

APPENDIX A-8-5

Capacity Calculation of the Water Treatment Plants

Capacity Calculation for Treatment Plant
Treatment Plant : T 3 (Khlung Khata)

Item	Total System (for 2011)	
Planned Flow	Q=	13,900 cu m/d
(Daily Max)	=	579 cu m/hr
	=	9.7 cu m/min
	=	0.161 cu m/sec
No. of Treatment Line	2 Lines	
	6,950 cu m/d x 2 lines	
(1)		
Receiving Well		
Criteria	T=	1.5 min
	d=	2.5 m
No.	1 unit	
Dimension	Circular	
	Dia	3.0 m
	v=	18 cu m
	t=	1.8 min
(2)		
Mixing Tank		
Criteria	T=	1.0 min
Dimension	Square x 4 units	
	L m x W m x D m x units	
	1.2 1.5 1.5 4	
	v =	11 cu m
	t =	1.1 min
Mixer	Mechanical Flush Mixer	

Capacity Calculation for Treatment Plant
 Treatment Plant : T-3 (Khlong Khata)

Item	Total System (for 2011)
(3) Coagulant Mixing	
Type	Hydraulic Mixing
Coagulant	Solid Aluminum Sulphate (Al ₂ (SO ₄) ₃) containing 15 % Al ₂ O ₃
Dosage Rate	10-25 mg-solid alum/l Average 10 mg/l
Coagulant Solution	5 % solution
Dosage Amount	139 kg-Alum/day
Coagulant Solution (5 % solution)	
	= 3 cu m/day
No. of Mixer	2 units
Type	Batch Type Mixing
Capacity	1.4 cu m/unit
Dimension	Square x 2 units (1 stand by): L m x W m x D m x units 1.0 1.5 2.0 2
	v = 3.0 cu m/unit
	Total V = 3.0 cu m

Capacity Calculation for Treatment Plant
 Treatment Plant : T 3 (Khlong Khata)

Item	Total System (for 2011)
(4)	
Flocculator	
Type	Hydraulic Flocculation
No.	N = 2 lines x 2 units
	= 4 units
Unit Flow	q = 2.41 cu m/min/unit
Criteria	T = 30 min
Dimension	W m x L m x D m x n lines
	1.5 20.0 2.5 2
	v = 75 cu m/unit
	t = 31.1 min

Capacity Calculation for Treatment Plant
Treatment Plant : T 3 (Khleng Khata)

Item	Total System (for 2011)
(5)	
Sedimentation Basin	
Type	Rectanglar, Horizontal Flow
No.	N = 2 line x 2 basins = 4 basins
Unit Flow	q = 144.8 cu m/hr/basin
Criteria	Retention Time T = 4 hours
Dimension	W m x L m x D m x N 5 30 4.0 4
	v = 600 cu m/basin
	t = 4.1 hours
Flow velocity	v = 12.1 cm/min
Surface Load	a = 23.2 m ³ /m ² /day
Sludge Removal	Hydraulic Removal
Sludge Amount	
Solid Amount (ton-DS)	$So = Q(K(T1-T2)+0.16xB) \times 10^{-6}$ <p>where So:Sludge dry weight(ton) Q :Treated water amount(m³/d) K :Coefficient converting turbi to SS (0.8-1.5 ->>1.2) T1 :Turbidity in raw water (ave T2 :Turbidity after Sedimentati B :Alum dosage rate (ave.= 10 m</p>
	So = 0.14 ton-DS/day
	Water Contents of Drained Sludge
	w = 99.5 %
	Sludge Volume
	v = 28 cu m/d

Capacity Calculation for Treatment Plant
Treatment Plant : T 3 (Khleng Khata)

Item	Total System (for 2011)
(6)	
Rapid Sand Filter	
Type	Down Flow, Single Media
No.	N = 2 lines x 4 units = 8 units
Unit Flow	q = 1,738 cu m/day/unit
Criteria	Surface Load 120 - 150 m ³ /m ² /day
Dimension	W m x L m x N units 3.0 4.5 8 a = 14 sq m/unit
Surface Load	La = 128.7 m ³ /m ² /day
Filter Washing Frequency	Once every other day for each filter
Rate	Surface Washing 0.2 m ³ /m ² /min x 5 min Backwashing 0.6 m ³ /m ² /min x 10 min
Water Amount required	Surface Washing v = 14 sq m/unit x 8 units x 0.2 m ³ /m ² /min x 5 min x (1/2) = 54 cu m/day Backwashing v = 14 sq m/unit x 8 units x 0.6 m ³ /m ² /min x 10 min x (1/2) = 324 cu m/day
	Total q= 378 cu m/day

Capacity Calculation for Treatment Plant
 Treatment Plant : T 3 (Khlung Khata)

Item	Total System (for 2011)
Solid Amount in Wastewater	
Solid Amount (ton-DS)	$S_o = Q * K * (T_1 - T_2) * 10^{-6}$ where S_o : Sludge dry weight (ton) Q : Treated water amount (m ³ /d) K : Coefficient converting turbidity to SS (0.8-1.5 ->>1.2) T_1 : Turbidity before filter (ave) T_2 : Turbidity after filter (ave)
	$S_o = 0.12$ ton-DS/day
SS Contents	$s = 309$ mg/l

(7)

Clear Water Reservoir

No.	$N = 1$ units
Criteria	Retention Time
	$T = 8$ hours
Required Volume	$V = 4,633$ cu m
Dimension	L m x W m x D m x N units
	32 15 5 2
	Total Volume
	$v = 4,800$ cu m
Retention Time	$t = 8.3$ hours

Capacity Calculation for Treatment Plant
 Treatment Plant : T 3 (Khlong Khata)

Item	Total System (for 2011)
: (8)	
: Chlorination Equipment	
: Injection Point	: at the Inlet of Clear Water Reservoir
: Dosage Rate	: 2.0 ppm
: Type	: Liquid Chlorine (50 kg cylinder)
: Amount	: 28 kg- Cl gas/day
: Injector	: Vacuum Type Injector
	: No. of unit 2 units
	: (excl. 1 units stand-by)
	: Rate 0.58 kg/h/unit
	: Capacity 10 kg/h/unit
: Storage	: 1 month
: Storage Amount	: 28 kg /day x 30 day = 834 kg
	: = 17 cylinders (50 kg)
: (9) Clear Water Pump	
: No.	: N = 3 units + 1 stand-by
: Flow per unit	: q = 4.5 cu m/min/unit
: Diameter	: D = 200 mm
: Head	: H = 40 m
: Motor output	: P = 50 KW
: Total Capacity	: Q = 19,460 cu m/day

Capacity Calculation for Treatment Plant
Treatment Plant : T 4 (Bang Nieo Dam)

Item	Total System (for 2011)
Planned Flow (Daily Max)	Q= 21,000 cu m/d
	= 875 cu m/hr
	= 14.6 cu m/min
	= 0.243 cu m/sec
No. of Treatment Line	2 Lines
	10,500 cu m/d x 2 lines
(1)	
Receiving Well	
Criteria	T= 1.5 min
	d= 3.0 m
No.	1 unit
Dimension	Circular
	Dia 3.0 m
	v= 21 cu m
	t= 1.5 min
(2)	
Mixing Tank	
Criteria	T= 1.0 min
Dimension	Square x 4 units
	L m x W m x D m x units
	1.5 2.0 1.5 4
	v = 18 cu m
	t = 1.2 min
Mixer	Mechanical Flush Mixer

Capacity Calculation for Treatment Plant
 Treatment Plant : T 4 (Bang Nieo Dam)

Item	Total System (for 2011)
(3) Coagulant Mixing	
Type	Hydraulic Mixing
Coagulant	Solid Aluminum Sulphate (Al ₂ (SO ₄) ₃) containing 15 % Al ₂ O ₃
	Dosage Rate : 10-25 mg-solid alum/l Average 10 mg/l
	Coagulant Solution : 5 % solution
	Dosage Amount : 210 kg-Alum/day
	Coagulant Solution (5 % solution) = 4 cu m/day
No. of Mixer	2 units
Type	Batch Type Mixing
Capacity	2.1 cu m/unit
Dimension	Square x 3 units (1 stand by): L m x W m x D m x units 1.0 1.5 2.0 3
	v = 3.0 cu m/unit
	Total V = 6.0 cu m

Capacity Calculation for Treatment Plant
 Treatment Plant : T 4 (Bang Nieo Dam)

Item	Total System (for 2011)
(4)	
Flocculator	
Type	Hydraulic Flocculation
No.	N = 2 lines x 2 units = 4 units
Unit Flow	q = 3.65 cu m/min/unit
Criteria	T = 30 min
Dimension	W m x L m x D m x n lines 2.0 24.0 2.5 4
	v = 120 cu m/unit
	t = 32.9 min

Capacity Calculation for Treatment Plant
 Treatment Plant : T 4 (Bang Nieo Dam)

Item	Total System (for 2011)
(5)	
Sedimentation Basin	
Type	Rectanglar, Horizontal Flow
No.	N = 2 line x 2 basins = 4 basins
Unit Flow	q = 218.8 cu m/hr/basin
Criteria	Retention Time T = 4 hours
Dimension	W m x L m x D m x N 6 38 4.0 4
	v = 912 cu m/basin
	t = 4.2 hours
Flow velocity	v = 15.2 cm/min
Surface Load	a = 23.0 m3/m2/day
Sludge Removal	Hydraulic Removal
Sludge Amount	
Solid Amount (ton-DS)	$So = Q(K(T1-T2)+0.16xB) \times 10^{-6}$ where So:Sludge dry weight(ton) Q :Treated water amount(m3/d) K :Coefficient converting turbi to SS (0.8-1.5 ->1.2) T1 :Turbidity in raw water (ave T2 :Turbidity after Sedimentati B :Alum dosage rate (ave.= 5 mg
	So = 0.19 ton-DS/day
	Water Contents of Drained Sludge
	w = 99.5 %
	Sludge Volume
	v = 39 cu m/d

Capacity Calculation for Treatment Plant

Treatment Plant : T 4 (Bang Nieo Dam)

Item	Total System (for 2011)
(6)	
Rapid Sand Filter	
Type	Down Flow, Single Media
No.	N = 2 lines x 4 units = 8 units
Unit Flow	q = 2,625 cu m/day/unit
Criteria	Surface Load 120 - 150 m ³ /m ² /day
Dimension	W m x L m x N units 4.0 5.0 8 a = 20 sq m/unit
Surface Load	La = 131.3 m ³ /m ² /day
Filter Washing Frequency	Once every other day for each filter
Rate	Surface Washing 0.2 m ³ /m ² /min x 5 min Backwashing 0.6 m ³ /m ² /min x 10 min
Water Amount required	Surface Washing v = 20 sq m/unit x 8 units x 0.2 m ³ /m ² /min x 5 min x (1/2) = 80 cu m/day Backwashing v = 20 sq m/unit x 8 units x 0.6 m ³ /m ² /min x 10 min x (1/2) = 480 cu m/day
	Total q= 560 cu m/day

Capacity Calculation for Treatment Plant
 Treatment Plant : T 4 (Bang Nieo Dam)

Item	Total System (for 2011)
Solid Amount in Wastewater	
Solid Amount (ton-DS)	$So = Q * K * (T1 - T2) * 10^{-6}$ where So: Sludge dry weight(ton) Q : Treated water amount(m3/d) K : Coefficient converting turbi to SS (0.8-1.5 ->>1.2) T1 : Turbidity before filter(ave T2 : Turbidity after filter(ave
	So = 0.18 ton-DS/day
SS Contents	s = 315 mg/l

(7) Clear Water Reservoir	
No.	N = 1 units
Criteria	Retention Time
	T = 8 hours
Required Volume	V = 7,000 cu m
Dimension	L m x W m x D m x N units
	35 20 5 2
	Total Volume
	v = 7,000 cu m
Retention Time	t = 8.0 hours

Capacity Calculation for Treatment Plant
 Treatment Plant : T 4 (Bang Niew Dam)

Item	Total System (for 2011)
:(8)	
:Chlorination Equipment	
: Injection Point	: at the Inlet of Clear Water Reservoir
: Dosage Rate	: 2.0 ppm
: Type	: Liquid Chlorine (50 kg cylinder)
: Amount	: 42 kg- Cl gas/day
: Injector	: Vacuum Type Injector
	: No. of unit 2 units
	: (excl. 1 units stand-by)
	: Rate 0.88 kg/h/unit
	: Capacity 10 kg/h/unit
: Storage	: 1 month
: Storage Amount	: 42 kg /day x 30 day = 1,260 kg
	: = 26 cylinders (50 kg)
:(9) Clear Water Pump	
: No.	: N = 3 units + 1 stand-by
: Flow per unit	: q = 6.8 cu m/min/unit
: Diameter	: D = 200 mm
: Head	: H = 40 m
: Motor output	: P = 80 KW
: Total Capacity	: Q = 29,400 cu m/day

Capacity Calculation for Treatment Plant
Treatment Plant : T 5 (Zone 7)

Item	Total System (for 2011)	
Planned Flow (Daily Max)	Q=	17,800 cu m/d
	=	742 cu m/hr
	=	12.4 cu m/min
	=	0.206 cu m/sec
No. of Treatment Line		2 Lines
		8,900 cu m/d x 2 lines
(1)		
Receiving Well		
Criteria	T=	1.5 min
	d=	3.0 m
No.		1 unit
Dimension	Circular	
	Dia	3.0 m
	v=	21 cu m
	t=	1.7 min
(2)		
Mixing Tank		
Criteria	T=	1.0 min
Dimension	Square x 2 units	
	L m x	W m x D m x units
	1.5	2.0 2.0 2
	v =	12 cu m
	t =	1.0 min
Mixer	Mechanical Flush Mixer	

Capacity Calculation for Treatment Plant
 Treatment Plant : T 5 (Zone 7)

Item	Total System (for 2011)
:(3) Coagulant Mixing	
Type	Hydraulic Mixing
Coagulant	Solid Aluminum Sulphate (Al ₂ (SO ₄) ₃) containing 15 % Al ₂ O ₃
	Dosage Rate : 5-10 mg-solid alum/l Average 5 mg/l
	Coagulant Solution : 5 % solution
	Dosage Amount : 89 kg-Alum/day
	Coagulant Solution (5 % solution) = 2 cu m/day
No. of Mixer	2 units
Type	Batch Type Mixing
Capacity	0.9 cu m/unit
Dimension	Square x 2 units (1 stand by): L m x W m x D m x units 1.0 1.5 2.0 2 v = 3.0 cu m/unit Total V = 3.0 cu m

Capacity Calculation for Treatment Plant
 Treatment Plant : T 5 (Zone 7)

Item	Total System (for 2011)
(4) Flocculator	
Type	Hydraulic Flocculation
No.	N = 2 lines x 2 units = 4 units
Unit Flow	q = 3.09 cu m/min/unit
Criteria	T = 30 min
Dimension	W m x L m x D m x n lines 2.0 20.0 2.5 4
	v = 100 cu m/unit
	t = 32.4 min

Capacity Calculation for Treatment Plant
 Treatment Plant : T 5 (Zone 7)

Item	Total System (for 2011)
(5)	
Sedimentation Basin	
Type	Rectanglar, Horizontal Flow
No.	N = 2 line x 2 basins = 4 basins
Unit Flow	q = 185.4 cu m/hr/basin
Criteria	Retention Time T = 4 hours
Dimension	W m x L m x D m x N 6 32 4.0 4
	v = 768 cu m/basin
	t = 4.1 hours
Flow velocity	v = 12.9 cm/min
Surface Load	a = 23.2 m3/m2/day
Sludge Removal	Hydraulic Removal
Sludge Amount	
Solid Amount (ton-DS)	$So = Q(K(T1-T2)+0.16xB) \times 10^{-6}$ where So: Sludge dry weight (ton) Q : Treated water amount (m3/d) K : Coefficient converting turbidity to SS (0.8-1.5 -> 1.2) T1 : Turbidity in raw water (ave) T2 : Turbidity after Sedimentati B : Alum dosage rate (ave. = 5 mg)
	So = 0.16 ton-DS/day
	Water Contents of Drained Sludge
	w = 99.5 %
	Sludge Volume
	v = 33 cu m/d

Capacity Calculation for Treatment Plant
 Treatment Plant : T 5 (Zone 7)

Item	Total System (for 2011)
(6)	
Rapid Sand Filter	
Type	Down Flow, Single Media
No.	N = 2 lines x 4 units = 8 units
Unit Flow	q = 2,225 cu m/day/unit
Criteria	Surface Load 120 - 150 m ³ /m ² /day
Dimension	W m x L m x N units 3.5 5.0 8 a = 17.5 sq m/unit
Surface Load	La = 127.1 m ³ /m ² /day
Filter Washing Frequency	Once every other day for each filter
Rate	Surface Washing 0.2 m ³ /m ² /min x 5 min Backwashing 0.6 m ³ /m ² /min x 10 min
Water Amount required	Surface Washing v = 18 sq m/unit x 8 units x 0.2 m ³ /m ² /min x 5 min x (1/2) = 70 cu m/day Backwashing v = 18 sq m/unit x 8 units x 0.6 m ³ /m ² /min x 10 min x (1/2) = 420 cu m/day
	Total q= 490 cu m/day

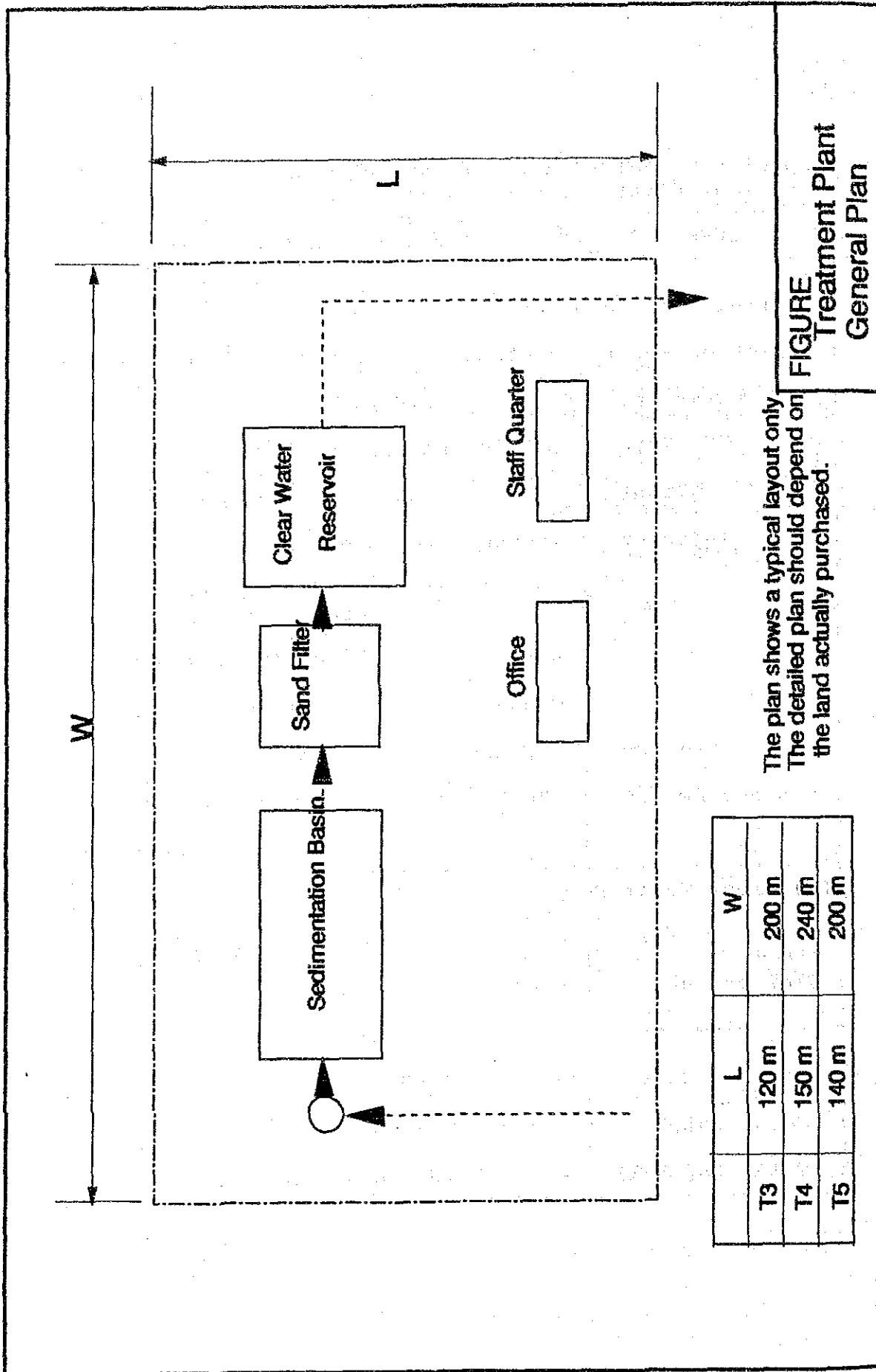
Capacity Calculation for Treatment Plant
 Treatment Plant : T 5 (Zone 7)

Item	Total System (for 2011)
Solid Amount in Wastewater	
Solid Amount (ton-DS)	$S_o = Q * K * (T_1 - T_2) * 10^{-6}$ where S_o : Sludge dry weight (ton) Q : Treated water amount (m ³ /d) K : Coefficient converting turbidity to SS (0.8-1.5 -> 1.2) T_1 : Turbidity before filter (ave) T_2 : Turbidity after filter (ave)
	$S_o = 0.15$ ton-DS/day
SS Contents	$s = 305$ mg/l

(7)	
Clear Water Reservoir	
No.	$N = 1$ units
Criteria	Retention Time
	$T = 8$ hours
Required Volume	$V = 5,933$ cu m
Dimension	$L \text{ m} \times W \text{ m} \times D \text{ m} \times N \text{ units}$
	$30 \quad 20 \quad 5 \quad 2$
	Total Volume
	$v = 6,000$ cu m
Retention Time	$t = 8.1$ hours

Capacity Calculation for Treatment Plant
Treatment Plant : T 5 (Zone 7)

Item	Total System (for 2011)
:(8)	
:Chlorination Equipment	
: Injection Point	: at the Inlet of Clear Water Reservoir
: Dosage Rate	: 2.0 ppm
: Type	: Liquid Chlorine (50 kg cylinder)
: Amount	: 36 kg- Cl gas/day
: Injector	: Vacuum Type Injector
	: No. of unit 2 units
	: (excl. 1 units stand-by)
	: Rate 0.74 kg/h/unit
	: Capacity 10 kg/h/unit
: Storage	: 1 month
: Storage Amount	: 36 kg /day x 30 day = 1,068 kg
	: = 22 cylinders (50 kg)
:(9) Clear Water Pump	
: No.	: N = 3 units + 1 stand-by
: Flow per unit	: q = 5.8 cu m/min/unit
: Diameter	: D = 200 mm
: Head	: H = 40 m
: Motor output	: P = 70 KW
: Total Capacity	: Q = 24,920 cu m/day



The plan shows a typical layout only
 The detailed plan should depend on
 the land actually purchased.

