APPENDIX A-4-4

Questionnaire Survey for Factories

APPENDIX A-4-4 QUESTIONNAIRE SURVEY IN PATUM THANI AND PRACHATIPAT (INDUSTRIAL)

Objective 1

The door-to-door questionnaire survey was conducted to obtain the basic information on the factories' production conditions, water use patterns, responses to the municipal system and/or their own water sources and willingness for house-connection supply, and covered the area served or unserved by the municipal water supply system aside from that for residents.

Survey Area 🚬 2

Four (4) areas were selected for the questionnaire survey taking into account the location of factories as shown in Figure A1-2-1. All areas are at present fully or partially served by the municipal system or by the private water supply system.

Survey Item 3

The form used for the questionnaire survey was originally written by Thai and included the following items.

1. General

- 1.1 Name of Company
- 1.2 Address
- 1.3 Type of Factory
- 1.4 Annual Production
- 1.5 No. of Present Employees
- 1.6 Area of Factory
- 2. Water Consumption by Usage
 - 2.1 Washing
 - 2.2 Cooling
 - 2.3 Raw Materials 2.4 Boiling
 - Boiling
 - 2.5 Re-use
 - Others 2.6

3. Wastewater Treatment Facility

- Type of Water Supply 4.

Conditions in case of Municipal system 5.

5.1 Pressure 5.2 Quantity

A - 4 - 4 - 1

Patum Thani & Prachatipat

6. Other Sources than Municipal System

6.1 Type of Source

6.2 Conditions in case of Groundwater

7. Potability

8. Water Quality

8.1 Municipal System (Color, Smell and Turbidity) 8.2 Other Sources (Color, Smell and Turbidity)

9. Willingness to Connect to the Municipal System

10. Willingness to Pay for Connection Fee

11. Willingness to Pay for Water Charge

4 Survey Method

The college students were employed as interviewers and engaged in the questionnaire survey after the guidance by the PWA Head Office staff. The survey was conducted to 11, 9, 21 and 15 factories in Ban Klang, Lad Lum Kaeo, the Nava Nakorn Industrial Estate and the FAC-GO Industrial Estate, respectively on September 13, 14 and 17, 1988 under the superintendence of the PWA Head Office staff.

Survey Results

The results of the questionnaire survey are summarized in Table A1-5-3.

1) General

A various type of factories such as food processing, chemical products, metal fabrication, machinery, textiles, construction materials, wooden products and others were in operation in the particular areas.

The average number of employees per factory was 165 persons and almost factories in Lad Lum Kaeo and FAC-GO were small with less than 100 employees

Area Name <50	>50 <100		No. >200 > <500 <1	500	ployees >1000	s Un- known	Total
Ban Klang 1	4	1	3	1	-	1	11
Lad Lum Kaeo 3	3	3	-	-			9
Nava Nakhorn 1	6	8	5	-	1	***	21
FAC-GO 10	3	-	й ла 	-	-	2	15
Total 15	16	12	8	1	1	3	56
The average m, however more than 10 ====================================	excludi	ng four q m, it ======	(4) fa was 13	ctorie ,700 s	s with q m. ======		ea of
	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	2 >5	>10 <50	>50 <100	>100		Total
Ban Klang	-	1 1	3	2	1	3	11
Lad Lum Kaeo		2 -	3		2	2	9
Nava Nakorn	1	3 6	7		1	3	21
FAC-GO	6	2 -			: —	7	15

2) Water Consumption by Usage

Only 6 out of 56 factories gave the breakdown of water consumption by usage. It suggests that it is difficult understand the actual status of water use in the factory.

Total 7 8 7 13 2 4 15 56

3) Wastewater Treatment Facility

50.0%, or 28 out of 56 factories had their own wastewater treatment facilities, especially in Ban Klang and the Nava Nakorn Industrial Estate. However, in case of Nava Nakorn, it may mean that they used the wastewater treatment facilities operated by the Nava Nakorn Co., Ltd, managing the Nava Nakorn Industrial Estate.

4) Type of Water Supply

There was some confusion in the questionnaire survey at the Nava Nakorn Industrial Estate. The factories in this area are at present supplied water by the Nava Nakorn Co., Ltd. of which the water sources are two deep wells. However, some factories answered that they used the municipal system and the others answered that they used the other source managed by the Nava Nakorn Co., Ltd. Such confusions are derived from the difference in interpretation and both the answers are same. Accordingly to distinguish the PWA municipal system from that of Nava Nakorn Co., Ltd, the answer that they used the municipal system were categorized in the other source.

23.2% used the municipal system only, 66.1% other sources than the municipal system and the remaining 10.7% the combination system of the municipal system and other sources.

In other sources, 51.1% or 22 out of 43 other sources were the groundwater only, 23.3% the rain/river water only and the remaining 25.6% the combined water source as shown below.

Area Name		Lad Lum Kaeo	n Nava Nakorn	FAC- T GO	otal
	********		.=======		****
Municipal System Only	2	****	· <u>-</u>	11	13
Plus Rain/River	1	1	· · · · ·	3	5
Plus Water Vendor	 ·	-		1	1
Well Only	3	3	16	-	22
Plus Pond/Reservoir	-	. — ¹	2		2
Plus Water Vendor	-		3	• • • • •	3
Rain/River Only	5	5	<u> </u>		10
Total	11	9	21	15	56

Though enough information was not obtained from the questionnaire survey, factories in Ban Klang and Lat Lum Kaeo had deep wells with depths ranging between 200 and 400 m.

and the second secon

5) Conditions of Municipal System

Ban Klang and lat Lum Kaeo is supplied water by the PWA Patum Thani Waterworks, while FAC-GO by the PWA Prachatipat Waterworks. The number of users of the municipal system was a few in the former area. In the latter area, the most users had complaints of low pressure, insufficient water, color, smell and turbidity.

6) Conditions of Other Sources

16.3% had a complaint of color, 20.9% of smell and 30.2% of turbidity. Among other sources, the water source for the Nava Nakorn Industrial Estate was comparatively blessed with water quality and only some users had complaints of low pressure, smell and turbidity.

7) Potability

14.3% used its water source for drinking and 17.9% for drinking and not-drinking. However, 60.7% used it for not drinking.

8) Willingness to Connect

The rates of the willingness-to-connect were high in all areas exclusive of FAC-GO already served. 75.0% was willing to connect to the municipal system in Ban Klong, 50.0% in Lat Lum Kaeo and 52.4% in Nava Nakorn in which 42.9% was unknown. Those factories wanted that the connection fee would be less than 5,000 Baht (47.6%) and the water charge less than 10,000 Baht (61.9%), although 38.1% was unknown in both.

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					· . ·		÷.,				1111		
										1			
:			Lad	Lum	:Na	va	: FA	C-GO	: Tr	otal	:Rate	(%)	
	:	L'Y CU LEU				Nakorn				:	:		
		-			مەنبەرىيەن				به میدو می				
No. of Samples	:	11	2	9	:	21	:	15	2	56	5 ;:	-	
:1.General	;		1 A.		:	1	:		•		:		
: 1.1 Name of Factory	1	:	:		:		:		:		:		
: 1.2 Address	:	:			•		:	· · · ·	;		:		
: 1.3 Type of Factory	:	. :	:	. •	:	, ,	:		: , .		:		
: 1.3.1 Food Processing	•	:			:		:		;		:	1.1	
: 1.3.2 Chemical Product	1 .	:	:		:		:		•		:		
1.3.3 Metal Fabrication	:	:			:		•		:		:	1. ·	
: 1.3.4 Electrical Appliance Parts	1				:	· .	:		:		t		
1.3.5 Machinery (Transportation)	:	:			:	11 A.	.:	1 - 14 1	ŧ.,	1	:		
(Others)	:	:	1		:		:		•	ę	:		
1.3.6 Medical Equipment	:	:			:		:				:		
1.3.7 Precision Equipment	:	:	1		:		:		:		:		
1.3.8 Optical Equipment	:	1			:	· .	:		•		:	1.12	
1.3.9 Textiles	:	:			:		:			1. 1.	:		
1.3.10 Construction Material	:	:			:		:		•	· .	• •		
1.3.11 Wooden Product	:	:			:		:		:	-	:		
1.3.12 Others	;	:		• •	:		:		:		:	• •	
1.4 Annual Production (mil. Baht)	:	:			:		:		•		•	÷.,	
Present	:		1. 	÷.	:		•		;	n da Nasilia	:		
1991	•	:		•	:		•		;		:		
2001	:	:			:		:			· · · · · · ·	:		
2011	:	•		14 1	:	1.1	:		:	en og fære Greg	:		
1.5 No. of Employees	:	2632 :		776	•	4908	:	428	:	8744	:		
(No. of Samples)	:	10 :		9	:	21	:	13	:	53	; :		
(Average)	\$	263 :	- ÷	86	:	234	:	33	ł	165	: •		
1.6 Area of Factory (sq m)	: 4	37600 :	55	8400	: 1	375200	;	16620		2387820	• =		
(No. of Samples)	:	8:		7	:	18	:	8	:	41	:		
: (Average)	: !	54700 :	79	9771	:	171900	:	2078	:	58240):		
	:	:			; ,		:		:		:		
2. Water Consumption (cu m/mo)	:	:			:		: ,		:		:		
2.1 Washing	:	12 :		13	:	-	:	54	:	79	:		
2.2 Cooling	:	- :		-	:	·	:		:		• •	· .	
2.3 Materials	:	- :		43	:	-	;	50	:	93	:	· ·	
2.4 Boiling	:	- :		10	:	-	:		:	10	2		
2.5 Re-use	:	30 :		-	:	-	:	-	:	30	:		
2.6 Others	:	37 :		-	:		:	-	:	37	' : '		
Total	:	79 :		66	:	-	;	104	:	249	:		
(No. of Samples)	:	1:		2	:		:	2	• .	5	:		
	:	• :			:		:		:		÷		
3. Wastewater Treatment Facility	:	:			:		:		:		:		
Yes	:	8:		4	:	13	:	. 3	 .	28		50.0	
No	:	2:		5	:	. 7	:	12	:	26		46.4	
Unknown	:	1 :	. '	-	:	1			:	2	:	3.6	•
	:	:			:		:		::. :		:	.*	
4. Type of Water Supply	:	:			:		:		:		:		
Municipal System	:	2:			:		:	11		13		23.2	
Municipal System Combined	:	1:		1	:	-	;	4				10.7	
Combined Other Sources	•	8:		8		21						56.1	

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Table A1-5-3 Summary of Questionnaire Survey in Patum Thani and Prachatipat (Industry) (Cont'd)

AREA	:Ban	Klang:Lad	Lum	:N	ava	:FACGO	:Total	:Rate	e (%)
ITEM	\$:	Kaeo	;	Nakorn	:	:	٠,	
5. Municipal System	*	:			ه المحالية	•	*	:	
Pressure	;	:		:		;	:	:	
LOW	:	3:	1	:	~	: 12	: 19);	65.5
High	:	- :	-	:	_	: 1	: (5 :	20.7
Unknown	:	- :	•	:		: 2	; 4	1:	13.8
Quantity	:	:		:		:	:	:	
Sufficient	:	1:	-	:		; 6	: 10	5:	55.2
Not sufficient	:	2:	~~~	:		: 9	: 13	2:	41.4
Unknown	:	- :	1	:	•••	: -	:	. :	3.4
	:	:		:		:	:	:	
6. Other Sources	-	:		:		:	:	:	
Rain/River	:	6:	6	:		: 3	· · 1	5:	
Pond/Reservoir		:	-	:	2			2:	
Water Vendor	1	•		:	3			4:	
Groundwater	•	3:	3	•	21		· .	1:	
Gr donowa cer		•		•		•			
7. Potability		•		:		:	•	:	
Drinking	•	1 :	2	:	3	•	: 1	3:	14.3
	•	7:	3		12			4:	60.7
Not drinking	•	2:	2		5			D:	17.9
Both	•		. 2		5			4 :	7.1
Unknown	-	1:	2	•	. 1		•	* • •	
	•	•		ł		÷	•	•	
8. Water Guality	•	•		÷		•	•	.•	
8.1 Municipal System	:	•		:		•	•	•	
8.1.1 Color	:			:		: 4	•	5 :	31.6
Yea	:	1:	1	:				9:	47.4
No	:	2:	-	:		•	-	≠ . 4 :	21.0
Unknown	:			:	-	: 4	:	•	£1.0
8.1.2 Smell	:	:		;		:	:	-	76 0
Yes	:	1:	1	:	-	• -	•	7::	36.8
No	•	1:	-	:		: 5	•	6:	31.6
Unknown	:	1:	-	:	-	: 5	•	6:	31.6
8.1.3 Turbidity	:	• •		:		:	:	:	40.4
Yes	:	1:	-	:				в: -	42.1
No	:	2:		:	-			8 : ~	42.1
Unknown	•	-:	1	:	-7	: 2		3:	15.8
8.2 Other Sources	:	:		:		;	:	:	
8.2.1 Color	:	:		:		:	:	:	
Yes	· •	1;		;	1			7:	16.3
No	:	б:		:	14			5:	58.1
Unknown	:	2;	2	:	6			1:	25.6
8.2.2 Smell	:	:		:			:	:	
Yes	;	2:	2	:	4			9:	20.9
No	:	5:	5	:	15		: 2	7:	62.8
Unknown	:	2:	2	:	2	:. 1	:	7:	16.3
8.2.3 Turbidity	:	:		:		:	:	:	
Yes	:	3:	5	:	4	: 1	: 1	3:	30.2
No	:	5:	2	:	13	: 2	: 2	z :	51.2
Unknown	-	1:		:			:	8:	18.6

A-4-4-7

Table A1-5-3 Summary of Questionnaire Survey in Patum Thani and Prachatipat (Industry) (Cont'd)

: AREA	• D	Klang:Lad	1	• 1.1 -		:FAC-GO	:Total		:Rate	(4)
	: Ban	KIANG:LAU			Nakorn		. 10tai	:*		(10)
: ITEM		ه د ب هار بند ونو ساله دنو موار ويدي		.*	Henor H	• • • • • • • • • • • • • • • • • • • •	•	djuar rak si		
:10 Willingness to Connect	:	:		:		:	:	-	:	
: Yes	:	6 :	4	:	11	:	:	21	: !	56.E
: No	:	2:	4	:	1	;	:	7		18.9
: Unknown	:			:	9	:	:	9	: :	24.
▲ ◆	:	:		:		:	1		: -	
11. Willingness to Pay	:	:		:		:	:	1	:	
for Connection Fee	:	:		:		:			:	
< 2,000 (Baht)	:	1 :	2	:	3	: -	:	6	: 3	28.
2,001 - 3,000	:	- :	1	:	1	:	:	2	:	9.
3,001 - 5,000	:	1 :	~	:	1	: -	:	2	:	9.
5,001 - 7,000	:	:	1	:		: -	:	1	:	4.
7,001 - 10,000	:	- : ·		:	1	:	••	1	:	4.
10,001 - 15,000	:	- :	-		· –	:	•	·	:	
15,001 - 20,000	:	- :		•	1	:	:	1	:	4.
20,000 <	:	- :		:	_	:	:	-	:	-
Unknown	:	4:		:	4	: -	:	8	÷, :	38.
	:	:		:		:	± `		:	
12. Willingness to Pay	:	:		:		:	:		:	
for Water Charge	1	÷ 1		:		:	1		•	-
< 1,000 (Baht/mo)	:	- :	2	:	1	: -	÷ .	3	;	14.
1,001 - 2,000	:	1:	1	:	1	: ~	:	3	:	14.
2,001 - 5,000	:	· 🗕 :	1	:	2	:	:	3	:	14.
5,001 - 10,000	:	1:		:	3	:	•	<u> 4</u>	:	19.
10,001 - 15,000	:	- :	6w1	:		:	• .	-	•	
15,001 - 20,000	:	- :		:	-	:	:		:	
20,001 - 30,000	:	- : ·		:	•••	* in	:	-	:	
30,001 - 50,000	:		. .	:	. **	: -	:	. <u> </u>	:	
50,001 -100,000	:	- :	-	:		:	:	-	:	
100,000 <	:	- Som 🛨		:		: -	•	÷.	:	•
Unknown	*	4 :	-		4		-	8	: 3	38.

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APPENDIX A-4-5

Industrial Wastewater from Existing Factories

Table A4-5-1 Existing Industrial Water Consumption

				· · · · · · · · · · · · · · · · · · ·		
		· · ·	SEWAGE	RATIO	FRESH	
	FACT	CATEG.	WATER	TO	WATER	
N0.	CODE	CODE	DISCHARGE	CAL.OF	CONSUMPTION	CODE
				FRESH WATER		
	(a)	<u>(b)</u>	(c)	(d)	(e)	
1	13	18	35	0.410	14	4.4
23	14	18	250	0.410	103	4.4
3	15	18	12	0.410	5	4.4
4	28	18	20	0.410	8	4.4
4 5	35	18	3	0:410	1	4.4
6	36	18	300	0:410	. 123	4.4
. 7	37	18	90	0.410	37	4.4
8	21	19	1,000	0.410	410	4.4
9		19	600	0.410	246	4.4
10	11	20	1,000	0.440	440	4.4
11	12	20	400	0.440		4 .4
12		$\tilde{20}$	300	0.440	132	4.4
13		20	1,200	0.440	528	4.4
14		20	800	0.440	352	4.4
15		20	1,800	0.440	792	4.4
16		20	700	0.440	308	4.4
17		20	5	0.440	2	4.7
18		20	120	0.440	53	4.7
19		20	6,000	0.440	2,640	4.7
20	7	20	900	0.440	396	4.7
20	8	20	2,200	0.440	- <u>968</u>	4.7
$\frac{21}{22}$		21	2,200	3.514	7,028	4.3
23		$\frac{21}{21}$	30	3.514	105	4.4
23		24	1,000	1.135		4.4
25		24 24			· 1,100 · 270	4.4
			2,000	1.135		4.4
26		24	1,000	1.135	1,135	
27		24	2,000	1.135	2,270	4.4
28		24	4,000	1.135		4.4
29		24	4,000	1.135		4.4
30		26	10	0.227	2	$4.4 \\ 4.4$
31	30	30	30	0.666		4.4
32	1	30	270	0.666	180	4.7
33		30	20	0.666	13	4.7
34		30	80	0.666	53	4.7
35		31	200	0.367	73	4.4
- 36		4 - 4 	5	1.000	5	4.4
37			25	1.000	25	4.4
38	34		5	1.000	5	4.4
		TOTAL	34,410	0.905	31,133	
					·····	
					هور 	
31	40	NAVA	2,000	1.000	2,000	4.4

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APPENDIX A-4-6

Data on Nava Nakorn Industrial Estate

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电压器 化乙酸乙酸 医马克氏试验检尿道 化乙基苯基乙基基

Table A4-6-1 Water Consumption at Naba Nakorn Industrial Estate

										N	a.1
FACTO		CATE(COL		NO.(Emi		LAND AREA	WATER	Q/EMP.	0/AREA	WATER	LAND
4 CO	νc	(00)C)	(pers		(ha)	CONSUMP. (cu m/m)			CONSUMP.	AREA
		an a		(a)) (b)=(e)*0.16	(cu m/m/)	(d)/(a)	(d)/(b)	(cu m/d) (d)=(c)/30	(rai) (e)
	1		12	<u>_</u>	8	0.33	284	1.18	28.69	9.47	2.09
	2	1.1	20		28	0.31	179	0.21	19.25	5.97	1.95
· .	3		13		35	0.18	2,380	2.27	440.74	79.33	1.12
	4		29	. C	23	0.18	9	0.01	1.67	0.30	1 12
	5		29	í :	252	0.43	562	0.07	43.57	18.73	2.70
	6		30		220	2.53	6.387	0.97	84.15	212.90	15.84
	: 6		20		25 30	0.36	163	0.22	15.09	5.43	2.22
	9		20 22		64	$0.26 \\ 0.40$	215 226	0.24	27.57	7.17	1.65
	10		17		57	0.54	220	0.12	$18.83 \\ 14.14$	7.53 7.63	$\begin{array}{c} 2.49 \\ 3.37 \end{array}$
	11		32		5	0.37	4L13	0.00	0.00	0.00	2.30
	12	A A	17	14	22	0.37	57	0.09	5.14	1.90	2.33
	13		32		745	0.87	1,637	0.07		54.57	5.46
-	14		12		60	1.07	1,804	1.00	56.20	60.13	6.71
	15		22		293	1.07	1,056	0.12	32.90	35.20	6.70
	16	the arts	26		33	0.43	426	0.43	33.02	14.20	2.69
	17 18		20		33	0.43	426	0.43	33.02	14.20	2.69
	10		31 12		28 41	0.85 0.95	543	0.65	21.29	18.10	5 34
1	20		13		60	0.95	4,551 2,370	$3.70 \\ 1.32$	159.68 84.04	151.70	5.92
	21	· · · ·	34		75	0.81	788	0.35	32.43	$79.00 \\ 26.27$	5.85 5.05
	22	•	23		52	0.45	637	0.41	47.18	21.23	2.80
	23	an an Gal	23		45	0.45	579	0.43	42.89	19.30	2.80
	24		30		73	0.45	462	0.21	34.22	15.40	2.84
	25	a. 1.	17		125	0.45	420	0.11	31.11	14.00	2.82
	26	. 1.	29	· · ·	45	0.49	419	0.31		13.97	3.05
	27		28		135	0.50	1,221	0.30	81.40	40.70	3.10
	28 29		20 30		18 620	0.39	139	0.26	11.88	4.63	2.45
	30		28		282	1.63 0.40	9,829 1,350	0.53 0.16	201.00	327.63 45.00	$\begin{array}{r}10.17\\2.53\end{array}$
	31	5	17		140	0.40	956	0.10	79.67	31.87	2.53
	32	6 A 1	20		7	0.46	132	0.63	9.57		
:	33	n In 1997 - Santa Alam	20		25	5.45	133	0.18	0.81	4.43	34.04
	34		15		360	0.51	1,878	0.17	122.75	62.60	3.17
	35		13	11	120	0.48	1,145	0.32	79.52	38.17	3.00
	36	÷	20	1.1.1 1.1.1	19	0.41	.88	0.15	7.15	2.93	2.57
	37	i en tra	25		67	0.39	641	0.32	54.79	21.37	2.43
	38 39		30 17		40 361	0.40	253	0.21	21.08	8.43 43.67	2.51
4 F	40	NA ANA ANA Ang ang ang ang ang ang ang ang ang ang a	26		398	3,69	1,310 10,239	$0.12 \\ 0.86$	114.91 92.49	341.30	2.40 23.09
	41		20		20	0.15	135	0.23	30.00	4.50	0.94
	42	1.1	26		50	0.15	62	0.04	13.78	2.07	0.93
	43		14		250	0.45	388	0.05	28.74	12.93	2.81
	44	an a	31		40	0.45	1,753	1.46	129.85	58.43	2.81
÷ 1	45		22	•	42		497	0.39	36.82	16.57	2.79
	46		12		20	0.22	220	0.37	33.33	7.33	1.40
· .	47		22	· · ·	20	0.21	135	0.23	21.43	4.50	1.31
	48	al a constante A constante	12	6 (s. 1) 11	37	0.51	1,278	1.15	83.53	42.60	3.16
	49 50		12 14		55 72	$\begin{array}{c} 0.49 \\ 0.22 \end{array}$	782 758	0.47	$\begin{array}{r} 53.20 \\ 114.85 \end{array}$	26.07 25.27	$3.08 \\ 1.39$
	51	n Balan George		- 	107	0.22	558	0.33	71.54	18.60	1.62
		ian Al-Araba Maria	13		101	0.25	000	0.11	0.00	0.00	1.54
	53		32		420	0.32	771	0.06	80.31	25.70	1.97
	54		20		20	0.32	195	0.33	20.31	6.50	1.97

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A-4-6-1

Table A4-6-1 Water Consumption at Naba Nakorn Industrial Estate (cont'd)

