Attachment 1.

Outline of the Water Supply System and Service Connections

1. General

The water supply of the system initiated in 1922 with capacity of 300 l/sec which water source is from Ciburial Spring, Bogor supplied by gravity. In 1957, the Pejompongan treatment plant I was constructed with a capacity of 2,000 l/sec and the plant II was completed in 1973 with a capacity of 3,000 l/sec adjacent to the plant I. Currently, a total production capacity of the system is about 6,900 l/sec including the Pulogadung plant (1,000 l/sec constructed under the First Stage Project), seven mini-plants, the Ciburial spring and groundwater.

Treated water is distributed to the service area of about 238 km2 through approximately 3,400 km of distribution pipelines and 140,000 service connections.

2. Production Facilities

There are three major treatment plant and seven mini-plants located at various places in the service area. In addition, spring water from Ciburial and groundwater are available. Rated capacity of the production facilities are summarized as follows:

- Pejompongan Treatment Plant I	2,000 l/sec
- Pejompongan Treatment Plant II	3,000 l/sec
- Pulogadung Treatment Plant	1,000 l/sec
- Mini-plants	435 l/sec
- Ciburial Spring	300 l/sec
- Groundwater	120*l/sec

* according to the estimation on the basis of 43 wells x 250 m3/day

A total production in 1982/83 was estimated as about 199 million m3 based on PDAM record. The production of each treatment plant was calculated as the built of rated capacity of distribution pumps and operation hours. The detailes of production is summarized in Attachment 2.

PDAM recently started the record of production based on the registration of flow meters for the major treatment plants. The production record of June 1984 is presented in Table 1.1 According to the table, monthly production registered based on flow meter is similar to that of calculated.

3. Distribution Trunk Main

The large sizes of pipelines (ø 300 mm and larger) are categorlized as the trunk main which composes primary network. A total length of trunk mains is estimated at about 220 km out of which about 50% was installed before 1950's as shown in Table 1.2. Layout of the trunk mains is shown in Fig. 1.1.

New pipelines are planned to be installed partly in parallel with old pipelines installed in 1920's. Such old pipelines are recommended to be withdrawn because the capacity of old pipelines is small and not affect hydraulically after completion of new pipelines installation and leakage from such old pipelines are projected. (See Fig. 1.4)

4. Secondary and Tertiary Mains

The secondary mains are pipelines of which sizes are ø 200 mm and ø 250 mm in diameter, and the tertiary mains are ø 150 mm in diameter ranging down to the smallest distribution pipes. In general, service pipes to houses and other users are tapped from the tertiary mains. Fig. 1.2 shows the layout of the existing secondary mains and ø 150 mm of tertiary mains. A total length of the pipelines estimated by PDAM is about 309 km and 1,810 km for secondary and tertiary mains respectively. The length of tertiary mains does not include ø 50 mm and smaller pipelines. Attempt was made to estimate the length of such pipelines applying the ratio of the length of tertiary mains in sample areas using map of 1/1,000 for distribution pipelines. As the result, about 1,050 km of the length was obtained. Therefore a total length of tertiary mains becomes about 2,860 km as shown in Table 1.3.

5. Service Connections

A total number of service connection was 135,300 in July 1983 as shown in Table 1.4. Approximately 6% of the total connections has no water meter.

The materials currently used for service connections are GI (Galvanized Steel Iron Pipe) and PVC (Polyvinyl Chloride Pipe). According to the information of PDAM, the life of GI pipes is very short especially in the northern part of the City due to corrosive soil. Probably sea water intrusion in such area is existent.

The typical tapping of service connection is illustrated in Fig. 1.3 where direct tapping is made from ø 100 mm and smaller sizes pipelines and tee branches are applied from larger pies. According to the figure, there is stop cocks on service connections before customers premises, beside this stop cocks could not be found at any service connections during site survey.

6. Water Meters

Approximately 6% of service connections is unmetered. Small sizes of water meters currently used are single dials, wet type and magnetic dial, dry type. The former type of water meter are mostly old and occupies major portion of the total, and PDAM intends to change this type to the latter due to the following reasons:

- glass of meter becomes dirty due to the deteriorated water quality.
- a paddle of meter is easily damaged or worn out due to the frequent use of suction pumps where water is sucked directly from the connection.

Shop test of meter for small sizes, Ø1/2 and 3/4", was made during field survey period. BOSCO and METRON meters were selected for the test. BOSCO has been used for 10 - 30 years and METRON for 5 - 10 years. Out of the total number of meters, 30 and 16 % are occupied by BOSCO and METRON respectively. The test result is shown in Table 1.5. Based on the table, the average of accuracy is estimated as about 95 %.

For Bulk meters, analysis was made for the range of water consumption of each size of meter, because accuracy of meter is affected much by the flow rate if it is too small comparing with minimum rated flow. According to the analysis, considerable percentage of the total was below the above minimum flow rate. The result of the analysis is presented in Table 1.6. Field test was made for several meters in the field as shown in Table 1.7. BOSCO meter shows rather low accuracy and PONTAMSON shows moderate range of accuracy. From the above analysis and field test together with the following assumption, the accuracy of bulk meters is estimated approximately at 80 % in average.

Assumption employed for the estimation of meter accuracy.

1. Accuracy of old water meter is 80 % in the range of nominal flow rate.

2. Accuracy of new water meter is 95 % in the range of nominal flow rate.

3. Accuracy of water meter with lower flow rate than minimum flow rate of meter.

4. Percentage of old and new meters of each size is

	Ø3"	Ø4"	Ø6"	Ø8"	Ø10"	Ø12"	Ø16"
Old Meter	61	53	67	67	100	75	100
New Meter	39	47	33	33	-	25	-

Table 1.1 Production of Major Plants Registered by Meter

Date	Pejompongan I	Pejompongan II	Pulogadung
1	157,088	252,163	71,930
2	157,088	255,700	71,840
3	167,588	260,645	71,910
4	162,988	260,064	72,350
5	168,788	268,610	70,210
6	120,788	266,611	68,160
7	171,988	255,162	70.060
8	164,366	250,292	69,090
9	184,688	259,548	70,660
10	165,888	256,968	70,970
11	112,088	248,970	70,580
12	169,535	252,163	71,150
13	169,588	268,320	70.220
14	169,782	255,065	70,310
15	160,288	251,292	69,660
16	170,988	258,194	71,510
17	155,588	257.000	71.700
18	179.388	262,257	71,900
19	175,988	257,962	72,430
20	182,688	253,582	73,120
21	178,888	265,412	72,820
22	176,088	256,581	72,800
23	183,088	170,312	74,100
24	168,688	251,421	73,430
25	175,784	265,611	73,430
26	180,688	265,934	70,140
27	177,088	262,193	71,960
28	176,488	260,580	72,120
29	165,588	256,581	79,600
30	175,488	252,647	71,290
Total	5,025,055	7,657,840	2.151,450
Average	167,502 (1,940 l/sec)	255.261 (2,950 l/sec)	71.715 (830 l/sec)

Data Source: monthly report of Production Division, PDAM

Table 1.2 Distribution Trunk Main

Diameter (mm)	1920's	1950's	1970's	1980's	Total 1/	PDAM's Information 2/
ø 1,250	-	0.2	-	-	0.2	0.2
ø 1,200	-	-	2.5	-	2.5	2.5
ø 1,000	-	-	2.5	-	2.5	2.5
ø 950	-	-	-	-	-	1.1
ø 900	-	8.0	3.9	-	11.9	11.2
ø 800	-	2.3	6.7	7.3	16.3	8.1
ø 600	31.6	17.4	15.3	4.8	69.1	58.4
ø 550	-	-	-	-	-	31.7
ø 500	-	-	11.1	-	11.1	24.2
ø 475	-	-	-	-	-	8.8
ø 450	4.7	-	-	-	4.7	8.9
ø 400	2.8	12.1	20.2	6.4	41.5	27.5
ø 350	14.9	2.4	7.2	1.8	26.3	27.7
ø 300	-	3.8	8.4	7.6	19.8	7.9
Total	54.0	46.2	77.8	27.9	205.9	220.7

Note: 1) Measured from the map of distribution trunk mains prepared by PDAM.

2) According to the figure in "BUKU DATA, PAM JAYA by Bidang Bina Program Evalusasi & Dokumentasi, Bidang Penelitian & Pengembangan, PDAM DKI April 1983.

Table 1.3 Secondary and Tertiary Mains

Diameter	Length	Pipe Materials				Year of Installation			
		DCIP	GIP	PVC	ACP	before 1950's	upto 1970's	upto 1975	after 1975
(mm)	(km)	(in %)				(in %)			
ø 250	103.9	100	-	-	-	15	20	25	40
ø 200	204.6	98	-	-	2	15	15	30	40
ø 150	415.7	96	3	1	-	10	15	25	50
ø 100	629.1	20	70	10	-	10	15	25	50
ø 75	767.6	10	80	10	-	15	20	30	45
ø 50	1,047.2*								

Note: * Estimated as follows:

Diameter	Present Pipe Length					Sample Area			
	before 1975		after 1975			Old Service Area		Newly Developed Service Area	
	Length	%	Length	%	Total	Length	(%)	Length	(%)
(mm)	(km)		(km)		(km)	(m)		(m)	
50	-		-		-	20580	32.1	20060	40.9
75	422.2	55	345.4	45	767.6	21450	33.5	9590	19.6
100	314.6	50	314.5	50	629.1	12900	20.1	14180	28.9
150	207.9	50	207.8	50	415.7	9190	14.3	5220	10.6
(Tertiary) Total	944.7		867.7		1812.4	64120	100.0	49050	100.0
50	446.7	32.1	600.5	40.9	1047.2				
75	422.2	30.3	345.4	23.5	767.6				
100	314.6	22.6	314.5	21.4	629.1				
150	207.9	14.9	207.8	14.2	415.7				
(Tertiary) Total	1391.4	100.0	1468.2	100.0	2859.6				

Table 1.4 Service Connection

Meter Size (inch)	1982 Jan.	1982 Apr.	1982 Jul.	1982 Oct.	1983 Jan.	1983 Apr.	1983 Jul.
1/2	110,571	111,660	113,695	115,556	118,002	119,392	121,525
3/4	3,264	3,232	2,917	2,885	2,772	2,746	2,739
1	1,425	1,451	1,481	1,488	1,522	1,573	1,590
1-1/2	232	236	239	243	241	237	241
Sub-total	115,492	116,579	118,332	120,172	122,537	123,948	126,095
2	341	346	355	354	360	367	373
3	123	127	128	130	131	130	133
4	117	116	120	118	122	123	122
6	39	39	40	40	40	39	41
8	11	11	9	9	10	9	9
10	4	4	4	4	3	4	4
12	4	4	4	4	4	4	4
16	2	2	2	2	2	2	2
Sub-total	641	649	662	661	672	678	688
Total	116,133	117,228	118,994	120,833	123,209	124,626	126,783
Unmetered conn.	7,831	8,027	7,840	7,757	8,690	8,682	8,517
Total service conn.	123,964	125,255	126,834	128,590	131,899	133,308	135,300

1) Sizes show diameters of water meter.

2) Including number of connections for public hydrants and wind mills.

3) Data Source: Bidang Pemasaran (Customer Service), Direktur Usaha (Marketing), PDAM.

Table 1.5 Shop Test of Meter Accuracy

Date	Water meter bland size	1000 l/hr(100 l) reading (lit.)	accuracy (%)	50 l/hr(20 l) reading (lit.)	accuracy (%)
30 Jul 84	Metron 3/4	105	5	18	-10
		105	5	20	0
		95	-5	19	-5
		95	-5	20	0
		108	8	20	0
		105	5	0	-100
		95	-5	19	-5
		92	-8	0	-100
		105	5	22	10
	AVERAGE	100.6	0.6	15.3	-23.3
30 Jul 84	Metron 1/2	101	1		
		106	6		
		100	0		
		98	-2		
		100	0		
		101	1		
		106	6		
		103	3		
		98	-2		
	AVERAGE	101.4	1.4		

Date	Water meter bland size	1000 l/hr (50 l) reading (lit.)	accuracy (%)	50 l/ hr(10 l) reading (lit.)	accuracy (%)
6 Aug 84	Bosco 1/2	59	18	12	20
		44	-12	0	-100
		49	-2	10	0
		49	-2	8	-20
		49	-2	10	0
		37	-26	0	-100
		44	-12	10	0
		40	-20	10	0
		50	0	10	0
		50	0	0	-100
		50	0	0	-100
		50	0	10	0
	AVERAGE	47.6	-4.8	6.7	-33.3

Table 1.6 Estimate for Meter Accuracy

Installing Year	Diameter	Number of Meter	Accuracy (%)
10 years or more	1/2"-3/4"	54,346	- 4.8
10 years or less	1/2"-3/4"	55,387	1.0
Average			- 1.9

Considaring the accuracy in small flow rate, meter accuracy is estimated at 95%.

Table 1.7 Bulk Meter Survey in the City

Survey Point	(Meter) Meter	Dia	(v) (m/s)	(Q) m3/h	(Flow Meter) Pipe	Dia	(v) (m/s)	METER COUNT (m3)	FLOW.M COUNT (m3)	METER ACCURACY (%)	Meter Condition
a) PPI 10	PONTAM.	4"	0.57	17.4	SGP	4"	0.57	6.183	6.0	103	good
c) SPI 2	PONTAM.	4"	0.36	11.4	SGP	4"	0.36	1.850	1.9	98	rathergood
d) SPI 6	PONTAM.	4"	0.67	21.0	SGP	4"	0.67	3.500	3.5	100	rathergood
d) SIP 2	BOSCO	6"	0.08	17.2	SGP	4"	0.23	1.85	2.4	77	rathergood
a) UPI 2	PONTAM.	8"	0.44	52.5	SGP	8"	0.44	16.76	17.5	96	good
b) UPA 2	BOSCO	10"	0.49	90.8	VP	10"	0.49	19.5	22.7	86	good
c) DPR.RI	(?)	12"	0.21	55.2	CIP	12"	0.21	24	23	104	bad

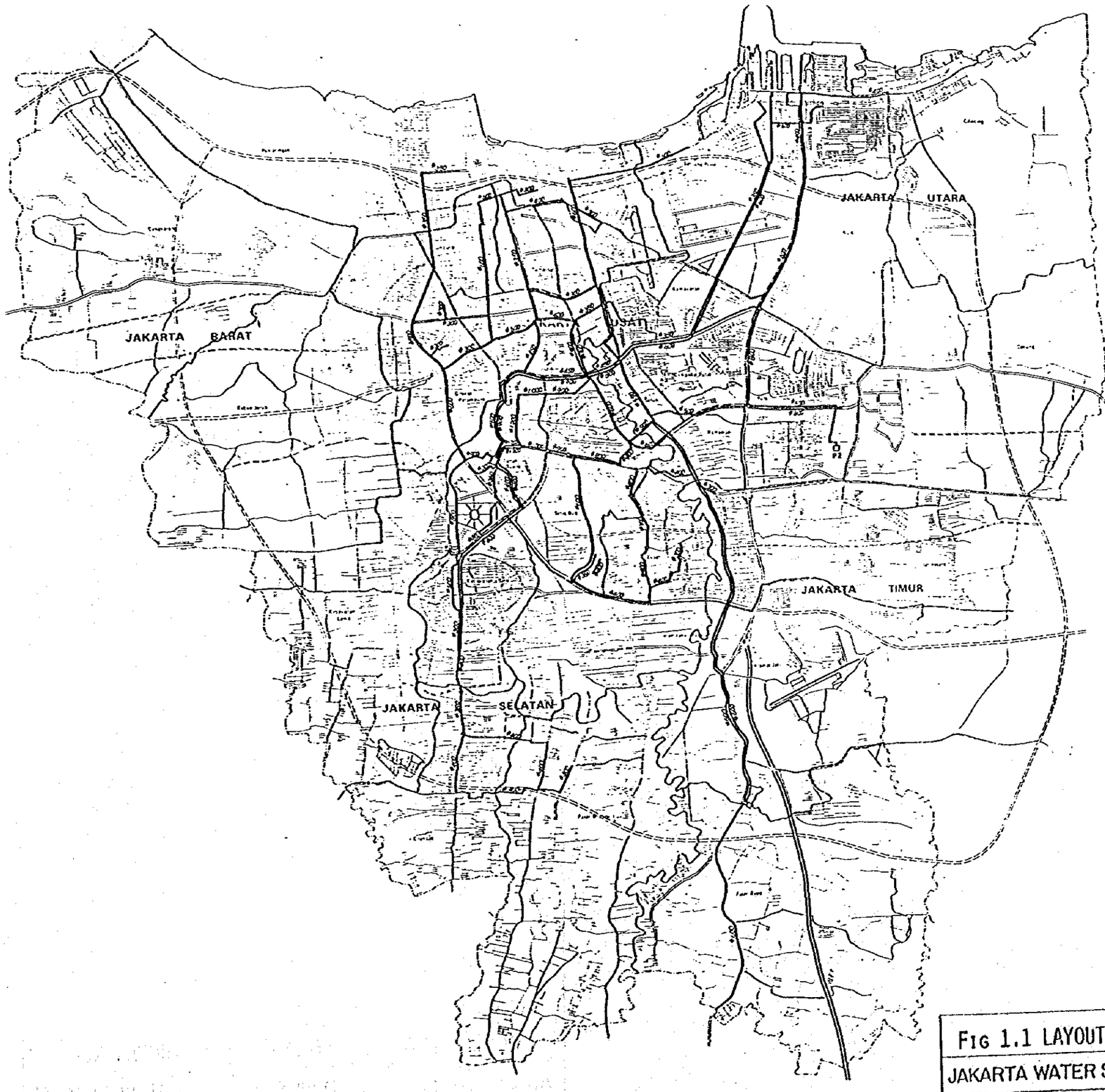


FIG 1.1 LAYOUT OF THE TRUNK MAINS

JAKARTA WATER SUPPLY DEVELOPMENT PROJECT | JICA

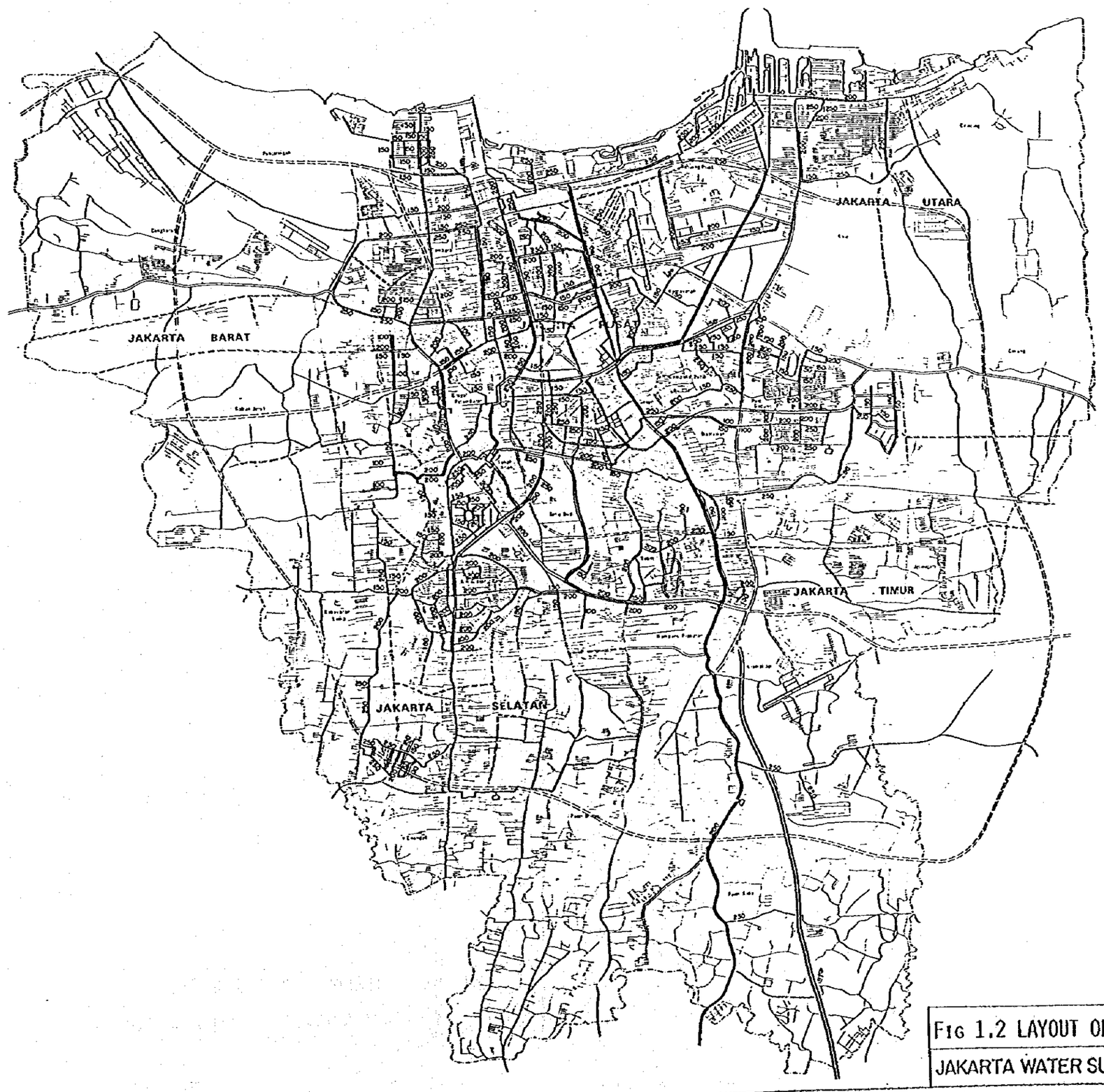
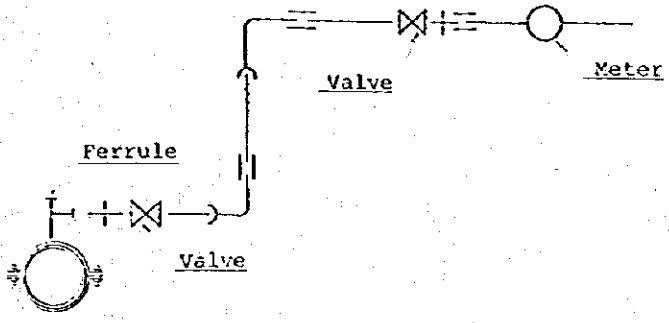
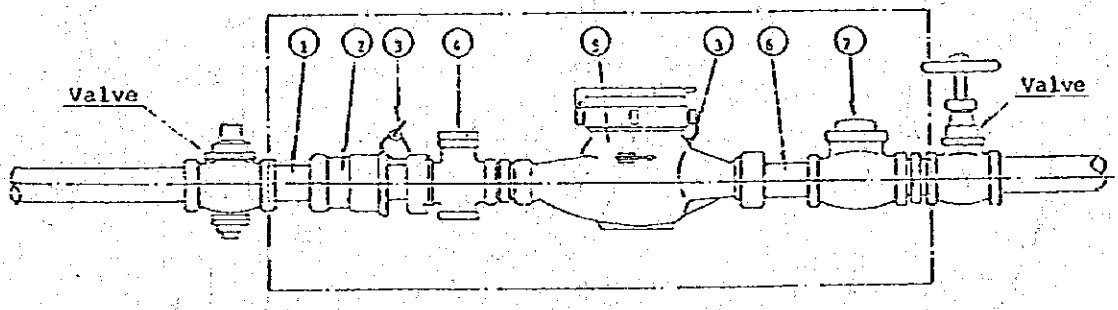


FIG 1.2 LAYOUT OF THE EXISTING SECONDARY MAINS

JAKARTA WATER SUPPLY DEVELOPMENT PROJECT | JICA





1. Nipple
2. Adjusting coupling with packing
3. Tamper proof
4. Strainer
5. Meter
6. Tail pieces (union tube, nut, packing)
7. Check valve

FIG 1.3 TIPICAL LAYOUT OF SERVICE CONNECTION

JAKARTA WATER SUPPLY DEVELOPMENT PROJECT | JICA

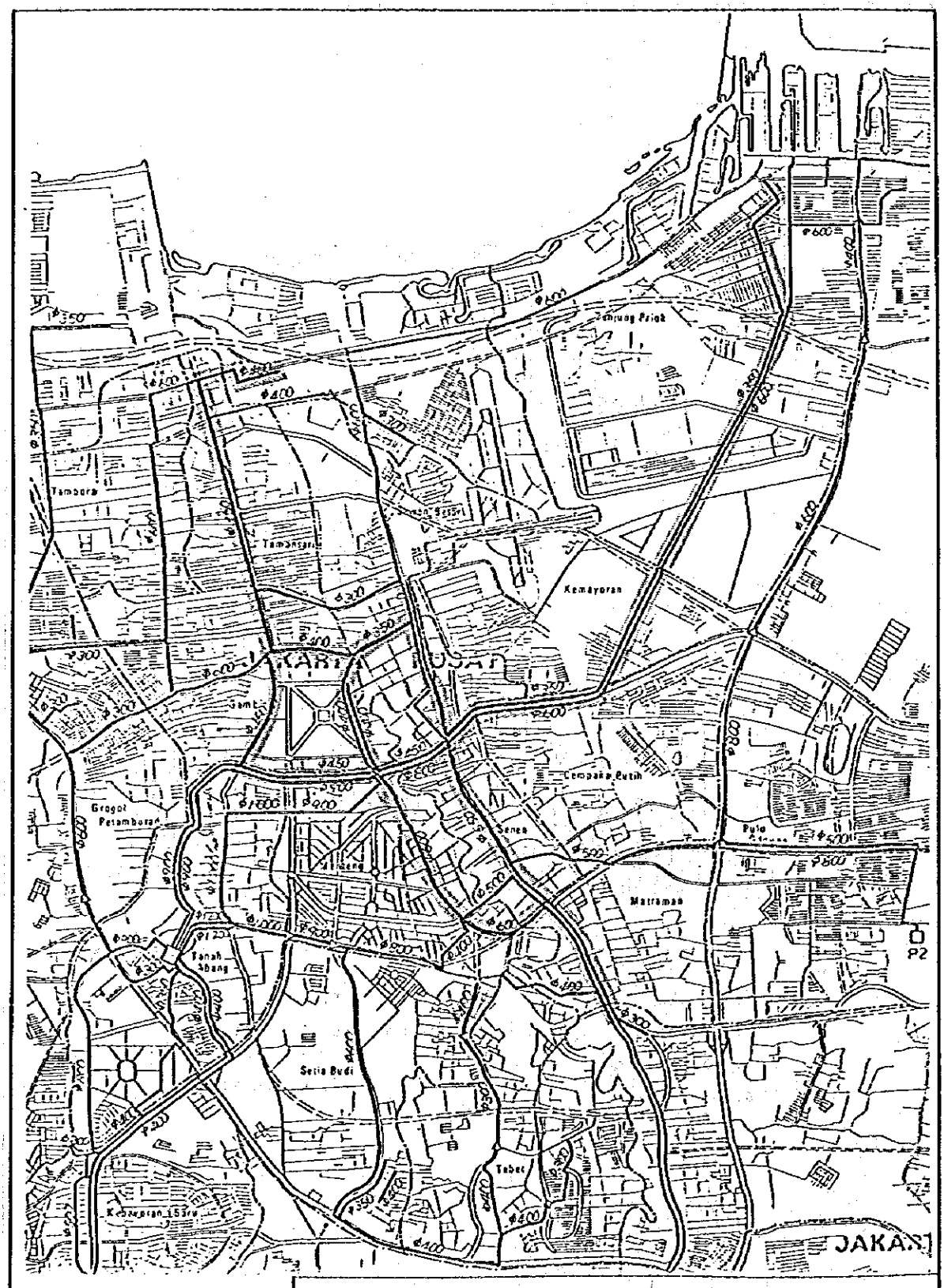


Fig 1.4 WITHDRAWAL OF OLD TRUNK MAIN

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Attachment 2.