FIGURE
Treatment Plant
General Plan

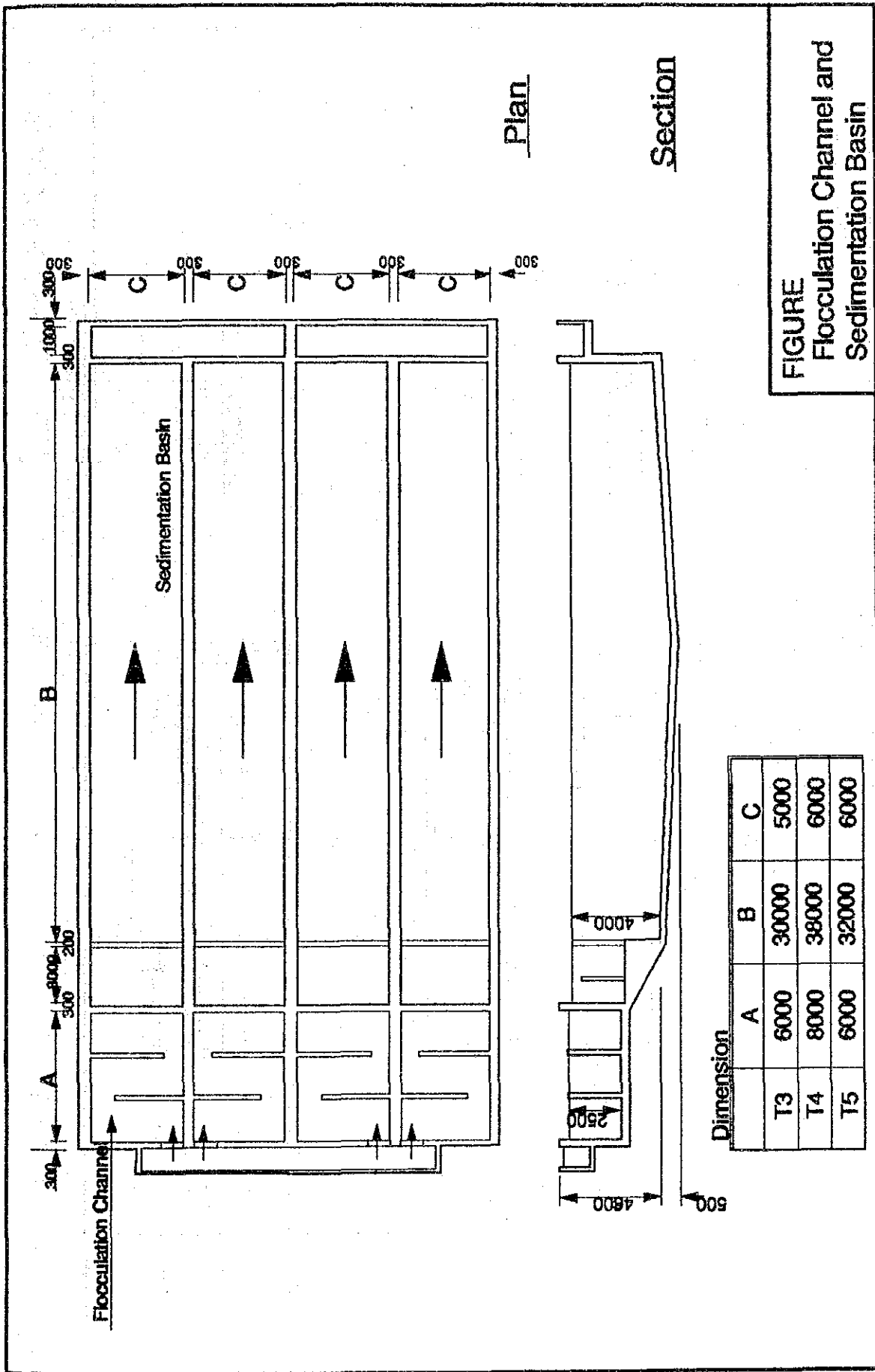
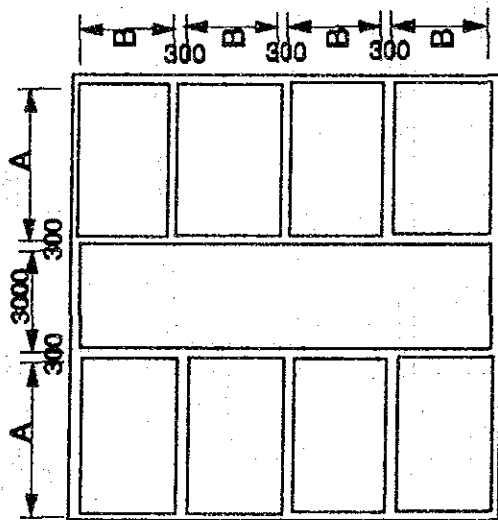


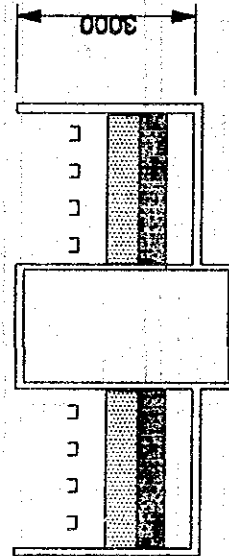
FIGURE
Flocculation Channel and
Sedimentation Basin



Dimension

	A	B
T3	4500	3000
T4	5000	4000
T5	5000	3500

Plan



Section

FIGURE
Rapid Sand Filter

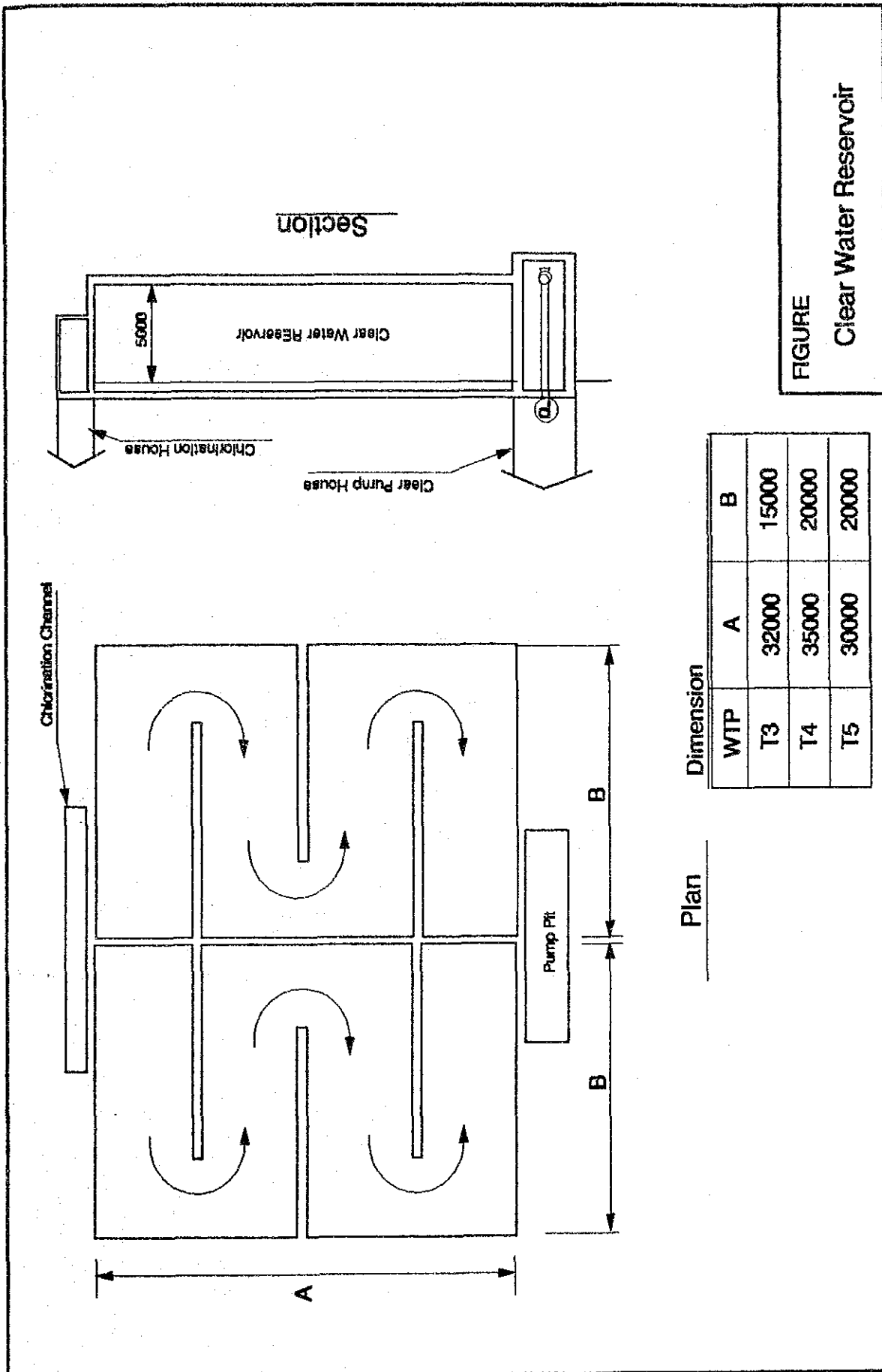


FIGURE
Clear Water Reservoir

WTP	Dimension	
	A	B
T3	32000	15000
T4	35000	20000
T5	30000	20000

Plan

APPENDIX A-8-6

Distribution Network Analysis

T I T L E : Phuket Zone 6 (WTP Bangwat)
 NO. OF PIPES : 23
 NO. OF NODES : 23
 PEAK FACTOR : 1.755
 MAX HEADLOSS/Km : 10
 MAX UNBAL(LPS) : 0

PIPE NO.	FROM Node	TO Node	LENGTH (M)	DIA (MM)	HWC	FLOW (LPS)	VELOCITY (MPS)	HEADLOSS (M/KM)	(M)
1	100	33	1000.00	400	110	18.14	0.14LO	0.09	0.09
2	33	34	1000.00	300	110	4.88	0.07LO	0.03	0.03
3	34	35	720.00	300	110	4.06	0.06LO	0.02	0.02
4	35	36	280.00	150	100	3.23	0.18LO	0.54	0.15
5	36	37	600.00	150	100	2.41	0.14LO	0.31	0.19
6	37	38	360.00	150	100	1.58	0.09LO	0.14	0.05
7	38	39	370.00	150	100	0.76	0.04LO	0.04	0.01
8	40	39	260.00	150	100	0.06	0.00LO	0.00	0.00
9	41	40	165.00	150	100	0.89	0.05LO	0.05	0.01
10	42	41	280.00	300	110	5.01	0.07LO	0.03	0.01
11	43	42	240.00	300	110	5.84	0.08LO	0.05	0.01
12	44	43	150.00	300	110	6.66	0.09LO	0.06	0.01
13	45	44	920.00	300	110	7.48	0.11LO	0.07	0.07
14	46	45	460.00	300	110	8.31	0.12LO	0.09	0.04
15	47	46	760.00	300	110	9.96	0.14LO	0.12	0.09
16	48	47	680.00	300	110	11.61	0.16LO	0.16	0.11
17	33	48	550.00	300	110	12.43	0.18LO	0.19	0.10
18	41	49	600.00	150	100	3.30	0.19LO	0.56	0.34
19	49	50	930.00	150	100	2.47	0.14LO	0.33	0.31
20	50	51	450.00	150	100	1.65	0.09LO	0.16	0.07
21	51	52	730.00	150	100	0.82	0.05LO	0.04	0.03
22	46	53	1200.00	150	110	0.82	0.05LO	0.04	0.04
23	47	54	1200.00	150	110	0.82	0.05LO	0.04	0.04

NODE NO.	FLOW (LPS)	ELEVATION (M)	H G L (M)	PRESSURE (M)
100 R	18.139	43.00	43.00	0.00
33	-0.824	20.10	42.91	22.81
34	-0.824	23.00	42.87	19.87
35	-0.824	29.20	42.86	13.66
36	-0.824	25.30	42.71	17.41
37	-0.824	29.80	42.52	12.72
38	-0.824	30.20	42.47	12.27
39	-0.824	29.30	42.45	13.15
40	-0.824	28.60	42.45	13.85
41	-0.824	28.30	42.46	14.16
42	-0.824	27.70	42.47	14.77
43	-0.824	27.30	42.48	15.18
44	-0.824	26.50	42.49	15.99

NODE NO.	FLOW (LPS)	ELEVATION (M)	H G L (M)	PRESSURE (M)
45	-0.824	21.70	42.56	20.86
46	-0.824	15.50	42.60	27.10
47	-0.824	18.40	42.69	24.29
48	-0.824	20.50	42.80	22.30
49	-0.824	27.10	42.12	15.02
50	-0.824	21.70	41.82	20.12
51	-0.824	17.50	41.75	24.25
52	-0.824	18.40	41.72	23.32
53	-0.824	10.00	42.55	32.55
54	-0.824	17.00	42.65	25.65

T I T L E : Phuket Zone 10 (WTP Bangwat)
 NO. OF PIPES : 32
 NO. OF NODES : 28
 PEAK FACTOR : 1.755
 MAX HEADLOSS/Km : 10
 MAX UNBAL(LPS) : .006

PIPE NO.	FROM Node	TO Node	LENGTH (M)	DIA (MM)	HWC	FLOW (LPS)	VELOCITY (MPS)	HEADLOSS (M/KM)	(M)
1	200	35	50.00	400	110	191.91	1.53	7.28	0.36
2	35	9	100.00	400	110	184.80	1.47	6.79	0.68
3	9	10	1090.00	300	100	50.50	0.71	2.98	3.25
4	10	11	360.00	250	100	43.39	0.88	5.47	1.97
5	11	12	680.00	200	100	28.43	0.90	7.42	5.05
6	12	13	210.00	200	100	21.32	0.68	4.36	0.92
7	13	14	270.00	150	100	7.11	0.40	2.32	0.63
8	13	36	400.00	150	100	7.11	0.40	2.32	0.93
9	9	15	20.00	300	100	127.20	1.80	16.47HI	0.33
10	15	16	1075.00	300	100	65.32	0.92	4.80	5.16
11	16	17	370.00	300	100	25.67	0.36	0.85	0.32
12	11	17	210.00	150	100	7.85	0.44	2.79	0.59
13	17	18	650.00	300	100	26.42	0.37	0.90	0.58
14	18	19	290.00	200	100	19.31	0.61	3.63	1.05
15	19	20	295.00	150	100	12.20	0.69	6.30	1.86
16	20	21	10.00	150	100	12.70	0.72	6.79	0.07
17	26	20	300.00	150	110	7.61	0.43	2.20	0.66
18	27	21	300.00	150	110	6.45	0.36	1.62	0.49
19	21	22	700.00	150	100	12.04	0.68	6.15	4.30
20	22	23	335.00	150	100	4.93	0.28LO	1.18	0.40
21	23	24	400.00	150	100	7.11	0.40	2.32	0.93
22	15	28	780.00	300	100	54.77	0.77	3.47	2.70
23	28	29	240.00	300	100	47.66	0.67	2.68	0.64
24	29	30	150.00	300	100	33.45	0.47	1.39	0.21
25	29	31	640.00	150	100	7.11	0.40	2.32	1.48
26	30	26	880.00	200	110	26.34	0.84	5.40	4.75
27	16	25	850.00	300	100	32.54	0.46	1.32	1.12
28	25	26	400.00	200	110	25.43	0.81	5.06	2.03
29	26	27	20.00	200	100	37.05	1.18	12.12HI	0.24
30	27	33	720.00	200	110	23.50	0.75	4.37	3.15
31	33	34	340.00	200	110	16.39	0.52	2.25	0.76
32	34	23	400.00	150	110	9.28	0.53	3.18	1.27

NODE NO.	FLOW (LPS)	ELEVATION (M)	H G L (M)	PRESSURE (M)
200 R	191.909	30.00	30.00	0.00
35	-7.108	28.00	29.64	1.64
9	-7.108	15.18	28.96	13.78
10	-7.108	6.50	25.71	19.21

NODE NO.	FLOW (LPS)	ELEVATION (M)	H G L (M)	PRESSURE (M)
11	-7.108	2.90	23.73	20.83
12	-7.108	3.80	18.69	14.89
13	-7.108	2.80	17.77	14.97
14	-7.108	4.00	17.15	13.15
15	-7.108	15.20	28.63	13.43
16	-7.108	6.50	23.47	16.97
17	-7.108	2.90	23.15	20.25
18	-7.108	3.20	22.56	19.36
19	-7.108	2.70	21.51	18.81
20	-7.108	2.50	19.66	17.16
21	-7.108	2.50	19.59	17.09
22	-7.108	3.90	15.28	11.38
23	-7.108	2.50	14.89	12.39
24	-7.108	2.30	13.96	11.66
25	-7.108	5.50	22.34	16.84
26	-7.108	4.50	20.32	15.82
27	-7.108	4.50	20.07	15.57
28	-7.108	12.00	25.92	13.92
29	-7.108	11.00	25.28	14.28
30	-7.108	10.50	25.07	14.57
31	-7.108	10.00	23.80	13.80
33	-7.108	4.50	16.92	12.42
34	-7.108	4.50	16.16	11.66
36	-7.108	4.00	16.84	12.84

T I T L E : Phuket Zone 11 (WTP Bangwat)
 NO. OF PIPES : 12
 NO. OF NODES : 12
 PEAK FACTOR : 1.755
 MAX HEADLOSS/Km : 10
 MAX UNBAL(LPS) : 0

PIPE NO.	FROM Node	TO Node	LENGTH (M)	DIA (MM)	HWC	FLOW (LPS)	VELOCITY (MPS)	HEADLOSS (M/KM)	HEADLOSS (M)
1	200	1	1200.00	300	110	64.17	0.91	3.90	4.67
2	1	2	400.00	300	110	30.97	0.44	1.01	0.40
3	2	3	700.00	200	110	25.14	0.80	4.96	3.47
4	3	4	1300.00	200	110	19.31	0.61	3.04	3.95
5	4	5	1500.00	200	110	13.47	0.43	1.56	2.34
6	1	6	500.00	200	110	27.36	0.87	5.80	2.90
7	6	7	1000.00	200	110	21.53	0.69	3.72	3.72
8	7	8	1000.00	200	110	15.70	0.50	2.07	2.07
9	8	9	1400.00	200	110	9.86	0.31	0.88	1.23
10	9	5	1500.00	200	110	4.03	0.13LO	0.17	0.25
11	5	10	650.00	200	110	11.67	0.37	1.20	0.78
12	10	11	800.00	150	110	5.83	0.33	1.35	1.08

NODE NO.	FLOW (LPS)	ELEVATION (M)	H G L (M)	PRESSURE (M)
200 R	64.170	45.00	45.00	0.00
1	-5.834	4.00	40.33	36.33
2	-5.834	3.00	39.92	36.92
3	-5.834	3.00	36.45	33.45
4	-5.834	22.00	32.50	10.50
5	-5.834	10.00	30.15	20.15
6	-5.834	5.00	37.43	32.43
7	-5.834	5.00	33.71	28.71
8	-5.834	20.00	31.63	11.63
9	-5.834	10.00	30.40	20.40
10	-5.834	22.00	29.37	7.37
11	-5.834	3.00	28.29	25.29

T I T L E : Phuket Zone 3 & 4 (WTP Khlong Katha)
 NO. OF PIPES : 38
 NO. OF NODES : 38
 PEAK FACTOR : 1.755
 MAX HEADLOSS/Km : 10
 MAX UNBAL(LPS) : 0

