

C4 WATER QUALITY SURVEY

Water quality and siltation survey was conducted for river and well water to assess briefly the fertility of sediment brought by Mekong river and the suitability of river and well water for drinking purpose. Since the method adopted was a simplified preliminary test for the basic items the result is insufficient to evaluate the whole situation. Test for heavy metals and carcinogens was not included.

C4.1 Sampling site

C4.1.1. River water sampling sites

Seven (7) sites were selected along Mekong, Tonle Sap and Bassac Rivers. The sites, selected to coincide with some of the hydrological stations and based on safe and easy access, give a reasonable coverage of the study area (Figure C4.1).

Along Mekong River:	R1, Kompong Cham (Ferry crossing)
	R2, Neak Luong (Ferry crossing)
	R3, Prek Dach District
Along Tonle Sap River:	R4, Prek Kdam (Ferry crossing)
At the confluence :	R5, Chaktomu
Along Bassac River :	R6, Prek Tanom
	R7, Koh Khel

C4.1.2 Well water sampling sites

Seven (7) existing wells, one each on both banks of upstream, middle stream and downstream of the Mekong River and along Bassac River were selected (Figure C4.1). Due to poor access, no well on the left bank of Bassac was selected. The wells are shallow well (dug/open or sealed tube wells equipped with hand pump), 3-10m deep with water depth of 1-5m.

Upstream	W1 & W2, in & around Kompong Cham
Middle stream	W3 & W4, in & around Phnom Penh
Downstream	W5 & W6, in & around Neak Luong
	W7, in & around Koh Khel

C4.2 Sampling schedule and test method

Two surveys, one each for dry (April & May) and wet (September & October) season, were conducted for each of the sites, and at the same river and well water sampling locations whenever possible. The samples collected were tested in-situ with simplified instrument (Water Checker U-10, a product by HORIBA, JAPAN) for items such as pH, Ec, SS, DO, water temperature and NaCl. Simple test for Colon Bacillus and bacteria was conducted by inoculating small plastic bags containing the reagents with 1 ml of sampled water in-situ. The samples were incubated at temperature of about 36-37°C for about 20-30 hours prior to colony count. Any appearance of colony, usually reddish or pink in color for C. Bacillus and bluish for bacteria, will conclude that the water is infested with C. Bacillus and/or bacteria and is therefore unfit for drinking without boiling or other sterilization method. Test to specify the strains and species of C. Bacillus is not performed.

In addition to the simplified in-situ test, the samples collected during wet season survey were brought back to analyze for the analytical items available at GDIMH laboratory. About 6 liters (4x 1.5 liter Polyethylen Terephthalate bottle) of water were sampled for each location.

C4.3 Results of Survey

The results of simplified in-situ test are shown in Table C4.1. Detail analysis results are given in Table C4.2

River water samples of wet season, on the whole, show a lower pH value, higher SS content and lower temperature, when compared with dry season samples. The test for C. Bacillus & bacteria also show that they are somewhat diluted by the large deluge. The results suggest that the quality of river water, in terms of salinity and soil permeability problem (TDS & adjusted SAR), is within the acceptable ranges for irrigation water indicated in published guideline values. However, removal of suspended solid is required, especially during wet season, when it is intended for drinking purpose.

The difference in the results for well water samples between dry and wet season is insignificant. Except for the heavy metals and carcinogens of which no test was conducted, the river and well water can be used for drinking. However, as it is evident from the C. Bacillus test well water can be made safer for drinking by boiling or chemical treatment.

Total suspended solids (TSS) in the river during dry season is insignificant, less than 10PPM. River water survey in the wet season of 1996 shows that Mekong, Bassac and Tonle Sap rivers contain about 900PPM, 400PPm and 80PPM of TSS, respectively. The data at GDIHM shows a lower value: 148-262PPM, 13-22 and 168-315 along Mekong, Tonle Sap and Bassac river, respectively. TSS value also shows a decreasing trend as Mekong flows southward, indicating siltation along this reach. TSS of reverse flow in Tonle Sap river is much lower than that in Mekong, showing that much of the sediment is deposited downstream of Prek Kdam.

River water in the wet season, with a TSS of 200PPM, was estimated to deposit about 5mm thick of sediment in the flooded area.

C4.4 Existing Water Quality Monitoring

The Water Quality Laboratory of GDIHM, manned by 2 engineers and 4 technicians, is currently monitoring water quality of surface water such as river, pond, spring and well in the Mekong, Tonle Sap and Bassac Basin. The Lab also provides water quality test service for samples brought in from wells in the provinces.

See below for the name and date when sampling and measurement were started for the main stations in the study area. Monthly sampling and measurement are made for each of the station.

<u>River System</u>	<u>Station name</u>	<u>Date started</u>
Mekong River	Kratie	Jul. 1995
	Kompong Cham	Aug. 1993
	Phnom Penh	Aug. 1993
	Neak Luong	Aug. 1993
Tonle Sap	Prek Kdam	Aug. 1993
	Chrouy Changvar (on the right bank of Japanese Friendship Bridge)	Jul. 1995
Bassac River	Takhmau	Jul. 1995
	Koh Khel	Aug. 1993
Prek Thnot	Prek Thnot	Jul. 1995

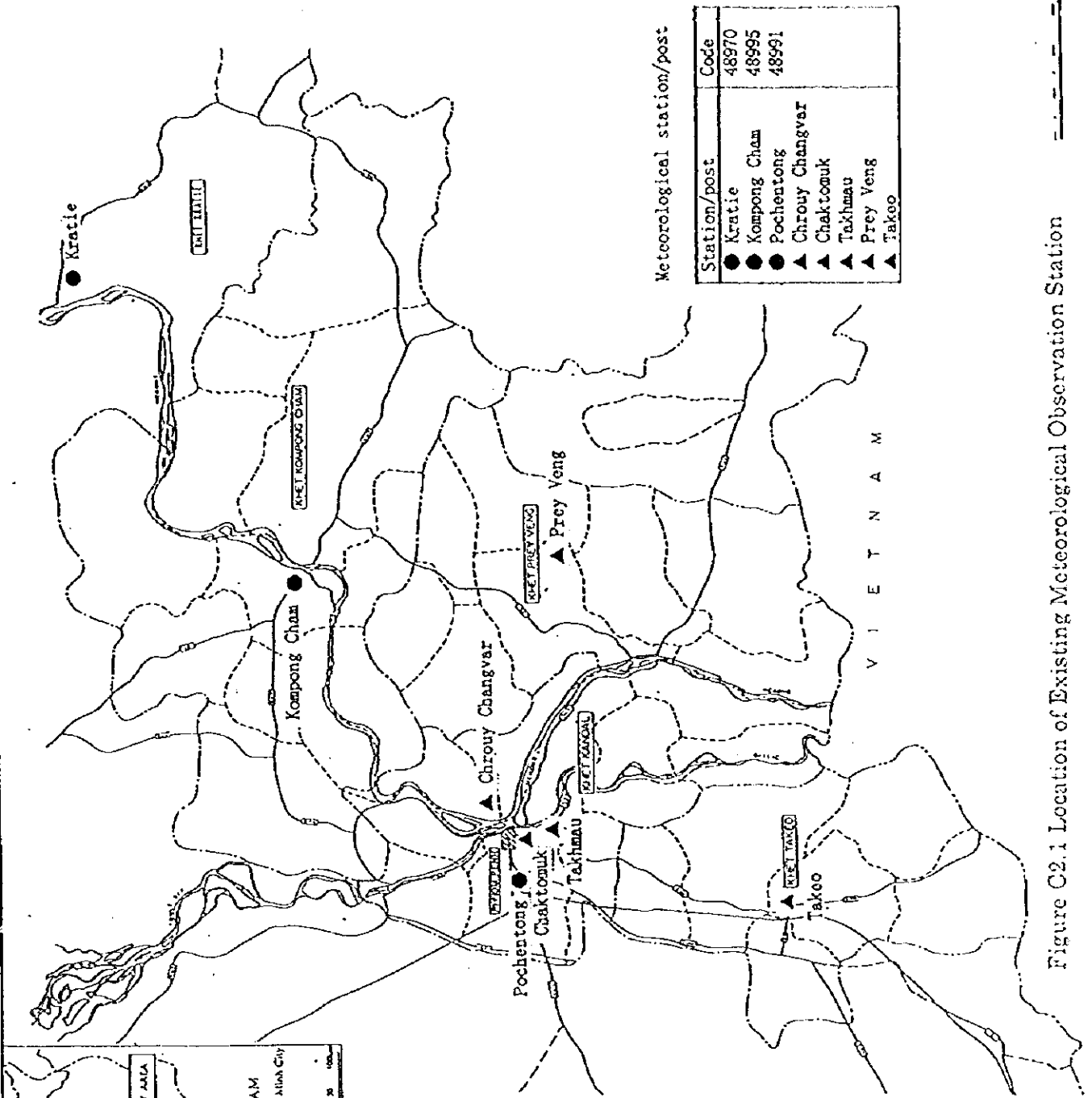
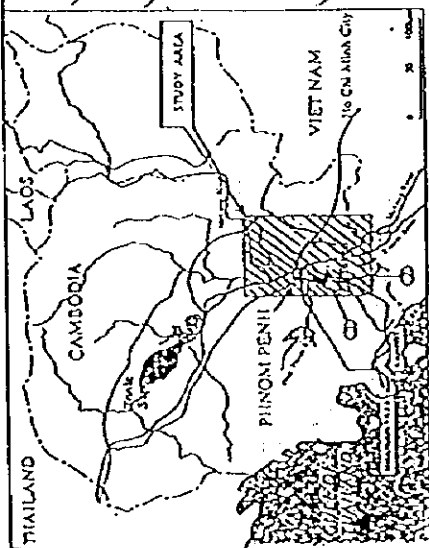


Figure C2.1 Location of Existing Meteorological Observation Station

Meteorological data at Pochentong (1985~1995)
 (No. 991, 11° 33' N, 104° 51' E, 10m M.S.L.)

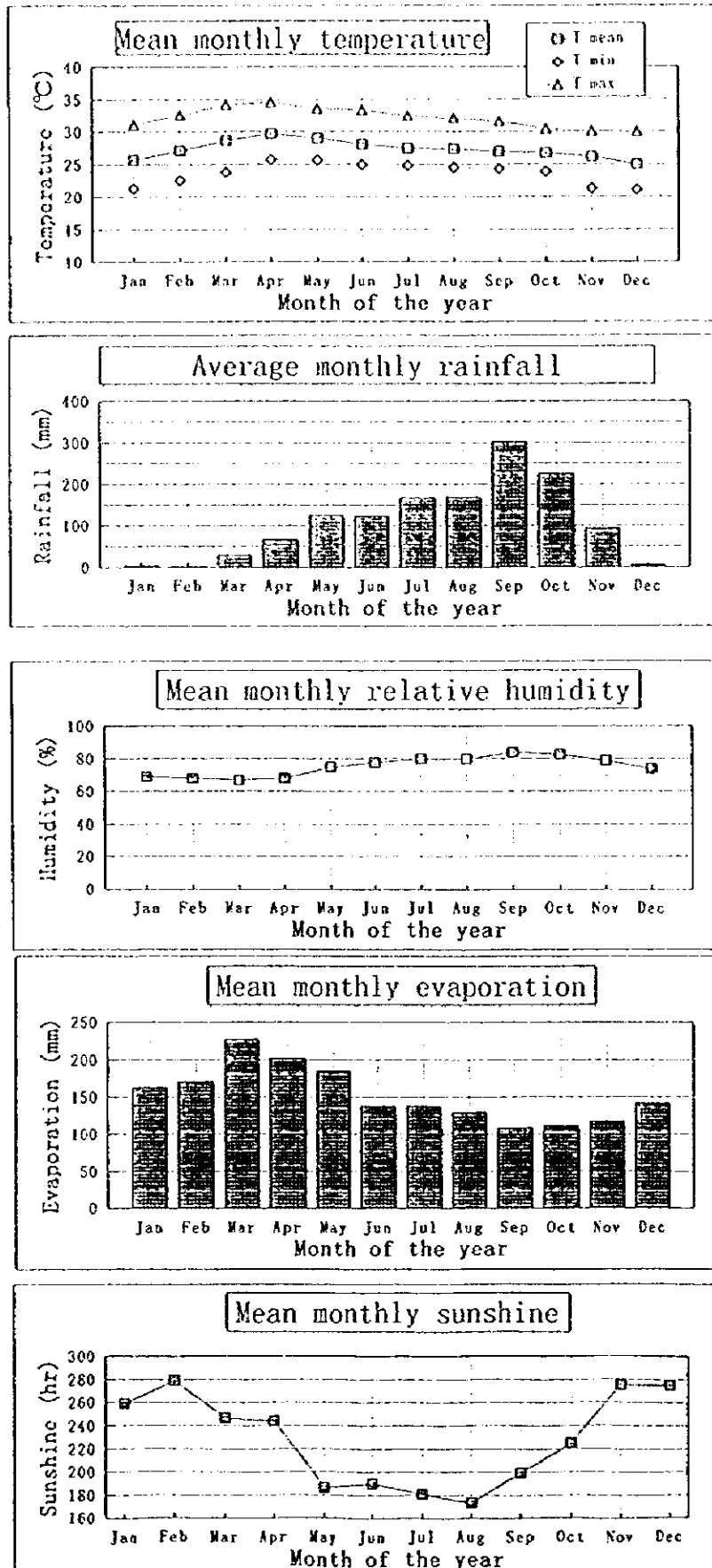
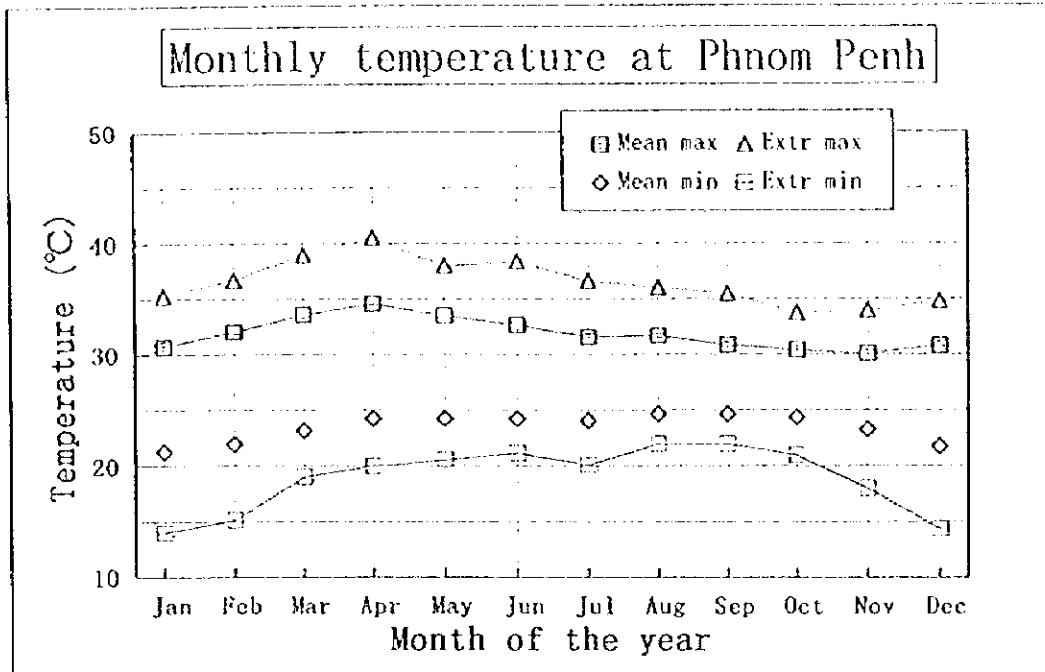
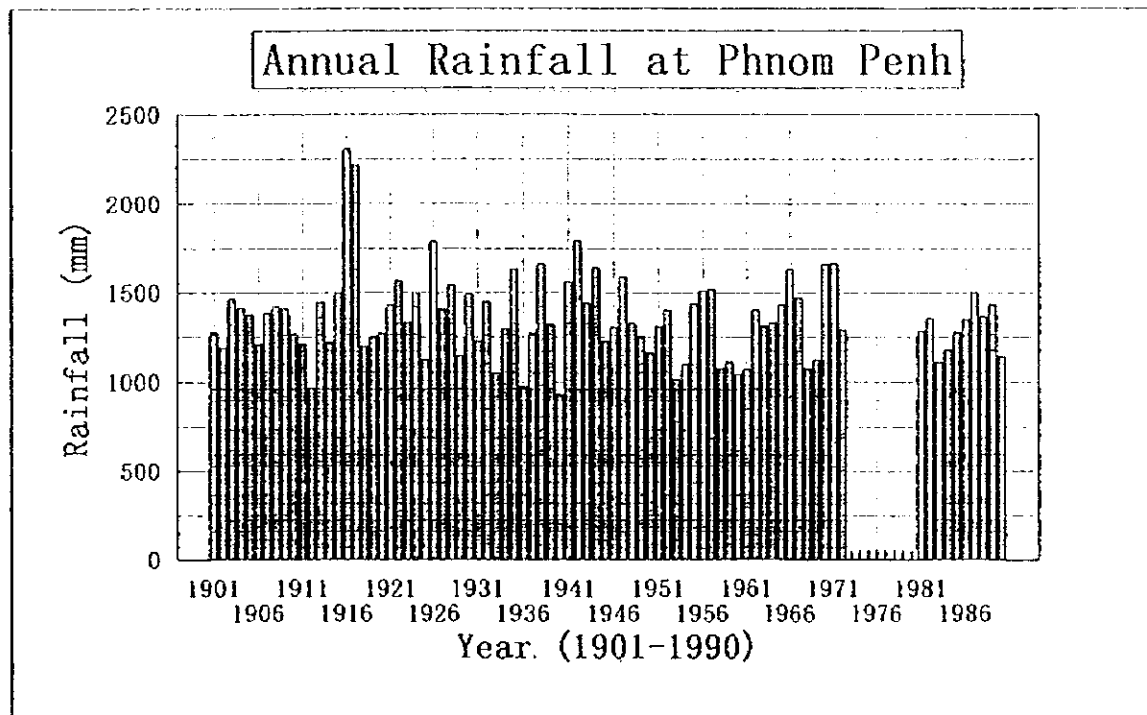


Figure C2.2 Basic Meteorological Data - Pochentong

Temperature and rainfall at Phnom Penh



Period of record: 1907-1909, 1919-1921, 1923-1938



Note: Mean temperature and annual rainfall from old record.

Figure C2.3 Temperature and Rainfall Record - Pochentong

Monthly rainfall at Kratie

	1981	1982	1983	1984	1985	1986	1987	1988	1992	1993	1994	Average
Jan	0.0	0.0	22.6	0.0	0.9	0.0	0.0	0.6	0.3	5.9	0.0	2.8
Feb	0.0	0.0	0.0	0.8	27.5	0.8	0.1	25.5	0.0	0.0	0.0	5.0
Mar	0.6	273.7	0.0	0.0	5.5	0.0	0.0	0.0	0.0	47.7	71.4	36.3
Apr	162.3	33.4	0.0	176.0	117.6	87.8	11.6	153.3	8.1	40.2	55.5	76.9
May	154.9	131.8	127.6	181.1	157.5	190.4	120.5	242.7	49.4	271.4	204.7	166.5
Jun	385.4	295.9	280.8	110.5	197.7	164.9	293.4	171.1	357.8	254.0	329.7	258.3
Jul	432.3	148.5	177.7	295.9	159.5	227.8	30.0	156.0	165.7	219.2	242.4	205.0
Aug	227.2	517.4	454.3	193.4	164.0	311.4	0.0	202.1	499.9	259.7	307.2	285.1
Sep	183.8	436.4	221.2	217.4	226.2	349.3	258.9	196.1	366.6	413.7	280.6	286.4
Oct	168.7	66.9	379.8	137.7	105.8	180.9	140.8	240.6	310.6	162.2	131.5	184.1
Nov	60.2	51.6	58.5	10.0	36.6	123.0	74.1	82.9	0.0	38.8	6.0	49.2
Dec	0.0	0.0	0.0	0.0	0.3	0.0	0.2	0.0	0.4	0.0	4.3	0.5
Annual	1775.4	1955.6	1722.5	1322.8	1199.1	1636.3	929.6	1470.9	1758.8	1712.8	1633.3	1556.1
Max	67.6	185.3	89.0	120.0	86.5	96.2	78.1	113.1	120.0	110.8	73.0	

Note: Max is maximum daily rainfall

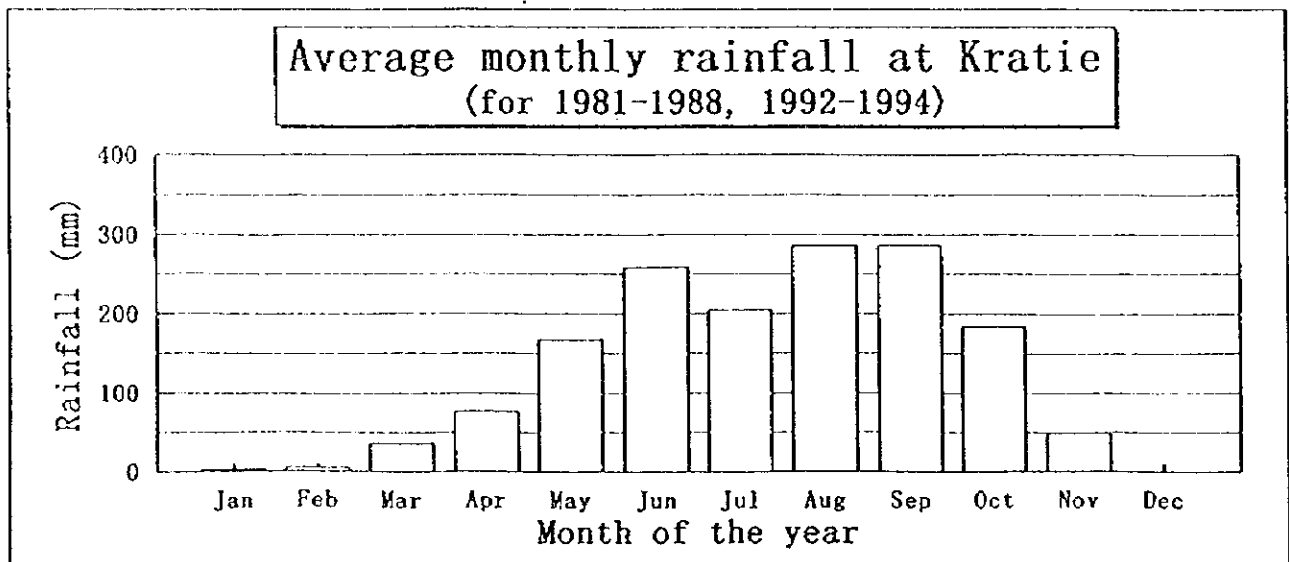
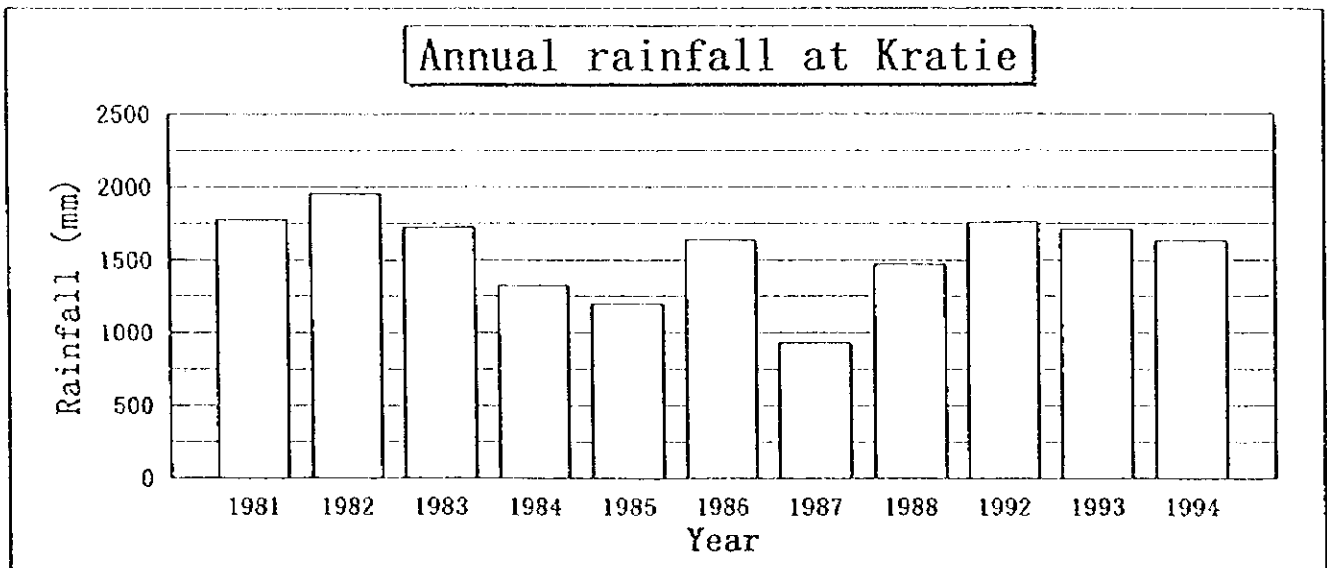


