

**APPENDIX N. HUI VIENG KOOK AND BANG PHUAN AREAS FLOOD
PROTECTION PROJECT**

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PART-2 DETAILED MASTER PLAN STUDY

CHAPTER 4 ALTERNATIVE PLAN

Data source ; RID

1. Existing Conditions

- 1) Farm elevation Bang Phuan, Vieng Kook 164.00 MSL.m
- 2) H-V curve

From water level record and computed discharge data (no previous rain, no gate operation)

Bang Phuan (1993 May) Y= 0.067X + 161.64
 Vieng Kook (1993 Aug) Y= 0.60 X + 164.00
 Y; Water level(MSL.m) X ; Storage water Volume (MCM)

3) Regulator gate Size and discharge

Bang Phuan 3.25 m * 2.50 m * 1 row
 Vieng Kook 3.25 m * 2.50 m * 2 rows

$Q = C \cdot A \cdot \sqrt{2gH}$ C ; Coefficient = 0.70 A ; Flow Area (sq.m)
 g = 9.8 m/s/s H ; Difference of water level

2. Check of present flood conditions

1) Present(1) --- Bang Phuan A = 233sqm f=0.60

	MSL.m	Actual	Computation
WL. max		166.61(Spt.06)	166.80
Flood duration	days		
Flood depth(d)			
d > 0.0 m		70 (Aug.02--Oct.10)	70 (Jly.30--Oct.10)
d > 0.5 m		49 (Aug.02--Spt.19)	57 (Aug.02--Spt.27)
d > 1.0 m		39 (Aug.10--Spt.17)	48 (Aug.06--Spt.22)
d > 1.5 m		35 (Aug.12--Spt.15)	32 (Aug.09--Spt.12)

Flooded duration computed shows a little longer days than actual duration.

2) Present(2) Case A-1 --- f = 0.65

	MSL.m	Bang Phuan	Vieng Kook
WL. max		A = 233sqm 167.05(Spt.04)	A = 151 sqm 166.66 (Spt.09)
Flood duration	days		
Flood depth(d)			
d > 0.0 m		78 (Jly.25--Oct.10)	62 (Aug.02--Oct.02)
d > 0.5 m		57 (Aug.02--Spt.27)	46 (Aug.08--Spt.22)
d > 1.0 m		48 (Aug.06--Spt.20)	39 (Aug.12--Spt.19)
d > 1.5 m		46 (Aug.09--Spt.20)	41 (Aug.18--Spt.17)

Flood conditions of Bang Phuan is more heavy than Vieng Kook by the reason of unbalanced of basin area and regulator sizes,

3. Project

1) Allowable maximum flood level and water depth

WL max = 165.00 (d max = 1.0 m)----- 1993 level

2) Alternative Plans (f=0.65)

Flood protection plans are as flows.

(See FIGURE Alternative plan case A & B)

Case A To establish new Regulators and pumps at river mouth

Case B To divide two basin areas, which are consist of upper and down stream area.

			Regulators	Pump
			m * m *rows	cum/s
			(Additional)	
Bang Phuan				
Case A-2	A=233 sqkm	Planing	2.50*3.25*2(1)	23.61
Case A-3	A=233 sqkm	Planing	2.50*3.25*3(2)	18.17
Case B-1	A=113 sqkm	Present	2.50*3.25*1(-)	--
	A=120 sqkm	Planing	Bypass (1)	--
Case B-2	A=113 sqkm	Planing	2.50*3.25*2(1)	6.37
	A=120 sqkm	Planing	Bypass	
Vieng Kook			m * m *rows	cum/s
			(Additional)	
Case A-2	A=151 sqkm	Planing	2.50*3.25*2(-)	11.57
Case B-1	A= 90 sqkm	Present	2.50*3.25*2(-)	--
	A= 61 sqkm	Planing	Bypass (1)	--
Case B-2	A= 90 sqkm	Planing	2.50*3.25*2(-)	3.70
	A= 61 sqkm	Planing	Bypass (1)	--

3) Flood conditions in each Plan

	d > 0.0 m Duration(days)	d > 0.5 m Duration(days)	d max Duration(days)
Bang Phuan			
Case A-2	42(Jly.31--Spt.10)	18(Aug.08--Aug.25)	1.00(Aug.14)
Case A-3	40(Aug.02--Spt.10)	16(Aug.10--Aug.25)	1.00(Spt.04)
Case B-1	63(Aug.06--Oct.07)	44(Aug.11--Spt.23)	2.17(Spt.11)
Case B-2	45(Aug.06--Spt.20)	38(Aug.12--Spt.18)	1.00(Spt.04)
Vieng Kook			
Case A-2	52(Aug.02--Spt.22)	42(Aug.08--Spt.18)	1.00(Spt.04)
Case B-1	67(Aug.02--Oct.07)	43(Aug.11--Spt.23)	1.69(Spt.11)
Case B-2	50(Aug.02--Spt.20)	39(Aug.13--Spt.20)	1.00(Spt.04)

Case A-2, A-3, B-2 in Bang Phuan and Case A-2, B-2 will be selected for alternative plans, respectively.

4) Project Works

	Case A-2			Case A-3			Case B-2		
	m	m	ROW	m	m	ROW	m	m	ROW
Bang Phuan									
Regulator(New)	2.50	3.25	*1	2.50	3.25	*2	2.50	3.25	*1
(Rehabitation)	2.50	3.25	*1	2.50	3.25	*1	2.50	3.25	*1
Pumping Station	23.61	cum/s		18.17	cum/s		6.37	cum/s	
	φ1500	*5 sets		φ1500	*4 sets		φ1000	*3 sets	
River (New)	--			--			Q=40	cum/s L=7 km	
(Rehabitation)	L= 15	km		L= 15	km		L= 9	km	
Regulator(New)	--			--			2.50	*3.25*1	
Vieng Kook									
Regulator(New)	--			--			2.50	*3.25*1	
(Rehabitation)	2.50	3.25	*2	--			2.50	*3.25*1	
Pumping Station	11.57	cum/s		--			3.70	cum/s	
	φ1350	*3		--			φ1000	*2	
River (New)	--			--			Q=30	um/s L=7 km	
(Rehabitation)	L= 18	km		--			L=14	km	
Regulator(New)	--			--			2.50	*3.25*1	

4. Construction Cost

Construction Cost

Case A

Description	Case A-2 Work	Case A-3 Work	Cost
Bang Phuan			1000B
Regulator(New) (Rehabitation)	m m row 2.50*3.25*1	m m row 2.50*3.25*2	11600
Pumping Station	2.50*3.25*1 23.61 cum/s φ1500 *5 sets	2.50*3.25*1 18.17 cum/s φ1500 *4 sets	3500
River (New) (Rehabitation)	-- L= 15 km	-- L= 15 km	240900
Total			120000
			376000
Vieng Kook			1000 B
Regulator(New) (Rehabitation)	m m row 2.50*3.25*2		7000
Pumping Station	11.57 cum/s φ1350 *3		122500
River (New) (Rehabitation)	-- L= 18 km		144000
Total			273500

Case B

Description	Case B-2	Cost
Bang Phuan		1000 B
Regulator(New) (Rehabitation)	m m row 2.50*3.25*1	11600
Pumping Station	2.50*3.25*1 6.37 cum/s φ1000 *3 sets	3500
River (New) (Rehabitation)	Q=40 cum/s L=7 km L= 9 km	98200
Regulator(New)	2.50*3.25*1	11600
Total		313100
Vieng Kook		1000 B
Regulator(New) (Rehabitation)	m m row 2.50*3.25*2	--
Pumping Station	3.70 cum/s φ1000 *2	7000
River (New) (Rehabitation)	Q=30 um/s L=7 km L=14 km	66200
Regulator(New)	2.50*3.25*1	11600
Total		313000

Case B-2 in Bang Phuan and Case A-2 are more economical than other Cases, respectively.

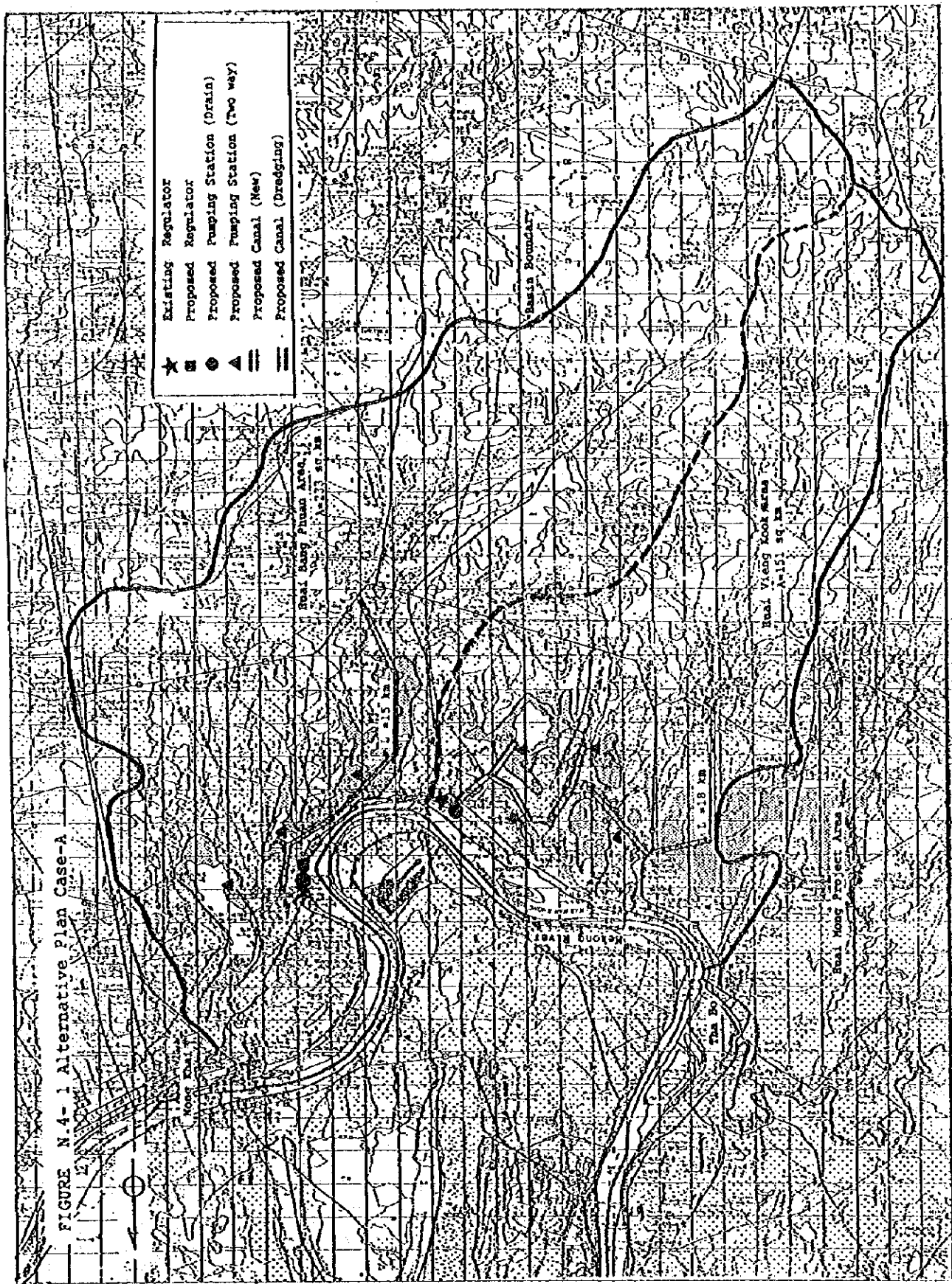
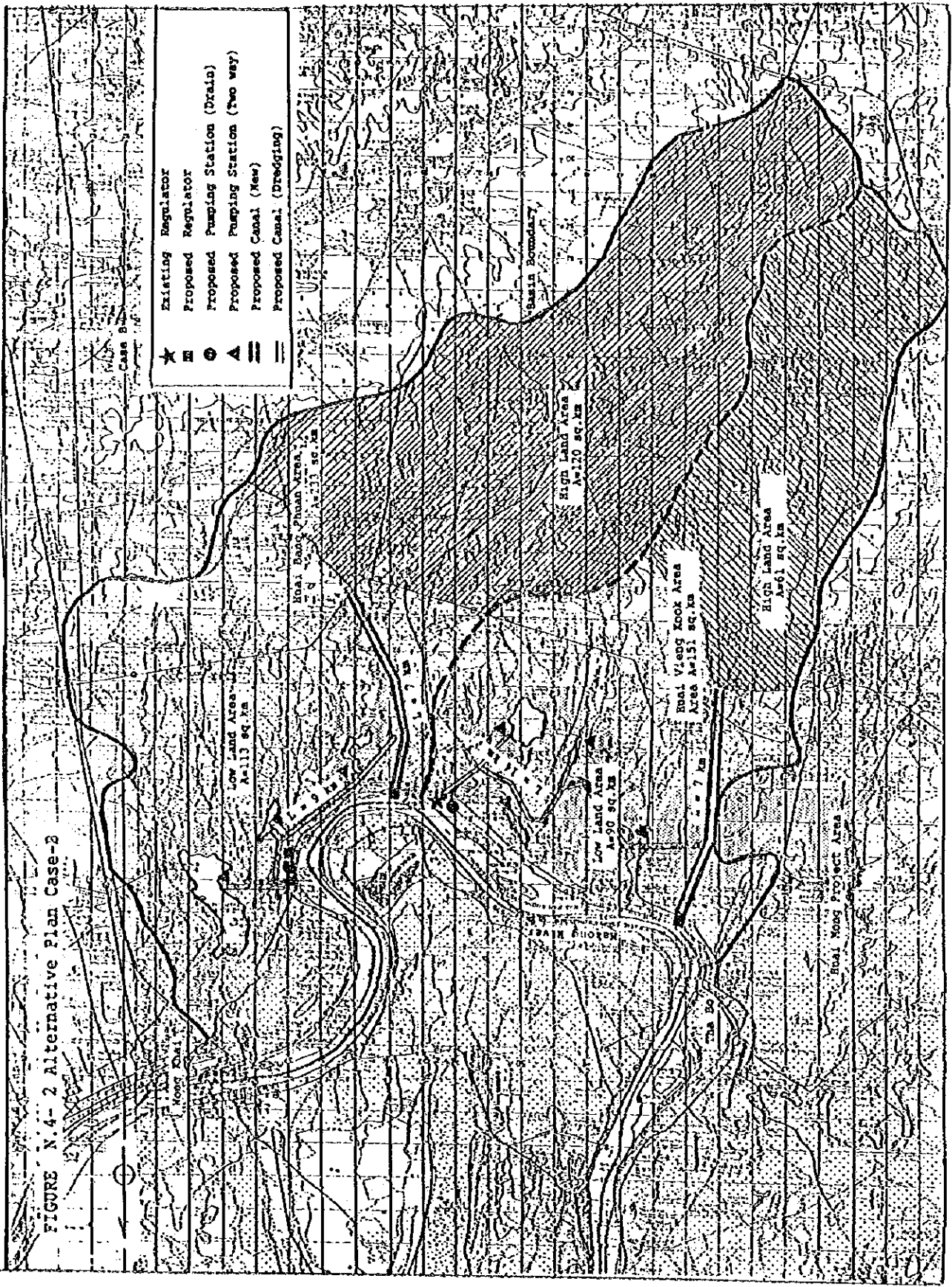