Production and Consumption Record in 1982/83

Table Production Record (Distribution)

Unit: 000' m^3

	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Total
Penjonpongan I	5,661	5,991	5,662	5,590	5,627	5,087	5,697	5,348	5,682	5,492	4,933	5,562	66,332
" II	7,745	8,034	7,744	7,997	7,969	7,563	7,824	7,409	7,934	7,749	6,954	8,006	92,928
Pulogadung	0	0	0	1,518	1,825	2,346	2,362	2,247	2,444	2,439	2,216	2,430	19,827
Cilanduk	436	450	424	401	388	372	395	297	351	414	395	447	4,770
Muarakarang	0	0	0	138	127	80	121	117	209	218	202	243	1,455
Cenkareng	0	0	0	0	0	0	3	16	29	39	41	51	179
Sunter	0	0	0	0	0	0	15	29	28	31	55	73	231
Cakung	0	0	0	6	11	4	11	9	11	11	8	7	78
Pejaten	0	0	0	0	0	0	0	0	0	0	0	0	0
Pesing	3	3	4	4	4	0	0	0	3	2	3	3	29
Sub-total	13,845	14,478	13,834	15,654	15,951	15,452	16,428	15,472	16,691	16,395	14,807	16,906	185,913
Ciburial Spring	778	804	778	804	804	778	804	778	804	804	726	804	9,466
Groundwater	323	333	323	333	333	323	333	323	333	333	301	333	3,924
Total	14,946	15,615	14,935	16,791	17,088	16,553	17,565	16,573	17,828	17,532	15,834	18,043	199,219

TOTAL WATER CONSUMPTION (1982/83)

	1982									1983			
	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	TOTAL
PUSAT	1,284,552	1,298,040	1,238,991	1,316,519	1,340,405	1,516,524	1,371,457	1,339,315	1,367,133	1,409,795	1,354,499	1,343,523	16,180,753
UTARA	137,597	138,586	155,326	192,876	199,455	210,927	220,044	255,656	229,184	229,851	235,592	239,378	2,414,472
BARAT	793,472	779,311	765,448	787,644	788,235	791,232	800,531	832,086	853,159	831,066	821,653	825,291	9,669,128
SELATAN	571,823	607,900	626,588	566,550	650,099	607,780	640,912	647,959	639,154	659,115	617,969	626,206	7,462,055
TIMUR	348,425	309,833	315,710	332,036	354,452	338,104	358,111	356,055	358,055	361,071	360,246	362,460	4,154,558
BOGOR	92,478	87,184	88,643	93,000	93,771	102,787	93,237	89,424	91,389	87,700	84,465	82,515	1,086,593
U - VII	114,819	106,382	108,078	120,339	113,742	119,218	113,406	137,168	133,396	151,716	157,532	164,495	1,540,291
U - VIII	410,043	404,341	425,102	392,961	463,140	446,129	463,378	454,983	457,277	461,780	459,929	419,692	5,258,755
U - IX	212,708	214,858	169,499	233,514	228,131	282,287	319,339	267,486	277,671	312,369	294,542	270,472	3,082,876
U - X	3,038,087	2,915,939	3,041,045	3,043,532	3,109,197	3,112,308	3,237,639	3,126,440	3,071,377	3,194,032	3,106,570	2,998,880	36,995,046
U - XI	325,743	314,966	339,518	340,724	356,343	352,853	380,745	369,912	411,576	357,065	336,445	364,764	4,250,654
KELENDER	49,286	50,895	39,363	44,117	48,636	65,349	78,740	71,596	82,960	63,506	61,300	58,501	714,249
KINCIR	1,640	819	871	940	930	1,025	2,185	1,380	1,985	4,415	7,995	4,812	28,997
MANCUR	28,859	31,425	32,402	32,439	31,095	29,029	27,646	30,266	30,153	30,153	30,396	27,974	361,837
TOTAL (m3/Mon)	7,409,532	7,260,479	7,346,584	7,497,191	7,777,631	7,975,552	8,107,370	7,949,726	8,004,469	8,153,634	7,929,133	7,788,963	93,200,264
AVERAGE (m3/day)	247,000	234,000	245,000	242,000	251,000	266,000	262,000	265,000	258,000	263,000	283,000	251,000	255,000

Consumption (Domestic and Small Commercial) 1982/83

Cabang	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	Monthly Average (cm3)
1 PUSAT	903,070	906,533	862,696	908,892	946,809	959,847	957,966		942,366	964,693	936,835	933,926	929,000
2. UTARA	128,950	129,869	144,664	181,122	184,074	196,239	204,334		214,077	213,358	220,437	223,464	186,000
3. BARAT	698,075	682,694	668,665	683,512	671,115	675,834	689,707		735,646	717,988	714,023	713,685	696,000
4. SELATAN	492,845	523,286	539,856	492,325	572,042	539,903	563,171		558,732	580,773	543,590	552,490	542,000
5. TIMUR	243,321	224,337	226,842	237,459	255,459	248,211	258,239		264,142	270,213	266,057	256,549	250,000
6. BOGOR	60,876	58,918	58,519	61,684	63,209	64,364	63,879		62,589	61,504	57,525	56,564	61,000
Unit VII													
7. PLUIT/ANCOL	103,690	96,271	98,248	103,616	103,632	109,127	98,853		123,052	139,594	144,749	148,987	115,000
Unit VIII													
8. BEN-HIL	347,615	339,701	356,548	328,424	388,635	374,781	384,591		382,697	379,842	383,544	356,294	366,000
Unit IX													
9. CEM.PUTIH	191,042	178,068	143,301	202,518	197,261	241,562	261,892		240,654	273,056	256,520	234,561	220,000
Unit X													
10. MTR.KHUSUS	20,387	17,052	17,505	16,795	17,598	19,199	16,606		17,520	16,252	16,657	17,332	18,000
Unit XI													
11. HYDRANT	325,743	314,966	339,518	340,724	356,343	352,853	380,745	369,912	411,576	357,065	336,445	364,764	386,000
12. KELENDER	49,286	50,895	39,363	44,117	48,636	65,349	78,740	71,596	82,960	63,506	61,300	58,501	65,000
13. KINCIR ANGIN	120	120	120	120	240	250	1,250		520	2,200	3,742	1,997	1,000
14. AIR MANCUR	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	3,565,020	3,522,710	3,495,845	3,601,308	3,805,053	3,847,519	3,959,973	441,508	4,036,531	4,040,044	3,941,424	3,919,114	3,834,000

Consumption (Non-Domestic) 1982/83

Unit: m3

	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	Monthly Average
Cabang													
PUSAT	381,482	391,507	376,295	407,627	393,596	556,677	413,491		424,767	445,102	417,664	409,597	420,000
UTARA	8,647	8,717	10,662	11,754	15,381	14,688	15,710		15,107	16,493	15,155	15,914	13,000
BARAT	95,397	96,617	96,783	104,132	117,120	115,398	110,824		117,513	113,078	107,630	111,606	108,000
SELATAN	78,978	84,614	86,732	74,225	78,057	67,877	77,741		80,422	78,342	74,379	73,716	78,000
TIMUR	105,104	85,496	88,868	94,577	98,993	89,893	99,872		93,913	90,858	94,189	105,911	95,000
BOGOR	31,602	28,266	30,124	31,316	30,562	38,423	29,358		28,800	26,196	26,940	25,951	30,000
Unit VII PLUIT/ ANCOL	11,129	10,111	9,830	16,723	10,110	10,091	14,553		10,344	12,122	12,783	15,508	12,000
Unit VIII BEN-HIL	62,428	64,640	68,554	64,537	74,505	71,348	78,787		74,580	81,938	76,385	63,398	71,000
Unit IX CEMPAKA PUTIH	21,666	36,790	26,198	30,996	30,870	40,725	57,447		27,017	39,313	38,022	35,911	36,000
Unit X METER KHUSUS	3,017,700	2,898,887	3,023,540	3,026,737	3,091,599	3,093,109	3,221,033		3,053,857	3,177,780	3,089,913	2,981,548	3,061,000
XI HYDRANT	-	-	-	-	-	-	-		-	-	-	-	
KELENDER	-	-	-	-	-	-	-		-	-	-	-	
KINCIR ANGIN	1,520	699	751	820	690	775	935		1,465	2,215	4,253	2,815	2,000
(AIR MANCUR	28,859	31,425	32,402	32,439	31,095	29,029	27,646		30,153	30,153	30,396	27,974	(30,000)
TOTAL	3,815,653	3,706,344	3,818,337	3,863,444	3,941,483	4,099,004	4,119,751		3,937,785	4,083,437	3,957,313	3,841,875	(3,926,000)

Water Consumption By Categories (1982/83)

Unit : m3

		Monthly Average Consumption			Percentage		
		Domestic and Small Commerical	Non-Domestic	Total	Domestic and Small Commercial	Non-Domestic	Total
Cabang	PUSAT	929,000	420,000	1,349,000	69	31	100
	UTARA	186,000	13,000	199,000	93	7	100
	BARAT	696,000	108,000	804,000	87	13	100
	SELATAN	542,000	78,000	620,000	87	13	100
	TIMUR 1/	315,000	95,000	410,000	77	23	100
	BOGOR	61,000	30,000	91,000	67	33	100
Unit VII	PLUIT/ANCOL	115,000	12,000	127,000	91	9	100
VIII	BEN-HIL	366,000	71,000	437,000	84	16	100
IX	PUTIH	220,000	36,000	256,000	86	14	100
Sub-Total		3,430,000 (44 %)	863,000 (11.1 %)	4,293,000 (55.1 %)	80	20	100
X	METER KHUSUS	18,000	3,061,000	3,079,000 (39.5 %)	1	99	100
XI	HYDRANT	386,000	-	386,000 (5.0 %)	0	100	100
KINCIR ANGIN		1,000	2,000	3,000 (-)	33	67	100
AIR MANCUR		-	30,000	30,000 (0.4 %)	0	100	100
TOTAL		3,835,000	3,956,000	7,791,000	49	51	100

1) including water consumption of KELENDER

2) including water consuption of ABRI

NUMBER OF SERVICE CONNECTION (1982/83)

	1982									1983			
	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	TOTAL
PUSAT	34,537 33,150	34,599 33,275	34,644 33,287	34,675 33,312	34,850 33,209	35,033 33,274	35,128 33,341	35,187 34,144	35,162 34,391	35,289 34,419	35,369 34,662	35,208 34,667	419,681 405,131
UTARA	8,716 6,974	8,777 7,020	9,028 8,275	9,423 8,279	9,749 8,640	9,667 8,547	9,697 8,643	9,833 8,736	10,169 8,927	10,274 9,043	10,368 9,468	10,409 9,439	115,840 101,991
BARAT	32,292 31,693	32,362 31,744	32,442 31,810	32,516 32,019	32,631 32,143	32,765 32,243	33,038 32,339	33,259 32,549	33,633 32,767	33,788 32,930	34,054 33,127	34,172 33,251	396,952 388,615
SELATAN	12,075 12,850	12,131 10,863	12,263 10,913	12,276 10,997	12,285 11,046	12,334 11,087	12,369 11,136	12,410 11,155	12,639 11,223	12,671 11,278	12,701 11,328	12,851 11,362	149,005 133,238
TIMUR	8,337 8,266	8,362 8,284	8,380 8,338	8,390 8,367	8,414 8,382	8,439 8,413	8,483 8,457	8,543 8,534	8,578 8,575	8,657 8,654	8,742 8,686	8,772 8,716	102,097 101,672
BOGOR	1,643 1,632	1,643 1,632	1,654 1,644	1,657 1,649	1,658 1,651	1,671 1,659	1,686 1,669	1,692 1,682	1,702 1,692	1,717 1,712	1,723 1,718	1,723 1,722	20,169 20,062
U - VII	3,529 3,397	3,532 3,397	3,548 3,434	3,584 3,443	3,653 3,433	3,668 3,518	3,675 3,560	4,539 4,435	4,555 4,527	4,741 4,713	4,759 4,721	4,767 4,738	48,550 47,316
U - VIII	8,435 8,030	8,449 8,057	8,452 8,076	8,472 8,111	8,515 8,172	8,555 8,240	8,589 8,315	8,662 8,395	8,743 8,528	8,764 8,594	8,730 8,616	8,750 8,666	103,116 99,800
U - IX	4,650 4,498	4,658 4,534	4,660 4,566	4,679 4,589	4,686 4,591	4,724 4,621	4,775 4,668	4,792 4,694	4,814 4,716	4,824 4,721	4,835 4,733	4,877 4,757	56,974 55,688
U - X	1,356 1,174	1,358 1,174	1,358 1,176	1,356 1,175	1,357 1,176	1,354 1,176	1,346 1,200	1,344 1,157	1,335 1,157	1,335 1,150	1,332 1,147	1,332 1,151	16,163 14,013
U - XI	1,350 958	1,374 983	1,381 990	1,381 995	1,387 996	1,391 1,002	1,392 1,004	1,403 1,051	1,412 1,024	1,418 1,034	1,440 1,064	1,445 1,073	16,774 12,174
KELENDER	8,053 4,252	8,065 4,232	8,068 4,265	8,144 4,173	8,144 4,120	8,141 4,352	8,140 4,473	8,140 4,603	8,139 4,709	8,139 4,705	8,140 4,742	8,140 4,757	97,453 53,383
KINCIR	281 16	281 16	281 16	281 16	282 18	282 18	282 18	282 17	282 18	282 18	282 18	282 18	3,380 207
TOTAL	125,254 114,890	125,591 115,211	126,159 116,790	126,834 117,125	127,341 117,577	128,024 118,150	128,600 118,823	130,086 121,152	131,163 122,254	131,899 122,971	132,475 124,030	132,728 124,317	1,546,154 1,433,290
MANCUR	12	12	12	12	12	12	12	12	12	12	12	12	48

Service Connection (Domestic and Small Commercial) 1982/83

		APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AVERAGE
CABANG	PUSAT	29,553 28,463	29,611 28,585	29,574 28,525	29,600 28,546	29,752 28,573	29,926 28,513	29,982 28,553		30,023 29,463	30,131 29,484	30,221 29,684	30,098 29,676	29,900 28,900
	UTARA	8,195 6,488	8,242 6,563	8,509 7,773	8,903 7,769	8,958 8,129	9,145 8,034	9,172 8,128		9,638 8,406	9,743 8,520	9,836 8,939	9,877 8,913	9,110 7,970
	BARAT	28,481 27,929	28,542 27,971	28,557 27,972	28,583 28,127	28,678 28,243	28,750 28,338	29,009 28,419		29,567 28,837	29,722 29,000	29,970 29,153	30,080 29,267	29,100 28,500
	SELATAN	11,288 10,119	11,341 10,131	11,462 10,171	11,475 10,258	11,483 10,305	11,530 10,346	11,563 10,395		11,833 10,476	11,859 10,526	11,889 10,576	12,040 10,613	11,600 10,400
	TIMUR	6,877 6,861	6,902 6,879	6,912 6,385	6,926 6,903	6,949 6,917	6,975 6,949	7,013 6,988		7,103 7,101	7,184 7,180	7,266 7,210	7,294 7,239	7,040 7,010
	BOGOR	1,489 1,479	1,489 1,479	1,500 1,491	1,503 1,496	1,504 1,498	1,517 1,506	1,532 1,516		1,547 1,538	1,562 1,558	1,568 1,564	1,568 1,568	1,530 1,520
UNIT VII	PLUIT/ANCOL	3,287 3,190	3,288 3,190	3,303 3,190	3,339 3,198	3,360 3,188	3,374 3,248	3,381 3,267		4,220 4,220	4,404 4,404	4,419 4,412	4,418 4,418	3,710 3,630
VIII	BEN-HIL	7,960 7,568	7,974 7,594	7,977 7,610	8,000 7,651	8,043 7,710	8,080 7,775	8,111 7,848		8,245 8,059	8,265 8,124	8,238 8,146	8,252 8,171	8,100 7,840
IX	CEMPAKA PUTIH	4,430 4,298	4,436 4,323	4,439 4,354	4,458 4,378	4,465 4,379	4,499 4,413	4,550 4,460		4,588 4,509	4,598 4,519	4,610 4,532	4,644 4,547	4,520 4,430
X	METER KHUSUS	124 124	124 124	124 124	123 123	123 123	123 123	123 123		123 122	123 122	122 122	122 122	123 123
XI	HYDRANT	1,350 958	1,374 983	1,381 990	1,381 995	1,387 996	1,391 1,002	1,392 1,004		1,412 1,024	1,418 1,034	1,440 1,064	1,445 1,073	1,340 1,010
	KLENDER	8,053 4,252	8,065 4,232	8,068 4,265	8,144 4,173	8,144 4,120	8,141 4,352	8,140 4,473		8,139 4,709	8,139 4,705	8,140 4,742	8,140 4,757	8,120 4,430
	KINCIR ANGIN	254 12	254 12	254 12	254 12	254 13	255 13	255 13		255 13	255 13	255 13	255 13	255 13
	TOTAL	111,341 101,741	111,642 102,066	112,060 103,362	112,689 103,629	113,100 104,194	113,706 104,612	114,223 105,187		116,693 108,477	117,403 109,189	117,974 110,157	118,233 110,377	114,000 106,000
	AIR MANCUR	-	-	-	-	-	-	-		-	-	-	-	

Unit Water Consumption By Categories (1982/83)

		Domestic and Small Commercial			Non-Domestic			Total		
		Consump.	Connect.[3]	Unit Consump.	Consump	Connect.[3]	Unit Consump.	Consump.	Connect.	Unit Consump.
Cabang	PUSAT	929,000	28,900	32.1	420,000	4,810	87.3	1,349,000	33,710	40.0
	UTARA	186,000	7,970	23.3	13,000	510	25.5	199,000	8,480	23.5
	BARAT	696,000	28,500	24.4	108,000	3,890	27.8	804,000	32,390	24.8
	SELATAN	542,000	10,400	52.1	78,000	740	105.4	620,000	11,140	55.7
	TMIUR[1]	315,000	11,400	27.6	95,000	1,460	65.1	410,000	12,860	31.9
	BOGOR	61,000	1,520	40.1	30,000	150	200.0	91,000	1,670	54.5
Unit VII	PLUTI/ANCOL	115,000	3,630	31.7	12,000	270	44.4	127,000	3,900	32.6
VII	BEN-HIL	366,000	7,840	46.7	71,000	470	151.1	437,000	8,310	52.6
IX	CEMPAKA PUTIH	220,000	4,430	49.7	36,000	210	171.4	256,000	4,640	55.2
	Sub-total	3,430,000	104,600	32.8	863,000	12,500	69.0	4,293,000	117,100	36.7
X	METER KHUSUS[2]	18,000	120	150.0	3,061,000	1,050	2,915.2	3,079,000	1,170	2,631.6
XI	HYDRANT	386,000	1,010	382.2	-	-	-	386,000	1,010	382.2
	Kincir Angin	1,000	12	83.3	2,000	5	400.0	3,000	17	176.5
	Air Mancur	-	-	-	30,000	12	2,500.0	30,000	12	2,500.0
	TOTAL	3,835,000	105,700	36.3	3,956,000	13,600	290.9	7,791,000	119,300	65.3

[1] including water consumption of KELENDER

[2] including water consumption of ABRI

[3] billed connection

Service Connection (Non-domestic) 1982/83

		APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	Average
CABANG	PUSAT	4,984 4,687	4,988 4,690	5,070 4,762	5,075 4,766	5,098 4,636	5,107 4,761	5,146 4,788		5,139 4,928	5,158 4,935	5,148 4,978	5,110 4,991	5,090 4,810
	UTARA	521 486	535 457	519 502	520 510	521 511	522 513	525 515		531 521	531 523	532 529	532 526	526 508
	BARAT	3,811 3,764	3,820 3,773	3,885 3,838	3,933 3,892	3,953 3,900	4,015 3,905	4,029 3,920		4,066 3,930	4,066 3,930	4,084 3,974	4,092 3,984	3,980 3,890
	SELATAN	787 731	790 732	801 742	801 739	802 741	804 741	806 741		806 747	812 752	812 752	811 749	803 742
	TIMUR	1,460 1,405	1,460 1,405	1,468 1,453	1,464 1,464	1,465 1,465	1,464 1,464	1,470 1,469		1,475 1,474	1,473 1,474	1,476 1,476	1,478 1,477	1,470 1,457
	BOGOR	154 153	154 153	154 153	154 153	154 153	154 153	154 153		155 154	155 154	155 154	155 154	154 153
UNIT VII	PLUIT/ANCOL	242 207	244 207	245 244	245 245	293 245	294 270	294 293		335 307	337 309	340 309	349 320	293 268
VIII	BEN-HIL	475 462	475 463	475 466	472 460	472 462	475 465	478 467		498 469	499 470	492 470	498 495	483 468
IX	CEMPAKA PUTIH	220 200	222 211	221 212	221 211	221 212	225 208	225 208		226 207	226 202	225 201	233 210	224 207
X	METER KHUSUS	1,232 1,050	1,234 1,050	1,234 1,052	1,233 1,052	1,234 1,053	1,231 1,053	1,223 1,077		1,212 1,035	1,212 1,028	1,210 1,025	1,210 1,029	1,220 1,050
XI	HYDRANT	-	-	-	-	-	-	-		-	-	-	-	
	KELENDER	-	-	-	-	-	-	-		-	-	-	-	
	KINCIR ANGIN	27 4	27 4	27 4	27 4	28 5	27 5	27 5		27 5	27 5	27 5	27 5	27 5
	TOTAL	13,913 13,149	13,949 13,145	14,099 13,428	14,145 13,496	14,241 13,383	14,318 13,538	14,377 13,636		14,470 13,777	14,496 13,782	14,501 13,873	14,495 13,940	14,300 13,600
	AIR MANCUR	12 12	12 12	12 12	12 12	12 12	12 12	12 12		12 12	12 12	12 12	12 12	12 12

Attachment 3.

Available Maps of Distribution Pipelines

There are four kinds of maps for the distribution pipelines which scales are 1/1,000, 1/5,000, 1/20,000 and 1/35,000 respectively showing the diameter of pipelines. No indication of pipe materials and year of installation is shown on the maps.

1/1,000 map:	All service area is covered by approximately 1,100 sheets of maps which show every sizes of pipelines, locations of valves, public hydrants, fire hydrants and other appurtenances and service connections.
1/5,000 map:	All service areas is covered by approximately 70 sheets of maps which show pipelines of 150 mm and larger in diameter. No appurtenances of pipelines are shown on them.
1/10,000 map:	All service area is covered by six sheets of maps which show also pipelines of 150 mm and larger in diameter.
1/35,000 map:	The map indicates only trunk mains which diameters are 300 mm and larger.

The above maps are available at Sub-bidang Documentasi of Bidang Perencanaan (Planning Section), Direktur Produksi/Teknis (Production and Technical Division).

In general, small sizes of pipelines (Ø 150 mm and smaller) are installed by the branch offices and larger sizes of pipelines are by the Distribution Division. All pipelines are to be recorded immediately after completion of the installation. However, some parts of pipelines are not recorded and shown on the maps according to the information. This is caused by the lack of communications between branch offices and head office and even in the head office, the information between divisions seems insufficient. Also it will be possible that pipelines already abandoned are still indicating on the maps. Therefore, the pipelines shown on the maps are considered to be limited accuracy.

No detailed map on service connection of each customer are arranged and not kept by each branch and unit who is in charge of the maintenance of it.

It is recommendable that materials and ages of pipelines are to be checked and indicated on maps together with sizes of pipelines. And at every end of the year, all pipelines installed or abandoned are to be checked and confirmed and indicated on the maps. To show the clear layout of pipelines and location of pipe appurtenances, the standard of index is to be prepared in details. As to the map for service connections, the followings is to be indicated that the sizes of service pipes and meters, location of tapping, stop cocks, meters and other necessary informations including conditions of road surface, locations of ditches, manholes and etc. together with alignment of service connection as a whole.

Attachment 4.

Past Activities on Leakage Abatement

PDAM currently has no significant system for leakage abatement program. However, PDAM has been fully aware of the need to reduce unaccounted-for water, and as the substantial improvement, he intends to start rehabilitation/replacement works of the distribution pipelines. But details of the work are still under consideration. PDAM started Census Program from 1978 and the survey was finished at the end of 1983. This program mainly aims to find out the illegal connections and miss classification of customer's registration for the increment of income. For technical matters, conditions of water meters of each customer are checked in the field. The details of the Program and analysis are described in Attachment 5 in this report.

On leakage repair, generally the execution of the works is made by the Branch Offices and the Units, and the Distribution Division is responsible overall control of the works and acts as the coordinator with other divisions concerned such as the logistic, Technical Equipment, Technical Planning and Finance. In fact, the Division execute the repair work by himself in case of emergency and leaks from the trunk mains.

The followings is the procedure for leakage repair works currently performed by PDAM:

- In general, leaks are informed by the citizen.
- PDAM confirms the leaks and locations.
- The information confirmed is sent to the Branch Office or Unit who is in charge of repair work.
- Preparation of tools/equipment and materials required which are usually brought from each Branch Office or Unit.
- After preparatory works, the leakage repair is done. According to the report of PDAM, about 75 % of the work is done by the temporary labours employed time to time, usually such labours is unskilled labour.
- After completion of the repair work, the report was made by the field stuff and the data is kept in the Division.
- The data collected from the field is summarized by weekly and monthly.
- Based on the report and approval of the Division, the claim for payment is made to the Financial Division.