PIPE NO.	FROM Node	TO Node	LENGTH (M)	DIA (MM)	HWC	FLOW (LPS)	VELOCITY (MPS)	HEADLOSS (M/KM)	(M)
3	103	102	960.00	500	110	0.84	0.00LO	0.00	0.00
4	104	103	1170.00	500	110	1.67	0.01LO	0.00	0.00
5	104	105	1520.00	400	110	154.10	1.23	4.85	7.38
6	105	106	270.00	400	110	153.26	1.22	4.80	1.30
7	106	107	280.00	400	110	152.43	1.21	4.76	1.33
8	107	108	160.00	400	110	90.55	0.72	1.81	0.29
9	108	109	800.00	400	110	89.72	0.71	1.78	1.43
10	109	110	320.00	400	110	88.88	0.71	1.75	0.56
11	110	111	770.00	400	110	27.00	0.21LO	0.19	0.15
12	111	112	770.00	400	110	26.17	0.21LO	0.18	0.14
13	112	113	960.00	400	110	25.33	0.20LO	0.17	0.17
14	113	114	1600.00	400	110	24.49	0.19LO	0.16	0.26
15	114	115	600.00	400	110	23.66	0.19LO	0.15	0.09
16	115	116	1250.00	400	110	22.82	0.18LO	0.14	0.18
17	116	117	480.00	200	110	21.99	0.70	3.87	1.86
18	117	118	1200.00	200	110	21.15	0.67	3.60	4.32
19	118	119	330.00	200	110	20.31	0.65	3.34	1.10
21	107	121	1000.00	250	110	61.04	1.24	8.63	8.63
22	110	122	1000.00	250	110	61.04	1.24	8.63	8.63
23	1	104	1000.00	500	110	156.61	0.80	1.69	1.69
24	100	9	1000.00	500	110	190.53	0.97	2.42	2.42
25	1	2	800.00	150	110	8.74	0.49	2.85	2.28
26	2	3	700.00	150	110	6.75	0.38	1.77	1.24
27	3	4	1000.00	150	110	4.75	0.27LO	0.92	0.92
28	4	5	1150.00	150	110	2.76	0.16LO	0.34	0.39
29	5	6	700.00	150	110	0.76	0.04LO	0.03	0.02
30	7	6	1500.00	150	110	1.23	0.07LO	0.08	0.11
31	8	1	1000.00	500	110	167.35	0.85	1.91	1.91
32	9	8	1000.00	500	110	169.34	0.86	1.95	1.95
33	9	10	1000.00	200	110	19.19	0.61	3.01	3.01
34	10	11	1000.00	200	110	17.20	0.55	2.46	2.46
35	11	7	1600.00	200	110	15.20	0.48	1.95	3.13
36	7	12	1000.00	150	110	11.97	0.68	5.10	5.10
37	12	13	1300.00	150	110	9.98	0.56	3.64	4.73
38	13	14	1000.00	150	110	7.98	0.45	2.41	2.41
39	14	15	1300.00	150	110	5.99	0.34	1.41	1.84
40	15	16	700.00	150	110	3.99	0.23LO	0.67	0.47
41	16	17	1250.00	150	110	2.00	0.11LO	0.19	0.23

NODE NO.	FLOW (LPS)	ELEVATION (M)	H G L (M)	PRESSURE (M)
102	-0.836	14.60	42.03	27.43
103	-0.836	16.00	42.03	26.03
104	-0.836	21.90	42.03	20.13
105	-0.836	11.20	34.66	23.46
106	-0.836	10.40	33.36	22.96
107	-0.836	9.00	32.03	23.03
108	-0.836	14.69	31.74	17.05
109	-0.836	11.06	30.31	19.25
110	-0.836	4.64	29.75	25.11
111	-0.836	5.50	29.60	24.10
112	-0.836	5.44	29.46	24.02
113	-0.836	14.90	29.30	14.40
114	-0.836	7.60	29.04	21.44
115	-0.836	6.30	28.95	22.65
116	-0.836	20.70	28.77	8.07
117	-0.836	8.10	26.91	18.81
118	-0.836	2.50	22.59	20.09
119	-20.312	2.70	21.49	18.79
121	-61.039	10.00	23.40	13.40
122	-61.039	5.00	21.12	16.12
100 R	190.532	10.00	50.00	40.00
1	-1.995	20.00	43.72	23.72
2	-1.995	12.00	41.44	29.44
3	-1.995	10.50	40.20	29.70
4	-1.995	11.00	39.28	28.28
5	-1.995	9.00	38.89	29.89
6	-1.995	10.00	38.87	28.87
7	-1.995	7.00	38.99	31.99
8	-1.995	16.00	45.63	29.63
9	-1.995	9.00	47.58	38.58
10	-1.995	14.50	44.57	30.07
11	-1.995	12.00	42.11	30.11
12	-1.995	8.00	33.88	25.88
13	-1.995	8.00	29.15	21.15
14	-1.995	22.00	26.74	4.74
15	-1.995	10.00	24.90	14.90
16	-1.995	3.00	24.44	21.44
17	-1.995	6.00	24.20	18.20

T I T L E : Phuket Zone 1 & 2 (WTP Bang Neow Dam)
 NO. OF PIPES : 28
 NO. OF NODES : 29
 PEAK FACTOR : 1.755
 MAX HEADLOSS/Km : 10

PIPE NO.	FROM Node	TO Node	LENGTH (M)	DIA (MM)	HWC	FLOW (LPS)	VELOCITY (MPS)	HEADLOSS (M/KM)	(M)
1	100	1	400.00	700	110	247.27	0.64	0.76	0.31
2	1	2	4280.00	700	110	245.67	0.64	0.75	3.22
3	3	2	1000.00	400	110	98.43	0.78	2.12	2.12
4	4	3	1200.00	400	110	100.03	0.80	2.18	2.62
5	5	4	1200.00	400	110	101.64	0.81	2.25	2.70
6	6	5	1250.00	400	110	103.24	0.82	2.31	2.89
7	7	6	1400.00	400	110	104.84	0.83	2.38	3.33
8	2	8	1300.00	600	110	342.50	1.21	2.95	3.84
9	8	9	1300.00	600	110	340.90	1.21	2.93	3.80
10	9	10	1300.00	600	110	339.30	1.20	2.90	3.77
11	10	30	1000.00	600	110	337.70	1.19	2.88	2.88
12	30	31	1000.00	600	110	336.10	1.19	2.85	2.85
13	31	32	1000.00	600	110	334.50	1.18	2.83	2.83
14	32	33	900.00	600	110	332.90	1.18	2.80	2.52
15	33	34	250.00	600	110	331.30	1.17	2.78	0.69
16	34	35	200.00	600	110	329.70	1.17	2.75	0.55
17	35	36	800.00	600	110	328.10	1.16	2.73	2.18
18	36	37	800.00	150	110	3.19	0.18LO	0.44	0.35
19	37	38	3800.00	100	110	1.60	0.20LO	0.88	3.36
20	36	39	900.00	600	110	313.74	1.11	2.51	2.26
21	36	40	2750.00	200	110	9.58	0.30	0.83	2.29
22	40	41	940.00	150	110	7.98	0.45	2.41	2.26
23	41	42	600.00	150	110	6.38	0.36	1.59	0.96
24	42	43	600.00	100	110	4.79	0.61	6.74	4.05
25	43	44	950.00	100	110	3.19	0.41	3.19	3.03
26	44	45	1600.00	100	110	1.60	0.20LO	0.88	1.41
27	200	7	11000.00	400	110	106.44	0.85	2.45	26.92
28	39	300	1000.00	600	110	312.14	1.10	2.49	2.49

NODE NO.	FLOW (LPS)	ELEVATION (M)	H G L (M)	PRESSURE (M)
100 R	247.267	50.00	70.00	20.00
1	-1.601	25.00	69.69	44.69
2	-1.601	7.00	66.47	59.47
3	-1.601	9.00	68.59	59.59
4	-1.601	10.00	71.21	61.21
5	-1.601	15.00	73.90	58.90
6	-1.601	17.00	76.79	59.79
7	-1.601	13.00	80.12	67.12

NODE NO.	FLOW (LPS)	ELEVATION (M)	H G L (M)	PRESSURE (M)
8	-1.601	5.50	62.63	57.13
9	-1.601	5.00	58.83	53.83
10	-1.601	4.90	55.06	50.16
30	-1.601	4.90	52.18	47.28
31	-1.601	5.00	49.33	44.33
32	-1.601	15.00	46.51	31.51
33	-1.601	5.00	43.99	38.99
34	-1.596	6.00	43.29	37.29
35	-1.596	7.00	42.74	35.74
36	-1.596	9.00	40.56	31.56
37	-1.596	14.50	40.21	25.71
38	-1.596	17.50	36.85	19.35
39	-1.596	20.00	38.30	18.30
40	-1.596	23.00	38.27	10.27
41	-1.596	25.00	36.01	11.01
42	-1.596	17.00	35.05	18.05
43	-1.596	14.00	31.01	17.01
44	-1.596	12.00	27.98	15.98
45	-1.596	10.00	26.57	16.57
200	106.437	60.00	107.04	47.04
300	-312.143	10.00	35.82	25.82

T I T L E : Phuket Zone 8 (WTP Bang Neow Dam)
 NO. OF PIPES : 9
 NO. OF NODES : 10
 PEAK FACTOR : 1.755
 MAX HEADLOSS/Km : 10

PIPE NO.	FROM Node	TO Node	LENGTH (M)	DIA (MM)	HWC	FLOW (LPS)	VELOCITY (MPS)	HEADLOSS (M/KM)	(M)
1	100	11	400.00	300	110	77.33	1.09	5.50	2.20
2	11	12	1950.00	300	110	71.05	1.01	4.70	9.17
3	12	13	760.00	300	110	64.76	0.92	3.96	3.01
4	13	14	400.00	150	110	12.57	0.71	5.58	2.23
5	14	15	1600.00	150	110	6.29	0.36	1.55	2.48
6	13	16	1000.00	300	110	45.90	0.65	2.10	2.10
7	16	17	1000.00	300	110	39.61	0.56	1.60	1.60
8	17	18	1000.00	200	110	33.33	1.06	8.35	8.35
9	18	19	1400.00	200	110	5.41	0.17LO	0.29	0.40

NODE NO.	FLOW (LPS)	ELEVATION (M)	H G L (M)	PRESSURE (M)
100 R	77.332	50.00	50.00	0.00
11	-6.286	25.00	47.80	22.80
12	-6.286	9.00	38.63	29.63
13	-6.286	8.00	35.62	27.62
14	-6.286	6.00	33.39	27.39
15	-6.286	3.00	30.91	27.91
16	-6.286	8.00	33.52	25.52
17	-6.286	6.00	31.93	25.93
18	-27.919	5.00	23.58	18.58
19	-5.409	2.00	23.17	21.17

T I T L E : Phuket Zone 9 (WTP Bang Neow Dam)
 NO. OF PIPES : 4
 NO. OF NODES : 5
 PEAK FACTOR : 1.755
 MAX HEADLOSS/Km : 10

PIPE NO.	FROM Node	TO Node	LENGTH (M)	DIA (MM)	HWC	FLOW (LPS)	VELOCITY (MPS)	HEADLOSS (M/KM)	(M)
1	200	20	800.00	200	110	21.64	0.69	3.75	3.00
2	20	21	850.00	150	110	16.23	0.92	8.95	7.61
3	21	22	1000.00	150	110	5.41	0.31	1.17	1.17
4	21	23	1000.00	150	110	5.41	0.31	1.17	1.17

NODE NO.	FLOW (LPS)	ELEVATION (M)	H G L (M)	PRESSURE (M)
200 R	21.636	35.00	35.00	0.00
20	-5.409	3.00	32.00	29.00
21	-5.409	3.00	24.39	21.39
22	-5.409	3.00	23.21	20.21
23	-5.409	3.00	23.21	20.21

T I T L E : Phuket Zone 7 (WTP Zone 7)
 NO. OF PIPES : 19
 NO. OF NODES : 20
 PEAK FACTOR : 1.755
 MAX HEADLOSS/Km : 10

PIPE NO.	FROM Node	TO Node	LENGTH (M)	DIA (MM)	HWC	FLOW (LPS)	VELOCITY (MPS)	HEADLOSS (M/KM)	(M)
1	200	1	450.00	400	110	115.78	0.92	2.86	1.29
2	1	2	2000.00	400	110	85.31	0.68	1.63	3.25
3	2	3	1000.00	300	110	79.22	1.12	5.75	5.75
4	3	4	1000.00	300	110	73.12	1.03	4.96	4.96
5	4	5	1000.00	300	110	67.03	0.95	4.22	4.22
6	5	6	1000.00	300	110	60.94	0.86	3.54	3.54
7	6	7	1000.00	200	110	18.28	0.58	2.75	2.75
8	7	8	1200.00	150	110	12.19	0.69	5.27	6.33
9	8	9	1400.00	150	110	6.09	0.34	1.46	2.05
10	6	10	1000.00	200	110	36.56	1.16	9.91	9.91
11	10	11	1000.00	200	110	30.47	0.97	7.07	7.07
12	11	12	1000.00	200	110	24.37	0.78	4.68	4.68
13	12	13	1000.00	200	110	18.28	0.58	2.75	2.75
14	13	14	1000.00	150	110	12.19	0.69	5.27	5.27
15	14	15	1000.00	150	110	6.09	0.34	1.46	1.46
16	1	16	1650.00	200	110	24.37	0.78	4.68	7.72
17	16	17	1000.00	200	110	18.28	0.58	2.75	2.75
18	17	18	1000.00	150	110	12.19	0.69	5.27	5.27
19	18	19	1000.00	150	110	6.09	0.34	1.46	1.46

NODE NO.	FLOW (LPS)	ELEVATION (M)	H G L (M)	PRESSURE (M)
200 R	115.781	70.00	70.00	0.00
1	-6.094	40.00	68.71	28.71
2	-6.094	17.00	65.46	48.46
3	-6.094	15.00	59.71	44.71
4	-6.094	10.00	54.75	44.75
5	-6.094	10.00	50.53	40.53
6	-6.094	10.00	46.99	36.99
7	-6.094	15.00	44.24	29.24
8	-6.094	25.00	37.91	12.91
9	-6.094	15.00	35.87	20.87
10	-6.094	7.00	37.08	30.08
11	-6.094	5.00	30.00	25.00
12	-6.094	5.00	25.32	20.32
13	-6.094	3.00	22.57	19.57
14	-6.094	3.00	17.30	14.30
15	-6.094	3.00	15.84	12.84
16	-6.094	17.00	60.99	43.99

NODE NO.	FLOW (LPS)	ELEVATION (M)	H G L (M)	PRESSURE (M)
17	-6.094	16.00	58.24	42.24
18	-6.094	15.00	52.97	37.97
19	-6.094	15.00	51.51	36.51