FIGURE N.4- 2 Alternative Plan Case-2



CHAPTER 5 PLANING

Table L.5- 1 Daily Rainfall at Bang Phuan (1/2)

Data source ; RID

Day	1993												Remarks
	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	
1	-	-	-	-	-	-	-	-	35.30	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	35.30	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	0.50	10.30	-	-	-	-	-	-
7	-	-	-	-	-	-	15.10	-	-	-	-	-	-
8	-	-	-	-	-	-	5.30	-	-	-	-	-	-
9	-	-	-	-	-	40.40	40.20	-	15.30	-	-	-	-
10	-	40.30	30.30	-	-	-	-	-	10.20	-	-	-	-
11	-	-	5.20	-	10.40	15.40	-	-	-	-	-	-	-
12	-	-	-	-	25.00	0.50	45.30	-	-	-	-	-	-
13	-	-	-	-	0.00	-	-	25.30	-	-	-	-	-
14	-	-	-	-	55.40	-	10.00	-	-	-	-	-	-
15	-	30.20	-	-	-	-	-	30.40	-	-	-	-	-
16	-	5.10	-	-	-	-	-	10.30	50.30	-	-	-	-
17	-	-	-	-	-	-	-	5.20	25.30	-	-	-	-
18	-	-	-	-	14.30	-	20.40	7.10	20.40	-	-	-	-
19	-	-	-	0.50	-	-	-	-	10.30	-	-	-	-
20	-	-	-	-	10.50	-	-	-	15.30	-	-	-	-
21	-	-	-	0.40	-	-	-	25.20	-	-	-	-	-
22	-	-	-	-	20.40	50.20	-	25.10	-	-	-	-	-
23	-	-	45.10	-	20.30	80.30	-	20.00	45.30	-	-	-	-
24	-	-	-	-	60.40	10.40	-	-	-	-	-	-	-
25	-	-	-	-	-	5.20	-	-	-	15.20	-	-	-
26	-	-	-	-	-	20.30	-	-	-	-	-	-	-
27	-	-	10.30	-	45.30	105.20	-	-	-	-	-	-	-
28	-	-	-	-	5.20	-	-	-	-	-	-	-	-
29	-	-	-	15.20	5.30	20.30	-	10.30	-	-	-	-	-
30	-	-	-	-	-	5.20	-	20.40	-	-	-	-	-
31	-	-	-	-	-	-	15.40	-	-	-	-	-	-
Sum	-	75.60	90.90	16.10	272.50	353.90	197.30	180.10	227.70	15.20	-	-	-
Max	-	40.30	45.10	15.20	60.40	105.20	45.30	30.40	50.30	15.20	-	-	-
											Total	1429.30	
											July+Aug	377.4	

Day	1994												Remarks
	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	
1	-	-	-	-	-	45.20	-	70.20	-	-	-	-	-
2	-	-	-	-	-	85.40	-	6.20	-	-	-	-	-
3	-	-	-	-	-	20.20	-	50.30	-	-	-	-	-
4	-	-	-	-	-	45.40	-	-	-	40.3	-	-	-
5	-	-	-	-	-	50.20	-	-	-	60.2	-	-	-
6	-	-	-	-	-	10.20	-	45.30	-	-	-	-	-
7	-	-	-	-	-	25.20	-	95.20	-	-	-	-	-
8	-	-	-	-	10.20	5.20	-	-	-	-	-	-	-
9	-	-	-	-	15.40	115.30	40.30	25.30	-	-	-	-	-
10	-	-	-	-	15.10	-	-	-	90.20	-	-	-	-
11	-	-	-	-	-	-	45.30	-	-	-	-	-	-
12	-	-	-	-	-	0.00	-	-	-	-	-	-	-
13	-	-	-	-	-	10.20	-	5.20	-	-	-	-	-
14	-	-	-	-	15.20	10.40	20.10	45.20	5.10	-	-	-	-
15	-	-	-	-	-	-	-	45.30	45.20	-	-	-	-
16	-	-	-	-	-	-	-	50.40	15.20	10.30	-	-	-
17	-	-	-	-	-	35.10	-	-	5.20	0.00	-	-	-
18	-	-	-	-	25.40	35.40	-	35.20	-	-	-	-	-
19	-	-	-	-	45.10	25.10	-	45.30	-	-	-	-	-
20	-	-	-	-	5.20	20.20	-	-	-	-	-	-	-
21	-	-	-	-	20.40	15.30	-	-	-	-	-	-	-
22	-	-	-	-	-	40.30	-	10.20	-	-	-	-	-
23	-	-	-	-	-	-	-	20.20	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-	-	-	-	-	-
26	-	3.00	-	-	20.20	10.20	-	10.30	-	-	-	-	-
27	-	-	-	30.40	-	5.30	-	-	-	-	-	-	-
28	-	-	-	-	-	-	-	-	-	-	-	-	-
29	-	-	-	-	-	-	-	-	-	-	-	-	-
30	-	-	-	-	-	-	25.30	55.20	-	-	-	-	-
31	-	-	-	-	5.40	-	40.20	20.20	-	-	-	-	-
Sum	-	3.00	-	45.60	207.90	585.20	246.00	605.10	105.60	100.50	-	-	-
Max	-	3.00	-	30.40	45.10	115.30	50.40	95.20	90.20	60.20	-	-	-
											Total	1907.70	
											July+Aug	851.9	

Table L.5- 2 Daily Rainfall at Bang Phuan (2/2)

Data source ; RID

Day	1995												Remarks
	Jan	Feb	Mar	Apr	May	Jun	Jly	Aug	Spt	Oct	Nov	Dec	
1	-	-	-	-	-	3.10	5.20	20.20	10.40	-	-	-	-
2	-	-	-	-	-	45.20	10.20	-	20.00	-	-	-	-
3	-	-	-	-	-	-	35.20	-	15.10	-	-	-	-
4	-	-	-	15.30	20.10	20.90	15.80	5.30	-	50.90	-	-	-
5	-	-	-	-	-	20.30	10.20	50.20	-	0.50	-	-	-
6	-	-	-	6.10	-	-	40.30	70.90	-	-	-	-	-
7	-	-	-	50.20	-	-	-	60.90	-	-	-	-	-
8	-	-	-	-	-	15.30	10.10	-	20.40	-	-	-	-
9	-	-	-	-	-	10.40	-	15.20	-	-	-	-	-
10	-	-	-	-	70.30	30.10	-	5.20	-	-	-	-	-
11	-	-	-	-	-	10.20	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	10.20	-	-	-	-	-
13	-	-	-	-	50.20	-	-	40.90	-	-	-	-	-
14	-	-	-	-	30.20	-	-	25.10	-	-	-	-	-
15	-	-	-	-	-	-	30.20	-	-	-	-	-	-
16	-	-	-	-	-	-	10.30	-	10.30	-	-	-	-
17	-	-	-	-	10.10	20.30	40.90	-	25.30	-	-	-	-
18	-	-	-	-	14.30	-	20.60	-	-	-	-	-	-
19	-	-	-	-	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	25.40	-	-	-	-	-
22	-	-	-	-	-	-	15.20	15.40	-	-	-	-	-
23	-	-	-	-	-	-	20.10	40.30	-	-	-	-	-
24	-	-	-	40.20	-	-	0.40	-	-	-	-	-	-
25	-	-	-	-	-	5.20	40.40	-	-	-	-	-	-
26	-	-	-	-	-	-	-	50.20	-	-	-	-	-
27	-	-	-	-	5.30	-	-	-	-	-	-	-	-
28	-	-	-	-	-	-	-	-	-	-	-	-	-
29	-	-	-	-	-	-	5.40	30.40	-	-	-	-	-
30	-	-	-	-	-	-	60.90	50.10	-	-	-	-	-
31	-	-	-	-	-	-	90.90	5.10	-	-	-	-	-
Sun	-	-	-	111.00	200.50	181.00	463.10	521.00	101.50	51.40	-	-	-
Max	-	-	-	50.20	70.30	45.20	90.90	70.90	25.30	50.90	-	-	-
											Total	1630.30	
											Jly+Aug	984.1	

Table L.5- 4 Daily Runoff of Bang Phuan(2/2)

Data source ; RID

g = 233 mm/hr (= 0.95)

Date	Runoff		mm		cm		in		ft		Total mm	Remarks
	mm	cm	in	ft	mm	cm	in	ft	mm	cm		
1968												
1	468	46.8	1.84	0.60	0.72	7.2	0.28	0.09	0.03	468		
2	480	48.0	1.89	0.62	0.74	7.4	0.29	0.09	0.03	948		
3	480	48.0	1.89	0.62	0.74	7.4	0.29	0.09	0.03	1428		
4	230	23.0	0.91	0.30	0.36	3.6	0.14	0.04	0.01	1658		
5	370	37.0	1.46	0.48	0.57	5.7	0.22	0.07	0.02	2028		
6	20	2.0	0.08	0.03	0.03	0.3	0.01	0.00	0.00	2048		
7	180	18.0	0.71	0.23	0.27	2.7	0.10	0.03	0.01	2228		
8	150	15.0	0.59	0.19	0.23	2.3	0.09	0.03	0.01	2378		
9	150	15.0	0.59	0.19	0.23	2.3	0.09	0.03	0.01	2528		
10	150	15.0	0.59	0.19	0.23	2.3	0.09	0.03	0.01	2678		
11	150	15.0	0.59	0.19	0.23	2.3	0.09	0.03	0.01	2828		
12	150	15.0	0.59	0.19	0.23	2.3	0.09	0.03	0.01	2978		
13	150	15.0	0.59	0.19	0.23	2.3	0.09	0.03	0.01	3128		
14	150	15.0	0.59	0.19	0.23	2.3	0.09	0.03	0.01	3278		
15	150	15.0	0.59	0.19	0.23	2.3	0.09	0.03	0.01	3428		
16	150	15.0	0.59	0.19	0.23	2.3	0.09	0.03	0.01	3578		
17	150	15.0	0.59	0.19	0.23	2.3	0.09	0.03	0.01	3728		
18	150	15.0	0.59	0.19	0.23	2.3	0.09	0.03	0.01	3878		
19	150	15.0	0.59	0.19	0.23	2.3	0.09	0.03	0.01	4028		
20	150	15.0	0.59	0.19	0.23	2.3	0.09	0.03	0.01	4178		
21	150	15.0	0.59	0.19	0.23	2.3	0.09	0.03	0.01	4328		
22	150	15.0	0.59	0.19	0.23	2.3	0.09	0.03	0.01	4478		
23	150	15.0	0.59	0.19	0.23	2.3	0.09	0.03	0.01	4628		
24	150	15.0	0.59	0.19	0.23	2.3	0.09	0.03	0.01	4778		
25	150	15.0	0.59	0.19	0.23	2.3	0.09	0.03	0.01	4928		
26	150	15.0	0.59	0.19	0.23	2.3	0.09	0.03	0.01	5078		
27	150	15.0	0.59	0.19	0.23	2.3	0.09	0.03	0.01	5228		
28	150	15.0	0.59	0.19	0.23	2.3	0.09	0.03	0.01	5378		
29	150	15.0	0.59	0.19	0.23	2.3	0.09	0.03	0.01	5528		
30	150	15.0	0.59	0.19	0.23	2.3	0.09	0.03	0.01	5678		
31	150	15.0	0.59	0.19	0.23	2.3	0.09	0.03	0.01	5828		
Total	1011	101.1	39.4	12.7	15.7	157	6.2	1.9	0.6	1011		

