Unit : m^3/s-d

Year Date	1986 JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1	5.01	3.97	2.21	2.42	3.97	11.11	11.91	16.00	37.00	23.20	26.20	9.92
2	4.73	3.97	2.42	2.21	3.97	10.32	11.91	13.70	32.50	25.00	25.00	9.53
3	4.73	3.97	2.42	2.62	4.73	9.92	12.31	13.70	29.20	20.80	24.40	9.53
4	4.73	3.97	2.42	2.04	4.45	8.53	12.31	13.70	31.00	19.00	23.00	9.53
5	4.73	3.97	2.42	2.04	5.28	9.53	11.91	14.90	34.70	19.00	22.00	9.13
6	4.73	3.97	2.42	1.87	5.01	9.13	11.91	20.20	37.00	18.40	21.40	9.13
7	4.73	3.72	2.42	1.87	6.15	9.53	11.91	16.00	44.50	17.20	20.80	9.13
8	4.45	3.72	2.42	1.87	6.15	9.13	11.91	16.60	45.20	16.60	19.60	9.13
9	4.45	3.72	2.42	2.04	6.46	8.73	11.91	22.00	41.50	16.00	19.00	8.78
10	4.21	3.43	2.21	3.24	7.09	8.44	11.91	26.20	41.50	14.90	18.41	8.14
11	4.21	3.03	2.62	2.83	7.40	8.78	11.91	34.00	38.50	14.90	17.82	8.09
12	4.21	2.83	2.42	2.21	7.75	10.72	11.11	37.80	37.80	14.90	18.41	8.09
13	4.21	2.83	2.21	2.42	8.44	13.69	9.13	38.50	45.20	14.90	17.32	8.09
14	4.21	2.83	2.21	2.62	8.78	12.70	8.78	54.50	40.00	20.80	17.23	7.40
15	4.21	2.83	2.21	2.83	8.78	10.72	11.51	128.00	35.50	18.40	17.32	7.40
16	3.97	2.83	2.04	2.83	9.92	11.51	13.10	58.30	28.60	17.20	16.05	7.40
17	3.97	2.83	2.04	3.03	11.11	11.91	15.45	43.00	28.60	16.00	14.37	7.40
18	3.97	2.83	2.62	3.48	10.32	11.91	16.54	39.30	28.00	17.20	14.28	6.78
19	3.97	2.83	2.62	3.97	16.05	11.91	19.60	37.00	28.20	17.80	14.28	6.46
20	3.97	2.83	2.83	4.21	19.00	12.70	19.60	34.00	25.60	14.90	13.59	6.15
21	3.97	2.83	3.72	5.01	13.10	13.69	12.31	30.40	22.00	14.30	13.10	5.84
22	3.97	2.83	3.03	5.56	11.91	11.11	11.91	32.50	22.00	54.50	12.70	5.56
23	3.97	2.83	2.62	5.28	11.91	10.32	12.31	31.80	22.00	26.80	13.40	5.23
24	3.97	2.83	2.62	5.01	13.69	12.31	13.59	29.20	21.40	26.80	11.91	5.01
25	3.97	2.83	3.03	5.46	13.10	12.70	13.59	34.00	22.60	26.80	11.51	5.91
26	3.97	2.83	3.03	6.46	12.31	13.40	14.23	32.50	23.20	26.80	10.32	5.56
27	3.97	2.62	2.62	5.84	11.91	13.63	14.28	29.20	22.00	26.80	9.92	5.84
28	3.97	2.42	2.62	5.01	9.92	14.23	17.28	37.80	21.40	27.40	9.92	5.84
29	3.97		2.42	4.45	10.72	14.23	16.64	35.50	22.00	29.20	9.92	5.84
30	3.97		2.42	3.72	11.11	12.70	16.05	45.20	23.20	28.60	9.92	5.84
31	3.97		2.42		11.11		16.64	38.50		26.80		5.56
TOTAL	131.07	88.93	78.15	104.45	291.60	339.24	415.46	1054.00	931.90	671.90	493.10	227.24
AVE.	4.23	3.18	2.52	3.48	9.41	11.31	13.40	34.00	31.06	21.67	16.44	7.33
MAX.	5.01	3.97	3.72	6.46	19.00	14.23	19.60	128.00	45.20	54.50	26.20	9.92
MIN.	3.97	2.42	2.04	1.87	3.97	8.44	8.78	13.70	21.40	14.30	9.92	5.01
DAYS	31	28	31	30	31	30	31	31	30	31	30	31

ANNUAL TOTAL	4827.0
ANNUAL AVERAGE	13.22
ANNUAL MAX.	128.00
ANNUAL MIN.	1.87
ANNUAL DAYS	365

Unit : m^3/s-d

YEAR	1989											
Date	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1					4.44	26.44		22.42	24.68	24.10		
2					4.44	26.44	13.96	20.26	50.00	22.97		
3	4.44	3.46	2.40	2.59	6.43	20.26		31.40	39.58	21.87	10.63	6.75
4					4.44	17.71		51.00	35.38	30.12		
5					19.74	20.26		68.00	43.00	31.40		
6					9.12	20.26		51.00	100.00			
7					5.83	17.71	14.86	32.05	88.50			
8	3.94	2.80	2.02	2.02	13.96	17.71		31.40	75.04	19.74	10.24	6.43
9					6.43	15.78		31.40	38.16			
10					11.42	68.50		28.87	74.08			
11					29.49	25.84		62.95	38.16	18.21		
12					6.13	25.26	13.09	75.04	34.04	17.71		
13	4.44	2.80	2.02	2.02	22.97	22.42		51.00	38.16	46.30	9.86	5.54
14					13.96	21.33		43.00	50.00	24.10		
15					7.07	18.71		28.87	31.40	19.74		
16								34.04				
17								32.05				
18	3.94	2.59	2.20	3.23	9.12	15.32	13.52	60.30	33.37	17.71	8.41	5.26
19								65.65				
20								31.04				
21							28.87	43.00				
22	3.70	2.40	2.20	3.94	8.41	16.73	13.09	28.87	28.87	13.09	7.39	4.98
23							185.00	35.38				
24							67.00	28.87				
25							46.00	28.87				
26					7.39	20.79	37.00					
27					5.83	14.86	35.00	24.68	26.44	11.02	7.39	4.71
28	3.46	2.40	1.84	4.98	123.00	18.71	28.87					
29					20.26	18.71	28.87					
30					18.21	13.96	31.40					
31	3.46	2.40	1.84	4.98	22.97	13.96	28.87	32.71	25.26	10.24	7.07	4.44
TOTAL	27.38	18.85	14.52	23.76	381.06	497.67	585.40	1074.12	874.12	328.32	60.99	38.11
AVE.	3.91	2.69	2.07	3.39	16.57	21.64	39.03	39.78	46.01	21.89	8.71	5.44
MAX.	4.44	3.46	2.40	4.98	123.00	68.50	185.00	75.04	100.00	46.30	10.63	6.75
MIN.	3.46	2.40	1.84	2.02	4.44	13.96	13.09	20.26	24.68	10.24	7.07	4.44
DAYS	31	28	31	30	31	30	31	31	30	31	30	31

ANNUAL TOTAL	3924.30
ANNUAL AVERAGE	17.59
ANNUAL MAX.	185.00
ANNUAL MIN.	1.84
ANNUAL DAYS	365

Unit : m^3/s-d

YEAR Date	1990 JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1	4.19	2.59	1.51	3.46		3.01	5.54	20.26	17.71	28.87	36.00	13.96
2												
3										80.00		
4			1.84	1.68		5.83		17.22		43.00		
5						3.23						
6												
7												
8									22.42			
9	3.70		4.71					17.71		34.71	22.97	
10			3.46					13.52				
11		1.68	3.23				6.13	11.02				13.09
12			1.84									
13						5.83	8.76			29.49		
14	3.46						9.12					
15							13.09			34.71	15.78	
16				3.70			15.32					
17						8.76	42.00			29.49		
18			1.51				15.32					
19						15.32						
20									43.00		13.52	
21						8.76				36.00		
22	2.80	1.51				5.83		43.00				
23						9.12		20.26				
24						12.24						
25						7.39			29.49			
26			3.23			5.83		15.32				
27				3.23								
28							17.71	22.97				
29												
30								17.71			13.96	
31												
TOTAL	14.15	5.78	21.33	12.07	0.00	91.15	132.99	198.99	112.62	316.27	102.23	27.05
AVE.	3.54	1.93	2.67	3.02		7.60	14.78	19.90	28.16	39.53	20.45	13.53
MAX.	4.19	2.59	4.71	3.70		15.32	42.00	43.00	43.00	80.00	36.00	13.96
MIN.	2.80	1.51	1.51	1.68		3.01	5.54	11.02	17.71	28.87	13.52	13.09
DAYS	31	28	31	30	31	30	31	31	30	31	30	31

ANNUAL TOTAL	1034.63
ANNUAL AVERAGE	14.10
ANNUAL MAX.	80.00
ANNUAL MIN.	1.51
ANNUAL DAYS	365

A3.5.2 Rainfall Record for TANK MODEL Analysis

Daily Rainfall Record at Nonghin Staton (1980-1990)

Unit : mm

NONGHINE PRECIPITATION 1980

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	0.0	0.0	1.0	0.0	0.0	58.0	0.0	29.4	2.1	2.0	0.0	0.0
2	0.0	0.0	0.0	8.6	0.0	3.1	4.8	0.0	10.7	0.0	4.0	0.0
3	0.0	0.0	0.0	0.8	2.0	8.8	16.0	0.0	2.7	0.0	6.1	0.0
4	0.0	0.0	0.0	25.0	12.2	0.0	14.9	0.0	57.3	0.0	0.0	0.0
5	0.0	0.0	0.0	7.2	6.3	0.0	12.4	0.0	11.9	1.1	0.0	2.2
6	0.0	6.0	0.0	4.2	18.0	0.0	2.8	12.9	3.3	13.1	0.0	0.0
7	0.0	0.0	0.0	11.0	1.8	29.0	14.8	0.0	1.3	0.9	0.0	0.0
8	0.0	0.0	0.0	6.8	0.0	34.5	0.1	0.0	0.0	4.1	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.0	13.2	0.0	0.0
10	0.0	0.0	0.0	0.0	37.8	27.6	0.4	7.2	0.0	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	15.4	0.2	7.0	15.1	26.4	0.0	0.0
12	0.0	0.0	7.2	0.0	48.2	0.6	0.3	10.0	0.0	0.0	0.0	0.0
13	0.0	0.0	22.0	0.0	46.0	1.0	0.1	10.6	10.4	0.2	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	0.0	0.0
15	0.0	0.0	0.0	0.0	18.2	47.8	0.0	21.2	20.2	3.9	0.0	0.0
16	0.0	0.0	0.0	48.6	134.8	1.4	10.1	26.1	42.0	4.0	4.0	0.0
17	0.0	0.0	0.0	0.0	59.0	16.2	0.0	0.0	5.4	2.3	9.0	0.0
18	0.0	0.0	4.0	0.0	0.0	7.0	10.4	0.0	35.0	2.1	0.6	0.0
19	0.0	0.0	0.0	0.0	82.4	6.5	10.4	13.4	6.0	9.2	0.0	0.0
20	0.0	0.0	31.6	0.0	0.0	6.8	13.4	0.0	2.4	0.0	0.0	0.0
21	0.0	0.8	5.0	0.0	0.0	0.2	67.8	24.2	16.4	0.0	0.0	0.0
22	0.4	27.2	8.6	0.0	0.0	39.2	57.6	15.4	41.0	0.0	0.0	0.0
23	0.0	0.0	34.2	0.0	0.0	4.0	49.9	12.4	5.1	8.2	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0	18.4	1.5	3.2	0.0	41.4	0.0	0.0
25	0.0	0.0	0.0	0.0	0.0	3.0	0.2	95.6	0.0	0.0	0.0	0.0
26	0.2	0.0	0.0	36.0	0.0	73.4	4.4	3.9	0.0	1.2	0.0	0.0
27	0.0	0.0	0.0	0.0	0.0	11.3	10.8	10.1	20.0	22.6	0.0	0.0
28	0.0	0.0	0.0	0.0	31.4	24.8	0.1	11.8	4.0	5.1	0.0	0.0
29	0.0	0.0	0.0	0.0	4.0	10.8	18.0	36.0	30.8	9.9	0.0	0.0
30	0.0		0.0	0.0	0.0	0.1	1.1	14.5	27.3	4.9	0.0	0.0
31	0.0		0.0		0.0		0.0	8.0		0.0		0.0
TOTAL	0.6	34.0	113.6	148.2	502.1	450.7	322.5	372.9	370.4	178.5	23.7	2.2
AVERAGE	0.0	1.2	3.7	4.9	16.2	15.0	10.4	12.0	12.3	5.8	0.8	0.1
MAXIMUM	0.4	27.2	34.2	48.6	134.8	73.4	67.8	95.6	57.3	41.4	9.0	2.2
MINIMUM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ANNUAL

TOTAL	AVERAGE	MAXIMUM	MINIMUM
2519.4	6.9	134.8	0.0

NONGHINE PRECIPITATION 1981

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	0.0	0.0	0.0	0.0	0.0	4.8	40.2	49.6	32.2	61.2	15.6	0.0
2	0.0	0.0	16.1	15.6	0.0	40.9	4.9	5.7	0.0	4.2	0.6	0.0
3	0.0	0.0	3.2	51.3	34.2	1.2	20.5	46.4	0.0	15.5	0.0	0.0
4	0.0	0.0	0.0	29.2	2.1	1.3	83.1	48.6	0.0	9.7	17.0	0.0
5	0.0	0.0	12.9	6.0	6.0	12.5	19.7	28.7	0.0	16.8	0.0	0.0
6	0.0	0.0	0.0	25.0	23.0	21.4	5.2	25.9	0.0	0.5	1.0	0.0
7	0.0	0.0	0.0	0.0	32.2	33.6	0.4	81.2	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	33.4	10.8	92.4	35.1	51.2	0.0	0.0
9	0.0	0.0	36.0	0.0	4.8	20.7	44.5	33.9	3.0	0.6	0.0	0.0
10	0.0	0.0	13.6	0.0	0.0	65.3	0.2	2.5	29.0	5.8	0.0	0.7
11	0.0	0.0	11.8	2.6	6.4	40.0	5.2	1.8	14.5	0.0	0.0	0.0
12	0.0	0.0	23.5	4.2	0.0	40.3	15.9	13.2	0.0	0.0	0.0	0.0
13	0.0	0.0	47.4	6.3	19.4	73.5	24.8	34.4	0.0	6.2	3.0	0.0
14	0.0	0.0	1.5	0.0	16.4	36.7	38.3	12.7	0.0	10.5	0.0	0.0
15	0.0	0.0	0.0	0.0	33.6	30.2	0.4	3.9	0.0	15.8	1.8	0.0
16	0.0	0.0	0.0	0.0	0.0	20.2	1.2	34.5	0.0	34.1	2.0	0.0
17	0.0	0.0	0.0	0.0	0.0	27.9	2.3	25.4	0.0	0.0	0.0	0.0
18	0.0	0.0	0.0	0.0	34.4	31.5	6.3	40.9	18.1	0.0	0.0	0.0
19	0.0	0.0	0.0	30.5	60.2	14.9	12.0	33.6	0.0	6.0	0.0	0.0
20	0.0	5.2	0.0	18.7	10.2	25.9	56.9	6.5	10.6	0.0	0.0	0.0
21	0.0	0.0	0.0	0.0	34.4	60.1	15.5	0.0	0.0	1.6	0.0	0.0
22	0.0	0.0	0.0	0.0	57.5	30.7	11.9	2.6	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0	0.0	6.2	9.6	0.9	12.7	0.0	8.8	0.0
24	0.0	4.4	0.0	13.0	0.0	0.0	10.1	0.0	0.0	0.0	0.0	0.0
25	0.0	6.0	4.0	15.9	15.5	0.0	0.0	25.1	0.0	0.0	0.0	0.0
26	0.0	85.2	3.7	0.0	16.5	0.0	2.0	12.9	0.0	0.0	0.0	0.0
27	0.0	46.6	0.4	0.0	0.0	11.8	15.7	0.0	14.6	0.0	0.0	0.0
28	5.8	22.0	0.0	14.6	0.0	6.4	1.3	12.8	14.8	0.0	0.0	0.0
29	2.3		0.0	30.9	0.5	0.5	3.7	10.3	3.5	0.0	0.0	0.0
30	0.0		0.0	21.9	0.0	0.0	0.6	13.5	5.2	3.5	0.0	0.0
31	0.0		4.2		0.0		0.5	5.7		0.0		0.0
TOTAL	8.1	169.4	178.3	285.7	407.3	691.9	463.7	705.6	193.3	243.2	49.8	0.7
AVERAGE	0.3	6.1	5.8	9.5	13.1	23.1	15.0	22.8	6.4	7.8	1.7	0.0
MAXIMUM	5.8	85.2	47.4	51.3	60.2	73.5	83.1	92.4	35.1	61.2	17.0	0.7
MINIMUM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ANNUAL

TOTAL	AVERAGE	MAXIMUM	MINIMUM
3397.0	9.3	92.4	0.0

NONGHINE PRECIPITATION 1982

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	0.0	0.0	16.1	4.6	0.0	0.0	4.8	0.0	71.0	9.8	0.0	43.2
2	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.0	43.2	5.4	0.0	0.0
3	0.0	0.0	6.8	7.9	46.1	4.7	7.3	12.8	6.6	2.6	0.0	0.0
4	0.0	0.0	0.0	16.2	0.0	0.0	110.0	4.6	11.4	0.0	0.0	0.0
5	0.0	0.0	17.2	2.5	0.0	17.4	30.5	30.2	21.8	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	7.6	5.0	108.7	0.0	11.2	0.0
7	0.0	0.0	26.1	0.0	0.0	5.9	0.0	17.8	8.2	0.0	40.0	0.0
8	0.0	0.0	7.5	18.9	0.0	3.3	20.8	16.8	17.8	0.0	21.5	0.0
9	0.0	0.0	30.2	0.0	0.0	17.5	1.5	14.4	2.5	0.0	0.0	0.0
10	0.0	0.0	5.4	0.0	0.0	25.8	0.0	53.2	26.2	10.2	18.5	0.0
11	0.0	0.0	0.0	15.8	0.0	3.0	4.4	12.5	2.2	2.9	0.0	0.0
12	0.0	0.0	0.0	38.2	1.2	2.6	0.0	36.8	19.2	5.0	8.4	0.0
13	0.0	0.0	0.0	25.0	0.0	8.7	3.3	1.0	0.0	0.0	33.2	0.0
14	0.0	0.0	0.0	7.8	0.0	3.3	76.2	2.3	0.0	0.0	5.8	0.0
15	0.0	0.0	0.0	0.0	0.0	2.4	3.2	8.1	0.0	0.0	48.8	0.0
16	0.0	0.0	0.0	0.0	15.3	3.4	50.4	15.1	0.0	0.0	22.5	0.0
17	0.0	0.0	0.0	0.0	8.5	3.2	4.5	15.0	18.4	0.0	14.4	0.0
18	0.0	0.0	0.0	54.2	3.7	3.0	37.9	15.7	0.0	0.0	0.0	0.0
19	0.0	0.0	0.0	9.3	4.6	21.2	3.2	22.8	0.0	13.1	10.4	0.0
20	0.0	0.0	0.0	0.4	3.8	0.4	15.3	60.4	0.0	7.2	0.0	0.0
21	0.0	1.7	0.0	0.4	63.5	0.0	17.6	17.8	12.6	0.0	13.1	0.0
22	0.0	2.1	0.0	0.0	0.0	6.8	0.0	9.3	2.4	0.0	0.0	0.0
23	0.0	30.1	0.0	5.1	0.0	6.2	2.2	10.5	11.5	11.4	0.0	0.0
24	0.0	5.9	0.0	10.6	0.0	20.8	39.5	4.2	9.2	10.2	18.3	0.0
25	0.0	0.0	0.0	0.0	8.9	33.9	16.2	3.7	1.3	2.1	20.6	0.0
26	0.0	0.0	20.4	0.0	0.0	60.5	87.2	0.0	2.9	8.2	0.0	0.0
27	0.0	2.7	5.5	1.2	0.0	29.5	36.5	3.7	0.0	5.1	15.8	0.0
28	0.0	0.0	0.0	0.0	49.8	68.8	14.1	13.7	54.2	0.0	0.0	0.0
29	0.0		0.0	0.0	0.0	15.5	3.1	26.4	5.7	0.0	19.8	0.0
30	0.0		5.2	0.0	0.0	9.4	16.3	6.4	23.2	0.0	0.0	0.0
31	0.0		4.0		0.0		7.6	2.4		0.0		0.0
TOTAL	0.0	42.5	144.4	218.1	205.4	377.2	622.9	442.6	480.2	93.2	322.3	43.2
AVERAGE	0.0	1.5	4.7	7.3	6.6	12.6	20.1	14.3	16.0	3.0	10.7	1.4
MAXIMUM	0.0	30.1	30.2	54.2	63.5	68.8	110.0	60.4	108.7	13.1	48.8	43.2
MINIMUM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

A N N U A L			
T O T A L	A V E R A G E	M A X I M U M	M I N I M U M
2992.0	8.2	110.0	0.0

NONGHINE PRECIPITATION 1983

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	0.0	0.0	0.0	0.0	2.8	0.0	7.4	19.0	29.1	31.1	2.3	0.0
2	9.3	0.0	0.0	23.4	4.2	0.0	0.0	65.0	0.0	29.1	0.0	0.0
3	0.0	0.0	0.0	0.0	105.8	0.0	0.0	8.9	11.8	26.1	0.0	0.0
4	0.0	0.0	0.0	0.0	1.0	0.0	0.0	21.6	0.0	10.3	9.1	0.0
5	0.0	0.0	0.0	0.0	56.7	0.0	4.2	0.0	0.0	4.1	1.8	0.0
6	0.0	0.0	0.0	0.0	3.8	17.8	6.4	0.0	72.6	6.4	0.0	0.0
7	0.0	0.0	0.0	0.0	66.5	23.2	12.4	0.0	12.2	12.0	0.0	0.0
8	0.0	0.0	0.0	0.0	0.0	51.8	3.4	17.8	0.0	18.0	0.0	0.0
9	0.0	0.0	0.0	0.0	16.8	0.0	0.0	0.0	0.0	10.6	0.0	0.0
10	0.0	0.0	38.2	0.0	95.5	0.0	0.0	0.0	0.0	0.0	0.0	5.3
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.2	0.0	4.5	0.0	1.2
12	0.0	0.0	0.0	0.0	0.0	49.8	7.8	0.0	0.0	1.6	10.3	0.3
13	0.0	0.0	0.0	0.0	0.0	79.7	0.0	5.2	0.0	56.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0	18.8	0.0	55.2	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	6.0	1.2	0.0	0.0	59.6	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	10.4	50.1	2.1	19.8	0.0	0.0	0.0	0.0	0.0
17	0.0	0.0	0.0	7.0	1.8	0.0	27.3	17.0	3.0	0.0	0.0	0.0
18	0.0	0.0	12.4	0.0	0.0	2.2	42.3	4.5	5.8	18.4	0.0	0.0
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.2	6.0	0.0	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0	0.0	37.8	1.3	23.6	30.2	0.0	0.0
21	0.0	0.0	0.0	12.6	0.0	0.0	27.2	8.4	0.0	0.0	0.0	0.0
22	0.0	0.0	0.0	16.4	0.0	0.0	8.9	5.2	2.4	0.0	8.1	0.0
23	0.0	0.0	0.0	0.0	0.0	14.8	1.1	64.2	1.1	0.0	2.4	0.0
24	0.0	0.0	0.0	0.0	0.0	17.2	1.4	18.6	33.8	0.0	0.0	1.5
25	0.0	0.0	0.0	66.8	0.0	178.0	2.5	15.2	44.8	18.3	0.0	0.0
26	0.0	0.0	0.0	55.1	0.0	116.3	5.1	7.3	14.6	14.8	0.0	0.0
27	0.0	0.0	0.0	0.0	45.0	14.2	2.2	3.1	43.2	0.0	0.0	0.0
28	0.0	0.0	0.0	0.0	5.1	0.0	0.0	0.0	50.7	8.5	0.0	0.0
29	0.0		0.0	9.1	9.7	0.0	0.0	0.0	39.5	0.0	0.0	0.0
30	0.0		0.0	35.2	11.2	0.0	0.0	22.2	26.4	0.0	0.0	0.0
31	0.0		19.3		3.4		2.3	4.8		9.8		0.0
TOTAL	9.3	0.0	69.9	242.0	480.6	585.9	219.5	442.5	420.6	309.8	34.0	8.3
AVERAGE	0.3	0.0	2.3	8.1	15.5	19.5	7.1	14.3	14.0	10.0	1.1	0.3
MAXIMUM	9.3	0.0	38.2	66.8	105.8	178.0	42.3	65.0	72.6	56.0	10.3	5.3
MINIMUM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ANNUAL			
TOTAL	AVERAGE	MAXIMUM	MINIMUM
2822.4	7.7	178.0	0.0

NONGHINE PRECIPITATION 1984

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	0.0	0.0	0.0	10.5	1.9	6.9	3.4	66.6	99.5	6.3	0.0	0.0
2	0.0	0.0	5.2	8.2	3.2	0.0	0.0	75.8	64.5	9.0	2.1	0.0
3	0.0	0.0	0.0	3.4	29.1	25.0	10.3	15.5	3.3	2.4	15.3	0.0
4	0.0	0.0	0.0	0.0	0.0	6.3	5.9	7.0	13.5	12.5	0.0	0.0
5	0.0	2.3	0.0	0.0	0.0	0.0	0.0	13.5	0.0	45.9	0.0	0.0
6	0.0	0.0	0.0	27.5	0.0	14.6	2.3	5.2	82.5	26.5	0.0	0.0
7	0.0	0.0	10.9	35.2	0.0	7.1	2.4	4.3	2.2	41.2	3.4	0.0
8	0.0	0.0	23.8	17.3	0.0	9.5	22.0	14.0	1.9	9.9	54.3	0.0
9	0.0	0.0	2.2	17.3	0.0	6.0	2.0	9.1	27.3	5.0	3.8	0.0
10	0.0	0.0	0.0	12.8	24.3	4.5	0.0	26.1	16.9	29.8	13.3	0.0
11	0.0	12.3	0.0	0.0	24.6	30.0	3.0	31.2	68.4	5.2	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	23.9	23.0	27.3	16.1	0.2	33.1	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.0	41.3	62.8	44.2	0.0
14	0.0	26.9	0.0	0.0	0.0	4.8	0.0	83.9	15.8	8.9	35.1	0.0
15	0.0	10.1	111.0	0.0	0.0	3.2	0.0	50.9	7.0	22.4	0.0	0.0
16	0.0	2.3	22.1	0.0	0.0	10.4	0.0	62.3	4.8	11.1	0.0	0.0
17	0.0	0.0	2.8	13.2	0.0	6.2	25.6	105.3	4.0	6.1	0.0	0.0
18	0.0	0.0	0.0	0.0	0.0	15.4	22.4	72.2	1.0	3.2	0.0	0.0
19	0.0	0.0	0.0	0.0	0.0	25.6	0.0	0.0	24.3	0.0	0.0	0.0
20	0.0	2.6	2.0	17.9	0.0	14.3	0.0	8.7	3.2	2.3	0.0	0.0
21	0.0	31.8	3.4	0.0	5.6	28.0	0.0	32.9	9.9	0.0	0.0	0.0
22	0.0	0.0	1.9	0.0	0.0	52.3	0.0	1.0	3.2	0.0	0.0	0.0
23	9.2	0.0	0.0	0.0	33.9	13.5	6.0	0.0	8.6	0.0	0.0	0.0
24	0.0	0.0	0.0	38.3	12.2	7.4	0.0	4.9	15.8	0.0	0.0	0.0
25	0.0	0.0	3.4	0.0	4.3	53.9	0.0	0.0	0.3	0.0	0.0	0.0
26	0.0	0.0	0.0	0.0	12.1	0.0	0.0	69.3	0.0	0.0	0.0	0.0
27	0.0	0.0	0.0	0.0	11.8	30.8	5.0	5.8	0.0	0.0	0.0	0.0
28	3.2	0.0	0.0	0.0	5.0	25.3	16.2	5.0	4.3	0.0	0.0	0.0
29	0.0	0.0	6.2	30.3	0.0	38.8	13.2	28.6	10.0	4.2	0.0	0.0
30	0.0		0.0	10.5	0.0	5.4	81.0	59.9	8.1	42.9	0.0	0.0
31	0.0		0.0		0.0		50.2	30.7		0.0		0.0
TOTAL	12.4	88.3	194.9	242.4	168.0	469.1	293.9	926.0	557.7	357.8	204.6	0.0
AVERAGE	0.4	3.0	6.3	8.1	5.4	15.6	9.5	29.9	18.6	11.5	6.8	0.0
MAXIMUM	9.2	31.8	111.0	38.3	33.9	53.9	81.0	105.3	99.5	62.8	54.3	0.0
MINIMUM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ANNUAL			
TOTAL	AVERAGE	MAXIMUM	MINIMUM
3515.1	9.6	111.0	0.0

NONGHINE PRECIPITATION 1985

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	0.0	0.0	0.0	0.0	0.0	10.8	7.9	2.2	10.7	0.4	0.0	0.0
2	0.0	0.0	22.9	0.0	0.0	0.0	7.1	7.8	52.3	10.0	0.0	0.0
3	0.0	0.0	12.6	15.9	0.0	0.0	26.6	11.4	0.0	1.0	0.0	0.0
4	0.0	0.0	7.3	16.9	0.0	1.1	11.7	47.6	4.2	0.0	0.0	0.0
5	0.0	0.0	3.2	134.0	5.1	0.3	12.6	2.6	33.3	0.0	0.2	0.0
6	0.0	0.0	0.0	4.1	10.8	2.2	5.2	1.4	30.0	0.0	0.0	22.3
7	0.0	0.0	0.0	18.2	0.0	0.0	56.6	17.6	3.1	0.0	15.4	0.0
8	0.0	1.5	0.0	3.9	0.0	2.7	83.0	72.1	0.0	10.3	1.5	1.2
9	0.0	0.0	0.0	10.9	37.3	0.0	24.8	2.3	38.3	51.7	10.4	0.0
10	0.0	0.0	0.0	16.1	15.6	0.0	71.0	15.2	25.4	0.9	0.0	0.0
11	0.0	16.3	0.0	0.2	2.0	6.1	1.6	71.8	36.2	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	37.2	5.8	6.6	19.8	2.4	0.5	2.6	0.0
13	0.0	25.5	0.0	0.0	0.0	61.1	7.8	46.9	21.0	3.0	25.2	0.0
14	0.0	20.9	0.0	0.0	11.1	37.6	0.0	38.0	2.3	0.4	26.6	0.0
15	0.0	0.0	0.0	13.2	0.7	28.6	0.0	3.4	4.2	2.3	0.0	0.0
16	0.0	0.0	0.0	42.0	15.9	18.1	67.6	15.0	8.9	43.2	0.0	0.0
17	0.0	0.0	0.0	5.1	27.7	113.0	3.7	4.2	14.2	8.4	0.0	0.0
18	0.0	0.0	0.0	9.8	0.0	48.7	19.6	1.7	11.0	16.5	0.0	0.0
19	0.0	0.0	0.0	35.2	21.0	109.1	6.4	11.3	0.5	0.0	0.0	0.0
20	0.0	1.2	0.0	21.2	2.0	20.1	0.0	21.2	9.5	0.0	1.1	0.0
21	0.0	62.0	0.0	9.0	21.7	31.4	10.8	0.6	2.4	2.5	0.0	0.0
22	0.0	22.0	0.0	12.0	3.1	18.8	11.5	39.4	0.0	0.8	0.0	0.0
23	0.0	41.3	1.2	6.1	6.0	7.3	23.5	15.1	0.0	0.0	0.0	0.0
24	0.0	10.9	0.0	40.0	0.2	9.3	0.0	12.5	0.0	2.5	0.0	0.0
25	3.1	0.0	0.0	70.1	11.7	3.8	0.0	21.1	0.4	2.8	0.0	0.0
26	4.7	0.0	0.0	12.1	6.9	5.3	4.6	9.2	0.0	0.0	0.2	0.0
27	12.0	21.7	0.0	3.8	0.0	27.6	3.6	28.7	0.0	3.5	1.2	0.0
28	10.0	6.3	0.0	38.2	0.0	8.1	17.2	58.6	0.0	20.4	29.8	0.0
29	0.0		15.3	5.7	0.0	21.2	7.2	3.6	0.0	0.0	0.0	0.0
30	0.0		4.9	0.0	2.9	4.6	0.0	3.9	0.0	0.0	0.0	0.0
31	0.0		0.0		0.1		13.4	1.6		0.0		0.0
TOTAL	29.8	229.6	67.4	543.7	239.0	602.7	511.6	607.8	315.3	181.1	114.2	23.5
AVERAGE	1.0	8.2	2.2	18.1	7.7	20.1	16.5	19.6	10.5	5.8	3.8	0.8
MAXIMUM	12.0	62.0	22.9	134.0	37.3	113.0	83.0	72.1	52.3	51.7	29.8	22.3
MINIMUM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0