Figure C2.4 Annual and Mean Monthly Rainfall - Kratie

Monthly rainfall at Kompong Cham

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1991	1992	1993	1994	1995	Average
Jan	0.0	0.0	10.6	7.2	12.5	0.0	0.0	0.9	5.8	0.0	26.6	30.0	0.0	0.0	6.7
Feb	31.9	0.0	0.0	3.5	0.0	0.3	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	2.6
Mar	24.6	61.6	0.0	42.6	9.0	6.0	2.5	0.0	118.4	0.0	0.0	80.8	81.3	114.6	38.7
Apr	72.8	117.3	11.0	151.5	218.4	54.4	13.7	156.2	75.2	61.1	14.9	19.1	165.6	14.3	81.9
May	191.3	113.0	112.0	159.8	188.3	177.9	82.1	150.2	211.0	196.1	193.7	213.0	178.7	241.7	165.0
Jun	113.0	411.5	158.1	128.5	143.3	0.0	153.1	256.4	170.2	110.8	283.8	165.3	423.7	181.4	192.8
Jul	151.2	205.5	146.2	167.2	269.7	0.0	51.1	159.6	279.1	288.6	190.7	317.2	118.1	181.1	180.4
Aug	138.2	285.9	291.9	89.3	128.0	297.5	53.9	128.2	318.7	204.5	269.8	103.0	102.3	115.1	180.4
Sep	238.6	112.3	187.5	301.4	199.6	320.7	353.1	259.3	209.4	164.4	339.7	243.3	288.5	458.5	262.6
Oct	224.4	93.6	278.2	241.3	233.4	151.0	212.0	182.7	342.0	188.5	218.4	334.8	147.9	238.9	220.5
Nov	119.7	111.9	94.4	53.7	79.3	118.5	197.9	102.4	83.4	0.0	48.0	47.3	0.0	38.9	78.2
Dec	0.0	0.0	0.0	0.4	1.0	37.0	0.0	0.0	0.0	4.0	13.9	10.3	32.2	1.5	7.2
Annual	1305.7	1512.6	1289.9	1346.4	1482.5	1163.3	1119.4	1395.9	1813.7	1218.0	1508.5	1564.1	1539.3	1586.0	1417.5
max	69.2	90.1	72.6	66.7	91.6	81.6	90.6	101.5	88.6	61.4	81.5	96.3	126.5	116.8	

Note: Max is maximum daily rainfall

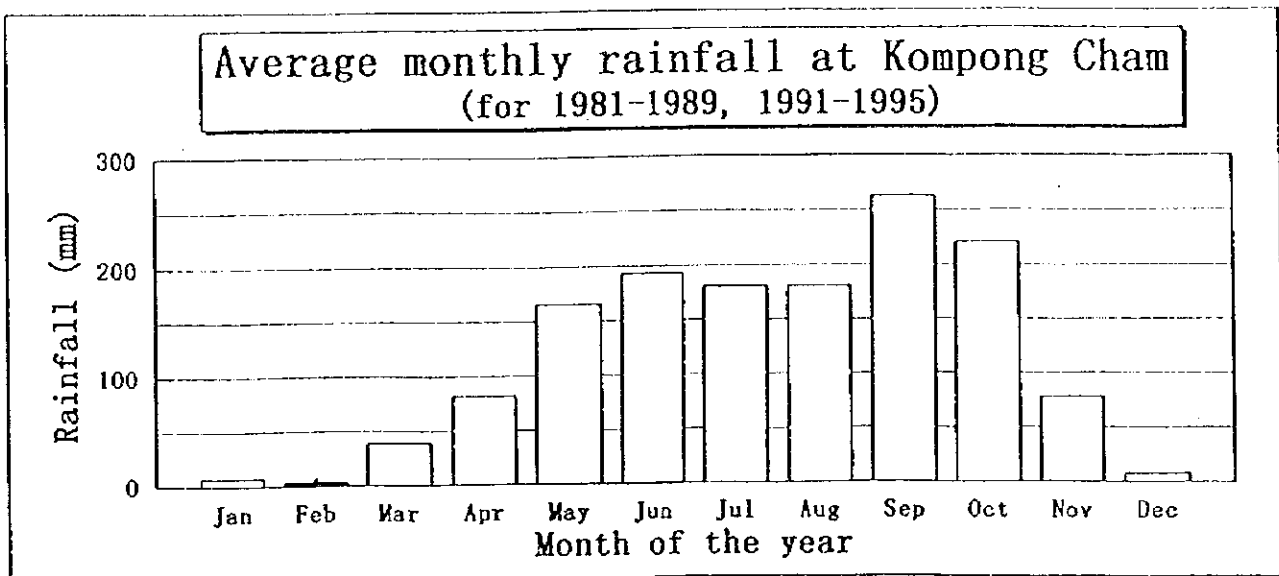
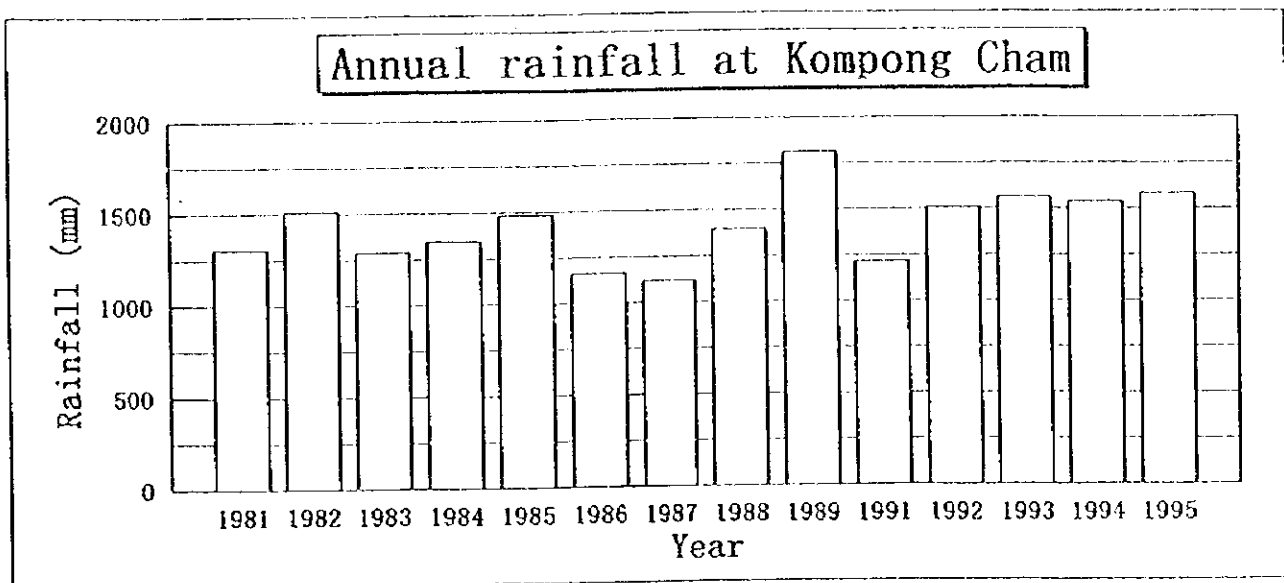


Figure C2.5 Annual and Mean Monthly Rainfall - Kompong Cham

Monthly rainfall at Pochentong

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	Average
Jan	0.4	0.0	1.4	0.0	0.0	0.0	0.0	15.0	0.0	0.0	3.1	0.0	0.4	0.0	1.5
Feb	0.5	0.0	1.1	1.1	4.5	0.0	22.9	0.0	0.0	0.0	2.5	0.0	0.0	0.0	2.3
Mar	14.2	0.0	0.0	0.0	4.5	0.0	22.2	54.0	0.0	0.0	0.6	0.0	164.2	18.0	19.8
Apr	181.0	0.0	128.7	157.6	48.7	0.0	96.3	63.2	26.2	83.4	35.0	0.0	61.1	91.3	69.7
May	196.8	47.5	62.2	102.7	149.8	24.6	70.2	183.5	227.1	53.4	93.4	47.5	157.7	234.6	117.9
Jun	158.9	55.1	142.6	77.0	90.9	150.2	172.9	38.4	63.8	304.5	113.9	55.1	106.1	146.8	119.7
Jul	74.9	170.1	127.1	117.6	181.3	138.2	152.9	86.6	166.8	284.3	219.5	170.1	96.5	156.4	153.0
Aug	161.1	312.2	106.1	92.5	224.5	183.6	177.8	162.4	174.6	193.7	198.4	312.2	154.3	208.9	190.2
Sep	246.7	174.1	264.3	283.7	301.3	474.3	445.0	398.7	246.6	120.2	216.5	174.1	332.9	277.1	282.5
Oct	218.5	203.1	292.7	260.8	235.1	257.1	137.4	328.6	98.3	210.2	197.2	203.1	126.9	243.6	215.2
Nov	107.5	155.4	51.5	188.6	86.9	323.8	71.4	107.3	138.7	2.2	10.9	155.4	5.6	22.4	102.0
Dec	0.1	3.2	1.1	0.9	23.8	0.0	0.0	0.0	0.0	1.7	3.8	3.2	17.9	11.2	4.8
Annual	1360.6	1120.7	1178.8	1282.5	1351.3	1551.8	1369.0	1437.7	1142.1	1253.6	1094.8	1120.7	1223.6	1413.3	1278.6
Max	91.8	80.0	83.3	62.5	75.4	113.5	128.0	96.9	74.0	85.2	80.0	80.0	79.2	110.5	

Note: Max is maximum daily rainfall

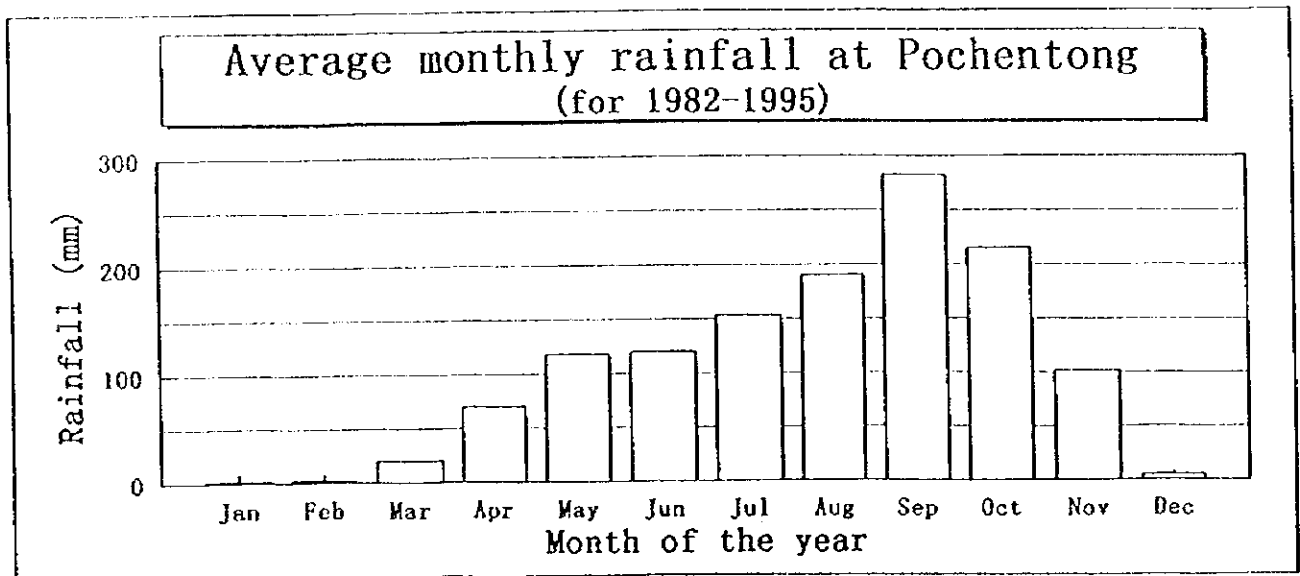
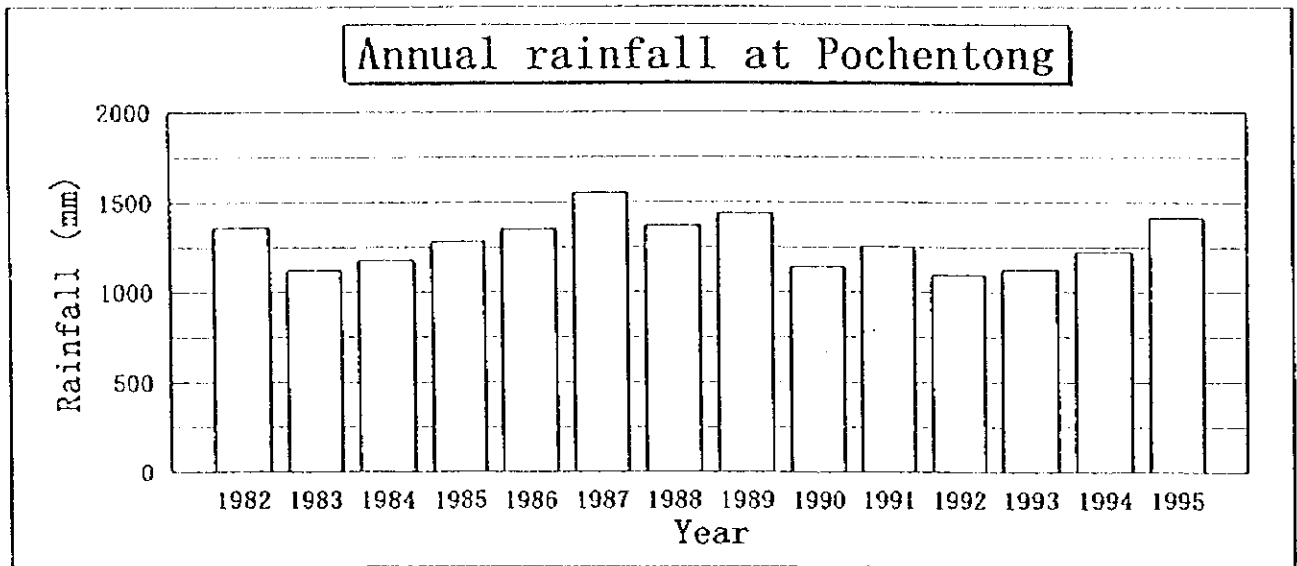


Figure C2.6 Annual and Mean Monthly Rainfall - Pochentong

Monthly rainfall at Prey Veng

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	Average
Jan	0.0	11.0	0.9	0.0	0.0	0.8	0.0	0.0	0.0	23.2	13.0	0.0	4.1
Feb	0.0	0.0	0.0	0.0	11.4	0.0	0.0	0.0	0.5	0.0	0.0	0.0	1.0
Mar	0.0	125.0	0.0	0.0	4.3	31.9	21.7	0.0	1.8	80.2	124.5	37.0	35.5
Apr	117.0	0.0	33.5	0.0	111.1	115.0	68.7	96.0	119.5	9.9	84.5	65.2	68.4
May	0.0	220.5	174.0	43.7	57.5	95.6	145.8	67.0	43.0	161.4	96.7	47.6	96.1
Jun	150.0	157.9	142.8	48.4	216.0	108.3	137.2	205.6	91.9	194.0	216.3	245.3	159.5
Jul	35.0	104.4	82.9	88.9	130.8	279.9	202.0	182.1	142.2	287.2	71.1	268.1	156.2
Aug	94.0	142.1	92.8	191.0	307.5	143.6	209.5	111.9	139.0	33.6	220.7	175.4	155.1
Sep	450.3	175.7	246.7	317.0	290.5	174.4	159.3	89.8	182.2	233.0	246.2	198.8	230.3
Oct	170.0	194.5	282.6	238.7	212.7	308.4	273.3	0.0	189.7	348.2	94.7	309.8	218.6
Nov	12.0	117.6	173.9	212.0	105.2	127.7	43.3	0.0	21.2	97.6	10.6	94.6	84.6
Dec	6.0	0.0	0.0	0.0	64.6	0.0	0.0	0.0	18.2	1.4	31.8	30.2	12.7
Annual	1034.3	1248.7	1230.1	1139.7	1511.6	1385.6	1260.8	752.4	949.2	1469.7	1210.1	1472.0	1222.0
Max		100.0		70.1			80.3	67.4	96.0	82.7		120.4	

Note: Max is maximum daily rainfall

1984, 1986, 1988, 1989, 1994 are monthly data collected from Prey Veng Department of Hydrology.

No daily data are available at DOH Prey Veng.

Data from DOH differ from those from Pochentong. Confirmation of data was not possible.

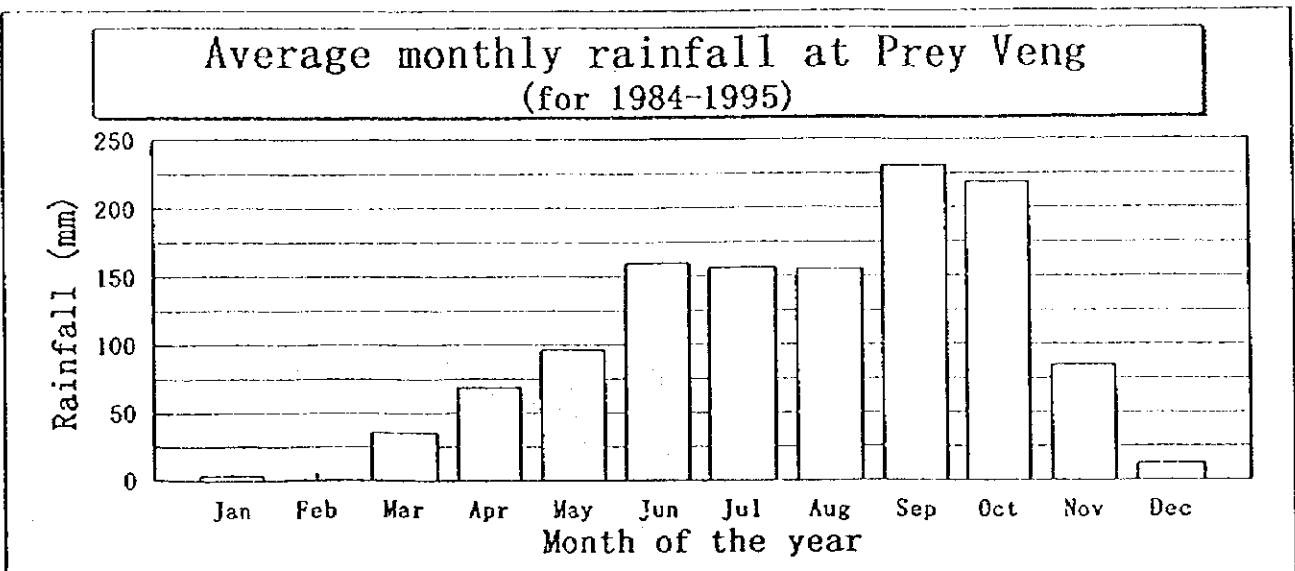
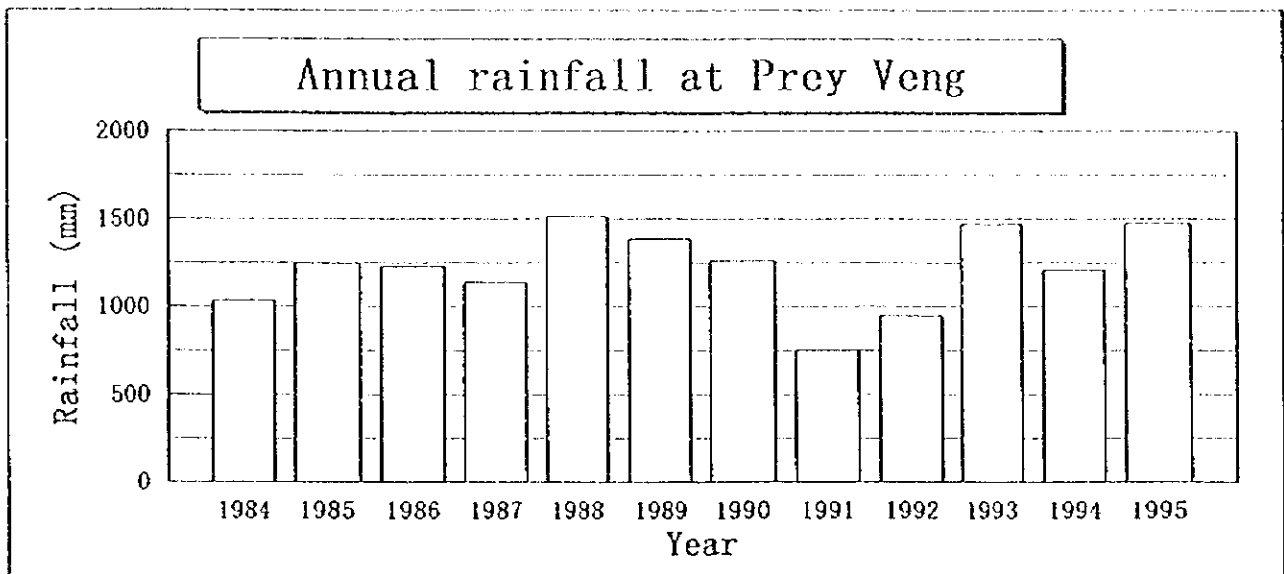


Figure C2.7 Annual and Mean Monthly Rainfall - Prey Veng

Monthly rainfall at Takeo

Average for 1985, 1989, 1991-1995 = 1014.9 mm

Source: Pochengtong

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	Average
Jan	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.2	2.8
Feb	0.0	0.0	0.0	3.0	11.0	0.0	0.0	0.0	0.0	2.0	0.0	1.5
Mar	2.0	0.0	5.0	22.0	0.0	0.0	0.0	0.0	33.0	49.3	39.5	13.7
Apr	140.0	18.0	3.0	41.0	8.0	67.0	0.0	20.0	103.3	52.0	48.5	45.5
May	222.0	160.0	13.0	134.0	128.0	0.0	6.0	30.0	91.0	177.5	116.0	99.8
Jun	106.0	37.0	46.0	42.0	93.8	56.3	137.1	182.3	118.5	149.2	121.3	99.0
Jul	182.0	49.0	18.0	163.0	215.4	95.8	233.7	100.7	140.2	200.2	42.2	130.9
Aug	37.0	55.0	50.0	46.0	108.8	139.4	186.3	189.1	10.2	190.0	133.5	104.1
Sep	130.0	120.6	7.0	52.0	99.2	187.4	326.5	282.0	257.0	172.1	230.5	169.5
Oct	247.0	117.0	148.0	50.0	414.1	110.0	155.7	270.5	489.9	144.2	285.3	221.1
Nov	84.0	43.0	253.0	14.0	144.5	2.6	0.0	5.0	140.9	0.0	49.5	67.0
Dec	15.0	18.0	0.0	0.0	0.0	0.0	0.0	8.0	0.0	21.0	94.5	14.2
Annual	1165.0	642.6	543.0	567.0	1222.8	658.5	1045.3	1087.6	1384.0	1157.5	1187.0	969.1
Max	60.0	60.0	75.0	58.0	81.0	100.0	74.2	118.3	88.0	93.5	82.0	

Note: Max is maximum daily rainfall

1994, 1995 are daily data collected from DOH Takeo

Annual total for 1986-1988, 1990 are exceptionally low, could be erroneous.