				•		····			N
FAC	TORY	CATEGORY	NO.OF	LAND	WATER	QZEMP	QZAREA	WATER	No. 2 LAND
Č	ODE	(CODE)	EMP.	AREA	CONSUMP.			CONSUMP.	AREA
			(pers.)	(ha)	(cu m/m)			(cu m/d)	(rai)
			<u>(a)</u>	(b)=(e)*0.16	(c)	(d)/(a)	(d)/(b)	(d)=(c)/30	<u>(e)</u>
	55	20		3.58	4,988	0.01	46,44	166.27	22.40
	56	30	130		1,624	0.42	15.74	54.13	21.52
	57	30		6.90	$5,871 \\ 2,728$	0.19	28.36 133.73	195.70	43.10
	58	18		0.68	2.728	0.36	133.73	90.93	4.22
	59	31			1,085 188	0.40	49.54 8.59	$\begin{array}{r} 36.17\\ 6.27\end{array}$	4.59
	60 61	18			2.628	0.31	59.19		4.59 9.22
	62	25		7.80	7,256	1.10	31.01	241.87	48.75
	63	14		0.99	307	1.02	10.34		6.20
	64	14	170		720	0.14	20.51	24.00	7.31
	65	31			4,875	0.35	84.64		12.00
	66	20			7,715	2.40	100.85	257.17	15.93
	67	17	120		579	0.16	20.32	19,30	5.93
	68		30		230	0.26	9.96	7.67	
	69	23			1,047	0.07	87.25		2.47
	70		30	0.42	925	1.03	73.41	30.83	2.62
	71	22			.89	0.25	5.21	2,97	3.58
	72	27		0.77	2,280	0.74	98,70	76.00	4.81
	73	20			173	0.19	13.41	5.77	
1.1	74	25		1.08	3,206		98.95		6.78
	75	15	250	0.44	481	0.06	36.44	16.03	
	76	. 23		0.39			0.00	0.00	2.43
	77	15	240		325	0.05	13.37	10.83	5.09
	78			0.39		the second	0.00	0.00	2.44
	79	18			1,395	0.25	9.12	46.50	
	80	34			1.430	0.11			
	81	22		0.42	194	0.31	15.40		
	82	30			12,032	0.37	466.36	401.07	5.37
	83	29			115	0.13	9.58	3.83	2.47
	84 85	30 24		0.44 0.44	519	$\begin{array}{c} 0.12 \\ 0.23 \end{array}$	39.32	17.30	2.74
	86	24			2,672	0.23	202.43 104.09	89.07 45.80	2.14
1.1.1	87	34			1,374 2,785	0.10		92.83	
	88	-20			2,105	0.09		26.93	
	89	30			165	0.46	12.50	5.50	
	90	32		1.34	1,491		37.09	49.70	8.35
	91	20		0.44	1,102	0.00	0.00	0.00	2.72
	92	26			3,339	0.38	11.16	111.30	62.34
	93	28		0.81	3,306	1.57		110.20	5.05
	94	23			787	0.03	46.02	26.23	3.56
	95	14	30		132	0.15	8.63	4.40	3.20
•	96	22		0.51			0.00	0.00	3.20
	97	20		1.09		· · · · · · · · · · · · · · · · · · ·	0.00	0.00	6.80
	98	23		1.13	422	0.20	12.45		7.05
	99	12	85		1,261		54.59	42.03	4.80
	100	20		0.67	270		13.43	9.00	4.20
	101	28		0.74			0.00		4.62
	102	20		0,38	386		33.86	12.87	2.40
	103	. 30		3.22	150		1.55		20.11
	104	13	40	10.08	100.		0.33		63.00
	105	27		24.14	3.771	0.25	5.21		150.87
	106	30			1,547	0.94		51.57	20.11
	107	34		1.60	605		12.60	20.17	10.00
	108	32	100		150	0.00	0.00	0.00	10.00
	109			0.40	453		37.75	15.10	2.50

A-4-6-2

Table A4-6-1 Water Consumption at Naba Nakorn Industrial Estate (cont'd)

	DV	CLTRCODY	NQ.OF	1 4 11 0	111760	0 / 0 10	0 (1001	N	0. 3
FACTO COD	KY C	CATEGORY (CODE)	EMP	LAND	WATER . CONSUMP.	Q/EMP.	Q/AREA	WATER CONSUMP.	LAND
τυν	Ľ.	(CODE)	(pers.)	(ha)	(cu m/m)				AREA (rai)
			(a)	(b)=(e)*0.16	(c)	(d)/(a)	(d)/(b)	(cù m/d) (d)=(c)/30	(e)
	110	34	120	0.40	269	0.08	22.42	8.97	2.50
	111	34	120	3.25	446	0.08	4.57	14.87	2.50
at e la constante da serie de la constante de l Recentra de la constante de la c	112	30	800	0.40	2,321	0.10	193.42	77.37	20.31 2.47
	113	23	30	0.40	131	0.15	10.92	4.37	2.50
	114			0.40	101	0.15	0.00	0.00	2.50
	115		80	0.40	300	0.13	25.00	10.00	2.50
	116	12	60	0.40	3,333	1.85	277.75	111.10	2.50
	117	15	60	0.40	223	0.12	18.58	7.43	2.50
	118		180		437	0.08	18.21	14.57	5.00
	119	32	75	1.60	234	0.00	4.88	7.80	10.00
	120			0,80	201	0.10	0.00	0.00	4.97
	121		35	0,80	529	0.50	22.04	17.63	5.00
	121	25	500	0.80	1,315	0.09	54.79	43.83	5.00
	123	23	500	0,80	1,534	0.03	63.92	51.13	5.00
	123	40		1.60	1,063		22.15	35.43	10.00
	125	· · · · · ·		1.60	1,000		0.00	0.00	10.00
	126	30		0.80	699		29.13	23.30	4.97
	120	17		1.03	199	•	6.44	6.63	6.44
	128	18	280	2.35	1,641	0.20	23.28	54.70	14.67
	129	31	200	2.35	1,011	. 0.20	0.00	0.00	14.70
	130	34	220	4 .70	2,067	0.31	14.66	68.90	29.40
	131	31	220	2.35	2,001	V.01	0.00		14.70
	132	34	150	1.96	586	0.13	9.97	19.53	12.25
	133	22	50	1.80	751	0.50	13.91	25.03	11.26
	134	44		13.12	101	0.00	0.00		82.03
	135	30	450	3.12	1,510	0.11	16.13		19.47
	136	31	100	1.55	328		7.05		9.69
	137	30		7.00	-		0.00		43.72
	138	30		7.19			0.00		44.93
	139	32	113	3.25	480	0.14	4.92		20.33
	140	27	240	1.47	723	0.10	16.40		9.21
	141	30	48	1.44	300	0.21	6.94		9.00
	142	20	50	1.44	500	0.33	11.57		9.00
	143	30		2.88	740		8.57	24.67	17.97
	144	30	200	2.96		0.00	0.00	0.00	18.47
	145	30	407	1.18		0.00	0.00	0.00	7.40
	146	30	167	1.18	810	0.16	22.88	27.00	7.40
	147		150	2.96		0.00	0.00	0.00	18.50
	148	28	229	2.84		0.00	0.00		17.75
· ·	149			8.47			0.00		52.92
	150	27	200	4.57		0.00	0.00		28.56
	151			12.54			0.00		78.40
	152			0.83			0.00		5.20
	153	8 - C.	*	0.40			0.00		2.50
	154	30		0.40			0.00		2.50
	155			0.48		-	0.00		3.00
	156	22	22	0.48	72	0.11	5.00		2.97
	157			2.93			0.00		18.30
	158	23		2.35	1,594		22.61		14.66
	159		· .	13.42			0.00		83.88
	160	32	450	7.40		0.00	0.00		46.27
	161	32	and the second	1.52			0.00		9.50
	162	32	300	6.15		0.00	0.00	0.00	38.46
	163	32	60	1.86	623	0.35	11.17		11.60
	164	27		2.71			0.00	0.00	16.92

A-4-6-3

Table A4-6-1 Water Consumption at Naba Nakorn Industrial Estate (cont'd)

FACT CO	DE	CATE (CO	GORY DE)	NO. Em	OF P.	LAND AREA	WATER CONSUMP.	Q/EMP.	Q/AREA	WATER CONSUMP.	LAND AREA
		• • •		(per	s.)	(ha)	(cu m/m)			(cu m/d) (d)=(c)/30	(rai)
- <u>-</u>	165		30	<u>(a</u>) (b) 440	e(e)*0.16 6.40	(c)	(d)/(a)	(d)/(b) ((d) = (c) / 30	(e)
	166				110	7.12	· . · · · ·	0.00	0.00 0.00	0.00	40.00
	167		~~	•		0.80			0.00	0.00	5.00
	168 169		$\frac{20}{20}$		30	0.95 0.80		0.00	0.00		5.96
	170					1.03	•	0.00	0.00	0.00 0.00	5.00
	171		30		230	3.30		0.00	0.00	0.00	20.60
	$\frac{172}{173}$		32		1	$0.85 \\ 1.17$			0,00		5.30
	174 175			:		5.58			0.00	0.00	7.30 34.89
	175 176					1.31			0.00	0.00	8.20
	110	;		38.5	11.00	<u>1.56</u> 331.91	180,242.00	0.16	0.00	0.00 6.008.07	9.76
·	•	,	· · · ·				100(212.00	0.10	10.10	0.000.01	2.014.46
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A - 4 - 6 - 4

APPENDIX A-6-1

Construction Unit Cost

lten		Naterial	Pitting	Labor	Subfotal	Transprt (<800km)	Profit etc.(21%)	Total 1 Pav (w/10%coat)	ement	Total 2	
Pipeline	т еннација – — — !				*********		********	*********			
			******		PKA's	Onit Bat	e (1987)	********	*****	ŧ‡ ‡ ‡‡	
100 150	30 24 83 83 83 83 83	ial Tytpe) 85 142 255 352 507 970 1362 1761	(234) 21 36 64 88 127 243 341 440	56 77 90 126 167 248 278 354	255 409 566 801 1461	6 11 19 29 40 80 132 161	35 56 90 125 17? 324 444 570	224 353 569 792 1119 2050 2812 3615	140 154 166 179 223 248 283 319	364 507 735 971 1342 2298 3095 3934	•
150 200 250 300		545 720 1080 1330 1420 1785 2140 2495	(351) 191 252 378 465 497 625 749 873	99 111 153 202 250 361 468 582	835 1083 1611 1998 2167 2771 3357 3950	12 22 38 58 80 160 264 322	178 232 346 432 472 615 760 897	1127 1471 2195 2736 2991 3901 4820 5686	140 154 166 179 223 248 283 319	1267 1625 2361 2915 3214 4149 5103 6005	
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A-6-1-1

lten	Katerial	Pitting (101)	Labor				Total 1 P (w/10%cont)		Yotal 2	· · · · · · · · · · · · · · · · · · ·		Adopte (1988)
a. A/C Pipe (rmal type)	Based on	Pipe Nate	rial Cos	t as of	December, 1988		******	PYA Price (1987)	Ratio	*******
		(10 X)	• •		•.		441					19 1 .
100 mm	115	12	63	190	7	41		153			1.14	
150 pr	189	19	87	295	12	61		168		507	1.14	58
200 mm	328	33 45	101	462	21 32	101		181 196	824 1091	735 971	1.12	82 1,09
250 mm 300 mm	454 643	40 64	142 188	641	56 44	141		244		1342	1.12	1,0:
300 mm 400 mm	1217	122	279	1618	87	358		271		2298	1.11	2,54
500 mm	1699	170	313	2182	144	488		309	3405	3095	1.10	3 4
500 EE 500 EB	2187	219	398	2804	176	526		349	4315	3934	1.10	4,3
			1	a series								art i
b. Steel Pipe		(15 X)										
150 mm	550	83	111	744	13	159		168		1267	0.93	1,2
200 mm	908	136	125	1168	24	250	 A state 	181	1769	1625	1.09	1,7
250 ER	1210	182	172	1564	42	337		198	2332	2361	0.99	
300 mm	1507	226	227	1960	63	425		244		2915	1.01	2,9
400 mm	1887	283	281	2451	87	533		271	3649	3214	1.14	
500 mm	2251	339	406	3006	175	668		309	4542	4149	1.09	4,5
600 mm	2723	408	526	3657	288	829		349	5600	5103	1.10	5 6
700 mm	3179	477	655	4311	352	979	6206	407	6612	6005	1.10	δ,6
800 mm	4527	679	932	6138	460	1385		465	9246			9,2
900 u a	5104	766	1051	6921	582	1575	9986	523	10508			10,5
1000 ##	6804	1021	1401	9225	718	2088	13234	581	13815			13,8
1100 BE	7926	1189	1632	10746	869	2439	15460	639	16099			16,1
1200 mm	9048	1357	1863	12268	1034	2793		697	18402			18,4
1350 mm	11000	1650	2265	14915	1309	3407	-	784	22378			22,38
1500 am	12953	1943	2667	17563	1616	4027	25526	871	26398			26,4

Por Transmission Pipeline (Transportation < 800 km)

*** Rote: Pipe material prices are estimated from the contractor's purchasing price

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as of Dec.1988

A-6-1-2

Dait Cost

Iten	Katerial	Fitting	Labor				Total 1 Pa ()(#/10%cont)	avement	Total 2	х.		Adopted (1988)
,								******		PWA		
				Pipe Kat	erial Cos	t as of	December, 1988		******	Price	Ratio	
a. A/C Pipe (C	lass 20 Noi		-							(1987)		
		(25 X)										
100 mm	115	29	63	207	1	.4		153		364	1.20	44(
150 mm	189	47	87	323	12	7(168	614	507	1.21	610
200 mm	328	82	101	511	21	11		181		135	1.21	89(
250 BR	454	113	142	709	32	15		196		971	1.22	1,180
300 ma	643	161	188	991	44	21		244		1342	1.21	1,62
400 mm	1217	304	279	1801	87	39		271		2298	1.21	2,78
500 w	1699	425	313	2437	144	54		309		3095	1.21	3,74
600 mm	2187	547	398	3132	176	69	5 4403	349	4752	3934	1.21	4,75
b. Steel Pipe		(35 X)										
150 mm	550	193	111	854	13	18	2 1154	168	1322	1267	1.04	1,32
200 mm	908	318	125	1350	24	28	1829	181	2010	1625	1.24	2,01
250	1210	424	172	1806	42	38	3 2459	198	2654	2361	1.12	2,65
300 mm	1507	527	221	2262	63	48	3095	244	3338	2915	1,15	3,34
400 mm	1887	660	281	2828	87	61	3880	271	4151	3214	1.29	4,15
500	2261	791	406	3458	175	76	4835	309	5144	4149	1.24	5,14
600 mm	2723	953	526	4202	288	94	3 5977	349	6325	5103	1.24	8,33
700 mm	3179	1113	655	4946	352	111	3 7052	407	7459	6005	1.24	7,46
800 mm	4527	1584	932	7043	460	157	6 9986	485	10451			10,45
900 mm	5104	1786	1051	7941	582	1790	11344	523	11867			11,87
1000 mm	6804	2381	1401	10586	718	237	1 15045	581	15825			15,63
1100 mm	7926		1632	12332	869	277	17570	639	18209			18,21
1200 an	9048	3167	1863	14077	1034	317	3 20113	697	20810			20,81
1350 mm	11000		2265	17115	1309	386		784				25,31
1500 m	12953		2667	20153	1616	457	-	871				29,85

Hote: Pipe material prices are estimated from the contractor's parchasing price
 as of Dec.1988

A - 6 - 1 - 3

ten	Katerial	Pitting (10X)	Labor	SubTotal			Total 1 P w/10%cont)	avenent	Total 2			Adopter (1988)
	(******	llait Rate	Rased on	Pine Ma	terial Cost	as of De	cenber, 1988	y et e	******			
. A/C Pipe (C			hadta om	прола	5011d1 0000					an e se		
	1400 00 401	(10 X)					·	1.1			· ·	
100 ви	115	12	63	190	13	43	270	153	423	354	1.16	42
150 mm	189	19	87	295	24	67	424	168	593	507	1.17	59
200 ни	328	33	101	462	42	105	670	181	852	735	1.16	851
250 wa	454	45	142	641	63	148	937	196	1133	971	1.17	1,130
300 BE	\$43	64	188	895	87	206	1308	244		1342	1.16	1,550
400 mm	1217	122	279	1618	175	377	2387	271	2658	2298	1.15	2,66
500 mm	1699	170	313	2182	288	519	3288	309	3597	3095	1.16	3,80
600 m m	2187	219	398	2804	352	863	4201	349	4549	3934	1.16	4,55
b. Steel Pipe		(15 X)								. *	Stal s	e de s
150 am	550	83	111	744	26	162	1025	168	1193	1267	0.94	1,27
200 mm	908	136	125	- 1168	48	255	1619	181	1801	1625	1.11	1,80
250	1210	182	172	1564	83	346	2192	196	2387	2361	1.01	2,39
300 mm	1507	226	227	1960	127	438	2778	244	3022	2915	1.04	3,02
400 же	1887	283	281	2451	175	551	3495	271	3766	3214	1.17	3,77
500 ##	2261	339	405	3006	350	705	4466	309	4795	4149	1.15	4,78
600 ##	2123	408	\$26	3657	577	889	5636	349	5984	5103	1.17	5,98
700 mm	3179	477	855	4311	704	1053	6674	407	7081	\$005	1.18	7,081
800 BR	4527	679	932	\$138	919	1482	9393	485	9857	and and a		9,86
900 mm	5104	766	1051	6921	1153	1898	10760	523	11283	5 		11,28
1000	6804	1021	1401	9225	1436	2239	14190	581	14771			14,77
1100 ##	7925	1189	1632	10746	1738	2622	16616	639	17256			17,260
1200 ee	9048	1357	1863	12268	2068	3011	19081	697	19778	1		19,78
1350 mm	11000	1650	2265	14915	2617	3682	23336	784	24120			24,12
1500 mm	12953	1943	2687	17563	3231	4367	27677	871	28548	2 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -	4 T	28,55

A-6-1-4

Item	Xaterial	Pitting	Labor	SubTotal T (Total I. Pa (w/10%coat)	vènent	Total 2			Adopte
				*********								(1988)
· · .					1. T.		5. 1					
			Based of	a Pipe Nate	rial Cost	as of D	ecember, 1988		******			
a. A/C Pipe (C	lass 20 Nor											
		(25 X)		· ·								
100 mm	115		63	207	13	46	293	153	446	364	1.23	4
150 ee	189	47	. 87	323	24	73	462	168	630	507	1.24	63
200 mm	328	82	101	511	42	116	736	181	917	735	1.25	91
250 mm	454	113	142	709	63	162	1028	196	1223	971	1.26	1,22
300 ##	643	161	188	991	87	221	1436	244	1680	.1342	1.25	1,6
400 mm	1217	304	279	1801	175	415	2630	271	2901	2298	1.28	2,91
500 mm	1699	425	313	2437	288	572	3627	309	3938	3095	1.27	3,9
600 BH	2187	547	398	3132	352	732	4637	349	4986	3934	1.27	4,9
. Steel Pipe		(35 X)										
-			- 111	854	25	185	1171	168	1340	1267	1.05	1,34
150 68	550	193	111	1350		294	1861	181	2042	1625	1.26	
200 BR	908	318			48 83		2514	101		2361	1.15	2,0
250 mm	1210	424	172	1805		397 500						2,7
300 mm	1507	527	227	2262	127	502	3179	244	3423	2915	1.17	3,4
400	1887	660	281		175	631	3997	271	4268	3214	1.33	4,2
500	2261	791	405	3458	350	800	5068	309	5377	4149	1.30	5,3
600 mm	2723	953	526	4202	577	1004	6361	349	6709	5103	1.31	6,7
700 BB	3179	1113	655	4946	704	1187	7520	407	7927	6005	1.32	7,9
800 BR	4527	1584	932		919	1672	10598	465	11062			11.0
900 ##	5104	1786	1051	7941	1163	1912	12118	- 523	12641			12,6
1000 mm	6804	2381	1401	10585	1436	2525	16001	581	16582			18,5
1100 BR	7926	2774	1632	12332	1738	2955	18726	639	19365			19,3
1200 ##	9048	3167	1863	14077	2068	3391	21490	697	22187		-	22,1
1350	11000	3850	2265	17115	2617	4144	26264	784	27049			27,0
1500 am	12953	4533	2867	20153	3231	4911	31125	871	31996			32,0

Par Distribution Disalian (Processitation 1- 600 but

*** Note: Pipe material prices are estimated from the contractor's purchasing price as of Dec.1988

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Construction Korks			3 Lovest (1988)	(stimate A)*1.35	•	-	PRA's U (for 19	nit Cost 87)	Adopted Cost (1988)		
Concrete Rork (incl.Rorm Wort,Scafolding)		2,200	/ca w	Baht	· · ·			•				
Re-Bar	Baht	18	/kg	Baht	24	/kg		-		n in a		
Unit Concrete Cost (incl.For# Work,Scafolding, Re-Bar(100kg/cu m conc				Baht		/cu u		-		5,400		
Barth Rork Excavation (with Backfill)		55	/cu e			/cu e	· .			80		
Soil Fill		53	/cu b		76		•	I		120 (From PVA	Cost)	-
Architectural Works Administration Bldg. Head Quarter Bldg.		4,516 3,612				/sq #	- 2			5,000	· · ·	
Chlorination Bonse	 Babt	2,830	/sg æ	Baht	4,043	/sq #		3610 - 4	300	3,800		
Pump House (excl.pump pit)	Babt	1,860	/sq ∎	Baht	2,657	/sq #		3540 - 4	200	3,600		

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Construction Korks	PWA's Cost (for 1987) (Baht 1000)	Unit Cost (Baht/cu m/h) (A)	Estimated Cost (for 1989) (A)‡1.30	Adopted Cost (1988)
Treatment Pacilities			Onit Cost	Unit Cost
.			(Baht/cu m/h)	(Baht/cu m/)
Sedimentation Basin	1 910	ስድ ብቢል	AZ 100	
50 cu s/hr	1,310	26,200	34,100	34,000
100 cu v/hr	1,633	16,330	21,200	21,000
200 cu n/hr	3,136	15,680	20,400	20,000
250 cu m/hr	5,133	20,532	26,700	27,000
500 cu n/hr	7,708	15,416	20,000	20,000
1000 cu m/hr	17,723	17,723	23,000	23,000
Filters				
50 cu #/hr	588	11,760	15,300	15,000
100 cu n/hr	1,044	10,440	13,600	14,000
200 cu #/hr	2,227	11,135	14,500	15,000
250 cu n/hr	2,337	9,348	12,200	12,000
500 cu m/hr	4,674	9,348	12,200	12,000
1000 ca s/ hr	11,356	11,356	14,800	15,000
Clear Water Reservoir			Unit Cost	Unit Cost
CIONE NATOL EDUCTIONE	:	й. -	(Baht/cu m)	(Baht/cu m)
500 cu u	887	1,794	2,300	2,300
1000 cu 🖬	1,628	1,628	2,100	2,100
1500 cu ø 👘	2,699	1,799	2,300	2,300
2000 cu m	2,803	1,402	1,800	1,800
2250 сц в	3,282	1,459	1,900	1,900
3000 cu B	6,633	2,211	2,900	2,900
3300 cu u	6,603	2,001	2,600	2,600
4000 cu s	7,730	1,933	2,500	2,500
5800 cu 🗉	10,809	1,864	2,400	2,400
Elevated Tank			Cost	Cost
			(Babt 1000)	(Bahi 1000)
50 cu m	722		940	900
120 cu n	1,146		1,490	1,500
250 cu m	1,394		1,810	1,800

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A-6-1-7

APPENDIX A-8-1

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Details of Water Demand Prediction