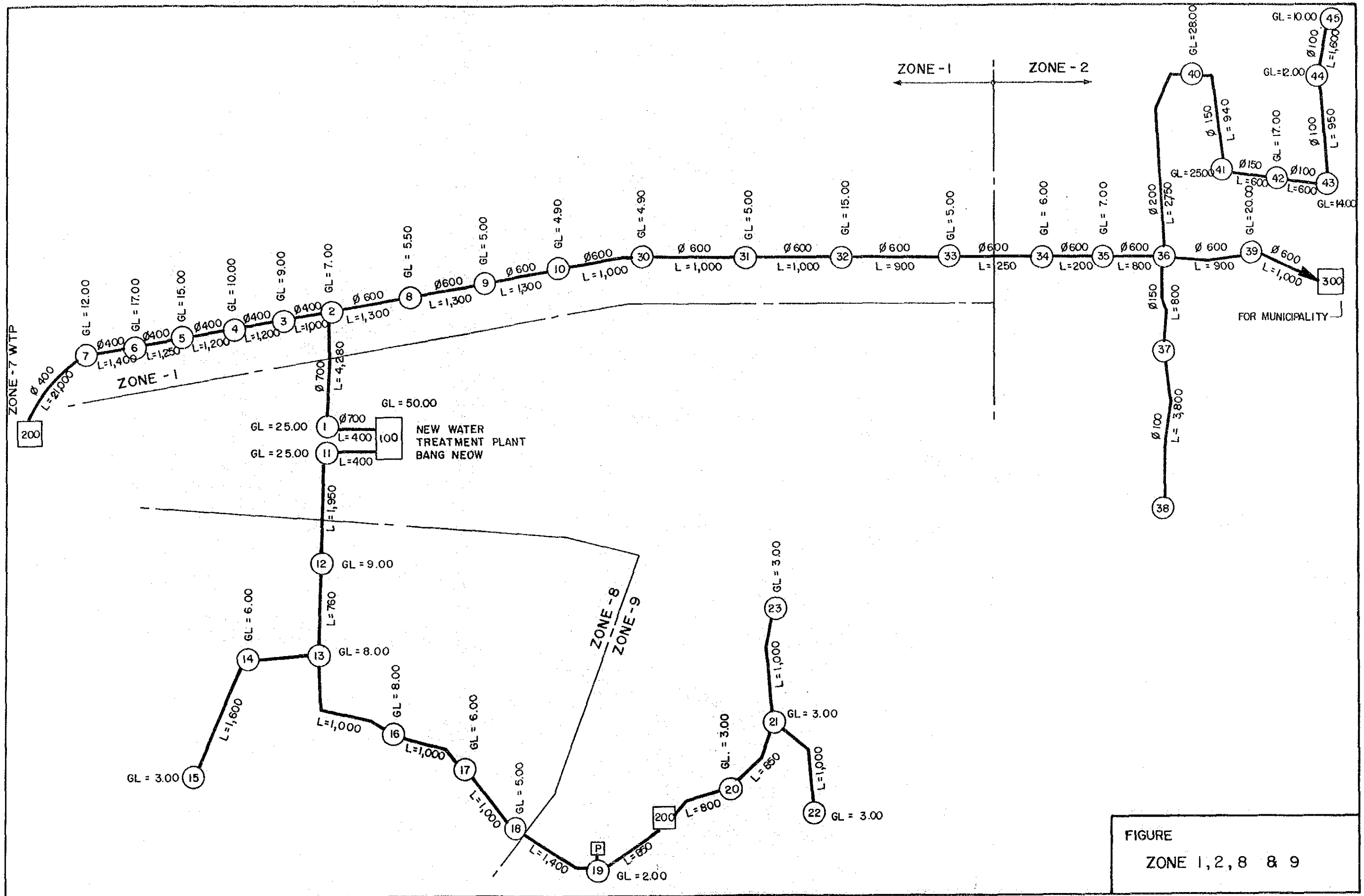


FIGURE
ZONE 1, 2, 8 & 9

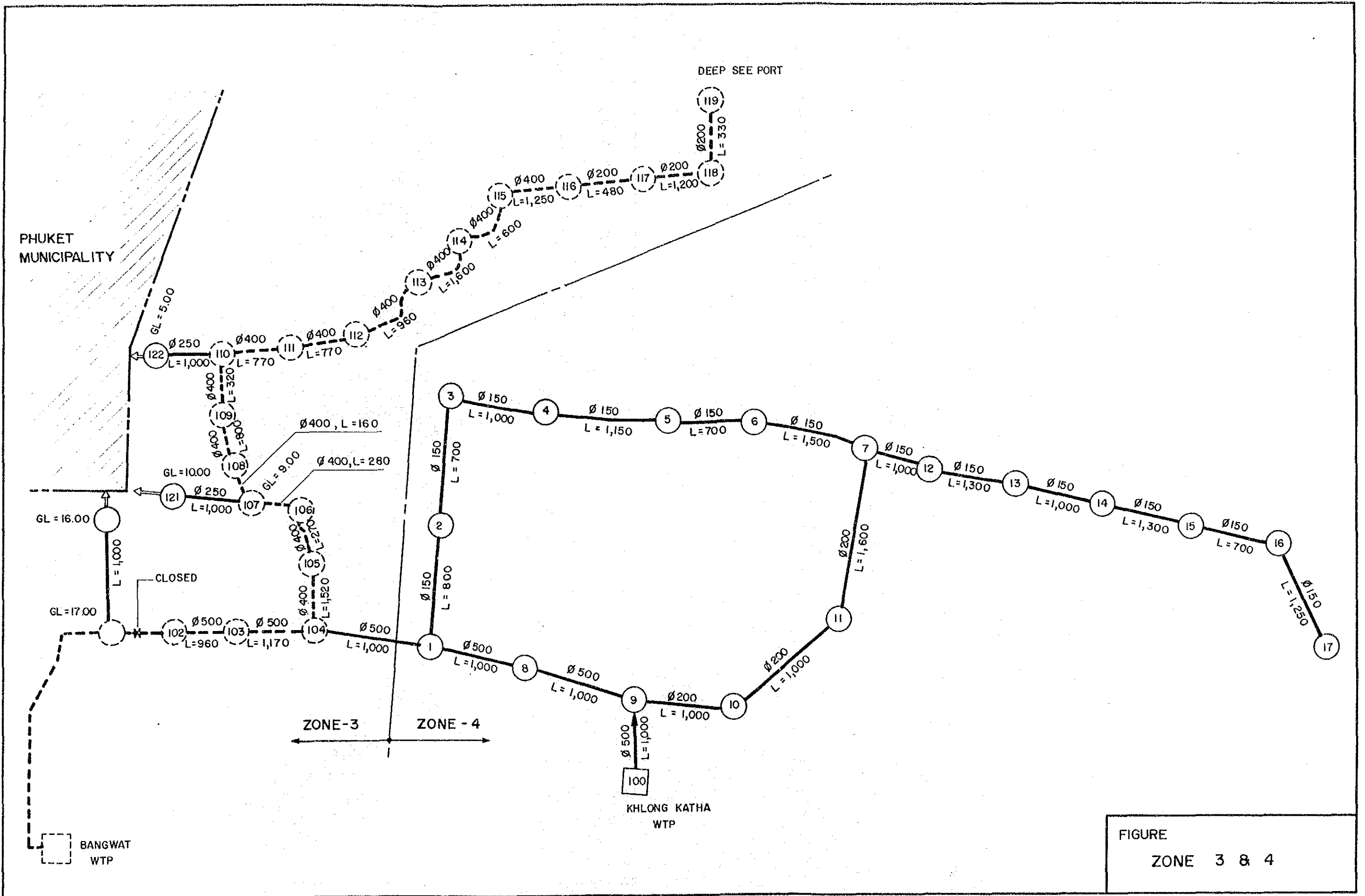


FIGURE
ZONE 3 & 4

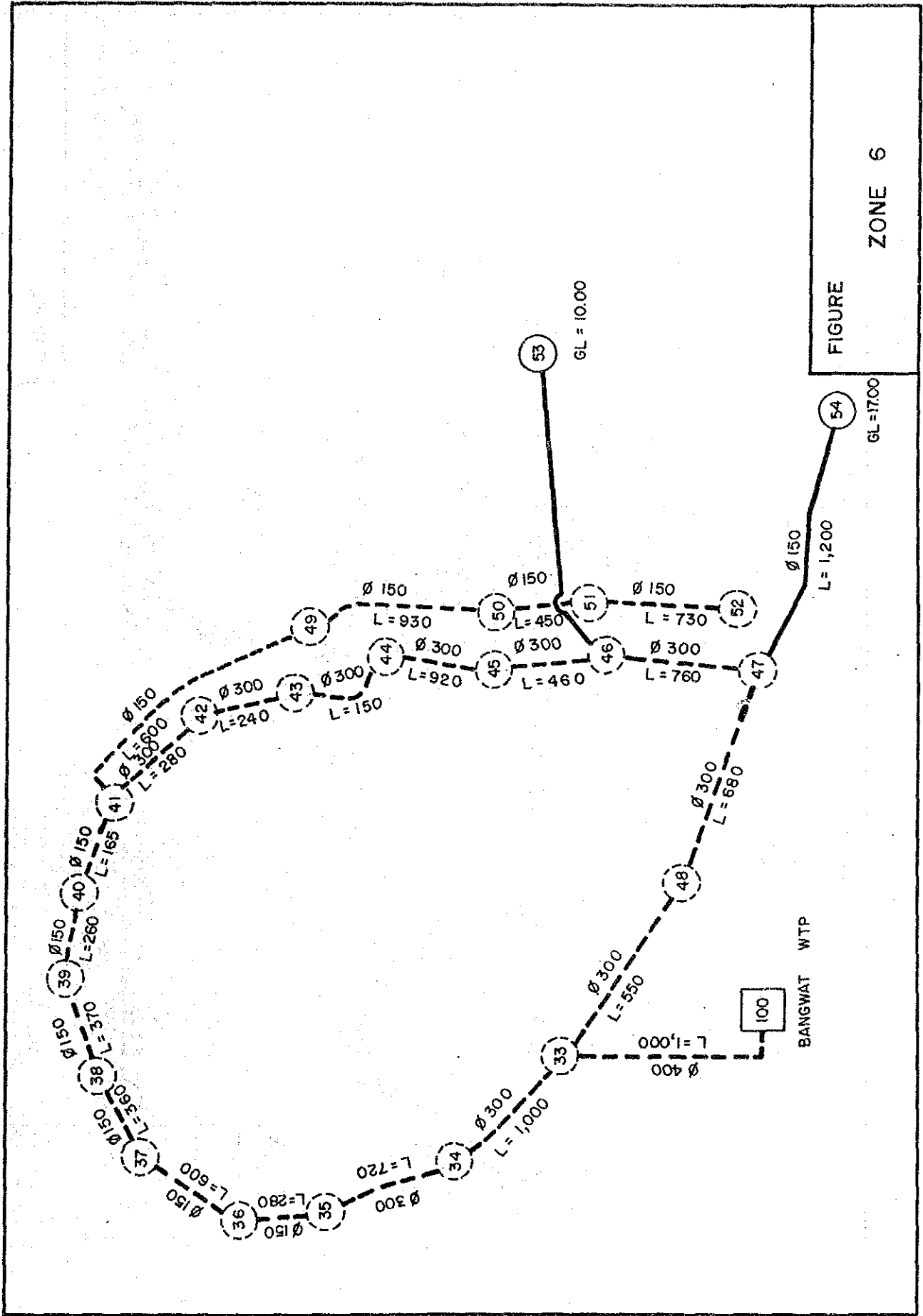


FIGURE
ZONE 6

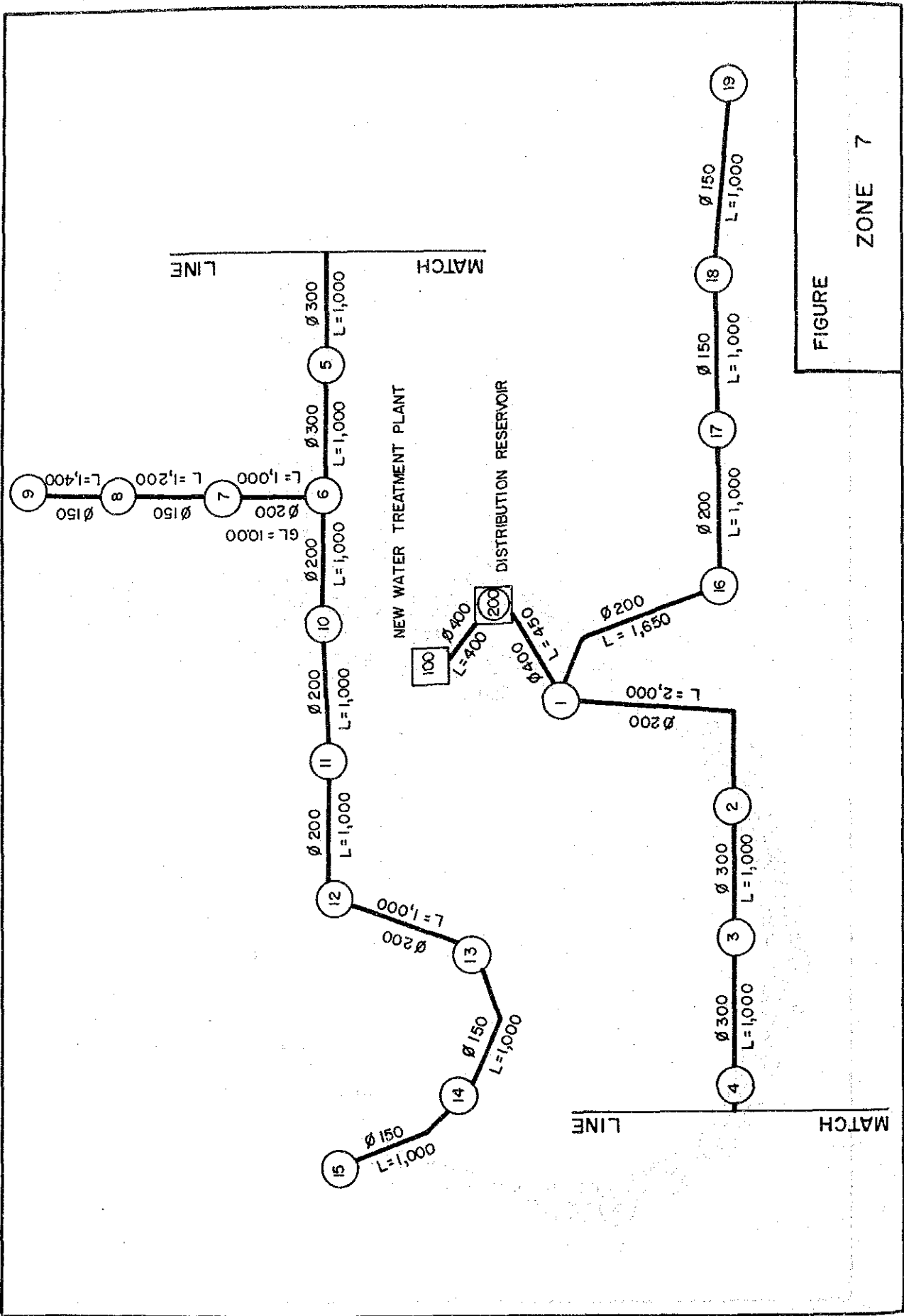


FIGURE 7
ZONE 7

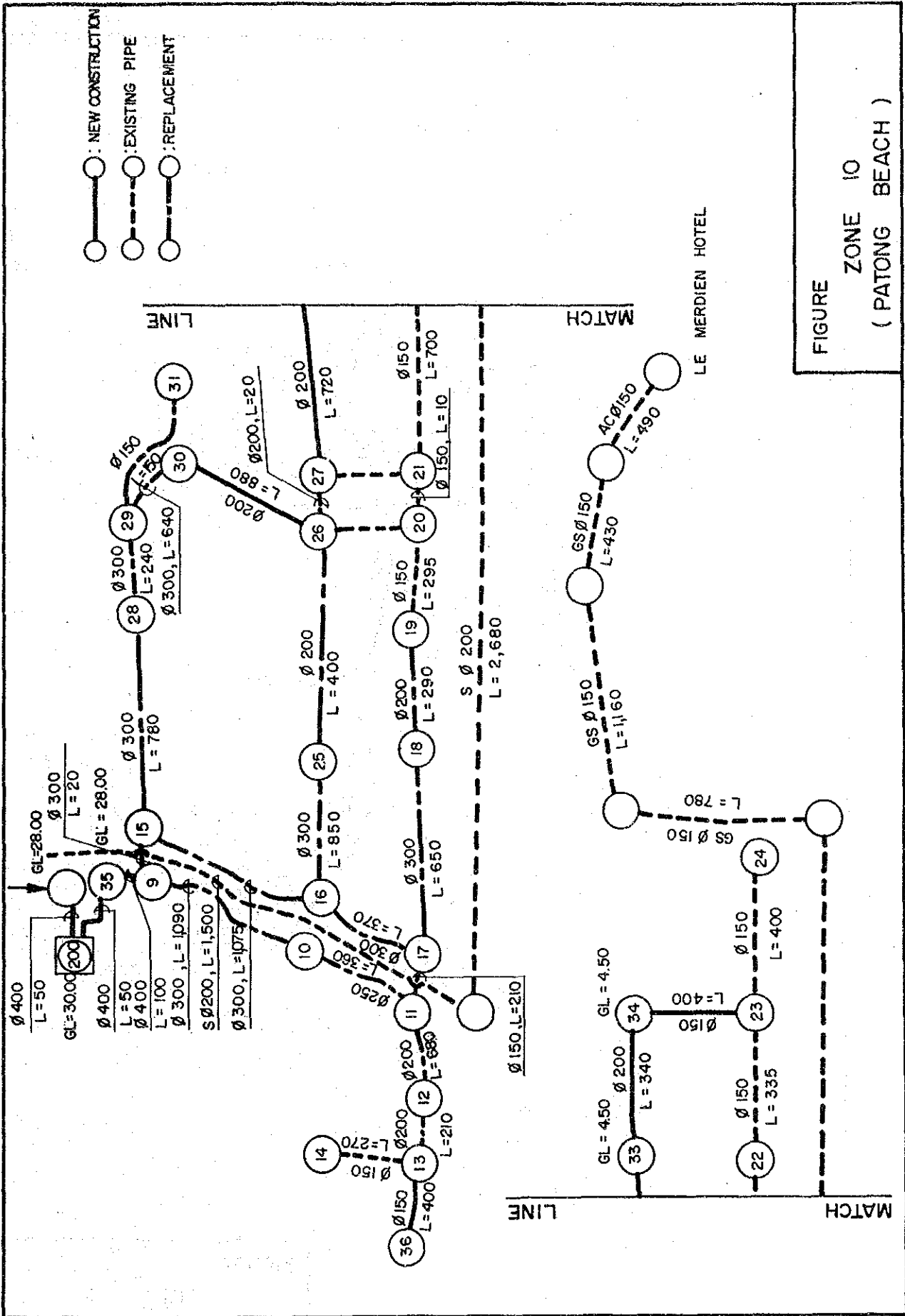


FIGURE
 ZONE 10
 (PATONG BEACH)

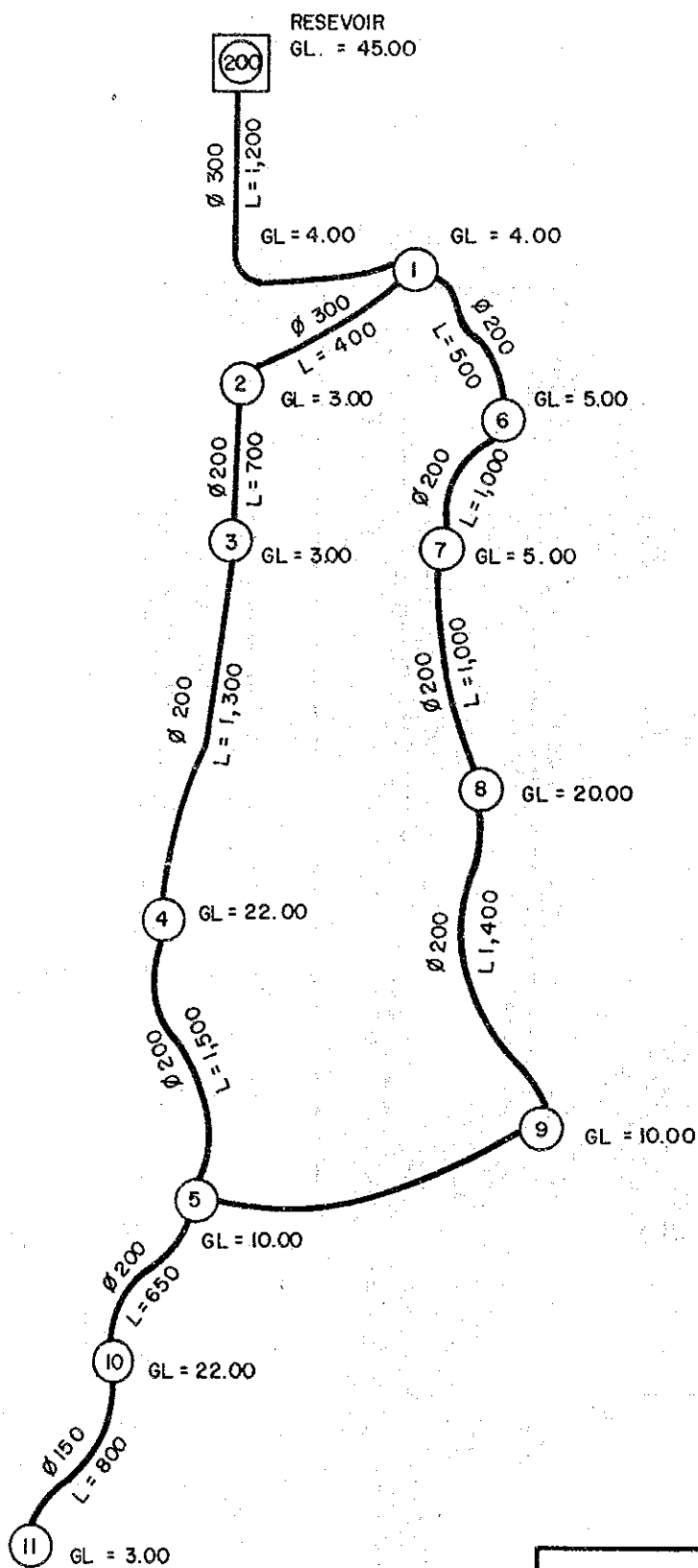


FIGURE
ZONE II
(KARON, KATHA BEACH)

APPENDIX A-9-1

Estimation on the Possible Water Supply Amount
and Operation Cost for Alternatives

Phuket Possible Water Supply Capacity (Alternative 1)

Year	1980	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
A. Potential Water Demand																						
A-1. Daily Average Demand																						
Zone 1	0	0	308	339	371	403	437	465	495	527	560	595	643	693	745	800	858	906	951	999	1,050	1,103
Zone 2	0	295	230	256	285	314	346	370	396	423	451	480	519	560	603	648	695	741	789	838	880	943
Zone 3	1,503	1,557	1,595	1,636	1,679	1,725	1,774	1,822	1,861	1,892	1,935	1,979	2,029	2,102	2,168	2,236	2,307	2,380	2,455	2,534	2,616	2,700
Zone 4	0	0	989	945	982	1,019	1,057	1,094	1,131	1,171	1,211	1,253	1,292	1,332	1,375	1,420	1,467	1,504	1,543	1,584	1,626	1,670
Zone 5	24,835	25,448	26,054	26,673	27,304	27,948	28,590	29,230	29,868	30,703	31,430	32,170	33,005	33,856	34,724	35,609	36,511	37,384	38,274	39,179	40,100	41,037
Zone 6	236	240	265	294	323	354	385	407	430	453	477	501	527	574	612	651	691	730	769	810	851	893
Zone 7	0	0	2,417	2,885	3,353	3,821	4,290	4,512	4,735	4,959	5,184	5,410	5,436	5,464	5,494	5,525	5,557	5,584	5,611	5,640	5,669	5,700
Zone 8	0	0	969	1,149	1,331	1,512	1,694	1,785	1,877	1,970	2,065	2,160	2,190	2,221	2,254	2,289	2,325	2,353	2,382	2,412	2,443	2,476
Zone 9	0	0	754	773	792	811	830	851	872	893	915	937	949	962	975	989	1,004	1,015	1,027	1,039	1,052	1,065
Zone 10	9,983	10,022	10,075	10,131	10,185	10,240	10,294	10,343	10,391	10,439	10,486	10,533	10,447	10,363	10,283	10,206	10,132	10,058	9,987	9,918	9,852	9,788
Zone 11	0	2,480	2,527	2,576	2,624	2,671	2,723	2,770	2,836	2,892	2,949	3,007	3,020	3,034	3,048	3,063	3,079	3,094	3,109	3,125	3,142	3,159
Total	36,577	39,952	46,106	47,656	49,228	50,821	52,437	53,710	55,004	56,322	57,662	59,026	60,076	61,161	62,281	63,436	64,626	65,747	66,897	68,079	69,291	70,533
A-2. Daily Maximum Demand																						
Zone 1	0	0	400	440	482	524	568	605	644	685	723	774	835	900	969	1,041	1,116	1,175	1,236	1,299	1,365	1,433
Zone 2	0	287	299	333	370	409	450	482	515	550	586	624	675	729	784	843	903	963	1,025	1,090	1,156	1,225
Zone 3	1,954	2,024	2,074	2,127	2,183	2,243	2,307	2,355	2,406	2,460	2,515	2,573	2,631	2,733	2,818	2,907	3,004	3,094	3,153	3,225	3,491	3,510
Zone 4	0	0	1,181	1,228	1,276	1,325	1,374	1,422	1,471	1,522	1,574	1,629	1,679	1,732	1,787	1,846	1,907	1,966	2,006	2,069	2,114	2,171
Zone 5	32,311	33,033	33,870	34,675	35,485	36,332	37,185	38,077	38,986	39,914	40,859	41,821	42,906	44,013	45,141	46,222	47,464	48,800	49,756	50,933	52,130	53,349
Zone 6	307	312	346	382	420	460	501	530	559	589	620	651	698	746	795	846	898	948	1,000	1,053	1,106	1,161
Zone 7	0	0	3,142	3,750	4,353	4,968	5,578	5,855	6,156	6,447	6,739	7,033	7,067	7,104	7,142	7,182	7,225	7,259	7,294	7,331	7,370	7,410
Zone 8	0	0	1,280	1,494	1,730	1,966	2,203	2,321	2,441	2,562	2,684	2,808	2,846	2,887	2,930	2,975	3,023	3,059	3,097	3,136	3,176	3,213
Zone 9	0	0	980	1,004	1,029	1,054	1,079	1,106	1,133	1,161	1,189	1,218	1,234	1,250	1,267	1,286	1,305	1,320	1,335	1,351	1,367	1,384
Zone 10	12,977	13,029	13,099	13,170	13,241	13,312	13,383	13,446	13,509	13,571	13,632	13,693	13,581	13,472	13,368	13,268	13,172	13,075	12,983	12,894	12,807	12,725
Zone 11	0	3,224	3,285	3,348	3,412	3,476	3,541	3,613	3,686	3,760	3,834	3,909	3,926	3,944	3,962	3,982	4,002	4,022	4,042	4,063	4,084	4,107
Total	47,549	51,948	59,938	61,953	63,996	66,068	68,168	69,822	71,506	73,218	74,961	76,744	78,099	79,509	80,965	82,466	84,014	85,471	86,967	88,502	90,078	91,693

Phuket Possible Water Supply Capacity (Alternative I)

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
B. Water Sources Available (Daily average supply capacity = 105 % of daily average demand)																						
B-1. Bangwat System																						
Bangwat WTP: Maximum Capacity = 24,000 cu m/d (incl. 3 % of treatment loss)																						
(Exis.) Maximum effective capacity (Qmax) = 23,301 cu m/d																						
Equivalent Daily Average Demand (Qda) = 17,924 cu m/d (Qmax/1.3)																						
(1) Daily Ave. Supply Capacity																						
a. Bangwat Reservoir	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700
b. Bang Tho Sang Reservoir	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600
c. Temporary Pumping	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224
Total	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700
(2) Daily Average Supply Amount																						
Zone 6	236	240	256	294	323	354	386	407	430	453	477	501	517	574	612	651	691	730	769	810	851	893
Zone 10	9,983	10,022	10,076	10,131	10,185	10,240	10,294	10,343	10,391	10,439	10,486	10,533	10,447	10,363	10,283	10,206	10,132	10,058	9,987	9,918	9,852	9,788
Zone 11	0	2,480	2,527	2,576	2,624	2,671	2,715	2,770	2,836	2,892	2,949	3,007	3,020	3,034	3,048	3,063	3,079	3,094	3,109	3,125	3,142	3,159
Zone 5	1,401	(1,042)	5,084	4,923	4,791	4,691	4,621	4,594	4,567	4,539	4,511	4,483	4,455	4,427	4,399	4,371	4,343	4,315	4,287	4,259	4,231	4,203
Total	11,700	11,700	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924

