	19	61	47	254	85	210	182	154	33	4	1111
1968	0	15	0	20	186	390	67	126	225	250	38	23	1342
1969	6	2	14	54	190	332	215	411	570	275	22	0	2091
1970	7	2	1	61	169	240	363	312	379	141	5	12	1691
1971	14	17	41	5	125	202	151	338	255	177	81	33	1438
1972	2	5	0	64	203	223	175	145	251	167	25	4	1262
1973	2	0	1	79	187	275	207	293	215	274	25	4	1561
1974	4	1	10	2	221	377	127	293	254	135	7	5	1435
1975	19	0	0	0	129	89	211	294	364	246	78	4	1433
1976	11	1	0	125	144	368	84	137	134	102	14	11	1131
1977	0	0	2	101	292	133	117	139	187	80	76	16	1142
1978	10	0	39	62	187	204	255	284	269	109	7	41	1466
1979	2	23	42	50	179	221	212	280	220	119	8	20	1375
1980	2	0	11	12	145	270	245	174	156	80	3	2	1098
1981	1	6	22	17	159	188	163	224	155	125	1	2	1064
1982	18	52	31	24	252	341	192	131	193	111	8	7	1360
1983	14	41	35	137	104	154	182	214	397	107	129	14	1530
1984	7	6	5	9	226	227	294	301	283	150	37	11	1557
1985	8	0	39	53	155	147	188	300	302	126	53	21	1390
1986	4	17	0	14	150	192	60	220	273	263	44	1	1237
1987	2	10	19	15	81	414	195	229	270	18	15	5	1272
1988	7	22	0	44	168	362	203	399	256	86	1	0	1547
1989	13	1	1	140	118	190	146	466	363	203	60	9	1709
1990	8	3	9	38	173	349	183	169	312	163	92	8	1507
1991	9	0	2	10	272	198	123	195	172	253	48	10	1291
1992	0	1	26	38	49	268	171	199	324	115	38	8	1236
1993	0	1	22	71	231	176	137	110	270	150	4	0	1171
1994	0	1	0	25	131	112	132	326	305	193	20	0	1245
1995	0	1	44	78	144	268	186	401	266	115	15	0	1516
1996	0	1	11	90	215	229	284	244	226	185	22	0	1507
1997	0	1	8	12	91	238	127	228	334	144	40	10	1233
1998	1	0	41	8	82	193	154	272	255	379	183	5	1573
1999	2	0	0	57	122	345	267	318	485	336	14	12	1958
2000	1	0	0	32	221	239	99	147	370	255	32	5	1401
Average	7	6	14	43	164	260	210	249	297	170	33	9	1461
Max.	57	52	71	140	380	508	429	466	570	379	183	51	2096
Min.	0	0	0	0	15	89	60	110	134	18	0	0	1064
Dev.	10	10	18	35	71	92	85	77	95	76	35	12	242

Station GOASCORAN/GOASCORÁN
Code 5204
Basin GOASCORAN

Latitude 13-56-30N
Longitude 87-45-15W
Elevation 50 m
Rainfall (mm)

EXTENDED RAINFALL

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1942	1	0	6	97	370	248	247	287	336	181	52	19	1842
1943	2	0	6	51	210	329	120	269	431	261	54	2	1735
1944	1	0	25	42	215	280	145	249	338	170	18	2	1485
1945	1	0	32	27	206	255	150	273	460	188	32	4	1627
1946	1	0	3	53	254	243	147	203	381	148	50	2	1483
1947	11	2	10	51	170	397	209	308	391	248	114	12	1921
1948	1	0	3	48	175	274	198	254	344	265	79	2	1642
1949	1	0	3	51	154	250	144	290	317	265	78	2	1554
1950	1	0	9	21	196	382	184	262	336	304	38	2	1735
1951	2	1	3	38	171	368	172	250	463	177	31	2	1677
1952	1	0	3	112	236	497	220	313	367	178	49	2	1978
1953	1	0	3	50	299	247	164	268	524	223	18	6	1804
1954	1	2	4	140	244	326	193	278	409	261	17	2	1875
1955	1	1	4	37	109	281	318	323	535	337	42	3	1990
1956	9	6	4	84	229	264	162	206	384	316	19	2	1684
1957	1	1	3	105	189	284	193	263	447	262	41	2	1789
1958	2	0	3	36	267	537	269	269	544	180	57	2	2165
1959	1	1	3	50	200	270	152	274	423	242	34	2	1650
1960	6	3	13	59	350	360	163	223	307	300	37	2	1822
1961	1	4	38	46	181	293	232	201	348	220	87	8	1657
1962	1	0	3	69	259	417	163	235	453	278	51	1	1930
1963	0	6	2	57	139	252	266	116	143	154	206	0	1340
1964	0	0	0	31	176	445	279	505	382	185	20	3	2026
1965	0	0	0	169	217	207	244	393	425	153	3	0	1811
1966	0	0	21	126	201	393	283	215	243	163	0	4	1649
1967	11	3	13	45	113	317	63	210	226	191	24	2	1219
1968	0	3	0	0	215	464	47	78	270	322	27	14	1441
1969	2	0	11	54	276	410	156	404	868	431	41	0	2653
1970	2	0	0	99	239	313	310	378	539	225	10	7	2121
1971	5	1	0	13	221	236	122	334	333	316	46	2	1629
1972	0	0	0	96	258	244	106	189	229	178	29	0	1330
1973	0	0	0	87	297	405	272	628	545	674	25	0	2932
1974	0	0	23	0	148	784	308	227	654	157	0	0	2300
1975	0	0	0	0	290	212	204	471	844	325	249	0	2593
1976	0	0	0	137	113	515	44	105	307	159	56	0	1435
1977	0	0	0	102	221	438	13	193	214	66	79	6	1331
1978	0	20	52	86	233	210	204	231	384	115	14	26	1572
1979	0	0	0	150	47	311	194	211	330	255	38	0	1534
1980	20	0	0	15	468	265	143	283	185	292	0	0	1671
1981	0	0	17	18	174	360	196	245	279	162	0	0	1449
1982	4	0	0	70	422	264	76	74	124	71	4	8	1116
1983	0	0	7	2	40	320	113	155	285	199	47	1	1169
1984	0	0	0	85	186	340	265	185	510	217	14	0	1800
1985	0	0	0	145	221	75	319	227	293	237	90	0	1607
1986	0	0	0	2	301	195	55	144	296	198	14	5	1211
1987	3	0	12	0	103	202	196	117	298	24	29	0	984
1988	0	0	0	78	203	354	158	531	618	250	36	0	2228
1989	0	0	0	12	312	203	298	317	591	77	101	16	1927
1990	0	0	21	105	192	319	172	215	414	464	33	15	1947
1991	1	0	9	26	258	275	102	272	365	209	74	22	1612
1992	0	0	17	53	63	322	139	216	431	156	55	4	1456
1993	0	0	15	98	299	212	112	119	360	203	5	0	1423
1994	0	0	0	34	169	134	108	354	406	262	29	0	1495
1995	0	0	30	109	186	322	152	434	354	155	21	0	1763
1996	0	0	8	126	278	276	232	265	300	251	31	0	1766
1997	0	0	5	17	118	287	104	247	445	196	56	5	1479
1998	0	1	16	12	163	242	271	424	429	421	188	1	2168
1999	0	1	2	44	156	377	373	657	472	492	15	44	2633
2000	0	1	2	12	374	283	195	330	490	140	22	1	1850
Average	2	1	8	61	216	315	184	274	397	233	46	4	1741
Max.	20	20	52	169	468	784	373	657	868	674	249	44	2932
Min.	0	0	0	0	40	75	13	74	124	24	0	0	984
Dev.	3	3	11	44	84	109	78	119	141	108	47	8	383