Table L.5- 5 Daily Runoff (1/2)

Month	Day	Bang Phuan						Vieng Kook						
		f=0.6		f=0.65				f=0.65		f=0.65				
		A=233 sqkm		A=120 sqkm		A=113 sqkm		A=151 sqkm		A=61 sqkm		A=90 sqkm		
	1000cum	1000cum	cum/s	1000cum	cum/s	1000cum	cum/s	1000cum	cum/s	1000cum	cum/s	1000cum	cum/s	
Jly	1	145	236	2.7	122	1.4	115	1.3	153	1.8	62	0.7	91	1.1
	2	394	621	7.2	320	3.7	301	3.5	402	4.7	163	1.9	240	2.8
	3	1271	2026	23.5	1044	12.1	983	11.4	1313	15.2	531	6.1	783	9.1
	4	1395	2095	24.2	1079	12.5	1016	11.8	1357	15.7	548	6.3	809	9.4
	5	1324	1975	22.9	1017	11.8	958	11.1	1280	14.8	517	6.0	763	8.8
	6	2286	3293	38.1	1696	19.6	1597	18.5	2134	24.7	862	10.0	1272	14.7
	7	1929	2437	28.2	1255	14.5	1182	13.7	1579	18.3	638	7.4	941	10.9
	8	1889	2392	27.7	1232	14.3	1160	13.4	1550	17.9	626	7.2	924	10.7
	9	1747	1586	18.4	817	9.5	769	8.9	1028	11.9	415	4.8	612	7.1
	10	1430	1123	13.0	578	6.7	545	6.3	728	8.4	294	3.4	434	5.0
	11	1283	850	9.8	438	5.1	412	4.8	551	6.4	222	2.6	328	3.8
	12	1141	463	5.4	238	2.8	224	2.6	300	3.5	121	1.4	179	2.1
	13	609	153	1.8	79	0.9	74	0.9	99	1.1	40	0.5	59	0.7
	14	498	76	0.9	39	0.5	37	0.4	50	0.6	20	0.2	30	0.3
	15	1201	1372	15.9	707	8.2	665	7.7	889	10.3	359	4.2	530	6.1
	16	992	1383	16.0	712	8.2	671	7.8	896	10.4	362	4.2	534	6.2
	17	1852	2856	33.1	1471	17.0	1385	16.0	1851	21.4	748	8.7	1103	12.8
	18	2005	2875	33.3	1481	17.1	1394	16.1	1863	21.6	753	8.7	1111	12.9
	19	1574	2173	25.1	1119	13.0	1054	12.2	1408	16.3	569	6.6	839	9.7
	20	1854	2396	27.7	1234	14.3	1162	13.4	1553	18.0	627	7.3	925	10.7
	21	1748	1780	20.6	917	10.6	863	10.0	1153	13.3	466	5.4	687	8.0
	22	1430	1358	15.7	699	8.1	658	7.6	880	10.2	355	4.1	524	6.1
	23	1920	1768	20.5	911	10.5	858	9.9	1146	13.3	463	5.4	683	7.9
	24	1505	1015	11.7	523	6.0	492	5.7	658	7.6	266	3.1	392	4.5
	25	2135	2535	29.3	1305	15.1	1229	14.2	1643	19.0	664	7.7	979	11.3
	26	1778	1652	19.1	851	9.8	801	9.3	1071	12.4	433	5.0	638	7.4
	27	1103	1228	14.2	633	7.3	596	6.9	796	9.2	322	3.7	474	5.5
	28	958	922	10.7	475	5.5	447	5.2	598	6.9	241	2.8	356	4.1
	29	1109	1015	11.8	523	6.1	492	5.7	658	7.6	266	3.1	392	4.5
	30	2527	3545	41.0	1826	21.1	1719	19.9	2298	26.6	928	10.7	1369	15.9
	31	4602	6403	74.1	3298	38.2	3105	35.9	4150	48.0	1676	19.4	2473	28.6
Aug	1	3822	5136	59.4	2645	30.6	2491	28.8	3329	38.5	1345	15.6	1984	23.0
	2	2906	3681	42.6	1896	21.9	1785	20.7	2386	27.6	964	11.2	1422	16.5
	3	2762	2840	32.9	1463	16.9	1377	15.9	1840	21.3	743	8.6	1097	12.7
	4	2628	2887	33.4	1487	17.2	1400	16.2	1871	21.7	756	8.7	1115	12.9
	5	3994	4585	53.1	2361	27.3	2224	25.7	2971	34.4	1200	13.9	1771	20.5
	6	5126	5857	67.8	3016	34.9	2840	32.9	3795	43.9	1533	17.7	2262	26.2
	7	5347	6288	72.8	3239	37.5	3050	35.3	4075	47.2	1646	19.1	2429	28.1
	8	4246	4296	49.7	2212	25.6	2083	24.1	2784	32.2	1125	13.0	1659	19.2
	9	3820	3988	46.2	2054	23.8	1934	22.4	2585	29.9	1044	12.1	1541	17.8
	10	3224	3493	40.4	1799	20.8	1634	19.6	2264	26.2	915	10.6	1349	15.6
	11	2903	2879	33.3	1483	17.2	1396	16.2	1866	21.6	754	8.7	1112	12.9
	12	2801	2271	26.3	1170	13.5	1101	12.7	1472	17.0	595	6.9	877	10.2
	13	3378	2937	34.0	1513	17.5	1425	16.5	1904	22.0	769	8.9	1135	13.1
	14	3259	2920	33.8	1504	17.4	1416	16.4	1892	21.9	764	8.8	1128	13.1

Table L.5- 6 Daily Runoff (2/2)

Month	Day	Bang Phuan							Vieng Kook						
		f=0.6		f=0.65					f=0.65						
		A=233 sqkm		A=120 sqkm		A=113 sqkm		A=151 sqkm		A=61 sqkm		A=90 sqkm			
1000' cum	1000' cum	cum/s	1000' cum	cum/s	1000' cum	cum/s	1000' cum	cum/s	1000' cum	cum/s	1000' cum	cum/s			
Aug	15	2447	2038	23.6	1049	12.1	988	11.4	1321	15.3	533	6.2	787	9.1	
	16	1670	1383	16.0	713	8.2	671	7.8	897	10.4	362	4.2	534	6.2	
	17	1208	1154	13.4	594	6.9	560	6.5	748	8.7	302	3.5	446	5.2	
	18	1208	1077	12.5	555	6.4	522	6.0	698	8.1	282	3.3	416	4.8	
	19	1030	690	8.0	355	4.1	335	3.9	447	5.2	181	2.1	266	3.1	
	20	708	190	2.2	98	1.1	92	1.1	123	1.4	50	0.6	73	0.8	
	21	1243	1154	13.4	594	6.9	560	6.5	748	8.7	302	3.5	446	5.2	
	22	1425	1469	17.0	757	8.8	712	8.2	952	11.0	385	4.5	567	6.6	
	23	1980	2875	33.3	1480	17.1	1394	16.1	1863	21.6	753	8.7	1110	12.9	
	24	1415	1955	22.6	1007	11.7	948	11.0	1267	14.7	512	5.9	755	8.7	
	25	1134	1533	17.7	790	9.1	744	8.6	994	11.5	401	4.6	592	6.9	
	26	1134	1228	14.2	633	7.3	596	6.9	796	9.2	322	3.7	474	5.5	
	27	1134	1036	12.0	534	6.2	502	5.8	671	7.8	271	3.1	400	4.6	
	28	956	727	8.4	374	4.3	353	4.1	471	5.5	190	2.2	281	3.3	
	29	1699	1686	19.5	869	10.1	818	9.5	1093	12.6	442	5.1	651	7.5	
	30	2605	3197	37.0	1647	19.1	1551	17.9	2072	24.0	837	9.7	1235	14.3	
	31	2008	2440	28.2	1257	14.5	1183	13.7	1581	18.3	639	7.4	942	10.9	
	Spt	1	1185	2226	25.8	1146	13.3	1079	12.5	1442	16.7	583	6.7	860	9.9
		2	1351	2559	29.6	1318	15.3	1241	14.4	1658	19.2	670	7.8	988	11.4
		3	1561	2825	32.7	1455	16.8	1370	15.9	1830	21.2	739	8.6	1091	12.6
		4	1315	2135	24.7	1100	12.7	1036	12.0	1384	16.0	559	6.5	825	9.5
		5	997	1260	14.6	649	7.5	611	7.1	817	9.5	330	3.8	487	5.6
		6	961	728	8.4	375	4.3	353	4.1	472	5.5	191	2.2	281	3.3
		7	923	610	7.1	314	3.6	296	3.4	396	4.6	160	1.8	236	2.7
		8	1208	1307	15.1	673	7.8	634	7.3	847	9.8	342	4.0	505	5.8
		9	890	732	8.5	377	4.4	355	4.1	475	5.5	192	2.2	283	3.3
		10	603	463	5.4	239	2.8	225	2.6	300	3.5	121	1.4	179	2.1
		11	531	309	3.6	159	1.8	150	1.7	200	2.3	81	0.9	119	1.4
		12	391	309	3.6	159	1.8	150	1.7	200	2.3	81	0.9	119	1.4
		13	285	309	3.6	159	1.8	150	1.7	200	2.3	81	0.9	119	1.4
		14	285	154	1.8	80	0.9	75	0.9	100	1.2	40	0.5	60	0.7
15		143	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	
16		431	468	5.4	241	2.8	227	2.6	303	3.5	123	1.4	181	2.1	
17		1066	1461	16.9	753	8.7	709	8.2	947	11.0	383	4.4	565	6.5	
18		675	1000	11.6	515	6.0	485	5.6	648	7.5	262	3.0	386	4.5	
19		498	731	8.5	376	4.4	354	4.1	474	5.5	191	2.2	282	3.3	
20		498	539	6.2	278	3.2	261	3.0	349	4.0	141	1.6	208	2.4	
21		498	539	6.2	278	3.2	261	3.0	349	4.0	141	1.6	208	2.4	
22		498	461	5.3	238	2.7	224	2.6	299	3.5	121	1.4	178	2.1	
23		426	192	2.2	99	1.1	93	1.1	124	1.4	50	0.6	74	0.9	
24		249	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	
25		249	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	
26		177	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	
27		0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	
28		0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	
29		0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	
30		0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	

Table L.5- 7 Flood Calculation --- Bang Puan Case B-2 (1/2)

A=113 sqkm Gate 2.50*3.25*2
Pump 6.36 cum/s

Month	Day	WL.(Out)	Inflow		Outflow(MCM)				Volume ③ ③-⑦	WL. (In) MSL.m	Gate Qmax MCM	V (Check)	Remarks
		①	cum ②	MCM ③=②n-1 +②n	Gate ④	Pump ⑤	Total ⑥ ④+⑤	Σ ⑦=⑦n-1 +⑥n					
Jly	1	160.13	115	0.12	-	-	-	-	0.12	< 164.00			
	2	160.13	301	0.42	-	-	-	-	0.42	< 164.00			
	3	160.13	983	1.40	-	-	-	-	1.40	< 164.00			
	4	160.36	1016	2.41	-	-	-	-	2.41	< 164.00			
	5	159.75	958	3.37	-	-	-	-	3.37	< 164.00			
	6	158.97	1597	4.97	-	-	-	-	4.97	< 164.00			
	7	158.93	1182	6.15	-	-	-	-	6.15	< 164.00			
	8	159.13	1160	7.31	-	-	-	-	7.31	< 164.00			
	9	159.85	769	8.08	-	-	-	-	8.08	< 164.00			
	10	159.92	545	8.63	-	-	-	-	8.63	< 164.00			
	11	161.16	412	9.04	-	-	-	-	9.04	< 164.00			
	12	161.90	225	9.26	-	-	-	-	9.26	< 164.00			
	13	162.37	74	9.34	-	-	-	-	9.34	< 164.00			
	14	162.54	37	9.37	-	-	-	-	9.37	< 164.00			
	15	162.50	665	10.04	-	-	-	-	10.04	< 164.00			
	16	162.47	671	10.71	-	-	-	-	10.71	< 164.00			
	17	162.45	1385	12.09	-	-	-	-	12.09	< 164.00			
	18	162.49	1394	13.49	-	-	-	-	13.49	< 164.00			
	19	162.61	1054	14.54	-	-	-	-	14.54	< 164.00			
	20	162.66	1162	15.70	-	-	-	-	15.70	< 164.00			
	21	162.79	863	16.57	-	-	-	-	16.57	< 164.00			
	22	163.18	659	17.23	-	-	-	-	17.23	< 164.00			
	23	163.28	857	18.08	-	-	-	-	18.08	164.00		35.22	
	24	163.20	492	18.58	-	-	-	-	18.58	164.00		35.22	
	25	163.15	1229	19.81	-	-	-	-	19.81	164.00		35.22	
	26	163.04	801	20.61	-	-	-	-	20.61	164.00		35.22	
	27	162.90	596	21.20	-	-	-	-	21.20	164.00		35.22	
	28	162.51	447	21.65	-	-	-	-	21.65	164.00		35.22	
	29	162.19	492	22.14	-	-	-	-	22.14	164.00		35.22	
	30	162.03	1719	23.86	-	-	-	-	23.86	164.00		35.22	
	31	162.38	3105	26.97	-	-	-	-	26.97	164.00		35.22	
Aug	1	163.37	2491	29.46	-	-	-	-	29.46	164.00		35.22	
	2	164.08	1785	31.24	-	-	-	-	31.24	164.00		35.22	
	3	164.08	1377	32.62	-	-	-	-	32.62	164.00		35.22	
	4	163.61	1400	34.02	-	-	-	-	34.02	164.00		35.22	
	5	163.18	2224	36.24	1.00	-	1.00	1.00	35.24	164.00	2.0	35.22	
	6	163.19	2841	39.08	2.00	-	2.00	3.00	36.08	164.06	2.0	36.12	
	7	163.64	3050	42.13	1.50	-	1.50	4.50	37.63	164.10	1.5	36.72	
	8	164.04	2083	44.22	1.00	-	1.00	5.50	38.72	164.23	1.0	38.72	
	9	164.43	1934	46.15	-	0.55	0.55	6.05	40.10	164.33	-	40.10	
	10	164.71	1694	47.85	-	0.55	0.55	6.60	41.25	164.40	-	41.25	
	11	164.98	1396	49.24	-	0.55	0.55	7.15	42.09	164.46	-	42.09	
	12	165.75	1101	50.34	-	0.55	0.55	7.70	42.64	164.50	-	42.64	
	13	165.23	1424	51.77	-	0.55	0.55	8.25	43.52	164.56	-	43.52	
	14	165.33	1445	53.21	-	0.55	0.55	8.80	44.41	164.62	-	44.41	
	15	165.40	988	54.20	-	0.55	0.55	9.35	44.85	164.65	-	44.85	
	16	165.56	671	54.87	-	0.55	0.55	9.90	44.97	164.65	-	44.97	
	17	166.14	560	55.43	-	0.55	0.55	10.45	44.98	164.65	-	44.98	
	18	166.56	522	55.95	-	0.55	0.55	11.00	44.95	164.65	-	44.95	
	19	166.90	335	56.29	-	0.55	0.55	11.55	44.74	164.64	-	44.74	