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Zone 4 2 Med			2	1	552	101	2	***	216.1	299 1	2,045										1,946
Zone 4 3 het			- -	=	• •		.	38	1	65 ⁶	1.753				10.5				1.71		38
A Sugar	•	•	•	,	•		•	1													
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Zone 2 2 Ked	-	. C 3		-	-	-		36		851							4,378	4,946			181.8
lone 2 3 Ked	-		•	•	•	0	-	Ŧ	178	<u>103</u>	Ξ	1 ¹	1,266								2,883
								1 1 1 1 1					7 205 4	64 DJ 61	10 100 0		204 400 1		36 UGB 1		010 311 314 4
lotal	40,415	43,659	840'54	50,16	P11/18	126,28	l ecc'ss	1 101 221	120,315	142,344	11 607 191	41 A7C+121	2 002.101	213,400 23	47 °C2' °C4	241,114 203	500,094 200	10 7C+ 007	177 530°./AC	210°00 72	321 705
Average Service Ratio(1)	35.9	35.0	33.4	33.5	34.5	31.5	34.2	35.2	36.4	37.9	39.60	(i.)	66.2	46.5	43.8	51.1	53.5	56.2	59.6	61.7	64.5

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25,725 5,063 11,466 1,582 6,358 1,582 1,582 1,582 1,582 1,582 1,582 1,50 5.312 35.321 25, 113 41,659 48,446 51,645 61,112 42,521 99,556 112,454 128,913 112,923 181,529 181,502 152,467 230,233 241,764 265,632 285,452 397,389 332,788 376,270 2011 10.015 61,352 52 . 35 63, 365 149 1.872 2.194 2.527 2.371 3.225 3.590 3.965 4.357 4.148 5.156 5.515 8 8 F 21,638 22,568 23,333 2 19,004 21,300 23,599 2 2,147 2,321 2,508 22,234 23,991 2 10,159 11,114 1 3,886 4,455 9,465 10,405 1 1,258 1,413 4,283 5,591 8,932 9,247 1 8,932 9,247 1 5,404 32.134 2010 513,58 25.581 11,002 11,919 13,058 14,218 15,165 18,186 28,112 22,563 25,512 28,959 32,903 35,154 38,084 40,793 42,444 49,650 52,945 56,330 59,803 87,529 92,264 98,356 1 8,583 9,519 9,563 E E 4,436 4,912 2,983 3,232 6**0.** 469 26,116 29.056 1,600 2,266 2,930 3,552 4,592 5,720 5,434 7,209 8,945 8,943 9,902 11,074 12,304 13,594 14,943 15,350 18,514 20,772 23,129 135 5063 E71 15 2008 191 1,971 20,902 2 16,351 1 1,910 16,411 18,481 20,514 23,286 82,351 -53,833 218 158 128 2607 3,194 3,534 2,436 18.510; 19.307; 20.121; 2 12.224; 13.533; 14,901; 1 1,618; 1,107; 1,791; 1 511 95 11, 802 1, 608 2, 653 2, 655 6, 951 11,331 842 3,086 6,785 445 215 125 2006 41, 775 12, 316 222 2005 2.865 18,510 1 12,224 1 13,119 6,555 1,985 5,985 5,985 5,846 5,846 5,846 5,846 67,393 36,689 39,357 42,094 44,900 設業部 2004 2,550 11,001 12,131 14,552 11,729 10,913 1,531 13.855 5.436 5.430 5.430 5.430 5.430 5.430 5.430 5.430 62, 630 6, 621 92 # E 2003 248 5,589 5,589 5,589 5,589 5,688 4,918 4,936 4,936 4,936 4,936 58, 138 6,240 1,354 2,246 16.966 9.789 1,445 82 E 2002 1,514 5,136 1,386 1,386 1,560 4,606 4,606 16,219 8,645 1,358 53, 767 5**, 2**61 222 2001 49, 175 5, 254 9,283 5.441 11,458 17,891 20,720 24,014 27,174 31,999 1,668 1,551 E 2 5 2000 ð 1,614 183'1 14, 755 6, 644 1, 180 1, 395 222 1999 Ģ 6, H1 4,140 14,048 8,283 3,914 158 2,888 2,888 3,528 3,528 1,139 2 2 E 1998 ø 181 13, 358 36 599 3 632 1,331 198 211 82 <u>7</u> 8 895 54 593 593 1991 0 12,685 4,055 922 32,807 3,157 3, 497 5,448 2,147 5,866 2,175 88 2,175 88 120 120 999 0 8 R 8 1996 29,627 3,209 3,209 838 6 5,521 1,328 533 1,528 1,328 1,328 1,328 1,328 1,328 1,328 1,656 185 185 182 321 1995 11,423 2,402 751 ø o 26 609 1 137 2,361 0 8 2 8 1994 10,811 1,964 677 23, 754 2,353 -2, 174 -22 22 E661 10,228 1,595 599 ç 21,050 1,385 115 œ 10 10 10 1912 Prediction of Service Population and Demand 9,655 1,295 522 18,528 • <u>e</u> e 2 1,811 3,152 • 1, 198 198 1961 Conestic Water Consumption by Zone 1.617 40,415 0661 17,282 0 9,347 555 430 -**1**31 . 2, BBS 22 H 1,657 Unit Mater Consurption (Need) Served Population by Zone High Beas Area Ned Deas Area Lov Deas Area Hed Lov Nec. ÷ F ĥed 5 <u>5 5</u> 5 5 Med 10 Test to 돌 Hed Med 20 ž Zone 1 Zone 2 Zone 4 Zone 5 Zone 5 Zone 1 Zone 1 -----Lone 5 Zokė 1 Zone 2 Zone 3 Zone 4 Zone 5 2016 7 Cone 8 Total ----lien

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67, 124

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35,560

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19,652

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12,303

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2.830 12,935 2,945 8,371 2,373 12,253 15,728 15,728 15,728 112 11:,922 2,131 2010 33,435 19,818 1,937 18,556 18,556 9,310 15,341 1,600 2 99, 339 101, 915 104, 432 505, 945 103, 465 676 395 371 371 371 153 307 307 307 2,614 33, 351 19, 557 17, 565 18, 255 14, 352 14, 352 14, 352 14, 352 826 490 491 491 491 235 235 33 33 33 2009 2 661 150 183 183 183 293 31 31 2,611 22,534 7,955 8,455 1,475 1,475 2 2003 653 388 359 559 514 141 141 243 259 259 259 231 20 2,548 32.237 19,174 6,527 2,389 2,389 8,789 14,159 1,411 805 473 542 554 354 355 355 355 355 8 2007 31,362 12,975 6,117 6,117 11,375 2,256 7,255 1,343 2.485 22 631 122 154 154 154 275 275 275 2006 683,86 2, 422 21, 173 13, 645 5, 844 17, 045 2, 133 7, 228 13, 512 13, 512 2 2005 2,359 34,366 30, 492 5, 570 5, 570 2, 005 6, 752 13, 257 13, 257 20 762 460 50 50 331 25 331 25 2004 2,295 29, 822 18, 113 5, 294 16, 387 16, 387 11, 87 113, 089 113, 089 51, 849 2 146 132 132 141 151 151 151 151 151 151 151 151 2003 88, 333 2,233 29, 163 5, 016 5, 016 1, 731 1, 731 5, 770 12, 770 994 22 4 22 4 4 7 55 23 24 22 4 4 7 55 23 26 4 7 55 24 4 7 55 25 2 583 357 321 35 255 255 255 255 20 2002 36,815 2,170 28,517 77,546 4,736 65,736 1,533 1,533 1,533 1,533 12,542 12,542 12,542 29 113 439 412 314 314 22 2001 81,096 21, 372 16, 092 4, 491 1, 275 1, 275 12, 253 317 2,021 684 402 364 364 364 117 305 305 305 305 2 2000 15,377 26,085 14,547 4,243 13,454 13,454 13,454 13,454 13,454 1,884 ្ត 6651 · 69, 657 1,741 24,551 13,181 3,957 3,957 12,384 744 3,388 11,453 2 8661 63,938 22,874 11,781 3,656 11,435 2,718 2,718 10,932 1.558 2 1997 (based on Population Ratio by Lone) 58,219 1,455 21.031 10.452 3.345 10.518 2.045 2.045 10.328 29 1395 526 84 84 555 265 265 265 265 265 258 258 0 0 (Number of student = X X of population in service area) 5 in service area) 93 184 93 184 51 74 51 74 224 269 6 5 1 27 211 258 211 258 1,325 1/day/student) 221 406 321 411 35 141 41 59 41 59 113 215 0 4 4 0 21 169 207 169 207 2 20,320 7,352 2,946 10,764 10,764 10,333 22,527 24,956 29,715 34,475 39,235 52,938 1995 15,063 3,729 3,945 8,945 8,442 8,442 0 0 381 1994 2 1/(day/pop 362 43 43 43 43 43 43 20 20 20 20 20 20 0 6,043 6,043 362 2 14, 658 1, 711 1, 727 8, 496 1993 . consumption = 212 254 0 21 19 21 137 155 0 0 0 131 149 0 0 0 0 9**2** 1,435 0 Ē 12,681 428 1,356 7,815 1997 Prediction of Service Population and Demand Iten 1951 Vater Consumption for 60%/Inst/Conmercial 0,558 0,558 19,591 096 147 6,847 22 624 (ust 193 124 116 0 116 0 0 3, 623 901 6, 177 6, 177 5, 616 5, 616 22 563 Kater Consumption Zone 1 Zone 2 Zone 4 Zone 5 Zone 5 Zone 7 Zone 8 Ratio (X) = Rumber of student Sub-Total Zone 1 Zone 2 Zone 3 Zone 4 Zone 5 Zone 5 Zone 8 Zone 8 Total B. School -Ľ ÷

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2,183

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Sub-Tota)

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	1990	1991	1992	6661	1994	\$661	9661	1665	1998	6661	2000	2001	2002	5003	2001	2005	2005	2007	2008	2009	2010	2011
C. Hospital Use	{ Pepulat	on per	ted :	345 De1	rson/bed		1.5	consumpti	- 10	1.5 CI	bad/bed											
Zone 1	205	230	216	315	349				103	295	565	620	163	648	663	673	693	101	205	719	8:1	138
Zone 2	-	•	5	5	80	168	223	256	287	318	350	381	882	394	100	105	112	111	121	3	12	30
Zone 3	20		29	%	19	84	EL	80	36	35	36	103	501	115	121	121	133	143	153	163	111	281
Zone 4	134	• •	170	185	161	1534	231	243	269	232	317	342	343	355	363	371	378	3E4	396	397	103	110
Zone 5	0		¢	B	æ	-	82	2	<u>ف</u>	11	23	*	38	Ħ	₽	9	57	52	55	57	33	29
Zone 5	9	ς	-	0	6	53	3	59	ž	38	101	Ē	125	135	143	151	167	021	193	265	217	225
Lone 7	125	ž	162.	115	184	. 225	225	238	249	259	266	213	213	283	382	162	299	363	E	325	E	342
Zone 8	 .	1	.	Ð	•	5	8	0	•	-	4 2	61	22	\$2	26	21	53	5	32	8	*	75
Sub-lotal	061	543	546	611	693	1,132	1,265	1,390	1,514	1,639	1,763	1,887	1,942	1,997	2,051 2	2,106 2	2, 161. 2	2,216 2	2,270 2	2.325 2	2.360	2.434
A+B+C Total of Governeotal/Insti-	tal/lestit	utional	Consurot	ua.			1															
Zone 1	C#9	· **	9 4 6	895	1,072	1,356	1,404	1,527	1,639	1,141	1,827	1, 903	1,946	1,990	,035	1. L			. 178	• •	.235	2,265
Zone 2	Ð	0	29	114	249	161	698	186	986	916	1,014	1,111	1.190	1,209	1,228	1,247 - 1	1,266	1,280 1	1.294	1,308 1	1,323	1.338
Zone 3	20	5	6	115	137	197	223	5112	264	283	300	316	335	ESE	112	1	•		470		945	556
Zoan 4	112	191	522	567	597.	718	602	163	827	868	216	1,050	1,072	1694	1,116			•	1,139		,223	9
Lona 5	0		Ċ,	.	•	ł	\$2	35	3	59		106	115	125	134				166	÷	184	5
Zone 5	•	D	8	_	0	2	136	181	526	270	312	351	385	418 4	151	÷.,	-	1.1	169		505	201
Zona 7	366	85	495	E	565	690	689	130	364	Ē	818	168	652	865	583		۰.		215		1.024	3
Zone 3	¢	====	•	0	-	•		•	-	•	\$2	13	99	51	52	• •			3		101	=
Total	1.503	1.566	685.	2.301	2.618	3, 335	1.885	1.257	613.3	5.031	5.412	5,794	2,962	6, 130	5.258	5. 466 S	5.63.4 G	6.887 5	2 225.8	1.133 7	1206	1.614
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Commercial Nater Consumption		{ ant c	con sumpt	ien =	1 01	day/pop	2	cê area)								- 1 T					Ì	
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7 3007		~ <u>-</u>	ະ :	8	<u>8</u>	5	2	60 C	52	E	8	119	2	306	075		595		595	386	155	8
(016.J		¥	2	5	6	Ē	191	3	P 51	212	52	[2]	22	265	612		306		352	315	111	-
Zone 4	59	162	16f	5	2	238 238	123	215	53	513	128			5	336		869		863	: 191	23	343
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(one f				е ş	- :	3	201	<u>ع</u>	5	8 :		192	82	8	ŝ		595 195		£		S 1	2
1 8407	162	376	2	Ę.	1	Ę	516	1			116	121	659	638	<u>19</u>	979	220	101	128	- 89 I	<u>i</u>	<u> </u>
2 2107	3	-	-	-	⇒ .	⇒ [`]	-		-	-	2 22 	2 `	2	ž	7		ž				3	50
Total	1, 126	1,248	1,486	1, 724	1,962	2,649	2,911	3, 197	3, (83	591 °C	4,055	4,341	4,467	4,592	4,718	4, 844	4,370 5	5,036 5	5, 222	5, 347 4 5	5,473	5,559
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	1990	1681	1912	6661	1661 6651	1995	1996	1661	1998	6661	2000	2001	2602	2003	2004	2003	2006	2087	2008	2002	2010	1102.
Kater Consumption by Univercity	on by Univercity/	/Colledge	53		1.2											-	÷				•	
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7ane 7				÷		3,184	3.278	312	3.467	3.561	3.656	3.750	3.844	3, 939	4 .633						4.600	6.525
Zono 1				-			-		G	-		-	0		e						0	
tane t	• •		-			-			-			5	0	0	0						e 7	ст)
2000 y			•.=						• •	-	-	0	-		4 29						~	*
Zone 5		ė	• •	• •	• •	0 2,417 2,598	2,598	2,779	2,960	3,148	3,321	3,502	3, 683	3,364	4,044		4,405	4,585	4 766	516.1	5,135	5, 305
Zone T	0	0			-	,	0	.	¢	-	0	e	P	.	0						- -	- -
Zone 8	0	0	-		. .	.	83		-	-	0 0	0		-	0						3	⇔ ,
fotal	Ģ		•	•	•	5,601	5,876	6, 151	6, 125 8, 102	£, 702	1 119, 9 21	252	1, 527	1,802 8,078		8 353	6.628	8,902 B. 177	111 E	9,451	9.725	HD, 630

Other Use (4.6 1 of Demostic & Governmental Use)

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Prediction of Service Population and Demand

18,720 1.66 4,580 1.00 3.090 30.413 2,303 815.4 1.00 5.5 102 39,413 3.952 8.550 1.05 16.728 1.59 4,530 1.90 1.00 2.303 4, 132 1.00 2018 30.-13 3,746 8.100 1.00 18,723 5.55 4,686 1.00 1.00 2,838 1,06 3.914 2009 1.650 18, 720 1.00 4, 630 3, 597 1.00 3,536 1.00 30.412 30.413 3 2.800 2008 18,720 1.00 4,630 1.00 2,838 1,00 3,473 1.68 7,209 1,08 fucore Bevelopment in 810P's industrial Area (4800 ha x 320 ha (480ha x 50% at Ihanyaburi + 480 ha at Beng Krabi) x 32 cu s/6/ha x 2.65) Actore Bevelopment outside 810P's industrial Area (680 ha x 38 cu s/6/ha) 1,328 1.00 1961 30,413 3,262 3, 120 6.750 18,720 1.40 1.680 1.00 1,00 2,808 1,00 2005 30,413 30,413 30,413 2,808 3,04 2.912 6,300 . 1.00 18,720 1.00 4,630 8. 2005 2,808 1.00 2,104 5,850 13,720 1.00 4,680 1.60 1.00 2,827 0.77 2004 2,495 5,400 2,603 18,720 1.00 4,680 1.00 2,808 1.06 0.90 2003 2,285 1,950 18, 720 1.00 4, 680 1.00 20,413 30,413 0,80 2,808 2,392 2002 1.00 1.00 4.580 1.00 2,808 2,175 2,080 0.70 4,500 0.78 2001 18,720 1.00 4,680 1.00 30,413 30,413 0.50 1,951 0.67 1,872 2000 0.60 2,808 18,720 1.00 4,680 1.00 1,748 3,600 0.50 .65 2, 808 1. 00 1959 30,413 3, 150 18,728 1.00 4,680 1.00 0,40 2,308 0.00 1,522 1,456 0.57 1998 30,412 2,700 2,808 18,728 1.00 4,580 1.08 0.30 1,305 1,248 1997 30,413 18,720 1.00 4,680 1.00 000 2,250 0.20 2,808 1,087 1996 30,413 876 0.25 18,728 1.00 3,744 **6.1**0 Future . 8858 2,808 0.00 832 0.25 ,800 (Other) 1995 30,413 3 16,720 0.00 2,608 0.60 Fatare 2, 305 0.00 652 0.00 524 0.60 1,350 5.00 0.63 (Rengs) 1661 30,413 fetare . 86° 86° 18,720 £ 19 19 0.0 2,305 1,872 0.00 58. 2,2 1993 Sak() Service States by Zone (1.Served, 0.Unserved) 30,413 30,413 18,720 6,00 935 0,00 2,808 0.00 208 708 0.08 150 0.00 Existing B.L.P 1992 6.9 23 73 0.6 8 8 Mava Existing | Makorn Factories 18,720 **9**.0 0.0 2,808 0.0 1661 0.00 0.00 -0.00 0.301 Exis. Factory 30, -{other than N.Rakorn} Connection Ratio Future (in DICP Benghrad Connection Ratio future (in DICP Rangsit) 0.10 8.1 Kaya Nakorn (Phase 1-3) Ratio of Consumption by Jone 1990 Kara Bakorn (Expansion) ************************* **Connection Ratio** Connection Ratio Future (Other Area) Connection Ratio Industrial Mater Consumption Connection Ratio Connection Ratio Zone 5 Zone 6: Zone 1 Zone 8 Zone 1 Zone 2 Zone 3 Zone 4 Cone 1 Zone 1 B. I. P 6

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28,529 28,529 1,580 1,580 1,580 1,580 1,580 1,580 1,532 1,532 1,532 2,000 70.628 71,504 72,379 73.255 74 130 107 2010 28,422 28,422 1,425 321 8,177 80,845 7,438 7,438 2,850 2009 12,898 28,454 1,355 304 8,133 8,133 8,133 10,590 10,590 2,344 2,344 2,344 12,699 28,417 1,275 287 287 8,698 10,336 7,251 7,251 2,550 2002 28,379 1,200 1,200 2,400 2,400 2,400 2007 28,342 28,342 1,125 253 9,826 9,826 2,250 2,250 63,153 2006 28,304 28,304 8,580 8,590 8,5000 8,5000 8,500 8,500 8,500 8,500 8,500 8,500 8,500 8,500 8, .2005 62.877 11,234 750 750 8,423 8,423 8,423 8,423 8,423 750 750 65.375 2004 0, 111 21, 679 675 675 152 1, 581 1, 581 5, 977 5, 977 5, 977 5, 977 2003 49,709 53,625 57,542 61,459 2002 21,204 600 6,138 6,138 1,402 1,200 2001 1,854 525,128 525 5,895 5,895 6,828 4,816 4,816 5,741 26,253 450 5,054 5,054 1,957 3,957 3,957 7000 25, 111 25, 111 115 115 115 115 1, 211 1, 211 1, 211 1, 211 1, 211 1, 211 1, 211 1939 45 042 4,494 25,302 2,295 2,295 2,295 2,295 2,295 2,295 38,461 1998 3,370 24,825 51 1,723 1,978 1,978 1997 0 26,231 30,334 34,700 24,351 \$661 1,123 1995 1991 1993 1992 Prediction of Service Population and Demand Industrial Mater Consumption (cu n/d) 1661 0661 Patum Thans & Prachatipat Zone 1 Zone 2 Zone 2 Zone 4 Zone 4 Zone 4 Zone 4 Zone 8 Zone 8 **Jota**] Cen.