Cases of leaks were analized by PDAM according to the sizes of pipelines and conditions of pipelines as follows:

By Sizes; leaks from small sizes of pipelines less than 4" in diameter occupies about 80% of a total. Therefore, about 20 % of leaks are derived from ø 150 mm of pipelines.

By pipeline conditions;

Old Pipeline

88 % of the total leaks is from old pipelines

Workmanship of Pipe Installation

Leaks is happened from the pipelines which installation works were improper embedding, backfilling and compaction and connection. About 3 % of a total leaks derives from such pipelines.

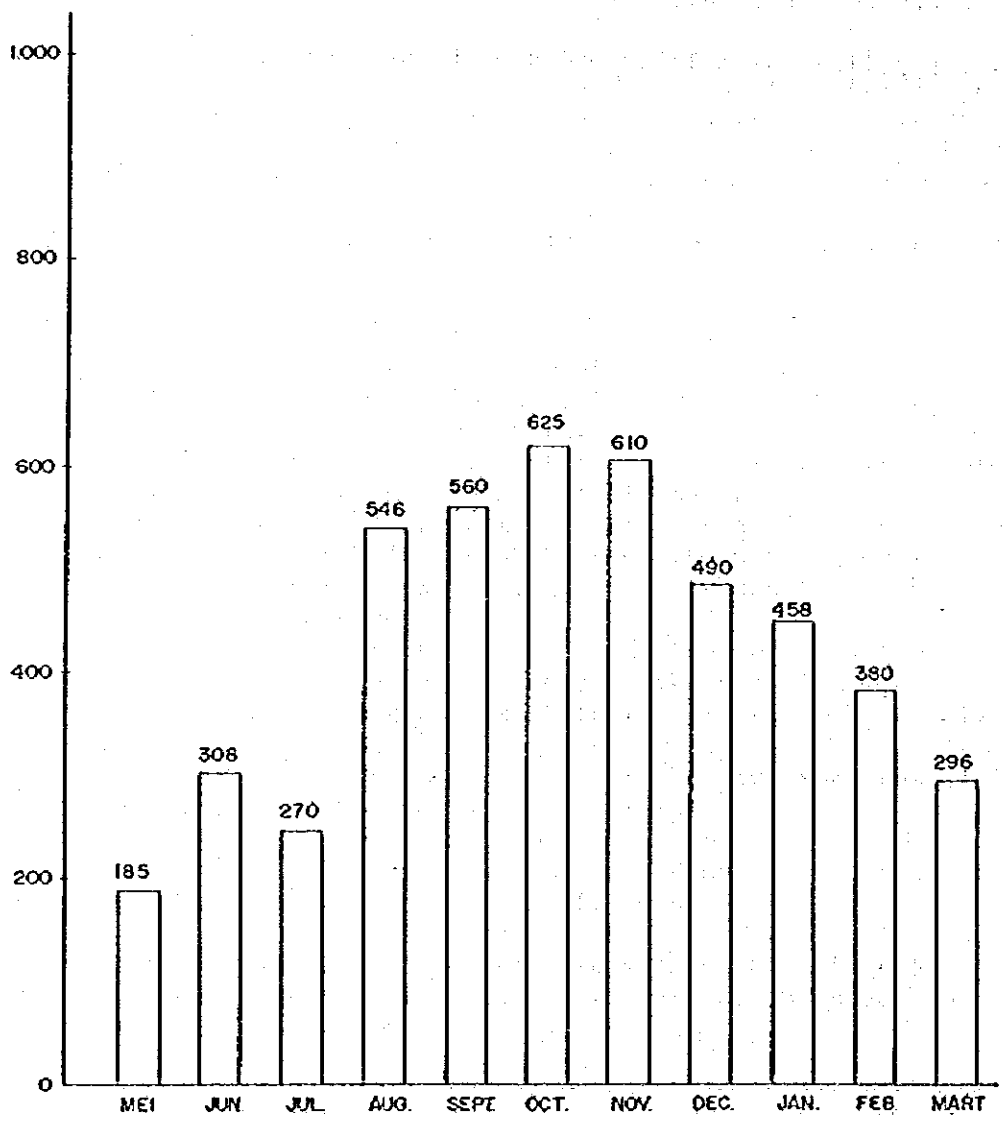
Environmental Impact

About 9 % of the total leaks occures from the following reasons:

- pipe accessaries are sometimes damaged by people.
- Pipe is cracked at road crossing point due to heaver loads of traffic also caused by small earth covering, expansion of road width.
- spots like scabies on pipe exterior is observed which will be caused by the corrocive soil.
- Corrosion is observed at pipe interior which will be derived from intrusion of corrosive water of corrosive water treated. These pipes are observed usually at the terminal point of pipelines where sometimes water is not filled or even empty.

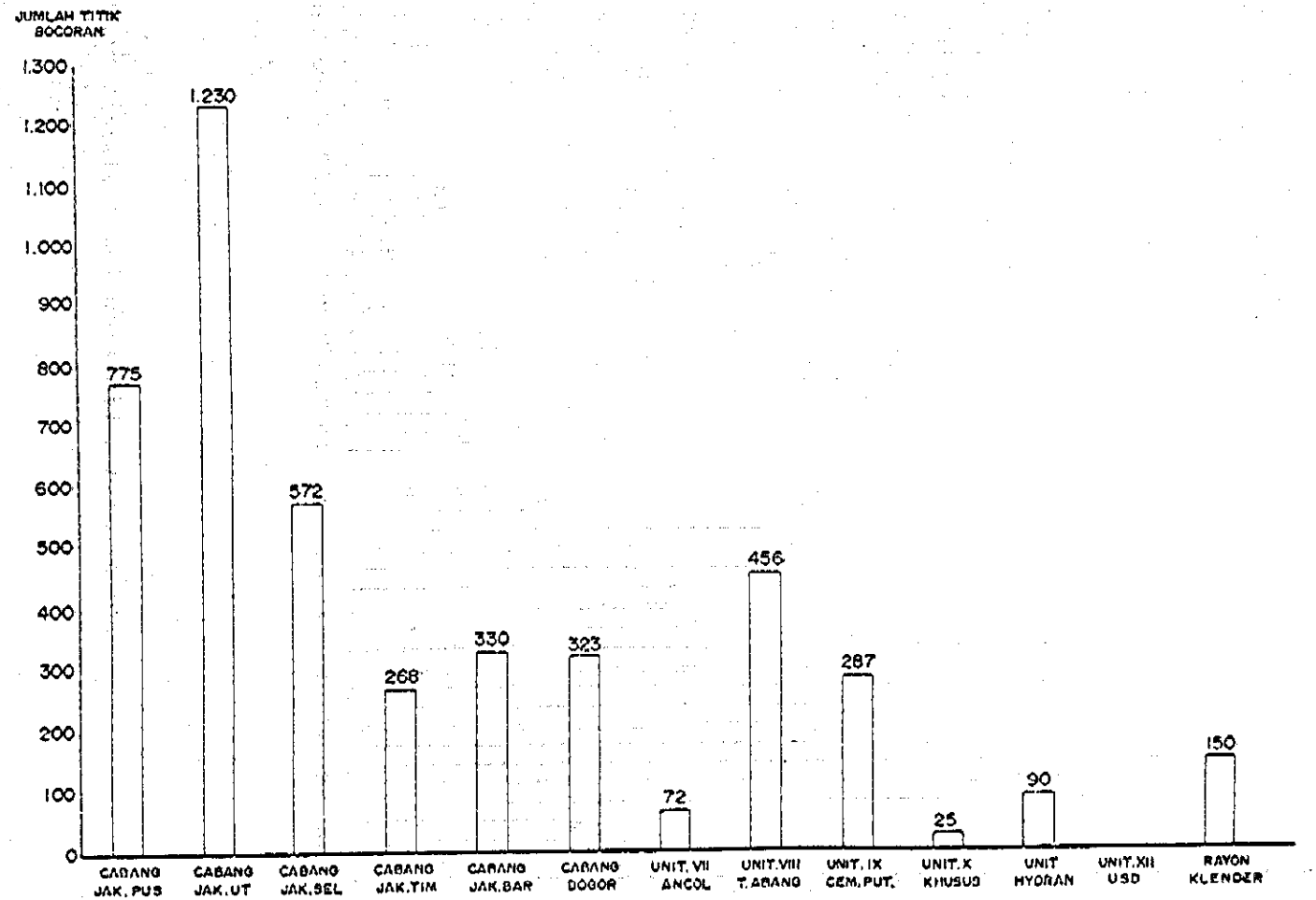
The pipelines with leaks or suspicious leaks are presented in Fig.4.4.

Fig 4.1 Cases of Leaks Repaired Monthly



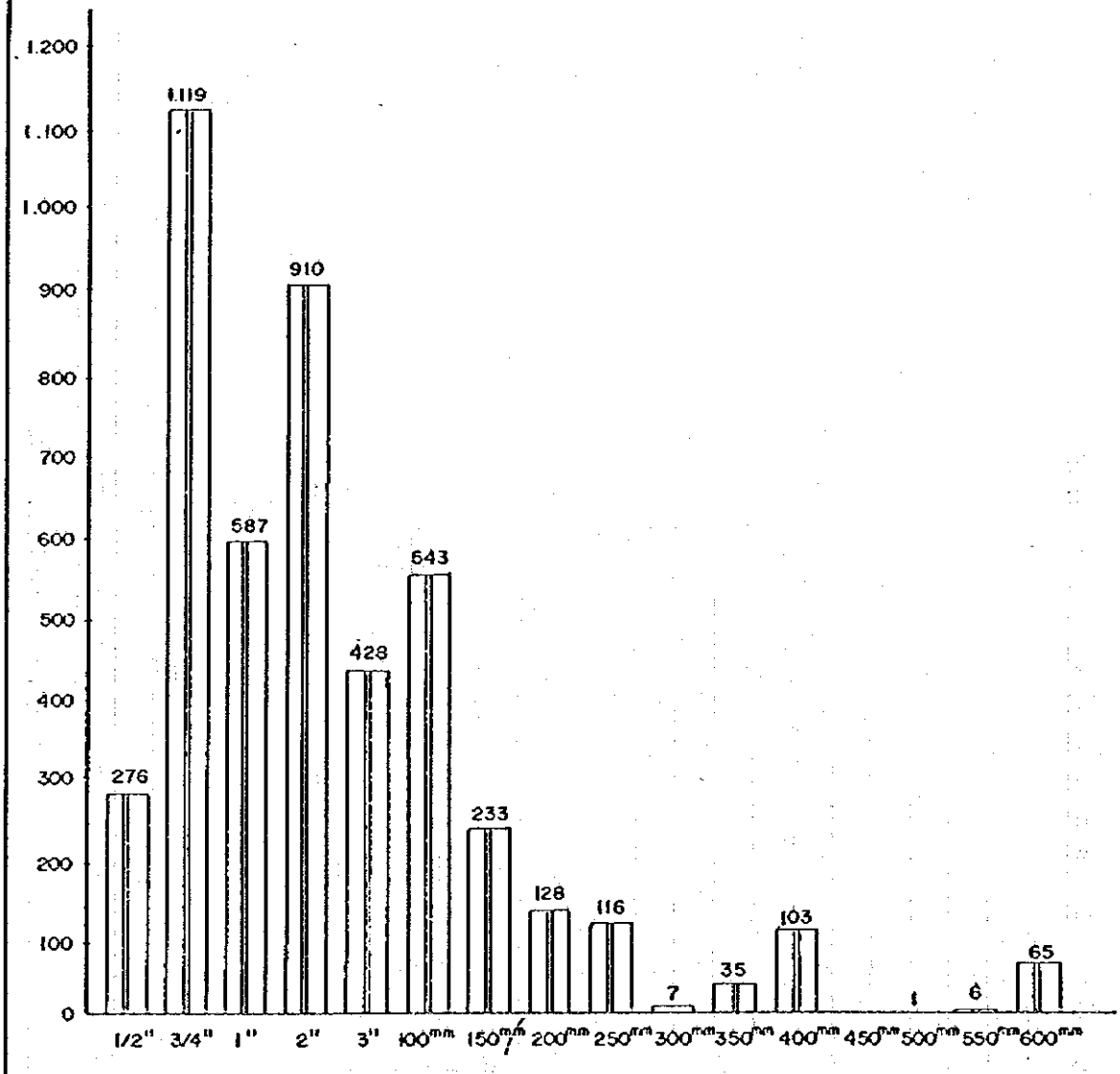
Source of Data : Distribution Division, PDAM.

Fig 4.2 Cases of Areawise Leak Repaired



Source of Data : Distribution Division, PDAM.

Fig 4.3 Cases of Leaks Repaired by Pipe Size



Source of Data : Distribution Division, PDAM.

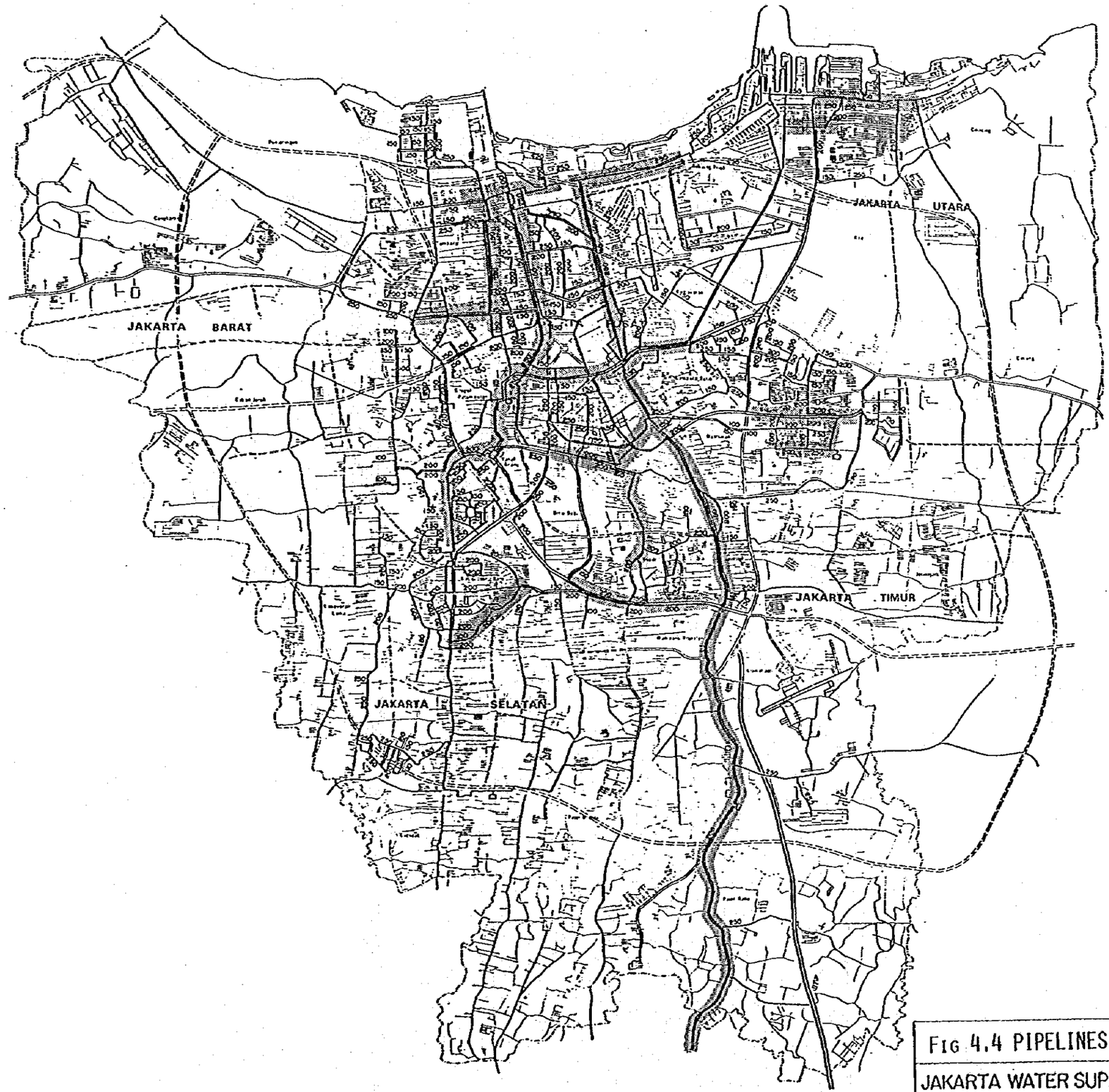


Fig 4.4 PIPELINES WITH LEAKS

JAKARTA WATER SUPPLY DEVELOPMENT PROJECT | JICA

Attachment 5.

Analysis of the Census Program

PDAM has been repairing leakage from service connections and distribution pipelines in accordance with the information from the citizens and leak detection by PDAM's staff (by Branch Office) as the first step of water loss reduction. However, the level of unaccounted-for water is still as high as 50 % or more. It was anticipated that unaccounted-for water includes not only leakages but also water losses of administrative aspects such as illegal connections, under-registration and under-estimation due to unmetered and inaccurate water meters and other reasons. It is necessary to know the sources of water losses. Therefore, PDAM started Census Program from 1978 conducting door to door survey. The survey was finished at the end of 1983. The major survey items concerning the unaccounted-for water study are listed as follows:

1. Identification of area where customers are belonging to. Jakarta city consists of five districts and they are divided by 30 kecamatans which are further divided by 235 kelurahan.

2. Classification of users and water tariffs.

3. Water supply conditions in terms of water supply pressure, supply quantity and quality by areas.

4. Usage of reservoirs in the premises of customers.

5. Materials used for service connections and their conditions (if leaks are observed or not).

6. Illegal connections.

7. Conditions of water meters.

8. Registration of metering.

The summary of the survey result prepared by PDAM is shown in Table 5.1 which is the basis of the analysis for unaccounted-for water. However condition of water meters shown in the table can not be used directly, because cases of defects of meters seem to be counted overlapped in case a connection has more than two defects. Therefore, original questionnaires were analized. The result of the analysis is shown in Table 5.2. Some of consumers are charged based on the estimate because their water meters are not functioned or can not readable. Percentage of estimated/metered consumption is also analized from the above questionnaires and shown in Table 5.3.

Table 5.1 Summary of Survey Result by Census Program

(1978 - 1983)

NO.	CABANG / UNIT	JUMLAH LANGGANAN	JUMLAH TERSENSUS	JUMLAH LANGGANAN TERKENA KASUS	JUMLAH LANGGANAN TANPA KASUS	EX PAM	NON PAM	R. KOSONG	ILLEGAL	IKUTAN	KETERANGAN
I.	UNIT VII (BEN-HIL)	7.065	7.980	4.965	2.100	309	606	-	-	-	Mei 1978 s/d Peb. 1981
II.	CABANG BOGOR	1.479	1.995	961	518	21	24	-	165	306	Sep.1978 s/d Peb. 1981
III.	CABANG JAKARTA - SELATAN	10.580	11.740	9.162	1.418	1.009	56	-	-	95	Jan.1979 s/d Peb. 1981
IV.	UNIT X (METER KHUSUS)	1.323	1.363	937	374	11	27	-		2	Jan.1979 s/d Peb. 1981
V.	UNIT IX / CEMPAKA PUTIH	3.272	3.770	2.705	567	27	2	130	334	5	Nop.1979 s/d Peb. 1981
VI.	UNIT XI / HYDRANT	1.206	1.571	1.108	120	110	-	9	246	-	Peb.1980 s/d Aug. 1983
VII.	CABANG JAKARTA - PUSAT	34.268	37.980	3.153	31.115	891	-	681	1.345	795	Des.1979 s/d Sep. 1982
VIII.	CABANG JAKARTA - BARAT	33.338	34.078	7.813	25.525	35	-	17	643	45	Okt.1980 s/d Sep. 1982
IX.	CABANG JAKARTA - UTARA	9.439	11.860	3.406	6.033	36	-	845	1.448	98	Jan.1983 s/d Sep. 1983
X.	CABANG JAKARTA - TIMUR	8.473	9.936	3.090	5.383	660	-	294	428	81	Mar.1983 s/d Okt. 1983
	J U M L A H	110.443	122.273	37.300	73.143	3.103	715	1.976	4.609	1.427	

		KASUS		METER		KASUS LANGGANAN			
		S.DIRUSAK	TANPA METER	M.T. FUNGSI	K .NAMA	K. TARIF	TUNGGAKAN	REREG	KETERANGAN
I.	UNIT VII (BEN-HIL)	3.931	252	494	234	392	1.616	96	Mei 1978 s/d Peb. 1981
II.	CABANG BOGOR	606	108	107	90	193	280	6	Sep.1978 s/d Peb. 1981
III.	CABANG JAKARTA - SELATAN	7.879	985	948	414	235	81	3.944	Jan.1979 s/d Peb. 1981
IV.	UNIT X (METER KHUSUS)	432	113	305	9	58	572	-	Jan.1979 s/d Peb. 1981
V.	UNIT XI / CEMPAKA PUTIH	1.775	105	282	-	-	1.399	-	Nop.1979 s/d Peb. 1981
VI.	UNIT XI / HYDRANT	39	28	145	34	35	-	-	Peb.1980 s/d Aug. 1983
VII.	CABANG JAKARTA - PUSAT	19.774	3.579	8.283	9.630	6.023	9.669	191	Des.1979 s/d Sep. 1982
VIII.	CABANG JAKARTA - BARAT	6.143	1.418	2.779	4.618	1.798	3.045	7	Okt.1980 s/d Sep. 1982
IX.	CABANG JAKARTA - UTARA	2.429	555	6.924	2.198	301	277	9	Jan.1983 s/d Sep. 1983
X.	CABANG JAKARTA - TIMUR	2.246	95	742	2.253	253	-	-	Mar.1983 s/d Okt. 1983
	J.U M L A H	45.254	7.238	21.009	19.480	9.288	16.939	4.253	

		KASUS	PELANGGARAN				
		DI. ILLEGAL	PENY. POMPA	MET. HILANG	BY PASS	IKUTAN	KETERANGAN
I.	UNIT VII (BEN-HIL)	86	84	233	28	-	Mei 1978 s/d Peb. 1981
II.	CABANG BOGOR	165	2	6	-	306	Sep.1978 s/d Peb. 1981
III.	CABANG JAKARTA - SELATAN	579	136	175	24	95	Jan.1979 s/d Peb. 1981
IV.	UNIT X (METER KHUSUS)	21	6	68	4	2	Jan.1979 s/d Peb. 1981
V.	UNIT XI / CEMPAKA PUTIH	334	204	334	4	5	Nop.1979 s/d Peb. 1981
VI.	UNIT XI / HYDRANT	187	3	2	-	-	Peb.1980 s/d Aug. 1983
VII.	CABANG JAKARTA - PUSAT	3.105	2.695	1.671	124	795	Des.1979 s/d Sep. 1982
VIII.	CABANG JAKARTA - BARAT	2.406	788	130	8	4	Okt.1980 s/d Sep. 1982
IX.	CABANG JAKARTA - UTARA	1.961	210	1.001	5	98	Jan.1980 s/d Sep. 1982
X.	CABANG JAKARTA - TIMUR	1.878	118	37	20	80	Mar.1983 s/d Sep. 1983
	J U M L A H	10.722	4.246	3.657	217	1.385	

Jumlah tersensus = 122.273
Jumlah Langganan = 110.443
Selisih = 11.830

Jumlah Langganan Tanpa Kasus = 73.143
Jumlah Langganan Terkena Kasus = 37.300
Jumlah = 110.443

Ex. PAM = 3.103
Non PAM = 715
Rumah Kosong = 1.976
Illegal = 4.609
Ikutan = 1.427
Jumlah = 11.830

Meaning of Items on the Table

1.	JUMULAH LANGGANAN:		Service connections registered by PDAM at the beginning of the survey
2.	JUMULAH TERSENSUS:		Service connections found during survey periods.
3.	JUMULAH LANGGANAN: TERKENA KAUSUS		Service connections with problems such as registration, meter, and so on.
4.	JUMULAH LANGGANAN: TANPA KAUSUS		Normal service connections.
5.	EX PAM	:	Service connection not registered due to misregistration by PDAM.
6.	NON PAM	:	Service connections do not belong to PDAM.
7.	RUMAH KOSONG	:	Empty houses but some of them are still registered by PDAM.
8.	ILLEGAL	:	Customers not authorized by PDAM but have service connections.
9.	IKUTAN	:	Customers who have more than two service pipes after meter and sometimes they sell water to neighbours.
10.	SEAGAL DIRUSAK	:	Seals of water meter are damaged or taken off.
11.	TANPA METER	:	Service connections with no meter. According to the request of customers, PDAM sometimes withdraw a meter to reduce water loss in low water pressure area.
12.	METER TAK BERFUNGSI	:	Meter is not functionable or not readable due to mechanical failure, under the ground, pavement and water and blurred glass.
13.	KAUSUS NAMA	:	Name of customer is different from the registration.
14.	KAUSUS TARIF	:	Classification of water tariff is different from the registration.
15.	TUNGGAKAN	:	Customer fails to pay a bill.
16.	HERREGRESSTRASI	:	Customers registered/re-registered after census program.

17.	DIPERKIRAKAN ILLEGAL	:	Suspicious illegal connections.
18.	PENYEDOTAN DENGAN POMPA	:	By-passed connection with pump sucked directly from service main.
19.	METER HILANG	:	Service connections which meters are lost.
20.	BY PASS	:	By-passed connection.