Appendix 6.5

Extended Discharge

at Hydrological Gauging Station (Osicala)

93
(94)

Monthly Discharge at Osicala

Basin Torola/MORAZAN

Catchment Area(km^2) 862
Mean Annual Rainfall(mm) 2005

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1942	4 5	2 7	2 1	13 8	104 2	53 3	61 8	54 9	71 4	37 6	15 6	10 0	36 2
1943	5 4	2 9	2 3	2 1	24 0	75 0	17 7	32 2	105 7	80 3	25 7	7 2	31 7
1944	3 3	2 6	13 0	5 3	25 4	51 8	21 9	28 4	67 2	33 5	6 7	2 1	21 8
1945	2 0	1 9	18 7	5 4	22 0	38 6	20 1	37 9	117 8	49 0	11 7	3 1	27 4
1946	2 3	1 8	1 7	1 5	44 7	40 2	18 5	14 2	76 9	27 1	9 2	3 9	20 2
1947	4 5	4 0	3 1	2 3	9 2	98 0	54 6	59 8	93 4	72 2	47 2	18 2	38 9
1948	5 7	3 0	2 0	1 7	11 8	42 5	38 2	37 4	69 3	75 6	34 3	10 3	27 8
1949	3 2	2 3	1 8	1 6	3 9	28 6	16 7	42 6	61 2	74 1	34 0	10 0	23 4
1950	3 0	2 2	1 7	1 5	18 5	96 0	42 8	38 5	67 2	92 7	22 9	4 1	32 7
1951	2 4	1 8	1 5	1 2	8 8	84 9	38 9	32 3	115 1	45 5	9 9	2 4	28 7
1952	1 5	1 4	1 2	18 6	42 9	153 7	69 1	63 8	86 6	38 9	13 9	4 8	41 4
1953	2 4	1 9	1 5	1 3	63 5	46 4	27 5	39 2	144 2	69 2	13 1	2 5	34 5
1954	1 9	1 6	1 5	28 5	53 9	79 7	43 8	47 8	100 3	79 6	15 4	2 5	38 1
1955	1 8	1 7	1 6	1 3	0 8	38 2	93 0	73 8	152 1	124 7	28 6	5 9	43 9
1956	4 3	7 3	2 6	8 3	38 2	47 4	26 3	17 9	79 7	103 5	19 7	2 6	29 9
1957	1 6	1 4	1 3	15 5	22 8	50 2	38 3	41 3	113 4	81 8	21 0	4 7	32 8
1958	2 5	1 9	1 5	1 2	49 9	175 2	95 5	52 3	152 4	53 0	18 9	6 3	50 9
1959	2 7	2 0	1 6	1 4	18 8	44 3	21 6	37 7	102 7	72 4	17 4	3 3	27 2
1960	2 3	3.2	5 9	4 6	90 9	102 7	36 0	24 7	51 4	88 3	22 4	4 3	36 6
1961	2 7	2 4	26 5	10 5	14 1	53 1	56 3	25 4	65 2	53 8	31 8	12 0	29 6
1962	4 5	5 7	4 7	4 5	13 3	115 7	44 0	45 4	137 5	95 5	9 1	6 8	40 6
1963	4 9	4 9	4 7	5 7	9 4	40 6	86 8	27 3	73 0	19 8	24 3	6 1	25 7
1964	6 4	5 8	5 2	6 0	10 2	54 5	80 6	53 7	87 5	47 6	9 1	8 0	31 3
1965	6 7	5 4	3 5	2 3	27 6	33 6	35 6	25 1	103 1	62 2	5 9	3 0	26 2
1966	4 5	1 7	3 7	8 5	39 2	81 7	70 4	32 8	106 0	69 0	9 9	7 3	36 3
1967	4 9	4 5	4 1	15 0	4 2	37 1	13 3	20 2	45 8	78 8	17 8	5 8	21 0
1968	4 5	4 1	3 5	3 6	27 0	43 4	17 8	8 6	52 1	77 8	19 2	7 8	22 5
1969	8 7	6 5	5 9	11 2	42 3	102 6	45 3	79 2	184 0	157 0	25 4	7 5	56 4
1970	4 5	3 3	2 7	4 4	13 1	30 6	49 8	90 2	148 8	97 5	14 4	5 7	38 9
1971	3 1	2 3	1 8	2 3	14 8	31 8	9 8	90 7	79 1	108 2	17 3	6 5	30 9
1972	3 3	1 9	1 5	2 8	24 2	81 9	11 9	9 4	23 3	28 5	12 2	3 6	17 0
1973	2 0	1 4	0 9	1 8	22 8	38 9	20 0	104 5	121 4	152 4	16 7	5 6	41 0
1974	3 2	2 0	3 3	1 4	31 6	94 5	39 7	15 1	200 1	39 3	6 1	3 1	36 5
1975	1 9	1 5	1 3	1 0	24 8	33 0	8 5	29 7	133 8	101 0	95 0	6 1	36 4
1976	3 0	2 0	1 5	3 0	10 7	128 8	24 6	11 2	20 1	26 1	7 6	3 7	20 1
1977	2 3	1 5	1 0	1 6	12 0	48 3	2 4	10 1	43 7	30 3	10 9	3 7	14 0
1978	2 4	1 5	2 0	2 2	11 1	21 0	32 2	12 0	103 4	51 9	7 4	4 1	21 0
1979	2 3	1 6	1 8	7 7	18 4	65 9	57 6	50 4	128 7	78 9	18 8	4 9	36 5
1980	3 0	2 1	1 5	2 9	60 0	78 8	29 4	34 9	64 6	59 0	16 9	3 8	29 9
1981	2 4	1 9	13 4	4 1	22 0	99 1	48 8	46 8	85 9	60 5	12 3	2 2	33 4
1982	2 0	3 9	2 2	1 6	75 3	93 9	19 1	1 9	67 4	26 1	3 5	1.3	24 9
1983	1 3	1 2	1 2	1 0	0 5	47 4	15 2	10 6	64 0	65 7	25 8	7 4	20 1
1984	2 6	1 8	1 2	0 7	30 0	61 7	51 6	20 9	108 9	53 6	11 5	2 0	28 9
1985	1 2	1 1	1 0	10 3	24 6	20 1	48 7	53 1	63 2	64 6	34 4	11 0	27 9
1986	3 2	1 9	1 3	0 9	50 4	38 6	8 0	12 7	66 3	51 8	11 3	1 6	20 7
1987	1 0	0 9	4 2	1 1	0 3	34 5	33 8	14 4	50 9	57 0	12 2	1 3	17 7
1988	0 6	0 5	0 5	1 4	25 3	95 4	40 9	108 5	155 8	75 9	23 2	6 0	44 6
1989	2 3	1 5	1 1	0 9	37 7	37 7	58 4	76 3	154 5	52 5	32 8	17 5	39 6
1990	5 7	2 3	2 1	16 3	37 2	75 8	37 7	32 6	104 5	119 4	39 3	11 4	40 5
1991	4 6	2 7	2 1	1 7	44 7	55 8	11 5	29 8	77 9	52 8	28 9	14 3	27 3
1992	5 4	2 5	4 5	3 5	1 5	58 6	25 2	23 2	97 3	41 8	15 5	5 3	23 6
1993	2 3	1 7	2 7	12 3	59 8	43 1	14 8	3 0	67 2	50 1	10 2	1 5	22 4
1994	1 5	1 5	1 3	1 0	13 8	11 2	3 3	51 7	97 9	73 2	17 6	3 0	23 2
1995	1 7	1 2	10 5	18.5	25 7	69.8	30.5	80 8	89 6	39 1	9 3	2 4	31 7
1996	1 6	1 5	1 4	16 1	55 1	62 2	51 1	44 1	66 6	65 0	17 6	3 7	32 3
1997	2 3	1 7	1 7	1 4	1 2	48 5	14 6	25 3	103 6	53 7	19 8	6 1	23 3
1998	2 5	1 7	5 3	1 7	6 5	26 7	37 9	71 1	51 5	130 7	66 6	7 0	34 4
1999	3 7	2 4	1 6	1 5	13 9	51 0	43 7	67 9	140 2	130 9	12 1	5 5	39 7
2000	3 2	2 2	1 7	1 4	31 7	55 7	8 3	32 5	135 2	59 1	7 5	3 9	28 5
Average	3 2	2 5	3 5	5 3	27 8	61 9	36 0	40 0	94 9	68 8	19 9	5 7	30 9
Max	8 7	7 3	26 5	28 5	104 2	175 2	95 5	108 5	200 1	157 0	95 0	18 2	56 4
Min	0 6	0 5	0 5	0 7	0 3	11 2	2 4	1 9	20 1	19 8	3 5	1 3	14 0
Dev	1 6	1 4	4 5	5 9	22 0	32 2	22 1	25 2	38 0	30 8	14 8	3 7	8 5