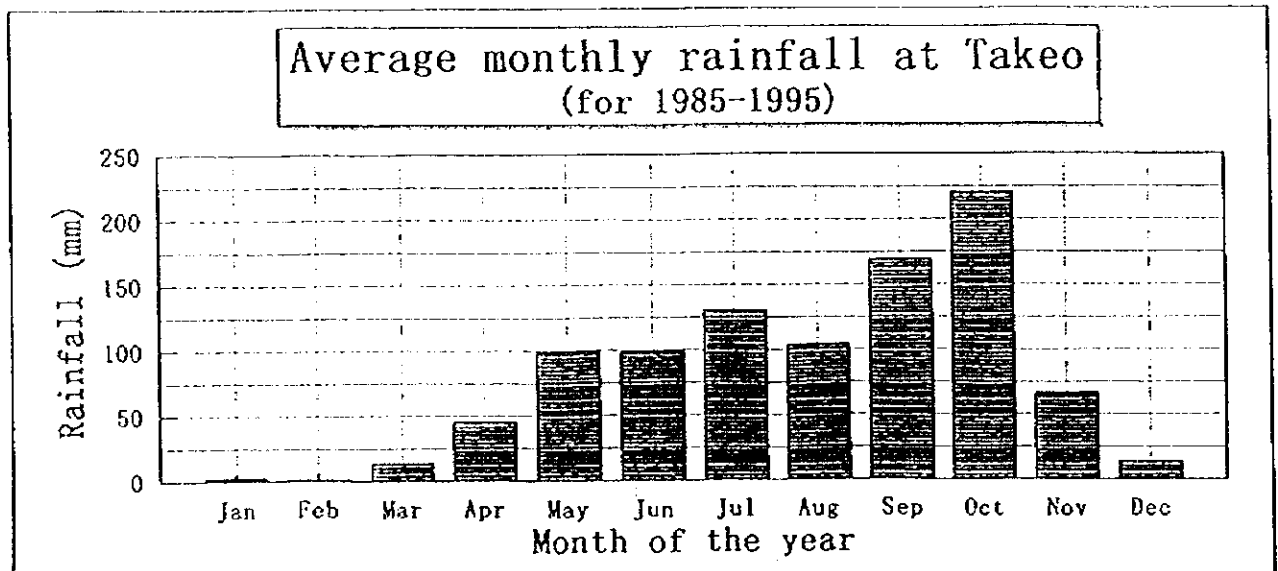
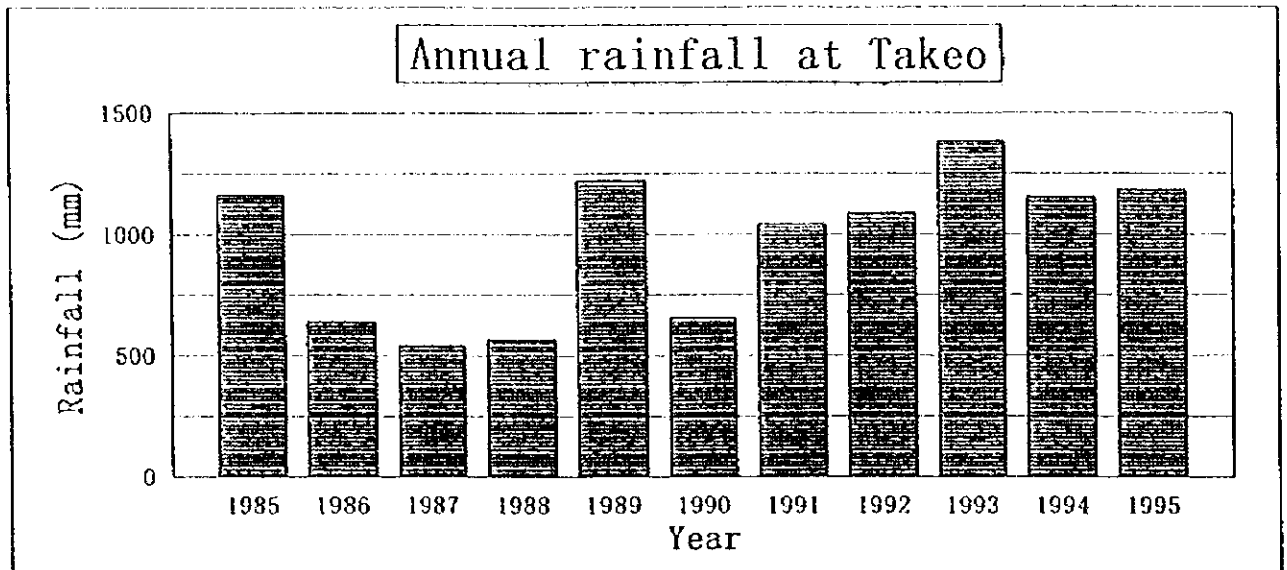


Figure C2.8 Annual and Mean Monthly Rainfall - Takeo

Average and design rainfall (R.P. 10 years)

Unit: mm

Province	Average Annual rainfall	Probability (Return Period)	
		Exceedance 1/10	Non-exceedance 1/10
Kratie	1556.1	2013.2	1156.6
Kompong Cham	1417.5	1676.7	1185.7
Pochentong	1278.6	1459.5	1132.6
Prey Veng	1222.0	1559.5	923.8
Takeo	969.1	1388.9	585.0

Note: The results for Takeo is much lower than expected, could be due to data error.

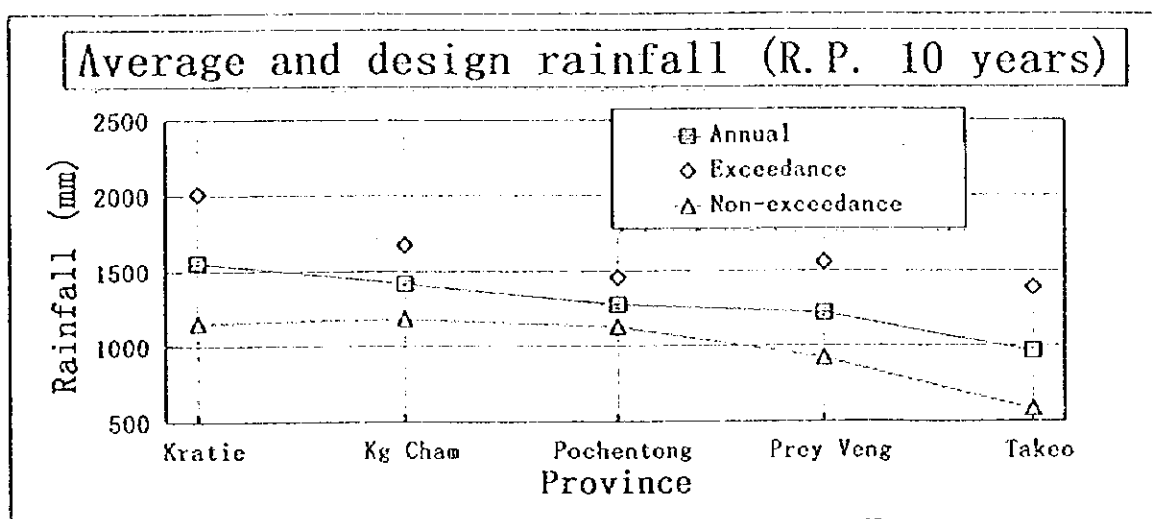
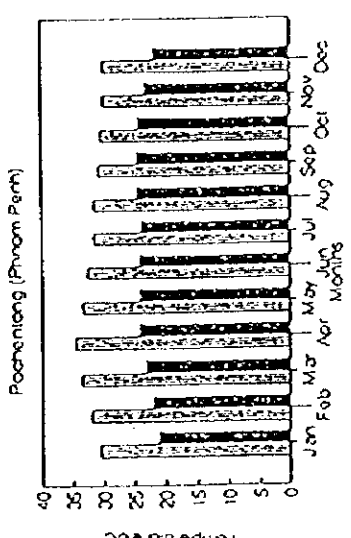
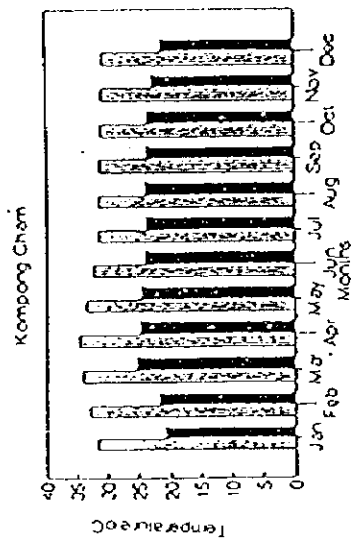
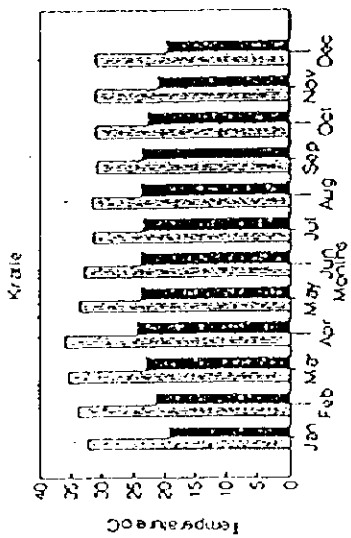


Figure C2.9 Mean and Design Rainfall

Mean Monthly Maximum & minimum Temperature



Abstracted from Irrigation Rehabilitation Study in Cambodia, Final Report, Mekong Secretariat

Mean Monthly Relative Humidity

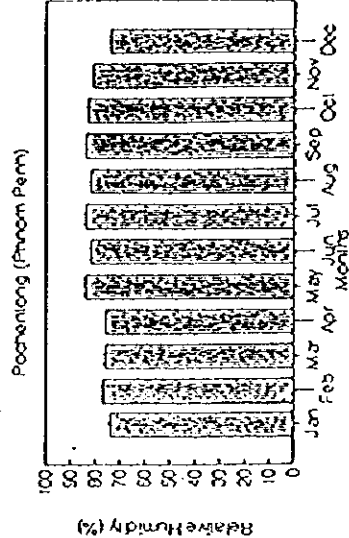
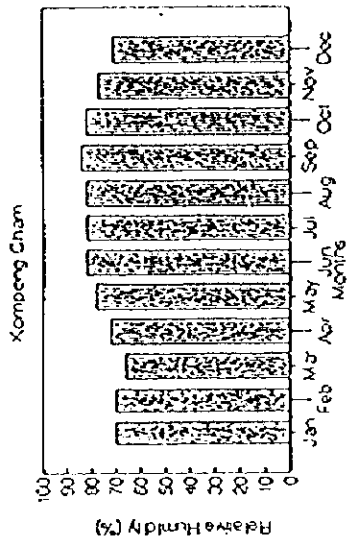
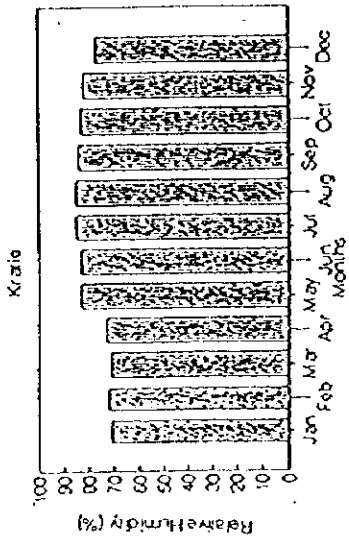
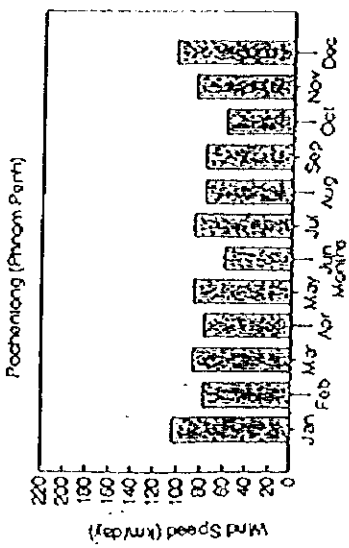
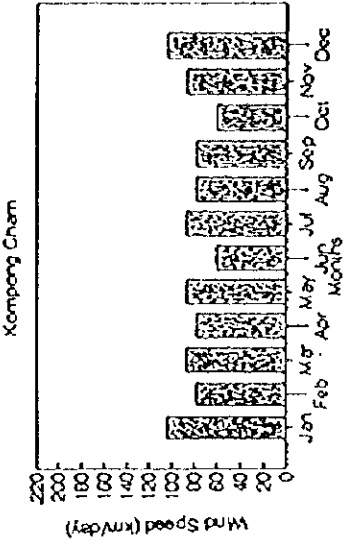
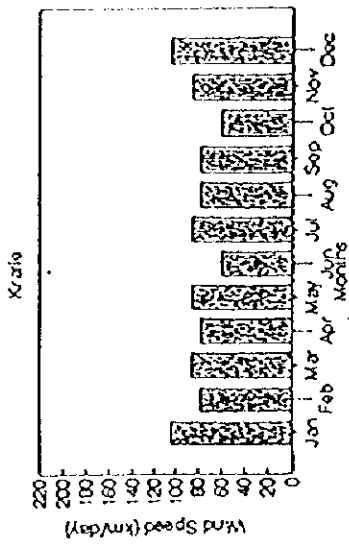
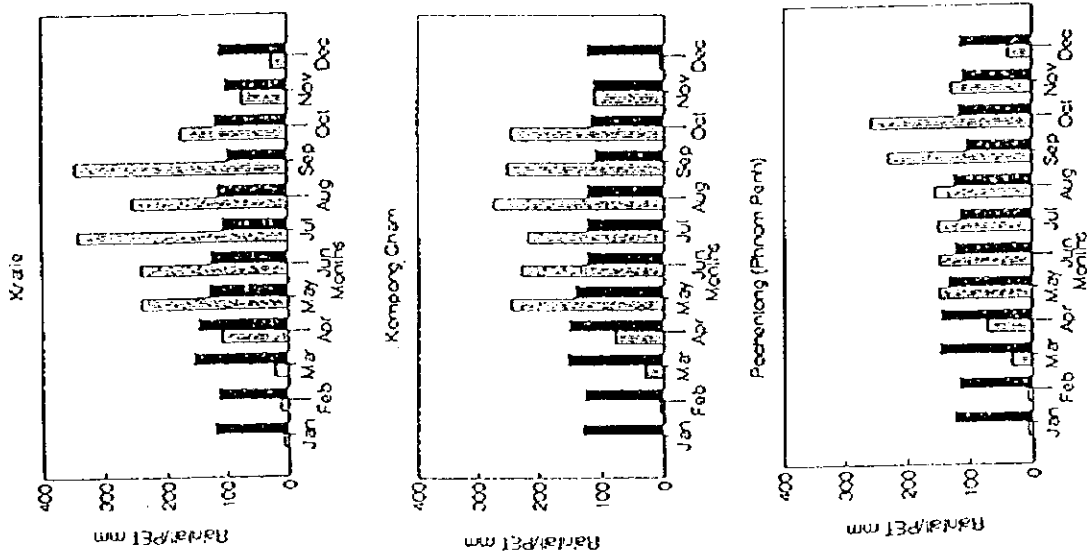


Figure C2.10 Mean Monthly Maximum & Minimum Temperature, Relative Humidity and Wind Speed

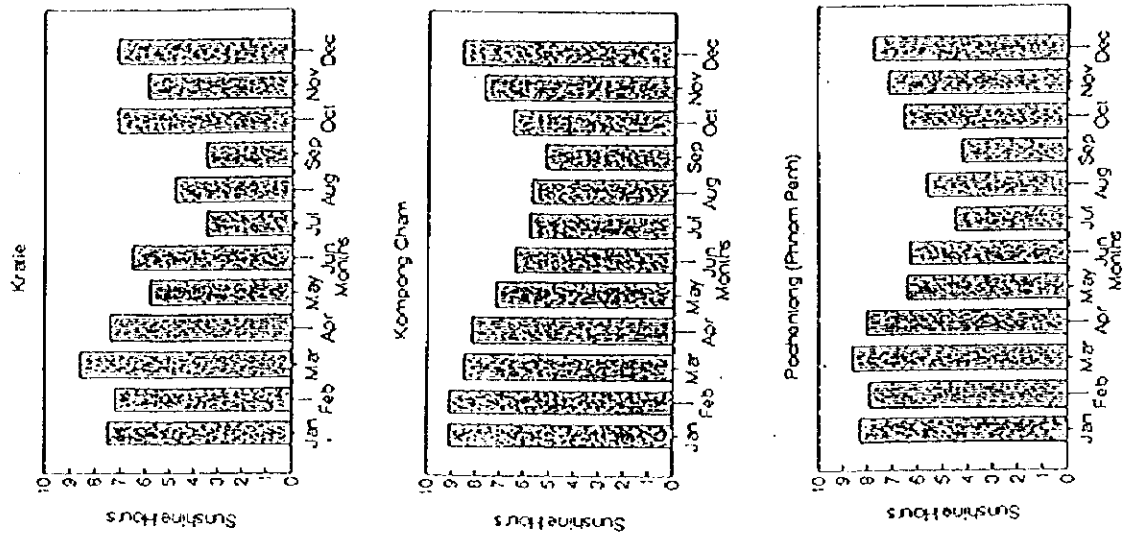
Mean Monthly Wind Speed



Mean Monthly Rainfall & Potential Evapotranspiration



Mean Monthly Sunshine Hours



Abstracted from Irrigation Rehabilitation Study in Cambodia, Final Report, Mookong Sekretariat

Figure C2.1.1 Mean Monthly Rainfall, Potential Evapotranspiration and Sunshine Hours

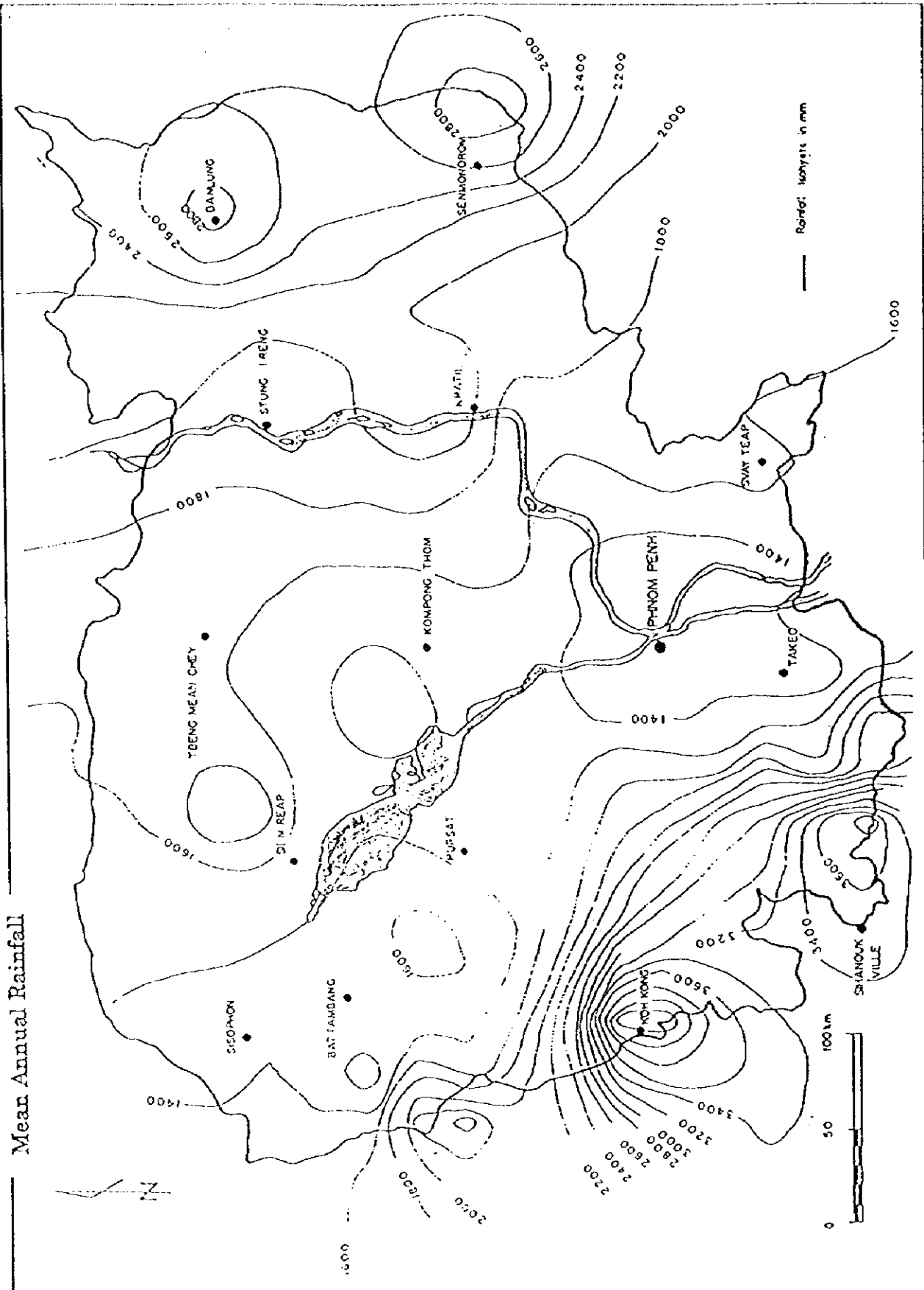


Figure C2.12 Isohyetal Map

Abstracted from Irrigation Rehabilitation Study in Cambodia, Final Report, Mookong Secretariat