Table 5.2A By-pass Connection/Defect Water Meter
(Summary in %)

KECAMATAN/KELURAHAN	Number of Connection	Number of Defect Meter	By-pass	No Meter Lost/ Released	Non-function Burried	Non-function Damaged	Cannot Read Soaked	Cannot Read Blurred Glass	Reverse Installation	Direct Suction	Unknown
Rumah Tanggah & Usaha Kecil											
JKT PUSAT	600	132	4	15	16	10	11	95	0	12 (6)	23
UTARA	269	63	0 (1)	41	6	1	33	23	0	12 (13)	10
BARAT	578	75	0	17	13	9	13	40	3	9 (6)	68
SELATAN	173	44	0	3	7	20	-	17	-	0	1
TIMUR	209	19	1 (1)	2	4	4	0	11	0	5 (1)	16
Sub-total	1,829	333	5 (2)	78	46	44	57	186	3	38 (26)	118
Usaha Komersil											
JKT PUSAT	296	90	0 (1)	4	33	7	6	44	1	5 (2)	18
UTARA	117	37	1 (2)	14	11	2	11	13	1	2 (19)	4
BARAT	473	152	0 (8)	8	123	5	13	11	0	13 (4)	45
SELATAN	25	4	0	0	0	1	-	3	-	0	0
TIMUR	266	48	0 (5)	1	31	6	1	18	2	5 (9)	16
Sub-total	1,177	331	1 (16)	27	198	21	31	81	4	25 (34)	83
Meter Khusus											
JKT PUSAT											
UTARA											
BARAT			- did not available during the field survey -								
SELATAN											
TIMUR											
Sub-total											
Public Hydrant											
JKT PUSAT	38	4	0	3	1	1	1	1	1	0	1
UTARA	32	5	2	11	1	1	2	1	0	1	3
BARAT	47	4	0	4	1	0	1	2	0	0	7
SELATAN	5	0	0	3	0	0	0	0	0	0	1
TIMUR	9	0	0	0	0	0	0	0	0	0	2
Sub-total	131	13	2	21	3	2	4	4	1	1	14
Total											

Table 5.2B By-pass Connection/Defect Water Meter
Rumah Tanggah & usaha Kecil

KECAMATAN/KELURAHAN	Number of Connection	Number of Defect Meter	By-pass	No Meter Lost/ Released	Non-function Burried	Non-function Damaged	Cannot Read Soaked	Cannot Read Blurred Glass	Reverse Installation	Direct Suction	No/Miss Indication
(JKT PUSAT)											
Gambir/Petojo sel.	152	27	3	1	5	4	5	13	0	4	6
Sawah Besar/Kartini	34	5	0	2	1	0	0	4	0	1 (1)	3
/Pasar Baru	59	14	0	2	5	0	0	9	0	2	2
	93	19	0	4	6	0	0	13	0	3 (1)	5
Kemayoran/Kemayoran	26	5	0	1	0	1	0	4	0	1 (1)	0
Keb. Kosong	19	3	0	1	0	1	1	1	0	0	3
	45	8	0	2	0	2	1	5	0	1 (1)	3
Senon/Kenori	41	10	1	1	0	1	1	8	0	2	1
Compakah Putih/ C. Putich Tim.	49	3	0	0	1	0	0	2	0	0 (2)	0
Menteng/Menteng	146	49	0	0	4	3	4	38	0	2 (2)	8
Tanah Abang/											
Kebon Melati	47	7	0	7	0	0	-	7	-	0	3
/Gelora	27	9	0	0	0	0	-	9	-	0	0
	74	16	0	7	0	0	-	16	-	0	3
Total	600	132	4	15	16	10	11	95	0	12 (6)	23

Table 5.2C By-pass Connection/Defect Water Meter
(Rumah Tanggah & Usaha Kecil)

KECAMATAN/KELURAHAN	Number of Connection	Number of Defect Meter	By-pass	No Meter Lost/ Released	Non-function Burried	Non-function Damaged	Cannot Read Soaked	Cannot Read Blurred Glass	Reverse Installation	Direct Suction	No/Miss Indication
(JKT UTARA)											
Penjaringan/											
Pedemangan Timurs	114	27	0	0	0	0	16	11	0	10 (4)	0
Penjaringan	11	3	0	0	3	0	0	0	0	0	1
	125	30	0	0	3	0	16	11	0	10 (4)	1
Tanjun Triok/											
Keb. Bamang	100	24	(1)	19	1	0	14	9	0	2 (6)	7
Koja/Koja Utar	44	9	0	22	2	1	3	3	0	(3)	2
Total	269	63	(1)	41	6	1	33	23	0	12 (13)	10

Table 5.2D By-pass Connection/Defect Water Meter
(Rumah Tanggah & Usaha Kecil)

KECAMATAN/KELURAHAN	Number of Connection	Number of Defect Meter	By-pass	No Meter Lost/ Released	Non-function Burried	Non-function Damaged	Cannot Read Soaked	Cannot Read Blurred Glass	Reverse Instal-lation	Direct Suction	No/Miss Indi-cation
(JKT BARAT)											
Grogol Petamburan/											
Tanjun Duren	110	7	0	0	1	1	0	5	0	(2)	15
Pal Merah	22	3	0	0	0	2	0	1	0	0	1
Tomang	62	13	0	0	1	1	0	11	0	2 (1)	1
	194	23	0	0	2	4	0	17	0	2 (3)	17
Taman Sani/Keagunugau	29	5	0	0	0	0	2	3	0	0	1
Maphar	81	8	0	4	3	1	0	4	1	1	18
	110	13	0	4	3	1	2	7	1	1	19
Tambora/Pekajon	97	12	0	7	5	1	3	3	0	2 (2)	17
Jembatan Besi	15	0	0	0	0	0	0	0	0	1 (1)	2
Tanah Sareal	162	27	0	6	3	3	8	13	2	3	13
	274	39	0	13	8	4	11	16	2	6 (3)	32
Total	578	75	0	17	13	9	13	40	3	9 (6)	68

Table 5.2E By-pass Connection/Defect Water Meter
(Rumah Tanggah & Usaha Kecil)

KECAMATAN/KELURAHAN	Number of Connection	Number of Defect Meter	By-pass	No Meter Lost/ Released	Non-function Burried	Non-function Damaged	Cannot Read Soaked	Cannot Read Blurred Glass	Reverse Installation	Direct Suction	No/Miss Indication
(JKT SELATAN)											
Tebet/Tebet Tim.	7	1	0	0	0	1		0		0	0
Setia Budi/Guntur	12	3	0	0	0	3		0		0	0
Kebayoran Beru/ Selong	50	20	0	1	4	0		16		0	0
Kolamat Pela	85	16	0	2	2	13		1		0	1
Kebayoran Lama/ Grogol Sel.	19	4	0	0	1	3		0		0	0
Total	173	44	0	3	7	20		17		0	1

Table 5.2F By-pass Connection/Defect Water Meter
(Rumah Tanggah & Usaha Kecil)

KECAMATAN/KELURAHAN	Number of Connection	Number of Defect Meter	By-pass	No Meter Lost/ Released	Non-function Burried	Non-function Damaged	Cannot Read Soaked	Cannot Read Blurred Glass	Reverse Installation	Direct Suction	No/Miss Indication
(JKT TIMUR)											
Matraman/Palmerian	54	3	0	1	1	1	0	1	0	1 (1)	10
Pulogadung/Kayu Putih	76	9	(1)	0	1	3	0	5	0	3	3
Jatinegara/Rawa Bunga	54	6	1	1	1	0	0	5	0	0	2
Kramat Jati/Kramat Jati	25	1	0	0	1	0	0	0	0	1	1
Total	209	19	1 (1)	2	4	4	0	11	0	5 (1)	16

Table 5.2G By-pass Connection/Defect Water Meter
(Usaha Komersil)

KECAMATAN/KELURAHAN	Number of Connection	Number of Defect Meter	By-pass	No Meter Lost/ Released	Non-function Burried	Non-function Damaged	Cannot Read Soaked	Cannot Read Blurred Glass	Reverse Installation	Direct Suction	No/Miss Indication
(JKT PUSAT)											
Gambir/Petojo Sel.	93	27	0	0	13	1	3	10	0	1 (1)	3
Sawah Besar/											
Kartini	7	2	(1)	0	1	0	1	0	0	1	2
Pasac Baru	86	24	0	1	13	0	0	11	0	3 (1)	3
	93	26	(1)	1	14	0	1	11	0	4 (1)	5
Kemayoran/Kemayoran	4	2	0	0	2	0	0	0	1	0	0
Keb. Kosong	—	—	—	—	—	no data	—	—	—	—	—
	4	2	0	0	2	0	0	0	1	0	0
Senen/Kenori	10	0	0	0	0	0	0	0	0	0	0
Compakah Putih/	-	-	-	-	-	-	-	-	-	-	-
C. Putich Tim.											
Menteng/Menteng	49	21	0	1	4	3	2	12	0	0	6
Tanah Abang/											
Kebon Melati	14	5	0	2	0	3	-	2	-	0	0
" /Gelora	33	9	0	0	0	0	-	9	-	0	4
	47	14	0	2	0	3	-	11	-	0	4
Total	296	90	(1)	4	33	7	6	44	1	5 (2)	18

Table 5.2H By-pass Connection/Defect Water Meter
(Usaha Komersil)

KECAMATAN/KELURAHAN	Number of Connection	Number of Defect Meter	By-pass	No Meter Lost/ Released	Non-function Burried	Non-function Damaged	Cannot Read Soaked	Cannot Read Blurred Glass	Reverse Installation	Direct Suction	No/Miss Indication
(JKT UTARA)											
Penjaringan/ Rodemangan Timur	3	2	0	0	0	0	2	0	0	(1)	0
Penjaringan/ Penjaringan	1	1	0	0	1	0	0	0	0	0	0
	—	—	—	—	—	—	—	—	—	—	—
	4	3	0	0	1	0	2	0	0	(1)	0
Tonjun Triok/ Keb Bawang	33	12	0	2	2	0	5	5	0	(2)	2
Koja/Koja Utar	80	22	1 (2)	12	8	2	4	8	1	2 (16)	2
Total	117	37	1 (2)	14	11	2	11	13	1	2 (19)	4

Table 5.2I By-pass Connection/Defect Water Meter
(Usaha Komersil)

KECAMATAN/KELURAHAN	Number of Connection	Number of Defect Meter	By-pass	No Meter Lost/ Released	Non-function Burried	Non-function Damaged	Cannot Read Soaked	Cannot Read Blurred Glass	Reverse Installation	Direct Suction	No/Miss Indication
(JKT BARAT)											
Grogol Petamburan/											
Tanjun Duren	35	4	(3)	0	4	0	0	0	0	0	9
Pal Merah	-	-	-	-	-	-	-	-	-	-	-
Tomang	4	2	0	0	0	1	0	1	0	0	0
	39	6	0 (3)	0	4	1	0	1	0	0	9
Taman Sani/Keagungan	-	-	-	-	-	-	-	-	-	-	-
Maphar	365	119	(5)	7	98	4	10	7	0	10 (3)	29
	365	119	(5)	7	98	4	10	7	0	10 (3)	29
Tambora/Pekajon	38	11	0	0	9	0	1	1	0	1	4
Jembatsu Besi	-	-	-	-	-	-	-	-	-	-	-
Tanah Sareal	31	16	0	1	12	0	2	2	0	2 (1)	3
	69	27	0	1	21	0	3	3	0	3 (1)	7
Total	473	152	0 (8)	8	123	5	13	11	0	13 (4)	45

Table 5.2J By-pass Connection/Defect Water Meter
(Usaha Komersil)

KECAMATAN/KELURAHAN	Number of Connection	Number of Defect Meter	By-pass	No Meter Lost/ Released	Non-function Burried	Non-function Damaged	Cannot Read Soaked	Cannot Read Blurred Glass	Reverse Installation	Direct Suction	No/Miss Indication
(JKT SELATAN)											
Tebet/Tebet Tim.						No data					
Setia Budi/Guntur						No data					
Kebayoran Baru/Selong	15	4	0	0	0	1		3		0	0
Kolamat Pela	10	0	0	0	0	0		0		0	0
	25	4	0	0	0	1		3		0	0
Kebayoran Lama/ Grogol Sel.						No data					
Total	25	4	0	0	0	1		3		0	0

Table 5.2K By-pass Connection/Defect Water Meter
(Usaha Komersil)

KECAMATAN/KELURAHAN	Number of Connection	Number of Defect Meter	By-pass	No Meter Lost/ Released	Non-function Burried	Non-function Damaged	Cannot Read Soaked	Cannot Read Blurred Glass	Reverse Installation	Direct Suction	No/Miss Indication
(JKT TIMUR)											
Matraman/Pelmerian	56	12	0 (1)	0	7	3	0	2	0	2 (4)	1
Pulogadung/ Kayu Putih	44	8	0 (1)	1	8	0	0	0	1	0 (2)	14
Jatinegara/ Rawa Buaga	104	15	0 (1)	0	8	1	0	6	0	2 (2)	0
Kramat Jati/ Kramat Jati	62	13	0 (2)	0	8	2	1	2	1	1 (1)	1
Total	266	48	0 (5)	1	31	6	1	10	2	5 (9)	16

Table 5.2L By-pass Connection/Defect Water Meter
(Public Hydrant)

KECAMATAN/KELURAHAN	Number of Connection	Number of Defect Meter	By-pass	No Meter Lost/ Released	Non-function Burried	Non-function Damaged	Cannot Read Soaked	Cannot Read Blurred Glass	Reverse Installation	Direct Suction	No/Miss Indication
JKT PUSAT	38	4	0	3	1	1	1	1	1	0	1
UTARA	32	5	2	11	1	1	2	1	0	1	3
BARAT	47	4	0	4	1	0	1	2	0	0	7
SELATAN	5	0	0	3	0	0	0	0	0	0	1
SIMUR	9	0	0	0	0	0	0	0	0	0	2
Total	131	13	2	21	3	2	4	4	1	1	14

Table 5.3 Percentage of Estimated/Metered Consumption

Category		Estimated Consumption			Metered Consumption		
		No. of Connection	Billing (Rp)	Estimated Consumption (m^3/conn/month)	No. of Connection	Billing (Rp)	Estimated Consumption (m^3/conn/month)
Domestic and Small Commercial							
JKT PUSAT	(Dec/79 - Jan/80)	16	45.805	59.8	49	133.600	57.1
	(Jan/80 - Jul/80)	20	47.645	31.0	40	84.015	27.5
	Sub-total	36		43.8	89		43.8
JKT UTARA	(Jun/82 - Jan/83)	20	29.820	19.9	27	57.640	27.9
	(Jun/83 - Sep/83)	4	10.690	30.9	8	24.490	32.2
	Sub-total	24		21.7	35		28.9
JKT BARAT	(Nov/80 - Jan/82)	23	55.945	31.7	140	338.900	31.5
JKT SELATAN	(Nov/79 - Dec/79)						
JKT TIMUR	(Nov/79 - Dec/79)	2	3.650	39.0	28	51.138	39.0
	(Jan/83 - Apr/83)	12	29.716	32.2	52	169.005	41.9
	(May/83 -)	1	2.080	26.0	24	118.710	38.5
	Sub-total	15		32.7	104		40.3

Attachment 6.

Field Survey for Unaccounted-for Water

1. Introduction

The first field survey was made on 5th - 6th March 1984 at Pulo Mas, Jakarta Timur. The second survey was made at the same place on 23th - 24th August 1984. Primarily, minimum flow of the survey area was measured in midnight which is considered more or less equivalent to leakage. The survey intended secondary 1) to know major causes of leaks, 2) to know preparatory works required for all leakage surveys, and 3) to recommend a leakage control program prepared based on all the findings of actual survey.

The field survey investigated the following items:

1. The past water consumption,
2. The number of persons receiving piped water from PDAM,
3. The number and volume of reservoir of consumer,
4. The total inflow into the survey area for 24 hours and minimum night flow,
5. The water pressure of the survey area for 24 hours,
6. Meter conditions of each service connection, and
7. Investigation of observable leakage from pipelines and service connections.

Details of the survey are described in the succeeding sections.

2. Survey Area

The survey area is located in the residential area of Pulo Mas, Kel. Kayu Putih, Jakarta Timur as shown on Fig. 1. The reasons such area were selected are as follows:

1. The water pressure is enough so that leaks can be observable if there are leaks on the pipelines and service connection.

2. The area can be easily isolated with adequate size of service area in terms of length of pipelines and number of service connections.

3. The area is occupied entirely by residential houses so that minimum night flow can be easily investigated and it will be more or less leakage.

4. The area is not recently developed.

5. Installation of flow meter can be easily done in such area that there is a pipe bridge or pipeline can be easily digged for meter installation without demolishment of pavement and not disturb public transportations.

The survey area is located near the Pulogadung Treatment plant (about 3.5 km) and receives water from two trunk mains, Ø 800 mm in Jl. Jen. A. Yani and Ø 500 mm in Jl. Pemuda. The average water pressure is about 1.5 kg/cm^2. About 2 km length of pipeline covers the survey area and it consists of Ø 200 mm DIP (Ductile Iron Pipe) and Ø 100 and 50 mm GI (Galvanized Steel Pipe). The area is occupied entirely with residential houses and total number of houses is 110. The service connections are all GI and meter size is 1/2". The distribution pipelines are installed in the open space beside the road along drain gutter with very small covering as about 30 - 50 cm only.

The service connections are laid penetrating the drain gutter to meter box located near by the drain gutter. This piping layout is susceptible to damage easily by the shock from outside and subsidence of meter box. The leakage might flow into the drain gutter and it might be difficult to observe it even there are small leaks from distribution pipelines and service connections. There is not stop cock on the service connections in spite of the standard drawing shows it.

The general layout of the survey area is shown on Fig. 2.

3. Survey Result

3.1 Consumer and Consumption

There are 110 house surveyed out of which 4 houses are disconnected and 2 houses are under construction or repair during the survey period, on March 1984. According to the 2nd survey on August 1984, 5 houses are disconnected.

As for the meter condition, 10 meters are damaged or whose meters cannot be read at the time of the survey on March, while those meters are 35 during the 2nd survey on August. This big difference will be derived from that those meters belong to the locked house and empty house were not counted in the 1st survey. Therefor such non-functioned meter is considered as 35 or 34% of a total service connection.

The total consumption of the past months were 120.4 m^3/day and 127.9 m3/day for the 1st and 2nd survey respectively. As the result of meter reading during survey period, total consumption was 93.1 m3/day on March and 89.9 m3/day on August.

Estimated total consumption of the area is about 150 m^3/day considering the consumptions of non-functioned meters and locked and absent houses.

The summary of the survey results are shown in the below tables.

1st Survey, 5th-6th March 1984

Category of Connection	Connection	Person	Billed Consumption Dec	Billed Consumption Nov	Meter Reading	Estimated Consumption
Disconnected	4	0	-	-	0	0
Absent	11	57	321	215	0	0
Not Surveyed	1	5	-	-	0	0.2
Under Construction	1	-	75	80	0	0
Under Repairing	1	(5)	85	85	3.3	3.3
Zero Reading	26	123	1,105	569	0	0
Locked House		(36)	220	211	-	10.0
Defective Meter	10	56	305	315	-	19.7
Meter Reading	49	255	1,927	1,953	89.8	89.8
Total	110	537	4,038	3,428	93.1	123.0

Per capita consumption: past two month average 245 lpcd
5th - 6th, March 229 lpcd

( ): apply the average number of person per a connection

2nd Survey, 23th-24th August 1984

Category of Connection	Number of Connection	Person	Billed Consumption May	Billed Consumption June	Billed Consumption July	Metered Consumption	Estimated Consumption
Disconnection	5	0	0	0	0	-	0
Absent	1	5	0	0	0	0.00	0
Non-funciton	35	188	1,608	1,461	1,399	-	52.30
Locked	5	24	166	92	83	-	6.68
Meter reading	54	279	2,084	2,377	2,217	89.85	89.85
Zero reading	10	44	117	154	12	0.00	0
Total	110	540	3,975	4,084	3,711	78.85	148.83

Per capita consumption: past three months average 239 lpcd
23nd - 24th, August 278 lpcd

3.2 Flow and Water Pressure

Flow meter (potable type ultra-sonic flow meter, Fuji Denki) was installed on pipe of Ø200 mm in diameter and flow rate into the area were measured for 24 hours. Simultaneously, water pressure was measured in the same periods. As shown in Figures 3 and 4, the minimum flow was observed at 13.8 m3/hr and 7 m3/hr and maximum flow was 22.0 m3/hr and 15 m3/hr by the 1st and 2nd surveys respectively. During the survey period, water pressure ranged from lowest of 0.70 kg/cm2 to highest of 2.4 kg/cm at 1st survey and 2.5 kg/cm at the second survey. The total inflow to the area was 404 m3/day during 1st survey and 250 m3/day during the 2nd survey. The different inflow of the above will be derived from small velocity in pipe. Reasonable relationship between water pressure and flow rate was observable, however the water pressure seems affected by the pressure on the trunk mains.

3.3 Observable Leakage

According to the site investigation of the 1st survey, no leakage was found from the distribution pipeline, but leakage from a service connection was observable at the penetration part at meter box. During the 2nd survey, a leakage was found from Ø 50 mm distribution pipe at joint which are rather big leakage, future two more leakage were found from the service connections. No repair work against a leakage found from service connection during the 1st survey.

It will be rather difficult to find small leaks because such leaks might flow into the drain gutter along every distribution pipelines even though there were leaks on the distribution pipelines and service connections especially in wet season.

4. Finding and Conclusion

Major findings of the survey are described as follows:

1. The existing drawing of pipelines do not show actual conditions of pipelines. Complete as-built drawings for pipelines and service connections should be prepared.

2. There are some valve missing because of road works.

3. About 34% of the installed meters are not working or cannot be read.

4. Accuracy for meters tested in the field fluctuate much the calculated average accuracy rate is 97% but it is not necessarily accurate figure.

5. Calculated leakage percentage is abnormally high.
Based on the midnight flow and average water pressure leakage is calculated as follows:

	1st survey	2nd survey
Midnight flow	15 m3/hr	8.5 m3/hr
Average water pressure	1.5 kg/m2	1.6 kg/m2
Water pressure at midnight	3.2 kg/m2	2.4 kg/m2
Calculated leakage	298 m3/day	136 m3/day
Leakage percentage	74%	54%

6. The total consumption during survey period are estimated as follows:

1st survey	122.8 m3
2nd survey	148.8 m3

7. Leakage of the system in the survey area is considered as about 40 - 50%.

8. Leaks from ϕ 50 mm distribution pipeline (one place) and connections (two places) were found in the second survey. Leakage were flowing into the ditch beside pipelines. This causes the difficulty to find leaks if they are small quantity and many especially in wet season.

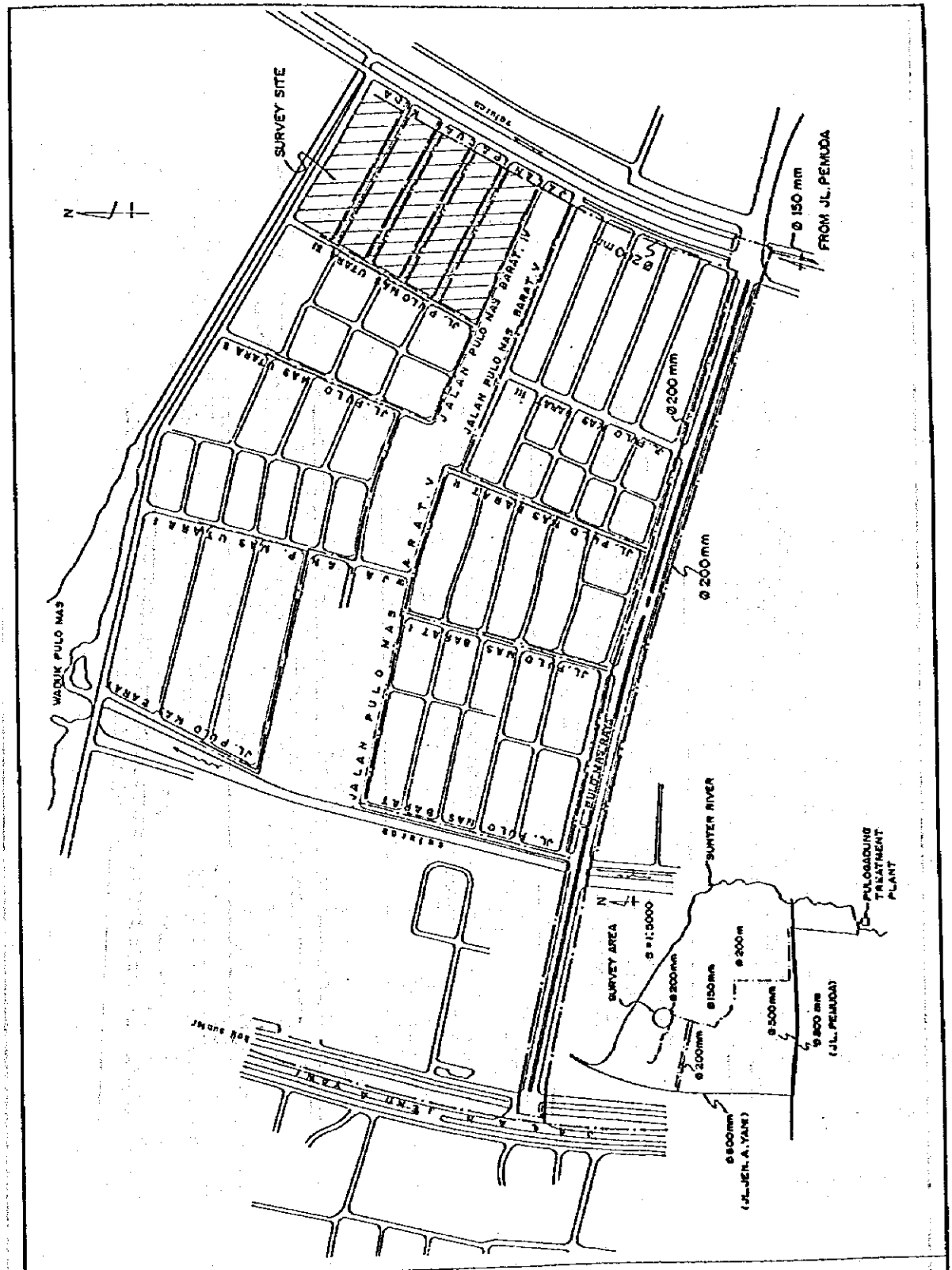


Fig 1 SURVEY SITE

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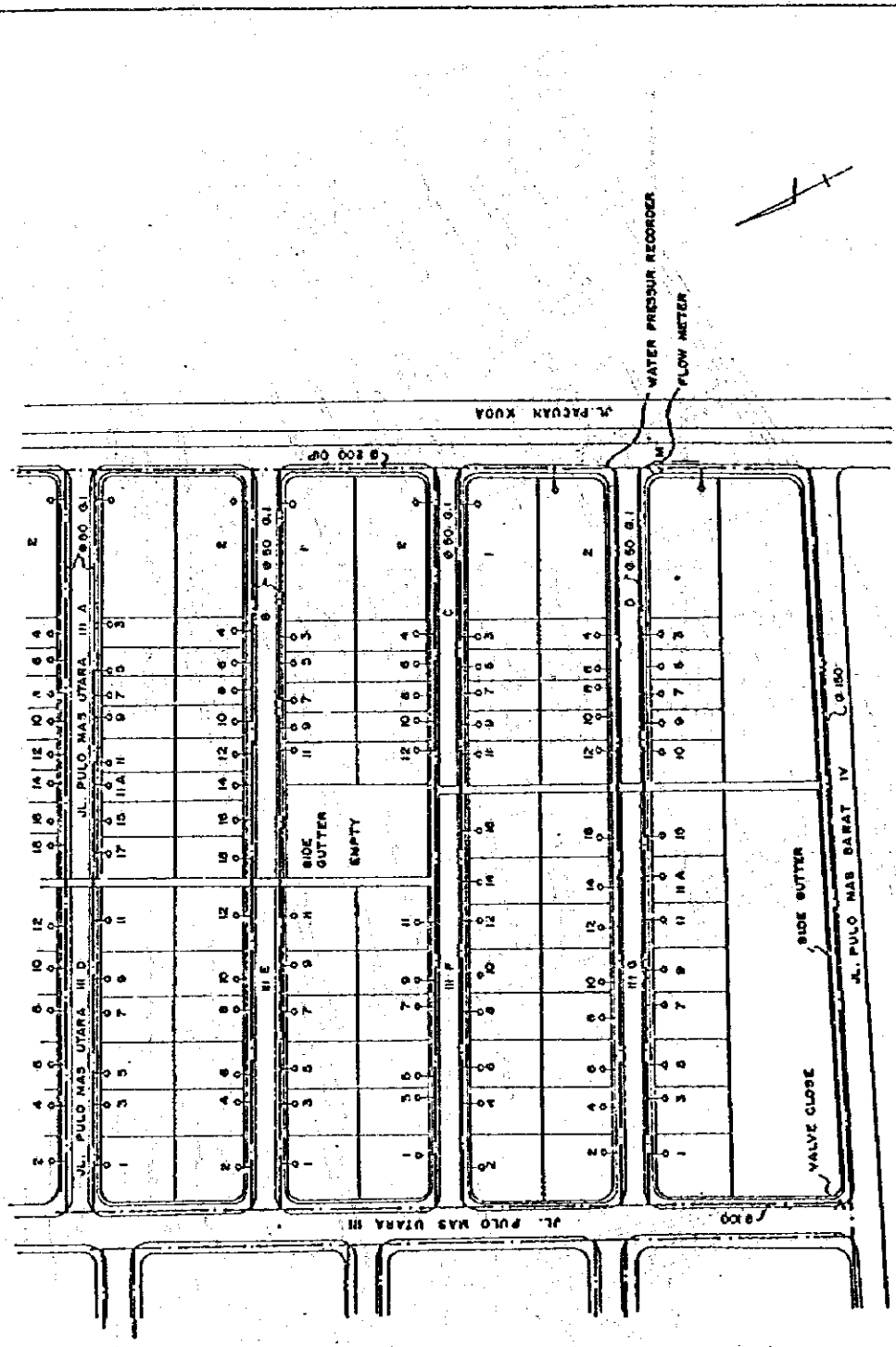