ANNUAL			
TOTAL	AVERAGE	MAXIMUM	MINIMUM
3465.7	9.5	134.0	0.0

NONGHINE PRECIPITATION 1986

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	0.0	0.0	0.0	30.2	29.0	0.0	1.2	0.0	1.0	26.3	0.0	0.2
2	0.0	0.0	0.0	0.0	3.9	0.0	0.0	0.0	13.4	6.3	0.0	7.9
3	0.0	0.0	0.0	0.0	9.6	0.0	16.9	9.4	12.8	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	2.7	0.5	41.1	53.3	0.8	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	41.5	2.0	3.1	47.2	23.1	0.0	0.0	13.2
6	0.0	0.0	0.0	0.0	30.4	9.0	7.4	31.2	83.9	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.5	5.2	0.0	23.3	4.3	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0	3.9	0.0	17.8	15.6	17.6	0.0	0.0	1.0
9	0.0	0.0	0.0	0.0	41.1	0.0	2.3	73.4	16.6	3.2	0.0	0.0
10	0.0	0.0	0.0	57.9	17.8	7.2	5.2	21.0	20.4	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0	28.6	10.6	13.8	7.2	19.3	0.0	0.7	0.0
12	0.0	0.0	0.0	15.1	0.8	16.8	63.4	26.5	11.7	0.8	11.4	0.0
13	0.0	0.0	0.0	11.4	0.5	16.1	3.6	67.3	30.8	0.0	2.7	0.0
14	0.0	0.0	0.0	3.6	0.3	21.5	10.0	56.4	0.0	6.5	9.2	0.0
15	0.0	0.0	0.0	0.9	0.0	32.4	31.0	25.2	0.0	21.3	0.0	0.0
16	0.0	0.0	0.0	1.5	8.2	0.8	1.4	41.8	0.0	1.2	0.0	0.0
17	0.0	0.0	0.0	0.0	18.6	0.5	13.4	0.0	0.0	0.0	0.0	0.0
18	0.0	0.0	0.0	0.0	29.6	0.0	4.6	3.5	0.0	10.8	0.0	0.0
19	0.0	0.0	20.5	2.5	33.9	0.8	117.6	2.0	3.6	0.5	0.0	0.0
20	0.0	16.8	0.0	0.0	30.8	1.2	75.3	6.9	0.0	0.0	0.0	0.0
21	0.0	0.0	0.0	16.2	3.9	0.0	5.3	4.2	0.0	0.0	0.0	0.0
22	0.0	0.0	10.2	25.5	10.4	5.3	15.5	4.4	0.0	75.0	0.0	0.0
23	0.0	0.0	13.2	6.2	5.9	70.6	0.0	3.7	0.0	28.7	0.0	0.0
24	0.0	0.0	0.0	0.0	51.8	25.7	0.0	36.8	0.0	0.0	0.0	0.0
25	0.0	0.0	1.1	79.5	17.6	5.6	3.0	5.5	16.2	0.0	0.0	0.0
26	0.0	0.0	85.2	7.5	4.8	9.9	3.7	21.8	52.2	4.1	0.0	0.0
27	0.0	0.0	0.0	0.0	33.8	8.3	4.8	26.5	52.2	22.4	0.0	0.0
28	0.0	0.0	0.0	16.1	0.0	2.3	4.8	110.1	5.1	5.0	0.0	0.0
29	0.0		0.0	0.0	6.3	0.0	2.3	1.6	23.2	6.2	0.0	0.0
30	0.0		0.0	0.0	0.0	0.0	2.8	2.6	8.8	3.4	0.0	0.0
31	0.0		0.0		2.8		0.0	3.5		0.0		0.0
TOTAL	0.0	16.8	130.2	274.1	469.0	252.3	471.3	731.9	417.0	221.7	24.0	22.3
AVERAGE	0.0	0.6	4.2	9.1	15.1	8.4	15.2	23.6	13.9	7.2	0.8	0.7
MAXIMUM	0.0	16.8	85.2	79.5	51.8	70.6	117.6	110.1	83.9	75.0	11.4	13.2
MINIMUM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ANNUAL			
TOTAL	AVERAGE	MAXIMUM	MINIMUM
3030.6	8.3	117.6	0.0

NONGHINE PRECIPITATION 1987

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	0.0	0.0	0.0	0.0	1.6	0.0	23.2	0.0	1.7	0.0	0.4	0.0
2	0.0	0.0	19.8	4.8	13.9	2.4	26.3	0.0	4.4	6.2	0.0	0.0
3	0.0	0.0	0.0	0.4	14.2	20.5	83.3	6.8	20.8	44.2	1.4	0.0
4	0.0	0.0	0.0	0.0	1.4	4.2	21.3	26.3	2.7	16.0	0.0	0.0
5	0.0	0.0	21.6	0.0	1.8	3.5	24.8	3.0	4.6	16.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	19.6	0.0	22.1	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	6.5	3.0	16.6	17.4	1.4	0.0	0.0
8	0.0	0.0	0.0	5.2	0.0	0.0	10.1	12.1	1.1	6.8	0.0	0.0
9	0.0	0.0	0.0	16.0	0.0	32.6	5.3	29.3	9.3	8.8	0.4	0.0
10	0.0	0.0	0.0	13.2	0.0	10.8	6.6	4.0	7.6	17.8	0.0	0.0
11	0.0	0.0	17.8	0.0	11.8	0.0	1.6	0.0	27.8	11.4	2.4	0.0
12	0.0	0.0	0.8	0.0	25.5	4.2	26.6	11.7	0.6	15.6	14.7	0.0
13	0.0	0.0	0.0	0.0	1.2	25.9	17.5	0.0	0.0	24.5	0.0	0.0
14	0.0	0.0	0.0	42.8	0.0	2.0	132.6	0.0	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	30.0	0.0	0.0	29.4	0.4	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	7.8	4.6	67.9	0.0	1.5	0.0	0.0
17	0.0	0.0	0.0	13.8	0.0	3.4	3.5	22.2	0.0	22.2	0.0	0.0
18	0.0	0.0	2.6	0.0	30.6	39.0	5.7	38.8	0.0	0.0	0.8	0.0
19	0.0	0.0	0.0	15.0	0.0	14.7	11.7	3.2	0.0	0.0	24.3	0.0
20	0.0	0.0	0.0	0.0	0.0	12.8	3.8	105.1	0.0	5.5	0.3	0.0
21	0.0	0.0	0.0	0.0	0.0	32.9	1.1	123.8	27.5	0.0	0.9	0.0
22	0.0	0.0	0.0	0.0	36.0	0.0	3.1	42.1	30.7	0.0	0.0	0.0
23	0.0	0.0	0.0	0.2	0.4	0.0	3.2	18.4	40.9	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0	0.6	0.0	8.2	20.4	2.2	4.8	0.0
25	0.0	1.0	5.5	40.4	0.0	0.0	0.0	0.0	2.5	0.0	3.2	0.0
26	0.0	4.8	12.4	13.2	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0
27	0.0	0.0	15.6	5.0	0.0	0.0	0.0	8.5	20.7	0.0	3.4	0.0
28	0.0	0.0	0.0	0.0	1.2	1.3	11.7	19.8	0.0	21.5	0.0	0.0
29	0.0		0.0	0.0	0.0	3.2	10.7	22.8	12.8	2.5	0.0	0.0
30	0.0		0.0	0.0	0.0	0.0	5.6	0.0	0.0	14.7	0.0	0.0
31	0.0		3.5		0.0		21.3	0.0		22.8		0.0
TOTAL	0.0	5.8	99.6	200.0	139.6	228.3	517.2	591.0	276.9	261.6	57.0	0.0
AVERAGE	0.0	0.2	3.2	6.7	4.5	7.6	16.7	19.1	9.2	8.4	1.9	0.0
MAXIMUM	0.0	4.8	21.6	42.8	36.0	39.0	132.6	123.8	40.9	44.2	24.3	0.0
MINIMUM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ANNUAL			
TOTAL	AVERAGE	MAXIMUM	MINIMUM
2377.0	6.5	132.6	0.0

NONGHINE PRECIPITATION 1988

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	0.0	0.0	2.4	0.0	0.0	26.9	8.2	50.9	0.0	0.0	0.0	0.0
2	0.0	0.0	5.6	12.2	0.0	30.3	14.6	46.8	0.0	0.0	0.0	0.0
3	0.0	0.0	3.8	0.0	0.0	33.8	0.0	9.2	0.0	3.5	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	2.2	23.6	0.0	0.0	35.8	0.0	9.7
5	0.0	0.0	0.0	0.0	0.0	35.0	3.7	4.0	2.2	0.0	7.5	5.4
6	0.0	0.0	0.0	0.0	0.0	7.4	3.0	18.8	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	31.1	0.0	1.3	0.0	0.0	17.8	45.5	0.0	0.0
8	1.4	2.7	0.0	0.0	0.0	0.0	2.2	6.0	13.2	2.4	0.0	0.0
9	0.0	6.7	0.0	0.0	1.2	0.0	0.0	16.4	33.4	20.6	0.0	0.0
10	0.0	1.2	0.0	0.0	0.0	0.0	4.5	24.0	17.0	5.7	0.0	0.0
11	0.0	0.0	0.0	6.1	0.0	8.0	15.0	0.0	0.0	15.7	0.0	0.0
12	0.0	0.0	0.0	32.1	0.0	8.8	2.6	27.4	3.8	14.7	0.0	0.0
13	0.0	0.0	0.0	5.9	97.8	35.8	0.0	75.4	1.6	16.1	0.0	0.0
14	0.0	0.0	0.0	16.3	29.2	4.7	21.6	4.2	0.0	10.1	0.0	0.0
15	0.0	0.2	20.5	75.4	48.6	7.5	13.7	6.3	0.0	25.2	0.0	0.0
16	0.0	0.0	11.1	0.0	6.4	21.6	11.5	3.8	0.0	16.2	0.0	0.0
17	0.0	0.0	0.0	0.0	9.7	10.5	23.5	11.3	13.7	20.4	0.0	0.0
18	0.0	0.0	0.0	0.0	32.6	1.7	0.0	0.0	9.2	11.5	0.0	0.0
19	0.0	0.0	31.0	14.4	6.4	7.1	5.7	1.8	10.1	5.3	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0	5.6	62.2	3.1	0.0	10.4	0.0	0.0
21	0.0	0.0	0.0	0.4	0.0	1.4	9.7	0.0	0.0	0.0	0.0	0.0
22	0.0	0.0	0.0	0.0	0.0	0.0	7.8	2.3	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	13.0	32.2	1.2	3.8	30.8	5.7	0.0	0.0	0.0
24	0.0	8.5	0.0	37.8	0.0	1.6	0.0	19.0	20.4	10.8	10.8	0.0
25	0.0	24.5	0.0	6.0	0.0	0.6	0.0	9.1	5.3	0.0	0.0	0.0
26	0.0	0.0	37.8	0.0	0.0	0.0	11.0	0.0	0.0	35.8	0.0	0.0
27	0.0	0.0	0.0	0.0	2.2	0.0	22.4	22.8	10.3	0.0	0.0	0.0
28	0.0	0.0	0.0	1.4	10.2	2.4	5.2	0.0	15.4	0.0	0.0	0.0
29	0.0	18.2	0.0	57.4	4.0	16.2	17.5	1.2	0.0	0.0	0.0	0.0
30	0.0		0.0	20.4	8.6	0.0	9.9	1.7	0.0	0.0	0.0	0.0
31	0.0		0.0		84.0		25.8	0.0		0.0		0.0
TOTAL	1.4	62.0	112.2	329.9	373.1	271.6	328.7	396.3	179.1	305.7	18.3	15.1
AVERAGE	0.0	2.1	3.6	11.0	12.0	9.1	10.6	12.8	6.0	9.9	0.6	0.5
MAXIMUM	1.4	24.5	37.8	75.4	97.8	35.8	62.2	75.4	33.4	45.5	10.8	9.7
MINIMUM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ANNUAL			
TOTAL	AVERAGE	MAXIMUM	MINIMUM
2393.4	6.5	97.8	0.0

NONGHINE PRECIPITATION 1989

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	0.0	0.0	0.0	0.0	17.0	39.4	0.0	2.6	58.4	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	11.0	0.0	2.8	5.8	0.0	0.0	0.0
3	0.0	0.0	1.5	0.0	4.3	0.0	21.2	5.6	0.4	12.6	12.0	0.0
4	0.0	0.0	1.6	0.0	2.3	0.0	0.0	45.6	5.8	2.1	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	28.8	50.2	7.4	0.0	25.4	0.0
6	0.0	0.0	0.0	0.0	5.6	0.0	2.2	7.0	63.1	0.0	0.0	0.0
7	0.0	0.0	0.0	7.2	3.4	0.0	0.6	4.6	2.3	0.0	0.0	0.0
8	0.0	0.0	0.0	15.8	0.0	14.0	2.4	2.4	3.0	0.0	0.0	0.0
9	0.0	0.0	0.0	1.6	22.0	2.0	10.4	16.8	24.7	0.0	0.0	0.0
10	0.0	0.0	0.0	1.8	2.5	75.2	0.0	12.9	29.0	0.8	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	22.4	22.6	31.8	1.2	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	10.0	42.6	103.6	0.0	25.1	0.0	0.0
13	0.0	0.0	0.0	21.8	0.0	0.0	15.1	10.6	4.2	3.3	0.0	0.0
14	0.0	0.0	0.0	48.6	11.0	0.0	7.0	0.0	5.8	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	3.0	0.0	6.6	0.0	4.0	0.0	0.0	0.0
16	0.0	0.0	0.0	8.8	0.0	0.0	0.0	0.0	2.2	0.0	0.0	0.0
17	0.0	0.0	27.3	0.0	2.0	1.0	0.0	0.0	9.0	0.0	0.0	0.0
18	6.9	0.0	6.2	0.0	4.8	1.2	6.0	6.4	4.8	27.1	0.0	0.0
19	0.0	0.0	0.0	0.0	3.0	0.0	21.4	19.6	10.6	2.2	0.0	0.0
20	0.0	0.0	0.0	68.2	0.0	0.0	21.0	16.2	18.0	0.0	0.0	0.0
21	0.0	0.0	1.4	0.0	0.0	1.0	6.3	2.6	5.4	0.0	0.0	0.2
22	0.0	0.0	10.1	0.0	0.0	0.0	8.1	3.8	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	4.1	4.2	1.2	153.4	5.2	0.8	0.0	0.0	0.0
24	0.0	0.0	0.0	1.8	21.6	0.0	15.2	8.2	1.4	0.0	0.0	0.0
25	0.0	0.0	6.7	0.0	74.0	7.4	3.9	6.6	8.7	14.5	0.0	0.0
26	0.0	0.0	39.5	23.5	22.0	4.9	8.3	11.2	18.8	1.0	0.0	0.0
27	0.0	0.0	7.4	0.0	17.4	4.9	5.7	7.0	0.0	12.2	27.8	0.0
28	0.0	0.0	0.0	58.4	0.0	2.8	2.4	24.6	0.0	0.0	1.2	0.0
29	0.0		9.3	20.5	3.3	0.0	10.4	16.7	0.0	0.0	0.0	0.0
30	0.0		3.4	0.0	6.8	0.0	19.3	0.0	28.8	0.0	0.0	0.0
31	0.0		22.3		23.8		17.8	5.7		0.0		0.0
TOTAL	6.9	0.0	136.7	282.1	254.0	198.4	458.7	430.3	323.6	100.9	66.4	0.2
AVERAGE	0.2	0.0	4.4	9.4	8.2	6.6	14.8	13.9	10.8	3.3	2.2	0.0
MAXIMUM	6.9	0.0	39.5	68.2	74.0	75.2	153.4	103.6	63.1	27.1	27.8	0.2
MINIMUM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ANNUAL			
TOTAL	AVERAGE	MAXIMUM	MINIMUM
2258.2	6.2	153.4	0.0

NONGHINE PRECIPITATION 1990

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	0.0	0.0	7.2	0.0	0.0	1.8	7.1	16.8	0.0	1.8	0.0	0.0
2	0.0	0.0	63.8	0.0	22.4	2.6	21.7	0.0	12.8	1.3	0.5	0.0
3	0.0	0.0	1.7	0.0	21.6	4.5	4.2	16.4	1.2	48.7	0.0	0.0
4	0.0	0.0	0.0	0.0	2.9	0.0	0.0	32.2	41.2	15.3	0.0	0.0
5	0.0	0.0	0.0	0.0	11.5	0.0	0.0	19.0	29.6	10.6	0.0	0.0
6	0.0	0.0	0.0	0.0	5.2	0.0	0.0	7.6	0.0	29.8	0.0	0.0
7	0.0	0.0	1.0	0.0	50.4	0.0	0.0	0.0	1.3	31.8	0.0	0.0
8	0.0	0.0	1.1	0.0	0.0	0.0	21.0	2.7	16.9	10.8	37.8	0.0
9	0.0	0.0	9.5	0.0	0.0	0.0	1.0	0.0	42.5	0.0	2.0	0.0
10	2.6	0.0	10.5	0.0	0.0	38.2	6.5	0.0	23.6	0.0	1.5	0.0
11	0.0	0.0	18.5	0.0	0.0	3.1	0.0	0.0	2.0	0.0	2.1	0.0
12	0.0	0.0	1.0	2.4	0.0	7.2	2.8	2.2	6.7	0.0	0.0	0.0
13	0.0	0.0	0.0	11.8	40.2	3.8	12.8	7.0	1.0	0.0	0.0	0.0
14	0.0	26.8	0.0	27.8	0.0	36.8	0.0	0.0	0.0	30.7	0.0	0.0
15	0.0	0.0	1.8	0.0	0.0	9.8	0.9	0.0	1.2	26.4	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	21.8	0.0	3.5	0.6	1.0	0.0	0.0
17	0.0	0.0	0.0	0.0	14.2	18.6	0.0	0.0	0.6	0.0	0.0	0.0
18	0.0	0.0	3.2	0.0	9.3	12.3	0.0	0.6	8.9	4.4	0.0	0.0
19	0.0	0.4	0.0	1.6	3.6	3.0	32.8	9.3	53.3	39.8	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0	20.6	0.0	36.7	25.9	0.3	0.4	0.0
21	0.0	0.0	0.0	12.6	4.7	15.6	5.1	8.0	5.0	4.2	0.0	0.0
22	0.0	0.0	0.8	0.0	4.1	8.0	35.9	2.8	11.6	0.0	0.0	0.0
23	0.0	0.0	0.9	0.0	21.8	21.3	5.8	0.0	31.2	1.0	0.0	0.0
24	0.0	0.0	0.0	0.8	27.6	35.1	1.0	1.7	5.8	3.8	0.0	0.0
25	0.0	0.0	1.8	4.2	17.6	20.1	2.2	59.9	1.2	0.0	0.0	0.0
26	0.0	0.0	12.8	32.8	13.2	24.7	6.8	25.7	3.4	0.0	0.0	0.0
27	0.0	0.0	38.1	0.0	0.0	8.5	0.0	5.4	6.0	0.0	0.0	0.0
28	0.0	0.0	108.5	0.0	0.0	18.6	6.8	7.4	3.8	0.0	0.0	0.0
29	0.0		40.2	0.0	5.8	1.0	16.5	104.1	39.8	0.0	0.0	0.0
30	0.0		2.5	0.0	2.3	2.2	9.4	44.8	0.0	0.0	0.0	0.0
31	0.0		0.0		3.3		5.6	11.9		5.6		0.0
TOTAL	2.6	27.2	324.9	94.0	281.7	339.2	205.9	425.7	377.1	267.3	44.3	0.0
AVERAGE	0.1	1.0	10.5	3.1	9.1	11.3	6.6	13.7	12.6	8.6	1.5	0.0
MAXIMUM	2.6	26.8	108.5	32.8	50.4	38.2	35.9	104.1	53.3	48.7	37.8	0.0
MINIMUM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ANNUAL			
TOTAL	AVERAGE	MAXIMUM	MINIMUM
2389.9	6.5	108.5	0.0

A3.5.3 Results of Discherge Estimation

Estimated Daily Discharge at Xe Katam Intake Site (1980-1990)

XE KATAM CALCULATED 1980

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	3.30	1.52	0.88	0.79	0.74	14.14	13.72	16.22	17.41	18.10	9.85	4.17
2	3.22	1.47	0.88	0.78	0.74	11.71	13.23	14.35	17.36	16.26	9.50	4.14
3	3.14	1.42	0.87	0.78	0.73	10.89	14.11	13.21	16.16	15.33	9.27	4.10
4	3.07	1.36	0.87	0.78	0.73	9.45	14.70	12.64	22.82	14.67	8.94	4.07
5	3.01	1.31	0.87	0.78	0.73	8.96	14.78	12.07	21.45	14.03	8.61	4.04
6	2.95	1.26	0.86	0.78	0.73	8.48	13.51	12.15	19.42	14.06	8.29	4.01
7	2.89	1.21	0.86	0.77	0.73	10.16	14.24	11.43	17.71	13.31	7.98	3.97
8	2.83	1.16	0.85	0.77	0.73	13.17	12.70	10.94	16.48	12.88	7.69	3.94
9	2.77	1.11	0.85	0.77	0.73	10.96	12.05	10.46	15.76	13.29	7.40	3.91
10	2.71	1.06	0.85	0.77	1.88	13.04	11.49	10.13	15.05	12.37	7.13	3.87
11	2.65	1.01	0.84	0.77	0.73	12.95	10.94	9.93	15.33	14.68	6.87	3.84
12	2.59	0.96	0.84	0.77	4.32	10.94	10.42	10.32	14.27	12.97	6.62	3.78
13	2.54	0.92	0.84	0.76	8.19	9.98	9.93	10.72	14.36	12.15	6.38	3.73
14	2.48	0.92	0.83	0.76	4.97	9.48	9.46	9.70	13.51	11.74	6.15	3.68
15	2.43	0.92	0.83	0.76	5.43	14.18	9.02	11.60	14.93	11.37	5.93	3.62
16	2.37	0.92	0.83	1.66	61.11	11.90	8.76	13.82	19.28	11.03	5.72	3.57
17	2.31	0.92	0.82	0.75	44.84	12.40	8.40	11.90	17.46	10.66	5.57	3.52
18	2.26	0.92	0.82	0.75	15.16	11.53	8.40	10.58	20.40	10.28	5.42	3.46
19	2.21	0.92	0.82	0.75	40.36	10.85	8.89	11.48	18.63	10.12	5.26	3.41
20	2.15	0.92	0.81	0.75	17.63	10.39	9.67	10.35	16.96	9.80	5.10	3.36
21	2.09	0.91	0.81	0.75	14.68	9.75	21.30	12.69	17.70	9.45	4.94	3.31
22	2.04	0.91	0.81	0.75	13.07	13.58	36.69	13.27	21.65	9.10	4.78	3.25
23	1.99	0.91	0.81	0.75	12.35	11.93	37.79	13.37	19.65	8.89	4.63	3.20
24	1.93	0.90	0.81	0.75	11.65	12.82	19.78	12.22	17.58	13.45	4.47	3.15
25	1.88	0.90	0.81	0.75	10.97	11.38	17.30	42.26	16.17	11.38	4.35	3.10
26	1.83	0.90	0.81	0.74	10.32	24.76	16.13	19.48	15.51	10.16	4.32	3.05
27	1.78	0.89	0.80	0.74	9.71	17.83	16.14	18.35	16.67	12.27	4.29	3.00
28	1.73	0.89	0.80	0.74	10.93	18.58	14.64	17.85	15.67	11.41	4.26	2.95
29	1.67	0.89	0.80	0.74	9.57	17.36	15.90	20.94	18.64	11.50	4.23	2.90
30	1.62		0.79	0.74	8.96	15.09	14.44	20.32	20.34	10.89	4.20	2.85
31	1.57		0.79		8.47		13.63	19.09		10.24		2.80
TOTAL	74.01	30.31	25.76	23.70	331.89	378.64	452.16	443.82	524.33	377.84	188.15	109.75
AVERAGE	2.39	1.05	0.83	0.79	10.71	12.62	14.59	14.32	17.48	12.19	6.27	3.54
MAXIMUM	3.30	1.52	0.88	1.66	61.11	24.76	37.79	42.26	22.82	18.10	9.85	4.17
MINIMUM	1.57	0.89	0.79	0.74	0.73	8.48	8.40	9.70	13.51	8.89	4.20	2.80

ANNUAL			
TOTAL	AVERAGE	MAXIMUM	MINIMUM
2960.36	8.09	61.11	0.73

XE KATAM CALCULATED 1981

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	2.75	1.29	2.71	0.87	3.62	10.32	23.84	22.10	25.83	20.07	9.73	5.22
2	2.70	1.25	2.63	0.87	3.12	14.21	22.04	20.32	23.36	17.72	9.33	5.18
3	2.64	1.20	2.46	4.02	6.26	12.14	22.90	24.78	21.54	17.80	9.07	5.14
4	2.59	1.16	2.26	5.33	4.68	10.71	48.25	34.61	20.61	17.16	9.62	5.09
5	2.55	1.11	2.02	3.46	4.18	11.20	29.43	28.33	19.76	17.75	8.98	5.05
6	2.50	1.07	1.83	4.97	6.23	12.77	26.68	28.50	18.95	15.96	8.72	5.01
7	2.45	1.02	1.61	3.00	9.09	15.65	24.10	60.56	18.19	14.93	8.47	4.96
8	2.40	0.98	1.39	2.85	6.87	17.84	23.62	82.42	21.06	20.65	8.22	4.92
9	2.35	0.93	1.38	2.66	6.06	17.89	27.86	51.21	19.43	18.11	7.97	4.86
10	2.30	0.89	1.43	2.46	5.56	34.69	24.81	33.74	21.87	17.10	7.73	4.80
11	2.25	0.84	1.41	2.26	5.37	31.38	23.31	30.87	21.67	15.63	7.49	4.74
12	2.20	0.83	2.38	2.07	5.10	31.62	23.64	30.29	19.57	15.08	7.27	4.67
13	2.15	0.83	6.83	1.91	6.00	55.41	25.03	32.70	18.13	14.66	7.05	4.61
14	2.11	0.83	3.93	1.77	6.98	39.22	27.92	31.39	17.47	14.73	6.85	4.55
15	2.06	0.83	3.00	1.61	10.17	30.64	24.84	29.19	16.80	15.72	6.66	4.49
16	2.01	0.83	2.79	1.46	7.98	29.27	22.75	31.76	16.15	18.97	6.47	4.42
17	1.96	0.82	2.56	1.31	6.65	29.71	21.30	32.32	15.53	16.69	6.31	4.36
18	1.92	0.82	2.32	1.15	10.23	30.64	20.67	34.93	16.12	15.09	6.14	4.30
19	1.87	0.82	2.07	1.79	19.90	29.12	20.85	35.91	15.00	14.73	5.96	4.24
20	1.82	0.82	1.84	2.84	14.42	29.61	27.13	33.01	15.23	14.19	5.80	4.18
21	1.78	0.82	1.63	1.79	16.69	42.40	26.03	30.05	14.41	13.69	5.65	4.12
22	1.73	0.81	1.42	1.70	30.41	34.57	24.88	28.17	13.91	13.19	5.60	4.06
23	1.68	0.81	1.22	1.58	17.32	30.89	23.79	26.57	14.11	12.71	5.56	4.00
24	1.64	0.81	1.03	1.45	14.86	27.77	23.06	25.43	13.40	12.25	5.52	3.95
25	1.59	0.80	0.85	1.87	15.25	25.40	21.08	26.84	12.95	11.81	5.48	3.89
26	1.55	4.78	0.85	1.59	15.67	24.14	19.95	26.50	12.51	11.40	5.43	3.83
27	1.50	6.79	0.85	1.50	13.69	23.54	20.66	24.37	12.88	11.00	5.39	3.77
28	1.46	5.55	0.86	1.52	12.76	22.56	19.17	24.49	13.85	10.61	5.35	3.71
29	1.42		0.86	4.36	12.11	21.40	18.40	24.11	13.00	10.25	5.31	3.66
30	1.38		0.87	5.55	11.49	20.37	17.68	24.17	12.63	9.90	5.26	3.60
31	1.34		0.87		10.89		16.93	23.05		9.59		3.54
TOTAL	62.65	40.34	60.16	71.57	319.61	767.08	742.60	992.69	515.92	459.14	208.39	136.92
AVERAGE	2.02	1.44	1.94	2.39	10.31	25.57	23.95	32.02	17.20	14.81	6.95	4.42
MAXIMUM	2.75	6.79	6.83	5.55	30.41	55.41	48.25	82.42	25.83	20.65	9.73	5.22
MINIMUM	1.34	0.80	0.85	0.87	3.12	10.32	16.93	20.32	12.51	9.59	5.26	3.54