95
(96)

Appendix 6.6

Extended Discharge

at ElChaparral, La Honda, La Honda Upstream Alternative

Monthly Discharge at El Chaparral (m^3/sec)

Basin Torola/MORAZAN

Catchment Area(km^2) 1233
Mean Annual Rainfall(mm) 2145

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1942	6 8	4 1	3 2	21 2	159 4	81 6	94 6	84 0	109 3	57 5	23 9	15 3	55 5
1943	8 3	4 5	3 5	3 3	36 7	114 7	27 1	49 3	161 7	122 8	39 4	11 0	48 5
1944	5 0	3 9	19 9	8 2	38 8	79 3	33 6	43 5	102 8	51 2	10 3	3 2	33 4
1945	3 1	2 9	28 6	8 3	33 6	59 0	30 7	57 9	180 2	74 9	18 0	4 8	41 9
1946	3 5	2 7	2 6	2 3	68 4	61 5	28 3	21 7	117 7	41 5	14 0	5 9	30 9
1947	6 8	6 1	4 7	3 5	14 1	150 0	83 6	91 5	142 9	110 5	72 3	27 8	59 6
1948	8 8	4 6	3 1	2 7	18 1	65 1	58 5	57 2	106 0	115 7	52 5	15 7	42 5
1949	4 9	3 5	2 7	2 4	6 0	43 8	25 6	65 2	93 6	113 5	52 0	15 3	35 8
1950	4 6	3 4	2 6	2 2	28 3	147 0	65 5	58 9	102 9	141 8	35 0	6 3	50 0
1951	3 7	2 8	2 2	1 8	13 4	130 0	59 5	49 5	176 1	69 7	15 1	3 7	43 9
1952	2 2	2 1	1 9	28 5	65 6	235 2	105 8	97 6	132 5	59 5	21 3	7 3	63 3
1953	3 7	2 8	2 3	2 0	97 2	70 9	42 0	60 0	220 7	106 0	20 0	3 8	52 8
1954	2 9	2 4	2 4	43 6	82 4	121 9	67 0	73 1	153 5	121 9	23 6	3 8	58 4
1955	2 7	2 7	2 5	2 1	1 2	58 5	142 3	112 9	232 8	190 8	43 8	9 0	67 1
1956	6 5	11 1	3 9	12 7	58 4	72 5	40 2	27 4	122 0	158 4	30 2	3 9	45 7
1957	2 4	2 2	2 0	23 7	34 9	76 8	58 6	63 2	173 6	125 1	32 2	7 1	50 3
1958	3 9	2 9	2 3	1 8	76 4	268 1	146 2	80 1	233 3	81 1	28 9	9 6	77 9
1959	4 1	3 1	2 4	2 1	28 8	67 8	33 1	57 8	157 2	110 8	26 6	5 0	41 7
1960	3 5	4 9	9 1	7 0	139 1	157 2	55 1	37 8	78 6	135 1	34 2	6 6	56 0
1961	4 1	3 6	40 6	16 1	21 5	81 3	86 2	38 9	99 8	82 4	48 7	18 4	45 3
1962	6 9	8 7	7 2	6 9	20 4	177 1	67 3	69 5	210 4	146 1	13 9	10 4	62 1
1963	7 5	7 5	7 2	8 7	14 4	62 1	132 8	41 8	111 7	30 3	37 2	9 3	39 3
1964	9 8	8 9	8 0	9 2	15 6	83 4	123 3	82 2	133 9	72 8	13 9	12 2	48 0
1965	10 3	8 3	5 4	3 5	42 3	51 4	54 5	38 4	157 8	95 2	9 0	4 6	40 1
1966	6 9	2 6	5 7	13 0	60 0	125 0	107 8	50 2	162 2	105 6	15 1	11 2	55 6
1967	7 5	6 9	6 3	23 0	6 4	56 8	20 4	30 9	70 1	120 6	27 2	8 9	32 1
1968	6 9	6 3	5 4	5 5	41 3	66 4	27 2	13 2	79 7	119 1	29 4	11 9	34 5
1969	13 3	9 9	9 0	17 1	64 8	157 0	69 3	121 2	281 6	240 3	38 9	11 5	86 4
1970	6 9	5 0	4 1	6 7	20 0	46 8	76 2	138 0	227 7	149 2	22 0	8 7	59 6
1971	4 7	3 5	2 8	3 5	22 6	48 7	15 0	138 8	121 0	165 6	26 5	9 9	47 2
1972	5 0	2 9	2 3	4 3	37 0	125 3	18 2	14 4	35 7	43 6	18 7	5 5	26 1
1973	3 1	2 1	1 4	2 8	34 9	59 5	30 6	159 9	185 8	233 2	25 6	8 6	62 7
1974	4 9	3 1	5 0	2 1	48 4	144 6	60 8	23 1	306 2	60 1	9 3	4 7	55 8
1975	2 9	2 3	2 0	1 5	38 0	50 5	13 0	45 4	204 8	154 6	145 4	9 3	55 8
1976	4 6	3 1	2 3	4 6	16 4	197 2	37 6	17 1	30 8	40 0	11 6	5 7	30 8
1977	3 5	2 3	1 5	2 4	18 4	73 9	3 7	15 5	66 9	46 4	16 7	5 7	21 4
1978	3 7	2 3	3 1	3 4	17 0	32 1	49 3	18 4	158 2	79 4	11 3	6 3	32 1
1979	3 5	2 4	2 8	11 8	28 2	100 8	88 1	77 1	196 9	120 7	28 8	7 5	55 8
1980	4 6	3 2	2 3	4 4	91 9	120 6	45 0	53 3	98 9	90 3	25 9	5 9	45 7
1981	3 6	2 8	20 4	6 3	33 7	151 7	74 7	71 5	131 5	92 6	18 9	3 4	51 0
1982	3 1	6 0	3 4	2 5	115 3	143 8	29 2	2 9	103 2	39 9	5 4	2 0	38 0
1983	1 9	1 9	1 8	1 6	0 7	72 5	23 3	16 2	98 0	100 5	39 5	11 4	30 8
1984	3 9	2 8	1 9	1 1	45 9	94 5	78 9	32 0	166 6	82 0	17 7	3 1	44 3
1985	1 8	1 6	1 5	15 7	37 6	30 8	74 5	81 2	96 7	98 9	52 6	16 9	42 8
1986	4 8	2 9	2 0	1 4	77 1	59 1	12 2	19 4	101 5	79 2	17 2	2 4	31 7
1987	1 5	1 4	6 4	1.7	0.5	52 8	51 8	22 0	77 8	87 2	18 6	2 0	27 1
1988	0 9	0 8	0 7	2 2	38 7	145 9	62 6	166 0	238 4	116 1	35 4	9 2	68 2
1989	3 6	2 3	1 6	1 4	57 6	57 7	89 4	116 8	236 4	80 4	50 2	26 7	60 5
1990	8 7	3 5	3 2	25 0	56 9	116 1	57 7	49 9	160 0	182 7	60 1	17 5	61 9
1991	7 1	4 1	3 2	2 6	68 4	85 5	17 5	45 6	119 3	80 8	44 3	21 9	41 8
1992	8 2	3 8	6 9	5 3	2 3	89 7	38 6	35 5	148 8	63 9	23 7	8 1	36 2
1993	3 6	2 5	4 1	18 9	91 5	65 9	22 6	4 6	102 9	76 6	15 7	2 4	34 4
1994	2 3	2 2	2 0	1 6	21 2	17 2	5 0	79 2	149 9	112 1	26 9	4 6	35 4
1995	2 7	1 8	16 0	28 2	39 4	106 8	46 7	123 7	137 1	59 8	14 2	3 6	48 5
1996	2 4	2 3	2 2	24 7	84 2	95 2	78 3	67 5	101 9	99 4	27 0	5 6	49 5
1997	3 6	2 7	2 6	2 1	1 9	74 3	22 3	38 7	158 5	82 2	30 3	9 3	35 6
1998	3 9	2 6	8 1	2 6	10 0	40 9	58 0	108 8	78 8	200 0	101 9	10 7	52 6
1999	5 7	3 7	2 4	2 3	21 3	78 0	66 9	103 9	214 5	200 3	18 5	8 4	60 8
2000	4 9	3 4	2 6	2 1	48 5	85 2	12 7	49 7	206 9	90 4	11 5	6 0	43 6
Average	4 9	3 8	5 4	8 1	42 6	94 7	55 0	61 2	145 2	105 2	30 5	8.8	47 2
Max	13 3	11 1	40 6	43 6	159 4	268 1	146 2	166 0	306 2	240 3	145 4	27 8	86 4
Min	0 9	0 8	0 7	1 1	0 5	17 2	3 7	2 9	30 8	30 3	5 4	2 0	21 4
Dev	2 4	2 2	6 8	9 0	33 7	49 3	33 7	38 6	58 1	47 2	22 7	5 6	13 0