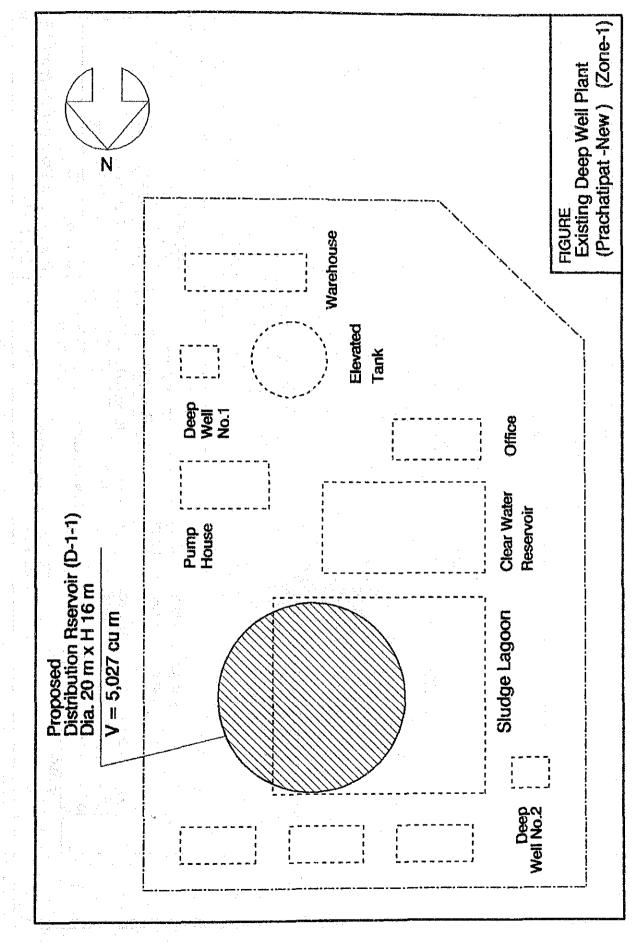
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Jotal Daily Average Consumption by Zone		1661	1992	6661	1994	1995	9551	1991	1298	6661	2000	2001	2002	2003	2064	2005	2006	2007	2008	5002	2010	2011
	mption b	*	(ce n/d)																			
Zone 1	4, 173	4,564	5,344	5,167		9,443	11.511					-	5 153 3				34.712 3		38.305 4	40.219 4	62.213 4	44.238
Zone 2	9	6	129	528	1,201 2				33.563	34,928 3	36,388 3	31, 953		40,128 4	11,249 4	42,067 4		43.187 4				46.307
Lone 3	210	291	60 1	533								2,542					4,423					7.199
Zone .4	1.853	2,913	2,357	2,524		3,341		f, 029	4,512		5,556	6,822	1,325									14.52
Zane 5	0,	0			•			2,113			5,541	6,528								18,378 1		0,322
7 016 D	-	•	-	⇒ :	•	3,320		211	6 189	-	1,455	12,571	13,668	-	-	-	-					24,315
1 auo7	2,430	2,682	2,967	3,238	3,502	4,661		6,649	1,699	8,764	9,840	10,934	12,031			15, 182 . 1						20,518
Zone B	0	3	•	0	φ.	⇔	¢	æ	æ .	•	1,029	1,373	1,578	1,187	1,998	2,663	2,850	a, 100		3,550	3, 781	t.015
lotal	8,126	609*5	11,206	13,050	15,261	51,049	59,358	66,413	13,195	14, 322	1 000.00	93,380 102,110 109,697 117,461 125,405	1-109,00	1.461 1	1 90 1 92	133,119 138,397 144,925	18,397 14	14 ,925 15	151,138 159.025 166.621	9, 825 16	6.521 17	17 4, 592
Unaccounted-for Water Ratio (\$) For Lone 1 and 7 only 26 For Other 20mes 30	cio (\$) 26 26	8	52 57	\$7 F	\$2 F	***		ងន	22	2.2	53 F	25	5	28	នុគ	25	12	5	21	\$2 \$2	នេះ	28
Total Daily Average Demand by Zone (cu	d by Zon	e (cu m/d)																				
Fore	5,639	191	7, 202	82. 8	164.6	12,625	15,349	18,275	21,239	21, 207	27,285		11'H	38,231	39,249	41,957	13, 539	46.043	48.243 5	50,526 5	52, 898 5	55,360
2 2005 2	- -) 1	ē.	199			38,910				· ·			÷.,								0.384
P auno	077	10, 0	2	100		1,616	1,508	2104		1	170.2			1 , 1 ,					1.1			\$ 5
tons -	2,316	269'2	2 345	3,280	3,502	921 -	4,481	5,037	5,115	6,524			193	9, 815	10.501	11,281				19,451		18, 159
C 3007	- -	- ·			-	201	2,200	1,33		1.1				10,509								13,528
7 nm 7	1 224	. 7 E3 E	1 200	1 263	1 505 L		1 189-	570 ⁴ 0	9, FI 2 11 t 5 6	12,300	212 61 51 512 61			16, 10U	107,25	21, 300 C	2 316*22	· · · · · · · · · · · · · · · · · · ·	20,130 Z	2 012'12	- 10, 12	30, 326 AC 610
Zone B	0	1		0	0			1			1.256	1.115	11	2.234								010
	01.01 10.11	1.00	14, 826	17.948	20.0K3	419 <u>31</u> , 111 - 59	75 614	11 574	01 K02 1	AL 512 03 505 181 006 187 50	1 130	124 200 128 760	1 100 1	12 387 159 DE1	58 DK1 1	187 579 174 704 181 827 10A 274	1 705	1 827 10	n 325 16	5	160.31	UFC 8
																		1				
Fotal Daily Maximum Demand by Zone (cu	of by Zon	e (cu z/	(p/#		•	• •						14. 1		n go te				• 		17	,÷	
	A 747	400 L	\$ 642	111	11 231	64 8KM	12 212	31 320 -			617 61	14 107	10 0.7	11 174	070 27	511.03	1 101 13					215 22
2006 2			161			12.590	121		50.345	266.42		56 930	12.2	5 A 1	- C - C			55, 531	9 200° U	1 695 89	10 610	
Zone 3	27	436	514	100		1.478	1.903				3.165	3.814	100	1.1.1	1. I.							1 6 20
Zone 4	2.779	3,110	3.535	3.936	(.323	5.011	5.378	5.044	1144	12.1	8,948	10.233	10.988	11.11	5 E			1.1				21.79F
Zone 5	-	~	e	æ	G	1.359	2.722	4.070	5.650	5.36.6	8.311	6.791	11, 198			1.1	6 E			1.1		5.1.3
Zone 6	•	-	0	-	0	4,960	5.646	8.171	134	15.546	11.182	18.657	÷				9 S		1.1	a 6	1.1	35.473
Zone T	116.	1.349	4, 798	5.222	5.633	101	8.978	10.582	12.188	13.501	15.415	17.048							26.507	2		111 118
Zone 8	e	•	-	-	9	-	-	0	-	•	1,543	1.053	2,368									6.073
total	13 843 15 25		782 21	20 K07 24 G76	24 676	73 045	101 00	1 280 1	12 870 1	40 117 101 480 117 550 128 530 147 116 555 121 156 450 117 945 129 561 200 665 200 664 216 121 228 229 259 551 551	111 67	1 1 1 1 1	66. 450 1	17 QAK 1	60 661 2.	6 330 A	1 52 1	10 101 01	10 DI 01	26 283 25	D 161 20	
		. I														* ****						
freatuent Plant Capacity fcv a	Capacity	tes a/de	víday) S	Starting in 1995	1995 A		((((#11					•		4				с ³²				• :
			¢ .		Line I	70, 750	1225225	******	181213122	(31,123). [30] attacknistististististististististististististi	1211111	1111111	1121221	******	******	1212222	\$2112292	ttrs###	*******	******	2312121	111)
	i				Line 2	10,750	******	*****	****	(/./)() 15() 14(2)2(2)2(2)2(2)2(2)2(2)2(2)2(2)2(2)2(2)	6122225	1111111	****	******	11122111	1111111	******	*****	*****	\$1\$\$\$¥	******	
			. •		Line.3 .					•	10,750 +	*****	*****	****	tristit	******	tttttt:	ttitiis.	70.750 stattatatatatatatat $xxxxxxxxxxxxxxxxxxxx$	11111111	11111111	

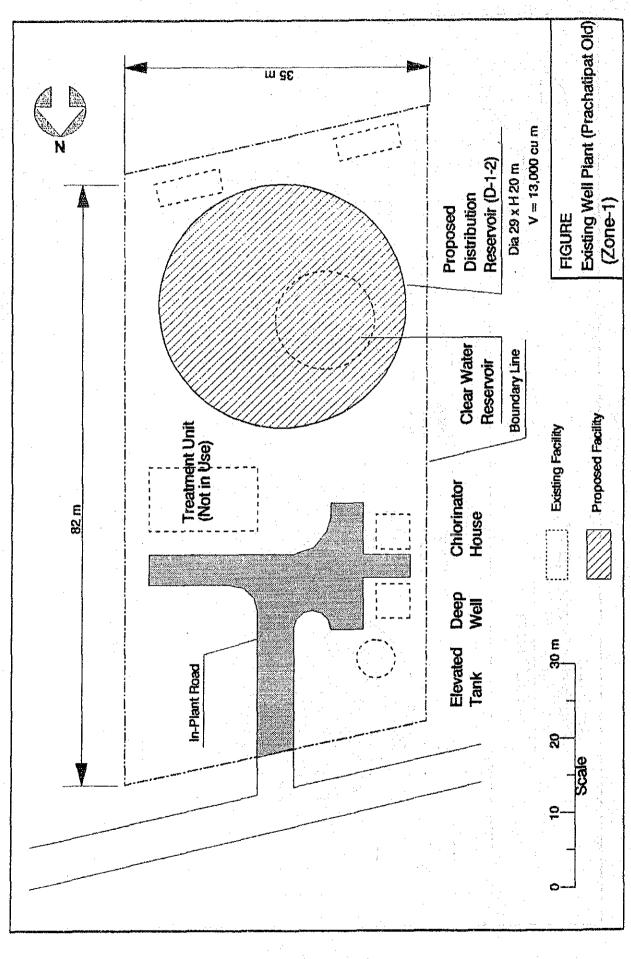
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APPENDIX A-8-2

Layout of the Distribution Reservoirs in the Existing Waterworks

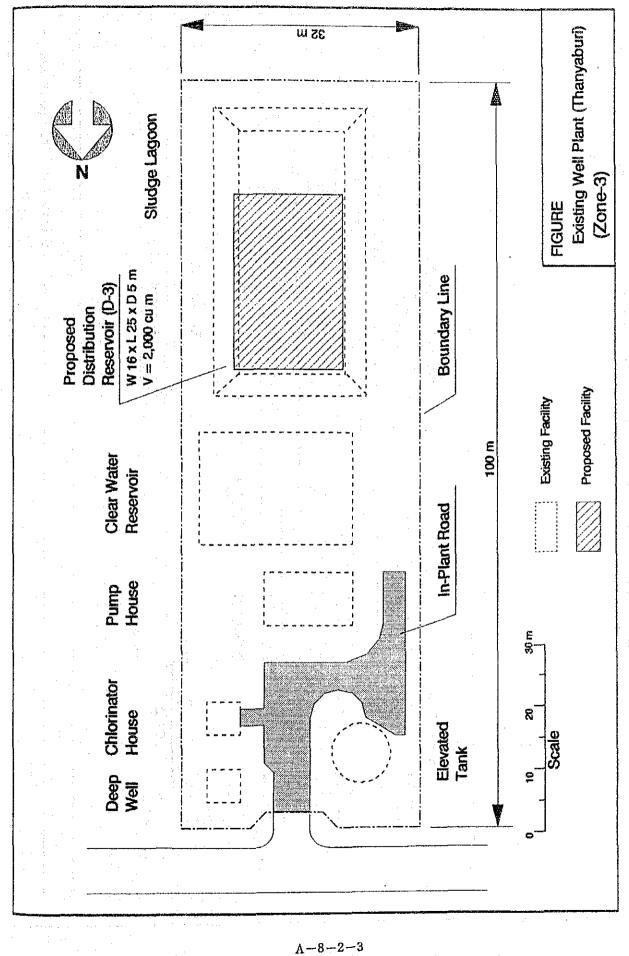


A-8-2-1

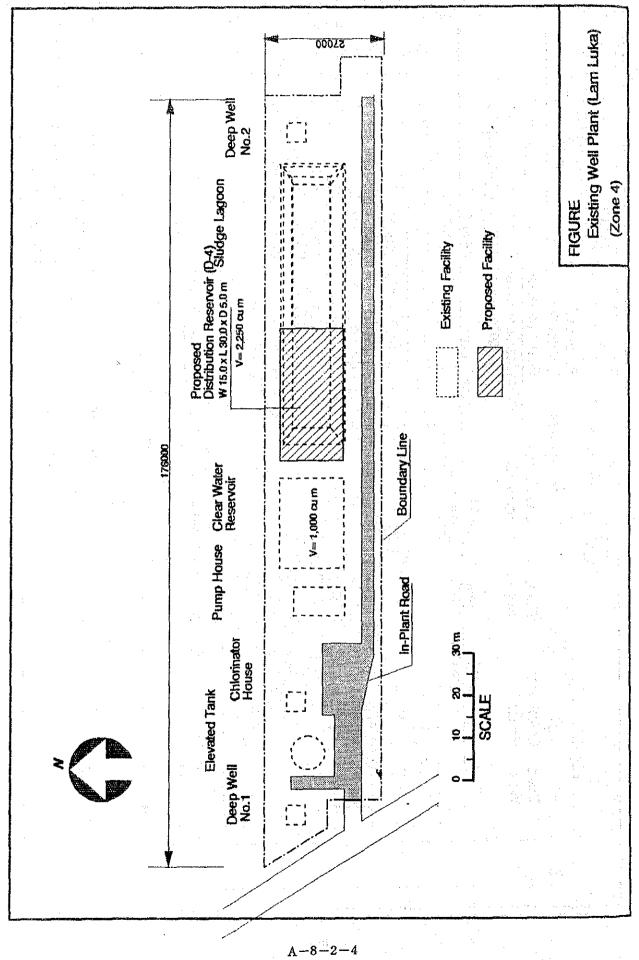


A-8-2-2

2

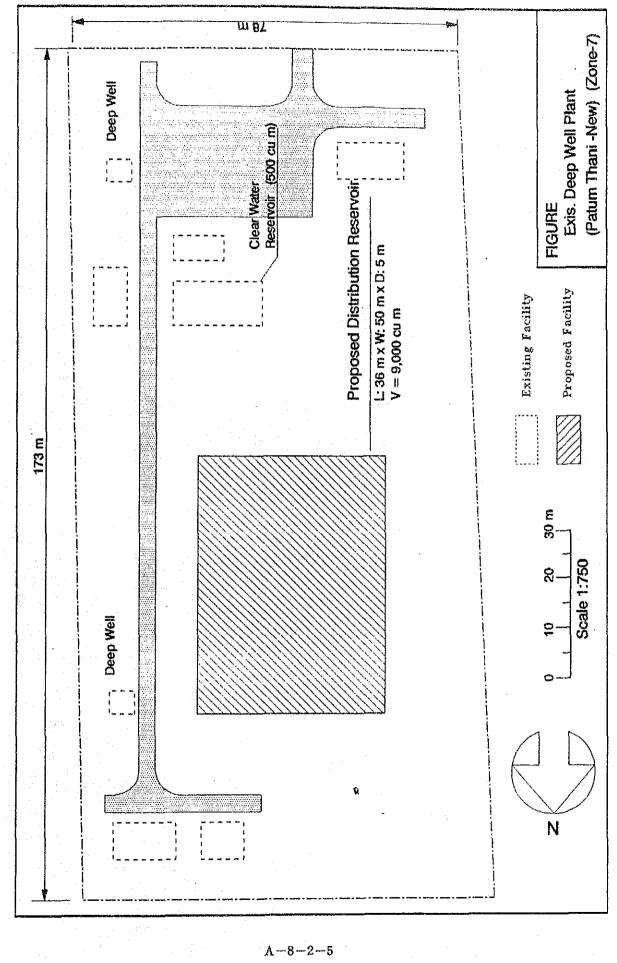


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V O P

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APPENDIX A-8-3

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Details of the Cost Comparison for the Alternatives

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 			÷		÷								Paton Th	ani and P	rachatipa
Alternativ	ve : 1-	-1													
Facility	Ref.		Status	Capacity Q(D.Ave) {cu æ/d}		·	Design Capa				é.		Cost (Bx1000)	Land Area (sq E)	Lanó Cost (Bx1050)
Raw Water Pumping Si			Pro	312,000		, 4 4 4 to to 1 4 1 4			·•-•-•				68,915	1,600	2,000
law Rater (1500 pr				Q(D.Xex)	Pros	To				Length (kr)		Unit Cost (Baht/#)			*****
			Pro	261,888	Chaopraya River	TI	312,000			0.2		26,400	5,280	0	0
reatment	Plant				 :		Q(D.vax)								
		кі.	FI	Fro	:		283,000						656,917	110,000	137,500
istributi	DI	erv	Pro	-						*-***			152,700	.0	10 7E
 	D2 D3 D4 D6		Pro Pro Pro Pro	20,600 2,000 2,200 8,800		•. •							163,200 16,900 17,500 67,000	6,000 0 0 6,000	18,75 18,75
· .	D7 ED1		Pro Ex	9,000 2,000									89,200 -	0	
	ED2 ED3 ED4	e # 2	Ex Ex Ex	1,000 1,000 500									- - -		
Sub-Potal				65,100									506,500	12,000	37,500
rans eis si istributi		R.	•••••••	Pipe Ko.	Froe	To	Design Q (cu m/d)	Dia. (ee)		Katerial	Fric.Los (e)	sUnit Cost (Baht/r)	Cost (Baht1000)		
				1 2 3		D2 1 N.Nakn	172,382 194,120 18,720	1000 1200 400	5.5 2.3 1.2	5 5 5	35.2 7.5 11.0	18,400 3,650	76,010 42,320 4,380		
	-			4 5 6	1 2 2	2 3 4	175,400 18,840 156,560	1200 500 1200 700	4.5 6.0 8.0 0.7	5 5 5	12.2 18.7 17.6 7.4	4,540 18,400	82,800 27,240 147,200 4,627		
				7 8 9 10	4 D1	DI D3 7 5	88,223 11,699 108,153 15,208	400 800 500	2.0 2.7 12.0	5 5 5 5	7.7 21.6 25.2	3,650 9,250 4,540	7,300 24,975 54,480		
	·. ·			11 12	5	6 D4 8	3,042 21,791 28,329	300 600 500	10.5 8.5 5.8	AC S S	13.5 14.3 38.5	1,490 5,600	15,645 47,600 26,332		

A-8-3-1

		•									Patur TI	ani and	Prachalips
							н ^а .		•	· .			
lternativ	ve : 1-1					· .				di shakar	viti El III.	·	- - -
acility	Ref.	Status	Capacity Q(D.Ave) (cn m/d)			Design Capa					Cost (Bx1000)	Land Area (sq r)	Land Cost (Bx1000)
				10 D6 12 12 12 12	10 D6 12 13 14 15	47,024 47,414 15,805 15,805 15,805	1200 8.0 700 4.1 600 1.0 500 5.1 500 4.1 400 1.0	5 5 5 5 5	6.9 14.8 7.1 12.4 10.1 6.7	18,400 6,610 5,600 4,540 4,540 3,650	5,600 24,970 20,430 3,650		
			22 23 24 25	10 11 11	14 15 11 16 D7 17	4,741 4,741 47,351 4,221 36,800 46,340	300 4.2 300 6.2 700 2.5 250 1.0 600 2.6 600 0.8	AC S AC S	13.2 19.0 8.3 5.7 11.5 5.4	1,490 1,490 6,610 1,090 5,600 5,600	6,705 9,685 16,525 1,090 14,560 4,480		
			27 28 29	17 17 19 19	18 19 20 21 22	4,001 42,339 20,005 17,832 7,829	300 5.8 600 2.0 500 7.5 500 5.6 400 5.0	AC S S S	12.4 11.5 26.1 14.1 9.1	1,490 5,600 4,540 4,540 3,650	8,642 11,200 34,050 22,700 18,250	- - - -	
ıb-Total							146.4			a sector de la companya de la compa	953,801		
								Grand Total)nstructi	on Cost 2,188,513		Land Cost 177,000
							·	Total Const	ruction (lost	2,365,513	n te Antonia National National	
						•					********		
								· · ·	tur V			n Nin Nin Nin Nin Nin	land Land
									•••				
								- - -		· · · ·	•		
		· ·			· · · · · · · · · · · · · · · · · · ·								

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ncility	Ref,	Status	Capacity Q(D.Ave) (cu m/d)			Vesign Capa						Cost (Bx1000)	Land Area (sg E)	ianó Cost (Bx1000)
water I Iping Sta		Pro	312,000									öE,915	1,600	2,000
w Water P 1500 mm S			Q(D.Kax)	From	10				Length (kr)	A.Lose (r)	Unit Cost (Bahl/r)			*****
		Pro	261,888	Chaopraya River	ı Tl	312,000			0.2		26,400 _.	5,280	Ç	Û
eatment P	lant .	· · · ·				Q(D.max)					.			
			Pro			283,000						656,017	110,000	187,500
istributio	n Rese Di D2 D3 D4 D6 D7	Pro Pro Pro Pro Pro Pro Pro Pro	(cu n) 18,000 19,100 2,000 2,200 13,000 9,000	 							·	152,700 163,200 16,900 17,500 99,000 89,200	6,000 0	6 18,750 0 18,750 18,750 0
	ED1 ED2	Ex Ex	2,000 1,000									-		·
· • .	EDJ EDJ ED4	Ex Ex Ex	1,000 500									-		
ub-Total			67,800									538,500	12,000	37,500
ransmissio istributio		1	Pipe No.	Fron	To	Design Q (cu ¤/d)	Dia. (ce)	Length (Kr)	Katerial	Fric.Los (r)	sUnit Cost (Baht/r)	Cost (Ex1000)		
			2 3 4 5 6 7 8 9 9	3 3 D1	1 D2 D1 2 NavNkn 3 4 5 5	172,382 72,460 99,922 94,199 18,720 75,479 18,840 23,550 86,361	800 1000 1000 400 1000 500 600 600	4.5 1.0 14.0 2.3 1.2 4.5 6.0 5.5 0.7	S S S S S S S S S S S	18.1 3.8 32.7 4.8 11.0 6.3 18.7 10.7 15.0	9,250 13,820 13,820 3,650 13,820 4,540 5,600 5,600	72,450 9,250 193,480 31,786 4,380 62,190 27,240 30,800 3,920		
· · ·			11 12 13	D1	7 10 D3 D4 8	43,181 21,791 11,699 21,791 15,208	600 500 300 500 500	4.0 2.7 2.7 8.5 12.0	S S AC S S	23.8 11.0 41.9 34.7 25.2	4,540 1,490 4,540	22,400 12,258 4,023 38,590 54,480		
						A	8-3	-3						

Q(D. Ave) (cu ɛ/d) (bx1600) (sq ɛ) Area (sq ɛ) Cos (sq ɛ) 15 8 9 3,042 300 10.5 AC 13.5 1,490 15,645 16 14 11 28,329 500 5.8 S 38.5 4,540 26,332 17 11 12 5,666 300 10.5 S 20.0 13,820 145,110 19 13 89,506 1000 10.5 S 20.0 13,820 145,110 19 15 86 52,705 6600 2.0 S 17.2 5,600 11,200 20 D6 14 21,103 500 8.2 3 0.8 4,540 908 21 14 15 16,552 400 4.2 S 13.3 3,650 15,330 22 06 16 47,414 600 1.0 S 6.7 3,650 5,650 26 17 19 4,741 300 6.5 AC 13.0 1,454 20,430 <th></th>														
Niteraalive : 1-2 Tacility Ref. Status Capacity {(0ve) {(cu m/d)} 15 8 9 3,042 300 10.5 AC 15.5 1,400 15,645 16 14 11 28,229 500 5.8 S 38.5 4,540 26,332 17 11 12 5,666 300 9.0 AC 36.6 1,400 13,410 18 71 13 89,506 1000 10.5 S 20.0 13,820 145,110 19 15 86 52,106 600 2.0 S 17.2 5,660 11,200 20 06 14 21,103 500 0.2 3 0.8 4,540 908 21 14 15 10,552 400 1.0 S 7.1 5,600 5,600 22 06 16 47,414 600 1.0 S 7.1 5,600 5,600 23 16 17 15,605 500 4.5 3 10.1 4,540 20,430 24 15 13 15,605 500 4.5 3 10.1 4,540 20,430 25 16 19 15,605 500 4.5 3 10.1 4,540 20,430 25 16 19 15,605 500 4.5 3 10.1 4,540 20,430 25 16 19 15,605 500 4.5 3 10.1 4,540 20,430 25 16 19 15,605 500 4.5 3 10.1 4,540 20,430 25 16 19 15,605 500 4.5 3 10.1 4,540 20,430 25 16 19 15,605 500 4.5 3 10.1 4,540 20,430 26 17 19 4,741 300 6.5 AC 13.2 1,600 5,600 26 17 19 4,741 300 4.5 AC 13.2 1,600 5,600 26 17 19 4,741 300 5.8 AC 13.2 1,600 5,765 27 17 18 4,741 300 6.5 8 5.4 5,600 4,600 30 20 21 4,001 306 5.8 AC 13.2 1,600 4,605 31 20 22 42,339 600 2.0 S 11.5 5,600 11,804 53 0 20 21 4,001 306 5.8 AC 12.4 1,400 8,642 31 20 22 42 57,329 600 5.0 S 14.1 4,540 22,700 34 24 25 7,829 400 5.0 S 14.1 4,540 22,700 34 24 25 7,829 400 5.0 S 14.1 4,540 34,050 33 22 24 17,832 500 5.0 S 14.1 4,540 34,050 34 24 25 7,829 400 5.0 S 14.1 4,540 22,700 34 24 25 7,829 400 5.0 S 14.1 4,540 22,700 34 24 25 7,829 400 5.0 S 14.1 4,540 22,700 34 24 25 7,829 400 5.0 S 14.1 4,540 22,700 34 24 25 7,829 400 5.0 S 14.1 4,540 22,700 34 24 25 7,829 400 5.0 S 14.1 4,540 34,050 35 22 24 17,832 500 5.0 S 14.1 4,540 34,050 37 22 24 37,829 400 5.0 S 14.1 4,540 22,700 34 24 25 7,829 400 5.0 S 14.1 4,540 22,700 34 24 25 7,829 400 5.0 S 14.1 4,540 22,700 34 24 25 7,829 400 5.0 S 14.1 4,540 22,700 34 24 25 7,829 400 5.0 S 14.1 4,540 22,700 34 24 25 7,829 400 5.0 S 14.1 4,540 22,700 34 24 25 7,829 400 5.0 S 14.1 4,540 22,700 34 24 25 7,829 400 5.0 S 14.1 7,1450 Construction Cost 2,844,660 1977,46								·				Fatur T	hani'and'	Frachavia
aciiiiy Ref. Status Gapacity (come/d) Design Capa Cost (bill Land Area (bill Land Cost (come/d) Land Area (bill 15 8 9 3,042 300 10.5 AC 13.5 1,490 15.643 15 8 9 3,042 300 10.5 AC 13.5 1,490 15.643 15 8 9 3,042 300 10.5 AC 13.5 1,490 15.643 16 11 25,666 300 9.0 AC 36.6 1,490 13,416 18 71 13 89,506 1000 10.5 20.0 13,220 145,110 19 15 86 25,705 500 2.0 5 17.2 5,600 15,200 20 06 14 21,103 500 0.2 3 16.5 16.5 16.5 16.5 16.5 16.5 16.5 16.5 16.5 16.5 16.5 16.5 16.5 16.5 16.5 16.5 16.5 16.5 16.5										· · .				
Q(D. Are) (cu e/d) (5x1000) Area (sq e) Ose (sq e) Ose (sq e) 15 8 9 3,042 300 10.5 AC 13.5 1,490 15,645 15 16 11 28,329 500 5.8 S 38.5 4,540 26,532 17 11 12 5,666 500 9.6 S 20.0 13,10 18 71 13 28,565 1000 10.5 20.0 13,200 145,110 19 13 85 52,706 600 2.0 S 17.2 5,600 11,200 20 06 14 21,103 500 4.2 S 13.3 3,650 15,330 21 14 15 16,552 400 1.0 S 7.1 5,600 5,600 22 16 16 47,414 600 1.0 S 6.7 3,640 24,970 24 18 15,805 500 4.5 10.1 4,540 20,130 25 <td< td=""><td>lternative</td><td>: 1-2</td><td></td><td></td><td></td><td></td><td></td><td>-</td><td></td><td>· ·</td><td></td><td></td><td></td><td></td></td<>	lternative	: 1-2						-		· ·				
16 14 11 28,329 500 5.8 S 38.5 4,540 26,332 17 11 12 5,666 300 9.0 AC 38.6 1,490 13,410 18 71 13 89,506 1000 10.5 S 20.0 13,820 145,110 19 13 80 52,706 600 2.0 S 17.2 5,600 16,20 20 D6 14 21,103 500 0.2 S 0.8 4,540 908 21 14 15 10,552 400 4.2 S 13.3 3,650 15,330 22 D6 16 47,414 600 1.0 S 7.1 5,600 5,600 23 16 17 15,805 500 4.5 S 10.1 4,540 20,400 25 16 19 15,805 500 4.5 S 10.1 4,540 20,400 26 17 19 4,741 300 6.5 <th>facility</th> <th>Ref. Status</th> <th>Q(D.Ave)</th> <th></th> <th></th> <th>Design Capa</th> <th></th> <th></th> <th>··</th> <th></th> <th></th> <th></th> <th>Area</th> <th>Land Cost (Bx100)</th>	facility	Ref. Status	Q(D.Ave)			Design Capa			··				Area	Land Cost (Bx100)
Grand Total Construction Cest 2,244,660 177,1 Total Project Cost			16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33	D4 11 T1 13 D6 14 D6 16 16 16 16 17 17 13 D7 20 20 22 22 22	11 12 13 D6 14 15 16 17 18 19 19 18 D7 20 21 22 23 24	28,329 5,666 89,506 52,706 21,103 10,552 47,414 15,805 15,805 15,805 4,741 4,741 35,300 46,340 4,001 42,339 20,005 17,832	500 300 1000 600 500 400 600 500 400 600 500 300 300 500 600 500 600 500 500 500 500 500 500 500 500 500	5.8 9.0 10.5 2.0 0.2 4.2 1.0 5.5 4.5 1.0 6.5 4.5 2.6 0.8 5.8 2.0 7.5 5.0	S AC S S S S S S S S AC S S S S S	38.5 36.6 20.0 17.2 0.8 13.3 7.1 12.4 10.1 13.2 25.9 5.4 12.4 11.5 26.1 14.1	4,540 1,490 13,820 5,600 4,540 3,650 5,600 4,540 1,540 1,490 1,490 1,490 1,490 1,490 1,490 1,490 1,490 1,490 1,490 1,490	26,332 13,410 145,110 145,110 11,200 908 15,330 5,600 24,970 20,430 9,685 6,705 11,804 4,480 8,642 11,200 34,050 22,700		
Construction Cest Land Co 2,244,060 177,0 	b-Total		i					163.5	ke			977,348	•	
									Grand Tota		Constructi			Land Ces 177,00
	·								fotal Proj	ect Cost				
		· · ·		,					·	· .	•••••••••••••••••••••••••••••••••••••••	2,421,060	· · ·	ele en L'étaire
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				*.								· · ·		· . :