ANNUAL

TOTAL	AVERAGE	MAXIMUM	MINIMUM
4377.07	11.99	82.42	0.80

XE KATAM CALCULATED 1982

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	3.48	1.84	0.96	0.89	0.86	2.77	14.52	21.54	31.34	19.65	7.56	16.28
2	3.43	1.79	0.96	0.89	0.86	2.59	12.98	20.28	36.34	18.41	7.32	13.84
3	3.37	1.74	0.95	0.88	3.29	2.41	12.62	20.27	26.25	17.11	7.09	12.26
4	3.32	1.69	0.95	0.88	1.29	2.25	51.07	19.28	25.06	16.23	6.87	11.79
5	3.26	1.63	0.95	0.88	1.22	2.36	30.22	22.00	25.69	15.58	6.66	11.33
6	3.20	1.58	0.95	0.88	1.12	2.23	21.42	20.42	70.57	14.96	6.51	10.88
7	3.15	1.53	0.94	0.88	1.01	2.13	18.70	21.05	31.77	14.36	10.66	10.44
8	3.09	1.48	0.94	0.87	0.89	2.02	19.65	21.33	30.77	13.79	11.62	10.03
9	3.04	1.43	1.08	0.87	0.86	2.87	17.66	21.21	28.00	13.25	9.54	9.63
10	2.98	1.38	0.94	0.87	0.86	5.27	16.04	26.53	29.28	12.88	10.72	9.24
11	2.93	1.33	0.94	0.87	0.86	3.97	15.40	24.88	26.84	12.49	9.08	8.83
12	2.87	1.28	0.94	2.50	0.86	3.32	14.66	27.23	27.37	12.16	9.11	8.53
13	2.82	1.23	0.94	2.92	0.86	3.38	13.98	24.11	25.00	11.73	12.58	8.20
14	2.77	1.18	0.94	1.37	0.86	3.30	26.22	22.09	23.34	11.31	11.39	7.89
15	2.71	1.13	0.93	0.87	0.86	3.13	19.65	21.38	22.33	10.91	16.62	7.59
16	2.66	1.08	0.93	0.87	0.86	2.97	25.17	21.74	21.33	10.52	16.97	7.30
17	2.60	1.03	0.93	0.87	0.86	2.82	21.36	21.91	21.82	10.15	16.35	7.02
18	2.55	0.99	0.93	4.70	0.86	2.67	24.14	22.09	20.18	9.80	14.07	6.76
19	2.50	0.97	0.92	3.46	0.85	4.12	21.47	23.18	19.36	9.65	13.93	6.51
20	2.45	0.97	0.92	2.09	0.85	3.09	21.31	34.34	18.53	9.58	12.68	6.27
21	2.40	0.97	0.92	1.96	6.49	2.95	21.52	27.59	18.38	9.31	13.03	6.03
22	2.34	0.97	0.91	1.81	3.74	2.89	19.24	25.74	17.50	9.03	12.16	5.82
23	2.29	0.97	0.91	1.64	2.10	2.88	17.84	24.65	17.73	8.96	11.69	5.60
24	2.24	0.97	0.91	1.49	1.99	4.60	21.91	22.97	17.62	9.36	12.39	5.40
25	2.19	0.97	0.90	1.38	1.94	8.01	21.62	21.61	16.43	8.91	13.84	5.20
26	2.14	0.96	0.90	1.25	1.83	19.82	51.48	20.28	15.92	8.88	12.07	5.01
27	2.09	0.96	0.90	1.11	1.71	14.74	38.37	19.49	15.31	8.80	12.99	4.83
28	2.04	0.96	0.90	0.97	6.33	39.12	27.83	19.76	21.23	8.55	11.64	4.75
29	1.99		0.90	0.86	4.12	17.88	25.09	21.87	19.39	8.30	13.08	4.72
30	1.94		0.89	0.86	3.10	16.12	24.97	20.61	20.61	8.05	11.57	4.68
31	1.89		0.89		2.94		23.64	19.12		7.80		4.65
TOTAL	82.73	35.01	28.87	42.64	57.13	188.68	711.75	700.55	741.29	360.47	341.79	247.36
AVERAGE	2.67	1.25	0.93	1.42	1.84	6.29	22.96	22.60	24.71	11.63	11.39	7.98
MAXIMUM	3.48	1.84	1.08	4.70	6.49	39.12	51.48	34.34	70.57	19.65	16.97	16.28
MINIMUM	1.89	0.96	0.89	0.86	0.85	2.02	12.62	19.12	15.31	7.80	6.51	4.65

ANNUAL

TOTAL	AVERAGE	MAXIMUM	MINIMUM
3538.27	9.69	70.57	0.85

XE KATAM CALCULATED 1983

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	4.62	3.04	1.50	0.94	3.00	7.62	18.96	11.83	19.13	27.18	12.70	5.09
2	4.58	2.98	1.45	0.94	2.83	7.24	18.06	20.85	17.01	27.82	12.23	5.05
3	4.54	2.92	1.40	0.94	29.75	6.86	17.17	17.56	17.12	28.08	11.77	5.02
4	4.51	2.87	1.35	0.94	9.69	6.50	16.32	18.19	15.54	26.24	11.46	4.98
5	4.47	2.81	1.30	0.94	14.80	6.15	15.52	15.82	14.85	24.12	11.08	4.94
6	4.44	2.75	1.25	0.93	11.45	6.03	14.90	14.16	25.05	22.87	10.69	4.90
7	4.40	2.70	1.20	0.93	22.41	7.99	15.03	13.40	21.71	22.65	10.31	4.86
8	4.37	2.64	1.15	0.93	13.62	13.51	14.11	14.39	19.08	23.23	9.94	4.83
9	4.33	2.58	1.11	0.92	13.30	10.56	13.51	12.99	17.24	22.57	9.58	4.79
10	4.30	2.53	1.06	0.92	43.05	8.62	12.89	12.49	16.19	20.55	9.24	4.75
11	4.25	2.47	1.05	0.92	17.91	7.96	12.29	12.96	15.51	19.67	8.91	4.71
12	4.19	2.42	1.02	0.92	14.90	13.22	11.83	11.99	14.84	18.89	8.67	4.67
13	4.13	2.36	0.99	0.91	13.26	39.06	11.31	11.67	14.20	24.93	8.41	4.63
14	4.07	2.31	0.98	0.91	12.55	18.86	10.81	18.19	13.60	21.92	8.14	4.59
15	4.01	2.25	0.98	0.91	11.86	15.62	10.33	34.35	13.02	19.80	7.88	4.55
16	3.95	2.20	0.98	0.90	16.05	13.72	11.18	19.35	12.47	18.55	7.63	4.49
17	3.89	2.14	0.98	0.90	13.53	12.46	13.69	19.38	11.96	17.76	7.38	4.43
18	3.83	2.08	0.98	0.90	11.84	11.87	17.70	17.78	11.57	18.44	7.14	4.37
19	3.77	2.03	0.98	0.90	11.22	11.28	14.94	16.61	11.28	16.95	6.91	4.31
20	3.72	1.98	0.98	0.89	10.62	10.72	18.36	15.33	13.36	19.75	6.68	4.25
21	3.66	1.92	0.98	0.89	10.03	10.18	19.54	15.30	11.82	17.67	6.47	4.20
22	3.60	1.87	0.98	0.89	9.48	9.66	18.07	14.75	11.23	16.38	6.27	4.14
23	3.54	1.82	0.97	0.89	8.94	9.37	16.05	22.50	10.87	15.73	6.11	4.08
24	3.48	1.76	0.97	0.89	8.43	10.44	14.66	21.93	14.19	15.08	5.95	4.02
25	3.43	1.71	0.97	4.24	7.95	95.85	13.98	21.28	18.63	15.75	5.79	3.96
26	3.37	1.65	0.96	8.23	7.50	101.65	13.53	19.86	17.88	16.36	5.62	3.91
27	3.32	1.60	0.96	4.32	10.73	36.69	13.03	18.29	21.55	14.74	5.46	3.85
28	3.26	1.55	0.96	2.58	9.22	24.42	12.46	16.72	34.07	14.70	5.30	3.80
29	3.21		0.95	2.42	8.87	21.59	11.91	16.05	32.63	13.93	5.17	3.74
30	3.15		0.95	4.81	8.86	19.68	11.38	17.51	26.25	13.39	5.13	3.69
31	3.09		0.95		8.00		10.88	16.51		13.09		3.63
TOTAL	121.48	63.94	33.29	48.55	395.65	575.38	444.40	529.99	513.85	608.79	244.02	137.23
AVERAGE	3.92	2.28	1.07	1.62	12.76	19.18	14.34	17.10	17.13	19.64	8.13	4.43
MAXIMUM	4.62	3.04	1.50	8.23	43.05	101.65	19.54	34.35	34.07	28.08	12.70	5.09
MINIMUM	3.09	1.55	0.95	0.89	2.83	6.03	10.33	11.67	10.87	13.09	5.13	3.63

ANNUAL			
TOTAL	AVERAGE	MAXIMUM	MINIMUM
3716.57	10.18	101.65	0.89

XE KATAM CALCULATED 1984

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	3.57	1.98	0.99	0.96	1.62	2.65	17.07	48.69	82.48	20.58	15.07	10.05
2	3.52	1.94	0.99	0.96	1.54	2.52	15.30	61.10	74.57	20.35	14.60	9.71
3	3.46	1.89	0.99	0.96	3.79	4.05	15.38	26.31	39.31	19.28	15.05	9.39
4	3.41	1.84	0.99	0.96	2.25	3.57	14.73	23.83	37.49	19.59	14.10	9.08
5	3.35	1.79	0.99	0.96	2.14	3.06	13.75	23.07	34.24	24.47	13.62	8.78
6	3.30	1.74	0.99	0.96	2.02	3.69	13.15	21.40	55.75	25.39	13.16	8.49
7	3.24	1.69	0.99	3.04	1.89	3.55	12.56	20.03	37.83	28.27	12.70	8.21
8	3.19	1.64	0.99	2.71	1.76	3.84	14.04	20.30	34.75	26.23	18.40	7.95
9	3.13	1.59	0.98	2.99	1.62	3.63	12.75	19.73	35.92	24.23	16.30	7.70
10	3.08	1.55	0.98	2.75	2.34	3.60	11.87	21.62	35.21	26.26	16.25	7.45
11	3.03	1.50	0.98	1.92	4.52	6.56	11.40	23.69	51.26	24.34	14.43	7.22
12	2.97	1.46	0.98	1.80	2.81	8.23	13.19	24.74	38.78	22.27	17.72	7.00
13	2.92	1.42	0.98	1.65	2.58	6.29	11.64	23.10	41.83	29.40	21.71	6.78
14	2.87	1.38	0.97	1.49	2.44	5.66	10.92	50.04	38.80	27.17	23.57	6.57
15	2.81	1.36	13.57	1.32	2.30	5.33	10.41	48.76	36.22	27.58	20.32	6.37
16	2.76	1.33	7.42	1.16	2.15	5.54	9.93	57.35	33.96	26.38	18.10	6.31
17	2.71	1.31	4.22	1.01	2.01	5.35	11.85	90.79	32.05	24.84	16.91	6.26
18	2.66	1.27	3.09	0.97	1.86	6.50	13.48	80.74	30.12	23.27	16.27	6.21
19	2.60	1.23	2.88	0.98	1.73	8.79	11.65	37.27	31.55	21.93	15.64	6.16
20	2.55	1.19	2.64	0.98	1.59	9.01	10.43	34.83	29.55	21.11	15.05	6.11
21	2.50	1.15	2.39	0.99	1.46	11.20	10.02	36.37	28.87	20.26	14.48	6.06
22	2.45	1.14	2.16	0.99	1.37	17.30	9.57	33.01	27.27	19.44	13.93	6.01
23	2.40	1.12	1.93	1.00	3.68	14.94	9.25	30.34	26.68	18.67	13.41	5.96
24	2.36	1.09	1.71	2.66	3.78	13.41	8.85	28.88	27.08	17.93	12.92	5.91
25	2.31	1.05	1.48	1.17	2.90	18.92	8.46	27.32	25.07	17.23	12.45	5.86
26	2.27	1.02	1.28	1.12	3.43	15.64	8.08	34.93	23.87	16.56	12.00	5.81
27	2.22	0.99	1.08	1.04	3.85	17.75	7.78	31.78	22.86	15.93	11.57	5.76
28	2.17	0.99	0.96	1.03	3.29	18.64	8.72	29.52	21.98	15.33	11.16	5.71
29	2.13	0.99	0.96	2.22	3.14	21.34	9.46	31.08	21.58	14.77	10.78	5.64
30	2.08		0.96	2.11	2.98	18.87	30.63	42.83	21.26	18.82	10.41	5.57
31	2.03		0.96		2.82		34.74	36.82		16.56		5.49
TOTAL	86.05	40.64	63.48	44.86	77.66	269.43	401.06	1120.27	1078.19	674.44	452.08	215.58
AVERAGE	2.78	1.40	2.05	1.50	2.51	8.98	12.94	36.14	35.94	21.76	15.07	6.95
MAXIMUM	3.57	1.98	13.57	3.04	4.52	21.34	34.74	90.79	82.48	29.40	23.57	10.05
MINIMUM	2.03	0.99	0.96	0.96	1.37	2.52	7.78	19.73	21.26	14.77	10.41	5.49

ANNUAL			
TOTAL	AVERAGE	MAXIMUM	MINIMUM
4523.74	12.36	90.79	0.96

XE KATAM CALCULATED 1985

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	5.42	3.40	3.21	1.88	12.22	7.99	20.86	17.61	24.68	14.39	9.48	6.34
2	5.35	3.34	3.24	1.85	11.62	7.67	20.11	17.43	30.14	14.01	9.19	6.17
3	5.27	3.28	3.33	1.81	11.04	7.35	22.18	17.71	26.89	13.55	8.91	6.00
4	5.20	3.22	3.26	1.79	10.48	7.04	21.57	22.89	25.16	13.10	8.64	5.82
5	5.13	3.16	3.15	47.40	9.95	6.74	21.26	20.50	28.58	12.66	8.38	5.65
6	5.06	3.10	3.01	9.76	9.62	6.45	19.98	18.69	29.93	12.24	8.14	5.95
7	4.99	3.04	2.86	9.17	9.18	6.19	26.16	19.62	27.27	11.83	8.08	5.67
8	4.91	2.98	2.70	7.02	8.75	5.93	60.07	35.90	24.94	11.56	7.90	5.55
9	4.84	2.92	2.53	6.57	11.80	5.70	34.29	23.87	28.49	17.39	7.92	5.42
10	4.77	2.86	2.38	7.04	11.97	5.47	58.61	23.48	29.27	15.01	7.74	5.29
11	4.71	2.80	2.37	6.10	10.32	5.24	30.80	42.69	31.42	13.31	7.56	5.26
12	4.64	2.76	2.36	5.80	14.07	5.11	28.58	29.03	28.41	12.67	7.36	5.22
13	4.56	2.71	2.35	5.49	11.73	12.24	27.13	37.82	28.87	12.31	9.02	5.19
14	4.50	2.68	2.34	5.19	11.66	14.78	24.90	37.70	26.59	11.92	11.30	5.15
15	4.43	2.67	2.34	4.88	10.31	15.74	23.51	29.54	25.15	11.54	9.40	5.11
16	4.36	2.64	2.33	8.57	11.20	15.33	31.03	28.85	24.63	15.88	8.62	5.07
17	4.30	2.60	2.31	6.92	13.58	64.68	27.94	26.84	24.86	14.92	8.38	5.04
18	4.23	2.56	2.30	6.51	11.54	45.82	27.99	24.97	24.49	15.48	8.14	5.00
19	4.16	2.51	2.29	9.82	13.02	82.83	26.21	24.81	22.68	13.68	7.90	4.96
20	4.09	2.46	2.28	10.42	11.49	35.97	23.99	25.93	22.50	12.85	7.67	4.93
21	4.03	4.73	2.26	9.34	13.14	29.95	23.75	23.80	21.25	12.47	7.44	4.89
22	3.96	4.11	2.25	9.11	11.78	28.69	23.54	27.57	20.46	12.06	7.22	4.85
23	3.90	6.92	2.20	8.19	11.21	26.33	24.96	26.93	19.65	11.67	7.00	4.81
24	3.83	5.15	2.16	12.27	10.52	24.92	22.66	26.15	18.86	11.28	6.80	4.78
25	3.77	3.74	2.12	28.93	10.63	23.07	21.02	26.78	18.12	10.92	6.60	4.74
26	3.71	3.57	2.08	16.56	10.36	21.81	20.29	25.59	17.42	10.59	6.41	4.69
27	3.65	3.47	2.04	14.15	9.80	23.85	19.56	27.43	16.75	10.26	6.22	4.63
28	3.60	3.34	2.00	17.32	9.37	22.54	20.41	38.82	16.11	11.49	7.86	4.57
29	3.56		1.96	15.24	8.95	23.36	19.75	29.13	15.51	10.35	6.64	4.51
30	3.51		1.94	13.05	8.55	21.61	18.30	26.91	14.94	10.06	6.50	4.45
31	3.45		1.91		8.17		18.81	24.96		9.77		4.40
TOTAL	135.89	92.72	75.86	308.15	338.03	610.40	810.22	829.95	714.02	391.22	238.42	160.11
AVERAGE	4.38	3.31	2.45	10.27	10.90	20.35	26.14	26.77	23.80	12.62	7.95	5.16
MAXIMUM	5.42	6.92	3.33	47.40	14.07	82.83	60.07	42.69	31.42	17.39	11.30	6.34
MINIMUM	3.45	2.46	1.91	1.79	8.17	5.11	18.30	17.43	14.94	9.77	6.22	4.40

ANNUAL			
TOTAL	AVERAGE	MAXIMUM	MINIMUM
4704.99	12.89	82.83	1.79

XE KATAM CALCULATED 1986

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	4.34	2.64	1.26	1.18	4.36	11.18	9.76	14.56	24.80	24.31	13.15	5.66
2	4.28	2.59	1.25	1.18	3.27	10.61	9.31	13.90	24.97	22.62	12.67	5.62
3	4.22	2.54	1.25	1.18	3.30	10.07	9.83	13.46	24.86	20.54	12.21	5.58
4	4.17	2.49	1.25	1.18	3.12	9.55	14.40	19.63	23.01	19.40	11.76	5.53
5	4.11	2.43	1.25	1.18	7.11	9.06	12.56	26.72	24.63	18.61	11.34	5.49
6	4.05	2.38	1.25	1.18	9.11	8.69	11.95	24.22	49.17	17.86	10.93	5.45
7	3.99	2.33	1.25	1.18	6.65	8.39	10.53	24.14	29.34	17.13	10.55	5.41
8	3.94	2.28	1.25	1.18	5.50	8.00	11.96	23.26	28.83	16.44	10.18	5.37
9	3.88	2.22	1.25	1.18	9.92	7.62	10.84	45.87	28.38	15.79	9.82	5.33
10	3.82	2.17	1.25	3.14	10.03	7.29	10.44	28.40	28.59	15.18	9.49	5.28
11	3.77	2.12	1.24	1.18	11.82	7.25	11.31	25.96	28.61	14.60	9.17	5.24
12	3.71	2.07	1.24	1.18	9.45	8.49	19.48	26.99	27.59	14.05	8.91	5.20
13	3.66	2.01	1.23	1.18	7.95	9.32	16.19	45.54	29.48	13.52	8.66	5.16
14	3.60	1.96	1.23	1.18	7.55	10.76	15.42	52.52	26.60	13.03	8.56	5.12
15	3.54	1.91	1.23	1.18	7.15	13.43	17.89	34.52	24.47	14.33	8.34	5.07
16	3.49	1.86	1.22	1.18	6.80	11.15	15.69	40.80	23.17	12.97	8.11	5.01
17	3.44	1.81	1.22	1.18	7.76	9.58	15.84	31.37	22.17	12.54	7.88	4.94
18	3.38	1.76	1.22	1.18	10.43	9.03	14.76	28.99	21.22	12.47	7.65	4.88
19	3.33	1.71	1.21	1.17	13.08	8.62	59.85	26.96	20.34	12.03	7.42	4.82
20	3.27	1.65	1.21	1.17	14.80	8.22	65.20	25.99	19.49	11.64	7.20	4.76
21	3.22	1.62	1.20	1.17	12.55	7.83	26.45	24.72	18.68	11.25	6.99	4.70
22	3.17	1.58	1.20	1.56	11.98	7.46	25.40	23.67	17.91	20.18	6.78	4.64
23	3.11	1.54	1.20	1.17	11.01	15.73	22.61	22.76	17.17	20.59	6.59	4.58
24	3.06	1.49	1.19	1.17	16.72	16.21	20.57	26.19	16.48	17.54	6.39	4.52
25	3.01	1.44	1.19	8.21	16.25	14.09	19.46	24.43	16.61	15.52	6.21	4.46
26	2.96	1.40	5.55	5.77	14.35	13.35	18.70	25.38	22.57	14.64	6.03	4.40
27	2.90	1.35	1.39	3.28	17.09	12.67	18.00	26.71	33.33	16.52	5.86	4.34
28	2.85	1.30	1.19	3.87	14.50	11.38	17.35	73.58	23.61	15.46	5.78	4.28
29	2.80		1.19	3.06	13.56	10.74	16.65	31.68	24.28	14.88	5.74	4.22
30	2.75		1.19	2.88	12.33	10.24	15.98	28.72	22.89	14.14	5.70	4.17
31	2.70		1.19		11.77		15.25	26.72		13.65		4.10
TOTAL	108.52	54.65	42.44	57.68	311.27	306.01	579.63	908.36	743.25	493.43	256.07	153.33
AVERAGE	3.50	1.95	1.37	1.92	10.04	10.20	18.70	29.30	24.78	15.92	8.54	4.95
MAXIMUM	4.34	2.64	5.55	8.21	17.09	16.21	65.20	73.58	49.17	24.31	13.15	5.66
MINIMUM	2.70	1.30	1.19	1.17	3.12	7.25	9.31	13.46	16.48	11.25	5.70	4.10

ANNUAL			
TOTAL	AVERAGE	MAXIMUM	MINIMUM
4014.64	11.00	73.58	1.17

XE KATAM CALCULATED 1987

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	4.05	2.37	1.26	1.16	1.12	1.10	4.55	11.31	20.26	14.18	11.01	4.59
2	3.99	2.32	1.26	1.16	1.12	1.10	7.04	10.54	19.44	13.73	10.21	4.56
3	3.93	2.26	1.26	1.16	1.12	1.10	32.26	10.25	20.63	18.45	9.85	4.53
4	3.88	2.21	1.25	1.15	1.11	1.10	14.95	12.80	19.16	18.28	9.50	4.50
5	3.82	2.16	1.25	1.15	1.11	1.10	15.42	11.53	18.27	18.30	9.15	4.47
6	3.76	2.11	1.25	1.15	1.11	1.10	15.35	10.34	19.95	16.18	8.82	4.44
7	3.71	2.05	1.25	1.14	1.11	1.10	13.22	11.56	20.47	14.86	8.50	4.41
8	3.65	2.00	1.24	1.14	1.11	1.10	12.79	11.89	18.57	14.57	8.19	4.38
9	3.59	1.95	1.24	1.14	1.11	2.72	11.85	14.56	18.31	14.56	7.89	4.34
10	3.53	1.90	1.24	1.14	1.11	2.14	11.34	13.08	17.81	15.75	7.61	4.31
11	3.48	1.85	1.23	1.13	1.11	1.09	10.51	11.53	20.19	15.72	7.34	4.28
12	3.42	1.80	1.23	1.13	1.71	1.09	12.87	12.03	18.14	16.28	7.30	4.25
13	3.37	1.75	1.23	1.13	1.11	3.03	13.53	10.87	16.56	17.96	7.10	4.22
14	3.31	1.70	1.22	1.37	1.11	1.80	72.19	10.43	15.90	15.84	6.89	4.19
15	3.26	1.64	1.22	2.64	1.11	1.63	35.97	9.96	15.21	14.44	6.67	4.15
16	3.21	1.59	1.22	1.12	1.11	1.63	21.58	17.86	14.55	13.93	6.46	4.12
17	3.15	1.54	1.21	1.12	1.11	1.56	19.34	18.01	13.92	15.49	6.25	4.08
18	3.09	1.49	1.21	1.12	1.83	5.52	18.06	20.72	13.32	13.88	6.05	4.03
19	3.04	1.44	1.20	1.12	1.11	5.64	17.92	18.03	12.75	13.25	7.08	3.97
20	2.99	1.39	1.20	1.12	1.11	5.65	16.65	60.48	12.21	12.87	6.25	3.92
21	2.94	1.34	1.20	1.12	1.11	8.60	15.53	99.09	14.06	12.37	6.10	3.87
22	2.88	1.29	1.19	1.12	2.84	6.36	14.86	58.10	16.77	11.88	5.92	3.82
23	2.83	1.26	1.19	1.12	1.10	5.06	14.21	31.72	20.29	11.42	5.75	3.76
24	2.78	1.26	1.19	1.12	1.10	4.80	13.50	29.16	20.22	10.97	5.57	3.71
25	2.73	1.26	1.18	1.88	1.10	4.54	12.83	26.23	17.92	10.56	5.42	3.66
26	2.68	1.26	1.18	1.43	1.10	4.28	12.19	24.04	16.19	10.16	5.28	3.61
27	2.62	1.26	1.18	1.12	1.10	4.03	11.58	23.46	17.63	9.77	5.13	3.55
28	2.57	1.26	1.17	1.12	1.10	3.79	11.23	24.44	15.80	10.78	4.99	3.50
29	2.52		1.17	1.12	1.10	3.56	11.58	25.46	16.23	9.84	4.85	3.45
30	2.47		1.17	1.12	1.10	3.36	11.12	23.00	14.75	10.87	4.71	3.40
31	2.42		1.17		1.10		12.94	21.15		12.76		3.35
TOTAL	99.67	47.71	37.66	36.76	37.40	90.68	518.96	693.63	515.48	429.90	211.84	125.42
AVERAGE	3.22	1.70	1.21	1.23	1.21	3.02	16.74	22.38	17.18	13.87	7.06	4.05
MAXIMUM	4.05	2.37	1.26	2.64	2.84	8.60	72.19	99.09	20.63	18.45	11.01	4.59
MINIMUM	2.42	1.26	1.17	1.12	1.10	1.09	4.55	9.96	12.21	9.77	4.71	3.35

ANNUAL			
TOTAL	AVERAGE	MAXIMUM	MINIMUM
2845.11	7.79	99.09	1.09

XE KATAM CALCULATED 1988

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	3.30	1.81	1.12	1.03	5.29	16.91	7.35	20.28	12.79	8.82	10.25	4.16
2	3.25	1.77	1.11	1.03	4.33	17.92	8.38	30.98	12.24	8.49	9.83	4.13
3	3.20	1.72	1.11	1.03	4.07	19.45	7.39	20.81	11.72	8.17	9.44	4.10
4	3.15	1.67	1.11	1.03	3.82	16.45	9.63	18.18	11.23	11.69	9.06	4.07
5	3.10	1.62	1.10	1.02	3.58	19.01	8.68	16.88	10.76	9.89	8.70	4.04
6	3.05	1.57	1.10	1.02	3.34	17.18	7.95	17.97	10.32	8.89	8.39	4.01
7	3.00	1.53	1.10	1.02	3.11	15.09	7.61	16.12	11.01	14.11	8.08	3.98
8	2.95	1.48	1.10	1.02	2.89	13.76	7.32	15.57	11.67	12.20	7.78	3.95
9	2.90	1.44	1.09	1.02	2.68	13.07	7.02	16.54	15.00	13.49	7.48	3.92
10	2.85	1.40	1.09	1.02	2.48	12.41	6.77	18.27	15.26	12.45	7.21	3.89
11	2.80	1.36	1.09	1.01	2.29	11.85	7.56	16.21	13.24	13.17	6.94	3.86
12	2.75	1.31	1.08	1.20	2.11	11.48	6.88	18.53	12.37	13.60	6.68	3.82
13	2.71	1.27	1.08	1.01	20.22	15.09	6.67	39.67	11.64	14.18	6.43	3.77
14	2.65	1.23	1.07	1.01	12.47	13.50	8.41	22.63	11.21	13.85	6.20	3.72
15	2.61	1.18	1.07	8.37	20.93	12.79	9.07	20.85	10.76	15.76	5.97	3.67
16	2.56	1.14	1.07	4.67	12.75	14.24	9.33	19.27	10.33	15.99	5.76	3.61
17	2.51	1.14	1.07	2.53	11.50	13.79	11.27	19.14	10.49	16.85	5.55	3.56
18	2.46	1.14	1.06	2.39	13.92	12.26	9.54	17.41	10.73	16.34	5.35	3.51
19	2.42	1.14	1.06	2.30	12.18	11.88	9.14	16.62	11.03	15.19	5.16	3.46
20	2.37	1.14	1.06	2.16	10.14	11.37	16.75	15.98	10.06	15.09	4.98	3.42
21	2.32	1.13	1.06	2.00	9.57	10.91	15.18	15.26	9.71	13.60	4.81	3.37
22	2.27	1.13	1.06	1.83	9.07	10.39	14.04	14.60	9.35	13.08	4.64	3.32
23	2.23	1.13	1.05	1.65	11.25	9.89	12.78	17.25	9.09	12.53	4.48	3.27
24	2.18	1.13	1.05	4.62	9.30	9.43	11.38	18.02	10.66	12.27	4.36	3.22
25	2.13	1.13	1.05	3.30	8.69	8.98	10.91	17.27	10.11	11.80	4.33	3.17
26	2.09	1.13	1.05	2.52	8.24	8.56	11.02	15.50	9.26	15.29	4.30	3.12
27	2.04	1.12	1.04	2.36	7.81	8.15	13.06	17.37	9.61	13.30	4.27	3.07
28	1.99	1.12	1.04	2.19	7.51	7.76	12.17	15.54	10.77	12.06	4.25	3.02
29	1.95	1.12	1.04	7.47	7.20	8.03	13.28	14.48	9.50	11.60	4.22	2.97
30	1.90		1.04	7.67	7.02	7.46	13.07	13.96	9.15	11.13	4.19	2.93
31	1.86		1.04		24.73		15.17	13.36		10.68		2.88
TOTAL	79.55	38.20	33.26	72.50	264.49	379.06	314.78	570.52	331.07	395.56	189.09	110.99
AVERAGE	2.57	1.32	1.07	2.42	8.53	12.64	10.15	18.40	11.04	12.76	6.30	3.58
MAXIMUM	3.30	1.81	1.12	8.37	24.73	19.45	16.75	39.67	15.26	16.85	10.25	4.16
MINIMUM	1.86	1.12	1.04	1.01	2.11	7.46	6.67	13.36	9.09	8.17	4.19	2.88