Table L.5- 8 Flood Calculation -- Bang Puan Case B-2 (2/2)

A=113 sqkm Gate 2.50*3.25*2
Pump 6.36 cum/s

Month	Day	WL (Out) ①	Inflow		Outflow (MCM)				Volume ⑧ ③-⑦	WL (In) MSL.m	Gate Q _{max} MCM	V (Check)	Remarks
			cum ②	MCM ③=② _{n-1} +② _n	Gate ④	Pump ⑤	Total ⑥ ④+⑤	Σ ⑦=⑦ _{n-1} +⑥ _n					
Aug	20	167.00	92	56.38	-	0.55	0.55	12.10	44.28	164.61	-	44.28	
	21	166.07	560	56.94	-	0.55	0.55	12.65	44.29	164.61	-	44.29	
	22	167.02	712	57.65	-	0.55	0.55	13.20	44.45	164.62	-	44.45	
	23	167.07	1394	59.05	-	0.55	0.55	13.75	45.30	164.67	-	45.30	
	24	167.01	948	59.99	-	0.55	0.55	14.30	45.69	164.70	-	45.69	
	25	166.94	743	60.74	-	0.55	0.55	14.85	45.89	164.71	-	45.89	
	26	166.91	596	61.33	-	0.55	0.55	15.40	45.93	164.72	-	45.93	
	27	166.87	502	61.84	-	0.55	0.55	15.95	45.89	164.71	-	45.89	
	28	166.62	353	62.19	-	0.55	0.55	16.50	45.69	164.70	-	45.69	
	29	166.11	818	63.01	-	0.55	0.55	17.05	45.96	164.72	-	45.96	
	30	165.80	1550	64.56	-	0.55	0.55	17.60	46.96	164.79	-	46.96	
	31	165.67	1183	65.74	-	0.55	0.55	18.15	47.59	164.83	-	47.59	
Spt	1	166.09	1080	66.82	-	0.55	0.55	18.70	48.12	164.86	-	48.12	
	2	166.37	1241	68.06	-	0.55	0.55	19.25	48.81	164.91	-	48.81	
	3	166.25	1370	69.43	-	0.55	0.55	19.80	49.63	164.97	-	49.63	
	4	166.46	1035	70.47	-	0.55	0.55	20.35	50.12	165.00	-	50.12	
	5	166.55	611	71.08	-	0.55	0.55	20.90	50.18	165.00	-	50.18	
	6	166.65	353	71.43	-	0.55	0.55	21.45	49.98	164.99	-	49.98	
	7	166.60	296	71.73	-	0.55	0.55	22.00	49.73	164.97	-	49.73	
	8	166.47	634	72.36	-	0.55	0.55	22.55	49.81	164.98	-	49.81	
	9	166.38	355	72.72	-	0.55	0.55	23.10	49.62	164.96	-	49.62	
	10	166.28	225	72.94	-	0.55	0.55	23.65	49.29	164.94	-	49.29	
	11	166.13	150	73.09	-	0.55	0.55	24.20	48.89	164.92	-	48.89	
	12	165.95	150	73.24	-	0.55	0.55	24.75	48.49	164.89	-	48.49	
	13	165.69	150	73.39	-	0.55	0.55	25.30	48.09	164.86	-	48.09	
	14	165.38	75	73.46	-	0.55	0.55	25.85	47.61	164.83	-	47.61	
	15	165.04	0	73.46	-	0.55	0.55	26.40	47.06	164.79	-	47.06	
	16	164.75	227	73.69	-	0.55	0.55	26.95	46.74	164.77	-	46.74	
	17	164.47	709	74.40	2.00	2.00	2.00	28.95	45.45	164.69	2.0	45.45	
	18	164.10	485	74.88	2.90	2.90	2.90	31.85	43.03	164.52	2.8	43.03	
	19	163.68	355	75.24	3.50	3.50	3.50	35.35	39.89	164.31	3.5	39.89	
	20	163.34	261	75.50	3.70	3.70	3.70	39.05	36.45	164.08	3.7	36.45	
	21	163.22	261	75.76	1.50	1.50	1.50	40.55	35.21	164.00	3.8	35.21	
	22	163.15	224	75.99	0.20	0.20	0.20	40.75	35.24	164.00	4.0	35.24	
	23	163.31	93	76.08	0.10	0.10	0.10	40.85	35.23	164.00	3.6	35.23	
	24	164.00	0	76.08	-	-	-	40.85	35.23	164.00	0.1	35.23	
	25	164.48	0	76.08	-	-	-	40.85	35.23	164.00	-	35.23	
	26	164.48	0	76.08	-	-	-	40.85	35.23	164.00	-	35.23	
	27	164.03	0	76.08	-	-	-	40.85	35.23	164.00	-	35.23	
	28	163.71	0	76.08	-	-	-	40.85	35.23	164.00	2.3	35.23	
	29	163.57	0	76.08	-	-	-	40.85	35.23	164.00	2.9	35.23	
	30	163.66	0	76.08	-	-	-	40.85	35.23	164.00	2.5	35.23	
	1	164.46	0	76.08	-	-	-	40.85	35.23	164.00	-	35.23	
	2	164.43	0	76.08	-	-	-	40.85	35.23	164.00	-	35.23	
	3	164.45	0	76.08	-	-	-	40.85	35.23	164.00	-	35.23	
	4	164.61	0	76.08	-	-	-	40.85	35.23	164.00	-	35.23	
	5	164.73	0	76.08	-	-	-	40.85	35.23	164.00	-	35.23	
	6	164.57	0	76.08	-	-	-	40.85	35.23	164.00	-	35.23	
	7	164.05	0	76.08	-	-	0.80	41.65	34.43	163.95	-	34.43	
	8	163.96	0	76.08	-	-	0.85	42.50	33.58	163.89	-	33.58	

FIGURE N.5- 1 H-V,H-A Curve

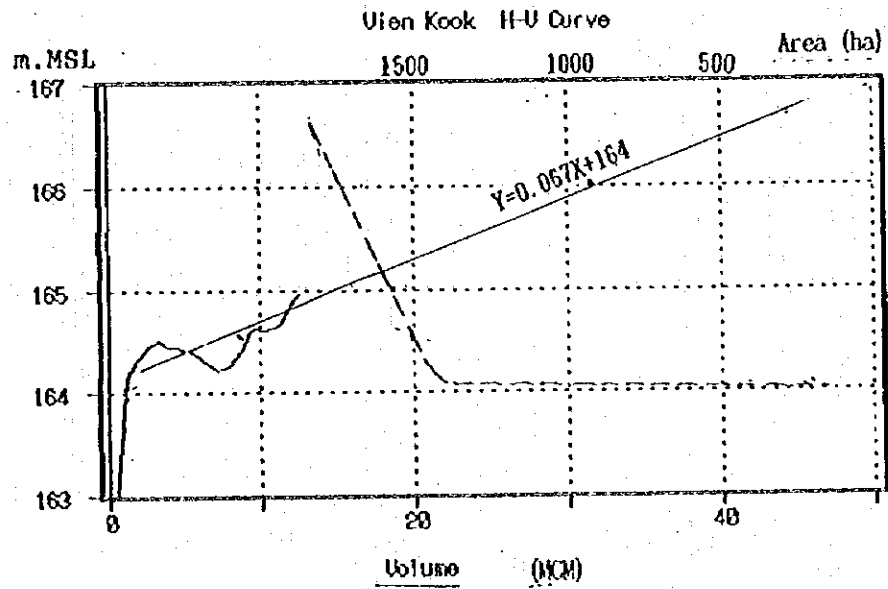
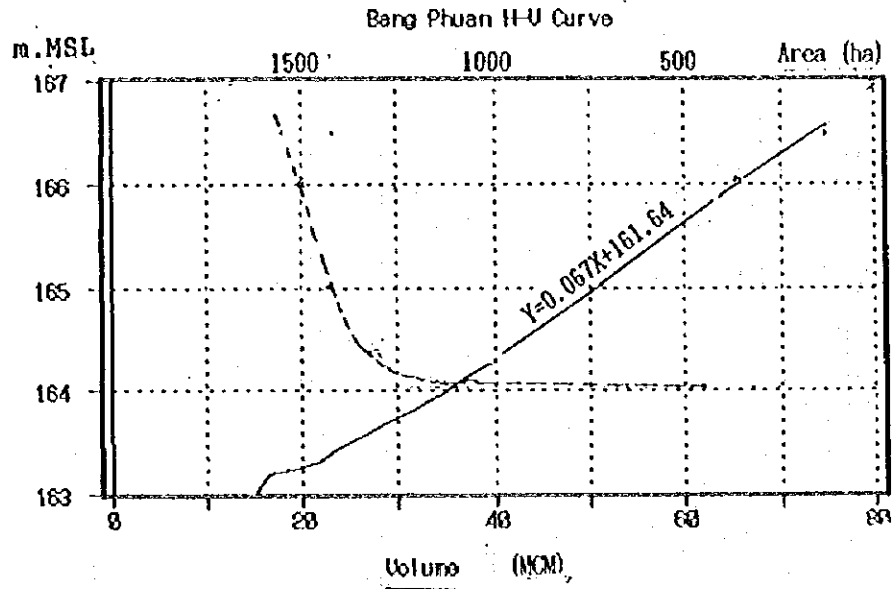


FIGURE N.5- 2 Inundation Curve (Present)

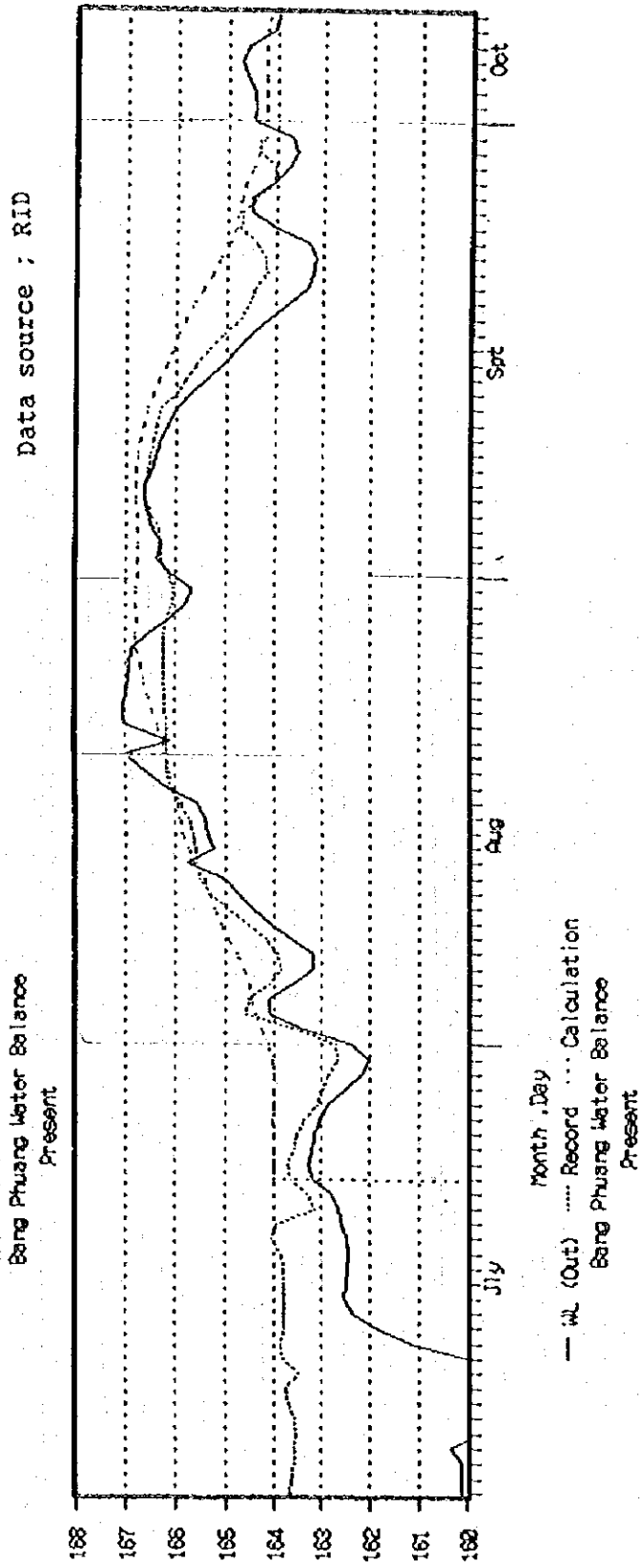


Table L.5- 9 Flood Calculation -- Vieng Kook Case A-2 (1/2)