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Estur Thani and Frachatipat

a 1997 - Santa Santa 1997 - Parlana Santa

Facility Rei	Î.		Capacity Q(D.Ave) (cu m/d)			besign Cap	A _					Cost (Bx1000)	Land Area (sq r)	Land Cost (Bx1000)
Raw Water Int Pumping Stati R(312,000	÷					****			66,915		
Raw Water Pij (1500 mm Ste		Pipe)	Q(D.Kax)	Fron	To			*****	Length (ke)		Unit Cost (Baht/c)			
		Pro	261,888	Chaopray River	a Ti	312,000			7.0		26,400	184,800	0	
freateent Pla	nt					Q(D.max)								
		1 1	Pro			283,000						656,017	116,000	137,50
Distribution D1 D2 D3 D4 D6 D7		ervoir Pro Pro Pro Pro Pro Pro Pro	(cu m) 18,000 20,600 2,000 2,200 8,800 9,000		• • •							152,700 163,200 16,900 17,500 67,000 89,200	0 6,000 0 6,000 0	18,7: 18,7
ED ED ED	2	Ex Ex Ex Ex	2,000 1,000 1,000 500									-		
Sub-Total			65,100		-							506,500	12,000	37,50
Transmission/ Distribution			Pipe No	Fron	ĩo	Design Q (cu m/d)			Katerial		sUnit Cost (Baht/m)	Cost (Beht 1000)		
			2 3 4 5 6 7 8 9 10 11 12	1 1 4 4 D1 5 7	02 1 2 3 4 D1 D3 7 5 6 D4 8 9	88,223 11,699 108,153	1000 800 500 1000 800 400 800 500 300	9.0 0.5 7.0 8.0 0.7 2.0 12.0 10.5 8.5 5.8 9.0	5 5 5 5 5 5 5 5 5 7 5 7 5 7 7 7 7 7 7 7	23.7 4.0 12.1 18.7 27.6 3.8 7.7 21.6 25.2 13.5 14.3 38.5 36.6	13,820 9,250 4,540 13,820 9,250 3,650 9,250 4,540 1,490 5,600 4,540	165,600 6,910 64,750 27,249 110,560 6,475 7,300 24,975 54,480 15,645 47,600 26,332 13,410		

Fatur Thani and Prachatipat

Facility	Ref.	Capacity				ign Capa		*******		*******				Cost	Land	Land
•		 Q(D.Ave) (cu ∎/d)				- -					• .		ad a	(Bx1000)		Cost
		 17 18 19 20 21 22	10 D6 12 12 12 12 13	D6 12 13 14 15 14	-	47,024 47,414 15,805 15,805 15,805 15,805 4,741	700 600 500 500 400 300	6.5 1.0 5.5 4.5 1.0 4.5	S S S S S AC		21.4 7.1 12.4 10,1 6.7 13.2	5,1 4,1 4,1 3,6	610 500 540 540 550	42,961 5,601 24,970 20,430 3,650 6,701		
		23 24 25 27 29	13 10 11 11 D7	15 11 16 D7 17		4,741 47,351 4,221 36,800 46,340	300 700 250 500 600	6.5 2.5 1.0 2.6 0.8	AC S AC S S	. 2	19.0 8,3 5.7 8.0 5.4	1,4 6,6 1,(4,5 5,6	190 510 190 140 100	9,685 16,525 1,090 11,804 4,480	· · · · · · · · · · · · · · · · · · ·	
		30 31 32 33 34	19 19	18 19 20 21 22		4,001 42,339 20,005 17,832 7,829	300 600 500 500 400	5.8 2.0 7.5 5.0 5.0	S S S	1 2 1	12.4 11.5 16.1 14.1 9.1	5,6 4,5 4,5		8,642 11,200 34,050 22,700 18,250		
Sub-Total						Ĩ	otal	146.4 6	ž					845,553		
					•			G	rand 1	otal		Constr		n Cost 2,259,785		Land Cost 177,000
				·				1	otal F	Project	Cost			2,436,785		
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	•									е С						

Alternative : 2-2

Facility	ßef.	Status	Capacity Q(D.Ave) (cu m/d)			besign Capa						Cost (Bx1000)	Land Area (sq r)	Land Cost (Ex1000)
Raw Water Pumping St		Pro	312,000					· · · · · · · · · · · · · · · · · · ·				66,915	1,600	2,000
Ram Water (1500 nm		ipe)	Q(D.Hax)	Fron	?o		•••••		Length (ke)	H.Loes (e)	Unit Cost (Babt/m)			
		Pro	261,888	Chaopraya River	. Tl	312,000	•		7.0		26,400	184,800	0	(
ireatment	Plant					Q(D.max)							•	
		T1	Pro		*	283,000	•					856,017	110,000	137,500
listributi	on Rese D1 D2 D3 D4 D6 D7	rvoir Pro Pro Pro Pro Pro Pro	(cu r) 18,000 19,100 2,000 2,200 13,000 9,000	· · · · · · · · · · · · · · · · · · ·	•					- - -		152,700 163,200 16,900 17,500 99,000 89,200	0 6,000 0 0 6,000 0	18,75
	ED1 ED2 ED3 ED4	Ex Ex Ex	2.000 1,000 1,000 500		•							- - -		
Sub-Total			ERR									538,500	12,000	37,50
Transnissi)istributi			Pipe No.	Fron	Ťo	Design Q (cu m/d)	Dia. (de)		Naterial		sUnit Cest (Baht/r)	Cəst (Bx1000)		
			1 2 3 4 5	T1 1 1 D2 2	1 D2 D1 2 3	1?2,382 72,460 99,922 94,199 47,099	1000 800 900 800 700	2.5 6.5 7.0 0.5 7.0	Տ Տ Տ	16.0 24.8 27.3 3.1 23.1	9,250 10,510 9,250	34,550 60,125 73,570 4,625 46,270		
	. ·		6 7 8 9 10 11	2 2 D1 6 D1 D1	4 5 6 7 10 D3	18,840 23,550 86,361 43,181 21,791 11,699	500 600 600 600 500 300	6.0 6.7 0.7 4.0 2.7 2.7	S S S S AC	18.7 13.0 15.0 23.8 11.0 41.9	4,540 5,600 5,600 5,600 4,540 1,490	27,240 37,520 3,920 22,400 12,258 4,023		
			12 13 14	10 D3 8	D4 8 9	21,791 15,208 3,042	500 500 300	8.5 12.0 16.5	S S AC	34.7 25.2 12.5	4,540	38,590 54,480 15,645		
· ·						А	8-3	3-7.						

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Alternative : 2-2				. •						• • • • •		- - 	· ·	
Facility Ref.		Capacity Q(D.Ave) (cn m/d)			Design Capa	*			•••••••		1 41 4 1 41 4 1 4	Cost (Bz1000)	Land Area (sy e)	Land Cost (Bx1000)
		15 16 17 18 19 20 21 22	D4 11 T1 13 D6 14 D6 16	11 12 13 D6 14 15 16 17	28,329 5,666 89,506 52,706 21,103 10,552 47,414 15,805	500 300 800 600 400 600 500	5.8 9.0 5.5 2.0 0.2 4.2 1.0 5.5	AC S S S S S		38.5 36.6 31.1 17.2 2.3 13.3 7.1 12.4	4,540 1,490 9,250 5,600 3,650 3,650 5,600 4,540	26,532 13,410 50,875 11,200 730 15,530 5,600 24,970		
		23 24 25 26 27 28 29 30 31	16 16 17 17 13 D7 20 20 22	18 19 19 18 DY 20 21 22 23	15,805 15,805 4,741 4,741 35,300 46,340 4,001 42,339 20,005	500 400 300 500 500 300 600 500	4.5 1.0 6.5 4.5 2.6 0.8 5.8 2.0 7.5	S AC AC S S AC S S		10.1 6.7 19.0 13.2 25.9 13.2 12.4 11.5 26.1	4,540 3,650 1,490 4,540 4,540 1,490 1,490 5,600 4,540	20,430 3,650 9,665 6,705 11,804 3,632 8,642 11,200 34,050		
		32 33	22 24	24 25	17,832 7,829	500 400	5.0 5.0	S S		14.1	4,540 3,650	22,700 18,250		. * .
ab-Potal	* .		•		•. •		155.7	÷ *	·			734,411		
								Grand	Total	Co	nstruct	ion Cost 2,180,643	÷ 1,	Land Cost 177,000
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		· · · .						Fotal	Project	t Cost				

Facility	Ref.	Status	Capacity Q(D.Ave) (cu m/d)			besign Cap						Cost (Bx1000)	Land Area (sq c)	Lanc Cost (Bx100ú)
Raw Fater 1 Purping Sta			312,000									66,915	1,600	2,000
Raw Water I (1500 em S			Q(D.Hax)		Ĩ0				Length (kr)		Unit Cost (Baht/m)			
		Pro	261,888	Chaopraya River	a îl				0.2		26,400 .	5,280	نا	0
freatment P	lant				*	Q(D.max)		-						
		TÍ	Fro			283,000						656,017	110,000	137,500
Distributio	n Res D1 D2 D3 D4 D6 D7	ervoir Pro Pro Pro Pro Pro Pro Pro	(cu m) 18,000 20,600 2,000 2,200 8,800 9,000									152,700 163,200 16,900 17,500 67,000 89,200		0 18,750 0 18,750 0
	ED1 ED2 BD3 ED4	Ex Ex Ex Ex	2,000 1,000			.*						- - -		
Sub-Total			65,100					*******		****		506,500	12,000	37,500
fransmission Distribution		1	Pipe No	Froe	fe	Design Q (cu ¤/d)	Dia. (de)		Katerial		sUnit Cost (Baht/ r) (Cost Baht 1000}		
			2 3 4 5 6	Ti D2 1 1 1 4	D2 1 2 3 4 D1	172,382 194,120 47,099 18,840 123,471 88,223	1000	9.0 0.5 7.0 6.0 8.0 0.7	5 5 5 5 5	23.7 4.0 12.1 18.7 27.6 3.8	18,400 13,820 9,250 4,540 13,820 9,250	165,600 6,910 64,750 27,240 110,560 6,475		
. *	• •		7	4 D1 D3 5 7 D4	D3 7 5 6 D4 8 3	11,699 108,153 15,208 3,042 21,791 28,329 5,666	400 800 500 300 600 500 300	2.0 2.7 12.0 10.5 8.5 5.8 9.0	S S AC S AC	7.7 21.6 25.2 13.5 14.3 38.5 36.6	3,650 9,250 4,540 1,490 5,600 4,540 1,490	7,300 24,975 54,480 15,645 47,600 26,332 13,410		
			15		3 10	94,376	900	3.0	ş	10.5	10,510	31,536		
								3-9						

Alternativ	ve : 5-	1														
Facility	Ref.	Status	Capacity G(D.Ave) (cu s/d)			De	sign Capa	L					· · ·	Cost (Bx1090)	Land Area (sq v)	Land Cost (Bx1000)
			17 18 19 20	10 D6 12 12	D6 12 13 14		47,024 47,414 15,805	700 600 500 500	6.5 1.0 5.5 4.5	S S	. 	21.4 7.1 12.4	6,610 5,600 4;540	5,600 24,970		
			21 22 23 24 25	12 13 13 10 11	15 14 15 11 16		15,805 15,305 4,741 4,741 47,351 4,221	400 300 300 700 250	1.0 4.5 6.5 2.5 1.0	S AC AC S AC		10.1 5.7 13.2 19.0 8.3 5.7	4,540 3,650 1,490 1,490 6,610 1,090	20,430 3,650 6,705 9,685 16,525 1,090		
			27 29 30 31 32 33 34	11 D7 17 17 19 19 21	D7 17 18 19 20 21 22		36,800 46,340 4,001 42,339 20,005 17,832 7,829	500 600 300 600 500 500	2.6 0.8 5.8 2.0 7.5 5.0 5.0	S AC S S S		28.0 5.4 12.4 11.5 26.1 14.1 9.1	4,540 5,600 1,490 5,600 4,540 4,540 3,650	11,804 4,480 8,642 11,200 34,050 22,700 18,250	 	
Sub-Total				21		-			146.4			711		845,553		
										Grand	Fotal	(Constructi	on Cost 2,080,265	<u>.</u>	Land Cost 177,000
					·					Total	Projec	t Cost		2,257,265		
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Alternative : 3-2

Facility	1.1	Status	Capac Q(D./ (cu i	(ve)	at in		Design Capa						Cost (Bx1000)	Land Area (sq e)	Land Cost (Bx1000)
Raw Water Pusping St			312,	,000			**************************************			· · · · · · · · · · · · · · · · · · ·	••••••••••••••••••••••••••••••••••••••		66,915	1,300	2,00
Raw Water (1500 mm		Pipe)	Q(D.K	(ax)	Fron	ĩo				Length (kg)	K.Loes (e)	Unit Cost (Baht/m)			
-: 		Pro	261,	888	Chaopraya River	Tł	312,000					26,400	5,280	0	
freatment	Plant						Q(D. max)								
		Ti	Pr	0	1 A A		283,000		· .				656,017	110,000	137,50
Distributi	ов Re: D1 D2 D3 D4 D6 D7	Pro Pro Pro Pro Pro Pro	13, 9,	000 100 000 200 000 000									152,700 163,200 16,900 17,500 99,000 89,200		18,75 18,75
	ED1 ED2 ED3 ED4	Ex Ex Ex Ex	1, 1,	000 000 000 500									- - -		
Sub-Total		- 	67,	800									538,500	12,000	37,5
Transmissi Distributi	oa/ on Nai		Pipe	No.	From	To	Design Q (cu m/d)			Katerial		sUnit Cost (Bakt/m)	Cost (Bx1000)		
				2 3 4 5 6 7 8 9 10 11 12	1 1 D2 2 2 2 D1 6 D1 D1 10 D3	1 D2 D1 2 3 4 5 6 7 10 D3 D4 8 9	172,382 72,460 99,922 94,199 47,099 18,840 23,550 86,361 43,181 21,791 11,699 21,791 15,208 3,042	800	2.5 6.5 7.0 6.5 7.0 6.0 6.7 4.0 2.7 2.7 8.5 12.0 10.5	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	16.0 24.8 27.3 3.1 23.1 18.7 13.0 15.0 23.8 11.0 41.9 34.7 25.2 13.5	9,250 10,510 9,250 6,610 4,540 5,600 5,600 5,600 4,540 1,490 4,540 4,540	34,550 60,125 73,570 4,625 46,270 27,240 37,520 3,920 22,400 12,258 4,023 38,590 54,480 15,645		
						·	A	8-3	11						

Alternative : 3-2

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Facility	Ref.	Status	Capacity Q(D.Ave) (cu ±/d)			Design Capa						Cost (Bx1000)	Land Area (sq p)	Land Cost (Bx1000)
			15	D4	11	28,329	500	5.8	S	38.5		26,332		
				. 11	12	5,666	300	9.0	AC.	36.6		13,410		
			17	1 1	13	89,506	800	5.5	S	31.1	9,250	50,875		
			18	13	D6	52,706	600	2.0	S .	17.2	5,600	11,200		· .
			19	D6	14	21,103	400	0.2	S	2.3		730		a a an
			20	14	15	10,552	400	4.2	5	13.3		15,330		
			21	D6	16	47,414	600 500	1.0	S	7.1		5,600		
			22	16	17	15,805	500 500	5.5	S	12.4		24,970		
			23	16 16	18	15,805	- 500	4.5	S	10.1		20,430		
			24 25	16 17	19	15,805	400	1.0 6.5	S AC	6.7 10 0		3,650		
				17	19	4,741	300 200			19.0		9,685		
			26 27	13	18 n7	4,741	300 500	4.5	AC C	13.2		6,705		
				13 D7	D7 .	35,300	500	0.8	S S	25.9 13.2		11,804		
			28 29	20	20 21	46,340 4,001	500 300	5.8	AC	12.4		3,632 8,642	•	
			2.9 30	20	22	42,339	500	2.0	.S	11.5		11,200		
	-		31	22	23	20,005	500	7.5	S	26.1		34,050		
			32	22	24	17,832	500	5.0	S	14.1		22,700	a di tar	e fortrefe
			33		25	7,829	400	5.0	S.	9,1		18,250		· . · ·
		.*					÷							·
ıb-Total								155.7 1	ke			734,411		
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eff 11,371 11,374 34,48 15,481 55,441 3,541 4,354 34,374 34,46 17,375 31,421 5,421 5,421 5,541 13,551 14,17 5,511 13,515 14,17 5,511 15,15	lose 8 (L. Lum Kaeo)			e	•	\$			•			•										4 °
Bill Attime Har Peans: g(one 1)m ⁴ (ra 1/0) Pean factor: 1_10 Paint Factor: 1_10 <td< td=""><td>Total (Tome i)</td><td>11,577</td><td>12, 146</td><td></td><td></td><td></td><td></td><td></td><td></td><td>.892 107.</td><td>160 119.</td><td>120</td><td>138.138.7</td><td>52 BTI 30</td><td>13 158 0</td><td>1.01.15</td><td>17 70</td><td>16 181 00</td><td>16 001 1</td><td>1 1 1 1 1 1 1</td><td>071 AUL</td><td>t e</td></td<>	Total (Tome i)	11,577	12, 146							.892 107.	160 119.	120	138.138.7	52 BTI 30	13 158 0	1.01.15	17 70	16 181 00	16 001 1	1 1 1 1 1 1 1	071 AUL	t e
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weight (b) (b) <td(c)< td=""> (c) (c) <td< td=""><td>Jone 2 (Ranosit)</td><td></td><td>3</td><td>191</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>63, 478</td><td>- 99</td></td<></td(c)<>	Jone 2 (Ranosit)		3	191																	63, 478	- 99
 a. 1.171 1.111 1.3.53 3.36 4.3.53 3.011 3.3.72 4.000 5.450 5.451 5.711 1.158 1.571 1.200 1.571 1.403 1.521 1.403 1.521 1.510 1.551 1.551 1.501 1.510 1.510 1.551 1.55 1.5	Ione 3 (Thanvaburi)	_	4	10			÷.,							· · ·				÷			70.638	22
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reich.) 3,441 4,149 4,749 5,722 5,432 7,477 8,782 4,362 1,449 1,12,610 4,555 2,568 2,569 2,567 2,591 2,517 2,517 2,517 2,517 2,510 2,517 2,517 2,510 2,517 2,517 2,510 2,517 2,510 2,517 2,517 2,510 2,517 2	Lone 6 (Muang)			• •	¢	• •		÷.,													15.836	-
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Gion Pipe Bead Loss for 0[2011] Dissign Flow 2 2011 bis (an) L (ks) (a 10) Lib (a 10) L 2 30, Li 150 0.2 2 80, OK 1,50 1,50 2 80, OK 1,50 1,50 1 1,1 1,1,10 1,50 1,50 2 301.1 1,1,50 1,50 1,51 1,51 0 5 200.1 1,0,45 11,51,11,16,450 11,745 19,51 20,163 20,163 1,15 0 5 200.1 1,0,1 1,0,11<16,165	Iotal (Ione i)	13,993	15, 295					0,737 10.	(,489 112	.670 128.	520 142.	116 155.1	171 166,4	50 177 . 94	5 189,66	1 200.76	6 208.55	÷ 218.191	229.330	238.987	258.163	761.5
Beign Flow Beign Flow Beid forse for qf(011) fa Q 2010 Bisign Flow Q 201 Bisign Flow P 405 Q 2010 Bisign Flow Q 201 Bisign Flow P 405 Q 2010 1.50 1.50 1.50 1.5 1.55 288,074 1.500 7.2 1.50 1.5 1.55 288,074 1.500 7.2 1.50 1.5 1.55 288,074 1.500 7.2 1.500 1.5 1.55 1.55 288,074 1.500 7.2 1.500 1.5 1.55 <td>1. Iransmission Pine</td> <td></td>	1. Iransmission Pine																					
q 2311 bia (m) (k) (k)660 1 (uu jd) 289,016 1,500 0.2 289,016 1,500 0.2 289,016 1,500 0.2 289,016 1,500 0.2 289,016 1,500 0.2 289,016 1,500 0.2 289,016 1,500 0.2 289,016 1,500 0.2 289,016 1,500 0.2 289,016 1,500 0.2 289,011 1,500 0.2 1.189 11,500 28,501 1.180 11,500 28,501 1.180 117,415 118,450 1.150 124,500 124,500 124,500 1.16 28,001 117,415 155,517 164,500 177,415 189,461 200,746 200,746 200,746 200,746 200,746 200,746 200,746 200,746 200,746 200,746 200,746 200,746 200,746 200,746 200,746 200,746 200,746 200,746 200,120 210,120 210	DIS20	n Flor																	Head to	se for Q((1102	(B)
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Perto Read and Flow faste Perto Read (or k/d) Kentum Kentum Required Mater Dewand in Each Year (or k/d) Kentum Kentum Point 2011 (<																					1.59	-
Total Flow in 2011 (<th))< th=""> ((</th))<>	2. Required Pump Rea	d and Flow	Rate																			
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e in Daily Arerage Operation (eu s/d) 65,037 75,644 84,574 95,892 107,100 118,420 127,009 138,708 149,287 158,051 167,472 135,795 184,827 199,152 258,469 65,037 75,644 84,574 93,882 107,100 118,420 129,369 138,708 149,287 158,051 167,472 135,795 181,827 149,795 284,469 65,037 75,644 84,574 93,882 107,100 118,420 129,369 138,708 149,287 158,051 167,472 135,795 181,827 149,795 204						-		0,737 101	489 112	670 128.	520 142,1	16 155,1	11 166,45	111,945	99 ⁶ 31 5	1 200, 941	208,554	218,193	228,336	238,982 2	50.16J	261,83
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AN FULL ACTIVE CALMENT CALLED TO A CONTRACT WAY AN ANALY ANALY ANALY ANALY ANALY ANALY ANALY ANALY ANALY ANALY ANALY ANALY ANA	2-1 4 2-2					•				101 107 1	1.911 M	10 129.J	11.951 PB	0 170,011 B	150 651 J	111, 101, 1 111, 171	(110.172) 101 701 -	128'191	111, 113 114, 213	7 701°441	(4), 45) 64 i.5	11.1
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A-8-3-13

