REPUBLIC OF INDONESIA
MINISTRY OF PUBLIC WORKS (DPU)
DIRECTORATE GENERAL OF HOUSING, BUILDING,
PLANNING AND URBAN DEVELOPMENT (CIPTA KARYA)

JAKARTA WATER SUPPLY DEVELOPMENT PROJECT

VOLUME I

EXECUTIVE SUMMARY

MARCH 1985

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

In response to the request of the Government of the Republic of Indonesia, the Japanese Government decided to conduct a survey on the Jakarta Water Supply Development Project and entrusted the survey to the Japan International Cooperation Agency(JICA). JICA sent to Indonesia a survey team headed by Mr. Fujio Ooyama, Nihon Suido Consultants Co., Ltd. from 20th June 1983 to 20th March 1984 and from 18th June 1984 to 31st August 1984. The team conducted the survey under the Guidance of the Work Committee Chaired by Mr. Kazumo Matsuo, former Chief of the Kanamachi Purification Administration Office, Bureau of Water Works, Tokyo Metropolitan Government.

The team exchanged views on the project with the officials concerned of the Government of Indonesia and conducted a field survey in the Jobotabek Metropolitan area and the City of Jakarta. After the team returned to Japan, further studies were made and the present report has been prepared.

I hope that this report will serve for the development of the Project and contribute to the promotion of frendly relations between our two countries.

I wish to express my deep appreciation to the officials concerned of the Government of Indonesia for their close cooperation extended to the team.

March, 1985

Keisuke Arita

Keisuke Arita
President
Japan International Cooperation Agency

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ABBREVIATION

millimeter	mm	kilogram per square centimeter	kg/cm^2
centimeter	cm		
meter	m		
kilometer	km	centimeters per second	cm/sec
		meter per second	m/sec
square centimeter	cm^2		
square meter	m^2	cubic meters per second	m^3/sec
square kilometer	km^2	cubic meters per minute	m^3/min
hectare	ha	cubic meters per day	m^3/d
		liter per capita per day	lpcd
cubic millimeter	mm^3		
cubic centimeter	cm^3	volt	V
cubic meter	m^3	kilovolt	kV
		kilowatt	kW
milliliter	ml	revolutions per minute	rpm
liter	l		
		ampere	A
milligram	mg	kilovolt-ampere	kVA
gram	g	direct current	DC
kilogram	kg	altering current	AC
metric ton	t		

ORGANIZATION

DPU	Ministry of Public Works
PLN	Ministry of Electric Power
Cipta Karya (DGCK)	Directorate General of Housing, Building Planning and Urban Development
DWS	Directorate of Water Supply
DGWRD	Directorate General of Water Resources Development
POJ	Jatiluhur Authority
DPMA	Institute of Hydraulic Engineering
DEG	Directorate of Environmental Geology
DKI Jakarta	Jakarta Municipality
PDAM Jaya	Jakarta Water Supply Enterprise
JATS	Jabotabek Advisory Team Services
JICA	Japan International Cooperation Agency
OECF	Overseas Economic Cooperation Fund, Japan

OTHERS

JMDP	Jabotabek Metropolitan Development Project
CJC Master Plan	Cisadane-Jakarta-Cibeet Water Resources Development Study
WTC	West Tarum Canal
TJC	Tarum Jaya Canal

CURRENCY EQUIVALENT

U.S.$1.0 = Rp 1,004 = Yen 224

(As of March, 1984)

EXECUTIVE SUMMARY

I. BACKGROUND OF THE PROJECT

The City of Jakarta is one of the biggest and most rapidly developing capital cities in South-East Asia, having a total population of 7 millions. Though the population has grown large, the presently served population accounts for no more than 30 % of the total population. The existing water supply system covers barely 44 % of the Metropolitan area. Besides, the future growth of population is anticipated to be very fast and exceed 10 millions around 1996.

On the other hand, the current supply conditions are far from satisfactory, not denying that the worst conditions in the past have been generally overcome by the ongoing First Stage Project, i.e., the construction of the Pulogadung Plant and its associated distribution pipelines. In the northern district of the City, water pressure is still so low that sometimes water is not available from the public mains. Newly developed areas on the periphery of the City, especially the western district which is under a rapid development as housing areas and a commercial center, have no water mains installed as yet.

As regards the existing pipelines, a vast portion thereof are already obsolete, because of elapse of half a century since their installation. Leakage from those pipelines is tremendous, reaching almost half of the production. In addition, consumers' meters are not necessarily properly maintained. Loss of water, or revenue of water sales, owing to this is also considered very significant.

To rectify the above situation and to cope with the anticipated future water demand, the present study has prepared a comprehensive Master Plan and carried out a Feasibility Study of the project required immediately to implement.

II. LONG TERM PLAN UP TO THE YEAR 2005

Outline of Long Term Plan

The long term plan proposes that by 2005, 8.8 million people as estimated, or 73 % of total population of the City, will be served with piped water, comprising 66 % of middle and high income groups through house connections and 34 % of low income group through public standpipes. Most of the remainder will obtain their water from groundwater. The water distribution network will be expanded to 454 km2, or 70 % of its present administrative area. The capacity of productions will increase from present 6.8 m3/sec to 10.8 m3/sec in 1988 after completion of the First Stage Project, and to 36.3 m3/sec by the end of Third Stage. Total requirements by 2005 is shown on Table 1.

Salient technical features of the long term plan are that 1) putting a greatest emphasis on reliability and continuity of water supply even in emergency, a new water source on the west side of the City is proposed in addition to the east side water source hitherto used, and 2) another emphasis is placed on fullest use of the existing capacity of the treatment plants, in parallel with extension works, so as to rectify the inefficient use of the already laid-out capital and developed water sources. For the new source, the Cisadane River will be tapped, and for the fullest use of the system, such works as rehabilitation of distribution pipelines for leakage reduction and extension of secondary and tertiary mains for full utilization of available water production, etc are planned in the earlier stage of the project implementation.

Table 1 Projected Water Demand for The City of Jakarta

Description	1985	1990	1995	2000	2005
Total Population (000) A.	7,630	8,873	9,950	11,005	12,000
Population in Served Area (000) B.	5,372	6,538	8,002	9,092	10,496
Served Population (000) C.	4,419	5,357	6,523	7,497	8,784
Service Ratio (%) C/B	82	82	81	82	84
(%) C/A	58	60	66	68	72
Water Requirement (000 m3/s)					
Domestic Connections	313.7	477.1	698.5	923.4	1,204.7
Public Standpipes	83.1	88.2	92.3	90.8	90.6
Non domestic Connections	192.2	261.2	381.9	536.8	745.3
Total (Average Demand)	589.0	826.5	1,172.7	1,551.0	2,040.6
(l/sec)	(6,800)	(9,600)	(13,600)	(18,000)	(23,600)
Day Max. Demand (l/sec) (Average x 1.15)	15,400	18,300	23,300	29,100	36,200
Unaccounted-for Water Ratio (%)	49	40	33	29	25
Water Production Required (l/sec)	15,400	18,600	23,300	29,300	36,300
Water Production to be Expanded (l/sec)	7,800*	11,000**	5,000	6,000	7,000

Note: * Total water production in 1985 before completion of Pulogadung Plant of 3 m3/sec.
** Including water production for Immediate Project.

Water Source

The water sources proposed for the long term plan are as follows:

1) For water demand up to 1990		
- WTC enlargement	5.3 m3/sec	Under detail design
- Cisadane River	3.2 m3/sec	Presently available
2) For water demand up to 1995		
- TJC	5.3 m3/sec	Under planning
3) For water demand up to 2005		
- Cisadane River	10.7 m3/sec	Under study
- TJC	3.2 m3/sec	Under planning

Construction Cost

The estimated costs of implementing the Master Plan to the year 2005 are summarized in Table 2.

Table 2 Total Costs of Water Supply System For the City of Jakarta

Rehabilitation and Improvement 1985-1990	Immediate Project 1985-1988	First Phase Second Stage 1986-1993	Second Phase Second Stage 1989-1977	Third Stage 1995-2005
Rp. billion of Mar. 1984 prices				
35	28	223	170	336

III. SHORT TERM WATER SUPPLY PROJECT (1986-1993)

Extension Projects

The projects of the First Phase of Second Stage, proposed for Short Term Project in the Master Plan and proved to be viable by the Feasibility Study, include the following and are shown on Fig. A.

1) Cisadane System

- Capacity	: 3.000 l/sec
- Intake	: at Serpong on the Cisadane River
- Raw water Transmission	: ø 1,500 mm x 16.5 km
- Treatment plant	: at Lebakbulus, 3,000 l/sec
- Treated water transmission	: ø 1,200 mm x 9.1 km
- Distribution center	: at Kebon Juruk, 1,100 l/sec
- Distribution pipeline	: ø 300 - ø 1,800 mm x 85 km ø 50 - ø 250 mm x 752 km
- Supply area	: Western and south-western areas

2) WTC System

- Capacity	: 3,000 l/sec
- Intake	: at Buaran, BTB 49
- Treatment plant	: at Buaran, 3,000 l/sec
- Treated water tarnsmission	: ø 1,500 - ø 1,650 mm x 16.3 km
- Distribution center	: at Cilincing, 3,000 l/sec
- Distribution pipeline	: ø 300 - ø 1,800 mm x 115 km ø 50 - ø 250 mm x 818 km
- Supply area	: Central and northern areas

When the project facilities are operational, western and southwestern areas now under developing as housing area and business center, will be served with plentiful water by the Cisadane system at the beginning of 1991, and northern area, which are now under intermittent supply condition, are covered and improved by WTC system in the middle of 1991.

Rehabilitation and Improvement Works Immediately Required

The following works identified as the Immediate Program should be executed as soon as practicable, so as to alleviate the present poor supply conditions and to make full use of the production capacity of the existing system and that of the extension project of First Phase of Second Stage.

1. Rehabilitation works for the water losses reduction
   1) Replacement of water meter (1985 - 1990)
   2) Replacement of old distribution pipelines (1986 - 1990)
   3) Replacement of old service connections (1986-1990)
   4) Leakage abatement study and staff training (1986-1990)

2. Relocation of the intakes of existing treatment plants for raw water improvement (to be implemented by POJ, 1986 - 1990)

3. Short term improvement for water treatment by reinforcing chlorination facilities (1986 - 1989).

4. Improvement of distribution pipelines for full utilization of available water productions (1985 - 1989)

5. Immediate Project for production increase by construction of a new treatment plant at Buaran (1985 - 1988)

Estimated Project Costs

The estimated project costs are summarized in Table 3. The estimated costs of the projects are Rp.55 billion for the rehabilitation program and improvement project, Rp.37 billion for the Immediate Project and Rp.366 billion for the First Phase of Second Stage Project, allowing price increases through the implementation period. The costs include an allowance of 10 % for physical contingency.

Table 3 Summary of Estimated Project Costs

Rehabilitation and Improvement Works	
Replacement of Water Meters	2,406
Replacement of Old Distribution Pipelines	9,156
Replacement of Old Service Connections	602
Leakage Abatement Study	3,737
Sub-total 1/	15,901
Short Term Improvement	1,170
Improvement of Distribution Pipelines	18,227
Sub-total 1/	19,397
Price Contingency	15.374
Reh. and Im. Total 2/	50,672
Immediate Project	
Land Cost	261
Construction Cost	10,080
Administration Cost	888
Engineering Cost	2,358
Physical Contingency	3,618
Sub-total 1/	28,380
Price Contingency	8,762
Immediate Project Total 3/	37,142
First Phase of Second Stage Project	
Cisadane System	
Land Cost	2,480
Construction Cost	89,334
Power Receiving and Administration Costs	2,452
Engineering Cost	4,754
Physical Contingency	9,904
Sub-total 1/	108,924
Price Contingency	67,135
Total	176,059
WTC System	
Land Cost	1,666
Construction Cost	95,832
Power Receiving Cost and Administration Costs	1,502
Engineering Cost	5,037
Physical Contingency	10,403
Sub-total 1/	114,440
Price Contingency	75,787
Total	190,227
First Phase of Second Stage Project Total 4/	366,286

Note: 1/ Sub-total shows prices as of March 1984
2/ Foreign exchange cost of 44.0 % for total costs
3/ Foreign exchange cost of 51.1 % for total costs
4/ Foreign exchange cost of 51.3 % for total costs

Project Implementation

The implementation schedule showing sequent implementation of projects is presented on Fig B. The ongoing project is also indicated on the schedule to show clearly the whole picture of projects under way at any given time of the schedule.

All actions necessary to complete the project preparation and implementation are recommendable as follows:

Ongoing Project

Secondary and tertiary mains to be constructed by the distribution pipelines improvement (shown as A-2-3) in the schedule) are to be connected to the distribution mains constructed under the ongoing First Stage Project. Further delay of the First Stage Project gives an adverse effect on the progress of the projects thereafter to be followed, so that the following actions should immediately be taken up for completing the ongoing project as scheduled:

1) To expedite immediate procedures on the tendering of distribution mains to be procured under the Loan No. IP-245.

2) To call the tender by middle of 1985 and complete the construction works of pipelines by 1988.

A. Immediate Program

To improve the present supply conditions, PDAM should proceed to set about the rehabilitation and short term improvement works for the existing water supply system. Recommended actions to be taken up for each work are as follows:

A-1 Rehabilitation Works

1) To start water meter replacement works in 1985 preparing a yearly program of procurement and replacement of the meters, and accomplish the works by 1990.

2) To identify old distribution pipelines and related service connections to be replaced, to commence the work in 1986 and complete in 1990.

   The rehabilitation works of the distribution pipelines after 1990 should be continued as a routine work on the basis of the actual results for water losses reduction according to the replacement of the distribution pipelines.

3) To engage consultants in 1986 for leakage abatement study including site investigation of the existing distribution pipelines to be rehabilitated, establish a leakage abatement organization and commence training of PDAM staff.

A-2 Short Term Improvement Projects

1) To start installation of chlorination equipment to the existing treatment plants for strengthening chlorination. To execute the pre-chlorination system of Pejompongan Treatment Plant before completion of the raw water transmission pipeline works from WTC to Pejompongan Pant in 1990.

2) To install the distribution pipelines for secondary and tertiary mains procured under the First Stage Project by 1987. Further, extension works of the pipelines for full utilization of the available water production should be planned by 1987.

A-3 Immediate Project

1) To acquire the land more than five (5) ha required for Buaran Treatment Plant in 1985.

2) To expedite a selection of consultants for the detailed design engineering as soon as possible as the Loan Agreement has been concluded. To start the engineering by middle of 1985 and call the tender on the construction works of the plant by the first quarter of 1986 upon approval of the agencies concerned so as to complete the project as scheduled.

3) To confer periodically with the agencies concerned on the schedule of the WTC enlargement project so as to avoid discrepancy between both schedules of raw water and water supply.

B First Phase of Second Stage Project

B-1 Cisadane System

1) To seek the financial support from prospective lending agencies, and provide the local fund for the project implementation in 1985.

2) To select consultants for detailed design engineering after project appraisal and loan negotiation at the beginning of 1986.

3) To acquire the land required for the treatment plant and distribution center sites within 1986 and for raw water transmission route in 1987.

4) To expedite the plan on outer link road in the City between Lebakbulus and Kebon Jeruk as treated water transmission main is planned to be constructed in the link road site in 1989 to 1990.

B-2 WTC System

1) To seek the financial support from lending agencies and provide the local fund for the project in 1985.

2) To select consultants for detailed design engineering after project appraisal and loan negotiation in middle of 1986.

3) To acquire the land required for treatment plant and distribution center sites within 1986.

4) To expedite the plan on outer link road between Jl Sal Tarum Barat and Cilincing as the treated water transmission main is planned to be installed in the road site in 1990 to 1991.

