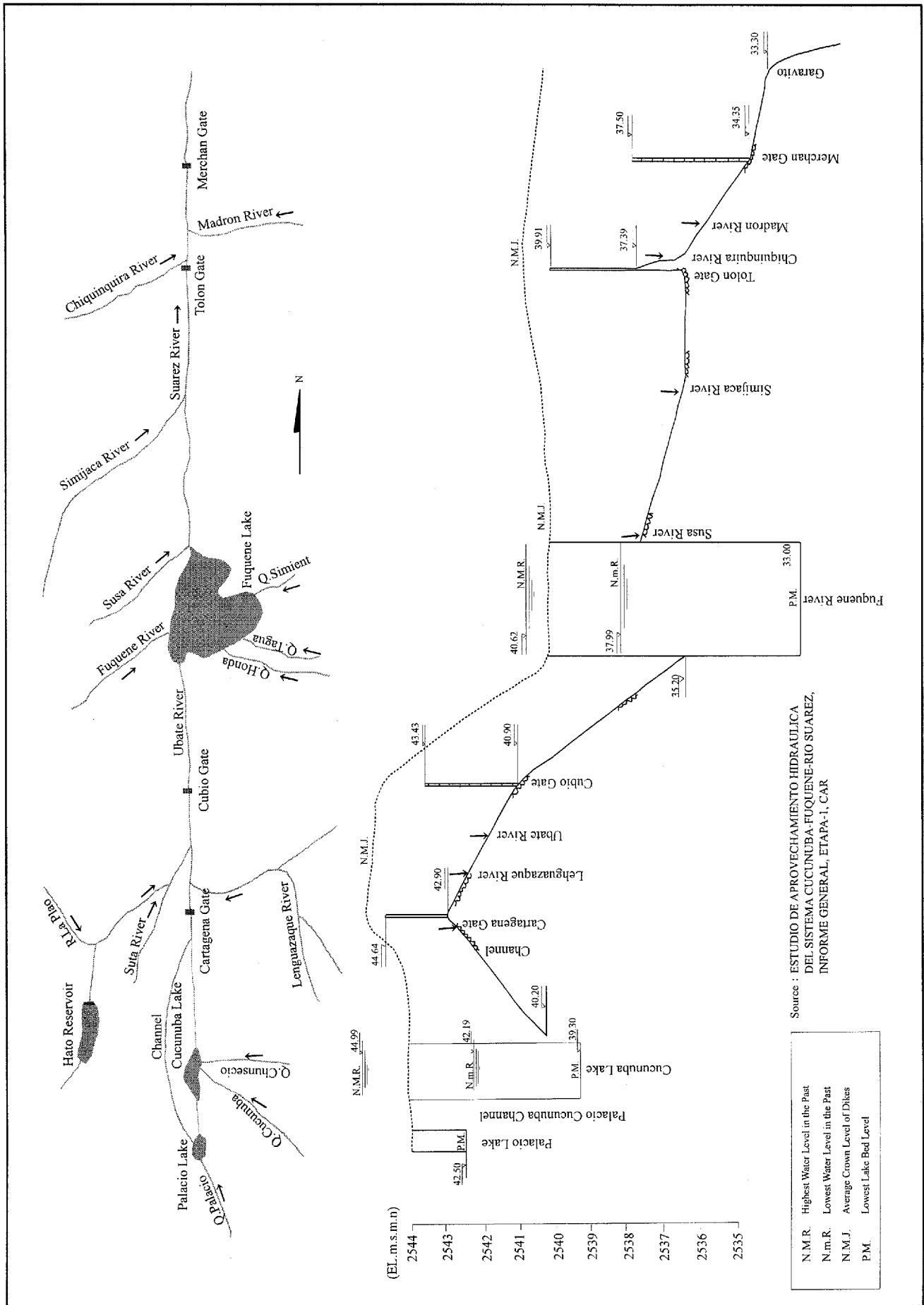


Source : ESTUDIO DE APROVECHAMIENTO HIDRAULICA DEL SISTEMA CUCUNUBA-FUQUENE-RIO SUAREZ, INFORME GENERAL, ETAPA-I, CAR

: PLANO GENERAL DEL SISTEMA DE RIEGO Y DRENAJE DE FUQUENE Y CUCUNUBA, CAR

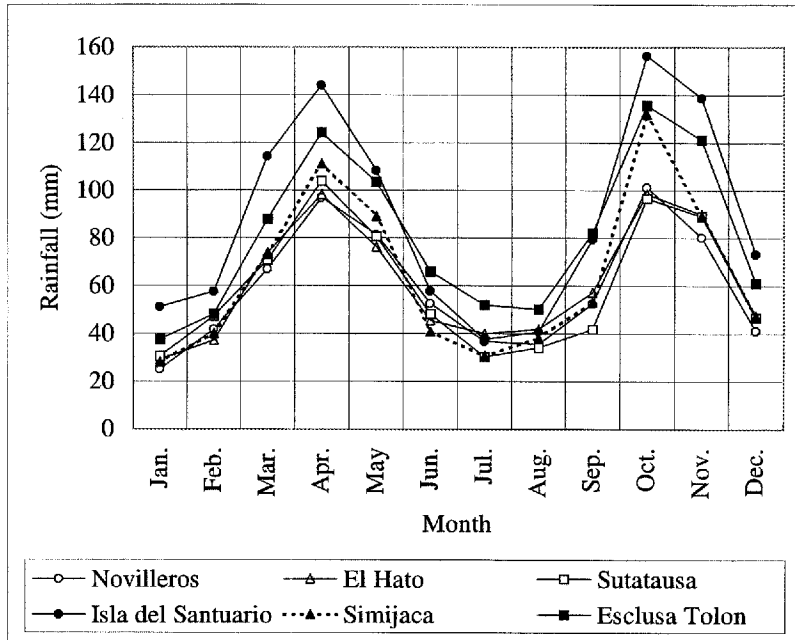
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Fig. B.1.1 Division of Sub-basin



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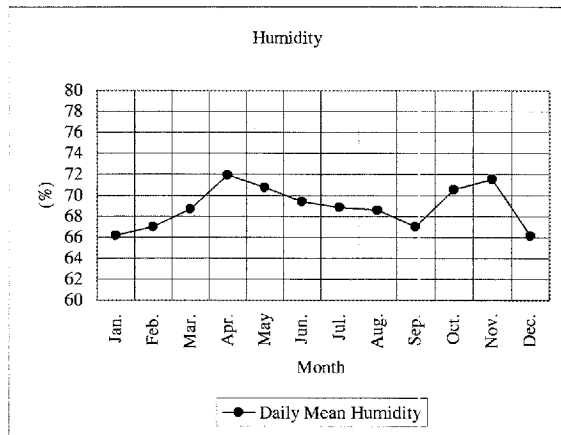
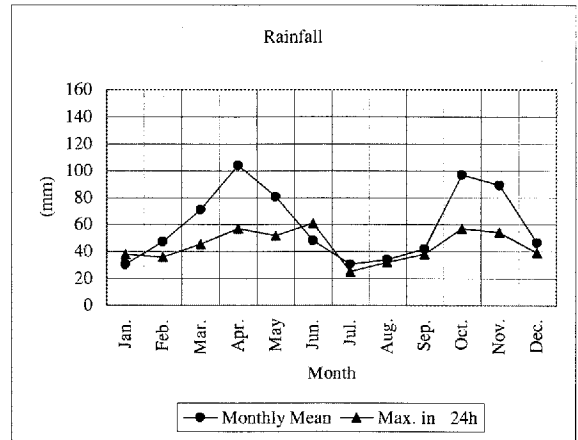
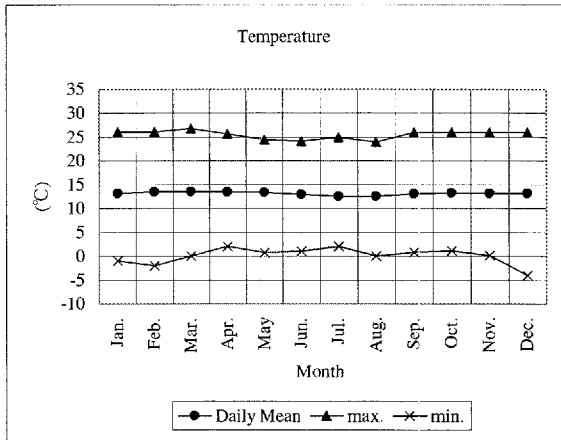
Fig. B.1.2 Profile of Cucunuba Lake - Ubate River - Fuquene Lake - Suarez River System



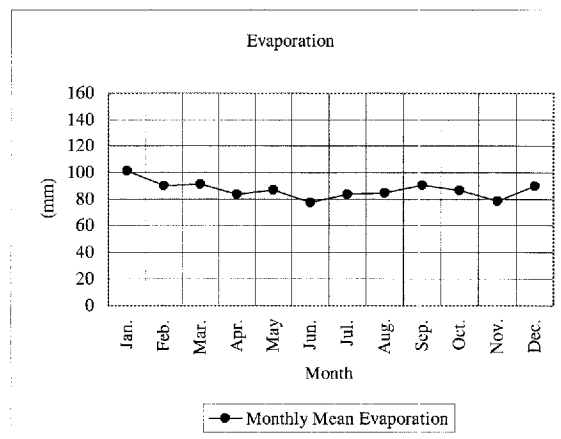
Month	Basin Station					
	Upper Ubate	Suta	Fuquen	Simijac	Suarez	
	Novilleros	El Hato	Sutatausa	Isla del Santuario	Simijaca	Esclusa Tolon
Jan.	25	29	31	51	28	38
Feb.	42	37	47	58	40	48
Mar.	67	74	71	114	73	88
Apr.	97	98	104	144	111	124
May	81	76	81	108	89	104
Jun.	53	45	48	58	41	66
Jul.	37	40	30	38	31	52
Aug.	36	42	34	41	38	50
Sep.	53	57	42	79	53	82
Oct.	101	98	97	156	132	136
Nov.	80	90	89	139	89	121
Dec.	41	47	47	73	47	61
Dec.-Feb.(Dry)	108	113	124	182	115	147
Mar.-May(Rainy)	245	248	255	367	273	316
Apr.-Jun. (Dry)	125	127	112	136	110	168
Jul.-Oct. (Rainy)	234	245	227	375	274	339
Annual	712	734	720	1,059	772	969

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Fig. B.1.4 Average Monthly Rainfall at Representative Stations