Monthly Discharge at La Honda Original (m3/sec)

Basin Torola/MORAZAN

Catchment Area(km^2) 1065
Mean Annual Rainfall(mm) 2169

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1942	6 0	3 6	2 8	18 5	139 2	71 2	82 6	73 4	95 5	50 2	20 9	13 4	48 4
1943	7 2	3 9	3 1	2 8	32 1	100 2	23 7	43 0	141 2	107 3	34 4	9 6	42 4
1944	4 4	3 4	17 4	7 1	33 9	69 3	29 3	38 0	89 8	44 8	9 0	2 8	29 1
1945	2 7	2 6	25 0	7 3	29 4	51 6	26 8	50 6	157 4	65 4	15 7	4 2	36 6
1946	3 1	2 4	2 2	2 0	59 8	53 7	24 7	19 0	102 8	36 2	12 3	5 2	27 0
1947	6 0	5 3	4 1	3 0	12 3	131 0	73 0	79 9	124 8	96 5	63 1	24 3	52 0
1948	7 7	4 0	2 7	2 3	15 8	56 8	51 1	50 0	92 6	101 0	45 8	13 7	37 1
1949	4 3	3 1	2 4	2 1	5 3	38 3	22 3	56 9	81 8	99 1	45 5	13 4	31 3
1950	4 1	3 0	2 3	2 0	24 8	128 4	57 2	51 4	89 8	123 9	30 6	5 5	43 7
1951	3 2	2 4	1 9	1 6	11 7	113 5	51 9	43 2	153 8	60 8	13 2	3 2	38 3
1952	2 0	1 8	1 6	24 9	57 3	205 4	92 4	85 3	115 7	52 0	18 6	6 4	55 3
1953	3 2	2 5	2 0	1 8	84 9	62 0	36 7	52 4	192 7	92 5	17 5	3 3	46 1
1954	2 5	2 1	2 1	38 1	72 0	106 5	58 5	63 9	134 1	106 5	20 6	3 3	51 0
1955	2 4	2 3	2 2	1 8	1 1	51 1	124 3	98 6	203 4	166 6	38 3	7 9	58 6
1956	5 7	9 7	3 4	11 1	51 0	63 3	35 1	23 9	106 6	138 3	26 4	3 4	40 0
1957	2 1	1 9	1 8	20 7	30 5	67 1	51 2	55 2	151 6	109 3	28 1	6 2	43 9
1958	3 4	2 5	2 0	1 6	66 7	234 2	127 7	69 9	203 7	70 9	25 2	8 4	68 0
1959	3 6	2 7	2 1	1 8	25 2	59 2	28 9	50 5	137 3	96 8	23 2	4 4	36 4
1960	3 0	4 3	7 9	6 1	121 5	137 3	48 2	33 0	68 7	118 0	29 9	5 7	48 9
1961	3 6	3 1	35 5	14 1	18 8	71 0	75 3	34 0	87 1	71 9	42 5	16 0	39 5
1962	6 0	7 6	6 3	6 0	17 8	154 6	58 8	60 7	183 8	127 6	12 2	9 1	54 2
1963	6 5	6 5	6 3	7 6	12 6	54 2	116 0	36 5	97 6	26 5	32 5	8 2	34 3
1964	8 6	7 8	7 0	8 0	13 6	72 8	107 7	71 8	116 9	63 6	12 2	10 7	41 9
1965	9 0	7 2	4 7	3 1	37 0	44 9	47 6	33 5	137 8	83 1	7 9	4 0	35 1
1966	6 0	2 2	4 9	11 4	52 4	109 2	94 1	43 8	141 7	92 2	13 2	9 8	48 6
1967	6 5	6 0	5 5	20 0	5 6	49 6	17 8	27 0	61 2	105 3	23 8	7 8	28 1
1968	6 0	5 5	4 7	4 8	36 1	58 0	23 8	11 5	69 6	104 0	25 7	10 4	30 1
1969	11 6	8 7	7 9	15 0	56 6	137 1	60 5	105 8	245 9	209 8	33 9	10 0	75 4
1970	6 0	4 4	3 6	5 9	17 5	40 9	66 6	120 6	198 9	130 3	19 2	7 6	52 0
1971	4 1	3 1	2 4	3 1	19 8	42 5	13 1	121 2	105 7	144 6	23 1	8 7	41 2
1972	4 4	2 5	2 0	3 7	32 3	109 5	15 9	12 6	31 1	38 1	16 3	4 8	22 8
1973	2 7	1 9	1 2	2 4	30 5	52 0	26 7	139 7	162 3	203 7	22 3	7 5	54 8
1974	4 3	2 7	4 4	1 9	42 2	126 3	53 1	20 2	267 4	52 5	8 2	4 1	48 8
1975	2 5	2 0	1 7	1 3	33 1	44 1	11 4	39 7	178 8	135 0	127 0	8 2	48 7
1976	4 0	2 7	2 0	4 0	14 3	172 2	32 8	15 0	26 9	34 9	10 2	4 9	26 9
1977	3 1	2 0	1 3	2 1	16 0	64 6	3 2	13 5	58 4	40 5	14 6	4 9	18 6
1978	3 2	2 0	2 7	2 9	14 8	28 1	43 0	16 0	138 2	69 4	9 9	5 5	28 0
1979	3 1	2 1	2 4	10 3	24 6	88 1	77 0	67 4	172 0	105 5	25 1	6 5	48 8
1980	4 0	2 8	2 0	3 9	80 2	105 4	39 3	46 6	86 4	78 9	22 6	5 1	39 9
1981	3 2	2 5	17 8	5 5	29 4	132 5	65 2	62 5	114 9	80 9	16 5	3 0	44 6
1982	2 7	5 2	3 0	2 2	100 7	125 6	25 5	2 5	90 1	34 9	4 7	1 7	33 2
1983	1 7	1 6	1 6	1 4	0 6	63 3	20 3	14 2	85 6	87 8	34 5	9 9	26 9
1984	3 4	2 4	1 6	0 9	40 1	82 5	68 9	28 0	145 5	71 6	15 4	2 7	38 7
1985	1 6	1 4	1 3	13 8	32 9	26 9	65 1	70 9	84 4	86 4	45 9	14 7	37 3
1986	4 2	2 6	1 7	1 3	67 3	51 6	10 6	17 0	88 6	69 2	15 0	2 1	27 7
1987	1 3	1 2	5 6	1 5	0 4	46 1	45 2	19 2	68 0	76 2	16 3	1 8	23 6
1988	0 8	0 7	0 6	1 9	33 8	127 5	54 7	145 0	208 2	101 4	30 9	8 0	59 6
1989	3 1	2 0	1 4	1 2	50 3	50 4	78 1	102 0	206 5	70 2	43 8	23 4	52 9
1990	7 6	3 1	2 8	21 8	49 7	101 4	50 4	43 6	139 7	159 5	52 5	15 3	54 1
1991	6 2	3 6	2 8	2 3	59 8	74 6	15 3	39 9	104 2	70 6	38 7	19 2	36 5
1992	7 2	3 4	6 0	4 6	2 0	78 4	33 7	31 0	130 0	55 8	20 7	7 1	31 6
1993	3 1	2 2	3 6	16 5	79 9	57 6	19 7	4 0	89 9	66 9	13 7	2 1	30 0
1994	2 0	1 9	1 7	1 4	18 5	15 0	4 4	69 1	130 9	97 9	23 5	4 0	31 0
1995	2 3	1 6	14 0	24 7	34 4	93 3	40 8	108 0	119 7	52 2	12 4	3 2	42 3
1996	2 1	2 0	1 9	21 6	73 6	83 2	68 4	58 9	89 0	86 9	23 6	4 9	43 2
1997	3 1	2 3	2 2	1 8	1 7	64 9	19 5	33 8	138 4	71 8	26 4	8 1	31 1
1998	3 4	2 3	7 1	2 3	8 7	35 7	50 7	95 0	68 8	174 7	89 0	9 4	45 9
1999	4 9	3 2	2 1	2 0	18 6	68 2	58 4	90 8	187 4	175 0	16 2	7 4	53 1
2000	4 3	2 9	2 3	1 9	42 4	74 4	11 1	43 4	180 7	79 0	10 0	5 2	38 1
Average	4 2	3 3	4 7	7 1	37 2	82 7	48 1	53 5	126 8	91 9	26 6	7 6	41 2
Max	11 6	9 7	35 5	38 1	139 2	234 2	127 7	145 0	267 4	209 8	127 0	24 3	75 4
Min	0 8	0 7	0 6	0 9	0 4	15 0	3 2	2 5	26 9	26 5	4 7	1 7	18 6
Dev	2 1	1 9	6 0	7 9	29 4	43 1	29 5	33 7	50 7	41 2	19 8	4 9	11 4

100

Monthly Dischrge at La Honda Upstream Alternative (m3/sec)