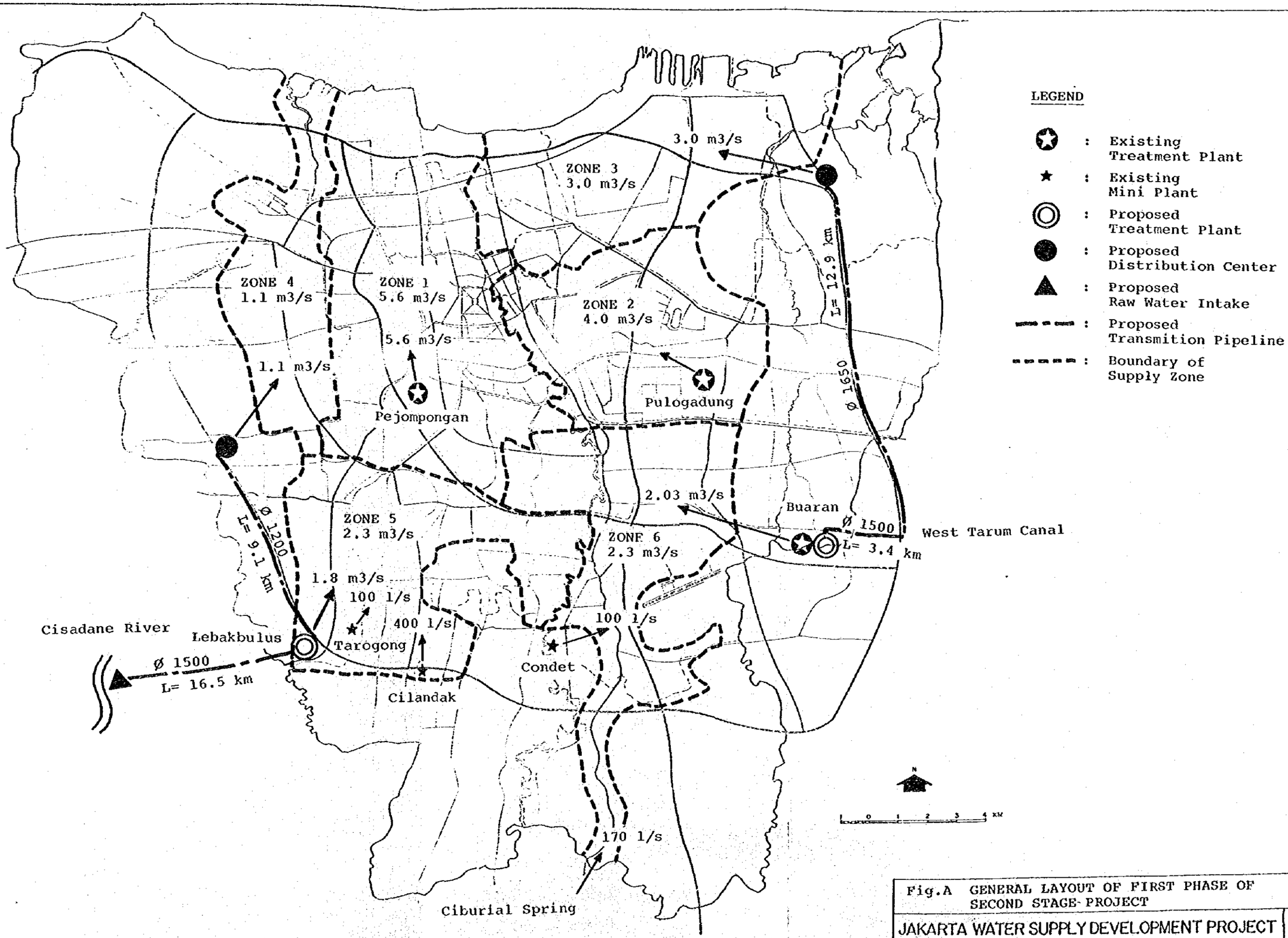


Fig.A GENERAL LAYOUT OF FIRST PHASE OF SECOND STAGE PROJECT

JAKARTA WATER SUPPLY DEVELOPMENT PROJECT | JICA

PROJECT	COST [1]	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
ONGOING PROJECT											
1. First Stage Project	55.9 [2]	9.1	13.8	21.7	9.9	1.4					
2. Pejompongan Plant I Improvement	3.3 [3]	1.6	0.5	1.2							
A. IMMEDIATE PROGRAM											
A-1 Rehabilitation	15.9		0.4	3.9	4.2	3.2	2.1	2.1			
1) Water Meter 74,000 nos											
2) Service Connection 10,000 nos											
3) Distribution Mains 200 km											
4) Leakage Abatement Study											
5) Training/Application in Pilot Area											
A-2 Short Term Improvement	19.4		1.2	1.6	3.5	6.2	6.9				
				Strengthening			Pre-Cl2 for Pejompongan Plant				
1) Chlorination											
2) Distribution Main Extension 970 km [4]											
A-3 Immediate Project	28.4			1.0	5.6	17.1	4.7				
1) F/S, L/A and Selection of Consultant											
2) D/D and Tendering											
3) Procurement/Delivery											
4) Construction/Installation											
Treatment Plant(Buaran I) 2.0 m3/s											
Distributiom Main 16.8 km											
B. FIRST PHASE OF SECOND STAGE PROJECT											
B-1 Cisadane System [5]	108.9				2.9	1.8	16.1	38.3	23.8	15.3	6.2	4.5
1) F/S, L/A and Selection of Consultant											
2) D/D and Tendering											
3) Procurement/Delivery											
Raw Water Intake											
Raw Water Transmission											
Treatment Plant											
Treated Water Transmission											
Distribution Center(DC R-4)											
Distribution Trunk Main											
Secondary/Tertialy/Zonal Meter											
4) Construction/Installation											
Raw Water Intake Q=3.2 m3/s											
Raw Water Transmission ø1500mmx16.5km											
Treatment Plant(Lebakbulus) Q=1.4 m3/s											
Treated Water Transmission ø1200x9.1km											
Distribution Center Q=1.4 m3/s											
Distribution Main											
Trunk Main 127.1 km											
Secondary/Tertialy/Zonal Meter 6)											
B-2 WTC System [5]	114.4				1.6	2.7	5.2	31.4	36.6	21.7	10.4	4.9
1) F/S,L/A and Selection of Consultant											
2) D/D and Tendering											
3) Procurement											
Treatment Plant											
Treated Water Transmission											
Distribution Center(DC R-3)											
Distribution Trunk Main											
Secondary/Tertialy/Zonal Meter											
4) Construction/Installation											
Treatment Plant(Buaran II) Q=3.0 m3/s											
Treated Water Trans. ø1500/ø1650x16.3km											
Distribution Center(DC R-3)											
Distribution Main											
Trunk Main 72.9 km											
Secondary/Tertialy/Zonal Meter 6)											

Note : 1) Unit cost: Billion Rupiah, Constant price as of March 1984
2) According to PDAM's information with adjustment of Implementation Schedule
3) According to PDAM's information
4) Length includes pipelines procured under the First Stage Project
5) WTC System includes supply zones 1, 2, 3 and 6, Cisadane System includes supply zones 4 and 5
6) Length and number of pipelines and zonal meters are tentatively estimated as follows:

	Total Length/Number	Cisadane System	WTC System
Secondary Main	70 km	67 %	33 %
Tertialy Main	1,500 km	47 %	53 %
Zonal Meter	200 km	23 %	76 %

Fig.B IMPLEMENTATION SCHEDULE

MASTER PLAN

SUMMARY OF REPORTS
FOR
MASTER PLAN AND FEASIBILITY STUDY

Following is the summary of the reports of Master Plan of Jakarta Water Supply Development Project to facilitate grasping the whole picture of the project to be implemented over a long term future and the Feasibility Study for implementation of the First Phase of Second Stage Project recommended by the Master Plan.

MASTER PLAN

CONCLUSION AND RECOMMENDATION

1. The water supply master plan of the City of Jakarta proposed a long term development program up to the year 2005 to be implemented by stages, namely, the Second and Third Stages. Further each stage is recommended to be implemented by two phases to avoid heavy investment and considering the construction period of the projects. The Master Plan also recommended the urgent implementation of the Immediate Program consisting of the rehabilitation and improvement of the existing system and execution of the Immediate Project during the intervening period to the next extension project.

2. Periodical review of population should be made as the actual growth of population may have a possibility to deviate from the population projected by JMDP and adopted in this Master Plan unless the policy of JMDP is realized as planned.

3. Review of water demand is also to be made periodically in line with the timing of project implementation and water resources development. Consumption pattern in service areas is also recommended to be monitored to operate the system efficiently and take appropriate actions required.

4. Review of the proposed system of the Master Plan should be made periodically with the demand deviation, change of circumstance of the project, etc., and especially it will be required to review the plan when the Cisadane River basin development is delayed.

5. Raw water from both east and west of the project area was proposed in the Master Plan putting emphasis on uninterrupted water supply to Metropolis and also economy of the project. In this connection, the study on water reosurces development of the Cisadane basin is emphatically proposed to be started urgently and to be concluded before the commencement of the First Phase of the Second Stage Project.

6. Groundwater study by areas should be started as early as possible to deal with various problems on groundwater, declining of groundwater table, sea water intrusion, land subsidence, etc. together with groundwater potential. The Master Plan stressed the needs for control and regulation of groundwater extraction especially by bulk users considering groundwater conservation in future and limitted groundwater potential assumed in the study area. Considerable amount of groundwater is expected to be necessary for domestic purpose as an important source in and out of the service area.

7. Urgent improvement of present supply condition is needed in 1) North District, 2) Sawah Besar and Kemayoran in Central District, 3) Taman Sari and Tambora in West District, 4) Grogol Petamburan in West District, 5) Tebet and Setia Budi in South District, and 6) Kebayoran Baru in South District, where deterioration of groundwater is observed and/or population is dense and growth rate is high.

8. The First Stage Project is to be implemented by all means as scheduled so as to avoid further deterioration of supply level and to utilize facilities of the Immediate Project efficiently which consists of treatment plant with capacity of 2.0 m3/sec and associated trunk mains.

9. Water loss reduction is vital for the sound operation of the system. The Master Plan recommended the actions among others to be taken immediately as the rehabilitation works as follows:

   1) Metering program including replacement of old and defective meters and installation of new meters on unmetered service connections.

   2) Replacement of old distribution pipelines and service connections, starting with those installed in 1920's.

   3) Intensive survey and study on leakage abatement and training of PDAM's staff for leak detection and repair.

   4) Establishment of an organization having overall responsibilities for water loss reduction.

   5) Preparation of precise distribution pipeline maps.

   6) Installation fo stop cocks on all service connections.

10. Improvement of water quality from the existing treatment plants is to be made. As the ultimate solution, the Master Plan recommended the relocation of the intake and taking raw water directly from WTC. Until the above realized, strengthening of chlorination is proposed together with improvement of plant operation.

11. Augmentation of distribution pipeline, secondary and tertiary mains, is required in connection with the improvement of water supply conditions and to utilize production increase fully under the First Stage and the Immediate Projects. The implementation is to be completed before the commencement of the First Phase Project.

12. Execution of the Immediate Project should follow the recommended schedule (up to 1988) to narrow the big gap between the production capacity of the system and water demand. In this connection, preparation of land and selection of consultants for detailed design are required urgently.

13. First Phase of the Second Stage Project was proposed as the next extension project succeeding to the First Stage Project now under way. It is recommended to commence immediately financing procedures, especially for external fund sources.

14. For appropriate and efficient operation and maintenance of the system, work shops are to be reinforced including improvement of meter repair shop and furnishing motor vehicles, tool and equipment as recommended.

15. Financial capability of PDAM to generate fund for financing forthcoming projects should be strengthened by flexibly and appropriately revising tariff, encouraging present groundwater users to switch to piped water, reducing administrative loss of water revenues, and so forth.

16. Funds generated by PDAM should be used mainly for alleviating the water scare situation of Jakarta. In this connection, obligations to pay tax and make contribution to DKI budget are advised to be exempted.

17. Financial plan of medium and long term perspective should be prepared applying appropriate accounting standards.

18. Decentralization policy has been taken in PDAM water service because of the recent complexity of operation of works due to increase of population served. It was found that necessary control and supervision by the central office is inevitable to manage, by decentralization, overall operation of water services efficiently.

19. PDAM was recommended to implement improvement and modification of its organizational structure based on the proposed structure, which was intended to effect necessary improvement with minimum extent, however, encouraging maximum efficiency.

20. PDAM's improvement was also focussed on management systems and overall personnel policy and administration including recruitment of a number of qualified engineers and other personnel, and training of staff for more effective man power utilization, together with upgrading functions of divisions and sections.

I. INTRODUCTION

The Government of Indonesia requested to the Government of Japan, in 1982, for technical assistance to prepare a master plan and feasibility study of the Jakarta water supply system considering the chronic water shortage prevailing in the Metropolitan area. In response to this request, the Government of Japan decided to undertake the work through Japan International Cooperation Agency (JICA) within the frame of the international cooperation of Japan. JICA contracted the work with Nihon Suido Consultants Co., Ltd. on June, 1983. The engineering services were commenced from June, 1983 upto March 1985 in accordance with the terms and conditions of the contract.

1.A Objective, Scope and Study Area

The objective of the work is to prepare a Master Plan for phased improvement of the water supply system up to the year 2005 and a Feasibility Study for an urgent project identified in the Master Plan.

The scope of works for present study is shown in Annex - 1. The study covers the administrative area of the City of Jakarta, together with those facilities in the adjacent areas of the City which are related to the project.

II. DESCRIPTION OF STUDY AREA

2.A Physical Aspect

Location The City is located in latitude 6°12'S and longitude 106°48'E with an area of 649 km2. The city is the core of the Jabotabek area with an area of 6,150 km2 consisting of Jakarta, Tangerang, Bogor and Bekasi.

Climate The area has two distinct seasons, i.e., the rainy season from November through May, and the dry season from June through October. The annual rainfall is rather abundant, 1,500 mm/year in the coastal plain to 5,500 mm/year in the southern mountains. The average annual temperature is 27.1 °C at Jakarta and 25.6 °C at Bogor.

Hydrology Rivers flowing through the City are all small, but in the Jabotabek area are large rivers, such as the Citarum river on the east and the Cisadane on the west. The Citarum river has a catchment area of 4,550 km2 at the Jatiluhur dam site and an average annual flow of 517 billion m3 or 181 m3/sec. The mean annual discharge of the Cisadane rivers is 62.3 m3/sec at Serpong gauging station with a catchment area 1,074 km2.

Geology Jakarta is covered by thick Quaternary sediments, with the thickness ranging from 100 to 300 m, which are mainly deltaic facies. The lowland and swampy area of coastal plain are mantled with Holocene sediments consisting of clay, silt, sand, gravel and pebbles.

Hydrogeology The Quaternary sediments contain relatively freshwater which has been one of the main water source for domestic and industrial uses. The study area is hydrogeologically classified into the following main aquifer systems:

1) Unconfined and semi-confined aquifer.
The shallow aquifer is an unconfined one which is located at shallower depth and tapped by shallow wells for domestic use. The water level fluctuations vary from 3 to 5 m in the wet and dry seasons.

2) Confined aquifer
Groundwater in the deeper aquifer is confined in three principal systems ranging from 20 m to 140 m, 140 m to 240 m and 240 m below ground surface.

Groundwater problems in Jakarta Groundwater is still an important source for domestic and industrial uses both within and outside the service area. For using groundwater, however, following problems have occured in the northern area in the City.

1) Groundwater Level decline by over-exploitation of deep aquifers. During dry seasons, the groundwater declines below shallw wells or pumps.

2) Saline water encroachment into unconfined and semiconfined aquifers.

3) Land subsidence observed along Jl. Thamrin.

4) Necessity of continuous groundwater investigation and the groundwater resource conservation

2.B Socioeconomic Aspect

Present economic acticity The City of Jakarta is the center of political and economic activities of the country with an estimated population of seven millions, and it is also the center of domestic and international transportation by land, air and sea. Economic activities in Jakarta are predominantly those in the trade and service sectors including public administration. According to the 1980 figures, the trade sectors shares 44 % of GRDP, the service sector 30 % and the public administration sector 11 %, while the agriculture sector shares only 1.6 %.

Jabotabek Metropolitan Development Plan (JMDP) This plan is an outstanding regional planning to develop the Jakarta Metropolis and adjacent Kabupatens (Bogor, Tangerang and Bekasi including Kotamaja Bogor) in one concept of the enlarged metropolitan region, undertaken Presidential Instruction No.13 of 1976. A very substantial basis conceived in the plan is the physical zoning system perceived for the purpose of avoiding over investment in the unsuitable areas in respect to the physical features.

Jakarta Master Plan DKI Jakarta is currently engaged in the preparation of its Strategic Development Plan (SDP) or Jakarta Master Plan (1985 - 2005), both of which have a same basic on the JMDP. These plans include various socio-economic parameters, which form the future structure of DKI Jakarta. Among such parameters, population, employment and income, and land use plan are significantly related the present Water Supply Master Plan.

Land Use Plan Land use plan being formulated in accordance with the Jakarta Master Plan includes three basic programs, namely, Urban Betterment Program, Guided Land Development Program and Staged Industrial Land Development Program. Detailed and concrete development programs are now being prepared in line with the basic programs.

Employment and Income The 1980 census shows that total employment was 1,596,618 persons, of which the manufacturing sector accounted for 14 %, the trade and hotel sector 19 %, and the service sector 34 %. The manufacturing sector registered a remarkable increase of annual 7 %.

The census also indicates that percentage of five income groups was as follows :

	Monthly Income per employed person	
Group I	Rp. 0 - 25,000	35.8 %
Group II	Rp. 25,500 - 50,000	38.6
Group III	Rp. 50,000 - 75,000	12.4
Group IV	Rp. 75,000 - 100,000	6.2
Group V	Rp.100,000	7.0

Water-borne Diseases and Fire Incidences In DKI Jakarta, water-borne diseases have rather high incidences compared with that of other diseases. Incidences of fire are also high; in 1980, 1,671 houses were burnt down, with 152 casualties.

2.C Demographic Aspect

The Master Plan projected future population as 8.87 million in 1990 and 12 millions in 2005, against that 1980 population 6.47 millions, taking account of the guided development in the future. The above projection may be rather optimistic when the past growth rate is considered. If it is assumed the present growth rate would continue until 2005, 12 million mark would be reached around 1996-1998. The actual growth may fall in between the above two target years. The actual growth therefore should be closely and periodically reviewed, and the projection be renewed accordingly.

III. EXISTING WATER SUPPLY SYSTEM

3.A Service Area and Population Served

The service area covers 283 km2 including the service areas by mini plants, accounting for 44 % of the DKI Jakarta administrative area of 644 km2.

The population in the service area is estimated at 4,957,000, equivalent to 76 % to the total population. Further, the population served, in 1980, is estimated at 2,100,000 equivalent to 42 % of the population living in the service area in 1980.

3.B Existing Water Supply System

The existing water supply system consists of the following:

Plant	Capacity	Year of Establishment	Service Area
Pejompongan I	2,000 l/sec	1957	Roughly west
Pejompongan II	3,000 l/sec	1970/1973	half of the City
Pulogadung	1,000 l/sec	1982	Roughly east half of the City
Ciburial Spring	300 l/sec	1922	Southern end of the City
Mini-plants	5 to 200 l/sec (Total 435 l/sec)	1976 to 1982	Scattering small area in the City

Total length of distribution trunk mains, 300 mm to 1,250 mm in diameter is 220 km of which 26 % was installed in 1920's and 22 % in 1950's. Secondary and tertiary mains, below 250 mm to 50 mm in diameter installed, are 3,170 km in total length.

3.C Present Water Sources, Raw Water Quality and Treatment Conditions

Present Water Source Pejompongan Plants I and II receive water through the Banjir Canal from the Ciliwung River, monthly mean discharge of 11.0 m3/sec in dry seasons, which is supplemented by the West Tarum Canal. The intake quantity is 5,300 l/sec.

Pulogadung Plant takes in water of the Sunter River whose tributary is the Cipinang River, monthly mean discharge of 1.3 m3/sec in dry season. This river system is also supplemented by the West Tarum Canal. The intake quantity is 1,050 l/sec.

The above mentioned rivers are not sufficient to supply all urban water needs, such as drinking water and flushing water. The West Tarum Canal is also insufficient to supplement the shortage of the rivers.

Raw Water Quality Raw water for the existing treatment plants, Pejompongan and Pulogadung, has rather high concentrations of Ammonium and Organic Matter showing pollution of the source water caused by waste water discharge from the densly populated area. The pollution is gradually worsening, and in the dry period the condition intensifies. Detergent is also remarkably contained in the source water.

Treatment Conditions As regards the treated water of Pejompongan, more than 20 % of samples have positive sign of Faecal Coli, and turbidity and Ammonium are also detected in samples and exceeding drinking water standard. For treatment, alum dosage has been gradually increased.

At the Pulogadung Plant, chlorine dosage is twice or three times bigger than that at Pejompongan. The treated water has lower turbidity than Pejompongan and no Faecal Coli, but sometimes a high concentration of Organic Matter.

Mini plants located in the north of the City have similar conditions to the main plants, because of the water source deterioration. They are considered to be put out of service when in the future a new treatment plant is constructed and operated.

3.D Water Supply Conditions

Production capacity of the system is considerably below water demand due to delay of the implementation of the expansion project. The northern part of the City, Pluit, Ancol, and particularly Tanjung Priok has poor supply with water pressure less than 0.5 kg/cm2.

PDAM categorizes the consumers to 26 classifications in respect of water tariff and about 134,000 of service connections are installed as of May 1984. Accounted-for water ratio for water output from the Plants was recorded as 46 percent in 1980.

Tap Water A large percentage of samples has shown positive sign of Faecal Coli; the tap water sometimes has color, turbidity and Ammonium. The cause for the above is suspected to be defects of the distribution pipelines and to be insufficient treated water due to shortage of chlorine dosage.