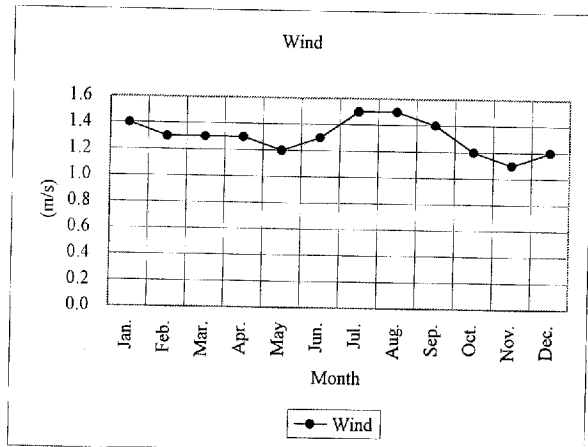
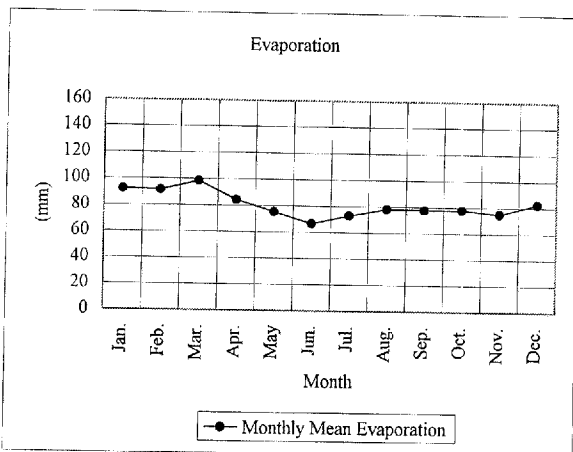
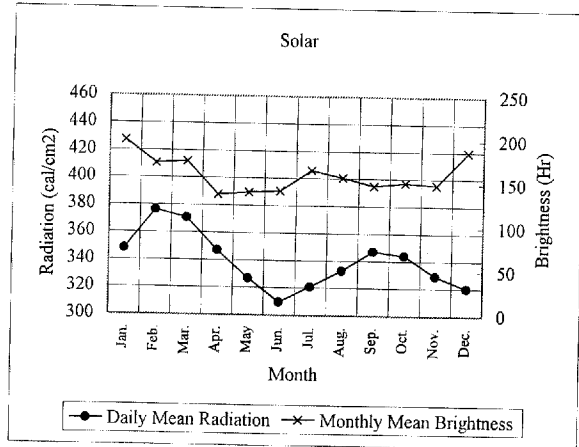
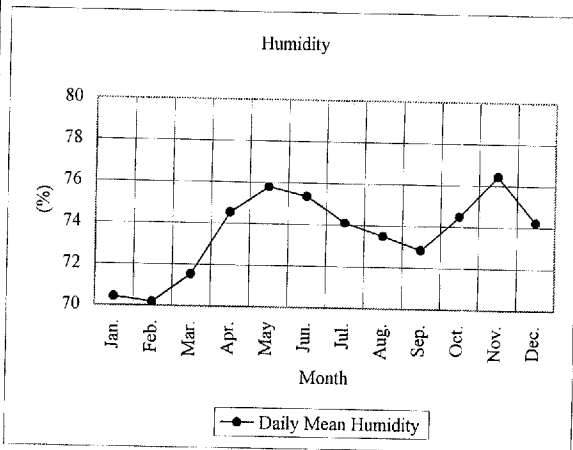
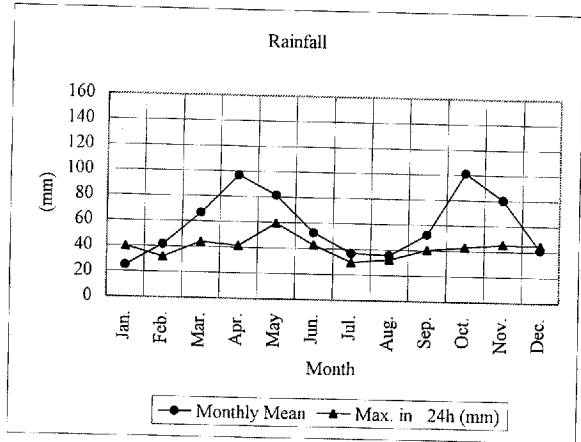
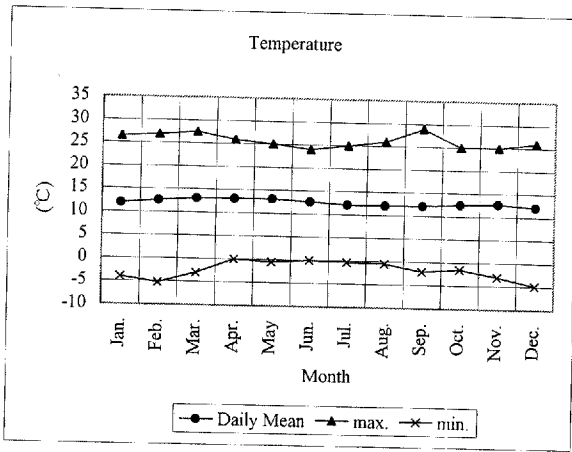


Not Observed (Solar)



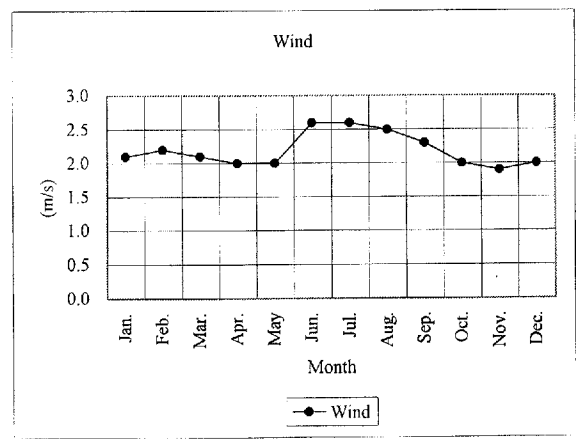
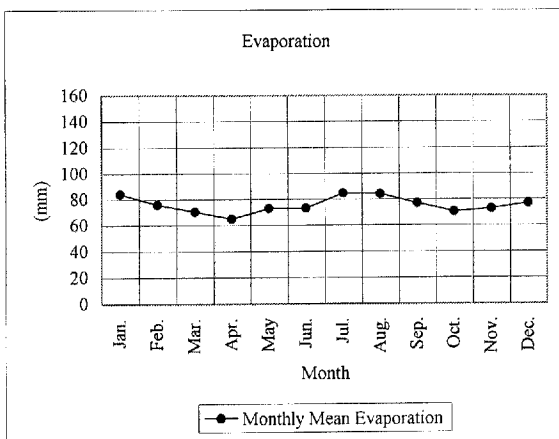
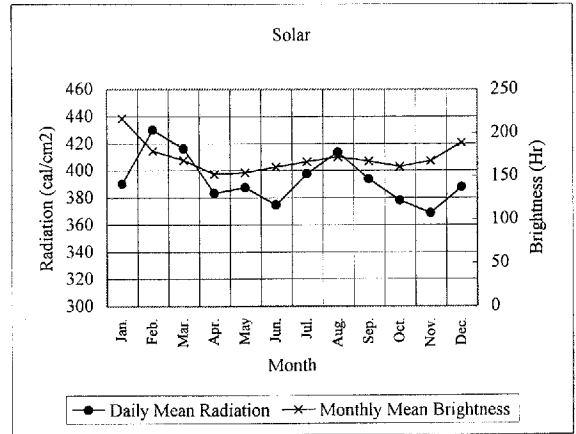
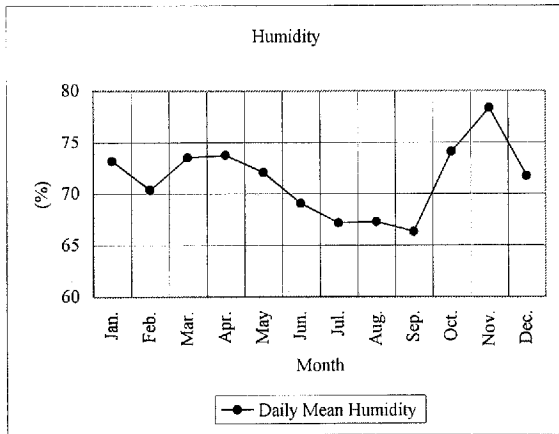
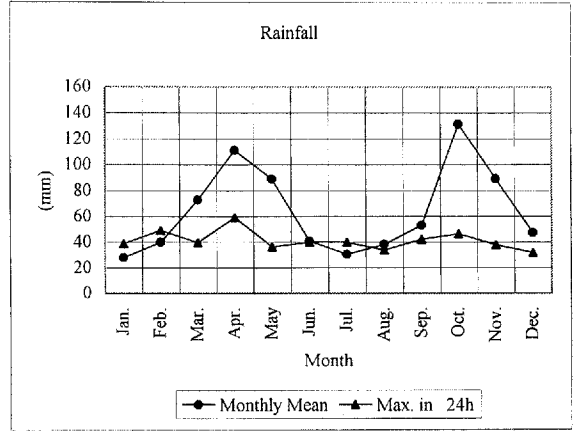
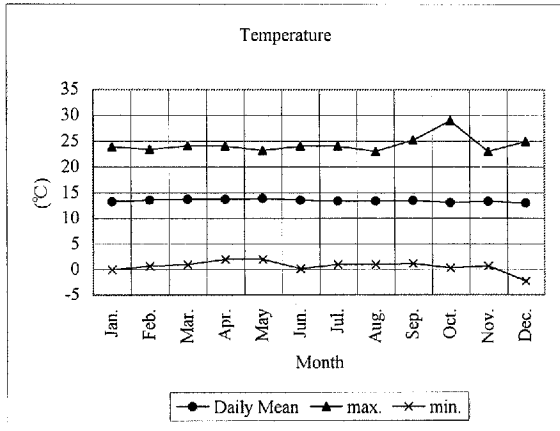
Not Observed (Wind)

Fig. B.1.5 (1/5) Fluctuation of Meteorological Data
(Sta. Sutatausa)



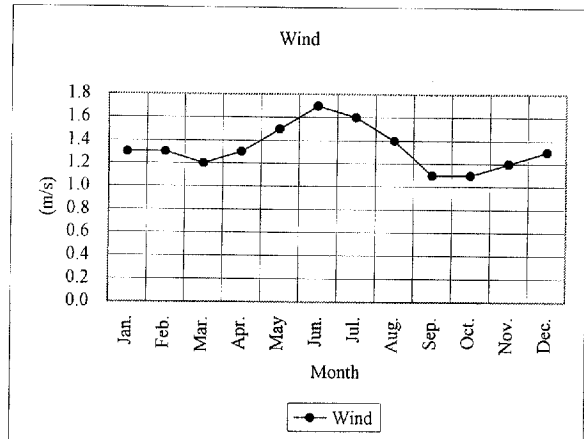
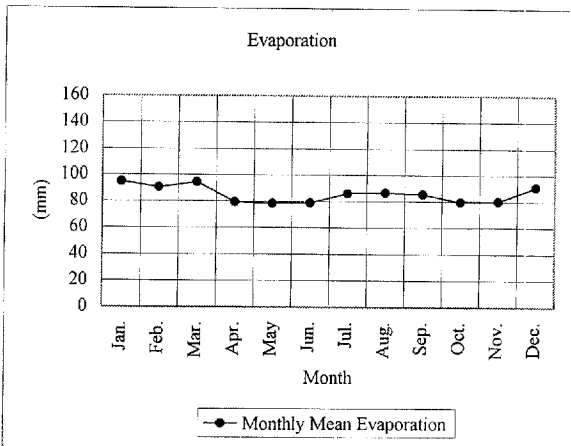
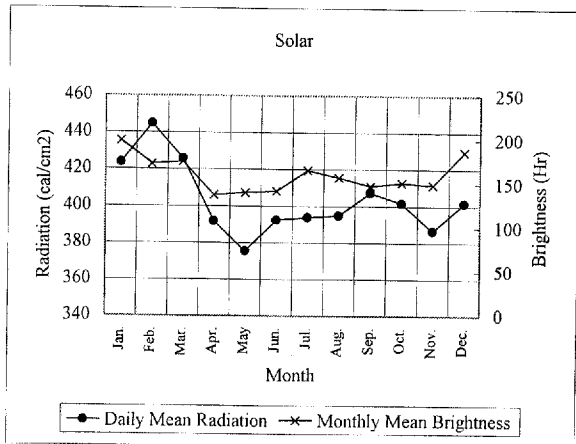
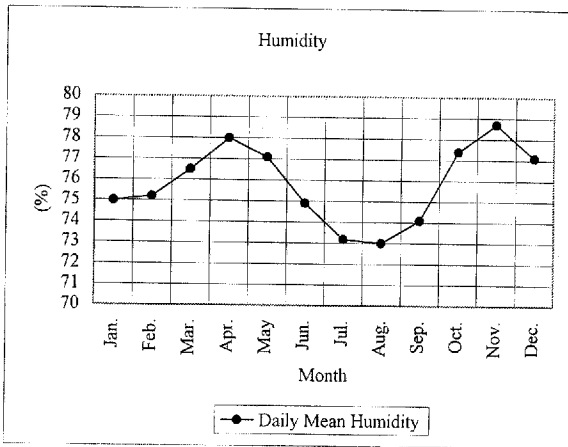
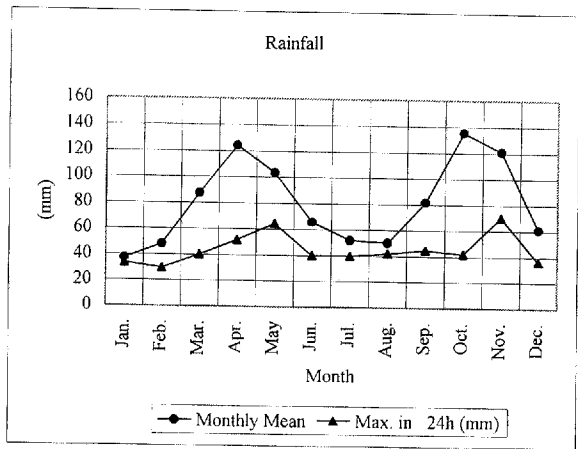
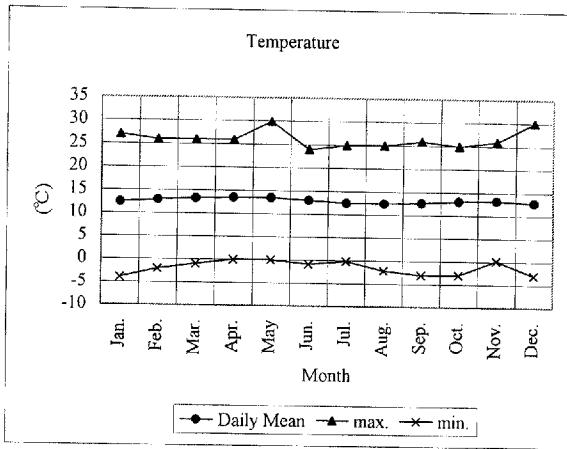
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Fig. B.1.5 (2/5) Fluctuation of Meteorological Data (Sta. Novilleros)