ANNUAL			
TOTAL	AVERAGE	MAXIMUM	MINIMUM
2779.07	7.59	39.67	1.01

XE KATAM CALCULATED 1989

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	2.83	1.43	1.01	0.91	4.78	11.86	3.99	15.51	22.15	12.55	6.06	3.79
2	2.78	1.39	1.00	0.91	3.65	10.83	3.79	14.36	19.91	11.69	5.85	3.77
3	2.73	1.35	1.00	0.91	3.43	8.74	4.61	13.85	17.70	12.12	5.78	3.74
4	2.69	1.30	1.00	0.90	3.21	7.79	3.95	18.97	16.86	11.35	5.63	3.71
5	2.64	1.26	0.99	0.90	2.99	7.38	6.75	26.46	16.42	10.95	7.52	3.68
6	2.59	1.21	0.99	0.90	2.77	6.98	5.51	20.69	23.80	10.53	6.14	3.66
7	2.54	1.17	0.99	0.90	2.57	6.60	4.79	18.79	20.85	10.12	5.97	3.63
8	2.50	1.12	0.98	0.89	2.38	6.41	4.65	17.15	18.97	9.73	5.79	3.60
9	2.45	1.08	0.98	0.89	2.82	6.13	4.78	17.93	20.65	9.35	5.61	3.57
10	2.40	1.06	0.97	0.89	2.44	16.63	4.56	17.92	22.49	9.00	5.43	3.54
11	2.36	1.06	0.97	0.89	2.31	14.73	6.40	20.53	20.05	8.66	5.25	3.51
12	2.31	1.06	0.97	0.89	2.16	13.23	11.06	63.05	18.16	10.22	5.07	3.46
13	2.26	1.06	0.96	0.88	2.00	10.96	10.83	26.73	17.30	9.31	4.90	3.41
14	2.22	1.06	0.96	3.41	1.85	9.64	9.78	23.38	16.79	8.74	4.74	3.36
15	2.17	1.06	0.96	0.88	1.74	9.15	9.11	21.03	16.15	8.44	4.57	3.31
16	2.12	1.05	0.95	0.88	1.63	8.67	7.79	19.33	15.56	8.15	4.42	3.27
17	2.08	1.05	0.95	0.88	1.52	8.21	7.47	18.46	15.33	7.86	4.27	3.22
18	2.03	1.05	0.95	0.88	1.40	7.78	7.26	17.74	14.79	9.77	4.15	3.17
19	1.99	1.05	0.94	0.88	1.31	7.36	9.05	18.94	15.12	8.66	4.12	3.12
20	1.95	1.04	0.94	5.22	1.21	6.97	10.60	19.44	16.33	8.12	4.09	3.07
21	1.91	1.04	0.94	2.22	1.11	6.59	9.79	17.88	15.44	7.85	4.06	3.03
22	1.87	1.04	0.93	1.42	1.01	6.24	9.54	16.87	14.10	7.58	4.04	2.98
23	1.82	1.03	0.93	1.32	1.01	5.90	79.40	16.24	13.60	7.32	4.01	2.93
24	1.78	1.03	0.93	1.20	1.61	5.59	27.40	16.09	13.07	7.06	3.98	2.88
25	1.74	1.02	0.92	1.07	13.79	5.29	19.05	15.67	12.76	7.14	3.95	2.84
26	1.70	1.02	0.92	1.09	10.24	5.03	17.76	15.92	14.35	6.92	3.92	2.79
27	1.65	1.02	0.92	1.04	9.85	4.84	16.53	15.46	12.88	7.32	4.49	2.75
28	1.61	1.01	0.92	6.59	7.43	4.62	15.17	17.53	12.25	6.89	3.87	2.70
29	1.56		0.92	6.61	6.27	4.41	15.23	17.94	11.77	6.69	3.85	2.65
30	1.52		0.91	4.05	6.06	4.20	16.45	15.98	14.25	6.47	3.82	2.60
31	1.48		0.91		8.09		17.12	15.34		6.26		2.56
TOTAL	66.28	31.12	29.61	51.30	114.64	238.76	380.17	611.18	499.85	272.82	145.35	100.30
AVERAGE	2.14	1.11	0.96	1.71	3.70	7.96	12.26	19.72	16.66	8.80	4.85	3.24
MAXIMUM	2.83	1.43	1.01	6.61	13.79	16.63	79.40	63.05	23.80	12.55	7.52	3.79
MINIMUM	1.48	1.01	0.91	0.88	1.01	4.20	3.79	13.85	11.77	6.26	3.82	2.56

ANNUAL			
TOTAL	AVERAGE	MAXIMUM	MINIMUM
2541.38	6.96	79.40	0.88

XE KATAM CALCULATED 1990

DAY	1	2	3	4	5	6	7	8	9	10	11	12
1	2.51	1.16	0.88	4.57	0.90	3.60	10.92	10.04	19.66	16.04	9.78	4.39
2	2.47	1.11	2.62	4.24	0.90	3.41	12.81	8.66	19.38	15.15	9.41	4.36
3	2.42	1.07	0.88	3.90	1.67	3.22	11.75	9.97	17.57	20.43	9.05	4.33
4	2.38	1.03	0.88	3.56	0.91	3.06	10.57	13.15	21.77	19.93	8.70	4.29
5	2.33	0.98	0.88	3.24	0.91	2.89	10.08	13.75	23.26	19.04	8.37	4.26
6	2.28	0.94	0.87	2.92	0.91	2.72	9.58	12.78	20.36	21.14	8.06	4.23
7	2.24	0.93	0.87	2.62	5.67	2.55	9.11	11.13	18.50	23.04	7.75	4.19
8	2.19	0.93	0.87	2.34	3.19	2.39	10.25	10.32	19.27	21.65	10.58	4.16
9	2.15	0.93	0.87	2.07	2.12	2.23	9.08	9.89	23.33	19.25	9.02	4.13
10	2.10	0.93	0.87	1.82	2.01	5.18	8.98	9.44	23.75	17.51	8.30	4.09
11	2.06	0.93	0.87	1.57	1.88	3.91	8.51	9.01	21.19	16.79	8.03	4.05
12	2.02	0.93	0.87	1.35	1.74	3.68	8.18	8.59	20.03	16.04	7.76	4.02
13	1.97	0.93	0.87	1.14	4.61	3.39	8.61	8.35	18.36	15.32	7.49	3.96
14	1.93	0.93	0.86	1.38	2.74	7.29	7.91	8.01	17.35	17.58	7.22	3.90
15	1.89	0.93	0.86	1.20	2.46	6.72	7.59	7.66	16.57	19.35	6.96	3.85
16	1.84	0.93	0.86	1.10	2.32	8.14	7.24	7.35	15.80	17.18	6.71	3.79
17	1.80	0.92	0.86	0.97	2.34	8.88	6.90	7.05	15.07	15.49	6.47	3.74
18	1.76	0.92	0.85	0.86	2.43	8.70	6.58	6.74	14.57	14.97	6.24	3.68
19	1.71	0.92	0.85	0.86	2.37	7.40	9.45	6.65	20.71	19.15	6.02	3.63
20	1.67	0.91	0.85	0.87	2.25	8.98	7.89	10.82	21.55	16.85	5.81	3.57
21	1.62	0.91	0.84	0.87	2.11	9.49	7.53	10.09	19.46	15.77	5.60	3.51
22	1.58	0.91	0.84	0.88	1.99	8.89	11.58	8.98	18.97	14.72	5.41	3.46
23	1.54	0.90	0.84	0.88	3.32	10.38	10.44	8.00	21.38	14.13	5.22	3.41
24	1.50	0.90	0.84	0.88	5.83	13.47	9.08	7.75	19.67	13.60	5.04	3.35
25	1.45	0.89	0.83	0.89	6.43	13.81	8.34	14.86	17.85	13.04	4.86	3.30
26	1.41	0.89	0.83	1.43	6.44	14.89	8.33	15.82	16.79	12.50	4.70	3.25
27	1.37	0.89	1.12	0.89	4.77	13.60	7.94	13.99	16.29	11.99	4.54	3.19
28	1.33	0.88	29.11	0.89	4.38	14.19	7.78	13.12	15.61	11.50	4.48	3.14
29	1.29		14.09	0.90	4.23	12.26	9.08	51.22	19.87	11.03	4.45	3.08
30	1.24		7.37	0.90	4.01	11.10	9.18	39.87	17.53	10.58	4.42	3.03
31	1.20		4.87		3.80		8.76	22.59		10.16		2.98
TOTAL	57.25	26.43	80.67	51.99	91.64	220.42	280.03	395.65	571.47	500.92	206.45	116.32
AVERAGE	1.85	0.94	2.60	1.73	2.96	7.35	9.03	12.76	19.05	16.16	6.88	3.75
MAXIMUM	2.51	1.16	29.11	4.57	6.44	14.89	12.81	51.22	23.75	23.04	10.58	4.39
MINIMUM	1.20	0.88	0.83	0.86	0.90	2.23	6.58	6.65	14.57	10.16	4.42	2.98

A N N U A L			
T O T A L	A V E R A G E	M A X I M U M	M I N I M U M
2599.24	7.12	51.22	0.83

A3.6 Comment from Meteorology and Hydorology Depertment, MAF of Lao on Hydrological Analyses in the Study

Some observations in Chpt 3 ..Meteorology and Hydrology
of the interim Report July '91

① Precipitation : estimation areal rainfall from point measurement
and rainfall variation with altitude h ..

② Temperature : in addition, Temperature at ATTAPU compare
with 2 periods 1900–1900 and 1990.
Potential Evapotranspiration (Penman) in 1990, ATT.
at Pakse 1983, monthly mean temp were completed in Table 3.3/2
Exceptional temp. were observed during 82/83
ENSO event.

③ Temperature regimes : ~~Ex~~ AT PAKSE (Th) and (TT) at Paksong

④ Evaporation, Evapotranspiration Potential PET at Pakse
1560 mm/year and at Paksong 1192 mm/year

⑤ 'PET' at Xiengkhouang Plain of Jarres computed with 4
methods (to compare) . Piche reading are not use

⑥ Assessment of Lenght of the main wet Period at NIKHOM 34
and AT PAKSONG Town . (relation between P and PET)

⑦ AT PAKSE in the plain The LWP is shorter than in the Plateau
and the availability of moisture is also smaller ..

⑧ Summarizing table of the surface wind in 1986 at
NIKHOM 34 and at PAKSONG (more clear for
utilization for general purpose)

⑨ Surface wind rose 1986 in Dec, the NE prevailing wind
direction and mean velocity of about 7.0 m/s produced late
rainfall for the dry season ..

9a and 9b wind rose for the period of 1983–87 AT PAKSONG
and 1961–1980 AT PAKSE respectively ..

⑩ Runoff calculation from Water Balance 1986 data at NK34

⑪ calculations of peak Flood Discharges at Project sites
(for information only)

Vientiane 22 July 91

① Precipitations

Some observations on the estimation of the areal rainfall from points rainfall.

Ingeneral, the average areal rainfall inputs to the area (catchment) are normally estimated from observation made of n number of gauging stations over the basin by using one or several methods of computation. For example, for flood forecast purpose, the standard error in areal average rainfall is given as $e = C_v/\sqrt{\pi}$, where $C_v = \left[\int_A (x-p)^2 \, dA/AP\right]^{\frac{1}{2}}$

and x = the point rainfall for a given duration, P - the areal rainfall for the same duration, p = the average areal rainfall of that duration, and A = the area with n gauging stations distributed at random (see Relative errors of raingauge networks after Ishizaki, 1979) whe the minimum of number of stations n = 10 — 100. Another logical approach to design of forecast raingauge network after Sugawara (1981) by using a statistical evaluation of spatial and temporal distribution of sampled showers in temperate and tropical climates, ex: in temperate zones five raingauges are sufficient (Japan) to provide a representative sample of the rainfall for forecast purposes, but in tropical zones this number is 15 (3 times more) being independent of the size of the basin.

In case of the Bolaven Plateau especially in the project area only one or two stations (not exactly located in the Catchment area).

Although a trend of decrease in rainfall amount is seen from the west to the east (Paksong km 42 to Nikhom 34), uncertainties still exist in the areas surrounding the Peaks of 1500m and 1700m altitude located in the ridge of the limit of the catchment where the exposure to the South west air flow will receive more rainfall than that observed in 1200m --.

Solution: From Fogel-Duckstein model: (Small mountainous watershed data based on 1 single raingauge) mainly on the variation of rainfall with altitude h by using regression equation of daily rainfall with altitude.

The study by Fogel and Duckstein of thunderstorms in the Tucson area (ARIZONA) shows rainfall amounts at storm centers to be distributed as Type I extremal (Gumbel) and thunderstorm rainfall given there is precipitation somewhere on the watershed from a thunderstorm, to be distributed exponentially. Example in the Santa Catalina Mountains adjacent to Tucson, gives the following regression equation of daily rainfall with altitude h (feet)

$$R(h) = 0.065675 + 0.00001791 (h - 2500)$$

Assuming that the difference in rainfall with altitude is due to a difference frequency of storms and assuming unit likelihood of storm at 2500 feet (760 m), the relative likelihood of a storm at altitude h is

$$L(h) = [1 + 0.0002727 (h - 2500)]$$

This equation is obtained by dividing R(h) above by 0.065675; the relative likelihood of a storm at 3500 ft is 1.27. This means a storm at 3500 feet (1067 m) is 1.27 times as likely as a storm at 2500 feet. The different height is 307 m.

In the Bolaven Plateau with a different of 307 m (5000 feet - 3936 feet = 1064 feet or 324 m is it possible or why not to consider the relative likelihood of storm of 1.27 at 1500 m altitude.

Example: MAXI DAILY Rainfall 29/August '90 from Typhoon BECKY

At Paksong 42 = 307.5 mm

Paksong Town = 202.4 m

Nong hin = 104.1 m $\rightarrow$ at 1500 m = 133 mm at least

at 1700 m ≈ 150 mm

Mikhon 34 = 75.1 m

① Temperature at ATTAPU STATION (14°48'N/106°50'E, El=106m)

AVERAGE FROM 1900 – 1910

	Jan	Feb	Mar	Apr	May	Jun	Jly	AUG	Sept	Oct	Nov	Dec	ANN
mean t°c	24.6	25.6	28.6	29.5	28.3	27.2	26.8	26.9	26.7	27.1	25.5	24.8	26.8
mean MAXi	32.2	33.2	35.9	35.8	33.5	31.2	30.5	30.7	30.6	31.9	31.2	30.8	
mean Mini	16.9	17.9	21.4	23.1	23.5	23.2	22.8	23.0	22.7	21.9	19.8	18.3	
Absolute													
Axi	39.6	38.8	41.3	40.4	41.2	35.9	34.8	34.8	36.7	37.8	35.0	38.7	
Mini	9.8	10.5	14.5	18.5	20.2	14.5	20.0	19.8	20.0	18.2	13.7	10.5	

1990

mean t°c	26.2	27.7	29.4	30.6	28.8	27.5	27.5	27.4	28.0	27.4	25.9	24.5	27.6
mean MAXi	34.1	34.9	36.3	36.0	34.2	31.0	31.6	31.5	32.4	32.6	31.7	32.2	
mean Mini	18.3	20.5	22.5	24.4	24.3	24.0	23.4	23.3	23.6	22.3	20.1	16.8	
Absolute													
MAXi	36.5	37.0	38.0	40.0	39.0	33.7	33.5	35.0	34.8	35.8	34.7	34.8	
Mini	14.8	15.5	20.5	22.0	22.1	22.8	21.0	21.2	21.5	19.6	16.6	14.1	

Note: Due to the global climatic change (environment change) all Kind of air temperature recorded in 1990 was higher than that observed from 1900 – 1910).

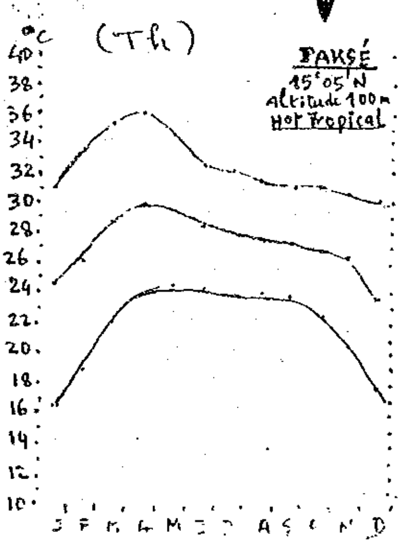
② Potential Evapotranspiration (PET from Penman's) 1990. monthly mean and annual total

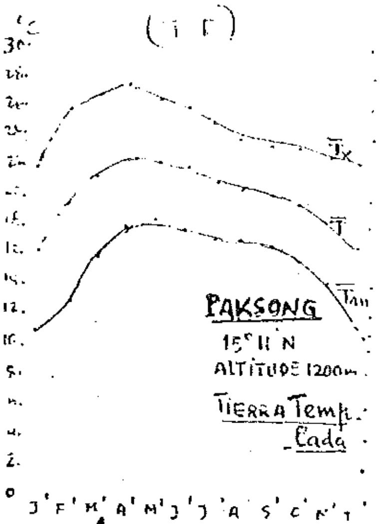
	Jan	Feb	Mar	Apr	May	Jun	Jly	AUG.	Sept	Oct	Nov	Dec	ANNUAL
PET (mm)	117.8	137.4	145.0	155.7	140.7	123.0	131.4	130.8	124.2	123.6	105.0	106.6	1541.2
Piche													890 mm

③ TEMPERATURE REGIMES
(FAO 1986)

The Tropical Temperature regime.

The mean minimum temperature of the coldest month varies between 13°c and 18°c, while the mean minimum t° of the warmest month is higher than 20°c





The Tierra Templada regime

The mean minimum temperature of all months is less than 20°c, while no frost risk occurs. Exceptionnaly once in several years.. (in the Bolaven Plateau) -2°C Jan 1983.

* The Tierra Fria regime

has in general mean minimum t° of the coldest months 8°-13°c a certain frost risk is present. Summers are relatively hot but the mean maxi t° of the warmest month remains below 33°5C

(IN The North LAOS with Alt >1500 m)

④ EVAPOTRANSPIRATION POTENTIELLE (PENMAN)

TOTAL DECADAIRES PAKSE 1961 - 1986
PAKSONG 1983 - 1990

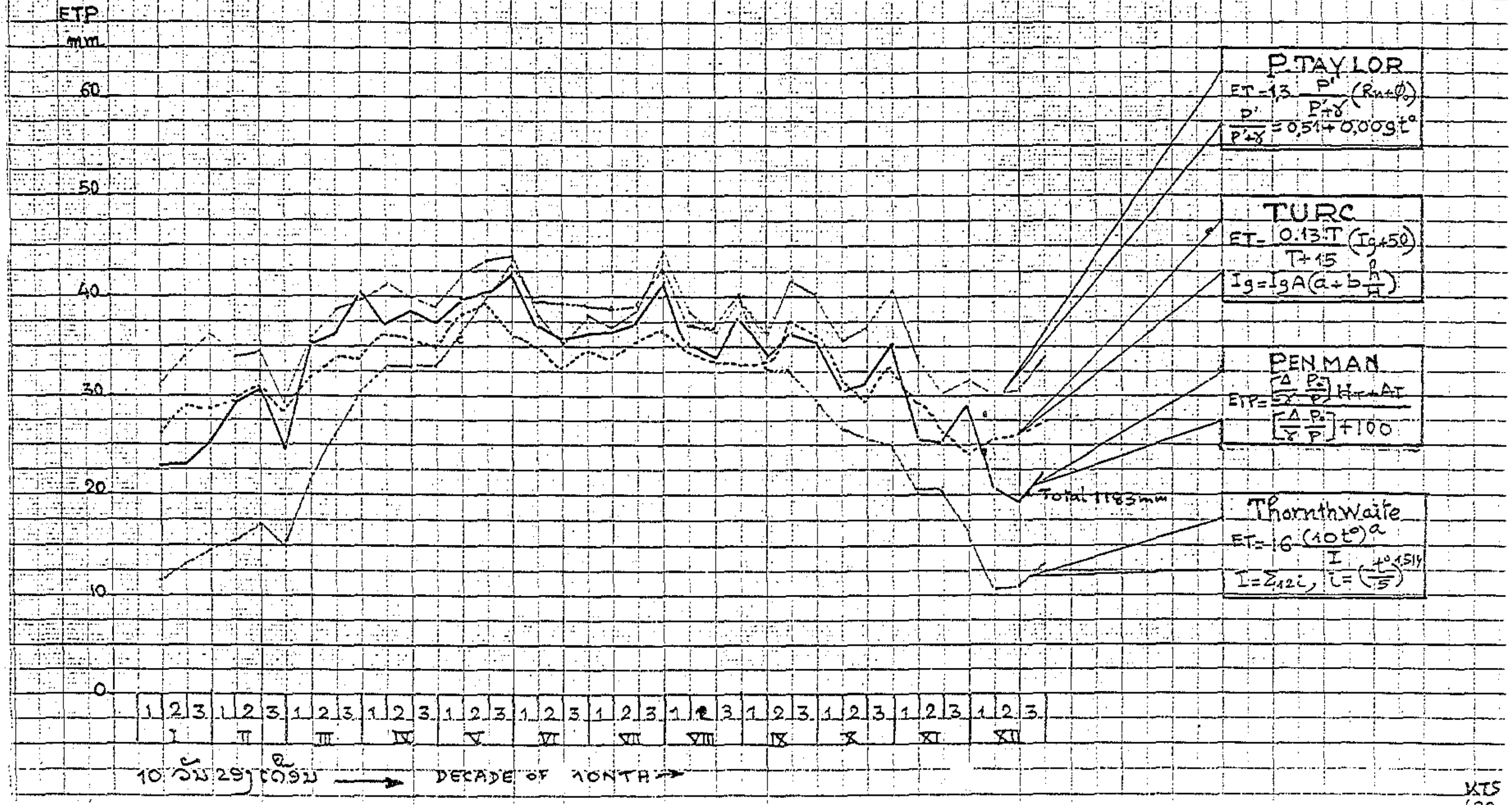
KTS '90

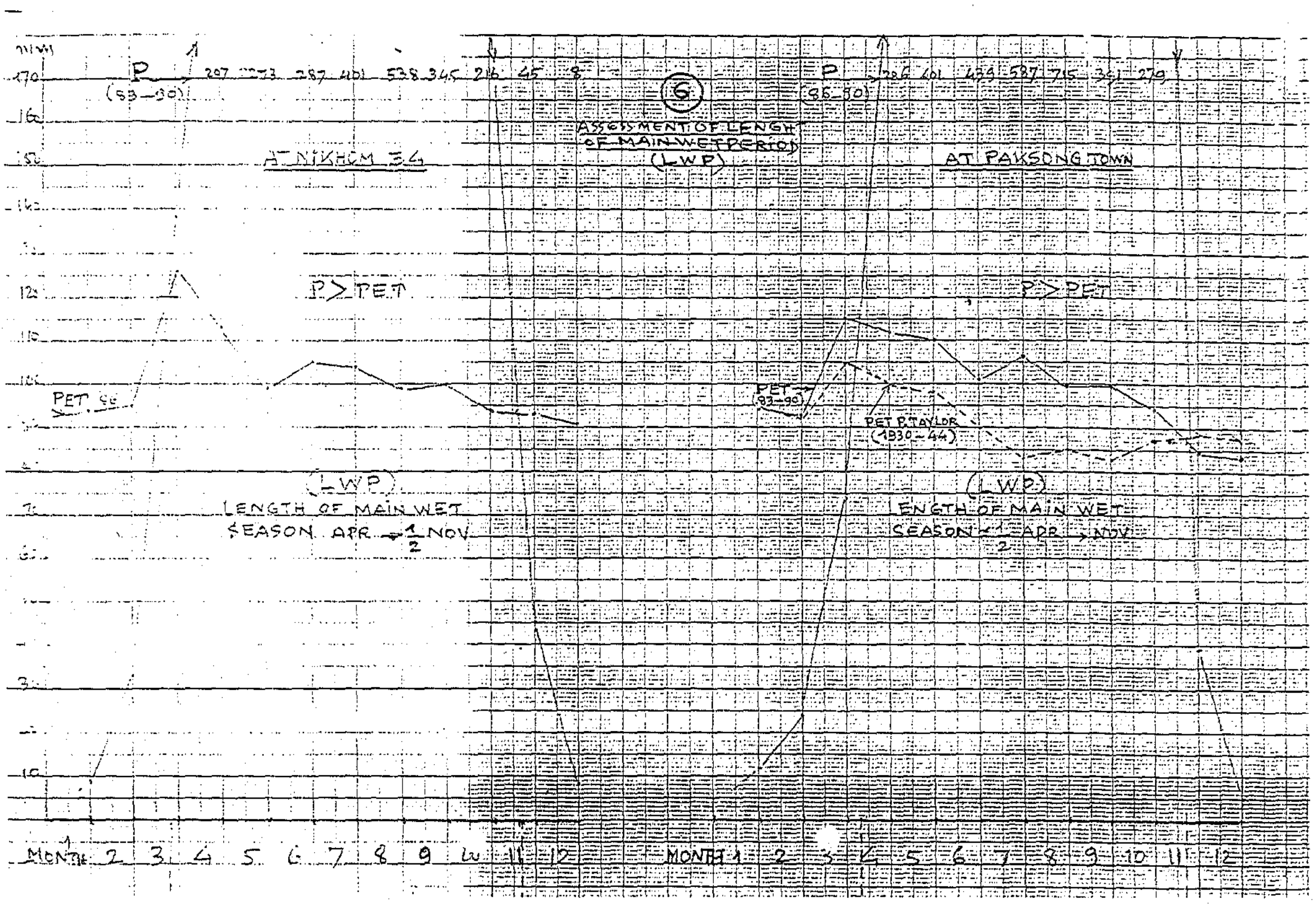
ຊຽງຂວາງ ທົ່ງໄຫຫີນ: ຄວາມອາດສາມາດລະເຫີຍ ພາຍ ສູງສຸດ (10 ວັນ)

(ສະເລ່ຍ : 1951 - 60, 1976 - 1987)

⑤ XIENGKHOUANG (PJ) EVAPOTRANSPIRATION POTENTIELLE ETP

(1050 m)




⑥
ASSESSMENT OF LENGH OF MAIN WET PERIOD (LWP)
mm
170
160
150
140
120
110
100
70
60
30
10
P (53–90)
207 273 287 401 538 345 216 45 8
AT NIKHOM 34
P > PET
PET 96
(LWP)
LENGTH OF MAIN WET SEASON APR → 1/2 NOV
MONTH 1 2 3 4 5 6 7 8 9 10 11 12
P (86–90)
206 401 439 587 715 341 279
AT PAKSONG TOWN
P > PET
PET (83–90)
PET P.TAYLOR (1930–44)
(LWP)
LENGTH OF MAIN WET SEASON 1/2 APR → NOV
MONTH 1 2 3 4 5 6 7 8 9 10 11 12

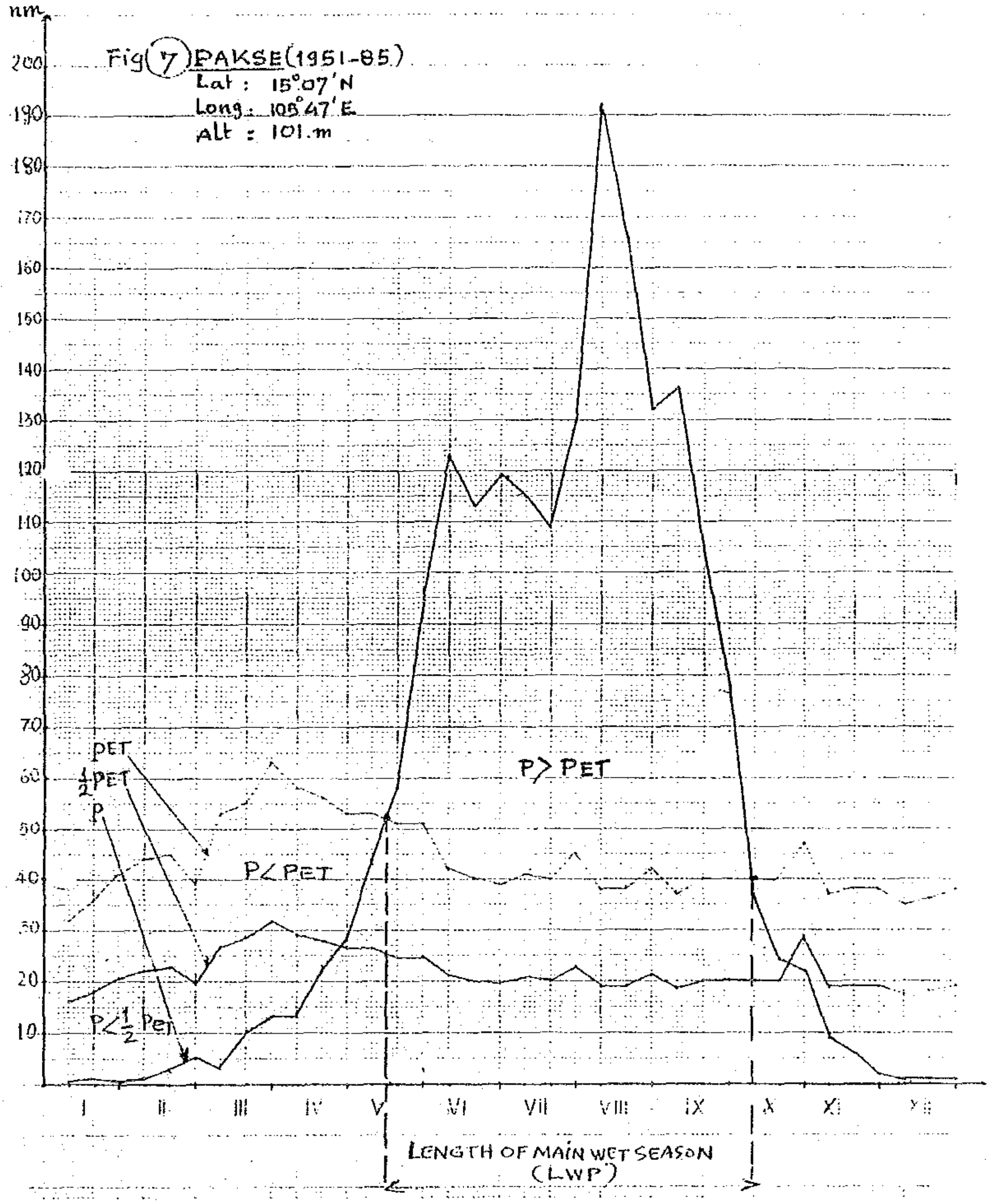


Fig 7 PAKSE (1951-85)
Lat : 15°07'N
Long : 105°47'E
Alt : 101.m
nm
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
PET
½PET
P
P>PET
P<PET
P<½ Pet
I
II
III
IV
V
VI
VII
VIII
IX
X
XI
XII
LENGTH OF MAIN WET SEASON (LWP)

⑧ 1986 Surface wind at NIKHOM 34 (Bolaven Plateau)

	calm	N		NE		E		SE		S		SW		W		NW	
JAN	% 7.26 2.09	%	v	%	v	%	v	%	v	%	v	%	v	%	v	%	v
Feb	7.86	17	3.4	22	3.6	13	3.6	8	2.8	7	2.3	7	3.5	6	1.5	20	1.8
		12	2.4	7	2.9	13	2.4	9	2.1	16	2.4	27	2.2	13	1.7	10	1.6
Mar	16.13	11	2.9	5	3.6	7	2.4	12	1.9	24	2.1	21	1.9	11	1.3	14	0.9
Apr	14.0	9	2.7	11	1.4	7	2.2	8	1.7	17	2.6	10	1.3	11	1.6	29	1.7
May	9.03	0	0.0	–	–	–	–	4	1.8	14	5.0	40	4.8	26	4.3	15	2.4
Jun	12.66	3	1.5	–	–	1	2.0	1	4.0	3	3.7	36	4.3	42	4.2	8	4.2
Jl	9.0	6	1.4	–	–	3	2.0	1	4.0	6	4.5	22	4.0	53	5.4	8	4.9
AUG	13.97	8	3.4	–	–	2	1.7	1	2.0	3	3.2	17	4.5	40	4.9	31	4.4
Sept	11.33	6	2.4	8	4.2	10	4.2	15	3.5	6	2.6	10	5.5	16	4.1	30	5.9
Oct	16.13	15	6.0	15	5.3	19	5.4	5	3.3	12	4.8	10	5.2	5	5.0	25	5.1
Nov	15.33	22	5.8	35	5.9	16	6.4	6	5.2	1	1.0	–	–	4	3.0	18	5.4
Dec	7.09	14	5.8	31	6.9	15	7.4	12	6.0	3	4.8	5	5.3	–	–	18	6.4