B-2. Phuket Municipality System

Phuket WTP: Maximum Capacity = 17,700 cu m/d (incl. 3 % of treatment loss)																						
(Exis.) Maximum effective capacity (Qmax) = 17,210 cu m/d (Qda + 1.3)																						
Equivalent Daily Average Demand (Qda) = 13,238 cu m/d (Maximum Raw Water Supply Capacity/1.05)																						
(1) Daily Ave. Supply Capacity																						
a. Mining Pits	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900
Total	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900
(2) Daily Average Supply Amount																						
Zone 5	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238
Total	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238

B-3. Khlong Katla System

Khlong Katla WTP: Maximum Capacity = 13,900 cu m/d (incl. 3 % of treatment loss)																						
(Proposed) Maximum effective capacity (Qmax) = 13,495 cu m/d (Qda + 1.3)																						
Equivalent Daily Average Demand (Qda) = 10,381 cu m/d (Maximum Raw Water Supply Capacity/1.05)																						
(1) Daily Ave. Supply Capacity																						
a. Khlong Katla Reservoir	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900
Total	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900
(2) Daily Average Supply Amount																						
Zone 3	0	0	0	0	1,679	1,725	1,774	1,812	1,851	1,892	1,935	1,979	2,039	2,102	2,168	2,236	2,307	2,380	2,455	2,534	2,615	2,700
Zone 4	0	0	0	0	982	1,019	1,057	1,094	1,131	1,171	1,211	1,253	1,292	1,332	1,375	1,420	1,467	1,514	1,562	1,611	1,661	1,710
Zone 5	0	0	0	0	7,720	7,635	7,549	7,475	7,398	7,318	7,235	7,146	7,059	6,977	6,893	6,807	6,719	6,628	6,535	6,440	6,343	6,244
Total	0	0	0	0	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381

Phuket Possible Water Supply Capacity (Alternative 1)

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------

8-4. Bang Neow Dam System

Maximum Capacity = 21,000 cu w/d (incl. 3% of treatment loss)
 Bang Neow Dam WTP: Maximum effective capacity (Qmax) = 20,429 cu w/d (Qda + 1.3)
 (Proposed) Equivalent Daily average demand(Qda) 15,714 cu w/d (Maximum Raw Water Supply Capacity/1.05)

(1) Daily Ave. Supply Capacity

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
a. Bang Neow Dam Reservoir	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900
b. Cha Tra Reservoir	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900

(2) Daily Average Supply Amount

Zone 1	0	0	0	0	371	403	437	463	485	527	560	585	643	693	745	800	858	904	951	999	1,050	1,103
Zone 2	0	0	0	0	285	314	346	370	396	423	451	480	519	560	603	648	695	741	789	838	890	942
Zone 3	0	0	0	0	1,331	1,512	1,694	1,785	1,871	1,970	2,065	2,160	2,421	2,421	2,454	2,389	2,353	2,382	2,412	2,443	2,475	2,507
Zone 4	0	0	0	0	792	811	830	851	872	892	915	937	949	962	975	989	1,004	1,015	1,027	1,039	1,052	1,065
Zone 5	0	0	0	0	5,699	5,435	5,169	5,004	4,836	4,663	4,486	4,304	4,176	4,041	3,899	3,752	3,600	3,443	3,281	3,114	2,942	2,765
Total	0	0	0	0	8,476	8,476	8,476	8,476	8,476	8,476	8,476	8,476	8,476	8,476	8,476	8,476	8,476	8,476	8,476	8,476	8,476	8,476

8-5. Zone 7 System

Maximum Capacity = 17,800 cu w/d (incl. 3% of treatment loss)
 Zone 7 WTP: Maximum effective capacity (Qmax) = 17,259 cu w/d (Qda + 1.3)
 (Proposed) Equivalent Daily average demand(Qda) 13,276 cu w/d (Maximum Water Supply Amount)

(1) Daily Ave. Supply Capacity

a. Khlong Lo Inag Reservoir	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

(2) Daily Average Supply Amount

Zone 7	0	0	0	0	3,821	4,290	4,512	4,735	4,959	5,184	5,410	5,436	5,464	5,494	5,525	5,557	5,584	5,611	5,640	5,669	5,700	5,736
Zone 5 (covered thru Khlong Matha System)	0	0	0	0	0	0	0	(822)	250	1,344	2,459	3,597	4,621	5,677	6,768	7,891	9,043	10,222	11,428	12,661	13,921	15,206
Total	0	0	0	0	3,821	4,290	4,512	4,735	4,959	5,184	5,410	5,436	5,464	5,494	5,525	5,557	5,584	5,611	5,640	5,669	5,700	5,736

(3) Available Water for

Thai Muang Resort	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Phadret Possible Water Supply Capacity (Alternative 1)

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
C-1. Possible Water Supply																						
C-1. Total of Possible Water Supply Amount																						
Zone 1	0	0	0	0	371	405	437	465	495	527	560	595	643	693	745	800	858	904	951	999	1,050	1,103
Zone 2	0	0	0	0	285	314	346	370	388	423	451	488	519	560	603	648	695	741	789	838	889	943
Zone 3	0	0	0	0	1,679	1,725	1,774	1,812	1,851	1,892	1,935	1,979	2,039	2,102	2,168	2,236	2,307	2,380	2,456	2,534	2,616	2,700
Zone 4	0	0	0	0	982	1,019	1,057	1,094	1,131	1,171	1,211	1,253	1,292	1,332	1,375	1,420	1,467	1,514	1,563	1,614	1,666	1,720
Zone 5	14,720	12,196	18,292	18,161	31,448	28,604	28,604	29,290	30,703	31,430	32,170	33,005	33,858	34,724	35,609	36,511	37,384	38,274	39,179	40,100	41,037	
Zone 6	235	240	266	294	323	354	386	407	430	453	477	501	527	574	612	651	691	730	769	810	851	893
Zone 7	0	0	0	0	3,321	4,290	4,512	4,735	4,959	5,184	5,410	5,636	5,864	6,094	6,324	6,555	6,787	7,021	7,256	7,492	7,729	7,967
Zone 8	0	0	0	0	1,331	1,512	1,694	1,785	1,877	1,970	2,065	2,160	2,254	2,351	2,454	2,561	2,671	2,782	2,892	3,004	3,118	3,234
Zone 9	0	0	0	0	792	811	830	851	872	893	915	937	949	962	975	989	1,004	1,015	1,027	1,039	1,052	1,065
Zone 10	9,993	10,022	10,076	10,131	10,185	10,240	10,294	10,343	10,391	10,439	10,486	10,533	10,447	10,363	10,283	10,206	10,132	10,058	9,987	9,918	9,852	9,788
Zone 11	0	2,480	2,527	2,576	2,624	2,674	2,723	2,773	2,826	2,882	2,940	3,007	3,020	3,034	3,048	3,063	3,079	3,094	3,109	3,125	3,142	3,159
Total	24,938	24,938	31,162	31,162	50,019	50,923	52,437	53,710	55,004	56,322	57,662	59,028	60,426	61,161	62,201	63,436	64,826	65,747	66,897	68,079	69,291	70,538

C-2. Shortage Amount against Potential Demand ((A-1)-(C-1))

Zone 1	0	0	308	339	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zone 2	0	205	230	255	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zone 3	1,503	1,577	1,595	1,636	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zone 4	0	0	909	945	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zone 5	10,135	13,252	7,763	8,511	(4,144)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zone 6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zone 7	0	0	2,417	2,885	3,353	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zone 8	0	0	959	1,119	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zone 9	0	0	754	773	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zone 10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zone 11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	11,638	15,014	14,314	16,194	(792)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Phuket Possible Water Supply Capacity (Alternative 1)

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	
D- Water Transmission Cost																							
D-1 Bangrat System																							
a. Raw Water																							
Temporary Pumping (Khlong Ban Yai) 600-																							
Pump Characteristics	Head	5.224	6.224	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	50 m, Dia.	300 mm, q =	10.0 cu m/min,	Motor	150 Kw, No.	3 units																	
No. of Operating Pump	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
b. Clear Water																							
for Zone 10 & 11																							
Pump Characteristics	Head	9.933	12.502	12.706	12.889	12.913	13.018	13.122	13.227	13.331	13.436	13.540	13.647	13.751	13.856	13.961	14.066	14.171	14.276	14.381	14.486	14.591	
	120 m, Dia.	300 mm, q =	5.5 cu m/min,	Motor	160 Kw, No.	3 units																	
No. of Operating Pump	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
(These figure shows the average characteristics of the clear water and the booster pumps.)																							
D-2 Khlong Kaha System																							
a. Clear Water																							
for Zone 3, 4 & 5																							
Pump Characteristics	Head	0	0	0	10.381	10.381	10.381	10.381	10.381	10.381	10.381	10.381	10.381	10.381	10.381	10.381	10.381	10.381	10.381	10.381	10.381	10.381	
	40 m, Dia.	200 mm, q =	4.2 cu m/min,	Motor	40 Kw, No.	3 units																	
No. of Operating Pump	0	0	0	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
D-3 Bang Muee Dan System																							
a. Clear Water																							
for Zone 1,2,8,9 & 5																							
Pump Characteristics	Head	0	0	0	8.476	8.476	8.476	8.476	8.476	8.476	8.476	8.476	8.476	8.476	8.476	8.476	8.476	8.476	8.476	8.476	8.476	8.476	
	40 m, Dia.	300 mm, q =	6.4 cu m/min,	Motor	60 Kw, No.	3 units																	
No. of Operating Pump	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
D-4 Zone 7 System																							
a. Raw Water																							
From Allong To Yang																							
Pump Characteristics	Head	0	0	0	0	342	2,539	3,875	5,235	6,618	8,025	9,457	10,950	11,609	12,875	6,487	7,737	8,914	10,122	11,263	12,535	13,940	
	30 m, Dia.	300 mm, q =	5.7 cu m/min,	Motor	40 Kw, No.	3 units																	
No. of Operating Pump	0	0	0	0	0	1	1	1	1	1	2	2	2	3	3	1	2	2	2	2	2	3	
b. Clear Water																							
for Zone 7 & 5																							
Pump Characteristics	Head	0	0	0	0	802	2,418	3,650	4,985	6,303	7,643	9,007	10,057	11,142	12,262	6,178	7,369	8,499	9,649	10,821	12,033	13,275	
	40 m, Dia.	300 mm, q =	5.4 cu m/min,	Motor	50 Kw, No.	3 units																	
No. of Operating Pump	0	0	0	0	0	1	1	1	1	1	2	2	2	3	3	1	2	2	2	2	2	3	
D-5 Energy Requirement																							
Total Output (Kw)	320	480	930	930	720	770	810	810	810	810	810	900	900	990	990	870	960	960	960	960	960	1,050	
Energy Consumption (Kwh/day)	5,061	6,338	6,375	6,409	9,224	9,733	9,515	10,216	10,929	11,654	11,363	12,050	12,543	12,224	12,719	12,866	12,491	13,005	13,534	14,078	14,617	15,259	
D-6 Energy Cost (baht 1000)																							
Demand Charge	879	1,319	2,556	2,556	1,979	1,979	2,256	2,256	2,256	2,256	2,473	2,473	2,473	2,721	2,721	2,291	2,638	2,638	2,638	2,638	2,885	2,885	
Energy Charge	2,272	2,816	2,862	2,878	4,141	4,369	4,272	4,587	4,997	5,232	5,101	5,410	5,488	5,710	5,776	5,662	5,839	6,076	6,320	6,574	6,828	7,082	
Total	3,152	4,135	5,418	5,433	6,119	6,348	6,498	6,810	7,133	7,458	7,575	7,883	7,961	8,208	8,431	8,167	8,246	8,477	8,714	8,958	9,309	9,332	
																						Total Cost	159,719

Phuket Possible Water Supply Capacity (Alternative 1)

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Total Treatment Amount (gds cu w/d)	24,338	24,338	31,162	31,162	50,019	50,921	52,437	53,710	55,004	56,322	57,662	59,026	60,416	61,161	62,281	63,436	64,626	65,747	66,897	68,079	69,291	70,532
Chemical Cost (Baht 1000)	497	497	621	621	996	1,012	1,045	1,078	1,096	1,122	1,149	1,176	1,197	1,218	1,241	1,264	1,287	1,310	1,333	1,356	1,380	1,405
Total Cost																						
23,850																						

Energy Costs are based on the 1988 EPA's charge rates as follows:

Desand Charge = Baht 229 /Mwh x 12 mo/year x Motor Output (Mw)
 Energy Charge = Baht 1.23 /Mwh x Energy Consumption(Mwh/dly) x 365 days/year

Chemical Cost

Alum (Average Dosage, 5 mg/l) : Baht 4.05 /kg
 Lime (Average Dosage, 2.5 mg/l) : Baht 1.25 /kg
 Cl₂ gas (Average Dos. 2.0 mg/l) : Baht 15.60 /kg

Phuket Possible Water Supply Assmnt. (Alternative 2)

Item	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
A. Potential Water Demand																						
A-1. Daily Average Demand																						
Zone 1	0	0	208	339	371	403	437	465	495	527	560	595	643	693	745	800	858	904	951	999	1,050	1,103
Zone 2	0	205	230	256	285	314	346	370	396	423	451	480	519	560	603	648	695	741	789	838	890	943
Zone 3	1,803	1,557	1,595	1,636	1,679	1,725	1,774	1,825	1,878	1,931	1,985	2,039	2,093	2,102	2,168	2,236	2,307	2,456	2,534	2,616	2,700	
Zone 4	0	0	909	945	982	1,019	1,057	1,094	1,131	1,171	1,211	1,253	1,292	1,332	1,375	1,420	1,467	1,504	1,543	1,584	1,626	1,670
Zone 5	24,855	25,440	26,054	26,673	27,304	27,948	28,594	29,250	29,906	30,703	31,430	32,170	33,005	33,856	34,724	35,609	36,511	37,384	38,274	39,190	40,100	41,037
Zone 6	235	240	268	294	323	354	386	407	430	453	477	501	537	574	612	651	691	730	769	810	851	893
Zone 7	0	0	2,417	2,885	3,353	3,821	4,290	4,512	4,735	4,959	5,184	5,410	5,436	5,464	5,494	5,525	5,557	5,584	5,611	5,640	5,669	5,700
Zone 8	0	0	968	1,149	1,331	1,512	1,694	1,785	1,877	1,970	2,065	2,160	2,221	2,254	2,289	2,325	2,362	2,402	2,443	2,485	2,528	2,576
Zone 9	0	0	754	773	792	811	830	851	872	893	915	937	949	962	975	989	1,004	1,015	1,027	1,039	1,052	1,065
Zone 10	9,983	10,022	10,076	10,131	10,185	10,240	10,294	10,343	10,391	10,439	10,486	10,533	10,447	10,363	10,283	10,206	10,132	10,058	9,987	9,918	9,852	9,786
Zone 11	0	2,480	2,527	2,576	2,624	2,674	2,723	2,779	2,838	2,892	2,949	3,007	3,020	3,034	3,048	3,063	3,079	3,094	3,109	3,125	3,142	3,159
Total	36,577	39,952	46,105	47,656	49,228	50,821	52,437	53,710	55,004	56,322	57,652	59,026	60,076	61,161	62,281	63,436	64,626	65,747	66,897	68,079	69,291	70,533
A-2. Daily Maximum Demand																						
Zone 1	0	0	400	440	482	524	568	605	644	685	728	774	835	900	969	1,041	1,116	1,175	1,236	1,299	1,365	1,433
Zone 2	0	267	299	333	370	409	450	482	515	550	586	624	675	729	784	843	903	963	1,025	1,090	1,156	1,225
Zone 3	1,954	2,024	2,074	2,127	2,183	2,243	2,307	2,355	2,406	2,460	2,515	2,573	2,651	2,733	2,818	2,907	3,000	3,094	3,193	3,295	3,401	3,510
Zone 4	0	0	1,181	1,228	1,276	1,325	1,374	1,422	1,471	1,522	1,574	1,628	1,679	1,732	1,787	1,846	1,907	1,956	2,006	2,059	2,114	2,171
Zone 5	32,311	33,083	33,870	34,675	35,495	36,332	37,185	38,077	38,986	39,914	40,859	41,821	42,706	44,013	45,141	46,292	47,464	48,600	49,756	50,933	52,130	53,348
Zone 6	307	312	345	382	420	460	501	530	559	589	620	651	698	746	795	846	898	948	1,000	1,053	1,106	1,161
Zone 7	0	0	3,142	3,750	4,359	4,968	5,578	5,865	6,156	6,447	6,739	7,033	7,067	7,104	7,142	7,182	7,225	7,259	7,294	7,331	7,370	7,410
Zone 8	0	0	1,260	1,494	1,730	1,966	2,203	2,321	2,441	2,562	2,684	2,808	2,846	2,887	2,930	2,975	3,023	3,059	3,097	3,136	3,176	3,219
Zone 9	0	0	980	1,004	1,029	1,054	1,079	1,106	1,133	1,161	1,189	1,218	1,244	1,250	1,267	1,286	1,305	1,320	1,335	1,351	1,367	1,384
Zone 10	12,877	13,029	13,099	13,170	13,241	13,312	13,383	13,446	13,509	13,571	13,632	13,693	13,472	13,368	13,268	13,172	13,075	12,983	12,894	12,807	12,725	
Zone 11	0	3,324	3,286	3,248	3,212	3,176	3,141	3,613	3,686	3,760	3,834	3,909	3,926	3,944	3,962	3,982	4,002	4,022	4,042	4,062	4,084	4,107
Total	47,549	51,938	59,938	61,953	63,996	66,068	68,168	69,822	71,406	73,118	74,961	76,734	78,099	79,509	80,965	82,466	84,014	85,471	86,961	88,502	90,078	91,635

Phuket Possible Water Supply Amount (Alternative 2)

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Water Sources Available (Daily average supply capacity = 105 % of daily average demand)	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700
0-1. Bangsat System																						
Bangsat WTP: Maximum Capacity =	24,000 cu m/d (incl. 3 % of treatment loss)																					
(Exis.)	24,301 cu m/d																					
Maximum effective capacity (Q _{max}) =	24,301 cu m/d																					
Equivalent Daily average demand(Q _{da})=	17,924 cu m/d (Q _{max} /1.3)																					
(1) Daily Ave. Supply Capacity	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700
a. Bangsat Reservoir	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700
b. Bang Pho Song Reservoir	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224
c. Temporary Pumping	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224
Total	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700
(2) Daily Average Supply Amount																						
Zone 5	255	240	265	234	323	354	366	407	430	453	477	501	527	574	612	651	691	730	769	810	851	891
Zone 10	9,983	10,022	10,078	10,131	10,185	10,240	10,294	10,343	10,391	10,439	10,486	10,533	10,447	10,363	10,280	10,206	10,132	10,058	9,987	9,918	9,852	9,788
Zone 11	0	2,490	2,527	2,576	2,624	2,674	2,723	2,779	2,836	2,892	2,949	3,007	3,020	3,034	3,048	3,063	3,079	3,094	3,109	3,125	3,142	3,159
Zone 5	1,491	(1,042)	5,054	4,923	4,791	4,657	4,521	4,384	4,247	4,109	4,011	3,863	3,930	3,953	3,981	4,004	4,022	4,043	4,059	4,071	4,079	4,083
Total	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700

B-2. Phuket Municipality System

Phuket WTP: Maximum Capacity = 17,700 cu m/d (incl. 3 % of treatment loss)

(Exis.)