Basin Torola/MORAZAN

Catchment Area(km^2) 1059
Mean Annual Rainfall(mm) 2169

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1942	5 9	3 6	2 8	18 4	138 4	70 8	82 1	73 0	94 9	49 9	20 8	13 3	48 2
1943	7 2	3 9	3 1	2 8	31 9	99 6	23 6	42 8	140 4	106 7	34 2	9 5	42 2
1944	4 3	3 4	17 3	7 1	33 7	68 9	29 2	37 7	89 3	44 5	9 0	2 8	29 0
1945	2 7	2 5	24 9	7 2	29 2	51 3	26 7	50 3	156 5	65 1	15 6	4 2	36 4
1946	3 1	2 4	2 2	2 0	59 4	53 4	24 5	18 9	102 2	36 0	12 2	5 2	26 8
1947	5 9	5 3	4 1	3 0	12 2	130.3	72 6	79 5	124 1	96 0	62 8	24 2	51 7
1948	7 6	4 0	2 7	2 3	15 7	56 5	50 8	49 7	92 1	100 5	45 6	13 6	36 9
1949	4 3	3 1	2 3	2 1	5 2	38 1	22 2	56 6	81 3	98 5	45 2	13 3	31 1
1950	4 0	2 9	2 3	2 0	24 6	127 6	56 9	51 1	89 3	123 2	30 4	5 5	43 4
1951	3 2	2 4	1 9	1 6	11 7	112 9	51 7	42 9	152 9	60 5	13 1	3 2	38 1
1952	1 9	1 8	1 6	24 8	57 0	204 2	91 9	84 8	115 1	51 7	18 5	6 4	55 0
1953	3 2	2 5	2 0	1 8	84 4	61 6	36 5	52 1	191 6	92 0	17 4	3 3	45 8
1954	2 5	2 1	2 0	37 8	71 6	105 9	58 2	63 5	133 3	105 9	20 5	3 3	50 7
1955	2 4	2 3	2 2	1 8	1 1	50 8	123 6	98 1	202 2	165 7	38 1	7 8	58 3
1956	5 7	9 7	3 4	11 0	50 7	62 9	34 9	23 8	106 0	137 6	26 2	3 4	39 7
1957	2 1	1 9	1 8	20 6	30 3	66 7	50 9	54 9	150 7	108 7	28 0	6 2	43 7
1958	3 4	2 5	2 0	1 6	66 3	232 9	127 0	69 5	202 6	70 5	25 1	8 4	67 6
1959	3 6	2 7	2 1	1 8	25 0	58 9	28 7	50 2	136 5	96 3	23 1	4 4	36 2
1960	3 0	4 2	7 9	6 1	120 8	136 5	47 9	32 8	68 3	117 4	29 7	5 7	48 6
1961	3 5	3 1	35 3	14 0	18 7	70 6	74 9	33 8	86 6	71 5	42 3	15 9	39 3
1962	6 0	7 6	6 2	6 0	17 7	153 8	58 5	60 3	182 7	126 9	12 1	9 0	53 9
1963	6 5	6 5	6 2	7 6	12 5	53 9	115 4	36 3	97 0	26 3	32 3	8 1	34 1
1964	8 5	7 7	6 9	8 0	13 6	72 4	107 1	71 4	116 3	63 3	12 1	10 6	41 6
1965	8 9	7 2	4 7	3 1	36 7	44 7	47 3	33 4	137 0	82 7	7 8	4 0	34 9
1966	6 0	2 2	4 9	11 3	52 1	108 6	93 6	43 6	140 9	91 7	13 2	9 7	48 3
1967	6 5	6 0	5 4	19 9	5 6	49 3	17 7	26 8	60 9	104 7	23 7	7 7	27 9
1968	6 0	5 4	4 7	4 8	35 9	57 7	23 6	11 4	69 2	103 4	25 5	10 4	29 9
1969	11 6	8 6	7 8	14 9	56 3	136 3	60 2	105 2	244 5	208 7	33 8	10 0	75 0
1970	6 0	4 4	3 6	5 8	17 4	40 7	66 2	119 9	197 8	129 6	19 1	7 6	51 7
1971	4 1	3 1	2 4	3 1	19 7	42 3	13 0	120 5	105 1	143 8	23 0	8 6	41 0
1972	4 4	2 5	2 0	3 7	32 2	108 8	15 8	12 5	31 0	37 9	16 2	4 8	22 6
1973	2 7	1 9	1 2	2 4	30 3	51 7	26 6	138 9	161 3	202 5	22 2	7 4	54 5
1974	4 3	2 7	4 4	1 9	42 0	125 6	52 8	20 1	265 9	52 2	8 1	4 1	48 5
1975	2 5	2 0	1 7	1 3	33 0	43 9	11 3	39 5	177 8	134 2	126 3	8 1	48 4