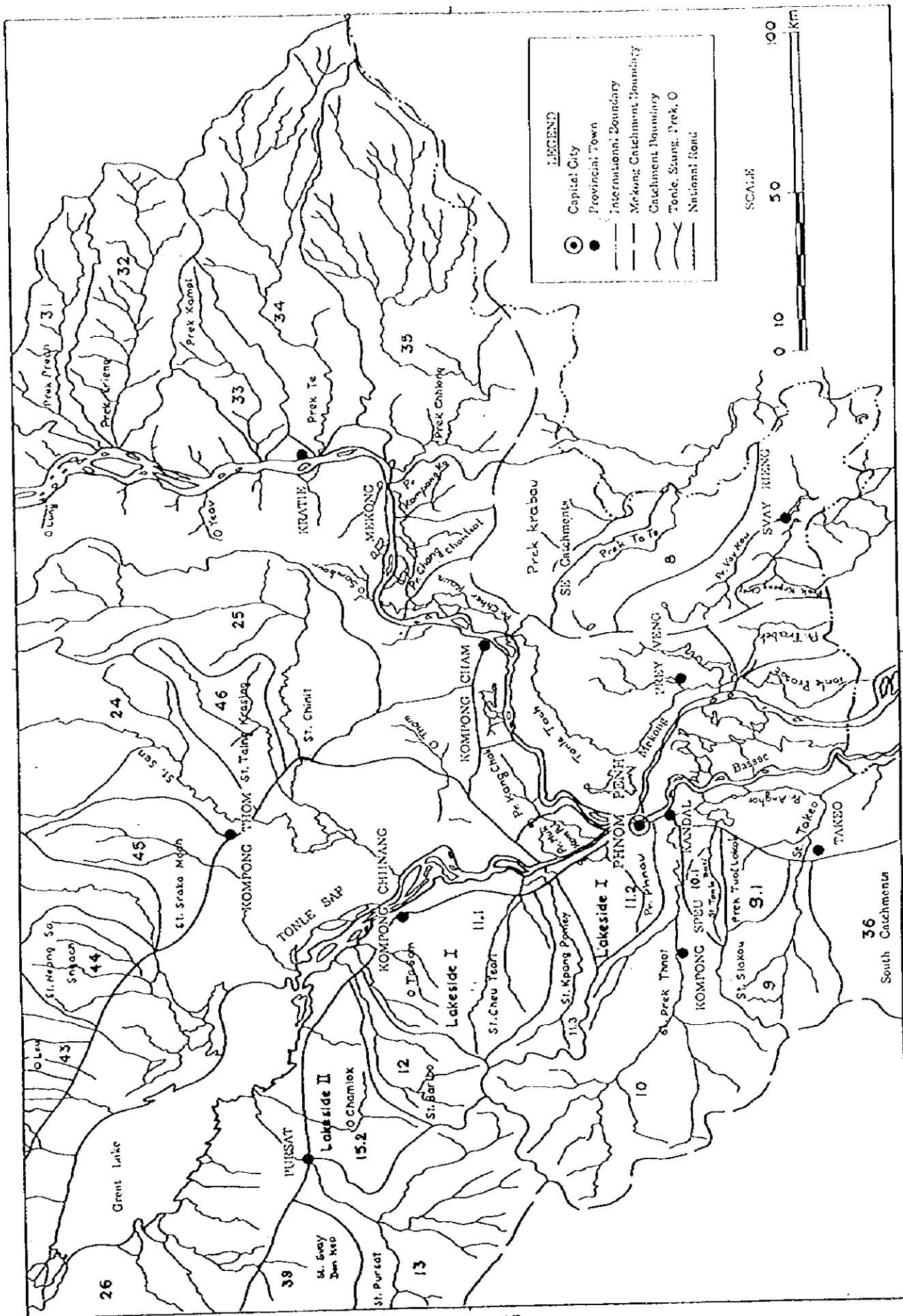


Figure C3.1 Catchment of Mainstreams and Tributaries in the Study Area

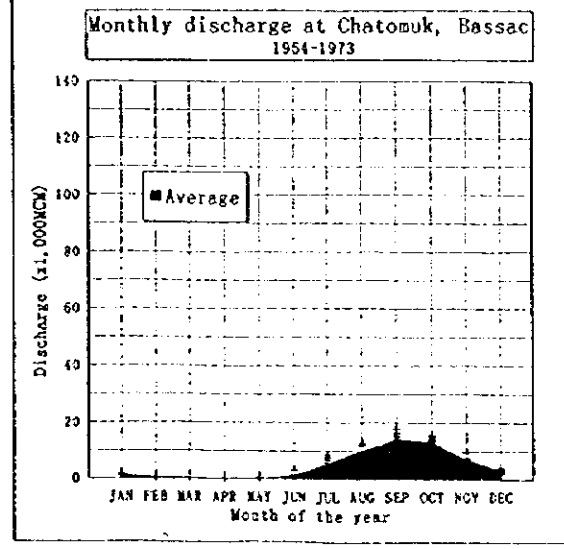
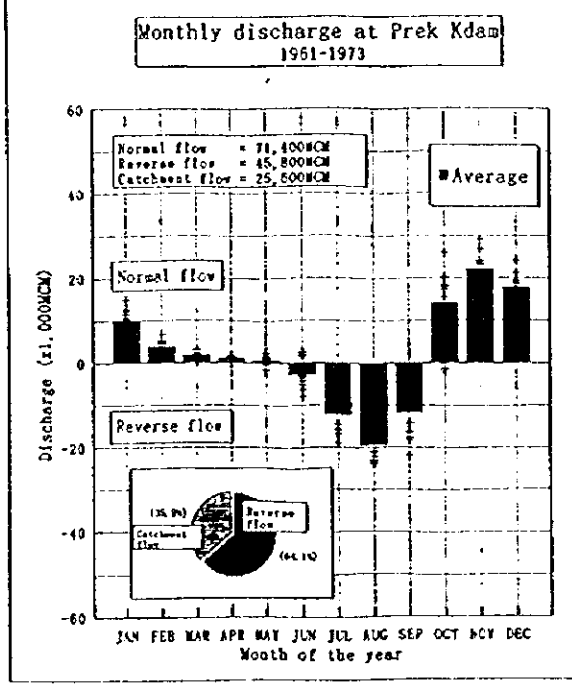
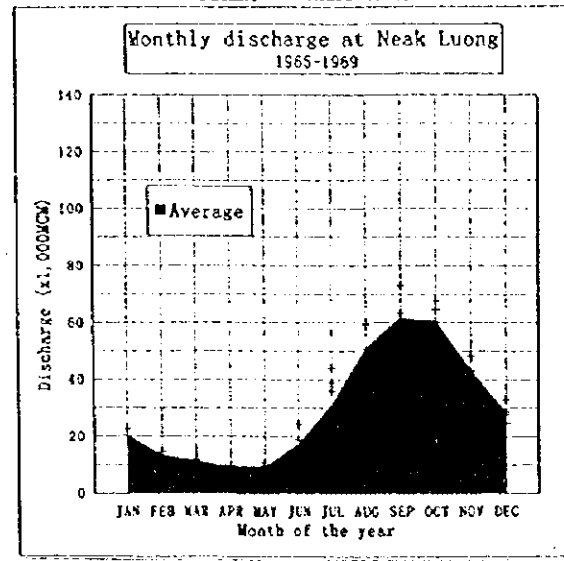
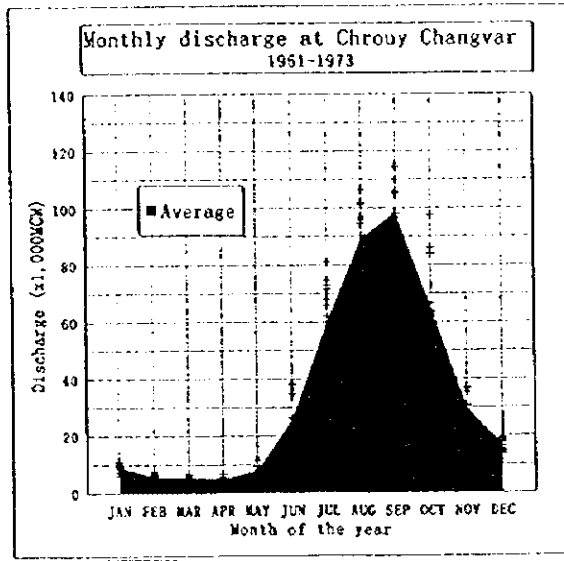
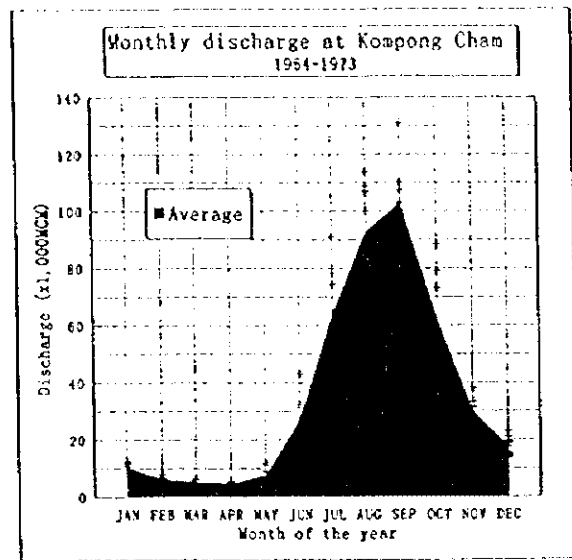
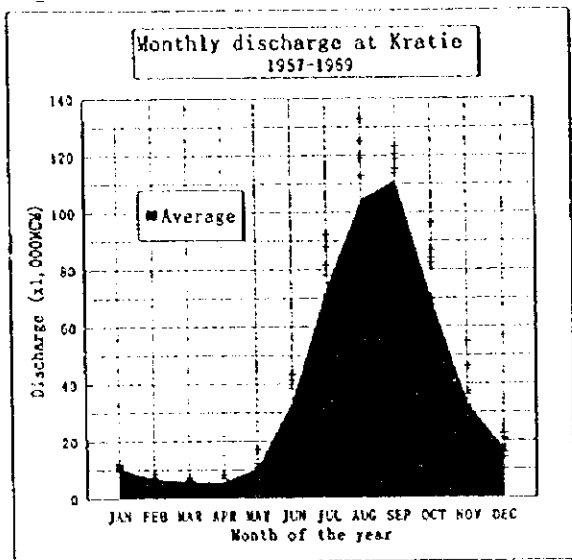


Figure C3.3 Mean Monthly Discharge at the Main Gauging Stations

Average monthly water level

	Mekong river				Bassac river		Tonle sap river
	Kratie	Kompong Cham	Chrouy Changvar	Neak Luong	Chatomuk	Koh Khel	Prek Kdam
Jan	5.41	2.76	2.52	1.89	2.63	2.16	2.89
Feb	4.64	1.80	1.61	1.30	1.67	1.37	1.73
Mar	4.15	1.29	1.09	0.99	1.15	0.99	1.17
Apr	3.98	1.05	0.89	0.79	0.90	0.82	0.95
May	5.17	1.42	1.04	0.79	1.06	0.81	1.08
Jun	8.92	4.37	2.52	1.78	2.61	1.73	2.64
Jul	12.87	8.05	4.86	3.31	4.81	3.89	4.87
Aug	16.52	11.27	7.03	5.14	6.98	5.56	6.90
Sep	17.38	12.27	8.35	6.19	8.30	6.09	8.25
Oct	14.03	10.13	8.07	5.96	8.03	5.86	8.33
Nov	9.76	6.76	6.04	4.43	6.06	4.68	6.66
Dec	6.97	4.33	4.07	2.84	4.09	3.24	4.68

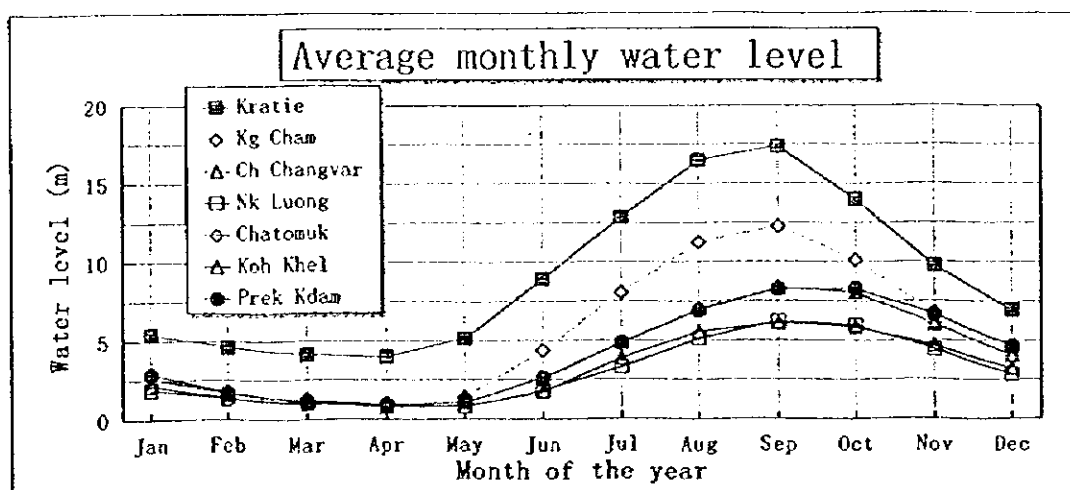
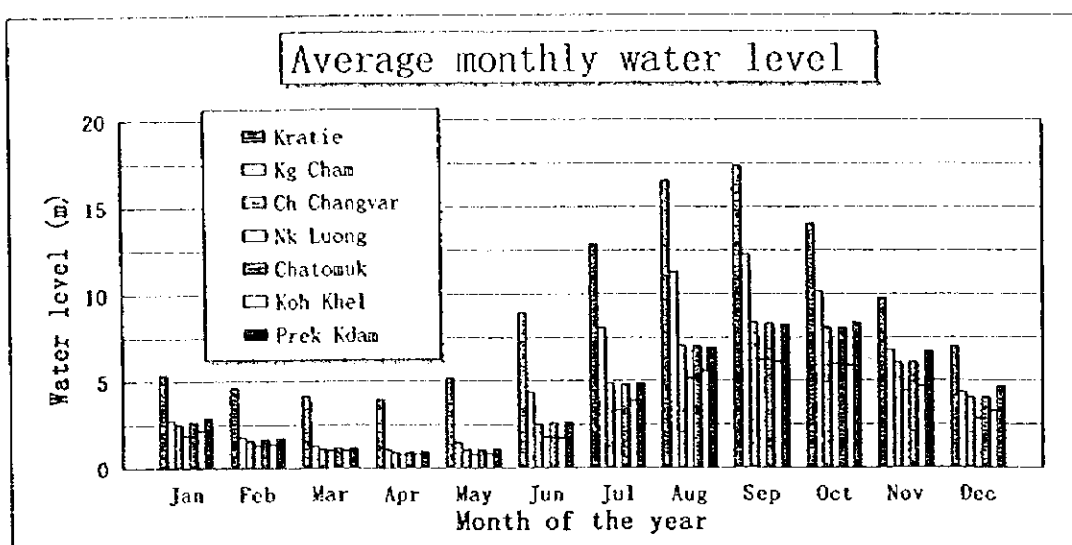
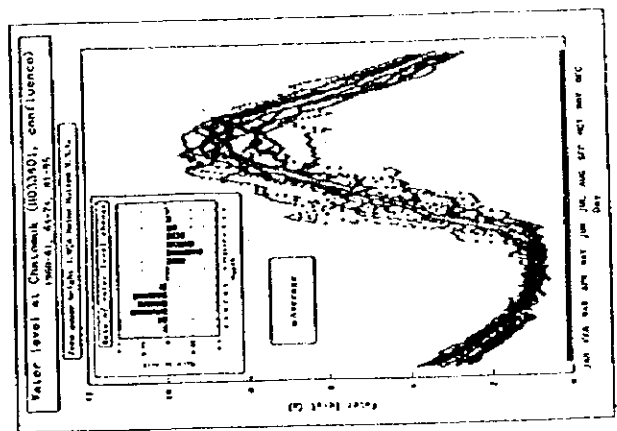
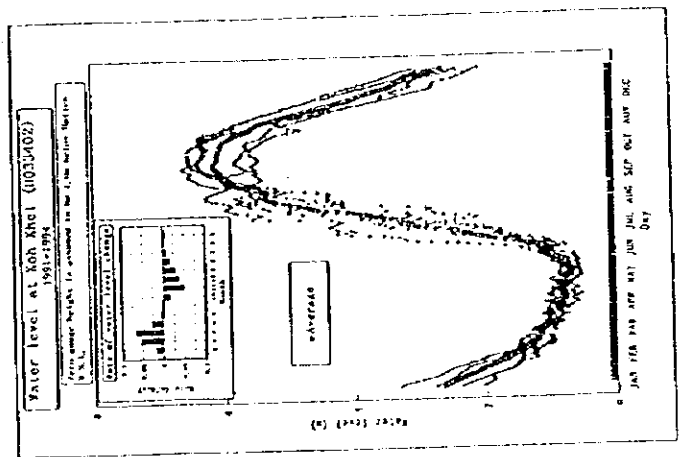
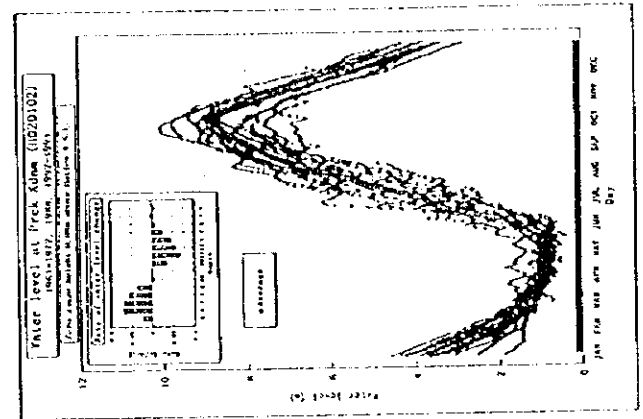
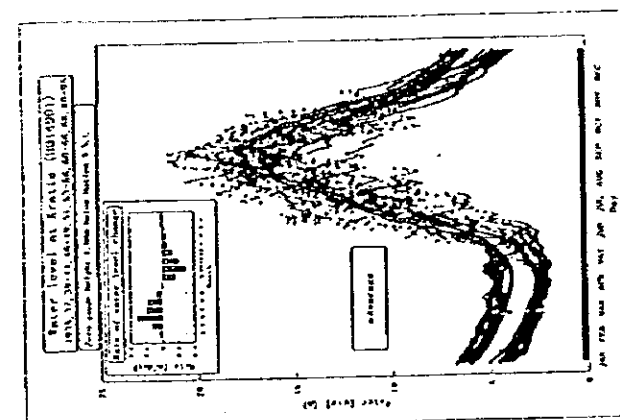
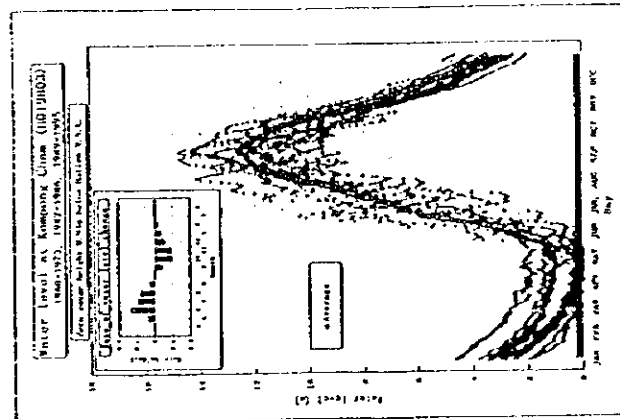
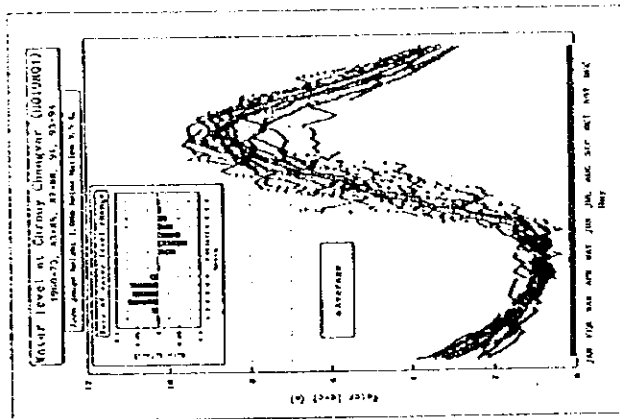
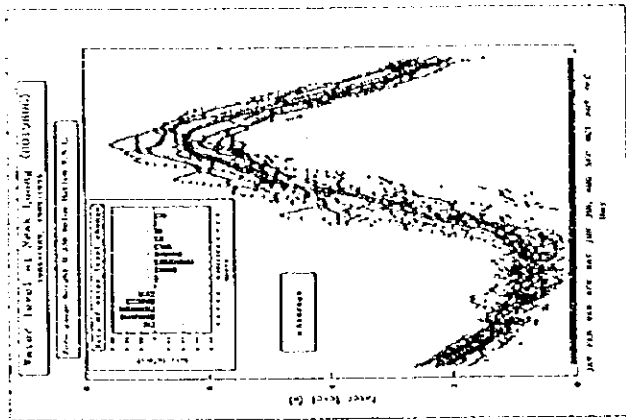
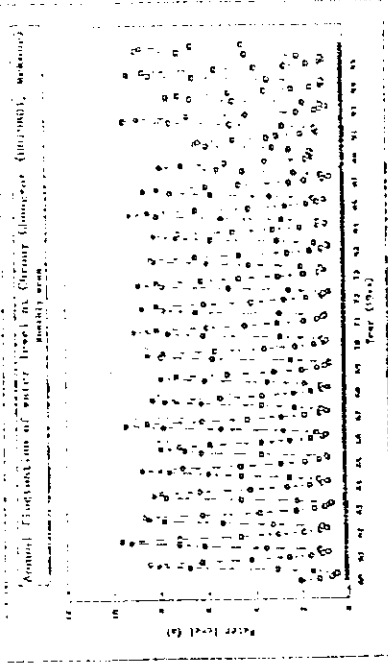


Figure C3.4 Mean Monthly Water Level at the Main Gauging Stations

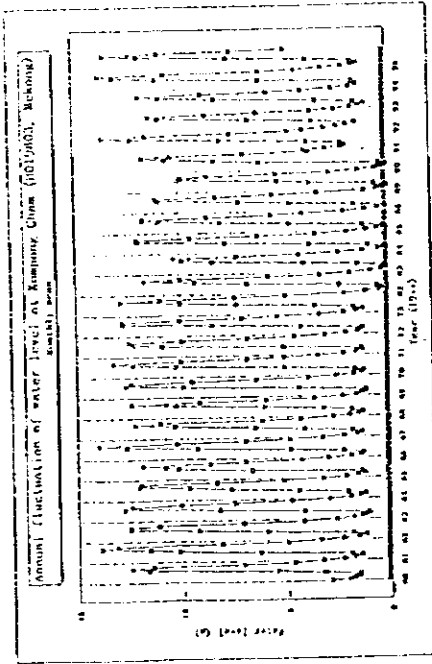
Figure C3.5 Water level at the
Main Gauging Stations
- Yearly Plot



