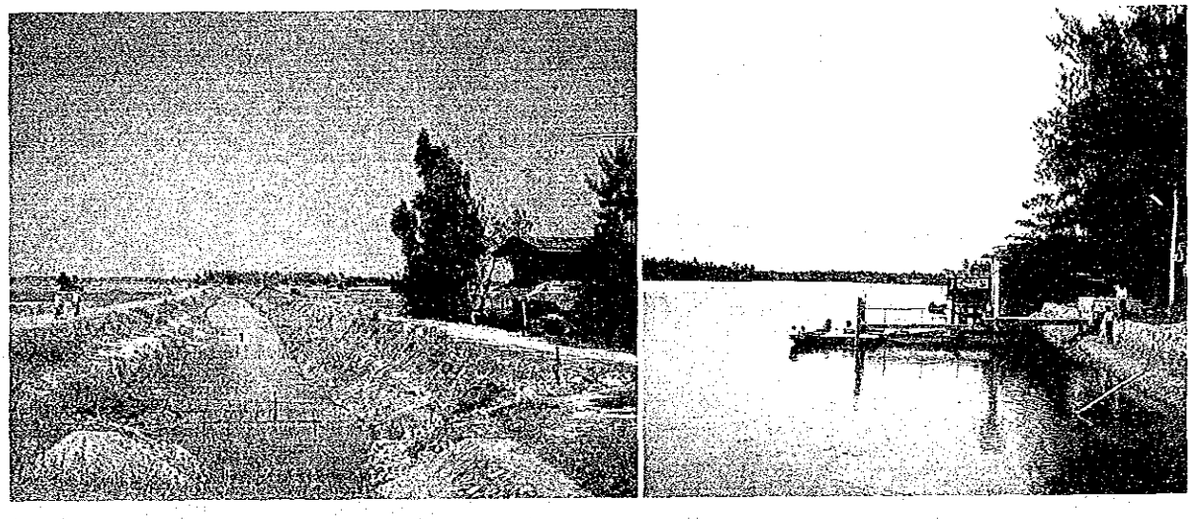
KINGDOM OF THAILAND
ROYAL IRRIGATION DEPARTMENT
MINISTRY OF AGRICULTURE AND COOPERATIVES

THE FEASIBILITY STUDY ON THE AGRICULTURAL WATER DEVELOPMENT PROJECT OF BANG PAKONG RIVER BASIN

Appendix (1)



OCTOBER 1990

JAPAN INTERNATIONAL COOPERATION AGENCY

KINGDOM OF THAILAND

ROYAL IRRIGATION DEPARTMENT

MINISTRY OF AGRICULTURE AND COOPERATIVES

THE FEASIBILITY STUDY
ON
THE AGRICULTURAL WATER DEVELOPMENT PROJECT
OF
BANG PAKONG RIVER BASIN

APPENDIX (1)

OCTOBER 1990

JAPAN INTERNATIONAL COOPERATION AGENCY

LIST OF APPENDIX

APPENDIX-A. METEOROLOGY AND HYDROLOGY

Appendix A- Meteorology and Hydrorology

LIST OF CONTENTS

A.1.1 Climatological Data at Prachinburi(1956-85)

Station Prachinburi
Index Station 48430
Latitude 14 03 N
Longtitude 101 22 N

Elevation of Station above MSL 5 Meters
Height of Balometer above MSL 6 Meters
Height of thermometer above groung 1.20 Meters
Height of wind vane above ground 11.00 Meters
Height of raingauge 0.80 Meters

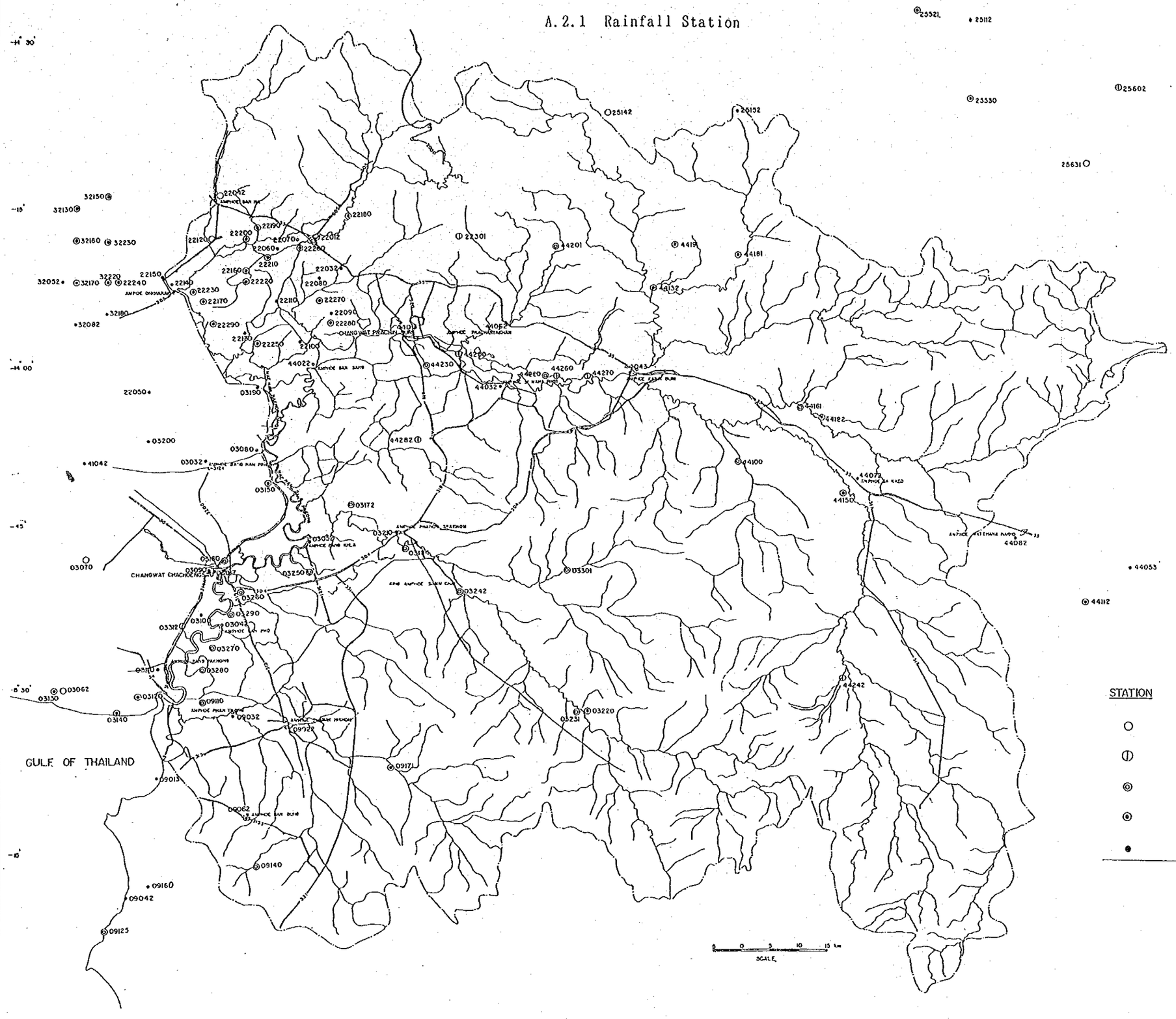
	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Year
Pressure(+1000 or 900 mbs)													
Mean	12.69	11.25	10.19	08.72	07.17	06.62	06.73	06.60	07.69	09.87	11.72	12.73	09.33
Max.	24.30	22.06	22.28	18.17	14.90	14.25	13.30	13.80	14.63	18.14	20.38	21.48	24.30
Ext. Min.	03.96	01.73	02.17	99.71	99.64	98.10	98.66	99.54	98.20	01.50	04.58	03.96	98.10
Mean Daily Range	5.18	5.55	5.72	5.31	4.54	3.95	3.73	3.88	4.33	4.46	4.43	4.67	4.65
Temperature (C)													
Mean	26.8	28.7	30.1	30.5	29.7	29.0	28.5	28.3	26.1	28.2	27.5	26.6	28.5
Mean Max.	32.4	34.1	35.7	36.0	34.4	33.0	32.2	31.8	31.6	31.8	31.8	31.6	33.0
Mean Min.	19.4	22.1	23.9	24.9	25.1	24.9	24.6	24.6	24.5	24.3	22.4	19.9	23.4
Ext. Max.	36.6	38.4	39.6	40.7	40.4	39.8	36.4	34.7	34.8	34.8	35.6	35.8	40.8
Ext. Min.	11.3	15.0	14.6	19.8	21.4	20.8	21.8	22.2	20.0	19.0	14.1	11.5	11.3
Relative Humidity (%)													
Mean	58.4	62.3	63.9	68.4	75.2	78.3	79.9	80.9	81.4	76.4	67.2	60.4	71.1
Mean Max.	83.1	86.2	87.9	89.4	91.4	92.7	93.3	93.9	94.1	90.0	84.5	81.9	89.1
Mean Min.	40.7	43.3	44.5	49.9	59.2	64.5	67.1	68.6	69.1	63.5	52.9	44.7	55.7
Ext.Min.	21.0	16.0	23.0	24.0	30.0	37.0	50.0	48.0	47.0	34.0	25.0	23.0	16.0
Dew Point (C)													
Mean	17.3	20.0	21.9	23.5	24.4	24.6	24.5	24.5	24.5	23.4	20.5	17.8	22.2
Evaporation													
Mean-Pan	146.8	134.8	173.6	167.4	164.5	123.2	147.6	136.6	131.4	129.5	129.9	143.9	1729.1
Cloudness(0-10)													
Mean	3.7	4.7	5.3	6.3	7.6	8.3	8.4	8.7	8.2	6.6	4.7	3.8	6.4
Wind(knot)													
Prevailing Wind	E	E	E	S	E	W	W	W	W	E	E	E	-
Mean Wind Speed	3.6	3.3	2.9	2.4	2.4	2.1	2.1	2.3	2.2	3.0	4.1	4.3	-
Max.Wind Speed	38NE	48 N	55SE	55SE	55 E	55WE	48 W	42 W	52 W	50EE	34NE	34NE	55ESS
Rainfall(mm)													
Mean	9.1	26.8	58.6	123.5	214.7	271.0	318.1	378.0	380.3	177.6	35.7	7.9	2001.3
Mean Rainy Days	1.1	2.2	4.8	9.7	17.4	19.1	21.7	23.3	21.6	14.7	4.5	0.8	141.1
Greatest in 24 hr.	58.2	65.2	50.6	109.0	125.0	168.0	124.7	161.7	116.9	123.8	59.5	85.5	168.0
Day/Year	22/84	11/70	8/56	18/62	23/58	25/64	15/83	15/70	20/69	6/84	12/67	7/72	25/64
Number of Days With													
Haze	24.4	21.6	20.7	14.5	4.3	1.0	0.9	0.7	0.8	4.5	12.2	19.9	125.5
Fog	3.4	2.8	1.3	0.4	0.1	0.0	0.0	0.1	0.0	0.2	1.5	2.2	12.0
Thunderstorm	0.6	2.5	6.8	14.8	18.0	12.9	14.5	14.4	12.8	10.3	2.3	0.2	110.0

A.1.2 Climatological Data at Chonburi (1956-85)

Station	Chon buri	Elevation of Station above MSL	1 Meters
Index Station	48459	Height of Balometer above MSL	2 Meters
Latitude	12 22 N	Height of thermometer above ground	1.50 Meters
Longitude	100 59 N	Height of wind vane above ground	13.45 Meters
		Height of raingauge	1.00 Meters

	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Year
Pressure(+1000 or 900 mbs)													
Mean	12.27	10.86	08.34	06.86	06.38	06.51	06.51	06.53	07.53	09.59	11.33	12.28	09.03
Max.	22.57	20.63	19.80	18.00	14.00	12.97	13.35	12.97	14.96	17.22	20.60	20.66	22.57
Ext. Min.	03.74	02.21	02.44	00.26	99.44	97.44	98.72	99.44	98.74	00.64	04.27	03.50	97.44
Mean Daily Range	4.65	4.64	4.73	4.60	4.26	3.66	3.54	3.77	4.25	4.41	4.34	4.49	4.28
Temperature (C)													
Mean	25.7	27.3	28.7	29.5	29.2	28.9	28.5	28.3	27.7	27.3	26.7	25.8	27.8
Mean Max.	31.7	32.4	33.3	34.3	33.6	32.7	32.2	31.9	31.6	31.7	31.6	31.7	32.4
Mean Min.	20.1	22.5	24.3	25.4	25.5	25.5	25.1	24.9	24.3	23.6	22.1	20.4	23.6
Ext. Max.	37.5	37.6	37.8	38.8	38.5	37.1	36.1	35.8	35.5	35.9	36.2	36.7	38.8
Ext. Min.	12.1	16.5	17.5	20.4	21.2	20.8	20.5	21.4	21.0	17.9	14.2	12.0	12.0
Relative Humidity (%)													
Mean	67.3	71.2	71.2	71.9	74.8	74.2	75.5	76.4	80.3	79.9	72.7	66.2	73.5
Mean Max.	84.4	87.4	86.8	87.0	88.0	87.2	88.3	89.2	92.2	92.3	88.0	83.3	87.8
Mean Min.	48.8	54.8	55.2	55.3	59.3	60.4	61.4	62.4	65.8	64.3	55.0	47.5	57.5
Ext.Min.	20.0	22.0	19.0	26.0	32.0	42.0	43.0	43.0	46.0	32.0	24.0	22.0	19.0
Dew Point (C)													
Mean	18.5	21.1	22.5	23.6	24.1	23.7	23.4	23.5	23.7	23.1	20.8	18.4	22.2
Evaporation													
Mean-Pan	129.0	128.4	167.4	164.4	153.8	146.8	150.3	129.9	129.8	125.1	118.3	138.7	1681.9
Cloudness(0-10)													
Mean	4.0	4.3	4.5	5.4	7.3	8.0	8.1	8.4	8.2	7.0	5.2	4.1	6.2
Wind(knot)													
Prevailing Wind	E	S	S	S	S	S	S	S	S	NE	NE	NE	-
Mean Wind Speed	4.7	5.2	5.3	4.8	4.2	4.9	4.6	4.6	3.5	3.5	4.9	5.1	-
Max.Wind Speed	28N	33 W	25S	40 E	40 W	40W	40 W	40 W	40sW	40NE	40NE	30NE	40E
Rainfall(mm)													
Mean	10.8	26.3	29.7	79.4	151.9	133.5	143.7	163.4	296.2	205.9	61.3	8.8	1310.9
Mean Rainy Days	1.3	3.0	4.2	8.0	14.2	14.4	15.3	18.5	20.2	17.0	6.7	1.4	125.2
Greatest in 24 hr.	60.8	92.1	33.7	90.9	103.3	132.7	79.1	131.0	186.2	121.5	91.8	37.7	186.2
Day/Year	3/78	25/58	23/80	19/77	7/66	5/84	21/64	27/71	16/81	19/74	4/75	1/70	16/81
Number of Days With													
Haze	27.6	23.6	24.0	14.2	1.6	0.6	0.5	1.0	1.2	4.4	14.7	24.1	137.5
Fog	0.9	1.0	0.3	0.2	0.0	0.0	0.0	0.0	0.1	0.2	0.4	0.2	3.3
Thunderstorm	0.6	2.2	5.8	13.4	15.2	7.5	8.5	8.9	13.6	12.2	3.9	0.5	92.3

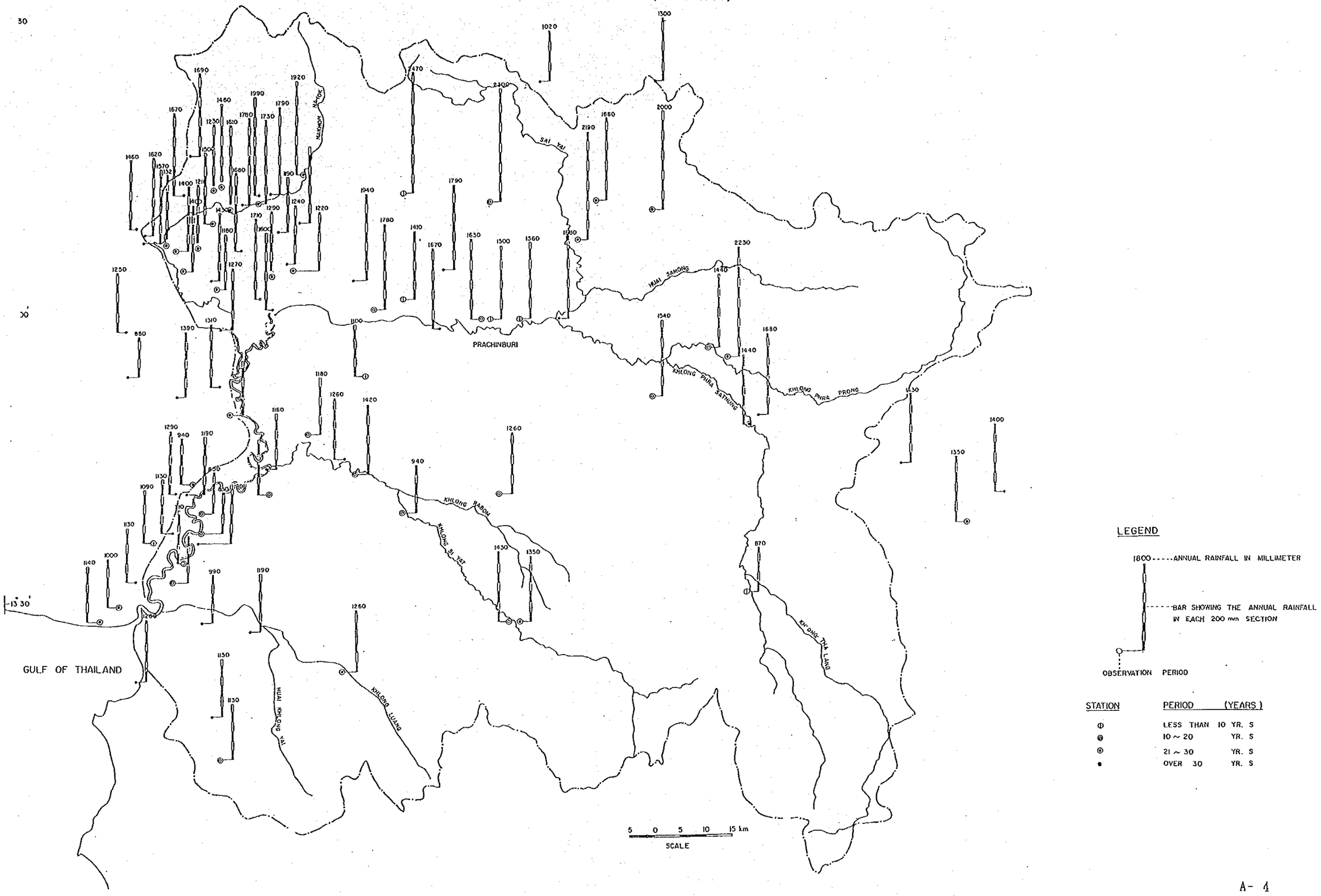
A.2.1 Rainfall Station



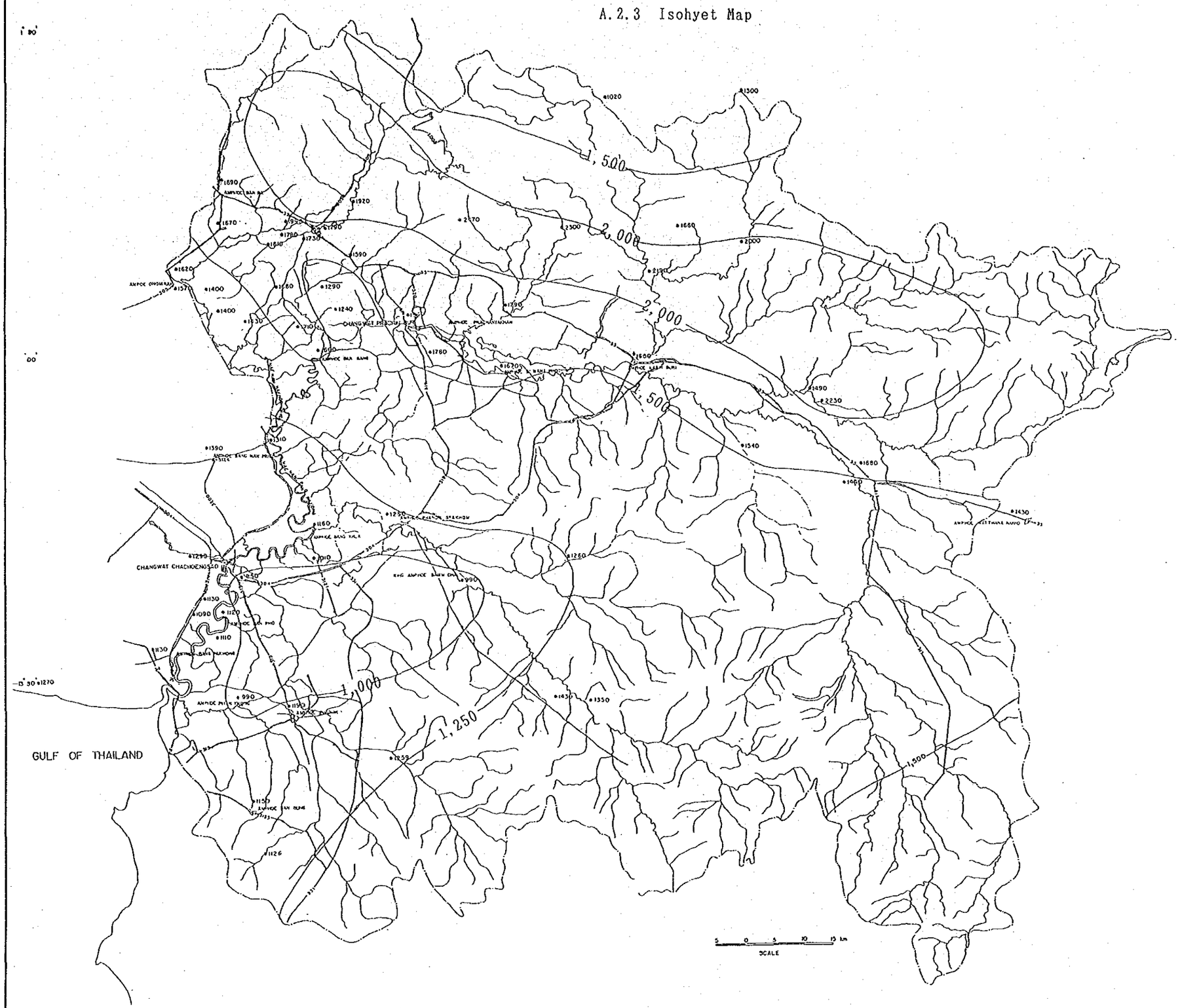
LEGEND

STATION	RECORDING START	PERIOD (YEARS)
○	SUSPENDED	SUSPENDED
◐	1979 ~	LESS THAN 10 YR. S
◎	1969 ~ 1978	10 ~ 20 YR. S
◉	1959 ~ 1968	21 ~ 30 YR. S
●	~ 1958	OVER 30 YR. S

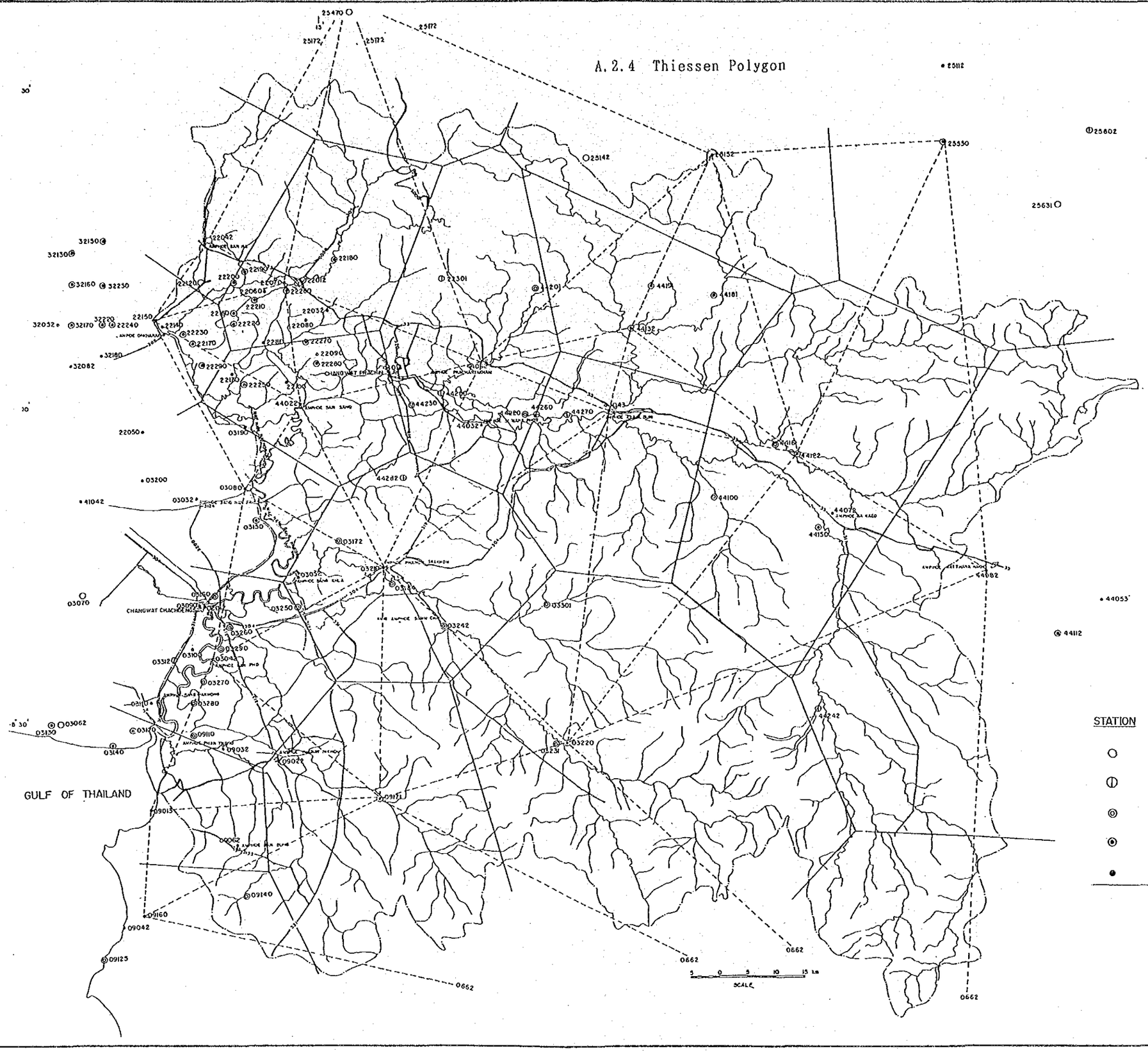
A.2.2 Mean Annual Rainfall (1968-1987)



A.2.3 Isohyet Map



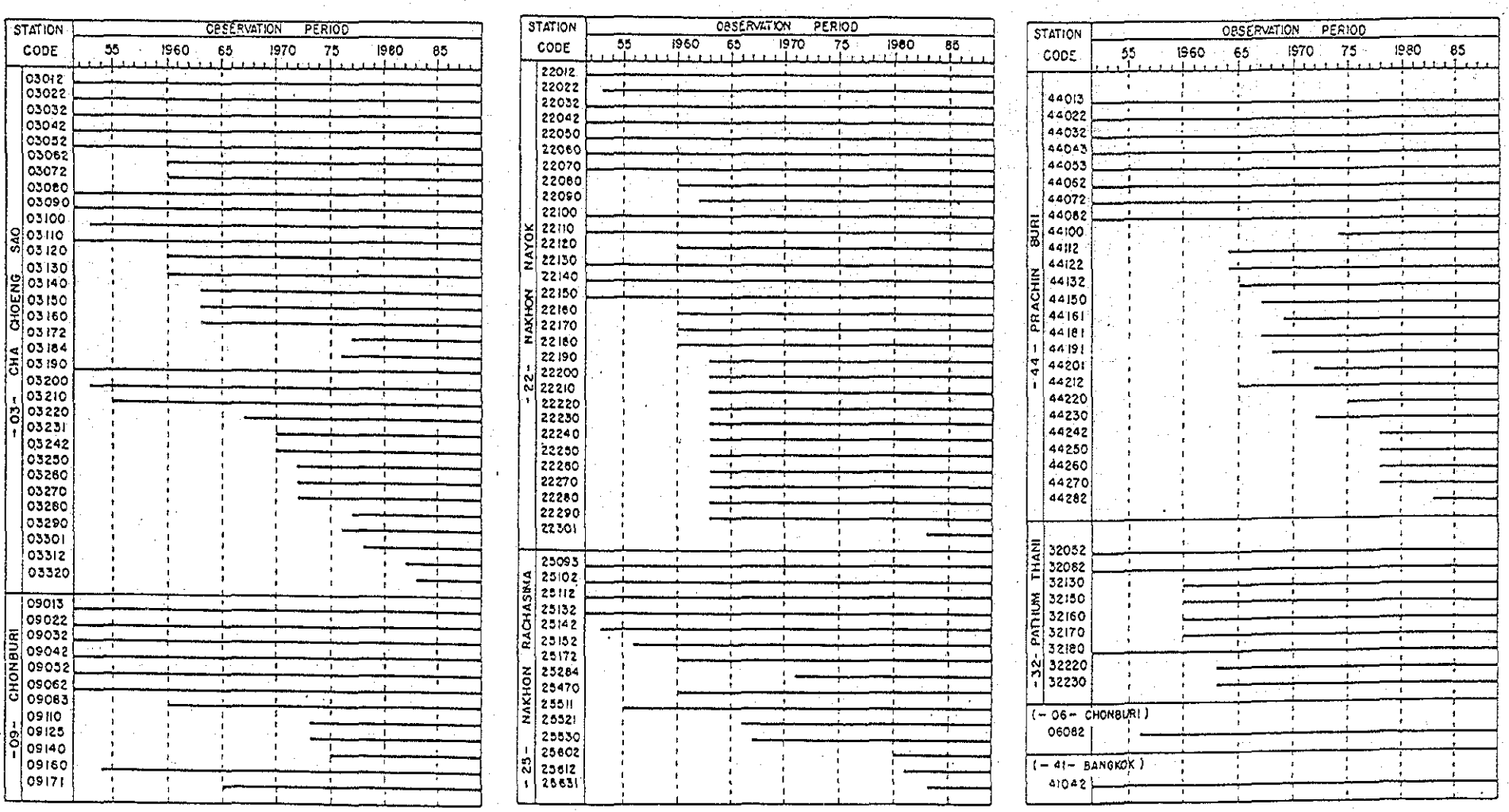
A.2.4 Thiessen Polygon



LEGEND

STATION	RECORDING START	PERIOD (YEARS)
○	SUSPENDED	SUSPENDED
◐	1979 ~	LESS THAN 10 YR. S
◎	1969 ~ 1978	10 ~ 20 YR. S
◉	1959 ~ 1968	21 ~ 30 YR. S
●	~ 1958	OVER 30 YR. S

A.2.1 Observation Period of Rainfall Station



A.2.6 Thiessen Areal Ratio

Block No.	C. Area (km^2)	Rainfall (mm)	Station Code (Thiessen %)																			
			03042	03080	03210	03220	09013	09160	09171	44022	44043	44062	44082	44122	44132	06062	25152	25172	25530	22042	22070	22150
LBP - 1	35	1,260	-	-	-	-	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	119	1,140	87	10	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	526	1,190	68	-	32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	142	1,210	37	-	-	-	63	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	279	1,260	-	-	-	-	80	5	15	-	-	-	-	-	-	-	-	-	-	-	-	-
6	80	1,200	44	-	-	-	-	-	56	-	-	-	-	-	-	-	-	-	-	-	-	-
7	501	1,260	-	-	-	-	-	29	71	-	-	-	-	-	-	-	-	-	-	-	-	-
8	182	1,210	36	-	-	-	-	-	64	-	-	-	-	-	-	-	-	-	-	-	-	-
9	88	1,260	-	-	-	-	-	-	100	-	-	-	-	-	-	-	-	-	-	-	-	-
10	85	1,260	-	-	-	-	-	-	100	-	-	-	-	-	-	-	-	-	-	-	-	-
11	184	1,260	-	-	-	5	-	-	95	-	-	-	-	-	-	-	-	-	-	-	-	-
12	344	1,270	-	-	-	13	-	-	87	-	-	-	-	-	-	-	-	-	-	-	-	-
13	56	1,160	82	-	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	201	1,260	-	-	5	-	-	-	95	-	-	-	-	-	-	-	-	-	-	-	-	-
15	65	1,320	-	-	89	-	-	-	11	-	-	-	-	-	-	-	-	-	-	-	-	-
16	199	1,320	-	-	75	10	-	-	15	-	-	-	-	-	-	-	-	-	-	-	-	-
17	20	1,330	-	-	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KTL - 1	32	1,330	-	-	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	86	1,330	-	-	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	69	1,330	-	-	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	137	1,330	-	-	42	58	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	617	1,350	-	-	8	87	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-
6	181	1,430	-	-	-	72	-	-	-	-	28	-	-	-	-	-	-	-	-	-	-	-
7	395	1,330	-	-	-	88	-	-	12	-	-	-	-	-	-	-	-	-	-	-	-	-
8	391	1,330	-	-	-	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	585	1,330	-	-	-	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Block No.	C. Area (km^2)	Rainfall (mm)	Thiessen (%)																			
			03042	03080	03210	03220	09013	09160	09171	44022	44043	44062	44082	44122	44132	06062	25152	25172	25530	22042	22070	22150
UBP - 1	1,060	1,480	-	14	44	-	-	-	-	24	-	18	-	-	-	-	-	-	-	-	-	-
2	446	1,750	-	7	-	-	-	-	-	25	-	44	-	-	-	-	-	-	-	-	24	-
3	750	1,690	-	-	9	-	-	-	-	-	60	28	-	-	3	-	-	-	-	-	-	-
4	394	1,800	-	-	-	-	-	-	-	-	-	95	-	-	5	-	-	-	-	-	-	-
5	107	1,860	-	-	-	-	-	-	-	-	-	82	-	-	18	-	-	-	-	-	-	-
MNR - 1	498	1,720	-	-	-	-	-	-	-	42	-	-	-	-	-	-	-	-	-	2	37	19
2	369	1,520	-	4	-	-	-	-	-	10	-	-	-	-	-	-	-	-	-	24	10	52
3	345	1,780	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	66	34	-
4	114	1,600	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	39	-	61	-	-
5	456	1,860	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	22	-	4	74	-
6	151	1,850	-	-	-	-	-	-	-	-	-	61	-	-	-	-	-	2	-	-	37	-
MPP - 1	970	1,930	-	-	-	7	-	-	-	-	44	-	-	49	-	-	-	-	-	-	-	-
MIM - 1	917	2,140	-	-	-	-	-	-	-	-	8	-	-	14	75	-	3	-	-	-	-	-
2	159	2,110	-	-	-	-	-	-	-	-	-	22	-	-	78	-	-	-	-	-	-	-
3	273	1,570	-	-	-	-	-	-	-	-	-	22	-	-	11	-	42	25	-	-	-	-
4	174	1,490	-	-	-	-	-	-	-	-	-	-	-	-	17	-	83	-	-	-	-	-
5	68	1,340	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	-	-	-	-	-
6	96	1,340	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	-	-	-	-	-
7	232	2,230	-	-	-	-	-	-	-	-	-	-	-	100	-	-	-	-	-	-	-	-
8	64	1,750	-	-	-	-	-	-	-	-	-	-	-	38	8	-	54	-	-	-	-	-
9	147	1,840	-	-	-	-	-	-	-	-	-	-	-	67	-	-	-	-	33	-	-	-
KPS - 1	390	1,970	-	-	-	-	-	-	-	-	-	-	33	67	-	-	-	-	-	-	-	-
2	801	1,470	-	-	-	29	-	-	-	-	-	-	63	8	-	-	-	-	-	-	-	-
3	838	1,520	-	-	-	11	-	-	-	-	-	-	54	-	-	35	-	-	-	-	-	-
4	614	1,570	-	-	-	23	-	-	-	-	-	-	19	-	-	58	-	-	-	-	-	-
UPP - 1	588	2,140	-	-	-	-	-	-	-	-	-	-	11	89	-	-	-	-	-	-	-	-
2	774	1,620	-	-	-	-	-	-	-	-	-	-	77	23	-	-	-	-	-	-	-	-
3	266	1,340	-	-	-	-	-	-	-	-	-	-	43	11	-	-	-	-	46	-	-	-

A.2.7 Maximum One Day Rainfall

Year	ST. 44181		ST. 44132		ST. 44122		ST. 22070	
	Rain (mm)	Date	Rain (mm)	Date	Rain (mm)	Date	Rain (mm)	Date
68	71.5	30 Jun	75.4	15 Jun	86.0	1 Feb	100.4	31 Jul
69	148.0	20 Sep	104.6	3 Sep	80.9	2 May	150.8	30 Sep
1970	102.5	1 Sep	48.3	6 Sep	74.4	21 Jun	105.4	7 Jun
71	72.3	19 Sep	63.7	21 Jun	76.8	19 Sep	144.2	3 Jul
72	115.6	6 Sep	124.6	6 Sep	109.5	5 Sep	169.8	18 Sep
73	132.5	26 Sep	117.2	16 Sep	74.8	5 Jul	104.7	20 Apr
74	80.2	14 Oct	60.4	12 Jun	98.7	11 Oct	70.3	6 Aug
75	94.8	10 Jul	154.1	10 Jul	93.2	9 Oct	119.3	22 Jun
76	84.8	2 Jun	187.6	24 Aug	162.0	1 Jul	120.0	26 Aug
77	78.7	1 May	86.4	15 Apr	108.3	30 Aug	87.2	25 Feb
78	66.0	28 Sep	91.5	13 Sep	144.0	21 Jul	97.8	17 Aug
79	74.2	10 Aug	84.4	22 Sep	124.6	3 Jul	112.7	10 Apr
1980	111.4	28 Sep	87.6	28 Aug	145.3	24 Aug	90.0	5 Aug
81	71.7	22 Oct	86.3	5 May	103.5	21 Aug	68.5	3 Aug
82	119.9	18 Jul	87.0	26 Oct	131.5	20 Aug	77.8	25 Sep
83	123.6	8 Jun	88.0	10 Oct	120.0	29 Sep	112.0	7 Jun
84	88.1	24 Sep	-	-	112.2	18 Aug	114.5	12 Jul
85	68.2	22 Oct	117.8	14 May	166.2	17 Apr	103.5	12 Jul
86	128.0	4 May	78.5	26 Aug	102.0	9 May	238.4	15 Aug
87	114.0	25 Apr	89.0	20 Jun	117.1	7 Jun	99.5	30 Jun