1986 AT PAKSONG KM 42.

	calm	N		NE		E		SE		S		SW		W		NW	
	%	%	v	%	v	%	v	%	v	%	v	%	v	%	v	%	v
jan	6.45	2.07	1.7	8.97	4.1	26.9	4.4	21.38	2.3	5.52	2.1	14.48	2.3	9.66	1.9	6.21	2.2
Feb	1.43	2.90	4.0	7.25	2.7	10.15	2.3	18.12	1.2	18.12	2.4	33.33	1.9	3.63	1.0	5.80	2.1
Mar	8.39	0.7	2.0	4.90	2.7	13.99	3.3	12.59	1.6	35.67	2.0	18.88	3.1	10.49	1.7	–	–
Apr	3.33	1.40	1.0	2.07	1.3	4.83	1.7	29.66	1.3	26.21	1.4	22.76	2.0	8.97	1.5	4.14	2.2
May	6.90	0.7	1.0	–	–	3.45	1.4	11.04	2.4	39.31	2.4	31.04	2.2	11.73	2.6	2.76	1.0
Jun	9.34	–	–	–	–	–	–	1.47	1.5	41.91	1.8	50.0	1.7	6.62	1.9	–	–
Jul	20.00	0.7	2.9	–	–	–	–	4.84	1.2	16.13	1.6	65.33	1.9	10.48	1.8	2.42	2.3
Aug	23.87	3.39	1.3	0.7	1.0	–	–	1.70	1.0	11.02	1.2	59.33	1.7	22.04	1.7	1.70	1.0
Sept	12.67	6.11	3.4	3.05	1.5	7.64	1.3	21.38	1.7	19.85	2.1	25.96	1.5	9.93	1.3	6.11	1.5
Oct	7.10	5.56	5.3	7.64	2.7	22.92	2.5	7.64	1.3	15.97	1.8	31.25	1.6	6.25	2.8	2.08	1.0
Nov	2.67	4.80	2.4	13.01	3.11	36.30	2.4	14.39	1.2	6.16	1.0	17.13	1.4	4.11	1.3	4.11	1.2
Dec	17.42	1.56	1.0	7.82	4.6	26.56	4.2	25.78	2.1	5.47	2.0	22.66	2.0	7.82	1.8	2.34	1.3

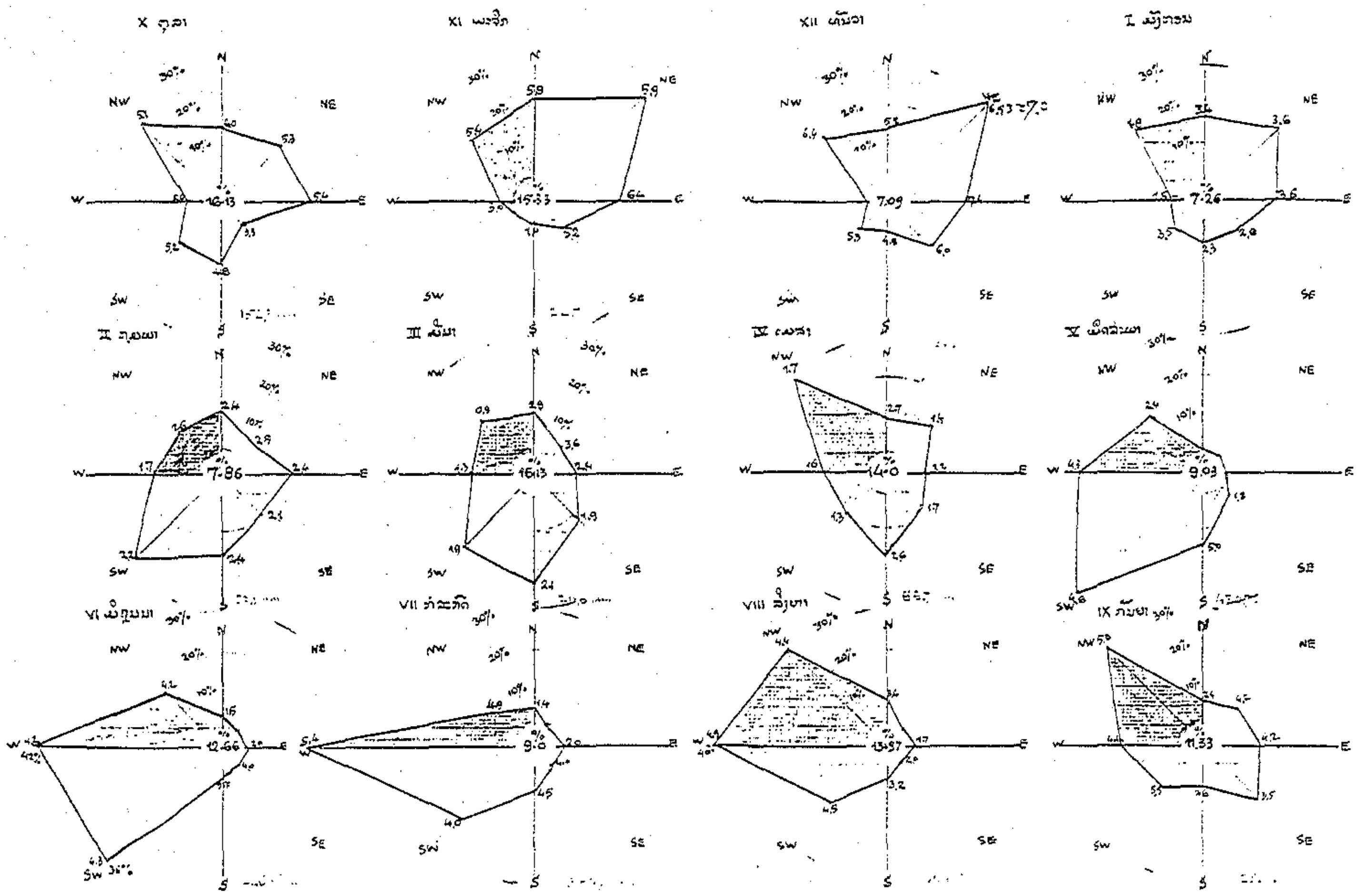
% = percentage of wind direction (frequency)
v = wind velocity in m/s (monthly mean value of each direction)

⑨ ລົມໜ້າພື້ນ ປີ 86
(VENT AUSOL)

ນິຄົມ ກະສິກຳ
ຫ້ວຍໝາກຈັບ NK㉞
1150 m

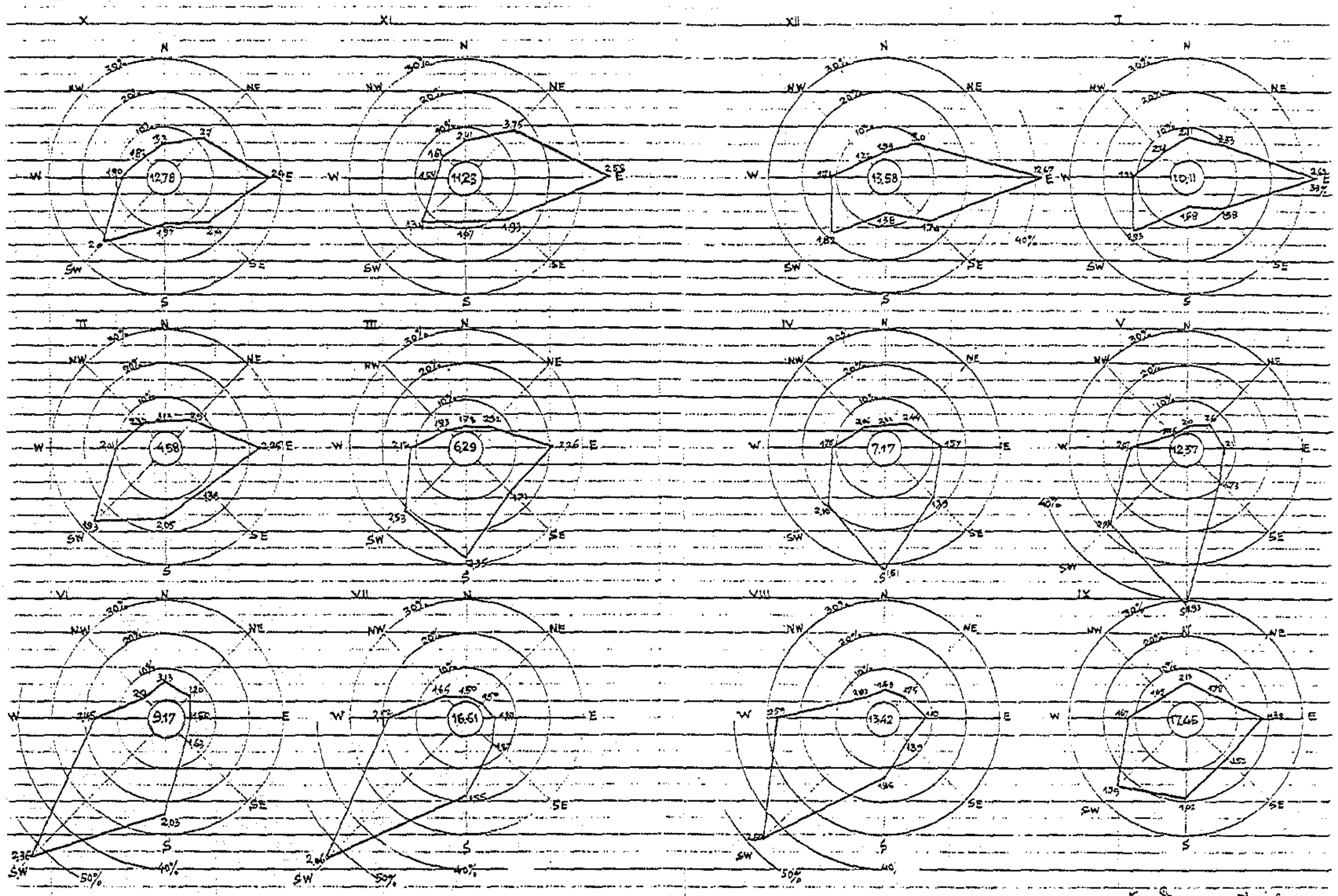
FERME D'ETAT
PL. DE BOLAVEN

1 ຈຸດ = 10% ...
... = m/s



SURFACE WIND(PAKSONG) ປາກຊ່ອງ 1160 ແມັດ ລົມຜິວພື້ນ 1985-87 PAKSONG VENT AU SOL 1983-87 V= m/s

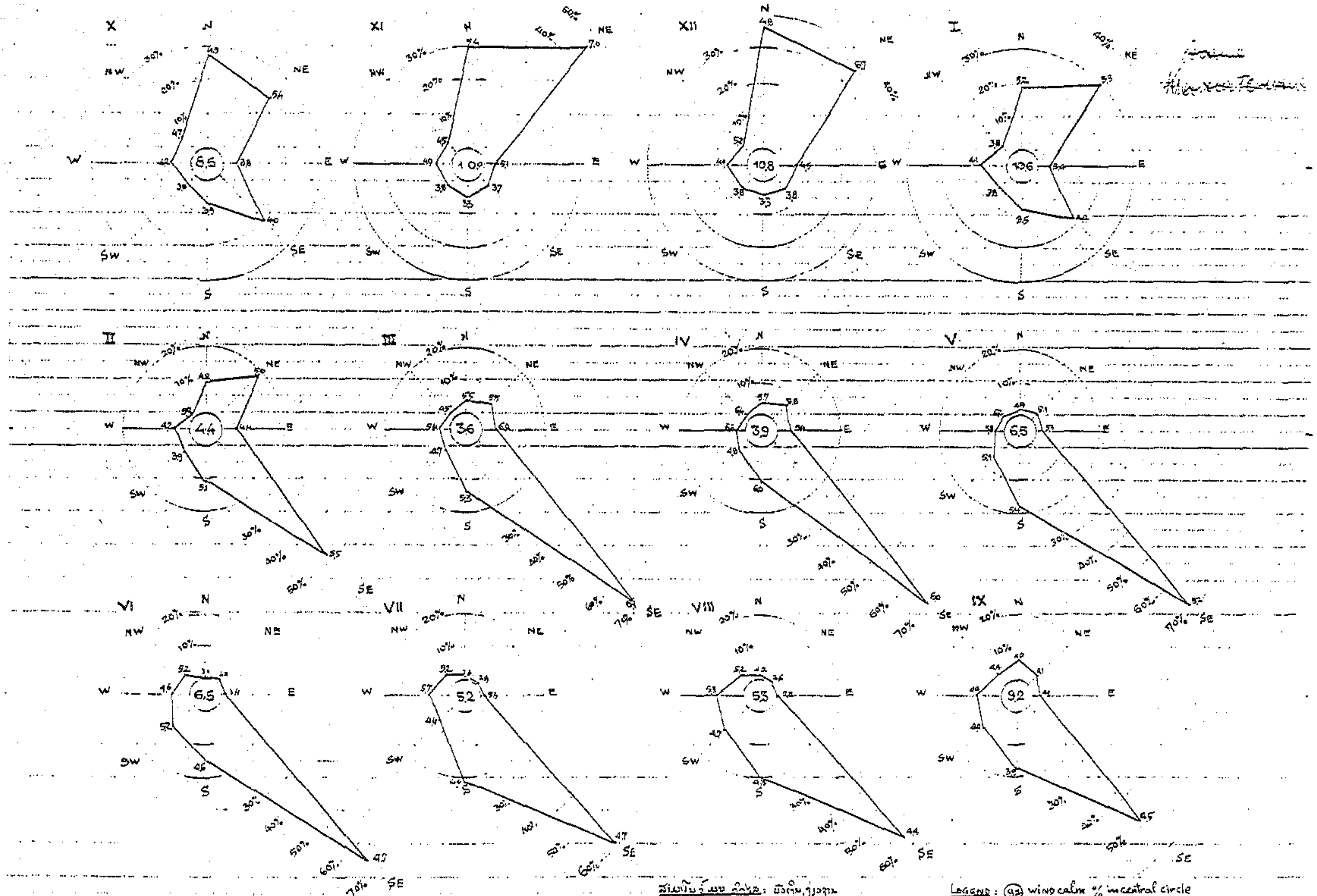
໑ ⓐ



ແຕ້ມ ເດືອນ III ໘໘

9 (b) ປາກເຊ: ຮູບກຸຫຼາບ ລົມ ຜິວພື້ນ, 8 ທິດ ຕົ້ນຕໍ, ຄວາມໄວ ແມັດ/ວິນາທີ (1961 _ 1980)

PAKSÉ : SURFACE WIND ROSE , 8 DIRECTIONS V= m/s (20-year AVERAGE)



[illegible]: [illegible] (1983)

LEGEND : (9,2) wind calm % in central circle
Frequency of directions 1 circle = 10%

(19) Run-off calculation from Water balance
1986 data at NIKHOM 34. (unit = mm), Q = m³/s

Parameter	Jan	Feb	Mar	Apr.	May	Jun	Jl	Aug	Sept	Oct	No	De	ANN.
P mm	0	33	24	67	431	241	444	650	243	280	23	31	2467
PET (Penman)	94	95	126	113	99	105	104	99	100	94	93	91	1213
P – PET	-94	-62	-102	-46	+332	+136	+340	+551	+143	+186	-70	-60	
Reserve	0	0	0	0	100	100	100	100	100	100	0	0	
Deficiency	-94	-62	-102	-46							-70	-60	
Surplus					+232	+136	+340	+551	+143	+186			
Run off.					116	184	238	445.5	347.	164.5	93	46.5	1634.5
Q at CA784 (Table 3.9)	9.62	5.76	3.20	4.19	24.13	25.94	47.00	73.15	63.54	41.59	22.94	13.24	28.03
M_0 l/s/km²	12.27	7.35	4.08	5.34	30.78	33.09	59.95	93.30	81.04	53.04	29.26	16.87	
Q calculated					33.95	55.00	69.67	130.4	105.	48.3	28.12	13.75	
at %					65	65	65	65	70	70	-		
Q at %					22.06	35.75	45.3	84.8	73.5	43.5	28.12	13.75	

* The basic principle.

To assess the loss of water from the soil, Thornthwaite takes the difference between potential Evapotranspiration PET and actual evapotranspiration when there is sufficient water available for vegetation (that is the case of the Bolaven Plateau from May ---). Assuming that the reserve RS = 100 mm. If the precipitation P is in excess of the needs of PET or water need, the actual evapotranspiration is equal to the PET and any excess water remains in Reserve up to 100mm, the remainder (water surplus) going to underground run off, half of it during the month and the other half during subsequent months.

In the example of computation we assume that the Surface run off is approximately 65% of the total run off from May - August and more higher from September - October for 1986 year. That is an assumption and Results can be compared with the other methods ---

(11) calculations of peak Flood Discharges at Projectsites

Two methods are used

(1) _ the SCS method

(2) _ the D. Sakolosky method:

(1) At XEKATAM Project Damsite (SCS method)

Catchment Area: 290 Km^2

H, thedifference elevation between the fartest point and Damsite, being. 1700m _ 450m = 1250m

Length of the river approx 45 Km

$L = 45000\ m \times 3,28 = 147600$ feet

$S = 0.02777$ ([illegible])

For computation of maximum peak flow from a daily rainfall of 200mm reasonnably accepted as Tr = 10 year period. and giving intensity in 4 hours, i = 50mm/h, uniformly over the catchment (hourly rainfall at Paksong Town for Tr = 10 y is about 65 mm/h computed from the period 1966 _ 1970).

Estimation of direct run off or Pe on the basis of

$$P_e = \frac{(P - 0.2S)^2}{P + 0.8S}$$

and the curve number:

$$CN = 60.$$

The time of concentration Tc is estimate from the kirpich's formula or from the Kinematic wave and SCS average velocity formula.

for Kirpich's formula: $T_c = 0.0078\, L^{0.77}\, S^{-0.385}$

$T_c = 0.0078 \times 9554{,}2477 \times 3.973534 = 296.1202$ minutes $\approx (5^{H})$

Consider 1h unit hydrograph,

$t_r = 1h\ ;\ t_p \approx 0.6 T_c = 0.6 \times 5 = (3^{H})$

$T_p = \frac{t_r}{2} + t_p = 0.5 + 3 = 3.5\ h$

and $t_b = 2.67 \times 3.5 \approx 9.4\ h$

for $A = 290\ Km^2$

$$q_p = \frac{2.08 . A}{T_p} = \frac{2.08 \times 290}{3.5} \approx 172\ m^3/s . cm$$

This means that each 1 cm of excess rainfall, Pe (direct runoff) will produce 172 m3/s from this catchment.

The peak discharge Qp, from each hr, Pe, increment is

$Q_{p,t} = q_p \times P_{e,t}$

For CN = 60

P = 200 mm/day and 50mm/h in 4 hours.

time	cumul.Rain. P=mm	cumulative	Pe (t)	Peak disch
h		Run-off Pe	cm	Qp m³/s
0	0	0	0	0
1	50	3	0.3	51.6
2	100	20	1.7	292.4
3	150	50	3	516.
4	200	86	3.6	619.2

2/ XÉNAMNOY at BAN LATSASIN.

CA = 537 Km² Altitude = 720 m

H = 1000 − 720 = 280 m

L = 40 Km (40 000 × 3,28 = 131200 feet

S = 0.007

$Tc = 0.0078 . 131200^{0.77} × 0.007^{-0.385} = 0.0078 × 8725,8763 × 6.755$

$= 459.7577$ minuts $= 7.66$ h

for tr = 1 h, tp = 0.6 Tc = 0.6 × 7.66 = 4.596 = 4.6 h

$Tp = \frac{tr}{2} + tp = 0.5 + 4.6 = 5.1$ h, tb = 2,67 × 5,1 = 13,6 h

A = 537 Km²

$qp = \frac{2.08 × 537}{5.1} = 219$ m³/s.cm

for the same CN = 60

Pe(t)	Qp
0	0
0.3	0.3 × 219 = 65.7 m³/s
1.7	1.7 × 219 = 372.3 m³/s
3	3 × 219 = 657.0 —
3.6	3.6 × 219 = 788,4 —

Vtiane, 22/7/91

Khamthong S

② calculation of Qmax from Sakolosky method.

Ex: A Small tributary of Sedone near the toe of the Bolaven plateau with a mean height H = 625m, the catchment area is F = 203 Km² no lake of pond in the basin
the calalation of a peak flood discharge Qmax(1%) for this example is:

$q_{200} = 5,4\ m^3/s/Km^2$; $m = 0,63$ and $\lambda = 1$, $P = 1\%$

$$Q_{max\,1\%} = 5.4\left(\frac{200}{203}\right)^{0.63} \times 1 \times 203 = \underline{1085\ m^3/s}$$

The formula is:

$$Q_P = q_{200}\left(\frac{200}{F}\right)^{m} \cdot \lambda \cdot \delta_1 \times F$$

where

F = the catchment area in sq.km
m = 0.63 for mountainous regions
$q_{200} = 5,4\ m^3/s/Km^2$ — "
λ : coefficient depend upon the size of river basin
$\delta = \frac{H_T}{(60.T)^{0.33}}$ or $\delta = A + B \log N$ for precipitation rate
T = 100 year period (P = 1%), A and B → figures

* For the same area with F = 51 Km² (upper Sedone) with L = 22,5 Km, mean Height of the basin = 410m

$$Q_{max\,1\%} = \frac{0.28 \cdot H_T\,\alpha \cdot F}{t_\pi} \times f$$

where $t_\pi = \frac{L}{3.6 V_\pi} = \frac{22.5}{3.6 \times 2.50} = 2,5\ h.$

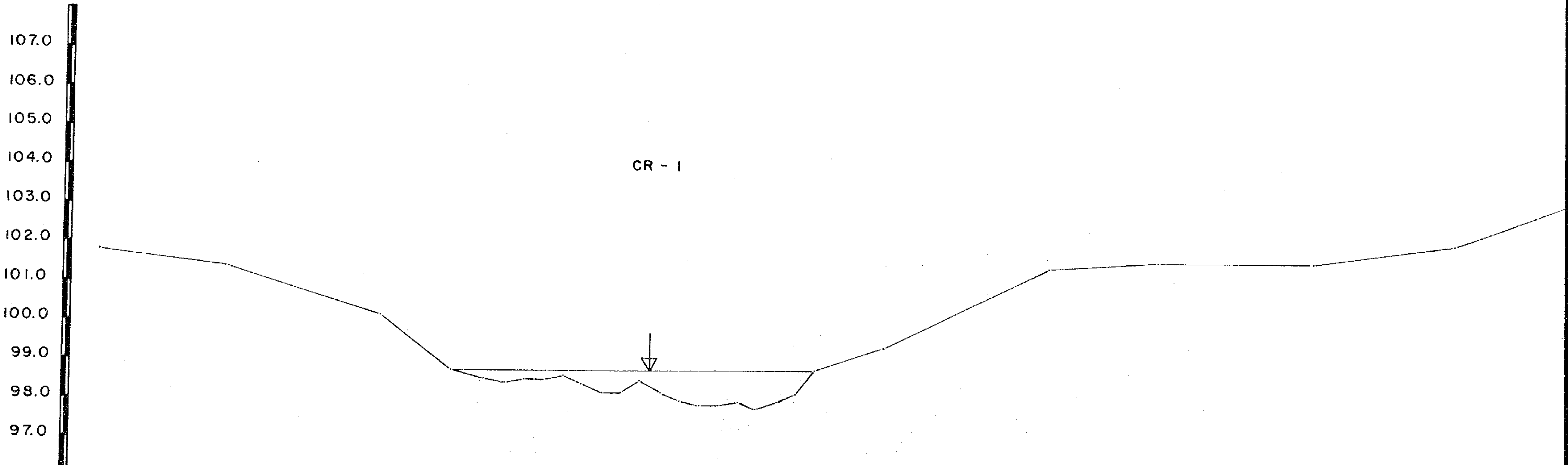
$V_\pi = 0.7 \times 3.57 = 2.50\ m/s$, $V_{max} = \underline{3.57}\ m/s$ (Seems to be higher)
$T = t_\pi \cdot \mu = 2.5 \times 0.78 = \boxed{2^H}$, $\mu = 0.78$ (coefficient of reduction)
$H_T = \delta(T.60)^{0.33} = 24,8\,(2,0 \times 60)^{0.33} = \underline{120}\ mm$ (precipitation)
$\alpha = \frac{Q_{cp\,max}}{Q_P}$ (table)
$\alpha = 0.35$ for $81 < H.T < 150$ mm and F between $\underline{10 \sim 100\ Km^2}$
$f = 0.923$ coefficient of the hydrograph shape.
Hence, $Q_{max\,1\%} = \frac{0.28 \times 120 \times 0.35 \times 51\,Km^2 \times 0.923}{2,5} = \underline{\underline{221\ m^3/s}}$

(all of these computations are only for information)

CROSS SECTION OF XE KATAM RIVER
AT BAN NONGHIN (1/3)

(10 m upstream from staff gauge)

SCALE 1: $\frac{100}{200}$

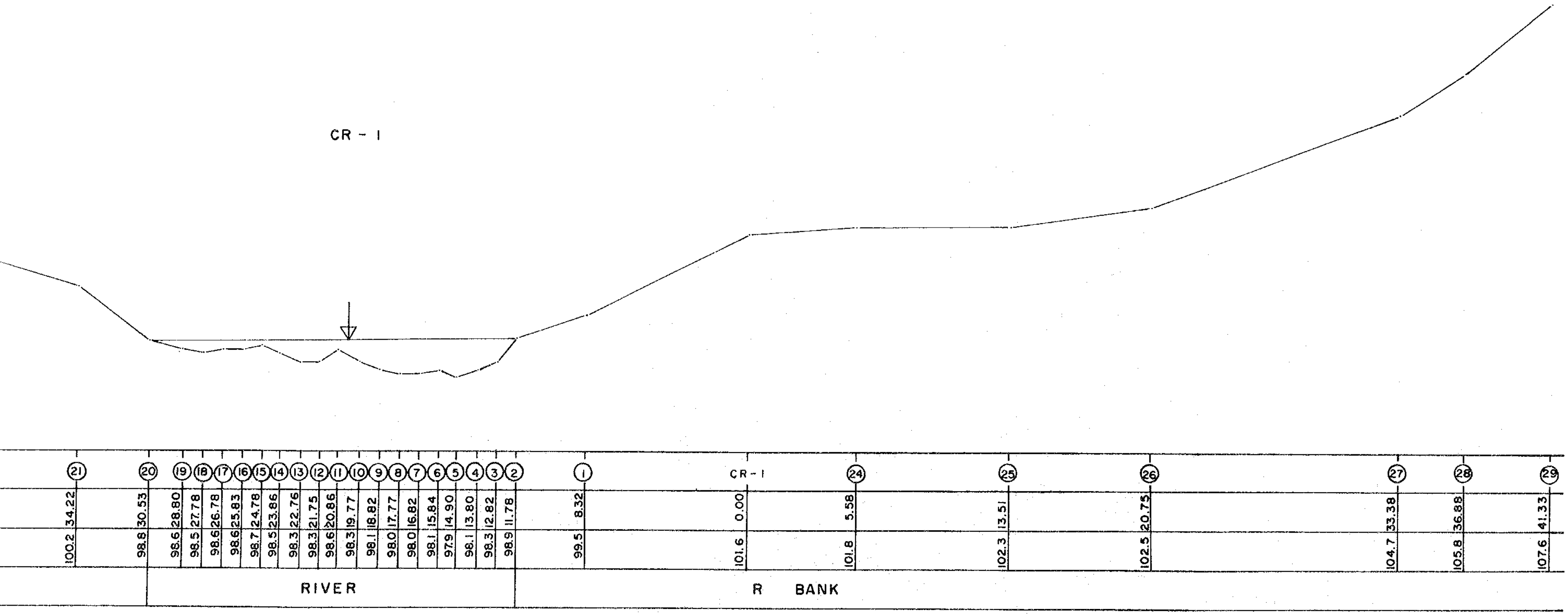


POINT	㉓	㉒	㉑	⑳	⑲	⑱	⑰	⑯	⑮	⑭	⑬	⑫	⑪	⑩	⑨	⑧	⑦	⑥	⑤	④	③	②	①	CR - I	㉔	㉕	㉖
DISTANCE	48.35	41.86	34.22	30.53	28.80	27.78	26.78	25.83	24.78	23.86	22.76	21.75	20.86	19.77	18.82	17.77	16.82	15.84	14.90	13.80	12.82	11.78	8.32	0.00	5.58	13.51	20.75
ELEVATION	101.8	101.4	100.2	98.8	98.6	98.5	98.6	98.6	98.7	98.5	98.3	98.3	98.6	98.3	98.1	98.0	98.0	98.1	97.9	98.1	98.3	98.9	99.5	101.6	101.8	102.3	102.5
REMARK	L BANK			RIVER																			R BANK				

CROSS SECTION OF XE KATAM RIVER
AT BAN NONGHIN (1/3)

(10 m upstream from staff gauge)

SCALE 1: $\frac{100}{200}$



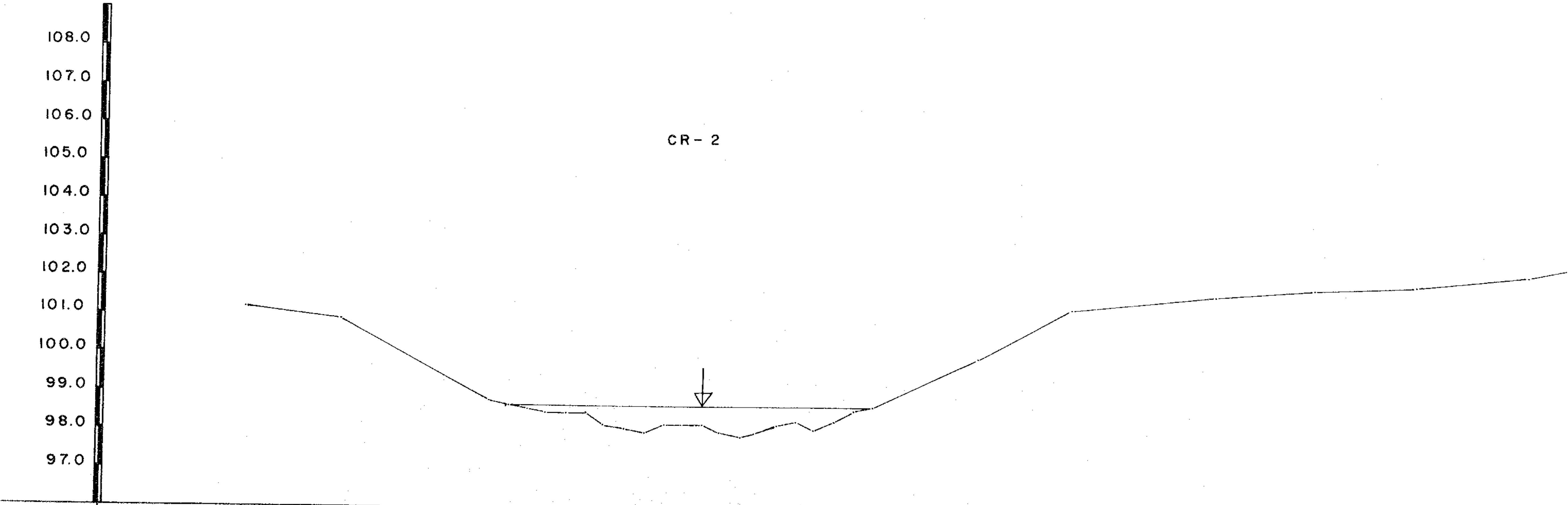
㉑	⑳	⑲	⑱	⑰	⑯	⑮	⑭	⑬	⑫	⑪	⑩	⑨	⑧
34.22	30.53	28.80	27.78	26.78	25.83	24.78	23.86	22.76	21.75	20.86	19.77	18.82	17.77
100.2	98.8	98.6	98.5	98.6	98.6	98.7	98.5	98.3	98.3	98.6	98.3	98.1	98.0
	RIVER												