Groundwater Use PDAM once had 111 deep wells including 22 wind mills, but these days 43 wells are in service. The total production is estimated at about 10,000 m3/day. On the other hand, there are 2,208 private wells registered to PDAM, the production of which is estimated at 69,000 m3/day.

3.E Unaccounted-for Water

Component of Unaccounted-for Water Large amount of wasted or lost portion of the distributed water, about 53 % of the total production in 1983, is regarded as the unaccounted-for water. The unaccounted-for water consists of mainly in two groups, illegal use, billing errors, etc and system leakage.

Present Leakage Abatement PDAM has been implementing leakage detection and repair works by branch office basis. Total 4,578 cases of leaks were founded and repaired in fiscal year 1982/83. PDAM is generally detecting only visible leakage. Recently, in 1984, PDAM organized a new team especially for leakage abatement works in the Central Office recruiting staff from the branch offices and Distribution Division.

Recommended Target of Unaccounted-for Water It was recommended to set the target of the unaccounted-for water to 40 % in immediate target by 1990 and 25 % in final target by 2005.

3.F Operation and Maintenance

Treatment Plant The facilities are operated in accordance with the operation manual in each plant. However, many issues in operation and maintenance stand out such as accumulation of sludge on the bottom of sedimentation basin and its unavoidable manual cleaning, ununiform backwash in filter bed due to crack formed in sand layer and inadequate chemical dosing.

Distribution Method The distribution of water to service areas depends on direct pumping system from Pejompongan Plants to western area bordering the Ciliwung river and to southern area, and from Pulogadung to eastern area. Booster pump stations receive water into the reservoir with a retention time of 2 to 3 hours for delivery capacity and covers low pressure area.

Public Hydrants DKI Jakarta has 1,509 public hydrants including 83 hydrants for public bathing, washing and excreta disposal uses and 1426 hydrants for general public uses. Approximately 25 % of the existing hydrants were out of services. The hydrants installed under MHT project and in the Community Kencana, about 70% of total hydrants, are operated by the community or part of the District.

Meter Repair Shop and Meter Storage Meter repair shop with space of 150 m2 is located on the premises of Pejompongan Plant I. In the meter shop, four meter test benches are equipped and machines for making parts and drilling are installed. At present, Meter Division is organized with three sections of Repair and Maintenance, Administration and Meter Control and 55 staff in total. Meter repair is performed by 17 staff of Repair and Maintenance Section and average number of repair per month is, at present, 300 to 500 for 1/2" to 1-1/2" and 30 to 50 for 2" and larger. Repaired meters are stored on storage space provided next to the shop after testing.

Storage Facilities of Chemicals and Parts of Materials Enough spaces are provided for chemicals in both plants of Pejompongan and Pulogadung. Alum, lime and activated carbon are supplied by local products from adjacent areas to Jakarta so that bulk storage is not necessary. Approximately 2 to 3 months supply is stored. Chlorine gas is supplied by regular transportation from Surabaya every day due to limited chlorine gas containers.

Storage and Stock Yard Each PDAM cabang has a closed storage for piping materials for service connection and tertiary pipes for rehabilitation work including saddles, fittings, valves and accessories. Nine stock yards with open and closed spaces for pipes and accessories are maintained by PDAM central office.

Motor Vehicles PDAM at present owns 120 numbers in total of motor vehicles of pick-up, truck, mini-bus and tank rolly, and 398 numbers of motor bikes for the routine operation and maintenance. About half of these motor vehicles and bikes have been used for ten years or more so that old ones need gradual replacement by new ones.

3.G Rehabilitation and Improvement Works

Work in Progress In accordance with the recommendation of Technical Team established in DKI Jakarta for the study of rehabilitation of the raw water intake and plant equipment in Pejompongan Plant I, PDAM started the rehabilitation of the mechanical and electrical equipment in 1983. Rehabilitation works are to be executed in four steps, namely, phase 1 for the raw water intake, phase 2 for treatment plant, phase 3 for chemical feeding system and phase 4 for electrical equipment for power substation.

The improvement works for Pejompongan Plant II for the production increase from 3,000 l/sec to 3,600 l/sec are to be completed in 1984 for replacement of equipment in raw water intake station and plant.

No systematic rehabilitation works of distribution pipelines have been performed for leakage abatement so far. PDAM carried out the Sensus Program for all customers registered from 1977 through 1983 to find out the illegal connections and misclassification of customer's registration for increment of the income.

Rehabilitation and Improvement Works Required The rehabilitation and improvement works immediately required are as follows: 1) Rehabilitation works of distribution pipelines including replacements of old water meters, old service connections and old distribution pipelines as well as leakage abatement study, 2) Relocation of the intakes for the existing treatment plants to the WTC, and installation of raw water transmission trunk mains, 3) Short term improvement for the present treatment process including strengthening of chlorination and improvement of plant operation, and 5) Augmentation of distribution pipeline system for full utilization of water production of Pulogadung and Buaran Treatment Plants in the existing service area.

3.H Institution and Finance

Present Institution Jakarta Water Supply Enterprise (PDAM JAYA), a public corperation of DKI municipality, operates and maintains the water supply system of Jakarta. It has been practiced that the construction of major capital works is carried out by the central government, and after completion of such works, the facilities are transfered to PDAM for operation and maintenance. PDAM, however, is carrying out the construction of mini treatment plant, installation of distribution mains and tertiary pipes, and rehabilitation of facilities.

Organization and Staffing The organization of PDAM was established as the sole water supply agency separated from the Public Works Department (Dinas Pekerjaan Umum) of DKI by the decision of the Governor DKI in 1968. The present organization, after several reorganization in the past, was set up in 1980 by the Governor Decree No. 664. The operation of PDAM is largely divided into the operation of the central office, and that of branch offices and special units. The function of PDAM is divided into three, namely, (1) technical and production, (2) business, and (3) administration and finance. PDAM is headed by the president director and three deputy directors, responsible for engineering, business, and administration and finance activities respectively. The present organization is shown in Fig. 1. Presently, PDAM keeps 2,025 employees for an average production and supply of 579,000 m3/day. The present staffing in each of divisions head office, branch offices, installation and special unit is shown in Table 1.

Proposed Organization Improvement and Modification Improving and modifying the existing organization to attain maximum efficiency and economy of the system management and operation, 3 alternative structures were studied and evaluated. Figs. 2, 3, and 4 show alternative structures.

Alternative 1 is intended to provide prompt service to customers and at the same time to improve and upgrades procedures of meter reading and operation of billing and collection.

Alternative 2 is intended to rearrange areas of production and technical and brach offices by shifting divisions and units to attain clear line of responsibility between the central office and field offices.

Alternative 3 is intended to strengthen areas of technical/ production and business. Largely speaking, engineering is newly provided with additional divisions in order to fulfill engineering performance. Business is improved and changed into "Services" to upgrade customer services. Branch offices is also receive direct control under new Service, so that effective and quick service to the customer will be possible.

Alternatives 1 and 2 are intended to change the structure minimum, while alternative 3 reuqires more changes and upgrading. It is of vital importance, however, to avoid a drastic change of the present strucutre, as paying attention of not causing overall disturbance in the maximum implementation possibility. It is therefore recommended for PDAM to employ alternative 3, for future modification. Table 2 shows comparision of alternative structure modification.

Conclusion and Recommendations PDAM has been taking policy of decentraliztion to carry out water service in each branch office scattered in the city because of complexity of operation of works due to the increase of population served. In order to manage operation of water service efficiently by decentralization, however, policy of water supply should be clearly directed through the central office. Assignment of required number of a staff should also be made accordingly. Necessary control and supervision by the central office is inevitable to achieve operation of branch office successfully. Following improvement is required to be made :

Assignment Costomer	No. of Costomers	No. of Employees	Customers per Employee
Operating Units :			
Branch Offices/Special Units/Rayon:			
Central	35,697	205	174
North	11,490	88	130
West	35,880	170	211
South	13,340	111	120
East	8,905	109	82
Bogor	1,798	42	43
Unit VII/Pluit Ancol	4,776	17	281
Unit VII/Kunigan	8,931	58	154
Unit IX/Cempaka Putih	5,050	41	123
Unit X/Commercial Meter	1,323	44	30
Unit XI/Hydrant	1,504	32	47
Unit XII/Sumbur Dalan	282	62	5
Rayon Klender	8,102	39	207
Installation		364	
Supporting Units:			
Management		4	
Inspection		83	
Research and Development		114	
Planning and Desinging		46	
Production		26	
Distribution		41	
Equipment and Maintenance		44	
Customer		43	
Logistic		34	
Water Meter		55	
Finance and Accounting		51	
Secretariat		79	
Personnel		23	
Total	137,078	2,025	68