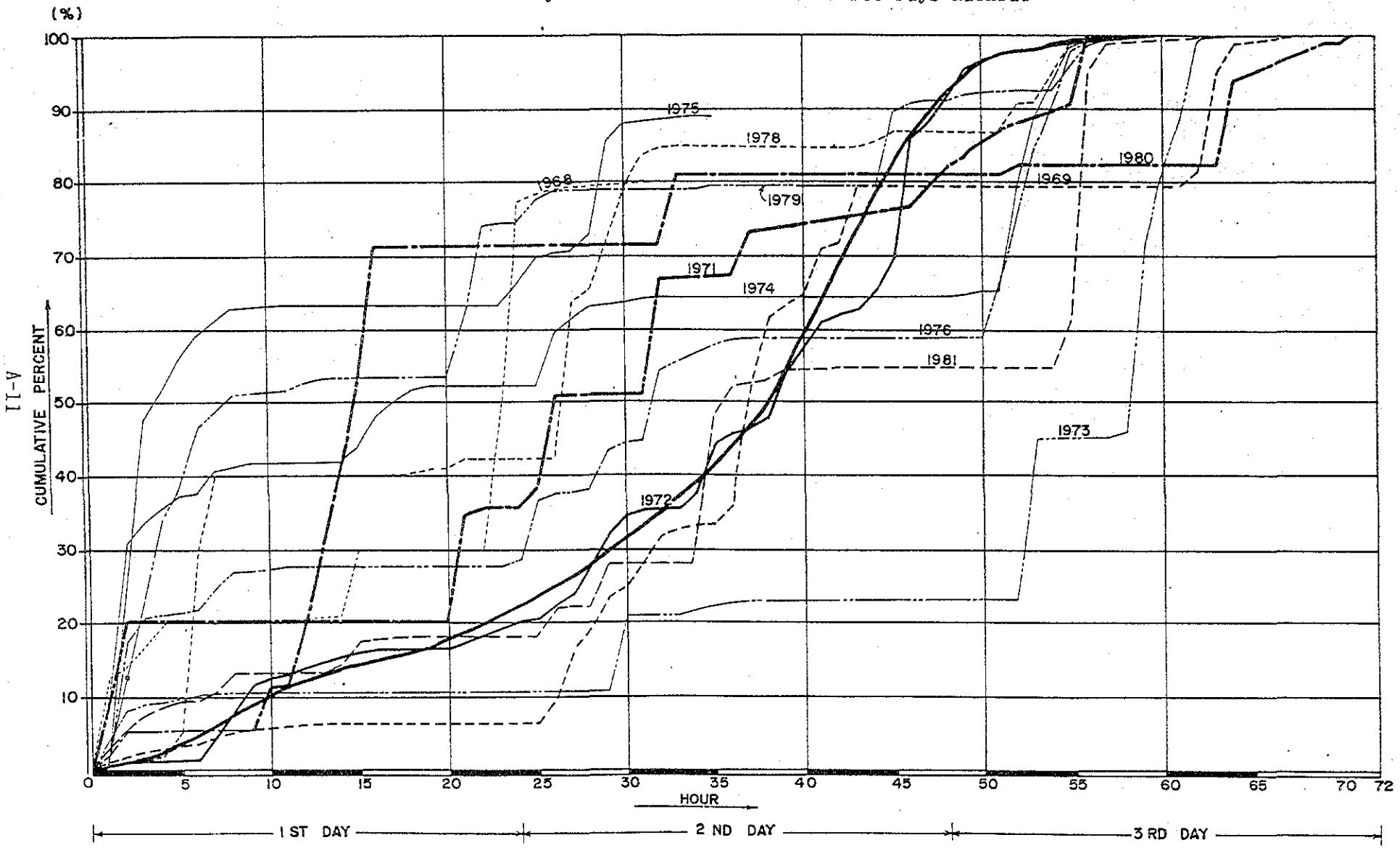
A.2.8 Maximum Two Days Rainfall

Year	ST. 44181		ST. 44132		ST. 44122		ST. 22070	
	Rain (mm)	Date	Rain (mm)	Date	Rain (mm)	Date	Rain (mm)	Date
68	96.9	29 Jun	130.0	29 Jun	86.0	1 Feb	126.7	31 Jul
69	189.5	20 Sep	183.0	3 Sep	144.0	16 Jun	191.0	29 Sep
1970	102.5	1 Sep	64.6	6 Sep	109.0	20 Jun	155.7	7 Jun
71	96.0	28 Aug	82.8	20 Jun	118.1	18 Sep	167.0	3 Jul
72	211.2	5 Sep	217.8	5 Sep	177.5	5 Sep	191.7	5 Sep
73	154.3	25 Sep	214.0	15 Sep	113.2	4 Jul	104.7	20 Apr
74	93.2	19 Jun	90.2	12 Jun	120.2	14 Oct	109.3	6 Aug
75	132.9	10 Jul	200.3	10 Jul	128.3	8 Oct	177.5	10 Jul
76	149.4	1 Jun	230.5	23 Aug	259.5	30 Jun	193.7	29 Aug
77	117.8	9 Sep	115.9	19 Aug	146.0	10 Sep	87.2	25 Feb
78	124.6	27 Sep	146.3	29 Sep	174.5	20 Jul	123.7	21 Jun
79	104.0	9 Aug	164.2	21 Sep	216.1	23 Sep	119.0	23 Sep
1980	138.2	23 Aug	128.9	27 Aug	203.2	17 Jun	114.4	13 Aug
81	122.9	21 Sep	134.1	4 May	126.1	19 Sep	113.5	7 May
82	129.2	17 Jul	87.0	2 Oct	159.7	19 Aug	102.1	1 Aug
83	142.6	8 Jun	133.4	3 Aug	191.2	28 Sep	162.8	10 Oct
84	110.8	18 Aug	-	-	191.7	9 Aug	121.2	12 Jul
85	88.6	22 Apr	130.2	11 Jul	182.5	16 Apr	193.2	11 Jul
86	140.5	3 May	94.2	25 Aug	159.5	8 May	304.9	14 Aug
87	156.9	9 Sep	117.4	9 Sep	117.1	7 Jun	149.6	6 Sep

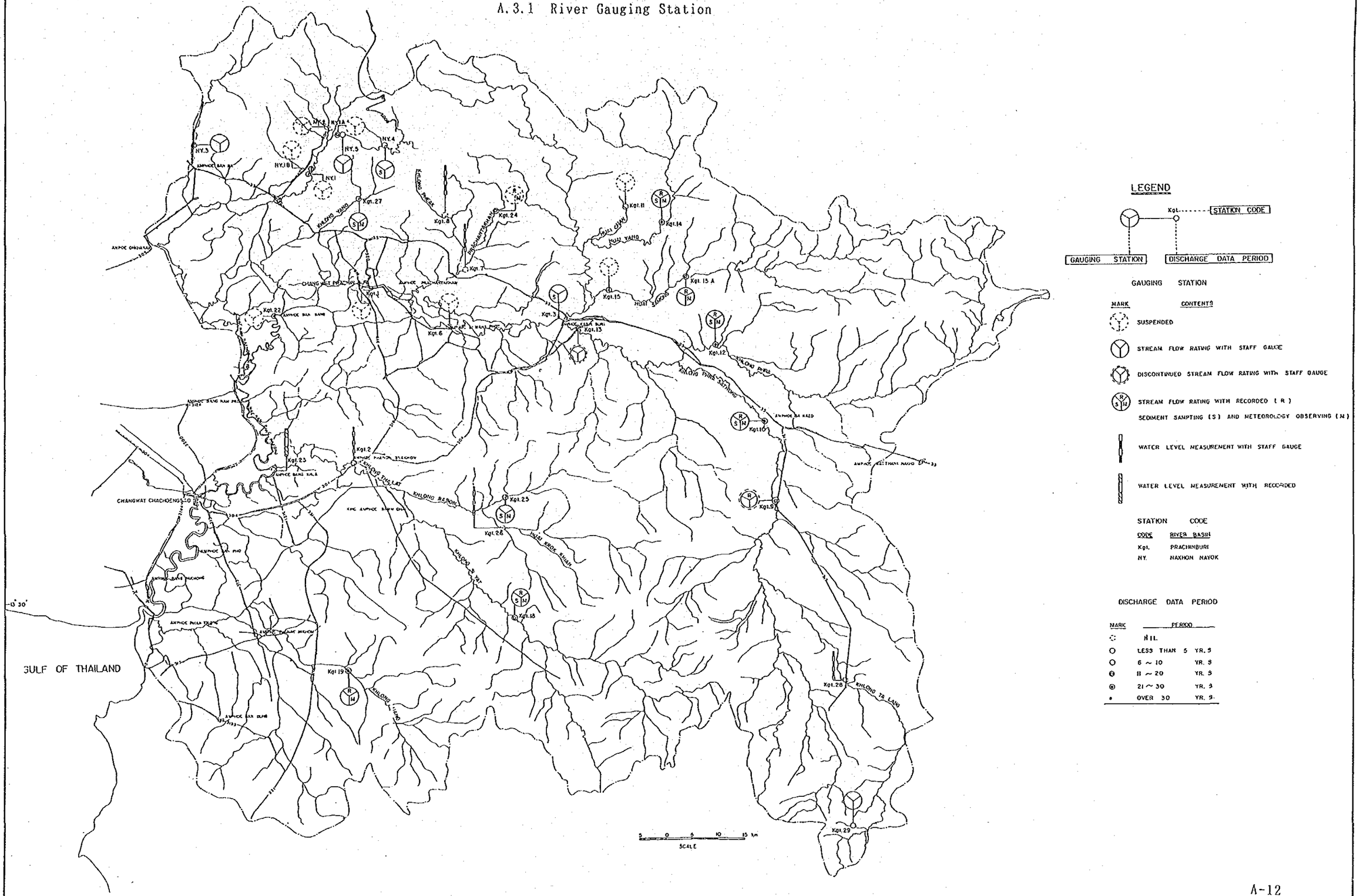
A.2.9 Maximum Three Days Rainfall

Year	ST. 44181		ST. 44132		ST. 44122		ST. 22070		Year	ST. 03042		ST. 03210		ST. 03220		ST. 44032	
	Rain (mm)	M/D	Rain (mm)	M/D	Rain (mm)	M/D	Rain (mm)	M/D		Rain (mm)	M/D	Rain (mm)	M/D	Rain (mm)	M/D	Rain (mm)	M/D
68	121.4	29 Jun	137.3	29 Jun	99.0	10 Aug	177.4	31 Jul	68	118.8	3 Aug	109.4	15 Agr	-	-	121.0	11 Sep
69	202.4	19 Sep	185.7	2 Sep	195.2	16 Jun	207.2	28 Sep	69	147.6	28 May	99.1	20 Sep	-	-	150.2	3 Sep
1970	107.9	1 Sep	83.2	9 Jul	112.1	19 Jun	158.2	7 Jun	1970	114.8	20 Jun	188.5	19 Jun	119.0	24 Aug	175.8	15 Aug
71	120.5	27 Aug	90.4	26 Aug	146.8	17 Sep	192.6	3 Jul	71	122.7	13 Jun	244.8	15 Jun	189.3	28 Aug	198.5	14 Jun
72	251.7	4 Sep	306.1	5 Sep	243.0	4 Sep	204.0	4 Sep	72	148.4	5 Sep	184.5	1 Jun	127.1	6 Sep	195.9	17 Sep
73	172.5	24 Sep	250.4	14 Sep	126.7	4 Jun	147.4	27 Sep	73	87.5	17 Sep	74.8	18 Sep	96.8	26 Sep	126.0	17 Sep
74	115.1	26 Aug	113.1	7 Jun	146.7	9 Oct	109.3	6 Aug	74	180.2	17 Oct	125.4	8 Oct	103.7	23 Jul	97.5	23 Apr
75	149.0	10 Jul	220.1	10 Jul	143.9	8 Oct	200.8	10 Jul	75	98.1	4 Sep	-	-	-	-	109.7	1 Oct
76	206.6	31 May	263.0	23 Aug	324.0	30 Jun	239.6	28 Aug	76	109.6	12 Sep	119.2	11 Sep	160.7	22 Jul	159.1	27 Jul
77	129.1	9 Sep	143.8	19 Aug	186.5	9 Sep	102.7	9 Sep	77	109.7	19 Jun	112.5	19 Jun	90.7	20 Sep	171.7	9 Sep
78	146.6	27 Sep	210.2	28 Sep	180.4	20 Jul	159.6	9 Sep	78	95.5	28 Sep	-	-	-	-	180.2	21 Jun
79	122.2	23 Sep	227.9	21 Sep	260.3	22 Sep	150.8	22 Sep	79	95.9	3 May	-	-	-	-	159.1	23 Sep
1980	155.5	28 Sep	152.5	26 Aug	227.7	16 Jun	147.7	24 Aug	1980	109.6	4 Aug	123.5	29 Sep	-	-	144.2	9 Sep
81	154.9	20 Sep	154.6	19 Sep	180.9	19 Sep	122.7	30 Aug	81	147.1	18 Sep	73.1	12 Sep	263.1	17 Sep	199.6	19 Sep
82	132.2	17 Jul	88.0	5 Sep	159.7	19 Aug	156.0	23 Sep	82	92.4	13 Apr	90.0	16 Sep	85.0	24 Aug	130.7	3 Jun
83	200.9	8 Jun	168.7	3 Aug	233.2	27 Sep	206.0	9 Oct	83	138.5	17 Aug	226.3	3 Aug	142.6	3 Aug	139.7	13 Aug
84	116.5	22 Sep	-	-	205.1	9 Aug	138.0	10 Jul	84	150.4	6 Jun	160.5	9 Aug	98.4	4 Jun	98.7	8 Aug
85	103.9	2 Jul	130.7	11 Jul	182.5	16 Apr	223.0	10 Jul	85	132.2	17 Sep	96.7	21 Oct	117.3	25 Jul	149.6	3 Sep
86	148.6	9 May	168.4	24 Aug	197.0	8 May	325.0	14 Aug	86	181.9	9 May	202.7	9 Aug	179.4	9 Aug	178.3	24 Aug
87	161.4	9 Sep	132.8	9 Sep	117.1	7 Jun	164.3	5 Sep	87	105.4	1 Nov	14.3	31 Oct	114.6	26 Sep	161.0	3 Jul

A.2.10 Hourly Cummulation of Maximum Three Days Rainfal



A.3.1 River Gauging Station



LEGEND

Kpt. ..... STATION CODE

GAUGING STATION ..... DISCHARGE DATA PERIOD

GAUGING STATION

MARK	CONTENTS
	SUSPENDED
	STREAM FLOW RATING WITH STAFF GAUGE
	DISCONTINUED STREAM FLOW RATING WITH STAFF GAUGE
R S M	STREAM FLOW RATING WITH RECORDED (R) SEDIMENT SAMPLING (S) AND METEOROLOGY OBSERVING (M)
	WATER LEVEL MEASUREMENT WITH STAFF GAUGE
	WATER LEVEL MEASUREMENT WITH RECORDED

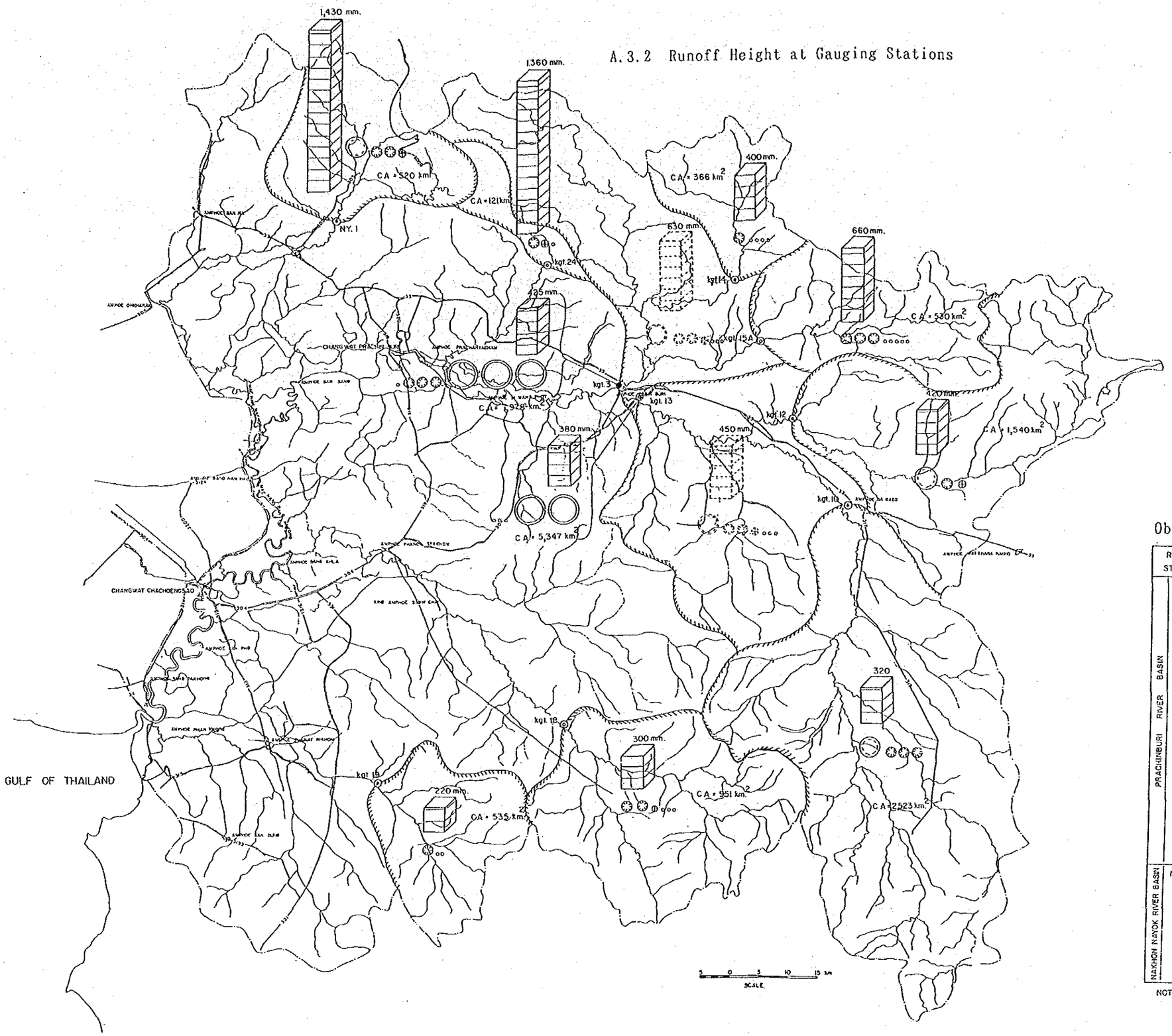
STATION CODE

CODE	RIVER BASIN
Kpt.	PRACHINBURI
NY.	NAKHON NAYOK

DISCHARGE DATA PERIOD

MARK	PERIOD
	NIL
	LESS THAN 5 YR.
	6 ~ 10 YR.
	11 ~ 20 YR.
	21 ~ 30 YR.
•	OVER 30 YR.

A.3.2 Runoff Height at Gauging Stations



LEGEND

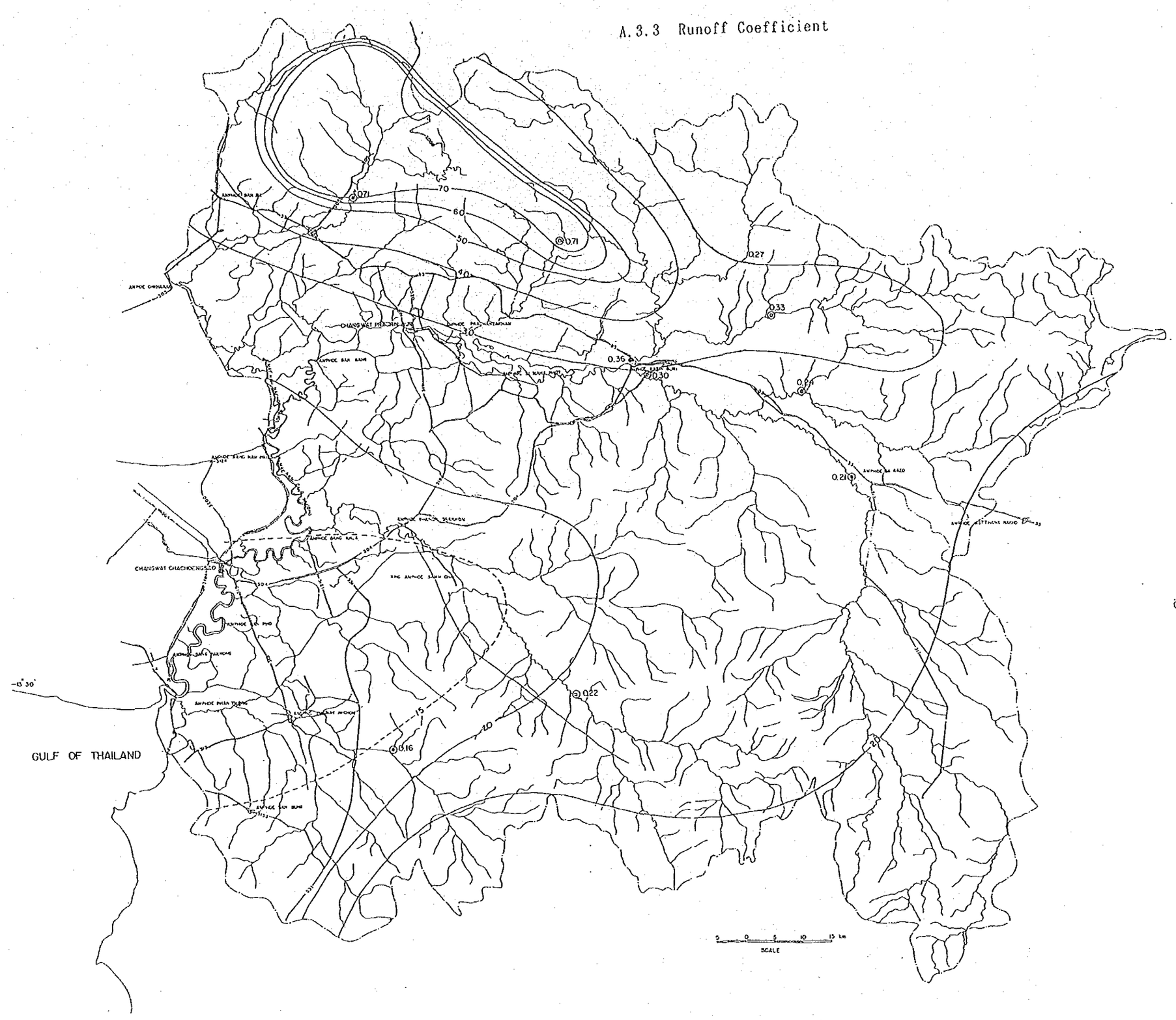
MARK	REFERENCE
——·——	PROJECT AREA BOUNDARY
//////////	CATCHMENT AREA BOUNDARY
	ANNUAL RUNOFF HEIGHT IN mm. (OBSERVED)
	ANNUAL RUNOFF DISCHARGE IN M.C.M. (OBSERVED) 1,000 500 100 50 10
◎ ◉ •	GAUGING STATION
C. A.	CATCHMENT AREA OF GAUGING STATION
	ASSUMED RUNOFF

Observation Period of Gauging Station

	RATING STATION	OBSERVATION PERIOD 1970 75 1980 85
PRACHINBURI RIVER BASIN	Kgt. 1*	
	3	1941
	6	
	9	
	10	
	11	
	12	
	13	
	14	
	15	
	15 A.	
	18	
	19	
	22*	
	24	
	25	
	27	
	29	
NAKHON NAYOK RIVER BASIN	NY. 1	1955
	1 A	1958
	1 B	
	2	
	3	
	4	
	5	

NOTE * ····· UNDER THE TIDAL INFLUENCE

A.3.3 Runoff Coefficient



A.3.4 Runoff Model

The model parameters such as the dimension of tank, effective rainfall and daily distribution factors were estimated using some selected data of actual observations of discharges on the river systems included in the Study.

Depletion Coefficient (k)

The k values used in the generation of daily runoff were determined using the equation described as under;

$$Q_1 = Q_0 \times e^{-kt}$$

where : Q_1 = outflow from tank outlet at time t_1 in mm/day

Q_0 = outflow at time t_0 in mm/day

e = natural number = 2.71828

k = depletion coefficient

t_0 , t_1 = time in day

The equation connotes that during period of no rain, outflow from the tank would diminish continuously according to the magnitude of k, meaning that the value of k could be determined by the depletion curve as shown in Figure 4-7. The depletion coefficients for the river systems were determined from hydrographs drawn with the daily streamflow observations at gauging stations.

Height of Tank (HT)

Overflow from the tank occurs when the tank filled with rain water. The capacity of the tank to hold rain water, denoted in the runoff model as the specific height of tank, HT, is given in the following equation.

$$HT = Qmax/k$$

where : HT = finite height of tank in mm

Qmax = runoff discharge on the depletion curve where overflow from the tank occurs, in mm

k = depletion coefficient

Tank Dimensions for Various Basins

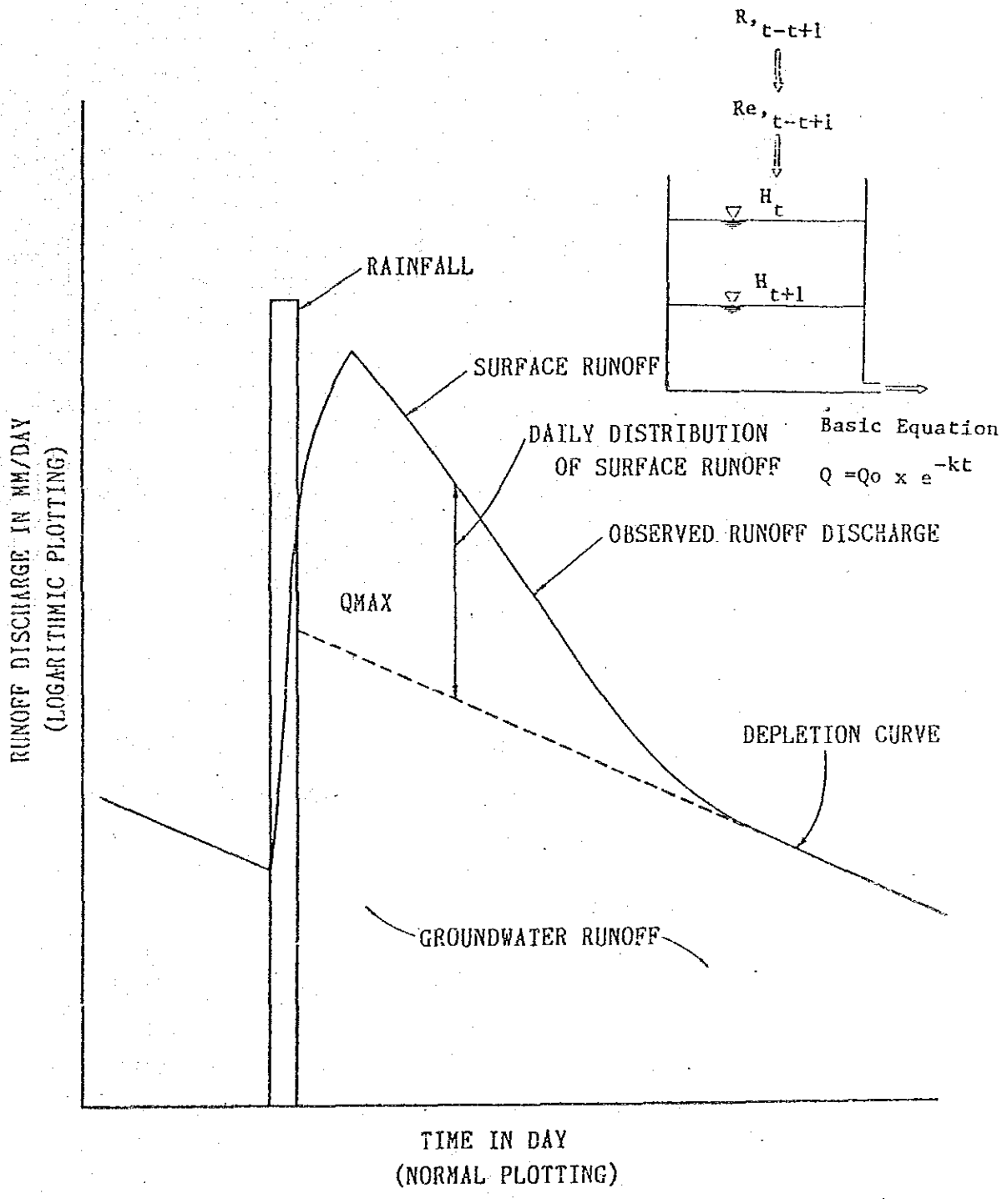
For basins of proposed dams and irrigation blocks where no runoff data applicable in determinating a depletion coefficient, k, and a height of tank, HT, are available, their values were estimated on a log-log paper by plotting the already computed values against the topographic/geographic condition of drainage areas, as shown in Figure 4-8. The topographic or geographic condition was expressed in terms of the drainage areas, river density, form factor and compactness of the drainage areas.

- Drainage Area = measured on 1/50,000 scale maps, in sq.km.
- River Density = TL/A in km/sq.km
  where TL = total length of stream inclusive of tributaries in km
  A = drainage area in sq.km.
- Form Factor = A/L/L
  where L = length of main stream in km
- Compactness = sq.rt (A)/LB
  where LB = length of boundary of drainage area in km
  π = ration of circumference of a circle to its diameter

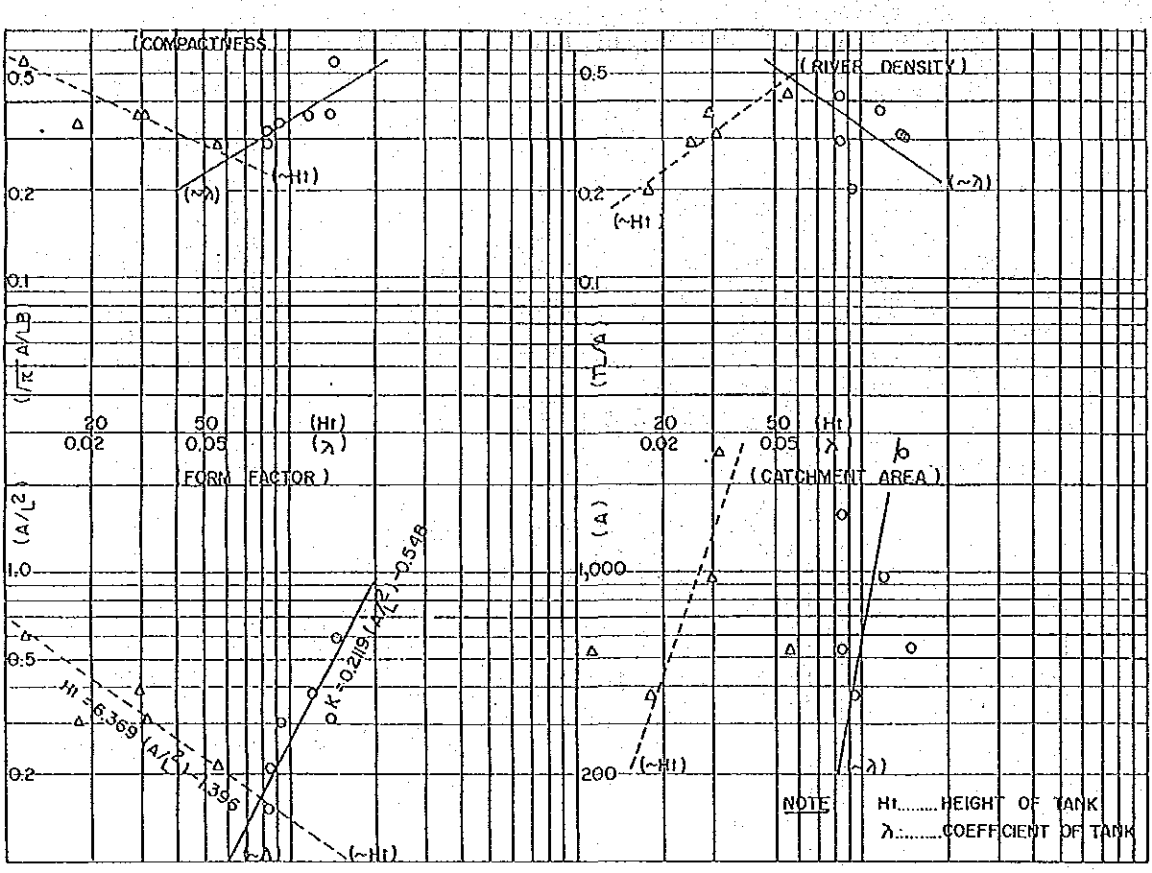
As is seen from Figure 4-8, the Form Factor, A/L/L, correlates well with both the k and HT, hence the following equations were used to determine tank dimension for the proposed storage damsite, where no measurement of streamflow is available.