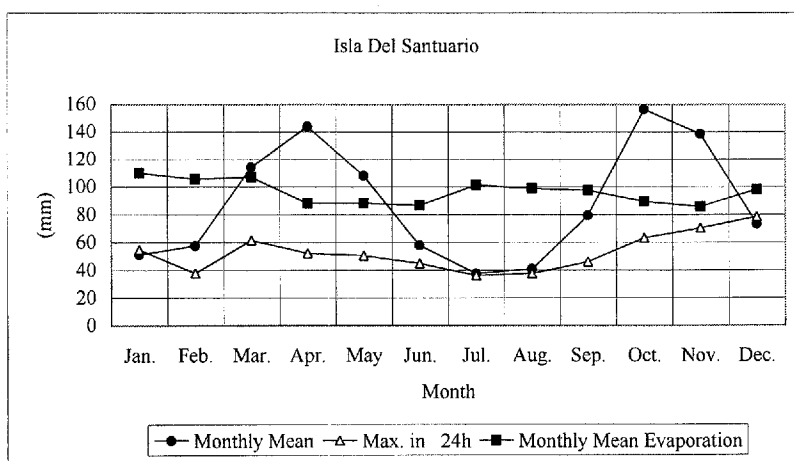
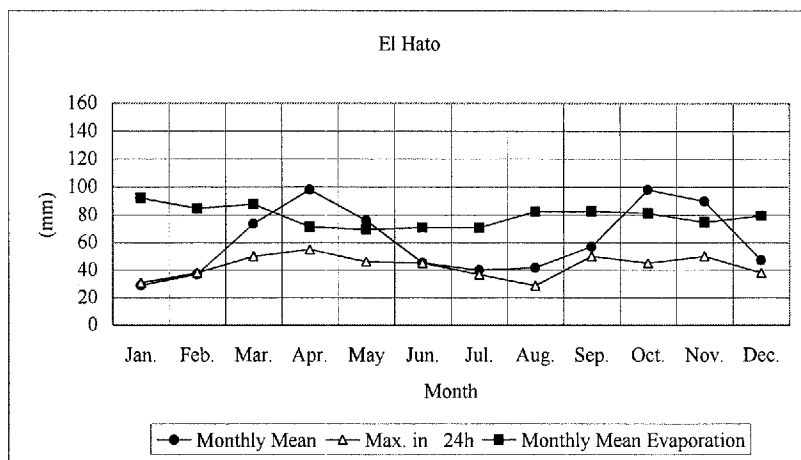
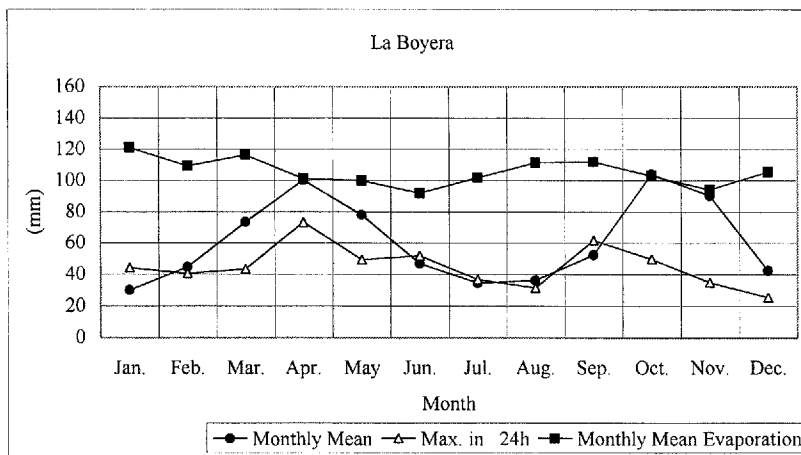
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Fig. B.1.5 (3/5) Fluctuation of Meteorological Data (Sta. Simijaca)



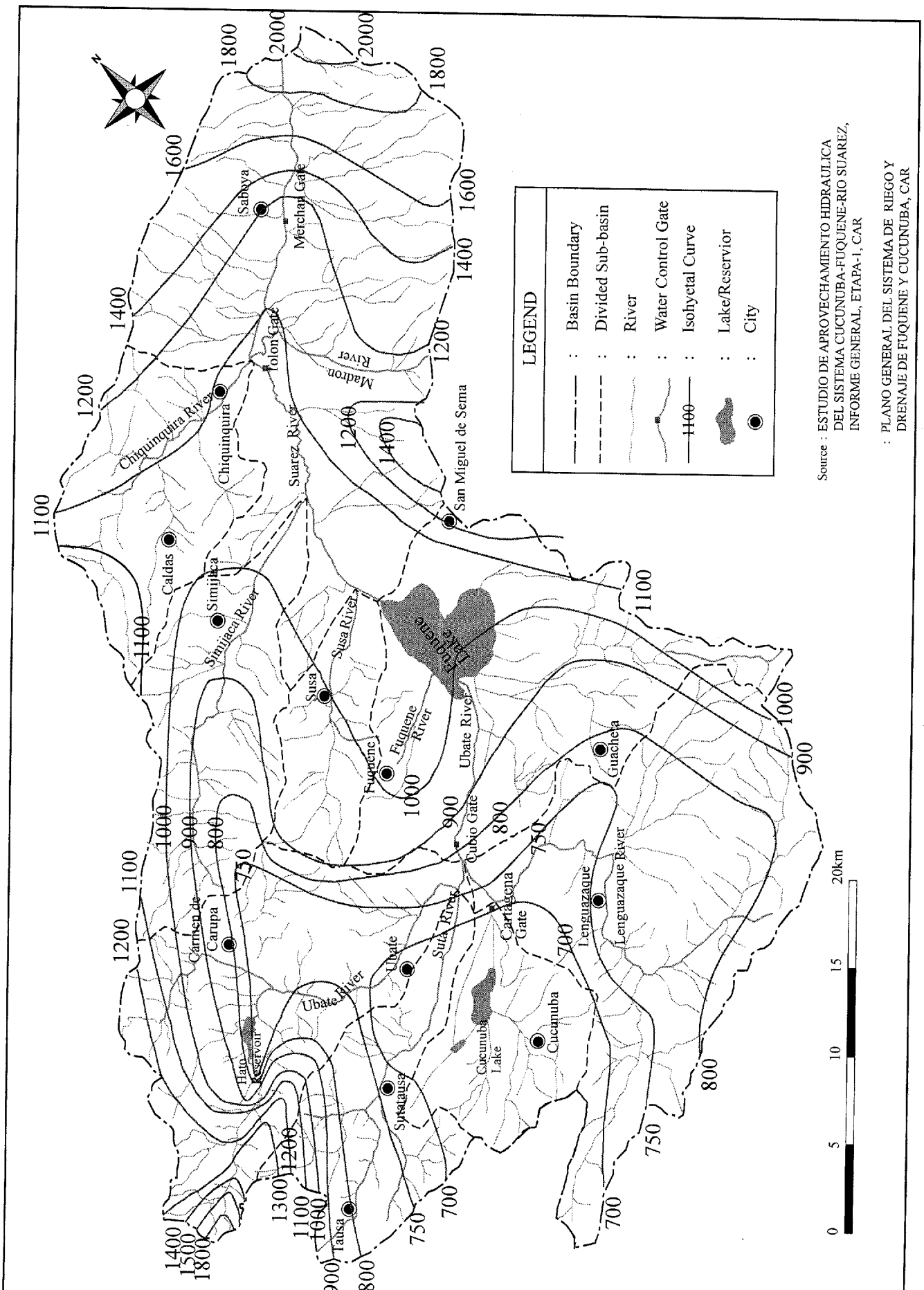
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Fig. B.1.5 (4/5) Fluctuation of Meteorological Data (Sta. Esclusa Tolon)



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Fig. B.1.5 (5/5) Fluctuation of Meteorological Data
(Sta. La Boyera, El Hato,
Isla Del Santuario)