A=151 sqkm Gate 2.50*3.25*2
 Pump 11.57 cum/s

Month	Day	WL(Out) ①	Inflow		Outflow (MCM)				Volume ⑧ ③-⑦	WL (In) MSL. m	Gate Q _{max} MCM	V (Check)	Remarks
			cum ②	MCM ③-②n-1 t②n	Gate ④	Pump ⑤	Total ⑥ ④+⑤	Σ ⑦-⑦n-1 t⑥n					
Jly	1	158.68	153	0.15	0.15	-	0.15	0.15	0.00	164.00	10.0	-	
	2	158.84	402	0.56	0.40	-	0.40	0.56	0.00	164.00	9.9	-	
	3	158.84	1313	1.87	1.31	-	1.31	1.87	0.00	164.00	9.9	-	
	4	159.44	1358	3.23	1.36	-	1.36	3.23	0.00	164.00	9.3	-	
	5	160.14	1280	4.51	1.28	-	1.28	4.51	0.00	164.00	8.5	-	
	6	160.35	2134	6.64	2.13	-	2.13	6.64	0.00	164.00	8.3	-	
	7	160.47	1579	8.22	1.58	-	1.58	8.22	0.00	164.00	8.2	-	
	8	160.91	1550	9.77	1.55	-	1.55	9.77	0.00	164.00	7.6	-	
	9	161.29	1028	10.80	1.03	-	1.03	10.80	0.00	164.00	7.2	-	
	10	161.58	728	11.53	0.73	-	0.73	11.53	0.00	164.00	6.8	-	
	11	161.76	551	12.08	0.55	-	0.55	12.08	0.00	164.00	6.5	-	
	12	162.33	300	12.38	0.30	-	0.30	12.38	0.00	164.00	5.6	-	
	13	162.77	99	12.48	0.10	-	0.10	12.48	0.00	164.00	4.8	-	
	14	162.95	49	12.52	0.05	-	0.05	12.52	0.00	164.00	4.5	-	
	15	162.86	889	13.41	0.89	-	0.89	13.41	0.00	164.00	4.6	-	
	16	162.79	896	14.31	0.90	-	0.90	14.31	0.00	164.00	4.8	-	
	17	162.85	1851	16.16	1.85	-	1.85	16.16	0.00	164.00	4.7	-	
	18	162.86	1863	18.02	1.86	-	1.86	18.02	0.00	164.00	4.6	-	
	19	163.08	1408	19.43	1.41	-	1.41	19.43	0.00	164.00	4.2	-	
	20	163.11	1553	20.99	1.55	-	1.55	20.99	0.00	164.00	4.1	-	
	21	163.19	1154	22.14	1.15	-	1.15	22.14	0.00	164.00	3.9	-	
	22	163.60	880	23.02	0.88	-	0.88	23.02	0.00	164.00	2.8	-	
	23	163.67	1146	24.16	1.15	-	1.15	24.16	0.00	164.00	2.5	-	
	24	163.56	658	24.82	0.66	-	0.66	24.82	0.00	164.00	2.9	-	
	25	163.52	1643	26.47	1.64	-	1.64	26.47	0.00	164.00	3.0	-	
	26	163.49	1071	27.54	1.07	-	1.07	27.54	0.00	164.00	3.1	-	
	27	163.31	796	28.33	0.80	-	0.80	28.33	0.00	164.00	3.6	-	
	28	163.00	598	28.93	0.60	-	0.60	28.93	0.00	164.00	4.4	-	
	29	162.69	658	29.59	0.66	-	0.66	29.59	0.00	164.00	5.0	-	
	30	162.41	2297	31.88	2.30	-	2.30	31.88	0.00	164.00	5.5	-	
	31	162.51	4150	36.03	4.15	-	4.15	36.03	0.00	164.00	5.3	-	
Aug	1	163.64	3328	39.36	3.33	-	3.33	39.36	0.00	164.00	2.6	-	
	2	164.45	2386	41.75	-	-	0.00	39.36	2.39	164.14	-	2.39	
	3	164.48	1841	43.59	-	-	0.00	39.36	4.23	164.25	-	4.23	
	4	164.12	1871	45.46	1.70	-	1.70	41.06	4.40	164.26	1.7	4.40	
	5	163.78	2971	48.43	3.00	-	3.00	44.06	4.37	164.25	3.0	4.37	
	6	163.88	3796	52.23	2.90	-	2.90	46.96	5.26	164.32	2.9	5.26	
	7	164.11	4075	56.30	2.40	-	2.40	49.36	6.94	164.42	2.4	6.94	
	8	164.84	2784	59.09	-	1.00	1.00	50.36	8.72	164.52	-	8.72	
	9	164.75	2584	61.67	-	1.00	1.00	51.36	10.31	164.62	-	10.31	
	10	165.06	2264	63.93	-	1.00	1.00	52.36	11.57	164.69	-	11.57	
	11	165.27	1866	65.80	-	1.00	1.00	53.36	12.44	164.75	-	12.44	
	12	165.47	1472	67.27	-	1.00	1.00	54.36	12.91	164.77	-	12.91	
	13	165.52	1903	69.17	-	1.00	1.00	55.36	13.81	164.83	-	13.81	
	14	165.63	1931	71.11	-	1.00	1.00	56.36	14.74	164.88	-	14.74	
	15	165.68	1321	72.43	-	1.00	1.00	57.36	15.06	164.90	-	15.06	
	16	165.80	896	73.32	-	1.00	1.00	58.36	14.96	164.90	-	14.96	
	17	166.38	748	74.07	-	1.00	1.00	59.36	14.71	164.88	-	14.71	
	18	166.98	698	74.77	-	1.00	1.00	60.36	14.41	164.86	-	14.41	
	19	167.32	447	75.22	-	1.00	1.00	61.36	13.85	164.83	-	13.85	

Table L.5-10 Flood Calculation -- Vieng Kook Case A-2 (2/2)

A=151 sqkm Gate 2.50*3.25*2
Pump 11.57 cum/s

Month	Day	WL.(Out) ①	Inflow		Outflow (MCM)				Volume ⑧ ③-⑦	WL (In) MSL.m	Gate Q _{max} MCM	V (Check)	Remarks
			cum ②	MCM ③-②n-1 +②n	Gate ④	Pump ⑤	Total ⑥ ④+⑤	Σ ⑦-⑦n-1 +⑥n					
Aug	20	167.40	123	75.34	-	1.00	1.00	62.36	12.98	164.78	-	12.98	
	21	167.34	748	76.09	-	1.00	1.00	63.36	12.72	164.76	-	12.72	
	22	167.39	952	77.04	-	1.00	1.00	64.36	12.68	164.76	-	12.68	
	23	167.48	1863	78.90	-	1.00	1.00	65.36	13.54	164.81	-	13.54	
	24	167.42	1267	80.17	-	1.00	1.00	66.36	13.81	164.83	-	13.81	
	25	167.25	993	81.16	-	1.00	1.00	67.36	13.80	164.83	-	13.80	
	26	167.27	796	81.96	-	1.00	1.00	68.36	13.60	164.82	-	13.60	
	27	167.21	671	82.63	-	1.00	1.00	69.36	13.27	164.80	-	13.27	
	28	166.92	471	83.10	-	1.00	1.00	70.36	12.74	164.76	-	12.74	
	29	166.47	1093	84.19	-	1.00	1.00	71.36	12.83	164.77	-	12.83	
	30	166.02	2072	86.27	-	1.00	1.00	72.36	13.90	164.83	-	13.90	
	31	165.89	1581	87.85	-	1.00	1.00	73.36	14.48	164.87	-	14.48	
Spt	1	166.86	1443	89.29	-	1.00	1.00	74.36	14.93	164.90	-	14.93	
	2	166.75	1658	90.95	-	1.00	1.00	75.36	15.59	164.94	-	15.59	
	3	166.50	1831	92.78	-	1.00	1.00	76.36	16.42	164.98	-	16.42	
	4	166.52	1384	94.16	-	1.00	1.00	77.36	16.80	165.00	-	16.67	
	5	166.90	817	94.98	-	1.00	1.00	78.36	16.62	165.00	-	16.62	
	6	167.02	472	95.45	-	1.00	1.00	79.36	16.09	164.97	-	16.09	
	7	166.95	395	95.85	-	1.00	1.00	80.36	15.48	164.93	-	15.48	
	8	166.82	847	96.69	-	1.00	1.00	81.36	15.33	164.92	-	15.33	
	9	166.71	474	97.17	-	1.00	1.00	82.36	14.81	164.89	-	14.81	
	10	166.64	300	97.47	-	1.00	1.00	83.36	14.11	164.85	-	14.11	
	11	166.47	200	97.67	-	1.00	1.00	84.36	13.31	164.80	-	13.31	
	12	166.31	200	97.87	-	1.00	1.00	85.36	12.51	164.75	-	12.51	
	13	166.05	200	98.07	-	1.00	1.00	86.36	11.71	164.70	-	11.71	
	14	165.75	100	98.17	-	1.00	1.00	87.36	10.81	164.65	-	10.81	
	15	165.46	0	98.17	-	1.00	1.00	88.36	9.81	164.59	-	9.81	
	16	165.25	303	98.47	-	1.00	1.00	89.36	9.11	164.55	-	9.11	
	17	164.96	947	99.42	-	1.00	1.00	90.36	9.06	164.54	-	9.06	
	18	164.59	648	100.07	-	1.00	1.00	91.36	8.70	164.52	-	8.70	
	19	164.23	474	100.54	1.98	-	1.98	93.34	7.20	164.43	2.0	7.20	
	20	163.94	349	100.89	2.60	-	2.60	95.94	4.95	164.30	2.6	4.95	
	21	163.83	349	101.24	2.50	-	2.50	98.44	2.80	164.17	2.5	2.80	
	22	163.64	299	101.54	2.68	-	2.68	101.12	0.42	164.02	2.7	0.42	
	23	163.69	124	101.66	0.60	-	0.60	101.72	0.00	164.00	-	-	
	24	164.26	0	101.66	-	-	0.00	101.72	-	164.00	-	-	
	25	164.87	0	101.66	-	-	0.00	101.72	-	164.00	-	-	
	26	164.82	0	101.66	-	-	0.00	101.72	-	164.00	-	-	
	27	164.46	0	101.66	-	-	0.00	101.72	-	164.00	-	-	
	28	164.18	0	101.66	-	-	0.00	101.72	-	164.00	-	-	
	29	164.05	0	101.66	-	-	0.00	101.72	-	164.00	-	-	
	30	164.05	0	101.66	-	-	0.00	101.72	-	164.00	-	-	
Oct	1	164.09	0	101.66	-	-	0.00	101.72	-	164.00	-	-	
	2	163.95	0	101.66	-	-	0.00	101.72	-	164.00	-	-	
	3	163.62	0	101.66	-	-	0.00	101.72	-	164.00	-	-	
	4	163.34	0	101.66	-	-	0.00	101.72	-	164.00	-	-	
	5												
	6												
	7												
	8												

FIGURE N.5- 4 Existing Swamp Area

List of Existing Swamp Area (ha)

Swamp Name	Hoai Mong Project Area		Vieng Kook Area		Remarks
	Swamp Area (ha)	Pond Area (ha)	Swamp Area (ha)	Pond Area (ha)	
1. Nong Kow Ko	550	310	1. Nong Hoo Chang	420	130
2. Nong Rusk	110	30	2. Nong Sank	80	30
3. Nong Bo 2	680	60	3. Nong Phang	120	20
4. Nong Ban	-	-	4. Nong No Rai	130	40
5. Nong Ban Be	70	-	5. Nong Ban Be	30	-
6. Ban Si Wila	-	-	6. Ban Si Wila	560	-
7. Others	-	-	7. Others	70	-
	1410	400		1450	220