- $Ht = 6.361 \ (A/L^2)^{1.396}$,for estimation of tank height, and
- $K = 0.2119 \ (A/L^2)^{0.548}$,for depletion coefficient

A.3.5 Estimating Depletion Curve



A.3.6 Tank Model Parameters and Geographic Conditions



CATCHMENT		TANK DIMENSION		RIVRER DENSITY		FORM FACTOR		COMPACTNESS	
STATION	AREA	K	Ht	TL	TL/A	L	A/L/L	LB	A/LB
	km			km		km			
Kgt.3	7,502	0.069	24.9	2,180	0.29	150	0.33	2,750	0.056
10	2,523	0.1407	31.2	780	0.31	90	0.31	250	0.36
12	1,540	0.0847	-	440	0.29	100	0.15	220	0.32
14	366	0.0937	18.1	75	0.20	35	0.30	100	0.34
15A	530	0.0847	55.8	220	0.42	50	0.21	140	0.29
18	951	0.120	29.5	350	0.37	50	0.38	150	0.36
19	535	0.146	11.6	160	0.30	30	0.59	75	0.55

A.3.7 Annual Sub-basin Runoff in 20 Years

(UNIT:MCM/YEAR)

SUB-BASIN	UPP	KPS	MPP	MHM	UBP	MNN	KTL	LBP	ENTIRE-BASIN
(km²)	(1,628)	(2,643)	(970)	(2,130)	(2,757)	(1,933)	(2,493)	(3,106)	(17,660)
1968	558	782	413	1,117	1,404	1,278	598	700	6,850
69	704	890	503	1,535	1,572	1,680	650	643	8,177
70	693	927	533	1,295	1,752	1,864	1,013	746	8,823
71	582	774	484	1,285	1,523	1,544	660	734	7,559
72	687	950	503	1,428	1,554	1,736	565	624	8,047
73	613	856	461	1,231	1,205	1,272	534	636	6,808
74	616	849	494	1,421	1,424	1,432	498	779	7,513
75	587	852	482	1,680	1,337	1,688	685	623	7,934
76	806	958	673	1,527	1,494	1,732	694	673	8,557
77	657	779	572	1,324	1,370	1,249	732	567	7,250
78	654	700	600	1,596	1,381	1,363	758	627	7,679
79	721	842	605	1,574	1,231	1,228	737	452	7,390
1980	809	926	709	1,679	1,673	1,683	799	600	8,878
81	727	1,006	628	1,639	1,773	1,662	1,107	677	9,219
82	745	876	604	1,350	1,417	1,667	597	615	7,871
83	859	1,070	715	1,524	1,804	2,015	894	848	9,729
84	725	833	582	1,542	1,405	1,461	602	564	7,714
85	752	925	581	1,390	1,445	1,581	615	510	7,799
86	736	946	593	1,263	1,526	1,666	702	668	8,100
87	579	801	460	1,242	1,337	1,076	570	666	6,731
MEAN	690	877	560	1,431	1,481	1,544	700	648	7,931
MAX.	859	1,070	715	1,679	1,804	2,015	1,107	848	9,729
MIN.	558	700	413	1,117	1,205	1,076	498	452	6,731
1/10	586	766	455	1,221	1,276	1,238	541	542	6,971
1/ 5	621	801	488	1,287	1,339	1,338	577	571	7,257

A.3.8 Monthly Runoff in Upper Phra Prong (UPP) basin

* BANG PAKONG RIVER BASIN DEVELOPMENT STUDY*

* UPPER PHRA PRONG SUB-BASIN (C.A.= 1628.0 SQ.KM)

(UNIT= RAIN.(MM) , RUNOFF(MCM))

YEAR	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	ANNUAL
1968	132.0	132.8	136.2	213.4	181.8	314.3	101.3	6.1	0.0	14.1	61.0	21.5	1314.6
	70.018	51.730	66.815	64.728	90.411	90.655	76.205	11.355	1.108	4.457	22.526	7.495	557.502
	0.326	0.239	0.301	0.186	0.305	0.177	0.462	1.142	0.000	0.194	0.227	0.214	0.261
1969	44.9	168.8	278.4	342.7	265.7	491.7	139.1	16.8	0.0	9.6	23.1	35.2	1815.8
	13.730	48.089	94.396	121.961	122.657	174.614	85.568	22.827	1.769	3.020	7.997	6.903	703.530
	0.188	0.175	0.208	0.219	0.284	0.218	0.378	0.836	0.000	0.194	0.212	0.121	0.238
1970	152.0	180.2	300.5	224.8	325.5	263.8	182.8	35.8	45.4	1.7	22.8	26.0	1761.3
	31.947	79.361	92.349	106.507	108.876	105.355	90.837	29.404	29.358	3.088	4.301	11.260	692.642
	0.129	0.270	0.189	0.291	0.205	0.245	0.305	0.504	0.397	1.127	0.116	0.266	0.242
1971	90.4	140.8	274.0	202.3	213.7	314.1	158.3	6.0	0.7	0.0	52.9	56.5	1509.7
	30.466	42.078	102.218	76.400	78.379	112.684	77.675	29.151	2.055	0.277	18.069	12.227	581.678
	0.207	0.184	0.229	0.232	0.225	0.220	0.301	2.993	1.806	0.000	0.210	0.133	0.237
1972	196.5	47.9	176.4	257.9	228.4	434.1	174.7	136.9	30.6	1.3	7.7	60.1	1752.4
	74.532	22.508	63.264	82.116	98.996	147.475	97.663	55.864	25.456	2.467	2.185	14.471	686.996
	0.233	0.289	0.220	0.196	0.266	0.209	0.343	0.251	0.511	1.206	0.175	0.148	0.241
1973	55.6	104.3	114.4	341.1	208.1	345.1	177.4	51.3	0.0	21.2	24.8	148.0	1591.3
	18.256	39.547	44.720	103.921	92.109	111.627	110.521	29.863	5.184	2.323	11.721	42.788	612.579
	0.202	0.233	0.240	0.187	0.272	0.199	0.383	0.357	0.000	0.067	0.291	0.178	0.236
1974	110.4	190.0	202.7	140.1	232.5	203.2	256.6	67.5	2.7	25.1	37.9	82.8	1551.5
	45.735	66.257	76.362	59.261	76.540	85.028	105.972	45.485	7.389	8.673	10.761	29.000	616.462
	0.255	0.214	0.231	0.260	0.202	0.257	0.254	0.414	1.673	0.212	0.174	0.215	0.244
1975	16.4	201.7	225.6	225.3	295.7	214.9	186.4	24.5	3.9	0.0	25.3	112.0	1531.9
	12.611	53.853	81.145	93.940	110.230	82.454	86.618	27.796	4.808	0.402	8.005	24.898	586.759
	0.473	0.164	0.221	0.256	0.229	0.236	0.285	0.697	0.752	0.000	0.194	0.136	0.235
1976	97.2	170.3	261.5	405.1	310.5	257.7	399.8	99.4	0.0	0.0	3.3	11.8	2016.6
	36.647	62.164	86.471	147.408	117.530	128.815	123.408	91.311	8.233	0.569	0.671	2.850	806.076
	0.232	0.224	0.203	0.224	0.233	0.307	0.190	0.565	0.000	0.000	0.124	0.149	0.246
1977	97.9	201.8	135.2	294.1	288.3	370.4	197.5	24.0	0.0	3.5	21.8	62.5	1696.8
	24.989	57.293	64.794	90.925	114.356	138.930	87.519	43.633	8.110	1.093	6.419	18.759	656.819
	0.157	0.174	0.294	0.190	0.244	0.230	0.272	1.117	0.000	0.194	0.181	0.184	0.238
1978	31.5	288.6	234.4	322.7	257.1	330.1	102.1	31.4	0.0	16.9	24.7	20.3	1659.7
	15.756	77.910	99.320	107.928	120.610	92.513	86.591	29.031	2.993	5.500	2.097	13.397	653.645
	0.307	0.166	0.260	0.205	0.288	0.172	0.521	0.568	0.000	0.200	0.052	0.406	0.242
1979	98.1	266.8	302.1	335.5	187.1	480.1	78.2	24.1	0.0	0.0	45.0	48.5	1865.5
	26.628	77.230	97.953	151.292	97.982	107.885	104.841	27.542	3.322	0.235	5.329	21.675	721.913
	0.167	0.178	0.199	0.277	0.322	0.138	0.824	0.702	0.000	0.000	0.073	0.275	0.238
1980	52.3	159.3	444.4	299.7	313.9	383.5	277.4	12.1	0.0	0.0	51.5	66.9	2061.0
	23.708	46.961	135.043	110.350	116.232	153.324	144.044	34.539	3.720	0.252	2.433	38.150	808.755
	0.278	0.181	0.187	0.226	0.227	0.246	0.319	1.755	0.000	0.000	0.029	0.350	0.241
1981	69.8	235.4	303.1	225.9	322.7	348.2	147.2	107.7	0.0	0.0	74.0	58.6	1892.7
	18.167	70.043	111.589	96.315	124.756	112.769	92.946	52.877	13.047	0.838	22.094	12.011	727.451
	0.160	0.183	0.226	0.262	0.237	0.199	0.388	0.302	0.000	0.000	0.183	0.126	0.236
1982	111.5	176.3	297.2	206.8	508.5	297.0	150.6	61.7	4.9	3.5	46.6	0.0	1864.6
	45.667	56.321	89.462	108.350	165.035	134.976	69.391	45.613	10.573	1.863	9.242	8.654	745.146
	0.252	0.196	0.185	0.322	0.199	0.279	0.283	0.454	1.316	0.331	0.122	0.000	0.245
1983	36.6	104.7	317.2	302.6	485.0	428.0	395.6	47.1	7.7	11.0	20.8	104.2	2260.6
	5.469	25.440	105.674	121.949	162.209	137.670	209.492	52.678	6.271	5.318	5.779	21.119	859.067
	0.092	0.149	0.205	0.248	0.205	0.198	0.325	0.687	0.501	0.297	0.171	0.124	0.233
1984	91.9	132.3	333.9	152.9	508.2	292.5	180.1	29.7	0.0	8.8	30.2	67.5	1827.9
	43.170	43.086	120.626	78.135	164.559	117.406	103.908	21.740	3.201	1.735	9.261	18.445	725.271
	0.289	0.200	0.222	0.314	0.199	0.247	0.354	0.450	0.000	0.121	0.188	0.168	0.244
1985	241.4	268.6	273.0	272.4	182.6	378.2	168.2	35.4	0.0	0.0	47.7	61.5	1928.8
	55.596	120.898	98.853	118.689	76.947	129.896	77.805	35.922	8.204	0.527	3.943	24.513	751.792
	0.141	0.277	0.222	0.268	0.259	0.211	0.284	0.624	0.000	0.000	0.051	0.245	0.239
1986	107.0	281.2	172.8	259.0	285.4	369.0	241.1	3.0	8.4	0.0	78.5	85.7	1891.2
	42.840	104.184	61.405	93.163	103.047	127.120	129.916	22.116	4.817	0.332	14.745	32.293	735.977
	0.246	0.228	0.218	0.221	0.222	0.212	0.331	4.459	0.351	0.000	0.115	0.231	0.239
1987	92.0	168.2	327.3	163.8	88.7	347.3	104.6	80.0	0.0	0.0	41.5	30.9	1444.3
	41.090	48.492	107.755	90.760	45.676	119.388	54.936	39.459	5.220	0.333	8.091	17.887	579.086
	0.274	0.177	0.202	0.340	0.316	0.211	0.323	0.303	0.000	0.000	0.120	0.355	0.246
AVERAGE													
(MM)	96.3	181.0	255.5	259.4	284.5	343.2	190.9	45.0	5.2	5.8	37.1	58.0	1761.9
(MCM)	33.851	59.672	90.011	101.205	109.357	120.529	100.793	37.410	7.742	2.165	8.783	18.940	690.456
(%)	0.216	0.203	0.216	0.240	0.236	0.216	0.324	0.510	0.911	0.228	0.146	0.201	0.241

A.3.9 Monthly Runoff in Khlog Phra Sathung (KPS) basin

* BANG PAKONG RIVER BASIN DEVELOPMENT STUDY*

* KHLONG PHRA SATHUNG SUB-BASIN (C.A.= 2643.0 SQ.KM)

(UNIT= RAIN.(MM) , RUNOFF(MCM))

YEAR	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	ANNUAL
1968	158.1	123.4	157.9	205.9	249.7	268.8	104.9	4.8	0.0	4.5	34.0	19.8	1331.8
	98.876	76.880	87.638	103.539	157.284	120.871	92.161	14.293	0.844	1.795	18.371	9.510	782.061
	0.237	0.236	0.210	0.190	0.238	0.170	0.332	1.122	0.000	0.152	0.204	0.182	0.222
1969	44.2	140.7	213.1	245.5	262.3	426.9	169.6	32.0	0.0	8.1	34.5	55.0	1631.8
	15.594	61.301	108.858	130.286	154.752	227.153	109.834	40.727	1.869	3.957	17.026	19.113	890.469
	0.133	0.165	0.193	0.201	0.223	0.201	0.245	0.481	0.000	0.185	0.187	0.131	0.206
1970	148.3	123.1	269.8	253.3	304.7	241.4	149.6	44.2	77.6	0.0	22.5	21.6	1656.2
	59.730	83.884	125.157	149.438	156.445	130.996	107.628	26.883	62.264	3.393	5.704	15.286	926.807
	0.152	0.258	0.176	0.223	0.194	0.205	0.272	0.230	0.303	0.000	0.096	0.268	0.212
1971	71.3	156.6	243.0	164.4	234.9	221.0	207.9	12.4	22.2	0.0	34.9	47.0	1415.5
	31.795	68.903	137.198	92.740	107.744	133.867	114.051	42.571	6.239	7.618	18.252	13.409	774.386
	0.169	0.166	0.214	0.213	0.174	0.229	0.208	1.300	0.107	0.000	0.198	0.108	0.207
1972	189.9	55.6	254.2	258.2	252.5	359.4	131.5	125.1	25.3	0.3	9.2	48.1	1709.4
	101.823	33.364	122.852	133.374	157.592	175.266	102.978	68.863	30.592	1.620	3.674	18.010	950.006
	0.203	0.227	0.183	0.195	0.236	0.184	0.296	0.208	0.457	1.778	0.151	0.142	0.210
1973	34.1	101.7	159.0	321.6	229.4	321.7	156.1	81.3	0.0	10.4	27.0	119.1	1561.4
	22.616	48.317	79.886	150.536	137.748	163.591	125.444	51.621	7.258	1.699	13.127	54.309	856.151
	0.251	0.180	0.190	0.177	0.227	0.192	0.304	0.240	0.000	0.062	0.184	0.173	0.207
1974	127.2	155.2	163.1	142.8	319.2	165.0	257.8	66.0	2.6	25.5	37.6	51.0	1513.0
	69.594	77.063	99.827	72.185	149.382	117.680	148.734	52.873	6.392	12.447	15.917	26.938	849.031
	0.207	0.188	0.232	0.191	0.177	0.270	0.218	0.303	0.933	0.185	0.160	0.200	0.212
1975	27.0	205.0	248.5	238.0	337.5	221.2	161.3	20.7	2.9	0.0	28.1	74.6	1564.9
	19.726	79.513	137.100	135.878	178.705	125.823	108.691	28.822	3.949	0.258	13.406	20.423	852.293
	0.276	0.147	0.209	0.216	0.200	0.215	0.255	0.526	0.511	0.000	0.180	0.104	0.206
1976	83.6	186.2	183.2	334.0	279.9	238.6	299.9	62.3	0.0	1.5	2.1	21.5	1692.7
	46.125	93.836	101.779	160.787	158.011	161.094	139.430	80.394	4.998	0.839	1.250	9.892	958.434
	0.209	0.191	0.210	0.182	0.214	0.255	0.176	0.488	0.000	0.208	0.224	0.174	0.214
1977	61.3	164.8	142.2	269.1	213.8	317.1	121.9	16.9	1.1	19.6	28.3	57.8	1413.8
	24.928	69.702	78.371	129.171	132.308	165.907	92.546	29.983	4.088	7.646	17.084	27.198	778.931
	0.154	0.160	0.209	0.182	0.234	0.198	0.287	0.673	1.368	0.148	0.228	0.178	0.208
1978	35.3	254.7	169.4	210.4	166.5	251.9	109.4	18.1	0.0	6.9	12.4	21.4	1256.4
	21.111	102.571	105.831	111.857	106.724	105.501	99.122	26.935	1.838	3.345	1.956	13.488	700.278
	0.227	0.152	0.236	0.201	0.242	0.158	0.343	0.564	0.000	0.184	0.059	0.238	0.211
1979	79.4	230.7	278.8	272.6	184.6	368.6	38.5	15.5	0.0	0.0	20.6	38.6	1527.8
	34.424	106.986	118.744	175.762	125.960	151.241	80.192	20.296	2.027	0.138	5.417	20.394	841.580
	0.164	0.175	0.161	0.244	0.258	0.155	0.788	0.495	0.000	0.000	0.100	0.200	0.208
1980	50.7	169.3	338.7	230.8	237.0	276.4	221.1	39.5	0.0	0.0	46.5	54.9	1664.9
	28.622	74.345	150.024	135.245	123.329	161.206	150.722	46.467	3.297	0.178	4.130	48.203	925.767
	0.214	0.166	0.168	0.222	0.197	0.221	0.258	0.445	0.000	0.000	0.034	0.332	0.210
1981	104.4	261.3	301.4	198.4	291.4	333.6	167.8	107.0	0.0	0.0	40.4	29.0	1834.6
	38.687	128.197	166.263	114.082	168.852	159.714	120.363	64.182	18.768	0.690	17.856	8.161	1005.813
	0.140	0.186	0.209	0.218	0.219	0.181	0.271	0.227	0.000	0.000	0.167	0.106	0.207
1982	106.5	157.7	287.2	205.7	355.9	220.9	123.3	44.7	12.7	0.9	44.5	0.0	1560.2
	59.592	72.575	125.367	140.397	181.430	139.110	75.589	45.949	10.917	0.917	14.462	10.054	876.358
	0.212	0.174	0.165	0.258	0.193	0.238	0.232	0.389	0.325	0.366	0.123	0.000	0.213
1983	45.6	153.2	257.5	225.5	422.8	302.3	352.9	73.5	5.5	19.2	17.1	105.7	1980.6
	9.374	46.659	160.121	128.077	208.840	150.585	234.332	66.871	6.739	9.517	9.199	39.941	1070.254
	0.078	0.115	0.235	0.215	0.187	0.188	0.251	0.344	0.465	0.188	0.203	0.143	0.204
1984	67.0	140.3	279.9	105.2	413.3	231.0	136.2	16.2	0.0	16.7	29.1	49.3	1484.3
	46.316	63.521	145.195	84.313	186.993	137.564	109.496	16.219	1.915	4.733	16.167	20.470	832.901
	0.262	0.171	0.196	0.303	0.171	0.225	0.304	0.379	0.000	0.107	0.210	0.157	0.212
1985	180.3	218.3	280.7	293.0	159.0	286.8	147.8	44.6	0.6	0.0	28.2	23.9	1663.3
	67.738	129.498	145.211	170.469	98.880	148.680	94.743	41.154	6.943	0.337	5.451	16.283	925.386
	0.142	0.224	0.196	0.220	0.235	0.196	0.242	0.349	4.518	0.000	0.073	0.258	0.211
1986	89.8	313.8	154.2	197.1	290.6	362.0	197.8	8.8	15.0	0.0	42.8	69.6	1741.4
	42.553	158.196	90.743	106.760	145.961	179.654	149.988	23.129	9.712	0.391	12.912	26.074	946.072
	0.179	0.191	0.223	0.205	0.190	0.188	0.287	0.991	0.245	0.000	0.114	0.142	0.206
1987	81.4	133.8	304.7	137.7	196.1	291.5	90.8	93.9	0.0	0.0	56.7	21.0	1407.6
	54.493	66.370	144.090	103.185	95.326	165.357	63.076	56.609	10.294	0.389	24.512	16.819	800.519
	0.253	0.188	0.179	0.283	0.184	0.215	0.263	0.228	0.000	0.000	0.163	0.302	0.215
AVERAGE													
(MM)	89.3	172.3	234.3	225.5	270.0	285.3	167.3	46.4	8.3	5.7	29.8	46.4	1580.6
(MCM)	44.686	82.084	121.513	126.404	146.613	151.043	115.956	42.242	10.047	3.095	11.794	21.699	877.174
(%)	0.189	0.180	0.196	0.212	0.205	0.200	0.262	0.345	0.459	0.206	0.150	0.177	0.210

A.3.10 Monthly Runoff in Middle Phra Prong (MPP) basin

* BANG PAKONG RIVER BASIN DEVELOPMENT STUDY*

* MIDDLE PHRA PHRONG SUB-BASIN (C.A.= 970.0 SQ.KM)

(UNIT= RAIN.(MM) , RUNOFF(MCM)

YEAR	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	ANNUAL
1968	76.8	103.7	146.5	259.4	215.7	337.6	98.7	7.5	0.0	21.1	64.3	11.9	1343.1
	32.437	26.864	44.537	55.080	84.992	80.225	53.979	6.663	0.868	5.122	18.257	3.842	412.865
	0.436	0.267	0.313	0.219	0.406	0.245	0.564	0.921	0.000	0.251	0.293	0.333	0.317
1969	34.0	163.3	292.3	397.1	284.9	375.8	138.0	12.0	0.0	3.8	10.0	34.4	1745.7
	6.361	37.297	72.442	109.549	93.998	108.153	52.250	13.105	0.797	0.920	2.470	5.790	503.131
	0.193	0.235	0.256	0.284	0.340	0.297	0.390	1.122	0.000	0.248	0.254	0.173	0.297
1970	99.0	198.5	411.6	214.5	422.2	255.9	139.2	16.5	36.1	1.2	6.7	25.3	1826.7
	20.222	51.812	100.351	84.726	100.632	81.464	57.260	13.355	14.148	1.530	1.040	6.005	532.544
	0.211	0.269	0.251	0.407	0.246	0.328	0.424	0.835	0.404	1.328	0.160	0.245	0.301
1971	142.5	148.5	307.0	259.6	248.4	280.4	192.5	7.5	0.7	0.0	33.6	60.0	1680.7
	29.577	39.337	87.457	72.274	67.212	80.515	63.176	23.068	1.355	0.193	8.694	10.891	483.748
	0.214	0.273	0.294	0.287	0.279	0.296	0.338	3.157	1.984	0.000	0.267	0.187	0.297
1972	149.4	50.4	168.6	231.7	280.1	462.4	149.9	113.5	47.3	1.4	0.0	75.9	1730.4
	41.760	15.772	45.302	60.092	78.568	129.365	59.353	33.974	21.380	1.952	0.194	14.790	502.501
	0.288	0.323	0.277	0.267	0.289	0.288	0.408	0.309	0.466	1.467	0.000	0.201	0.299
1973	51.0	169.6	154.7	309.0	266.7	306.1	140.7	45.6	0.0	17.9	26.7	95.7	1583.9
	12.437	45.160	47.579	82.567	69.079	84.044	66.909	16.604	2.871	1.605	8.497	23.629	460.980
	0.251	0.274	0.317	0.275	0.267	0.283	0.490	0.375	0.000	0.093	0.328	0.254	0.300
1974	131.5	195.2	221.4	199.5	284.8	172.6	323.6	61.3	0.0	20.0	14.8	68.5	1693.2
	29.844	51.656	64.825	54.817	70.555	67.003	90.505	36.447	3.691	5.180	3.463	15.697	493.682
	0.234	0.273	0.302	0.283	0.255	0.400	0.288	0.613	0.000	0.267	0.242	0.236	0.301
1975	36.5	197.1	268.8	248.2	318.6	215.6	216.4	37.3	1.3	0.0	46.1	92.4	1678.3
	10.559	41.054	68.216	86.247	87.330	62.043	72.782	22.719	2.899	0.143	11.817	16.484	482.292
	0.298	0.215	0.262	0.358	0.283	0.297	0.347	0.627	2.259	0.000	0.264	0.184	0.296
1976	56.2	185.1	320.8	525.5	336.4	329.6	411.5	107.8	0.6	0.3	2.0	9.5	2285.5
	18.859	42.224	77.824	145.511	97.889	114.574	101.604	67.019	4.878	0.369	0.027	2.311	673.088
	0.346	0.235	0.250	0.285	0.300	0.358	0.255	0.641	8.164	1.109	0.014	0.251	0.304
1977	94.6	212.5	190.6	371.8	342.3	439.0	226.3	27.0	0.0	12.9	17.0	51.3	1985.3
	19.055	43.418	59.589	94.794	96.268	134.093	64.645	34.838	6.620	3.249	2.830	12.819	572.217
	0.208	0.211	0.322	0.263	0.290	0.315	0.295	1.330	0.000	0.260	0.172	0.257	0.297
1978	35.4	263.2	319.5	396.9	345.6	494.4	98.3	30.1	0.0	23.9	30.5	15.4	2053.2
	11.626	51.531	91.840	103.179	114.861	120.751	63.972	20.439	2.027	5.976	2.334	10.976	599.511
	0.339	0.202	0.296	0.268	0.343	0.252	0.671	0.701	0.000	0.258	0.079	0.735	0.301
1979	148.9	330.9	312.9	400.3	219.7	494.0	91.3	23.3	0.0	0.0	35.7	51.1	2108.1
	27.950	80.002	78.062	132.775	78.468	105.870	62.075	18.618	1.809	0.087	2.155	16.855	604.725
	0.194	0.249	0.257	0.342	0.368	0.221	0.701	0.823	0.000	0.000	0.062	0.340	0.296
1980	20.3	127.0	524.3	481.3	382.2	512.5	263.2	26.4	0.0	0.0	32.9	99.3	2469.3
	10.831	25.916	124.559	129.440	112.822	143.074	103.056	27.235	2.445	0.117	1.342	28.324	709.160
	0.551	0.210	0.245	0.277	0.304	0.288	0.404	1.062	0.000	0.000	0.042	0.294	0.296
1981	107.2	235.1	329.4	335.5	401.5	374.9	112.9	153.1	0.0	0.0	65.3	63.0	2177.9
	21.126	63.657	87.816	94.392	120.919	103.786	55.358	42.496	13.641	0.654	15.765	8.241	627.850
	0.203	0.279	0.275	0.290	0.311	0.285	0.506	0.286	0.000	0.000	0.249	0.135	0.297
1982	96.5	233.4	334.6	270.2	584.4	330.6	141.6	34.0	9.9	3.8	0.0	0.0	2039.1
	32.728	52.449	78.446	99.201	158.130	95.548	55.040	24.752	6.354	1.371	0.082	0.005	604.105
	0.350	0.232	0.242	0.378	0.279	0.298	0.401	0.750	0.661	0.375	0.000	0.000	0.305
1983	5.3	140.0	368.4	371.6	619.0	462.4	392.9	29.6	14.1	7.7	46.7	79.5	2537.3
	0.264	21.937	93.806	105.841	168.307	128.266	140.959	26.928	2.753	4.797	7.786	13.752	715.395
	0.051	0.162	0.263	0.294	0.280	0.286	0.370	0.937	0.202	0.642	0.172	0.178	0.291
1984	93.8	241.1	334.1	201.2	485.6	309.0	182.1	28.6	0.3	14.9	17.3	79.5	1987.4
	30.338	50.516	107.853	67.829	125.797	85.649	76.242	14.181	1.887	2.090	5.730	13.834	581.945
	0.333	0.216	0.333	0.348	0.267	0.286	0.432	0.511	7.369	0.145	0.342	0.179	0.302
1985	208.3	304.9	267.6	257.6	197.1	433.8	197.8	37.9	0.2	0.0	33.5	51.9	1990.7
	46.128	81.264	83.141	75.520	67.467	114.512	61.155	29.825	5.322	0.256	1.968	14.628	581.185
	0.228	0.275	0.320	0.302	0.353	0.272	0.319	0.810	23.751	0.000	0.061	0.290	0.301
1986	110.7	281.6	243.8	253.4	382.9	421.3	240.7	0.4	5.5	0.0	49.0	44.7	2034.0
	33.387	75.169	63.622	72.511	99.863	117.035	91.544	15.540	2.332	0.145	7.468	14.278	592.893
	0.311	0.275	0.269	0.295	0.269	0.286	0.392	35.760	0.441	0.000	0.157	0.329	0.301
1987	81.7	165.5	278.7	214.5	167.3	324.3	123.9	92.5	0.0	0.0	95.5	22.2	1566.3
	21.370	31.757	78.285	69.037	55.609	83.600	50.471	31.897	4.772	0.229	8.487	24.246	459.759
	0.270	0.198	0.290	0.332	0.343	0.266	0.420	0.355	0.000	0.000	0.092	1.124	0.303
AVERAGE (MM)	89.0	197.3	289.8	309.9	339.3	366.6	194.1	44.6	5.8	6.4	31.4	51.6	1925.8
(MCM)	22.843	46.439	77.777	89.769	97.438	101.978	72.117	25.985	5.142	1.799	5.520	12.870	559.678
(%)	0.265	0.243	0.277	0.299	0.296	0.287	0.383	0.600	0.914	0.288	0.181	0.257	0.300

A.3.11 Monthly Runoff in Maenum Hanuman (MHM) basin

* BANG PAKONG RIVER BASIN DEVELOPMENT STUDY*

* MAENUM HANUMANN SUB-BASIN (C.A.= 2130.0 SQ.KM)

(UNIT= RAIN.(MM) , RUNOFF(MCM)

YEAR	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	ANNUAL
1968	94.4	139.9	178.6	253.0	243.5	265.3	104.3	12.2	0.0	61.7	41.1	58.3	1452.3
	67.182	109.657	115.201	172.695	221.741	181.863	118.874	18.312	2.875	40.135	37.237	31.817	1117.587
	0.334	0.368	0.303	0.320	0.428	0.322	0.535	0.702	0.000	0.305	0.426	0.256	0.361
1969	105.1	143.7	335.5	373.6	306.2	541.0	211.8	12.4	0.0	1.0	8.8	42.2	2081.3
	57.379	91.370	234.914	289.521	234.946	372.960	171.609	53.462	3.877	0.761	5.701	18.506	1535.006
	0.256	0.298	0.329	0.364	0.360	0.324	0.380	2.030	0.000	0.366	0.303	0.206	0.346
1970	131.2	198.9	293.9	220.7	302.9	252.0	233.9	16.5	46.4	7.0	23.5	25.2	1752.2
	62.353	148.241	194.784	175.975	211.242	194.936	174.232	54.406	38.418	7.443	13.404	19.803	1295.235
	0.223	0.350	0.311	0.374	0.327	0.363	0.350	1.545	0.389	0.497	0.268	0.369	0.347
1971	99.5	151.0	358.1	283.6	293.1	249.1	168.6	14.7	0.3	0.0	41.6	43.9	1703.6
	59.913	93.209	250.197	224.390	209.367	180.074	137.389	55.642	2.574	0.251	23.722	21.202	1257.929
	0.283	0.290	0.328	0.371	0.335	0.339	0.383	1.772	3.582	0.000	0.268	0.227	0.347
1972	81.1	61.2	254.6	269.7	258.7	586.7	200.8	125.1	24.7	0.6	2.1	53.4	1918.6
	64.948	40.427	156.583	198.826	216.648	408.735	175.924	100.745	34.308	2.449	1.176	26.898	1427.666
	0.376	0.310	0.289	0.346	0.393	0.327	0.411	0.378	0.653	1.810	0.266	0.236	0.349
1973	37.1	121.7	177.9	215.2	228.9	500.1	174.7	38.8	0.0	10.6	45.2	97.9	1648.3
	27.427	82.829	127.004	160.823	150.234	360.857	182.277	34.173	5.277	2.558	25.740	71.520	1230.718
	0.347	0.319	0.335	0.351	0.308	0.339	0.490	0.414	0.000	0.113	0.267	0.343	0.351
1974	152.5	273.8	307.0	241.5	318.3	154.5	276.2	64.4	0.1	20.4	15.2	75.0	1898.9
	89.233	185.840	245.995	173.715	229.650	142.766	213.249	71.097	7.933	13.309	10.194	37.853	1420.832
	0.275	0.319	0.376	0.338	0.339	0.434	0.362	0.518	55.350	0.307	0.314	0.237	0.351
1975	46.4	163.0	386.1	332.5	436.8	381.4	311.7	58.7	4.8	0.0	36.8	99.7	2257.7
	44.529	84.341	275.657	260.969	319.395	272.548	271.446	64.708	8.800	0.461	16.681	60.260	1679.794
	0.451	0.243	0.335	0.368	0.343	0.335	0.409	0.518	0.869	0.000	0.213	0.284	0.349
1976	39.6	164.4	268.6	361.0	411.3	340.9	290.9	114.6	8.7	0.0	4.5	38.1	2042.6
	39.648	96.319	175.860	274.650	291.238	266.287	206.820	136.229	10.421	4.151	0.164	25.178	1526.963
	0.470	0.275	0.307	0.357	0.332	0.367	0.334	0.558	0.560	0.000	0.017	0.310	0.351
1977	99.3	200.0	170.6	311.9	333.4	340.3	223.3	39.9	0.2	13.4	10.7	42.6	1785.5
	67.531	113.842	142.841	216.916	243.219	266.258	167.607	56.247	17.388	1.474	14.662	15.757	1323.740
	0.319	0.267	0.393	0.327	0.342	0.367	0.352	0.662	39.808	0.052	0.641	0.174	0.348
1978	72.9	279.0	289.0	335.0	425.4	524.6	139.0	32.9	0.0	19.6	12.7	5.6	2135.7
	65.493	153.128	221.453	251.799	309.021	356.336	163.494	41.458	7.516	13.469	2.774	10.404	1596.344
	0.422	0.258	0.360	0.353	0.341	0.319	0.552	0.592	0.000	0.322	0.103	0.866	0.351
1979	89.6	340.9	401.8	382.5	258.1	541.2	61.4	9.7	0.0	0.0	48.6	40.1	2173.9
	46.599	206.367	272.004	296.978	221.147	345.459	98.439	28.873	1.798	0.067	22.194	34.384	1574.307
	0.244	0.284	0.318	0.365	0.402	0.300	0.752	1.395	0.000	0.000	0.214	0.402	0.340
1980	42.3	127.4	396.9	375.7	464.1	479.8	252.1	7.6	0.0	0.0	33.0	113.2	2292.2
	32.773	72.598	253.642	280.400	340.872	344.131	223.837	39.817	2.559	0.111	11.690	76.725	1679.155
	0.364	0.267	0.300	0.350	0.345	0.337	0.417	2.473	0.000	0.000	0.166	0.318	0.344
1981	143.5	271.4	382.7	299.0	354.1	350.1	150.8	145.5	5.8	0.0	36.2	56.8	2195.8
	85.580	211.478	258.793	235.281	273.846	239.736	149.528	116.404	23.404	1.007	22.844	20.712	1638.611
	0.280	0.366	0.317	0.369	0.363	0.322	0.466	0.376	1.896	0.000	0.296	0.171	0.350
1982	64.1	153.7	230.0	235.3	420.7	401.5	191.7	78.3	5.1	3.2	0.0	0.0	1783.6
	58.804	92.975	155.433	188.825	307.366	282.519	155.098	63.306	41.197	3.806	0.296	0.027	1349.650
	0.430	0.284	0.317	0.377	0.343	0.330	0.380	0.380	3.778	0.565	3.377	0.000	0.355
1983	8.7	112.2	243.3	271.5	528.0	383.6	420.5	23.1	10.7	14.1	31.9	94.9	2142.6
	1.806	54.937	166.109	203.057	365.609	260.889	357.960	41.300	4.454	14.067	16.151	38.005	1524.344
	0.097	0.238	0.321	0.351	0.325	0.319	0.400	0.848	0.196	0.469	0.238	0.188	0.334
1984	93.3	190.6	368.7	195.4	505.0	343.5	211.2	37.5	0.0	2.4	19.0	74.3	2041.1
	88.397	111.377	282.338	164.911	351.329	240.784	208.685	39.271	4.726	1.116	11.220	37.574	1541.727
	0.445	0.274	0.359	0.396	0.327	0.329	0.464	0.492	107.370	0.219	0.277	0.237	0.355
1985	188.6	297.5	246.6	237.4	181.3	355.4	226.7	42.7	0.0	0.0	32.5	44.8	1853.5
	99.838	229.598	194.351	177.452	151.893	250.993	156.680	68.417	18.725	0.662	7.826	33.745	1390.178
	0.248	0.362	0.370	0.351	0.393	0.332	0.324	0.752	0.000	0.000	0.113	0.354	0.352
1986	154.0	241.5	158.6	201.4	304.5	323.8	239.2	1.2	10.8	0.0	37.5	46.9	1719.2
	99.902	175.132	119.426	147.189	200.618	233.862	203.994	28.542	9.084	0.437	12.310	32.567	1263.061
	0.305	0.340	0.354	0.343	0.309	0.339	0.400	11.229	0.396	0.000	0.154	0.326	0.345
1987	103.4	158.5	233.9	178.1	255.5	427.8	113.5	90.6	0.0	0.7	70.4	14.7	1647.1
	63.137	115.716	162.887	149.039	175.349	308.040	126.430	70.350	10.243	0.614	31.857	28.797	1242.457
	0.287	0.343	0.327	0.393	0.322	0.338	0.523	0.365	0.000	0.439	0.212	0.920	0.354
AVERAGE													
(MM)	92.3	189.5	284.1	278.7	341.5	387.1	210.1	48.3	5.9	7.7	27.6	53.4	1926.3
(MCM)	61.123	123.469	200.273	212.170	251.236	275.501	183.178	59.138	12.779	5.417	14.392	32.087	1430.764
(%)	0.311	0.306	0.331	0.357	0.345	0.334	0.409	0.575	1.021	0.329	0.245	0.282	0.349

A.3.12 Monthly Runoff in Bang Pakong (UBP) basin

* BANG PAKONG RIVER BASIN DEVELOPMENT STUDY*

* UPPER BANG PAKONG SUB-BASIN (C.A.= 2757.0 SQ.KM)

(UNIT= RAIN.(MM) , RUNOFF(MCM))

YEAR	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	ANNUAL
1968	145.3	103.4	153.7	340.1	290.5	244.3	124.1	22.0	0.0	35.9	9.0	20.9	1489.3
	115.116	117.241	123.520	291.630	308.880	219.353	139.707	25.053	2.713	24.889	19.382	16.711	1404.193
	0.287	0.411	0.292	0.311	0.386	0.326	0.408	0.414	0.000	0.251	0.778	0.290	0.342
1969	63.2	178.0	227.6	350.2	242.3	391.7	130.5	18.8	0.0	8.0	26.7	71.4	1708.5
	48.991	133.965	222.085	333.617	222.175	364.998	129.938	37.952	1.344	4.672	22.608	49.673	1572.017
	0.281	0.273	0.354	0.346	0.333	0.338	0.361	0.732	0.000	0.211	0.308	0.252	0.334
1970	129.0	157.8	339.4	247.3	518.1	281.6	130.0	10.7	61.8	0.4	7.4	21.7	1905.3
	101.708	150.949	271.830	231.195	483.846	251.436	148.557	21.571	57.645	11.434	3.955	18.235	1752.359
	0.286	0.347	0.291	0.339	0.339	0.324	0.415	0.728	0.338	9.411	0.193	0.305	0.334
1971	105.1	145.8	397.4	225.1	325.5	260.2	179.4	15.7	1.3	0.0	15.3	63.5	1734.2
	63.593	119.716	343.047	221.537	265.364	242.901	163.220	58.800	1.809	0.590	13.553	28.819	1522.948
	0.220	0.298	0.313	0.357	0.296	0.339	0.330	1.356	0.493	0.000	0.322	0.165	0.319
1972	110.7	61.9	269.9	159.5	267.3	371.1	227.3	123.2	55.8	0.0	0.0	43.7	1690.4
	105.982	54.030	213.525	169.800	229.782	328.576	237.874	109.025	76.062	2.636	0.064	26.484	1553.839
	0.347	0.317	0.287	0.386	0.312	0.321	0.380	0.321	0.495	0.000	0.000	0.220	0.333
1973	54.0	167.2	155.8	223.7	273.4	252.0	83.4	35.0	0.0	3.4	26.1	60.5	1334.3
	47.043	132.782	151.666	194.693	233.677	218.348	121.121	32.847	3.499	0.790	16.654	51.682	1204.800
	0.316	0.288	0.353	0.316	0.310	0.314	0.527	0.341	0.000	0.085	0.232	0.310	0.327
1974	126.6	169.1	164.3	244.6	295.9	164.7	261.6	87.9	0.9	27.5	14.8	25.7	1583.5
	81.998	138.944	180.010	194.114	276.204	165.154	241.464	93.973	4.220	17.569	12.207	18.478	1424.333
	0.235	0.298	0.397	0.288	0.339	0.364	0.335	0.388	1.728	0.232	0.300	0.261	0.326
1975	31.0	128.4	266.3	282.6	335.3	247.8	120.7	35.3	1.9	0.0	27.4	31.8	1508.4
	25.151	87.531	222.895	268.641	300.951	223.604	126.709	43.726	3.879	0.161	18.674	14.880	1336.801
	0.294	0.247	0.304	0.345	0.326	0.327	0.381	0.450	0.755	0.000	0.247	0.170	0.321
1976	83.8	125.0	133.5	353.4	359.1	318.4	258.1	19.5	1.9	1.2	1.2	25.3	1680.5
	52.677	101.145	91.391	308.484	338.164	292.895	224.272	58.808	2.456	0.867	0.665	22.450	1494.273
	0.228	0.293	0.248	0.317	0.342	0.334	0.315	1.092	0.466	0.256	0.198	0.322	0.323
1977	81.1	159.2	201.9	232.8	279.8	319.2	138.2	10.5	0.0	13.3	44.2	49.1	1529.3
	66.767	107.730	187.272	201.709	256.810	303.974	131.605	35.206	4.067	7.432	22.659	44.718	1369.948
	0.299	0.246	0.336	0.314	0.333	0.345	0.345	1.220	0.000	0.202	0.186	0.330	0.325
1978	43.1	217.2	256.3	298.0	222.9	356.8	56.0	39.5	0.0	5.3	5.9	26.4	1527.3
	44.305	166.949	235.915	267.368	218.376	277.593	106.560	36.203	7.976	4.048	1.581	13.973	1380.846
	0.373	0.279	0.334	0.325	0.355	0.282	0.690	0.332	0.000	0.280	0.098	0.192	0.328
1979	94.1	318.3	168.4	242.4	214.2	278.7	19.0	1.0	0.0	0.0	3.5	29.1	1368.7
	72.679	260.881	154.929	224.200	211.733	207.431	75.400	6.773	0.213	0.005	2.884	14.296	1231.423
	0.280	0.297	0.334	0.336	0.359	0.270	1.438	2.386	0.000	0.000	0.300	0.178	0.326
1980	41.9	118.5	361.7	355.8	338.7	385.2	177.1	14.8	0.0	0.0	19.6	53.3	1866.6
	38.287	87.277	297.311	322.215	315.676	337.066	186.483	35.492	1.056	0.022	8.528	43.148	1672.560
	0.331	0.267	0.298	0.328	0.338	0.317	0.382	0.872	0.000	0.000	0.158	0.294	0.325
1981	131.8	241.6	322.4	355.5	409.1	233.4	76.3	110.4	0.3	0.0	16.3	28.8	1925.7
	88.476	230.941	286.683	346.980	388.402	191.517	104.647	88.764	17.882	0.335	9.906	18.901	1773.432
	0.244	0.347	0.323	0.354	0.344	0.298	0.498	0.292	20.782	0.000	0.221	0.238	0.334
1982	77.5	127.9	280.4	237.0	421.2	280.0	74.6	22.8	32.8	0.1	0.0	3.5	1557.7
	61.196	87.159	234.540	236.178	379.808	254.126	94.948	31.650	34.819	0.832	0.023	2.105	1417.383
	0.287	0.247	0.303	0.362	0.327	0.329	0.462	0.504	0.385	2.573	3.742	0.215	0.330
1983	4.5	204.4	240.2	314.1	506.7	322.7	301.4	31.7	34.8	18.0	62.2	45.1	2085.9
	2.321	116.373	233.600	284.628	421.393	261.472	313.251	38.937	10.792	36.639	40.539	43.861	1803.804
	0.186	0.207	0.353	0.329	0.302	0.294	0.377	0.446	0.112	0.738	0.236	0.352	0.314
1984	67.1	172.7	211.2	179.7	385.1	257.8	203.4	16.8	0.1	35.9	1.0	43.0	1573.8
	60.782	119.156	204.695	177.220	315.581	212.536	238.678	20.468	2.173	17.194	13.755	22.809	1405.046
	0.328	0.250	0.352	0.358	0.297	0.299	0.426	0.442	8.048	0.174	4.895	0.192	0.324
1985	156.4	190.8	148.0	245.4	205.7	438.2	140.9	43.5	0.0	0.0	2.6	4.8	1576.3
	103.033	176.347	160.416	214.674	208.788	372.080	132.451	64.288	7.529	0.136	1.077	3.845	1444.663
	0.239	0.335	0.393	0.317	0.368	0.308	0.341	0.537	0.000	0.000	0.147	0.289	0.332
1986	133.1	238.7	188.5	238.8	421.4	329.4	144.8	2.1	8.9	0.0	0.0	18.6	1724.2
	90.234	219.825	162.177	204.015	366.484	288.218	153.330	22.647	8.377	0.284	0.008	10.030	1525.627
	0.246	0.334	0.312	0.310	0.315	0.317	0.384	3.851	0.343	0.000	0.000	0.196	0.321
1987	78.9	152.8	188.4	196.7	164.5	374.8	75.0	103.4	0.0	0.0	78.0	36.4	1448.9
	58.445	124.394	175.911	184.022	167.297	336.769	98.590	87.642	8.450	0.168	45.723	49.764	1337.174
	0.269	0.295	0.339	0.339	0.369	0.326	0.477	0.307	0.000	0.000	0.212	0.496	0.335
AVERAGE													
(MM)	87.9	168.9	233.8	266.1	323.8	305.4	146.1	38.2	10.0	7.5	18.1	35.1	1640.9
(MCM)	66.439	136.667	207.671	243.846	295.469	267.502	158.440	47.491	12.848	6.535	12.722	25.743	1481.372
(%)	0.274	0.293	0.322	0.332	0.331	0.318	0.393	0.451	0.465	0.318	0.256	0.266	0.327