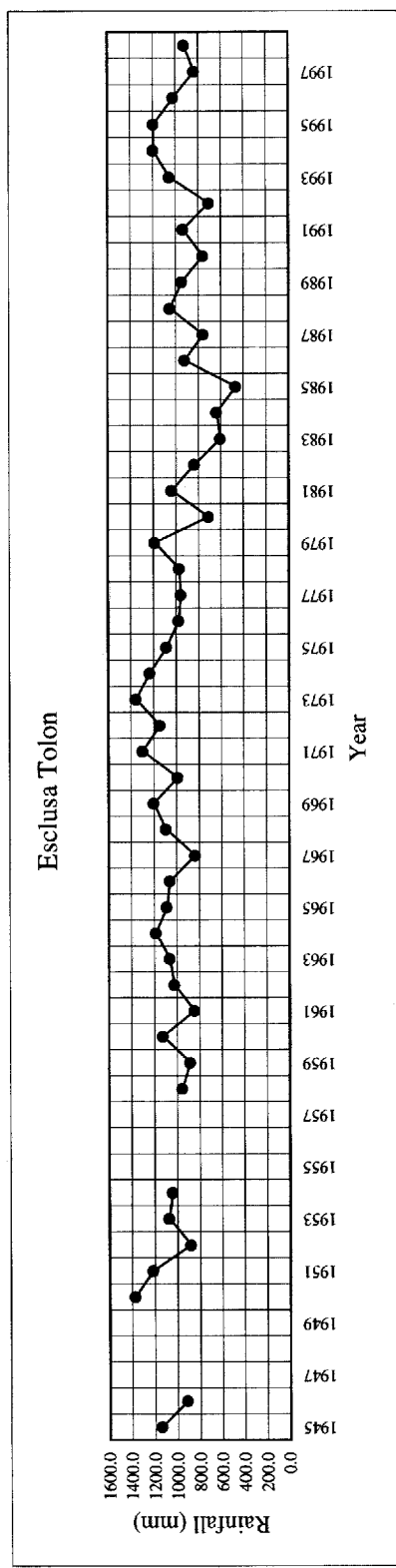
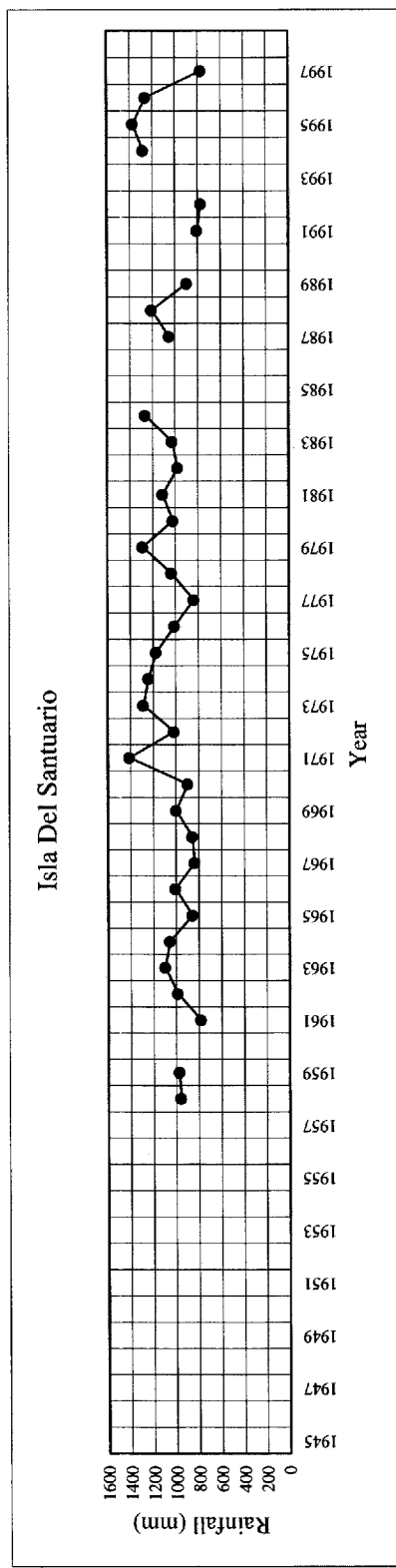
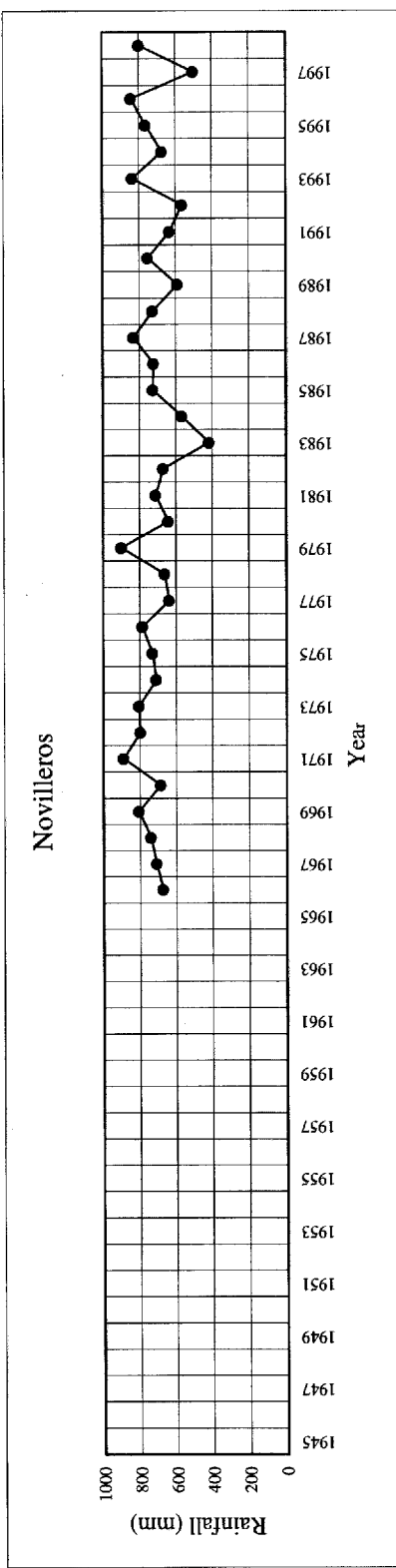


Source : ESTUDIO DE APROVECHAMIENTO HIDRAULICA DEL SISTEMA CUCUNUBA-FUQUENE-RIO SUAREZ, INFORME GENERAL, ETAPA-1, CAR

: PLANO GENERAL DEL SISTEMA DE RIEGO Y DRENAJE DE FUQUENE Y CUCUNUBA, CAR

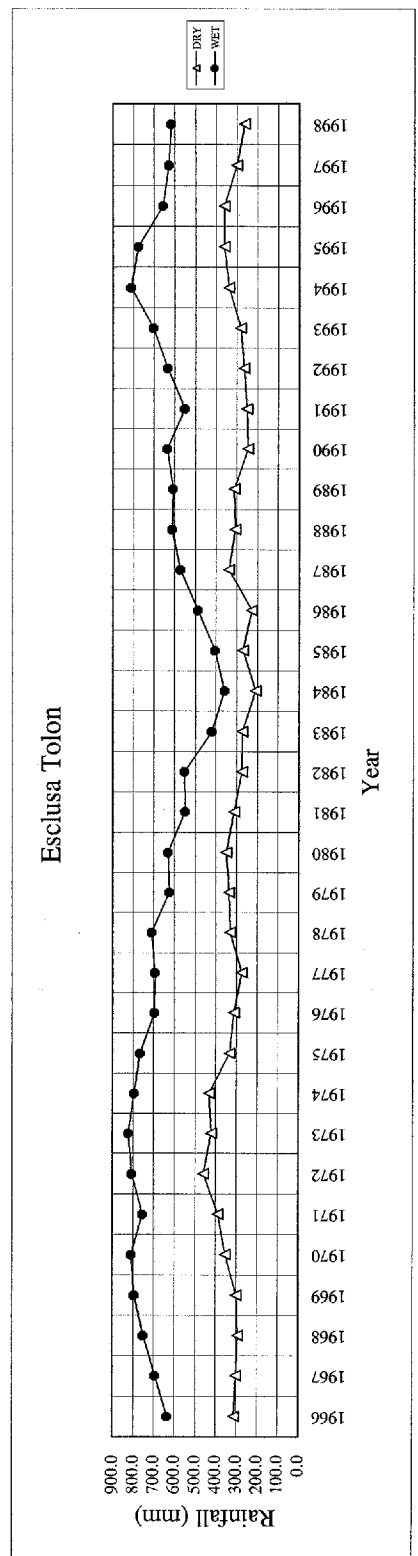
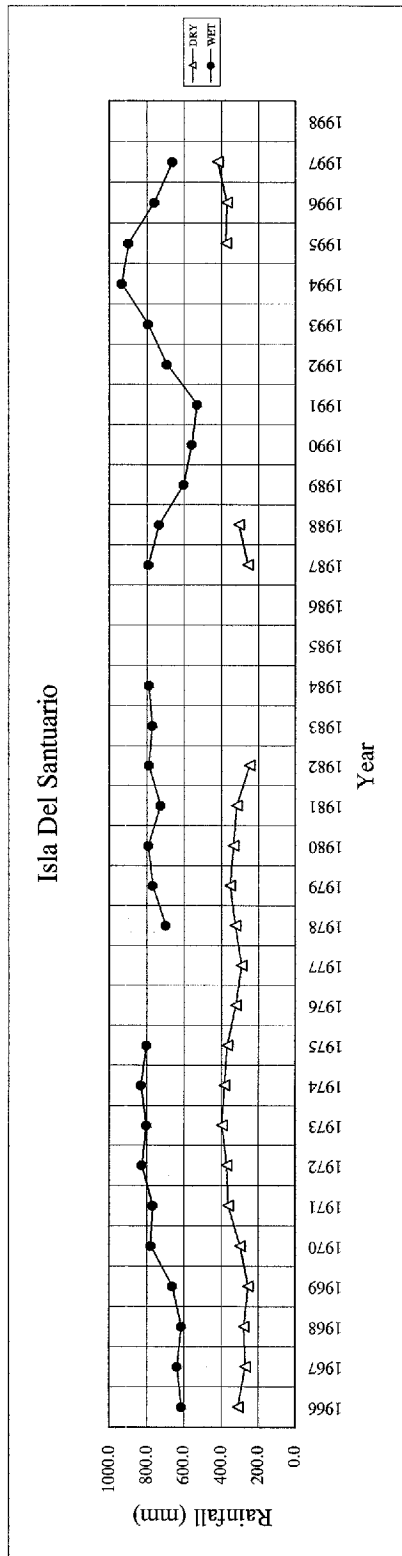
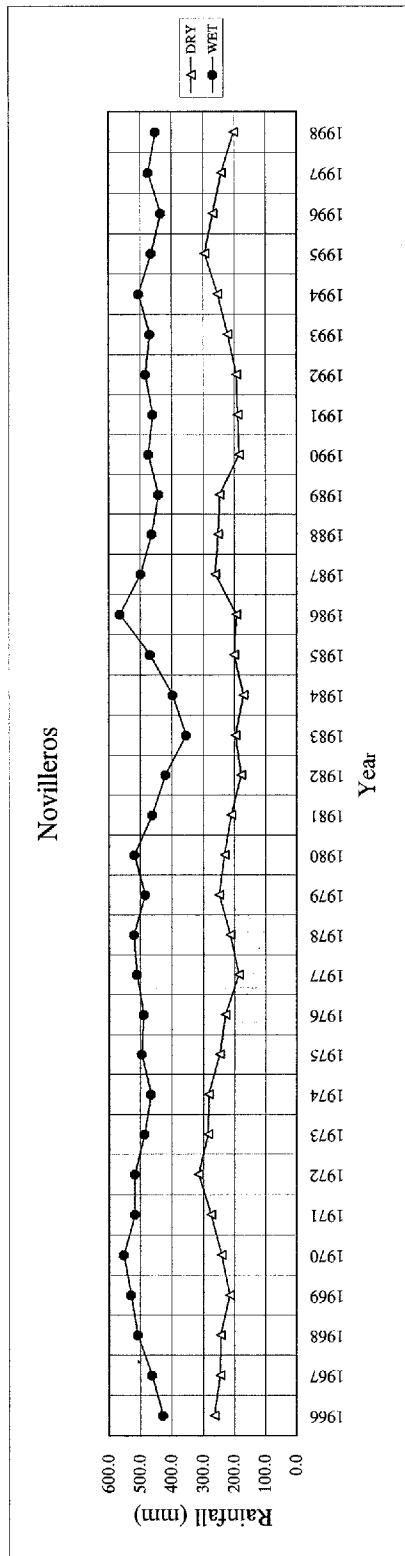
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Fig. B.1.6 Isohyetal Map (1986)