⑦	⑥	⑤	④	③	②	①	CR-I	㉔	㉕	㉖	㉗	㉘	㉙
16.82	15.84	14.90	13.80	12.82	11.78	8.32	0.00	5.58	13.51	20.75	33.38	36.88	41.33
98.0	98.1	97.9	98.1	98.3	98.9	99.5	101.6	101.8	102.3	102.5	104.7	105.8	107.6
						R BANK							

by HEC

CROSS SECTION OF XE KATAM RIVER
AT BAN NONGHIN (2/3)

(at staff gauge)

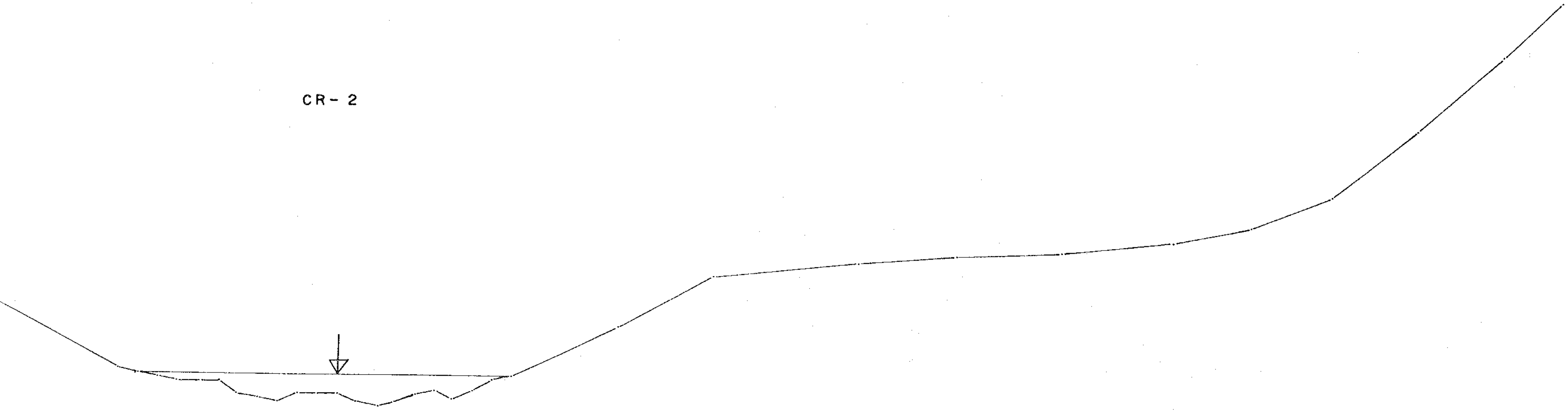


POINT	㉝	㉜	㉛	㉚	㉙	㉘	㉗	㉖	㉕	㉔	㉓	㉒	㉑
DISTANCE	42.65	37.67	29.97	29.00	28.03	27.08	26.00	25.05	24.06	23.05	21.99	21.00	20.06
ELEVATION	101.2	100.9	98.8	98.7	98.6	98.5	98.5	98.5	98.2	98.1	98.0	98.2	98.2
REMARK	L BANK			RIVER									

POINT	⑳	⑲	⑱	⑰	⑯	⑮	⑭	⑬	⑫	⑪	⑩	CR -2	①	②	③	④
DISTANCE	19.00	18.12	17.03	16.32	15.09	14.13	13.15	12.16	11.21	10.22	4.80	0.00	7.43	12.36	17.68	23.44
ELEVATION	98.2	98.0	97.9	98.0	98.2	98.3	98.1	98.3	98.6	98.7	100.0	101.3	101.7	101.9	102.0	102.3
REMARK	RIVER										R BANK					

CROSS SECTION OF XE KATAM RIVER
AT BAN NONGHIN (2/3)

(at staff gauge)



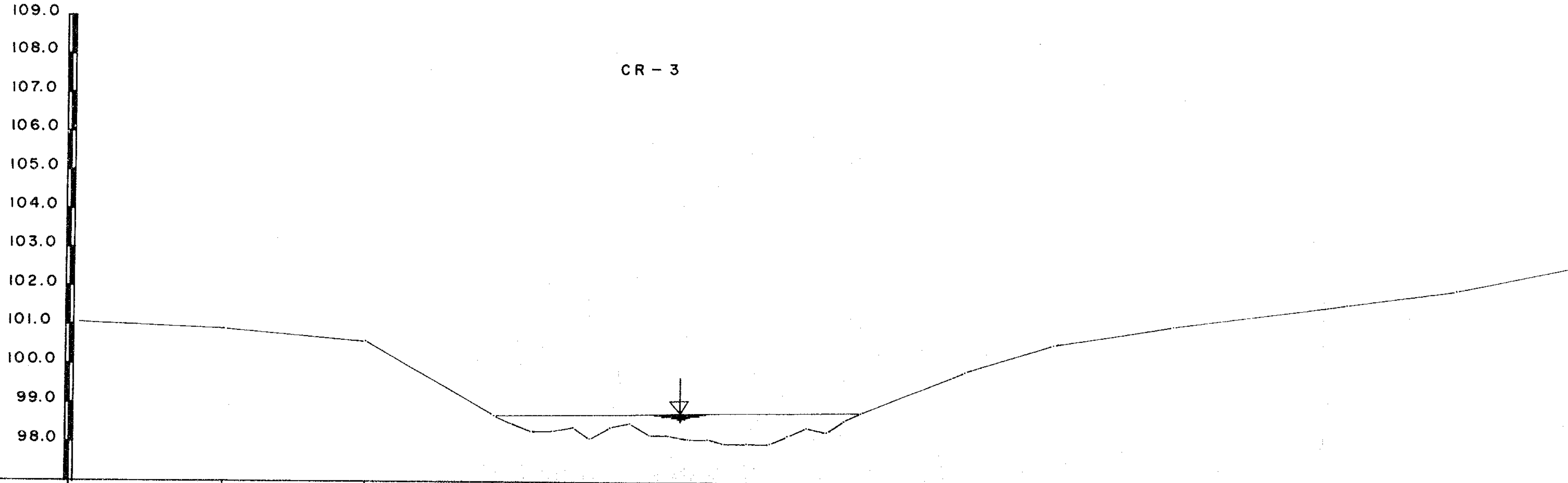
㉛	㉚	㉙	㉘	㉗	㉖	㉕	㉔	㉓	㉒	㉑	⑳	⑲	⑱	⑰	⑯	⑮	⑭	⑬	⑫	⑪
29.97	29.00	28.03	27.08	26.00	25.05	24.06	23.05	21.99	21.00	20.06	19.00	18.12	17.03	16.32	15.09	14.13	13.15	12.16	11.21	10.22
98.8	98.7	98.6	98.5	98.5	98.5	98.2	98.1	98.0	98.2	98.2	98.2	98.0	97.9	98.0	98.2	98.3	98.1	98.3	99.6	98.7
	RIVER																			

⑩	CR -2	①	②	③	④	⑤	⑥	⑦	⑧	⑨
4.80	0.00	7.43	12.36	17.68	23.44	27.33	31.45	35.60	39.93	42.78
100.0	101.3	101.7	101.9	102.0	102.3	102.7	103.5	105.2	107.1	108.5
R BANK										

by HEC

CROSS SECTION OF XE KATAM RIVER
AT BAN NONGHIN (3/3)

(10 m downstream from staff gauge)



POINT	㉓	㉒	㉑	⑳	⑲	⑱	⑰	⑯	⑮	⑭	⑬	⑫	⑪	⑩	⑨	⑧	⑦	⑥	⑤	④	③	②	①	CR–3	㉕	㉖	㉗
DISTANCE	42.22	34.75	28.51	27.56	26.59	25.53	24.44	23.62	22.63	21.64	20.57	19.55	18.60	17.62	16.67	15.62	14.45	13.57	12.65	11.63	10.68	9.77	4.28	0.00	6.06	15.03	20.64
ELEVATION	100.9	100.6	98.7	98.5	98.3	98.3	98.4	98.1	98.4	98.5	98.2	98.2	98.1	98.1	98.0	98.0	98.0	98.2	98.4	98.3	98.6	98.8	99.9	100.6	101.1	101.7	102.1
REMARK	L BANK		RIVER																				R BANK				

CROSS SECTION OF XE KATAM RIVER
AT BAN NONGHIN (3/3)

(10 m downstream from staff gauge)

㉒	㉑	⑳	⑲	⑱	⑰	⑯	⑮	⑭	⑬	⑫	⑪	⑩	⑨	⑧	⑦	⑥	⑤	④	③	②	①	CR-3	㉕	㉖	㉗	㉘	㉙
34.75	28.51	27.56	26.59	25.53	24.44	23.62	22.63	21.64	20.57	19.55	18.60	17.62	16.67	15.62	14.45	13.57	12.65	11.63	10.68	9.77	4.28	0.00	6.06	15.03	20.64	33.00	41.01
100.6	98.7	98.5	98.3	98.3	98.4	98.1	98.4	98.5	98.2	98.2	98.1	98.1	98.0	98.0	98.0	98.2	98.4	98.3	98.6	98.8	99.9	100.6	101.1	101.7	102.1	103.5	108.9
	RIVER																				R BANK						

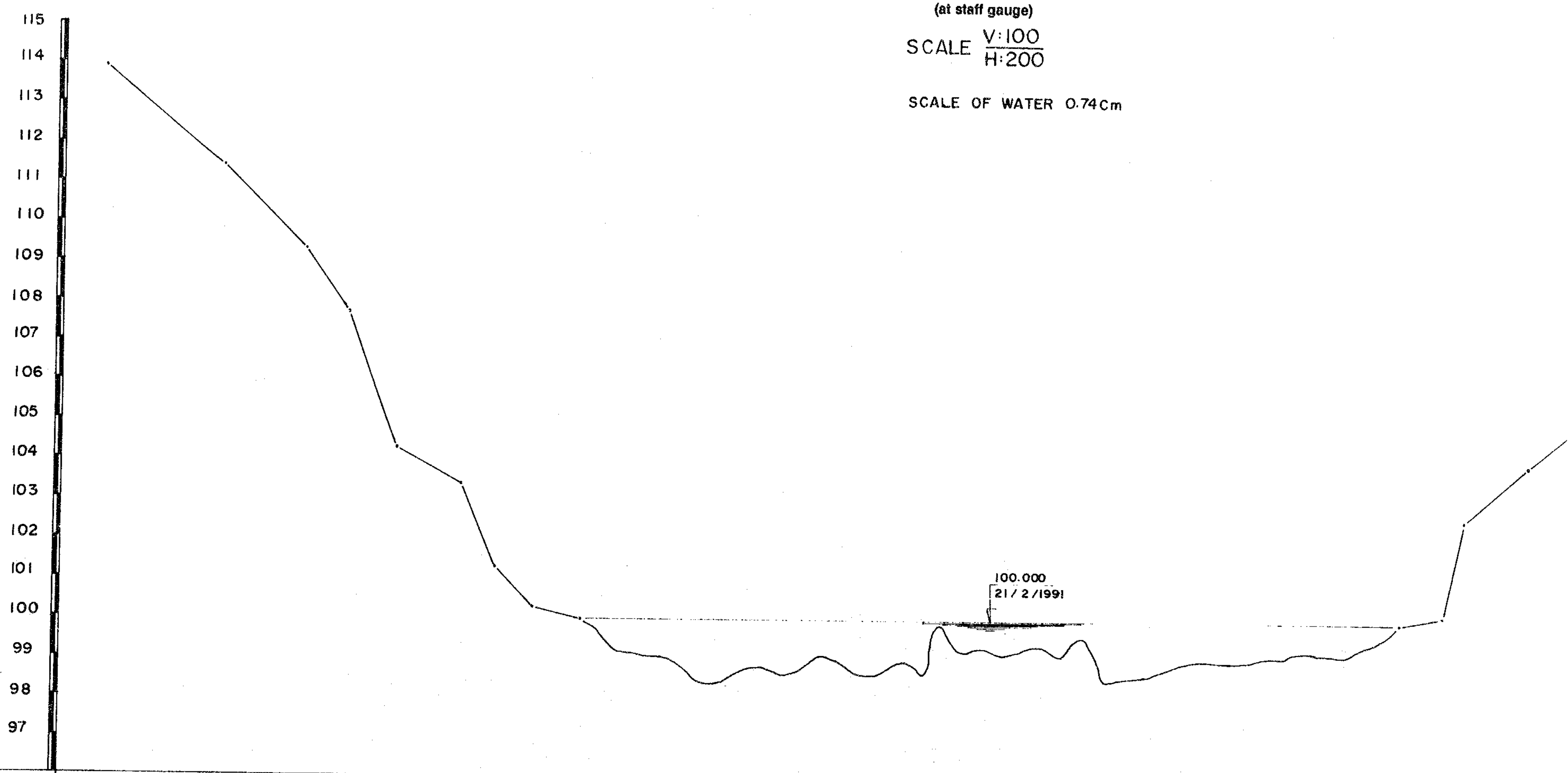
by HEC

CROSS SECTION OF XE NAMNOY RIVER
AT BAN LATSASIN (2/2)

(at staff gauge)

SCALE $\frac{V:100}{H:200}$

SCALE OF WATER 0.74cm



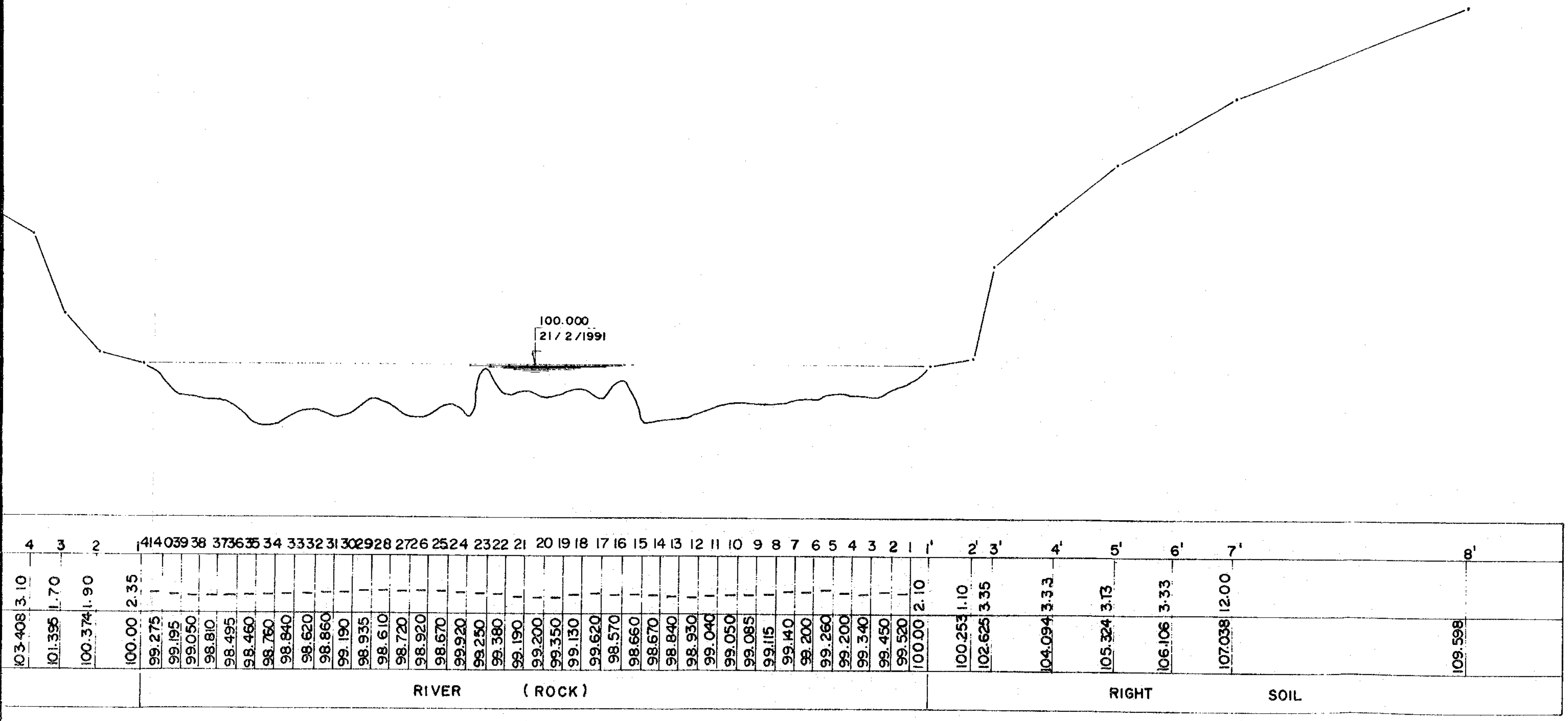
POINT	DISTANCE	ELEVATION	REMARK
9		113.968	SOIL LEFT
8	6.00	111.418	
7	4.15	109.302	
6	2.5	107.731	
5	2.25	104.384	
4	3.10	103.408	
3	1.70	101.395	
2	1.90	100.374	
1 41	2.35	100.00	
40	–	99.275	RIVER (ROCK)
39	–	99.195	
38	–	99.050	
37	–	98.810	
36	–	98.495	
35	–	98.460	
34	–	98.760	
33	–	98.840	
32	–	98.620	
31	–	98.860	
30	–	99.190	
29	–	98.935	
28	–	98.610	
27	–	98.720	
26	–	98.920	
25	–	98.670	
24	–	99.920	
23	–	99.250	
22	–	99.380	
21	–	99.190	
20	–	99.200	
19	–	99.350	
18	–	99.130	
17	–	99.620	
16	–	98.570	
15	–	98.660	
14	–	98.670	
13	–	98.840	
12	–	98.930	
11	–	99.040	
10	–	99.050	
9	–	99.085	
8	–	99.115	
7	–	99.140	
6	–	99.200	
5	–	99.260	
4	–	99.200	
3	–	99.340	
2	–	99.450	
1	–	99.520	
1'	2.10	100.00	
2'	1.10	100.253	
3'	3.35	102.625	
4'	3.33	104.094	

CROSS SECTION OF XE NAMNOY RIVER
AT BAN LATSASIN (2/2)

(at staff gauge)

SCALE $\frac{V:100}{H:200}$

SCALE OF WATER 0.74Cm



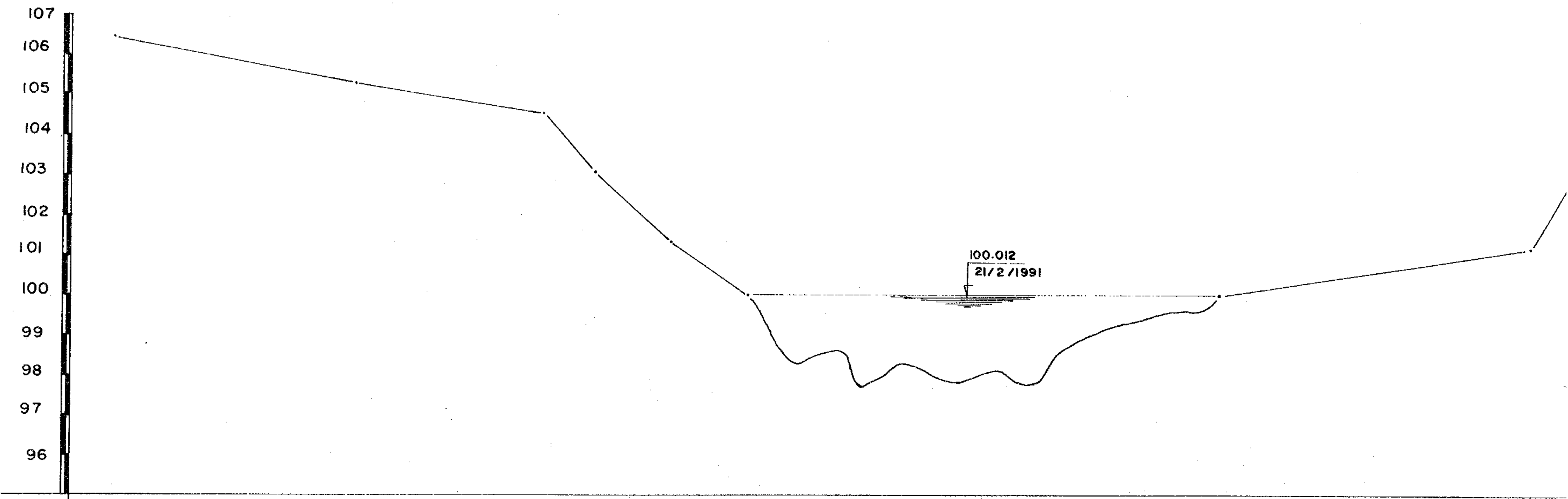
by HEC

CROSS SECTION OF XE NAMNOY RIVER AT BAN LATSASIN (1/2)

(15 m upstream from staff gauge)

SCALE $\frac{V: 100}{H: 200}$

SCALE OF WATER 0.74 Cm



POINT	6	5	4	3	2	1	1	2	3	4	5	6	7	8
DISTANCE		12.6	8.9	2.5	4.4	3.76	–	–	–	–	–	–	–	–
ELEVATION	106.457	105.284	104.562	103.054	101.395	100.012	99.767	98.762	98.287	98.512	98.637	97.642	97.997	98.332
REMARK	SOIL LEFT			ROCK			RIVER (ROCK)							

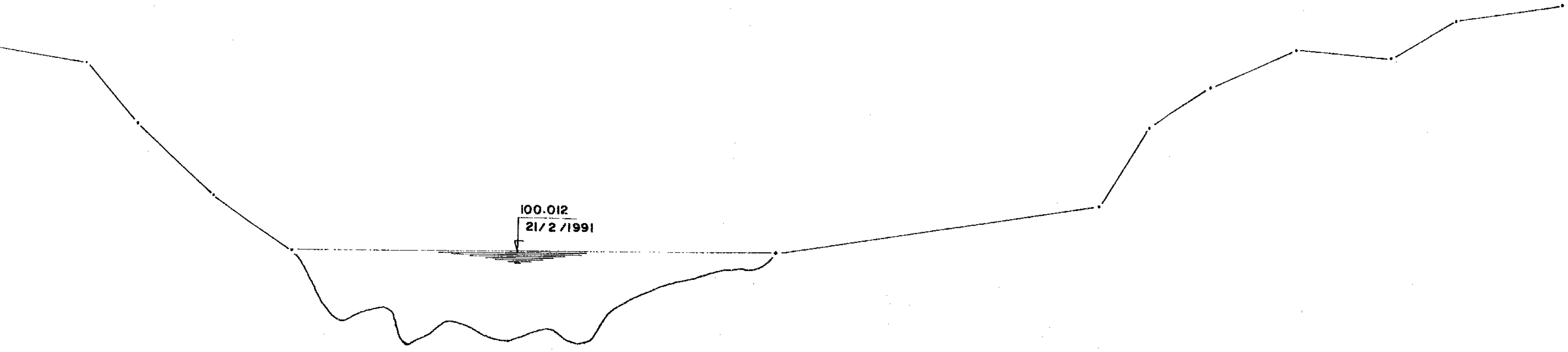
POINT	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23 1'	2'
DISTANCE	–	–	–	–	–	–	–	–	–	–	–	–	–		15.3	2.4
ELEVATION	98.152	97.827	97.717	98.012	98.172	97.772	97.732	98.682	98.892	99.072	99.342	99.352	99.562	99.402	100.012	101.266
REMARK																RIGHT ROCK

CROSS SECTION OF XE NAMNOY RIVER
AT BAN LATSASIN (1/2)

(15 m upstream from staff gauge)

SCALE $\frac{V: 100}{H: 200}$

SCALE OF WATER 0.74 Cm



4	3	2	1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23 1'	2'	3'	4'	5'	6'	7'	8'
8.9	2.5	4.4	3.76	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		15.3	2.4	3.00	4.4	4.75	4.05	5.15	
104.562	103.054	101.395	100.012	99.767	98.762	98.287	98.512	98.637	97.642	97.997	98.332	98.152	97.827	97.717	98.012	98.172	97.772	97.732	98.682	98.892	99.072	99.342	99.352	99.562	99.402	100.012	101.266	103.194	104.175	105.084	104.864	105.890	106.240
ROCK				RIVER (ROCK)																							RIGHT ROCK	SOIL					

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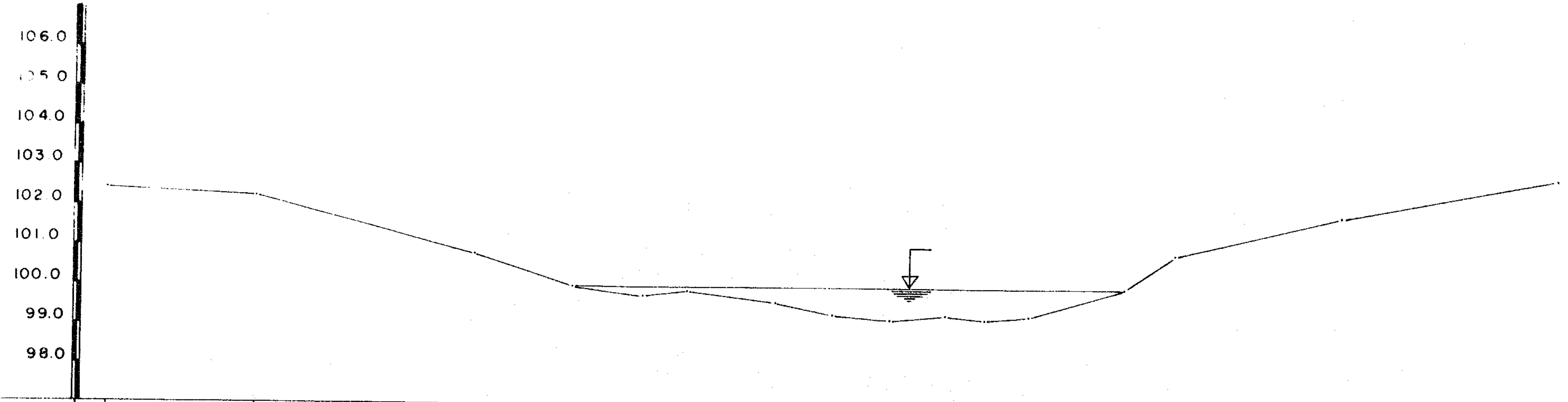
CROSS SECTION OF HOUAY MAKCHAN RIVER
AT NIKHON34 (1/3)

(10 m upstream from staff gauge at bridge)

SCALE $1\frac{100}{100}$

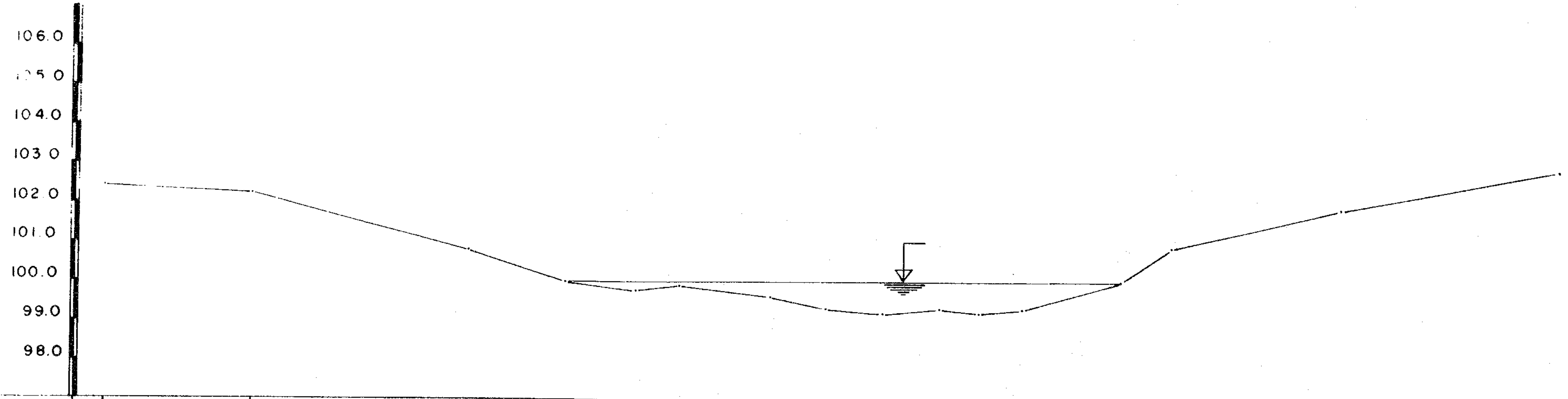


POINT	①	②	CR-1	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭	⑮
DISTANCE	9.25	5.50	0.00	2.48	4.26	5.38	7.65	9.05	10.52	11.87	12.93	14.02	16.36	17.74	21.94	27.44
ELEVATION	102.4	102.2	100.7	100.0	99.8	99.9	99.6	99.3	99.2	99.3	99.2	99.3	100.0	101.9	101.9	102.9
REMARK	L BANK			RIVER									R BANK			

CROSS SECTION OF HOUAY MAKCHAN RIVER
AT NIKHON34 (1/3)

(10 m upstream from staff gauge at bridge)

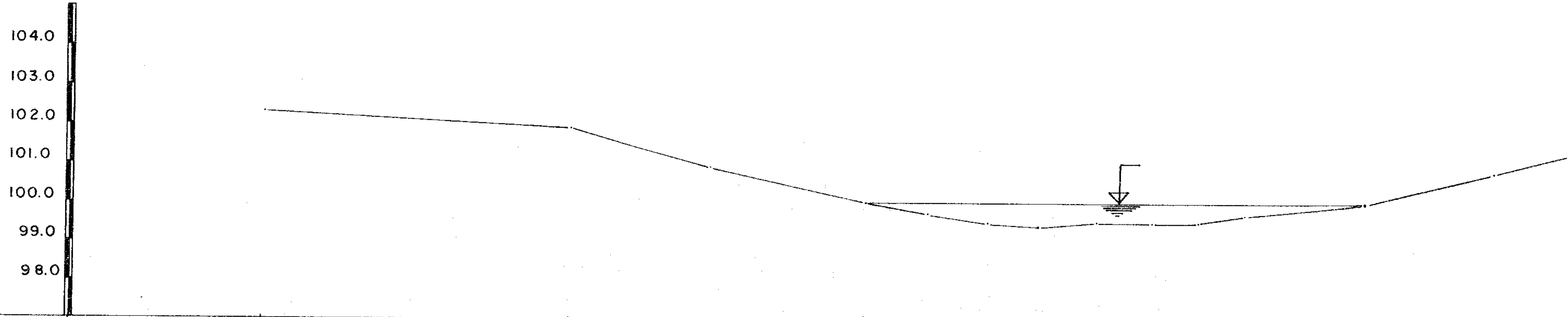
SCALE $1\frac{100}{100}$



T	①	②	CR-I	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭	⑮
ANCE	9.25	5.50	0.00	2.48	4.26	5.38	7.65	9.05	10.52	11.87	12.93	14.02	16.36	17.74	21.94	27.44
VATION	102.4	102.2	100.7	100.0	99.8	99.9	99.6	99.3	99.2	99.3	99.2	99.3	100.0	101.9	101.9	102.9
ARK	L BANK			RIVER									R BANK			