A.3.13 Monthly Runoff in Maenum Nakhon Nayok (MNN) basin

* BANG PAKONG RIVER BASIN DEVELOPMENT STUDY*

* MAENUM NAKON NAYOK SUB-BASIN (C.A.= 1933.0 SQ.KM)

(UNIT= RAIN.(MM) , RUNOFF(MCM))

YEAR	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	ANNUAL
1968	162.6	122.6	129.4	291.8	274.0	238.5	73.4	39.5	0.0	13.4	0.0	93.1	1438.3
	113.043	128.291	116.989	235.369	269.374	209.394	91.606	35.079	4.789	11.289	2.435	60.382	1278.038
	0.360	0.541	0.468	0.417	0.509	0.454	0.645	0.459	0.000	0.436	0.000	0.335	0.460
1969	80.4	152.8	336.5	383.4	156.5	514.6	147.2	23.5	1.8	2.3	16.1	49.3	1864.4
	90.125	128.096	285.300	346.138	162.948	414.202	166.755	33.796	1.992	2.925	13.765	34.237	1680.278
	0.580	0.434	0.439	0.467	0.539	0.416	0.586	0.743	0.559	0.668	0.442	0.360	0.466
1970	157.9	228.5	371.2	293.9	353.1	437.0	147.7	11.0	47.6	0.0	42.0	31.9	2121.6
	120.168	200.357	320.911	248.061	322.386	372.501	148.065	19.305	48.136	3.086	23.079	37.648	1863.701
	0.394	0.454	0.447	0.437	0.472	0.441	0.519	0.909	0.523	0.000	0.285	0.611	0.454
1971	99.2	141.3	306.0	297.1	365.6	315.1	157.0	11.2	0.2	0.0	1.3	60.4	1754.4
	70.604	123.200	270.812	276.300	294.534	289.428	145.017	37.130	1.152	0.144	1.580	34.177	1544.076
	0.368	0.451	0.458	0.481	0.417	0.475	0.478	1.709	3.543	0.000	0.614	0.293	0.455
1972	143.2	71.3	275.5	239.5	309.1	485.1	171.9	143.2	61.0	0.0	2.7	47.6	1950.1
	123.301	64.667	240.057	230.689	255.534	415.508	179.247	117.841	75.031	3.129	1.996	29.486	1736.485
	0.446	0.469	0.451	0.498	0.428	0.443	0.539	0.426	0.637	0.000	0.377	0.320	0.461
1973	85.4	191.5	226.2	271.3	230.8	223.3	95.4	29.5	0.0	1.9	8.8	50.9	1415.0
	67.112	167.768	206.649	230.437	208.804	196.261	114.814	31.654	2.677	0.691	7.701	37.421	1271.988
	0.406	0.453	0.473	0.439	0.468	0.455	0.623	0.555	0.000	0.188	0.451	0.381	0.465
1974	101.6	172.3	190.7	225.4	291.5	202.4	269.3	77.7	1.4	50.3	12.0	40.9	1635.5
	76.131	124.518	180.336	191.536	257.420	189.209	234.247	92.051	4.766	38.114	14.011	30.029	1432.367
	0.388	0.374	0.489	0.440	0.457	0.484	0.450	0.613	1.758	0.392	0.604	0.380	0.453
1975	51.8	177.4	389.0	366.7	360.8	281.1	151.9	46.7	34.1	0.0	18.7	31.3	1909.4
	51.211	141.204	343.902	330.942	302.141	247.434	148.991	54.286	35.097	1.085	15.769	16.050	1688.110
	0.512	0.412	0.457	0.467	0.433	0.455	0.508	0.602	0.533	0.000	0.435	0.266	0.457
1976	92.4	164.7	132.3	440.2	527.4	332.2	183.2	52.8	0.4	0.0	3.0	15.5	1944.1
	51.400	142.367	118.492	380.220	474.766	300.166	166.686	82.167	2.505	0.282	1.476	11.526	1732.052
	0.288	0.447	0.463	0.447	0.466	0.467	0.471	0.805	3.323	0.000	0.257	0.385	0.461
1977	59.5	160.3	151.1	224.4	233.0	325.9	126.3	35.9	0.5	5.6	86.9	11.1	1420.6
	50.018	119.459	141.529	179.831	216.509	294.407	114.189	40.524	8.738	4.773	48.870	30.566	1249.412
	0.435	0.386	0.484	0.415	0.481	0.467	0.468	0.584	9.238	0.439	0.291	1.420	0.455
1978	39.0	207.8	236.7	338.5	227.7	405.4	40.5	15.7	0.0	10.1	0.1	2.8	1524.1
	30.767	168.566	214.116	305.296	213.997	312.909	85.061	18.479	1.386	9.449	1.121	1.867	1363.012
	0.409	0.420	0.468	0.467	0.486	0.399	1.087	0.610	0.000	0.486	7.585	0.346	0.463
1979	139.4	198.2	163.7	215.6	253.5	291.4	70.3	0.0	0.0	0.0	2.5	36.9	1371.5
	105.889	177.787	142.708	197.540	226.140	241.271	87.900	18.807	0.573	0.018	2.382	27.120	1228.134
	0.393	0.464	0.451	0.474	0.461	0.428	0.647	254.492	0.000	0.000	0.491	0.381	0.463
1980	57.1	141.7	320.9	296.1	440.0	348.7	231.7	22.2	0.0	0.0	32.9	17.8	1909.0
	41.854	123.460	255.905	272.356	390.779	292.087	214.893	47.167	1.869	0.057	17.320	24.965	1682.710
	0.379	0.451	0.413	0.476	0.460	0.433	0.480	1.100	0.000	0.000	0.272	0.726	0.456
1981	151.7	205.9	250.7	327.5	343.1	344.3	109.9	92.7	0.1	0.0	1.3	44.5	1871.7
	128.242	178.582	210.175	298.029	297.628	306.561	128.469	76.891	14.866	0.379	1.023	21.060	1661.904
	0.437	0.449	0.434	0.471	0.449	0.461	0.605	0.429	91.438	0.000	0.410	0.245	0.459
1982	113.0	165.1	257.0	285.9	340.6	465.7	73.1	61.1	48.3	3.4	0.7	13.4	1827.2
	99.422	138.635	228.905	261.461	301.187	404.658	102.595	54.022	58.101	4.854	0.908	12.439	1667.186
	0.455	0.434	0.461	0.473	0.457	0.450	0.727	0.457	0.623	0.745	0.645	0.481	0.472
1983	0.6	286.9	226.9	225.1	641.3	322.3	432.0	59.4	6.9	3.2	49.6	53.7	2307.8
	0.422	217.254	210.846	200.340	546.020	275.054	412.924	65.982	8.182	6.337	31.290	40.407	2015.056
	0.397	0.392	0.481	0.460	0.440	0.441	0.495	0.575	0.609	1.030	0.326	0.390	0.452
1984	107.6	169.5	108.2	310.0	415.8	234.4	143.3	9.3	0.0	13.5	4.5	78.2	1594.1
	96.412	146.991	119.957	295.796	355.646	200.122	160.251	16.169	1.248	5.552	6.222	57.032	1461.396
	0.464	0.449	0.574	0.494	0.443	0.442	0.579	0.903	0.000	0.213	0.720	0.377	0.474
1985	125.4	213.8	171.6	275.0	276.3	532.2	114.4	50.6	0.0	0.0	0.0	0.0	1759.1
	115.543	188.675	163.834	246.099	238.385	450.704	107.855	58.796	10.620	0.249	0.008	0.000	1580.766
	0.477	0.457	0.494	0.463	0.446	0.438	0.488	0.601	0.000	0.000	0.000	0.000	0.465
1986	150.3	228.3	144.6	319.6	444.0	319.7	207.0	3.0	19.1	0.0	7.5	35.8	1878.9
	108.113	205.281	132.576	267.179	394.247	275.250	207.938	26.429	18.657	0.828	1.826	27.896	1666.219
	0.372	0.465	0.474	0.433	0.459	0.445	0.520	4.615	0.504	0.000	0.126	0.404	0.459
1987	66.1	108.7	206.8	128.4	87.4	360.2	74.5	52.6	0.0	1.6	48.1	8.7	1143.1
	55.859	91.023	172.168	135.145	97.223	326.197	85.721	53.364	6.600	1.180	37.255	14.270	1076.003
	0.437	0.433	0.431	0.544	0.575	0.469	0.595	0.525	0.000	0.389	0.401	0.851	0.487
AVERAGE (MM)	99.2	175.4	229.7	287.8	328.6	349.0	151.0	41.9	11.1	5.3	16.9	36.2	1732.0
(MCM)	79.782	148.809	203.808	256.438	291.283	300.666	155.161	48.997	15.349	4.721	11.502	27.429	1543.943
(%)	0.416	0.439	0.459	0.461	0.459	0.446	0.532	0.605	0.717	0.465	0.351	0.392	0.461

A.3.14 Monthly Runoff in Khlong Tha Lat (KTL) basin

* BANG PAKONG RIVER BASIN DEVELOPMENT STUDY*

* KHLONG THA LAT SUB-BASIN (C.A.= 2493.0 SQ.KM)

(UNIT= RAIN.(MM) , RUNOFF(MCM))

YEAR	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	ANNUAL
1968	182.2	138.3	123.4	73.7	146.6	287.7	105.3	0.5	0.0	2.0	2.6	2.3	1064.4
	101.650	102.021	48.162	48.455	71.981	113.192	90.195	17.899	0.659	0.957	1.436	0.907	597.513
	0.224	0.296	0.157	0.264	0.197	0.158	0.344	15.837	0.000	0.194	0.225	0.160	0.225
1969	34.3	153.7	76.7	101.0	252.2	281.1	204.4	22.9	0.0	5.0	31.8	130.8	1293.7
	13.617	50.111	63.905	51.120	94.787	164.430	112.493	33.741	1.503	1.829	14.182	48.273	649.990
	0.159	0.131	0.334	0.203	0.151	0.235	0.221	0.591	0.000	0.148	0.179	0.148	0.202
1970	149.1	204.9	438.0	171.0	368.8	232.4	189.0	4.7	116.6	0.1	17.8	7.4	1899.8
	79.503	95.807	204.614	131.281	153.807	107.080	144.139	20.424	60.569	3.761	1.730	10.490	1013.204
	0.214	0.188	0.187	0.308	0.167	0.185	0.306	1.747	0.208	17.085	0.039	0.570	0.214
1971	105.6	167.7	186.1	145.6	286.0	139.9	218.0	0.7	0.2	0.0	1.7	41.2	1292.7
	28.700	90.281	98.752	84.297	91.706	111.632	93.824	46.576	1.726	0.153	0.761	11.557	659.964
	0.109	0.216	0.213	0.232	0.129	0.320	0.173	26.049	3.852	0.000	0.178	0.112	0.205
1972	207.4	36.8	229.4	10.9	67.3	341.3	86.7	53.5	15.2	0.0	0.2	39.7	1088.4
	88.569	29.975	100.159	40.449	31.951	142.724	74.180	28.675	14.795	0.760	0.124	13.008	565.368
	0.171	0.327	0.175	1.485	0.190	0.168	0.343	0.215	0.390	6.167	0.315	0.132	0.208
1973	6.8	151.9	109.5	140.7	217.7	217.2	83.9	34.7	0.0	0.3	20.1	39.6	1022.4
	9.162	60.130	69.635	68.039	94.987	98.708	83.993	22.103	2.966	0.183	3.908	20.729	534.542
	0.539	0.159	0.255	0.194	0.175	0.182	0.402	0.256	0.000	0.213	0.078	0.210	0.210
1974	160.3	55.2	34.3	178.8	151.4	50.1	225.1	84.6	0.0	8.0	3.1	7.9	958.9
	68.286	40.379	19.370	64.458	80.446	51.293	105.143	57.615	3.644	3.030	1.811	2.230	497.704
	0.171	0.293	0.227	0.145	0.213	0.411	0.187	0.273	61.994	0.151	0.232	0.114	0.208
1975	22.9	184.9	86.1	254.5	176.1	284.7	209.0	13.8	0.0	0.0	46.1	60.0	1338.2
	11.043	65.699	62.340	121.976	77.048	149.424	136.154	18.134	1.464	0.070	21.723	19.493	684.567
	0.193	0.142	0.290	0.192	0.175	0.211	0.261	0.529	0.000	0.000	0.189	0.130	0.205
1976	84.8	79.6	32.7	298.8	150.7	285.7	268.4	74.0	0.8	4.6	0.9	33.6	1314.5
	33.231	51.486	23.885	109.468	102.657	144.777	122.992	79.935	4.783	2.459	0.418	17.514	693.604
	0.157	0.260	0.293	0.147	0.273	0.203	0.184	0.433	2.433	0.213	0.196	0.209	0.212
1977	61.7	139.2	186.5	294.8	202.7	268.3	55.8	28.3	0.0	60.2	51.2	74.6	1423.4
	29.088	48.344	93.284	144.708	106.187	137.499	67.459	15.940	3.838	30.367	25.921	29.483	732.117
	0.189	0.139	0.201	0.197	0.210	0.206	0.485	0.226	0.000	0.202	0.203	0.159	0.206
1978	29.4	157.9	88.3	322.8	173.1	408.9	196.3	3.3	0.0	12.6	26.3	20.2	1439.1
	22.432	60.970	55.073	135.961	111.460	179.684	131.217	32.530	1.248	6.073	3.893	16.984	757.523
	0.306	0.155	0.250	0.169	0.258	0.176	0.268	3.992	0.000	0.193	0.059	0.338	0.211
1979	85.2	283.2	203.6	260.9	176.0	352.7	1.2	23.8	0.0	0.0	1.0	20.2	1407.7
	29.620	147.714	102.071	114.189	112.839	175.702	32.410	12.104	1.691	0.053	0.312	8.193	736.897
	0.139	0.209	0.201	0.176	0.257	0.200	11.019	0.204	0.000	0.000	0.121	0.163	0.210
1980	30.0	107.7	294.7	220.1	146.6	364.6	158.7	128.1	0.0	0.0	28.5	61.4	1540.3
	14.306	46.581	135.533	104.848	90.877	156.155	116.905	87.781	5.139	0.197	3.996	37.167	799.483
	0.191	0.174	0.184	0.191	0.249	0.172	0.296	0.275	0.000	0.000	0.056	0.243	0.208
1981	179.9	431.8	227.7	167.9	243.8	548.6	159.1	149.7	0.0	0.0	2.2	14.2	2125.0
	57.114	224.340	134.401	87.278	146.882	258.524	105.286	55.612	33.332	0.990	0.716	2.735	1107.208
	0.127	0.208	0.237	0.209	0.242	0.189	0.265	0.149	0.000	0.000	0.128	0.077	0.209
1982	117.4	132.0	272.3	96.1	211.3	138.2	81.9	20.5	60.7	0.0	0.6	2.2	1133.2
	56.974	53.223	111.601	93.909	92.110	74.635	59.437	19.992	32.554	1.163	0.309	0.898	596.804
	0.195	0.162	0.164	0.392	0.175	0.217	0.291	0.391	0.215	0.000	0.211	0.161	0.211
1983	60.5	101.5	213.4	127.8	544.8	266.9	287.0	60.0	0.9	33.9	22.5	37.5	1756.9
	4.468	47.375	120.809	59.358	269.459	110.231	192.596	48.747	3.843	10.385	15.976	10.934	894.180
	0.030	0.187	0.227	0.186	0.198	0.166	0.269	0.326	1.705	0.123	0.285	0.117	0.204
1984	63.5	140.5	171.1	94.3	160.9	221.3	161.4	19.1	0.0	32.6	63.2	29.8	1157.9
	35.791	63.605	89.919	56.546	77.937	101.528	100.350	16.994	1.925	7.240	34.700	15.475	602.009
	0.226	0.182	0.211	0.240	0.194	0.184	0.249	0.356	39.352	0.089	0.220	0.208	0.209
1985	164.6	233.4	29.7	199.2	96.1	137.9	210.7	75.7	2.7	0.0	10.6	2.7	1163.3
	61.505	126.532	40.112	70.299	75.258	66.366	95.524	65.075	7.524	0.300	4.400	2.011	614.905
	0.150	0.217	0.542	0.142	0.314	0.193	0.182	0.345	1.101	0.000	0.166	0.295	0.212
1986	165.6	134.3	139.8	114.9	308.7	238.3	243.4	6.7	1.1	0.0	0.0	73.4	1426.2
	57.163	89.113	62.150	57.972	152.678	97.450	159.259	23.874	2.009	0.104	0.012	0.366	702.149
	0.139	0.266	0.178	0.202	0.198	0.164	0.263	1.420	0.714	0.000	0.000	0.002	0.197
1987	57.9	17.4	118.3	112.0	197.1	210.8	112.6	78.3	0.0	0.0	105.9	16.1	1026.4
	52.053	20.233	56.220	59.920	92.363	81.474	94.191	38.564	12.878	0.412	45.696	15.628	569.631
	0.361	0.467	0.191	0.215	0.188	0.155	0.336	0.197	0.000	0.000	0.173	0.390	0.223
AVERAGE													
(MM)	98.5	152.6	163.1	169.3	213.9	263.8	162.9	44.1	9.9	8.0	21.8	35.7	1343.6
(MCM)	42.714	75.696	84.600	85.226	106.371	126.125	105.887	37.116	9.904	3.524	9.101	14.204	700.467
(%)	0.174	0.199	0.208	0.202	0.199	0.192	0.261	0.337	0.401	0.177	0.167	0.159	0.209

A.3.15 Monthly Runoff in Lower Bang Pakong (LBP) basin

* BANG PAKONG RIVER BASIN DEVELOPMENT STUDY*

* LOWER BANG PAKONG SUB-BASIN (C.A.= 3106.0 SQ.KM)

(UNIT= RAIN.(MM) , RUNOFF(MCM))

YEAR	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	ANNUAL
1968	107.0	148.6	198.5	115.5	153.6	247.1	133.0	21.5	0.1	58.0	23.6	52.8	1259.3
	81.735	76.565	93.850	58.720	86.923	123.038	90.269	17.744	0.971	29.214	15.461	25.312	699.801
	0.246	0.166	0.152	0.164	0.182	0.160	0.219	0.265	3.209	0.162	0.211	0.154	0.179
1969	89.4	186.3	81.0	101.7	211.4	328.4	96.6	39.1	0.0	14.3	19.8	73.4	1241.3
	44.107	74.615	63.736	56.351	91.128	164.494	71.187	28.502	0.969	6.814	9.130	31.607	642.639
	0.159	0.129	0.253	0.178	0.139	0.161	0.237	0.235	0.000	0.153	0.148	0.139	0.167
1970	86.1	190.8	330.9	107.6	197.8	187.6	142.1	30.4	59.7	0.9	50.4	34.3	1418.7
	46.630	85.226	150.040	90.001	87.055	93.320	91.191	14.147	43.757	2.710	15.022	27.326	746.423
	0.174	0.144	0.146	0.269	0.142	0.160	0.207	0.150	0.236	0.989	0.096	0.256	0.169
1971	93.1	175.8	201.8	73.2	356.5	257.8	204.0	1.3	3.4	0.0	18.3	55.2	1440.4
	42.422	68.374	113.617	50.752	143.768	150.062	108.834	28.719	2.019	1.020	9.296	15.143	734.024
	0.147	0.125	0.181	0.223	0.130	0.187	0.172	7.254	0.190	0.000	0.163	0.088	0.164
1972	118.0	29.0	221.8	35.9	79.0	380.7	131.5	104.5	18.6	1.5	3.9	60.8	1185.4
	67.281	18.927	101.584	37.332	29.416	173.678	95.850	57.040	15.850	1.392	2.329	23.223	623.900
	0.184	0.210	0.147	0.335	0.120	0.147	0.235	0.176	0.274	0.303	0.191	0.123	0.169
1973	66.6	167.5	91.5	162.4	229.5	257.1	76.9	42.3	0.7	0.9	37.1	88.4	1220.9
	31.473	81.433	58.067	75.183	122.041	117.767	66.860	25.309	2.538	0.244	13.871	40.919	635.703
	0.152	0.157	0.204	0.149	0.171	0.147	0.280	0.193	1.113	0.085	0.120	0.149	0.168
1974	146.0	144.2	75.8	168.2	184.0	172.4	396.2	95.1	0.2	49.1	29.2	30.5	1490.7
	68.142	77.480	38.522	82.752	97.555	94.143	195.997	68.883	3.541	22.851	16.143	12.751	778.758
	0.150	0.173	0.164	0.158	0.171	0.176	0.159	0.233	7.429	0.150	0.178	0.135	0.168
1975	24.6	158.1	85.2	190.8	157.7	262.8	166.0	33.5	0.7	0.0	48.0	91.6	1219.1
	17.771	66.202	49.737	97.724	73.643	135.405	105.007	26.594	1.361	0.045	23.311	26.681	623.479
	0.232	0.135	0.188	0.165	0.150	0.166	0.204	0.255	0.617	0.000	0.156	0.094	0.165
1976	95.9	143.8	74.8	203.8	182.1	225.8	239.0	36.7	0.9	1.6	15.1	33.6	1253.3
	49.878	83.375	45.493	89.598	87.168	133.683	102.891	53.273	1.693	0.782	6.482	19.172	673.486
	0.167	0.187	0.196	0.142	0.154	0.191	0.139	0.467	0.599	0.156	0.138	0.184	0.173
1977	91.1	185.4	134.6	150.1	116.6	167.0	89.5	32.6	0.1	34.8	37.8	73.0	1112.5
	41.893	82.596	67.668	78.287	58.007	82.389	64.215	21.748	6.407	15.101	17.486	31.675	567.470
	0.148	0.143	0.162	0.168	0.160	0.159	0.231	0.215	36.483	0.140	0.149	0.140	0.164
1978	54.3	241.1	111.5	201.3	78.0	350.8	94.5	15.9	0.0	8.2	16.8	12.5	1184.8
	33.293	119.932	62.615	88.720	57.797	147.895	79.042	17.562	0.918	4.299	2.693	11.866	626.630
	0.197	0.160	0.181	0.142	0.239	0.136	0.269	0.356	0.000	0.170	0.052	0.305	0.170
1979	72.3	120.4	99.7	96.9	130.5	227.3	19.0	6.8	0.1	0.0	14.5	88.6	876.2
	27.073	62.725	52.176	48.798	55.349	113.232	37.938	7.403	0.450	0.018	6.319	41.019	452.498
	0.121	0.168	0.168	0.162	0.137	0.160	0.643	0.349	1.602	0.000	0.140	0.149	0.166
1980	65.8	74.2	231.1	133.9	180.2	231.6	137.1	35.7	0.0	0.5	25.8	37.2	1153.1
	38.664	33.436	110.043	66.959	90.993	109.327	94.253	29.658	1.289	0.298	10.700	14.856	600.474
	0.189	0.145	0.153	0.161	0.163	0.152	0.221	0.268	0.000	0.190	0.133	0.128	0.168
1981	158.1	207.7	96.6	149.6	100.1	328.5	137.6	74.5	0.0	0.0	9.6	54.6	1316.9
	73.435	105.898	57.334	71.265	65.338	146.018	84.476	46.320	8.601	0.272	1.939	15.648	676.542
	0.150	0.164	0.191	0.153	0.210	0.143	0.198	0.200	0.000	0.000	0.065	0.092	0.165
1982	143.6	88.3	236.6	132.4	120.6	180.1	120.4	61.0	49.0	0.0	14.3	9.5	1155.8
	79.680	46.342	106.678	77.953	59.013	86.294	74.446	40.757	30.043	0.750	7.427	5.530	614.910
	0.179	0.169	0.145	0.190	0.158	0.154	0.199	0.215	0.197	13.264	0.168	0.187	0.171
1983	51.0	125.2	140.9	165.5	457.2	215.4	320.8	54.6	5.3	20.4	73.0	26.8	1656.1
	16.082	54.032	79.979	76.057	221.749	107.351	179.741	50.119	3.266	9.545	34.986	14.816	847.721
	0.101	0.139	0.183	0.148	0.156	0.160	0.180	0.296	0.199	0.151	0.154	0.178	0.165
1984	86.3	98.8	185.9	165.0	149.2	162.6	149.1	15.7	0.0	19.9	22.0	30.7	1085.2
	42.963	48.967	89.932	92.810	70.763	79.371	91.836	12.849	1.173	6.104	12.550	14.195	563.511
	0.160	0.160	0.156	0.181	0.153	0.157	0.198	0.264	0.000	0.099	0.184	0.149	0.167
1985	90.4	195.4	12.7	111.7	79.8	238.3	160.6	69.1	0.1	0.0	10.3	6.3	974.7
	40.197	95.366	26.627	43.444	48.452	102.385	91.865	46.156	7.436	0.184	2.637	5.481	510.229
	0.143	0.157	0.675	0.125	0.196	0.138	0.184	0.215	30.525	0.000	0.082	0.280	0.169
1986	130.2	172.6	139.0	155.8	250.2	149.5	262.2	12.9	3.1	0.0	1.8	27.1	1304.3
	56.305	93.997	66.437	72.991	133.404	71.870	140.271	21.094	3.105	0.110	0.896	7.187	667.665
	0.139	0.175	0.154	0.151	0.172	0.155	0.172	0.525	0.327	0.000	0.159	0.085	0.165
1987	63.6	139.5	119.4	130.0	122.0	238.8	185.4	97.8	0.0	0.0	108.3	54.0	1258.7
	28.873	69.383	70.838	50.194	79.113	104.259	102.854	67.319	6.877	0.172	50.827	35.474	666.181
	0.146	0.160	0.191	0.124	0.209	0.141	0.179	0.222	0.000	0.000	0.151	0.211	0.170
AVERAGE													
(MM)	91.7	149.6	143.5	137.6	176.8	240.5	163.1	44.1	7.1	10.5	29.0	47.1	1240.4
(MCM)	46.395	72.243	75.248	70.294	87.934	116.799	98.451	34.060	7.113	5.096	12.975	20.994	647.601
(%)	0.163	0.155	0.169	0.165	0.160	0.156	0.194	0.249	0.323	0.156	0.144	0.144	0.168

A.3.16 Monthly Runoff in Entire Bang Pakong Basin

* BANG PAKONG RIVER BASIN DEVELOPMENT STUDY*

* ENTIRE BASIN (C.A.=17660.0 SQ.KM)

(UNIT= RAIN.(MM) , RUNOFF(MCM))

YEAR	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	ANNUAL
1968	136.5	128.5	156.2	211.0	218.4	268.1	108.7	14.8	0.0	28.1	25.1	35.7	1331.1
	680.053	689.244	696.707	1030.211	1291.581	1138.586	752.992	146.398	14.827	117.858	135.105	155.976	6849.512
	0.282	0.304	0.252	0.276	0.335	0.241	0.392	0.561	49.006	0.237	0.305	0.248	0.291
1969	64.5	161.9	211.5	264.0	244.1	410.0	153.7	24.1	0.2	7.1	22.8	66.4	1630.2
	289.903	624.840	1145.630	1438.539	1177.385	1990.999	899.629	264.111	14.120	24.898	92.879	214.102	8177.016
	0.254	0.219	0.307	0.309	0.273	0.275	0.332	0.620	3.966	0.197	0.231	0.183	0.284
1970	131.1	182.1	339.8	210.9	341.7	262.5	163.2	21.7	65.2	1.3	25.8	24.0	1769.3
	522.257	895.631	1460.031	1217.178	1624.282	1337.083	961.903	199.495	354.292	36.445	68.235	146.053	8822.871
	0.226	0.279	0.243	0.327	0.269	0.288	0.334	0.520	0.308	1.581	0.150	0.345	0.282
1971	97.4	155.6	279.0	192.8	297.7	247.7	188.4	8.6	4.3	0.0	23.0	52.9	1547.4
	357.067	645.093	1403.292	1098.685	1258.068	1301.157	903.180	321.653	18.929	10.246	93.927	147.425	7558.707
	0.208	0.235	0.285	0.323	0.239	0.297	0.271	2.116	0.248	0.000	0.232	0.158	0.277
1972	147.5	50.7	238.0	166.6	204.4	416.1	157.9	113.5	33.0	0.6	3.3	51.7	1583.3
	668.192	279.667	1043.321	952.673	1098.481	1921.323	1023.064	572.021	293.470	16.405	11.742	166.370	8046.715
	0.256	0.313	0.248	0.324	0.304	0.261	0.367	0.285	0.504	1.585	0.199	0.182	0.288
1973	48.0	146.8	144.9	235.5	234.8	296.8	117.3	45.1	0.1	6.7	27.6	84.7	1388.4
	235.526	657.962	785.202	1066.194	1108.674	1351.198	871.934	244.174	32.270	10.093	101.219	342.993	6807.426
	0.278	0.254	0.307	0.256	0.267	0.258	0.421	0.307	14.145	0.085	0.207	0.229	0.278
1974	134.0	162.9	157.0	192.1	255.1	156.8	285.1	78.1	1.0	29.2	21.0	43.0	1515.3
	528.958	762.132	905.242	892.833	1237.746	912.271	1335.305	518.420	41.576	121.173	84.507	172.976	7513.125
	0.223	0.265	0.327	0.263	0.275	0.329	0.265	0.376	2.431	0.235	0.228	0.228	0.281
1975	31.2	173.1	230.6	263.8	292.4	266.6	185.0	32.9	5.6	0.0	34.8	71.6	1587.7
	192.601	619.392	1240.988	1396.312	1449.439	1298.730	1056.393	286.782	62.257	2.625	129.386	199.169	7934.055
	0.349	0.203	0.305	0.300	0.281	0.276	0.323	0.493	0.630	0.000	0.211	0.158	0.283
1976	81.4	147.6	154.6	341.1	305.7	284.8	279.7	64.0	1.7	1.4	4.6	25.7	1692.3
	328.462	672.911	721.190	1616.121	1667.417	1542.286	1188.097	649.131	39.967	10.318	11.153	110.893	8557.930
	0.229	0.258	0.264	0.268	0.309	0.307	0.241	0.575	1.332	0.425	0.138	0.244	0.286
1977	79.3	173.7	162.8	254.3	235.9	299.5	134.8	26.3	0.3	22.9	38.8	54.6	1483.2
	324.266	642.380	835.344	1136.335	1223.658	1523.452	789.780	278.116	59.256	71.135	155.931	210.975	7250.609
	0.232	0.209	0.290	0.253	0.294	0.288	0.332	0.599	13.036	0.176	0.228	0.219	0.277
1978	43.6	234.2	197.4	288.0	216.8	378.0	105.4	22.4	0.0	11.4	14.9	16.1	1528.2
	244.783	901.551	1086.157	1372.102	1252.840	1593.178	815.053	222.637	25.902	52.159	18.449	92.955	7677.742
	0.318	0.218	0.312	0.270	0.327	0.239	0.438	0.564	0.000	0.259	0.070	0.327	0.284
1979	94.6	251.0	225.7	255.1	197.1	357.0	39.6	11.7	0.0	0.0	18.6	44.9	1495.2
	370.858	1119.687	1018.641	1341.528	1129.612	1448.085	579.189	140.416	11.883	0.621	46.992	183.936	7391.430
	0.222	0.253	0.256	0.298	0.325	0.230	0.829	0.679	42.291	0.000	0.143	0.232	0.280
1980	47.2	124.6	342.1	276.5	294.8	353.2	203.1	38.5	0.0	0.1	32.7	59.0	1771.9
	229.045	510.569	1462.054	1421.808	1581.576	1696.365	1234.187	348.153	21.374	1.232	60.139	311.534	8878.023
	0.275	0.232	0.242	0.291	0.304	0.272	0.344	0.512	0.000	0.786	0.104	0.299	0.284
1981	135.6	264.2	264.2	246.4	291.6	354.2	133.7	113.5	0.8	0.0	25.5	41.0	1870.6
	510.823	1213.130	1313.049	1343.616	1586.618	1518.619	841.068	543.541	143.541	5.165	92.143	107.469	9218.766
	0.213	0.260	0.281	0.309	0.308	0.243	0.356	0.271	10.737	0.000	0.205	0.148	0.279
1982	105.6	143.4	268.5	198.2	337.0	272.9	115.6	47.6	31.1	1.4	13.6	4.0	1539.0
	494.059	599.674	1130.427	1206.269	1644.073	1471.860	686.540	326.038	224.558	15.556	32.749	39.712	7871.500
	0.265	0.237	0.238	0.345	0.276	0.305	0.336	0.388	0.409	0.612	0.136	0.560	0.290
1983	29.8	153.5	234.6	235.6	512.3	317.6	352.9	49.3	10.8	17.5	42.1	64.2	2020.1
	40.206	584.003	1170.939	1179.302	2363.581	1431.512	2041.249	391.558	46.300	96.605	161.706	222.835	9729.773
	0.076	0.216	0.283	0.283	0.261	0.255	0.328	0.450	0.242	0.312	0.218	0.197	0.273
1984	81.3	152.1	237.2	168.8	350.9	245.7	168.9	20.3	0.0	19.6	23.8	51.8	1520.5
	444.165	647.214	1160.509	1017.555	1648.600	1174.955	1089.441	157.891	18.248	45.764	109.605	199.834	7713.758
	0.309	0.241	0.277	0.341	0.266	0.271	0.365	0.439	29.479	0.132	0.260	0.218	0.287
1985	160.7	230.5	159.9	227.9	163.3	332.5	168.3	52.3	0.5	0.0	18.1	19.7	1533.9
	589.573	1148.172	912.540	1116.639	966.065	1635.611	818.073	409.628	72.303	2.651	27.310	100.506	7799.055
	0.208	0.282	0.323	0.277	0.335	0.279	0.275	0.443	8.183	0.000	0.085	0.288	0.288
1986	131.5	229.0	161.0	207.5	329.5	296.7	219.6	5.7	8.8	0.0	22.0	48.4	1659.6
	530.493	1120.891	758.531	1021.774	1596.296	1390.453	1236.234	183.371	58.093	2.631	50.177	150.691	8099.617
	0.229	0.277	0.267	0.279	0.274	0.265	0.319	1.836	0.374	0.000	0.129	0.176	0.276
1987	76.5	126.5	209.0	152.4	162.0	314.7	112.1	87.6	0.0	0.3	77.5	27.4	1346.1
	375.316	567.363	968.149	841.296	807.951	1525.079	676.265	445.201	65.334	3.497	252.448	202.885	6730.770
	0.278	0.254	0.262	0.313	0.282	0.274	0.342	0.288	0.000	0.790	0.184	0.419	0.283
AVERAGE (MM)	92.9	169.6	218.7	229.4	274.3	306.6	169.7	43.9	8.2	7.4	25.8	44.3	1590.7
(MCM)	397.829	745.074	1060.896	1185.347	1385.696	1469.138	989.977	332.436	80.925	32.354	86.790	173.964	7931.410
(%)	0.243	0.249	0.275	0.293	0.286	0.270	0.330	0.429	0.561	0.248	0.191	0.222	0.282

A.3.17 Annual Runoff at Proposed Dam Sites

(unit: MCM/yr.)