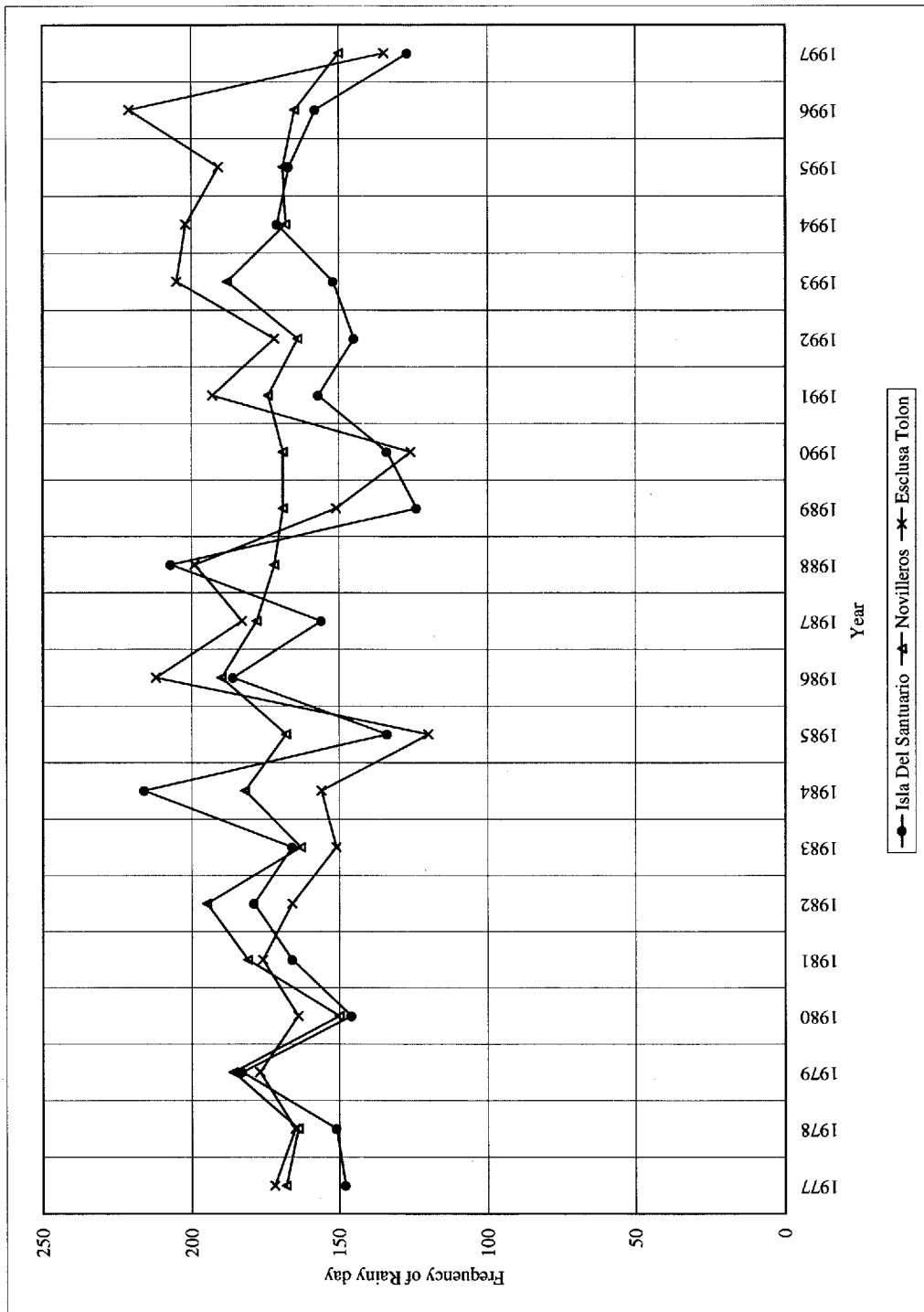
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REGIONAL ENVIRONMENTAL IMPROVEMENT PLAN
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Fig. B.1.7 Historical Change of Annual Rainfall



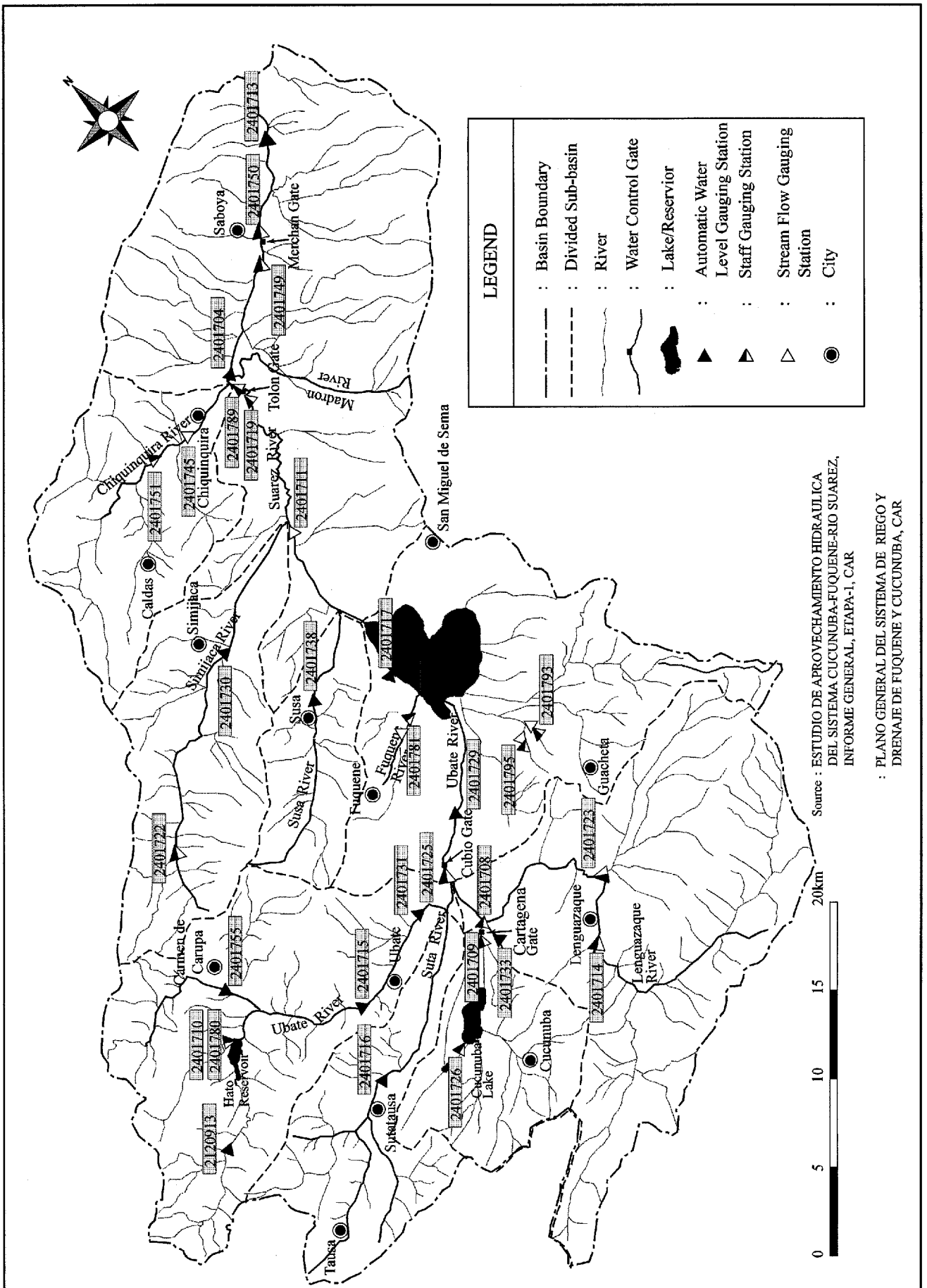
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Fig. B.1.8 Historical Change of Rainfall Distributed in Dry and Wet Seasons (3 Month Moving Average)



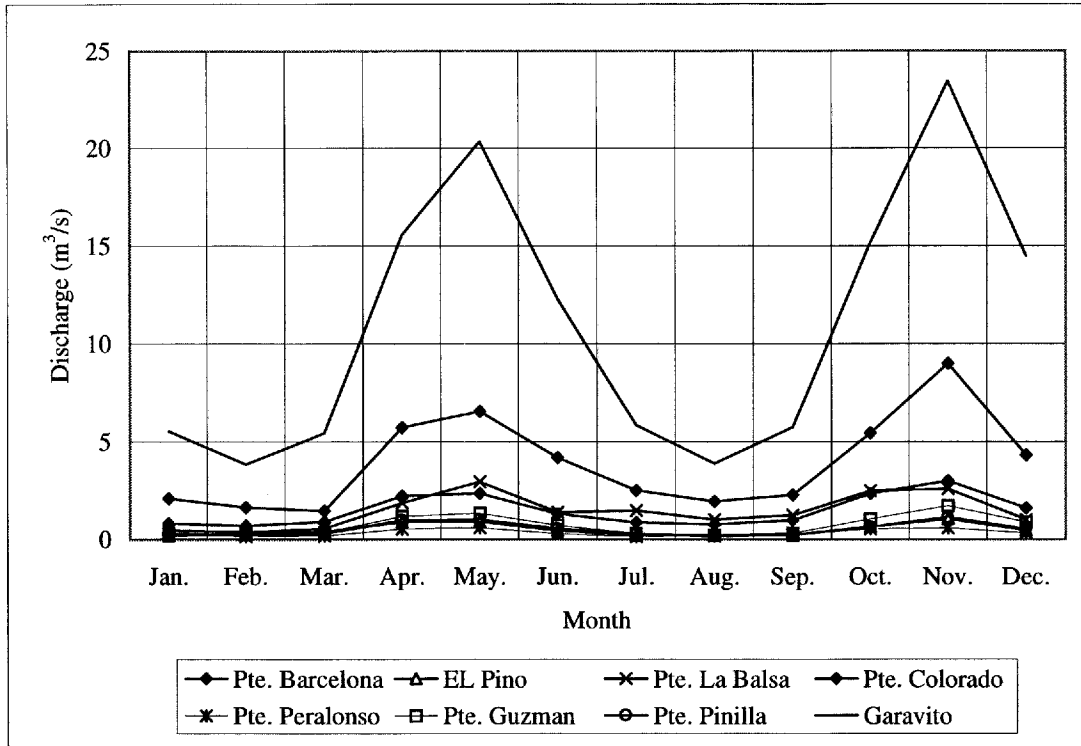
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Fig. B.1.9 Frequency of Rainy Day



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Fig. B.2.1 Location of Gauging Stations



Catchment Area (km ²)	(m ³ /s)							
	219.5	81.0	284.4	808.0	49.2	108.2	102.7	1729.3
Basin Station	Upper Ubate	Suta	Lenguazaque	Fuquene	Susa	Simijaca	Chiquinquirá	Suarez
	Pte. Barcelona	EL Pino	Pte. La Balsa	Pte. Colorado	Pte. Peralonso	Pte. Guzman	Pte. Pinilla	Garavito
Jan.	0.83	0.16	0.81	2.41	0.23	0.40	0.30	5.10
Feb.	0.71	0.24	0.72	1.96	0.15	0.32	0.23	3.42
Mar.	0.91	0.36	0.90	1.77	0.17	0.42	0.32	5.01
Apr.	2.24	0.88	2.22	6.05	0.53	1.24	1.02	15.12
May.	2.37	0.89	3.31	6.87	0.60	1.41	1.04	19.91
Jun.	1.31	0.42	1.73	4.51	0.29	0.79	0.59	11.84
Jul.	0.87	0.20	1.82	2.83	0.14	0.37	0.30	5.41
Aug.	0.78	0.20	1.36	2.27	0.17	0.30	0.19	3.45
Sep.	0.99	0.20	1.59	2.60	0.23	0.39	0.26	5.30
Oct.	2.36	0.63	2.85	5.78	0.53	1.11	0.66	14.74
Nov.	3.02	1.02	2.94	9.32	0.58	1.79	1.15	23.01
Dec.	1.62	0.44	1.36	4.64	0.32	0.95	0.54	14.05
Average	1.50	0.47	1.80	4.25	0.33	0.79	0.55	10.53
Record	'71-'98	'66-'98	'72-'98	'67-'90	'66-'98	'66-'98	'68-'98	'66-'94