1976	4 0	2 7	2 0	4 0	14 2	171 2	32 7	14 9	26 7	34 7	10 1	4 9	26 8
1977	3 1	2 0	1 3	2 1	15 9	64 2	3 2	13 4	58 1	40 3	14 5	4 9	18 5
1978	3 2	2 0	2 7	2 9	14 8	27 9	42 8	15 9	137 4	69 0	9 8	5 4	27 9
1979	3 1	2 1	2 4	10 2	24 5	87 6	76 6	67 0	171 0	104 9	25 0	6 5	48 5
1980	4 0	2 8	2 0	3 9	79 8	104 8	39 1	46 3	85 9	78 4	22 5	5 1	39 7
1981	3 2	2 5	17 7	5 4	29 2	131 8	64 9	62 1	114 2	80 5	16 4	3 0	44 3
1982	2 6	5 2	3 0	2 2	100 1	124 9	25 3	2 5	89 6	34 7	4 7	1.7	33 0
1983	1 7	1 6	1 6	1 4	0 6	62 9	20 2	14 1	85 1	87 3	34 3	9 9	26 7
1984	3 4	2 4	1 6	0 9	39 9	82 1	68 5	27 8	144 7	71 2	15 3	2 7	38 4
1985	1 5	1 4	1 3	13 7	32 7	26 8	64 7	70 5	83 9	85 9	45 7	14 6	37 1
1986	4 2	2 5	1 7	1 2	67 0	51 3	10 6	16 9	88 1	68 8	15 0	2 1	27 5
1987	1 3	1 2	5 5	1 5	0 4	45 8	45 0	19 1	67 6	75 7	16 2	1 8	23 5
1988	0 8	0 7	0 6	1 9	33 6	126 7	54 4	144 2	207 1	100 8	30 8	8 0	59 3
1989	3 1	2 0	1 4	1 2	50 1	50 2	77 6	101 4	205 3	69 8	43 6	23 2	52 6
1990	7 6	3 1	2 8	21 7	49 4	100 8	50 1	43 4	138 9	158 6	52 2	15 2	53 8
1991	6 1	3 6	2 8	2 3	59 4	74 2	15 2	39 6	103 6	70 2	38 5	19 1	36 3
1992	7 1	3 3	6 0	4 6	2 0	77 9	33 5	30 9	129 3	55 5	20 6	7 1	31 4
1993	3 1	2 2	3 6	16 4	79 4	57 2	19 6	4 0	89 4	66 6	13 6	2 1	29 8
1994	2 0	1 9	1 7	1 3	18 4	14 9	4 4	68 8	130 1	97 3	23 4	4 0	30 8
1995	2 3	1 5	13 9	24 5	34 2	92 8	40 5	107 4	119.1	51 9	12 3	3 2	42 1
1996	2 1	2 0	1 9	21 4	73 2	82 7	68 0	58 6	88 5	86 4	23 4	4 9	43 0
1997	3 1	2 3	2 2	1 8	1 7	64 5	19 4	33 6	137 7	71 4	26 3	8 0	30 9
1998	3 4	2 3	7 1	2 3	8 7	35 5	50 4	94 5	68 4	173 7	88 5	9 3	45 7
1999	4 9	3 2	2 1	2 0	18 5	67 8	58 1	90 2	186 3	174 0	16 1	7 3	52 8
2000	4 3	2 9	2 3	1 9	42 1	74 0	11 0	43 2	179 7	78 5	10 0	5 2	37 9
Average	4 2	3 3	4 7	7 1	37 0	82 2	47 8	53 2	126 1	91 4	26 5	7 6	41 0
Max	11 6	9 7	35 3	37 8	138 4	232 9	127 0	144 2	265 9	208 7	126 3	24 2	75 0
Min	0 8	0 7	0 6	0 9	0 4	14 9	3 2	2 5	26 7	26 3	4 7	1 7	18 5
Dev	2 1	1 9	5 9	7 8	29 2	42 9	29 3	33 5	50 5	41 0	19 7	4 9	11 3

Appendix 6.7

Hydrological Data for

Tank Model Calculation

Staion: Average Rainfall for Torola Basin
Basin: Torola

Rainfall: (mm)

RAINFALL DATA for the TANK MODEL

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1970	3	2	3	102	310	376	361	366	535	267	12	5	2342
1971	4	4	3	25	259	291	167	390	384	371	51	2	1951
1972	0	3	1	120	299	316	153	164	246	224	54	0	1580
1973	0	0	0	79	315	415	326	497	454	552	27	3	2668
1974	1	1	87	2	288	445	165	227	530	140	1	1	1888
1975	2	0	1	4	355	204	193	348	551	325	188	2	2173