DamNo.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Area	528		1371		585		2253		614		266		147		338		68		273		151	
(km)		344		976		798		1452		1040		443		64		96		159		107		114
1968	155	102	338	241	142	192	650	443	196	328	70	204	57	22	91	23	17	131	138	135	180	73
69	142	94	370	266	160	212	730	478	203	407	95	288	82	33	145	37	28	169	182	156	220	93
70	162	108	595	433	258	331	778	474	195	432	105	260	77	33	162	44	33	127	198	157	231	116
71	149	99	363	261	156	218	646	415	173	353	81	223	63	27	123	32	24	139	149	131	193	83
72	132	87	307	219	131	186	796	544	233	411	87	262	72	30	130	33	25	156	176	142	205	105
73	144	95	302	215	129	180	722	484	203	378	82	221	62	24	95	23	17	138	128	106	146	80
74	157	103	259	182	109	165	711	497	218	367	86	243	70	25	109	27	20	166	154	131	167	100
75	144	96	387	278	167	226	720	492	218	247	80	236	67	29	136	32	24	202	174	122	168	112
76	135	89	377	271	162	233	769	497	208	451	100	336	93	34	133	34	25	151	168	125	193	104
77	117	79	420	306	184	243	620	396	174	347	82	297	85	27	85	20	15	142	132	124	158	83
78	129	86	435	316	189	251	536	326	142	325	76	322	88	34	137	35	26	169	168	130	169	87
79	101	68	431	315	188	246	662	417	179	374	73	332	85	39	171	45	34	146	197	110	145	90
80	118	79	457	333	199	269	726	467	205	415	94	376	103	37	134	34	25	170	183	110	145	90
81	146	99	666	487	291	364	830	535	241	393	80	316	84	33	133	34	25	180	209	171	225	113
82	120	80	339	245	147	201	696	453	192	401	84	320	87	30	100	25	18	131	167	120	189	107
83	175	117	492	355	212	294	868	565	242	478	106	361	100	37	144	38	28	139	205	144	231	126
84	114	76	324	234	140	198	656	428	183	384	82	321	88	30	104	24	19	163	180	125	170	110
85	100	67	349	254	152	205	745	496	214	408	85	322	87	30	103	26	19	139	167	129	185	107
86	136	91	390	282	168	231	772	521	228	406	91	315	87	32	129	35	26	109	178	123	206	87
87	147	97	321	229	137	188	668	460	204	336	78	236	67	26	110	28	21	131	178	130	164	77
MEAN	136	91	396	286	171	232	715	470	203	387	86	289	80	31	124	32	23	150	172	133	188	98
MAX.	162	117	595	487	258	364	868	544	241	478	106	376	100	39	171	45	34	202	209	171	231	126
MIN.	100	67	259	182	109	165	536	415	142	325	70	204	57	22	85	20	15	109	132	106	145	73
Probability																						
1/10	110	74	295	210	126	179	617	381	170	337	74	226	64	25	95	23	17	124	143	114	154	80
1/5	116	79	317	227	136	191	648	402	180	352	78	246	69	27	104	26	19	131	151	120	165	85

A.4 Probable Flood Hydrograph at Proposed Dam Sites

A.4.1 Probable Storm Rainfall

1) Storm Records

The storm rainfall is estimated in high rainfall area over 2,000 mm/yr.,on basis of the isohyet map. The maximum one day, two days, and three days rainfall in 20 years from 1968 to 1987 are examined as to four stations being operated by RID in the said area.

Consequently, following items are made clear from the storm records.

- The consecutive storm rainfall could be expressed on three days maximum.
- Three days rainfall less than 200 mm, relatively small rainfall, has an areal difference among four stations.
- The big storm over 200 mm of three days maximum in 1972 and 1979 shows the same span of occurrence on examined four stations.
- The three days maximum in 1972 is recorded at the same period in whole basin and assumed to arise the biggest damage.
- The linear interpolation between three days maximum and the mean annual rainfall at stations could be adopted.

The correlation between the probable storm and the mean annual rainfall at the station (code 4412), which has the highest annual rain among four stations, is selected as the basis to estimate the storm rainfall of proposed dam sites.

2) Hourly Rainfall

The hourly record of three days maximum rainfall is available at the station (code 44181) which is equipped with an automatic recorder and it shows the following characreristics.

- Total rainfall amount reaches 100 % in 60 hours from the biginning.
- Three days rainfall on 4 - 6 September, 1972 is recorded as the maximum of 20 years in the entire basin and its hourly cummulation shows the typical pattern.

3) Effective Storm Rainfall

In consideration of runoff loss, the effective rainfall for the direct runoff is determined from the consecutive three days rainfall. The runoff record and storm rainfall are reviewed and resulted in Appendics D.

5) Dimensionless Unit Hydrograph

Dimensionless unit hydro-graphs are given in A.4.5 - 10 and those watershed parameters are also listed in A.4.3 .

A.4.2 Design Storm Rainfall

Time (Hour)	Runoff Ratio(%)	Probable Rainfall (mm/hr.) 1/10	1/20	1/100	1/500	1/1000	1/10000
1	0.4	1.0	1.1	1.4	1.6	1.7	2.0
2	0.5	1.3	1.4	1.7	2.0	2.1	2.6
3	0.7	1.8	2.0	2.4	2.8	3.0	3.6
4	1.3	3.4	3.7	4.5	5.3	5.6	6.6
5	1.0	2.6	2.9	3.5	4.1	4.3	5.1
6	1.1	2.8	3.1	3.8	4.5	4.7	5.6
7	1.3	3.4	3.7	4.5	5.3	5.6	6.6
8	1.6	4.1	4.6	5.6	6.5	6.9	8.2
9	1.2	3.1	3.4	4.2	4.9	5.1	6.1
10	1.2	3.1	3.4	4.2	4.9	5.1	6.1
11	1.3	3.4	3.7	4.5	5.3	5.6	6.6
12	0.7	1.8	2.0	2.4	2.8	3.0	3.6
13	0.9	2.3	2.6	3.1	3.6	3.9	4.6
14	0.8	2.1	2.3	2.8	3.2	3.4	4.1
15	0.4	1.0	1.1	1.4	1.6	1.7	2.0
16	0.7	1.8	2.0	2.4	2.8	3.0	3.6
17	0.5	1.3	1.4	1.7	2.0	2.1	2.6
18	0.5	1.3	1.4	1.7	2.0	2.1	2.6
19	0.8	2.1	2.3	2.8	3.2	3.4	4.1
20	1.2	3.1	3.4	4.2	4.9	5.1	6.1
21	0.8	2.1	2.3	2.8	3.2	3.4	4.1
22	1.0	2.6	2.9	3.5	4.1	4.3	5.1
23	1.4	3.6	4.0	4.9	5.7	6.0	7.1
24	1.1	2.8	3.1	3.8	4.5	4.7	5.6
25	1.2	3.1	3.4	4.2	4.9	5.1	6.1
26	1.3	3.4	3.7	4.5	5.3	5.6	6.6
27	1.5	3.9	4.3	5.2	6.1	6.4	7.7
28	1.7	4.4	4.9	5.9	6.9	7.3	8.7
29	1.9	4.9	5.4	6.6	7.7	8.2	9.7
30	1.6	4.1	4.6	5.6	6.5	6.9	8.2
31	2.0	5.2	5.7	6.9	8.1	8.6	10.2
32	1.8	4.6	5.1	6.2	7.3	7.7	9.2
33	2.1	5.4	6.0	7.3	8.5	9.0	10.7
34	1.8	4.6	5.1	6.2	7.3	7.7	9.2
35	1.9	4.9	5.4	6.6	7.7	8.2	9.7
36	3.1	8.0	8.9	10.8	12.6	13.3	15.8
37	2.8	7.2	8.0	9.7	11.3	12.0	14.3
38	3.3	8.5	9.4	11.5	13.4	14.2	16.8
39	4.6	11.9	13.2	16.0	18.6	19.7	23.5
40	4.7	12.1	13.4	16.3	19.0	20.2	24.0
41	4.4	11.4	12.6	15.3	17.8	18.9	22.4
42	4.7	12.1	13.4	16.3	19.0	20.2	24.0
43	4.9	12.6	14.0	17.0	19.8	21.0	25.0
44	4.7	12.1	13.4	16.3	19.0	20.2	24.0
45	4.1	10.6	11.7	14.2	16.6	17.6	20.9
46	4.1	10.6	11.7	14.2	16.6	17.6	20.9
47	2.8	7.2	8.0	9.7	11.3	12.0	14.3
48	2.8	7.2	8.0	9.7	11.3	12.0	14.3
49	2.2	5.7	6.3	7.6	8.9	9.4	11.2
50	2.1	5.4	6.0	7.3	8.5	9.0	10.7
51	1.0	2.6	2.9	3.5	4.1	4.3	5.1
52	0.4	1.0	1.1	1.4	1.6	1.7	2.0
53	0.2	0.5	0.6	0.7	0.8	0.9	1.0
54	0.7	1.8	2.0	2.4	2.8	3.0	3.6
55	0.3	0.8	0.9	1.0	1.2	1.3	1.5
56	0.2	0.5	0.6	0.7	0.8	0.9	1.0
57	0.2	0.5	0.6	0.7	0.8	0.9	1.0
58	0.1	0.3	0.3	0.3	0.4	0.4	0.5
59	0.2	0.5	0.6	0.7	0.8	0.9	1.0
60	0.2	0.5	0.6	0.7	0.8	0.9	1.0
Total	100.0	258.	286.	347.	405.	429.	510.

A.4.3 Parameters of Dimensionless Unit Hydro-graph

Item	S.1	S.2	S.3	S.4	S.5	S.6	S.7	S.8	S.9	S.10	S.11
1.Block	LBP-11 -12	LBP-12	KTL-9 -8 -7	KTL-9 -8	KTL-9	KTL-5 -6	KPS-4 -3 -2	KPS-4 -3	KPS-4	UPP-2 -3	UPP-3
2.C.Area (km)	528	344	1,371	976	585	798	2,253	1,452	614	1,040	266
3. L.	25	15	71	38	38	43	83	68	48	88	30
4. Lc.	15	10	45	20	33	25	45	40	25	40	15
5. H1	70	70	180	180	160	110	300	300	300	600	600
H2	30	40	30	45	50	10	40	60	90	40	80
Tp	8.4	7.1	11.6	8.8	9.1	9.6	11.5	10.8	9.1	10.7	7.1
K	8.41	6.76	12.86	8.98	9.36	10.11	12.75	11.77	9.38	11.68	6.79
Tlag	23892	8725	170190	32296	39200	55834	163522	113038	39629	109022	8888
Qp	15.92	12.32	29.52	27.70	16.25	20.81	48.35	33.37	17.01	24.20	9.55
6.Mean Annual Rain.(mm)	1266	1268	1331	1334	1334	1369	1513	1538	1566	1547	1339

Item	S.12	S.13	S.14	S.15	S.16	S.17	S.18	S.19	S.20	S.21	S.22
1.Block	MHM-9 -8 -7	MHM-9	MHM-8	MHM-6 -5 -4	MHM-6	MHM-3	MHM-2	MHM-3	UBP-5	MNN-6	MNN-4
2.C.Area (km)	443	147	64	338	96	68	159	273	107	151	114
3. L.	48	20	10	26	7	8	28	37	15	18	8
4. Lc.	20	12	6	15	4	4	14	22	10	10	4
5. H1	170	480	260	400	400	220	700	700	520	410	300
H2	40	170	120	70	130	110	40	580	40	380	70
Tp	8.4	9.3	6.5	7.2	4.2	4.7	6.8	9.0	5.0	7.4	4.4
K	8.41	9.71	6.02	6.86	3.46	3.97	6.38	9.20	5.04	7.17	3.68
Tlag	46379	5071	1370	9280	395	746	6678	36120	2243	11407	520
Qp	12.04	5.85	3.20	11.99	5.82	3.75	6.04	7.80	4.89	5.27	6.59
6.Mean Annual Rain.(mm)	2030	1836	1748	1417	1342	1342	2109	1571	1855	1851	1602

A.4.4 Peak Flood Discharge

(unit:cu.m/s)

Dam Site	C.Area (sq.km)	Probability 1/10	1/20	1/100	1/500	1/1000	1/10000
No.1	528	579	665	844	1,007	1,073	1,294
2	344	407	466	593	709	756	911
3	1,371	1,357	1,547	1,954	2,332	2,488	3,001
4	976	1,110	1,270	1,605	1,912	2,040	2,452
5	585	663	760	961	1,146	1,221	1,471
6	798	904	1,028	1,291	1,539	1,640	1,976
7	2,253	2,597	2,950	3,694	4,384	4,665	5,608
8	1,452	1,791	2,028	2,532	3,000	3,190	3,831
9	614	851	964	1,203	1,424	1,514	1,816
10	1,040	1,300	1,472	1,836	2,170	2,313	2,777
11	226	338	386	488	582	620	746
12	443	822	921	1,134	1,334	1,417	1,693
13	147	289	325	400	471	500	598
14	64	130	147	182	213	227	271
15	338	462	527	662	787	837	1,006
16	96	148	169	212	252	269	322
17	68	102	116	147	174	185	223
18	159	359	402	494	580	615	735
19	273	390	442	551	652	694	832
20	107	226	253	312	366	388	464
21	151	286	322	397	467	497	594
22	114	217	245	304	358	380	454

A.4.5 Design Flood Hydrograph (1/10)

********** (UNIT: A=SQ.KM/RUNOFF=CU.M/S)

(DAM NO.) CATCHMENT HOUR	(NO. 1) A= 528	(NO. 2) A= 344	(NO. 3) A=1371	(NO. 4) A= 976	(NO. 5) A= 585	(NO. 6) A= 798	(NO. 7) A=2253	(NO. 8) A=1452	(NO. 9) A= 614	(NO.10) A=1040	(NO.11) A= 226
2	0.2	0.3	0.3	0.4	0.2	0.2	0.5	0.4	0.2	0.3	0.2
4	1.9	2.4	1.9	3.3	1.8	2.1	3.6	2.9	2.2	2.2	2.0
6	9.0	10.3	7.3	14.7	8.0	9.0	14.0	11.8	9.7	8.8	8.4
8	24.6	25.5	22.7	41.1	22.5	26.1	43.3	35.8	27.6	26.7	20.8
10	47.4	43.8	52.1	82.2	46.2	55.5	98.9	80.0	56.6	59.5	35.7
12	72.0	60.6	95.6	128.3	73.5	90.6	180.7	140.5	90.0	103.8	49.5
14	93.0	73.4	146.2	168.8	98.2	125.0	275.1	207.5	120.3	152.4	59.9
16	106.6	78.8	193.0	197.1	116.4	151.3	361.3	263.5	142.5	192.8	64.2
18	110.9	77.8	228.4	208.0	124.0	164.5	425.8	302.0	151.8	220.0	63.4
20	108.4	74.2	247.4	205.5	123.7	167.2	459.5	318.3	151.4	231.2	60.5
22	105.0	71.9	253.1	200.1	120.8	164.2	469.0	318.8	147.9	231.0	58.6
24	105.8	74.7	253.1	200.2	120.3	162.6	468.6	317.0	147.3	229.5	60.9
26	112.7	82.0	256.9	211.4	126.4	169.5	476.0	324.5	154.7	235.3	66.8
28	124.2	90.6	269.8	232.2	138.4	183.9	500.5	344.4	169.4	250.1	73.9
30	137.5	100.3	293.1	256.6	152.6	202.5	544.4	377.8	186.9	274.6	81.8
32	153.1	112.5	322.7	285.4	169.7	225.2	599.7	417.4	207.8	303.6	91.8
34	172.2	126.8	359.3	320.6	190.5	252.1	667.9	465.4	233.2	338.5	103.4
36	192.5	140.4	400.9	358.8	213.3	282.2	745.4	520.7	261.1	378.9	114.5
38	212.6	154.1	447.4	397.1	236.4	313.8	831.9	580.8	289.4	422.5	125.7
40	236.4	173.9	499.5	441.0	262.4	348.4	928.8	646.9	321.6	470.5	141.8
42	273.2	206.9	561.7	507.3	300.8	397.4	1047.4	733.0	371.2	533.5	168.9
44	329.1	253.1	646.7	609.3	359.2	470.4	1217.7	860.5	452.4	627.6	207.9
46	399.2	307.2	767.8	743.9	437.4	573.0	1468.4	1053.8	569.0	770.6	256.6
48	477.2	363.6	920.7	900.4	530.2	697.9	1794.4	1293.8	699.5	947.2	306.3
50	545.7	403.2	1095.0	1038.6	614.4	814.8	2148.3	1539.2	802.1	1125.1	336.9
52	579.0	407.0	1247.5	1110.3	663.1	891.3	2438.9	1717.9	851.9	1252.2	337.7
54	568.4	381.1	1343.8	1099.8	663.4	904.4	2597.3	1791.0	843.4	1300.9	315.3
56	522.9	335.4	1357.4	1021.9	621.9	860.5	2597.2	1756.2	787.2	1271.8	277.2
58	458.4	283.6	1295.7	905.1	555.1	778.2	2461.4	1633.7	701.3	1180.0	234.3
60	394.3	241.3	1185.0	782.7	482.4	683.2	2243.0	1467.8	609.2	1058.0	199.4
62	341.5	207.1	1057.2	679.1	419.3	595.4	1996.4	1293.6	529.6	931.7	171.1
64	298.2	179.0	936.8	593.9	366.9	522.1	1767.9	1141.4	463.5	821.6	147.9
66	261.3	155.0	832.6	521.9	323.2	461.3	1570.6	1011.8	408.5	728.3	128.1
68	229.6	133.5	744.0	460.3	285.5	408.5	1403.4	901.7	361.2	648.7	110.3
70	202.1	115.4	666.9	406.6	252.8	363.0	1257.9	806.0	319.9	579.6	95.4
72	178.7	100.4	599.7	360.8	224.9	324.1	1131.3	723.3	284.6	520.1	83.0
74	158.7	87.6	542.3	321.8	201.1	290.9	1023.5	653.1	254.6	469.4	72.4
76	141.2	76.7	493.1	287.7	180.4	262.0	930.7	592.8	228.3	425.9	63.4
78	125.9	67.3	450.8	257.5	162.0	236.5	850.7	539.8	205.0	387.6	55.6
80	112.5	59.1	413.3	231.0	145.7	213.6	779.6	492.6	184.4	353.4	48.9
82	100.7	51.9	379.5	207.6	131.2	193.3	715.4	449.8	166.2	322.5	43.0
84	90.3	45.6	348.8	186.9	118.4	175.1	656.9	411.0	150.0	294.4	37.7
86	81.1	40.0	320.7	168.6	107.1	158.9	603.4	375.8	135.7	269.1	33.0
88	72.8	35.0	294.9	152.2	97.0	144.5	554.6	344.2	122.9	246.3	28.9
90	65.3	30.7	271.5	137.4	87.9	131.5	510.4	315.7	111.4	225.8	25.4
92	58.4	27.0	250.3	123.8	79.6	119.8	470.3	289.9	100.9	207.3	22.3
94	52.2	23.7	231.0	111.4	72.0	109.2	434.0	266.7	91.2	190.5	19.6
96	46.6	20.8	213.5	100.0	65.0	99.4	401.0	245.5	82.3	175.3	17.2
98	41.6	18.2	197.6	89.7	58.6	90.3	370.9	226.1	74.1	161.4	15.1
100	37.3	15.9	183.0	80.6	52.7	81.9	343.4	208.3	66.8	148.5	13.2
102	33.4	13.7	169.5	72.5	47.5	74.1	318.0	191.8	60.2	136.5	11.4
104	30.0	11.8	157.1	65.3	42.9	67.1	294.4	176.2	54.3	125.3	9.7
106	26.9	9.9	145.5	58.9	38.7	60.8	272.4	161.7	49.1	114.8	8.2
108	24.1	8.2	134.6	53.2	35.1	55.2	251.7	148.2	44.5	105.1	6.8
110	21.5	6.7	124.4	47.9	31.8	50.2	232.2	135.8	40.3	96.3	5.5
112	19.1	5.2	114.7	43.1	28.7	45.6	213.9	124.5	36.5	88.2	4.3
114	16.8	3.9	105.8	38.6	26.0	41.6	197.0	114.2	33.0	80.8	3.3
116	14.6	2.8	97.5	34.3	23.3	37.8	181.6	104.8	29.6	74.1	2.3
118	12.6	1.9	89.9	30.2	20.9	34.3	167.6	96.2	26.5	68.0	1.5
120	10.7	1.2	83.1	26.4	18.5	31.1	154.7	88.5	23.5	62.5	0.9
122	8.9	0.7	76.8	22.8	16.3	27.9	142.9	81.4	20.7	57.5	0.5
124	7.2	0.4	71.0	19.4	14.2	24.9	132.0	74.8	18.0	52.8	0.3
126	5.7	0.2	65.6	16.3	12.2	22.1	122.0	68.8	15.5	48.5	0.2
128	4.3	0.1	60.7	13.3	10.4	19.4	112.8	63.1	13.1	44.4	0.1
130	3.1	0.1	56.1	10.5	8.6	16.9	104.2	57.7	10.9	40.4	0.0
132	2.1	0.0	51.9	8.0	6.9	14.5	96.3	52.4	8.8	36.6	0.0
134	1.3	0.0	47.8	5.8	5.4	12.2	88.7	47.4	6.8	33.0	0.0
136	0.8	0.0	44.0	3.9	4.0	10.1	81.4	42.6	5.0	29.6	0.0
138	0.4	0.0	40.3	2.5	2.8	8.1	74.3	38.0	3.5	26.3	0.0
140	0.2	0.0	36.7	1.5	1.9	6.2	67.5	33.6	2.3	23.1	0.0

A.4.5 Design Flood Hydrograph (1/10)

(UNIT: A=SQ.KM,RUNOFF=CU.M/S)

(DAM NO.) CATCHMENT HOUR	(NO.12) A= 443	(NO.13) A= 147	(NO.14) A= 64	(NO.15) A= 338	(NO.16) A= 96	(NO.17) A= 68	(NO.18) A= 159	(NO.19) A= 273	(NO.20) A= 107	(NO.21) A= 151	(NO.22) A= 114
2	0.2	0.2	0.2	0.3	0.4	0.2	0.2	0.1	0.3	0.1	0.5
4	1.9	2.1	1.9	2.5	3.9	2.0	2.2	1.0	2.5	1.3	4.9
6	8.4	8.4	6.4	10.9	10.8	6.3	9.1	4.6	9.0	5.9	14.1
8	24.1	19.4	12.3	27.2	17.8	11.2	21.9	13.0	18.6	15.0	24.1
10	50.1	31.3	17.6	47.1	24.3	15.5	36.5	26.5	27.9	26.4	33.0
12	80.5	42.0	22.0	65.7	28.5	19.0	49.7	41.9	36.0	37.4	39.3
14	108.9	49.3	23.9	79.9	29.2	20.0	59.3	55.7	40.4	46.0	40.8
16	130.0	51.4	23.4	86.3	27.5	19.2	62.6	65.7	40.5	50.2	38.7
18	139.6	49.8	21.8	85.5	24.9	17.7	61.2	69.7	38.3	50.2	35.3
20	140.3	47.0	20.4	81.7	23.2	16.5	58.0	69.2	35.8	48.1	32.9
22	137.4	45.8	20.6	79.1	24.9	17.0	56.4	67.6	35.6	46.5	34.8
24	136.4	48.7	22.8	81.9	27.5	19.0	59.2	67.4	38.7	47.9	38.5
26	142.9	53.7	25.2	89.7	30.9	21.0	65.3	70.9	42.9	52.2	43.0
28	155.9	59.4	27.8	99.2	33.6	23.1	72.1	77.8	47.5	57.8	47.0
30	171.9	65.7	31.0	109.8	38.3	26.0	79.8	85.8	52.6	63.9	53.3
32	191.2	74.1	35.4	123.1	43.7	29.7	89.8	95.4	59.9	71.6	60.9
34	214.4	83.5	39.4	138.8	48.2	32.9	101.2	107.1	67.1	80.7	67.2
36	240.0	92.0	43.0	153.8	52.1	35.8	111.9	119.9	73.5	89.6	72.8
38	267.6	100.9	47.3	168.9	58.6	39.7	124.8	132.8	80.7	98.6	81.4
40	302.9	117.3	57.4	190.3	71.3	47.7	150.7	147.7	97.1	112.4	99.3
42	363.4	151.7	77.6	226.5	90.7	59.8	196.1	170.7	130.5	139.9	134.8
44	458.6	201.5	102.3	281.8	112.8	74.8	252.8	208.7	171.8	183.7	176.3
46	578.0	246.9	120.5	353.0	138.5	92.1	305.8	262.9	204.2	230.5	206.0
48	694.8	277.9	130.4	421.9	148.3	101.6	343.8	323.1	224.1	266.8	217.2
50	780.8	289.1	128.8	461.7	141.5	99.6	359.6	369.4	225.9	286.0	207.2
52	821.9	278.9	118.8	462.2	127.1	91.0	349.7	390.9	211.8	284.8	186.5
54	812.6	253.9	102.9	432.2	103.7	77.0	320.7	385.7	187.6	266.5	154.4
56	760.3	217.7	83.4	381.0	81.0	61.1	278.2	358.9	155.7	236.1	121.5
58	680.0	182.2	68.8	323.1	65.7	50.1	234.0	318.9	128.8	201.3	99.0
60	593.4	154.5	57.0	274.9	52.7	40.9	199.0	276.4	108.2	171.7	80.0
62	516.6	131.8	47.5	236.4	43.1	33.8	170.4	240.2	91.0	148.1	65.7
64	453.0	113.2	39.7	204.6	34.3	27.7	146.9	210.1	77.0	128.5	53.1
66	400.1	96.8	32.7	177.4	27.0	22.3	126.5	185.0	64.4	111.7	42.2
68	354.3	82.5	27.0	153.1	21.5	18.2	108.4	163.5	54.0	96.8	33.9
70	314.4	70.7	22.5	132.7	17.2	14.9	93.5	144.7	45.6	84.2	27.4
72	280.3	60.9	18.8	115.6	13.7	12.2	81.0	128.7	38.6	73.6	22.2
74	251.1	52.7	15.8	101.0	11.0	10.0	70.4	115.0	32.9	64.5	17.9
76	225.6	45.7	13.2	88.6	8.7	8.2	61.4	103.0	27.9	56.8	14.5
78	203.1	39.7	11.0	77.8	6.9	6.7	53.6	92.4	23.7	50.1	11.6
80	183.0	34.4	9.2	68.5	5.3	5.5	46.8	83.0	20.2	44.2	9.2
82	165.2	29.8	7.7	60.3	4.0	4.4	40.8	74.7	17.1	39.1	7.2
84	149.4	25.8	6.4	53.0	2.8	3.5	35.6	67.4	14.6	34.5	5.3
86	135.4	22.4	5.3	46.6	1.9	2.7	31.1	60.9	12.4	30.4	3.8
88	122.9	19.5	4.3	40.9	1.2	2.0	27.1	55.2	10.5	26.8	2.5
90	111.6	16.9	3.4	35.9	0.7	1.4	23.7	49.9	8.8	23.6	1.6
92	101.3	14.7	2.6	31.6	0.4	0.9	20.8	45.1	7.3	20.8	0.9
94	91.9	12.7	1.9	27.8	0.2	0.6	18.1	40.7	5.9	18.4	0.5
96	83.2	10.9	1.3	24.5	0.1	0.3	15.8	36.7	4.6	16.3	0.3
98	75.2	9.2	0.8	21.6	0.1	0.2	13.6	33.0	3.5	14.4	0.1
100	67.9	7.7	0.5	18.9	0.0	0.1	11.7	29.7	2.5	12.7	0.1
102	61.3	6.3	0.3	16.4	0.0	0.0	9.9	26.8	1.7	11.2	0.0
104	55.4	5.0	0.1	14.1	0.0	0.0	8.2	24.1	1.0	9.7	0.0
106	50.2	3.9	0.1	12.0	0.0	0.0	6.6	21.8	0.6	8.4	0.0
108	45.5	2.8	0.0	10.1	0.0	0.0	5.2	19.7	0.3	7.1	0.0
110	41.4	1.9	0.0	8.3	0.0	0.0	3.9	17.9	0.2	6.0	0.0
112	37.6	1.3	0.0	6.6	0.0	0.0	2.8	16.1	0.1	4.9	0.0
114	34.1	0.8	0.0	5.1	0.0	0.0	1.9	14.6	0.0	3.9	0.0
116	30.8	0.4	0.0	3.7	0.0	0.0	1.2	13.0	0.0	3.0	0.0
118	27.7	0.2	0.0	2.5	0.0	0.0	0.7	11.6	0.0	2.2	0.0
120	24.8	0.1	0.0	1.6	0.0	0.0	0.4	10.2	0.0	1.5	0.0
122	22.0	0.1	0.0	1.0	0.0	0.0	0.2	9.0	0.0	1.0	0.0
124	19.4	0.0	0.0	0.5	0.0	0.0	0.1	7.8	0.0	0.6	0.0
126	16.9	0.0	0.0	0.3	0.0	0.0	0.1	6.6	0.0	0.3	0.0
128	14.5	0.0	0.0	0.2	0.0	0.0	0.0	5.5	0.0	0.2	0.0
130	12.3	0.0	0.0	0.1	0.0	0.0	0.0	4.5	0.0	0.1	0.0
132	10.2	0.0	0.0	0.0	0.0	0.0	0.0	3.6	0.0	0.0	0.0
134	8.2	0.0	0.0	0.0	0.0	0.0	0.0	2.7	0.0	0.0	0.0
136	6.3	0.0	0.0	0.0	0.0	0.0	0.0	1.9	0.0	0.0	0.0
138	4.7	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0
140	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0

A.4.6 Design Flood Hydrograph (1/20)

(UNIT: A=SQ.KM/RUNOFF=CU.M/S)

(DAM NO.) CATCHMENT HOUR	(NO. 1) A= 528	(NO. 2) A= 344	(NO. 3) A=1371	(NO. 4) A= 976	(NO. 5) A= 585	(NO. 6) A= 798	(NO. 7) A=2253	(NO. 8) A=1452	(NO. 9) A= 614	(NO.10) A=1040	(NO.11) A= 226
2	0.2	0.3	0.3	0.4	0.2	0.3	0.6	0.4	0.3	0.3	0.2
4	2.2	2.7	2.1	3.6	2.0	2.4	4.0	3.3	2.5	2.4	2.2
6	9.9	11.4	8.1	16.3	8.8	10.0	15.5	13.1	10.8	9.8	9.3
8	27.2	28.3	25.2	45.5	25.0	28.9	48.0	39.7	30.6	29.6	23.0
10	52.5	48.5	57.7	91.1	51.3	61.5	109.6	88.7	62.8	65.9	39.6
12	79.8	67.2	106.0	142.2	81.5	100.5	200.3	155.8	99.8	115.1	54.8
14	103.1	81.4	162.1	187.1	108.9	138.5	305.0	230.0	133.3	168.9	66.4
16	118.1	87.3	214.0	218.5	129.0	167.7	400.5	292.1	157.9	213.7	71.2
18	122.9	86.2	253.2	230.6	137.5	182.4	472.1	334.8	168.3	243.8	70.3
20	120.1	82.2	274.2	227.8	137.1	185.3	509.4	352.9	167.8	256.2	67.1
22	116.4	79.7	280.6	221.8	134.0	182.0	519.9	353.4	164.0	256.1	65.0
24	117.3	82.8	280.6	222.0	133.4	180.3	519.5	351.4	163.3	254.4	67.5
26	124.9	90.9	284.8	234.3	140.1	187.9	527.6	359.7	171.5	260.8	74.1
28	137.7	100.4	299.1	257.4	153.4	203.8	554.8	381.7	187.8	277.3	81.9
30	152.4	111.1	324.9	284.4	169.2	224.5	603.4	418.8	207.1	304.4	90.6
32	169.7	124.7	357.7	316.3	188.2	249.7	664.7	462.7	230.4	336.6	101.7
34	190.9	140.6	398.3	355.4	211.2	279.4	740.4	515.9	258.5	375.3	114.7
36	213.4	155.7	444.4	397.8	236.4	312.9	826.3	577.2	289.4	420.0	127.0
38	235.6	170.8	495.9	440.2	262.0	347.9	922.2	643.8	320.8	468.4	139.3
40	262.0	192.8	553.8	489.1	291.0	386.4	1031.1	718.3	357.6	522.5	157.3
42	303.4	230.1	623.9	564.5	334.6	442.4	1168.5	819.4	417.7	596.8	188.7
44	369.3	286.2	722.9	686.8	404.3	529.8	1371.5	973.7	520.2	711.0	238.0
46	458.3	357.8	867.0	857.5	502.8	658.4	1680.0	1212.0	660.8	887.3	300.7
48	556.7	426.9	1055.9	1048.6	616.5	809.9	2068.4	1494.6	807.4	1094.6	356.8
50	634.7	466.0	1264.3	1201.8	711.7	943.0	2476.0	1769.8	915.2	1292.8	386.3
52	665.4	464.9	1440.5	1270.9	760.1	1021.1	2789.2	1958.6	964.3	1426.6	384.0
54	648.0	433.3	1540.7	1250.3	754.6	1028.2	2950.5	2028.4	951.4	1472.3	357.3
56	594.3	380.6	1547.0	1158.5	705.2	975.1	2936.7	1982.8	886.4	1435.4	313.6
58	520.4	321.7	1470.8	1024.8	628.7	880.5	2778.0	1841.9	789.3	1330.1	265.1
60	447.5	273.7	1343.3	886.0	546.2	772.7	2529.4	1653.6	685.7	1191.8	225.6
62	387.5	235.0	1197.7	768.8	474.7	673.4	2250.5	1457.4	596.2	1049.4	193.7
64	338.5	203.2	1061.1	672.4	415.4	590.5	1993.0	1286.1	521.9	925.5	167.5
66	296.8	176.0	943.1	591.2	366.1	521.9	1770.9	1140.3	460.2	820.6	145.1
68	260.9	151.6	842.7	521.6	323.6	462.4	1582.6	1016.3	407.0	731.1	125.0
70	229.6	131.1	755.6	460.9	286.5	411.0	1418.8	908.9	360.5	653.6	108.1
72	203.0	114.0	679.6	409.0	255.0	367.0	1276.6	816.0	320.9	586.6	94.0
74	180.3	99.5	614.8	364.9	228.0	329.5	1155.3	736.9	286.9	529.5	82.1
76	160.4	87.1	559.3	326.1	204.5	296.8	1050.8	668.9	257.3	480.5	71.9
78	143.1	76.5	511.4	291.9	183.6	267.8	960.6	609.2	231.1	437.3	63.1
80	127.8	67.2	468.8	261.9	165.2	241.9	880.2	555.8	207.9	398.7	55.4
82	114.5	59.0	430.5	235.4	148.8	218.9	807.7	507.5	187.3	363.8	48.7
84	102.7	51.8	395.7	211.9	134.3	198.3	741.6	463.7	169.1	332.2	42.7
86	92.2	45.4	363.7	191.2	121.5	180.0	681.3	424.1	153.0	303.6	37.5
88	82.8	39.8	334.5	172.7	110.0	163.7	626.2	388.4	138.6	277.9	32.8
90	74.2	34.9	307.9	155.9	99.7	149.0	576.3	356.3	125.6	254.8	28.8
92	66.4	30.7	283.9	140.4	90.3	135.8	531.1	327.2	113.8	233.9	25.3
94	59.3	27.0	262.0	126.3	81.7	123.7	490.1	301.0	102.8	215.1	22.3
96	53.0	23.7	242.2	113.4	73.7	112.6	452.8	277.1	92.8	197.9	19.6
98	47.3	20.8	224.1	101.8	66.4	102.3	419.0	255.3	83.6	182.1	17.2
100	42.4	18.1	207.6	91.4	59.8	92.7	387.9	235.2	75.4	167.6	14.9
102	38.0	15.7	192.4	82.2	53.9	84.0	359.2	216.4	67.9	154.1	12.9
104	34.2	13.4	178.3	74.1	48.6	76.1	332.6	198.9	61.3	141.4	11.1
106	30.7	11.3	165.1	66.8	44.0	69.0	307.7	182.5	55.4	129.6	9.3
108	27.5	9.4	152.7	60.4	39.8	62.6	284.2	167.2	50.2	118.6	7.7
110	24.5	7.6	141.0	54.4	36.1	56.9	262.1	153.2	45.5	108.6	6.3
112	21.7	6.0	130.1	49.0	32.7	51.8	241.5	140.5	41.2	99.5	4.9
114	19.1	4.5	119.9	43.8	29.5	47.2	222.5	128.9	37.2	91.2	3.7
116	16.6	3.1	110.6	38.9	26.5	42.9	205.2	118.3	33.5	83.7	2.6
118	14.3	2.1	102.1	34.3	23.7	39.0	189.3	108.7	29.9	76.8	1.7
120	12.2	1.3	94.3	30.0	21.0	35.2	174.8	99.9	26.5	70.6	1.0
122	10.1	0.7	87.1	25.9	18.5	31.7	161.4	92.0	23.3	64.9	0.6
124	8.2	0.4	80.5	22.1	16.1	28.3	149.1	84.6	20.3	59.7	0.3
126	6.5	0.2	74.5	18.5	13.9	25.1	137.9	77.8	17.5	54.8	0.2
128	4.9	0.1	68.9	15.1	11.8	22.0	127.5	71.4	14.8	50.2	0.1
130	3.5	0.1	63.7	11.9	9.8	19.2	117.9	65.2	12.2	45.7	0.0
132	2.3	0.0	58.9	9.0	7.9	16.4	108.9	59.2	9.8	41.4	0.0
134	1.4	0.0	54.4	6.4	6.1	13.9	100.3	53.5	7.6	37.3	0.0
136	0.8	0.0	50.0	4.3	4.5	11.4	92.0	48.1	5.6	33.4	0.0
138	0.5	0.0	45.8	2.7	3.2	9.1	84.1	43.0	3.9	29.7	0.0
140	0.2	0.0	41.7	1.6	2.1	7.0	76.4	38.0	2.6	26.1	0.0