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Fig. B.2.2 Monthly Mean Discharge at Principal Gauging Stations

Year	AVG	MAX	MIN
1966	39.02	39.93	38.20
1967	39.28	39.79	39.06
1968	39.32	40.14	38.91
1969	39.07	39.93	38.12
1970	38.96	39.97	38.53
1971	39.33	40.50	38.33
1972	38.93	40.36	38.40
1973	38.71	40.50	37.99
1974	38.96	40.04	38.34
1975	38.73	39.73	38.32
1976	38.96	39.76	38.18
1977	38.66	39.98	38.34
1978	38.74	39.51	38.39
1979	39.04	40.48	38.36
1980	38.76	39.99	38.43
1981	38.97	40.23	38.52
1982	39.09	40.07	38.51
1983	38.91	39.34	38.63
1984	38.94	39.18	38.68
1985	38.96	39.86	38.60
1986	39.08	39.97	38.61
1987	39.07	39.84	38.63
1988	38.98	39.68	38.71
1989	38.94	39.43	38.69
1990	38.98	39.47	38.14
1991	39.18	39.53	38.96
1992	38.62	39.22	38.12
1993	38.91	39.74	38.32
1994	39.20	39.57	38.89
1995	39.14	39.32	38.82
1996	39.20	39.47	39.01
1997	39.05	39.33	38.76
1998	39.03	39.75	38.32
AVERAGE	38.99	39.81	38.51
MAX	39.33	40.50	39.06
MIN	38.62	39.18	37.99

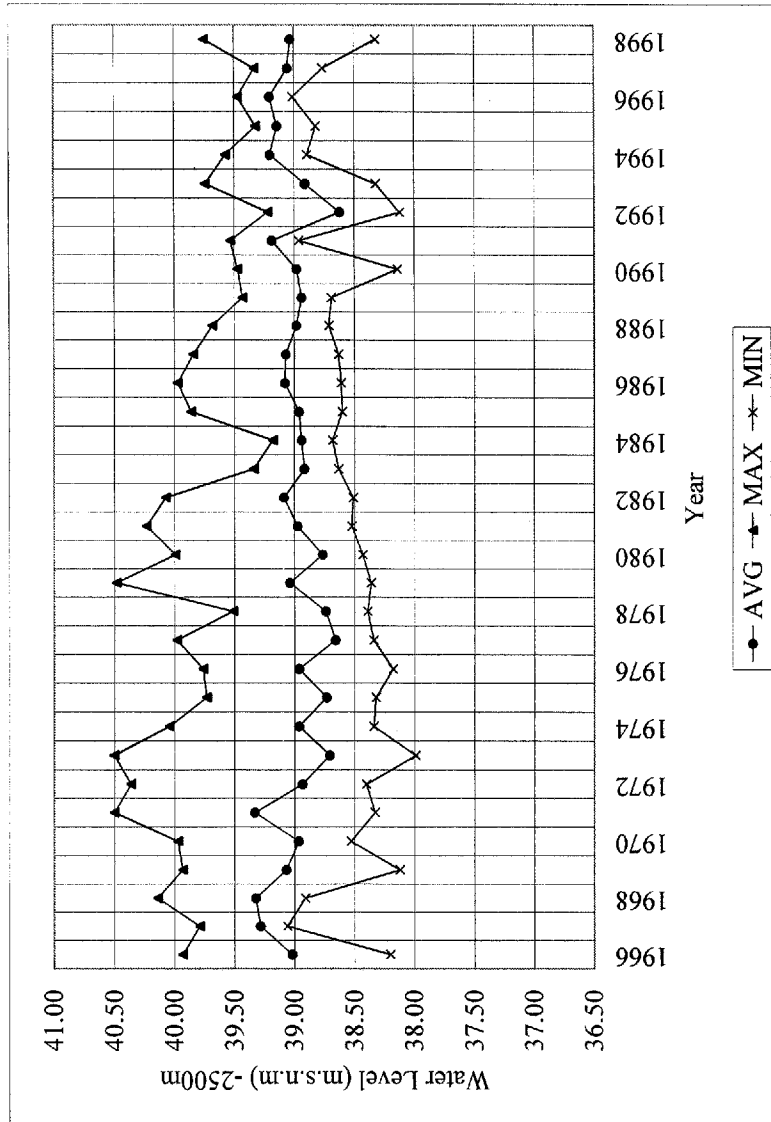
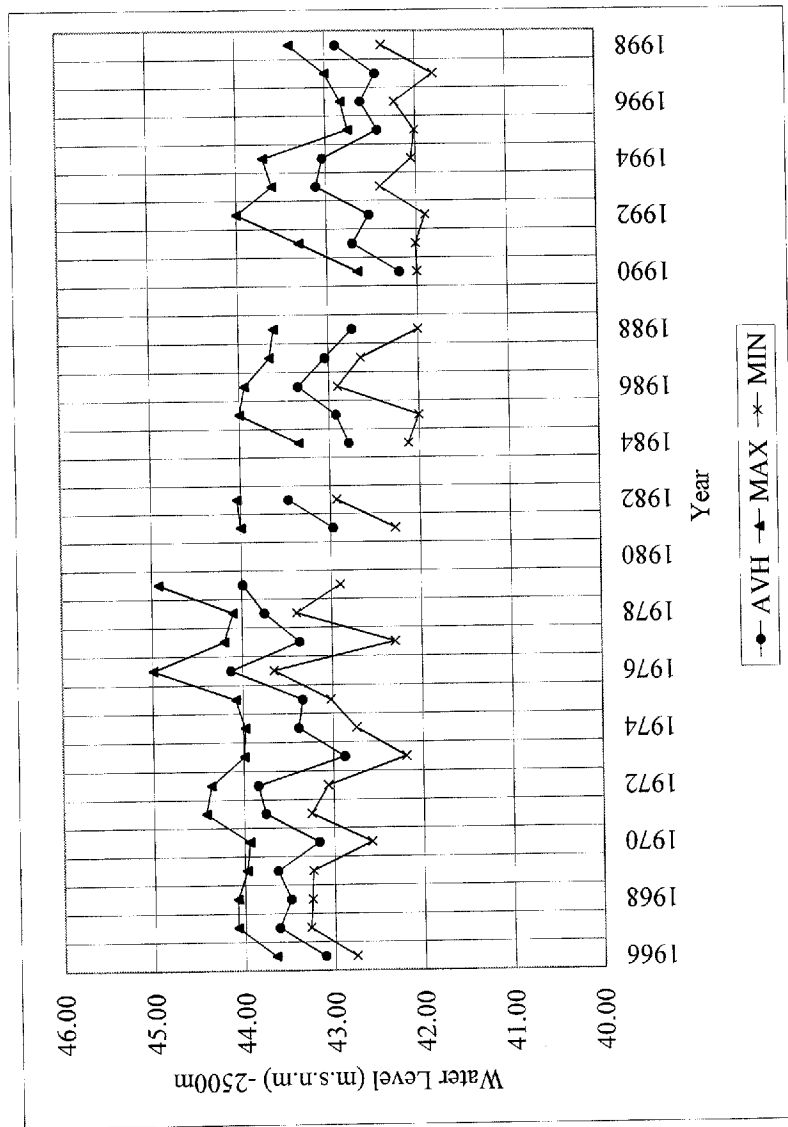


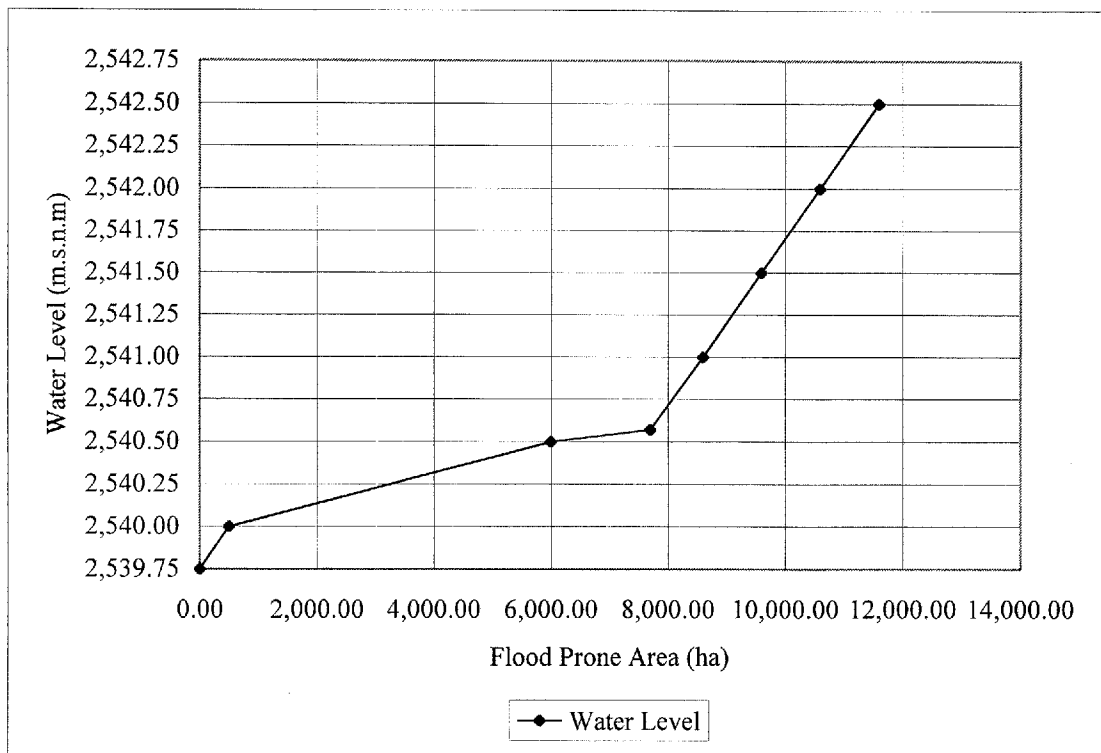
Fig. B.2.3 Historical Change of Water Level of Lake Fuquene

Year	(m.s.n.m)-2500m	
	AVH	MAX MIN
1966	43.11	43.66 42.76
1967	43.62	44.08 43.27
1968	43.49	44.08 43.25
1969	43.63	43.97 43.24
1970	43.17	43.94 42.58
1971	43.76	44.42 43.25
1972	43.84	44.36 43.06
1973	42.87	43.99 42.19
1974	43.38	43.98 42.74
1975	43.34	44.08 43.02
1976	44.13	44.99 43.65
1977	43.36	44.20 42.30
1978	43.75	44.10 43.39
1979	43.99	44.92 42.90
1980		
1981	42.97	44.00 42.28
1982	43.47	44.04 42.93
1983		
1984	42.78	43.34 42.12
1985	42.92	44.00 42.00
1986	43.34	43.94 42.90
1987	43.04	43.66 42.64
1988	42.73	43.61 42.00
1989		
1990	42.20	42.66 42.00
1991	42.71	43.31 42.01
1992	42.53	44.00 41.90
1993	43.11	43.60 42.40
1994	43.04	43.70 42.05
1995	42.42	42.75 42.01
1996	42.60	42.83 42.23
1997	42.44	43.00 41.80
1998	42.88	43.40 42.37
AVERAGE	43.15	43.82 42.57
MAX	44.13	44.99 43.65
MIN	42.20	42.66 41.80