FIG 2 SERVICE CONNECTION IN SURVEY AREA

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Table 1 Water Consumption

Adress	Regist Ration Number	Person	Billed Consumption Dec	Billed Consumption Jan	Metered Consumption 5- 6th,Mar	Remarks
Jl.PULOMAS UTARA						
III D - 1	91690	8	30	0	1.3	
3	91691	7	20*	20*	1.0	*estimated
5	91962	3	26	15	0.3	
7	91693	-	66	65	-	locked
9	91694	2	0	20*	2.0	*estimated
11	91695	-	8	14	-	locked
2	91717	4	0	30	1.2	
4	91716	6	81	57	1.2	
6	91715	-	51	45	-	absent
8	91714	-	10*	10*	-	10cked
10	91713	2	11	10	0	zero reading
12	91712	2	30	30	1.0	
III E - 1	91718	6	71	64	1.5	
3	91719	8	44	17	0	zero reading
5	91720	4	40	100	1.22	
7	91721	6	11	6	0.12	
9	91722	7	40	45	1.48	
11	91723	5	35	40	7.38	
2	91742	4	54	54	1.90	
4	91741	5	39	49	1.62	
6	91740	3	32	8	0.29	
8	91730	-	-	-	0	
10	91738	4	2	6	0	zero reading
12	91737	5	30*	30*	-	non-function *estimated
III F - 1	91743	2	30	87	0.30	
3	91744	7	50	20	0	zero reading
5	91745	-	91	77	-	locked
7	91746	-	-	-	0	absent
9	91747	-	-	-	-	absent
11	91748	4	101	127	0	zero reading
2	91766	7	0	23	2.69	
4	91765	8	35*	40*	0.31	*estimated
6	91764	-	-	-	-	disconnected
8	91763	-	20	20	-	locked
10	91762	5	9	9	0	zero reading
12	91767	-	10	10	0	absent
14	91760	4	23	20	0.7	
16	91759	6	116	85	0	zero reading

Table 2 Water Consumption

Adress	Registration Number	Person	Billed Consumption Dec	Billed Consumption Jan	Metered Consumption 5- 6th,Mar	Remarks
Jl. PULOMAS UTARA						
III G - 1	91767	8	30	0	0	absent
3	91768	5	90	110	0	zero reading
5	91769	4	119	97	4.19	
7	91770	-	-	-	0	absent
9	91771	3	0	0	0	zero reading
11	91772	6	0	0	0	zero reading
11 A	91773	7	63	63	1.91	
15	91774	5	82	9	0	zero reading
2	91792	5	105	98	3.43	
4	91791	5	181	39	0	zero reading
6	91790	-	30*	30	0	absent
8	91789	5	35*	40*	-	non-function *estimated
10	91788	4	10	20	0	zero reading
12	91787	-	-	-	0	disconnected
14	91786	9	50	11	0.61	
16	91785	6	7	11	0	zero reading
A - 1	91789	-	138	130	0	absent
3	91704	4	10	10	0	zero reading
5	91705	4	94	0	0	zero reading
7	91706	3	30	30	1.2	
9	91707	9	20*	20*	-	non-function *estimated
11	91708	5	29	22	1.2	
11 A	91709	2	4	1	1.0	
15	91710	-	25	25	-	locked
17	91711	6	35	35	1.2	
2	91787	-	75	80	0	house is under repairing
A - 4	91703	6	42	29	1.3	use reservoir
6	91702	-	85	85	3.3	house id under construction
8	91701	5	30	35	0.5	
10	91700	4	30	31	2.4	
12	91699	6	48	26	0	zero reading
14	91698	3	10	10	0	zero reading
16	91697	5	77	81	2.1	
18	91696	4	50	69	11.1	

Table 3 Water Consumption

Adress	Registration Number	Person	Billed Consumption Dec	Billed Consumption Jan	Metered Consumption 5- 6th,Mar	Remarks
J1.PULOMAS UTARA						
B - 1	91800	-	-	-	0	absent
3	91732	10	90	89	4.45	
5	91733	5	37	32	2.85	
7	91734	6	10	2	0.30	
9	91735	8	21	15	0.70	
11	91736	3	39	26	1.53	
2	91799	-	92	0	0	absent
4	91731	6	45	45	2.17	
6	91730	5	176	0	0	zero reading
8	91729	2	24	17	0.92	
10	91728	5	39	35	1.01	
12	91727	6	47	60	2.28	
14	91726	7	10*	10*	-	non-function *estimated
16	91725	-	-	-	0	disconnected
18	91724	2	0	0	0	zero reading
C - 1	91802	11	73	45	1.1	
3	91754	3	0	10	0	zero reading use reservoir
5	91755	7	50*	50*	2.1	*estimated
7	91756	4	43	37	1.5	
9	91757	-	0	0	0	absent
11	91758	-	0	0	-	locked
2	91801	7	0	40	4.1	use reservoir
4	91753	7	35*	35*	-	non-function *estimated
6	91752	4	41*	39	0	zero reading
8	91751	7	13	1	0	zero reading
10	91750	4	35*	35*	-	non-function *estimated
12	91749	7	40*	40*	1.1	*estimated
D - 3	91780	4	35*	35*	-	*estimated
5	91781	2	10	10	0	zero reading
7	91782	3	4	6	0.06	
9	91783	4	64	64	1.11	
11	91784	3	40	40	2.90	
2	-	-	-	-	-	not surveyed
4	91770	7	0	0	0	zero reading
6	91778	6	0	0	0	zero reading
8	91777	4	35*	40*	-	non-function *estimated
10	91776	4	35*	35*	-	*estimated
12	91775	7	35*	35*	-	*estimated

Table 4 Water Consumption (23rd Aug. 1984)

Adress			Registration No.	Person	Billed Consumption May	June	July	Metered Consumption	Remarks
Jl. PULOMAS UTARA									
III	D	1	91690	8	35	35	35	-	non-function
III	D	3	91691	7	35	35	35	0.09	
III	D	5	91692	3	15	20	20	-	locked
III	D	7	91693	-	77	60	0	-	non-function
III	D	9	91694	2	31	30	30	-	non-function
III	D	11	91695	-	6	11	12	0	zero reading
III	D	2	91717	4	0	0	0	0.14	
III	D	4	91716	6	49	40	41	1.23	
III	D	6	91715	-	63	102	75	1.65	
III	D	8	91714	-	0	0	0	-	empty
III	D	10	91713	2	10	0	0	0	zero reading
III	D	12	91712	2	40	40	0	0	zero reading
III	E	1	91718	6	59	65	54	0.91	
III	E	3	91719	8	11	43	42	0.83	
III	E	5	91720	4	29	42	26	0.59	
III	E	7	91721	6	3	5	18	0.23	
III	E	9	91722	7	43	65	48	1.82	
III	E	11	91723	5	36	0	29	0.48	
III	E	2	91742	4	52	62	53	0.61	
III	E	4	91741	5	39	49	42	1.40	
III	E	6	91740	3	10	30	80	1.12	
III	E	8	91739	-	-	-	-	-	disconnection
III	E	10	91738	4	2	14	0	0	zero reading
III	E	12	91737	5	35	35	40	-	non-function
III	F	1	91743	2	38	55	26	0.28	
III	F	3	91744	7	0	0	0	0	zero reading
III	F	5	91745	-	83	98	81	0.03	
III	F	7	91746	-	0	0	0	0.01	
III	F	9	91747	-	0	0	2	0.56	
III	F	11	91748	4	6	3	49	0.07	
III	F	2	91766	7	67	63	58	1.32	
III	F	4	91765	8	45	45	45	-	non-function
III	F	6	91764	-	-	-	-	-	disconnection
III	F	8	91763	-	31	30	30	1.06	
III	F	10	91762	5	11	10	9	0.01	
III	F	12	91761	-	30	30	30	-	non-function
III	F	14	91760	4	17	21	17	0.38	
III	F	16	91759	6	91	76	70	-	non-function

Table 5 Water Consumption (23rd Aug. 1984)

Adress	Registration No.	Person	Billed Consumption May	June	July	Metered Consumption	Remarks
JL. PULOMAS UTARA							
III G 1	91767	8	30	30	31	-	non-function
III G 3	91768	5	30	30	30	-	non-function
III G 5	91769	4	62	26	88	-	non-function
III G 7	91770	-	-	-	-	-	disconnection
III G 9	91771	3	23	9	0	0	zero reading
III G 11	91772	6	0	50	0	0	zero reading
III G 11 A	91773	7	48	56	49	1.15	
III G 15	91774	5	30	30	0	0	zero reading
III G 2	91792	5	92	115	61	3.11	
III G 4	91791	5	47	52	50	-	non-function
III G 6	91790	-	30	30	0	0.03	
III G 8	91789	5	45	45	45	-	non-function
III G 10	91788	4	35	35	35	-	non-function
III G 12	91787	-	-	-	-	-	disconnection
III G 14	91786	9	162	44	11	0.09	
III G 16	91785	6	88	110	77	1.76	
A 1	91798	-	142	216	221	6.18	
A 3	91704	4	35	35	35	-	non-function
A 5	91705	4	0	0	0	0	zero reading
A 7	91706	3	1	2	1	0.01	
A 9	91707	9	35	35	30	1.02	
A 11	91708	5	38	37	37	1.37	
A 11 A	91709	2	55	53	0	-	non-function
A 15	91710	-	95	20	89	1.24	
A 17	91711	6	45	45	45	-	non-function
A 2	91797	-	85	85	85	-	non-function
A 4	91703	6	20	30	30	-	non-function
A 6	91702	-	20	30	30	-	non-function
A 8	91701	5	41	40	40	-	non-function
A 10	91700	4	22	62	80	4.25	
A 12	91699	6	35	35	35	-	non-function
A 14	91698	3	0	68	169	2.82	
A 16	91697	5	43	68	60	2.18	
A 18	91696	4	36	28	26	0.69	

Table 6 Water Consumption (23rd Aug. 1984)

Adress		Registration No.	Person	Billed Consumption May	June	July	Metered Consumption	Remarks
JL. PULOMAS UTARA								
B	1	91800	-	0	0	0	-	locked
B	3	91732	10	196	89	80	-	non-function
B	5	91733	5	12	20	33	0.21	
B	7	91734	6	11	19	12	0.41	
B	9	91735	8	94	0	2	-	locked
B	11	91736	3	52	39	26	0.86	
B	2	91799	-	30	30	0	3.41	
B	4	91731	6	54	48	34	1.14	
B	6	91730	5	65	76	57	2.45	
B	8	91729	2	12	21	27	0.42	
B	10	91728	5	22	37	26	-	locked
B	12	91727	6	32	22	3	0.24	
B	14	91726	7	30	30	30	-	non-function
B	16	91725	-	-	-	-	-	disconnection
B	18	91724	2	9	33	10	0.95	
C	1	91802	11	42	46	52	1.51	
C	3	91754	3	35	35	35	-	locked
C	5	91755	7	55	55	55	-	non-function
C	7	91756	4	27	35	33	1.19	
C	9	91757	-	0	0	4	5.42	
C	11	91758	-	10	10	10	-	non-function
C	2	91801	7	31	41	41	23.86	
C	4	91753	7	50	50	50	-	non-function
C	6	91752	4	30	30	0	1.51	
C	8	91751	7	0	39	20	1.41	
C	10	91750	4	45	45	45	-	non-function
C	12	91749	7	45	45	45	-	non-function
D	3	91780	4	40	40	40	-	non-function
D	5	91781	2	35	35	35	-	non-function
D	7	91782	3	20	20	20	-	non-function
D	9	91783	4	44	53	47	1.07	
D	11	91784	3	40	40	40	1.08	
D	2	91803	-	79	76	52	1.99	
D	4	91779	7	6	0	0	0	zero reading
D	6	91778	6	35	35	35	-	non-function
D	8	91777	4	30	40	40	-	non-function
D	10	91776	4	43	40	40	-	non-function
D	12	91775	7	45	45	45	-	non-function

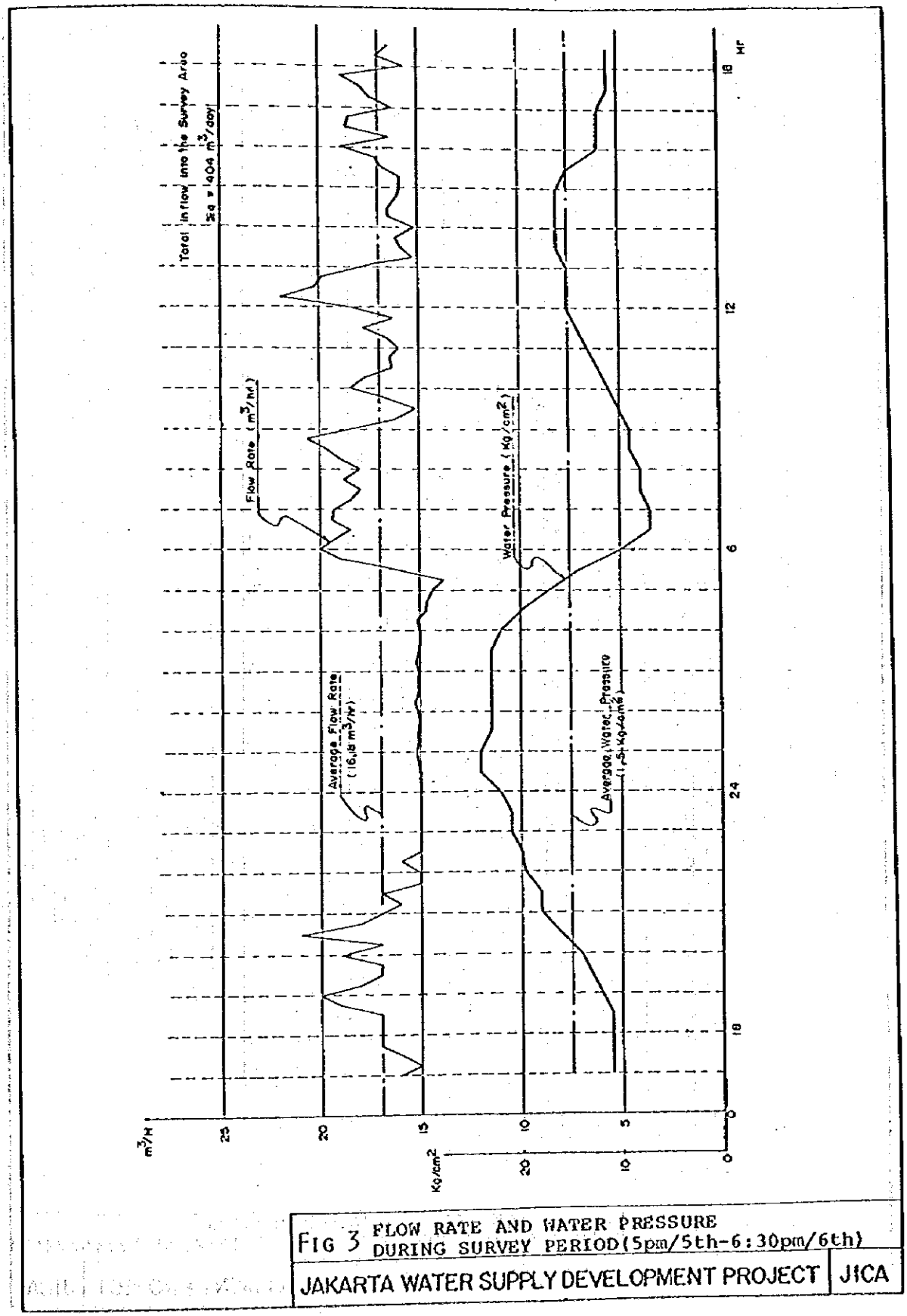

FIG 3 FLOW RATE AND WATER PRESSURE DURING SURVEY PERIOD(5pm/5th-6:30pm/6th)

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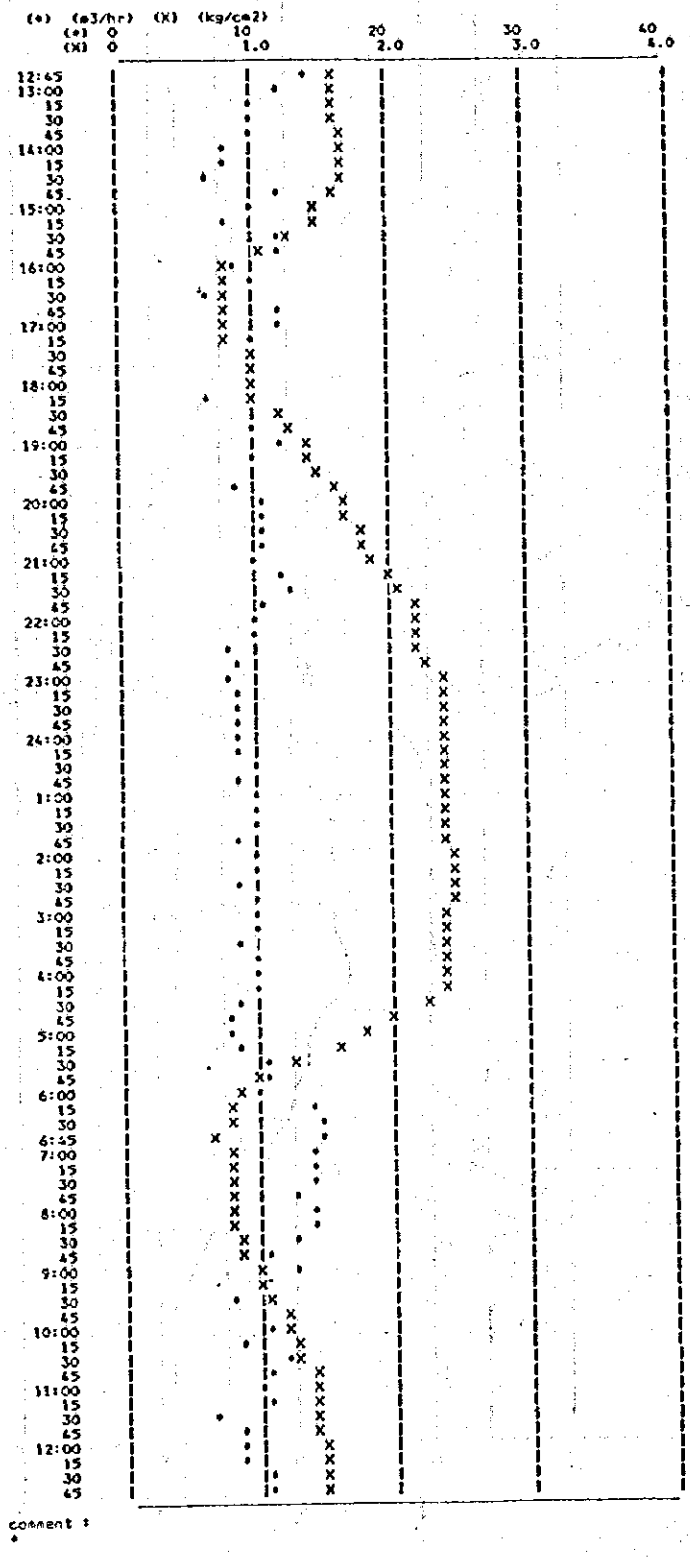

FIG 4 FLOW RATE AND WATER PRESSURE DURING SURVEY PERIOD(12:45/23rd-12:45/24th)

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Table 7 Records of Flow and Pressure

TIME	FLOW RATE (m3/H)	PRESSURE (kg/cm2)	TIME	FLOW RATE (m3/H0	PRESSURE (kg/cm2)	TIME	FLOW RATE (m3/H)	PRESSURE (kg/cm2)
(5th)								
17:00	16	1.1	1:15	15.1		9:30	15.2	1.0
15	15		30	15.1	2.3	45	16.7	
30	16	1.1	45	15.0		10:00	18.5	1.1
45	17		2:00	15.1	2.3	15	17.8	
18:00	17	1.1	15	15.2		30	16.3	1.2
15	17		30	15.1	2.3	45	16.5	
30	17	1.1	45	15.1		11:00	16.0	1.3
45	19		3:00	15.1	2.3	15	16.6	
19:00	20	1.2	15	15.2		30	17.8	1.4
15	18		30	15.1	2.3	45	16.3	
30	17	1.3	45	15.0		12:00	18.3	1.5
45	17		4:00	15.0	2.2	15	22.0	
20:00	19	1.4	15	15.1		30	20.2	1.5
15	17		30	14.7	2.0	45	19.9	
30	21	1.6	45	14.6		13:00	17.9	1.5
45	18		5:00	14.4	1.7	15	15.2	
21:00	17	1.8	15	13.8		30	15.9	1.6
15	16		30	16.0	1.4	45	16.1	
30	17	1.8	45	19.0		14:00	15.2	1.6
45	15		6:00	20.0	1.0	15	16.5	
22:00	15	2.0	15	19.3		30	16.5	1.6
15	16		30	18.5	0.7	45	16.1	
30	15	2.0	45	19.4		15:00	15.9	1.6
45	15		7:00	19.3	0.7	15	15.9	
23:00	15	2.1	15	18.5		30	16.8	1.5
15	15		30	18.0	0.8	45	17.1	
30	15	2.1	45	18.8		16:00	18.9	1.2
45	15		8:00	18.0	0.8	15	16.5	
24:00	15	2.2	15	18.9		30	18.6	1.2
15	15		30	20.6	0.9	45	18.5	
30	15	2.4	45	21.6		17:00	16.3	1.2
45	15.1		9:00	18.4	0.9	15	17.5	
(6th)								
1:00	15.2	2.4	15	16.2		30	17.9	1.1
17:45	18.9							
18:00	15.7	1.1						
15	17.1							
30	16.6	1.1						

Average flow rate : 16.8 m3/hr

Average water pressure: 1.5 kg/cm2

Total inflow : 404 m3/day

Table 8 Records of Flow and Pressure

TIME	FLOW RATE (m3/hr)	PRESSURE (kg/cm2)	TIME	FLOW RATE (m3/hr)	PRESSURE (Kg/cm2)	TIME	FLOW RATE (m3/hr)	PRESSURE (kg/cm2)
12:45	14	1.6	21:45	11	2.2	6:45	15	0.7
13:00	12	1.6	22:00	10	2.2	7:00	14	0.8
15	10	1.6	15	10	2.2	15	14	0.8
30	10	1.6	30	8	2.2	30	14	0.8
45	10	1.7	45	9	2.3	45	13	0.8
14:00	8	1.7	23:00	8	2.4	8:00	14	0.8
15	8	1.7	15	9	2.4	15	14	0.8
30	7	1.7	30	9	2.4	30	13	0.9
45	12	1.6	45	9	2.4	45	11	0.9
15:00	10	1.5	24:00	9	2.4	9:00	13	1.0
15	8	1.5	15	9	2.4	15	10	1.0
30	12	1.3	30	10	2.4	30	8	1.1
45	12	1.1	45	9	2.4	45	12	1.2
16:00	9	0.8	1:00	10	2.4	10:00	11	1.2
15	10	0.8	15	10	2.4	15	9	1.3
30	7	0.8	30	10	2.4	30	12	1.3
45	12	0.8	45	9	2.4	45	11	1.4
17:00	12	0.8	2:00	10	2.5	11:00	10	1.4
15	10	0.8	15	10	2.5	15	11	1.4
30	10	1.0	30	9	2.5	30	7	1.4
45	10	1.0	45	10	2.5	45	9	1.4
18:00	10	1.0	3:00	10	2.4	12:00	9	1.5
15	7	1.0	15	10	2.4	15	9	1.5
30	12	1.2	30	9	2.4	30	11	1.5
45	10	1.3	45	10	2.4	45	11	1.5
19:00	12	1.4	4:00	10	2.4			
15	10	1.4	15	10	2.4			
30	15	1.5	30	9	2.3			
45	9	1.6	45	8	2.0			
20:00	11	1.7	5:00	8	1.8			
15	11	1.7	15	9	1.6			
30	11	1.8	30	11	1.3			
45	11	1.8	45	11	1.0			
21:00	10	1.9	6:00	10	0.9			
15	12	2.0	15	14	0.8			
30	13	2.1	30	15	0.8			
TOTAL							1014	155.6

Average flow rate : 10.5 m3/hr
Average water pressure : 1.6 kg/cm2
Total inflow :250.4 m3/day