A.4.6 Design Flood Hydrograph (1/20)

(UNIT: A=SQ.KM,RUNOFF=CU.M/S)

(DAM NO.) CATCHMENT HOUR	(NO.12) A= 443	(NO.13) A= 147	(NO.14) A= 64	(NO.15) A= 338	(NO.16) A= 96	(NO.17) A= 68	(NO.18) A= 159	(NO.19) A= 273	(NO.20) A= 107	(NO.21) A= 151	(NO.22) A= 114
2	0.2	0.3	0.2	0.3	0.5	0.2	0.3	0.1	0.3	0.2	0.6
4	2.1	2.3	2.1	2.8	4.3	2.3	2.5	1.2	2.8	1.5	5.4
6	9.3	9.3	7.1	12.0	12.0	7.0	10.1	5.1	9.9	6.5	15.7
8	26.7	21.5	13.6	30.1	19.7	12.4	24.3	14.4	20.6	16.6	26.7
10	55.6	34.7	19.5	52.2	27.0	17.2	40.4	29.4	30.9	29.3	36.6
12	89.2	46.6	24.4	72.8	31.5	21.0	55.1	46.5	39.9	41.5	43.6
14	120.7	54.7	26.5	88.6	32.4	22.1	65.7	61.7	44.8	51.0	45.2
16	144.1	56.9	25.9	95.6	30.5	21.2	69.4	72.8	44.9	55.6	42.9
18	154.8	55.2	24.2	94.8	27.6	19.6	67.8	77.3	42.4	55.6	39.1
20	155.5	52.1	22.6	90.6	25.8	18.2	64.3	76.8	39.7	53.3	36.5
22	152.3	50.8	22.9	87.7	27.6	18.9	62.5	74.9	39.4	51.5	38.5
24	151.3	53.9	25.2	90.8	30.5	21.0	65.7	74.7	42.9	53.1	42.7
26	158.4	59.5	28.0	99.5	34.2	23.3	72.4	78.6	47.6	57.9	47.7
28	172.9	65.8	30.8	110.0	37.2	25.6	80.0	86.2	52.6	64.0	52.1
30	190.6	72.9	34.4	121.7	42.5	28.8	88.5	95.1	58.3	70.9	59.1
32	211.9	82.2	39.3	136.5	48.4	32.9	99.5	105.8	66.4	79.4	67.5
34	237.7	92.5	43.7	153.8	53.4	36.5	112.3	118.8	74.3	89.4	74.5
36	266.8	102.1	47.7	170.5	57.7	39.6	125.9	133.0	81.5	99.4	80.7
38	300.6	113.2	53.0	187.2	64.9	44.0	145.4	147.3	91.3	110.3	90.3
40	347.3	136.6	67.2	211.2	79.1	52.9	178.3	164.2	114.9	129.1	114.2
42	422.9	179.1	92.0	254.3	104.1	68.1	227.0	192.2	153.7	164.2	161.5
44	531.2	232.6	117.7	325.5	135.7	89.2	287.2	240.4	196.7	213.3	204.4
46	660.1	280.2	136.6	414.0	161.0	107.8	344.3	305.5	230.8	262.8	234.2
48	785.2	313.1	146.8	488.3	169.3	116.3	385.4	372.6	251.9	301.3	245.0
50	877.8	324.6	144.6	526.7	160.4	113.1	402.2	421.1	253.2	321.5	233.0
52	921.4	312.5	133.1	524.0	143.7	102.9	390.7	442.3	237.1	319.4	209.4
54	909.6	284.2	115.3	488.5	117.1	87.0	358.2	435.0	209.9	298.5	173.3
56	850.4	243.8	93.5	430.1	91.5	69.0	310.7	404.0	174.3	264.3	136.4
58	760.6	204.1	77.1	364.7	74.2	56.6	261.4	358.8	144.2	225.5	111.1
60	663.8	173.1	63.9	310.5	59.5	46.2	222.3	311.0	121.1	192.4	89.8
62	578.1	147.7	53.3	267.1	48.6	38.2	190.4	270.3	101.9	165.9	73.8
64	507.0	126.9	44.5	231.1	38.7	31.4	164.2	236.6	86.2	144.0	59.6
66	447.9	108.5	36.6	200.5	30.5	25.2	141.4	208.4	72.1	125.2	47.4
68	396.6	92.4	30.3	173.0	24.3	20.6	121.2	184.2	60.4	108.6	38.1
70	352.1	79.3	25.3	150.0	19.4	16.8	104.5	163.1	51.0	94.4	30.8
72	313.9	68.3	21.1	130.7	15.5	13.8	90.5	145.0	43.3	82.5	24.9
74	281.2	59.1	17.7	114.2	12.4	11.3	78.7	129.5	36.8	72.4	20.2
76	252.7	51.2	14.8	100.2	9.9	9.3	68.6	116.1	31.3	63.7	16.3
78	227.5	44.5	12.4	88.1	7.8	7.6	59.9	104.1	26.6	56.2	13.1
80	205.0	38.6	10.3	77.6	6.0	6.2	52.3	93.6	22.6	49.6	10.3
82	185.1	33.5	8.6	68.2	4.5	5.0	45.7	84.3	19.2	43.8	8.0
84	167.4	29.0	7.2	60.0	3.2	4.0	39.9	76.0	16.3	38.7	5.9
86	151.7	25.2	5.9	52.7	2.1	3.1	34.8	68.7	13.9	34.1	4.2
88	137.7	21.8	4.8	46.3	1.3	2.3	30.4	62.2	11.7	30.1	2.8
90	125.0	19.0	3.8	40.6	0.7	1.6	26.5	56.3	9.8	26.5	1.7
92	113.5	16.5	2.9	35.8	0.4	1.0	23.2	50.9	8.1	23.4	1.0
94	102.9	14.2	2.1	31.5	0.2	0.6	20.3	45.9	6.5	20.7	0.5
96	93.2	12.2	1.4	27.8	0.1	0.4	17.6	41.4	5.1	18.3	0.3
98	84.2	10.3	0.9	24.4	0.1	0.2	15.2	37.2	3.8	16.2	0.2
100	76.1	8.6	0.5	21.4	0.0	0.1	13.0	33.5	2.7	14.3	0.1
102	68.7	7.1	0.3	18.6	0.0	0.1	11.0	30.2	1.8	12.5	0.0
104	62.1	5.6	0.2	16.0	0.0	0.0	9.1	27.2	1.2	10.9	0.0
106	56.3	4.3	0.1	13.6	0.0	0.0	7.4	24.6	0.7	9.4	0.0
108	51.1	3.1	0.0	11.4	0.0	0.0	5.8	22.3	0.4	8.0	0.0
110	46.4	2.2	0.0	9.4	0.0	0.0	4.3	20.2	0.2	6.7	0.0
112	42.1	1.4	0.0	7.5	0.0	0.0	3.1	18.2	0.1	5.5	0.0
114	38.2	0.8	0.0	5.7	0.0	0.0	2.1	16.4	0.1	4.4	0.0
116	34.6	0.5	0.0	4.2	0.0	0.0	1.3	14.7	0.0	3.3	0.0
118	31.1	0.3	0.0	2.8	0.0	0.0	0.8	13.1	0.0	2.4	0.0
120	27.8	0.1	0.0	1.8	0.0	0.0	0.4	11.5	0.0	1.6	0.0
122	24.7	0.1	0.0	1.1	0.0	0.0	0.2	10.1	0.0	1.1	0.0
124	21.7	0.0	0.0	0.6	0.0	0.0	0.1	8.7	0.0	0.6	0.0
126	18.9	0.0	0.0	0.3	0.0	0.0	0.1	7.5	0.0	0.4	0.0
128	16.2	0.0	0.0	0.2	0.0	0.0	0.0	6.2	0.0	0.2	0.0
130	13.7	0.0	0.0	0.1	0.0	0.0	0.0	5.1	0.0	0.1	0.0
132	11.3	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.1	0.0
134	9.1	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0
136	7.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	0.0	0.0	0.0
138	5.2	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0
140	3.6	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0

A.4.7 Design Flood Hydrograph (1/100)

(UNIT: A=SQ.KM/RUNOFF=CU.M/S)

(DAM NO.) CATCHMENT HOUR	(NO. 1) A= 528	(NO. 2) A= 344	(NO. 3) A=1371	(NO. 4) A= 976	(NO. 5) A= 585	(NO. 6) A= 798	(NO. 7) A=2253	(NO. 8) A=1452	(NO. 9) A= 614	(NO.10) A=1040	(NO.11) A= 226
2	0.3	0.3	0.4	0.5	0.3	0.3	0.7	0.5	0.3	0.4	0.3
4	2.6	3.3	2.5	4.4	2.4	2.9	4.8	4.0	3.0	2.9	2.7
6	12.1	13.8	9.8	19.8	10.7	12.1	18.8	15.9	13.1	11.9	11.3
8	33.0	34.3	30.5	55.2	30.3	35.1	58.2	48.1	37.1	35.9	28.0
10	63.7	58.9	70.0	110.5	62.2	74.6	133.0	107.6	76.2	80.0	48.0
12	96.9	81.6	128.6	172.6	98.9	121.9	243.0	189.0	121.1	139.6	66.5
14	125.0	98.8	196.7	227.0	132.1	168.1	370.0	279.0	161.8	205.0	80.6
16	143.3	105.9	259.6	265.2	156.5	203.5	485.9	354.4	191.6	259.3	86.4
18	149.2	104.6	307.2	279.8	166.8	221.3	572.7	406.2	204.2	295.8	85.3
20	145.8	99.8	332.7	276.4	166.3	224.8	618.0	428.1	203.6	310.9	81.4
22	141.2	96.7	340.5	269.1	162.5	220.8	630.8	428.8	199.0	310.7	78.8
24	142.3	100.4	340.5	269.3	161.9	218.7	630.3	426.4	198.2	308.7	81.9
26	151.6	110.2	345.5	284.3	170.0	228.0	640.2	436.4	208.1	316.4	89.9
28	167.1	121.9	362.8	312.3	186.1	247.3	673.1	463.1	227.8	336.4	99.4
30	184.9	134.8	394.2	345.1	205.3	272.4	732.1	508.2	251.3	369.4	110.0
32	205.9	151.3	434.0	383.8	228.3	302.9	806.5	561.4	279.5	408.4	123.4
34	231.6	170.6	483.2	431.2	256.2	339.0	898.3	625.9	313.7	455.3	139.1
36	258.9	188.9	539.2	482.6	286.8	379.6	1002.9	700.7	351.5	509.9	154.0
38	285.9	207.3	602.0	534.4	318.1	422.5	1122.1	784.4	392.4	570.8	169.2
40	319.0	235.2	674.1	597.4	355.3	472.1	1266.4	885.9	447.4	645.1	193.3
42	376.2	289.6	767.4	705.6	417.1	551.3	1463.5	1036.3	543.3	756.5	242.0
44	477.1	379.1	906.7	892.6	523.0	683.6	1764.7	1266.8	689.9	927.0	318.9
46	608.7	479.7	1117.6	1136.4	664.9	866.9	2192.4	1588.8	864.1	1163.5	399.4
48	733.6	556.1	1378.2	1373.5	808.8	1060.5	2689.9	1937.3	1030.6	1416.9	459.4
50	817.3	593.2	1646.1	1539.4	913.7	1211.0	3172.1	2252.9	1150.2	1643.4	488.4
52	843.5	585.9	1849.3	1604.6	961.0	1291.3	3524.6	2461.4	1202.6	1790.8	481.5
54	815.6	543.4	1954.0	1568.4	947.3	1290.2	3694.4	2531.5	1181.7	1836.4	446.2
56	745.5	476.5	1945.9	1448.7	882.2	1219.1	3660.8	2466.1	1098.9	1784.4	391.2
58	652.1	402.9	1843.7	1280.2	785.5	1099.0	3455.1	2287.0	978.0	1650.8	330.9
60	560.9	343.0	1681.2	1107.0	682.4	964.3	3142.7	2052.2	849.8	1478.6	281.8
62	485.9	294.7	1498.1	960.8	593.3	840.6	2796.1	1809.0	739.3	1302.2	242.1
64	424.7	254.9	1327.3	841.0	519.5	737.4	2476.8	1596.9	647.7	1148.9	209.4
66	372.6	220.7	1180.0	739.9	458.1	652.2	2201.6	1416.5	571.3	1019.1	181.3
68	327.6	190.1	1054.8	653.1	405.2	578.2	1968.3	1263.3	505.4	908.6	156.2
70	288.5	164.6	946.1	577.2	358.9	514.2	1765.7	1130.5	447.8	812.7	135.2
72	255.1	143.2	851.6	512.4	319.5	459.3	1589.7	1015.4	398.6	729.7	117.7
74	226.6	125.0	771.0	457.0	285.7	412.3	1439.3	917.1	356.5	658.9	102.7
76	201.6	109.5	701.6	408.6	256.2	371.4	1309.4	832.6	319.8	597.9	90.0
78	179.8	96.1	641.6	365.8	230.1	335.2	1197.1	758.3	287.2	544.2	79.0
80	160.7	84.5	588.2	328.2	207.0	302.8	1096.9	691.8	258.4	496.1	69.4
82	144.0	74.2	540.1	295.1	186.6	274.0	1006.5	631.7	233.0	452.7	61.0
84	129.3	65.1	496.3	265.8	168.4	248.4	924.1	577.2	210.4	413.4	53.5
86	116.1	57.1	456.2	239.9	152.4	225.5	849.0	528.0	190.4	377.9	46.9
88	104.2	50.0	419.6	216.6	138.1	205.1	780.4	483.7	172.5	346.0	41.1
90	93.3	43.9	386.3	195.4	125.1	186.7	718.3	443.7	156.2	317.3	36.1
92	83.5	38.6	356.2	176.0	113.3	170.2	662.1	407.7	141.4	291.3	31.7
94	74.6	34.0	328.8	158.3	102.4	155.0	611.0	375.1	127.8	267.9	27.9
96	66.6	29.9	303.9	142.2	92.4	141.0	564.7	345.3	115.4	246.5	24.6
98	59.6	26.2	281.4	127.7	83.2	128.0	522.5	318.1	104.0	226.9	21.5
100	53.4	22.8	260.6	114.7	75.0	116.1	483.8	293.0	93.7	208.7	18.8
102	47.9	19.7	241.5	103.2	67.6	105.2	448.0	269.5	84.5	191.8	16.2
104	43.1	16.9	223.8	93.0	61.0	95.3	414.7	247.6	76.3	176.0	13.9
106	38.7	14.2	207.2	84.0	55.2	86.4	383.5	227.2	69.0	161.2	11.7
108	34.7	11.8	191.6	75.9	50.0	78.5	354.2	208.2	62.5	147.7	9.7
110	30.9	9.5	176.9	68.5	45.4	71.3	326.6	190.9	56.7	135.3	7.8
112	27.4	7.4	163.2	61.6	41.1	65.0	300.9	175.0	51.3	123.9	6.1
114	24.1	5.5	150.4	55.0	37.1	59.2	277.4	160.5	46.4	113.6	4.5
116	21.0	3.8	138.8	48.9	33.3	53.9	255.8	147.5	41.7	104.3	3.1
118	18.1	2.5	128.1	43.1	29.8	49.0	236.0	135.5	37.2	95.8	2.1
120	15.3	1.6	118.4	37.6	26.4	44.2	218.0	124.7	33.0	88.1	1.3
122	12.7	0.9	109.4	32.5	23.2	39.8	201.4	114.8	29.0	81.0	0.7
124	10.3	0.5	101.1	27.7	20.2	35.5	186.2	105.5	25.2	74.5	0.4
126	8.0	0.3	93.6	23.1	17.4	31.4	172.3	97.1	21.7	68.4	0.2
128	6.0	0.1	86.6	18.8	14.7	27.6	159.2	89.0	18.3	62.5	0.1
130	4.2	0.1	80.1	14.7	12.2	24.0	147.2	81.3	15.1	57.0	0.1
132	2.8	0.0	74.1	11.1	9.8	20.6	136.0	73.9	12.1	51.6	0.0
134	1.7	0.0	68.4	7.9	7.5	17.3	125.2	66.8	9.3	46.5	0.0
136	1.0	0.0	62.9	5.3	5.6	14.2	114.9	60.0	6.8	41.6	0.0
138	0.6	0.0	57.6	3.3	3.9	11.3	104.9	53.5	4.7	36.9	0.0
140	0.3	0.0	52.5	2.0	2.5	8.6	95.4	47.3	3.1	32.5	0.0

A.4.7 Design Flood Hydrograph (1/100)

(UNIT: A=SQ.KM,RUNOFF=CU.M/S)

(DAM NO.) CATCHMENT HOUR	(NO.12) A= 443	(NO.13) A= 147	(NO.14) A= 64	(NO.15) A= 338	(NO.16) A= 96	(NO.17) A= 68	(NO.18) A= 159	(NO.19) A= 273	(NO.20) A= 107	(NO.21) A= 151	(NO.22) A= 114
2	0.3	0.3	0.3	0.4	0.6	0.3	0.3	0.2	0.4	0.2	0.7
4	2.6	2.8	2.6	3.4	5.2	2.8	3.0	1.4	3.3	1.8	6.6
6	11.3	11.3	8.6	14.6	14.6	8.4	12.3	6.2	12.1	7.9	19.0
8	32.4	26.1	16.5	36.5	24.0	15.1	29.5	17.5	25.0	20.2	32.4
10	67.4	42.1	23.6	63.3	32.7	20.9	49.0	35.6	37.5	35.6	44.4
12	108.2	56.5	29.6	88.4	38.3	25.5	66.9	56.4	48.4	50.4	52.9
14	146.4	66.4	32.1	107.5	39.3	26.8	79.7	74.9	54.3	61.8	54.8
16	174.8	69.1	31.4	116.0	37.0	25.8	84.2	88.3	54.5	67.5	52.1
18	187.8	66.9	29.3	115.0	33.5	23.8	82.3	93.7	51.5	67.5	47.5
20	188.7	63.2	27.4	109.9	31.3	22.1	78.1	93.1	48.1	64.7	44.3
22	184.7	61.6	27.7	106.4	33.5	22.9	75.9	90.9	47.8	62.5	46.8
24	183.5	65.4	30.6	110.2	37.0	25.5	79.7	90.7	52.1	64.4	51.8
26	192.2	72.2	34.0	120.7	41.5	28.3	87.8	95.3	57.8	70.2	57.9
28	209.7	79.9	37.4	133.5	45.2	31.1	97.0	104.6	63.8	77.7	63.2
30	231.2	88.4	41.7	147.7	51.5	35.0	107.4	115.4	70.8	86.0	71.7
32	257.6	99.7	47.7	165.6	58.8	40.0	122.0	128.3	80.6	96.3	81.8
34	292.1	113.0	53.2	186.7	64.8	44.2	143.4	144.1	91.4	109.1	90.4
36	337.2	129.1	60.3	206.9	70.0	48.1	169.9	161.5	105.8	124.4	98.8
38	394.5	151.8	72.3	227.8	78.9	53.4	197.5	180.2	125.5	145.1	119.7
40	463.7	185.6	92.3	262.6	101.8	67.1	233.3	205.9	155.1	174.4	160.1
42	555.5	234.3	119.6	332.5	145.6	93.7	287.9	250.6	198.0	216.8	213.4
44	679.0	294.6	148.3	437.1	180.7	120.1	358.3	319.1	247.0	272.4	259.4
46	828.1	349.5	169.9	543.0	205.5	138.4	425.8	399.1	286.6	329.3	292.4
48	975.2	387.5	181.5	622.6	212.7	146.6	474.3	475.0	310.9	374.0	303.6
50	1084.0	400.2	178.1	662.2	200.1	141.4	493.7	528.8	311.6	397.0	287.8
52	1134.2	384.5	163.8	654.4	178.7	128.2	478.9	551.3	291.4	393.4	258.1
54	1117.8	349.5	141.8	608.0	145.5	108.2	438.9	540.1	257.8	367.3	213.5
56	1044.4	299.8	115.0	534.8	113.8	86.0	380.6	500.7	214.0	325.2	168.1
58	934.0	251.0	94.8	453.7	92.2	70.5	320.4	444.5	177.1	277.5	137.0
60	815.6	213.0	78.6	386.5	74.0	57.5	272.5	385.4	148.8	236.9	110.7
62	710.6	181.7	65.5	332.6	60.5	47.5	233.4	335.2	125.2	204.3	91.0
64	623.4	156.1	54.8	287.9	48.1	39.1	201.3	293.5	106.0	177.3	73.5
66	550.9	133.5	45.1	249.8	37.9	31.5	173.4	258.7	88.7	154.3	58.4
68	487.9	113.9	37.3	215.7	30.2	25.6	148.7	228.8	74.3	133.7	47.0
70	433.1	97.7	31.1	187.0	24.2	21.0	128.2	202.5	62.8	116.3	38.0
72	386.2	84.2	26.0	163.0	19.4	17.2	111.1	180.1	53.2	101.8	30.8
74	346.1	72.8	21.8	142.5	15.5	14.1	96.6	160.9	45.3	89.3	24.9
76	311.1	63.1	18.2	125.1	12.3	11.6	84.2	144.2	38.5	78.5	20.1
78	280.0	54.8	15.3	110.0	9.7	9.5	73.5	129.4	32.7	69.3	16.1
80	252.4	47.5	12.7	96.8	7.4	7.7	64.2	116.3	27.8	61.2	12.7
82	228.0	41.2	10.6	85.1	5.5	6.2	56.1	104.8	23.7	54.0	9.8
84	206.2	35.8	8.8	74.8	3.8	4.9	48.9	94.5	20.1	47.7	7.2
86	186.9	31.0	7.3	65.8	2.5	3.8	42.7	85.5	17.1	42.1	5.1
88	169.6	26.9	5.9	57.7	1.6	2.8	37.3	77.4	14.4	37.1	3.4
90	153.9	23.4	4.6	50.8	0.9	1.9	32.6	70.0	12.0	32.7	2.1
92	139.7	20.3	3.5	44.7	0.5	1.2	28.5	63.3	9.9	28.9	1.2
94	126.7	17.5	2.5	39.4	0.3	0.8	24.9	57.1	8.0	25.5	0.7
96	114.7	15.0	1.7	34.7	0.1	0.4	21.6	51.4	6.2	22.6	0.3
98	103.7	12.7	1.1	30.6	0.1	0.2	18.6	46.3	4.6	20.0	0.2
100	93.7	10.6	0.7	26.7	0.0	0.1	15.9	41.7	3.3	17.6	0.1
102	84.7	8.6	0.4	23.2	0.0	0.1	13.4	37.5	2.2	15.4	0.0
104	76.6	6.8	0.2	20.0	0.0	0.0	11.1	33.9	1.4	13.4	0.0
106	69.4	5.2	0.1	17.0	0.0	0.0	9.0	30.7	0.8	11.6	0.0
108	62.9	3.8	0.1	14.2	0.0	0.0	7.0	27.8	0.4	9.8	0.0
110	57.2	2.6	0.0	11.6	0.0	0.0	5.3	25.1	0.2	8.2	0.0
112	51.9	1.7	0.0	9.2	0.0	0.0	3.8	22.7	0.1	6.7	0.0
114	47.1	1.0	0.0	7.0	0.0	0.0	2.5	20.4	0.1	5.3	0.0
116	42.6	0.6	0.0	5.1	0.0	0.0	1.6	18.3	0.0	4.0	0.0
118	38.2	0.3	0.0	3.4	0.0	0.0	0.9	16.3	0.0	2.9	0.0
120	34.2	0.2	0.0	2.2	0.0	0.0	0.5	14.4	0.0	2.0	0.0
122	30.3	0.1	0.0	1.3	0.0	0.0	0.3	12.6	0.0	1.3	0.0
124	26.6	0.0	0.0	0.7	0.0	0.0	0.1	10.8	0.0	0.8	0.0
126	23.1	0.0	0.0	0.4	0.0	0.0	0.1	9.2	0.0	0.4	0.0
128	19.8	0.0	0.0	0.2	0.0	0.0	0.0	7.7	0.0	0.2	0.0
130	16.7	0.0	0.0	0.1	0.0	0.0	0.0	6.2	0.0	0.1	0.0
132	13.8	0.0	0.0	0.1	0.0	0.0	0.0	4.9	0.0	0.1	0.0
134	11.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7	0.0	0.0	0.0
136	8.5	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.0	0.0	0.0
138	6.3	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.0
140	4.4	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0

A.4.8 Design Flood Hydrograph (1/500)

(UNIT: A=SQ.KM,RUNOFF=CU.M/S)

(DAM NO.) CATCHMENT HOUR	(NO. 1) A= 528	(NO. 2) A= 344	(NO. 3) A=1371	(NO. 4) A= 976	(NO. 5) A= 585	(NO. 6) A= 798	(NO. 7) A=2253	(NO. 8) A=1452	(NO. 9) A= 614	(NO.10) A=1040	(NO.11) A= 226
2	0.3	0.4	0.4	0.6	0.3	0.4	0.8	0.6	0.4	0.5	0.3
4	3.1	3.8	2.9	5.1	2.8	3.3	5.6	4.6	3.5	3.4	3.1
6	14.1	16.1	11.5	23.1	12.5	14.2	22.0	18.5	15.3	13.9	13.2
8	38.6	40.0	35.6	64.5	35.4	40.9	67.9	56.2	43.3	41.9	32.6
10	74.4	68.7	81.7	129.0	72.6	87.1	155.2	125.6	88.9	93.4	56.0
12	113.1	95.2	150.1	201.4	115.4	142.3	283.6	220.6	141.3	162.9	77.6
14	145.9	115.3	229.5	265.0	154.2	196.2	431.8	325.7	188.8	239.2	94.0
16	167.3	123.7	303.0	309.5	182.6	237.5	567.1	413.6	223.6	302.6	100.9
18	174.1	122.1	358.5	326.5	194.6	258.3	668.5	474.1	238.3	345.3	99.6
20	170.1	116.5	388.3	322.6	194.1	262.4	721.4	499.7	237.7	362.9	95.0
22	164.8	112.8	397.4	314.1	189.7	257.7	736.3	500.5	232.2	362.6	92.0
24	166.1	117.2	397.4	314.3	188.9	255.3	735.6	497.6	231.3	360.3	95.6
26	176.9	128.7	403.3	331.8	198.4	266.1	747.2	509.4	242.9	369.3	104.9
28	195.0	142.2	423.5	364.5	217.2	288.6	785.6	540.6	265.9	392.6	116.0
30	215.8	157.4	460.1	402.7	239.6	317.9	854.5	593.1	293.3	431.1	128.4
32	240.3	176.6	506.6	447.9	266.5	353.6	941.3	655.3	326.3	476.6	144.1
34	270.3	199.1	564.0	503.3	299.0	395.7	1049.4	731.4	367.0	532.2	162.4
36	302.2	220.5	629.7	563.8	335.0	443.6	1176.2	823.6	415.9	599.7	180.0
38	335.1	243.7	704.8	628.3	373.8	497.3	1329.9	935.2	477.2	681.7	200.4
40	380.7	285.2	797.3	718.0	425.7	566.8	1530.9	1082.8	560.8	790.6	238.8
42	465.2	365.9	923.7	877.1	516.5	682.7	1806.4	1289.9	683.3	943.2	308.2
44	599.9	478.3	1115.6	1120.9	656.0	855.5	2192.5	1575.5	849.7	1152.6	398.1
46	755.1	588.2	1384.2	1402.9	822.3	1071.5	2698.9	1945.3	1043.5	1422.7	485.5
48	891.7	669.8	1695.8	1663.1	981.4	1286.8	3262.3	2336.1	1230.8	1706.5	550.8
50	981.2	708.8	1998.5	1843.8	1095.6	1451.7	3803.1	2690.2	1365.6	1960.9	581.7
52	1006.8	697.2	2221.9	1911.7	1145.7	1538.9	4197.2	2924.2	1423.3	2126.6	571.6
54	970.5	645.4	2332.9	1863.2	1125.9	1532.7	4383.8	2998.9	1396.2	2174.7	528.9
56	885.9	565.7	2316.2	1718.8	1047.0	1445.9	4335.1	2916.8	1297.4	2110.0	463.6
58	774.8	478.6	2191.0	1518.5	931.8	1302.9	4087.5	2703.2	1154.6	1950.9	392.3
60	666.7	407.7	1996.5	1313.5	809.7	1143.3	3717.0	2425.6	1003.7	1747.3	334.2
62	577.9	350.3	1779.0	1140.7	704.4	997.0	3307.5	2138.6	873.6	1539.2	287.2
64	505.3	303.0	1576.6	998.9	617.1	875.1	2930.6	1888.6	765.5	1358.6	248.4
66	443.5	262.4	1402.1	879.1	544.4	774.3	2605.9	1676.0	675.4	1205.6	215.1
68	390.0	226.1	1253.7	776.2	481.5	686.7	2330.8	1495.3	597.6	1075.2	185.4
70	343.4	195.8	1125.1	686.0	426.7	610.8	2091.8	1338.5	529.5	962.0	160.5
72	303.7	170.4	1013.3	609.0	379.8	545.7	1883.8	1202.4	471.4	864.0	139.7
74	269.8	148.8	917.6	543.3	339.6	489.9	1705.9	1086.3	421.7	780.2	122.1
76	240.2	130.4	835.1	485.8	304.7	441.3	1552.2	986.2	378.3	708.0	107.0
78	214.2	114.5	763.7	435.0	273.6	398.3	1419.0	898.1	339.8	644.4	93.9
80	191.5	100.6	700.2	390.4	246.2	359.9	1300.3	819.5	305.8	587.5	82.5
82	171.6	88.3	642.9	351.0	221.9	325.7	1193.1	748.4	275.7	536.1	72.4
84	154.1	77.5	590.8	316.3	200.4	295.2	1095.5	683.9	249.0	489.7	63.5
86	138.3	67.9	543.0	285.5	181.4	268.1	1006.5	625.7	225.3	447.7	55.7
88	124.1	59.6	499.5	257.7	164.3	243.8	925.4	573.2	204.1	409.9	48.9
90	111.2	52.3	460.0	232.5	148.9	222.1	851.8	525.9	184.9	376.0	42.9
92	99.4	46.0	424.1	209.3	134.7	202.3	785.2	483.2	167.3	345.2	37.7
94	88.9	40.5	391.6	188.3	121.8	184.3	724.7	444.6	151.2	317.5	33.2
96	79.4	35.6	362.0	169.1	109.9	167.6	669.9	409.3	136.5	292.1	29.2
98	71.0	31.2	335.2	151.9	99.1	152.2	619.9	377.0	123.1	268.8	25.6
100	63.7	27.2	310.5	136.5	89.3	138.0	573.9	347.1	110.9	247.2	22.3
102	57.2	23.5	287.7	122.8	80.5	125.0	531.3	319.3	100.0	227.1	19.3
104	51.4	20.1	266.6	110.8	72.7	113.3	491.8	293.4	90.4	208.5	16.5
106	46.2	16.9	246.8	100.1	65.8	102.8	454.7	269.2	81.8	191.0	13.8
108	41.4	14.0	228.1	90.5	59.6	93.4	419.9	246.7	74.1	175.0	11.4
110	36.9	11.2	210.6	81.5	54.1	84.9	387.3	226.2	67.2	160.3	9.2
112	32.7	8.7	194.2	73.3	48.9	77.3	356.9	207.5	60.8	146.9	7.1
114	28.7	6.4	179.1	65.5	44.2	70.5	329.0	190.3	54.9	134.7	5.2
116	25.0	4.5	165.3	58.2	39.7	64.1	303.4	174.9	49.3	123.7	3.7
118	21.5	2.9	152.6	51.3	35.5	58.2	279.9	160.8	44.0	113.6	2.4
120	18.2	1.8	141.0	44.7	31.4	52.6	258.6	147.9	39.0	104.5	1.5
122	15.1	1.0	130.4	38.6	27.6	47.3	239.0	136.2	34.2	96.1	0.8
124	12.2	0.6	120.6	32.8	24.0	42.2	221.0	125.2	29.8	88.3	0.5
126	9.5	0.3	111.6	27.3	20.6	37.4	204.5	115.1	25.5	81.1	0.2
128	7.0	0.2	103.3	22.1	17.4	32.8	189.1	105.5	21.5	74.1	0.1
130	4.9	0.1	95.5	17.3	14.4	28.5	174.8	96.3	17.7	67.5	0.1
132	3.3	0.0	88.4	12.9	11.5	24.4	161.4	87.6	14.1	61.2	0.0
134	2.0	0.0	81.5	9.2	8.9	20.5	148.6	79.1	10.8	55.0	0.0
136	1.2	0.0	75.0	6.2	6.5	16.7	136.3	71.0	8.0	49.2	0.0
138	0.7	0.0	68.7	3.9	4.5	13.2	124.5	63.4	5.5	43.7	0.0
140	0.3	0.0	62.6	2.3	3.0	10.1	113.1	56.0	3.6	38.4	0.0

A.4.8 Design Flood Hydrograph (1/500)

(UNIT: A=SQ.KM/RUNOFF=CU.M/S)

(DAM NO.) CATCHMENT HOUR	(NO.12) A= 443	(NO.13) A= 147	(NO.14) A= 64	(NO.15) A= 338	(NO.16) A= 96	(NO.17) A= 68	(NO.18) A= 159	(NO.19) A= 273	(NO.20) A= 107	(NO.21) A= 151	(NO.22) A= 114
2	0.3	0.4	0.3	0.4	0.6	0.3	0.4	0.2	0.4	0.2	0.8
4	3.0	3.3	3.0	4.0	6.1	3.2	3.5	1.6	3.9	2.1	7.7
6	13.2	13.2	10.0	17.1	17.0	9.9	14.4	7.2	14.1	9.2	22.2
8	37.8	30.5	19.3	42.6	28.0	17.6	34.4	20.4	29.2	23.5	37.8
10	78.7	49.1	27.6	73.9	38.2	24.4	57.2	41.6	43.8	41.5	51.8
12	126.3	66.0	34.6	103.2	44.7	29.8	78.0	65.8	56.5	58.8	61.7
14	170.9	77.4	37.5	125.5	45.8	31.3	93.0	87.4	63.4	72.2	64.0
16	204.1	80.6	36.7	135.4	43.2	30.1	98.2	103.1	63.6	78.8	60.8
18	219.2	78.1	34.2	134.2	39.1	27.8	96.0	109.4	60.1	78.7	55.4
20	220.2	73.7	32.0	128.3	36.5	25.8	91.1	108.7	56.2	75.5	51.7
22	215.6	71.9	32.4	124.2	39.1	26.8	88.5	106.1	55.8	73.0	54.6
24	214.2	76.4	35.8	128.6	43.1	29.8	93.0	105.8	60.8	75.2	60.4
26	224.4	84.3	39.6	140.9	48.4	33.0	102.5	111.3	67.4	82.0	67.5
28	244.9	93.2	43.6	155.8	52.7	36.2	113.4	122.1	74.5	90.7	73.8
30	271.0	103.3	48.7	172.3	60.1	40.8	127.7	134.7	82.8	100.5	83.6
32	306.6	118.1	56.3	193.3	68.6	46.7	152.0	149.8	96.6	113.8	95.6
34	358.3	140.3	66.7	217.9	75.6	51.6	184.1	168.6	116.5	133.4	109.1
36	424.1	166.5	79.1	242.7	82.1	56.3	213.8	191.3	137.1	158.3	129.6
38	495.6	192.2	91.5	274.0	99.3	65.9	241.8	219.7	156.7	184.3	155.7
40	571.3	227.4	112.6	330.4	134.6	88.2	280.9	258.6	188.2	215.4	197.4
42	671.6	281.6	143.2	422.6	181.1	117.8	343.0	315.2	236.6	261.9	256.4
44	811.5	350.4	175.9	539.8	218.2	145.7	423.8	392.4	292.7	325.0	308.3
46	982.5	413.2	200.6	655.5	245.2	165.5	501.7	481.5	338.1	390.1	345.7
48	1151.8	456.8	213.7	743.7	252.4	174.1	557.7	566.9	365.9	441.3	357.9
50	1277.0	470.9	209.5	786.6	236.9	167.5	579.8	627.6	366.2	467.6	338.7
52	1334.1	452.1	192.4	775.2	211.2	151.6	562.1	652.2	342.2	462.8	303.5
54	1313.9	410.8	166.6	719.4	171.9	127.9	514.9	638.0	302.7	431.9	251.0
56	1227.3	352.4	135.1	632.7	134.5	101.7	446.6	591.1	251.4	382.4	197.7
58	1097.7	295.1	111.4	537.0	109.0	83.4	375.9	524.7	208.1	326.4	161.1
60	958.7	250.4	92.4	457.7	87.4	68.0	319.8	455.2	174.8	278.6	130.2
62	835.4	213.7	77.0	393.9	71.4	56.3	274.0	396.0	147.1	240.4	107.0
64	733.0	183.6	64.4	341.0	56.9	46.2	236.3	346.9	124.6	208.6	86.4
66	647.9	157.1	53.0	295.8	44.8	37.2	203.6	305.8	104.2	181.5	68.7
68	573.9	133.9	43.9	255.5	35.7	30.3	174.6	270.4	87.3	157.4	55.3
70	509.5	114.9	36.6	221.6	28.6	24.8	150.6	239.4	73.8	137.0	44.7
72	454.4	99.0	30.6	193.2	22.9	20.4	130.4	213.0	62.6	119.8	36.2
74	407.3	85.7	25.6	169.0	18.3	16.7	113.5	190.3	53.2	105.1	29.3
76	366.1	74.3	21.4	148.3	14.5	13.7	98.9	170.6	45.3	92.5	23.5
78	329.6	64.5	17.9	130.4	11.4	11.2	86.4	153.1	38.5	81.6	18.8
80	297.2	56.0	15.0	114.8	8.7	9.1	75.4	137.6	32.7	72.0	14.8
82	268.4	48.6	12.5	100.9	6.4	7.4	65.9	124.0	27.8	63.6	11.4
84	242.7	42.1	10.4	88.8	4.5	5.8	57.5	111.9	23.6	56.2	8.4
86	219.9	36.5	8.5	78.0	3.0	4.4	50.2	101.2	20.0	49.5	5.9
88	199.5	31.7	6.8	68.5	1.8	3.2	43.8	91.5	16.9	43.7	4.0
90	181.2	27.5	5.4	60.2	1.1	2.2	38.3	82.8	14.1	38.5	2.5
92	164.5	23.9	4.1	53.0	0.6	1.5	33.4	74.8	11.6	34.0	1.4
94	149.1	20.6	2.9	46.8	0.3	0.9	29.2	67.5	9.3	30.1	0.8
96	135.0	17.6	2.0	41.2	0.2	0.5	25.3	60.9	7.2	26.6	0.4
98	122.1	14.9	1.3	36.3	0.1	0.3	21.8	54.8	5.4	23.5	0.2
100	110.4	12.3	0.8	31.7	0.0	0.1	18.6	49.3	3.9	20.7	0.1
102	99.8	10.1	0.4	27.6	0.0	0.1	15.6	44.5	2.6	18.1	0.1
104	90.2	8.0	0.2	23.7	0.0	0.0	12.9	40.1	1.6	15.8	0.0
106	81.7	6.1	0.1	20.1	0.0	0.0	10.5	36.3	1.0	13.6	0.0
108	74.1	4.4	0.1	16.8	0.0	0.0	8.2	32.9	0.5	11.5	0.0
110	67.3	3.0	0.0	13.7	0.0	0.0	6.2	29.8	0.3	9.6	0.0
112	61.1	2.0	0.0	10.8	0.0	0.0	4.4	26.9	0.1	7.8	0.0
114	55.4	1.2	0.0	8.2	0.0	0.0	3.0	24.2	0.1	6.2	0.0
116	50.1	0.7	0.0	5.9	0.0	0.0	1.9	21.7	0.0	4.7	0.0
118	45.0	0.4	0.0	4.0	0.0	0.0	1.1	19.3	0.0	3.4	0.0
120	40.2	0.2	0.0	2.6	0.0	0.0	0.6	17.0	0.0	2.3	0.0
122	35.6	0.1	0.0	1.5	0.0	0.0	0.3	14.8	0.0	1.5	0.0
124	31.2	0.1	0.0	0.8	0.0	0.0	0.2	12.8	0.0	0.9	0.0
126	27.1	0.0	0.0	0.5	0.0	0.0	0.1	10.8	0.0	0.5	0.0
128	23.2	0.0	0.0	0.2	0.0	0.0	0.0	9.0	0.0	0.3	0.0
130	19.5	0.0	0.0	0.1	0.0	0.0	0.0	7.3	0.0	0.1	0.0
132	16.1	0.0	0.0	0.1	0.0	0.0	0.0	5.7	0.0	0.1	0.0
134	12.9	0.0	0.0	0.0	0.0	0.0	0.0	4.3	0.0	0.0	0.0
136	9.9	0.0	0.0	0.0	0.0	0.0	0.0	3.1	0.0	0.0	0.0
138	7.3	0.0	0.0	0.0	0.0	0.0	0.0	2.1	0.0	0.0	0.0
140	5.1	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0