Maximum effective capacity (Q_{max}) = 17,210 cu m/d (Q_{da} + 1.3)

Equivalent Daily average demand(Q_{da})= 13,238 cu m/d (Maximum Raw Water Supply Capacity/1.05)

(1) Daily Ave. Supply Capacity	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900
a. M-raing Pits	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900
Total	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900
(2) Daily Average Supply Amount																						
Zone 5	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238

B-3. Allong Katha System

Allong Katha WTP: Maximum Capacity = 13,900 cu m/d (incl. 3 % of treatment loss)

(Proposed)

Maximum effective capacity (Q_{max}) = 13,495 cu m/d (Q_{da} + 1.3)

Equivalent Daily average demand(Q_{da})= 10,381 cu m/d (Maximum Raw Water Supply Capacity/1.05)

(1) Daily Ave. Supply Capacity	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900
a. Allong Katha Reservoir	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900
Total	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900	10,900
(2) Daily Average Supply Amount																						
Zone 3	0	0	0	0	1,679	1,725	1,774	1,812	1,851	1,892	1,935	1,979	2,039	2,102	2,168	2,236	2,307	2,380	2,456	2,534	2,616	2,700
Zone 4	0	0	0	0	982	1,019	1,057	1,094	1,131	1,171	1,211	1,253	1,292	1,332	1,375	1,420	1,467	1,504	1,543	1,584	1,626	1,670
Zone 5	0	0	0	0	3,720	7,636	7,449	7,479	7,498	7,318	7,235	7,148	7,059	6,947	6,838	6,725	6,607	6,496	6,382	6,263	6,139	6,011
Total	0	0	0	0	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381

Plant Possible Water Supply Amount (Alternative 2)

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	
Item																							

B-1. Bang Hov Ban System
 Bang Hov Ban WTP (Proposed)
 Maximum Capacity = 21,000 cu m/d (incl. 3 % of treatment loss)
 Maximum effective capacity (Max) = 20,429 cu m/d (Qda + 1.3)
 Equivalent Daily average demand(Qda) 15,714 cu m/d (Maximum Raw Water Supply Capacity/1.05)

(1) Daily Ave. Supply Capacity

Zone	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
a. Bang Hov Ban Reservoir	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900
b. Che-Tra Reservoir	7,600	7,600	7,600	7,600	7,600	7,600	7,600	7,600	7,600	7,600	7,600	7,600	7,600	7,600	7,600	7,600	7,600	7,600	7,600	7,600	7,600	7,600
Total	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500

(2) Daily Average Supply Amount

Zone	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Zone 1	0	0	0	0	371	403	437	463	495	527	560	595	643	693	745	800	858	904	951	999	1,050	1,103
Zone 2	0	0	0	0	235	314	416	570	796	123	151	180	219	269	330	403	489	588	699	833	990	1,163
Zone 3	0	0	0	0	1,331	1,512	1,824	2,285	2,917	3,730	4,765	6,140	7,985	10,429	13,500	17,245	21,800	27,200	33,500	40,800	49,200	58,700
Zone 4	0	0	0	0	792	811	830	831	872	893	915	937	949	962	975	989	1,004	1,015	1,027	1,039	1,052	1,065
Zone 5	0	0	0	0	1,555	2,416	3,226	4,182	5,086	6,007	6,945	7,901	8,795	9,718	10,666	11,632	12,616	13,628	14,668	15,734	16,825	17,939
Total	0	0	0	0	4,332	5,457	6,804	8,604	10,725	13,073	15,714	18,614	21,814	25,314	29,114	33,214	37,614	42,314	47,314	52,614	58,214	64,114

B-3. Zone 7 System
 Zone 7 WTP (Proposed)
 Maximum Capacity = 17,600 cu m/d (incl. 3 % of treatment loss)
 Maximum effective capacity (Max) = 17,239 cu m/d (Qda + 1.3)
 Equivalent Daily average demand(Qda) 13,276 cu m/d (Maximum Water Supply Amount)

(1) Daily Ave. Supply Capacity

Zone	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
a. Khlong Lo Jung Reservoir	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400
Total	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400

(2) Daily Average Supply Amount

Zone	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Zone 5 (conveyed thru Khlong Kaha System)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

(3) Available Water for

Zone	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Thai Muang Resort	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Packet Possible Water Supply Amount (Alternative 2)

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
C-1. Possible Water Supply																						
C-1. Total of Possible Water Supply Amount.																						
Zone 1	0	0	0	0	371	403	437	465	495	527	560	595	633	673	715	800	858	904	951	999	1,050	1,103
Zone 2	0	0	0	0	285	314	346	370	396	423	451	480	519	560	603	648	695	741	789	838	890	943
Zone 3	0	0	0	0	1,679	1,725	1,774	1,812	1,851	1,892	1,935	1,979	2,029	2,102	2,188	2,236	2,307	2,380	2,456	2,534	2,615	2,700
Zone 4	0	0	0	0	982	1,019	1,057	1,094	1,131	1,171	1,211	1,253	1,292	1,332	1,375	1,420	1,467	1,516	1,545	1,584	1,625	1,670
Zone 5	11,720	12,196	18,292	18,181	27,304	27,948	28,588	29,250	29,950	30,703	31,430	32,170	33,005	33,856	34,724	35,609	36,511	37,264	38,274	39,179	40,100	41,037
Zone 6	236	240	266	294	323	354	386	407	430	453	477	501	527	574	612	651	691	730	769	810	851	893
Zone 7	0	0	0	0	3,821	4,290	4,512	4,735	4,959	5,184	5,410	5,436	5,464	5,494	5,525	5,557	5,584	5,611	5,640	5,669	5,700	
Zone 8	0	0	0	0	1,331	1,512	1,694	1,785	1,877	1,970	2,065	2,160	2,190	2,221	2,254	2,289	2,325	2,352	2,382	2,412	2,443	2,476
Zone 9	0	0	0	0	792	811	830	851	872	893	915	937	949	962	975	985	1,004	1,015	1,027	1,039	1,052	1,065
Zone 10	9,983	10,022	10,076	10,131	10,185	10,240	10,294	10,343	10,391	10,439	10,486	10,533	10,447	10,363	10,263	10,206	10,132	10,058	9,987	9,918	9,852	9,788
Zone 11	0	2,480	2,527	2,576	2,624	2,674	2,723	2,772	2,820	2,868	2,919	3,007	3,020	3,034	3,048	3,063	3,079	3,094	3,109	3,125	3,142	3,159
Total	24,938	24,938	31,182	31,182	45,875	50,821	52,437	53,710	55,004	56,322	57,662	59,026	60,076	61,161	62,281	63,436	64,626	65,747	66,891	68,079	69,291	70,533

C-2. Shortage Amount against Potential Demand ((A)-(C-1))

Zone 1	0	0	308	339	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zone 2	0	205	230	255	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zone 3	1,503	1,557	1,595	1,636	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zone 4	0	0	909	945	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zone 5	10,135	13,252	7,783	8,511	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zone 6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zone 7	0	0	2,417	2,885	3,353	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zone 8	0	0	989	1,149	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zone 9	0	0	754	773	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zone 10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zone 11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	11,638	15,014	14,944	16,494	3,353	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Phuket Possible Water Supply Amount (Alternative 2)

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
D. Water Transmission Cost																						
D-1 Bangval System																						
a. Raw Water																						
Reservoir Pumping (Khlong Ban Yai) Q _{raw} = 6,224																						
Pump Characteristics Head 50 m, Dia. 300 mm, q = 10.0 cu m/min, Motor 150 Kw, No. 3																						
No. of Operating Pump 3																						
b. Clear Water																						
For Zone 19 & 11 9,393 12,502 12,604 12,706 12,809 12,913 13,016 13,122 13,227 13,331 13,436 13,540 13,647 13,757 13,861 13,969 14,071 14,172 14,276 14,381 14,485 14,591 14,694																						
Pump Characteristics Head 120 m, Dia. 300 mm, q = 5.3 cu m/min, Motor 160 Kw, No. 3																						
(These figure shows the average characteristics of the clear water and the booster pumps.)																						
No. of Operat'g Pump 2 3																						
D-2 Khlong Naha System																						
a. Clear Water																						
For Zone 3, 4 & 5 0																						
Pump Characteristics Head 40 m, Dia. 200 mm, q = 4.2 cu m/min, Motor 40 Kw, No. 3																						
No. of Operat'g Pump 0																						
D-3 Bang Neow Ban System																						
a. Clear Water																						
For Zone 1, 2, 3 & 5 0																						
Pump Characteristics Head 40 m, Dia. 300 mm, q = 5.4 cu m/min, Motor 60 Kw, No. 2																						
No. of Operat'g Pump 0																						
D-4 Zone 7 System																						
a. Raw Water																						
From Khlong Lo Yung 0																						
Pump Characteristics Head 30 m, Dia. 300 mm, q = 5.7 cu m/min, Motor 40 Kw, No. 3																						
No. of Operat'g Pump 0																						
b. Clear Water																						
For Zone 7 & 5 0																						
Pump Characteristics Head 40 m, Dia. 300 mm, q = 5.4 cu m/min, Motor 30 Kw, No. 3																						
No. of Operat'g Pump 0																						
D-5 Energy Requirement																						
Total Output (kw) 320 480 500																						
Energy Consumption (kwh/day) 5,061 6,338 6,375 6,409 6,432 6,455 6,478 6,501 6,524 6,547 6,570 6,593 6,616 6,639 6,662 6,685 6,708 6,731 6,754 6,777 6,800 6,823 6,846																						
D-6 Energy Cost (Baht 1000)																						
Demand Charge 879 1,319 2,556																						
Energy Charge 2,272 2,816 2,862 2,872																						
Total 3,152 4,135 5,418 5,433																						
																						Total Cost
																						189,022

Phuket Possible Water Supply Amount (Alternative 2)

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Total Treatment Amount (Mgd cu y/d)	24,330	24,930	31,162	31,162	45,875	50,821	52,437	53,710	55,004	56,322	57,662	59,026	60,476	61,161	62,281	63,436	64,626	65,747	66,897	68,079	69,221	70,522
Chemical Cost (Baht 1000)	497	497	621	621	914	1,012	1,045	1,070	1,096	1,122	1,149	1,176	1,187	1,216	1,241	1,264	1,287	1,310	1,333	1,356	1,380	1,405
Total Cost																						
33,308																						

Energy Costs are based on the 1998 EPA's charge rates as follows:

- Demand Charge = Baht 229 /Kv/nc x 12 mo/year x Motor Output (Kw)
- Energy Charge = Baht 1.33 /Kwh x Energy Consumption(Kwh/day) x 365 days/year

Chemical Cost:

- Alum (Average Dosage, 5 mg/l) : Baht 4.05 /kg
- Line (Average Dosage, 2.5 mg/l) : Baht 1.25 /kg
- Cl Gas (Average Dos. 2.0 mg/l) : Baht 15.60 /kg

Phuket Possible Water Supply Amount (Alternative 3)

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	
Zone 1	0	0	308	339	371	403	437	465	495	527	560	595	643	693	745	800	858	904	951	999	1,050	1,093	
Zone 2	0	0	205	230	256	285	314	346	370	396	423	451	480	519	560	603	648	695	741	789	838	890	943
Zone 3	1,303	1,557	1,895	1,636	1,679	1,725	1,774	1,812	1,851	1,892	1,935	1,979	2,039	2,102	2,168	2,226	2,307	2,380	2,456	2,534	2,616	2,700	
Zone 4	0	0	909	945	982	1,019	1,057	1,094	1,131	1,171	1,211	1,253	1,292	1,332	1,375	1,420	1,467	1,504	1,543	1,584	1,626	1,670	
Zone 5	21,855	25,148	26,054	26,673	27,304	27,948	28,604	29,290	29,990	30,703	31,430	32,170	33,005	33,956	34,724	35,609	36,511	37,384	38,274	39,179	40,100	41,037	
Zone 6	236	240	265	294	323	354	386	407	430	453	477	501	527	554	581	609	637	665	693	720	748	775	
Zone 7	0	0	2,417	2,685	3,053	3,021	4,290	4,512	4,735	4,959	5,184	5,410	5,436	5,464	5,494	5,525	5,557	5,564	5,611	5,640	5,665	5,700	
Zone 8	0	0	969	1,149	1,331	1,512	1,694	1,785	1,877	1,970	2,065	2,160	2,221	2,254	2,254	2,259	2,325	2,353	2,352	2,412	2,443	2,476	
Zone 9	0	0	734	773	792	811	830	851	872	893	915	937	949	962	975	989	1,004	1,004	1,015	1,027	1,033	1,065	
Zone 10	9,983	10,022	10,076	10,131	10,185	10,240	10,294	10,343	10,391	10,438	10,485	10,533	10,447	10,365	10,283	10,205	10,132	10,058	9,987	9,918	9,852	9,788	
Zone 11	0	2,480	2,527	2,576	2,624	2,674	2,723	2,779	2,836	2,892	2,949	3,007	3,020	3,034	3,048	3,063	3,079	3,094	3,109	3,125	3,142	3,159	
Total	36,577	39,952	46,106	47,656	49,228	50,821	52,437	53,710	55,004	56,322	57,662	59,026	60,076	61,161	62,281	63,436	64,626	65,747	66,897	68,079	69,291	70,533	

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Zone 1	0	0	400	440	482	524	568	605	644	685	728	774	835	900	969	1,041	1,116	1,175	1,236	1,299	1,365	1,432
Zone 2	0	267	299	333	370	409	450	482	515	550	586	624	673	729	784	843	903	963	1,025	1,090	1,156	1,225
Zone 3	1,354	2,024	2,074	2,127	2,183	2,243	2,307	2,355	2,406	2,460	2,515	2,573	2,631	2,733	2,818	2,907	3,000	3,094	3,193	3,295	3,401	3,510
Zone 4	0	0	1,181	1,228	1,276	1,325	1,374	1,422	1,471	1,522	1,574	1,629	1,679	1,732	1,787	1,846	1,907	1,956	2,005	2,055	2,114	2,171
Zone 5	32,311	33,083	33,870	34,675	35,495	36,332	37,185	38,077	38,986	39,914	40,859	41,821	42,806	44,013	45,141	46,292	47,464	48,600	49,756	50,933	52,130	53,349
Zone 6	307	312	346	382	420	460	501	530	559	589	620	651	698	746	795	846	898	940	1,000	1,053	1,106	1,161
Zone 7	0	0	3,142	3,750	4,359	4,968	5,578	6,156	6,739	7,333	7,933	8,539	9,167	9,804	10,442	11,082	11,725	12,359	12,994	13,631	14,270	14,910
Zone 8	0	0	1,260	1,494	1,730	1,966	2,203	2,321	2,441	2,562	2,684	2,808	2,846	2,987	2,930	2,975	3,023	3,059	3,097	3,136	3,176	3,219
Zone 9	0	0	980	1,004	1,029	1,054	1,079	1,105	1,133	1,161	1,218	1,234	1,250	1,267	1,286	1,305	1,320	1,335	1,351	1,367	1,384	1,401
Zone 10	12,977	13,009	13,039	13,170	13,241	13,312	13,383	13,446	13,509	13,571	13,632	13,693	13,581	13,472	13,368	13,268	13,172	13,075	12,983	12,894	12,807	12,725
Zone 11	0	3,254	3,286	3,318	3,412	3,476	3,541	3,613	3,686	3,760	3,834	3,909	3,926	3,944	3,962	3,982	4,002	4,022	4,042	4,062	4,084	4,107
Total	47,549	51,938	59,938	61,953	63,996	66,068	68,168	69,822	71,506	73,218	74,961	76,734	78,099	80,965	82,466	84,011	85,471	86,967	88,502	90,078	91,693	

Phuket Possible Water Supply Amount (Alternative 3)

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
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B. Water Sources Available (Daily average supply capacity = 105 % of daily average demand)

B-1. Bangwat System

Bangwat WTP: Maximum Capacity = 24,000 cu m/d (incl. 3 % of treatment loss)
 Maximum effective capacity (Qmax) = 23,301 cu m/d
 (Exis.)
 Equivalent Daily average demand(Qda) = 17,924 cu m/d (Qmax/1.3)

(1) Daily Ave. Supply Capacity	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	
a. Bangwat Reservoir	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700	11,700
b. Bang Tho Song Reservoir																							
c. Temporary Pumping	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224
Total	11,700	11,700	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924

(2) Daily Average Supply Amount

Zone 6	236	240	265	294	323	354	385	407	430	453	477	501	527	574	612	651	691	730	769	810	851	893
Zone 10	9,953	10,022	10,076	10,131	10,185	10,240	10,294	10,343	10,391	10,439	10,486	10,533	10,447	10,363	10,283	10,205	10,132	10,058	9,987	9,918	9,852	9,788
Zone 11	0	2,480	2,527	2,576	2,624	2,674	2,723	2,779	2,835	2,892	2,949	3,007	3,020	3,034	3,048	3,063	3,079	3,094	3,109	3,125	3,142	3,159
Zone 5	1,461	(1,042)	5,054	4,923	4,791	4,657	4,521	4,394	4,267	4,139	4,011	3,883	3,820	3,653	3,481	4,004	4,022	4,043	4,059	4,071	4,079	4,083
Total	11,700	11,700	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924	17,924

B-2. Phuket Municipality System

Phuket WTP: Maximum Capacity = 17,700 cu m/d (incl. 3 % of treatment loss)
 Maximum effective capacity (Qmax) = 17,210 cu m/d (Qda + 1.3)
 (Exis.)
 Equivalent Daily average demand(Qda) = 13,238 cu m/d (Maximum Raw Water Supply Capacity/1.05)

(1) Daily Ave. Supply Capacity	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	
a. Mining Pits	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900
Total	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900	13,900

(2) Daily Average Supply Amount

Zone 5	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238	13,238
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B-3. Khlong Katha System

Khlong Katha WTP: Maximum Capacity = 13,900 cu m/d (incl. 3 % of treatment loss)
 Maximum effective capacity (Qmax) = 13,495 cu m/d (Qda + 1.3)
 (Proposed)
 Equivalent Daily average demand(Qda) = 10,381 cu m/d (Maximum Raw Water Supply Capacity/1.05)

(1) Daily Ave. Supply Capacity	10,300	10,300	10,300	10,300	10,300	10,300	10,300	10,300	10,300	10,300	10,300	10,300	10,300	10,300	10,300	10,300	10,300	10,300	10,300	10,300	10,300	10,300	
a. Khlong Katha Reservoir	10,300	10,300	10,300	10,300	10,300	10,300	10,300	10,300	10,300	10,300	10,300	10,300	10,300	10,300	10,300	10,300	10,300	10,300	10,300	10,300	10,300	10,300	10,300
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

(2) Daily Average Supply Amount

Zone 3	0	0	0	0	1,679	1,725	1,774	1,812	1,851	1,892	1,935	1,979	2,039	2,102	2,168	2,236	2,307	2,380	2,456	2,534	2,615	2,700
Zone 4	0	0	0	0	382	1,019	1,057	1,094	1,131	1,171	1,211	1,253	1,292	1,332	1,375	1,420	1,467	1,504	1,543	1,584	1,626	1,670
Zone 5	0	0	0	0	7,720	7,636	7,549	7,475	7,398	7,318	7,236	7,148	7,050	6,947	6,838	6,725	6,607	6,485	6,358	6,226	6,090	5,951
Total	0	0	0	0	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381

Phuket Possible Water Supply Amount (Alternative 3)

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
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8-4. Bang Neow Dam System

Maximum Capacity = 21,000 cu m/d (incl. 3 x of treatment loss)
 Bang Neow Dam WTP: Maximum effective capacity (Q_{max}) = 20,429 cu m/d (Q_{da} + 1.3)
 (Proposed) Equivalent daily average demand(Q_{da}) 15,714 cu m/d (Maximum Raw Water Supply Capacity/1.05)

(1) Daily Ave. Supply Capacity

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
a. Bang Neow Dam Reservoir	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900
b. Che Tra Reservoir	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900	8,900

(2) Daily Average Supply Amount

Zone 1	0	0	0	0	371	403	437	465	495	527	560	595	643	693	745	800	855	904	951	999	1,050	1,103
Zone 2	0	0	0	0	285	314	346	370	396	423	451	480	519	560	603	648	695	741	789	838	890	943
Zone 8	0	0	0	0	1,331	1,512	1,694	1,785	1,877	1,970	2,065	2,160	2,221	2,354	2,499	2,625	2,753	2,882	2,992	3,112	3,243	3,475
Zone 9	0	0	0	0	792	811	830	851	872	893	915	937	949	962	975	989	1,004	1,015	1,027	1,039	1,052	1,065
Zone 5	0	0	0	0	5,699	5,435	5,169	5,004	4,836	4,663	4,485	4,304	4,176	4,041	3,899	3,750	3,602	3,452	3,302	3,156	3,020	2,899
Total	0	0	0	0	8,476	8,476	8,476	8,476	8,476	8,476	8,476	8,476	8,476	8,476	8,476	8,476	8,476	8,476	8,476	8,476	8,476	8,476

8-5. Zone 7 System

Maximum Capacity = 17,600 cu m/d (incl. 3 x of treatment loss)
 Zone 7 WTP: Maximum effective capacity (Q_{max}) = 17,259 cu m/d (Q_{da} + 1.3)
 (Proposed) Equivalent daily average demand(Q_{da}) 13,276 cu m/d (Maximum Water Supply Amount)

(1) Daily Ave. Supply Capacity

a. Shlong Lo Yung Reservoir	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400
Total	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400

(2) Daily Average Supply Amount

Zone 7	0	0	0	0	0	3,821	4,290	4,512	4,735	4,959	5,184	5,410	5,436	5,464	5,494	5,525	5,557	5,581	5,611	5,640	5,669	5,700
Zone 5 (conveyed thru Khlong Kaha System)	0	0	0	0	0	(3,013)	(1,872)	(822)	250	1,344	2,459	3,597	4,621	5,677	6,768	7,751	1,812	2,906	4,023	5,162	6,364	7,575
Total	0	0	0	0	0	802	2,418	3,690	4,985	6,303	7,643	9,007	10,057	11,142	12,262	13,276	7,369	8,489	9,640	10,821	12,033	13,276

(3) Available Water for

Tha Kuang Resort	0	0	0	0	0	20,498	18,982	17,710	16,415	15,097	13,757	12,493	11,243	10,258	9,438	8,624	7,831	7,061	6,324	5,620	4,949	4,311
Total	0	0	0	0	0	20,498	18,982	17,710	16,415	15,097	13,757	12,493	11,243	10,258	9,438	8,624	7,831	7,061	6,324	5,620	4,949	4,311

Plant Possible Water Supply Amount (Alternative 3)