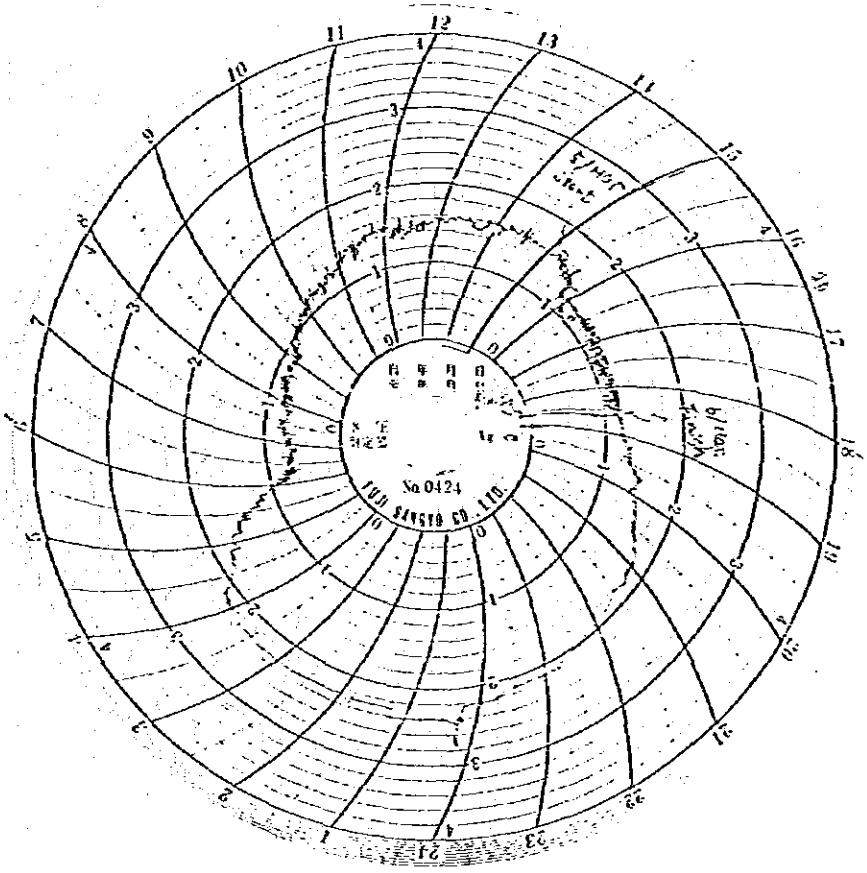


Fig 5 PRESSURE RECORD

JAKARTA WATER SUPPLY DEVELOPMENT PROJECT | JICA

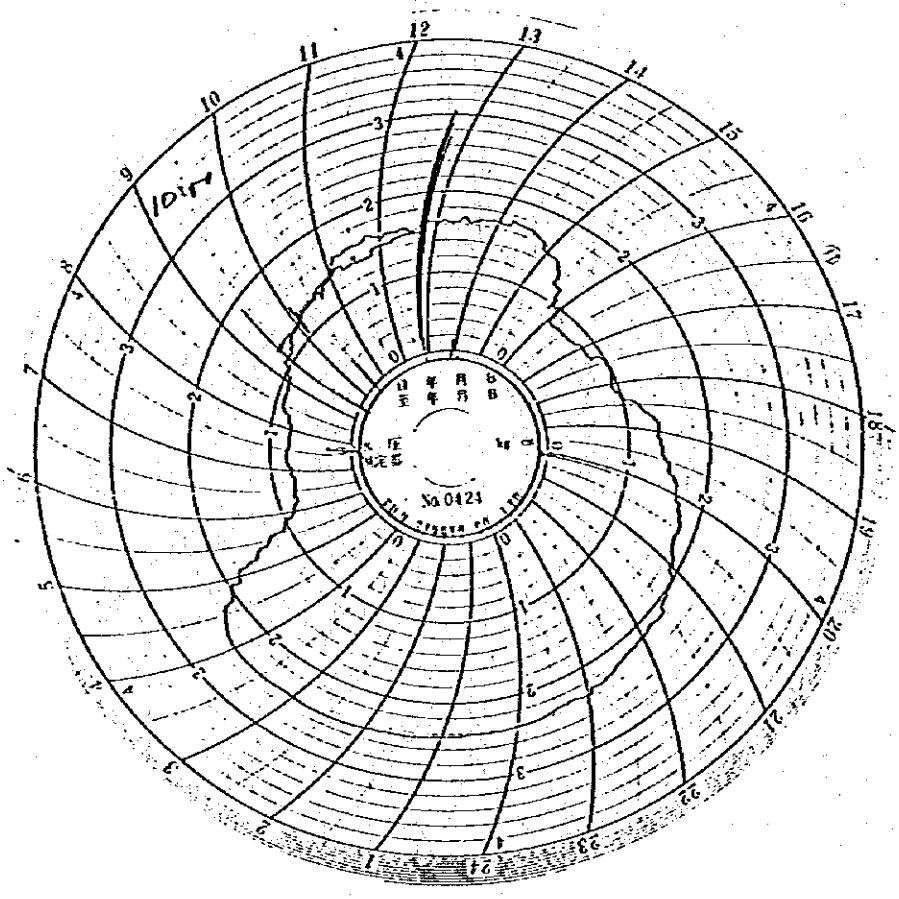


FIG 6 PRESSURE RECORD

JAKARTA WATER SUPPLY DEVELOPMENT PROJECT | JICA

Table 9 Field Test of Meter Accuracy

No.	TYPE OF METER	MESSURE TANK 20.1	5.1	HOUSE METER 20.1	5.1	METER ACCURACY 20.1	5.1
84	SB	5.89	7.34	5.87	7.38	-0.3	-0.5
41	METRON	1.78	4.50	1.77	4.25	-0.6	-5.6
42	METRON	0.64	7.93	1.64	6.45	0.0	-18.7
45	METRON	0.99	3.54	1.04	6.04	5.1	14.1
47	METRON	1.55	2.95	1.62	3.20	4.5	8.5
52	METRON	2.33	8.79	2.19	9.25	-6.0	5.2
62	METRON	1.19	5.25	1.29	4.82	8.4	-8.2
67	METRON	1.45	3.63	1.63	3.13	12.4	-13.8
7		1.57	5.78	1.62	6.30	3.2	9.0
29		1.60	3.673	1.65	3.60	3.1	-0.8
31		3.52	1.80	2.93	1.97	-16.8	9.4
33		1.27	2.35	1.30	1.72	2.4	-26.8
	AVERAGE	2.1	4.8	2.0	4.7	1.3	-2.3

MASTER PLAN FOR

JAKARTA WATER SUPPLY DEVELOPMENT PROJECT

M5. APPENDIX MIII-4

COMPARATIVE STUDY FOR PRE-TREATMENT OF FBT METHOD AND RAW WATER TRANSMISSION MAIN SYSTEM ON RAW WATER IMPROVEMENT FOR THE EXISTING TREATMENT PLANTS

1. Introduction

To remedy the existing condition that the existing facilities can hardly produce safe potable water due to the prevailing extreme pollution of raw water, two possible methods has been studied, namely, to install the pre-treatment facility to the existing plants of Pejompongan and Pulogadung, or to take raw water from the WTC directly.

For pre-treatment of raw water, four methods, that is,

1) Ozone oxidation method
2) Activated sludge method
3) Fixed biological film contact oxidation (FBF), and
4) Aerated lagoon

were compared (Appendix - MIII-2 Water Quality and Treatment Process), and FBF method was recommended as the most suitable method for pre-treatment of polluted raw water taking into account easier operation and maintenance and high efficiency. Besides, the selecting of intak point of the WTC for direct raw water intake, three intake points were compared for:

1) End of the Canal, for Pejompongan
2) 2 km east of crossing point with the Sunter river, for both plants of Pejompongan and Pulogadung, and
3) Outside of DKI Jakarta boundary, for Pulogadung, or both plants

With the environmental condition of raw water quality, the outside of DKI boundary was recommended as intake point.

For the Immediate Project, the intake point was selected within the DKI boundary, at crossing point with the Jati Kramat river, based on possible land acquisition, costs comparison and intake conditions by gravity considering no significant difference of the raw water quality between points 5 and 4 as shown Fig.1 (refer to Figs. 2 to 5 and Table 1). Then, intake point of raw water for the existing plants is proposed at same intake point with the Buaran treatment plant to be constructed under the Immediate Project.

This paper is prepared to recommend which system between the pre-treatment plant and direct intake from the WTC for raw water improvement is preferable. Comparision for systems will be made only for Pejompongan system and omitted for Pulogadung system considering duly advantage on cost due to shorter raw water transmission pipeline to Pulogadung plant than that to Pejompongan plant.

2. Comparision of Pre-treatment System of FBF Method and Raw Water Transmission System

Locations of the pre-treatment plant, intake point for raw water from WTC and raw water transmission pipeline are shown on Fig. 6

The comparision is done under the following conditions :

1) As there is no land space to construct the pre-treatment system at the intake and treatment plant sites in Pejompongan area, the land, 200 m x 230 m = 4.6 ha might be acquired in the area at distributary point of the Banjir Canal from the Ciliwung River.

2) Land cost is not included, for both systems

3) Cost of pipe materials is estimated with ductile iron pipe

4) Cost estimates cover overall facilities from intake to Pejompongan treatment plant.

To construction costs and operation/maintenance costs are shown in Tables 2 and 3 respectively. The pre-treatment system is more costly in the construciton cost than the raw water transmission system, but its operation cost is cheeper, so that both systems are compared on the basis of the least cost solution according to a present worth calculation for the construction and operaiton/maintenance costs. The result is shown below :

Systems	Discount Rate: 8 %			Discount Rate: 12 %		
	Const. Cost	O/M Costs	Total	Const. Cost	O/M Cost	Total
- Pre-treatment	48,475	5,105	53,580	45,959	3,164	49,123
- Transmission pipeline	31,883	7,058	38,941	30,383	4,375	34,758

As shown on the above table, it is clear that the raw water transmission system is more economical than the pre-treatment system of FBD method. Then, the raw water transmission system from the WTC at proposed Buaran Plant site to the existing Pejompongan treatment plant is proposed as the raw water improvement.

Fig.1 SAMPLING POINT FOR WATER QUALITY ANALYSIS OF WEST TARUM CANAL

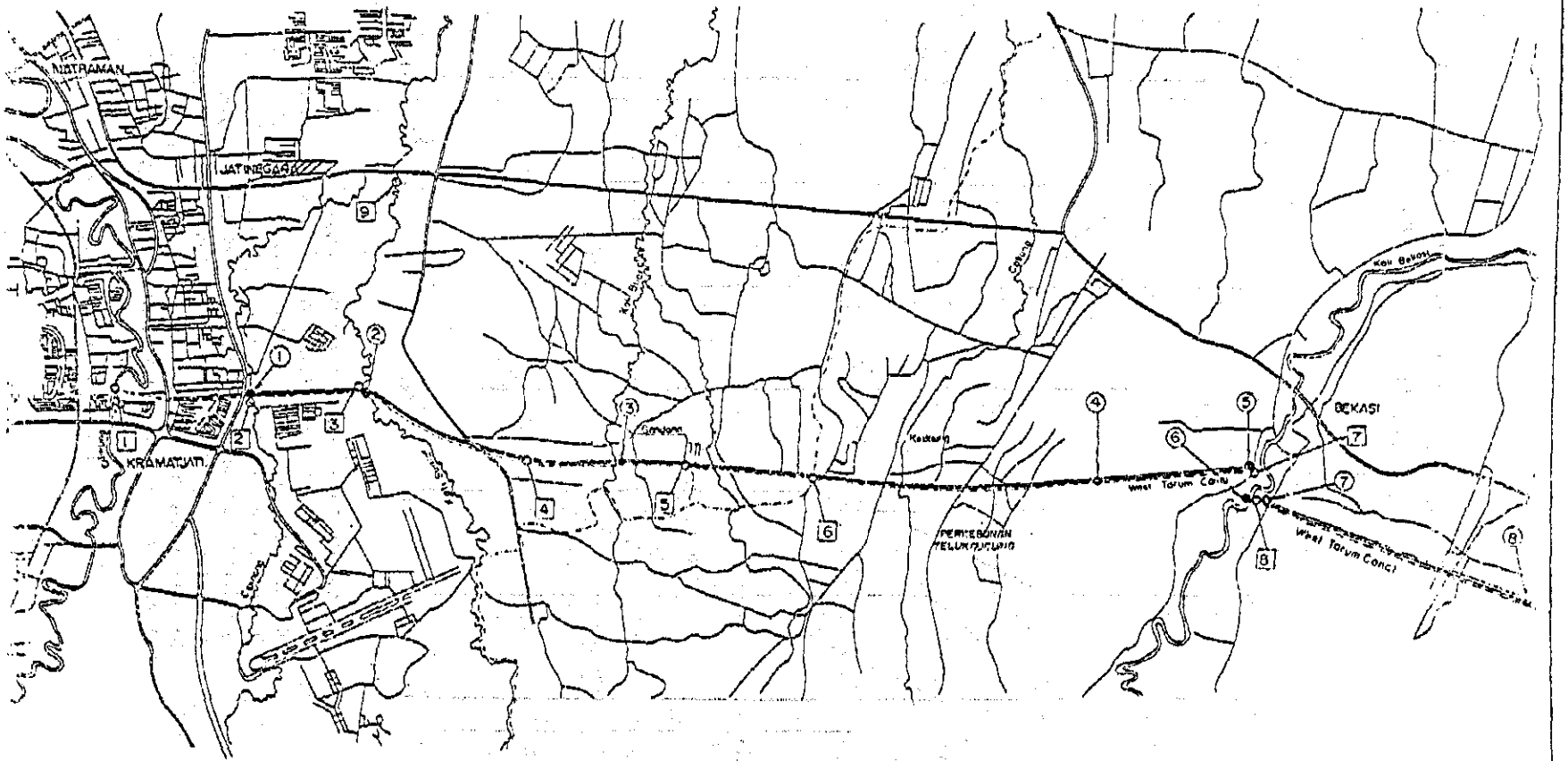


Fig.2 WATER QUALITY ALONG THE WEST TARUM CANAL

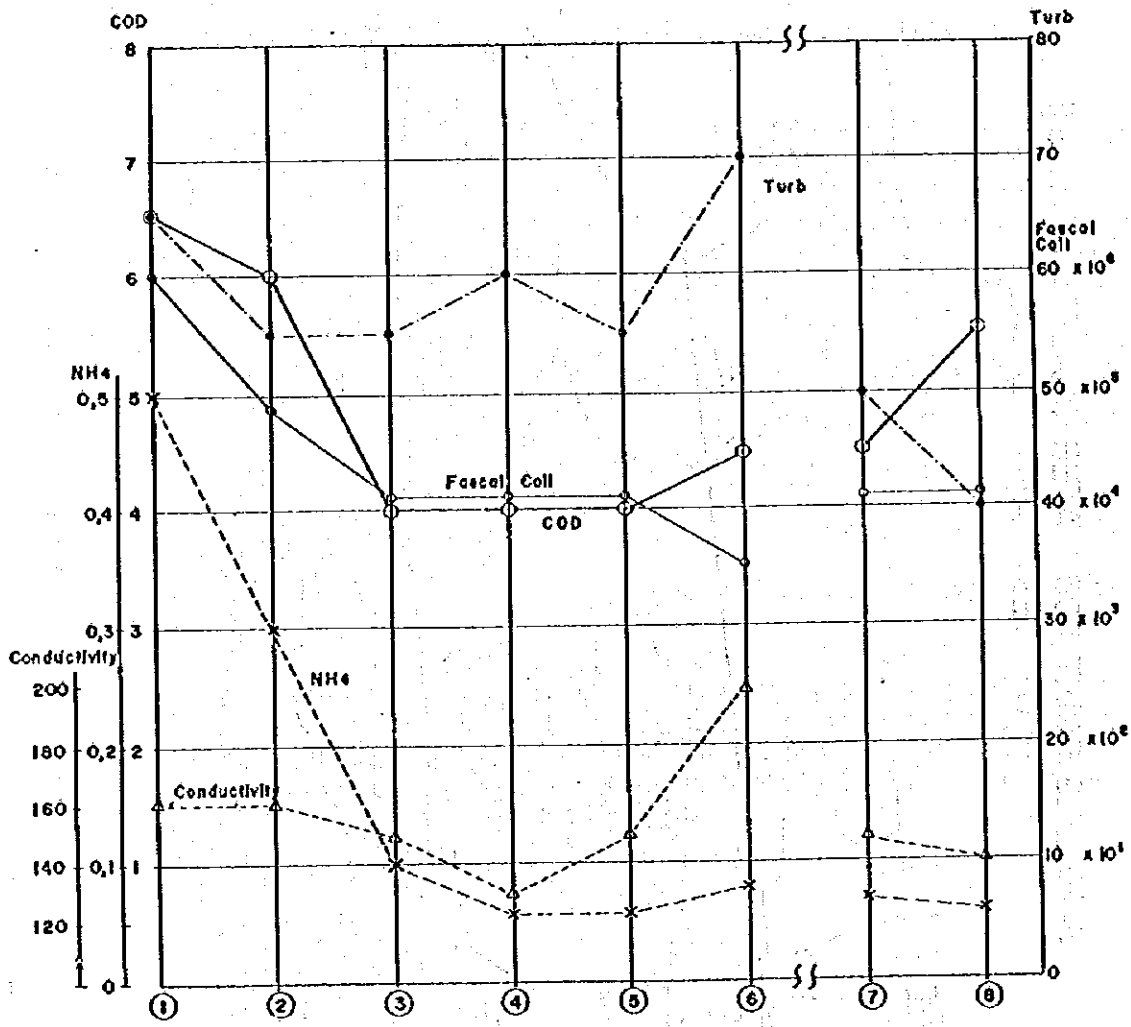
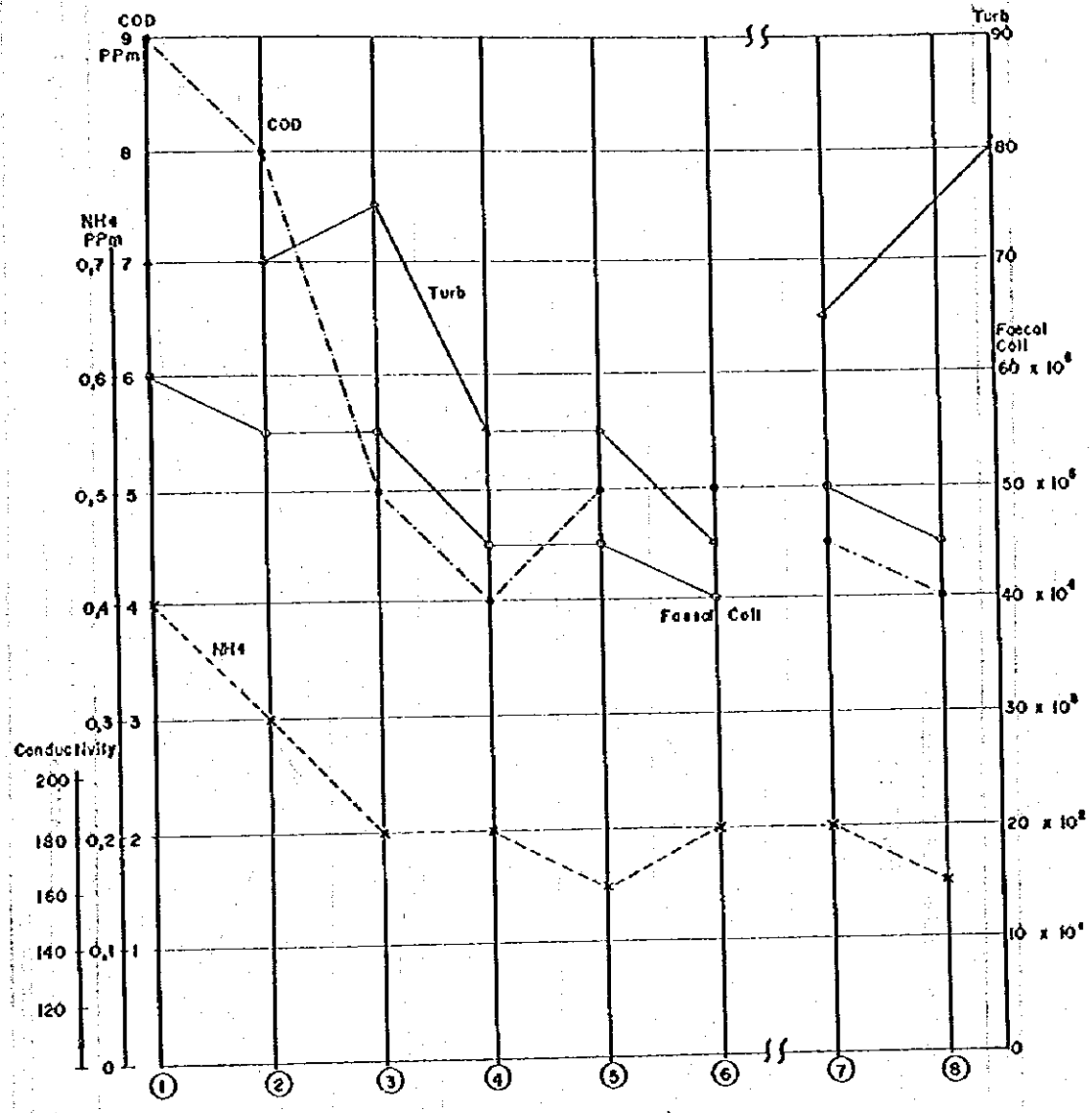


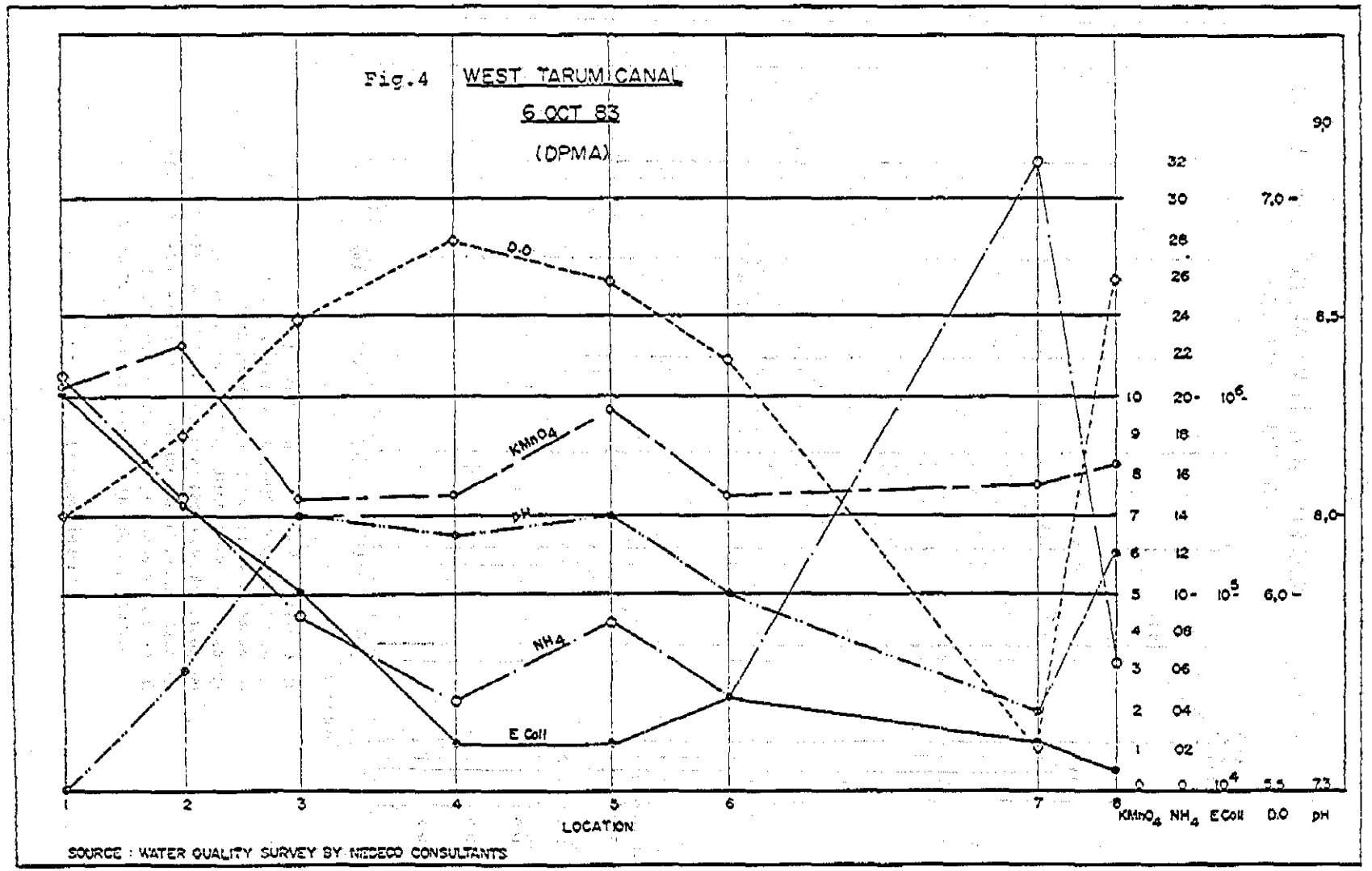
Fig.3 WATER QUALITY ALONG THE WEST TARUM CANAL



NOTE :

① CROSSING POINT WITH THE CIPINANG RIVER
② JUST BEFORE CROSSING POINT WITH THE SUNTER RIVER
③ CROSSING POINT WITH THE BUARAN RIVER
④ CROSSING POINT WITH THE CAPUNG RIVER
⑤ JUST AFTER CROSSING POINT WITH THE BEKASI RIVER
⑥ JUST BEFORE CROSSING POINT WITH THE BEKASI RIVER
⑦ BEKASI RIVER JUST BEFORE JOINT POINT
⑧ BEKASI RIVER 4Km UPSTREAM FROM JOINT POINT