Mater Transmission/Distribution Cost - Patum Thani & Prachatipat

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[ten	1990	1661	1992	5661	Y 1994	5661	1996	E .	1998	1999	Å 2000	2001	2002	R 2003	2004	2005	2006	1001	2008	2005	2010	2011
4. Pup Characteristics Alternative 1-1 4 1-2 2-1 4 2-2 3-1 4 3-2			, ; ; ; ; ; ; ;	01ja (sm) 808 809 800	ž	Notor Power(Kw) 200 460 206	(XK)	H (a) 12.0 23.6 12.0		Q (cu 1) 86.7 66.7	Q (cu #/#in/unit) 86.7 66.7 66.7		0.01 Pu 3 3	Mo.of Pump(unit) 80.of Pump(unit) 3 (excluding 1 unit stand-by) 3 (excluding 1 unit stand-by)	ig Lunit g Lunit g Lunit	stand-by stand-by stand-by						
5. Xo.of Operating Pumps Alternative 1-1 & 1-2 2-1 & 2-2 3-1 & 3-2				-					~~~~	~~~		~~~	the first and		~~~~		CH (H CH	мим			ten en en	20 49 49
6. Unriane Pous Capacity (cu s/d) Alternative 1-1 ± 1-2 2-1 ± 2-2 3-1 ± 3-2	(cw a/d					96,025 94	1, 025 19 11, 025 19	94,025 172,051 172,051 172,051 172,051 172,051 172,051 172,051 128,056 175 288,076 288,076 288,076 288,076 288,076 386,076 385,076 288,076 385,076 288	7, 051 1: 1, 1:0,1 1, 1:0,2	92,051 1 92,051 1	1 150,22	92,051 92,051	192,051	192,051 192,051 192,051	192,051 192,051 192,051	188,016 2 188,016 2 188,016 2	85.076 2 85.076 2 88.076 2	38.076 2 88.076 2 38.075 2	58,076 2 88,076 2 158,076 2	88.076 2 88.076 2 88.076 2	25.076 85.076 58.876	238,676 238,076 288,076
7. Notor Dutput (Aw) Alternative 1-1 & 1-2 2-1 & 2-2 5-1 & 3-2	•	includ	chuo gai	 including output for a stand-by purp (10) including output for a stand-by purp (10) 	stand-b	001 026 001	88.90	600 600	600 4,380 4,600	500 1,380 600	600 600	809 1*386	600 600	1,580 1,580	009 1.780	200 1,840 800	800 840 840	800 L.840 800	800 1,849 300	800 1,848 350	800 800	300 1.246 800
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A-8-3-14

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2.198 4,673 6.877 11.265 15.321 191.672 -----

[otal of 1995 - 2011 =

15, 336

14,877

111'11

10,952 11,446 11,950

10,467

8 . Energy Consumption (XMh) = No.of Pueps x Notor Ourport(XH) x 24 h/day x (actual deily denamd(q1a)/max.capacity of pump)

Note: Pumps is designed for Qda (Baily Maximum Demand) times 1.1

Iotal Cost

5,056

5,056 15,817

10,760

2011

2010

2,011 7.1 6.9 15.3 2,910 2.067 6.31 14.9 2,003 10 10 11 11 2,007 6.J 2,006 6.1 13.7 2,065 6.0 12.0 2,006 5.2 EL.4 2,003 5.0 E:0 2,002 4.8 10.5 2,001 9.9 6.6 2,000 1.2 1.999 72 1,998 8.5 Gerand Charge = Saht 229 //W/mon x 12 montyeer x Motor Genand XN Energy Charge = Saht 1.23 //Wh x Energy Consumption KNh/day x 365 days/year Design Pump Head=(Read Loss of Pipeline)+(Actual Mead, = 10 m)+(Pump Loss 1.5 m) Electricity fee = Rate of Provincial Electricity Authority (PEA) as of January, 1989. 1,994 1,995 1,996 1,994 3.5 6.4 2.8 2.9 2.6 . 0"0 1,991 1,992 1,993 с. С. С. 0.0 0.0 1,989 1,990 • ø Alt. 1-1,1-2,5-1 2 3-2 Year Operation Cost Alt. 2-14 2-2

22.85 Million Baht 46.16 Million Baht 3 00 5 Alt. 1-1,1-2,3-1 2 3-2 Alt. 2-1 2 2-2 Discount Rate

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-8-3-15 A-

Water Transmission/Bistribution Cost - Patum Thani & Prachatipat

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Mater Transmission/Distribution Cost - Patum Thani & Prachatipat

1,410 630 1,200 1,200 1,920 1,60 260 260 6,280 94,375 94,376 144,206 154,120 15,203 28,329 17, 414 45, 340 273 458 2011 -----31,459 31,459 31,459 31,459 42,911 22,911 62,911 62,911 91,316 91,316 91,316 91,316 91,376 91,320 91 42,414 46,349 1,410 630 900 1,920 140 260 270 3,920 3,920 4,690 5,160 5,520 5,980 5,930 5,980 5,980 5,988 2010 114,921 114,921 114,921 114,921 114,921 114,921 114,921 114,921 117,382 112,582 172,582 172,582 172,582 172,582 47,414 46 340 1.600 23 2003 31,610 31,610 31,640 31,640 47,414 47,414 47,414 47,414 30,873 30,893 30,893 46,540 46,540 46,540 46,540 250 250 250 250 1.10 22 72 72 2068 22 2807 906 99 59 59 -140 2906 23 ÷-7 22 110 88 82 82 2 2 2005 3 926 926 269 ene' inc 80 20 20 2014 33. 630 ac 420 600 70 260 20 P2 99 2003 300 2002 180 2001 31.610 2.02 26 F8 420 600 ,280 2080 3 31,610 1, 920 280 428 580 690 130 728 80 M 1999 15,805 3,170 3,170 3,170 3,170 8 S E . 2 2 15, 805 \$ <u>8</u> 28 25 32 28 25 25 1997 2 2 15,805 8 2 1996 3 15,805 300 ន ន 1995 3±0 210 盟 1994 1993 1932 1991 I 6.Maximum Pump Capacity (cu u/d) 0661 5. Mo.of Operating Pumps 7. Hotor Output (Xw) Alternative : Il for lone 1-4 Il for lone 5-8 Zone 1-4 Zone 5-8 It for tone 1-4 It for tone 5-8 Total 11 for 2 11 for 2 l tea -S 3 3 8 3 2 i 333 2 æ 88

A-8-3-18

2.010 11,257 2,007 58.2 26,961 32,601 3.232 6.783 102,929 161"59 715,003 1102 1.942 15,672 -----5,719 6,445 20102 25, 380 14,760 1,743 71,156 75,871 80,684 84,037 88,454 73,956 97,898 14,132 22,745 24,840 24,707 30,708 32,998 35,553 40,742 44,055 47,114 50,495 52,656 54,136 56,145 58,218 60,384 10,867 31.173 16,435 16,435 16,435 16,455 16,455 16,455 36,223 37,751 39,712 41,777 43,951 2.008 56.1 fotal (1991-2011) = 29,311 1,557 3,142 3,517 24,656 10,362 2,007 200 13, 591 28,522 1,334 2,853 3,324 23, 587 13,066 2,006 52.7 2008 9, 381 27,2% 1,222 2,649 3,140 5,504 22.573 9.421 12.282 2,005 50.5 2007 26,325 1,122 2,994 2 001 21.771 2006 9,063 11°91 16,433 34,062 25,086 20.146 10,308 2,313 2,728 2,003 2005 365 14,180 15,169 29,876 31,945 2,002 40.7 2,525 23,776 19,662 , 386 2,162 2004 871 **e**4 2,335 62,039 .66,546 -22,497 2,001 12.605 2,017 2002 182 10 it. Energy Consumption (XMh) = No.of Pumps x Notor Cutput(XM) x 24 h/day x (actual daily demand(qla)/max.capacity of pump) 9.18 Pumps is designed for QBM (Daily Kaximum Demand) for transmission, and for QNM (Nourly Maximum Demand) for distribution. 12,888 1 27,853 2 2,148 2.000 33.0 11.573 21,250 1,878 2002 20 8.00 6.335 151.12 24,580 1,999 3,294 -16, 304 5, 668 19,715 62H 1,663 3. 2001 Emergy Charge = Baht 1.23 /KWh x Emergy Consumption KWh/Gay x 365 days/year Design Pump Read={Read Loss of Pipeline}+{Actual Read, =0 }+{Residual Read 10.3 m}+{Pump Read 1.5 m} 1,998 26.7 18,260 2,630 19,507 8,711 8,711 10,772 10,772 16,149 11,996 19,936 22,226 0002 101.21 1,65 1,65 6.63 11, 105 16,873 1,259 2,367 1,997 13,954 3,654 5,817 £661 8 18 : Mourly Maximum Electricity fee = Rate of Provincial Electricity Authority(PEA) as of January, 1939. 1,996 22.8 2,055 10,085 12,869 3,047 5,050 15,561 19 19 229 [XW/mon x 12 mon/year x Notor Demand XN 1998 ÷. 1,935 14.1 17.7 11,320 350 1.74 35,970 2,449 38 66 8,711 8,711 5,421 14,053 1,994 0.0 1,452 31,303 3,601 10,507 1996 928 22 1,992 1,993 0.0 0.0 12,014 \$19 10,00 , 0<u>)</u>{ 3661 161 **** 166T 8. Energy Consumption (AwH/day) for Daily Average Demand 1,989 1,999 1,980 1,980 1,980 1,980 1,980 1,980 1,980 1,980 1,980 1,980 1,980 1,980 1,980 1,980 1,980 1,980 1,9 1651 160.80 x Killion Saht 1992 10.01 Pump Operation Cost (Baht x1,000/year) 166T 066T II. Demand Charge = Baht Ξ **DA : Daily Average** DA : Daily Haxiaun ********************** Alternative : II for Lone 1-4. II for Lone 5-8. Operation Cost Discount Rate Denand Charge Energy Charge Total fotal Cost lote: -----Year. 3 Ьđ 8 S 2 8 83 33

-8 - 3 - 19A-

Mater Transmission/Distribution Cost - Patum Thani & Prachatipat

Itea 1 1. Transmission Pipe Design Flow No From To Q2011 Design Flow No From To Q2014 Design Flow 1.1 172,382 1.1 172,382 1.1 172,382 1.1 172,382 2.1 D2 72,469 3.1 D1 93,922 3.1 D1 93,922 3.1 D1 93,419 5.2 Markin R.200 8 7.3 4.199 90	1990						>						-		~							
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Nater Transmission/Distribution Cost - Patum Ingni. A Prachatipat

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kater Transmission/Distribution Cost - Patum Thani & Prachatipat

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Dia (m) Motor Power(Na) H (m) Q (cr s/min/mait) Mo.of 400 630 530 52.3 39.9 400 530 57.4 20.7 400 260 57.4 20.7 400 260 57.4 20.7 400 260 57.4 20.7 400 220 57.2 15.1 500 110 53.4 8.1 500 130 41.3 21.8 300 130 50.2 5.3 400 130 50.9 9.8 300 150 50.9 9.6	Dia (an) Kolor Power(Na) H (a) Q (cu a/ain/unit) 400 630 82.3 39.9 400 630 82.3 39.9 400 200 210 21.1 400 220 57.2 15.1 400 230 23.4 20.7 400 220 57.2 15.1 300 110 53.4 8.1 300 130 90.0 9.6 400 130 31.0 9.6 400 150 54.5 10.7																		
Dia (m) Motor Power(14) H. (m) Q (cct st/link/mait) Motor Motor Motor	Dia Motor Forer(Na) H.(a) Q (cu s/lin/unit) 400 630 57.4 20.7 500 300 57.4 20.7 400 220 57.4 20.7 400 220 57.4 20.7 400 220 57.4 20.7 400 220 57.4 20.7 500 220 57.4 21.8 500 230 41.3 21.8 500 230 41.3 21.8 500 130 53.4 8.1 500 130 90.0 9.6 50.0 130 90.0 9.6 50.0 150 91.0 9.6 500 150 94.5 10.7	aracteristics																	
600 6.30 82.3 39,9 500 500 53,4 20,7 39,9 400 260 57,4 20,7 30,9 400 220 57,2 15,1 15,1 400 220 57,2 15,1 15,1 300 110 57,4 8,1 3,1 300 23,6 41,3 21,8 3,1 300 130 14,3 21,8 3,1 300 130 9,0 9,5 5,3 300 130 13,0 9,0 9,5 300 130 14,0 9,5 3,1 300 15,0 3,1,0 15,7 10,7	600 6.30 8.2.3 500 5.30 8.2.3 400 2.60 57.4 400 2.60 57.4 400 2.60 57.4 500 2.7 50.5 500 2.7 50.5 500 2.7 51.2 300 1.10 59.2 400 1.30 50.0 400 1.30 50.0 300 1.30 50.0 300 1.30 50.0		10		Kotor P	ONET (KN)	() 1 1 1		0 (ca #/	Lin/usi		a.of Penp.	(unit)						
500 500 500 50.1 20.1 400 2.6 30.3 20.0 400 2.20 57.2 15.1 400 2.20 57.2 15.1 300 1.10 57.4 8.1 300 230 41.3 21.8 300 70 50.2 5.3 300 1.30 90.2 50.2 300 1.30 90.0 9.6 300 1.30 90.0 9.6 300 1.30 91.0 9.6 300 1.50 9.10 9.6	500 500 500 50.4 400 260 50.5 50.5 400 226 50.5 50.5 700 279 41.1 50.5 500 70 59.2 51.1 500 70 59.2 50.2 700 130 130 50.0 800 130 130 50.0 800 150 130 50.0				<u>8</u>		5		19.			9 	xcluding	l unit s	tand-by)				
400 260 30.5 20.0 400 220 51.2 15.1 300 110 53.4 8.1 300 230 29.2 5.3 300 130 11.3 21.8 300 70 90.2 5.3 300 130 90.2 5.3 300 130 90.9 9.6 300 130 91.9 9.6 300 150 91.0 9.6	400 260 30.5 400 220 57.2 500 120 57.4 500 70 59.2 300 130 41.3 60 130 59.0 70 150 54.0 800 130 14.0 800 130 14.0 800 130 14.0		-	203					20.1				xcluding		tand-by)				
4:00 226 5).2 15.1 300 140 53.4 8.1 300 70 50.2 5.3 300 130 90.2 5.3 300 130 14.0 15.9 300 130 14.0 5.3 300 130 14.0 9.4 300 150 94.0 9.1 300 150 14.0 15.9	4.00 2.22 57.2 300 1.10 55.4 500 2.30 41.3 300 70 50.2 300 1.30 50.2 400 1.30 50.2 300 1.30 31.0 300 1.30 31.0 300 1.30 31.0			₽ :	09Z				20.0				xcluding		1/20-DUS1				
300 130 230 1.1 5.1 500 230 1.1.3 21.8 300 70 50.2 5.3 300 1.30 50.2 5.3 300 1.30 50.2 5.3 300 1.30 50.9 9.46 400 1.30 31.0 15.9 300 150 34.5 10.7	300 1.10 3.3.4 500 2.30 41.3 300 1.30 50.0 300 1.30 31.0 300 1.30 31.0 300 1.30 1.30	insaission for lose-4		004	328	_			1.1				xcluding		(Yd-bas)				
300 239 41.3 24.5 300 70 50.2 5.3 300 130 50.6 9.4 400 130 31.0 15.9 300 156 54.5 10.7	300 70 41.3 300 76 50.2 300 130 50.0 400 130 31.0 300 150 54.5	Insalssion for Lone-a	-	ş :	911		2 :					-	xcluting	tun T	tang-by)				
000 100 200 200 200 200 200 200 200 200	000 130 50.0 300 130 50.0 400 130 31.0 300 150 54.5	•	. *		967				2.12			200	xcutuding		tanc-oy)				
400 150 31.8 15.9 300 150 54.5 10.7	400 120 31.0 300 150 150 34.5			30.0	2 12		5	• .	- - -			2 - -	xelnding velnding	1 noi 1	tand-by)				
400 130 31.8 15.9 300 150 54.5 10.7	400 150 31.0 300 156 54.5																		
300 150 54.5 10.7	300 159 54.5			400	120		31.0		15.9			3 (e.	xcluding	l unit s	tand-by)				
	(UX)			300	150		у. У		10.7			3 (e	xcluding	l unit s	tand-by)				

A---3-21 .- - -

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saission/Bistribution Cost - Patum Thani & Prachatipat		
	ani 4	

lten 11 5. No.of Operating Punps																•						
. No.of Operating Pumps	1661 0661		1 2661	1661	1991	Y 1995	1996	1997	E 1998	1995	2000	A 2001	2002	2003	R 2004	2005	2006	2007	2008	2603	2010	1102
										-												
11 for lone 1-4						7	2	2	2	2		، ۲	2	• 1	**3	·~	м	~	-1	r,	**	10
T1 for lone 5-8								-		~	2	. 2	2		2		~		1-3	м		
01 for Distribution									-4	~	~ 3	7	~	~	2	2	r.	**	~	**3	>	ir>
Ot for Transmission for Lone-4 Dt for Transmission for Lone-4					,			_, -	- 1		 ,		ء اب			-1				•••• •	4 =	- 1
DE TVI II GIISEESSEVII I VI LUIII D2	2					- ~	- ~	-1	-1 9-7	-	-1 6-7		- M		- 65		-4 9-5	н м		-4 2-7	- F	-4 1-
10							••		•		>4	••	•	•		• ••	• ~•	, ,	. ~	•~•	2 04	
04	·						-1					-	~	~	e-4	2	2	7	2	2	2	
(50)										-												
106	•			-			-4		~	~	2	2	2	2	~ ·	~	•••	ю	*7	**	•••	£3
01 (08)						~~ ·		4	i+	2	2	2	~	~ [`]	•• [•]	м.	17	-7	~*	~~ [`]	r7	
6.Kaximum Pump Capacity (cu m/d)	(p/e																					
	- -											-17		· ·			•					
11 for 2one 1-4			•	•	Ξ.	· · ·			114,921 1		114.921 114.921	114,921	114.921	172 382 1			172 382			_		172,582
11 for lone 5-8											59 670	59,610		53 670	905.68	20°206						89,506
01 for Transfeeler for Tanti						28,181 2			28,781		11 2/1	115115	15'15	115 15	115.15	21,574	26, 36] 21, 25	86,361		86-361	86, 36I	86.J4I
UL FUL ITERCEPTAGION FOR TABLET		•					11 400	10,00		11,405	11 690	7/1"T7	11,171	11 600	71, 700	11 660	11 1201	11, 100 11, 100	11 405	767 57	11,111	141 11
	•	:	1.							1.1	61 163	1199		94 199	61.19	661.46				61 16		94,199
03											7,604	7,604		109"1	1,601	15,208						15,268
2		7				11, 164. I	14,164	14 164	11,161	11,161	11 IN	H, IH	Z8, 379	28, 329	28,329	28.329	28 329	28,329	28,329	28 329	28, 329	28, 329
(cu) 10					ſ	010 04	010 64	010 61	010 10	16 674	047 JT	827 35	16.230	16 170	60 610	C0 C10	28 E13	61 E 10	L0 110	20 23	10 616	10 110
DT for Distribution												30, 893	30,493	30.893	46,340	16.340						69°340
(80)																						
													•									2
7. Notor Gutput (K*)			•							 				1 1								
11 far 7ame t-d		·				260	946 1	1 240	1 260	1 264	1 760	074 1	076 1	1 200	1 600	1 200	1 900		1 000	1 200	1 930	
11 for Zone 5-8								300	2002	009		009	÷.	009	300	906 100	2	2006 		- 1 - 1	2006 2006	
el for distribution						269	260	240	2692	25	520	520		250	220	- 520	- 			180	780	181
01 for Transmission for Tone-4			ین بر بر			220	220	170	122	220	220	220		220	220	072	872			922	220	121
01 for Transmission for Lone-3 no	ne-3					611	1	01 91		110	110	110	89	110	3	33	011	110	011	110	011	110
2 2 2	у.						ē -				0.4	24		010	1	0/0	011			074		
04 04			N	:		13	2	2	2 23	2 <u>1</u>	2 22	2 23	-	260	260	268	266		1	260	. :	260
(50)	•••			ji.				ł	5 		-				; ;					с. 1		
10 10	2		."			81 ST	150	051	120	266	88	206 206		300	250 262	20	530 450	530 120	662	8 9	230 550	20 20 20
(83)																						
Iotal						3,090	3,070	3,320	3,329	4,160	1,160	4,160	4,290	4,920	5,500	225,5	5,830	5,830	5,830	5.830	5,830	5,830