Staion: OSICALA
Basin: Torola

Discharge: ($m^3/s \cdot day$)

DISCHARGE DATA for the TANK MODEL

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1970	139.5	95.7	83.7	132	406.1	918	1543.8	2796.2	4464	3022.5	432	170.5	1189
1971	96.1	69.6	55 8	69	458.8	954	303.8	2811.7	2367	3354.2	519	201.5	945
1972	102.3	55.1	43.4	84	750.2	2454	368.9	291 4	699	883.5	366	111.6	517
1973	62	40.6	27 9	54	709.9	1074	620	3267.4	3642	4817.4	498	173.6	1258
1974	99.2	58	102.3	42	982.7	2835	1230.7	468.1	6003	1218.3	183	96.1	1106
1975	58.9	43.5	40 3	30	768.8	990	263.5	920.7	4014	3131	2880	189 1	1110

Appendix 6.8

Rainfall and Discharge Data

of Hurricane FIFI

107
(108)

Rainfall and Discharge Data of FIFI (1/4)

DD/MM/YY	TIME	Hourly Rainfall (mm)			Hourly Discharge (m^3/sec)
		(mm)			
		Z-3	Z-4	Z-5	Osicala
17/9/74	0-1	0 00	0 00	0 00	89 90
	1-2	0 00	0.00	0 00	89 90
	2-3	0 00	0 00	0 00	86 30
	3-4	0 00	0.00	0 00	86.30
	4-5	0 00	0 00	0.00	76 10
	5-6	0.00	0.00	0 00	76 10
	6-7	0 00	0 00	0 00	71 10
	7-8	0 00	0 00	0 00	71.10
	8-9	0 00	0.00	0 00	68.00
	9-10	0 00	0.00	0 00	68 00
	10-11	0 00	0 00	0 00	64.80
	11-12	0.00	0 00	0 00	64.80
	12-13	0 00	0.00	0.00	61 80
	13-14	0 00	0.00	0 00	61.80
	14-15	0 00	0.00	0.00	60 30
	15-16	0 10	0 00	0 00	60.30
	16-17	0.00	0.00	4.20	64 80
	17-18	4 20	0.00	0 00	64 80
	18-19	0 20	0.00	0.00	76 10
	19-20	0 00	0 00	0 00	76.10
	20-21	0 00	3 10	0 00	129 00
	21-22	0.00	0 00	0 00	129 00
	22-23	0.00	0.00	0 00	250 00
	23-24	0 00	0.00	0.00	250 00
18/9/74	0-1	0 00	0 10	0 00	142 00
	1-2	0 10	0 60	0 00	142.00
	2-3	0 30	0 20	0 20	142 00
	3-4	0.30	0 80	0 10	142 00
	4-5	0 30	1.20	0 10	77 70
	5-6	2 10	2.90	0.60	77.70
	6-7	0 60	0 90	1.60	77 70
	7-8	0 10	0 00	0.10	77.70
	8-9	0 00	0 00	0 00	72.80
	9-10	0 10	0 30	0 00	72 80
	10-11	0 90	1.70	0 00	72 80
	11-12	0 30	1 00	0 00	72 80
	12-13	0 40	0 50	0.00	74 40
	13-14	0 20	0 30	0 00	74.40
	14-15	0 00	0 00	0 40	74.40
	15-16	0 00	0 00	0 00	74 40
	16-17	0 00	0 00	0 60	79 40
	17-18	0 00	0.00	0 10	79 40
	18-19	0 00	0.40	0 00	79 40
	19-20	0 50	1 80	0 60	79.40
	20-21	1 30	1 10	0 10	76 10
	21-22	0.20	1 50	0 10	76 10
	22-23	0 30	1 50	0 00	76 10
	23-24	1 00	2.70	0 50	76 10

Rainfall and Discharge Data of FIFI (2/4)

DD/MM/YY	TIME	Hourly Rainfall (mm)			Hourly Discharge (m^3/sec)
		(mm)			
		Z-3	Z-4	Z-5	Osicala
19/9/74	0-1	1.70	3 20	1.30	74 40
	1-2	0 20	2 50	1 40	74 40
	2-3	0 80	2 20	3 40	72 80
	3-4	0 80	1 40	0 80	72 80
	4-5	1 00	3.40	1 40	71 10
	5-6	1 50	5.80	1 90	71 10
	6-7	3 80	9 90	0 90	72 80
	7-8	0 60	8 40	1.00	72.80
	8-9	0 80	5 00	1.00	72 80
	9-10	0 10	3 10	0 00	72 80
	10-11	0 30	2 90	12 80	74 40
	11-12	6 80	2 70	9 70	77 70
	12-13	16 30	14 10	3 10	81 10
	13-14	6.70	19 70	8 10	84 60
	14-15	9 70	20 30	8 10	105 00
	15-16	8 40	21.30	3.90	129 00
	16-17	2 30	9 00	1.20	216 00
	17-18	3 50	4 30	10 80	274.00
	18-19	4 60	7 60	10.00	483 00
	19-20	6 50	10 20	3 90	747 00
	20-21	3 30	4 00	3 90	1,064 00
	21-22	2.10	3 20	5 30	1,513.00
	22-23	5 00	3 80	3 70	1,853 00
	23-24	1 30	5.70	0.40	2,042 00
20/9/74	0-1	0 80	1 90	1.10	2,004 00
	1-2	3 10	3 50	6 30	1,794.00
	2-3	4 10	10 40	4 60	1,513.00
	3-4	0.60	1 80	1 40	1,595 00
	4-5	0.70	2 70	0 80	1,823 00
	5-6	1 60	7.80	2 10	1,882 00
	6-7	1 00	3.10	2.40	1,928 00
	7-8	4.20	3 60	14 50	1,943.00
	8-9	3 60	6 80	3 40	1,973.00
	9-10	0.20	1 10	1 90	1,981 00
	10-11	3 20	3 50	4 60	1,981 00
	11-12	7 90	12 30	12 80	1,707 00
	12-13	8 70	15 70	6.20	1,665.00
	13-14	12 40	5 10	12 50	1,523 00
	14-15	17 40	13 40	10 10	2,914 00
	15-16	1.30	3 90	0 70	2,892 00
	16-17	0.20	0 50	4 60	2,389 00
	17-18	0 10	1 10	0.40	2,280 00
	18-19	0 30	0 60	0.40	2,129 00
	19-20	1 60	0.50	1 40	2,129 00
	20-21	0 40	0 40	0.50	1,853 00
	21-22	0 20	0 30	0 20	1,736 00
	22-23	0 00	0 30	0 40	1,513 00
	23-24	0 50	0 60	1 00	1,480 00

Rainfall and Discharge Data of FIFI (3/4)