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
C-1. Total of Possible Water Supply Amount																						
Zone 1	0	0	0	0	371	403	437	465	495	527	560	595	643	693	745	800	858	904	951	999	1,050	1,103
Zone 2	0	0	0	0	285	314	346	370	396	423	451	480	519	560	603	648	695	741	789	836	880	943
Zone 3	0	0	0	0	1,679	1,725	1,774	1,812	1,851	1,892	1,935	1,979	2,029	2,102	2,168	2,236	2,307	2,380	2,456	2,534	2,616	2,700
Zone 4	0	0	0	0	982	1,019	1,057	1,094	1,131	1,171	1,211	1,253	1,292	1,332	1,375	1,420	1,467	1,504	1,545	1,584	1,626	1,670
Zone 5	14,760	12,196	18,292	18,161	31,448	27,918	28,604	29,280	29,990	30,703	31,430	32,170	33,005	33,895	34,724	35,463	36,531	37,384	38,274	39,179	40,100	41,037
Zone 6	236	210	266	294	323	354	386	407	430	453	477	501	527	574	612	651	691	730	769	810	851	893
Zone 7	0	0	0	0	0	3,821	4,290	4,512	4,735	4,959	5,184	5,410	5,436	5,464	5,494	5,525	5,557	5,584	5,611	5,640	5,669	5,700
Zone 8	0	0	0	0	1,331	1,512	1,694	1,785	1,877	1,970	2,065	2,160	2,190	2,221	2,254	2,289	2,325	2,353	2,382	2,412	2,445	2,476
Zone 9	0	0	0	0	792	811	830	851	872	893	915	937	949	962	975	989	1,004	1,015	1,027	1,039	1,052	1,065
Zone 10	9,983	10,022	10,076	10,131	10,185	10,240	10,294	10,343	10,391	10,439	10,486	10,533	10,447	10,363	10,283	10,206	10,132	10,058	9,987	9,916	9,852	9,788
Zone 11	0	2,480	2,527	2,576	2,624	2,674	2,723	2,779	2,836	2,892	2,949	3,003	3,050	3,094	3,046	3,063	3,079	3,094	3,109	3,125	3,142	3,159
Total	24,938	24,938	31,162	31,162	50,819	50,821	52,437	53,710	55,004	56,322	57,652	59,026	60,076	61,161	62,281	63,295	64,626	65,747	66,807	68,079	69,391	70,533

C-2. Shortage Amount against Potential Demand [(A)-(C-1)]																						
Zone 1	0	0	0	388	339	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zone 2	0	205	230	256	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zone 3	1,503	1,557	1,595	1,636	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zone 4	0	0	909	945	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zone 5	10,135	13,252	7,763	8,511	(4,144)	0	0	0	0	0	0	0	0	0	0	141	0	0	0	0	0	0
Zone 6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zone 7	0	0	2,417	2,885	3,353	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zone 8	0	0	969	1,149	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zone 9	0	0	354	773	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zone 10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zone 11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	11,638	15,014	14,944	16,434	(792)	0	0	0	0	0	0	0	0	0	0	141	0	0	0	0	0	0

Phuket Possible Water Supply Amount (Alternative 3)

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
D- Water Transmission Cost																						
D-1 Banphat System																						
a. Raw Water																						
Temporary Pumping (Khlong Ban Yai) Qmax	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	6,224	0
Pump Characteristics	50 m, Dia.	300 mm, q =	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	0
No. of Operating Pump	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	0
b. Clear Water																						
for zone 10 & 11	9,993	12,502	12,664	12,766	12,809	12,911	13,018	13,122	13,227	13,331	13,436	13,540	13,647	13,757	13,869	13,986	14,106	14,229	14,356	14,486	14,619	14,757
Pump Characteristics	120 m, Dia.	300 mm, q =	5.4 cu m/min,	Motor	150 Kw, No.	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
No. of Operat'g Pump	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
D-2 Khlong Iatka System																						
a. Clear Water																						
for zone 3, 4 & 5	0	0	0	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381	10,381
Pump Characteristics	40 m, Dia.	200 mm, q =	4.2 cu m/min,	Motor	40 Kw, No.	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
No. of Operat'g Pump	0	0	0	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
D-3 Bang Neow Dam System																						
a. Clear Water																						
for zone 1, 2, 9 & 5	0	0	0	8,476	8,476	8,476	8,476	8,476	8,476	8,476	8,476	8,476	8,476	8,476	8,476	8,476	8,476	8,476	8,476	8,476	8,476	8,476
Pump Characteristics	40 m, Dia.	300 mm, q =	6.4 cu m/min,	Motor	60 Kw, No.	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
No. of Operat'g Pump	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
D-4 Zone 7 System																						
a. Raw Water																						
From Khlong Lo Yang	0	0	0	0	0	842	2,539	3,875	5,235	6,618	8,025	9,457	10,950	11,699	12,695	13,940	14,737	15,614	16,522	17,463	18,435	19,440
Pump Characteristics	30 m, Dia.	300 mm, q =	5.7 cu m/min,	Motor	40 Kw, No.	0	0	0	0	1	2	2	2	3	3	3	2	2	2	2	2	3
No. of Operat'g Pump	0	0	0	0	0	0	0	1	1	1	2	2	2	3	3	3	2	2	2	2	2	3
b. Clear Water																						
for zone 7 & 5	0	0	0	0	0	802	2,418	3,699	4,995	6,303	7,643	9,007	10,397	11,422	12,262	13,276	13,969	14,640	15,321	16,021	16,753	17,516
Pump Characteristics	40 m, Dia.	300 mm, q =	5.4 cu m/min,	Motor	50 Kw, No.	0	0	0	0	1	1	2	2	2	3	3	2	2	2	2	2	3
No. of Operat'g Pump	0	0	0	0	0	0	0	1	1	1	2	2	2	3	3	3	2	2	2	2	2	3
D-5 Energy Requirement																						
Total Output (kw)	320	480	930	930	1,170	1,170	1,260	1,260	1,260	1,260	1,350	1,350	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440
Energy Consumption (kwh/day)	5,651	6,358	6,375	6,409	10,377	10,856	10,992	11,685	12,389	13,106	13,665	13,755	14,266	14,101	14,513	15,077	14,293	14,821	15,363	15,922	16,517	17,139
D-6 Energy Cost (Baht 1000)																						
Demand Charge	879	1,319	2,556	2,556	3,215	3,215	3,462	3,462	3,462	3,462	3,710	3,710	3,710	3,957	3,957	3,957	3,957	3,957	3,957	3,957	3,957	3,957
Energy Charge	2,272	2,816	2,862	2,878	4,639	4,874	4,933	5,246	5,552	5,884	6,266	6,180	6,405	6,330	6,561	6,709	6,417	6,654	6,897	7,148	7,403	7,656
Total	3,152	4,165	5,418	5,433	7,874	8,089	8,397	8,708	9,025	9,346	9,976	9,890	10,115	10,388	10,518	10,726	10,392	10,528	10,772	11,023	11,365	11,753
																						Total Cost

Phuket Possible Water Supply Amount (Alternative 3)

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	
Loss																							
E. Treatment Chemical Cost																							
Total Treatment Amount (Qds cu m/d)																							
	24,338	24,338	31,162	31,162	50,019	50,021	52,137	53,710	54,804	55,322	54,652	59,026	60,075	61,161	62,281	62,295	64,626	65,747	66,297	68,079	69,231	70,533	
Chemical Cost (Bath 1000)	497	497	621	621	996	1,012	1,045	1,070	1,095	1,122	1,149	1,176	1,197	1,218	1,241	1,261	1,287	1,310	1,333	1,356	1,380	1,405	
																						Total Cost	23,888

Energy Costs are based on the 1988 EPA's charge rates as follows:

- Desand Charge = Bath 229 /M³/40 x 12 mo/year x Motor Output (Kw)
- Energy Charge = Bath 1.21 /Kwh x Energy Consumption(Kwh/d) x 365 days/year

Chemical Cost

- Alum (Average Dosage, 5 mg/l) : Bath 4.05 /kg
- Line (Average Dosage, 2.5 mg/l) : Bath 1.25 /kg
- Cl₂ Gas (Average Dos. 2.0 mg/l) : Bath 15.60 /kg

APPENDIX A-11-1

Details of Dam Construction Cost Estimates

Table All-1-1 Breakdown of Dam Construction Cost

Location : Bang Tho Sung

Description	Quantity	Unit	Foreign Currency		Local Currency		Total Amount *1,000B
			Unit Cost	Amount *1,000B	Unit Cost	Amount *1,000B	
1. Site Cleaning	9 (30ha*30%)	ha	0	0	8,000	72	72
2. Excavation							
a) Normal Soil	783,000	m ³	11	8,769	4	3,288	
b) Rock	335,000	m ³	84	28,140	30	10,083	
Sub-Total				36,909		13,371	50,280
3. Embankment							
a) Core	539,000	m ³	28	15,092	11	6,036	
b) Filter Zone	283,000	m ³	118	33,478	277	78,249	
c) Transition	924,000	m ³	45	42,688	9	8,408	
d) Rock	821,000	m ³	123	101,147	21	17,241	
e) Miscellaneous	(a+b+c+d)*20%			38,481		21,986	362,806
Sub-Total				230,886		131,920	
4. Foundation							
a) Treatment	4,500	m	1,183	5,324	322	1,449	
b) Miscellaneous	a*20%			1,064		289	
Sub-Total				6,388		1,738	8,126
5. Spillway, Intake							
a) Structure	14	m ³ /s	3,549,000	50,396	1,911,000	27,136	
b) Miscellaneous	a*20%			10,079		5,427	
Sub-Total				60,475		32,563	93,038
6. Grand Total				334,657		179,664	514,321

Location : Khlong Katha

Description	Quantity	Unit	Foreign Currency		Local Currency		Total Amount #1,000B
			Unit Cost	Amount #1,000B	Unit Cost	Amount #1,000B	
1. Site Cleaning	8 (40ha*20%)	ha	0	0	5,600	45	45
2. Excavation							
a) Normal Soil	287,000	m ³	11	3,214	4	1,205	
b) Rock	123,000	m ³	84	10,332	30	3,702	
Sub-Total				13,546		4,908	18,454
3. Embankment							
a) Core	472,500	m ³	28	13,230	11	5,292	
b) Filter Zone	247,500	m ³	119	29,453	277	68,607	
c) Transition	810,000	m ³	46	37,422	9	7,371	
d) Rock	720,000	m ³	123	88,704	21	15,120	
e) Miscellaneous	(a+b+c+d)*20%			33,761		19,278	
Sub-Total				202,570		115,668	318,238
4. Foundation							
a) Treatment	5,600	m	1,183	6,625	322	1,803	
b) Miscellaneous	a*20%			1,324		360	
Sub-Total				7,949		2,163	10,112
5. Spillway, Intake							
a) Structure	17	m ³ /s	3,549,000	61,043	1,911,000	32,869	
b) Miscellaneous	a*20%			12,208		6,573	
Sub-Total				73,251		39,442	112,693
6. Grand Total				297,316		162,226	459,541

Location : Bang Nieo Dam

Description	Quantity	Unit	Foreign Currency		Local Currency		Total Amount *1,000B
			Unit Cost	Amount *1,000B	Unit Cost	Amount *1,000B	
1. Site Cleaning	25	ha	0	0	5,600	140	140
	(50ha*50%)						
2. Excavation							
a) Normal Soil	502,000	m ³	11	5,622	4	2,108	
b) Rock	215,000	m ³	84	18,060	30	6,471	
Sub-Total				23,682		8,579	32,261
3. Embankment							
a) Embankment	1,127,000	m ³	38	42,600	32	36,289	
e) Miscellaneous	a*20%			8,520		7,257	
Sub-Total				51,120		43,546	94,666
4. Foundation							
a) Treatment	6,000	m	1,183	7,098	322	1,932	
b) Miscellaneous	a*20%			1,419		386	
Sub-Total				8,517		2,318	10,835
5. Spillway, Intake							
a) Structure	17	m ³ /s	3,549,000	61,042	1,911,000	32,869	
b) Miscellaneous	a*20%			12,208		6,573	
Sub-Total				73,250		39,442	112,692
6. Grand Total				156,569		94,025	250,594

Location : Khao Che Tra

Description	Quantity	Unit	Foreign Currency		Local Currency		Total Amount #1,000B
			Unit Cost	Amount #1,000B	Unit Cost	Amount #1,000B	
1. Site Cleaning	18 (60ha*30%)	ha	0	0	8,000	144	144
2. Excavation							
1) Main Dam							
a) Normal Soil	220,500	m3	11	2,470	4	926	
b) Rock	94,500	m3	84	7,938	30	2,844	
Sub-Total				10,408		3,770	14,178
2) Saddle Dam							
a) Normal Soil	21,350	m3	11	239	4	89	
b) Rock	9,150	m3	84	768	30	275	
Sub-Total				1,007		364	1,371
Total				11,415		4,134	14,196
3. Embankment							
1) Main Dam							
a) Core	684,000	m3	28	19,152	11	7,660	
b) Filter Zone	60,800	m3	118	7,192	277	16,811	
c) Transition	0	m3	46	0	9	0	
d) Rock	15,200	m3	123	1,872	21	319	
e) Miscellaneous (a+b+c+d)*20%				5,643		4,958	
Sub-Total				33,859		29,748	63,607
2) Saddle Dam							
a) Core	34,700	m3	28	971	11	388	
b) Filter Zone	3,100	m3	118	366	277	857	
c) Transition	0	m3	46	0	9	0	
d) Rock	700	m3	123	86	21	14	
e) Miscellaneous (a+b+c+d)*20%				284		251	
Sub-Total				1,707		1,510	3,217
Total				35,566		31,258	66,824
4. Foundation							
a) Treatment	8,100	m	1,183	9,582	322	2,608	
b) Miscellaneous a*20%				1,916		521	
Sub-Total				11,498		3,129	14,627
5. Spillway, Intake							
a) Structure	14	m3/s	3,549,000	50,396	1,911,000	27,136	
b) Miscellaneous a*20%				10,079		5,427	
Sub-Total				60,475		32,563	93,038
6. Grand Total				118,953		71,228	190,182

Location : Khlong Lo Young

Description	Quantity	Unit	Foreign Currency		Local Currency		Total Amount #1,000B
			Unit Cost	Amount #1,000B	Unit Cost	Amount #1,000B	
1. Site Cleaning	120 (120*100%)	ha	-	0	5,600	672	672
2. Excavation							
a) Normal Soil	735,000	m3	11	8,232	4	3,087	
b) Rock	315,000	m3	84	26,460	30	9,482	
Sub-Total				34,692		12,569	47,261
3. Embankment							
a) Core	393,000	m3	28	11,004	11	4,402	
b) Filter Zone	206,000	m3	118	24,370	277	56,959	
c) Transition	674,000	m3	46	31,139	9	6,133	
d) Rock	599,000	m3	123	73,797	21	12,579	
e) Miscellaneous (a+b+c+d)*20%				28,061		16,014	264,457
Sub-Total				168,370		96,087	
4. Foundation							
a) Treatment	6,100	m	1,183	7,216	322	1,964	
b) Miscellaneous a*20%				1,443		392	
Sub-Total				8,659		2,356	11,016
5. Spillway, Intake							
a) Structure	23	m3/s	3,549,000	81,982	1,911,000	44,144	
b) Miscellaneous a*20%				16,396		8,828	
Sub-Total				98,378		52,972	151,350
6. Grand Total				310,100		164,656	474,755

APPENDIX A-17-1

Alternatives for Debt Service, Cash Flow
and Unit Cost of Water

Table A17-1-1 Debt Services (Alternative 1)

(Unit : Baht x 1000)

Year	Capital	Interest	Total annual repayment	Balance of Capital
1990	0	4,393	4,393	62,751
1991	0	9,420	9,420	134,578
1992	0	11,145	11,145	159,212
1993	0	13,061	13,061	186,583
1994	0	26,009	26,009	371,557
1995	14,786	51,969	66,755	742,417
1996	15,821	63,946	79,767	913,517
1997	16,928	62,839	79,767	897,696
1998	18,113	61,654	101,923	880,768
1999	19,381	60,386	101,923	862,654
2000	42,894	59,029	101,923	843,273
2001	45,896	56,027	101,923	800,379
2002	49,109	52,814	101,923	754,483
2003	52,546	49,376	101,923	705,374
2004	56,225	45,698	101,923	652,828
2005	60,160	41,762	101,923	596,603
2006	64,372	37,551	101,923	536,442
2007	68,878	33,045	101,923	472,071
2008	73,699	28,224	101,923	403,193
2009	78,858	23,065	101,923	329,494
2010	43,583	17,544	61,128	250,636
2011	46,634	14,494	61,128	207,052
2012	49,898	11,229	61,128	160,418
2013	53,391	7,736	61,128	110,520
2014	57,129	3,999	61,128	57,129
Total	928,303.0	846,413.9	1,819,027.9	

Table A17-1-2 Debt Services (Alternative 2)
for Foreign Portion

(Unit : Baht x 1000)

Year	Capital	Interest	Total Annual Repayment	Balance of Capital
1990	0	66	66	2,431
1991	0	82	82	3,039
1992	0	525	525	19,448
1993	0	1,017	1,017	37,680
1994	0	4,387	4,387	162,471
1995	0	11,142	11,142	412,664
1996	0	14,528	14,528	538,063
1997	0	14,528	14,528	538,063
1998	0	14,528	14,528	538,063
1999	0	14,528	14,528	538,063
2000	20,643	14,528	35,171	538,063
2001	21,200	13,970	35,171	517,420
2002	21,773	13,398	35,171	496,220
2003	22,361	12,810	35,171	474,447
2004	22,964	12,206	35,171	452,087
2005	23,584	11,586	35,171	429,122
2006	24,221	10,950	35,171	405,538
2007	24,875	10,296	35,171	381,317
2008	25,547	9,624	35,171	356,442
2009	26,236	8,934	35,171	330,895
2010	26,945	8,226	35,171	304,659
2011	27,672	7,498	35,171	277,714
2012	28,420	6,751	35,171	250,041
2013	29,187	5,984	35,171	221,622
2014	29,975	5,196	35,171	192,435
2015	30,784	4,386	35,171	162,460
2016	31,615	3,555	35,171	131,676
2017	32,469	2,702	35,171	100,061
2018	33,346	1,825	35,171	67,592
2019	34,246	925	35,171	34,246
Total	538,063	240,679	778,742	

Table A17-1-2 Debt Services (Alternative 2)
for Local Portion

(Unit : Baht x 1000)

Year	Capital	Interest	Total Annual Repayment	Balance of Capital
1990	0	4,222	4,222	60,320
1991	0	9,208	9,208	131,539
1992	0	9,783	9,783	139,764
1993	0	10,423	10,423	148,903
1994	0	14,636	14,636	209,086
1995	8,320	23,083	31,403	329,753
1996	8,903	26,734	35,637	381,920
1997	9,526	26,111	35,637	373,017
1998	10,193	25,444	42,846	363,490
1999	10,906	24,731	42,846	353,297
2000	18,879	23,967	42,846	342,391
2001	20,200	22,646	42,846	323,512
2002	21,614	21,232	42,846	303,312
2003	23,127	19,719	42,846	281,697
2004	24,746	18,100	42,846	258,570
2005	26,479	16,368	42,846	233,823
2006	28,332	14,514	42,846	207,345
2007	30,315	12,531	42,846	179,013
2008	32,437	10,409	42,846	148,697
2009	34,708	8,138	42,846	116,260
2010	14,181	5,709	19,890	81,552
2011	15,174	4,716	19,890	67,371
2012	16,236	3,654	19,890	52,197
2013	17,372	2,517	19,890	35,961
2014	18,589	1,301	19,890	18,589
Total	390,240	359,896	764,554	

Table A17-1-2 Debt Services (Alternative 2)

(Unit : Baht x 1000)

Year	Capital	Interest	Total Annual Repayment	Balance of Capital
1990	0	4,288	4,288	62,751
1991	0	9,290	9,290	134,578
1992	0	10,309	10,309	159,212
1993	0	11,441	11,441	186,583
1994	0	19,023	19,023	371,557
1995	8,320	34,225	42,545	742,417
1996	8,903	41,262	50,165	919,983
1997	9,526	40,639	50,165	911,080
1998	10,193	39,972	57,374	901,553
1999	10,906	39,259	57,374	891,360
2000	39,522	38,495	78,017	880,454
2001	41,401	36,616	78,017	840,932
2002	43,387	34,630	78,017	799,531
2003	45,488	32,529	78,017	756,144
2004	47,711	30,306	78,017	710,656
2005	50,063	27,954	78,017	662,946
2006	52,553	25,464	78,017	612,883
2007	55,190	22,826	78,017	560,330
2008	57,984	20,033	78,017	505,139
2009	60,945	17,072	78,017	447,155
2010	41,126	13,934	55,060	386,210
2011	42,846	12,214	55,060	345,085
2012	44,655	10,405	55,060	302,238
2013	46,559	8,501	55,060	257,583
2014	48,563	6,497	55,060	211,024
2015	30,784	4,386	35,171	162,460
2016	31,615	3,555	35,171	131,676
2017	32,469	2,702	35,171	100,061
2018	33,346	1,825	35,171	67,592
2019	34,246	925	35,171	34,246
Total	928,303	600,576	1,543,296	

Table A17-1-3 Debt Services (Alternative 3)
for Foreign Portion

(Unit : Baht x 1000)