Table 1 PDAM STAFF DISTRIBUTION

JAKARTA WATER SUPPLY DEVELOPMENT PROJECT | JICA

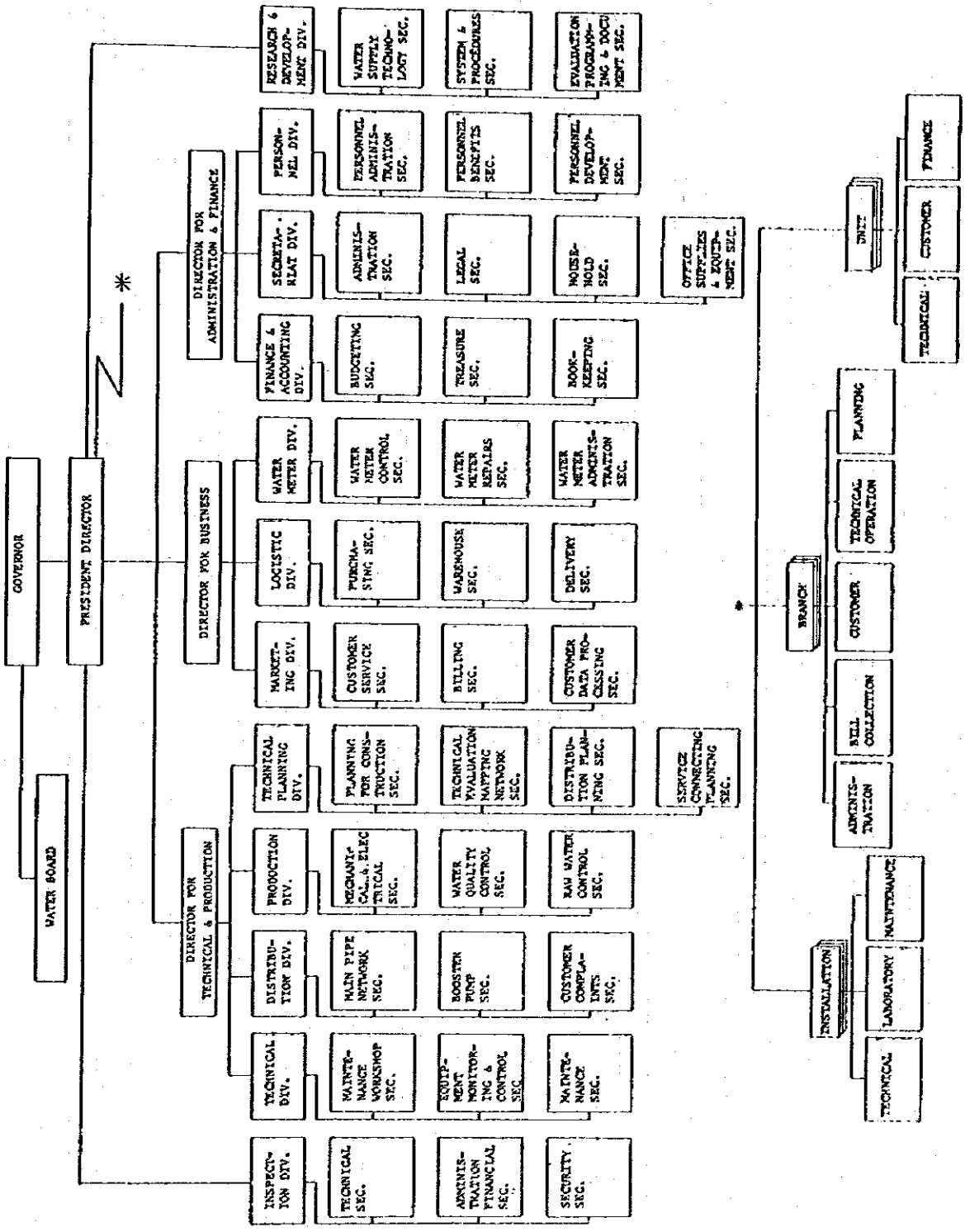


Fig.1 PRESENT ORGANIZATION STRUCTURE

JAKARTA WATER SUPPLY DEVELOPMENT PROJECT | JICA

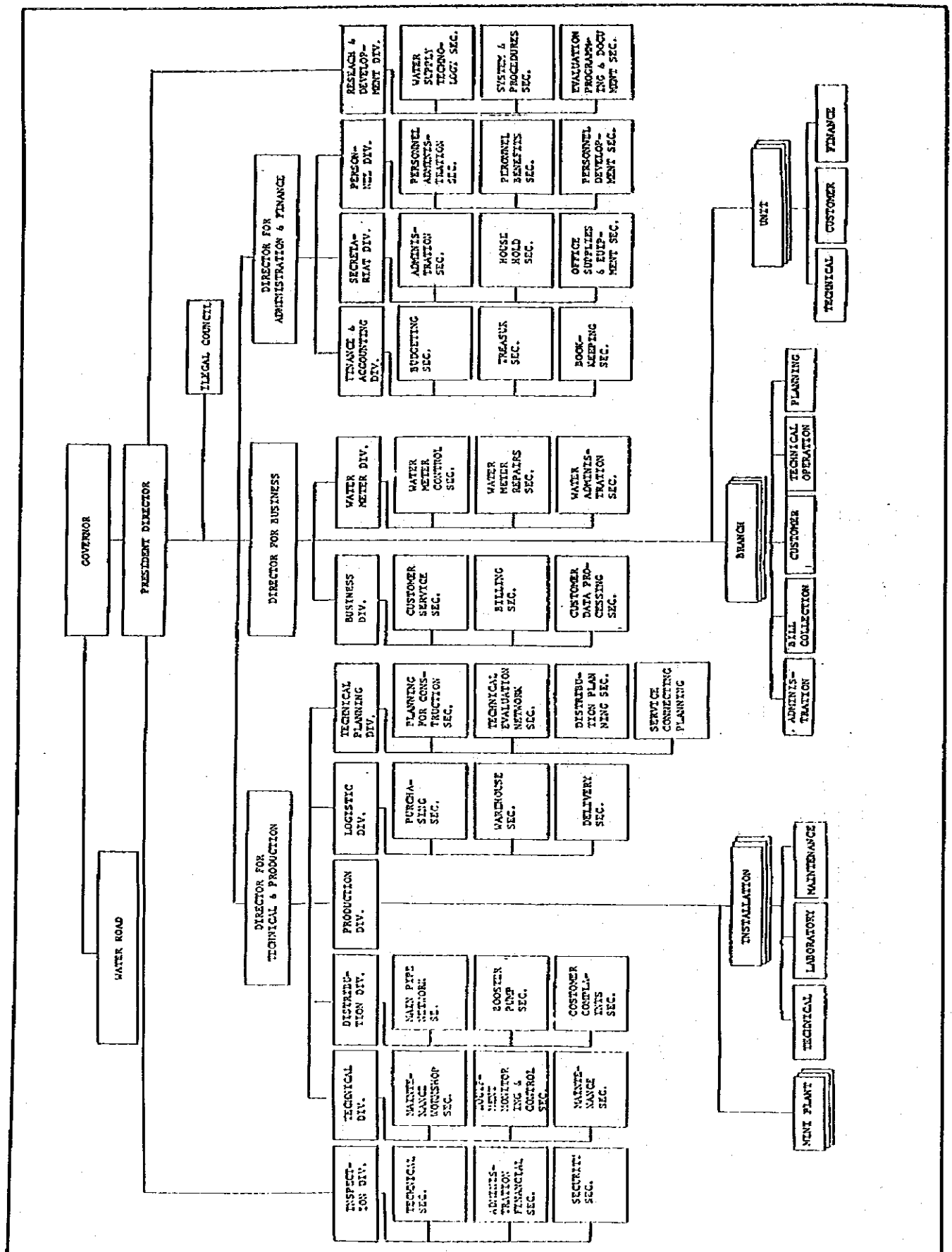


Fig.2 MODIFIED ORGANIZATION STRUCTURE, ALTERNATIVE 1

JAKARTA WATER SUPPLY DEVELOPMENT PROJECT | JICA

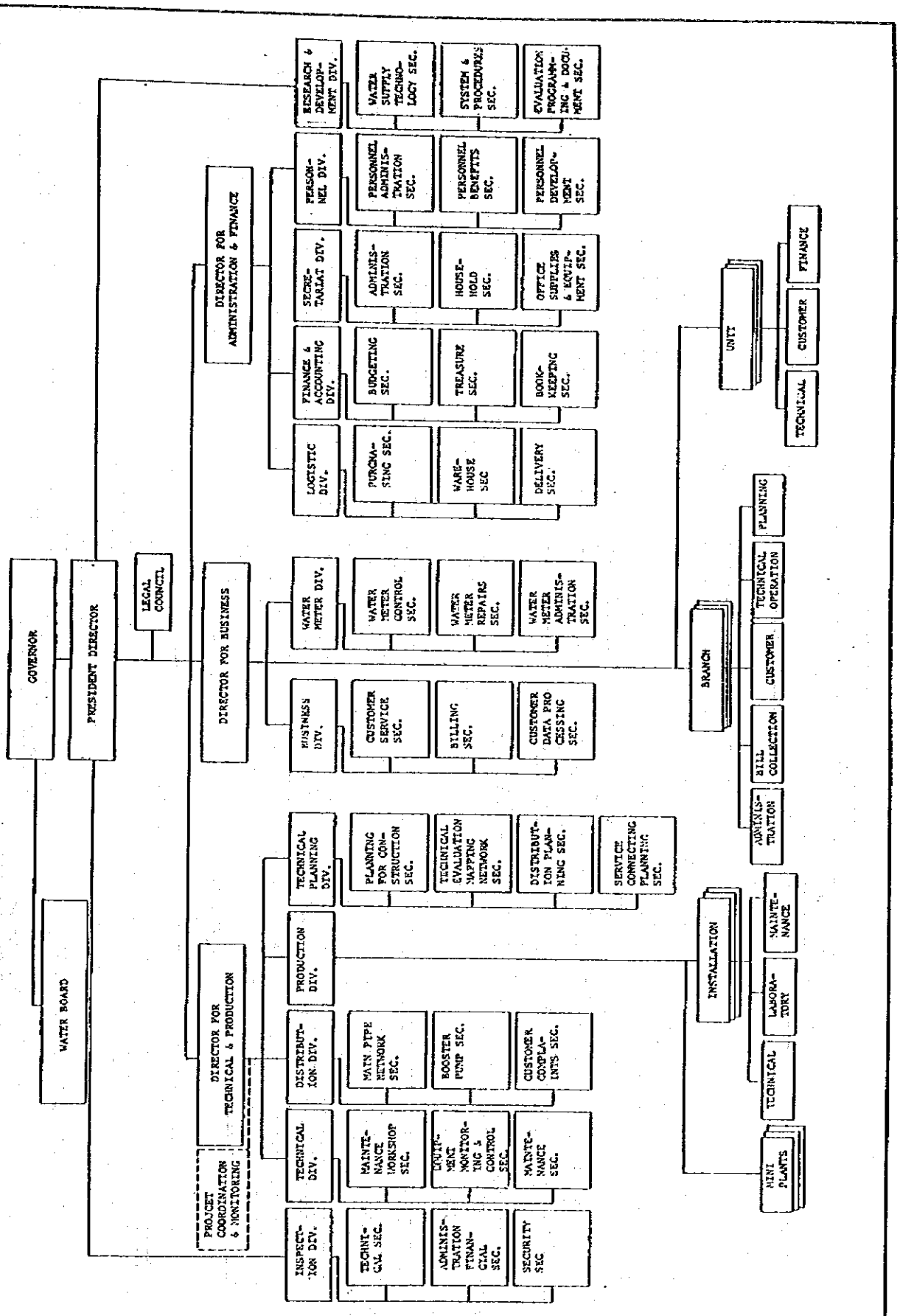


Fig.3 MODIFIED ORGANIZATION STRUCTURE, ALTERNATIVE 2

JAKARTA WATER SUPPLY DEVELOPMENT PROJECT | JICA

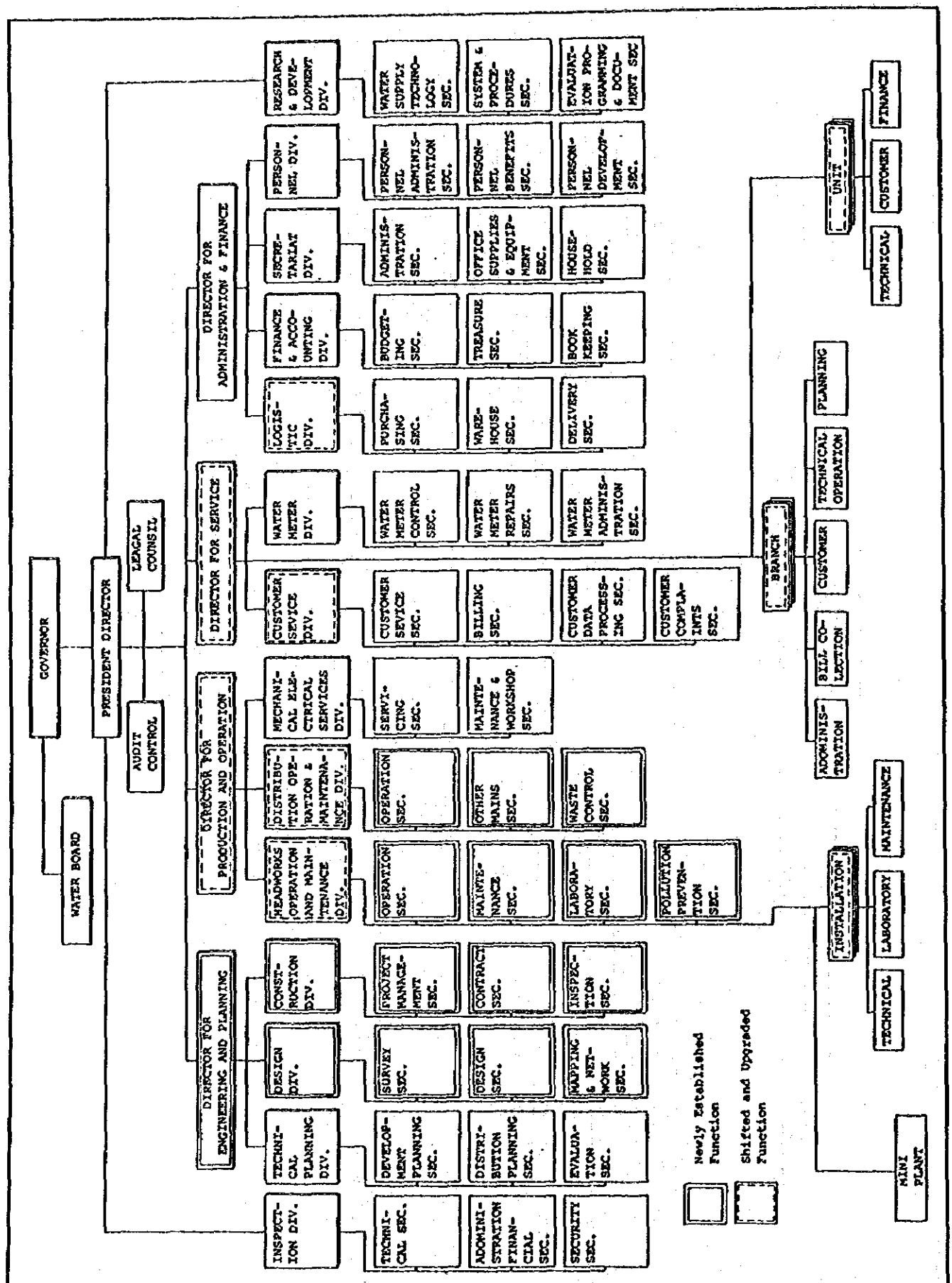


Fig.4 MODIFIED ORGANIZATION STRUCTURE, ALTERNATIVE 3

JAKARTA WATER SUPPLY DEVELOPMENT PROJECT | JICA

Factors	Alternative 1	Alternative 2	Alternative 3
1. Coordination between Central Office and Branch Offices	- Improved better and close, since line of organization is shifted from President Director to the level of related existing division.	- Same as Al. 1	- Strengthened and improved, since line of organization is shifted from President Director to related newly provided division and existing division.
2. Organization Modification Required	- Logistic Division is shifted from the line under Business to the line under Technical & Production. - Branches and Units are under Business. - Installation/Mini-Plants are under Production Division, Technical & Production. - Legal Section under Secretariat is reformed newly in Legal Council independently under the line of President Director.	- Logistic Division is shifted from the line under Business to the line under Administration & Finance. - Branches and Units are under Business. - Installation/Mini-Plants are under Production Division, Technical & Production. - Legal Section under Secretariat is reformed newly in Legal Council independently under the line of President Director. - Project Coordination & Monitoring are provided when required under Technical & Production.	- Technical & Production will be divided into Engineering and Planning and Production and Operation. Under Engineering and Planning, new divisions of Design and Construction are provided. - Under Production and Operation, new divisions of Headworks Operation and Maintenance and Mechanical and Electrical Services are provided. - Business is modified to Service. - Logistic Division is shifted from the line under Business to Administration and Finance. - Audit Control and Legal Council are formed independently under the line of President Director.
3. Degree of Organization Change	- Minimum	- Minimum	- Significant, but not drastic.
4. Maximum Implementation Possibility	- Better	- Better	- Best

Table 2 COMPARISON OF ALTERNATIVE STRUCTURE MODIFICATION

JAKARTA WATER SUPPLY DEVELOPMENT PROJECT | JICA

1) PDAM's clear objective should be set up and management strategies should be formulated, and be fully recognized by employee.

2) Present organization structure should be improved so as to achieve such objectives.

3) Function of divisions and sections should be established according to the improved structure, and divisional coordination should be attained.

4) To rectify the present imbalanced personnel distribution in areas of technical and administration, recruitment of a number of engineers and technicians should be made to strengthen also manpower capacity in the areas of engineering.

5) Overall personnel policy and administration should be set up to select, train, and utilize capable staff.

Investment Finance Construction of water supply facilities for Jakarta has been administered by both the Ministry of Public Works and PDAM. The works and finance for construction of treatment plants, installation of trunk mains, and a part of installation of secondary and tertiary pipes have been managed by the former, and construction of mini-plants, installation of most of secondary and tertiary pipes, and rehabilitation of treatment plants and pipes have been covered by the latter utilizing PDAM's own generated funds and DKI Jakarta's equity financing.

The facilities constructed under thr project management of the Ministry of Public Works are handed over to PDAM against financial obligations of DKI Jakarta/PDAM unless financing condition is grant.

Financing sources available for the central government are the following four funds:

- Approved Project List Fund (DIP) : normally for grant finance
- State Capital Participation Fund (PMP) : normally for equtiy finance
- Investment Plan Fund (RDI) : normally for loan finance
- Foreign Aid Fund (BLN)

Future projects are expected to be financed fully by loan. The likely terms of a loan are 30 year repayment period including 6 year grace at 11 percent interest rate.

Tariff Revision of water tariff has been made every two to four years, and the latest one was made in May 1983. For tariff revision PDAM is required to obtain approval of the Governor and the Local Assembly. The Ministry of Home Affairs has been preparing general guidelines on a level and strucutre of water tariff; however, they are not mandatory and Jakarta's tariff does not strictly conform with them.

Residential users are subject to progressive block tariff, which is designed to penalize excessive water use, especially the use of more than 30 m3 per connetion per month. More generous progressive tariff is applied to small industry/commerce and offices. Others are charged at a flat rate. Heavy cross-subsidy from the commercial and service users to the residential is observed.

Although the tariff increase in May 1983 brought up the average rate from Rp. 100/m3 to Rp. 250/m3, which cannot be considered as low comparing to levels of other developing countries, the decrease in total water consumption from the previous year's level was very small. This result, together with the fact that people living in the water-scarece part of the city are paying at an extreamly high rate to water vendors, may suggest that people's willingness to pay for water is very strong and that demand is not significantly sensitive to a price level.

At present, middle income families with monthly revenues of Rp.75,000 to 150,000 are estimated to be paying about 1.4 percent of their income for the use of water. However, it is difficult to obtain assurance regarding whether the present level of connection charges, which is estimated to amount to about 2 month worth of middle income families' income, is affordable for the majority of potential customers.

Financial Performance PDAM's total revenue reported in the income statement of 1983/84 was almost doubled from the previous year's level of Rp.13.7 billion to Rp.25.3 billion as the result of the tariff increase in May 1983. Water sales comprised 83 percent of the total revenue and 16 percent came from connection charges. The largest contributor to PDAM's water sales revenue is Port Tanjung Priok (30.9% of the total), followed by Trade and Service (29.4%). Residential shares only 10 percent of the water sales revenues while consuming 43 percent of the total water supplied.

In addition to the above revenues stated in the income statement, PDAM collected about Rp.6 billion ground water charges in 1983/84 on behalf of DKI Jakarta. Then, more than half of them were paid out to DKI and balance was entered into the balance sheet as Equity of Local Government.

About 8 - 13 percent of billings of water sales are not collectable and contributing to build up a fairly large accounts receivable, which amounted to 4.3 month worth of water billings at the end of 1982/83.

Major components of Rp.12.3 billion operating expenses were: personnel (21%), power(21%), chemical(17%), administration (12%), maintenance(10%).

PDAM had been exempted from tax payments since its establishment; however, it has become subject to income tax from 1984/85 according to the following schedule stipulated in the Income Tax Low (1983 No.7, Chapter IV, Article 17):

Net Income	Tax Rate
Rp. 0 - 10 million	15 percent
Rp. 10 - 50 million	25 percent
Rp. more than 50 million	35 percent

By the Governor's Decree, PDAM has to dispose its surplus funds from yearly operations according to the following schedule and is not allowed to retain funds for other than those stipulated below:

- 50 percent: contribution to DKI's budget
- 15 percent: production service (productivity bonus for PDAM's employees)
- 15 percent: social/pension funds
- 20 percent: PDAM's reserve

Financial performance indicators of the past three years reported by PDAM tell us that PDAM's financial position, especially after the tariff revision in May 1983, is very healthy, showing low working ratios of 48 - 66% (defined as operating expense exclusive of depreciation divided by operating revenues), low operating ratio of 60 - 83% (operating expenses inclusive of depreciation divided by operating revenues), high rates of return on fixed assets of 13 - 24% and zero debt/debt & equity ratio.

Improvement Required In order to strengthen PDAM's financial capabilities for generating sufficient funds to meet the financial requirements of further expansion and improvement projects, the review of financial matters suggests that efforts should be forcused on the following issues:

In the light of vast financial requirements for meeting the people's needs for drinking water supply and recent stringent financial conditions of the central government, PDAM's capabilities to share the burden of investment costs should be strengthened. In this connection:

(1) Tariff should be reviewed every year and revision, if necessary, should be made with greater flexibility. Affordability, in addition to PDAM's financial requirement, should be carefully examined in determing the water rate and connection charges. Furthermore, tariff should be designed not to discourage people currently relying on ground water to use piped water.

(2) Administrative loss of revenue, i.e., delinquencies in paying water bills and administrative unaccounted-for water should be reduced to a greater extent.

(3) Meter installation, proper meter maintenance, and correct meter reading should be regarded as a prerequisite for reducing the administrative loss.

The funds generated by PDAM must be used solely for expansion and improvement of water supply facilities and should not be taken out of PDAM to use for other purposes. In this connection:

(4) Tax obligations imposed on PDAM should be reconsidered by the authorities concerned.

(5) Contribution to DKI budget also should be reconsidered.

(6) Surplus funds should be accumulated in the hands of PDAM in order to flexibly meet the varying levels of cash outlay. It would happen, depending upon schedule of investment and repayment, that substantial cash surplus is generated in some years and serious shortages in other years.

In order to effectively invest the generated funds and to determine the degree of dependence on outside financial sources, it is necessary to prepare appropriate financial planning based on data and information which correctly reflect the existing financial operation and performance. In this connection:

(7) Medium and long-term financial plan should be prepared. Such plan should continuously be revised taking into consideration changes in later years.

(8) Accrual basis accounting should be fully implemented.

(9) Assets including inventories should be appropriately recorded paying particular attention to their aquisition date and valuation.

(10) External audit by public accountant should be recognized, and be fully utilized, as an effective means to establish appropriate accounting systems and practices.

3.I Legal Status of PDAM Jaya

The present laws and legislations that support the operation of PDAM Jaya are, (i) Law No.3, year 1977, Regional Regulation of the Capital Special Region of Jakarta, Establishment and Management of Water Enterprise, PAM, Jaya, (ii) Regulation No. 664, year 1980, Structure of Organization and Task Assignment of Municipal Water Enterprise of the Capital Special Region of Jakarta, and (iii) the hetter of Decision from the Director of "PAM JAYA" No. 23 PAM/DIR/1980. The Law No.3 stipulates PDAM's establishment, principal tasks, capital provision, management, and supervisory body etc., clearly defining status and function of PDAM to be a regional company. Regulation No.664 stipulates the structure of organization and task assignments for undertaking the public service.

Decision of the Director No. 23 stipulates establishment of structure of organization, job specification and work order of PDAM Jaya. The present legislations do not necessarily meet the requirements of supporting PDAM operation, considering the recent water supply development which is complicated and diversified. It is important to prepare laws and regulations that will strongly and legislatively support PDAM to give adequate powers to carry out its operation including provision of water tariff and collection of revenue, right of access and right-of-way, and necessary punitive provision to discourage illegal connections and collect overdue revenue.

IV. MASTER PLAN UP TO THE YEAR 2005

4.A Service Area and Population Served

Service Area The service area to be served up to the year 2005 is shown below and Fig.4.1 in Master Plan Report. In determing the service area, the Jakarta City Master Plan, Highway and Public Road Plan and population density were taken into consideration. The population density considered for inclusion in the service area is 150 persons/hectare or more.

Service Area

Year	Service Area (km2)	Percentage 2/
1980 1/	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 Administration Area of 644 km2.

Population Served The population in the service area is estimated as follows:

Population in Service Area

Year	Service Area (km2)	Pop. in Service Area	Pop. In DKI boundaries
1980	283	4,949,000 (76 %)	6,468,500
1985	283	5,372,000 (70 %)	7,630,100
1990	338	6,538,000 (74 %)	8,872,900
2995	383	8,002,000 (80 %)	9,949,600
2000	414	9,092,000 (83 %)	11,004,900
2005	454	10,496,000 (87 %)	11,998,900

Following assumptions, namely, 1) use of groundwater is different according to Zones and 2) percentage of population served is different by income (as shown below) are made, and population served is estimated as follows:

Use of groundwater by Zones :

Zone I (Northern area)	:	All people living in this Zone of northern coastal area depend wholly on piped water for domestic purpose
Zone II (Middle area)	:	The higher income group use more piped water, while the lower income group rely more on groundwater.
Zone III (Southern area)	:	Both high and low income groups use groundwater, because of the higher availability of groundwater than Zone II.

Population Served VS Population in Service Area

Year	Service Area (km2)	Population Served		Population in Service Area		Population In DKI boundaries
1980	283	* 4,024,000	(62 %) (81 %)	4,949,000	(76 %) (100 %)	6,468,500
1985	293	4,419,000	(58 %) (82 %)	5,372,000	(70 %) (100 %)	7,630,100
1990	338	5,357,000	(60 %) (82 %)	6,538,000	(74 %) (100 %)	8,872,900
1995	383	6,523,000	(66 %) (81 %)	8,002,000	(80 %) (100 %)	9,949,600
2000	414	7,497,000	(68 %) (82 %)	9,092,000	(83 %) (100 %)	11,004,900
2005	454	8,784,000	(73 %) (84 %)	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 on the above table, 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 that if the supply capacity were not limited, the potential population might be served.

4.B Water Requirement

The present water demand projection has regrouped the PDAM's 26 classifications of consumers into 14 categories for convenience. The results of projection are shown on Fig. 5. Day maximum demand will increase to 18,300 l/sec in 1990 and 36,200 l/sec in 2,005 against the present supply capacity, 6,800 l/sec in 1984.

Potential groundwater requirement is estimated at 8.6 m3/sec in 1990 for Jakarta administration area. The requirement will be gradually increasing toward the year 1990 and decreasing after 1990.

4.C Raw Water Sources

For the present water supply master plan, the following water sources are proposed :

1) Short-term water requirement (1987 - 1990) : Enlargement of the West Tarum Canal (WTC)
2) Mid-term water requirement (1991 - 1999): Tarum Jaya Canal (TJC) to be constructed from Curug to Bekasi and Cisadane River at Serpong
3) Long-term water requirement (after 2000): Cisadane River development and TJC

Planning of the enlargement of the West Tarum Canal is at present under way. When the work is completed, the conveyance capacity will be enhanced to 19 m3/sec, including an additional water supply use 2 m3/sec. This water will be used for the immediate project.

TJC project is under planning to take water from the Citarum River system. Currently the proposed capacity is 30 m3/sec, but it is subject to change in the future where required.