A-8-3-22

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2,010 56.8 6,000 5,977 12, 15 58, 536 2,003 54.3 57,800 18,000 12,000 1,406 2,154 16.021 673,163 900 95,726 2011 3,192 17,166 36,139 11.466 5, 738 5, 687 99,836 16,021 10,781 19.264 21,153 23,448 25,195 29,721 31,719 35,841 37,567 41,245 44,828 46,973 49,040 50,846 52,750 54,714 56,602 2.003 2010 1.354 2,951 1,912 3.697 1,067 fotal (1991-2011) : 5.489 5.410 86,186 34,556 Lt.369 10.957 2,2 3.41 16.021 16.021 16.021 15.021 35.021 33.033 34.326 36.769 2,007 50.8 602 22. 2,723 E. 5, 25L 5, 148 31,049 15,609 12,13 11,571 2.005 8002 1.45 3.112 ÷ 1.5 2,5 5 5,024 4,300 31,617 2,005 2.388 :001 14,883 .932 Ξ 2, 35 . 38 5. HI 10,593 30.258 1,807 1,665 2,004 44.8 14.191 2,619 2006 12. 2,914 <u>۽ ج</u> H. .222 29.182 13,652 1,502 1,502 66,185 70,535 2,003 2005 S60* 1166 2.12 13,520 15,114 15,306 27,725 29,714 31,667 27,808 12,639 +, 261 4, 261 2,002 37.6 2004 1,508 2,546 985 1,866 985 985 2,513 æ 26,356 11,614 3,940 3,940 2,001 35,799 40,738 45,323 49,914 57,419 61,755 2,378 892 1,725 2,162 1002 **213** 7,854 10. Energy Consumption (KWB) = Mo.of Pumps X Motor Output(KW) x 24 M/day x (actuch daily demand(qis)/max.capacity of pump) 11. Gemand Charge = Saht Note: Pumps is designed for QDM (Daily Maxiaus Demand) for transmission, and for QMM (Hourly Maxiaum Demand) for distribution. 3,623 8,491 8,491 9,123 9,123 11,432 11,432 11,432 11,789 10,773 12,662 14,325 16,672 18,289 20,348 22,409 25,778 2,000 31.8 24,958 10,602 200 1.0I 1,610 786 200 9,602 3,310 1, 599 23,556 0 1.878 2001 1,199 102 .58 . 966 Energy Charge = Baht 1.23 /KWh x Energy Consumption XMh/day x 365 days/year Design Pump Read=(Read Loss of Pipeline)+(Actual Read, =0)+(Pump Loss 1.5 m) 2,994 1,998 1,663 200 2 8,537 1,311 129 16.916 1° ÷3 2,580 1,997 185,1 1999 0 1,13 1.437 0.241 1,282 5,256 3 55 Electricity Fee = Rate of Provincial Electricity Authority(PEA) as of January, 1989. 1.996 21.2 2,367 229 [KW/mon x 12 mon/year x Notor Demand KW 1.259 E 1998 0 L8, 704 5,505 1,005 3 <u>ج</u> Ξ 1,995 15.3 2,055 31,907 17,250 885 414 101 1937 (.598 361 83 1,744 28,203 1.994 0.0 15,874 1996 380 359 358 3,689 ,327 1,993 0.0 1,452 23, 995 1795 ,084 2,737 쥖 2,779 1,992 0.0 164 Energy Consumption (KwB/day) for Daily Average Desand 0.0 1,91 1773 IS4.51 x Killion Baht 1,990 0 1992 10.00 Purp Operation Cost (Baht xL,000/year) -1,989 1991 Energy Charge = Baht 7 11 for Zone 1-4 11 for Zone 5-8 01 for Distribution D1 for Transmission for Zone-4 D1 for Transmission for Zone-3 02 03 DA : Daily Average DA : Daily Maximum MA : Nourly Maximum 06ST Alternative : Energy Charge Operation Cost Denand Charge Total **Discount Rate** lotal Cost lear λдж Iten (S) 8 ;; (e) į

Water Transmission/Distribution Cost - Patum Thami & Prachatipat

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A-8-3-23

1102 loss (III) 3 2009 2010 1.13 Head Loss for G(2011)0A (b/sec) 1917 0.66 1.76 2.66 3.30 0.50 0.33 1.67 2.3 1.90 1.1 7 2008 2007 2006 2002 2001 2003 2002 1997 2000 666T 1997 : ######>> shows a starting year of water transmission 9661 5651 7661 1661 1661 1661 6661 Total 146.4 km Dia (m) L (km) 9.9 0.5 2.8 8 6 0 2.5 2.0 2.0 lê.5 8.5 9.6 5.5 5.5 5.5 5.5 5 2-1 4 3-1 -----1,200 1,000 800 1,900 282 200 22 8 Š 8 88 8 3 2 3 80 8
 No
 From
 Design Flow

 No
 From
 10
 2011

 1
 12
 0
 2011

 1
 12
 0
 2011

 1
 12
 12
 372

 2
 12
 134,120
 344

 3
 1
 3
 18,494

 4
 1
 3
 18,494

 5
 1
 4
 123,471

 6
 101
 68,223
 344
 11,699 108,153 15,208 3,042 17 021 1,41,1 20,005 17,832 7,829 21, 791 28, 329 91 371 4,741 47,551 47,551 4,221 46,340 46,340 42,339 5,666 11 L. Transmission Pipe Alternative': ************* Ites 23 <u>.</u>

Water Transmission/Distribution Cost - Patum Thami & Prachatigat

Itea	-	I 0661	1661	1992	£66I	1994	ید ۲۹۹۶ ک	1996	1661	1998 1998	1999	2003	А 2001	2002	2003	R 2004	2005	2006	2007	2008	2003	0102	2011
2 Required Pump Head and Flow Rate	Read and	low Rate																					
Routing 1 Pine Wo 1	iotal i vec(=)	F109	Flow im 2011 ADM SWfru afwin)	l lain)		÷	11111).	122322222222222222222222222222222222222	11111	.	quired 1	later De	uand tu	Each Yea	Required Water Demand in Each Year (cu m/d)	Ŧ	-	12242251	1111111	*****	to and the		
-	1.1	1	1.6			- 33				5.298 9		99,665 11	101.423 1	113.729 1	ZU. 191 L	126.814 1	133.081 1	137.986 14	161,186,1	50.716 1	157.587 1	64 306	111,362
	46.8	-0	5.5			Ξ	н, 221-1	19,162 24		29,001 3				56,080	11,537							90,123	94, 374
	35.9	~	1.1			a				3,600 3	39,645	15, 105		S8, 162	51.942	10.070	76,085	80.613 8	56, 082		11,875 1	104,211	3.011
02 2-5-1 87 \$ 16	12.1	5								0, 102 16 	108,626 1J	116.039 1		31,292 1	-	6,376 1	152,011 11	_	Te3,890 1		178,257 1	185, 297	1 K
94 12 11	38.5		19.7				1121	- 166 '9	1,851	8,916 1	10,177	1,633	11,302	11,286	12°	•, 812 16, 382	11,598	8,60 18,763 7	7, F/V	22,250	24,160	28, 185	28,329
(00)																							
D6 16-17	19.5 1 1		5.3 2 - 5	į	•	÷	6 474	3,639 JI	10,622 10,622	12,654 2 14 141 1	29,210	11°21	24,514	26,653 25, 221	28.830	31,045	31,170	12, 85, 52 23, 85, 52 23, 52, 52	11 91 11 11	40,146 70,120	12 156 11 156	11 011	47 450 14 450
(08)		-	1			-									660'97							001 ° 04	
3. Flow Rate in Daily Average Operat	Daily Aver	age Operi	ation (cu m/d)	(p/= n									:										
11 for Zone 1-4						3		60,328 . 6	65,556 7				89, 519	94,774 1	00,159 1	15, 679 1	10,900 1	14,998 12	0 155 1	25.597 L	94,774 100,159 105,679 110,900 114,990 120,155 125,597 151,322 157,518	37, 338	143,65
TL for Lone 5-8						-								43,934 48,128	(8, 128	52, 372	56,571	56,571 58,805 61,672	1 672	64,678	67,829	71 131	74, 568
81 82						- 6	18,052 7 53,524 6	71,416 2 60.326 6	25,185 2 65,556 7	29,128 3 71,082 37	33,263 76.923 1	83,056	42,078 89,519	45,987: 49,999 94,774 100,159-1	45,5882 49,999 54,117 58,317 61,496 65,421 69,555 73,904 94,774 600,159,105 679 410,900 14,990 120,155 125 237 131-322	711 12 105 679 11	58, 317 18, 908-11	51,196 1 4,930 12	6, 421 - 4 0, 155 12	69, 555 125, 537 1		137, 326	83, 268 143, 652
50						:								3,557	1, 153	1 36	610°S	5,529 6,263 7,049	6 263	1,049	7,891	061 8	9,749
(65)					1	, ,	• T/0	~ 1914		CT/ 0	H7C*9	164.1	175-6	161.4		' TAC'AT	11,281	1 179,11	1 111,61	1, 642, 41		16,163	CT 21
2						:		5,538	6.809	1.211.0	12,955	11,319	11.21	.17,085	18,480	105 61	21,904 2	22, 777 2	24, 323 2	25,735	27,215	18, 167	30,394
(80)	ŗ					-	107 0															C71 42	00*A0
4. Puap Characteristics	ristics }					()			. (**)	(T) -			,										
Il for Ine 1-4						un (m) 480		rotor Powertany.	(av) ::				e (ce a/mia/unic) 39_9		no.or Pump(unit) 3 fexciluiti	otuare) vzcludie:	t Lumit	rump(uatu) 3 (excluding l unit stand-by)					
11 for Zone 5-B	•					200		326				31.8				xcluding	1 mit	(excluding 1 unit stand-by)					
10						200		300		17.4		25.0				rcluding	1 1 unit	(excluding 1 unit stand-by)	_				
60						89		620 10		9°55	,	6.7 7				excluding	excluding 1 unit avelation 1 unit	stand-by) stand-hu)					
3 25						(2		120				8.6			. ~	xcluding	1 unit	excluding 1 unit stand-by)	~~				
(co) 90			.'			(0 0		130		31.0		16.5			2 (6	xcluding	r'l unit	2 (excluding 1 unit stand-by)	~				

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A-8-3-25

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					3			L						¢							
Ites	0661	7661	1992	1991	1994 1995	3 1996	1997	1998	1999	2000	1001	2002	2003	1 - 2004	1005	2006	2001	2008	2003	2010	2011
5. No.of Operating Pumps								*													
Ti for lose 1-4						7	2	1	7	1	~	2	~	••••		'n	**	**	eri	.	
tor tone 5-8										~				~			PD 1	10	+7 I		5.1
02									~ ~	~ ~				~	im pr. :		~ e~	1 7 17	m ~	PY P	-17 P
~										1		•			7	, ~,	~	. ~		, ~1	
					•	_	1	-						~	2	7	2	~	2	7	7
(cu)			· · ·		-		-	-		-	ŕ			F	ŕ		ŗ	•		. •	r
10						• •			4							.	~~	4 6	~ ~	4 ~	4 10
(08)				٠			, i		· ···.	· · ·	:				'.	' .'				•	
6.Naximum Pump Capacity (cu m/d)	cu n/d)																				
Il for lone 1-4					114,921	114,921	1 114, 921	114,911	114.921	14, 911 114, 911 114, 911 114, 911 114, 911 114, 911 112, 312	114,921	111.921	172 382		112.382 112.382 112.352 172.282 172.382 172.352 172.552	132 352	172,287 1	172,382 1	172, 352	172.582	172, 582
11 for lone 5-8			•		31,459	9 31,459	9 31, 459	31,459	62,917	62,917	116.79	62,917 + 62,917	62.917		94,376 94,376	915° 16	94,376=	94, 376 - 94, 376	94.376	91.376	31:376
01 10					36,051	L 36,051	1 36,051	19° %	72,102	72, 102	72,102	12,102	71,102		72,102,108,155	108,153	108,155.3	108,153	108,153	108,153	111,201
20					107 L	5 127,6L3	177, ALS	101 L	2 216",JT 276",ZT	709 L	115 AT	071'141	1. 1. 601 1. 604	q -	-214, 12U-194, 12U	174 128	194,120 1	194,120 194,128 174,129 194,129 15 260 15 205 15 702 15 200	174 . LZU 14 . ZA2	15, 200	134 2ZU
					14, 164					•	14,164				28, 329		28, 329	28,329		28, 329	28.529
(02)		•	i M																		
1 0	:		7		N 52 .	10122 -1	1 25,00 1 25,100	101, 25	111,55	23, /01 23, 134	- 414° 24	414529	11-11 11 - 12		41,414 - 47,414 44 340 - 44 340	11 II 11 II	11 NO	11 10 11 10	(1 11) (1 11)	-11,411- 14,115	11,11
(88)																					
	:					Ż		:	5	• •		÷.					•••	: :	•		• .
J. Motor Output (Kw)					* * * * * * * * * * * * * * * * * * * *																
		1			1						. ,	•	2		:	÷. [
IL TOT CONC 1-4 TI for Tone La					Ξ.Ē	÷	924 - B				87 J	021 0	980 T (0201 0	1,080	1.80	. D83 1	1,089	. 1.050 940	1,056	1,088
					300	0	· .							·		r 1 g s	1905			205 1	1.296
~		5			1.240	-	-	-	-		1	-	1		-	-	1.360	1.860	1.860	1.360	1.360
3					2				·	g -				1		.e.,	011	160	140	1	100
					130	8 130	0 130		0 130	1 130	2		092 (3 260	268	168	260	260	260	266
(05)			÷				÷.,	÷	9 - N	•			1		٠						
2					151		1 130		÷	i.				÷.	;		369	560	Z60	560	260
0/ (ne)				-	121			220	. 220	. 220	0 1	€	140		012	440	013	01	÷:	4 4 6	011
- Ton		. 1							÷		. '								•		
Intal					3.130	0 3.139	10 3.130	3.130	3.750	3.750	100	916 7 0	0 5,210	0 5,530	0.5.960	1990.2	5.900	5.900	5, 948	106 2	902 Y

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316 1	1990 - 1991 - 1922 - 1955 - 1994	1 1395 H	1996	1491	966T	6663	2000	A 2001 -	2002	2003	2002	2005	2006	1007	2008	2003	2010	2011
8. Energy Consumption (Awk/day) for Daily	r Daily Average Demend		1															
far Tana I.I		6 U 8	1 U U U	0 017	497 V:	11 575				15 0.60	16 250	11.4.16	1 000 10	19 61	10 205 1	141 01	26 101	11 430
11 for Lone 5-8		2.911		1.663			8,636	11.6	10.726	11.76		1.1					11 26	18 20
10		3,601			5.817									1.1			15,672	16.639
02		12, 308			16, 366												31,582	13,014
8		111	2 350		<u>s</u>	3	2	2	186	118	595	1,122	1,222	. 38 1	1.53		1 942	7 12
ut (85)		174		1,107	ACT.1	1.151	1,645	210 1	110.1	791'7	ere*7	C34-7		202 7	747°C	, 10, 10,	110 0	201 - F
12		546			1,068	1,705	1,884	2,068	2,249	2, 132	2,619	2,885	5,024	3, 201			3,736	160
07 (ao)		1,420	0 1,705	2,009	7, 314	2,621	3,220	3,627	3,992	4,361	1 736	5,160	135,381	5 .574	5,980	6,301	6,637	6,988
101	-								· .									
Total		29, 927	1 34,724	39,634	115 21	19,580	\$5,099	60, 139	64,998	69,657	69,657 74,419 79,286	19,286	87.648	196 98	6 515*T6	101 101 111		106.616
9. Pump Operation Cost (Baht x1,000/year Dewand Charge Energy Charge)0{year)	9,601 13,436	1 8,601 6 15.589	8,601	8,601 19,543	10,305	10,305	11, 267 21, 136	13, 328	14,317	15,196	16,213 1	16.213 1 37.105 3	16,213	16,213 1 16,213 1	16,213 1 16,213 1	16,213	17:038
Total Cost		22, 031			51 16			38,401			18, 597		53.318 5	55, 251			1.107	64,903
· · · · · · · · · · · · · · · · · · ·														I	iotal (1991-2011) =	1-2611)		746,953
Note: Pumps is designed for 9DH (Daily Maximum Demand) for transmission, and for QHH (Hourly Maximum Demand) for distribution. 10. Emergy Consumption (NRh) = Mo.of Pumps x Motor Gutput(NM) x 24 M/day x (actual daily demand(qla)/Max.capacity of pum 11. Demand Charge = Baht 229 /W/Meon x 12 mon/year x Motor Demand KN Energy Charge = Baht 1.23 /WHH x Energy Consumption KNh/day x 856 days/year Design Pump Meddr(Meed Loss of Pipeline)/(Actual Mead, =0)/(Residual Mead MB.0 Non Loss 1.5 m)	ONM (Daily Naximum Demand) for transmission, and for QNM (Hourly Naximum Demand) for distribution. A (NMN) = Mc.of Penge x Motor Output(NM) x 34 M/day x (actual daily demand(qla)/max.copecity of pump) and 229 /NW/mon x 12 mon/year x Motor Bemand X dt 1.23 /NMM x Emergy Consumption NM/day x 365 days/year d toss of Pipeline)+(Actual Mead, =0)*(Residual Mead 10.0 m)+(Pump toss 1.5 m)	for tram or Gutput on x 12 m K Energy (Head, =0	smission, (KW) x 24 on/year x Consumptio)4(Reside	and for h/day x Motor De on KWh/d ual Head	QHK (Hour (actual c mand KY ay x 365 19.0 m)4(iy Maxin Maily den days/yea Pump Los	un Deman Land(qla) Lr s 1.5 m)	ld) for d //sax.cap	istribut acity of	Dunp)								
DA : Baily Average DM : Baily Haximum HK : Kourly Maximum																		
Electricity fee = Rat	Electricity fee = Rate of Provincial Electricity Authority(FEA) as of January, 1989	Authorit	y(PEA) ≵	s of Jan	ary, 1981													
						•						•						
- 	1 000 F 001	41 10	760 I 1		700 I	1 007	800 1	1 949	2 008	tuu (2 007		2 GN4		7.006 2	2.001 2	968	2.063
Tear Operation Cost Aiscourd Pate	1,747 1,774 1,774 1,774 0 0 0 0.0 0.0 10.00 1	0.0 0.1		22.0	24.2	26.1	1,778 28.1	32.6	35.6	38.4		45.6		51.8 51.8			57.3	59.6

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Water Transmission/Distribution Cost - Patum Thani & Prachatipat

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I. Transistion Pape: transistion Pape: tead toget for large field statements Be Fire: Not 2011 Not 2011 Not 2012 11:11:1 TST/40 Sec. 2 Not 2012 11:10:1 TST/40 Sec. 2 Not 2012			1991	1661 0661	7651	1993	ł 1994	5663	1996	1991	1 9661	1999 2(A 2000 26	2002 2002	17 2003	2001	2005	2006	2007	2003	2003	2016	1101
Free 10 Carloli Free 10 Carloli Free 10 Free 10 <t< th=""><th>Transex:</th><th>ssion Pipe</th><th># </th><th>1042 ((111)</th><th></th><th>ting year</th><th>of vate</th><th>er transa</th><th>ISSIOR</th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th>Head Loss</th><th>for Q(2)</th><th>611)</th><th>3</th></t<>	Transex:	ssion Pipe	# 	1042 ((111)		ting year	of vate	er transa	ISSIOR											Head Loss	for Q(2)	611)	3
			Dia (n	(m) 1 (m)																		-	Loss
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	2 7								•	· .				1				•		· . ^	н. 11. 1	99° 0	
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24 25 7,325 M 400 5.0 M M M M M M M M M M M M M M M M M M M		:		0 S.0					·	~				••		:	1. 				•.	1 05	Ξ
「「「「「」」「「」」」「「」」」」」」」」」」」」」」」」」」」」」」」			, P	0 5.0													•		:.			0.72	0
	; •		1																				

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A-8-3-28

Mater Fransmission/Distribution Cost - Patum Thani & Prachatipat

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	* * * * *																				
Itea	1661 0661	1992	1995	1994	1995	1996	1991 1997	1998	1999	A 2008	2001	2002	R 2003 2	2004	2005	2006	2007	2008	2069 2	2010	1102
2. Required Punp Head and Flow Rate	i flow Rate				2- 1-																
Routing Total Fl	Iotal Flow is 2011		•		********************	******	11111	. 8eo	mired K	ater Bea	Required Mater Reamd in Fach Year (cm m/d)	ich Year	(cr •/d)		11		122231123	11221321	111111	2222222	
•.••	Loss(a)QDM,HH(cu a/min)	:.				::															
13.3	119.7			-		165,27					107,423 113	113,729 120				137, 988, 144,	156 150,	716 157	587 164.		72.382
11 17-27 57.0	62.2				13,316 1		22,822 2		36,212 4				51,753 62,		61,885 70		71,007 77,			÷	81,566
	6U.U			-				24,133 28			181 13			,229 Sé		545 62	835 66,				11,361
DI 11 (LONETS) 41.Y	8. ľ									3 392		+ 369 +		210 6		6,633	515 8			÷	11,539
	1.01	1			. 110 * 5	24,700,42	-	6,858 /	1,878		10,233 10		11.777 12. 18 26 28				15,737 11,				11.73 11.73
-9	10.6						-		_					60,415 57. 2 017 7					1.5		34, 199
	19.7		-								-	·	_		17.598 16	8, 963 - 79 16 763 - 20	20.452 22.	22.258 24	24 160 - 26, 185		807'CT
			•													1. U					
	9719				8,243													59 959 62	62,577 65,528		68,515
0/ 18-30-51 30.8	51.1					10,172 12	12 256 14	11,344 16	16,441 20	20,546 23	23, 329 25	25,827 28	28,356 30,	30,918 33,	33,825 35	35 339 37	37,341 ,19,	13, 133 - 11			f6,310
(on)							·	•••		,			ъ. -	-							
3. Flow Rate in Daily Average Operation (cu m/d)	erage Operation	(cu a/d)								•.	•										
11 for Zone 1-4												174 tm	119 105	611 11A		111 228 120 145	101 351	121 205	177 511 562 121 105 51	~	627 1
11 for Zone 5-8												934 48	128 52	372 56	56 571 58	805 61	672 64,678	678 67.1	829 71 F		76.588
01 for Distribution					12,625 1	15,349 18	18, 275 21						36, 231 39, 249	249 41.		12 939 46	16 018 18 245		50.526 52.878		55, 360
Di for Franshission for Zone-3	Zone-3							2,114 2					,953 4,	367 5.							9,749
DT TOL ILGUSETSSTON TOL	+- 210T			-	4,1/6 4 71 101 71				6,524 7						11.281 12						151.8
8				-						-	41,441 48, 7 670 7	48,/8/ 50, 7 CCT 7	20,160 XI.	31,361 · 52,					118 58 865 101 6 366		0.384
10					1.176	1977 - 19	5.037 5	5.715 6	6.524 7	7.457 8				_	1, 281 17 11 281 17	** 170 CI	196 J UII 207 0	1,047 1,071 1,071			7.147 18 150
(02)										1.				•	-	•			•		
76					5,283	7,806 10							28,589 31,5		33,921 35,	35, 191, 36, 36	36,774 38,435	135 40,178	78 42,005		43,922
0) (08)			÷				8,818 10	10,156 11	11,501 12	12,846 14	14,200 15,	15,544 LG,		18,293 19,							25,648
4. Pump Characteristics																					
			Dia (mm)		Notor Power(Kv)	E)	Ē	G	. (cu m/m	iin/unit)		No.of Pump(unit)	uit)								
11 for lone 1-4			ę00	÷	550		51.8		39.9			3 (exc	i (excluding 1 unit stand-by)	unit st	and-by)						
1] for Lone 5-8 Di far Distribution			8 s		360		68.5 6 2		20.7	20.7		3 (exc	(excluding 1	unit stand-by	(/d-bae						
us ive used success Al for Transmission for long-1	7.000 L				N07				0.61 1 4			5 (ext	(excluding 1)	(YOTO STAND-DY)	ang-oy)						
Di for iransmission for	tone-4		8		042		, (I)					1 (evr			- (10_01) and-bu						
			200		210				21.8			I (Pyc		whit stand-by)	and-hy)						
10			309		R		50.2	·				2 (exc	••	unit st	and-by)						
10			8		130		50.6		8.4			2 (exc	(excluding I unit stand-by)	enit st.	and-by)						
(63)							-	-						-	2						•
116 17					0/L		9.1. 2		2			2 (EXC	Z (excluding 1 unit Stand-Dy) S (sucluding 1 unit stand-dy)	nut st							
(03)			224		n.n 1				7.07			1217	Clarcturating t diffe stand-cy	10 110	dRUTC)/						

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(60) (10

-3-29 A--8

Waler Transmission/Distribution Cost - Patum Thani & Prachatipat

2-2 4 3-2	
Alternative :	