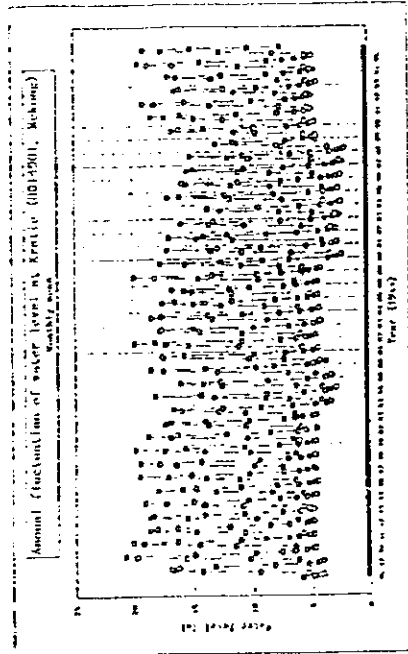
Chroy Changvar



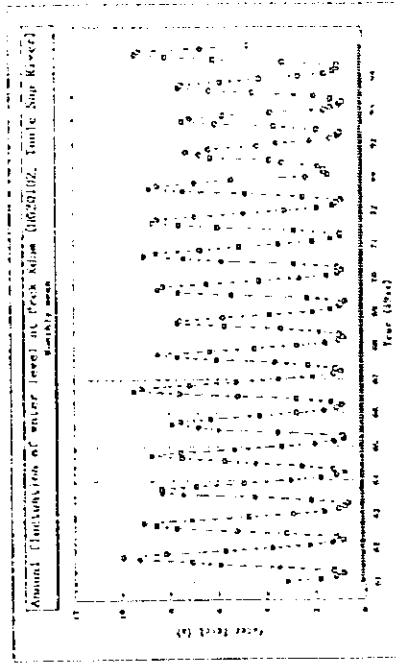
Kompong Cham



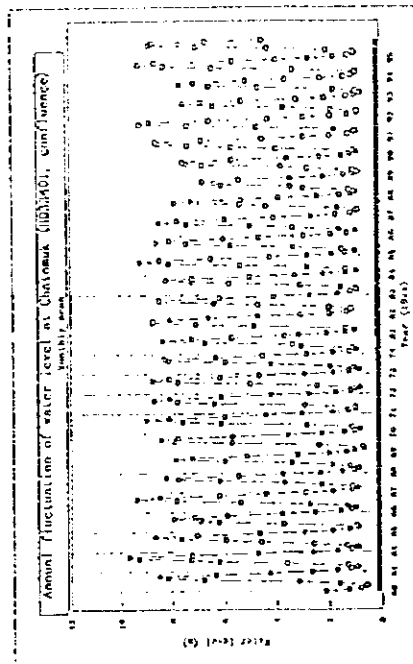
Kratie



Prek Kdam



Chaktomuk



Neak Luong

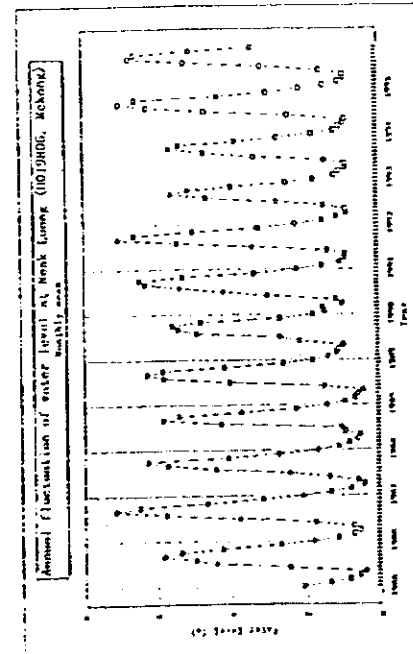


Figure C3.6 Fluctuation of Water Level at the Main Gauging Stations

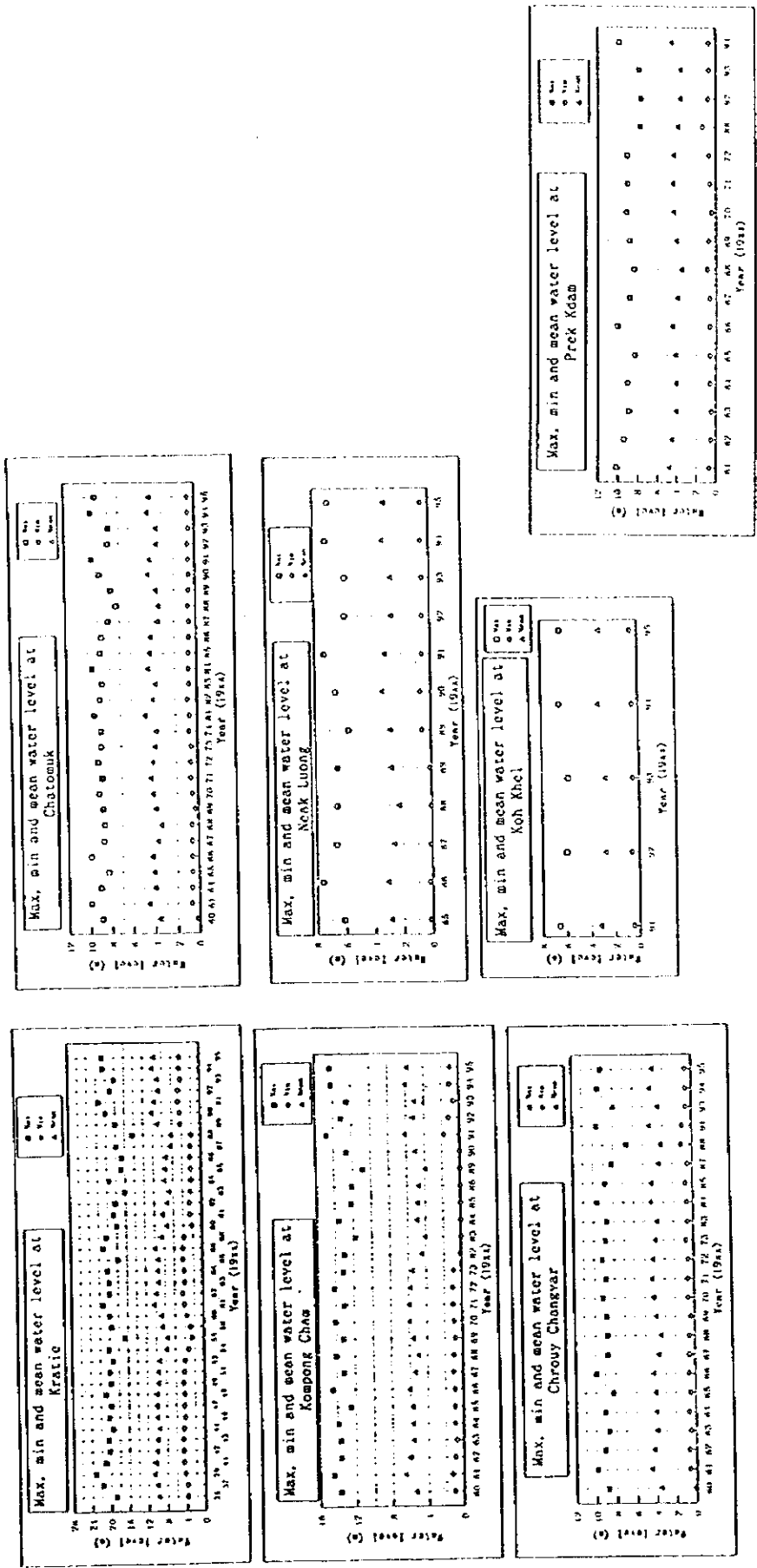


Figure C3.7 Annual Maximum, Minimum and Mean Water level

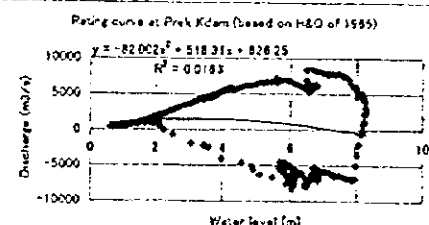
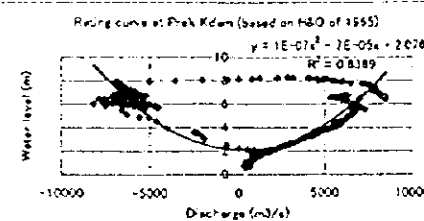
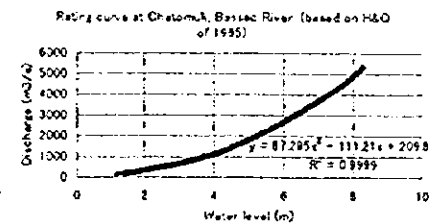
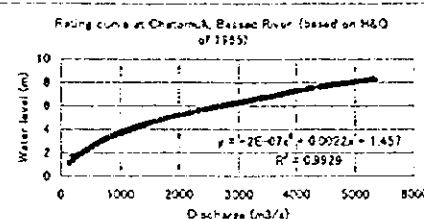
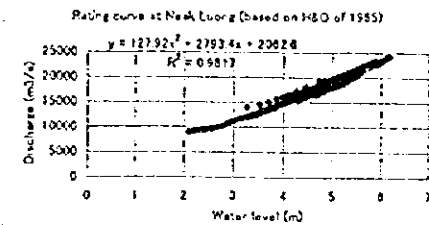
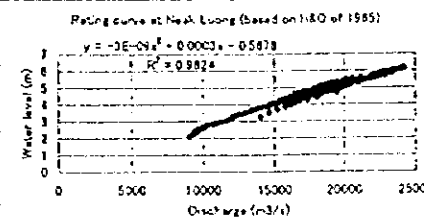
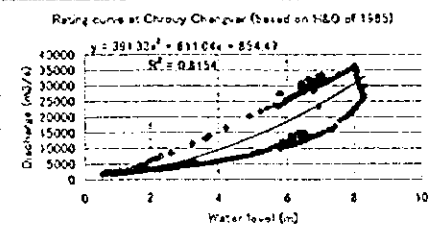
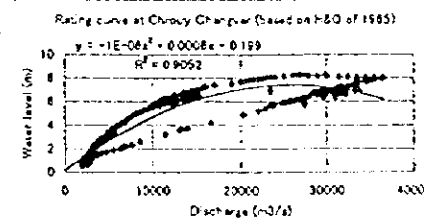
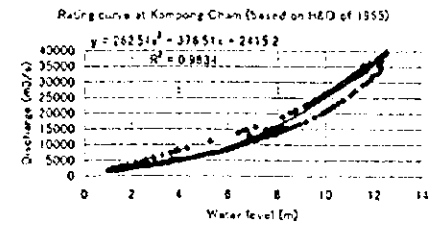
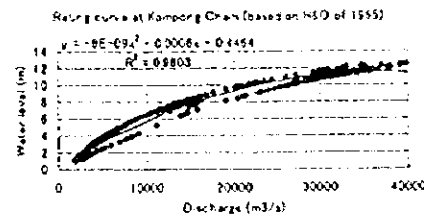
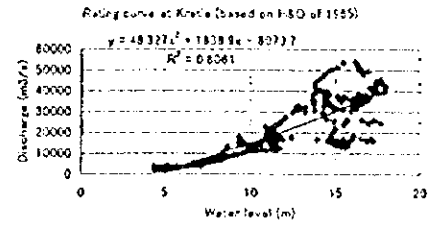
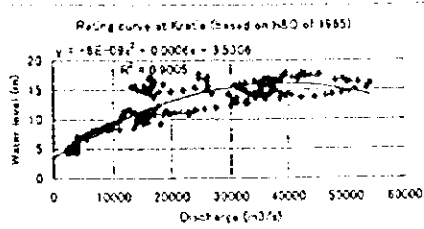
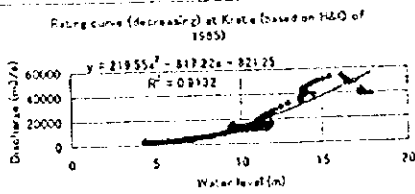


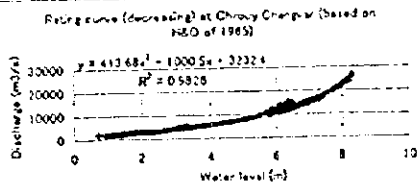
Figure C3.8 Rating Curves at the Main Gauging Stations

Falling Water Level

Kratie

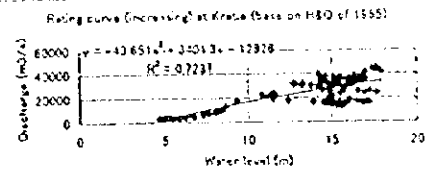


Chrouy Changvar

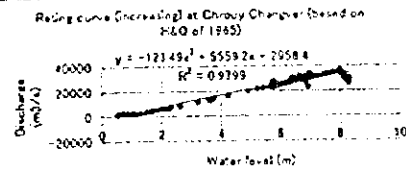


Rising Water Level

Kratie

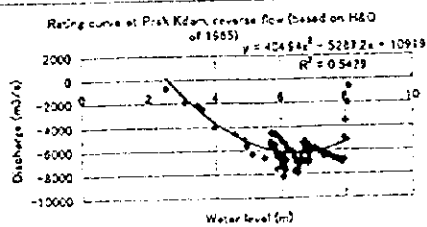
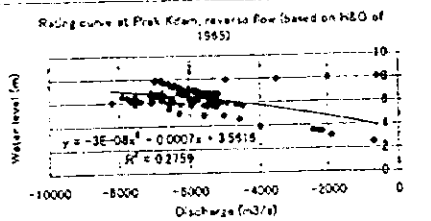


Chrouy Changvar



Prek Kdam

Reverse Flow



Normal Flow

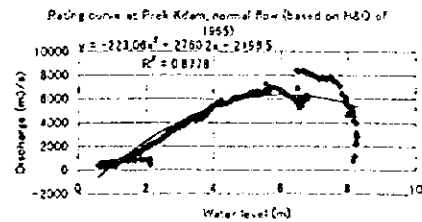
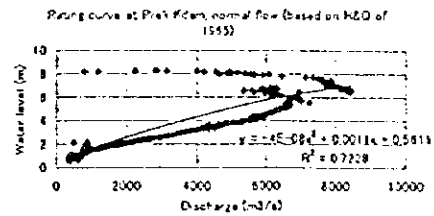


Figure C3.9 Rating Curves for rising and falling water level at Kratie and Chrouy Changvar and normal and reverse flow at Prek Kdam

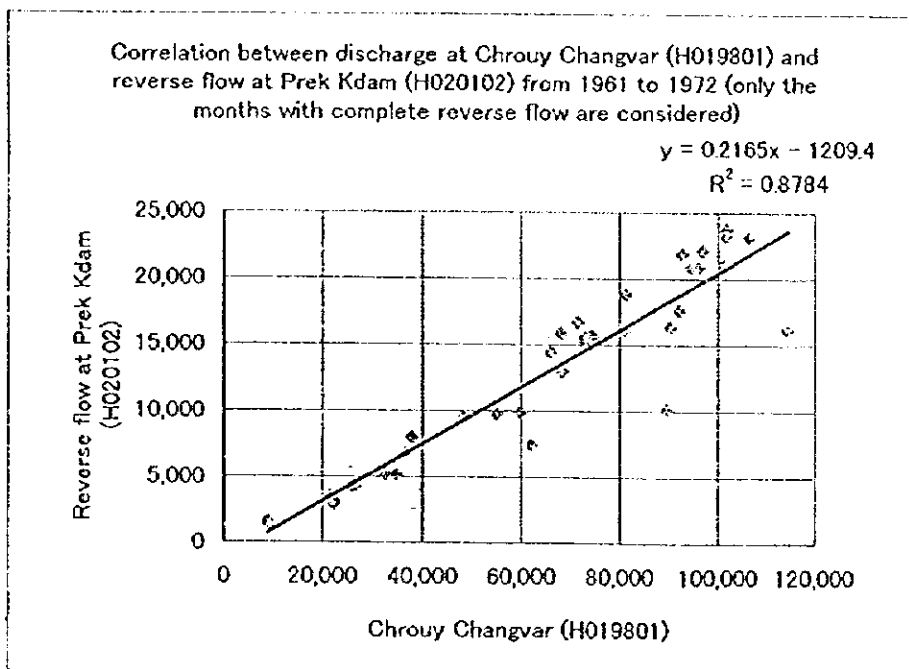
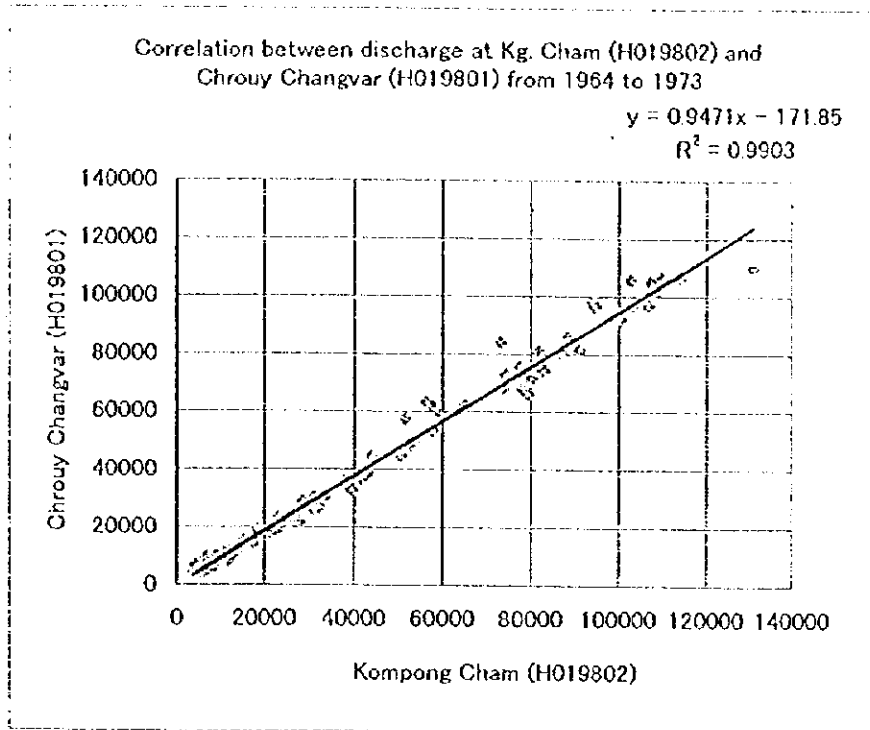


Figure C3.10 Correlation of Discharge between stations in Mekong and between Stations in Mekong and Tonle Sap River

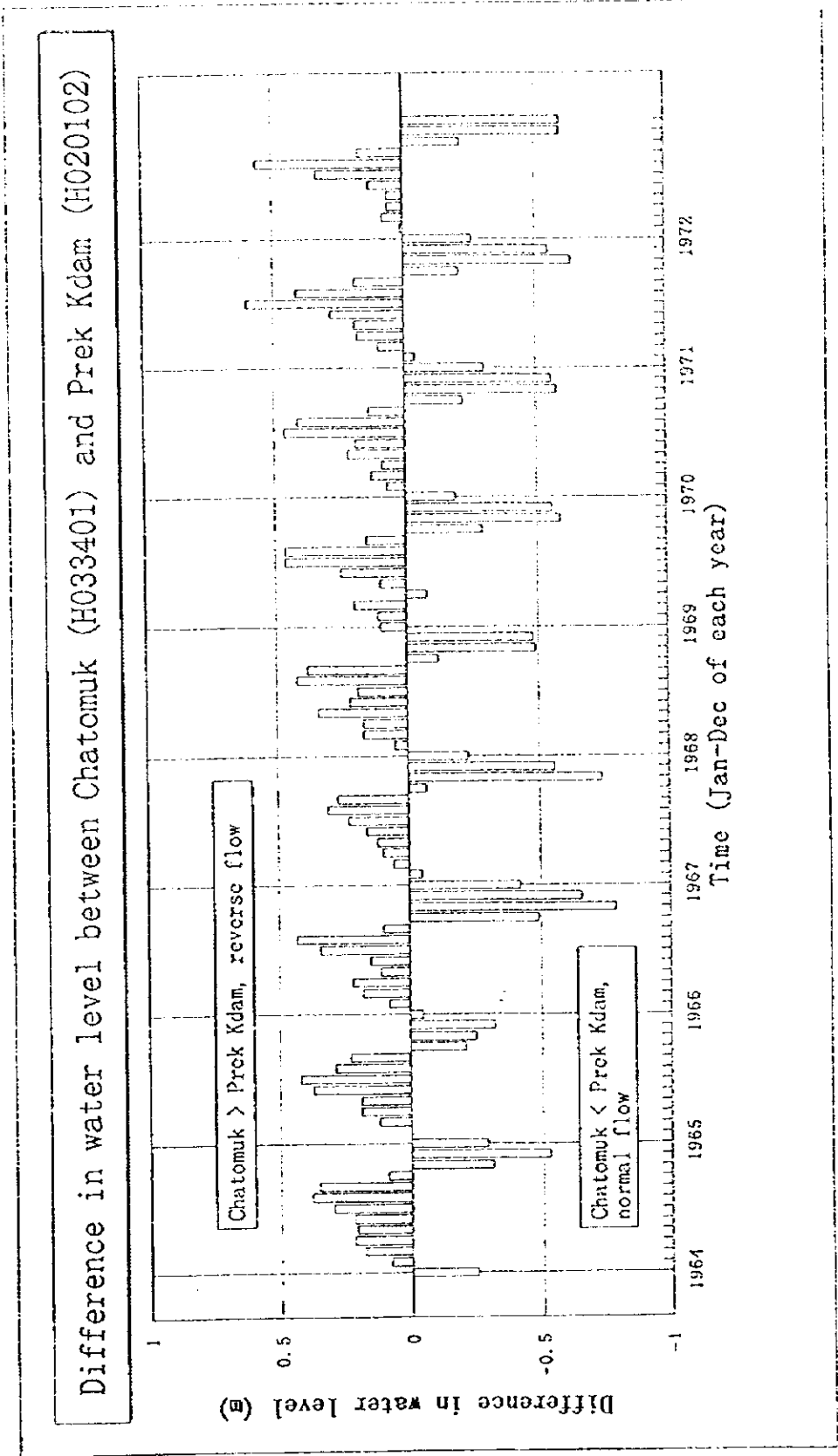
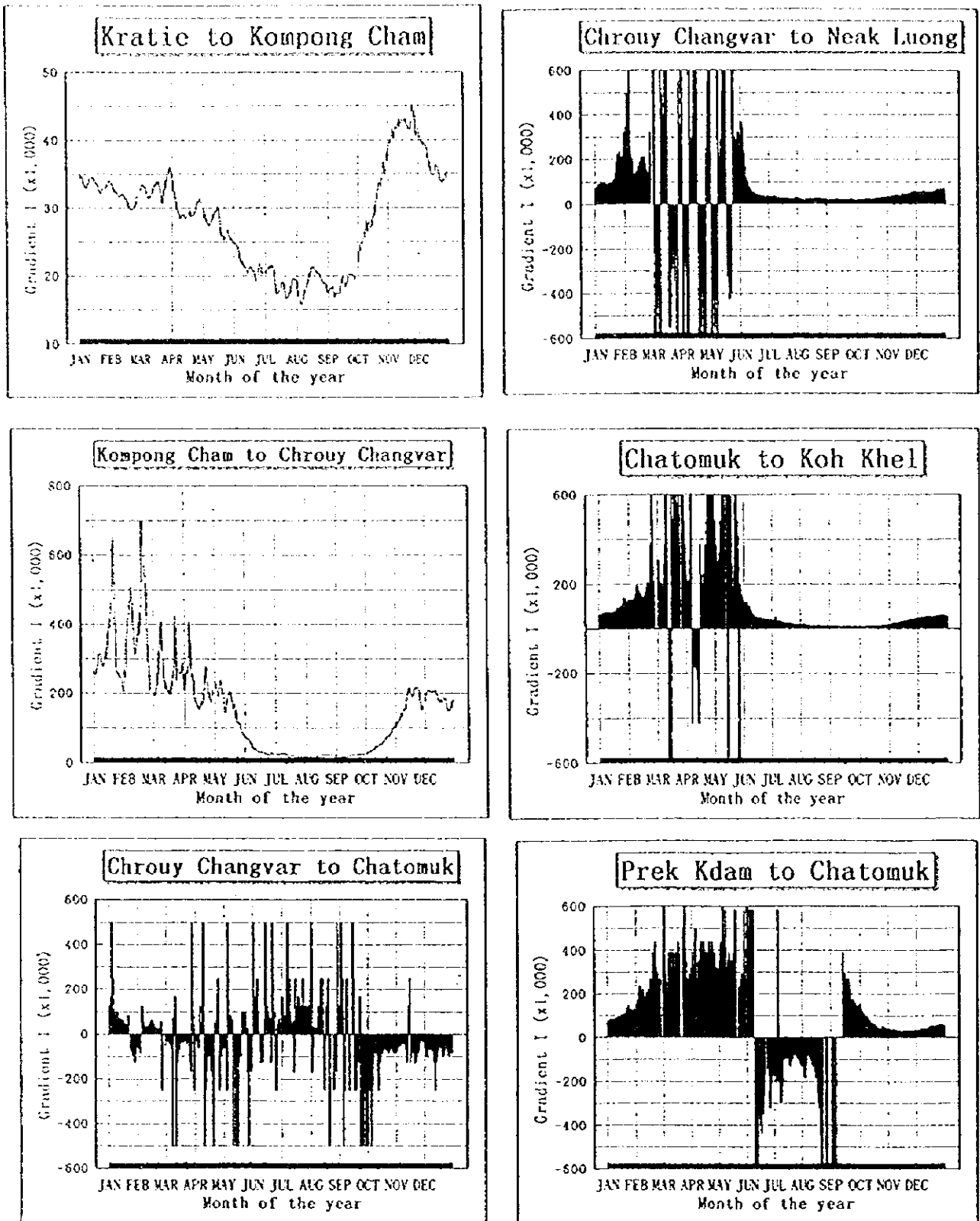


Figure C3.11 Difference in Water Level between Chaktomuk and Prek Kdam

Daily water surface gradient (1/1) for 1994



Note: Positive value shows normal gradient. Negative value shows reverse gradient.

Larger I shows gentler gradient.