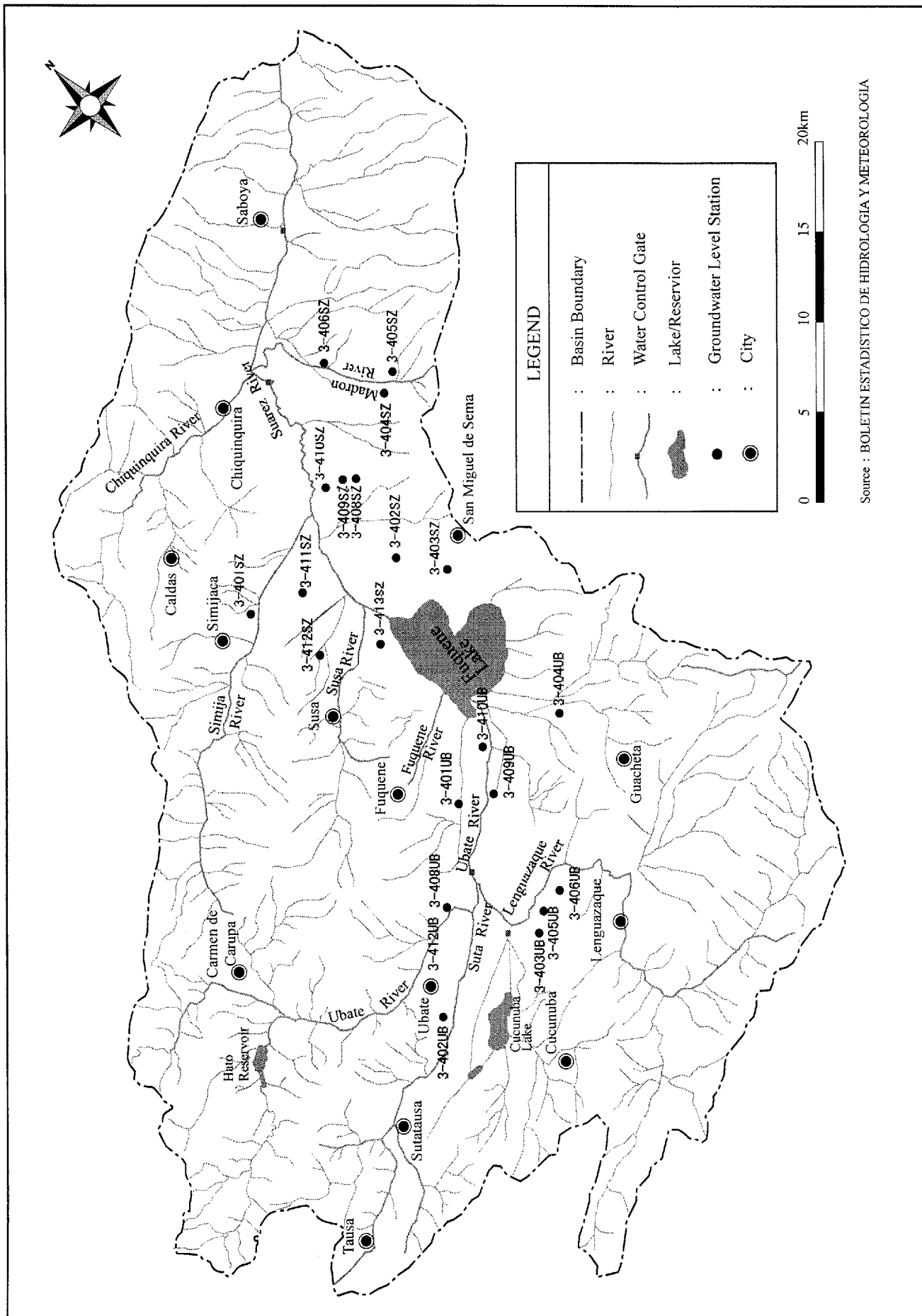


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Fig. B.2.4 Historical Change of Water Level of Lake Cucunuba



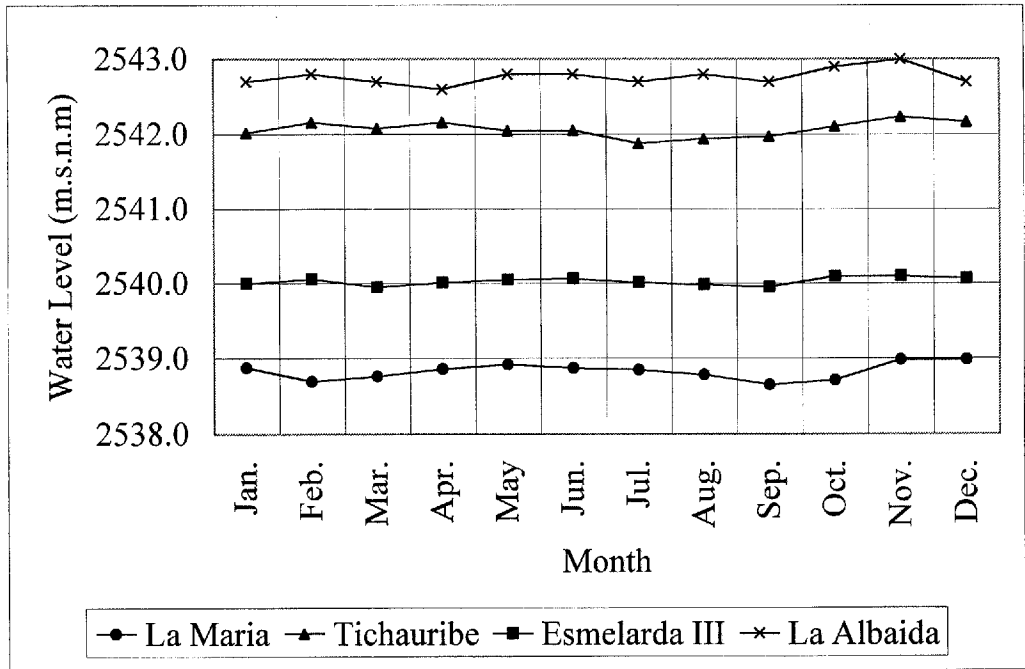
Water Level (m.s.n.m)	Flood Prone Area (ha)
2,539.75	0
2,540.00	500
2,540.50	6,000
2,540.57	7,700
2,541.00	8,600
2,541.50	9,600
2,542.00	10,600
2,542.50	11,600



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Fig. B.2.6 Location of Groundwater Stations

Source : BOLETIN ESTADISTICO DE HIDROLOGIA Y METEOROLOGIA

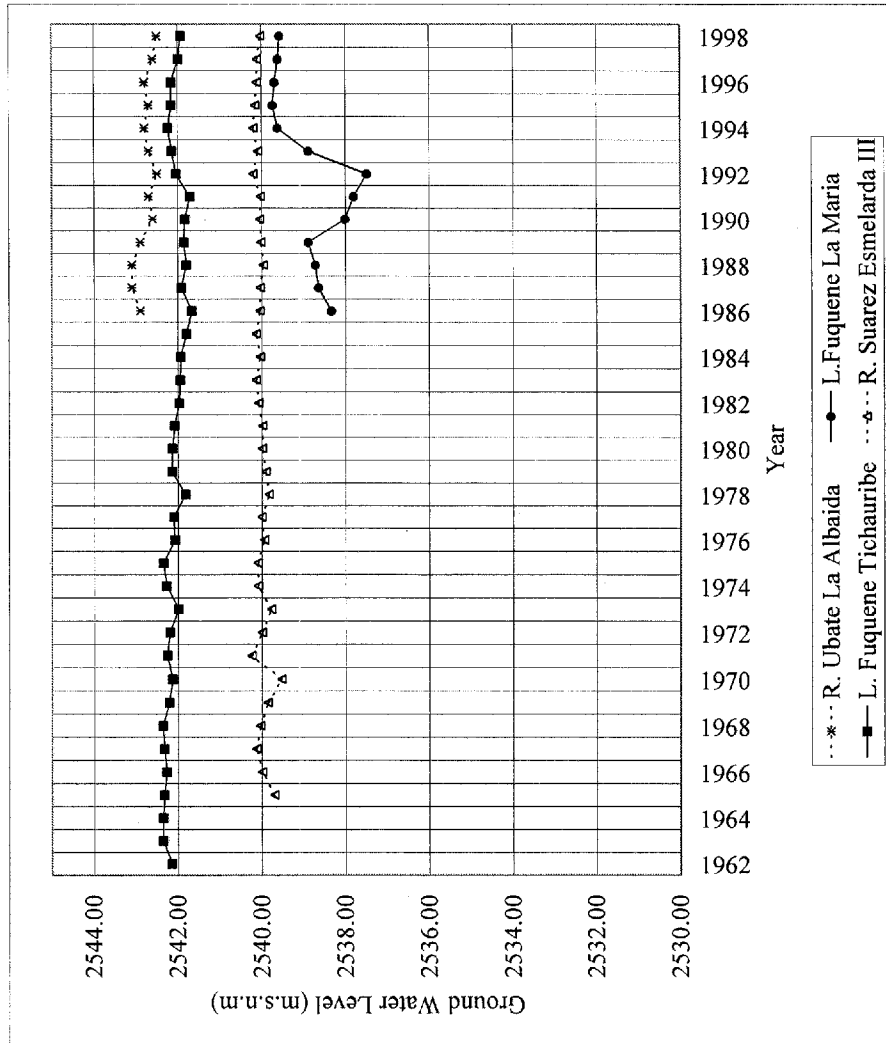


(m.s.n.m)				
No.	UB 3-408	UB 3-401	UB-3-404	SZ 3-410
Station	R. Ubate	L. Fuquene	R. Suarez	R. Suarez
Month	La Albaida	La Maria	Tichauribe	Esmelarda III
Jan.	2542.7	2538.9	2542.0	2540.0
Feb.	2542.8	2538.7	2542.2	2540.1
Mar.	2542.7	2538.8	2542.1	2540.0
Apr.	2542.6	2538.9	2542.2	2540.0
May	2542.8	2538.9	2542.1	2540.1
Jun.	2542.8	2538.9	2542.1	2540.1
Jul.	2542.7	2538.8	2541.9	2540.0
Aug.	2542.8	2538.8	2541.9	2540.0
Sep.	2542.7	2538.7	2542.0	2540.0
Oct.	2542.9	2538.7	2542.1	2540.1
Nov.	2543.0	2539.0	2542.2	2540.1
Dec.	2542.7	2539.0	2542.2	2540.1
Max.	2543.0	2539.0	2542.2	2540.1
Min.	2542.6	2538.7	2541.9	2540.0
Annual Rang	0.40	0.33	0.36	0.15

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Fig. B.2.7 Groundwater Level at Principal Stations