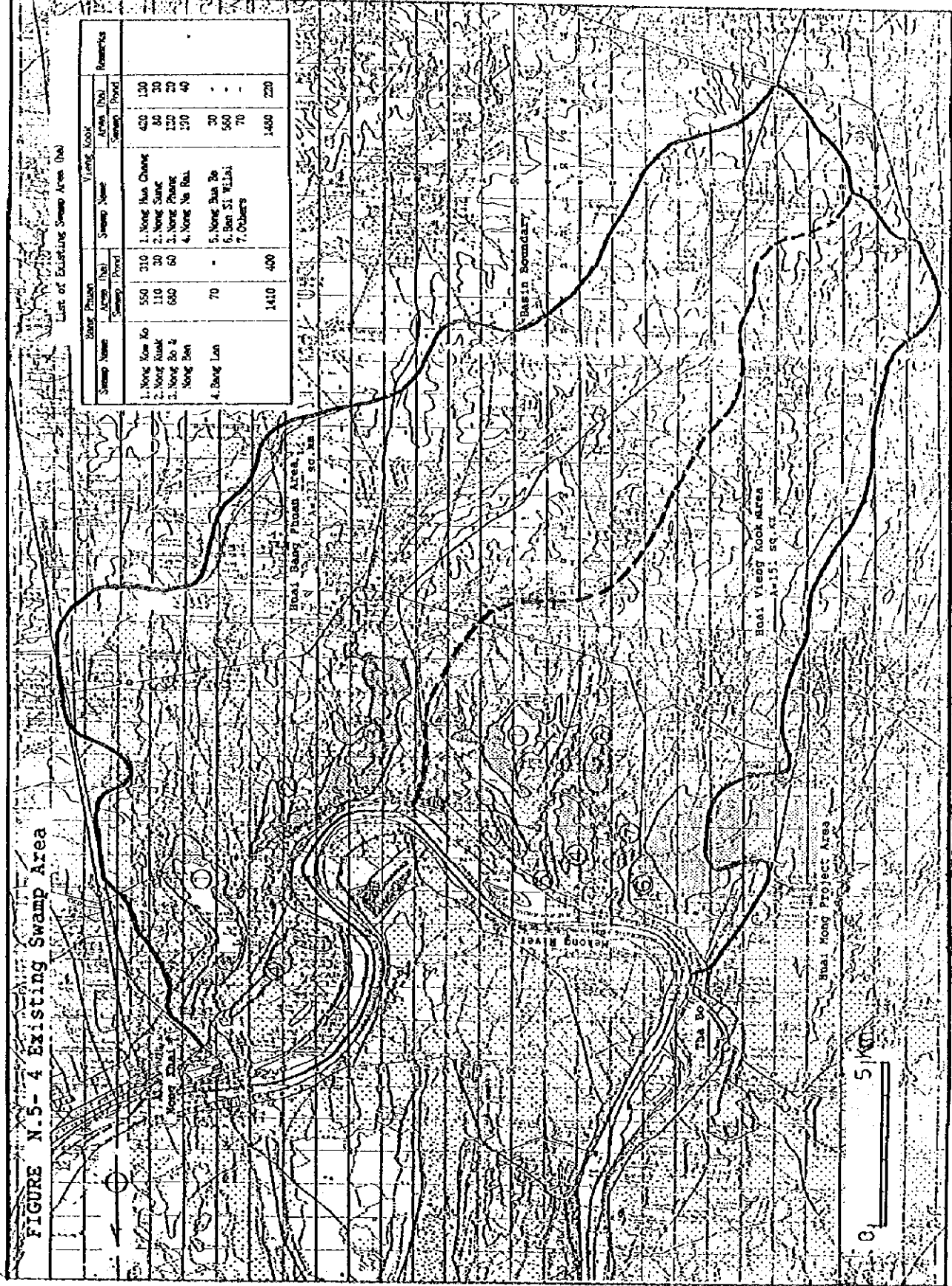
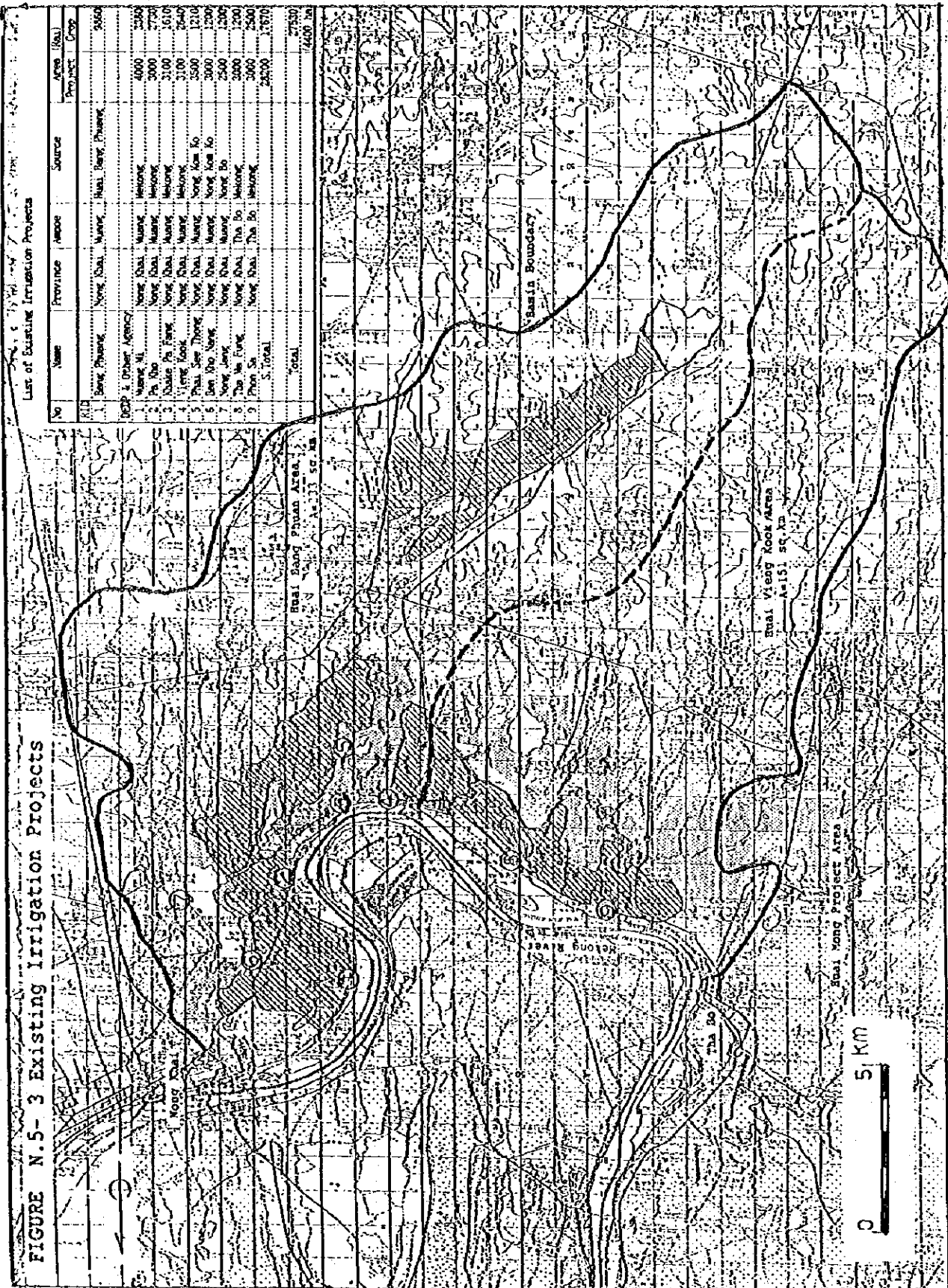


FIGURE N.5-3 Existing Irrigation Projects



List of Existing Irrigation Projects

No	Name	Province	Amoe	Source	Area (ha)
1	Bong Phouang	Song Khao	Muang	Hual Bery Phouang	2000
DEP 4 Other Agency					
1	Wang Mi	Song Khao	Muang	Historic	4000
2	Pa Tho	Song Khao	Muang	Historic	2000
3	Naan Pa Yang	Song Khao	Muang	Historic	2100
4	Vieng Kook	Song Khao	Muang	Historic	1610
5	Phai Sae Thong	Song Khao	Muang	Song Kom Ko	3500
6	Don Tho Song	Song Khao	Muang	Song Kom Ko	1210
7	Ngay Lang	Song Khao	Muang	Song Do	1200
8	Tha Na Fong	Song Khao	Tha Do	Historic	2000
9	Phou Sa	Song Khao	Tha Do	Historic	2000
	S. Total				26700
	Total				27530
					1400 ha

Table L.5-11 Disbursement Schedule of Bang Phuan

Items	Amounts (1000B)			1st year			2nd year			3rd year			4th year			5th year			Remarks	
	Total	L/C	F/C	Total	L/C	F/C	Total	L/C	F/C	Total	L/C	F/C	Total	L/C	F/C	Total	L/C	F/C		
1. Preparation work	20850	7700	13250	12570	4620	7950	20955	770	1325	2095	770	1325	2095	770	1325	2095	770	1325		
2. Construction Work																				
2-1. Flood Protection																				
1) Regulators (D/S)	8100	4550	3550	-	-	-	3240	1820	1420	4860	2730	2130	-	-	-	-	-	-	-	
Civil Works	3500	350	3150	-	-	-	-	-	-	3500	350	3150	-	-	-	-	-	-	-	
Gates Works																				
2) Regulator (Rehabilitation)	3500	350	3150	-	-	-	-	-	-	3500	350	3150	-	-	-	-	-	-	-	
Gates Works																				
3) Pumping Station	2200	13000	10200	-	-	-	-	-	-	9280	5200	4080	13920	7800	6120	-	-	-	-	
Civil Works	75000	7500	67500	-	-	-	-	-	-	-	-	-	75000	7500	67500	-	-	-	-	
Pump/Motor																				
4) Regulators (D/S)	8100	4550	3550	-	-	-	-	-	-	3240	1820	1420	4860	2730	2130	-	-	-	-	
Civil Works	3500	350	3150	-	-	-	-	-	-	-	-	-	3500	350	3150	-	-	-	-	
Gates Works																				
5) Drainage Canals																				
Bypass	116200	50400	65800	-	-	-	45480	20150	25320	69720	30240	39480	-	-	-	-	-	-	-	
Rehabilitation	72000	27900	44100	-	-	-	21600	8370	13230	28800	11160	17640	21600	8370	13230	-	-	-	-	
Sub Total	333100	108950	224150	-	-	-	71320	30350	40970	122900	51850	71050	118880	26730	32130	-	-	-	-	
2-2. Swamp Area Development																				
1) Reservoir Development	26400	2960	23440	-	-	-	5280	782	4498	7920	1188	6732	7920	1188	6732	5280	782	4498		
2) Dike/Road (Fill)	12960	5030	7930	-	-	-	2592	1166	1426	3588	1749	2138	3888	1749	2138	2592	1166	1426		
3) Dike/Road (Cut-and-Fill)	2140	1940	200	-	-	-	428	338	40	642	582	60	642	582	60	428	338	40		
4) Pumps	3000	1500	1500	-	-	-	-	-	-	-	-	-	3000	1500	1500	-	-	-		
5) On-farm	28400	19460	7920	-	-	-	-	-	-	-	-	-	10560	7392	3168	15840	11088	4752		
6) Fishery Pond (Cut)	5600	990	5610	-	-	-	-	-	-	-	-	-	8600	990	8600	990	5610			
7) Fishery Pond (Fill)	10800	4860	5940	-	-	-	-	-	-	-	-	-	10800	4860	5940	-	-	-		
8) Others	17600	7500	10100	-	-	-	-	-	-	-	-	-	8800	3750	5050	8800	3750	5050		
Sub Total	105900	45060	60840	-	-	-	8300	2346	5954	12450	3519	8931	31810	14661	17149	53340	24534	28806		
Total (1+2+3)	439950	161710	278240	12570	4620	7950	81715	33466	48249	137445	56139	81306	152785	42181	110604	55435	25804	30131		
3. Land Acquisition Cost	35000	35000	-	35000	35000	-	-	-	-	-	-	-	-	-	-	-	-	-		
4. Engineering Cost	12200	4900	8300	13200	4900	8300	-	-	-	-	-	-	-	-	-	-	-	-		
5. Administration Cost	44000	16200	27800	8800	3240	5560	8800	3240	5560	8800	3240	5560	8800	3240	5560	8800	3240	5560		
6. Contingencies	58200	21800	36400	7000	4800	2200	9100	3700	5400	14600	5900	8700	16100	4500	11600	5400	2500	2900		
7. Price escalation L/C	124300	87100	47200	22400	19100	3300	22800	14700	8100	36800	23800	13000	35600	18200	17400	16700	11300	5400		
Total Project Cost	719650	326710	392940	36970	71660	27310	122415	55106	67308	187645	89079	108586	212235	68120	145164	87225	42744	44591		
	720000	327000	393000	99000	72000	27000	122000	55000	67000	188000	89000	109000	213000	68000	145000	87000	43000	45000		