Figure C3.12 Fluctuation of Water Surface Gradient between Stations along Mekong, Bassac and Tonle Sap River

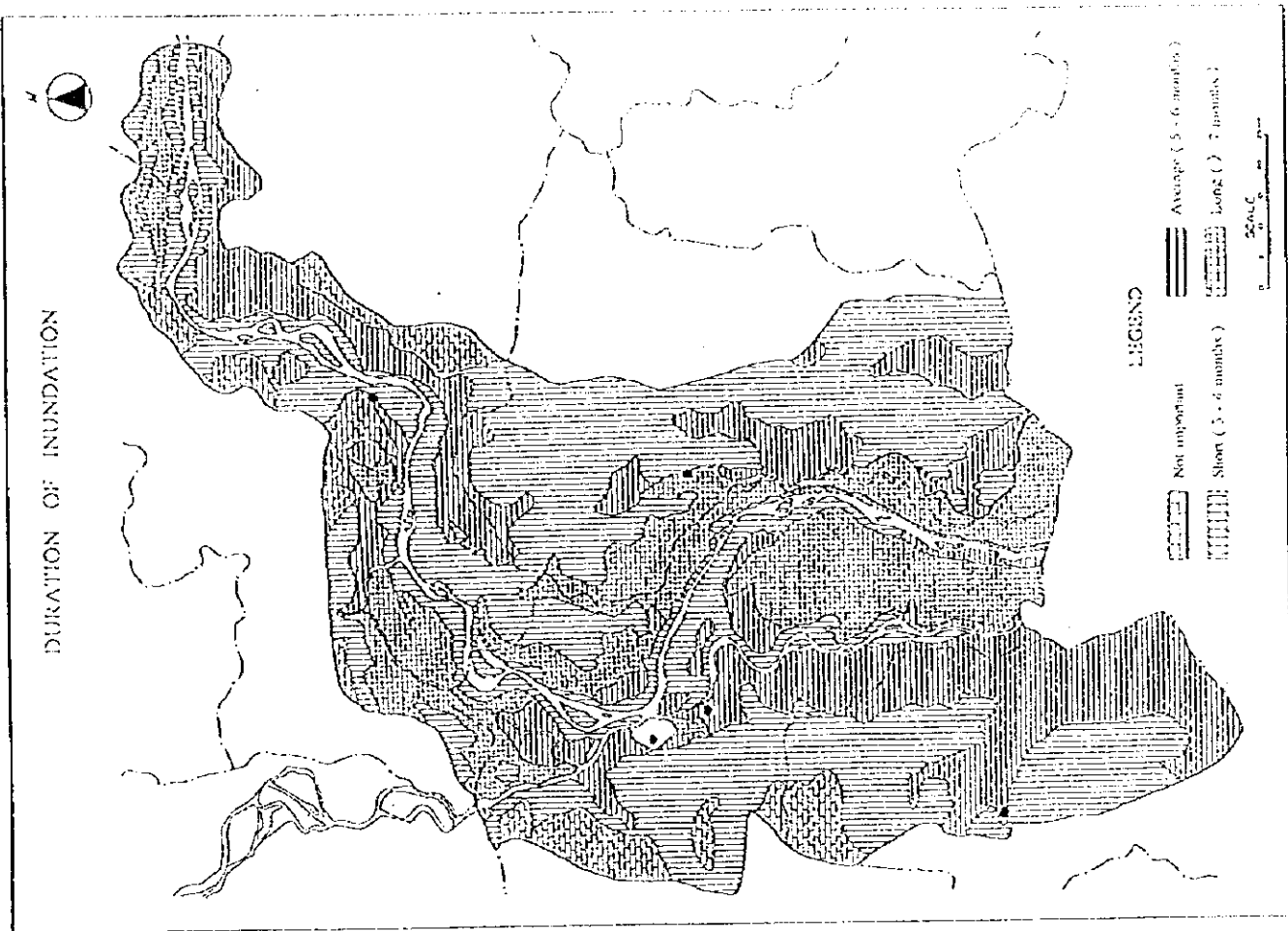
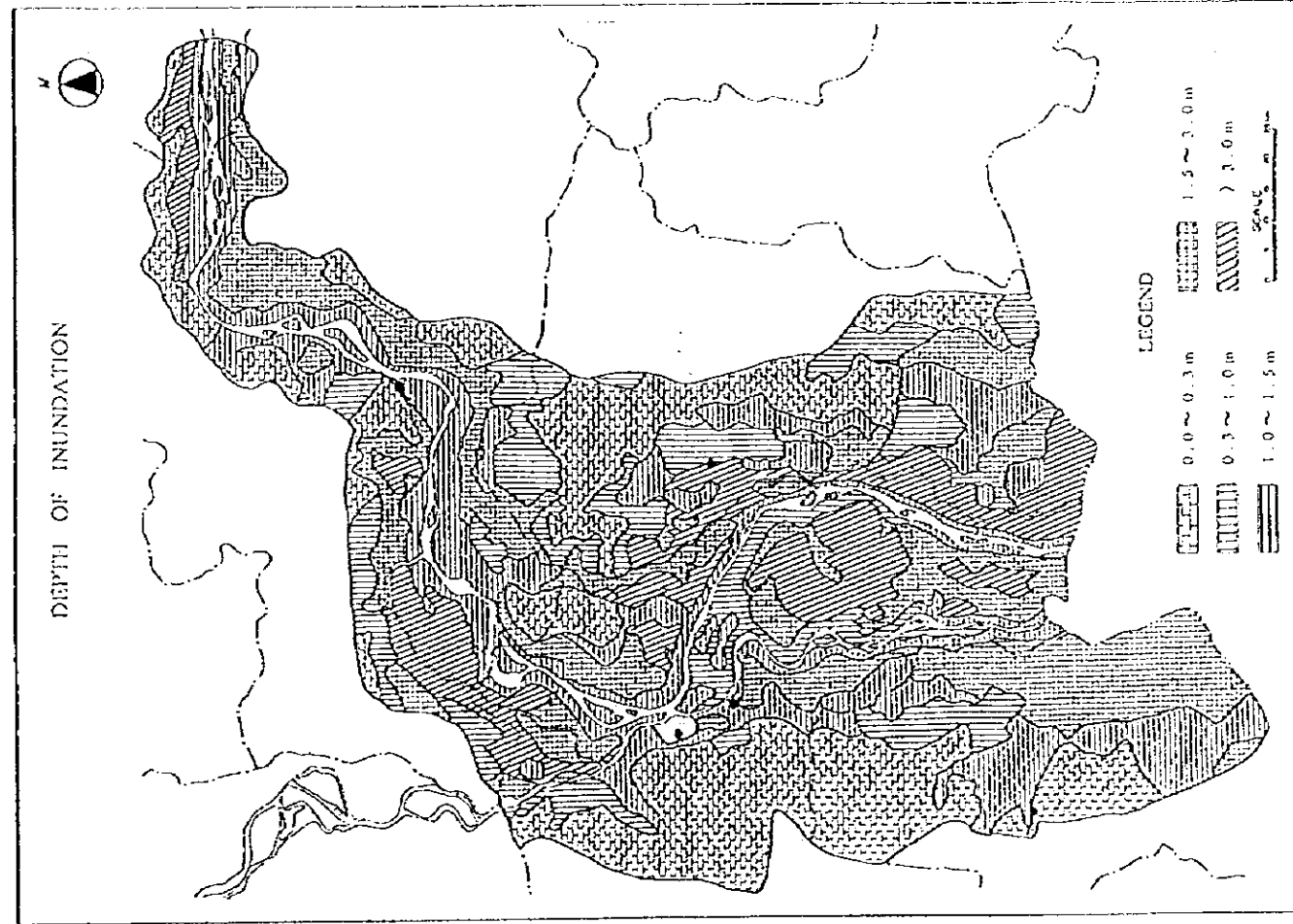


Figure C8.13 Depth and Duration of Inundation in the Study Area
 (adapted from DES AGRO-ECOSYSTEM DE LA REPUBLIQUE POPULAIRE DE KAMPUCHEA)

Change of flooded forest and water surface area

	92/93				85/87				73/76	
	Ff	Ffs	Ff+Ffs	W	Ff	Ffs	Ff+Ffs	W	Ff	W
Kratie	0	0	0	310	99	0	99	296	203	322
Kg Cham	153	0	153	202	871	4	875	315	1181	251
Kandal	706	22	728	282	789	129	918	441	926	336
Prey Veng	79	14	93	74	302	48	350	434	385	199
Takeo	185	45	230	46	284	63	347	301	41	186
Phnom Penh	11	0	11	27	14	5	19	22	52	59

Note : Ff Flooded forest, Ffs Flooded secondary forest
W Water surface

Source: FAO, UNDP, Land Cover Atlas, 1985/87, 92/93, MRC

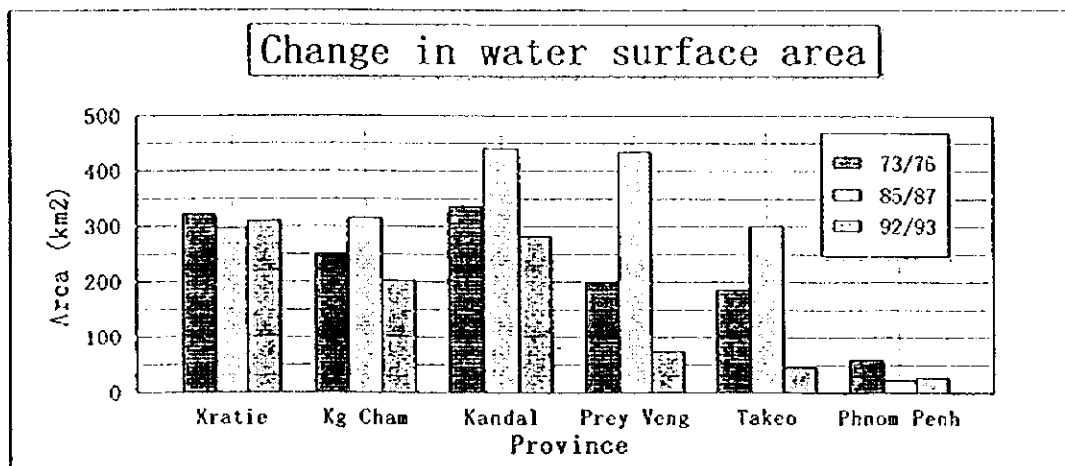
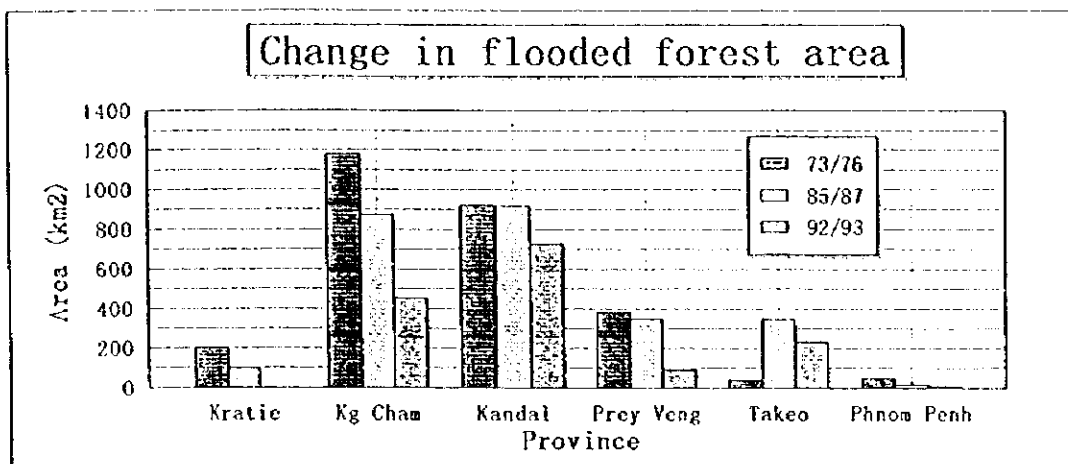


Figure C3.14 Change of Flooded Forest and Water Surface Area

Elevation of banks along Mekong, Bassac and Tonle Sap river

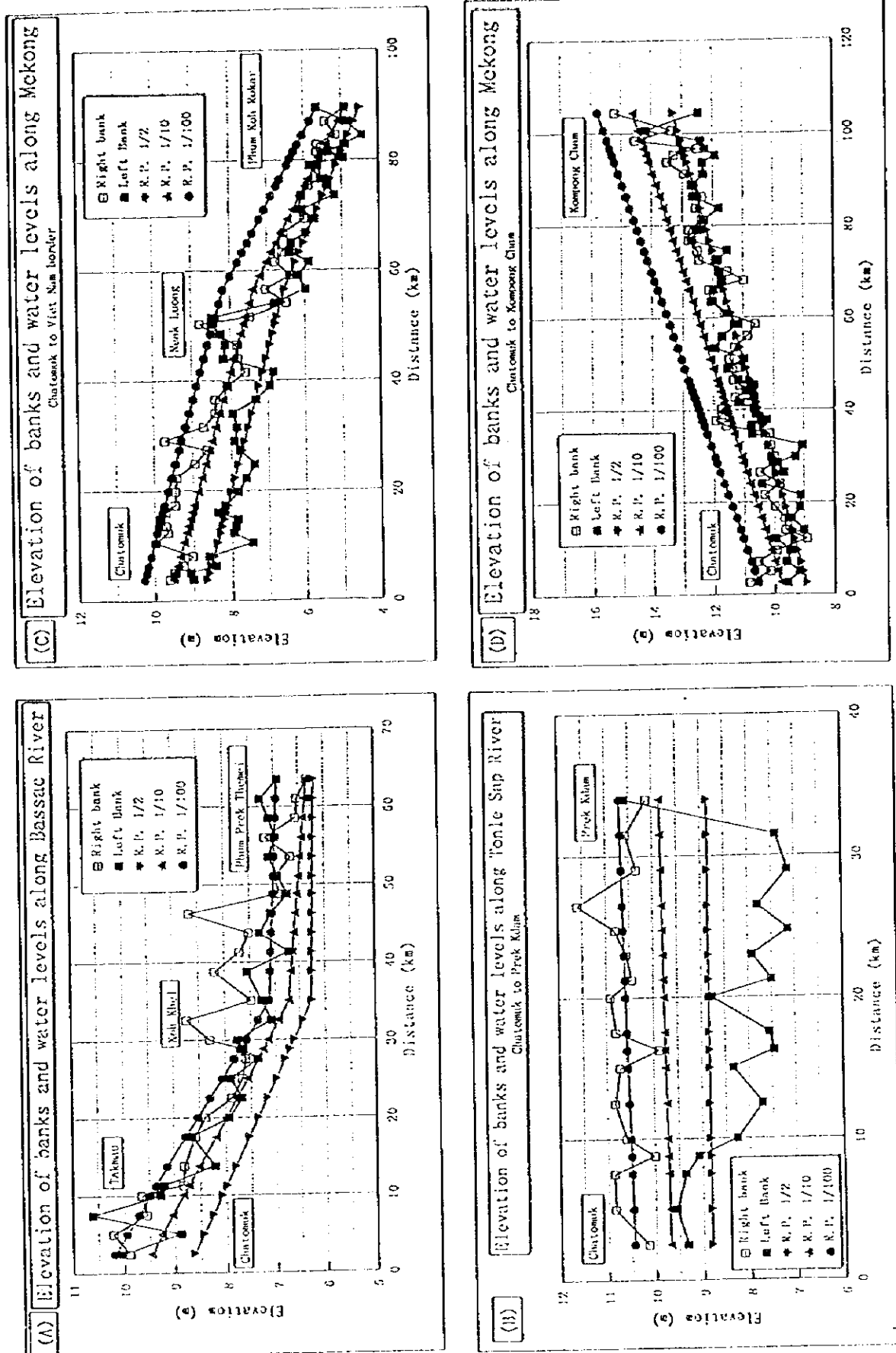


Figure C3.15 Elevation of Banks and Design Water Level (1/2, 1/10, 1/100 R.P.) along Mekong, Bassac and Tonle Sap River.

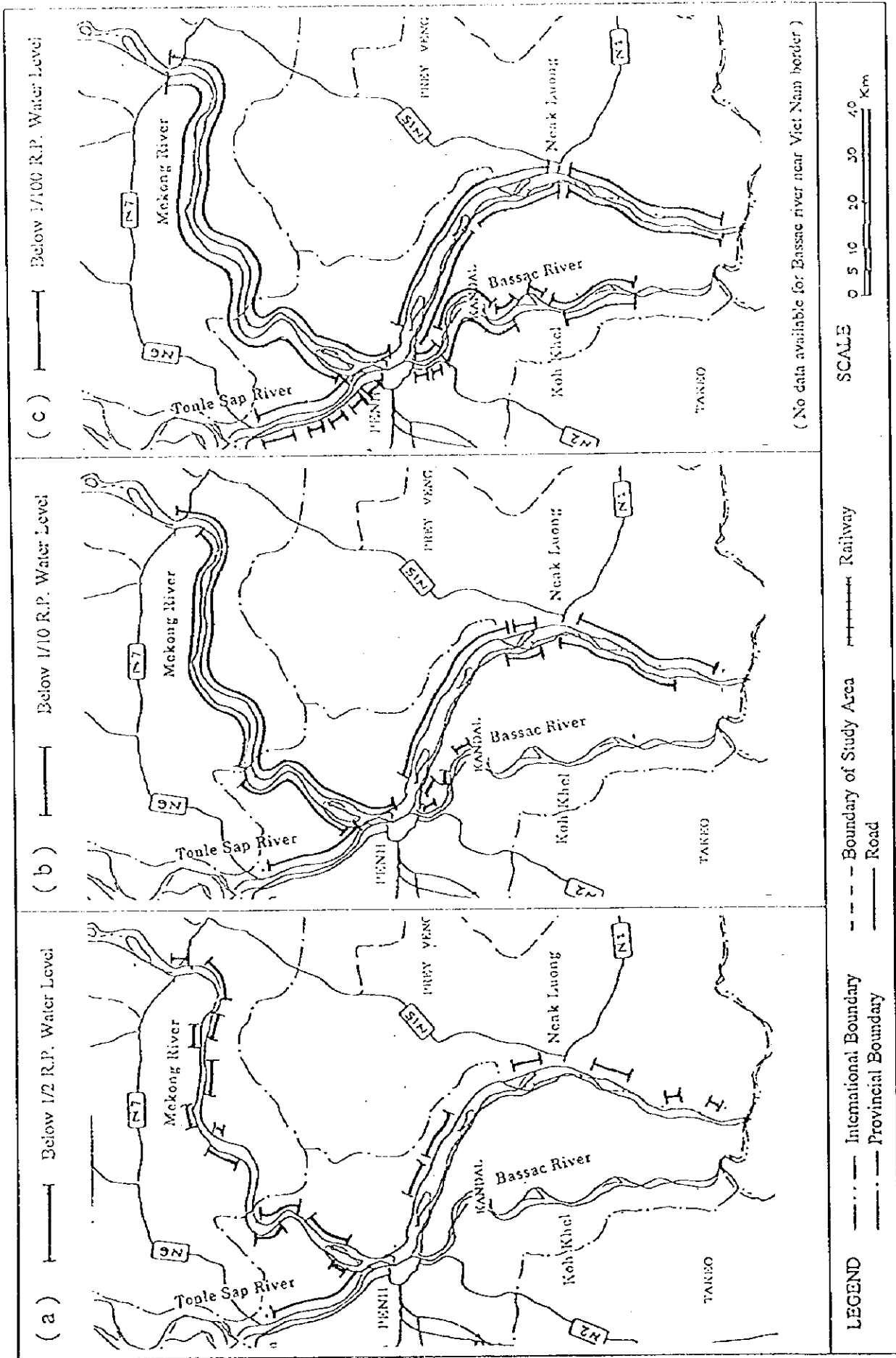


Figure C3.16 Stretches of Left and Right Bank along Mekong, Bassac and Tonle Sap River below 1/2, 1/10 and 1/100 Return Period Flood Level.

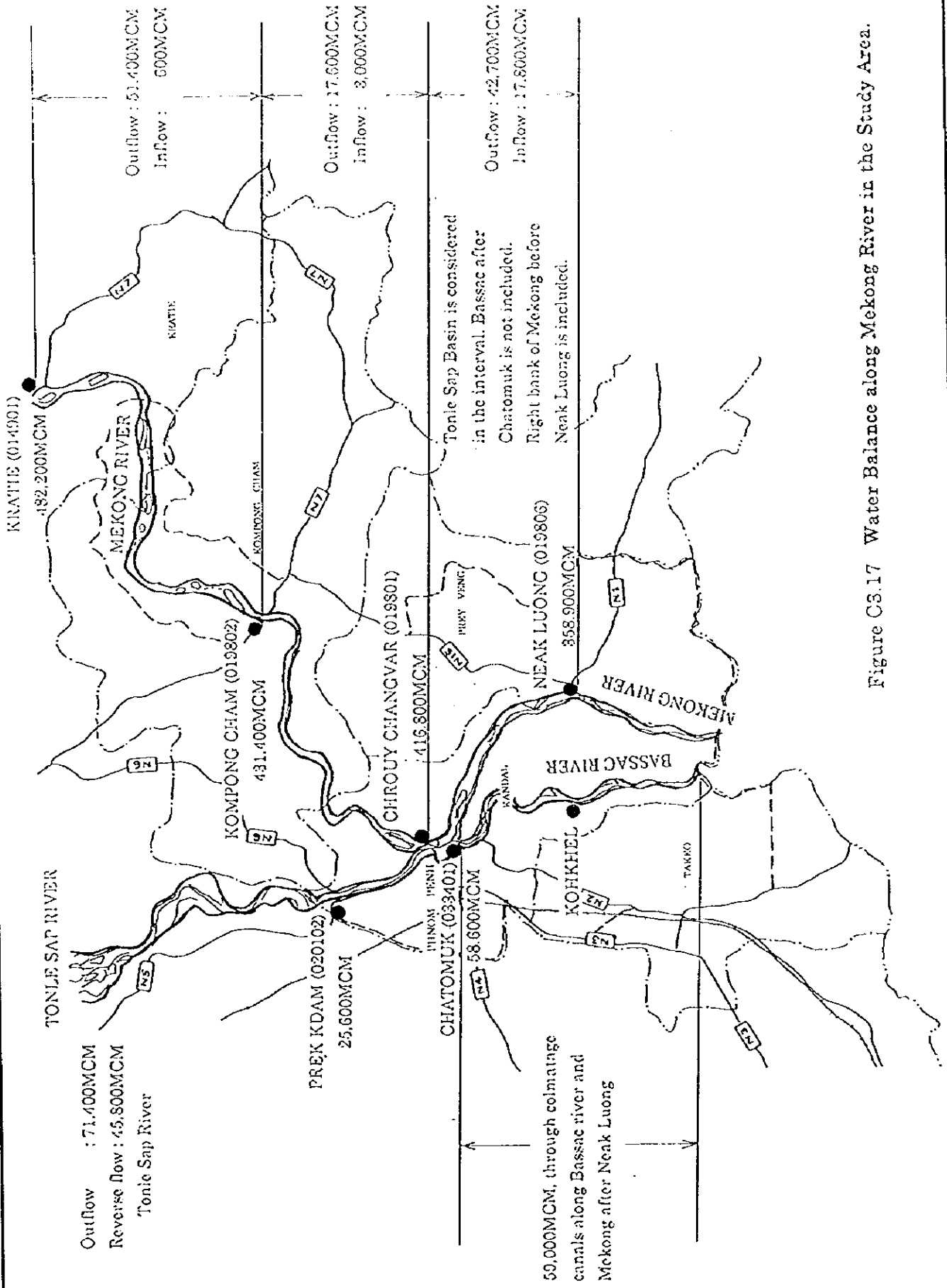


Figure C3.17 Water Balance along Mekong River in the Study Area.