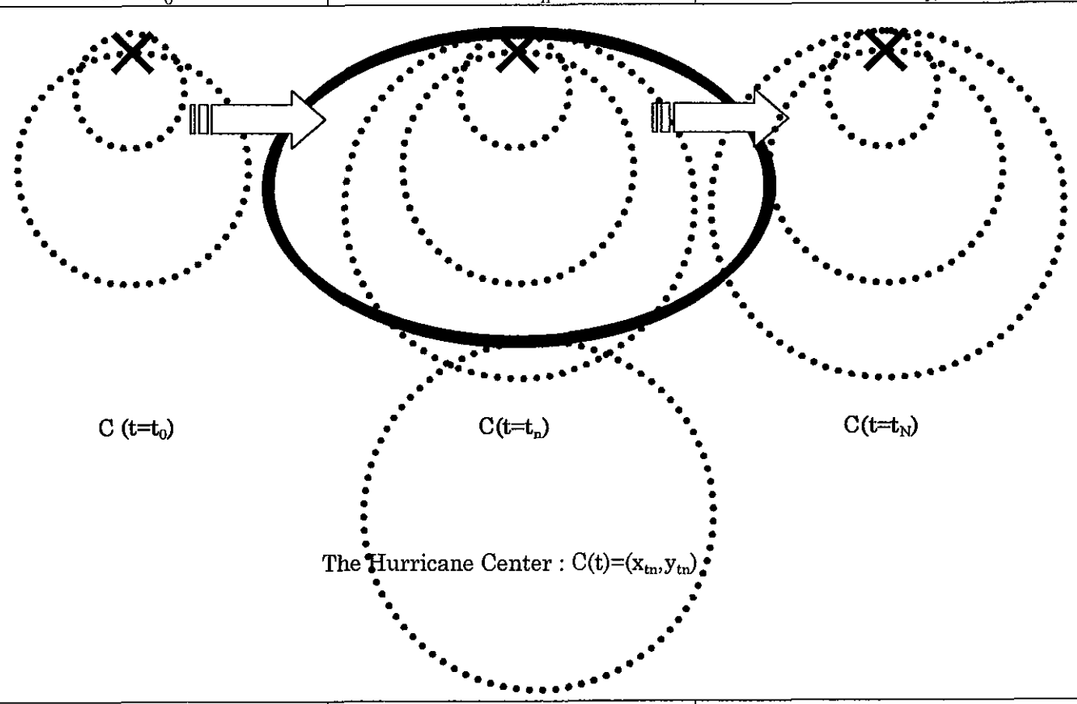
DD/MM/YY	TIME	Hourly Rainfall (mm)			Hourly Discharge (m^3/sec)
		(mm)			
		Z-3	Z-4	Z-5	Osicala
21/9/74	0-1	0 20	0 10	0 00	1,305 00
	1-2	0 10	0 10	0 10	1,305 00
	2-3	0 50	1 30	0 50	1,087.00
	3-4	0 80	1 50	0 00	1,087 00
	4-5	1 20	1 40	0 60	921 00
	5-6	1 10	0 40	0.30	921.00
	6-7	0 90	0 80	0 30	767 00
	7-8	0 50	0 80	0 00	767 00
	8-9	0 90	0 30	0 00	672 00
	9-10	0 00	0 00	0 00	672 00
	10-11	0 00	0 00	0 00	565 00
	11-12	0.00	0 00	0 00	565 00
	12-13	0.00	0 00	0 00	491 00
	13-14	0 00	0 00	0 00	491 00
	14-15	0 00	0 00	0 00	415 00
	15-16	0 00	0 00	0 00	415.00
	16-17	0 00	0 00	0 00	379.00
	17-18	0 00	0 00	0 00	379 00
	18-19	0 00	0 00	0 00	344.00
	19-20	0.00	0 00	0 00	344.00
	20-21	0 00	0 00	0 00	321 00
	21-22	0 00	0 00	0 00	321 00
	22-23	0.00	0.00	0 00	305 00
	23-24	0.00	0.00	0 00	305 00
22/9/74	0-1				286 00
	1-2				286.00
	2-3				286 00
	3-4				286 00
	4-5				253 00
	5-6				253 00
	6-7				253 00
	7-8				253 00
	8-9				227.00
	9-10				227.00
	10-11				227 00
	11-12				227 00
	12-13				211 00
	13-14				211 00
	14-15				211 00
	15-16				211.00
	16-17				190.00
	17-18				190 00
	18-19				190 00
	19-20				190 00
	20-21				170 00
	21-22				170 00
	22-23				170.00
	23-24				170 00

Rainfall and Discharge Data of FIFI (4/4)

DD/MM/YY	TIME	Hourly Rainfall (mm)			Hourly Discharge (m^3/sec)
		Z-3	Z-4	Z-5	Osicala
23/9/74	0-1				185 00
	1-2				185 00
	2-3				318 00
	3-4				318 00
	4-5				216.00
	5-6				216 00
	6-7				195 00
	7-8				195 00
	8-9				175 00
	9-10				175 00
	10-11				163.00
	11-12				163 00
	12-13				156 00
	13-14				156 00
	14-15				147 00
	15-16				147 00
	16-17				143 00
	17-18				143 00
	18-19				175 00
	19-20				175 00
	20-21				156 00
	21-22				156 00
	22-23				161 00
	23-24				161 00
	0 00				151 00

Appendix 6.9

PMP Calculation

	$t = t_0$	$t = t_n$	$t = t_N$
1. Image and Conditions of Calculation (1) Calculation Grid dx=5km, dy=5km (2)Calculation time step dt=1hr (3)Speed of Hurricane Center Vc=8km/hr (4)Rainfall Intensity in proportion to distance from the hurricane center D<8km: Ir=0mm/hr 8<D<16km. Ir=235mm/hr 16<D<32km: Ir=59.9mm/hr 32<D<48km:Ir= 18.5mm/hr 48<D<64km: Ir=9.9mm/hr 64<D<80km: Ir=5.4mm/hr 80<D<96km: Ir=3.3mm/hr 96<D<192km: Ir=1.2mm/hr D>192km: Ir=0mm/hr			
2. Calculation Process (1)Distance between the hurricane center and each grid point : D_{ij} (2)Rainfall intensity at each grid point : $Ir_{ij}(D_{ij})$ (3)Average rainfall intensity on each grid cell : AIr_{ij} (4)Average rainfall intensity over the catchment area : R	$D_{ij}=\{(x_i-x_{t0})^2+(y_j-y_{t0})^2\}^{1/2}$ $Ir_{ij}(D_{ij})$: see 1. (4) $AIr_{ij}=(Ir_{i,j}+Ir_{i+1,j}+Ir_{i,j+1}+Ir_{i+1,j+1})/4$ $R(t=t_0)=\sum_{i=1}^{I-1}\sum_{j=1}^{J-1}(A_{ij}\times AIr_{ij})$	$D_{ij}=\{(x_i-x_{tn})^2+(y_j-y_{tn})^2\}^{1/2}$ $Ir_{ij}(D_{ij})$: see 1. (4) $AIr_{ij}=(Ir_{i,j}+Ir_{i+1,j}+Ir_{i,j+1}+Ir_{i+1,j+1})/4$ $R(t=t_n)=\sum_{i=1}^{I-1}\sum_{j=1}^{J-1}(A_{ij}\times AIr_{ij})$	$D_{ij}=\{(x_i-x_{tN})^2+(y_j-y_{tN})^2\}^{1/2}$ $Ir_{ij}(D_{ij})$: see 1. (4) $AIr_{ij}=(Ir_{i,j}+Ir_{i+1,j}+Ir_{i,j+1}+Ir_{i+1,j+1})/4$ $R(t=t_N)=\sum_{i=1}^{I-1}\sum_{j=1}^{J-1}(A_{ij}\times AIr_{ij})$
3. PMP