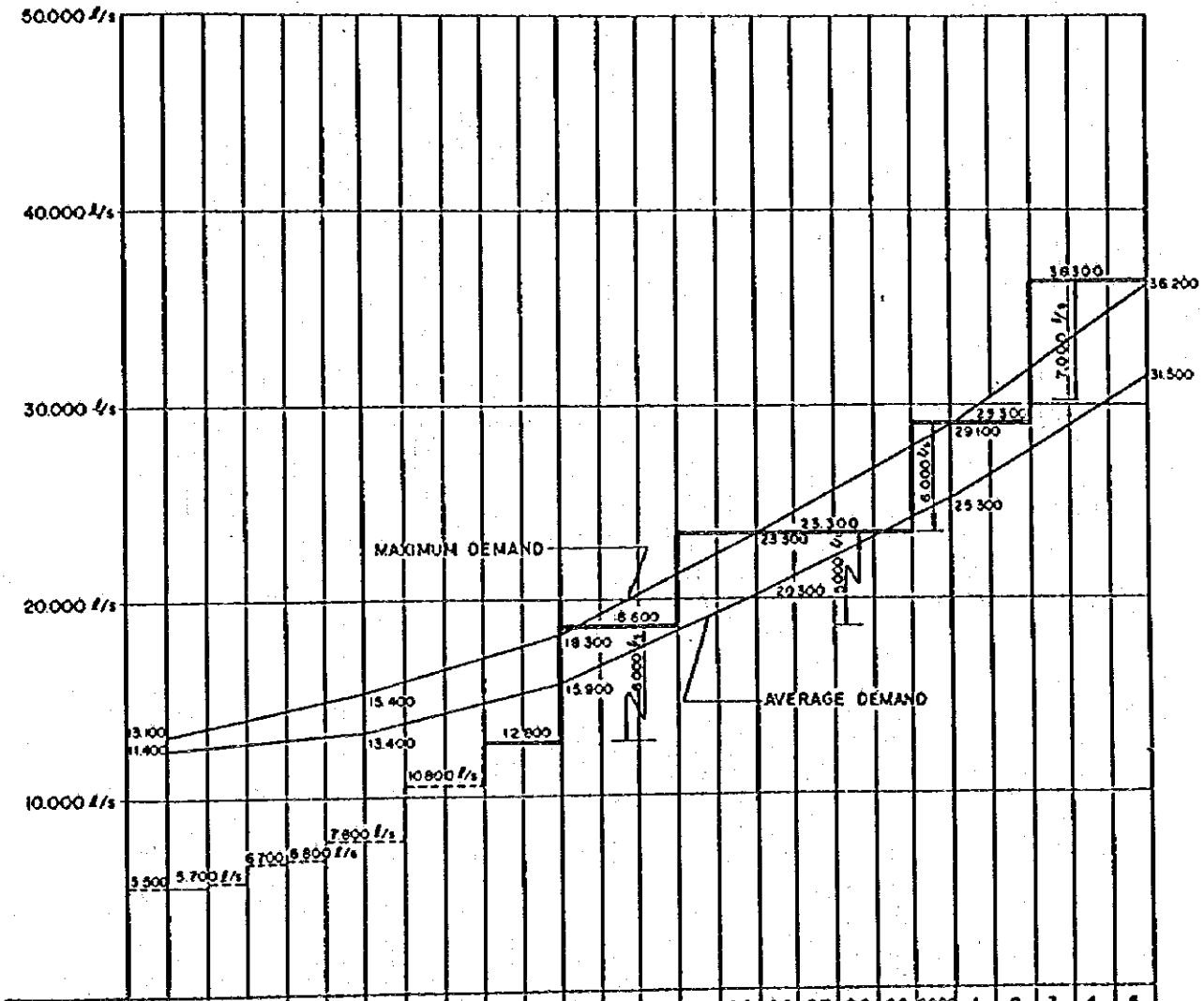
The study of the Cisadane River development is shceduled to start mid 1985 and finalized in 1987. If this proejct should be taken up preceding the TJC project, it would be more advantageous for water supply than the TJC.

The general plan of water sources is shown on Fig. 6 and relation between water requirement and raw water required is shown on Fig. 7.

Groundwater is fairly widely in use for domestic and industrial purposes in addition to PDAM's water supply. However, as the groundwater potentiality is limited new groundwater extraction in large quantity should be prohibited.

4.D Raw Water Quality and Treatment Process

Raw water sources proposed for water supply system to be constructed in the Master Plan period are the West Tarum Canal, Cisadane river, TJC and Cisadane dam systems. Charactristics of the water quality and treatment processes for each raw water are briefed as follows:



YEAR	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	2000	1	2	3	4	5
PHASING	1ST PHASE			2ND PHASE				IMM		1ST PHASE		2ND PHASE					1ST PHASE					2ND PHASE				
	FIRST STAGE							SECOND STAGE									THIRD STAGE									
EXISTING PRODUCTION	5.500 ℓ/s (475.000 m³/d)	5.700 ℓ/s	5.700	6.800	6.800	7.800 ℓ/s (566.000 m³/d)		10.800		10.800 ℓ/s (933.000 m³/d)		10.800 ℓ/s (934.000 m³/d)			10.300 ℓ/s (890.000 m³/d)		10.300 ℓ/s (890.000 m³/d)				10.300 ℓ/s (890.000 m³/d)			10.300 ℓ/s (890.000 m³/d)		
NEW TREATMENT PRODUCTION										2.000 ℓ/s (173.000 m³/d)		8.000 ℓ/s (691.000 m³/d)			13.000 ℓ/s (1.123.000 m³/d)					19.000 ℓ/s (1.726.000 m³/d)				26.000 ℓ/s (2.419.000 m³/d)	
TOTAL PRODUCTION	5.500 ℓ/s (475.000 m³/d)	5.700	5.700	6.800	6.800	7.800 ℓ/s (566.000 m³/d)		10.800		12.800 ℓ/s (1.106.000 m³/d)		18.800 ℓ/s (1.625.000 m³/d)			23.300 ℓ/s (2.013.000 m³/d)					29.300 ℓ/s (2.532.000 m³/d)				36.300 ℓ/s (3.136.000 m³/d)	

Fig.5 WATER DEMAND AND PROPOSED WATER PRODUCTION

JAKARTA WATER SUPPLY DEVELOPMENT PROJECT | JICA

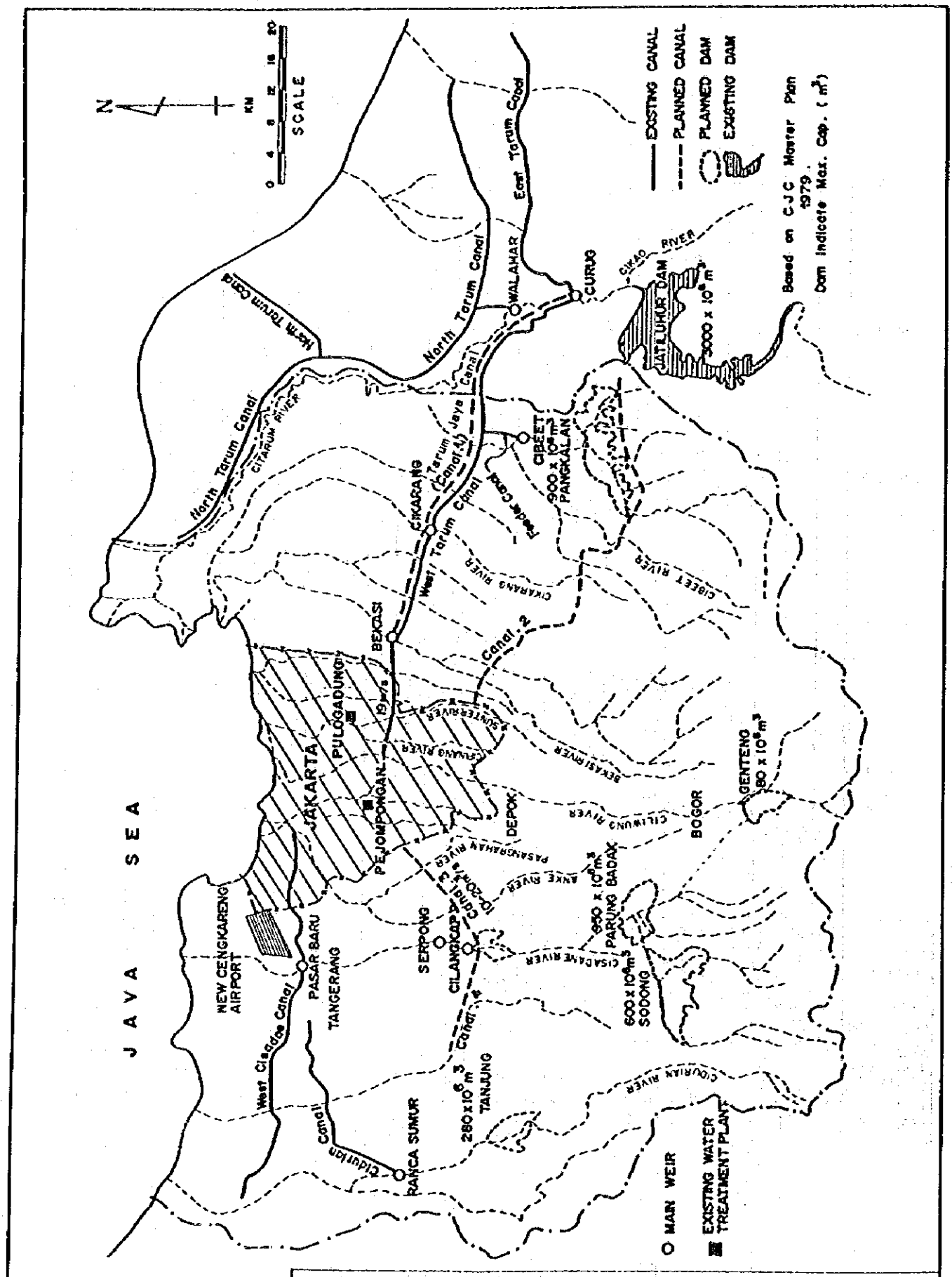
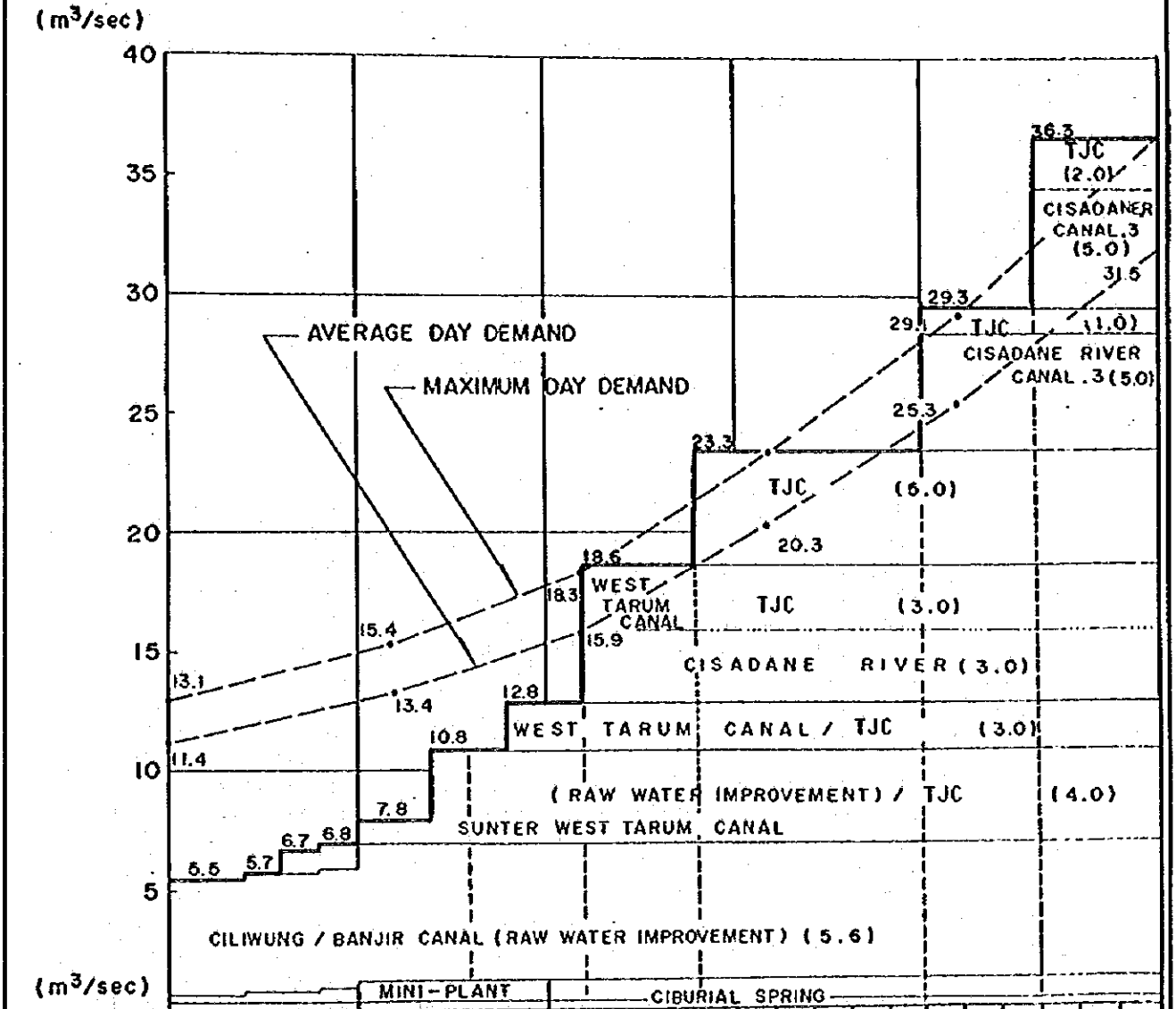


Fig.6 WATER RESOURCE DEVELOPMENT PLAN

JAKARTA WATER SUPPLY DEVELOPMENT PROJECT | JICA



YEAR	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	2000	1	2	3	4	5
PHASING	1 ST PHASE			2 ND PHASE				1 MM	1 ST PHASE		2ND PHASE						1 ST PHASE					2ND PHASE				
	FIRST STAGE							SECOND STAGE									THIRD STAGE									
EXISTING PRODUCTION	6.5		5.7	6.7	6.8	7.8		10.8	10.8		10.6			10.3			10.3					10.3				
NEW PRODUCTION									2.0		8.0			13.0			19.0					26.0				
TOTAL PRODUCTION	6.5		5.7	6.7	6.8	7.8		10.8	12.8		18.6			23.3			29.3					36.3				
RAW WATER DEMAND AT PLANT	(NEW SOURCE)								2.1		8.5			13.8			20.2					27.7				
	(EXISTING SOURCE)								Raw Water Improvement (4.3 + 6.0)																		

Fig.7 WATER REQUIREMENT AND NECESSARY OF RAW WATER

JAKARTA WATER SUPPLY DEVELOPMENT PROJECT | JICA

1) West Tarum Canal

Concentrations of Turbidity, Color, KMnO4, Fe, Mn, NH4 and Bacteria are comparatively high, and BOD and Faecal Coli frequently high by influence of the Bekasi River. Treatment processes proposed based on the quality charactristics are pre-chlorination, coagulation using Alum and Polymer, intermediate-chlorination, pH control and disinfection.

2) Cisadane River

Raw water of the Cisadane River at Serpong is rather high Turbidity, Color and Fe, and low concentration of NH4, KMnO4 and Faecal Coli. The turbidity and color are changeable. Treatment processes proposed are pre-chlorination, coagulation using Alum, pH control and disinfection.

3) Tarum Jaya Canal

Water of the proposed TJC at Bekasi is to be composed of water from Jatiluhur dam. Charactrictics of raw water are low Turbidity and light suspended solids, not so much pollutants of NH4, BOD and Faecal Coli, high pH value and Alkalinity and comparactively high Color and KMnO4. Treatment processes proposed are pre-chlorination, coagulation using Alum and polymer, pH control and disinfection.

4) Cisadane Dam

Utilization of impounded water in Cisadane dam system is proposed for the Third Stage Project. In present planning of treatment processes, the treatment methods proposed for the TJC water will be provisionally employed.

4.E Immediate Program

The immediate program to rehabilitate and to improve the existing water supply system is described as follows:

Rehabilitation Works The rehabilitation program for the reduction of water losses to be executed immediately includes replacement of old meters, old service connections and old distribution pipelines, and leakage abatement study. Outline of proposed rehabilitation works is as follows:

- Replacement of water meter, 74,000 meters (1985 to 1990)
- Replacement of distribution pipelines, 200 km (1986 to 1990)
- Replacement of old service connection 10,000 nos (1985 to 1990)
- Leakage abatement study (1986 to 1990)

Total costs are estimated at Rp.22,643 million.

Pejompongan Treatment Plant 1 No systematic rehabilitation nor improvement has been made since operation of the plant. PDAM started the normaliztion of mechanical and electrical equipment with own fund in 1983. The rehabilitation works are to be performed separated into four phases, namely, I) replacement of equipment of intake pump station, II) replacement of the treatment plant equipment, III) replacement of chemical feeding equipment and IV) replacement and overhaul of electrical equipment. The works are scheduled to be completed in 1986. Total cost of rehabilitation works is estimated at Rp. 4,340 million.

Raw water conveyance system Based on the recommendation of the present study, POJ has undertaken the feasibility study of raw water transmission from the WTC at Buaran to the Existing plants. Raw water is to be conveyed to Pejompongan Plant by pumping up from Buaran Treatment Plant which will be constructed under the Immediate Project and by gravity from crossing point with the Buaran River to Pulogadung Plant. Total costs is estimated at US$ 46.7 million (equivalent to Rp. 46,890 million), including construction cost, and contingencies.

Short Term improvement Project for treatment process In order to treat the present deteriorated raw water until the completion of the raw water conveyance system from the WTC, strengthening of chlorination is recommended as short term improvement project for the existing plant. Total costs is estimated at Rp. 1,170 million.

Improvement project for distribution pipeline For full utilization of available water production, augmentation of secondary and tertiary pipelines is proposed. Total length of secondary pipeline is estimated at 38 km and of tertiary pipeline at 930 km inclusive of installation of 347 km long procured by the First Stage Project. Total costs are estimated at Rp. 26,859 million.