Overtopping and flow into/from colmatage & tributaries

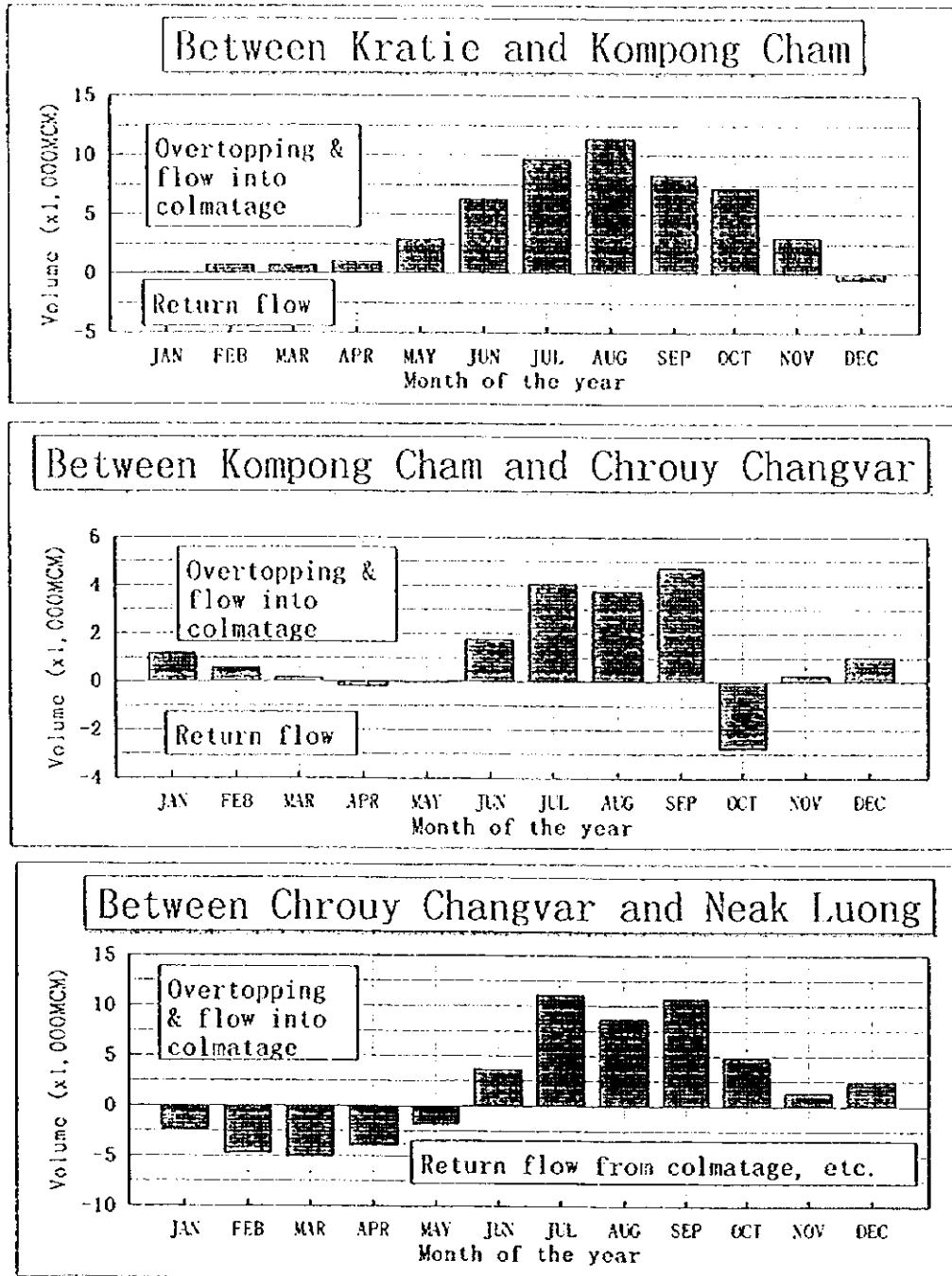
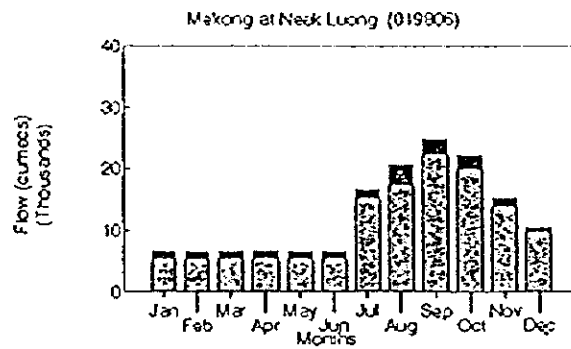
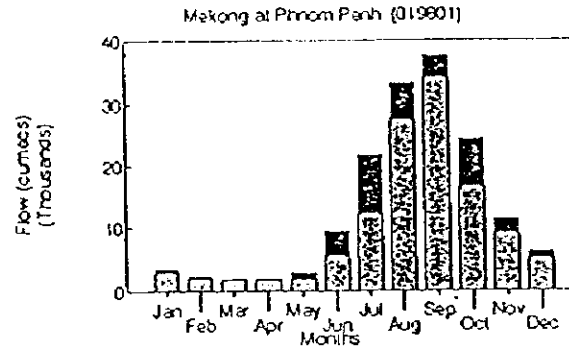
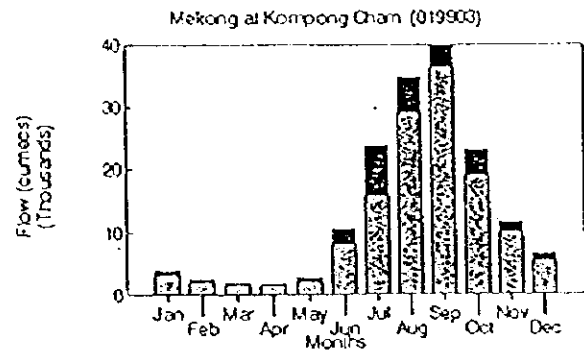
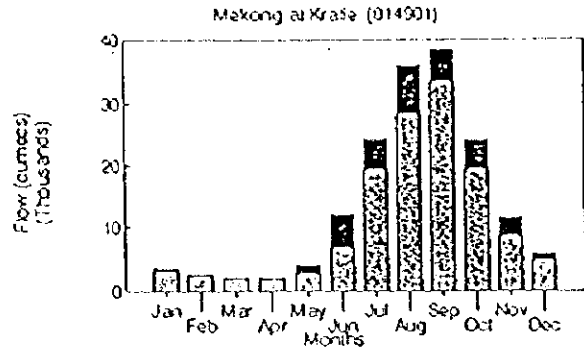


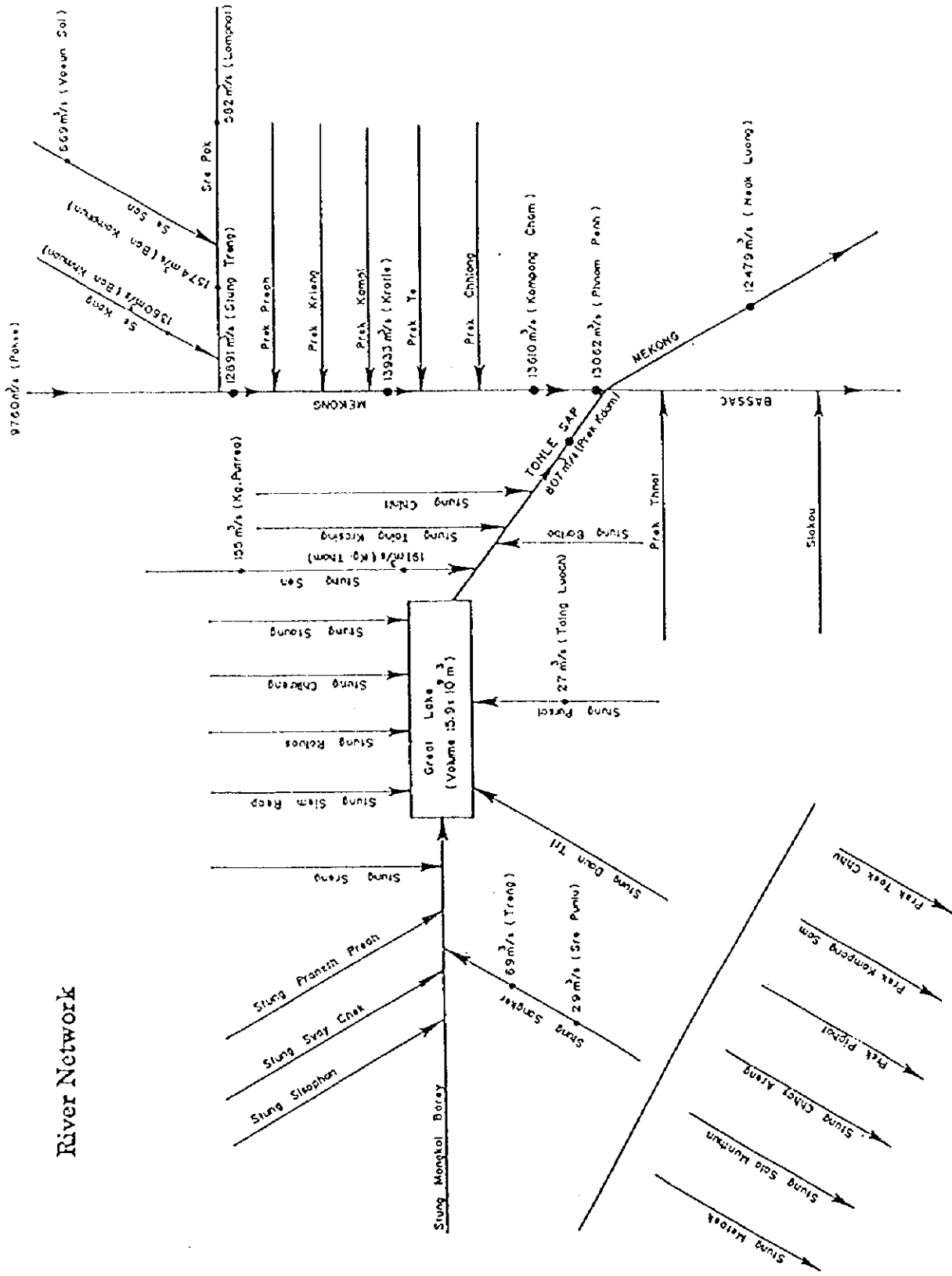
Figure C3.18 Overtopping and Flow into/from Colmatage and Tributaries

Monthly Flow



Abstracted from Irrigation Rehabilitation Study in Cambodia, Final Report, Mekong Secretariat

Figure C3-19 Monthly Flow at the Main Gauging Station along Mekong

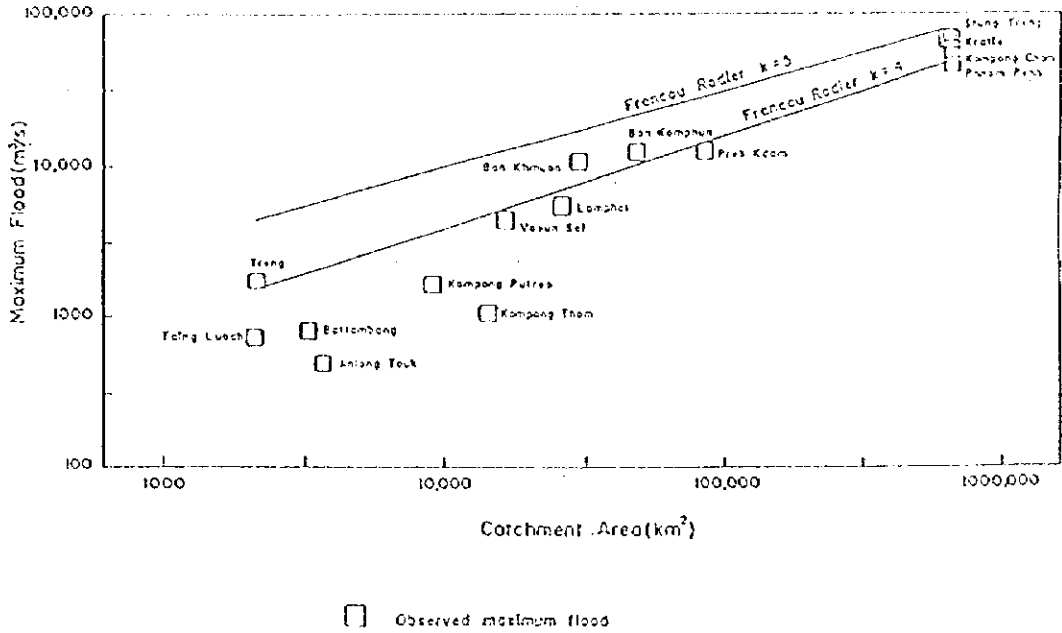


River Network

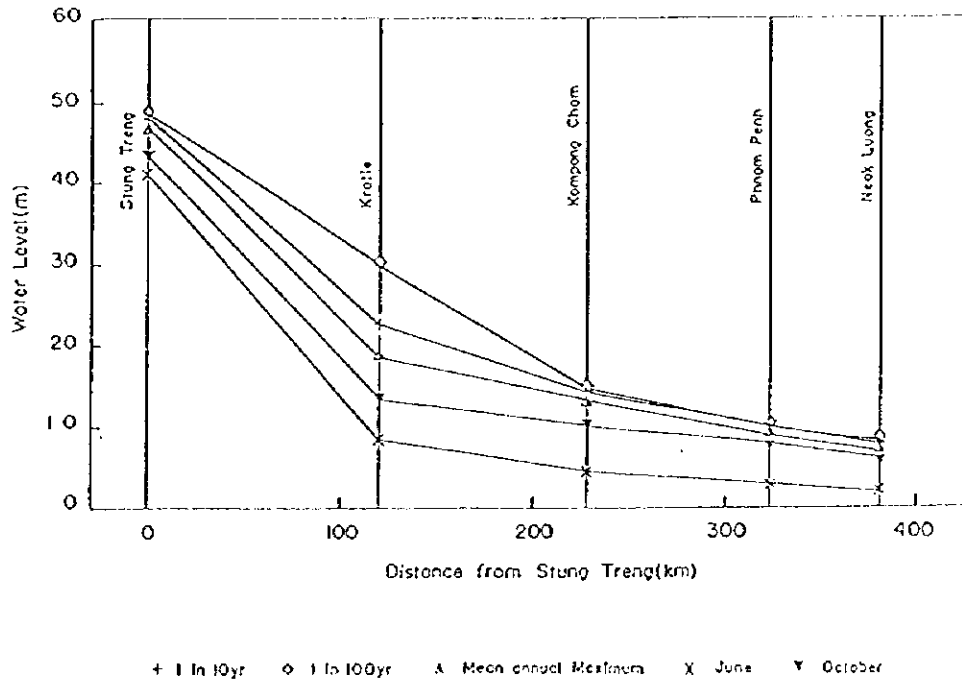
Figure C3-20 River Network of Cambodia

Abttracted from Irrigation Rehabilitation Study in Cambodia, Final Report, Mokong Secretariat

Maximum Floods and Catchment Area



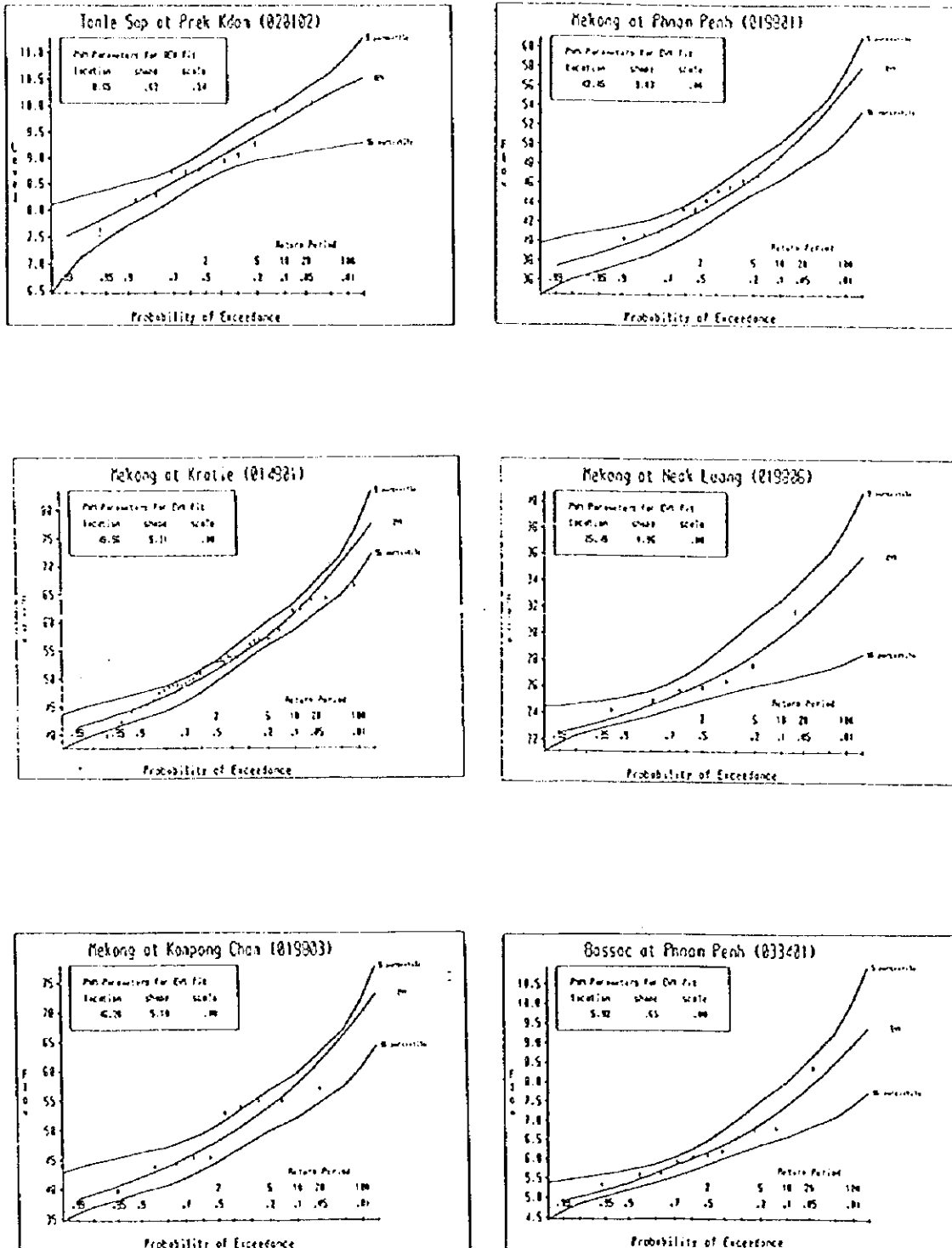
Variation in Mekong River Levels



Abstracted from Irrigation Rehabilitation Study in Cambodia, Final Report, Mekong Secretariat

Figure C3-21 Maximum Flood and Catchment Area, and Variation in Mekong River Water Level

Frequency of Peak Water Level

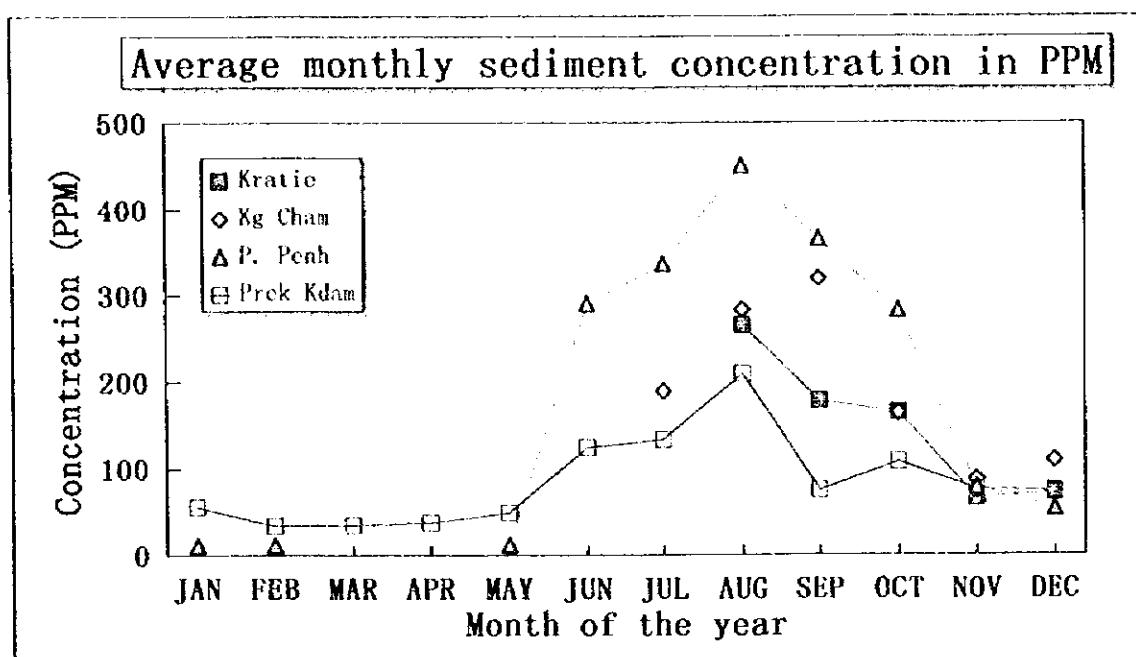


Abstracted from Irrigation Rehabilitation Study in Cambodia, Final Report, Mekong Secretariat

Figure C3-22 Frequency of Peak Water Level

Average monthly sediment concentration in PPM

	Kratie	Kompong Cham	Phnom Penh	Prek Kdam
JAN			11	56
FEB			11	31
MAR				35
APR				38
MAY			12	49
JUN			291	125
JUL		190	337	134
AUG	266	281	450	210
SEP	179	320	366	75
OCT	165	164	283	108
NOV	66	88	79	76
DEC	72	110	51	74



Reproduced from the composition of Mekong river silt and its possible role as a source of plant nutrient in the delta soils, Uehara, 1974.

Figure C3.23 Average Monthly Sediment Concentration in Mekong Water.

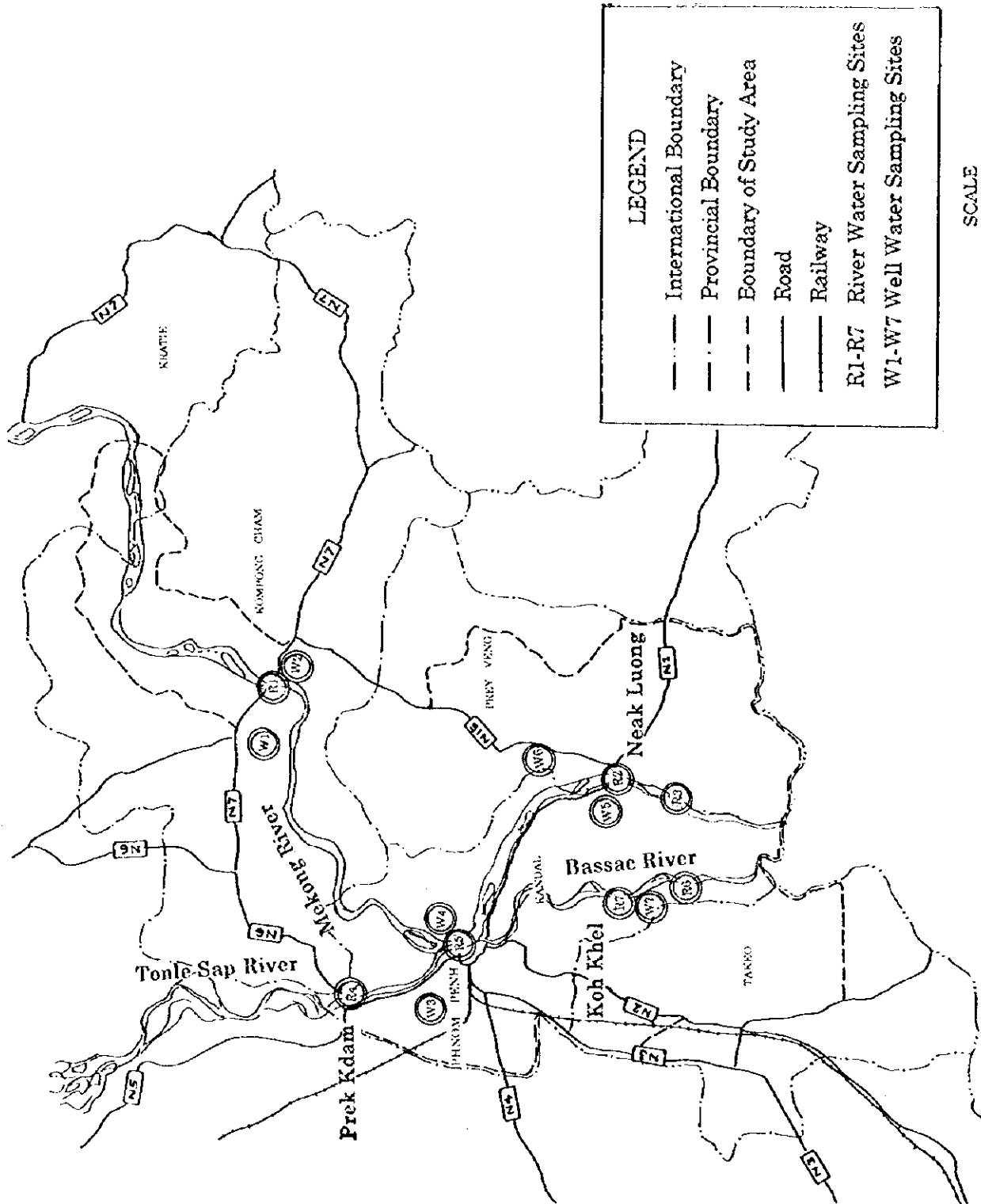


Figure C4.1 Location of Water Sampling sites in the Study Area.