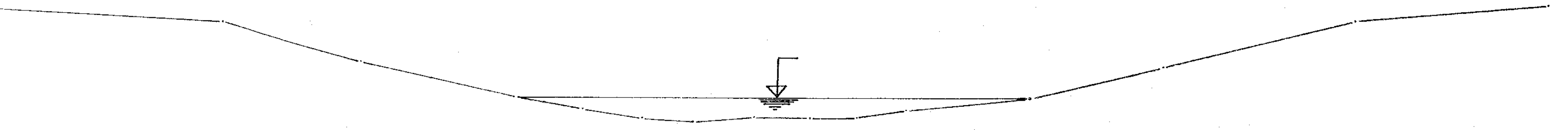
by HEC

CROSS SECTION OF HOUAY MAKCHAN RIVER
AT NIKHON34 (2/3)
(at staff gauge)



POINT	①	②	③	CR-2	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬
DISTANCE	15.10	7.42	3.88	0.00	1.64	3.08	4.41	5.92	7.31	8.48	9.72	10.99	12.83	16.11
ELEVATION	102.3	101.9	100.9	100.0	99.7	99.5	99.4	99.5	99.5	99.5	99.7	99.8	100.0	100.8
REMARK	L BANK			RIVER										

CROSS SECTION OF HOUAY MAKCHAN RIVER
AT NIKHON34 (2/3)
(at staff gauge)



②	③	CR-2	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭	⑮
7.42	3.88	0.00	1.64	3.08	4.41	5.92	7.31	8.48	9.72	10.99	12.83	16.11	20.92	25.66
101.9	100.9	100.0	99.7	99.5	99.4	99.5	99.5	99.5	99.7	99.8	100.0	100.8	102.0	102.4
L BANK		RIVER									R BANK			

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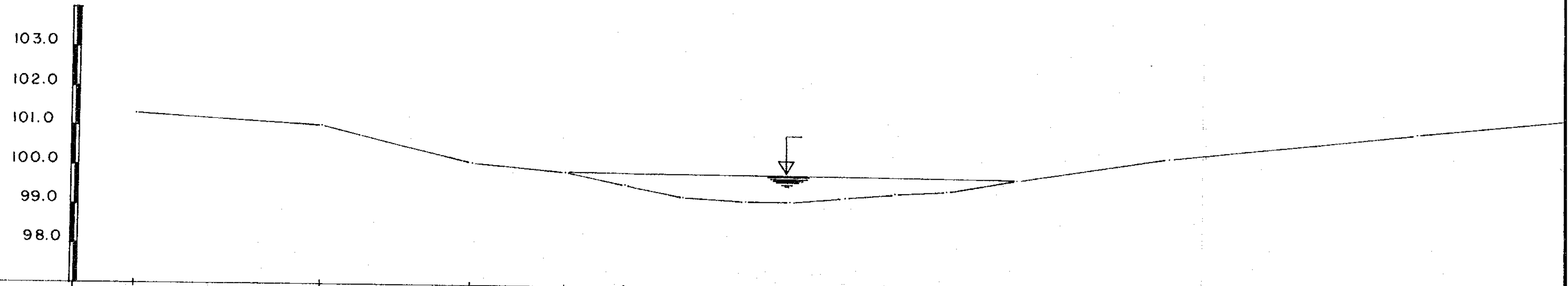
CROSS SECTION OF HOUAY MAKCHAN RIVER
AT NIKHON34 (3/3)

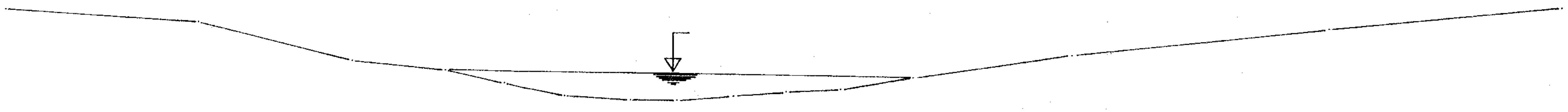
(10 m downstream from staff gauge)



POINT	①	②	CR-3	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬
DISTANCE	8.50	3.77	0.00	2.45	3.90	5.45	6.97	8.09	9.50	10.83	12.11	13.93	17.75	24.17
ELEVATION	101.3	101.0	100.1	99.9	99.6	99.3	99.2	99.2	99.3	99.4	99.5	99.8	100.4	101.1
REMARK	L BANK			RIVER									R BANK	

CROSS SECTION OF HOUAY MAKCHAN RIVER
AT NIKHON34 (3/3)

(10 m downstream from staff gauge)



①	②	CR-3	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭
8.50	3.77	0.00	2.45	3.90	5.45	6.97	8.09	9.50	10.83	12.11	13.93	17.75	24.17	29.75
101.3	101.0	100.1	99.9	99.6	99.3	99.2	99.2	99.3	99.4	99.5	99.8	100.4	101.1	101.7
L BANK			RIVER								R BANK			

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APPENDIX-4 Regulating Pond Capacity

APPENDIX-4

Contents

Appendix 4

A4.1 Necessity of Pond

Xe-Katam Small-scale Hydroelectric Power Station is a run-of-river, therefore basically generating power is limited up to current stream energy at anytime.

On the other hand, power demand fluctuates from bottom load to peak load during day. After commissioning, according to demand growth in future, this power station will spill water in midnight as bottom load and will not generate enough power to demand at peak load.

Provided that, spill energy can be used for peak load portion, stream energy will be used in so high effectivity. As following daily load curve, this power station can serve stable power to Se Kong and Attapeu up to stream capability.

For this solution, required capacity has been calculated and examined. Calculation conditions are shown in A4.2.

A4.2 Calculation Condition

Calculation condition are follows.

Inflow : 1.10 m^3/sec equivalent value to 95% firm capacity
Spill Energy : Adjustment to zero
Effective Head : Constant
Efficiency : Depend on load
Received Power : Required power for adjusting spill energy to zero
Study Team : From 1995 to the year, that expected bottom load at midnight will exceed 1,400 kW (1.1 m^3/sec equivalent power) (1995 ~ 2006)

Results of these calculation are shown in Table A-4-1.

A4.3 Results of Analysis

From the results of this analysis, the maximum required pond capacity is estimated as 11,100 m^3 in 2000. However, after 2001 this value will be reduced, and daily load curve is calculated by estimated value. Therefore, adequate capacity of this pond is recommended as 10,000 m^3.

A4.4 Regulating Pond Operation

Since above analysis was carried out based on 95% firm capacity, it appeared that this pond is not effective after 2001. However, at that time it will be still effective, if the critical inflow set larger value than 1.1 m^3/sec, such as 1.5 m^3/sec.

Table A-4-1 Calculation of Regulating Pond Capacity (1)

Inflow=1.10m^3/S

Hours			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
Power Demand as of 1995	(KW)		645	645	645	671	738	802	879	1074	1291	1265	1265	1291	808	952	1265	1291	1361	1174	859	8
Number of Operation Units			1	1	1	1	1	1	1	2	2	2	2	2	1	1	2	2	2	2	1	
Purchase	(KWh)																					
Inflow (Minimum Inflow)	(m^3/S)		1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.
Discharge	(m^3/S)		0.52	0.52	0.52	0.54	0.59	0.64	0.70	0.86	1.04	1.01	1.01	1.04	0.65	0.76	1.01	1.04	1.09	0.94	0.69	0.
Surplus or Shortage	(m^3/S)		0.58	0.58	0.58	0.56	0.51	0.46	0.40	0.24	0.06	0.09	0.09	0.06	0.45	0.34	0.09	0.06	0.01	0.16	0.41	0.
Accumulation	(10^3*m^3)		12.85	14.95	17.05	19.07	20.90	22.55	23.97	24.83	25.06	25.37	25.68	25.91	27.54	28.76	29.07	29.30	29.33	29.90	1.48	3.
Sub Total	(10^3*m^3)																			29.90	Start	
Required Reservoir Volume	(10^3*m^3)	0.00																				
Power Demand as of 1996	(KWh)		722	722	722	752	827	898	984	1203	1446	1417	1417	1446	905	1067	1417	1446	1524	1315	962	9
Number of Operation Units			1	1	1	1	1	1	1	2	2	2	2	2	1	2	2	2	2	2	1	
Purchase	(KWh)																					
Inflow (Minimum Inflow)	(m^3/S)		1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.
Discharge	(m^3/S)		0.58	0.58	0.58	0.60	0.66	0.72	0.79	0.97	1.16	1.14	1.14	1.16	0.72	0.86	1.14	1.16	1.22	1.05	0.77	0.
Surplus or Shortage	(m^3/S)		0.52	0.52	0.52	0.50	0.44	0.38	0.31	0.13	-0.06	-0.04	-0.04	-0.06	0.38	0.24	-0.04	-0.06	-0.12	0.05	0.33	0.
Accumulation	(10^3*m^3)		11.24	13.11	14.99	16.78	18.36	19.73	20.85	21.34	21.13	21.00	20.87	20.66	22.01	22.89	22.76	22.55	22.11	0.16	1.35	2.
Sub Total	(10^3*m^3)									21.34				20.66		22.89			22.11	Start		
Required Reservoir Volume	(10^3*m^3)	0.78																				
Power Demand as of 1997	(KWh)		773	773	773	804	884	961	1053	1288	1547	1516	1516	1547	968	1141	1516	1547	1631	1407	1029	9
Number of Operation Units			1	1	1	1	1	1	2	2	2	2	2	2	1	2	2	2	2	2	2	
Purchase	(KWh)																					
Inflow (Minimum Inflow)	(m^3/S)		1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.
Discharge	(m^3/S)		0.62	0.62	0.62	0.64	0.71	0.77	0.84	1.03	1.24	1.21	1.21	1.24	0.78	0.92	1.21	1.24	1.31	1.13	0.83	0.
Surplus or Shortage	(m^3/S)		0.48	0.48	0.48	0.46	0.39	0.33	0.26	0.07	-0.14	-0.11	-0.11	-0.14	0.32	0.18	-0.11	-0.14	-0.21	-0.03	0.27	0.
Accumulation	(10^3*m^3)		9.91	11.64	13.37	15.01	16.42	17.61	18.53	18.77	18.27	17.85	17.44	16.94	18.11	18.77	18.36	17.85	17.11	17.01	0.99	2.
Sub Total	(10^3*m^3)									18.77				16.94		18.77				17.01	Start	
Required Reservoir Volume	(10^3*m^3)	1.83																				
Power Demand as of 1998	(KWh)		827	827	827	860	946	1028	1127	1378	1655	1622	1622	1655	1036	1221	1622	1655	1745	1506	1101	10
Number of Operation Units			1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
Purchase	(KWh)																					
Inflow (Minimum Inflow)	(m^3/S)		1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.
Discharge	(m^3/S)		0.66	0.66	0.66	0.69	0.76	0.83	0.90	1.10	1.33	1.30	1.30	1.33	0.83	0.98	1.30	1.33	1.40	1.21	0.88	0.8
Surplus or Shortage	(m^3/S)		0.44	0.44	0.44	0.41	0.34	0.27	0.20	0.00	-0.23	-0.20	-0.20	-0.23	0.27	0.12	-0.20	-0.23	-0.30	-0.11	0.22	0.2
Accumulation	(10^3*m^3)		8.65	10.22	11.80	13.28	14.51	15.50	16.20	16.19	15.37	14.66	13.94	13.12	14.09	14.52	13.81	12.99	11.92	11.54	0.78	1.6
Sub Total	(10^3*m^3)									16.19				13.12		14.52				11.54	0.78	
Required Reservoir Volume	(10^3*m^3)	3.06																				
Power Demand as of 1999	(KWh)		885	885	885	921	1013	1100	1205	1474	1771	1736	1736	1771	1109	1307	1736	1771	1867	1611	1178	114
Number of Operation Units			1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
Purchase	(KWh)																					
Inflow (Minimum Inflow)	(m^3/S)		1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.1
Discharge	(m^3/S)		0.71	0.71	0.71	0.74	0.81	0.88	0.97	1.18	1.42	1.39	1.39	1.42	0.89	1.05	1.39	1.42	1.49	1.29	0.94	0.9
Surplus or Shortage	(m^3/S)		0.39	0.39	0.39	0.36	0.29	0.22	0.13	-0.08	-0.32	-0.29	-0.29	-0.32	0.21	0.05	-0.29	-0.32	-0.39	-0.19	0.16	0.1
Accumulation	(10^3*m^3)		7.32	8.73	10.13	11.44	12.48	13.26	13.74	13.44	12.30	11.25	10.21	9.06	9.82	10.01	8.97	7.82	6.40	5.71	0.56	1.2
Sub Total	(10^3*m^3)								13.74					9.06		10.01				5.71	Start	
Required Reservoir Volume	(10^3*m^3)	4.67																				

culation of Regulating Pond Capacity (1)

Inflow=1.10m^3/S

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Total	
	645	645	645	671	738	802	879	1074	1291	1265	1265	1291	808	952	1265	1291	1361	1174	859	832	780	723	671	645	22573	
	1	1	1	1	1	1	1	2	2	2	2	2	1	1	2	2	2	2	1	1	1	1	1	1		
																									0	
	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	(Average)
	0.52	0.52	0.52	0.54	0.59	0.64	0.70	0.86	1.04	1.01	1.01	1.04	0.65	0.76	1.01	1.04	1.09	0.94	0.69	0.67	0.62	0.58	0.54	0.52	0.75	(Average)
	0.58	0.58	0.58	0.56	0.51	0.46	0.40	0.24	0.06	0.09	0.09	0.06	0.45	0.34	0.09	0.06	0.01	0.16	0.41	0.43	0.48	0.52	0.56	0.58	0.35	(Average)
	12.85	14.95	17.05	19.07	20.90	22.55	23.97	24.83	25.06	25.37	25.68	25.91	27.54	28.76	29.07	29.30	29.33	29.90	1.48	3.05	4.76	6.63	8.65	10.75	29.90	
																		29.90	Start							
00																										
	722	722	722	752	827	898	984	1203	1446	1417	1417	1446	905	1067	1417	1446	1524	1315	962	932	874	810	752	722	25281	
	1	1	1	1	1	1	1	2	2	2	2	2	1	2	2	2	2	2	1	1	1	1	1	1		
																									0	
	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	(Average)
	0.58	0.58	0.58	0.60	0.66	0.72	0.79	0.97	1.16	1.14	1.14	1.16	0.72	0.86	1.14	1.16	1.22	1.05	0.77	0.75	0.70	0.65	0.60	0.58	0.84	(Average)
	0.52	0.52	0.52	0.50	0.44	0.38	0.31	0.13	-0.06	-0.04	-0.04	-0.06	0.38	0.24	-0.04	-0.06	-0.12	0.05	0.33	0.35	0.40	0.45	0.50	0.52	0.26	(Average)
	11.24	13.11	14.99	16.78	18.36	19.73	20.85	21.34	21.13	21.00	20.87	20.66	22.01	22.89	22.76	22.55	22.11	0.16	1.35	2.63	4.07	5.69	7.49	9.36	22.11	
								21.34				20.66		22.89			22.11	Start								
78																										
	773	773	773	804	884	961	1053	1288	1547	1516	1516	1547	968	1141	1516	1547	1631	1407	1029	997	935	866	804	773	27051	
	1	1	1	1	1	1	2	2	2	2	2	2	1	2	2	2	2	2	2	1	1	1	1	1		
																									0	
	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	(Average)
	0.62	0.62	0.62	0.64	0.71	0.77	0.84	1.03	1.24	1.21	1.21	1.24	0.78	0.92	1.21	1.24	1.31	1.13	0.83	0.80	0.75	0.69	0.64	0.62	0.90	(Average)
	0.48	0.48	0.48	0.46	0.39	0.33	0.26	0.07	-0.14	-0.11	-0.11	-0.14	0.32	0.18	-0.11	-0.14	-0.21	-0.03	0.27	0.30	0.35	0.41	0.46	0.48	0.20	(Average)
	9.91	11.64	13.37	15.01	16.42	17.61	18.53	18.77	18.27	17.85	17.44	16.94	18.11	18.77	18.36	17.85	17.11	17.01	0.99	2.08	3.34	4.80	6.44	8.17	17.01	
								18.77				16.94		18.77				17.01	Start							
83																										
	827	827	827	860	946	1028	1127	1378	1655	1622	1622	1655	1036	1221	1622	1655	1745	1506	1101	1067	1000	927	860	827	28945	
	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1		
																									0	
	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	(Average)
	0.66	0.66	0.66	0.69	0.76	0.83	0.90	1.10	1.33	1.30	1.30	1.33	0.83	0.98	1.30	1.33	1.40	1.21	0.88	0.86	0.80	0.74	0.69	0.66	0.97	(Average)
	0.44	0.44	0.44	0.41	0.34	0.27	0.20	0.00	-0.23	-0.20	-0.20	-0.23	0.27	0.12	-0.20	-0.23	-0.30	-0.11	0.22	0.24	0.30	0.36	0.41	0.44	0.13	(Average)
	8.65	10.22	11.80	13.28	14.51	15.50	16.20	16.19	15.37	14.66	13.94	13.12	14.09	14.52	13.81	12.99	11.92	11.54	0.78	1.66	2.73	4.02	5.50	7.07	11.54	
								16.19				13.12		14.52				11.54	0.78							
06																										
	885	885	885	921	1013	1100	1205	1474	1771	1736	1736	1771	1109	1307	1736	1771	1867	1611	1178	1142	1070	992	921	885	30971	
	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1		
																									0	
	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	(Average)
	0.71	0.71	0.71	0.74	0.81	0.88	0.97	1.18	1.42	1.39	1.39	1.42	0.89	1.05	1.39	1.42	1.49	1.29	0.94	0.92	0.86	0.79	0.74	0.71	1.03	(Average)
	0.39	0.39	0.39	0.36	0.29	0.22	0.13	-0.08	-0.32	-0.29	-0.29	-0.32	0.21	0.05	-0.29	-0.32	-0.39	-0.19	0.16	0.18	0.24	0.31	0.36	0.39	0.07	(Average)
	7.32	8.73	10.13	11.44	12.48	13.26	13.74	13.44	12.30	11.25	10.21	9.06	9.82	10.01	8.97	7.82	6.40	5.71	0.56	1.22	2.09	3.19	4.50	5.91	5.71	
							13.74					9.06		10.01				5.71	Start							
67																										

Table A-4-1 Calculation of Regulating Pond Capacity (2)

Power Demand as of 2000	(KWh)		947	947	947	985	1083	1177	1290	1577	1895	1857	1857	1895	1186	1398	1857	1895	1998	1724	1260	1221
Number of Operation Units			1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Purchase	(KWh)													40			40	50	50			
Inflow (Minimum Inflow)	(m^3/S)		1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
Discharge	(m^3/S)		0.76	0.76	0.76	0.79	0.87	0.94	1.03	1.26	1.52	1.49	1.49	1.49	0.95	1.12	1.45	1.48	1.56	1.38	1.01	0.98
Surplus or Shortage	(m^3/S)		0.34	0.34	0.34	0.31	0.23	0.16	0.07	-0.16	-0.42	-0.39	-0.39	-0.39	0.15	-0.02	-0.35	-0.38	-0.46	-0.28	0.09	0.12
Accumulation	(10^3*m^3)		5.89	7.12	8.35	9.47	10.30	10.86	11.10	10.51	9.01	7.61	6.22	4.84	5.37	5.29	4.02	2.66	1.01	0.00	0.32	0.75
Sub Total	(10^3*m^3)								11.10											0.00	Start	
Required Reservoir Volume	(10^3*m^3)	11.10																				
Power Demand as of 2001	(KWh)		1013	1013	1013	1054	1159	1260	1380	1688	2028	1987	1987	2028	1269	1496	1987	2028	2138	1845	1349	1307
Number of Operation Units			2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Purchase	(KWh)									150	300	300	300	300			300	300	300	273		
Inflow (Minimum Inflow)	(m^3/S)		1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
Discharge	(m^3/S)		0.81	0.81	0.81	0.85	0.93	1.01	1.11	1.23	1.38	1.35	1.35	1.38	1.02	1.20	1.35	1.38	1.47	1.26	1.08	1.05
Surplus or Shortage	(m^3/S)		0.29	0.29	0.29	0.25	0.17	0.09	-0.01	-0.13	-0.28	-0.25	-0.25	-0.28	0.08	-0.10	-0.25	-0.28	-0.37	-0.16	0.02	0.05
Accumulation	(10^3*m^3)		4.34	5.37	6.40	7.32	7.93	8.25	8.23	7.75	6.73	5.83	4.92	3.90	4.20	3.84	2.94	1.91	0.58	0.00	0.07	0.25
Sub Total	(10^3*m^3)							8.25												0.00	Start	
Required Reservoir Volume	(10^3*m^3)	8.25																				
Power Demand as of 2002	(KWh)		1084	1084	1084	1128	1240	1348	1477	1806	2170	2126	2126	2170	1358	1601	2126	2170	2288	1974	1443	1398
Number of Operation Units			2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Purchase	(KWh)						200	200	200	500	500	500	500	500		300	400	400	500	250	56	
Inflow (Minimum Inflow)	(m^3/S)		1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
Discharge	(m^3/S)		0.87	0.87	0.87	0.90	0.83	0.92	1.02	1.05	1.34	1.30	1.30	1.34	1.09	1.04	1.38	1.42	1.43	1.38	1.11	1.12
Surplus or Shortage	(m^3/S)		0.23	0.23	0.23	0.20	0.27	0.18	0.08	0.05	-0.24	-0.20	-0.20	-0.24	0.01	0.06	-0.28	-0.32	-0.33	-0.28	-0.01	-0.02
Accumulation	(10^3*m^3)		2.99	3.81	4.64	5.35	6.30	6.94	7.22	7.41	6.55	5.82	5.09	4.24	4.28	4.48	3.47	2.32	1.13	0.12	0.08	0.00
Sub Total	(10^3*m^3)									7.41												0.00
Required Reservoir Volume	(10^3*m^3)	7.41																				
Power Demand as of 2003	(KWh)		1160	1160	1160	1207	1327	1442	1580	1932	2322	2275	2275	2322	1453	1713	2275	2322	2448	2112	1544	1496
Number of Operation Units			2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Purchase	(KWh)						180	200	300	700	700	700	700	700	200	300	700	700	700	650	220	12
Inflow (Minimum Inflow)	(m^3/S)		1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
Discharge	(m^3/S)		0.93	0.93	0.93	0.97	0.92	1.00	1.03	0.99	1.30	1.26	1.26	1.30	1.01	1.13	1.26	1.30	1.40	1.17	1.06	1.19
Surplus or Shortage	(m^3/S)		0.17	0.17	0.17	0.13	0.18	0.10	0.07	0.11	-0.20	-0.16	-0.16	-0.20	0.09	-0.03	-0.16	-0.20	-0.30	-0.07	0.04	-0.09
Accumulation	(10^3*m^3)		1.90	2.51	3.12	3.60	4.24	4.62	4.88	5.28	4.57	3.98	3.40	2.68	3.02	2.91	2.32	1.61	0.53	0.27	0.41	0.09
Sub Total	(10^3*m^3)									5.28												
Required Reservoir Volume	(10^3*m^3)	5.29																				
Power Demand as of 2004	(KWh)		1241	1241	1241	1291	1420	1543	1691	2068	2484	2434	2434	2484	1555	1833	2434	2484	2619	2260	1652	1601
Number of Operation Units			2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Purchase	(KWh)								50	1000	1000	1000	1000	1000	500	500	1000	1000	1000	900	400	155
Inflow (Minimum Inflow)	(m^3/S)		1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
Discharge	(m^3/S)		1.00	1.00	1.00	1.04	1.14	1.24	1.31	0.86	1.19	1.15	1.15	1.19	0.85	1.07	1.15	1.19	1.30	1.09	1.00	1.16
Surplus or Shortage	(m^3/S)		0.10	0.10	0.10	0.06	-0.04	-0.14	-0.21	0.24	-0.09	-0.05	-0.05	-0.09	0.25	0.03	-0.05	-0.09	-0.20	0.01	0.10	-0.06
Accumulation	(10^3*m^3)		0.99	1.36	1.74	1.97	1.83	1.34	0.57	1.45	1.12	0.94	0.77	0.44	1.35	1.47	1.29	0.97	0.26	0.29	0.64	0.42
Sub Total	(10^3*m^3)					1.97																
Required Reservoir Volume	(10^3*m^3)	1.97																				

ulation of Regulating Pond Capacity (2)

	947	947	947	985	1083	1177	1290	1577	1895	1857	1857	1895	1186	1398	1857	1895	1998	1724	1260	1221	1145	1061	985	947	33139	
	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1		
												40			40	50	50								180	
	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	(Average)
	0.76	0.76	0.76	0.79	0.87	0.94	1.03	1.26	1.52	1.49	1.49	1.49	0.95	1.12	1.45	1.48	1.56	1.38	1.01	0.98	0.92	0.85	0.79	0.76	1.10	(Average)
	0.34	0.34	0.34	0.31	0.23	0.16	0.07	-0.16	-0.42	-0.39	-0.39	-0.39	0.15	-0.02	-0.35	-0.38	-0.46	-0.28	0.09	0.12	0.18	0.25	0.31	0.34	0.00	(Average)
	5.89	7.12	8.35	9.47	10.30	10.86	11.10	10.51	9.01	7.61	6.22	4.84	5.37	5.29	4.02	2.66	1.01	0.00	0.32	0.75	1.41	2.30	3.42	4.65	0.00	
							11.10											0.00	Start							
1.10																										
	1013	1013	1013	1054	1159	1260	1380	1688	2028	1987	1987	2028	1269	1496	1987	2028	2138	1845	1349	1307	1225	1136	1054	1013	35458	
	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2		
								150	300	300	300	300			300	300	300	273							2523	
	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	(Average)
	0.81	0.81	0.81	0.85	0.93	1.01	1.11	1.23	1.38	1.35	1.35	1.38	1.02	1.20	1.35	1.38	1.47	1.26	1.08	1.05	0.98	0.91	0.85	0.81	1.10	(Average)
	0.29	0.29	0.29	0.25	0.17	0.09	-0.01	-0.13	-0.28	-0.25	-0.25	-0.28	0.08	-0.10	-0.25	-0.28	-0.37	-0.16	0.02	0.05	0.12	0.19	0.25	0.29	0.00	(Average)
	4.34	5.37	6.40	7.32	7.93	8.25	8.23	7.75	6.73	5.83	4.92	3.90	4.20	3.84	2.94	1.91	0.58	0.00	0.07	0.25	0.68	1.36	2.27	3.30	0.00	
						8.25												0.00	Start							
8.25																										
	1084	1084	1084	1128	1240	1348	1477	1806	2170	2126	2126	2170	1358	1601	2126	2170	2288	1974	1443	1398	1311	1215	1128	1084	37940	
	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2		
					200	200	200	500	500	500	500	500		300	400	400	500	250	56						5006	
	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	(Average)
	0.87	0.87	0.87	0.90	0.83	0.92	1.02	1.05	1.34	1.30	1.30	1.34	1.09	1.04	1.38	1.42	1.43	1.38	1.11	1.12	1.05	0.97	0.90	0.87	1.10	(Average)
	0.23	0.23	0.23	0.20	0.27	0.18	0.08	0.05	-0.24	-0.20	-0.20	-0.24	0.01	0.06	-0.28	-0.32	-0.33	-0.28	-0.01	-0.02	0.05	0.13	0.20	0.23	0.00	(Average)
	2.99	3.81	4.64	5.35	6.30	6.94	7.22	7.41	6.55	5.82	5.09	4.24	4.28	4.48	3.47	2.32	1.13	0.12	0.08	0.00	0.18	0.63	1.33	2.16	0.00	
								7.41												0.00	Start					
7.41																										
	1160	1160	1160	1207	1327	1442	1580	1932	2322	2275	2275	2322	1453	1713	2275	2322	2448	2112	1544	1496	1403	1300	1207	1160	40596	
	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2		
					180	200	300	700	700	700	700	700	200	300	700	700	700	650	220	12					7662	
	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	(Average)
	0.93	0.93	0.93	0.97	0.92	1.00	1.03	0.99	1.30	1.26	1.26	1.30	1.01	1.13	1.26	1.30	1.40	1.17	1.06	1.19	1.12	1.04	0.97	0.93	1.10	(Average)
	0.17	0.17	0.17	0.13	0.18	0.10	0.07	0.11	-0.20	-0.16	-0.16	-0.20	0.09	-0.03	-0.16	-0.20	-0.30	-0.07	0.04	-0.09	-0.02	0.06	0.13	0.17	0.00	(Average)
	1.90	2.51	3.12	3.60	4.24	4.62	4.88	5.28	4.57	3.98	3.40	2.68	3.02	2.91	2.32	1.61	0.53	0.27	0.41	0.09	0.00	0.21	0.68	1.29	0.00	
								5.28													0.00	Start				
5.29																										
	1241	1241	1241	1291	1420	1543	1691	2068	2484	2434	2434	2484	1555	1833	2434	2484	2619	2260	1652	1601	1501	1391	1291	1241	43438	
	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2		
							50	1000	1000	1000	1000	1000	500	500	1000	1000	1000	900	400	155					10505	
	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	(Average)
	1.00	1.00	1.00	1.04	1.14	1.24	1.31	0.86	1.19	1.15	1.15	1.19	0.85	1.07	1.15	1.19	1.30	1.09	1.00	1.16	1.20	1.12	1.04	1.00	1.10	(Average)
	0.10	0.10	0.10	0.06	-0.04	-0.14	-0.21	0.24	-0.09	-0.05	-0.05	-0.09	0.25	0.03	-0.05	-0.09	-0.20	0.01	0.10	-0.06	-0.10	-0.02	0.06	0.10	0.00	(Average)
	0.99	1.36	1.74	1.97	1.83	1.34	0.57	1.45	1.12	0.94	0.77	0.44	1.35	1.47	1.29	0.97	0.26	0.29	0.64	0.42	0.05	0.00	0.23	0.61	0.00	
				1.97																		0.00	Start			
.97																										

Table A-4-1 Calculation of Regulating Pond Capacity (3)

Power Demand as of 2005	(KWh)		1328	1328	1328	1382	1520	1651	1809	2212	2658	2605	2605	2658	1664	1961	2605	2658	2802	2418	1768	171
Number of Operation Units			2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
Purchase	(KWh)						500	500	700	1000	1000	1000	1000	1000	1000	900	1000	1000	1000	1000	400	30
Inflow (Minimum Inflow)	(m^3/S)		1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.1
Discharge	(m^3/S)		1.06	1.06	1.06	1.11	0.82	0.92	0.89	0.97	1.33	1.29	1.29	1.33	0.53	0.85	1.29	1.33	1.44	1.14	1.10	1.1
Surplus or Shortage	(m^3/S)		0.04	0.04	0.04	-0.01	0.28	0.18	0.21	0.13	-0.23	-0.19	-0.19	-0.23	0.57	0.25	-0.19	-0.23	-0.34	-0.04	0.00	-0.0
Accumulation	(10^3*m^3)		0.25	0.38	0.51	0.48	1.49	2.13	2.88	3.34	2.52	1.85	1.19	0.36	2.40	3.30	2.63	1.81	0.57	0.44	0.45	0.3
Sub Total	(10^3*m^3)									3.34												
Required Reservoir Volume	(10^3*m^3)	3.34																				
Power Demand as of 2006	(KWh)		1421	1421	1421	1478	1626	1767	1936	2367	2844	2787	2787	2844	1780	2098	2787	2844	2999	2588	1892	183
Number of Operation Units			2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
Purchase	(KWh)		200	200	200	500	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	600	40
Inflow (Minimum Inflow)	(m^3/S)		1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.1
Discharge	(m^3/S)		0.98	0.98	0.98	0.79	0.50	0.62	0.75	1.10	1.48	1.43	1.43	1.48	0.63	0.88	1.43	1.48	1.60	1.27	1.04	1.1
Surplus or Shortage	(m^3/S)		0.12	0.12	0.12	0.31	0.60	0.48	0.35	0.00	-0.38	-0.33	-0.33	-0.38	0.47	0.22	-0.33	-0.38	-0.50	-0.17	0.06	-0.0
Accumulation	(10^3*m^3)		0.44	0.87	1.31	2.44	4.59	6.33	7.59	7.60	6.25	5.05	3.86	2.51	4.21	5.00	3.81	2.45	0.66	0.04	0.27	0.0
Sub Total	(10^3*m^3)									7.60												
Required Reservoir Volume	(10^3*m^3)	7.60																				

ation of Regulating Pond Capacity (3)

	1328	1328	1328	1382	1520	1651	1809	2212	2658	2605	2605	2658	1664	1961	2605	2658	2802	2418	1768	1713	1606	1489	1382	1328	46479	
	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2		
					500	500	700	1000	1000	1000	1000	1000	1000	900	1000	1000	1000	1000	400	300	200	45			13545	
	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	(Average)
	1.06	1.06	1.06	1.11	0.82	0.92	0.89	0.97	1.33	1.29	1.29	1.33	0.53	0.85	1.29	1.33	1.44	1.14	1.10	1.13	1.13	1.16	1.11	1.06	1.10	(Average)
	0.04	0.04	0.04	-0.01	0.28	0.18	0.21	0.13	-0.23	-0.19	-0.19	-0.23	0.57	0.25	-0.19	-0.23	-0.34	-0.04	0.00	-0.03	-0.03	-0.06	-0.01	0.04	0.00	(Average)
	0.25	0.38	0.51	0.48	1.49	2.13	2.88	3.34	2.52	1.85	1.19	0.36	2.40	3.30	2.63	1.81	0.57	0.44	0.45	0.34	0.24	0.03	0.00	0.13	0.00	
								3.34															0.00	Start		
.34																										
	1421	1421	1421	1478	1626	1767	1936	2367	2844	2787	2787	2844	1780	2098	2787	2844	2999	2588	1892	1833	1719	1593	1478	1421	49732	
	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2		
	200	200	200	500	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	600	400	400	150	90	50	16790	
	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	(Average)
	0.98	0.98	0.98	0.79	0.50	0.62	0.75	1.10	1.48	1.43	1.43	1.48	0.63	0.88	1.43	1.48	1.60	1.27	1.04	1.15	1.06	1.16	1.11	1.10	1.10	(Average)
	0.12	0.12	0.12	0.31	0.60	0.48	0.35	0.00	-0.38	-0.33	-0.33	-0.38	0.47	0.22	-0.33	-0.38	-0.50	-0.17	0.06	-0.05	0.04	-0.06	-0.01	0.00	0.00	(Average)
	0.44	0.87	1.31	2.44	4.59	6.33	7.59	7.60	6.25	5.05	3.86	2.51	4.21	5.00	3.81	2.45	0.66	0.04	0.27	0.09	0.25	0.04	0.00	0.00	0.00	
								7.60															0.00	Start		
.60																										

APPENDIX-5 Preliminary Design

APPENDIX 5 Preliminary Design

Contents

A5.1 Stability Calculation of Intake Dam

The stability calculation of the dam was conducted for the following two cases concerning its overflowing section.