A.4.9 Design Flood Hydrograph (1/1,000)

(UNIT: A=SQ.KM/RUNOFF=CU.M/S)

(DAM NO.) CATCHMENT HOUR	(NO. 1) A= 528	(NO. 2) A= 344	(NO. 3) A=1371	(NO. 4) A= 976	(NO. 5) A= 585	(NO. 6) A= 798	(NO. 7) A=2253	(NO. 8) A=1452	(NO. 9) A= 614	(NO.10) A=1040	(NO.11) A= 226
2	0.3	0.4	0.5	0.6	0.3	0.4	0.9	0.7	0.4	0.5	0.3
4	3.2	4.0	3.1	5.4	3.0	3.5	5.9	4.9	3.7	3.6	3.3
6	14.9	17.1	12.2	24.5	13.2	15.0	23.3	19.6	16.2	14.7	13.9
8	40.8	42.4	37.8	68.3	37.5	43.4	72.0	59.5	45.9	44.4	34.6
10	78.8	72.8	86.6	136.6	76.9	92.2	164.4	133.0	94.2	98.9	59.3
12	119.8	100.8	159.0	213.4	122.3	150.7	300.4	233.7	149.7	172.6	82.2
14	154.6	122.1	243.2	280.7	163.3	207.8	457.4	345.0	200.0	253.4	99.6
16	177.2	131.0	320.9	327.8	193.5	251.5	600.7	438.1	236.9	320.5	106.8
18	184.4	129.3	379.8	345.9	206.2	273.6	708.1	502.2	252.4	365.8	105.5
20	180.2	123.4	411.3	341.7	205.6	277.9	764.1	529.3	251.8	384.4	100.6
22	174.6	119.5	420.9	332.7	200.9	273.0	779.9	530.1	246.0	384.1	97.5
24	176.0	124.1	420.9	333.0	200.1	270.4	779.2	527.1	245.0	381.6	101.3
26	187.4	136.3	427.2	351.4	210.1	281.9	791.5	539.6	257.2	391.2	111.2
28	206.6	150.6	448.6	386.1	230.1	305.7	832.2	572.6	281.7	415.9	122.9
30	228.6	166.7	487.3	426.6	253.8	336.7	905.2	628.3	310.7	456.6	136.0
32	254.5	187.1	536.6	474.5	282.2	374.5	997.4	694.4	345.9	505.1	152.6
34	286.3	210.9	597.5	533.2	316.8	419.3	1113.1	776.4	390.7	565.0	172.0
36	320.4	233.8	667.7	598.3	355.5	471.1	1253.0	878.8	447.2	640.2	191.5
38	356.9	260.5	749.8	671.7	399.3	531.7	1427.1	1008.0	519.7	735.5	216.4
40	410.6	310.7	853.0	778.7	460.9	613.8	1657.6	1175.9	612.5	859.0	261.9
42	507.1	401.0	997.7	956.9	562.9	743.4	1961.7	1402.4	739.5	1025.3	335.9
44	652.1	517.5	1209.2	1214.9	711.6	927.6	2372.7	1701.1	912.3	1243.9	428.6
46	813.4	630.9	1497.9	1507.9	884.6	1152.8	2902.3	2087.1	1115.1	1525.6	519.5
48	954.7	715.6	1824.2	1778.6	1050.0	1376.8	3490.8	2495.8	1311.9	1822.7	587.6
50	1047.6	755.7	2140.0	1967.0	1169.1	1549.2	4057.8	2867.8	1453.5	2089.9	619.6
52	1073.3	742.6	2372.4	2036.7	1220.8	1639.8	4471.2	3113.1	1513.6	2263.6	608.4
54	1033.8	687.1	2487.4	1983.7	1198.8	1631.8	4665.6	3190.2	1484.2	2313.2	562.8
56	943.4	602.3	2467.5	1829.4	1114.5	1538.8	4611.4	3101.7	1378.9	2243.5	493.3
58	825.1	509.6	2333.1	1616.2	991.8	1386.5	4346.9	2874.1	1227.3	2074.1	417.5
60	710.1	434.2	2125.8	1398.2	862.0	1216.7	3952.8	2579.0	1067.0	1857.6	355.7
62	615.6	373.1	1894.3	1214.5	750.0	1061.2	3517.5	2274.1	928.7	1636.7	305.7
64	538.4	322.7	1678.9	1063.6	657.1	931.7	3117.0	2008.6	813.9	1444.8	264.3
66	472.6	279.5	1493.2	936.2	579.7	824.3	2772.2	1782.6	718.2	1282.3	229.0
68	415.6	240.9	1335.5	826.6	512.8	731.2	2479.8	1590.6	635.4	1143.7	197.4
70	365.9	208.6	1198.7	730.6	454.4	650.4	2225.7	1423.9	563.1	1023.4	170.9
72	323.7	181.5	1079.6	648.6	404.5	581.1	2004.6	1279.3	501.3	919.2	148.8
74	287.6	158.6	977.8	578.7	361.8	521.7	1815.4	1155.7	448.5	830.0	130.0
76	256.0	139.0	889.9	517.4	324.5	470.0	1651.8	1049.2	402.4	753.3	113.9
78	228.4	122.0	813.9	463.4	291.5	424.2	1510.1	955.6	361.5	685.6	100.0
80	204.2	107.2	746.2	415.9	262.3	383.3	1383.8	871.9	325.3	625.1	87.8
82	183.0	94.1	685.1	374.0	236.5	346.9	1269.7	796.3	293.3	570.5	77.1
84	164.2	82.5	629.6	337.0	213.6	314.5	1166.0	727.7	264.9	521.0	67.6
86	147.5	72.4	578.7	304.1	193.2	285.6	1071.3	665.8	239.7	476.4	59.4
88	132.3	63.5	532.3	274.5	175.1	259.8	985.0	610.0	217.1	436.2	52.0
90	118.5	55.8	490.2	247.6	158.6	236.6	906.7	559.7	196.6	400.1	45.7
92	106.0	49.0	452.1	223.0	143.5	215.5	835.9	514.3	178.0	367.4	40.2
94	94.7	43.2	417.4	200.6	129.7	196.3	771.5	473.2	160.9	337.8	35.4
96	84.7	38.0	385.9	180.2	117.1	178.4	713.1	435.6	145.2	310.8	31.1
98	75.7	33.3	357.3	161.8	105.5	162.1	659.9	401.2	130.9	286.0	27.3
100	67.9	29.0	330.9	145.4	95.1	147.0	610.8	369.4	118.0	263.1	23.7
102	61.0	25.0	306.7	130.9	85.8	133.2	565.5	339.7	106.4	241.7	20.5
104	54.9	21.4	284.1	118.1	77.5	120.7	523.4	312.2	96.1	221.8	17.5
106	49.3	18.0	263.0	106.6	70.1	109.5	483.9	286.5	87.0	203.3	14.7
108	44.1	14.8	243.1	96.4	63.5	99.5	446.9	262.6	78.8	186.2	12.1
110	39.3	11.9	224.5	86.9	57.6	90.5	412.2	240.8	71.5	170.6	9.7
112	34.8	9.2	207.0	78.1	52.1	82.4	379.9	220.8	64.7	156.3	7.5
114	30.6	6.8	190.9	69.8	47.1	75.1	350.2	202.6	58.4	143.4	5.5
116	26.6	4.8	176.2	62.0	42.3	68.3	323.0	186.2	52.4	131.7	3.9
118	22.9	3.1	162.6	54.6	37.8	62.1	298.0	171.1	46.8	120.9	2.5
120	19.4	1.9	150.3	47.6	33.5	56.1	275.4	157.5	41.5	111.2	1.6
122	16.0	1.1	139.0	41.1	29.4	50.4	254.5	144.9	36.4	102.3	0.9
124	12.9	0.6	128.5	34.9	25.6	45.0	235.3	133.2	31.6	94.0	0.5
126	10.0	0.3	119.0	29.0	21.9	39.8	217.8	122.5	27.0	86.3	0.3
128	7.4	0.2	110.1	23.5	18.5	34.9	201.3	112.3	22.8	78.9	0.1
130	5.2	0.1	101.9	18.3	15.3	30.3	186.1	102.5	18.7	71.8	0.1
132	3.5	0.0	94.2	13.7	12.2	25.9	171.8	93.2	14.9	65.1	0.0
134	2.2	0.0	86.9	9.7	9.4	21.7	158.2	84.2	11.5	58.5	0.0
136	1.2	0.0	79.9	6.5	6.9	17.7	145.1	75.6	8.4	52.4	0.0
138	0.7	0.0	73.2	4.1	4.8	14.0	132.5	67.4	5.9	46.5	0.0
140	0.4	0.0	66.7	2.4	3.1	10.7	120.4	59.5	3.8	40.8	0.0

A.4.9 Design Flood Hydrograph (1/1,000)

(UNIT: A=SQ.KM/RUNOFF=CU.M/S)

(DAM NO.) CATCHMENT HOUR	(NO.12) A= 443	(NO.13) A= 147	(NO.14) A= 64	(NO.15) A= 338	(NO.16) A= 96	(NO.17) A= 68	(NO.18) A= 159	(NO.19) A= 273	(NO.20) A= 107	(NO.21) A= 151	(NO.22) A= 114
2	0.4	0.4	0.3	0.4	0.7	0.4	0.4	0.2	0.4	0.2	0.9
4	3.2	3.5	3.2	4.2	6.5	3.4	3.7	1.7	4.1	2.2	8.1
6	14.0	14.0	10.6	18.1	18.0	10.4	15.2	7.7	14.9	9.8	23.5
8	40.0	32.3	20.4	45.2	29.6	18.7	36.5	21.6	31.0	24.9	40.0
10	83.4	52.0	29.2	78.3	40.4	25.8	60.6	44.1	46.4	44.0	54.9
12	133.8	69.9	36.6	109.3	47.3	31.5	82.7	69.7	59.8	62.2	65.4
14	181.0	82.0	39.7	132.9	48.6	33.2	98.6	92.6	67.1	76.5	67.8
16	216.2	85.4	38.9	143.4	45.7	31.9	104.0	109.2	67.3	83.4	64.4
18	232.2	82.7	36.3	142.2	41.4	29.4	101.7	115.9	63.6	83.4	58.7
20	233.3	78.1	33.9	135.9	38.6	27.4	96.5	115.1	59.5	79.9	54.7
22	228.4	76.2	34.3	131.5	41.4	28.3	93.8	112.4	59.1	77.3	57.8
24	226.9	80.9	37.9	136.2	45.7	31.5	98.5	112.1	64.4	79.7	64.0
26	237.7	89.3	42.0	149.2	51.3	35.0	108.6	117.9	71.4	86.8	71.5
28	259.6	98.7	46.2	165.0	55.8	38.4	120.7	129.3	78.9	96.1	78.1
30	288.7	109.9	51.7	182.6	63.7	43.2	138.1	142.6	88.3	106.7	88.6
32	330.1	127.9	61.1	204.8	72.7	49.4	166.8	158.8	105.8	122.2	102.1
34	389.9	154.5	74.0	231.2	80.1	54.7	200.7	179.6	128.6	145.9	121.1
36	462.0	181.7	86.3	259.9	88.9	60.6	230.6	205.9	148.9	173.2	143.1
38	536.0	207.3	98.7	299.2	111.1	73.3	259.2	239.4	168.6	199.5	168.6
40	613.7	243.7	120.5	362.7	146.6	96.5	300.0	282.4	201.4	231.3	211.7
42	718.3	300.6	152.7	458.0	194.5	126.8	365.3	341.0	252.2	279.9	273.6
44	865.4	373.0	187.2	579.2	233.1	155.7	450.7	421.1	311.4	346.3	328.1
46	1045.6	439.3	213.2	700.2	261.2	176.4	532.9	514.4	359.3	415.0	367.4
48	1224.3	485.2	227.0	792.5	268.5	185.3	592.1	604.2	388.5	469.0	380.1
50	1356.5	500.0	222.4	837.3	251.8	178.2	615.3	667.9	388.7	496.6	359.6
52	1416.5	480.0	204.2	824.5	224.4	161.2	596.4	693.6	363.2	491.4	322.2
54	1394.7	436.0	176.8	765.0	182.7	136.0	546.3	678.2	321.2	458.5	266.4
56	1302.7	374.0	143.4	672.8	142.9	108.1	473.8	628.2	266.7	405.9	209.9
58	1165.2	313.2	118.3	571.1	115.9	88.7	398.9	557.7	220.8	346.5	171.0
60	1017.7	265.8	98.0	486.8	92.9	72.3	339.3	483.8	185.5	295.8	138.2
62	886.9	226.9	81.8	418.9	75.9	59.8	290.8	421.0	156.1	255.2	113.5
64	778.2	195.0	68.4	362.7	60.5	49.1	250.8	368.8	132.2	221.5	91.7
66	687.9	166.8	56.2	314.7	47.6	39.6	216.0	325.1	110.6	192.8	73.0
68	609.3	142.2	46.6	271.8	38.0	32.2	185.3	287.5	92.7	167.2	58.7
70	541.0	122.0	38.8	235.7	30.4	26.4	159.8	254.6	78.3	145.5	47.5
72	482.6	105.2	32.5	205.6	24.4	21.7	138.4	226.5	66.4	127.2	38.4
74	432.5	91.0	27.2	179.8	19.4	17.8	120.4	202.4	56.5	111.6	31.0
76	388.8	78.9	22.7	157.8	15.4	14.6	104.9	181.4	48.1	98.2	25.0
78	350.0	68.5	19.0	138.7	12.1	11.9	91.7	162.8	40.9	86.6	20.0
80	315.6	59.4	15.9	122.1	9.2	9.7	80.1	146.4	34.7	76.5	15.7
82	285.0	51.6	13.2	107.4	6.8	7.8	69.9	131.9	29.5	67.6	12.1
84	257.8	44.7	11.0	94.4	4.7	6.2	61.0	119.0	25.1	59.7	8.9
86	233.5	38.8	9.0	83.0	3.1	4.7	53.2	107.6	21.3	52.6	6.3
88	211.9	33.7	7.2	72.9	1.9	3.4	46.5	97.3	17.9	46.4	4.2
90	192.4	29.2	5.7	64.1	1.1	2.4	40.6	88.1	14.9	40.9	2.6
92	174.7	25.3	4.3	56.5	0.6	1.5	35.5	79.6	12.2	36.1	1.5
94	158.4	21.8	3.1	49.8	0.3	0.9	30.9	71.8	9.8	31.9	0.8
96	143.4	18.6	2.1	43.9	0.2	0.5	26.9	64.7	7.7	28.3	0.4
98	129.7	15.7	1.4	38.6	0.1	0.3	23.1	58.3	5.7	25.0	0.2
100	117.2	13.1	0.8	33.7	0.0	0.1	19.7	52.5	4.1	22.0	0.1
102	106.0	10.7	0.5	29.3	0.0	0.1	16.6	47.3	2.8	19.2	0.1
104	95.8	8.4	0.2	25.2	0.0	0.0	13.7	42.7	1.7	16.7	0.0
106	86.8	6.4	0.1	21.4	0.0	0.0	11.1	38.6	1.0	14.4	0.0
108	78.7	4.7	0.1	17.8	0.0	0.0	8.7	35.0	0.6	12.2	0.0
110	71.5	3.2	0.0	14.5	0.0	0.0	6.5	31.7	0.3	10.1	0.0
112	64.9	2.1	0.0	11.4	0.0	0.0	4.7	28.6	0.2	8.3	0.0
114	58.8	1.3	0.0	8.7	0.0	0.0	3.1	25.7	0.1	6.5	0.0
116	53.1	0.7	0.0	6.2	0.0	0.0	2.0	23.0	0.0	5.0	0.0
118	47.7	0.4	0.0	4.2	0.0	0.0	1.2	20.5	0.0	3.6	0.0
120	42.6	0.2	0.0	2.7	0.0	0.0	0.6	18.0	0.0	2.5	0.0
122	37.7	0.1	0.0	1.6	0.0	0.0	0.3	15.7	0.0	1.6	0.0
124	33.1	0.1	0.0	0.9	0.0	0.0	0.2	13.6	0.0	1.0	0.0
126	28.7	0.0	0.0	0.5	0.0	0.0	0.1	11.5	0.0	0.5	0.0
128	24.6	0.0	0.0	0.3	0.0	0.0	0.0	9.6	0.0	0.3	0.0
130	20.7	0.0	0.0	0.1	0.0	0.0	0.0	7.7	0.0	0.1	0.0
132	17.0	0.0	0.0	0.1	0.0	0.0	0.0	6.1	0.0	0.1	0.0
134	13.6	0.0	0.0	0.0	0.0	0.0	0.0	4.5	0.0	0.0	0.0
136	10.5	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0	0.0	0.0
138	7.8	0.0	0.0	0.0	0.0	0.0	0.0	2.2	0.0	0.0	0.0
140	5.4	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0

A.4.10 Design Flood Hydrograph (1/10,000)

********** (UNIT: A=SQ.KM,RUNOFF=CU.M/S)

(DAM NO.) CATCHMENT HOUR	(NO. 1) A= 528	(NO. 2) A= 344	(NO. 3) A=1371	(NO. 4) A= 976	(NO. 5) A= 585	(NO. 6) A= 798	(NO. 7) A=2253	(NO. 8) A=1452	(NO. 9) A= 614	(NO.10) A=1040	(NO.11) A= 226
2	0.4	0.5	0.6	0.7	0.4	0.5	1.1	0.8	0.5	0.6	0.4
4	3.8	4.8	3.7	6.5	3.6	4.2	7.0	5.8	4.4	4.3	3.9
6	17.7	20.3	14.5	29.1	15.7	17.8	27.7	23.4	19.3	17.5	16.6
8	48.6	50.4	44.9	81.2	44.5	51.5	85.6	70.8	54.5	52.8	41.1
10	93.7	86.5	102.9	162.4	91.4	109.7	195.5	158.1	111.9	117.6	70.5
12	142.4	119.9	189.1	253.7	145.3	179.1	357.1	277.8	178.0	205.2	97.8
14	183.8	145.2	289.1	333.7	194.2	247.0	543.8	410.1	237.8	301.3	118.4
16	210.7	155.7	381.5	389.7	230.0	299.0	714.2	520.8	281.6	381.1	127.0
18	219.2	153.7	451.5	411.2	245.1	325.2	841.8	597.0	300.1	434.8	125.4
20	214.2	146.7	489.0	406.2	244.5	330.4	908.4	629.2	299.3	456.9	119.6
22	207.5	142.1	500.4	395.5	238.9	324.5	927.2	630.2	292.4	456.7	115.9
24	209.2	147.6	500.4	395.8	237.9	321.5	926.3	626.7	291.2	453.7	120.4
26	222.8	162.0	507.8	417.8	249.8	335.1	940.9	641.4	305.8	465.1	132.1
28	245.6	179.1	533.3	459.1	273.5	363.5	989.3	680.7	336.9	496.4	146.1
30	271.8	198.2	579.3	507.2	301.7	400.3	1077.2	748.0	370.3	543.7	161.6
32	302.7	222.5	638.5	564.8	335.9	445.9	1192.4	832.2	417.5	605.8	181.8
34	341.8	252.6	713.5	640.1	380.0	503.8	1347.4	945.9	486.0	689.5	208.5
36	389.4	288.9	806.1	736.7	436.3	579.2	1551.3	1101.1	575.1	804.4	242.8
38	450.9	338.3	924.3	858.8	508.0	676.1	1810.4	1290.5	673.4	943.4	285.4
40	534.3	408.2	1078.5	1012.8	598.3	794.1	2122.2	1508.2	778.5	1101.4	340.4
42	653.4	509.8	1275.7	1223.4	721.0	950.4	2490.0	1769.3	918.7	1291.6	421.2
44	816.6	639.8	1535.1	1512.3	888.1	1158.0	2958.2	2106.3	1116.0	1537.9	526.1
46	998.9	769.2	1867.6	1845.7	1084.6	1414.0	3562.7	2549.1	1351.9	1861.6	630.8
48	1160.8	866.3	2240.4	2158.3	1275.4	1672.7	4243.3	3024.8	1581.8	2207.8	709.4
50	1266.9	911.4	2603.2	2375.3	1412.6	1872.0	4904.5	3458.9	1747.1	2519.7	745.8
52	1294.2	893.9	2871.2	2452.8	1470.9	1975.5	5385.4	3744.2	1816.2	2721.7	731.2
54	1244.8	826.5	3001.2	2385.7	1442.1	1962.7	5608.1	3830.7	1779.3	2777.1	676.0
56	1135.4	724.4	2972.2	2199.0	1339.9	1849.5	5537.1	3721.4	1652.7	2691.4	592.4
58	993.2	613.2	2808.2	1943.1	1192.5	1666.3	5217.1	3447.5	1471.1	2487.5	501.5
60	855.3	522.5	2558.2	1681.8	1036.8	1462.7	4743.8	3093.8	1279.3	2228.3	427.4
62	741.7	449.1	2280.0	1461.3	902.5	1276.3	4222.5	2729.1	1113.8	1964.0	367.4
64	648.7	388.4	2021.5	1280.1	790.9	1120.9	3743.3	2411.4	976.3	1734.3	317.7
66	569.5	336.5	1798.7	1126.8	697.9	992.0	3330.3	2140.7	861.6	1539.6	275.3
68	500.9	290.1	1609.3	995.0	617.5	880.1	2979.9	1910.5	762.4	1373.6	237.4
70	441.2	251.3	1445.0	879.7	547.2	782.9	2675.2	1710.6	675.8	1229.2	205.6
72	390.3	218.8	1301.8	781.2	487.2	699.6	2410.0	1537.0	601.8	1104.2	179.0
74	346.9	191.1	1179.2	697.0	435.8	628.2	2182.7	1388.7	538.4	997.2	156.4
76	308.8	167.5	1073.4	623.4	391.0	566.0	1986.2	1260.9	483.1	905.1	137.0
78	275.5	146.9	981.7	558.4	351.3	510.9	1815.9	1148.5	434.1	823.9	120.2
80	246.4	129.1	900.1	501.2	316.2	461.8	1664.1	1048.0	390.7	751.3	105.7
82	220.8	113.4	826.4	450.8	285.0	418.0	1527.1	957.2	352.2	685.6	92.8
84	198.1	99.5	759.5	406.1	257.4	379.0	1402.4	874.9	318.1	626.3	81.4
86	177.9	87.3	698.2	366.4	232.9	344.1	1288.6	800.6	287.8	572.8	71.5
88	159.6	76.6	642.3	330.7	211.0	313.0	1185.0	733.5	260.6	524.5	62.7
90	143.0	67.3	591.6	298.3	191.1	285.0	1090.9	673.1	236.1	481.1	55.1
92	127.9	59.1	545.6	268.7	173.0	259.6	1005.8	618.5	213.7	441.7	48.4
94	114.3	52.1	503.8	241.7	156.3	236.4	928.4	568.9	193.2	406.1	42.6
96	102.2	45.8	465.9	217.2	141.1	215.0	858.2	523.7	174.4	373.6	37.4
98	91.5	40.1	431.3	195.1	127.2	195.3	794.0	482.2	157.3	343.7	32.8
100	82.0	34.9	399.5	175.4	114.7	177.1	734.9	444.0	141.8	316.2	28.5
102	73.7	30.1	370.1	157.9	103.5	160.5	680.3	408.5	127.9	290.5	24.6
104	66.2	25.7	342.8	142.5	93.4	145.6	629.6	375.3	115.6	266.6	21.0
106	59.5	21.5	317.3	128.6	84.6	132.0	582.2	344.4	104.6	244.4	17.6
108	53.2	17.7	293.3	116.2	76.6	120.0	537.7	315.7	94.7	223.9	14.4
110	47.4	14.2	270.9	104.7	69.5	109.1	495.9	289.6	85.9	205.2	11.6
112	42.0	11.0	249.8	94.1	62.9	99.4	457.1	265.6	77.7	188.0	8.9
114	36.9	8.1	230.4	84.1	56.7	90.6	421.4	243.8	70.1	172.5	6.6
116	32.0	5.6	212.7	74.6	51.0	82.3	388.7	224.1	62.9	158.4	4.6
118	27.5	3.7	196.3	65.7	45.5	74.8	358.8	205.9	56.1	145.5	3.0
120	23.2	2.3	181.5	57.2	40.3	67.5	331.6	189.4	49.7	133.8	1.9
122	19.2	1.3	167.9	49.2	35.3	60.7	306.4	174.3	43.5	123.0	1.1
124	15.4	0.7	155.3	41.7	30.7	54.1	283.4	160.3	37.7	113.0	0.6
126	11.9	0.4	143.8	34.6	26.3	47.8	262.2	147.3	32.2	103.7	0.3
128	8.8	0.2	133.1	27.9	22.1	41.9	242.3	135.0	27.1	94.8	0.2
130	6.2	0.1	123.0	21.8	18.2	36.3	223.9	123.2	22.3	86.3	0.1
132	4.1	0.0	113.8	16.3	14.5	31.0	206.8	112.0	17.8	78.1	0.0
134	2.6	0.0	105.0	11.6	11.1	25.9	190.3	101.0	13.6	70.2	0.0
136	1.5	0.0	96.5	7.8	8.2	21.1	174.5	90.6	10.0	62.8	0.0
138	0.8	0.0	88.3	4.9	5.7	16.7	159.3	80.7	7.0	55.6	0.0
140	0.4	0.0	80.5	2.9	3.7	12.7	144.6	71.2	4.6	48.8	0.0

A.4.10 Design Flood Hydrograph (1/10,000)

(UNIT: A=SQ.KM,RUNOFF=CU.M/S)

(DAM NO.) CATCHMENT HOUR	(NO.12) A= 443	(NO.13) A= 147	(NO.14) A= 64	(NO.15) A= 338	(NO.16) A= 96	(NO.17) A= 68	(NO.18) A= 159	(NO.19) A= 273	(NO.20) A= 107	(NO.21) A= 151	(NO.22) A= 114
2	0.4	0.4	0.4	0.5	0.8	0.4	0.5	0.2	0.5	0.3	1.0
4	3.8	4.1	3.8	5.0	7.7	4.0	4.4	2.1	4.9	2.7	9.7
6	16.6	16.6	12.6	21.5	21.4	12.4	18.1	9.1	17.7	11.6	28.0
8	47.6	38.3	24.2	53.7	35.2	22.2	43.4	25.7	36.8	29.6	47.6
10	99.1	61.8	34.7	93.1	48.1	30.7	72.1	52.4	55.2	52.3	65.3
12	159.1	83.1	43.6	129.9	56.3	37.5	98.3	82.9	71.1	74.0	77.7
14	215.2	97.5	47.2	158.0	57.7	39.4	117.2	110.0	79.8	90.9	80.6
16	257.0	101.5	46.2	170.5	54.4	37.9	123.7	129.8	80.1	99.2	76.5
18	276.0	98.4	43.1	169.0	49.2	34.9	120.9	137.8	75.6	99.1	69.8
20	277.3	92.8	40.3	161.5	45.9	32.5	114.7	136.9	70.8	95.0	65.1
22	271.5	90.5	40.8	156.4	49.2	33.7	111.5	133.6	70.3	91.9	68.7
24	269.8	96.2	45.0	162.0	54.3	37.5	117.4	133.2	76.8	94.7	76.1
26	283.7	106.2	49.9	177.4	61.0	41.6	131.7	140.1	85.0	103.3	85.0
28	314.5	118.9	55.5	196.2	66.4	45.6	153.6	153.7	96.0	115.3	93.0
30	360.9	138.7	65.9	217.1	75.7	51.4	182.2	170.1	114.6	132.7	109.1
32	424.8	169.0	82.3	245.1	87.2	59.2	216.0	191.9	141.1	159.2	137.2
34	502.4	201.1	96.4	285.2	103.7	69.4	251.7	223.9	165.1	190.6	162.2
36	584.1	228.8	108.3	336.8	122.3	82.4	284.0	265.3	185.5	219.8	182.3
38	664.7	256.0	121.5	393.8	144.9	96.7	316.1	310.2	206.9	247.5	208.8
40	751.6	297.3	146.6	464.0	182.6	120.9	363.2	358.4	244.6	283.2	258.0
42	872.5	363.5	184.2	568.8	237.2	155.3	439.8	423.1	304.0	339.5	330.2
44	1044.5	448.6	224.7	707.6	281.7	188.6	540.5	514.8	373.7	417.3	394.0
46	1256.7	526.7	255.3	847.9	314.2	212.5	637.7	623.3	430.1	498.2	440.0
48	1467.5	580.6	271.3	955.0	322.1	222.6	707.4	728.3	464.4	561.8	454.4
50	1623.2	597.7	265.6	1006.3	301.7	213.6	734.5	802.6	464.2	594.1	429.6
52	1693.5	573.4	243.8	989.8	268.6	193.1	711.6	832.1	433.6	587.5	384.7
54	1666.7	520.8	211.1	917.8	218.7	162.9	651.7	812.9	383.4	547.9	318.1
56	1556.5	446.7	171.2	807.2	171.2	129.5	565.3	752.9	318.4	485.0	250.6
58	1392.2	374.2	141.2	685.3	138.7	106.2	476.0	668.5	263.6	414.1	204.2
60	1216.1	317.6	117.1	584.2	111.2	86.7	405.0	580.1	221.5	353.5	165.0
62	1060.0	271.1	97.7	502.9	90.9	71.7	347.0	504.8	186.4	305.1	135.6
64	930.2	233.0	81.7	435.4	72.4	58.9	299.3	442.3	157.9	264.8	109.6
66	822.3	199.3	67.2	377.8	57.1	47.4	257.9	390.0	132.1	230.5	87.2
68	728.5	170.0	55.7	326.5	45.5	38.7	221.2	345.0	110.7	199.9	70.1
70	647.0	145.8	46.4	283.2	36.4	31.7	190.7	305.5	93.6	174.0	56.7
72	577.1	125.7	38.8	247.0	29.1	26.0	165.3	271.8	79.4	152.2	45.8
74	517.3	108.8	32.5	216.0	23.2	21.3	143.8	243.0	67.5	133.5	37.0
76	465.1	94.3	27.2	189.6	18.4	17.5	125.3	217.8	57.4	117.5	29.7
78	418.7	81.9	22.7	166.7	14.4	14.3	109.5	195.5	48.8	103.6	23.7
80	377.5	71.1	19.0	146.7	11.0	11.6	95.6	175.8	41.5	91.5	18.7
82	340.9	61.7	15.8	129.1	8.1	9.3	83.5	158.4	35.2	80.9	14.4
84	308.4	53.5	13.1	113.5	5.6	7.3	72.9	142.9	29.9	71.4	10.6
86	279.4	46.4	10.7	99.8	3.7	5.6	63.6	129.2	25.3	63.0	7.5
88	253.5	40.2	8.6	87.7	2.3	4.1	55.5	116.9	21.3	55.5	5.0
90	230.2	34.9	6.7	77.1	1.3	2.8	48.4	105.7	17.7	49.0	3.1
92	209.0	30.2	5.1	67.9	0.7	1.8	42.3	95.6	14.6	43.2	1.8
94	189.5	26.0	3.7	59.9	0.4	1.1	36.9	86.2	11.7	38.2	1.0
96	171.6	22.2	2.5	52.7	0.2	0.6	32.0	77.7	9.1	33.8	0.5
98	155.2	18.7	1.6	46.4	0.1	0.3	27.5	70.0	6.8	29.8	0.3
100	140.3	15.6	1.0	40.5	0.0	0.2	23.4	63.1	4.9	26.3	0.1
102	126.8	12.7	0.5	35.1	0.0	0.1	19.7	56.8	3.3	23.0	0.1
104	114.7	10.0	0.3	30.1	0.0	0.0	16.3	51.3	2.1	19.9	0.0
106	103.9	7.7	0.1	25.5	0.0	0.0	13.2	46.4	1.2	17.1	0.0
108	94.2	5.6	0.1	21.2	0.0	0.0	10.3	42.0	0.7	14.5	0.0
110	85.5	3.8	0.0	17.2	0.0	0.0	7.7	38.0	0.4	12.1	0.0
112	77.6	2.5	0.0	13.6	0.0	0.0	5.5	34.3	0.2	9.8	0.0
114	70.3	1.5	0.0	10.3	0.0	0.0	3.7	30.9	0.1	7.8	0.0
116	63.5	0.8	0.0	7.4	0.0	0.0	2.3	27.6	0.0	5.9	0.0
118	57.0	0.5	0.0	5.0	0.0	0.0	1.4	24.5	0.0	4.3	0.0
120	50.8	0.2	0.0	3.2	0.0	0.0	0.8	21.6	0.0	2.9	0.0
122	44.9	0.1	0.0	1.9	0.0	0.0	0.4	18.8	0.0	1.9	0.0
124	39.4	0.1	0.0	1.1	0.0	0.0	0.2	16.2	0.0	1.1	0.0
126	34.1	0.0	0.0	0.6	0.0	0.0	0.1	13.7	0.0	0.6	0.0
128	29.2	0.0	0.0	0.3	0.0	0.0	0.1	11.4	0.0	0.3	0.0
130	24.6	0.0	0.0	0.2	0.0	0.0	0.0	9.2	0.0	0.2	0.0
132	20.2	0.0	0.0	0.1	0.0	0.0	0.0	7.2	0.0	0.1	0.0
134	16.2	0.0	0.0	0.0	0.0	0.0	0.0	5.4	0.0	0.0	0.0
136	12.5	0.0	0.0	0.0	0.0	0.0	0.0	3.9	0.0	0.0	0.0
138	9.2	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.0	0.0	0.0
140	6.4	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0

APPENDIX-B. LAND USE AND SOIL

APPENDIX - B LANDUSE AND SOIL

B.1 LAND USE

1) INTRODUCTION

Land use information in the area is very important for development of crop diversification planning which is in turn needed for estimation of irrigation water demand and also the designation of irrigation system. This is because different land use type such as paddy, upland crop orchard require different irrigation method.

2) STUDY METHODOLOGY

A) Data Collection and Review

Information on land use was collected from, various government agencies concerned both in Bangkok and other provinces in the study area as follows

1) Land use Planning Division. Department of Land Development

   - Land Use Maps at scale 1:100,000 of Chon Buri, Chachoengsao Prachin Buri and Nakhon Nayok

2) Provincial Agricultural Extension Offices of Chon Buri, Chachoengsao Prachin Buri and Nakhon Nayok

   - Agricultural data of each province

3) Provincial Commercial Offices of Chon Buri, Chachoengsao, Prachin Bun and Nakhon Nayok

   - Annual Reports

These mentioned maps and reports are reviewed and extracted to obtain specific information required for study.

B) Field Survey

The field survey carried out during study period was done in parallel with the soil every in order to:

- make supplementary land use survey with particular emphases on changes of land use patterns.
- collect land use data from provincial agencies and interview with government officers, private sectors and farmers to obtain information necessary for study.

3) RESULT OF STUDY

A) General Land Use Feature

General land use of Bang Pakong river besin is clearly defined by its topography. The low flat land in the western is entirely devoted to paddy cultivation with some orchards along the river banks. The upland and mountainous areas in the eastern are mostly under several upland crops, orchard plantation and forest. In total study area of approximately 1,766,000 ha, the agricultural land comprises 993,760 ha or about 56 percent. Amount this, paddy, upland crop, orchard and vegetables with others share 467,290 ha (27 percent), 391,060 ha (22 percent), 102,000 ha (6 percent) and 24,410 ha (1 percent) respectively. The other 772,240 ha (44 percent) is devoted to forest, mountainous and miscellaneous areas. The agriculture is mostly still under rainfed.

Paddy cultivation in the area is largely limited only in wet season. Dry season cropping after rice is rare. Prachin Buri occupies the largest area whereas Chon Buri has smallest.