Basic meteorological data at Pochentong

Month	Jan I	Feb II	Mar III	Apr IV	May V	Jun VI	Jul VII	Aug VIII	Sep IX	Oct X	Nov XI	Dec XII	Total
Rainfall	3.6	2.8	29.5	66.3	124.6	122.5	167.7	168.3	303.4	225.5	92.5	6.5	1313.2
Temperature													
T mean	25.7	27.1	28.7	29.7	29	28.1	27.5	27.4	27	26.8	26.2	25	
T min	21.3	22.6	23.8	25.8	25.7	25	24.9	24.6	24.4	24	21.3	21.1	
T max	31.1	32.6	34.2	34.6	33.6	33.4	32.5	32.1	31.6	30.4	30.1	30	
Humidity													
U mean	69	68	67	68	75	78	80	80	84	83	79	74	
Evaporation	162	170.7	227.5	202.6	184.6	137.8	137.5	130.1	108.8	111.2	117.6	142.2	1832.6
Sunshine	258.8	279.7	246.9	244.1	186.5	190.3	181.5	173.9	199.5	225.1	275.3	275.3	2736.9

Note: Sunshine obtained from Meteorological station for September was 370.1 hr, much higher than expected.
 The data shown here was the average of August and October.

Table C2.2 Basic Meteorological Data - Pochentong

Meteorological Data - Kratie

Station: Kratie										
Latitude: 12° 29' N										
Longitude: 105° 1' E										
Altitude: 24 m										
Length of Record: 20 years										
Month	Max Temp °C	Min Temp °C	Rel. Humid %	Wind km/day	Sun-shine hours	Solar Rad. MJ/m ² /d	ET _p Panmen		Rain mm	Eff. Rain mm
							mm/d	mm/m		
Jan	32.2	19.5	71	104	7.5	17.8	3.9	120.8	8	9
Feb	33.7	21.8	72	78	7.2	18.8	4.1	114.8	13	13
Mar	35.3	23.1	71	85	8.6	22.3	5.0	155.0	23	22
Apr	35.9	24.5	73	78	7.4	20.9	4.9	147.0	108	89
May	33.8	24.0	83	85	5.8	18.3	4.2	130.2	242	148
Jun	32.8	23.8	83	60	6.5	19.0	4.2	128.0	242	148
Jul	31.4	23.5	85	85	3.5	14.7	3.4	105.4	343	155
Aug	31.8	23.8	85	78	4.8	16.8	3.7	114.7	258	151
Sep	30.8	23.8	84	78	3.5	14.5	3.3	99.0	345	160
Oct	31.0	22.8	83	60	7.1	19.0	3.9	120.9	175	128
Nov	31.0	21.7	82	85	5.9	15.9	3.4	102.0	75	65
Dec	31.0	19.8	77	104	7.1	18.8	3.8	111.6	25	25
Av/Sum	32.5	22.5	79	82	6.2	17.3	4.0	1447.5	1858	1116

Source: Agrometeorological Group of the FAO Research and Technology Development Division, 1991.

Station: Kampong Cham										
Latitude: 12° 0' N										
Longitude: 105° 27' E										
Altitude: 16 m										
Length of Record: 10 years										
Month	Max Temp °C	Min Temp °C	Rel. Humid %	Wind km/day	Sun-shine hours	Solar Rad. MJ/m ² /d	ET _p Panmen		Rain mm	Eff. Rain mm
							mm/d	mm/m		
Jan	31.6	21.0	70	104	9.1	20.1	4.2	130.2	2	2
Feb	32.9	21.9	70	78	9.1	21.8	4.5	125.0	6	6
Mar	34.0	25.5	66	85	8.5	22.2	5.0	155.0	29	28
Apr	34.6	24.9	72	78	8.2	22.2	5.1	153.0	77	68
May	33.4	24.7	78	85	7.2	20.3	4.5	142.6	245	149
Jun	32.2	24.1	82	60	6.4	18.8	4.1	129.0	228	145
Jul	31.4	23.9	82	85	5.8	18.0	4.0	124.0	219	142
Aug	31.5	24.0	82	78	5.7	18.1	4.0	124.0	274	152
Sep	31.2	23.8	84	78	5.2	17.1	3.7	111.0	253	150
Oct	31.0	23.6	82	60	6.5	18.1	3.8	117.8	245	149
Nov	30.9	22.8	77	85	7.7	18.4	3.8	114.0	112	92
Dec	30.7	21.6	71	104	8.6	18.9	4.0	124.0	6	6
Av/Sum	32.1	23.5	75	82	7.3	19.5	4.2	1544.6	1698	1089

Source: Agrometeorological Group of the FAO Research and Technology Development Division, 1991.

Station: Pnom Penh (Pochentong)										
Latitude: 11° 33' N										
Longitude: 104° 51' E										
Altitude: 10 m										
Length of Record: 65 years										
Month	Max Temp °C	Min Temp °C	Rel. Humid %	Wind km/day	Sun-shine hours	Solar Rad. MJ/m ² /d	ET _p Panmen		Rain mm	Eff. Rain mm
							mm/d	mm/m		
Jan	30.7	21.3	74	104	8.3	19.1	4.0	124.0	7	7
Feb	32.1	22.0	77	78	7.9	20.0	4.2	117.6	8	8
Mar	33.8	23.2	75	85	8.8	22.4	4.8	148.8	32	30
Apr	34.6	24.3	76	78	8.0	21.9	4.5	147.0	72	64
May	33.5	24.3	84	85	6.4	19.1	4.3	133.3	143	113
Jun	32.7	24.3	82	60	6.0	18.7	4.1	123.0	249	113
Jul	31.6	24.3	84	85	4.5	18.1	3.7	114.7	150	114
Aug	31.7	24.7	82	78	5.5	17.9	4.0	124.0	156	117
Sep	30.9	24.7	84	78	4.2	15.7	3.5	105.0	230	145
Oct	30.4	24.4	83	60	6.5	18.2	3.8	117.8	259	151
Nov	30.1	23.3	81	85	7.1	17.7	3.7	111.0	123	102
Dec	30.0	21.8	74	104	7.7	17.8	3.7	114.7	37	35
Av/Sum	31.8	23.5	80	82	6.5	18.7	4.1	1480.9	1376	599

Source: Agrometeorological Group of the FAO Research and Technology Development Division, 1991.

Abstracted from Irrigation Rehabilitation Study in Cambodia, Final Report, Mekong Sub-comit

Table C2.3 Meteorological Data - Kratie, Kompong Cham & Pochentong

Effective rainfall at the provinces of the study area

Kratie			Kampong Cham			Pochentong		
Unit:mm			Unit:mm			Unit:mm		
Year	Effective rainfall (a)	Annual Total (b)	Year	Effective rainfall (a)	Annual Total (b)	Year	Effective rainfall (a)	Annual Total (b)
(a)/(b)			(a)/(b)			(a)/(b)		
81	999.0	1775.4	81	759.8	1305.7	82	741.6	1360.6
82	931.4	1955.6	82	761.9	1512.6	83	606.8	1120.7
83	869.2	1722.5	83	726.6	1289.9	84	583.8	1178.8
84	687.9	1322.8	84	762.6	1346.4	85	707.8	1282.5
85	679.8	1199.1	85	831.4	1482.5	86	695.3	1351.3
86	918.2	1636.3	86	637.0	1163.3	87	774.0	1551.8
87	542.6	929.6	87	585.5	1119.4	88	762.5	1369.0
88	790.2	1470.9	88	784.7	1395.9	89	733.1	1437.7
92	918.5	1758.8	89	896.3	1813.7	90	658.8	1142.1
93	829.4	1712.8	91	659.8	1218.0	91	612.4	1253.6
94	940.1	1633.3	92	843.8	1508.5	92	597.6	1094.8
Average			827.8	1556.1	0.54	93	606.8	1120.7
						94	667.0	1223.6
						95	738.6	1413.3
						Average		
						677.6	1278.6	0.53

Prey Veng			Takoo		
Unit:mm			Unit:mm		
Year	Effective rainfall (a)	Annual Total (b)	Year	Effective rainfall (a)	Annual Total (b)
(a)/(b)			(a)/(b)		
85	587.9	1248.7	85	760.0	1165.0
87	657.2	1139.7	89	652.7	1222.8
90	657.8	1260.8	91	562.7	1045.3
91	439.2	752.4	92	552.6	1087.6
92	561.5	949.4	93	727.0	1384.0
93	780.6	1469.7	94	658.9	1157.5
95	798.2	1472.0	95	638.2	1187.0
Average			640.3	1184.7	0.55

Note: Most of the effective rainfall occurs in the rainy season. For Prey Veng and Takoo, some doubtful data are deliberately omitted.

Table C2.4 Effective Rainfall

Water Level Data Available in the Study Area

Station Name	code	Latitude	Longitude	Altitude (m)	Items	Data availability																										
						6	7					8					9															
						0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	
Prek Kdam	020102	11° 48.7'	104° 48.1'		Water level	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Tonle Sap Phnom Penh Port	020101	11° 34.3'	104° 55.9'		Water level	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Tonle Sap	014901	12° 28.6'	106° 00.9'		Water level	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Kratie	019803	11° 59.7'	105° 27.9'		Water level	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Mekong River Kompong Chum St.	019803	11° 59.7'	105° 27.9'		Water level	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Mekong River	019801	11° 33.07"	104° 56' 33"		Water level	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Chrouy Changvar (Mekong River, Phnom Penh)	019806	11° 15.37"	105° 17' 13"		Water level	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Neak Luong	033401	11° 33.7'	104° 55.9'		Water level	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Mekong River	033401	11° 33.7'	104° 55.9'		Water level	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Chaktomuk (Bassac River, Phnom Penh)	033402	11° 27'	105° 02'		Water level	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Koh Khel																																
Bassac River																																

Discharge Data Available in the Study Area

Station Name	code	Latitude	Longitude	Altitude (m)	Items	Data availability																											
						6	7					8					9																
						0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5		
Prek Kdam	020102	11° 48.7'	104° 48.1'		Discharge	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Tonle Sap Phnom Penh Port	020101	11° 34.3'	104° 55.9'		Discharge	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Tonle Sap	014901	12° 28.6'	106° 00.9'		Discharge	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Kratie	019803	11° 59.7'	105° 27.9'		Discharge	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Mekong River Kompong Chum St.	019803	11° 59.7'	105° 27.9'		Discharge	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Mekong River	019801	11° 33.07"	104° 56' 33"		Discharge	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Chrouy Changvar (Mekong River, Phnom Penh)	019806	11° 15.37"	105° 17' 13"		Discharge	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Neak Luong	033401	11° 33.7'	104° 55.9'		Discharge	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Mekong River	033401	11° 33.7'	104° 55.9'		Discharge	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Chaktomuk (Bassac River, Phnom Penh)	033402	11° 27'	105° 02'		Discharge	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Koh Khel																																	
Bassac River																																	

* : Data available from sources such as Hydrological Department, Lower Mekong Hydrological Yearbook.

* also include incomplete dataset.

Table C3.1 Data Availability - Hydrological Data

Annual maximum, minimum and mean value of water level

Kratie				Kompong Cham				Chrouy Changvar			
Year	max	min	mean	Year	max	min	mean	Year	max	min	mean
35	18.87	3.87	9.97	60	13.73	1.07	5.50	80	8.67	0.14	3.63
37	21.75	3.81	10.28	61	14.43	1.33	6.62	61	9.90	0.66	4.60
39	23.20	4.33	10.63	62	13.68	0.99	6.12	62	9.14	0.69	4.31
41	21.06	4.61	10.71	63	13.70	0.81	5.71	63	8.75	0.53	3.97
42	20.25	4.67	10.30	61	13.93	0.99	5.79	64	9.11	0.71	4.05
43	20.47	4.75	10.15	65	12.52	0.99	5.60	65	8.31	0.52	4.13
44	19.41	4.56	9.72	66	14.51	0.93	6.10	66	9.91	0.67	4.31
45	20.22	4.15	10.15	67	13.23	1.09	5.45	67	8.76	0.62	3.78
47	19.60	4.42	10.27	68	14.05	1.03	5.03	68	8.71	0.59	3.48
48	20.91	4.28	10.22	69	13.21	0.81	5.61	69	8.81	0.37	3.95
49	19.72	4.48	9.77	70	14.09	0.93	5.99	70	9.16	0.64	4.23
51	19.99	4.26	9.77	71	13.03	1.02	6.01	71	8.83	0.64	4.35
53	19.21	4.00	9.42	72	14.15	1.00	5.89	72	9.20	0.60	4.16
54	20.17	3.24	7.95	73	13.13	0.93	5.64	73	8.87	0.76	3.96
55	16.69	2.60	7.79	62	13.03	0.10	4.52	83	8.65	0.57	3.69
56	19.51	2.82	8.69	63	11.77	0.00	4.13	84	9.62	0.63	4.39
60	19.89	3.59	9.03	84	13.59	0.01	5.03	85	8.84	0.74	4.29
64	21.30	4.06	10.49	85	12.21	0.00	4.93	87	8.18	0.51	3.53
62	19.81	4.49	10.00	88	12.11	0.00	4.74	88	6.64	1.16	3.31
63	19.89	3.95	9.49	89	10.84	0.00	4.03	91	9.61	1.02	4.41
64	20.28	4.04	9.69	90	12.63	0.00	5.07	93	7.90	0.64	3.51
65	17.91	4.37	9.55	91	14.77	1.74	6.25	94	9.50	0.65	4.33
66	21.08	4.29	10.00	92	13.13	1.21	5.32	95	9.12	0.66	4.08
68	20.42	3.95	8.83	93	12.50	0.63	5.10				
80	18.10	2.26	7.52	94	14.24	1.08	6.16				
81	18.74	2.51	8.46	95	14.33	0.97	5.83				
82	16.33	2.64	7.41								
83	16.24	2.42	6.95								
84	19.51	2.18	7.66								
85	16.69	2.22	7.76								
86	16.77	2.31	7.55								
87	17.95	2.18	6.57								
89	14.39	1.93	6.41								
89	17.93	4.37	9.15								
90	20.07	4.41	10.32								
91	21.47	4.72	9.83								
92	19.00	4.70	8.96								
93	18.20	4.20	9.01								
94	20.57	4.45	10.18								
95	20.58	4.36	9.78								
Average	17.96	3.89	9.16	Average	12.61	0.92	5.47	Average	8.55	0.65	4.02

Chatomuk				Neak Luong				Prek Kdaa			
Year	max	min	mean	Year	max	min	mean	Year	max	min	mean
1960	8.93	0.20	3.68	1965	6.47	0.17	2.95	1961	10.14	0.69	4.82
1961	9.96	0.72	4.66	1966	7.60	0.21	3.15	1962	9.37	0.52	4.59
1964	9.04	0.70	4.06	1967	6.63	0.12	2.69	1963	8.86	0.48	4.14
1965	8.29	0.64	4.13	1968	6.56	0.07	2.31	1964	9.01	0.63	4.15
1966	9.91	0.62	4.34	1969	6.53	0.14	2.87	1965	8.28	0.62	4.23
1967	8.74	0.64	3.77	1989	5.71	0.66	2.89	1966	10.02	0.66	4.53
1968	8.66	0.64	3.46	1990	6.57	0.73	3.41	1967	8.83	0.66	3.98
1969	8.77	0.31	3.94	1991	7.35	0.60	3.23	1968	8.38	0.84	3.57
1970	9.14	0.38	4.22	1992	5.91	0.56	2.72	1969	8.83	0.73	4.07
1971	8.82	0.69	4.36	1993	5.87	0.53	2.74	1970	9.15	0.43	4.37
1972	9.16	0.64	4.18	1994	7.19	0.57	3.34	1971	9.01	0.65	4.50
1973	8.86	0.60	3.93	1995	6.99	0.53	3.17	1972	9.04	0.71	4.37
1974	8.82	0.78	3.82	Average	6.38	0.61	2.95	1988	7.72	1.36	3.68
1981	9.45	0.70	4.81					1992	7.62	0.76	3.70
1982	8.92	0.90	4.06					1993	7.87	0.70	3.65
1983	8.72	0.72	3.77					1994	9.77	0.72	4.57
1984	9.61	0.76	4.46								
1985	8.87	0.74	4.36								
1986	8.70	0.67	4.21								
1987	8.07	0.63	3.56								
1988	7.30	0.74	3.46								
1989	7.80	0.63	3.67								
1990	8.80	0.60	4.36								
1991	9.54	0.64	4.21								
1992	7.99	0.68	3.53								
1993	7.93	0.56	3.53								
1994	9.51	0.64	4.34								
1995	9.12	0.63	4.14								
Average	8.43	0.84	4.03	Average	6.16	0.70	3.11	Average	8.68	0.83	4.19

Note: For Koh Khel, since zero gauge height was not available, 1.0m was assumed

Table C3.2 Annual Maximum, Minimum and Mean Water level

Results of simplified in-situ test for water quality survey

River water

Location	Kompong Cham		Neak Luong		Prek Dach		Prek Kdam		Chaktomuk		Prek Tanom		Koh Khel		Remarks
Latitude			11-15-22N		11-10-09N		11-48-41N		11-33-39N		11-03-45N		11-16-21N		
Longitude			105-16-49E		105-14-09E		104-48-30E		104-56-22E		105-04-11E		105-01-570E		
No./code		R1	R2		R3		R4		R5		R6		R7		
Season		Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet		
Date (96/xx/xx)		4/25	8/30	4/11	9/5	4/24	9/5	4/12	9/10	4/23	9/10	4/24	9/9	4/24	9/9
Time		11:00	10:30	10:30	09:30	14:15	09:30	08:00	09:30	14:15	14:30	11:15	13:30	15:30	
pH		8.20	7.73	7.60	7.38	7.70	7.63	7.20	7.48	7.10	7.62	8.50	7.69	9.00	7.70
Ec (mS/cm)		0.22	0.13	0.22	0.12	0.19	0.12	0.67	0.12	0.71	0.12	0.91	0.15	0.12	0.12
SS (NTU)		10	999	10	635	12	830	10	212	10	327	66	450	117	450
DO (mg/l), PPM		6.5	4.3	5.2	5.0	3.8	4.0	3.5	4.6	4.3	4.4	8.3	5.5	10.3	5.8
Temp (C)		31.0	27.8	30.5	28.7	30.1	28.8	30.7	28.9	31.0	29.2	34.6	29.3	34.4	29.2
NaCl (%)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00
C. Bacillus		+ve	+ve	+ve	+ve	+ve	+ve	+ve	+ve	+ve	+ve	+ve	+ve	+ve	+ve

Note: R1, R2, R3, R4 and R6 were sampled from ferry at middle of river. For R5 & R7 sample was take at the bank.

Well water

Location	Kompong Cham		Phnom Penh		Neak Luong		Koh Khel	
Village		Prek Kumun	Ban Salang	Wat Fai Churam				
Latitude			11-36-14N	11-35-34N		11-22-47N		11-15-58N
Longitude			105-54-52E	104-57-24E		105-20-04E		105-01-50E
No./code		W1	W2	W3	W4	W5	W6	W7
Type		Open	Open	Open	Tube	Tube	Tube	Tube
Date (96/xx/xx)		4/25	8/30	4/23	9/10	4/24	9/5	4/24
Time		09:30	09:15	12:00	10:55	11:30	10:20	10:00
pH		7.30	7.67	6.90	7.05	6.70	6.96	6.60
Ec (mS/cm)		1.05	1.75	0.61	0.66	0.53	0.53	0.48
SS (NTU)		10	1	10	4	10	5	46
DO (mg/l), PPM		1.8	3.5	3.7	1.4	3.5	2.3	1.4
Temp (C)		28.0	28.5	29.5	28.9	29.8	29.5	29.5
NaCl (%)		0.04	0.08	0.02	0.02	0.02	0.01	0.01
C. Bacillus		+ve	+ve	+ve	+ve	+ve	+ve	+ve

Note: Open: dug/open well Tube: Tube well, sealed and equipped with hand pump, constructed mostly by UNICEF

Table C4.1 Results of Simplified In-situ test

Water Quality Analysis results for river water (wet season)

PARAMETERS	R1	R2	R3	R4	R5	R6	R7
pH	6.86	7.48	7.58	7.56	7.69	7.64	7.62
TSS mg/l	1376	516	828	84	180	300	588
Cond ms/m 25 °C	12.100	11.400	11.300	11.300	57.400	11.000	10.920
Ca meq/l	0.863	0.700	0.761	0.729	0.695	0.732	0.689
Mg meq/l	0.189	0.308	0.256	0.250	0.217	0.141	0.229
Na meq/l	0.160	0.110	0.110	0.110	0.110	0.210	0.220
K meq/l	0.060	0.030	0.060	0.040	0.060	0.080	0.060
Alk meq/l	1.010	0.986	0.975	1.004	0.925	0.931	0.945
Cl meq/l	0.050	0.062	0.065	0.067	0.076	0.067	0.077
SO ₄ meq/l	0.109	0.144	0.092	0.086	0.086	0.102	0.092
Tot. Fe mg/l	3.720	2.840	4.420	1.150	3.600	1.890	2.670
(NO ₃ +NO ₂)-Nmg/l	0.342	0.248	0.300	0.125	0.197	0.245	0.687
NO ₂ -N mg/l	0.092	0.083	0.090	0.020	0.027	0.045	0.477
NH ₄ -N mg/l	0.020	0.260	0.090	0.090	0.250	0.070	0.060
PO ₄ -P mg/l	0.050	0.040	0.050	0.050	0.070	0.100	0.100
Tot P mg/l	0.060	0.050	0.060	0.070	0.100	0.140	0.120
Si mg/l	0.820	0.920	0.920	0.880	0.930	0.900	0.880
COD _{Mn} mg/l	1.720	2.624	3.198	2.260	1.690	3.136	2.993
ΣAn	1.169	1.193	1.132	1.157	1.087	1.102	1.114
ΣCat	1.272	1.148	1.187	1.129	1.082	1.163	1.198
$\frac{\Sigma An - \Sigma Cat}{\Sigma An + \Sigma Cat} \cdot 100$	4.20%	1.92%	2.37%	1.22%	0.23%	2.69%	3.63%

Water Quality Analysis results for well water (wet season)

PARAMETERS	W1	W2	W3	W4	W5	W6	W7
pH	7.730	7.040	7.080	6.860	7.450	7.330	7.430
TSS mg/l	0	0	0	48.000	8.000	0	0
Cond ms/m 25 °C	168.800	65.500	51.200	36.100	50.100	21.200	57.500
Ca meq/l	2.981	2.755	0.624	1.512	3.060	0.592	0.153
Mg meq/l	6.311	3.092	4.608	1.156	1.980	0.828	3.347
Na meq/l	8.200	1.300	0.720	0.850	0.600	0.850	0.660
K meq/l	0.040	0.015	0.020	0.020	0.040	0.040	0.030
Alk meq/l	11.700	6.180	5.190	3.340	5.319	1.869	3.500
Cl meq/l	0.012	0.005	0.009	0.170	0.012	0.280	0.032
SO ₄ meq/l	0.448	0.324	0.992	0.352	0.310	0.098	0.768
Tot. Fe mg/l	1.400	0.350	0.800	14.440	13.250	0.550	0.95
(NO ₃ +NO ₂)-Nmg/l	0.089	2.702	0.124	0.021	0.064	0.029	0.0216
NO ₂ -N mg/l	0.002	0.002	0.002	0.016	0.027	0.001	0.0006
NH ₄ -N mg/l	0.030	0.060	0.020	4.700	1.180	0.020	0.040
PO ₄ -P mg/l	0.040	0.060	0.060	0.260	0.020	0.110	0.080
Tot P mg/l	0.050	0.070	0.070	0.270	0.030	0.120	0.090
Si mg/l	6.800	7.550	3.450	3.600	4.100	6.000	3.400
COD _{Mn} mg/l	2.337	0.328	0.600	1.810	3.751	0.656	0.492
ΣAn	16.336	6.509	6.090	3.862	5.319	2.247	4.300
ΣCat	17.532	7.162	5.972	3.490	5.680	2.310	4.190
$\frac{\Sigma An - \Sigma Cat}{\Sigma An + \Sigma Cat} \cdot 100$	3.53%	4.70%	0.97%	4.30%	3.28%	2%	1.29%

Table C4.2 Results of Detail Test (by Water Quality Lab in GDMH)