No.	UB 3-408 R. Ubate La Albaida	UB 3-401 L. Fuquene La Maria	UB 3-404 L. Fuquene Tichauribe	SZ 3-410 R. Suarez Esmelarda III
1962			2542.14	
1963			2542.35	
1964			2542.35	
1965			2542.33	2539.70
1966			2542.27	2539.99
1967			2542.32	2540.13
1968			2542.36	2540.04
1969			2542.21	2539.86
1970			2542.14	2539.53
1971			2542.25	2540.25
1972			2542.19	2540.00
1973			2541.99	2539.78
1974			2542.27	2540.09
1975			2542.34	2540.10
1976			2542.08	2539.94
1977			2542.10	2540.01
1978			2541.82	2539.83
1979			2542.14	2539.91
1980			2542.13	2539.99
1981			2542.08	2539.98
1982			2541.97	2540.07
1983			2541.94	2540.14
1984			2541.94	2540.04
1985			2541.80	2540.13
1986	2542.90	2538.33	2541.67	2540.04
1987	2543.10	2538.64	2541.92	2540.04
1988	2543.10	2538.71	2541.79	2539.96
1989	2542.90	2538.89	2541.86	2540.02
1990	2542.60	2538.00	2541.83	2540.04
1991	2542.70	2537.80	2541.71	2540.03
1992	2542.50	2537.49	2542.04	2540.20
1993	2542.70	2538.89	2542.14	2540.08
1994	2542.80	2539.62	2542.23	2540.20
1995	2542.70	2539.73	2542.16	2540.16
1996	2542.80	2539.69	2542.16	2540.12
1997	2542.60	2539.61	2541.99	2540.11
1998	2542.50	2539.56	2541.93	2540.03



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Fig. B.2.8 Historical Change of Groundwater

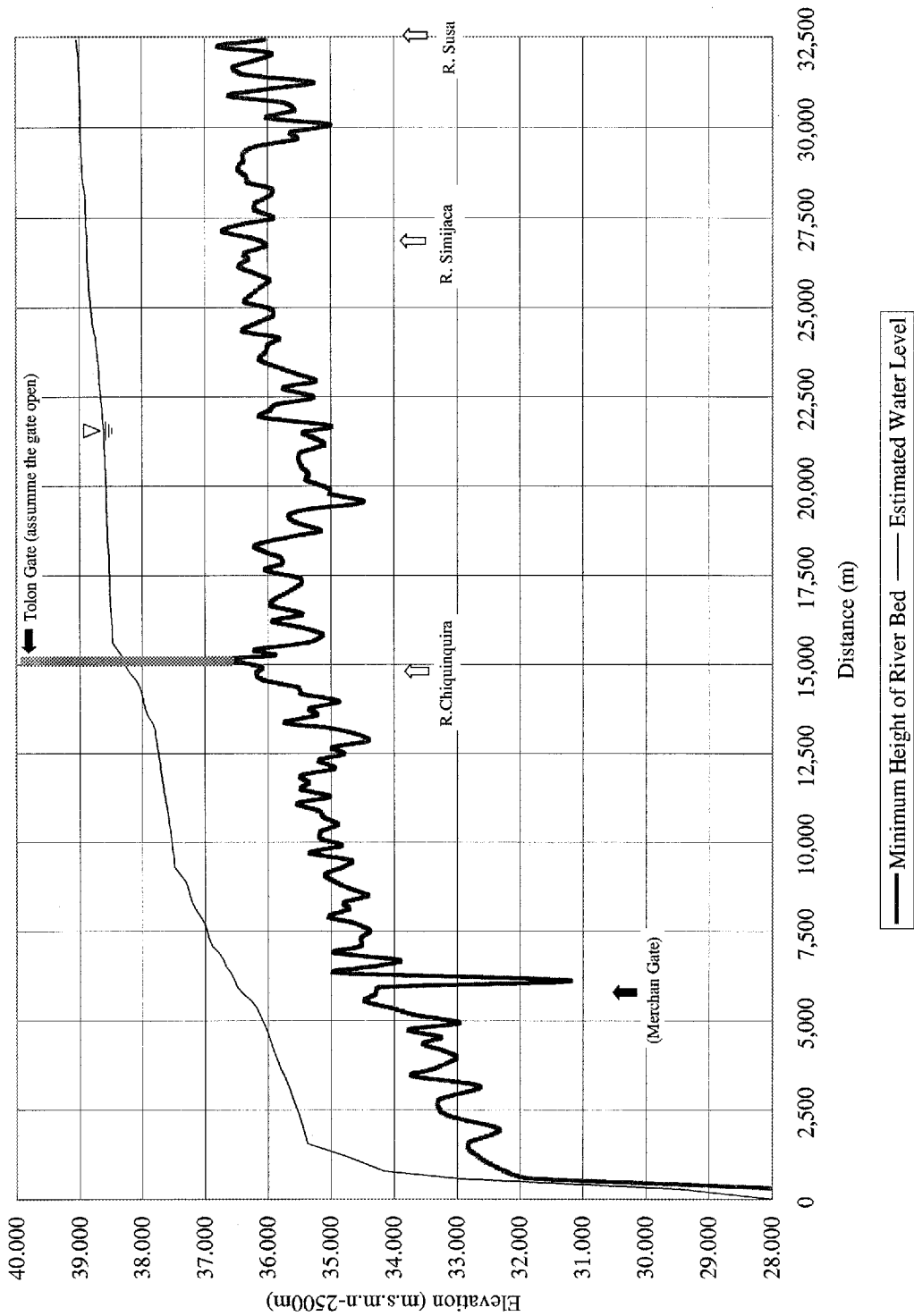
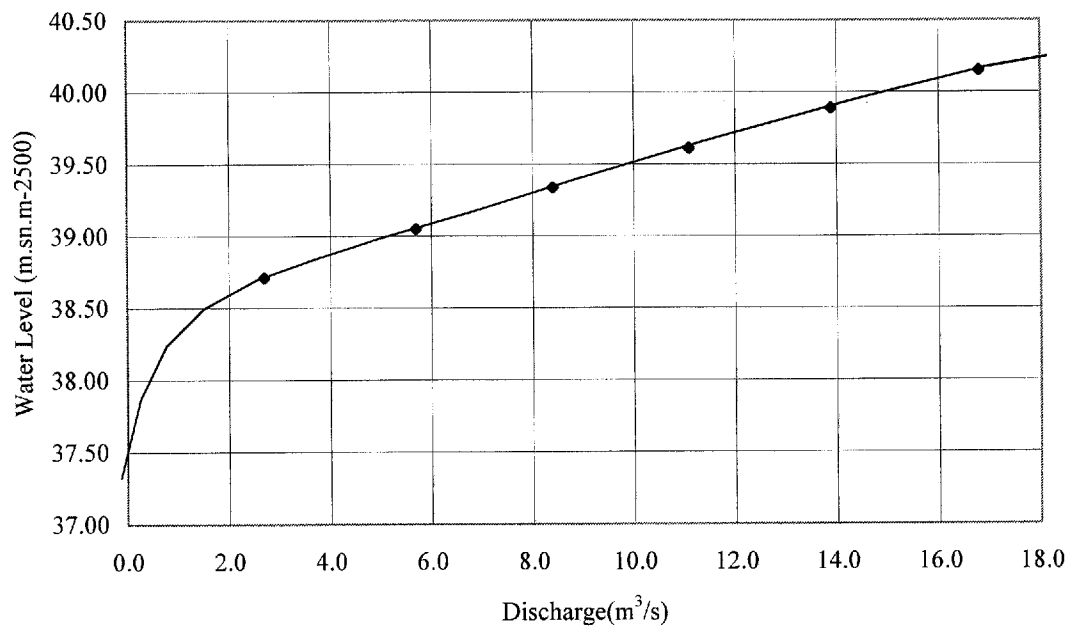
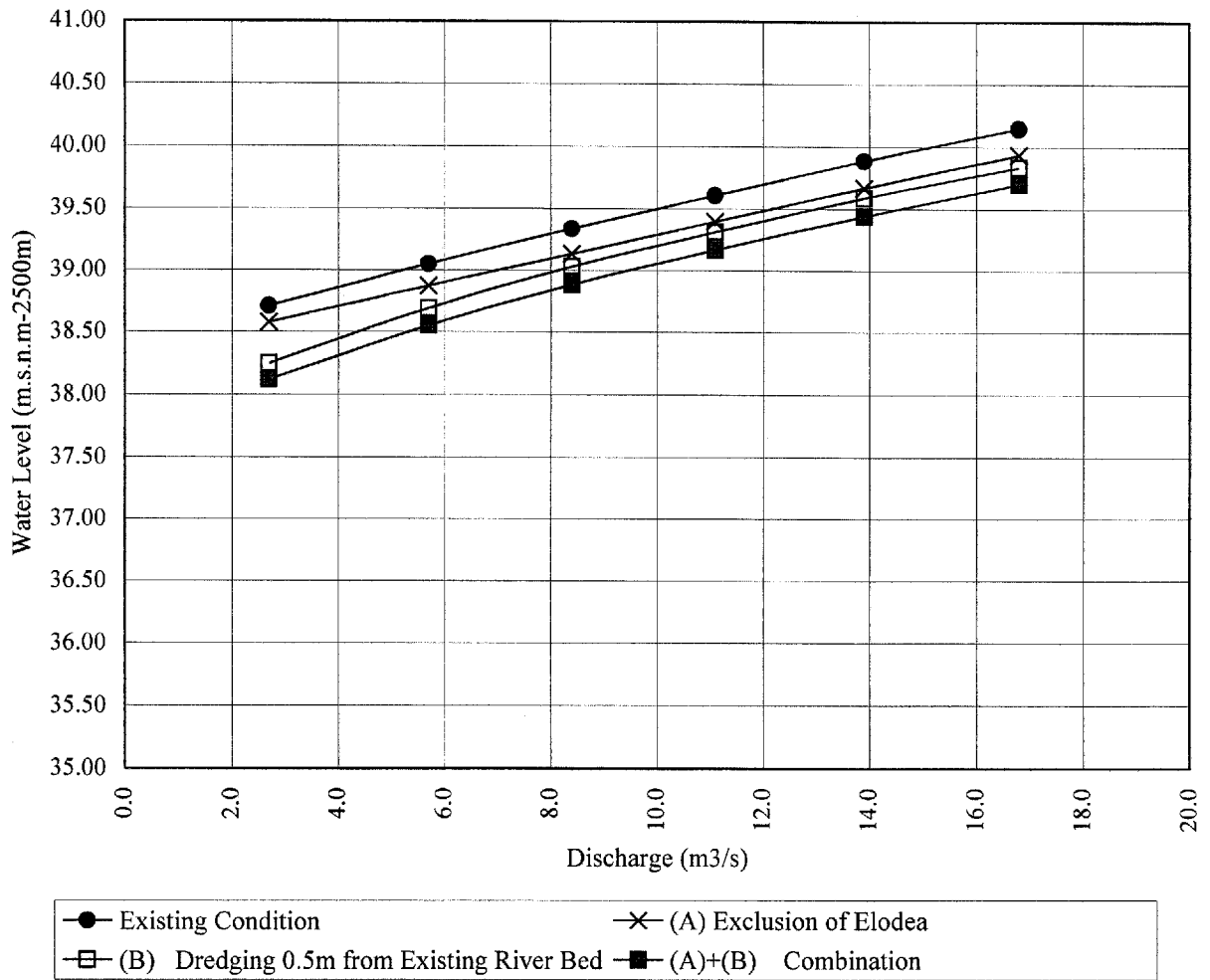


Fig. B.3.1 Estimated Water Level Profile of Suarez River



Water Level (m.s.n.m-2500)	Discharge (m ³ /s)
38.71	2.7
39.05	5.7
39.34	8.4
39.61	11.1
39.89	13.9
40.15	16.8



Discharge (m3/s)	Water Level (m.s.n.m-2500)			
	Existing Condition	(A) Exclusion of Elodea	(B) Dredging 0.5m from Existing River Bed	(A)+(B) Combination
2.7	38.71	38.58	38.25	38.12
5.7	39.05	38.87	38.69	38.55
8.4	39.34	39.14	39.03	38.88
11.1	39.61	39.40	39.31	39.17
13.9	39.89	39.67	39.59	39.44
16.8	40.15	39.94	39.84	39.70
Case	-	Case1	Case2	Case3