Table L.5-12 Disbursement Schedule of Viengk Kook

Items	Amount (000B)			1st year			2nd year			3rd year			4th year			5th year			Remarks
	Total	L/C	F/C	Total	L/C	F/C	Total	L/C	F/C	Total	L/C	F/C	Total	L/C	F/C	Total	L/C	F/C	
1. Preparation Work	17200	5700	11500	10320	3420	6900	1720	570	1150	1720	570	1150	1720	570	1150	1720	570	1150	
2. Construction Work																			
2-1. Flood Protection																			
1) Regulators (D/S)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Civil Works	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Grates Works	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
2) Regulator Rehabilitation	7000	700	6300	-	-	-	7000	700	6300	-	-	-	-	-	-	-	-	-	
Grates Works	29500	16500	13000	-	-	-	-	-	-	11800	6600	5200	17700	9900	7800	52000	28000	24000	
Civil Works	93000	9300	83700	-	-	-	-	-	-	-	-	-	-	-	-	93000	9300	83700	
Pump/Apoc																			
4) Regulators (U/S)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Civil Works	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Grates Works	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Drainage Canals	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Sycess Rehabilitation	144000	55800	88200	-	-	-	209000	11160	17640	42000	16740	25460	42200	16740	25460	288000	11160	17640	
Sub Total	273500	82300	191200	-	-	-	289000	11160	17640	50200	17440	32760	55000	23340	31660	109500	30360	109140	
2-2. Swamp Area Development																			
1) Reservoir Dredging	14520	2178	12342	-	-	-	-	-	-	4956	693	3702	5808	871	4937	4256	683	3702	
2) Dike/Road (Fill)	11520	5180	6340	-	-	-	-	-	-	2458	1554	1902	4608	2072	2528	2458	1554	1902	
3) Dike/Road (Concrete)	1970	1730	190	-	-	-	-	-	-	576	519	57	788	692	76	576	519	57	
4) Piers	3000	1500	1500	-	-	-	-	-	-	-	-	-	-	-	-	3000	1500	1500	
5) Openings	18800	11760	5040	-	-	-	-	-	-	-	-	-	6720	4704	2016	10030	7056	3024	
6) Fishery Pond (Cur)	4400	680	3720	-	-	-	-	-	-	-	-	-	-	-	-	4400	680	3720	
7) Fishery Pond (Fill)	7200	3240	3960	-	-	-	-	-	-	-	-	-	-	-	-	7200	3240	3960	
8) Others	11740	5152	6588	-	-	-	-	-	-	-	-	-	5870	2576	3294	5870	2576	3294	
Sub Total	71100	31400	39700	-	-	-	3388	2728	5662	23774	10815	12859	30938	17758	21180	30938	17758	21180	
Total (1+2+3)	361800	119400	242400	10520	3420	6900	30520	11720	18790	60388	20736	29572	80494	34825	45669	120158	48688	121470	
3. Land Acquisition Cost	32500	32500	-	22500	32500	-	-	-	-	-	-	-	-	-	-	-	-	-	
4. Engineering Cost	10900	3600	7300	10900	3600	7300	-	-	-	-	-	-	-	-	-	-	-	-	
5. Administration Cost	36100	11900	24200	7220	2380	4840	7220	2380	4840	7220	2380	4840	7220	2380	4840	7220	2380	4840	
6. Contingencies	44100	16700	27400	6100	4200	1900	3800	1400	2400	6800	2300	4000	8300	3700	5100	13600	5100	8500	
7. Price escalation L/C	108100	67000	41100	19700	18500	2800	9100	5600	3500	15900	9200	6700	22500	14900	7800	40900	20500	20400	
Total Project Cost	593500	251100	342400	36740	62800	23840	50640	21110	29530	90223	24516	55612	119014	55805	62109	246878	76683	170210	
				86740			50640												
	593900	251000	342000	37000	63000	24000	51000	21000	30000	90000	25000	55000	119000	56000	63000	247000	59000	147000	

APPENDIX O. HUAI LUANG DEVELOPMENT PROJECT

APPENDIX O HUAI LUANG IMPROVEMENT PROJECT

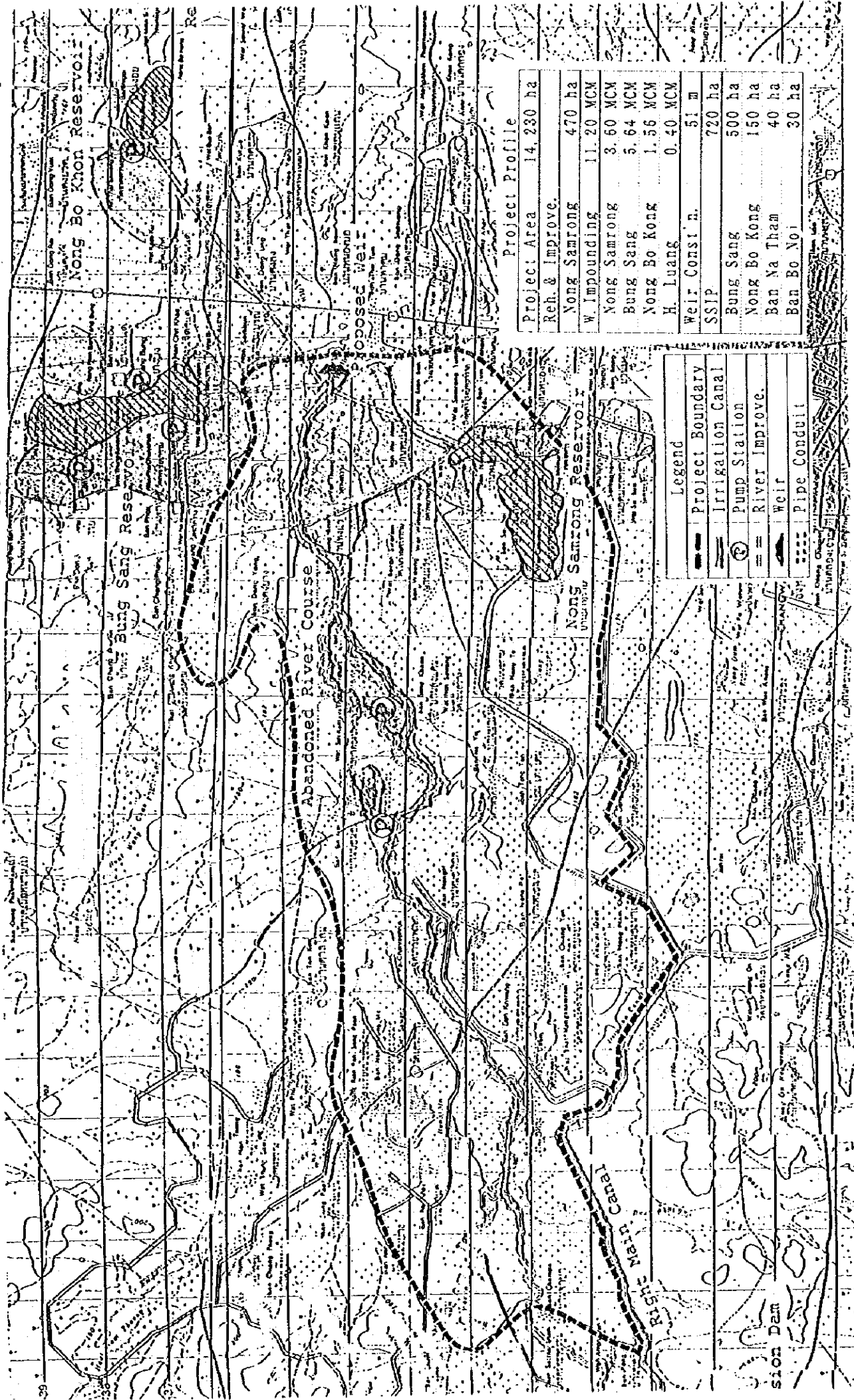
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GENERAL MAP OF HUAI LUANG IMPROVEMENT PROJECT



Project Profile

Project Area	14,230 ha
Reh. & Improve.	
Nong Samrong	470 ha
W. Impounding	11.20 MCM
Nong Samrong	3.60 MCM
Bung Sang	5.64 MCM
Nong Bo Kong	1.56 MCM
H. Luang	0.40 MCM
Weir Consi. n.	51 m
SSIP	720 ha
Bung Sang	500 ha
Nong Bo Kong	150 ha
Ban Na Tham	40 ha
Ban Bo Noi	30 ha

Legend

- Project Boundary
- Irrigation Canal
- ⊕ Pump Station
- River Improve.
- Weir
- Pipe Conduit

SION DAN

CHAPTER 1. LOCATION AND AREA

1.1 Location

The Project Area is located in the central part of the Study Area, and extended over the Tambon Mu Mon, Ban Luem, Chiang Pin and Chiang Yun of Amphoe Muang, and Tambon Pa Ko of Amphoe Kut Chap of Udon Thani province along the Huai Mong in the upper reaches.

1.2 Area

The Area is the suburban farm land area of some 7,200 ha for the drainage improvement and some 1,190 ha for the Irrigation, and extended over The area includes a part of existing Huai Luang large scale project area and Nong Samrong reservoir project area.

<u>Amphoe</u>	<u>Project Area</u>	
	<u>Irrigation Area</u>	<u>Drainage Area</u>
Muang Udon Thani	1,190 ha	5,500 ha
Ku Chap	-	1,700 ha
Total	<u>1,190 ha</u>	<u>7,200 ha</u>

CHAPTER 2. THE AREA

2.1 Climate

The climate in the project area is tropical and monsoonal, consists of two seasons, the rainy season for the months of May through October and the dry season for the months of November through April. The mean annual rainfall at Udon Thani is about 1,400 mm, of which about 90 % fall in the rainy season. A standard deviation of varied from 34 % to 262 % in the monthly rainfall but about 21 % of average rainfalls in the rainy season rain.

2.2 Topography

The land is generally flat but some are moderately sloped and undulated. Several swamps exist in the depressed land.

2.3 Geology

The land consists of mudstone, shale and siltstone with rock salt and other evaporates of Maha Sarakham formation in the cretaceous tertiary age in geology. Soils are silty loam made from those mother rock. The land infected with salt are not reported within the project area.

2.4 Irrigation and Drainage

About 90 % of drainage area is included in the Huai Luang reservoir project area and Nong Samrong reservoir project area. However, actually irrigated area are uncertain, as mentioned previously. very few area are irrigated for the dry season crop land. Other lands for the proposed small scale project are cultivated with mostly rainfed paddy only but not with the dry season crops.

Drainage systems are not organized. it is seemed that farmers generally inquire the water keeping during the rainy season and no cultivation in the poor drainage lands.

CHAPTER 3. THE PROJECT

3.1 Improvement of Existing Nong Samrong Reservoir Project

Nong Samrong Reservoir, constructed for the purpose of irrigation and domestic water use to the Udon Thani urban area in 1952, has a catchment area of some 18.0 sq.km and have also been receiving the water from the Right Main Canal of Huai Luang Project. The reservoir, however, seems to use only for domestic water and has a function of water tank for the drainage area at present. The dikes have provided only for about 2.2km against about 6.6km in the circumference of the reservoir, to drain the excess water from the vicinity of the reservoir, which those existing dikes are irregular shaping and the reservoir is silted up.

The proposed project will improve the reservoir by Dredging, rehabilitating the dike and providing the drainage canal to convey the excess water to the downstream area, and reconstruct the intake by making

its sill lower to facilitate the diversion of more water, rehabilitate and improve and existing irrigation canals and structures together with the provision of on-farm facilities. Moreover, the reservoir will be upgraded in its storage capacity by receiving the water from the Huai Luang river. The dike will be heightened up by 1.0 m so that reservoir capacity will be increased from its present capacity of 5.17 MCM to 8.75 MCM.

3.2 Improvement of Huai Luang

The Huai Luang river is narrow and meandered. It spills the water during flooding and inundates the land along the river. According to the hydrological data at station Kh-27, Water levels range between 183 and 184 m MSL all the year round. the current flood may be affected by these water levels. To improve this situation, the Project proposes to train the river by dredging and provide the dike for the section between the confluence of Huai Raeng and the railway bridge, 20 km in the existing river length. The dike will be constructed, considering a design discharge of 510 cu.m/s, corresponding to 50 years flood, for a length of 20 km, with a top width of 6m and 4m for the O&M and farm-to-market road. The main figures of cross-section are listed, below:

Bottom Width;	35.0 m
Side slope;	2.0:1
Design Water depth;	6.4m
Free board;	0.6 m
Top Width of river;	63.0m

3.3 Weir and Water impounding

3.3.1 Weir

The proposed project will also provide the Huai Luang #1 weir at the immediate upstream of the railway bridge, to divert the water to the said reservoirs and store the water in the river course for the purposes of irrigation/domestic water use. To facilitate the operation of dam and timely discharge the flood, rubber dam will be adequate facility. The top

elevation of rubber dam have been designed to get enough water head to divert the water to the proposed natural reservoirs. Major elements of weir are listed, as follows:

Weir Length	51.0 m
Weir Height	1.0 m
Rubber Dam	
Height	2.8 m
Length	24.0 m
Top El.	173.5 m
Quantity	2 sets
Storage	0.38 MCM
Irrigable A.	30.0 ha

2) River Water Impounding

The Project will provide the weir across the river to distribute water to the Bung Sang and Nong Bo Kong natural reservoirs in addition to the Nong Samrong reservoir by constructing the dike around those reservoirs and feeder canal. The abandoned river land, which is brought about by the river training, will be impound the water by providing the crossing dikes with control gate in both the upstream and downstream sides. The river water of about 108 MCM a year mostly in the rainy season is available at Ban Tha Tum gauge station on the Hual Luang at a small distance downstream from the Project Area (refer to Appendix B). In this plan the drainage in the surrounding area shall be carefully studied before the construction. The proposed reservoirs are listed, below:

Proposed Water Impounding Reservoirs

<u>Reservoir</u>	<u>Distance</u>	<u>Storage</u>	<u>Irrigable A.</u>
Nong Samrong	2.3 km	3.58 MCM	470 ha
Bung Sang	2.1 km	5.64 MCM	500 ha
Nong Bo Kong	5.0 km	1.56 MCM	150 ha
Abandoned H. Luang	-	0.40 MCM	40 ha
Total		<u>11.18 MCM</u>	<u>1,160 ha</u>

3.4 Small Scale Irrigation Projects

The Project will also provide the Small Scale Irrigation Projects for the domestic use and the dry season crop irrigation by using the impounded water in the reservoirs and river. The proposed projects are listed below:

Propose Small Scale Projects

<u>Name</u>	<u>Tambon</u>	<u>Province</u>	<u>Irr. A.</u>	<u>Irr.Method</u>
Bung Sang				
Ban Phok	Mu Mon	Udon Thani	100 ha	Pump
Non Nok Hae	Mu Mon	Udon Thani	200 ha	Pump
Ban Yung	Mu Mon	Udon Thani	80 ha	Pump
Dobsang Khwai	Mu Mon	Udon Thani	120 ha	Pump
Nong Bo Kong	Kut Sra	Udon Thani	150 ha	Pump
Ban Na Tham	Mu Mon	Udon Thani	40 ha	Pump
Ban Bo Noi	Mu Mon	Udon Thani	30 ha	Pump
Total			<u>720 ha</u>	

All area will be supplied with pumps, because the natural reservoirs are located in the lower land. Bung Sang area will receive the water in October because there is no adequate drainage method due to lower lying reservoir. For Bung Sang reservoir irrigation area, its pumping irrigation method will be pumped up to the water tank within the village compound to use for domestic water, and the irrigation water will be delivered from the tank to the farm plot by the gravity. on the other hand, Nong Bo Khong area may be applied mainly for irrigation, expecting intensive farming. Ban Na Thum area water will be supplied directly from the river by pump. Ban Bo Noi area will be receive the water from the Nong Bo Noi existing reservoir near the village. The construction of canals and structures are suggested up to the commanded area of some 10 ha (60 rai).