Year	Capital	Interest	Total Annual Repayment	Balance of Capital
1990	0	66	66	2,431
1991	0	82	82	3,039
1992	0	525	525	19,448
1993	0	1,017	1,017	37,680
1994	0	4,387	4,387	162,471
1995	0	11,142	11,142	412,664
1996	0	14,528	14,528	538,063
1997	0	14,528	14,528	538,063
1998	0	14,528	14,528	538,063
1999	0	14,528	14,528	538,063
2000	20,643	14,528	35,171	538,063
2001	21,200	13,970	35,171	517,420
2002	21,773	13,398	35,171	496,220
2003	22,361	12,810	35,171	474,447
2004	22,964	12,206	35,171	452,087
2005	23,584	11,586	35,171	429,122
2006	24,221	10,950	35,171	405,538
2007	24,875	10,296	35,171	381,317
2008	25,547	9,624	35,171	356,442
2009	26,236	8,934	35,171	330,895
2010	26,945	8,226	35,171	304,659
2011	27,672	7,498	35,171	277,714
2012	28,420	6,751	35,171	250,041
2013	29,187	5,984	35,171	221,622
2014	29,975	5,196	35,171	192,435
2015	30,784	4,386	35,171	162,460
2016	31,615	3,555	35,171	131,676
2017	32,469	2,702	35,171	100,061
2018	33,346	1,825	35,171	67,592
2019	34,246	925	35,171	34,246
Total	1538,063	240,679	778,742	

Table A17-1-3 Debt Services (Alternative 3)
for Local Portion

(Unit : Baht x 1000)

Year	Capital	Interest	Total Annual Repayment	Balance of Capital
1990	0	3,318	3,318	30,160
1991	0	7,235	7,235	65,770
1992	0	7,687	7,687	69,882
1993	4,179	8,190	12,369	74,452
1994	4,639	11,040	15,679	100,364
1995	5,149	17,166	22,315	156,059
1996	11,396	19,927	31,323	181,153
1997	12,650	18,673	31,323	169,757
1998	14,041	17,282	31,323	157,107
1999	17,394	15,737	33,132	143,066
2000	19,308	13,824	33,132	125,672
2001	21,432	11,700	33,132	106,364
2002	23,789	9,343	33,132	84,932
2003	14,540	6,726	21,266	61,143
2004	16,139	5,126	21,266	46,603
2005	17,915	3,351	21,266	30,464
2006	3,755	1,380	5,135	12,549
2007	4,168	967	5,135	8,794
2008	4,626	509	5,135	4,626
Total	195,120	179,181	374,301	

Table A17-1-3 Debt Services (Alternative 3)

(Unit : Baht x 1000)

Year	Capital	Interest	Total Annual Repayment	Balance of Capital
1990	0	3,383	3,383	32,591
1991	0	7,317	7,317	68,809
1992	0	8,212	8,212	89,330
1993	4,179	9,207	13,386	112,132
1994	4,639	15,427	20,065	262,835
1995	5,149	28,308	33,457	568,723
1996	11,396	34,455	45,851	719,216
1997	12,650	33,201	45,851	707,820
1998	14,041	31,809	45,851	695,170
1999	17,394	30,265	47,659	681,129
2000	39,951	28,352	68,302	663,735
2001	42,632	25,670	68,302	623,784
2002	45,562	22,740	68,302	581,152
2003	36,900	19,536	56,436	535,590
2004	39,104	17,333	56,436	498,690
2005	41,499	14,937	56,436	459,586
2006	27,976	12,330	40,306	418,087
2007	29,043	11,263	40,306	390,111
2008	30,173	10,133	40,306	361,068
2009	26,236	8,934	35,171	330,895
2010	26,945	8,226	35,171	304,659
2011	27,672	7,498	35,171	277,714
2012	28,420	6,751	35,171	250,041
2013	29,187	5,984	35,171	221,622
2014	29,975	5,196	35,171	192,435
2015	30,784	4,386	35,171	162,460
2016	31,615	3,555	35,171	131,676
2017	32,469	2,702	35,171	100,061
2018	33,346	1,825	35,171	67,592
2019	34,246	925	35,171	34,246
Total	733,183	419,860	1,153,043	

Table A17-1-4 Debt Services (Alternative 4)
for Foreign Portion

(Unit : Baht x 1000)

Year	Capital	Interest	Total Annual Repayment	Balance of Capital
1990	0	94	94	3,473
1991	0	117	117	4,342
1992	0	750	750	27,783
1993	0	1,453	1,453	53,829
1994	0	6,267	6,267	232,102
1995	0	15,917	15,917	589,521
1996	0	20,754	20,754	768,662
1997	0	20,754	20,754	768,662
1998	0	20,754	20,754	768,662
1999	0	20,754	20,754	768,662
2000	29,490	20,754	50,244	768,662
2001	30,286	19,958	50,244	739,172
2002	31,104	19,140	50,244	708,886
2003	31,944	18,300	50,244	677,782
2004	32,806	17,438	50,244	645,838
2005	33,692	16,552	50,244	613,032
2006	34,602	15,642	50,244	579,340
2007	35,536	14,708	50,244	544,739
2008	36,495	13,748	50,244	509,203
2009	37,481	12,763	50,244	472,708
2010	38,493	11,751	50,244	435,227
2011	39,532	10,712	50,244	396,734
2012	40,599	9,644	50,244	357,202
2013	41,696	8,548	50,244	316,603
2014	42,821	7,423	50,244	274,907
2015	43,977	6,266	50,244	232,086
2016	45,165	5,079	50,244	188,109
2017	46,384	3,859	50,244	142,944
2018	47,637	2,607	50,244	96,560
2019	48,923	1,321	50,244	48,923
Total	1,768,662	343,828	1,112,490	

Table A17-1-4 Debt Services (Alternative 4)
for Local Portion

(Unit : Baht x 1000)

Year	Capital	Interest	Total Annual Repayment	Balance of Capital
1990	0	3,260	3,260	29,639
1991	0	7,163	7,163	65,118
1992	0	7,229	7,229	65,715
1993	3,930	7,301	11,231	66,377
1994	4,362	7,238	11,600	65,798
1995	4,842	7,497	12,339	68,156
1996	6,016	7,336	13,352	66,687
1997	6,678	6,674	13,352	60,670
1998	7,413	5,939	13,352	53,992
1999	8,430	5,124	13,554	46,579
2000	9,357	4,196	13,554	38,149
2001	10,387	3,167	13,554	28,792
2002	11,529	2,025	13,554	18,405
2003	1,639	756	2,395	6,876
2004	1,819	576	2,395	5,238
2005	2,019	376	2,395	3,419
2006	419	154	573	1,399
2007	465	108	573	981
2008	516	57	573	516
Total	79,820	76,176	155,996	

Table A17-1-4 Debt Services (Alternative 4)

(Unit : Baht x 1000)

Year	Capital	Interest	Total Annual Repayment	Balance of Capital
1990	0	3,354	3,354	33,112
1991	0	7,280	7,280	69,460
1992	0	7,979	7,979	93,498
1993	3,930	8,755	12,685	120,206
1994	4,362	13,504	17,867	297,900
1995	4,842	23,414	28,256	657,677
1996	6,016	28,089	34,106	835,349
1997	6,678	27,428	34,106	829,332
1998	7,413	26,693	34,106	822,654
1999	8,430	25,878	34,308	815,241
2000	38,847	24,950	63,797	806,811
2001	40,673	23,125	63,797	767,964
2002	42,633	21,165	63,797	727,291
2003	33,582	19,057	52,639	684,659
2004	34,625	18,014	52,639	651,076
2005	35,711	16,928	52,639	616,451
2006	35,020	15,796	50,816	580,740
2007	36,001	14,816	50,816	545,719
2008	37,011	13,805	50,816	509,719
2009	37,481	12,763	50,244	472,708
2010	38,493	11,751	50,244	435,227
2011	39,532	10,712	50,244	396,734
2012	40,599	9,644	50,244	357,202
2013	41,696	8,548	50,244	316,603
2014	42,821	7,423	50,244	274,907
2015	43,977	6,266	50,244	232,086
2016	45,165	5,079	50,244	188,109
2017	46,384	3,859	50,244	142,944
2018	47,637	2,607	50,244	96,560
2019	48,923	1,321	50,244	48,923
Total	848,483	420,003	1,268,486	

Table A17-1-5 Debt Services (Alternative 5)
for Foreign Portion

(Unit : Baht x 1000)

Year	Capital	Interest	Total Annual Repayment	Balance of Capital
1990	0	94	94	3,473
1991	0	117	117	4,342
1992	0	750	750	27,783
1993	0	1,453	1,453	53,829
1994	0	6,267	6,267	232,102
1995	0	15,917	15,917	589,521
1996	0	20,754	20,754	768,662
1997	0	20,754	20,754	768,662
1998	0	20,754	20,754	768,662
1999	0	20,754	20,754	768,662
2000	29,490	20,754	50,244	768,662
2001	30,286	19,958	50,244	739,172
2002	31,104	19,140	50,244	708,886
2003	31,944	18,300	50,244	677,782
2004	32,806	17,438	50,244	645,838
2005	33,692	16,552	50,244	613,032
2006	34,602	15,642	50,244	579,340
2007	35,536	14,708	50,244	544,739
2008	36,495	13,748	50,244	509,203
2009	37,481	12,763	50,244	472,708
2010	38,493	11,751	50,244	435,227
2011	39,532	10,712	50,244	396,734
2012	40,599	9,644	50,244	357,202
2013	41,696	8,548	50,244	316,603
2014	42,821	7,423	50,244	274,907
2015	43,977	6,266	50,244	232,086
2016	45,165	5,079	50,244	188,109
2017	46,384	3,859	50,244	142,944
2018	47,637	2,607	50,244	96,560
2019	48,923	1,321	50,244	48,923
Total	768,662	343,828	1,112,490	

Table A17-1-5 Debt Services (Alternative 5)
for Local Portion

(Unit : Baht x 1000)

Year	Capital	Interest	Total Annual Repayment	Balance of Capital
1990	0	6,521	6,521	59,278
1991	0	14,326	14,326	130,236
1992	0	14,457	14,457	131,429
1993	7,860	14,603	22,463	132,754
1994	8,724	14,475	23,200	131,595
1995	9,684	14,994	24,678	136,312
1996	12,033	14,671	26,704	133,373
1997	13,356	13,347	26,704	121,340
1998	14,826	11,878	26,704	107,984
1999	16,860	10,247	27,107	93,158
2000	18,714	8,393	27,107	76,298
2001	20,773	6,334	27,107	57,584
2002	23,058	4,049	27,107	36,811
2003	3,278	1,513	4,790	13,753
2004	3,638	1,152	4,790	10,475
2005	4,038	752	4,790	6,837
2006	837	308	1,145	2,799
2007	930	216	1,145	1,961
2008	1,032	113	1,145	1,032
Total	159,641	152,351	311,992	

Table A17-1-5 Debt Services (Alternative 5)

(Unit : Baht x 1000)

Year	Capital	Interest	Total Annual Repayment	Balance of Capital
1990	0	6,614	6,614	62,751
1991	0	14,443	14,443	134,578
1992	0	15,207	15,207	159,212
1993	7,860	16,056	23,916	186,583
1994	8,724	20,742	29,466	363,697
1995	9,684	30,911	40,595	725,833
1996	12,033	35,425	47,458	902,035
1997	13,356	34,101	47,458	890,002
1998	14,826	32,632	47,458	876,646
1999	16,860	31,001	47,861	861,820
2000	48,204	29,147	77,351	844,960
2001	51,059	26,292	77,351	796,756
2002	54,162	23,189	77,351	745,697
2003	35,221	19,813	55,034	691,535
2004	36,444	18,590	55,034	656,314
2005	37,730	17,304	55,034	619,869
2006	35,439	15,950	51,389	582,139
2007	36,465	14,924	51,389	546,700
2008	37,527	13,862	51,389	510,235
2009	37,481	12,763	50,244	472,708
2010	38,493	11,751	50,244	435,227
2011	39,532	10,712	50,244	396,734
2012	40,599	9,644	50,244	357,202
2013	41,696	8,548	50,244	316,603
2014	42,821	7,423	50,244	274,907
2015	43,977	6,266	50,244	232,086
2016	45,165	5,079	50,244	188,109
2017	46,384	3,859	50,244	142,944
2018	47,637	2,607	50,244	96,560
2019	48,923	1,321	50,244	48,923
Total	928,303	496,179	1,424,482	

Table A17-1-6 Projected Cash Flow at Current Price

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Cash Inflow																
Government Contribution	0	0	0	4,040	4,484	4,977	6,327	7,023	7,796	8,923	9,905	10,954	12,204	2,076	2,304	2,558
Capital Contribution	33,112	38,165	26,501	30,918	220,764	454,745	244,585									
Loan	29,639	37,253	658	767	4,073	8,577	4,519									
Local Loan	3,473	912	25,844	30,152	216,692	456,167	240,066									
Foreign Loan	18,052	26,939	26,365	26,606	46,314	58,694	61,349	72,902	78,915	77,773	92,364	94,796	96,146	116,642	113,007	114,684
Operating Revenue	17,292	24,205	24,230	24,406	43,452	55,456	57,965	68,740	71,222	72,961	86,612	88,840	89,368	104,178	104,563	105,898
Water Sales	0	1,714	1,051	1,049	1,157	1,219	1,240	1,539	4,718	1,686	1,955	1,976	2,618	7,194	2,972	3,087
Connection Fee	414	537	600	663	836	909	985	1,248	1,551	1,667	2,065	2,204	2,373	3,187	3,361	3,581
Service Charge	346	484	485	488	669	1,109	1,159	1,375	1,424	1,459	1,732	1,777	1,787	2,084	2,091	2,118
Other Income	2,164	0	7,748	7,547	32,317	26,105	27,269	32,977	34,415	35,880	43,263	45,024	47,010	56,762	59,153	61,201
Income From Municipality	53,328	65,104	60,614	69,112	303,680	554,521	339,530	112,902	121,126	122,576	145,532	150,815	155,360	175,480	174,464	178,442
Total Inflow																
Cash Outflow																
Project Expenditures																
Local Portion	60,320	74,780	9,068	10,580	73,153	154,005	81,058									
Foreign Portion	2,431	638	18,091	21,106	151,684	319,317	168,047									
Amortization																
Principal	0	0	0	4,040	4,484	4,977	6,327	7,023	7,796	8,923	9,905	10,954	12,204	34,421	35,522	36,673
Interest	3,354	7,477	8,247	9,145	9,735	22,501	28,933	28,237	27,464	26,607	25,625	23,729	21,692	19,499	18,398	17,247
Operating Expenses	9,585	13,160	14,831	15,470	23,075	26,514	31,784	35,913	42,042	43,247	48,438	51,667	54,981	67,132	69,333	73,778
O & M Cost	5,739	7,199	9,196	9,806	13,866	15,157	19,974	21,902	26,003	28,417	30,890	33,716	36,616	43,652	47,906	52,058
Connection Expenses	0	857	526	524	579	610	620	770	2,359	843	977	988	1,309	3,597	1,486	1,543
Share of Head Office	3,846	5,104	5,109	5,140	8,630	10,748	11,190	13,242	13,680	13,987	16,571	16,963	17,056	15,873	19,941	20,176
Payment to RID	854	977	942	989	2,712	2,921	3,236	3,518	3,834	4,175	4,543	4,939	5,325	5,740	6,189	6,653
Total Outflow	76,544	97,032	51,178	61,329	264,843	530,235	319,375	74,691	81,136	82,951	118,371	121,996	125,695	126,792	129,442	134,351
Net Cash Flow	-23,216	-31,927	9,436	7,782	39,037	24,285	20,155	38,211	39,990	39,625	27,161	28,819	29,664	48,688	45,022	44,091
Accumulated	-23,216	-55,143	-45,707	-37,925	1,111	25,387	45,552	83,763	123,752	163,377	190,538	219,357	249,021	297,710	342,731	386,823

Note : Based upon the assumption that water tariff increase every three year at the rate of 5 % per annum.
Inflation rate of 5 % per annum is applied for price escalation.

Table A17-1-6 Projected Cash Flow at Current Price (Cont'd)

(Unit: Baht x 1000)

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Cash Inflow															
Government Contribution															
Capital Contribution	561	623	691												
Laon															
Local Loan															
Foreign Loan															
Operating Revenue	134,702	136,117	138,099	161,309	163,879	166,472	192,712	192,712	192,712	223,088	223,088	223,088	258,253	258,253	258,253
Water Sales	124,267	125,917	127,672	149,130	151,283	153,588	177,797	177,797	177,797	205,823	205,823	205,823	238,265	238,265	238,265
Connection Fee	3,576	3,124	3,132	3,502	3,662	3,687	4,268	4,268	4,268	4,941	4,941	4,941	5,719	5,719	5,719
Service Charge	4,374	4,558	4,741	5,693	5,908	6,125	7,091	7,091	7,091	8,209	8,209	8,209	9,502	9,502	9,502
Other Income	2,485	2,518	2,553	2,983	3,026	3,072	3,556	3,556	3,556	4,116	4,116	4,116	4,765	4,765	4,765
Income From Municipality	69,928	69,143	68,307	78,055	99,104	102,561	118,728	118,728	118,728	137,442	137,442	137,442	159,106	159,106	159,106
Total Inflow	205,191	205,882	207,097	239,364	262,983	269,033	311,440	311,440	311,440	360,530	360,530	360,530	417,359	417,359	417,359
Cash Outflow															
Project Expenditures															
Local Portion															
Foreign Portion															
Amortization															
Principal	35,597	36,604	37,644	37,951	38,976	40,028	41,109	42,219	43,359	44,529	45,732	46,966	48,234	49,537	
Interest	16,045	15,037	13,997	12,923	11,899	10,846	9,765	8,656	7,516	6,345	5,143	3,908	2,640	1,337	
Operating Expenses	80,624	85,603	91,781	102,488	103,647	110,835	119,706	123,901	128,305	138,575	143,430	148,529	160,418	166,039	171,941
O & M Cost	55,185	60,097	65,963	72,425	73,125	79,896	83,891	88,085	92,489	97,114	101,970	107,068	112,421	118,043	123,945
Connection Expenses	1,788	1,562	1,566	1,751	1,831	1,843	2,134	2,134	2,134	2,470	2,470	2,470	2,860	2,860	2,860
Share of Head Office	23,651	23,944	24,252	28,312	28,691	29,095	33,681	33,681	33,681	38,990	38,990	38,990	45,136	45,136	45,136
Payment to R/D	7,197	7,745	8,334	8,968	10,857	11,554	12,236	12,848	13,491	14,165	14,873	15,617	16,398	17,218	18,079
Total Outflow	135,463	144,988	151,756	162,330	165,379	173,362	182,816	187,624	192,670	203,614	209,179	215,020	227,689	234,130	190,019
Net Cash Flow	65,728	60,894	55,340	77,033	97,604	95,671	128,623	123,816	118,769	156,916	151,352	145,510	189,669	183,228	227,339
Accumulated	452,551	513,445	568,785	645,819	743,423	839,094	967,717	1,091,533	1,210,302	1,367,219	1,518,570	1,664,081	1,853,750	2,036,979	2,264,318

Note : Based upon the assumption that water tariff increase every three year at the rate of 5 % per annum.

Inflation rate of 5 % per annum is applied for price escalation.

Table A17-1-7 Unit Cost of Water after Depreciation

(Unit :Baht x 1000)

year	Water Consum. (cu.m/day)	Capital Invest.	Operating Expenses	Payment to RID	Depreciation	Total Expenses	Unit Water Cost (Baht/cu.m)
1990	7,818	62,751	9,585	854	0	73,190	25.65
1991	8,449	71,827	12,533	930	0	85,290	27.66
1992	13,694	24,634	13,708	854	3,124	42,320	8.47
1993	13,760	27,371	13,866	854	3,124	45,215	9.00
1994	31,491	184,974	18,984	2,231	3,124	209,313	18.21
1995	31,525	370,860	21,220	2,289	3,124	397,493	34.54
1996	33,042	185,886	24,621	2,407	3,124	216,038	17.91
1997	34,296	0	25,523	2,500	22,999	51,022	4.08
1998	35,573	0	28,999	2,595	22,999	54,593	4.20
1999	36,871	0	28,857	2,691	22,999	54,547	4.05
2000	38,192	0	29,737	2,789	22,999	55,525	3.98
2001	39,533	0	30,734	2,888	22,999	56,621	3.92
2002	40,656	0	31,664	2,965	22,999	57,628	3.88
2003	41,806	0	35,602	3,044	22,999	61,645	4.04
2004	42,878	0	35,559	3,126	22,999	61,684	3.94
2005	43,949	0	36,560	3,200	22,999	62,759	3.91
2006	44,001	0	36,935	3,297	22,999	63,231	3.94
2007	44,062	0	37,905	3,379	22,999	64,283	4.00
2008	44,117	0	39,237	3,463	22,999	65,699	4.08
2009	44,062	0	40,558	3,549	22,999	67,106	4.17
2010	50,108	0	39,639	4,092	22,999	66,730	3.65
2011	51,397	0	40,922	4,183	22,999	68,104	3.63
2012	51,397	0	40,922	4,183	22,999	68,104	3.63
2013	51,397	0	40,922	4,183	22,999	68,104	3.63
2014	51,397	0	40,922	4,183	22,999	68,104	3.63
2015	51,397	0	40,922	4,183	22,999	68,104	3.63
2016	51,397	0	40,922	4,183	22,999	68,104	3.63
2017	51,397	0	40,922	4,183	22,999	68,104	3.63
2018	51,397	0	40,922	4,183	22,999	68,104	3.63
2019	51,397	0	40,922	4,183	22,999	68,104	3.63
2020	51,397	0	40,922	4,183	22,999	68,104	3.63
Average Unit Water Cost (1990-2020) :							5.76

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