Immediate Project The immmediate project has been conceived on the conditions of; i) to narrow the present gap between the supply capacity and the potential demand, ii) to use 2.0 m3/sec of raw water by enlargement of the WTC around the end of 1988, and iii) to minimize construction cost by connecting with the existing distribution networks. The project is summarized below:

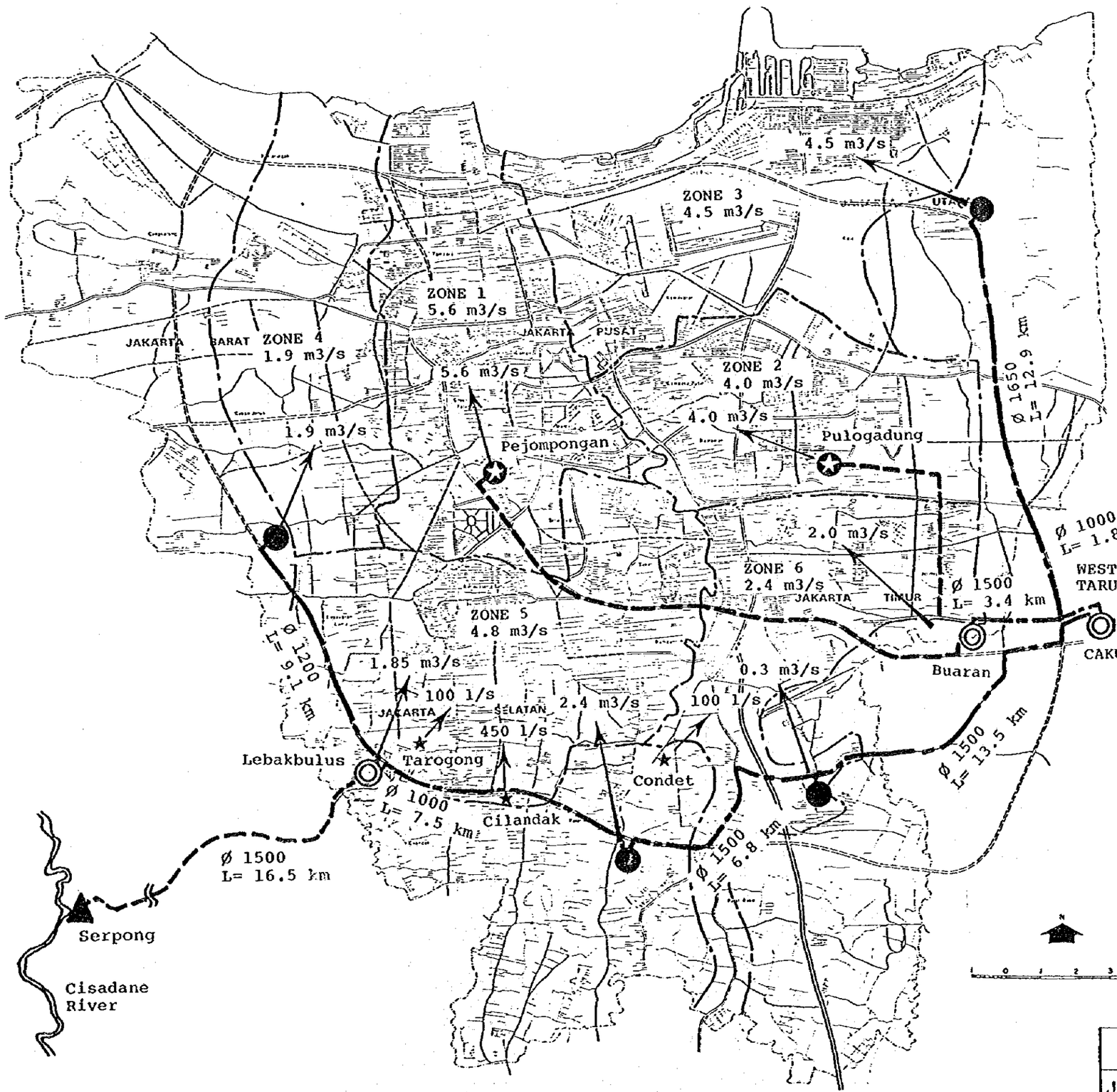
- Water source	:	West Tarum Canal
- Raw water intake	:	At the crossing point with the Jati Kramat River
- Treatment plant	:	Same site as intake point
Treatment process	:	Applications of alum and polymer, pre-, intermediate-, and post-chlorination, and post-lime.
- Distribution mains	:	ø 1,200 x 7.6 km, / 1,000 x 5.8 km and ø 900 x 3.4 km
- Project cost	:	Equivalent to US$ 32.45 million, F/C US$ 17.0 million and L/C Rp. 15,300 million.

4.F Future Expansion Program

Expansion Project The long range plan of the extension of the Jakarta Water Supply System shall be executed by stagewise implementation in the Second Stage and Third Stage. Outline of the projects in each Stage is briefed as follows:

Description	Second Stage Project	Third Stage Project
Target year	1995	2005
Total Population	9,949,600	11,998,900
Population Served	6,523,000	8,784,000
Served Area (km^2)	383	454
Supply Capacity	Total 23.3 m^3/sec Existing 12.3 " Additional 11.0 "	Total 36.3 m^3/sec Existing 23.3 " Additional 13.0 "
Phase of Implementation	2 phases	2 phases
Water Source	WTC 3.2 m^3/sec Cisadane R. 3.2 " TJC 5.3 "	Canal 3 10.7 m^3/sec TJC 3.2 "
Location of Treatment Plant	Buaran, Lebakbulus and Cakung	Lebakbulus and Cakung
Major Facilities		
- Raw water intake and transmission	Raw water main ø1500 x 16.5 km Raw water canal Cap. 20 m^3/s x 6.7 km Cap. 11 " x 4.9 "	-
- Treatment Plant	Buaran 3.0 m^3/s Lebakbulus 3.0 " Cakung 5.0 "	Lebakbulus 10.0 m^3/s Cakung 3.0 "
- Treated water transmission	ø1000 to ø1650x55 km	ø1100 to ø1500x45 km
- Distribution	Service area: 6 zones Distribution center: 2 Distribution pipeline: Trunk mains, ø300 to ø1800 x 289 km Secondary/tertiary mains, ø50 to ø250 x 3,600 km	Service area: 9 zones Distribution center: 5 Distribution pipeline: Trunk mains, ø300 to ø1200 x 202 km Secondary/tertiary mains, ø50 to ø250 x 3,800 km

General layouts of each Stage Project are shown in Figs. 8 and 9.



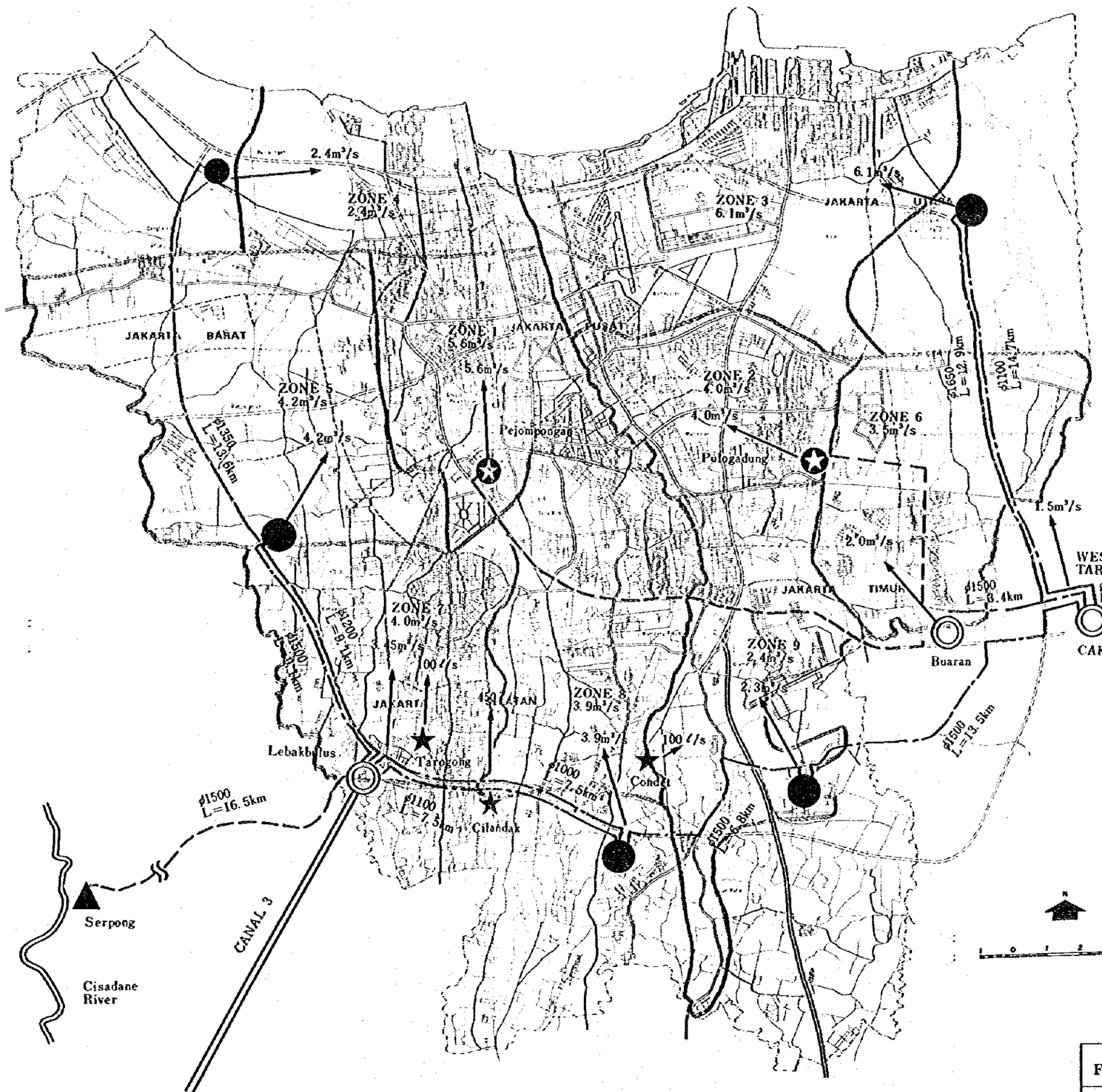
	First Phase (1990) (m3/s)	Second Phase (1995) (m3/s)
WATER SOURCE		
West Tarum Canal (WTC)	15.6	6.0
Cisadane River (CSR)	3.2	3.2
Tarum Jaya Canal (TJC)	-	14.9
Total	18.8	24.1
TREATMENT PLANT		
Pejompongan	5.6 (WTC)	5.6 (WTC)
Pulogadung	4.0 (WTC)	4.0 (TJC)
Buaran (Immediate)	2.0 (WTC)	2.0 (TJC)
Buaran	3.0 (WTC)	3.0 (TJC)
Lebakbulus	3.0 (CSR)	3.0 (CSR)
Cakung	-	5.0 (TJC)
Total	17.6	22.6

LEGEND

- : Existing Treatment Plant
- : Existing Mini Plant
- : Proposed Treatment Plant
- : Proposed Distribution Center
- : Proposed Raw Water Intake
- : Proposed Raw Water Transmission Pipeline
- : Proposed Treated Water Transmission Pipeline
- : Boundary of Supply Zone

Fig.8 GENERAL LAYOUT OF 2ND STAGE PROJECT

JAKARTA WATER SUPPLY DEVELOPMENT PROJECT | JICA



	Second Stage (1995) (m3/s)	Third Stage (2005) (m3/s)
WATER SOURCE		
West Tarum Canal (WTC)	6.0	6.0
Cisadane River (CSR)	3.2	3.2
Tarum Jaya Canal (TJC)	14.9	18.1
Canal 3 (C.3)	-	10.7
Total	24.1	38.0
TREATMENT PLANT		
Pejompongan	5.6 (WTC)	5.6 (WTC)
Pulogadung	4.0 (TJC)	4.0 (TJC)
Buaran (Immediate)	2.0 (TJC)	2.0 (TJC)
Buaran	3.0 (TJC)	3.0 (TJC)
Lebakbulus	3.0 (CSR)	3.0 (CSR)
	-	10.0 (C.3)
Cakung	5.0 (TJC)	8.0 (TJC)
Total	22.6	35.6

LEGEND

- : Existing Treatment Plant
- : Existing Mini Plant
- : Proposed Treatment Plant
- : Proposed Distribution Center
- : Proposed Raw Water Intake
- : Proposed Raw Water Transmission Pipeline (Second Stage)
- : Proposed Treated Water Transmission Pipeline (Second Stage)
- : Proposed Treated Water Transmission Pipeline (Third Stage)
- : Boundary of Supply Zone

Fig.9 GENERAL LAYOUT OF 3RD STAGE PROJECT

JAKARTA WATER SUPPLY DEVELOPMENT PROJECT

Service Connection and Meter Installation The service connections and water meters are planned to be installed at a five year interval as follows:

Service connection

Year	Domestic Residential	Domestic Public Hyd.	Non-domestic	Total	Increment
1983	111,451	1,417	21,106	133,974	7,500
1985	131,720	1,780	23,500	157,000	23,026
1990	272,800	3,300	41,870	318,000	161,000
1995	470,830	5,480	74,690	551,000	233,000
2000	691,320	7,950	177,730	817,000	266,000
2005	954,010	15,090	175,900	1,145,000	328,000

Water meter

Year	1/2" to 1-1/2" No.	1/2" to 1-1/2" Additional	2" to 16" No.	2" to 16" Additional	Total No.	Total Additional
1983	126,095	-	688	-	126,783	-
1985	147,760	21,665	740	52	148,500	21,717
1990	307,950	160,190	1,550	810	309,500	161,000
1995	539,790	231,840	2,710	1,160	542,500	233,000
2000	804,460	264,670	4,040	1,330	808,500	266,000
2005	1,130,820	326,360	5,680	1,640	1,136,500	328,000

Public Hydrant Number of public hydrants proposed are distributed to each Administration District considering low income group as follows:

Area Kotamaya	Schedule of Public Hydrant 1984 (Aug. 1984)	1985	1990	1988	2000	2005
PUSAT (Central)	466	500	790	1,120	2,430	2,280
TIMUR (East)	86	190	520	950	1,440	3,120
BARAT (West)	481	500	770	1,330	2,100	4,410
SELATAN (South)	57	120	350	670	960	1,610
UTARA (North)	419	470	870	1,410	2,020	3,670
Total	1,509	1,780	3,300	5,480	7,950	15,090

Meter Repair Shop and Meter Storage For improving present meter repair works, furnishing additional meter test equipment is proposed. More storage spaces are required for increase of provision of meters for replacement and new service connections in future.

4.G Cost Estimates

Total project costs estimated for the Second Stage and Third Stage Projects are summarized below:

Unit: F/C US$ million
L/C Rp billion

Items	Immediate Project		Second Stage Project						Third Stage Project	
			Phase I		Phase II		Total			
	F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C	F/C	L/C
1. Land	-	0.3	-	4.1	-	2.8	-	6.9	-	7.7
2. Raw Water Intake	Included to Item 4		3.0	1.8	-	-	3.0	1.8	-	-
3. Raw water Tarnsmission Facilities	Included to Item 4		10.2	3.7	-	10.2	10.2	13.9	-	-
4. Treatment Facilities	5.7	5.8	14.4	14.6	12.0	12.4	26.4	27.0	31.2	31.7
5. Transmission Facilities	-	-	17.5	5.8	19.1	7.4	36.6	13.2	23.6	9.9
6. Distribution Facilities	6.5	3.1	60.4	53.4	40.4	39.9	100.8	93.3	90.4	90.0
7. Power Receiving Cost	Included to Item 4		-	2.3	-	1.6	-	3.9	-	3.7
8. Administration Cost	-	0.9	-	1.7	-	1.5	-	3.2	-	2.9
9. Engineering Cost	1.3	0.6	7.4	2.4	5.0	2.1	12.4	4.5	10.2	3.9
Sub-total (Items 1 to 9)	13.5	10.7	112.9	89.8	76.5	77.9	189.4	167.7	155.4	149.8
10. Physical Contingency 1/	1.4	1.3	11.3	9.0	7.7	7.8	19.0	16.8	15.5	15.0
Sub-total (Items 1 to 10)	14.9	12.0	124.2	98.8	84.2	85.7	208.4	184.5	170.9	164.8
11. Price Contingency 2/	2.1	3.3	62.8	79.2	75.8	111.3	138.6	190.5	321.1	444.2
Total	17	15	187	178	160	197	347	375	492	609

Note: 1/ applied at 10% for basic cost
2/ applied at 7.5% (1984), 7.0% (1985) and 6.0% (1986 and thereafter) for F/C and at 15.0% (¢1984), 11.0% (1985) and 7.0% (1986 and thereafter) for Second and Third Stage Projects

4.H Implementation Schedule

The implementation of the present water supply project shall be undertaken by stepwise construction, two stages implementation are recommended with Second Stage for target year 1995 and Third Stage for 2005. The Second Stage Project is proposed to be executed by two phases in its implementation; First Phase and Second Phase, to avoid a heavy investment, and starts from the First Phase Program as an immediate extension project. The implementation schedule for the whole projects is shown in Table 3.

4.I PDAM Proposed Organization

Alternative Structure In order to meet the expansion of the systems in the Second Stage Project, PDAM is required (See Master Plan, Chapter 3);

(1) To attain maximum utilization of the existing water supply facilities through efficient and effective control of every possible resources.

(2) To maintain and/or upgrade level of service.

(3) To provide its customers with required services at the lower possible costs.

(4) To ensure further establishment of system of financial self-supporting.

Proposed Organization and Modification Required Alternative structures were studied and evaluated for the purpose of overall reinforcement of PDAM management structure. As a result of comparison of advantageous and disadvantageous, Alternative 3 was recommended for PDAM to employ for future modification as shown on Fig. 4 in the Master Plan.