SAMPLING : 25 AUGUST. 1983



SOURCE : WATER QUALITY SURVEY BY NEDECO CONSULTANTS

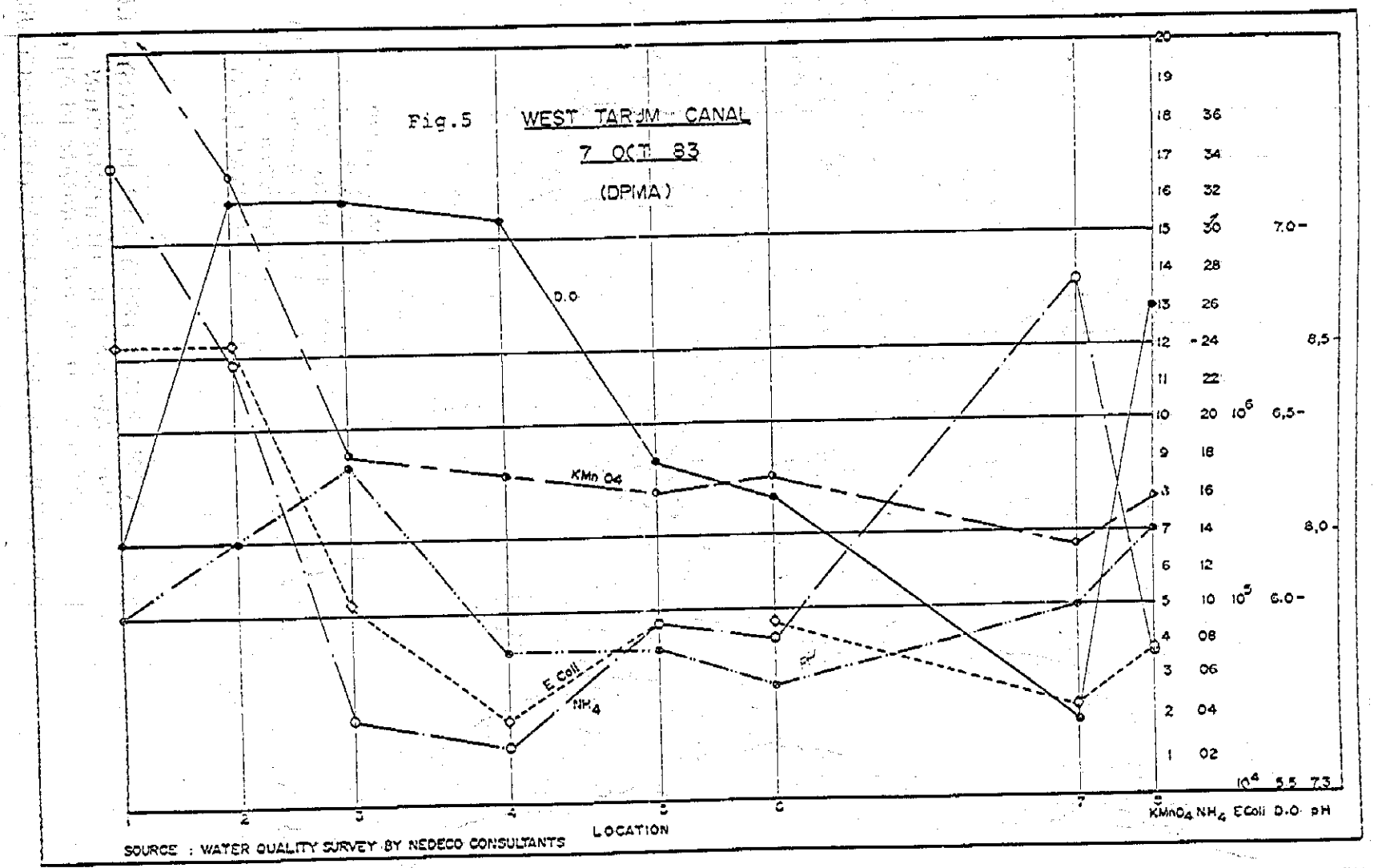


Fig.5 WEST TARUM CANAL
7 OCT 83
(DPMA)
D.O
KMn O4
E Coli
NH4
pH
LOCATION
KMnO4 NH4 EColi D.O pH
SOURCE : WATER QUALITY SURVEY BY NEDECO CONSULTANTS

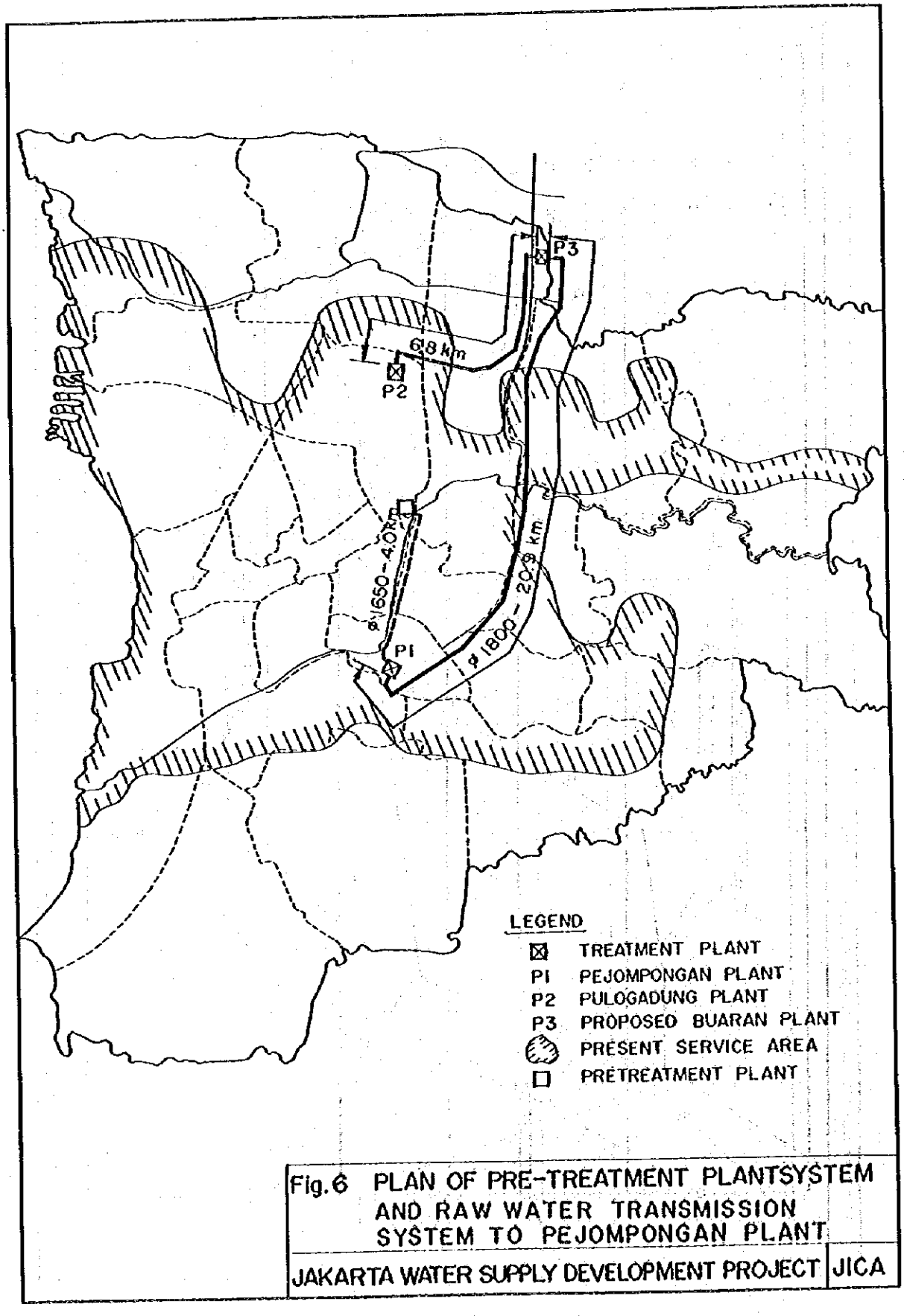


Fig.6 PLAN OF PRE-TREATMENT PLANTSYSTEM AND RAW WATER TRANSMISSION SYSTEM TO PEJOMPONGAN PLANT

JAKARTA WATER SUPPLY DEVELOPMENT PROJECT | JICA

Table 1 Water Quality Analysis of West Canal Water

Analyzed by Institute of Hydraulic Engineering (DPMA)

No.	PARAMETER	Unit	Result of Analysis 1		2		3		4		5		6		7		8		9	
			6 Oct 83	7 Oct 83	6 Oct 83	7 Oct 83	6 Oct 83	7 Oct 83	6 Oct 83	7 Oct 83	6 Oct 83	7 Oct 83	6 Oct 83	7 Oct 83	6 Oct 83	7 Oct 83	6 Oct 83	7 Oct 83	6 Oct 83	7 Oct 83
1.	Temperatur	°C	31	31	31	32	31	32	31.5	30	31	30	31.5	29	30	29	31	29	21	32
2.	Dissolved Oxygen	mg/l	6.2	6.2	6.4	7.2	6.7	7.2	6.9	7.1	6.8	6.4	6.6	6.3	5.9	5.7	6.8	6.8	6.0	6.0
3.	pH	-	7.5	7.8	7.6	8.0	8.0	8.2	7.95	7.7	8.0	7.7	7.8	7.6	7.5	7.8	7.8	8.0	8.1	7.9
4.	Conductivity	Umho/cm	190	199	190	305	184	195	188	200	189	197	190	198	191	198	185	199	173	182
5.	Turbidity	mg/l SiO2	24	24	26	24	23	21	21	24	21	21	22	20	23	23	20	20	21	21
6.	Colour	PtCo	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
7.	Organic matter KMnO4	mg/l KMnO4	10.2	21	11.4	16.7	7.4	9.3	7.6	8.7	9.7	8.2	7.5	8.6	7.8	6.6	8.3	7.8	8.3	9.1
8.	T.O.C	mg/l	4.2	5.8	4.6	5.3	3.3	4.1	4.6	4.2	4.1	5.1	4.2	4.5	5.8	5.7	4.2	6.3	4.7	4.1
9.	Amonia - N	mg/l	0.21	0.34	0.15	0.28	0.090	0.45	0.045	0.030	0.066	0.095	0.037	0.085	0.320	0.275	0.064	0.076	0.065	0.035
10.	Nitrate - N	mg/l	0.30	0.61	0.27	0.51	0.32	0.44	0.39	0.43	0.41	0.48	0.42	0.46	0.37	0.36	0.16	0.18	0.38	0.48
11.	Nitrite - N	mg/l	0.031	0.020	0.029	0.013	0.029	0.021	0.031	0.022	0.028	0.019	0.040	0.024	0.073	0.042	0.012	0.007	0.030	0.052
12.	f. Coli	MPN/100ml	$1.1x10^6$	$4.6x10^6$	$4.6x10^5$	$4.6x10^6$	$1.1x10^5$	$1.5x10^5$	$2.4x10^4$	$4.3x10^4$	$2.4x10^4$	$9.3x10^4$	$4.6x10^4$	$9.3x10^4$	$2.4x10^4$	$4.6x10^4$	$1.5x10^4$	$7.5x10^4$	$2.4x10^4$	$9.3x1$
13.	Total Coli	MPN/100ml	$1.1x10^6$	$4.6x10^5$	$4.6x10^6$	$4.6x10^6$	$1.1x10^5$	$1.5x10^5$	$2.4x10^4$	$4.3x10^4$	$2.4x10^4$	$9.3x10^4$	4.6^x10^4	$9.3x10^4$	$2.4x10^4$	$4.6x10^4$	$1.5x10^4$	$7.5x10^4$	$2.4x10^4$	$9.3x1$

Number location of sampling.

1. West Tarum Canal outlet to Ciliwung
2. West Tarum Canal inlet to Cipinang (BTB 53)
3. West Tarum Canal near Sunter river (BTB 51 a)
4. West Tarum Canal (BTB 49), middle of the Sunter and Buaran Rivers.
5. West Tarum Canal (BTB 48) , near the Buaran river
6. West Tarum Canal (BTB 47) , near DKI boundary
7. West Tarum Canal at silt trap
8. West Tarum Canal (BTB 45), out let to the Bekasi River
9. Sunter river at down stream

Source: Water Quality Survey by NEDECO Consultants

Table 2 Cost Estimates for Pre-treatment and Raw Water Transmission System

FBF Contact Oxidation System	Cost Rp. million US$ million	Raw Water Transmission System Items/ Description	Cost Rp. million US$ million
A. Civil and Architecture Works - Intake bay - Raw water pump well and house - Receiving well - Contact basins 10 m x 10 m x 180 basins - Air blower house 880 m2 - Pump well (1,800 m3) and Pump house (500 m2) - Yard piping and land scraping	37,814.0 38.6	A. Civil and Architecture Works - Intake bay - Pump well (3,700 m3) - Pump house (1,300 m2)	1,747.0 1.8
B. Mechanical and Electrical Facilities - Raw water pump, 6 sets (2-standby) 150 kW x 9.3 m3/min x 6 m - Blower system, 8 sets (2-standby) - Transmission pump, 9 sets (3-standby) 210 kW x 61.3 m3/min x 15 m - Electrical facilities including Sub-station, instrumentation and lighting	4,840.0 4.9	B. Mechanical Facilities - Raw water pump, 6 sets (2-standby) 850 kW x 93 m3/min x 41 m	1,372.0 1.4
C. -		C. Electrical Facilities - Power substation - Instrumentation - Lighting	1,274.0 1.3
D. - Transmission mains ø 1,650 x 4 km	3,729.0 3.8	D. Transmission mains ø 1,800 x 20.9 km	26,166.0 26.7
Sub-total	46,383.0 47.3	Sub-total	30,532.0 31.2
E. Contingency (Approx. 10 %)	4,637.0 4.7		3,058.0 3.1
Total cost	Rp. 51,020.0 million US$ 52.0 million	Total cost	Rp. 33,590.0 million US$ 34.3 million

Note : 1. Estimated cost is based on the costs of material and labor as of September 1983.

2. Conversion rate : US$ 1.0 = Rp. 980.-

Table 3 Operation and Maintenance Cost Estimates

Unit : Rp. 1,000

FBF Pre-treatment System

A.	Personnel cost (Chief 1 + 3 shifts x 5 staff) @ Rp. 50 x 12 months	Rp. 9,600
B.	Power cost (150 kW x 4 sets + 210 kW x 6 sets) x (1 + 0.15, Blower) x 24 hrs x 0.87* x 365 days x @ Rp.0.0265/kWH	Rp.432,900
C.	Maintenance cost Rp. 4,840 million x 2 %	Rp. 96,800
	Total	Rp.539,300.-

Raw Water Transmission System

A.	Personnel cost (Chief 1 + 3 shifts x 3 staff) @ Rp. 50 x 12 months	Rp. 6,000
B.	Power cost 850 kW x 4 sets x 24 hrs x 0.87 * x 365 days @ Rp. 0.0265/kWH	Rp.686,700
C.	Maintenance cost Rp. 2,646 million x 2 %	Rp. 52,900
	Total	Rp.745,600.-

Note : * Operation ratio for maximum production.

MASTER PLAN FOR
JAKARTA WATER SUPPLY DEVELOPMENT PROJECT

M6. APPENDIX MIII-5

FINANCE

FINANCE

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Table 1 Tariff

A. WATER CHARGES

CATEGORIES Year	1971	1973	1976	1980	1983
I. Non-Commercial Users					
a. Residential Users					
Up to 15 m3	10-15	15	25	40	40
16 - 30 m3	15	15	50	80	80
more than 30 m3	15	30	50	80	300
b. Offices					
Up to 30 m3	20	30	50	75	200
more than 30 m3	20	30	50	75	250
c. Guest Houses/ABRI	-	-	-	-	200
d. Schools, Educational Institutions	20	30	50	60	180
e. Lodging Houses, Social Bodies	-	-	-	-	200
f. Religious Institutions	20	10-30	10-25	25	50
g. Public Hospitals	20	25	40	60	200
II. Commercial Users					
1) Industrial Users					
Small	80	80	125	150	-
Large	80	80	215	250	-
a. Food and Beverage Factories	-	-	-	-	350
b. Chemicals, Medicals, Cosmetics	-	-	-	-	600
c. Storage, Other factories using water for production pueposes	-	-	-	-	500
2) Trade and Commerce					
a. Commercial Private, Government Pasar, Drug stores, Shops, Restaurants, Supermarkets	80	80	125	75-150	500
b. Small Scale Commercial Small Shops, Small Workshops, Small Shops with residence					
up to 15 m3	-	30	50	75	200
16 - 30 m3	-	30	10	150	500
more than 30 m3	-	60	100	150	500

CATEGORIES	1971	1973	1976	1980	1983
III. Services					
a. Hotels, Motels, Inns,	60	60	125	250	600
b. Steambath, Beauty Salon	60	60	125	250	600
c. Night Clubs, Casions, Discos	60	60	125	250	600
d. Barber Shops					
e. Tailor Shops					
f. Doctors with residence					
g. Lawyers, Notary Publics Accountants, Consultants					
up to 15 m3	-	-	-	-	200
more than 15 m3	-	-	-	-	500
h. Banks	-	-	-	-	500
i. Large Workshops	-	-	-	-	500
j. Private Hospitals	-	-	-	-	200
k. Private Clinics, Laboratories	-	-	-	-	250
IV Others					
a. Public Hydrants	25	30	60	60	125
b. Depok housing	-	-	-	35	50
c. Wind Mills, Orphanages	-	25	50	60	50
e. Inpres Market	-	-	-	-	100
f. Tank Lorries	-	-	-	-	300

B. METER MAINTENANCE CHARGES

(Unit: Rp/connection)

ø 1/2"	300
ø 3/4"	750
ø 1"	1,000
ø 1 1/2"	1,250
ø 2"	4,000
ø 3"	4,500
ø 4"	5,000
ø 6"	8,500
ø 8"	10,000
ø 10"	15,000
ø 12"	20,000
ø 16"	55,000

C. ADMINISTRATION CHARGES

(Unit: Rp/connection)

Ordinary	300
Special	3,000

D. CONNECTION CHARGES

(Unit: Rp./connection)

Land Property (m2)	Connection	Administration	Total
1 - 100	150,000	25,000	175,000
101 - 200	200,000	25,000	225,000
201 - 300	275,000	25,000	300,000
301 - 400	400,000	25,000	425,000
401 - 500	500,000	25,000	522,000
501 - 600	600,000	25,000	625,000

Note : Additional costs on piping materials and installation work are charged in case the distance from the tap on service pipes to the meter installed is more than 6 meters.

E. DEPOSITS

(Unit : Rp./connection)

Residential	Rp. 10,000
Industry, Commercial, Hydrant	Rp. 100,000
Small Industry	Rp. 15,000

Table 2 Government Guideline on Tariff

1. Classification of Users

Group I : Social

A. General Social
- Public Standpipes
- Public Bath Houses
- Public Toilets

B. Special Social
- Health Centers
- Government Clinics
- Government Hospitals
- Worship Places

Group II : Non-Commercial

A. Residential

B. Government Institutions
- Government Institutions
- Other Government Facilities
- Government Swimming Pools

Group III : Commercial

A. Small Commercial
- Shops
- Stores
- Small Restaurants
- Small Hotels
- Private Offices
- Private Hospitals/Clinics

B. Large Commercial
- Large Hotels, Restaurants
- Service Stations
- Entertainments

Group IV : Industries

A. Small Industries
- Home Industries
- Handicraft Industries

B. Large Industries
- Beverages
- Ice
- Fish

Group V: Special
- Sea Ports
- River Ports

2. Tariff Structure
(applicable to cities with the population of more than 500,000)

Group/ Classification	I		II		III		IV		V
Water Consumption	A	B	A	B	A	B	A	B	
0 - 15 m3	0.8 A	0.8 A	1 A	1.5 A	4 A	5A	4.5 A	6A	20 A
16 - 30 m3		1.5 A	2 A	2.5 A					
31 - 50 m3		2 A	3 A	4 A	8 A	10 A	9 A	12 A	
More than 50 m3		3 A	5 A	6 A					

Table 3 Income Statement (Unit: Rp. million)

Operating Revenues	Reported 1981/82	Reported 1982/83	Reported 1983/84	Revised 1983/84
Water Sales	8,600	9,310	20,937	20,937
Connection Charges	1,712	3,429	4,016	4,016
Others	437	983	338	338
Total Billings	10,749	13,722	25,291	25,291
Less: Bad Debt	-	-	-	2,994
Net Operating Revenues	10,749	13,722	25,291	22,297
Operating Expenses				
Personnel	1,946	2,105	2,618	2,618
Chemicals	886	1,920	2,055	2,055
Power	1,244	1,761	2,534	2,534
Raw Water	-	-	47	47
House Connection	-	-	-	1,606
Maintenance	1,217	1,466	1,216	1,216
Administration	507	709	1,423	1,423
Sales	1,253	620	830	830
Others	-	1,078	1,533	1,533
Total Operating Expenses	7,053	9,659	12,256	13,862
Operating Income before Depreciation	3,696	4,063	13,035	8,435
Less: Depreciation: Historic Cost	1,461	1,731	2,797	2,854
Revalued Cost	-	-	-	6,600
Income before Interest	2,235	2,332	10,238	1,835
Less: Interest	-	-	-	-
Less: Allowances for Bad Debts	-	-	5,631	-
Net Income	2,235	2,332	4,607	1,835
Average Net Plant: Historic Cost	15,849	18,076	19,552	33,949 1/
Revalued Cost	-	-	-	108,938 1/
Rate of Return: Historic Cost (%)	14.1	12.9	23.6	16.4
Revalued Cost (%)	-	-	-	1.7
Working Ratio (%)	65.6	70.4	48.4	62.2
Operating Ratio: Historic Cost (%)	79.2	83.0	60.0	75.0
Revalued Cost (%)	-	-	-	91.8

Note: 1/ Net plant at the end of the year

Table 4 Balance Sheet (Unit: Rp.-million)

	Reported			Revised
	1981/82	1982/83	1983/84	1983/84
Assets				
Fixed Assets: Historic Cost	15,290	28,859	32,546	46,404
Revalued Cost	-	-	-	159,413
Less: Accumulated Depreciation: Historic Cost	8,133	9,864	12,438	12,455
Revalued Cost	-	-	-	50,475
Net Fixed Assets in Operation: Historic Cost	17,157	18,995	20,108	33,949
Revalued Cost	-	-	-	108,938
Construction in Progress	-	-	-	28,051
Total Fixed Assets	17,157	18,995	20,108	136,989
Cash/Bank	2,389	1,923	4,446	4,446
Accounts Receivable	3,347	4,007	7,465	3,141
Other Receivables	1,623	436	2,039	2,039
Inventories	2,743	3,584	4,855	4,855
Total Current Assets	10,102	9,950	18,805	14,481
Total Assets	27,259	28,945	38,913	151,470
Liabilities				
Reserves	9,707	10,252	12,992	20,757
Revaluation Surplus	-	-	-	74,989
Central Government Equity	9,012	9,012	9,012	9,012
Local Government Equity	6,579	8,235	10,733	10,733
Total Equity	25,298	27,499	32,737	115,497
Long-term Borrowings	-	-	-	34,524
Allowances for Bad Debts	-	-	4,721	-
Accounts Payable	1,961	1,446	1,455	1,455
Total Debts	1,961	1,466	6,176	35,979
Total Liabilities	27,2598	28,945	38,913	151,470
Debt 1/ /Debt & Equity Ratio (%)	-	-	-	23.0

Note : 1/ Long-term debt only

Table 5 Funds Flow Statement

(Unit: Rp. million)

	Reported			Revised
	1981/82	1982/83	1983/84	1983/84
Source				
Income before Interest	2,235	2,332	10,238	1,835
Depreciation	1,461	1,731	2,797	6,600
International Cash Generation	3,696	4,063	13,035	18,435
Long-term Borrowings	-	-	-	15,003
Equity of Local Government	1,917	1,656	12,498	2,498
Increase in Accounts Payable	- 288	- 515	9	9
Total Sources	5,385	5,204	15,542	25,945
Applications				
Investment	4,079	3,568	3,687	18,804
Debt Service	-	-	-	-
Increase in Accounts Receivable 1/	77	- 527	5,061	3,347
Increase in Inventories	349	841	1,271 3/	1,271 3/
Constibution to DKI Budget 2/	1,977	1,788	- 3/	- 3/
Others/Unknown	26	-	3,000	-
Total Applications	6,508	5,670	13,019	23,422
Increase in Casb	1,123	- 466	2,523	2,523
Cash at Beginning	2,512	2,389	1,923	1,923
Cash at End	2,389	1,923	4,446	4,446

Notes: 1/ Increase in Other Receivables are included.
2/ Social Fund and Production Service are included.
3/ Figures are not yet confirmed.

Notes on Financial Statements

1. Data Source

Income Statement and Balance Sheet of 1981/82 and 1982/83 were obtained from the audit report of the public accountant. The source of 1983/84 statements is PDAM's internal report before the external audit. PDAM has not been preparing funds flow statements which precisely reconcile with the income statements and balance sheets and, therefore, they have not been audited. Funds Flow Statement listed here is the estimate based on Income Statement and Balance Sheet.

2. Revised Estimate of 1983/84

Revision of PDAM's 1983/84 report was made in order to present a clearer view on financial positions. Major modifications made were change in treatment of Bad Debts and related Accounts Receivable and revaluation of fixed assets.

Bad Debts were deducted directly from Operating Revenues instead of deducting them after calculating Income. This alternation was made in order not to show an optimistic view on Working and Operating Ratio.

Bad Debts cited in PDAM's internal report seems to be overstated. Allowances for Bad Debts in Balance Sheet shows the difference between Water Sales "accrued" and "collected" during the year, which naturally includes the bills "collectable in the following years." Furthermore, the difference between Allowances for Bad Debts of Income Statement and Balance Sheet is the amount of written-off Accounts Receivable which, in fact, includes the receivable of less than 5-year old. Considering these deficiencies in PDAM's treatment of bad debts, the figure estimated in section 3 of this Notes was used.

Accounts Receivable shows the size of "collectable" accounts receivable, which are assumed to be 15 percent of revenues accrued from Water Sales. Then, the accounts receivable which appear to be "uncollectable" were deleted from Balance Sheet. Accordingly, Increase in Accounts Receivable in Funds Flow Statement indicates the increases in "collectable" Accounts Receivable and Other Receivables.

PDAM's Investments in the past two years as well as the facilities being constructed under the management of the Ministry of Public Works were added to Total Fixed Assets as Construction in Progress.

The asset value of Pulogadung treatment plant (1,000 litters/sec. completed by the end of 1982/83) was not included in PDAM's report and, therefore, it was added to Fixed Assets. A counter entry of PDAM's debt obligation was made in Balance Sheet as Long-term Borrowings and additional Depreciation was provided, accordingly.

In depreciating fixed assets, PDAM has started from 1983/84 to use higher rates than those used previously. The new rates may be advantageous for saving tax payments; however, they seem to overstate Depreciation from the viewpoint of technical life of fixed assets. In this connection, the old, in other words, the lower rates were used for the revised estimate.

In addition, Fixed Assets was revalued with the procedures detailed in section 4. of this Notes. The results were indicated as Revalued Cost in the rows of Fixed Assets, Accumulated Depreciation, Net Fixed Assets in Operation in Balance Sheet and Depreciation in Income Statement. The difference between Revalued Cost and Historic Cost of Net Fixed Assets in Operation was credited in Balance Sheet as Revaluation Surplus.