	Water Level	Case	Earthquake
1.	At Design Flood	Normal Condition	---
2.	At Normal Full Water Level	Under Earthquake	K = 0.02 to downstream direction

(a) Stability Calculation

The dam stability calculation are performed concerning turn-over, slide and bearing force.

i) Stability Study Concerning Turn-Over

$X_0 = \Sigma M / \Sigma V$

$e = X_o - (B/2 - B_1) \leq e_a = B/6$

Where: X_o ; position at which composite force is applied (distance from dam axis) (m)

e ; distance of eccentricity (m)

B ; width of foundation

B_1 ; distance from dam axis to upstream end of foundation (m)

e_a ; Middle Third (m)

ii) Stability Calculation Concerning Sliding

The stability condition against sliding is that the shearing friction safety factor is 4 or more.

$N = (\tau_a B + f \cdot \Sigma V)/H \geq 4$

Where: N ; safety factor against sliding

τ_a ; shearing strength between concrete and foundation rock (t/m^2)

f ; friction coefficient between concrete and foundation rock

H ; total horizontal force acting on the dam (t)

iii) Stability Study Concerning Bearing Force

The stability condition concerning bearing force is studied by examining the allowable bearing force of dam and foundation rock.

$P_1 = \Sigma V/B(1 + 6 \cdot e/B) \leq \sigma_a$

$P_2 = \Sigma V/B(1 + 6 \cdot e/B) \leq \sigma_a$

Where: P_{12}: reaction force of foundation rock against vertical force (t/m^2)

σ_a : allowable bearing force of foundation rock (t/m^2)

(b) Design Condition

i) Dam Dimensions

Dam Crest Elevation	EL 468.000 (m)	Dam Height	6.200 (m)
Dam Foundation Elevation	EL 462.000 (m)	Crest Width b =	2.000 (m)
Slope of Upstream Side	1:0.00		
Slope of Downstream side	1:0.80		

ii) Regulating Pondage Dimensions

Design Flood Water Level WL. 472,370 (m)
Normal Full water Level WL. 469,000 (m)
Downstream Water Level (with flood design water level) WL 465.800 (m)
Downstream Water Level (with normal full water level) WL 462.000 (m)
Sediment Level EL 469.00 (m) Wave Height hW = 0.000 (m)
With no drain hole

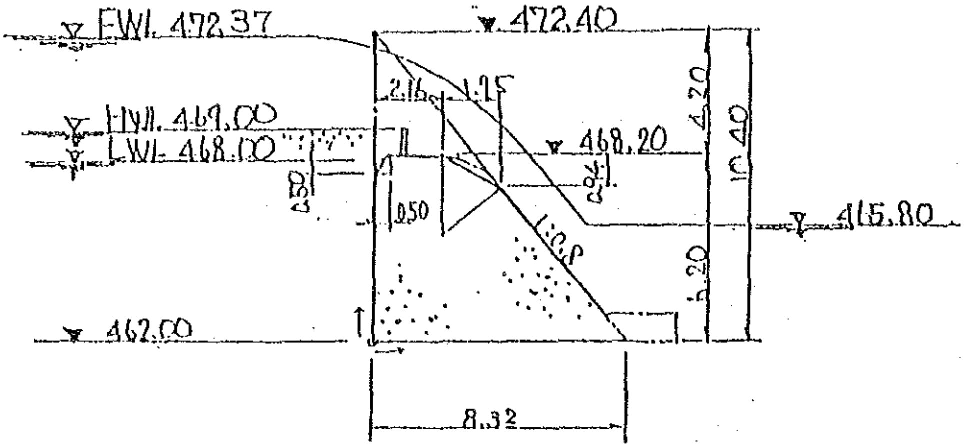
iii) Unit Weight

Concrete $\gamma c = 2.30\ (t/m^3)$
Sediments $\gamma d = 1.20\ (t/m^3)$

iv) Coefficients

Sediment Pressure Coefficient	Ce = 0.50
Friction Coefficient between Concrete and Foundation Rock	f = 0.70
Shearing Unit Stress of Foundation Rock	To = 50.0 (t/m^2)
Allowable Bearing Capacity of Foundation Rock	Ra = 100.0 (t/m^2)

Design Seismic Intensity Kh = 0.02



(c) Calculation

i) At Design Flood (under Normal Conditions)

[1] EL 462.000 (m)

Item		V (t)	H (m)	X (m)	Y (m)	M (m)
Dead Load		81.684	0.000	3.104	0.000	253.533
Water Pressure		12.000	45.136	3.000	2.660	156.061
Sediment Pressure		0.000	14.700	0.000	2.333	34.300
Upstream Surface	Water Weight	0.000	0.000	0.000	0.000	0.000
Upstream Surface	Sediment Weight	0.000	0.000	0.000	0.000	0.000
Downstream Surface	Water Weight	5.776	0.000	7.307	0.000	42.203
Downstream Surface	Sediment Weight	0.000	-7.220	0.000	1.267	-9.145
Uplift Force		-40.740	0.000	3.849	0.000	-156.827
Total		58.720	52.616			320.126

[2] EL 463.000 (m)

Item		V (t)	H (m)	X (m)	Y (m)	M (m)
Dead Load		63.468	0.000	2.857	0.000	181.336
Water Pressure		12.000	32.256	3.000	2.268	115.949
Sediment Pressure		0.000	10.800	0.000	2.000	21.600
Upstream Surface	Water Weight	0.000	0.000	0.000	0.000	0.000
Upstream Surface	Sediment Weight	0.000	0.000	0.000	0.000	0.000
Downstream Surface	Water Weight	3.136	0.000	6.773	0.000	21.241
Downstream Surface	Sediment Weight	0.000	-3.920	0.000	0.933	-3.659
Uplift Force		-29.303	0.000	3.407	0.000	-99.843
Total		49.301	42.136			236.625

[3] EL 464.000 (m)

Item		V (t)	H (m)	X (m)	Y (m)	M (m)
Dead Load		47.092	0.000	2.611	0.000	122.977
Water Pressure		12.000	26.376	3.000	1.866	85.216
Sediment Pressure		0.000	7.500	0.000	1.677	12.500
Upstream Surface	Water Weight	0.000	0.000	0.000	0.000	0.000
Upstream Surface	Sediment Weight	0.000	0.000	0.000	0.000	0.000
Downstream Surface	Water Weight	01.296	0.000	6.240	0.000	8.087
Downstream Surface	Sediment Weight	0.000	-1.620	0.000	0.600	-0.972
Uplift Force		-19.466	0.000	2.936	0.000	-57.150
Total		40.923	32.256			170.657

EL (m)	V (t)	H (t)	X (m)	Y (m)	M (t·m)	N	B (m)	P1 (t/m^2)	P2 (t/m^2)
462.00	58.720	52.161	320.126	5.452	1.292	8.688	8.320	13.632	0.483
463.00	49.301	42.136	236.526	4.800	1.040	9.742	7.520	11.994	1.118
464.00	40.923	32.256	170.657	4.170	0.810	11.305	6.720	10.495	1.684

ii) At Normal Full Water Level (under Earthquake)

[1] EL 462.000 (m)

Item		V (t)	H (m)	X (m)	Y (m)	M (m)
Dead Load		81.684	1.634	3.104	2.598	257.777
Water Pressure		0.000	24.180	0.000	2.279	55.097
Hydraulic Pressure		0.000	0.550	0.000	2.651	1.457
Sediment Pressure		0.000	14.700	0.000	2.333	34.300
Upstream Surface	Water Weight	0.000	0.000	0.000	0.000	0.000
Upstream Surface	Sediment Weight	0.000	0.000	0.000	0.000	0.000
Uplift Force		-9.707	0.000	2.773	0.000	-26.920
Total		71.978	41.063			321.711

[2] EL 463.000 (m)

Item		V (t)	H (m)	X (m)	Y (m)	M (m)
Dead Load		63.468	1.269	2.857	2.202	181.336
Water Pressure		0.000	17.680	0.000	1.937	34.251
Hydraulic Pressure		0.000	0.432	0.000	2.240	0.967
Sediment Pressure		0.000	10.800	0.000	2.000	21.600
Upstream Surface	Water Weight	0.000	0.000	0.000	0.000	0.000
Upstream Surface	Sediment Weight	0.000	0.000	0.000	0.000	0.000
Uplift Force		-7.520	0.000	2.507	0.000	-18.850
Total		55.948	30.181			222.100

[3] EL 464.000 (m)

Item		V (t)	H (m)	X (m)	Y (m)	M (m)
Dead Load		47.092	0.942	2.611	1.798	124.670
Water Pressure		0.000	12.180	0.000	1.593	19.404
Hydraulic Pressure		0.000	0.323	0.000	1.828	0.590
Sediment Pressure		0.000	7.500	0.000	1.667	12.500
Upstream Surface	Water Weight	0.000	0.000	0.000	0.000	0.000
Upstream Surface	Sediment Weight	1.296	0.000	0.000	0.000	0.000
Uplift Force		-5.600	0.000	2.240	0.000	-12.544
Total		41.492	20.945			144.620

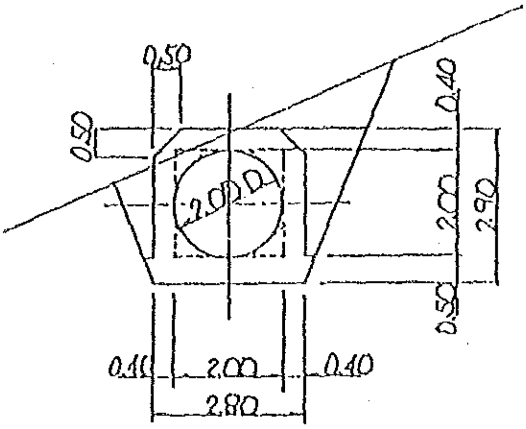
EL (m)	V (t)	H (t)	X (m)	Y (m)	M (t·m)	N	B (m)	P1 (t/m²)	P2 (t/m²)
462.00	71.978	41.063	321.711	4.470	0.310	11.358	8.320	10.583	6.720
463.00	55.948	30.181	222.100	3.970	0.210	13.756	7.520	8.685	6.195
464.00	41.492	20.945	144.620	3.485	0.125	17.429	6.720	6.866	5.483

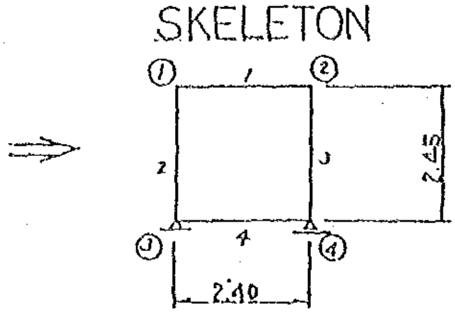
A5-2 Stress Analysis of Culvert

The stress is analyzed concerning the external water pressure in river flood and internal water pressure of the channel.

(1) Analysis Concerning External Water Pressure At River Flood

(a) The stress is calculated by assuming the cross section of the channel as a rahmen structure having the skeleton given in the figures below.

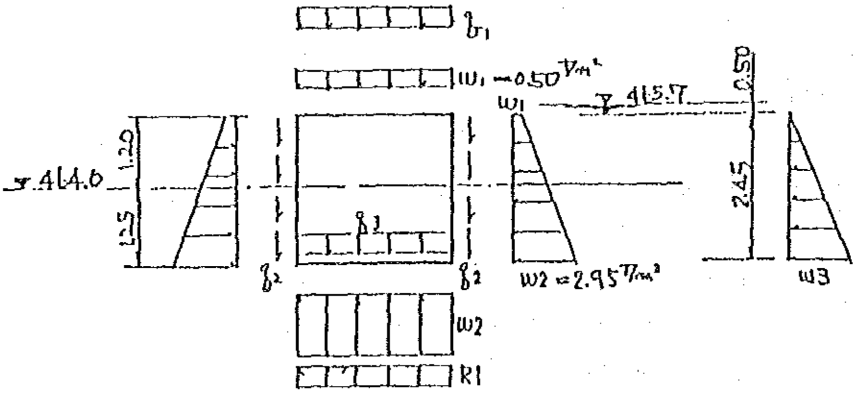




(b) Load

The river water level of 465.7 m at the most upstream section of the culvert, which is reached at the time of 1/200 flood with 840 m^3/s is assumed to be the external water pressure.

External water pressure: $W_1 = 0.50\ t/m^2$, $W_2 = 2.95\ t/m^2$



Dead-weight: $q_1 = q_2 = 0.40 \text{ m} \times 2.4 \text{ t/m}^3 = 0.96 \text{ t/m}^2$

$q_3 = 0.50 \text{ m} \times 2.4 \text{ t/m}^3 = 1.20 \text{ t/m}^2$

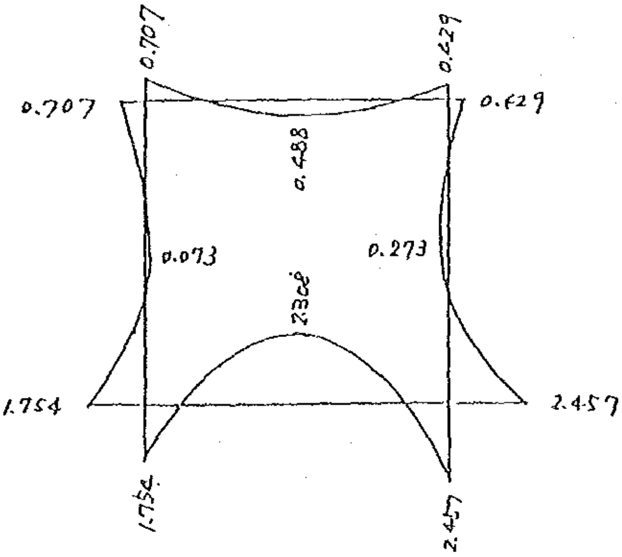
Reaction force: $R_1 = 0.96 \text{ t/m}^2 \times 2.45 \text{ m} \times 2/2.4 \text{ m} + 0.96 \text{ t/m}^2 + 1.20 \text{ t/m}^2 = 4.12 \text{ t/m}^2$

Earth pressure: $W_3 = 0.5 \times 0.8 \text{ t/m}^3 \times 2.45 \text{ m} = 0.98 \text{ t/m}^2$

(Static earth pressure)

(c) Calculation Result

MOMENT DIAGRAM



Stress Calculation for Rectangular Cross Section

Cross Section No.		1. (Inside)	2. (Outside)
M	[t•m]	2.31	2.46
N	[t]	0.00	0.00
S	[t]	0.00	7.64
b	[cm]	100.0	100.0
h	[cm]	50.0	50.0
d	[cm]	43.0	43.0
d'	[cm]	7.0	7.0
As	[cm^2]	11.500 D19@250	15.500 D22@250
As'	[cm^2]	15.500	11.500
n=Es/Ec		15.00	15.00 Ec=220,000 kg/cm^2
P=As/(b x d)	[%]	0.267	0.360
u=d-h/2	[cm]	18.000	18.000
f=M/N+u	[cm]	18.000	18.000
f/d		0.419	0.419
d' / d		0.163	0.163
As' / As		1.348	0.742
M' =M + N x u	[t•m]	2.308	2.457
X	[cm]	9.996	11.458
C		8.278	7.437
S		27.331	20.472
Z		1.096	1.107
σ_c	[kg/cm^2]	10.3	9.9
σ_s	[kg/cm^2]	511.7	408.1
σ'_s	[kg/cm^2]	46.5	57.7
τ	[kg/cm^2]	0.00	1.97
τ_m	[kg/cm^2]	0.00	1.78
σ_{ca}	[kg/cm^2]	70.0	70.0
σ_{sa}	[kg/cm^2]	1,800.0	1,800.0
τ_a	[kg/cm^2]	4.00	4.00

Note: The negative sign of σ_s signifies compression. The negative sign of σ'_s signifies tension. τ_m signifies the average unit shearing stress.

(2) Analysis for Internal Pressure

(2)-1 Check of Stress in Lining Concrete of Culvert

* The calculation is performed by assuming the culvert to be a cylindrical culvert having internal diameter of 2 m and concrete thickness of 0.4 m.

* The circumferential stress σ of a cylindrical culvert having internal diameter of γ and concrete thickness of δ is expressed by the following equation.

$$\sigma = \frac{P}{\rho^2-1}\left(1 + \sigma^2 \frac{\gamma_i^2}{\gamma^2}\right) (kg/cm^2)$$

Here, the internal water pressure is:
$470 - 461.5 + 1.63 = 10.13$ m/m^2 = 1.013 kg/cm^2
(static pressure)(water hammer)

Letting γ be the distance from the center of the cylinder to the cross section to be analyzed (m), and

$$\rho = \frac{\gamma_i + \delta}{\gamma_i} = \frac{1+0.40}{1} = 1.40$$

The stress σ_1 on the internal surface of concrete is, as $\gamma = \gamma_i$,

$$\sigma_1 = \frac{P}{\rho^2-1}(1+\rho^2) = P \cdot \frac{1.40^2+1}{1.40^2-1} = 3.08\ kg/cm^2$$

The stress δ_2 on the outside surface of concrete is, as $\gamma = \gamma_i + \delta$,

$$\sigma_2 = \frac{P}{\rho^2 - 1}(1+1) = 1.0136 \times \frac{2}{1.40^2 - 1} = 2.11\ kg/cm^2$$

The allowable tensile stress can be regarded as $\sigma_{st} = 10$ kg/cm^2 when concrete rich in cement is placed at the site and sufficiently compacted.
Therefore, it is safe with $\sigma_{1,2} < 10$ kg/cm^2

Reinforcing steel bars of 19 mm diameter will be placed circumferentially in double layer on the inside and outside surface with 25 cm intervals, to improve strength and prevent crack.
The effect of reinforcement per 1 cm is:

$$\lambda = \frac{\delta}{\delta + 8a_{st}} = \frac{40}{40+8\text{x}11.46} = 0.303$$

$\lambda\sigma_1 = 0.303 \text{ x } 3.08 = 0.933$ kg/cm^2

$$<\delta_{ct}\, 10 kg/cm^2$$

$\lambda\sigma_2 = 0.303 \text{ x } 2.11 = 0.639$ kg/cm^2

(2)-2 Check of Stress Based on Assumption that All Water Pressure is Borne by Steel Reinforcing Bars

The steel reinforcing bars are regarded as thin cylinders to calculate the stress of steel bars, σ_t (kg/cm^2).

$$\sigma_t = \frac{P \cdot D}{2 \cdot t}$$

P: internal water pressure, 1.013 kg
D: inside diameter to steel bars, 214 cm
t: thickness of thin plate equivalent to bar cross section (cm)

Assuming the steel bar of 19@250, $\frac{2.865\ cm^2 \times 4}{100\ cm} = 0.1146\ cm^2/cm$

Therefore, $\sigma_t = \frac{1.013 \times 214}{2 \times 0.1146} = 946\ kg/cm^2 < \sigma_{ta} = 1,800\ kg/cm^2$

A5.3 Stress Analysis of Internal Water Pressure of Headrace Tunnel

The analysis of the stress caused by the tunnel internal water pressure has been performed by Ott-Frey-Bear's equation.

The water pressure at the most downstream part of the lined section of the tunnel, where the internal pressure (static pressure plus water hammer pressure) becomes maximum, of $P = 2.439$ kg/cm^2 was used to calculated the tensile stress of the reinforcing steel bars. In the analysis, the following Figure has been utilized.

When the steel reinforcing bars, D19, are installed with interval of 30 cm, the amount of steel bars in the circumferential direction;

$Fe = 0.0955$ cm^2/cm

$(Fe/D) \times 10^3 = (0.0955/200) \times 10^3 = 0.4775$

where D = internal diameter of 200 cm.

* Assuming the modulus of elasticity of the surrounding rocks, Er, to be 10,000 kg/cm^2,

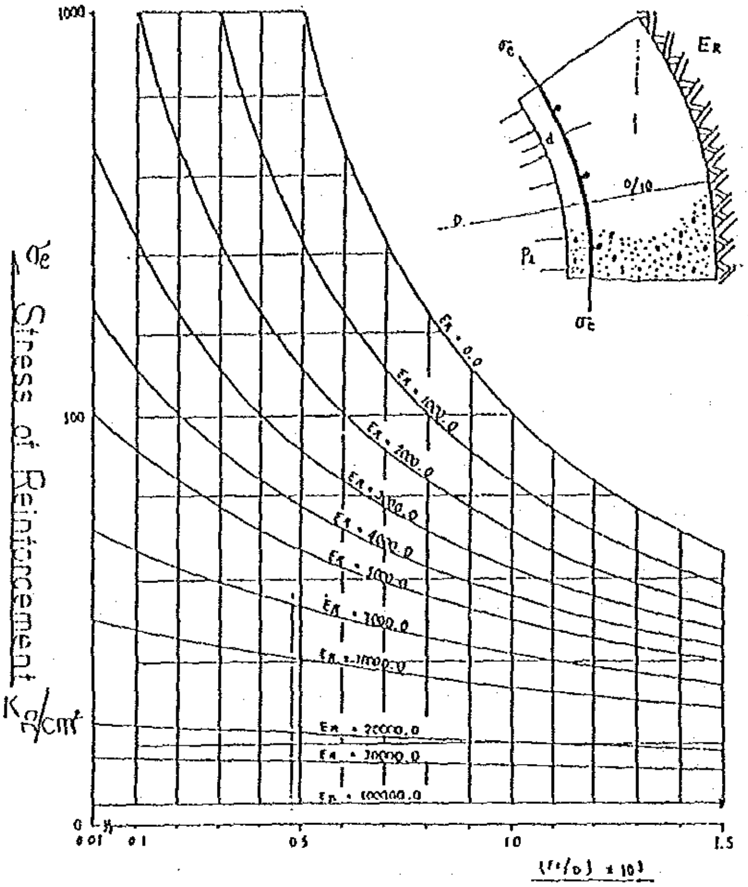
The unit stress of the steel bar, $\sigma e = 200$ kg/cm^2

Therefore, the unit stress of the real steel bars;

$\sigma_{el} = 200 \times 2.439 = 488$ kg/cm^2 $< \sigma_{ta} = 1{,}800$ kg/cm^2

* $Er = 30{,}000$ kg/cm^2 $\dashrightarrow \sigma_e = 80$ kg/cm^2

$\therefore \sigma_{el} = 80 \times 2.439 = 195$ kg/cm^2 $< \sigma_{ta} = 1{,}800$ kg/cm^2



Water Pressure : $P_1 = 1 kg/cm^2$
Fe : Area of Reinforcement (cm^2/cm)
D : Tunnel Dia. (cm)

A5.4 Bearing Capacity of Penstock Foundation

According to the penetration test of (III-2), the N-value down the depth of 2.3 m is from 5 to 18, and its average value is 11.

In the construction work, the talus pile will be excavated and removed for the depth below this range, the penstock is installed on a continuous concrete foundation, and soil will be filled back on the penstock for a depth of more than 1 m. Therefore, the foundation will be installed at depth which is more than 2 m below the ground surface. The ultimate bearing capacity of continuous footing, q_d, is given by the following equation according to Terzaki and Peck.

$$q_d = \alpha \cdot \beta \cdot \gamma \cdot N_r + D_t \cdot \gamma \cdot N_q$$

α = coefficient determined by the geometry of the loading surface of the foundation; 0.5 for continuous foundation
β = width of footing; 1.5 m
γ = unit weight of soil; 1.8 t/m^3
D_t = setting depth of footing; 2.5 m

For the value of N = 11, $N_r = 7$, $N_q = 10$ (with internal friction angle of 30°) is obtained from the Related Graph (Omission).

From these values, we obtain the ultimate bearing capacity of approximately 55 t/m^2. Taking a safety factor of 3, the allowable bearing capacity is 18 t/m^2. In this case, the load on the foundation is no more than 5 t/m^2, and sufficient safety is assured.

A5.5 Calculation of FRP Pipe Strength

(a) Load

i) Maximum design head = High water level 469.0 m + Flood water level 1.0 m - Minimum elevation of penstock 305.2 m = 164.8 m
Maximum water hammer head = (469.0 + 1.0 - water turbine nozzle center elevation 306.7 m) x 0.1 = 16.3 m
Maximum design head = 181.1 m

ii) Earth cover: First Stage: 1.0 m, Latter Stage: 1.2 m or more (refer to *1)

iii) Bulldozer load: 3 ton class, 1 bulldozer

iv) Weight of unit volume of earth: 0.0018 kg/cm^4

v) Passive earth pressure resistance coefficient: 14 kg/cm^2

*1. (Reference)

Earth Cover on the Buried Section

It is possible that the ground water level rises to the ground surface due to very heavy rain. The pipe must be buried in such a depth that the pipe does not float up when the ground water rises. The minimum earth cover, H (m), with which the FRP pipe does not float up, is calculated by the following equation.

$$H \geq \frac{\pi D_c}{4} \cdot \frac{S - \left\{1 - \left(\frac{D}{D_c}\right)^2\right\} \gamma_P}{W}$$

S: safety factor of 1.2

D_c: pipe outside diameter; 0.936 and 1.144 m

D: pipe inside diameter; 0.9 m and 1.1 m

γ_p: weight per unit volume of pipe material; 1.8 t/m^3

W: weight per unit volume of filled back earth which is saturated; 1.8 t/m^3

D = 0.9 m ----> H = 0.98 m ==> 1.0 m

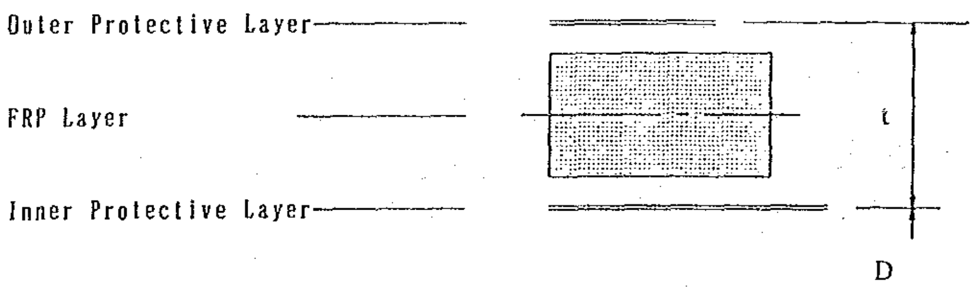
D = 1.1 m ----> H = 1.19 m ==> 1.2 m

(The required depth of earth cover.)

(b) Strength Calculation

i) Pipe Structure

The structure and dimensions of FRP pipe are given below.



	D	t
	mm	
FRP Pipe	900 1100	18 22

The pipe thickness is the value set forth in JIS A 5350.
No marginal wall thickness is provided.

ii) Strength and Cross Section Characteristics of Pipe

ii-1 Pipe Strength

ii-1-1 Pipe Strength

The strength of the FRP layer is illustrated below.

kg/cm^2

Classification	Symbol	FRP Pipe	
		Circumferential Direction	Axial Direction
Modulus of Elasticity	Ej	181300	90510
Tensile Strength	σt	3780	1641
Compression Strength	σc	3333	1389
Shearing Strength	τ	550	

ii-1-2 Allowable Stress of Pipe

The allowable stress of the FRP layer is the fracture strength of FRP divided by the safety factor of 6.

The allowable stress values of the FRP layer is given below.