CHAPTER 4. PROJECT COSTS AND MANAGEMENT

4.1 Estimated Costs

The project costs have been estimated to be about 744.3 Million Bahts for the contract based works at the price of 1995 level, excluding the construction of on-farm facilities, which will be undertaken by the force account or farmer themselves, including the Costs for Engineering, Land Acquisition, Administration, Project Contingencies and Price Escalation. The estimated costs are only for the budgetary purposes, as shown in Table O-4.1.

4.2 Construction Schedule and Management

The Project will be implemented by the RID within the period of 5 years including one year for engineering service, such as survey, design, etc. (refer to Table O-4.2).

The Project Manager will be appointed under the director of the Regional office 4, who will be responsible for the project implementation, and supported by the adequate number of technical and administrative staff. In particular, the staff, who will deal with the organization of Water Users Cooperatives and assist in the construction of on-farm facilities, are essential for the smooth implementation of the Project.

The land acquisition shall be finished before the start of the respective works. For the construction of the on-farm facilities, the Water Users Cooperatives shall be organized in the initial stage of the Project implementation for each commanded area of laterals or even further smaller areas.

4.3 Operation and Maintenance

The major project facilities will be operated and maintained by the RID. While, on-farm facilities and small scale projects will be done

by the Water Users Cooperatives with the assistance of Udon Thani Irrigation Office.

For the efficient use of the water, the proper water management will be required. In the sense of the above, the close coordination between the RID and water users will be very important, and the efficient organization of the RID for the water management is expected.

Table 0-4.1 Costs for Huai Luang Improvement Project

Item	unit	Qty	Amount (M. B)	In F. C. (M. B)	Remarks
Improv. Rehab.					
Nong Samrong Res.	1	L. S.	13.4	7.9	See Bd-1
On-farm	470	ha	1.9	1.2	See Bd-2
Sub-total			15.3	9.1	
R. Train. & W. Impound					
River Training	20	km	113.2	71.9	See Bd-3
Weir	1	WEIR	82.2	48.6	See Bd-4
Reservoir					
N. Samrong	1	L. S.	82.2	48.6	See Bd-5a
Bung Sang	1	L. S.	60.2	46.6	See Bd-5b
N. Bo Kong	1	L. S.	70.0	47.5	See Bd-5c
H. Luang	1	L. S.	28.6	19.6	See Bd-5d
Sub-total			436.4	282.8	
SSIP	720	ha	20.9	10.5	See Bd-6
Total for Field Costs			472.6	302.4	
Engineering Costs			14.2	5.7	
Land Acquisition	156.9	ha	41.7	0.0	
Administration Costs			56.3	0.0	
Contingencies			58.5	30.8	
Price Escalation (7%)			101.0	36.0	F. C. (3%)
Total Project Cost			744.3	374.9	

Breakdown-1 Nong Samrong System Improvement

Item	Spec.	Unit	Qty	Unit C. (Bahts)	Amount (B' 000)	In F. C. (B' 000)
Dam Boddy	Strip	cu. m	15,120	14	212	170
	Embank	cu. m	15,120	135	2,041	1,633
Intake	Earth W.	cu. m	1,091	15	19	27
	Demolish	cu. m	7	1,880	13	6
Spillway	Concrete	cu. m	14	5,800	81	34
	Sill'ng	L. S.	1		246	108
Dredging	Drain C.	m	200	3,049	610	158
		cu. m	179,000	23	4,117	3294
Canal	Repair	L. S.	1		616	185
Structures	Siphon	L. S.	1		15	6
	Check	L. S.	1		60	34
	T/O	L. S.	1		7	4
	Other	L. S.	1		140	9
Drainage	Canal	m	500	5,351	2,676	766
	Bridge	L. S.	1		800	400
Misc. Works		L. S.	1		1,717	1,066
Total					13,400	7,900
Land for Acquis'n		ha	1.6	310,000	496	0

Breakdown-2 On-farm Development

Item	Spec.	Unit	Qty	Unit C. (Bahts)	Amount (B' 000)	In F. C. (B' 000)
F. Ditches	90m/ha	km	42.3	20	846	519
F. Drans	20m/ha	km	9.4	4	38	33
F. Roads	90m/ha	km	42.3	17	719	440
	(20%)				297	208
Total					1,900	1,200

Breakdwon-3 River Training

Item	Spec.	Unit	Quantity	Unit C. (Bahts)	Amount (B' 000)	In F. C. (B' 000)
Dike	Strip	cu. m	380	14,000	5,320	4,300
	Fill	cu. m	1,440	45,000	64,800	35,600
Dredging	Cut	cu. m	1,230	23,000	28,290	22,600
Others	(15%)	L. S.	1		14,790	9,400
Total					113,200	71,900
Land for Acquis'n		ha	138.0	250,000	34,500	0

Breakdwon-4 Weir

Item	Spec.	Unit	Quantity	Unit C. (Bahts)	Amount (B' 000)	In F. C. (B' 000)
Earth W.	Cut	cu. m	8,119	23	187	150
	B. Fill	cu. m	1,957	39	76	42
Concrete	Dam	cu. m	3,740	5,257	19,661	8,825
	Epron	cu. m	3,915	5,257	20,581	9,238
	Cutoff	cu. m	232	5,268	1,222	548
	Wall	cu. m	353	5,436	1,919	839
	Misc. w.	L. s.	1		4,338	1,945
Gate	2.8x24m	set	2	10752000	21,504	20,429
Masonry	d=0.4	cu. m	462	1,100	508	51
	Bed'g	cu. m	231	672	155	31
Riprap		cu. m	1,416	960	1,359	136
Misc. Works	(15%)	L. s.	1		10,690	6,366
Total Field Costs					82,200	48,600

Breakdwon-5a Nong Samrong Reservoir

Item	Spec.	Unit	Quantity	Unit C. (Bahts)	Amount (B' 000)	In F. C. (B' 000)
Embankment	Strip	cu. m	27,520	14	385	308
	Fill	cu. m	347,359	135	46,893	37,514
Intake	Cut	cu. m	1,178	23	27	22
	B. Fill	cu. m	638	39	25	14
	Concre.	cu. m	47	5,716	269	113
	Gate	set	1	1,200	1	1
Feeder C.	Cut	cu. m	44,220	23	1,017	814
	B. Fill	cu. m	36,366	39	1,418	780
	Pipe	m	2,200	1,060	2,332	968
Outlet	Cut	cu. m	12	23	0.3	0.2
	B. Fill	cu. m	6	39	0.2	0.2
	Concre.	cu. m	4	5,716	22.9	18.3
	Gate	set	1	900	0.9	0.7
Misc. Works					7,809	6,047
Total Field Costs					60,200	46,600
Land Acqui.		Ha	15.7	310,000	4,867	

Breakdwn-5b Bung Sang Reservoir

Item	Spec.	Unit	Quantity	Unit C. (Bahts)	Amount (B'000)	In F. C. (B'000)
Dredging		cu. m	940,000	23	21,620	17296
Embankment	Strip	cu. m	16,100	14	225	180
	Fill	cu. m	135,625	135	18,309	14647
Intake	Cut	cu. m	646	23	15	12
	B. Fill	cu. m	483	39	19	10
	Concre.	cu. m	81	5,716	463	195
	Gate	set	1	2160	2	2
Feeder C.	Cut	cu. m	41,580	23	956	765
	B. Fill	cu. m	34,860	39	1,360	748
	Box-C.	cu. m	3,087	5,786	17,861	7,448
Outlet	Concre.	cu. m	5	5,716	29	12
	Gate	set	1	1320	1	1
Misc. Works					9,140	6,184
Total Field Costs					70,000	47,500
Land Acqui.		Ha	1.6	310,000	496	

Breakdwn-5c Nong Bo Khong

Item	Spec.	Unit	Quantity	Unit C. (Bahts)	Amount (B'000)	In F. C. (B'000)
Dredging		cu. m	325,000	23	7,475	5980
Embankment	Strip	cu. m	8,320	14	116	93
	Fill	cu. m	81,600	135	11,016	8813
Intake	Cut	cu. m	34	23	1	1
	Fill	cu. m	27	39	1	1
	Concre.	cu. m	2	5,716	11	5
	Gate	set	1	290	0.3	0.2
Feeder C.	Cut	cu. m	20,160	23	464	371
	B. Fill	cu. m	18,573	39	724	398
	PC-Pipe	m	4,500	960	4,320	1,080
Outlet	Canal	m	500	1,415	708	276
	Concre.	cu. m	2	5,716	11	5
	Gate	set	1	260	0.3	0.2
Misc. Works					3,752	2,577
Total Field Costs					28,600	19,600
Land for Acquis'n		ha	4.2	310,000	1,302	

Breakdwn-5d Huai Luang Closed

Item	Spec.	Unit	Quantity	Unit C. (Bahts)	Amount (B'000)	In F. C. (B'000)
Banking	Strip	cu. m	3,770	14	53	42
	Cut	cu. m	2,853	23	66	53
	Fill	cu. m	9,274	39	362	199
Sloices	Conc.	cu. m	34	5,716	194	82
	Riprap	cu. m	1,279	960	1,228	123
	Gates	set	2	1,200	2	2
Misc. Works (15%)					295	99
Total Field Costs					2,200	600

Breakdown-6 Small Scale Projects

Item	Spec.	Unit	Quantity	Unit C. (Bahts)	Amount (B' 000)	In F. C. (B' 000)
Bung Sang						
B. Phok		ha	100	44,448	4,400	2100
Non Nok Hae		ha	200	29,273	5,900	2900
B. Yung		ha	80	23,000	1,800	1000
DobsangKhwai		ha	120	37,758	4,500	2200
N. Bo Kong		ha	150	22,042	3,300	1700
H. Luang		ha	40	3,508	100	100
B. Bo Noi		ha	30	29,248	900	500
Total		ha	720		20,900	10,500

Table 0-4.2 Construction Schedule

Item	1st Yr.	2nd Yr.	3rd Yr.	4th Yr.	5th Yr.
Impr. N. Samrong					
On-farm Facilities					
River Training					
Weir Construction					
N. Samrong Reservoir					
Bung Sang Reservoir					
N. Bo Kong Reservoir					
H. Luang River Land					
Small Scale Project					
Land Acquisition					

Table 0-4.3 Disbursement Schedule

Item	1st Yr.	2nd Yr.	3rd Yr.	4th Yr.	5th Yr.	Total
Impr. N. Samrong	0	5.4	8.0	0	0	13.4
On-farm Facilities	0	0	0.8	1.1	0	1.9
River Training	0	22.6	34.0	34.0	22.6	113.2
Weir Construction	0	0	49.3	82.9	0	82.2
N. Samrong Reservoir	0	0	32.9	49.3	0	82.2
Bung Sang Reservoir	0	0	0	24.1	36.1	60.2
N. Bo Kong Reservoir	0	0	0	28.0	42.0	70.0
H. Luang River Land	0	0	0	0	28.6	28.6
Small Scale Project	0	0	0	10.5	10.4	20.9
Sub-total	0.0	28.0	125.0	179.9	139.7	472.6
Engineering Costs	7.1	2.8	1.4	1.4	1.5	14.2
Land Acquisition	16.7	16.7	8.3	0	0	41.7
Administration Cost	11.3	11.3	11.3	11.3	11.1	56.3
Contingencies	3.5	5.9	14.6	19.3	15.2	58.5
Price Escalation	1.2	5.6	20.6	36.7	36.9	101.0
Total Project Costs	39.8	70.3	181.2	248.6	204.4	744.3

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