(1) Creation of Engineering Directorate

(2) Upgrading of Service Directorate

(3) Shift of line organization of Branch Office, Installations and Units (See Master Plan, Chapter 4)

Staffing plan up to the year 2005, target year of the present Master Plan, required in each of division and sections in the revised PDAM organization, is developed to carry out the proposed water supply expansion program. The staffing plan, as guidelines in determining in number of staff in different qualifications to conduct assigned work in the function, was prepared on the assumption that the production increase of the plant will be made according to the phased programs and total

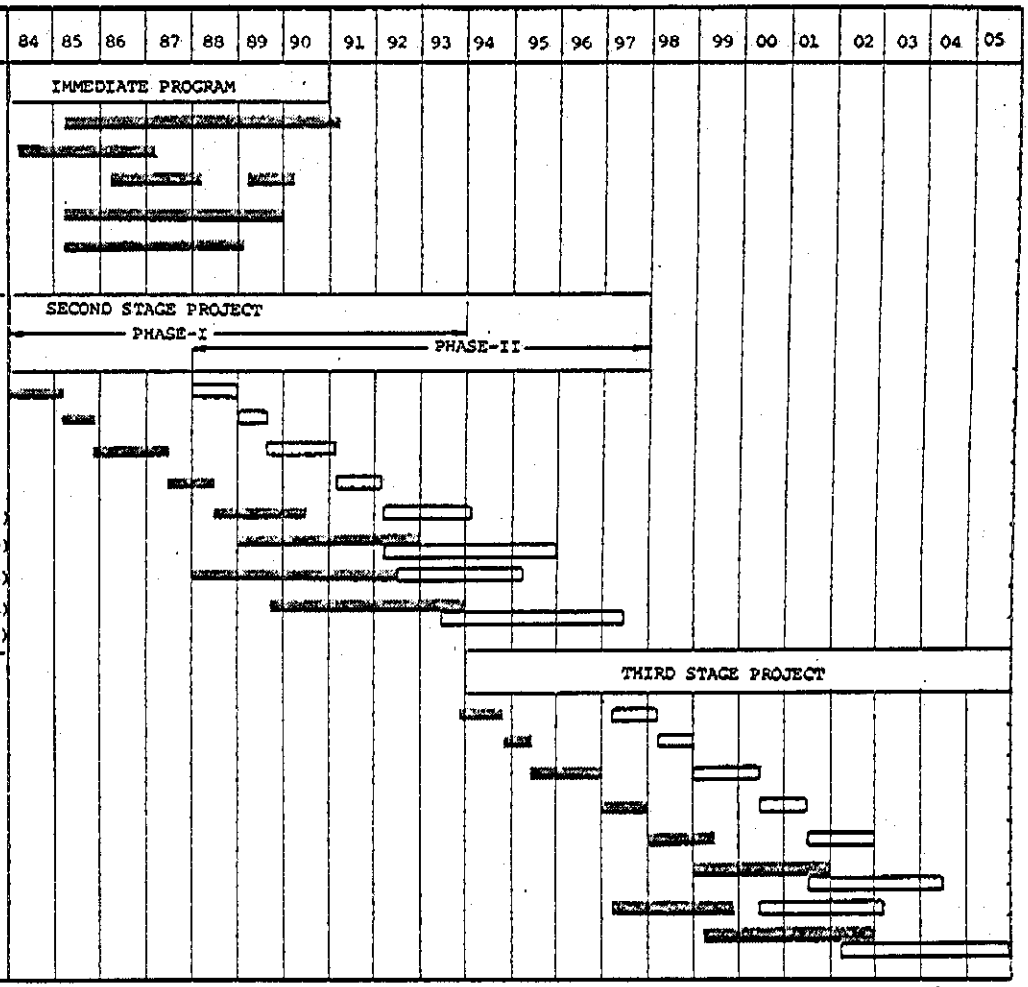
number of connection will be increased in order to distribute produced water to consumers. The total staff required at the end of the year 1985, 1990, 1995, 2000 and 2005 is as follows. (See Master Plan Chapter 4)

	1985	1990	1995	2000	2005
Staff Required	2,134	3,356	4,720	6,186	7,653

Vigorous efforts will be required to retain and recruit the required numbers of qualified staff as proposed, and to achieve the target of the proposed staffing plan as intented, PDAM is required to develop recruitment policy with allocation of necessary budget. Also concensus on necessary recruitment should be obtained among divisions in PDAM and an approval from Water Board in DKI.

Table 3 MASTER PLAN IMPLEMENTATION SCHEDULE

Program	Period (M)	Cost (Rp. Bill)
IMMEDIATE PROGRAM		
1) Rehabilitation Works of D/P	72	13.25
2) Improvement of Pejompongan Plant I	36	4.34
3) Short Term Improvement	36	1.17
4) Improvement of Distribution Pipelines	57	18.23
5) Immediate Project	46	26.89
Sub-total		63.88
SECOND STAGE PROJECT		
1) Review of M/P and Preparation of F/S	20(12)	-
2) Appraisal and Loan Negotiation	8(8)	-
3) Selection of Consultants and D/D	19(18)	-
4) Tendering/Award of Contract	12(12)	-
5) Manufacturing/Shipping of P/E	24(18)	29.14(17.92)
6) Manufacturing/Shipping of Pipes	48(46)	95.47(66.59)
7) Construction of Civil Works	42(33)	28.11(22.46)
8) Pipelaying Works	52(48)	53.42(63.18)
Sub-total		206.14(170.15)
THIRD STAGE PROJECT		
1) Review of M/P and Preparation of F/S	12(12)	-
2) Appraisal and Loan Negotiation	8(8)	-
3) Selection of Consultants and D/D	18(18)	-
4) Tendering/Award of Contract	12(12)	-
5) Manufacturing/Shipping of P/E	18(18)	46.97
6) Manufacturing/Shipping of Pipes	36(36)	124.09
7) Construction of Civil Works	33(33)	58.89
8) Pipelaying Works	46(46)	105.91
Sub-total		335.86



Note : M/P : Master Plan
F/S : Feasibility Study
D/D : Detailed Design Engineering
D/P : Distribution Pipelines
P/E : Plant Equipment
Cost : shown in Rp. Billion in present cost as of March 1984.
( ) : Phase II

FEASIBILITY STUDY

CONCLUSION AND RECOMMENDATION

1. First Phase of Second Stage Project is proposed to be implemented as the next extension project succeeding to the ongoing First Stage Project. The project consists of two systems, namely, WTC and Cisadane systems, with an incremental capacity of 6.0 m3/sec taking raw water from enlarged WTC (3.2 m3/sec) and the Cisadane River at Serpong (3.2 m3/sec). The plant sites of both systems are proposed at Buaran for WTC system and Lebakbulus for Cisadane system.

2. Local development in the served area should be reviewed from time to time, so as to install timely distribution mains revising the original implementation schedule.

3. To achieve simultaneous implementation of the two systems, WTC and the Cisadane systems, as proposed, all activities of agencies concerned are recommended to be well coordinated for such as funding, provision of raw water, land acquisition, construction works etc.

4. In detailed design engineering the following should be observed:

   1) Intake facilities at Serpong should designed based on detailed topographical survey and water level fluctuation.

   2) Raw water transmission pipeline from Serpong to Lebakbulus plant needs detailed study on selection of pipeline route based on precise topographic map which is under preparation by DGWRD.

   3) Detailed study on treatment facilities especially for WTC water should be made considering difficulty of clarifying raw water at certain period due to fine silt in suspension. It will be worthy to consider setting up of pilot scale plant for economy of construction.

   4) Study on distribution methods such as direct pumpage and elavated tank shall be done in terms of economy, comparing initial cost and operation cost, and control of pressure of distribution mains in view of leakage of the system.

5. Water quality analysis of the Cisadane River should be carried out at Serpong at least twice a month continuously for a year for the cmoing detailed design, since up-to-date data is necessary.

6. Trend of demand should be monitored continuously for prompt actions to minimize adverse effects of water demand deviation from planned in areas. Actions to be taken among others will be overload operation of facilities until succeeding project, provisional change of boundary of supply zones, extention of secondary and tertiary mains.

7. Tariff level and structure should be carefully determined, for avoiding a large deviation from the projected level of revenues by analysing consumption pattern and behaviour of water users based on accurate and relevant data.

8. Groundwater management system should be appropriately established in order to encourage present groundwater users to switch to piped water.

9. Improvement of PDAM organization and upgrading of its management system was proposed for sound business operation as well as operation and maintenance of facilities to be expanded in the Second Stage.

10. Modification and improvement of PDAM organization and management were recommended to be initiated with start of the detailed design and implemented during the design and completed at the end of 1987, ensuring PDAM build up capability of actual operation and maintenance of the newly expanded system, and also to participate in planning and designing by assignment of engineering staff.

11. Strengthening of engineering forces and increase of manpower in production and also operation of the system together with necessary training was recommended in order to increase operation capacity of overall engineering and field activities expanded by PDAM's policy of decentralization.

12. Coordination among agencies concerned is required for smooth execution of the projects which are many in kind and large in volume including Immediate Program and First Phase of Second Stage Project. In this connection, the following arrangements will be needed.

    1) Establishing a special group of experts to supervise and control all relevant projects to be implemented by different agencies.

    2) Preparing and giving a guideline defining direction and scope of works, approach etc to consultants of each project.

    3) Providing PDAM with consultants for coordination and management for expansion of all its business operation and projects.

I. INTRODUCTION

1.A Outline of the Second Stage Project

Master Plan has proposed two stages implementation for the whole construction up to the year 2005. The Second stage Project succeeding to the First Stage Project, was planned to meet the water demand in the year 1995. The Project is to be executed by two phases and outlined in Table 4.

1.B Scope of Feasibility Study

The Feasibility Study covers the First phase of Second Stage Project due to the following reasons: 1) Total supply capacity of the water supply system provided by this project in capable of nearly meeting the potential water demand without unrealistically large investment; 2) water sources required are available from the Cisadane River and WTC; and 3) Financing, both internal and international, of the required fund is considered in the affordable range of the agencies concerned.

II. WATER REQUIREMENT

2.A Service Area

The area proposed to be extended in the First Phase of the Second Stage Project is 55 km2 from the existing area of 283 km2 and the following areas are to be newly included: 1) Parts of Kec. Penjaringan and Cengkareng, North and West Districts, 2) Parts of Kec. Kebon Jeruk and Kebayoran Lama, West and South Districts, 3) Part of Kec. Koja, North District, 4) Part of Kec. Jatinegara, East District, and 5) Part of Kec. Mampang Prapatan, South District. The area extended in the First Phase Project are shown on Fig. 10.

2.B Population served, Water requirement and Production

Population served to be covered by the First Phase of Second Stage Project is shown on Table 4.

2.C Water Demand Distribution

The areawise day maximum demand in 1990 is shown below:

	Central District	North District	West District	South District	East District
Service Area (km2)	48.54	89.34	56.10	74.86	69.56
Max. Day Demand (m3/sec)	4.24	3.31	3.12	3.66	3.86

Description		Present		1st Phase	2nd Phase
Target Year		1988 (Completion of 1st Stage Project)		1990	1995
Service Area (km2)		283		338	383
Total Population (x 1,000)	(A)	8,375	*	8,872	9,949
Total Population in Service Area (x 1,000)	(B)	6,072	*	6,538	8,002
Population Served (x 1,000)	(C)	3,707	*	5,357	6,523
Service Ratio (%)	(C/B)	61.0		81.9	81.5
	(C/A)	44.3		60.4	65.5
Water Requirement					
Average Consumption (l/s)	(D)	5,200	*	9,600	13,600
Unaccounted-for Water (l/s)	(E)	4,200 (45 %)	*	6,300 (40 %)	6,700 (33 %)
Average Demand (l/s)	(F)	9,400	*	15,900	20,300
Gross Per Capita Demand (lpcd)	(F/C)	254		257	268
Maximum Daily Demand (Average Demand x 1.15)		10,800	**	18,300	23,300
Expanded Capacity)l/s)		-		6,000	5,000
Raw Water Requirement (l/s) (expanded Capacity x 1.07)		-		6,400	5,300

Note : * Projected figures
** Total water production

Table 4 OUTLINE OF THE SECOND STAGE PROJECT

JAKARTA WATER SUPPLY DEVELOPMENT PROJECT | JICA

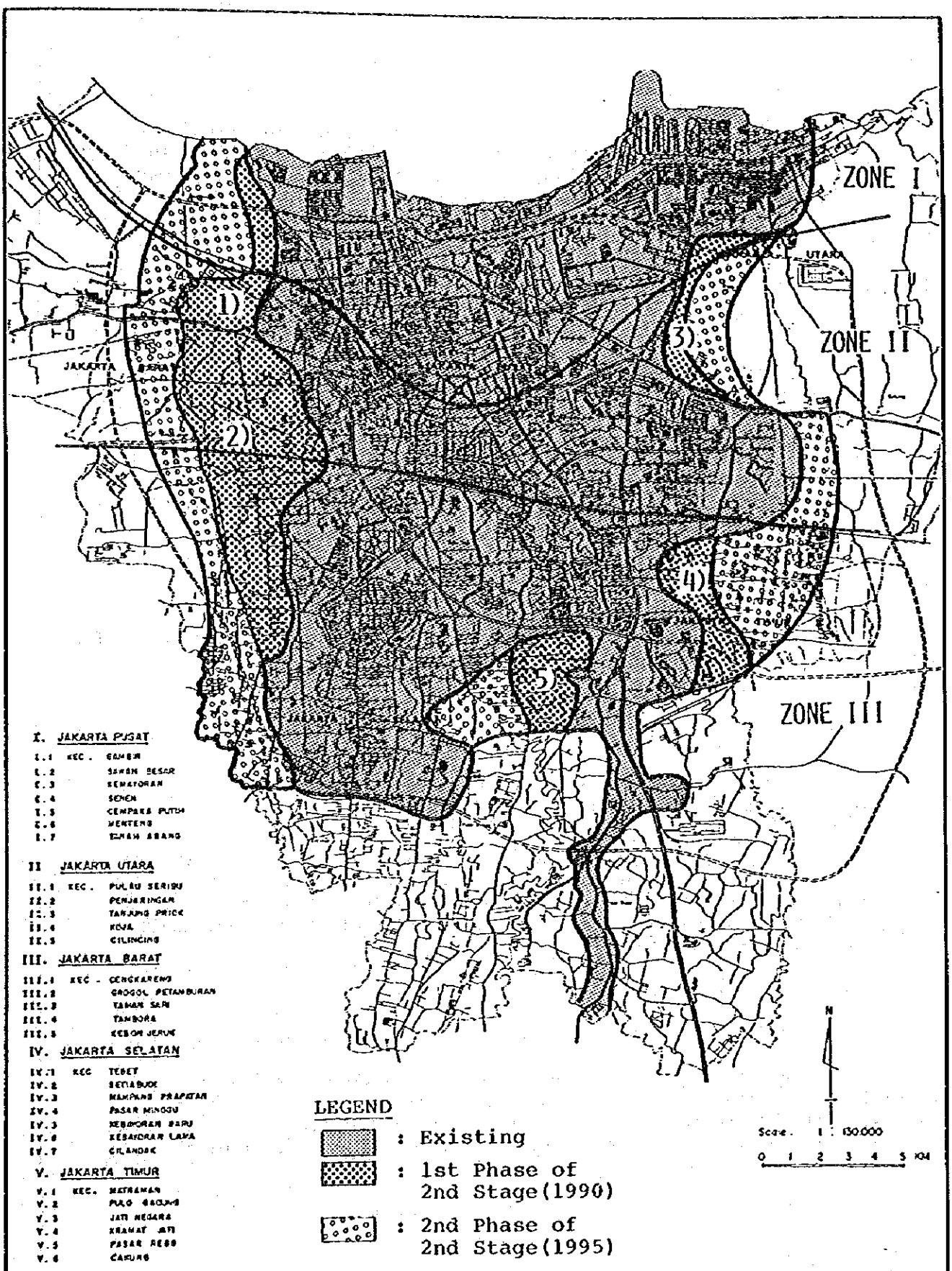


Fig.10 SERVICE AREA IN YEAR 1990/1995

JAKARTA WATER SUPPLY DEVELOPMENT PROJECT | JICA

III. IMMEDIATE PROGRAM

Prior to the implementation of the First Phase of Second Stage Project, an execution of the following projects was immediately required as proposed in the Master Plan. The costs required for these project are to be reflected in the financial analysis.

1) Rehabilitation works and leakage abatement study for water loss reduction

   Total costs : Rp 22,643 million
   Period : 1985 to 1990

2) Short term improvement for water treatment by reinforcing chlorination facilities

   Total Costs : Rp 1,170 million
   Period : 1986 and 1989

3) Improvement of distribution pipeline for full utilization of available water production

   Total costs : Rp 26,859 million
   Period : 1985 to 1989

4) Immediate Project for production increase by construction of a treatment plan at Buaran.

   Total costs : Rp 37,148 million
   Period : 1985 to 1988

IV. FIRST PHASE OF SECOND STAGE PROJECT

The First Phase of Second Stage Project is composed of two system according to the location of water sources and areawise water demand. They are the Cisadane River System (Cisadane System) and the West Tarum Canal System (WTC System) both with a capacity of 3.0 m3/sec. General layout is shown on Fig. 11.

4.A WTC System

The WTC system covers supply zone 3, northern area.

Raw Water Intake The WTC System takes raw water from the WTC through the intake channel, which is constructed by the Immediate Project, by gravity flow. For the purpose of constant level of intake, the regulator is to be constructed close to and downstream of the channel.

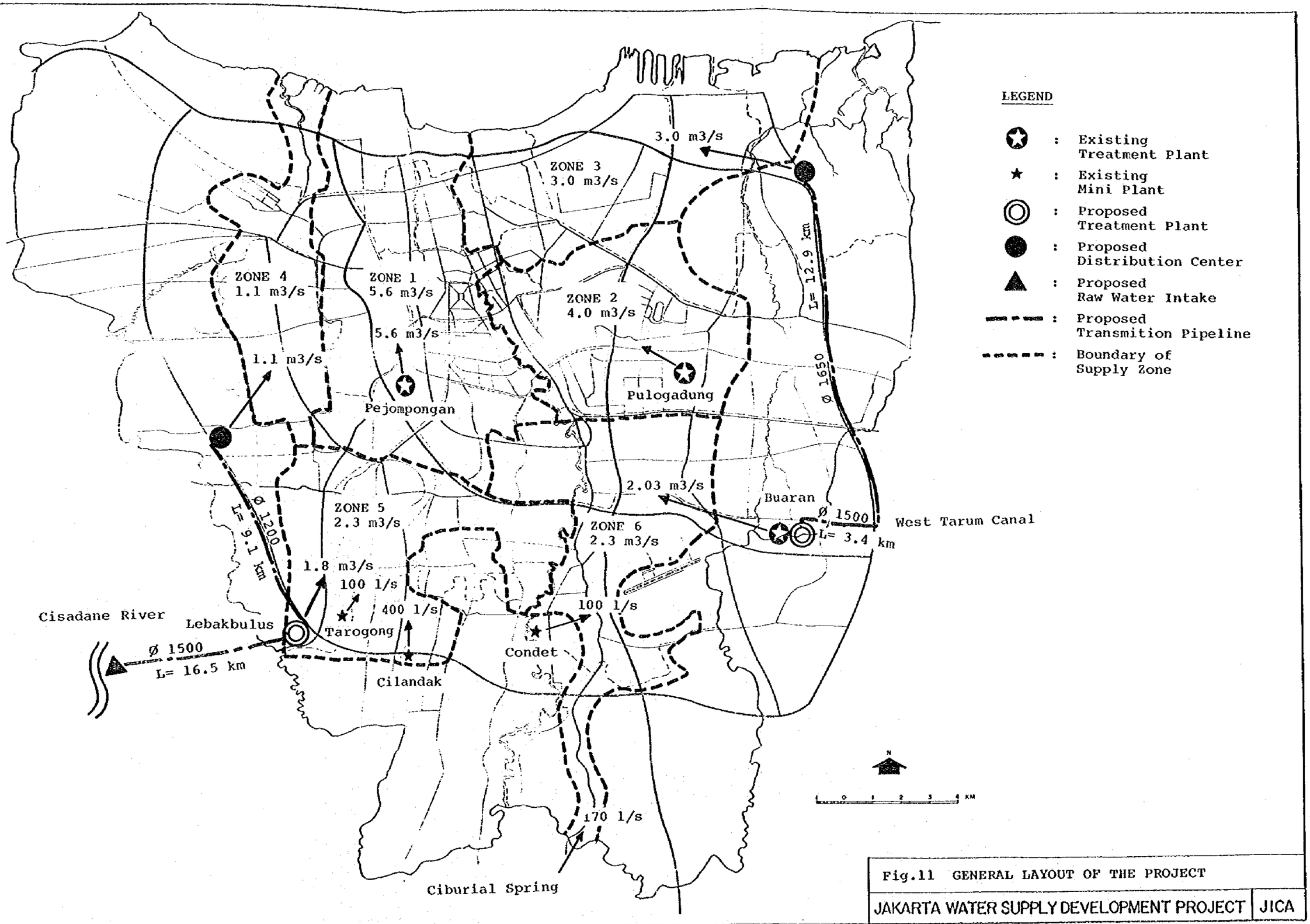


Fig.11 GENERAL LAYOUT OF THE PROJECT

JAKARTA WATER SUPPLY DEVELOPMENT PROJECT | JICA

Treatment Plant The treatment plant is to be constructed on the premises of the plant of the Immediate Project. The plant type is selected from among various possible types which are applicable to the raw water.