Total upland crop area of the basin is 391,060 ha or about 22 percent with the largest in Prachin Buri and smallest in Nakhon Nayok. Dominant crop is cassava grown widespreadly in every province. Maize is another economic crop largely cultivated in Amphoe Wang Nam Yen and Sa Kaew of Prachin Buri province.

Orchard plantations totalling about 102,000 ha or approximately 6 percent include mainly mango, coconut and other mixed orchards. Prachin Buri and Nakhon Nayok have the largest and smallest planted arear respectively. Chachoengsao is now popular in mango plantation while Prachin Buri is well known in sweet bamboo and durian.

For vegetables which are grown in very small area of about only one percent can be recognized only where there is adequate water available.

Land use maps of Chan Buri, Chachoengsao, Prachin Buri and Nakhon Nayok were shown in Figures B1 to B4.

B) Land Use Area by Amphoc-wise

Area coverages of main land use categories by Amphoc-wise of the four provinces were presented in Tables B-1. The main categories are agricultural land and other land use. The agricultural land comprises paddy, upland crop, orchard and vegetables.

C) Land Use Area by Sub-basin

The study area was analyzed and divided into 8 sub-basins as follows:

a) Lower Bang Pakong (LBP)
b) Khlong Thalat (KTL)
c) Upper Bang Pakong (UBP)
d) Mac Nam Nakhon Nayok (MNN)
e) Middle Phra Prong (MPP)
f) Mac Nam Hanuman (MNH)
g) Khlong Phra Sathung (KPS)
h) Upper Phra Prong (UPP)

The area coverages of land use by each sub-basin were summarized in Table B-2 to 6.

D) Preliminary Land Use Patterns Under Project Implementation

Generally, factors to be considered when making land use planning namely soil suitability, topography, water source, market, farmers traditions, etc. In this study area major crops are paddy in lowland and cassava with maize on upland. Cassava is facing with marketing problem. At the same time soybean, mungbean and fruit orchards are extensively promoted by government due to market demand is high. Thus cassava area should considered to be reduced or freezed and replaced by other promissing crops as mentioned above. Under project implementation the dry season cropping area in the service area especially in paddy land will be certainly considerable increased. Suitable crops recommended for dry season should be soybean, mungbean and groundnut better than second rice due to water is limited. Preliminary land use planning with project is thus designated as follows:

paddy land	wet season: paddy dry season: soybean, mungbean, ground and some second rice
upland area	wet season: maize dry season: soybean, mungbean, groundnut
orchard:	mainly mango, palmelo and durian
vegetables:	grown in both wet and dry seasons
orchard extension:	some paddy land should be changed to mango plantation.

TABLE B-1 LAND USE OF PROJECT AREA BY AMPHOE

area : ha

Province / Amphoe	Project area	Agricultural Land					Other land
		Paddy	Upland	orchard	Vegetable and other	sub-tota	
CHON BURI	206,520	48,310	84,160	25,700	19,450	177,620	28,900
A. Muang	10,400	3,340	1,570	1,550	340	6,800	3,600
A. Phanat Nikhom	72,710	24,280	18,410	5,440	14,030	62,160	10,500
A. Ban Bung	58,320	7,160	34,670	7,630	2,070	51,530	6,790
A. Phan Thong	17,590	11,290	1,580	1,090	1,550	15,510	2,080
King A. Bo Thong	42,380	2,190	24,090	8,760	1,460	36,500	5,880
A. Nong Yai	5,120	50	3,840	1,230	-	5,120	-
CHACHOENGSAO	444,490	91,210	75,030	19,500	750	186,490	258,000
A. Muang	6,760	5,110	-	780	120	6,010	750
A. Bang Khla	25,650	16,460	500	7,730	250	24,940	710
A. Ban Pho	14,770	12,550	-	950	-	13,500	1,270
A. Bang Pakong	5,450	2,680	-	440	30	3,150	2,300
A. Phanom Sarakham	112,200	21,850	22,880	1,740	120	46,590	65,610
A. Sanam Chai Khet	236,290	6,050	41,350	3,030	-	50,430	185,860
King A. Plaeng Yao	23,560	8,470	10,300	3,880	230	22,880	680
King A. Ratchasan	19,810	18,040	-	950	-	18,990	820
PRACHIN BURI	846,200	254,570	219,060	38,770	2,920	515,320	330,880
A. Muang	42,860	21,700	650	9,700	940	32,990	9,870
A. Ban Sang	29,440	25,710	-	840	30	26,580	2,860
A. Khok Pip	13,140	9,130	1,610	360	90	11,190	1,950
A. Si Maha Phot	31,820	16,580	6,320	3,050	170	26,120	5,700
A. Prachanta Kham	77,280	18,090	150	3,050	80	21,370	55,910
A. Kabin Buri	119,500	43,490	18,890	2,800	80	65,260	54,240
A. Nadi	111,180	15,010	17,330	9,700	30	42,070	69,110
A. Sa Kaew	206,550	67,070	66,310	4,830	400	138,610	67,940
A. Wang Nam Yen	69,200	4,620	56,100	1,450	80	62,250	6,950
A. Watthana Nakhon	104,050	30,960	15,480	2,500	1,000	49,940	54,110
King A. Khlong Hat	41,180	2,210	36,220	490	20	38,940	2,240
NAKHON NAYOK	149,590	80,400	1,210	7,590	1,290	90,490	59,100
A. Maung	66,030	33,490	140	3,280	290	37,200	28,830
A. Ban Na	22,270	14,890	750	2,050	930	18,620	3,650
A. Ongkharak	15,550	13,810	300	1,060	10	15,180	370
A. Pak Phli	45,470	18,120	20	1,200	60	19,490	26,250
OTHER PROVINCES	119,200	1,800	11,600	10,440	-	23,840	95,360
TOTAL	1,766,000	476,290	391,060	102,000	24,410	993,760	772,240

TABLE B-2 LAND USE BY IRRIGATION BLOCK

Irrigation Block	Project Area (ha)	Agricultural Land					Other Land Area (ha)
		Paddy (ha)	Upland (ha)	Orchard (ha)	Vegetable & RTC (ha)	Sub-total (ha)	
1 Lower Bang Pakong							
- LBP 1	3,500	-	-	160	-	160	3,340
- LBP 2	11,900	4,840	-	1,020	240	6,100	5,800
- LBP 3	52,600	43,890	1,440	5,390	1,390	52,110	490
- LBP 4	14,200	8,390	-	1,280	2,880	12,550	1,650
- LBP 5	27,900	10,480	11,870	1,490	3,860	27,700	200
- LBP 6	8,000	5,960	470	830	-	7,260	740
- LBP 7	50,100	3,970	36,440	5,110	-	45,520	4,580
- LBP 8	18,200	9,950	6,620	1,160	-	17,730	470
- LBP 9	8,800	2,620	5,460	-	-	8,080	720
- LBP 10	8,500	2,530	5,250	140	-	7,920	580
- LBP 11	18,400	640	12,770	1,020	-	14,430	3,970
- LBP 12	34,400	140	24,770	230	-	25,140	9,260
- LBP 13	5,600	2,780	1,270	-	-	4,050	1,550
- LBP 14	20,100	1,250	17,130	-	-	18,380	1,720
- LBP 15	6,500	1,850	4,180	-	-	6,030	470
- LBP 16	19,900	2,200	16,080	-	-	18,280	1,620
- LBP 17	2,000	1,190	360	-	-	1,550	450
Sub-total	310,600	102,680	144,110	17,830	8,370	272,990	37,610

TABLE B-3 LAND USE BY IRRIGATION BLOCK

Irrigation Block	Project Area (ha)	Agricultural Land					Other Land Area (ha)
		Paddy (ha)	Upland (ha)	Orchard (ha)	Vegetable & RTC (ha)	Sub-total (ha)	
2 Khlong Tha Lat							
- KTL 1	3,200	1,370	1,380	60	80	2,890	310
- KTL 2	8,600	130	7,510	140	80	7,860	740
- KTL 3	6,900	-	6,270	-	-	6,270	630
- KTL 4	13,700	790	10,080	-	-	10,870	2,830
- KTL 5	61,700	760	11,620	500	-	12,880	48,820
- KTL 6	18,100	180	8,230	-	-	8,410	9,690
- KTL 7	39,500	250	9,870	-	-	10,120	29,380
- KTL 8	39,100	380	3,640	-	-	4,020	35,080
- KTL 9	58,500	130	2,450	-	-	2,580	55,920
Sub-total	249,300	3,990	61,050	700	160	65,900	183,400
3 Upper Bang Pakong							
- UBP 1	106,000	91,940	4,670	4,910	3,900	105,420	580
- UBP 2	44,600	17,720	330	25,330	620	44,000	600
- UBP 3	75,000	34,690	31,750	3,480	2,220	72,140	2,860
- UBP 4	39,400	23,030	380	8,160	1,820	33,390	6,010
- UBP 5	10,700	-	-	-	-	-	10,700
Sub-total	275,700	167,380	37,130	41,880	8,560	254,950	20,750

TABLE B-4 LAND USE BY IRRIGATION BLOCK

Irrigation Block	Project Area (ha)	Agricultural Land					Other Land Area (ha)
		Paddy (ha)	Upland (ha)	Orchard (ha)	Vegetable & RYC (ha)	Sub-total (ha)	
4 Nae Nam Nakhon Nayok							
- NNN 1	49,800	34,280	-	800	-	35,080	14,720
- NNN 2	36,900	26,030	-	2,540	2,080	30,650	6,250
- NNN 3	34,500	17,940	1,450	1,660	1,300	22,350	12,150
- NNN 4	11,400	-	-	-	-	-	11,400
- NNN 5	45,600	3,430	1,100	7,110	-	11,640	33,960
- NNN 6	15,100	-	-	-	-	-	15,100
Sub-total	193,300	81,680	2,550	12,110	3,380	99,720	93,580
5 Middle Phra Prong							
- MPP 1	97,000	19,520	21,820	-	-	41,340	55,660
Sub-total	97,000	19,520	21,820	-	-	41,340	55,660

TABLE B-5 LAND USE BY IRRIGATION BLOCK

Irrigation Block	Project Area (ha)	Agricultural Land					Other Land Area (ha)
		Paddy (ha)	Upland (ha)	Orchard (ha)	Vegetable & STC (ha)	Sub-total (ha)	
6 Mae Nam Hanuman							
- MHM 1	91,700	20,640	18,510	15,470	80	54,700	37,000
- MHM 2	15,900	-	-	-	-	-	15,900
- MHM 3	27,300	-	-	-	-	-	27,300
- MHM 4	17,400	3,880	390	-	-	4,270	13,130
- MHM 5	6,800	-	-	-	-	-	6,800
- MHM 6	9,600	-	5,650	-	-	5,650	3,950
- MHM 7	23,200	-	-	-	-	-	23,200
- MHM 8	6,400	-	-	-	-	-	6,400
- MHM 9	14,700	-	-	-	-	-	14,700
Sub-total	213,000	24,520	24,550	15,470	80	64,620	148,380

TOTAL B-6 LAND USE BY IRRIGATION BLOCK

Irrigation Block	Project Area (ha)	Agricultural Land					Other Land Area (ha)
		Paddy (ha)	Upland (ha)	Orchard (ha)	Vegetable & RTC (ha)	Sub-total (ha)	
7 Khlong Phra Sathung							
- KPS 1	39,000	16,130	11,930	3,860	530	32,450	6,550
- KPS 2	80,100	9,240	7,040	1,990	1,300	19,570	60,530
- KPS 3	83,800	2,620	29,150	1,160	110	33,040	50,760
- KPS 4	61,400	1,970	21,850	1,160	110	25,090	36,310
Sub-total	264,300	29,960	69,970	8,170	2,050	110,150	154,150
8 Upper Phra Prong							
- UPP 1	58,800	25,040	22,840	3,850	520	52,250	6,550
- UPP 2	77,400	21,520	7,040	1,990	1,290	31,840	45,560
- UPP 3	26,600	-	-	-	-	-	26,600
Sub-total	162,800	46,560	29,880	5,840	1,810	84,090	78,710

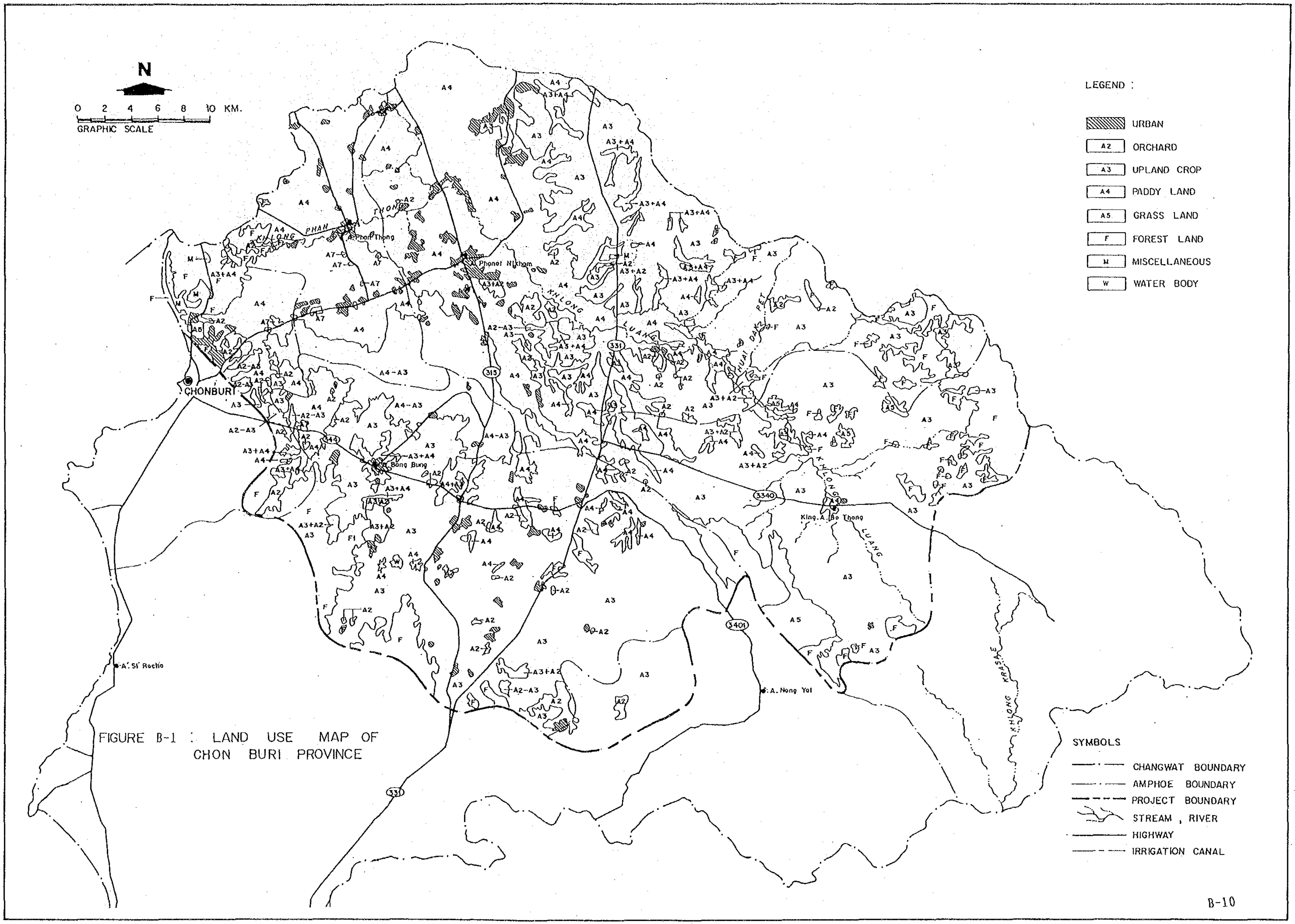


FIGURE B-1 : LAND USE MAP OF CHON BURI PROVINCE

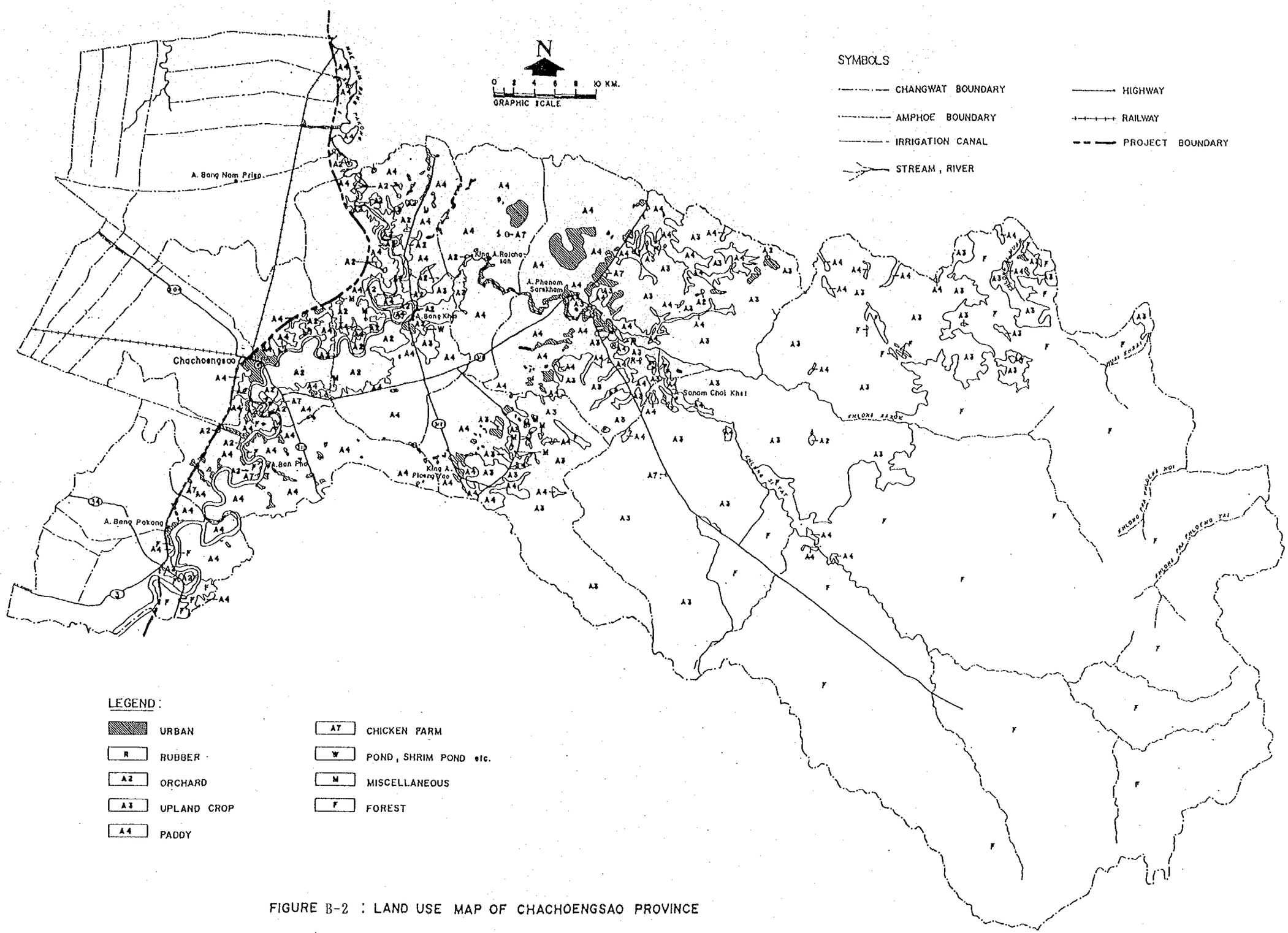


FIGURE B-2 : LAND USE MAP OF CHACHOENGSAO PROVINCE

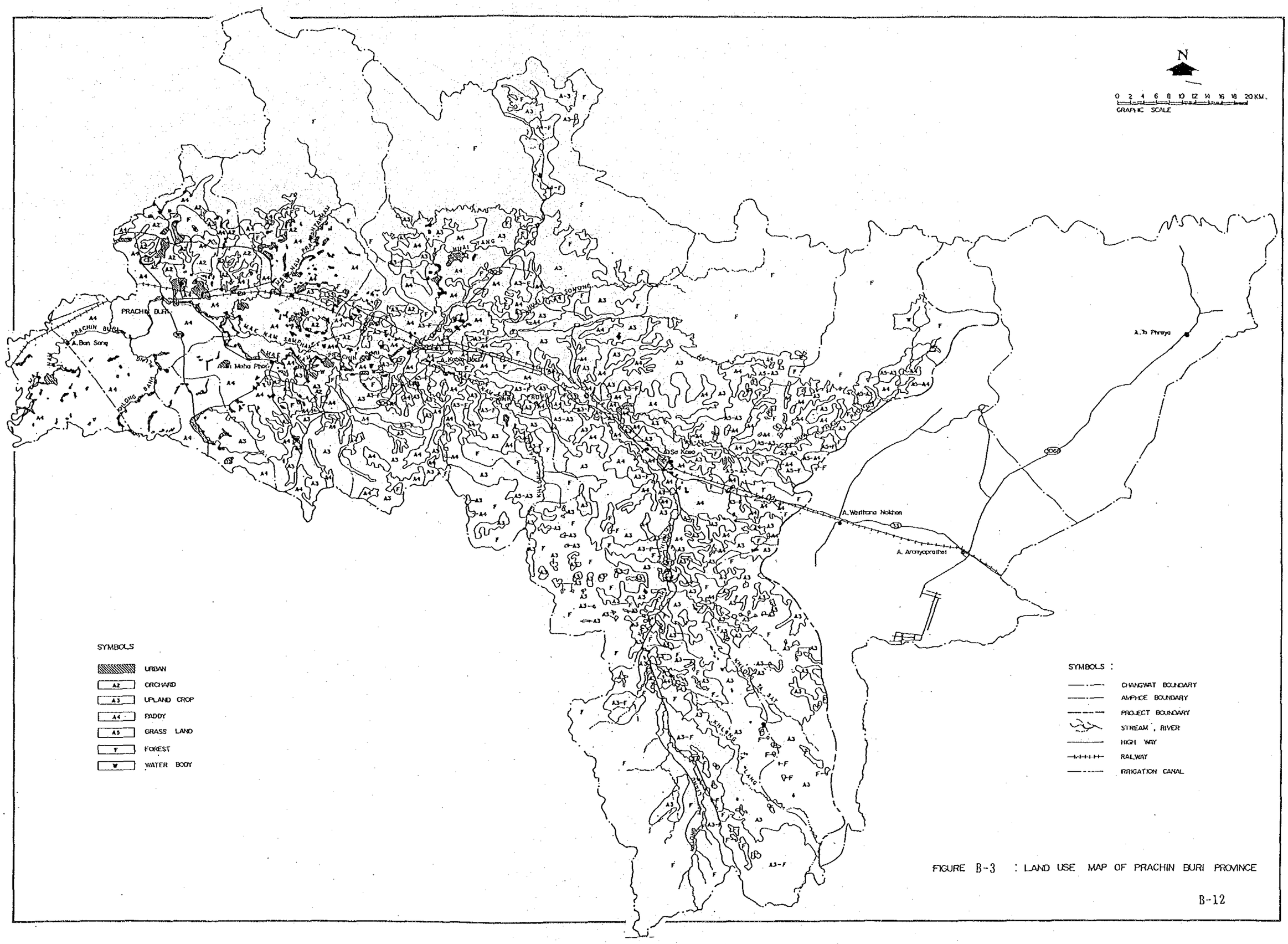


FIGURE B-3 : LAND USE MAP OF PRACHIN BURI PROVINCE

N

0 2 4 6 8 10 KM.

GRAPHIC SCALE

LEGEND :

URBAN

A2 ORCHARD + URBAN

A4 PADDY

F FOREST

SYMBOLS

CHANGWAT BOUNDARY

AMPHOE BOUNDARY

PROJECT BOUNDARY

STREAM , RIVER

HIGHWAY

IRRIGATION CANAL

Nakhon Nayok

A. Pak Phli

A. Ongkharak

A. Bon Na

Prachin Buri

Khlong Mae Nam Nai

Khlong Mae Nam Kok

Khlong Hok Wo

Mae Nam Nakhon Nayok

Mae Nom Prachin Buri

3052

3050

33

FIGURE B-4 : LAND USE MAP OF NAKHON NAYOK PROVINCE

B.2. SOIL (ALLOVER BASIN STUDY)

1. INTRODUCTION

Information on soils is very necessary for agricultural water resources development project. Soil characteristics and their suitability are certainly a guidance for land use planning, irrigation water demand estimation, irrigation system designing. The study on soils for this project is thus to provide such data for crop-diversification planning and for irrigation development as well. These data will be obtained through soil survey, soil analysis and soil suitability interpretation.

2. STUDY METHODOLOGY

A. Data Collection and Review

Soils in this area have been studied by the Department of Land Development and other agencies. As the results, following maps and references were collected and reviewed to obtain specific information required.

A) Soil Survey Division, Department of Land Development (DLD)

- Detailed Reconnaissance Soil Maps at scale 1:100,000 of Chon Buri, Chachaengsao, Prachin Buri and Nakhon Nayok.
- Soil Survey Reports of the four mentioned provinces
- Land Use Planning Reports of Chon Buri, Chachoengsao and Prachin Buri

B) Nakhon Nayok Agricultural Extension Office (DOAE)

- Report on Acid Sulfate Soil Improvement

C) Prachin Buri Rice Research Center (DOA)

- Reports on Rice Fertilizer Trials on Acid Sulfate Soils

D) Geotechnical Division, Royal Irrigation Department (RID)

- Land Classification Map (some part of project area)
- Soil analysis data

B. Field Survey

Field survey was carried out in order to:

A) check the validity of the above mentioned soil maps for use in agricultural planning.

B) make the supplementary soil survey with particular emphasis on: a) soil texture, b) problem soils

C) determine suitability for cropping and irrigation of various soil series.

D) interview with government officers of the provincial agencies concerned, private sectors and farmers.

Additional soil survey was made by an examination of soils from auger borings, road cuts and in excavations. Observations were made to a depth of 150 cm. A short description of each soil horizon was recorded in the field sheets. Descriptions contained information about depth, texture, colour, pH, occurrence of mottles and others. Soil classification at soil series level currently used in DLD was adopted. Soil sample collection was done and analyzed in laboratory.

3. RESULT OF STUDY

A. Parent Material and Landform

Soils in study area are derived from four main parent materials namely marine sediments, brackish water sediments riverine sediments and residuum and colluvium. The flat lowlands in the western of the study area occupying approximately 30 percent are mainly formed from sediments of marine, brackish water, recent and semi-recent riverine alluvium. The highlands in the eastern are originated from old alluvial deposits and residual materials from mostly elastic rocks with some granite and limestone. Old alluvium found about 28 percent occurs on terrace landform little higher than paddy land whereas residuum and colluvium are dominated on piedmont and foothill areas. Extent is about equal to old alluvial terrain, that is about 28 percent. The rest of 19 percent is devoted to mountainous and slope complex areas.

Major landforms of this area can be identified into seven groups including tidal flat, former tidal flat, floodplain, low terrace, higher terrace, foothill and mountainous areas. Soils and their distribution patterns are highly correlated with the landforms on which they occur.

B. Soil Mapping Unit

Based on detailed reconnaissance soil maps of Chon Buri, Chachoengsao, Prachin Buri and Nakhon Nayok as presented in Figures B1, 2, 3 and 4. These are distributed in the mentioned four provinces in the numbers of 28, 36, 37 and 15 units as shown in Tables B-7 to B13 respectively. Mapping units are soil series, association and complex. These subgroups and families are also shown in the mentioned tables. Their extents by Amphoe-wise in each province from Chon Buri to Nakhon Nayok were tabulated in Tables B14 to B17 respectively.

C. Soil Types and Their Characteristics

Major characteristics of all soils are tabulated in Table B-18 to B-32. Their fertility levels are shown in Table B-33 to B-39. Soil types and

characteristics can be summarized based on parent materials and landforms as follows:

A) Soils on Lowland

a) Soils Divided from Marine Sediment

These marine sediment soil types are formed on tidal flat and former tidal flat.

a) Soils on Tidal Flat

The tidal flat areas are found around the river mouth. They are still under the influences of sea water. The soils are very deep, poorly drained very dark gray unripen marine clay. Soil reaction is neutral to mildly alkaline with pH ranging from 7 to 8. Soil fertility is rather high. Theses soils are potential acid sulfate containing high content of pyrite in subsoils. Under present reduction condition, they do not show acid reaction. However, they are rapidly transformed into acid sulfate soils when they are drained due to the pyrite will be oxidized and becoming acid condition.

Soils of this group comprise The Chin and Bung Pakong series making up 6,140 ha or about 0.4 percent of study area.

Due to these soils are flooded by sea water during high tide and still being under mangrove forest, they are not suited for crop cultivation and should strict their use for existing mangrove forest and some shrimp ponds.

b) Soils on Former Tidal Flat

Former tidal flats occupy the flat areas away from the reach of sea water flooding. Soils are very deep, poorly drained, slow permeability. They are characterized by gray or brownish gray clay with brownish and greenish mottles overlying gray, olive gray or greenish gray clay with brownish and greenish mottles. Bluish unriper marine clay clay occur in deep horizon. Soil reaction is slightly acid to neutral (pH6.5 7.0) subsoil increasing to alkaline (pH8.0) with depth. They are fertile soils with high nutrient status.

Soil units grouped into this category include Smert Prakarn, Bangkok, Phan Thong, Bang Nam Pries and Chachoengsao constituing the area coverage of about 40,200 ha or 2.5 percent of study area. Chachoengsao series is the biggist unit covering about 24,000 ha or around 1 percent.

These soils are now under paddy, they are best suited for paddy cultivation and worthy for irrigation development. Many upland crops such as soybean, mungbean and vegetables can be grown in dry season under irrigation scheme.

b) Soils Derived from Brackish Water Sediment

They occur on former tidal flat area developing from brackish water deposits. Most soils are actual acid sulfate having clayey texture throughout the profile. Horizon of dark gray clay occurs in the deep subsoils normally below 150 cm. The profile contains straw yellow jarosite mottles at some depths causing very strongly acid to extremely acid reaction. Such a low pH will reduce availability of phosphorus and make alluminum and iron toxic. Activity of soil microbs becomes very low and physical property of soils are poor resulting in low productivity.

Soils included are Cha-am, Maha Phot, Rangst, Rangsit-very acid, Onkharak, Don Muang and undifferentiated ridged acid soils. The extents are approximately 204,800 ha or 12 percent of study area. Rangsit series is the biggest unit covering some 96,500 ha or 6 percent of study area.

Due to acidity, these soils are modurately to poorly suited for paddy. However, with lime application at favorable rate and under irrigated water, acidity will be reduced resulting in increasing of rice yield. Some paddy areas have been changed to many kinds of fruit orchards such as mango, coconut, tangerine and palmelo. In dry season, many upland crops and vegetables can be grown. To leach soil acidity dry season rice crop is most favorable.

c) Soils Derived from Riverine Sediment

Riverine alluvial sediments are transported by riverine flesh water. On lowlands of the project area, they are formed on floodplain and low terrace which can be discussed as following.

i) Soils on Floodplain

Floodplain formations include river levees and flat areas or back swamps away from river.

Soils on levees: They are very deep, moderately well drained, stratified, fine-loamy with some mottles in subsoils. Soil reaction varies from strongly acid to slightly acid with pH of 5.0 to 6.5. Nutrient status is relatively low.

There are two soil series including Chiang Mai and Pran Bri. They are recognized only small extent of about 900 ha or 0.5 percent of study area.

They are well suited for orchard and for irrigation purpose.

Soils on back swamps: They are very deep, poorly drained with grayish brown or yellowish brown clay loam to clay. They are flooded by impounded rain and river water during the rainy season. Soil reaction is from medium to slightly acid with pH of 5.5 to 6.5.

Two soils are mapped namely Ratchaburi and Bang Pa-in covering about 12,000 ha or 0.7 percent of study area.

They are now used for paddy cultivation which is well suitable for irrigation.

ii) Soils on Low Terrace: They are move matured than those of floodplains. Clay illuviation has brought about the formation of an argillic horizon in most soils. They consist of either fine loamy or clayey with a wide range of colours from gray to brown. Distinct and prominent red and yellowish brown mottles occur throughout the profile. Soil reaction is between slightly to strongly and with pH of 5.0 to 6.5. Nutrient status is relatively low.

Soil units in this group are Alluvial Complex-poorly drained and well drained, Chon Buri, Klang, La-ngu, Hin Kong, Roi Er, Makham and Phen. They cover about 228,400 ha or 14 percent of study area.

The are considered moderately suited for paddy and well suited for irrigation development.

B) Soils on Highland

On highlands, soils are developed from the materials namely old alluvium on middle terrace, residuum and colluvium from elastic rocks, granite and limestone on high terrains.

a) Soils Derived from Old Aluvium

These soils occur on middle terraces which are found in positions above nearly flat low terraces. Topography is undulating dissected by many small tributaries. Soils derived from this parent material an either sandy, loamy or gravelly textures.

i) The sandy soils are very deep, excessively drained having sand or loamy sand texture throughout. Sandy clay loam may occur in the deep subsoil below 80-100 cm. Water holding capacity is very low and

permeability is high. Fertility is low. Only one soil unit is recognized in the area of about 8,250 ha or 0.5 percent of study area. These soils are generally not suited for paddy and poorly suited for upland crops due to sandy texture. Irrigation water cannot be irrigated by normal method because of the soil is too permeable and topography is uneven and high. They should be under rainfed upland crop cultivation.

ii) The loamy soils are very deep, moderately well drained to well drained. Colours vary from brown, strong brown to yellowish red. Water holding capacity is medium and permeability is moderate. Fertility is low. They are generally well suited for orchard and moderately suited for upland crops. Irrigation development is possible by particular method depending on topography. Soil units are Ko Khanun, Don Rai, Khor Satuk, Warin and Yosothon covering the area about 293,660 ha or about 18 percent of study area. Khorat series occupies the most extent about 80,000 ha or 5 percent.

iii) The gravelly soils are those having lateritic concretions at shallow depth making them poorly suited for upland crops and not favorable for irrigation. Soils classified in this type are Phon Phi Bang Khla, Pang Rai, Nong Khok and Mae Rim making up 165,700 ha or about 10 percent. Bang Khla series are the biggest covering about 85,200 ha or 5 percent of study area. These soils should be cultivated to upland crop, tree crop or reforest.

b) Soils Derived from Residuum and Colluvium

The residual and colloquial soils occur on highlands, foothill slopes and mountainous areas comprising those formed from elastic rock, granite and limestic.

i) Soils developed from elastic rocks are mostly gravelly soils poorly suited for upland crops, and not suited for irrigation. Those are Kabin Buri, Chiang Khan, Wang Shaphung. O Lum Chiak, Husi Yot, Muak Lat Ya and Tha Yang, totalling 214,850 ha or about 13 percent of study area. Kabin Buri series cover the largest area of about 93,200 ha or 6 percent of study area. They are suited for upland crops, tree crops or reforestation. Thap Phrik and Thap Kwang series are only two soils that are very deep, medium-textured suitable for orchard and upland crops. However, irrigation suitability is based on topography.

ii) Soils derived from granitic rocks are very deep sand y and coarse loamy-textured poorly suited for upland crops and not suited for irrigation. Soil units include Ban Bung, Hup Kapong, Sattahip, Map Bon and Mong Mot series. They occupy 111,600 ha or about 7 percent

of study area. Ban Bung series having 41,300 ha or 2.5 percent are the biggest soils. They should be under upland crop or tree crop.

iii) Soils derived from limestone are found very small area of about 9,200 ha. or 0.5 percent. Mast are clayey soils having relatively high fertility. Lop Buri, Takhli and Bung Chanang are included, Lop Buri series are very deep, black or very dark grayish brown clay. Tha Khli series are similar to Lop Buri but containing lime concretions. Bung Chanang series are shallow to moderately deep, yellowish red clay. Lop Buri soils should be used for orchard or upland crop while Tha Khli and Bung Chanang are for upland crop or tree crop plantation.

Soils on mountainous areas are generally very shallow. Due to many severe limitations such as very high and steep topgraphy, severe erosion, they are not suited for any kind of crop cultivation and should be under forest. The extents are approximately 287,350 ha or about 17 percent of study area.

D. Soil Suitability Classification

For effective land use planning, soil suitability for specific use is essential. In this section, the suitability of soils is identified for paddy (P), non-flooded annual crop (N) and fruit tree plantation (F).

(1) Soil Suitability Class: Principally, there are five classes as follows:

Class I (P-I, N-I, F-I): Soils very well suited having no significant limitations

Class II (P-II, N-II, F-II): Soils well suited having slight limitations

Class III (P-III, N-III, F-III): Soils moderately suited having moderate limitations that require special management

Class IV (P-IV, N-IV, F-IV): Soils poorly suited having severe limitations that require very careful management

Class V (P-V, N-V, F-V): Soils not suited having very severe limitations that preclude their use for crop production with ordinary method.

(2) Soil Suitability Subclass: At the lower level, the suitability classes are further identified into subclasses based on kinds and degree of hazard of limitations.

The followings are the main limitations used in identifying suitability classes into subclasses.

f: flooding - susceptibility to flash floods or prolonged dup flooding or both, which damage the crops or limit choice of crops.

x: salinity - excessive salts which affect crop growth

s: unfavorable surface soil texture

j: jarosite

n: low nutrient status or low fertility

g: gravels in soil profile

w: risk of water shortage - water stress in growing season

d: impeded drainage

t: topography of slope

c: consolidated layer.

Suitability subclass for paddy, non-flooded annual crop and fruit tree of each soil unit are given in Table B-40 to B-42.

E. Land Plan Analysis and Management

This section will cover general view of land use planning emphazing on analysis of land use suitability zonings for crop cultivation and other land use types. These are made based on information on soil suitability discussed in 3.5 and existing land use conditions.

In all, eightzones of suitable land use of study area were distinguished listed as follows:

Zone 1: Soils suited for paddy, well suited for irrigation

Zone 2: Soils suited for upland crop, not suited for irrigation

Zone 3: Soils suited for upland crop, tree crop or reforestation, not suited for irrigation

Zone 4: Soils suited for upland crop on tree crop, not suited for irrigation.