[\$en [370	1661 (1992	1995	1 1396	568T	1996	1997	3661	424T	1008	1082	1001	1001	1691	2005	2004	2003	2008	2001	0102	102
5. Ro.of Operating Pumps																					
Il for lone 1-4					2	7	2	1	1	7	7	1	'n		Ň	м	5	ы	17	m	*7
11 for Zone 5-8							- i-	·• •	~	~.•	~ `	~ ~	~ •	~ ~	~ •	r-7 7		~ ~	2		
ul ior ulstrigation A: for irzasmiction for Jone-1					~ -		-1 -1		7 -	- 14			r-s	~•		~ -	~a	-, -		••••	
DI for Iransmission for Zone-4					••		••	44						• ~			a ~4	•			
					2	2	**3	ы	•••	m	••	5	ю	5	F3	~	ы	**3	. 143	ы	2
					4	-	••• 1		•	- -		1 [*]	~-1	-	7	e- 4 (7	~	~1	~	
(M					-1		1		-	-	~ *`	~	~	7	~	r.1	~	F-4	2	2	
fea)			•		·	-	-	_		-	•	•	e-	**	~	r	,	ŗ	~	~	
10			•		•	44	• •-•	4	•	a'	. ~	• ~	• ~	4 . 64	• •	,		• •	4 ~	• ~	
(88)					•	•						: : ج		r .	. :	, '		•	•	• .	· .
6.Maximus Pump Capacity (cu m/d)	(P)																				
	•							 			۰ م			•	•						
11 for lone 1-4						114,921	111, 721 1		114,921 1			114,921,11	172, 382, 17	_	12,382 11	17,382,1		12,382 1		172,522	112,382
Il for lone 5-8						1. A													1.1	\$1,596	
01 for Distribution					18, 181															56.361	191°58
01 for Transmission for Lone-J	- 64				11,699						•									11.679	11,679
D1 for Iransaission for Lone-4					21,191	21,791		÷	<i>1</i>	- C - C -										111.12	11.131
				_	62 . 199	62,739						1.5.5								94,199 	34 I99
					11 3.LT	14 145	10,111	11	1,000 16 161	11 121	1.944 3.6 164 -		10 10	1 100"/		1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	5 6 6 6	201.02	10,400	207°C7	29, 215
(BS)								·		÷.				÷ .							
90													1.0							68,518	81.89
61					23,170	23,170	23,170	23,170	23,170	23,170	16,340	16.360	16,318	46,340 4	Y 815 99	46,340 4	10*2*9	16, 316	46,340.	46,240	£6,340
(101)							۰. 	· . ·	:							• •		;			
7. Notor Output (Xw)							:					· .			÷.,		÷	•		•	
11 for less 1-6					6U1 (1 100	100	ant 1	1.100	T tim	1,300	1,100	1.650	929	854 5	659	9591	1 654	U59 1	857	59
It for lose 5-8					360	260	350	360	120	720	720	120	126	080	1 (80	1 080	1.080	1 020	1.050	1.980	1.05
01 for Distribution					260	260	260	260	220	520	S 20	520	220	520	520	180	180	730	780	780	780
01 for Iransmission for Ione-3					110	110	911	110	110	110	110	110	1F0	- 110	110	110	110.	110	110	110	=
for Iransmission for long-	-				110	971	220	110	220	220	220	720	121	228	220	228	228	220	220	D72	-4
14					120	<u>ş</u> :	029	0 <u>1</u> 9	83	8	659	8 I	5 5	639	B <u></u>	630	929	83	83	639	619
					2	2	2	2	E :	2	2	2		9	2	P. S	10			3	35
State of the second sec		2			130	120		0	8	130	150	197	761	260	897	201	147	197	791	708	147
(ca) 90					196	190	130	190	190	190	380	160	180	530	386	389	330	380	330	350	190
			:		260	260	260	260	769	268	220	520	520	520	520	520	520	520	520	526	23
(80)	-																				

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12,000 2,206 4,400 2,915 2,154 5.846 6.907 55,022 15,856 2011 13.000 1,500 58.516 677,596 15,856 15,856 38,401 40,478 2010 20 599 11,466 1,942 31,550 96 5.59 32,235 36,490 42,427 42,434 52,405 56,703 61,092 65,573 69,969 73,007 76,966 81,140 85,536 90,151 1 98 2.594 19,181 21,219 23,623 25,535 29,902 32,150 35,619 37,905 41,388 44,388 46,554 18,635 59,410 52,284 34,257 56,334 iotal (1991-2011) = 5,348 30, 168 19,643 1.143 2009 18 352 2,486 191.1 3,755 15,856 15,856 1 34,554 36,628 2 5,949 5,949 18,730 1.557 2003 10,457 3,456 7,283 L.531 27,602 17,860 , 932 4,895 -5,662 11 1,384 2007 1.413 101 15,856 32,777 26, 116 17.029 1.222 4,684 5,399 2006 9.524 1.248 1, 931 15,141 31,412 16,382 25.476 (..516 5.202 1,122 2005 260,4 1,116 1,133 1,811 12,091 12,448 13,960 14,949 23,527 25,457 27,427 29,439 24, 277 2,313 1, 205 5.167 2004 1,685 Ξ 3 3.859 4.553 23,007 13, 937 2003 2,578 515 2,162 10. Energy Consumption (KWh) = Mo.of Pumps x Motor Output(KM) x 24 M/day x (actual daily demand(qia)/aax.capacity of pump) Mote: Pueps is designed for QBM (Daily Maximum Demand) for transmission, and for QMM (Mourly Maximum Demand) for distribution. 3,516 21, 772 12.723 2002 2,017 112 3 2.219 5 3,178 3,824 20 565 11,523 1,878 2001 6.584 2,966 36 702 Demand Charge = Saht 229 /KW/non x 12 mon/year x Motor Demand KW Energy Charge = Saht 1.23 /KWh x Energy Consumption KW/day x 565 days/year Design Pump Mead=(Mead Koss of Pipeline))(Actual Mead. =0)(Residual Mead 10.0 m)+(Pump loss 1.5 a) 10,855 2,828 3,460 19,073 10.245 624 1,643 2000 11 . 53 10 10 10 10 1,197 -19,048 10,855 119'11 2,486 3,097 1999 .256 ē, 2 E 38 Electricity fee = Aate of Provincial Electricity Authority(PEA) as of January, 1989. 9,151 16,329 6,606 1,681 1998 69 585 110 88 120 5 9,151 14,472 15,060 5,508 1.220 808 414 414 1,358 2,375 1937 361 22 28,167 12,646 8,574 13,858 356 119 387 387 1,019 1996 19 33 23,628 10,608 8,574 703 1,678 1995 \$20 2,296 2 2 10 629 1994 Energy Consumption (KuH/day) for Daily Average Dewand 1993 1992 9. Pump Operation Cost (Baht x1,000/year) 1991 2-2 4 3-2 DM : Daily Kaximum HM : Hourly Kaximum 11 for lone 1-4 11 for lone 5-8 01 for Distribution 01 for Transmission for lone-5 01 for Transmission for Lone-4 DA : Daily Average 1990 Alternative : Demand Charge Energy Charge Total Total Cost 5 6 5⁸ 1 12 ន 3

Mater Transmission/Distribution Cost - Patum Thani & Prachatipat

2,011 58.5 2,010 56.3 2.003 54.3 2,008 2,607 2,006 48.6 2,005 2,004 2,003 2,002 37.3 2,001 35.6 2,000 32.2 1,999 29.9 1,998 1.97 1,976 21.2 19.2 1,994 0.0 1,993 0.0 1,992 0.0 166°T 176.93 x Hillion Baht 1, 990 o 9,00.4 1,989

Year Operation Cost Discount Rate RPY

A-8-3-31

APPENDIX A-9-4

Capacity Calculation for the Water Treatment Plant

and Distribution Reservoirs

	Distribution Reservoir Capac		· · · · · · · · · · · · · · · · · · ·	
	Item	Alternative 1-1 2-1 3-1	1-2 2-2 3-2	·
i	1. D-1			
	a. Zone-1 Demand (Daily Max b. Zone-3 Demand (Daily Max c. Zone-4 Demand (Daily Max) 11,699	75,501 11,699	
	* Required reservoir volume	, , , , , , , , , , , , , , , , , , , ,	12,722	
	= a*6hrs+(b+c)* 0.5 hr ** Proposed Reservoir **	19,384	19,384	
	a. D-1 at exis.new Plant exis. Reservoir 2,000 +	7,000	7,000	
	New construction 5,000) b. D-1 at old Plant New construction 13,000)	13,000	13,000	
	Total	20,000	20,000	
	2. D-2			
·	a. Zone-2 Demand (Daily Max b. Zone-1 Demand (Daily Max c. Zone-3 Demand (Daily Max d. Zone-4 Demand (Daily Max) 75,501) 11,699	74,074 75,501 11,699 12,722	
	<pre>* Required reservoir volume = a*6hrs+(b+c+d)* 0.5hr</pre>	20,600		
	= a*6hrs		19,019	
n an the second se	** Proposed Reservoir **			
41	New Construction	20,600	19,100	
	3. D-3			
	a. Zone-3 Demand (Daily Max)	11,699	11,699	
111.	* Required reservoir volume = a*6hrs	2,925	2,925	
	** Proposed Reservoir * *	· .		
	a. D-3 at exis.Plant exis. Reservoir 1,000 + New construction 2,000)	3,000	3,000	

	Distribution Reservoir Capacity		
		ernative 1-1 2-1 3-1	1-2 2-2 3-2
	4. D-4		
	a. Zone-4 Demand (Daily Max)	12.722	12,722
		3,181	3,181
	** Proposed Reservoir **		· ·
· · · · ·	a. D-4 at exis.Plant exis. Reservoir 1,000 + New construction 2,200)	3,200	3,200
	and a start of the		
	5. D-6		
	a. Zone-5 Demand (Daily Max) b. Zone-6 Demand (Daily Max)	16,233 34,859	16,233 34,859
	<pre>* Required reservoir volume</pre>	8,715	
· · · · · · · · · · · · · · · · · · ·	= (a+b)*6hrs	in the second	12,773
	** Proposed Reservoir **		
	New Construction	8,800	13,000
	6. D-7	• • • • • • • • • • • • • • •	
	a. Zone-7 Demand (Daily Max) b. Zone-8 Demand (Daily Max)	30,777 6,023	30,777 6,023
. *	<pre>* Required reservoir volume = (a+b)*6hrs</pre>	9,200	9,200
	** Existing Reservoir Volume		
	a. D-7 at exis.new Plant exis. Reservoir 500 + New construction 9,000)	9,500	9,500
		ina el gale de la contra de la co En tra persoa de la contra de la c	· · · · · · · · · · · · · · · · · · ·

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Iten	: Total System (for 2011)	: Phase 1 (for 2001)
Flanned Flow	: Q= 283,000 cu m/d	: Q= 141,500 cu n/d
(Daily Max)	: = 11.792 cu n/hr	= 5,896 cu m/hr
		$= 983$ cu π
	: = 3.275 cu n/sec	: = 98.3 cu n/min : = 1.638 cu n/sec
No. of Treatment	Line	:
	t Lines	2 Lines
	*	;
	: 70,750 cu m/d x 4 lines	: 70,750 cu n/d x 2 lines
(1) ¹	:	:
Receiving Well		;
	: T= 1.5 min	: T= 1.5 min
	:d= 5 m	: d= 5 œ
No.	: I unit	: 1 unit
		: Circular
	: Dia 9 m	: Dia 9 m
	: v= 318 cu m	: v= 318 cu B
	: t= 1.6 ain	: t= 3.2 ain
(2)		•
Nixing Tank		
	:	:
Criteria	: T= 1.0 ain	: T= 1.0 sin
Dimension	: Square x 4 units	: : Square x 2 units
	Lax Wax Dax units	: Lax Vax Dax units
	: 4.0 4.0 3.0 4	: 4.0 4.0 3.0 2
4		· · · · · · ·
	: v = 192 cu n	: v = 96 cu m
	: : t = 1.0 ain	: : t =
	•	
Xixer	: Kechanical Flush Kixer	: Mechanical Plush Kixer

A-8-4-3

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Capacity	Calculation	for	Treatment	Plant	-

Item :	Total System (for 2011)	: Phase 1 (for 2001)
(3) Coagulant Mixe	r	
Coagulant : :	Solid Aluminum Sulphate (Al2(SO4)3) containing 15 % Al2-O3	: Solid Aluminum Sulphate (A12(SO4)3) : containing 15 % A12 O3
:	Dosage Rate : 20-50 ng-solid alum/l Average 25 ng/l	: : Dosage Rate : 20-50 mg(A12 03)/1 : Average 25 mg/1
	Coagulant Solution : 5 % solution	: : Coagulant Solution : 5 % solution
:	Dosage Amount : 7,075 kg-Alua/day	: : Dosage Amount : : 3,538 kg-A12 O3/day
4 4 4	Coagulant Solution (5 % solution)	: Coegulant Solution (5 %)
	= 142 cu n/day	= 71 cu n/day
No. of Mixer :	8 units	4 units
Туре	Batch Type Mixing	: Batch Type Mixing
Capacity :	1?.? cu m/unit	17.7 cu u/unit
•	-	: Square x 4 units : Lax Kax Dax units : 3.0 3.0 2.0 4
:	v = 18.0 cu m/unit	: v = 18.0 cu m/unit
•	Total V = 144.0 cu m	V = 72.0 cu a

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A-8-4-4

Iten	: Total System (for 2011)	: Phase 1 (for 2001)
(4) Plocculator		:
Туре	: Mechanical Flocculator	: : Hechanical Flocculator
	N = 4 lines x 4 units	: : N = 2 lines x 4 units
	= 16 units	: : = 8 units
	: q = 12.28 cu n/min/unit	: : q = 12.28 cu m/min/unit
	: T = 30 min : n = 3 stages :	: : T = 30 min : n = 3 stages
	:WaxLaxDaxnstages :10 3.6 3.6 3	: :WaxLaxDax n stages : 10 3.6 3.6 3
	: v = 389 cu a/unit	: : v = 389 cu m/unit
·	: t = 31.7 min	: : t =31.7

Capacity Calculation for Treatment Plant

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Capacity Calculation for Treatment Plant : Total System (for 2011) : Phase 1 (for 2001) Iten : (5) Sedimentation Dasin Type : Rectanglar, Horizontal Flow : ٠. : Rectanglar, Horisontal Flow • _1___ . : N = 4 line x 4 basins : N = 2 line x 4 basins No. ÷ 11. L. L. L. ÷. : = 8 basins : = 16 basins . : Unit Flow : q = 737.0 cu m/hr/basin : q = 737.0 cu m/hr/basin . : Retention Time : T = 4 hours : T = 4 hour Criteria : T = 4 hours : Wax Lax Dax N : Way :)? TA ٠ Dimension : 12 50 5.0 8 : v = 3,000 cu n/basin : v ; v = 3,000 cu m/basin t = 4.1 hours : t = 4.1 hours : :Flow velocity : v = 20.5 cm/min . : v = 20.5 cm/min . : 1 : Surface Load : a = 29.5 m3/m2/day : a = 29.5 m3/m2/day : : Hechanical Scraper :Sludge Removal : Mechanical Scraper : : : : Sludge Amount : Solid Amount : (ton-DS) : So = Q(K(T1-T2)+0.16xB)x10^-6 : where So:Sludge dry weight(ton) • 1 Q :Treated water amount(m3/d) 2 : : K :Coefficient converting turbidity : to SS $(0.8-1.5 \rightarrow 1.2)$: T1 :Turbidity in raw water (ave 57) : T2 : Turbidity after Sedimentation (ave = 7) B :Alum dosage rate (ave.= 25 mg/l) : : : So = 9.08 ton-DS So = 18.11 ton-DS/day : : Water Contents of Drained Sludge : Water Contents of Drained Sludge . ¥ = 99.5 % v = 99.5 X : : Sludge Volume : Sludge Volume . : v = 3,622 cu m/d : v = 1,811 cu m/d

Capacity Calculation for Treatment Plant

Item	: Total System (for 2011)	: Phase 1 (for 2001)
(6) Lapid Sand Filter		
Туре	: Down Flow, Single Hedia	: Down Flow, Single Hedia
No.	N = 4 lines x 4 units	: N = 2 lines x 4 units
	: = 16 units	= 8 units
Unit Flow	: q = 17,688 cu m/day/unit	: : q = 17,688 cu m/day/unit
	: Surface Load 120 - 150 m3/m2/day	: Surface Load : 120 - 150 m3/m2/day
	. N m x L m x N units : 10 15.0 16	Ках Сах N units : 10 15.0 8
	: a = 150 sq m/unit	a = 150 sq m/unit
Surface Load	: La = 117.9 m3/m2/day	La = 117.9 m3/m2/day
Filter Washing Frequency	: : Once a day for each filter	. Once a day for each filter
Rate	: Surface Washing	Surface Washing
	0.2 a3/a2/ain x 5 ain	0.2 m3/m2/min x 5 min
· · · .	: Backwashing	Backwashing
	: 0.6 m3/m2/min x 10 min	0.6 a3/a2/min x 10 min
	: : Surface Washing	: Surface Washing
required	: : v = 150 sq m/unit x 16 units	: : v = 150 sq m/unit x 8 units
	: x 0.2 m3/m2/min x 5 min	x 0.2 e3/æ2/ein x 5 ein
	: = 2,400 cu æ/day	= 1,200 cu m/day
	: : Backwashing	: Backwashing
	: : v = 150 sq a/unit x 16 units	: : v = 150 sq ¤/unit x 8 units
a the set	: x 0.6 a3/a2/min x 10 min	x 0.6 m3/m2/min x 10 min
n e proteo di	: = 14,400 cu n/day	: : = 7,200 cu m/day
	: : : Total q= 16,800 cu n/day	: : Tota q = 8,400 cu ¤/day

Patun Thani and Prachatipat

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Iten	: To	tal System (for 201	1):	Phase 1 (f	or 2001)	
Solid Amount	:		*=q,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			•••••
in Wastewater						
Solid Amount	:				· .	
(ton-DS)		*K* (T1-T2)*10^-6				
	: wher	e – So:Sludge dry wei		÷.		
	:	Q :Treated water				
	:	K :Coefficient co		y .		
	:	to SS (0.8-1.5		, , , , , , , , , , , , , , , , , , ,		
		T1 :Turbidity bef T2 :Turbidity aft			• •	
	•	B :Alum dosage ra			*	
	•	D INTER AASOFC 10	ες (αιει- αν αθ /1	1		
	: 1	So = 2.38 ton-DS	/day :	So = 1	19 ton-DS	
	• •		•			
SS Contents	:	s = 142 mg/1	:	s =	142 ag/1	

	ion for Treatment Plant	
: Iten	: Total System (for 2011)	: Phase 1 (for 2001)
: (7) :Clear Water Reser	voir	:
No.	:N= 2 units	: :N = 1 units
: Criteria :	: : : Retention Time	: : : Retention Time
•	: T = 3 hours	: :T = 3 hours
: : Required Volume	: V = 35,375 cu m	: : Y = 17,688 cu m
	: :Lax Wax Dax Nunits :60 60 5 2	: :Lax Wax Dax Nunits :60 60 5 1
	: : Total Volume	: Total Volume
	: : v = 36,000 си в	: : v = 18,000 cu m
: Retention Time	: : t = 3.1 hours	: : t = 3.1 hours
:Chlorination Equi :		: :
1	: at the Inlet of Clear Water Reservoir : : 2.0 ppm	: at the inlet of Glear Water Reservor : : 2.0 ppm
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	: : Liquid Chlorine (1-ton cylinder)	: : Liquid Chlorine (1-ton cylinder)
: Anount	:	: 283 kg- Cl gas/day
ARCOULT	: : : Vacuum Type Injector	: : Vacuum Type Injector
: : Injector		:
: Injector : :	: : No. of unit 4 units : (excl. 2 units stand-by)	: Ne. of unit 2 units : (excl. 1 units stand-by
 A State <		
 A State <	: (excl. 2 units stand-by) :	: (excl. 1 units stand-by ;
 1 - A A A A 1 - A A A A A 1 - A A A A A A A A A A A A A A A A A A	: (excl. 2 units stand-by) : : Rate 5.90 kg/h/unit :	: (excl. 1 units stand-by : : Rate 5.90 kg/h/unit :
: : : : : : : : : : : : : : : : : : :	: (excl. 2 units stand-by) : : Rate 5.90 kg/h/unit : : Capacity 10 kg/h/unit :	: (excl. 1 units stand-by : Rate 5.90 kg/h/unit : Capacity 10 kg/h/unit :

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Capacity Calculati	on for Prostmant Blant	والمحاج و
	ON IOI ILEASUENC FIGHC	
Iten :	Total System (for 2011)	: Phase 1 (for 2001)
(9) : iludge Lagoon :		en ouer 1915 en
: Filter Washing : Water :	ql = 16,800 cu m/day	: q1 = 8,400 cu u/day :
Retention Time :	T = 1.0 day	T = 1.0 day
: Required Volume :	v = 16,800 cu m	v = 8,400 cu u
: No of Lagoon :	n = 2 units	: n = 2 units
Dimension : : : : :	Lax Wax Dax N 68 33 3.0 2 (Top) Lax Wa	: (Bottom) :Lax Wax Dax N : 68 33 3 2 : (Top) :Lax Wa
:	80 45	10 80 45 Colored Color
	y = 17,532 cu m	: v = 17,532 cu a
Side Slope :	s = 1 : 2.0	: s = 1 : 2.0
	t = 1.04 Day	: t = 2.09 Day

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Iten	: Total System (for 2011)	: Pha	se 1 (for	2001)
(10) Sludge Dryin		***********		
Drain Water	from Sedimentation Basin	:		
Volume	: v1 = 3,622 cu n/d	: : v1 =	1,811	cu #/d
Solid	s1 = 18.1 ton-DS/d	: : si =	9.1	ton-DS/d
Drain Water	from Sludge Lagoon (Thickened backwash wa	ter)	•••••••• ·	
Solid	s1 = 2.4 ton-DS/d	: s1 =	1.2	ton-DS/d
Water Contents	: ; w = 99.0 %	•		
Volume	: : v = 238 cu ∎/d	t. F	•	
Total Solid	: s = s1 + s2 = 20.5 ton-DS/d	: s = s	1 + s2 =	10.2 ton-DS/d

Water Contents of Dried Sludge		R R	= 55	¥ 2
Sludge Thickness	d = 60 cm after dried	: : d	= 60	Ca
Drying Period	t ≈ 30 day	: : t	= 30	day
Required Area	a = 2,277 sq m	: : a	= 1,138	sý a
No of Unit	n = 4 units	: : n =	2 units	
Туре	Recutanglar, Concrete Kade	• • •		
Dimension	: Lax Hax Dax N	: :(Bottom) :Lmx W :30 2	n x D n 20 1	
Surface Area	a = 2,400 sq m at Bottom	: ; a = 1,20)0 sq a at 1	lotton

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: Item		Total System (for 2011)	: Phase 1	(for 2001)
: :(11) Clear Water	 Puap			
for Zone 1-4 . No.	: N =	3 units + 1 stand-by		nits + 1 stand-by
: : Flow per unit	: ; q = ·	40.4 cu n/nin/unit	: ; g ≈ 40,4 c	u m/min/unit
: Dianeter	: : D =	600 ma	: : D = 600 @	E
: Head	: : H =	50 m	: : H = 50 m	
: : Hotor output	: : P =	560 K¥	: : P = 560 K	¥
: Total Capacity	: : Q =	174,528 cu m/day	: Q = 116,352 c	u æ/day
: for Zone 5-8			iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii	
No.	: N = :	3 units + 1 stand-by		
: Flow per unit	; q = :	21.3 cu m/min/unit	:q = 21.3 c	u m/min/unit
: Dianeter	: D =	400 mg	: D = 400 e	
: Head	: =	72 m	: H = 72 s	and a shear and a start of the second se
: Kotor output	: P =	300 KW	: P = 300 K	W to the second s
: Total Capacity	:Q =	92,016 cu n/day	: Q = 30,672 c	u n/day
:(12) Sludge Lagoon	n Drain	i Pump		
No.	: N =	2 units + 1 stand-by	: N = 2	units + 1 stand-by
: Quantity drained	: Q =	16,800 cu m/day	: Q = 8,400 c	u m/day
: Braining Time	: : t_=	12.0 hours	: :t = 12.0 h	ours
Pump Flow	: q =	11.7 cu m/ain/unit	: : q = 11.7 c	u m/m in/unit
Diameter	: D =	300 an	: D = 300 m	R
Head	: : H` = `	10 a	: :H = 10 œ	
: Notor output	P =	30 KW	: : P =30 K	u