Reserves here was calculated as a balancing item. Items other than those noted above were employed directly from PDAM's report.

3. Bad Debts

The difference between the revenues accrued from water sales and the revenues actually received, i.e., the water revenues-not received, have amounted to about 9 to 23 percent of the revenues accrued. These differences have contributed to build up a fairly large amount of accounts receivable, which was about 42 percent of the annual billings or about 5-month worth of monthly billings in 1982/83.

Table 6 shows that, while Bogor, Cempaka Putih, and Commercial Meter have small accounts receivable of less than one month worth of the annual billings, the receivables of Jakarta Central, North, East, South, West, Kincir Angin, and ABRI exceed 5-month worth. It is likely that a certain portion of these large accounts receivable is uncollectable and, therefore, should be deleted as bad debts from PDAM's book.

It is stated by PDAM's staff that in principle the accounts receivable which have outstood for more than five years are written off as bad debs. It appears that this principle has not been strictly enforced. Table 6 shows that 9 percent of the accounts receivable at the end of 1982/83 was more than five-year old. Then, in 1983/84, Rp. 910 million receivables, clearly including the receivables of less than five-year old, were deleted from the list. In fact, the amount of written-off accounts receivable in the past four years fluctuated largely in the range of 3 percent to 10.2 percent, averaging 4.3 percent. These facts may suggest that each year's write-off amount has been determined somewhat arbitrary and, therefore, has not reflected the true rate of bad debts.

Accordingly, for the purpose of grasping the present financial position, the rate of bad debts was estimated in the following manner:

Theoretically, Water Sales-Not Collected (Row 3 of Table 7), the difference between Water Sales-Billed (Row 1) and Water Sales-Collected (Row 2), can be divided into two components; one is the increase in Collectable Accounts Receivable (Row 8) and the other is Uncollectable Accounts Receivable (Row 9). As the first step, the former was estimated assuming that 15 percent of annual billings remains as "collectable" accounts receivable at the end of the year and is carried forward to the next year. Then, by deducting them from Water Sales-Not Collected, Uncollectable Accounts Receivable was derived. Finally, dividing by each year's billings, the rate of bad debts was obtained.

The results was 11.0 percent on the average in the past four years.

4. Revaluation of Fixed Assets

Revaluation of fixed assets was made applying different methods to: i) Lands; ii) Pipes installed before 1970; iii) Other Fixed Assets.

i) Lands

Unit prices of lands as of 1979 of the Pejompongan, Pulogadung, and Cilandak treatment plants, which constitute a fairly large portion of PDAM's total land, were obtained from DKI Jakarta (Sub. Dit. Pengelolaan, Direktorat Bangunan). These prices were escalated to the 1983 price level using GDP deflator and, then, multiplied by the areas. It was difficult to obtain data for other lands since most of them are fragmentary and scattered about within and outside the city. Accordingly, although somewhat arbitrary, a uniform rate of Rp. 5,000/m2 was assumed.

ii) Pipes before 1970

According to PDAM's information, the value of pipes installed before 1970 is not included in the balance sheet. Their current value inclusive of materials and installation costs was estimated applying the unit prices used in the cost estimate of Master Plan to pipe lengths of each diameter. Then, accumulated depreciation was calculated assuming 28 years use for those installed in the 1950s and 18 years for the 1960s. These values are indicated in Table 8 under the label of Revalued Cost. Those noted as Historic Cost are the estimates, not actual, based on the Revalued Cost. It should be noted that there still remain pipes of the 1920s; however, they are not included in the above revaluation procedures since they are expected to be retired within a few years.

iii) Other Fixed Assets.

Sum of procurement value of fixed assets is recorded in PDAM's book. Yet, data on their acquisition date are not available. Under these circumstances, an average life of the fixed assets (weighted by book values) was estimated by dividing the accumulated depreciation by yearly depreciation. Then, price escallation factors for the period of the average life were computed using DGP deflator. Finally, Procurement Value, Accumulated Depreciation, and Book Balue on Historic Cost basis were multiplied by them.

The revaluation process of i) through iii) above yielded around 4.5 times increase of PDAM's fixed assets compared with the value recorded in the PDAM's balance sheet of 1983/84.

Table 6 Age Structure and Area-wise Accounts Receivable

	Accounts Receivable (Rp. million)	% Share	Accounts Receivable/Annual Billinbs %	months
1. Total Receivables from Water Sales at the end of 1982/83	4,007	100.0	42.3	5.1
2. Breaksown by Years				
1975/76	258.6	6.5	2.7	0.3
1976/77	75.3	1.9	0.8	0.1
1977/78	23.5	0.6	0.2	0.1
1978/79	46.7	1.2	0.5	0.1
1979/80	506.2	12.6	5.3	0.6
1980/81	422.8	10.6	4.5	0.5
1981/82	1,232.4	30.8	13.0	1.6
1982/83	1.442.0	36.0	15.2	1.8
3. Breakdown by Branches/Units				
Jakarta Central	1,222.8	30.5	75.7	9.1
" North	94.4	2.4	42.9	5.1
" East	277.1	6.9	70.0	8.4
" South	318.5	7.9	50.4	6.1
" West	1,076.6	26.9	116.3	14.0
Bogor	10.0	0.2	8.1	0.1
Pluit Ancol	43.7	1.1	30.3	3.6
Kuningan	76.2	1.9	16.4	2.0
Cempaka Putih	17.0	0.4	5.7	0.7
Commercial Meter	145.8	3.6	4.2	0.1
Hydrant	76.8	1.9	25.7	3.1
Kincir Angin	6.4	0.2	444.4	53.3
Klender	28.5	0.7	23.8	2.9
ABRI	613.6	15.3	74.6	9.0

Table 7 Accounts Receivable and Bad Debts

(Unit : Rp. million)

Year	1979/80	1980/81	1981/82	1982/83	1983/84	Average 1980/81 - 83/84
1. Water Sales - Billed	4,674	8,291	8,601	9,492	20,937	11,830
2. Water Sales - Collected		7,163	7,695	8,578	16,216	9,913
3. Water Sales - Not Collected (1 - 2)		1,128	906	914	4,721	1,917
4. 3/1 (%)		13.6	10.5	9.6	22.5	16.2
5. Written-of Accounts Receivable		847	27	245	910	507
6. 5/1 (%)		10.2	.3	2.6	4.3	4.3
7. Collectable Accounts Receivable (15 % of 1)	697	1,244	1,290	1,424	3,141	1,775
8. Annual Increase of 7		547	46	134	1,717	611
9. Uncollectable Accounts Receivable (3 - 8)		581	860	780	3,004	1,306
10. Uncollectable Water Sales (9/1)		6.3	9.9	8.1	14.3	11.0

Table 8 Revaluation of Fixed Assets

(Unit: Rp. million)

	(1) Procurement Value: Historic Cost	(2) Procurement Value: Revalued Cost	(3) Accumulated Depreciation: Historic Cost	(4) Accumulated Depreciation: Revalued Cost	(5) Book Value: Historic Cost	(6) Book Value: Revalued Cost	(7) Yearly Depreciation (percent)	(8) Average Life (years)	(9) Price Escalation (times)
Lands	846	33,225	-	-	846	32,225	-	-	-
Buildings, Structures, Mini-plants, etc.	6,550	13,559	755	1,567	5,795	11,992	2.5	4.6	2.07
Treatment Plants	11,619	37,878	6,542	21,327	5,077	16,551	7.0	8.0	3.26
Pipes after 1970	8,350	20,291	1,165	2,831	7,185	17,460	2.5	5.6	2.43
before 1970	16	29,555	7	18,022	9	11,533	2.5	22.3	1,281.56
Total pipes	8,366	49,846	1,172	20,853	7,194	28,993	2.5	-	17.79
Technical/Office Equipment, Deep Wells, Hydrants, etc.	3,308	6,120	1,394	2,579	1,914	3,541	10.0	4.2	1.85
Meters, Vehicles, etc.	1,873	3,559	1,623	3,084	250	475	20.0	4.3	1.90
Total	32,562	144,187	11,486	49,410	21,076	94,777	-	-	-

Table 9 Current Value of Lands

	(1) Area	(2) Unit Price in 1979	(3) Price Escalation between 1979 - 83	(4) Unit Price in 1983	(5) Current Value of Lands
Pejompongan	110,529 m2	Rp. 130,000/m2	1.741	Rp. 226,330/m2	Rp. 25,106 million
Pulogadung	108,965 m2	Rp. 22,500/m2	1.741	Rp. 39,173/m2	Rp. 4,268 "
Cilandak	90,600 m2	Rp. 12,500/m2	1.741	Rp. 21,763/m2	Rp. 1,972 "
Others	393,722 m2	-	-	Rp. 5,000/m2	Rp. 1,969 "
Total	703,806 m2	-	-	-	Rp. 33,225 "

Source of land price : DKI Jakarta (Survey of SUB. DIT. PENGELOLAAN, DIREKTORAT TATA BANGUNAN; COMPILED IN 1981)

Table 10 Current Value of Pipes

(Unit: Rp. million)

Year installed	Diameter	ø 1,250	ø 900	ø 800	ø 600	ø 400	ø 350	ø 300	ø 250-ø 50	Total
1950 s	Procurement Value	134 (0.2)	3,241 (8.0)	800 (2.3)	4,272 (17.4)	1,730 (12.1)	297 (2.4)	406 (3.8)	8,012 (429.0)	18,892 (475.2)
	Accumulated Depreciation (28 years)	94	2,269	560	2,990	1,211	208	284	5,608	13,224
	Book Value	40	972	240	1,282	519	89	122	2,404	5,668
1960 s	Procurement Value								10,663 (579.3)	10,663 (579.3)
	Accumulated Depreciation (18 years)								4,798	4,798
	Book Value								5,865	5,865
Total :	Procurement Value	134	3,241	800	4,272	1,730	297	406	18,675	29,555
	Accumulated Depreciation	94	2,269	560	2,990	1,211	208	284	10,406	18,022
	Book Value	40	972	240	1,282	519	89	122	8,269	11,533

Note : Figures in parentheses indicate length of pipes (km).

Table 11 Repayment Schedule

(Unit : Rp. million)

		Principal	Interest Rate	1984/85	85/86	86/87	87/88	88/89	89/90	90/91	91/92	92/93	93/94	94/95	95/96
1. Loan															
. 1st Phase/1st Stage															
	Interest		9 %	576	1,141	1,126	1,109	1,080	1,059	1,036	1,011	983	953	920	884
	Amortization	12,802		79	170	185	202	231	252	275	300	328	358	391	427
	Total			655	1,311	1,311	1,311	1,311	1,311	1,311	1,311	1,311	1,311	1,311	1,311
. 2nd Phase/1st Stage															
IP 226	Interest		9 %			1,034	991	947	904	860	817	773	921	686	642
	Amortization	11,615				484	484	484	484	484	484	484	484	484	484
	Total					1,518	1,475	1,431	1,388	1,344	1,301	1,257	1,205	1,170	1,126
Ip 238	Interest		9 %				1,187	1,137	1,087	1,037	987	938	888	838	788
	Amortization	13,328					555	555	555	555	555	555	555	555	555
	Total						1,742	1,692	1,642	1,592	1,542	1,493	1,443	1,393	1,343
IP 245	Interest		9 %					2,219	2,126	2,033	1,939	1,846	1,752	1,659	1,565
	Amortization	24,926						1,039	1,039	1,039	1,039	1,039	1,039	1,039	1,039
	Total							3,258	3,165	3,072	2,978	2,885	2,791	2,698	2,604
. Immediate *															
	Interest		11 %							4,174	4,000	3,826	3,652	3,478	3,305
	Amortization	37,944								1,581	1,581	1,581	1,581	1,581	1,581
	Total									5,755	5,581	5,407	5,233	5,059	4,885
2. PMP/Equity															
. 1st Phase/1st Stage *			0 %												
	Amortization	9,279							640	640	640	640	640	640	640
. 2nd Phase/1st Stage			0 %												
	Amortization	34,452							2,376	2,376	2,376	2,376	2,376	2,376	2,376
3. Total															
	Interest			576	1,141	2,160	3,287	5,383	5,176	9,140	8,754	8,366	7,966	7,581	7,183
	Amortization	144,346		79	170	669	1,241	2,309	5,346	6,950	6,975	7,003	7,033	7,066	7,102
	Total			655	1,311	2,829	4,528	7,692	10,522	16,090	15,729	15,369	14,999	14,647	14,283

Note : Repayment schedule for the asterisked projects has not been finalized yet.

MASTER PLAN FOR
JAKARTA WATER SUPPLY DEVELOPMENT PROJECT

M7. APPENDIX MIV-1

WATER DEMAND

PREFACE

The water demand study for Jakarta Water Supply Development Project was carried out from July 1983 to November 1983 initially and results of the study was presented in the Interim Report of Master Plan prepared in December 1983. Further reassessment of water demand was made in response to the requirement presented in DOCUMENT "A" attached to a LIST OF MATERIALS TO RECEIVE THE ATTENTION OF JICA prepared and issued by DSE in January 1984 and submitted in February 1984 to DSE.

Contents of the study results of the above are attached to present appendix for reference as follows:

I. WATER DEMAND STUDY
(Extracted from Section 6 in the Interim Report of Master Plan, prepared in December 1983)

II. REASSESSMENT OF WATER DEMAND
(prepared in February 1984)

Water Demand for the Master Plan and Feasibility Study was finalized based on the above studies compiling the substances of the studies agreed upon.

I. WATER DEMAND STUDY

(Extracted from Section 6 in Interim Report of Master Plan prepared in December 1983)

WATER DEMAND STUDY

(Extracted from Section 6 in Interim Report
of Master Plan prepared in December 1983)

Table of Contents

6. Master Plan up to the Year 2005

This chapter describes the water supply master plan up to the year 2005 conceived based on the results of studies described in the foregoing chapters.

The master plan will be presented in the following manner : 1) to define the service area, 2) to forecast population served and water requirement, 3) to select water sources, 4) to determine treatment processes based on raw water quality of the selected water resources, 5) on these basic factors clarified, to propose the water supply system to be constructed, 6) to estimate construction costs, and then 7) to prepare an overall implementation schedule. Staging of the whole construction will be clarified in the implementation schedule, and also the relationship between the water requirement and the capacity of the water supply system will be made clear in the schedule.

6.1 Service Area and Population Served.

6.1.1 Service Area

The Areas to be served by future water Supply system are determined, as deseribed below taking into account following information and data, and by the field investigation conducted by the Study Team.

(1) City Plan and Land Use Plan ::

DKI Jakarta has been developing City Master Plan covering from year 1980 to 2005. The Master Plan has prepared a general land use plan for year 2005 which covers the city administrative area. While this land use plan is not officially approved yet by City Planning Board, this is considered to provide a basic guideline in indentifying direction of development, which would give general concept in considering future service area.

(2) Population Density :

Population density, present and future, is also to be considered as one of the factors in determining boundary of service area for most feasible system extension. The densely populated area will pollute groundwater quality, so that the people using groundwater and living in the densely populated area will gradually rely on piped water.

For the above purpose, and reason, population density of such areas to be considered is proposed basically above 150 persons per hectare for the planning purpose.

(3) Highway and Public Road Plan :

Highway and public road construction plans provided in the Master Plan has been refered and consideredin planning the service area, as this would reveal information on future extension of city activities such as housing and commercial establishment development due to acessibility of better transportation.

Based on the Jakarta City Master Plan, Land Use Plan in future, and highway and public road plans, together with consideration on the population density in the city area, projected by DKI city planning team, future service area up to the year 2005 is proposed as shown on Figure 6.1

Projected Service area in each year are as follows :

Table 6.1 Service Area

	Year	Service Area (km2)	Percentage (2)
(1)	1980	283	44 %
	1985	283	44 %
	1990	338	53 %
	1995	383	59 %
	2000	414	64 %
	2005	454	71 %

Note : 1. Present service area as of June 1983, is applied for service area in the year 1980 and also in the year 1985.

2. Percentage to Total Administrative Area of 644 km2.

6.1.2 Population in the Service Area

Based on the population distributed to the areas, Kotamadja/Kecamatan in the DKI boundaries as shown on Fig 6.1 , population in the service area up to the year 2005 by five years intervals is projected as follows :

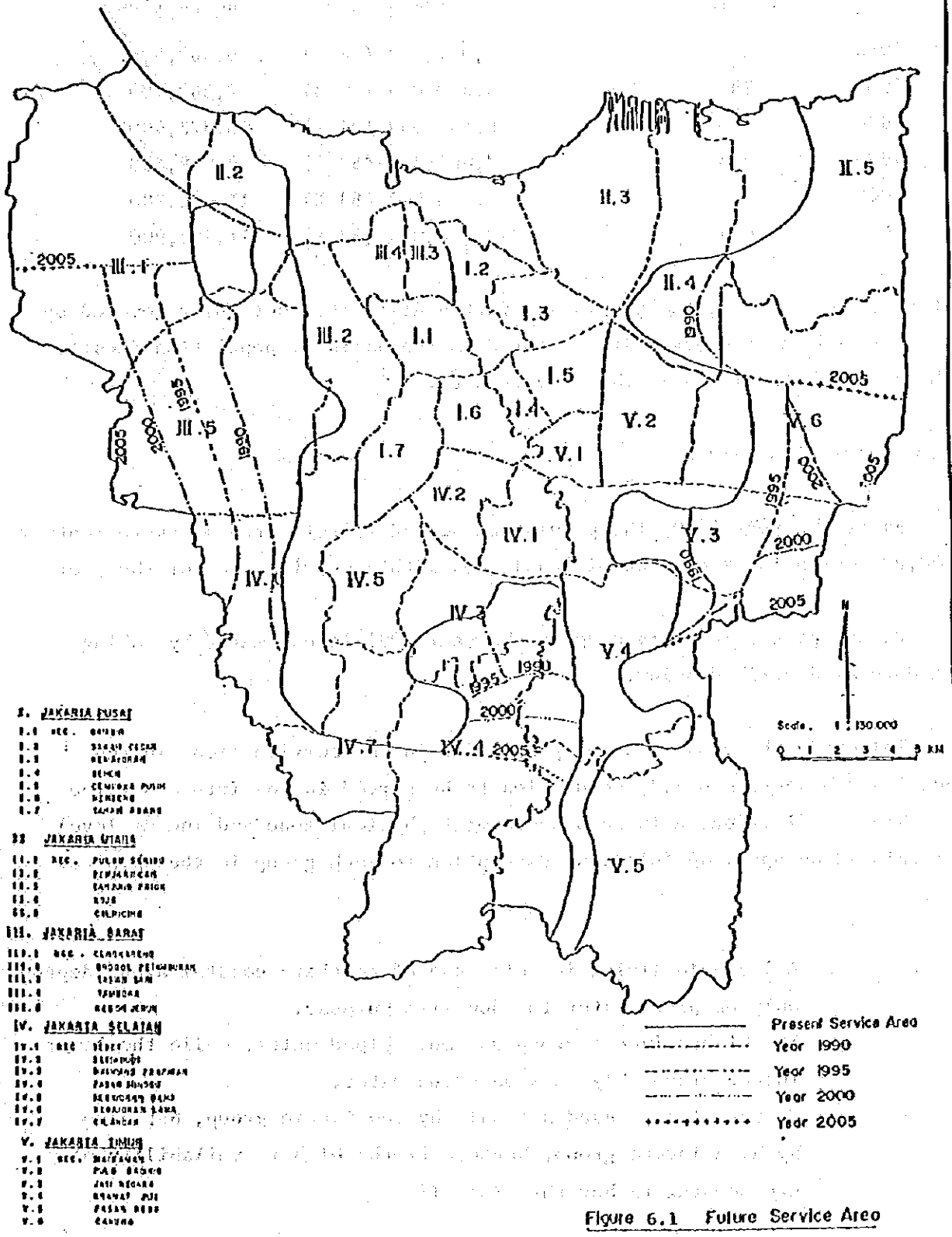

Figure 6.1 Future Service Area

Table 6.2 Population in Service Area

Year	Service Area (km2)	Pop. In Service Area	Pop. In DKI boundaries
1980	283	4,957,000 (76 %)	6,468,500
1985	283	5,380,000 (70 %)	7,360,100
1990	338	6,545,000 (74 %)	8,872,900
1995	383	8,006,000 (80 %)	9,949,600
2000	414	9,093,000 (83 %)	11,004,900
2005	454	10,496,000 (87 %)	11,998,900

In the above estimate, the population in the districts, not fully covered by the projected service area, is estimated on the basis of population density with area to be included in the service area.

6.1.3 Population Served.

As of the year 1980, the population served is estimated at approximately 2,100,000 which is 42 percent of population within service area of the year.

Future population served up to the year 2005 is estimated by taking procedure as described below.

Following the projection of population in the service area, in the preceding sub-section 6.1.2, population to be served in the future service area which is distributed in accordance with physical zone and income level is developed by applying following assumption to each group in the physical zone.

Zone I : All people living in this zone of northern coastal area, depand only on piped water for domestic purpose.

Zone II : The higher income group use more piped water, while the lower income group rely more on groundwater.

Zone III : Groundwater is used not only by low income group, but also by high income group, because of the higher availability of groundwater rather than Zone II.

The Study on physical zone and study on income levels and this distibution are described in detail in section 3 Socioeconomic Aspects seperately prepared to this portion, which are described based on the study and projection made by

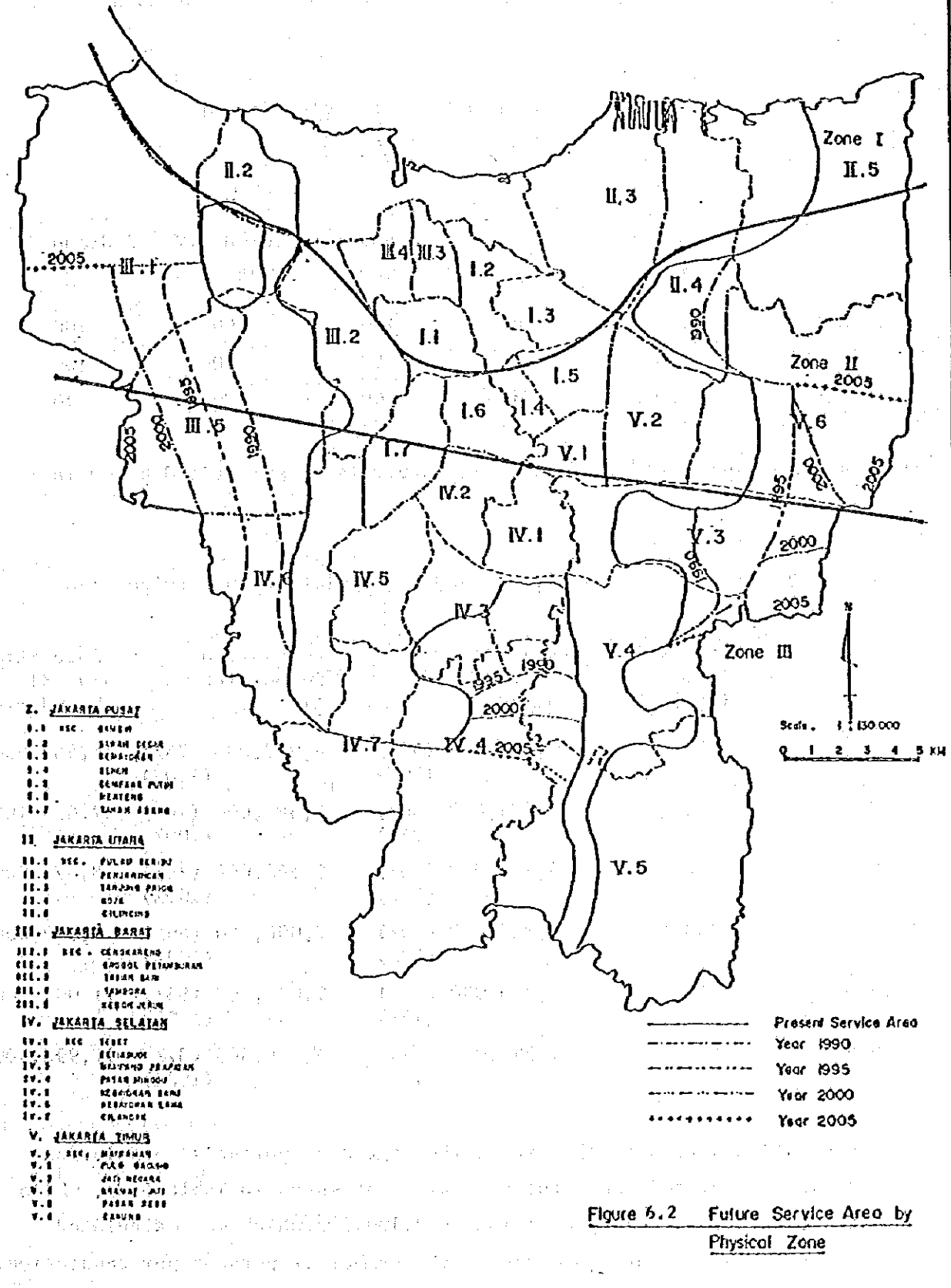

Figure 6.2 Future Service Area by Physical Zone

Jabotabek Advisory Team Service (JATS) and DKI Jakarta study team. Percentages applied for projection of population served to the population, distributed to physical zone and further income group, in the service area are proposed, considering the availability of groundwater in the physical zone as shown in Table 6.3

Table 6.3 Percentage Applied For Projection of Population Served

	Income Group I %	Income Group II %	Income Group III %	Income Group IV %	Income Group V %
Zone I	100	100	100	100	100
Zone II	40	50	80	90	100
Zone III	30	40	60	80	90

Population served projected by five-years intervals is summarized below in Table 6.4

Table 6.4 Population Served VS Population in Service Area

Year	Service Area (km2)	Population Served	Population in Service Area	Population in DKI boundaries
1980	283	* 3,462,000 (54%) (70%)	4,957,000 (76%) (100%)	6,468,500
1985	283	3,871,000 (50%) (71%)	5,380,000 (70%) (100%)	7,630,100
1990	338	4,736,000 (53%) (72%)	6,545,000 (74%) (100%)	8,872,000
1995	383	5,843,000 (59%) (73%)	8,006,000 (80%) (100%)	9,949,600
2000	414	6,785,000 (62%) (75%)	9,093,000 (83%) (100%)	11,004,900
2005	454	7,997,000 (67%) (76%)	10,496,000 (87%) (100%)	11,998,900

* Population served in 1980 shows the figure of potential population served calculated under the assumption as shown in Table 6.3 , while the estimated served population is 2,100,000,which was calculated using the number of connections, the number of persons per connection, and per capita consumption. It is considered reasonable to assume