The facilities in the plant are consisted of; raw water main from the channel, receiving well, mixing well, flocculation and sedimentation basins, rapid sand filter, clear water reservoir, wastewater pond, backwash tank, chemical feeding equipment, chemical and operation buildings, and electrical equipment including instrumentation and monitoring system.

Chemicals applied through treatment processes will be Alum and Polymer for coagulations, pre-, intermediate- and post-chlorinations and post-lime for pH control.

Treated Water Transmission The transmission facilities to be constructed for transmitting treated water from the treatment plant to the distribution center for Zone 3 are composed of pumps, pump house and trunk mains of 16.3 km long ranging ø 1500 to ø 1650 mm in diameter.

4.B Cisadane System

Locations of intake and treatment plant sites are selected at Serpong for the intake and at Lebakbulus for the plant. The System covers Supply Zones 4 and 5.

Raw Water Intake Considering raw water quality condition, position of the main stream in the river cross section, better access to the site, availability of land and most shortcut to the plant, Location of the intake site is selected at Serpong. Raw water intake facilities consist of intake bay, channel, grit chamber, raw water transmission pump and pump house.

Raw Water Transmission Pipeline The pipeline crosses several small rivers and streams from the intake to the plant and is ø 1,500 mm in diameter and 16.5 km long.

Treatment Plant A few water samples employed for the present study are obtained in a rather short period of the wet season. In the detailed design stage, samples covering longer period should be analyzed, and accordingly the chemical application and treatment processes proposed here are subject to review.

Raw water has rather high turbidity, color and iron, and low concentrations of Ammonium, Organic Matter and Faecal Coli. For treatment of this raw water, ordinary treatment method is employed by applying Alum and pre-line for coagulation, pre- and post- chlorination and post-line for pH control.

The facilities in the plant are composed of receiving well, mixing well, floculation and sedimentation basins, filter, clear water reservoir, backwash tank, wastewater pond, chemical feeding equipment, chemical and operation buildings, and electrical equipment including instrumentation and monitoring system.

Treated Water Transmission Transmission of treated water is by gravity flow from the treatment plant to the distribution center for Zone 4. The transmission main is planned inclusive of the capacity required in the Second Phase and 9.1 km long of ø 1200 mm in diameter.

4.C Distribution System

Whole service area is divided into six supply zones. Each zone has basically a treatment plant and a distribution center from where water is distributed by pumps. The supply zones are to be interconnected to supplement water to each other for emergency cases.

Distribution Center Two distribution centers are proposed for the supply zone 3 located at northeastern fringe of the service area and the zone 4 at western fringe. Each center is composed of service reservoir, distributions pump and chlorination facilities.

Distribution Trunk Main The length of distribution trunk main to be installed by the First Phase Project was estimated at 200 km in total. The diameter and length in each zone are as follows:

Zone 1	ø 300 to ø 900 mm	42.2 km
Zone 2	ø 300 to ø 600 mm	23.6 km
Zone 3	ø 300 to ø 1800 mm	32.5 km
Zone 4	ø 300 to ø 1500 mm	41.6 km
Zone 5	ø 300 to ø 1500 mm	43.3 km
Zone 6	ø 300 to ø 1000 mm	16.8 km

4.D Service Connection and Water Meter

Numbers of service connections and water meters proposed were presented in the Master Plan (refer to the table in the Master Plan, section 4.6).

4.E Public Hydrant

Numbers of public hydrants to be installed in the District and improvement schedule proposed were presented in the Master Plan (refer to the table in the Master Plan, section 4.6).

4.F Work Shop, Meter Test Facility, Storage, Equipment and Tools, and Motor Vehicles

The workshop furnished by necessary machines and tools to overhaul and repair equipment was proposed on the premises of Buaran Plant. About 2.5 ha of land is required for stock yard of distribution pipes for extension and replacement of old distribution pipes, and is also proposed on the premises of Buaran Plant.

A few tools and equipments are provided in PDAM for pipelaying works of extension and replacement of distribution small pipes and installing service connections. Procurement of pipe cutters, pipe beveler, tapping and drilling machines and tools such as pipe threader, torque wrench and chair wrench were proposed as well as equipments necessary for pipelaying works; drain pump, road cutter, tamper, compactor etc.

A meter test facility for large meters was proposed to be installed in adjacent to the present meter repair shop.

Considering need at present and near future for operation and maintenance of the system at branch offices, plants and central office, purchase of motor vehicles; pick-up truck, mini-bus, tank rolly and motorbike are proposed.

V COST ESTIMATE

The costs for the First Phase of Second Stage Project were estimated on the basis of manufacturer's quotations for supplies of materials and equipment which were adjusted according to the past bidding prices in Jakarta and prevailing market prices for construction materials and labors in Jakarta.

1) Foreign currency component: the cost to be paid in the foreign currency such as imported equipment and materials (CIF price) and small size pipe materials locally produced, and foreign currency portion of expatriate service cost.

2) Local currency Component: the cost to be paid in the local currency portion for local labors and materials manufactured or produced locally, handling charges and local transportation charges for imported equipment and materials, taxes for contractors and expatriate's local cost.

3) Contingencies: Physical contingency is allowed at 10 % rate both for the basic cost of materials and works, and price contingency is allowed for both the basic cost and physical contingency for overall period of the project implementation at the following escalation rates per annum:

Currency	1984	1985	1986 and thereafter
Foreign Component	7.5 %	7.0 %	6.0 %
Local Component	15.0	11.0	7.0

Total cost estimates are presented below:

Unit : F/C US $ 1,000
L/C Rp. million

Items	Cisadane System		WTC System		Total	
	F/C	L/C	F/C	L/C	F/C	L/C
1. Land Aquisition Cost	-	2,480	-	1,666	-	4,146
2. Supply and Construction Costs	51,606	37,522	53,844	41,773	105,450	79,295
3. Power Receiving Cost	-	1,620	-	620	-	2,240
4. Administration Cost	-	832	-	882	-	1,714
5. Engineering Cost	3,613	1,126	3,769	1,253	7,382	2,379
6. Contingencies	5,523	4,359	5,761	4,619	11,284	8,978
Sub-total (March 1984 price)	60,742	47,939	63,374	50,813	124,116	98,752
7. Price Contingency	29,809	37,207	33,143	42,511	62,952	79,718
Total	90,551	85,146	96,517	93,324	187,068	178,470

VI. IMPLEMENTATION OF PROJECT

6.A Construction Materials and Labor Force

Most of construction materials for the civil works are available locally of cement, steel, pipe frame scaffolding, form work materials, paint and cable and lighting apparatuses. Pipe materials as distribution pipes are locally produced of spiral steel pipes ranging ϕ 50 to ϕ 2,000 mm, galvanized iron pipe and fittings ranging 1/2" to 6", PVC pipe and fittings ranging ϕ 75 to ϕ 300 mm and asbestos cement pipe and fittings ranging ϕ 80 to ϕ 600 mm.

Enough manpower for constructions works is also available. Only a few skilled labors are available so that sufficient supervising by inspector or superintendent will be required for the construction works.

6.B Construction Ability of Local Contractor

The registration system of general contractors and suppliers to the Central and Local Governments has been established for undertaking the public works. The registered contractors are qualified by their ability taking into account holding numbers of constructions machines and qualified engineer and past experience. There are not so many contractors experienced in watertight structures of water supply facilities, although most of local contractors are sufficiently experienced in usual structures.

6.C Construction and Procurement Method

In principle, procuerment of equipment and materials under the external resources has to be performed by the open internal competitive bidding procedure in accordance with the Guideline on procurement procedure of bilateral/multilateral lending agencies. The tendering will be grouped by plant equipment, pipe materials for transmission mains and distribution mains.

6.D Construction Schedule of the First Phase of Second Stage Project

The construction schedue of each construction work on the First Phase of Second Stage Project is presented on Table 5 Construction Schedule. The schedule is prepared splitting the whole construction works into several groups of intake pump station, treatment plant, distribution center and transmission and distribution pipelines, and also considering the capability of contractors. Considering such capability of the local contractors, it is desirable that the construction of plant facilities should be undertaken under joint venture of local and foreign experienced contractors.

6.E Implementation Schedule

All project to be executed under the Immediate Program and First Phase of Second Stage Project are complementary to each others. From this consideration, complehensive implementation schedule including all projects is worked out and shown on Table 6.

Recommendation of Project Implementation Prior to the completion of the extension project of First Phase of Second Stage Project, it is an essential requirement to accomplish the rehabilitation and improvement works planned as the Immediate Program and the ongoing project of the First Stage. Therefore the following actions are recommended:

(1) Completing the First Stage Project, in progress, by 1988 as shceduled because the distribution mains to be installed by the Project must receive water from the Buaran Plant at the beginning of 1989.

(2) Commencing the leakage abatement study in 1986.

(3) Replacing of old and defective meters and installing new meters on unmetered service connections starting from 1985 providing yearly program for implementation immediately.

(4) Replacing old distribution pipelines laid in 1920's and related service connections starting from 1986. Rehabilitation may be necessary to continue on pipelines installed in 1950's after 1990 as routine works on the basis of the actual results of water loss reduction.

(5) Installing distribution pipelines for secondary and tertiary mains procured under the First Stage Project as scheduled and planning further extension works of the said pipes for full utilization of the available water production before the completion of the above works.

(6) Installing the chlorination equipment in the existing treatment plants as early as possible for strengthening chlorination and executing the construction of pre-chlorination system for Pejompongan plant at the same time of installation for raw water transmission pipeline.

(7) Selecting consultants urgently for detailed design engineering of Immediate Project to complete the Project as scheduled.

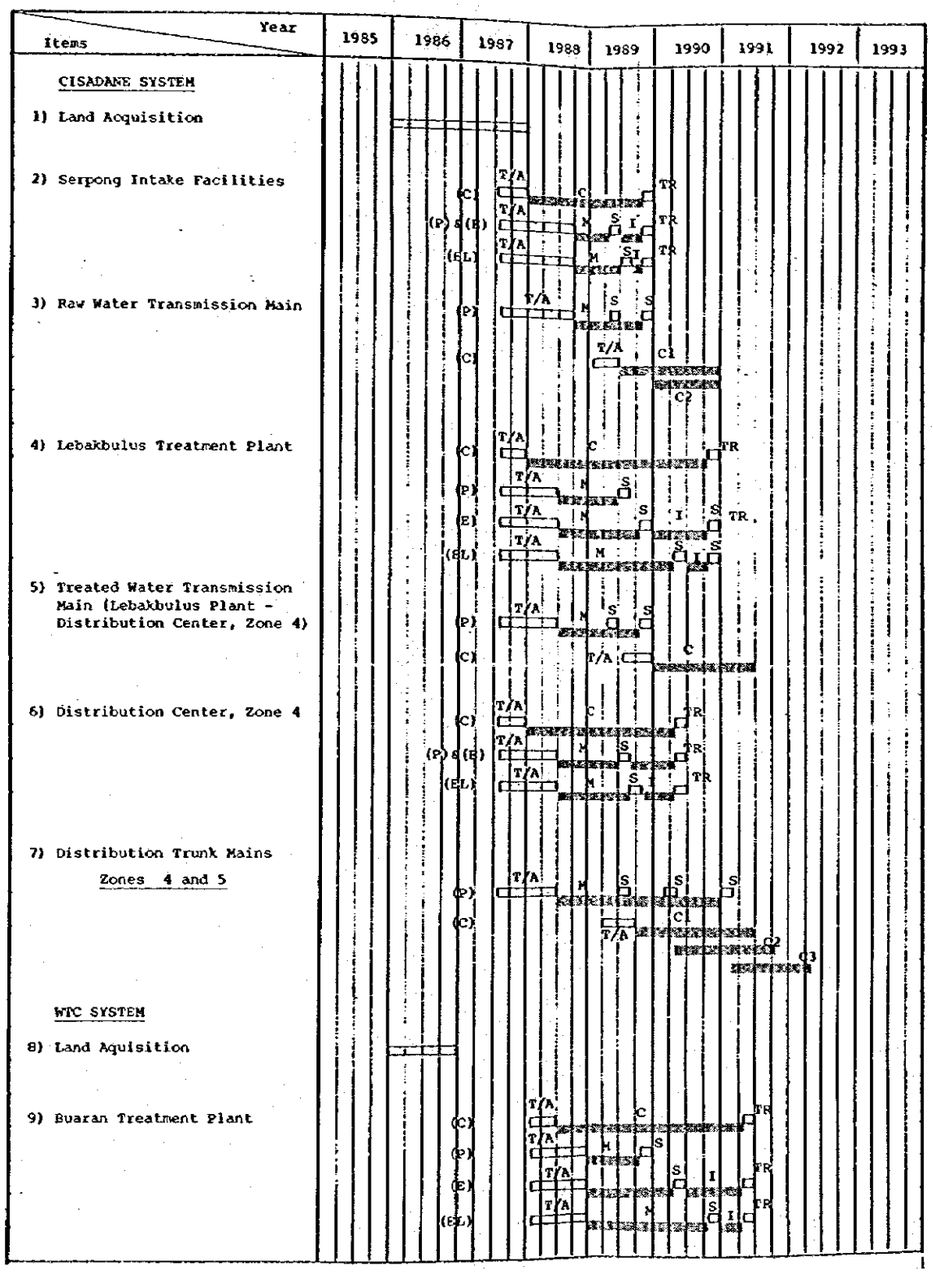
(8) Seeking financial support from lending agencies and provide local fund for the First Phase of Second Stage Project in 1985.

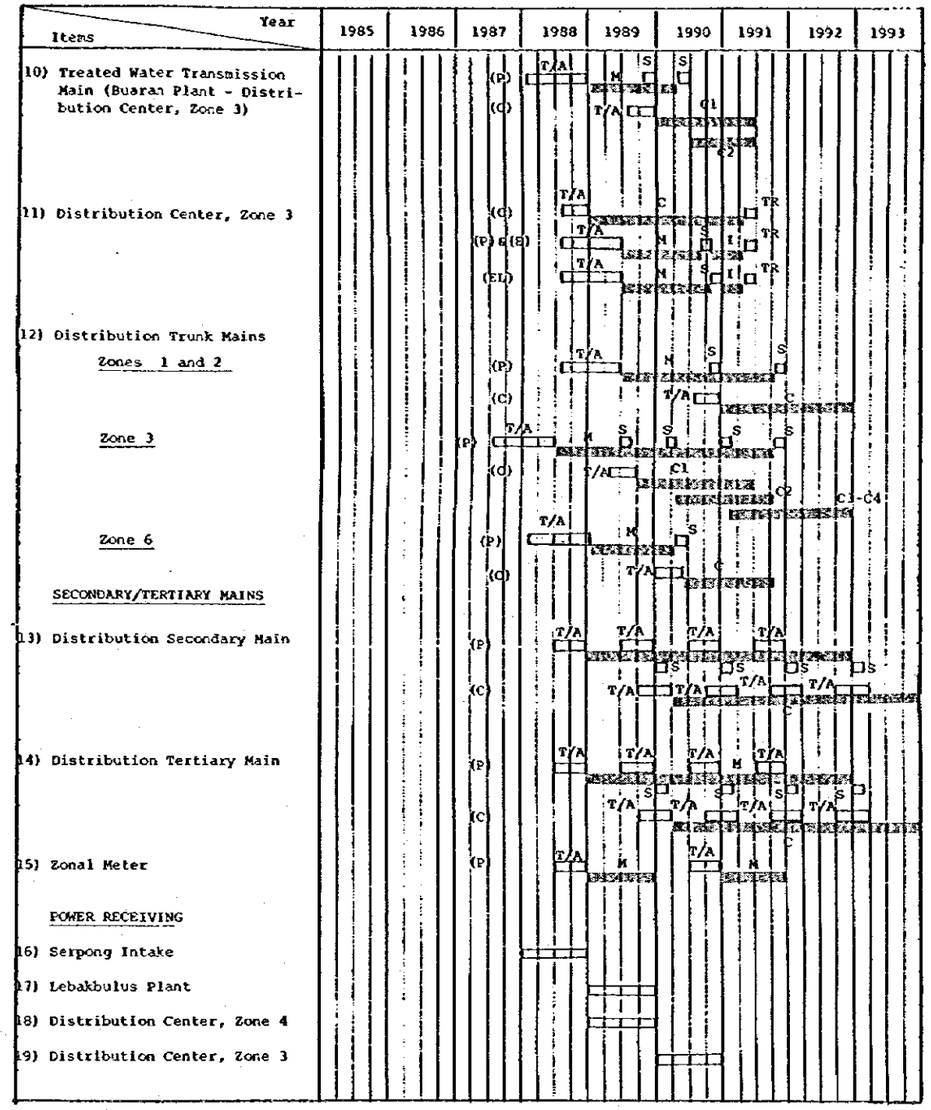
Especially, the future projects concerned the expansion and improvement are to be executed by the agencies interrelated with the Jakarta Water Supply System, such as the systen expansion by Cipta Karya, the raw water source development project by DGWRD/POJ and rehabilitation and improvement projects by PDAM. In order to make an attempt for smooth implementation as scheduled, the following are recommended:

(1) Establishing a special group of experts to supervise and control all relevant projects to be implemented by different agencies,

(2) Preparing and giving a guideline difining direction and scope of works, approach etc to the consultants of each project, and

(3) Providing PDAM Jaya with a consultants for coordination and management for expansion of all its business operation and project.





Legend

(C) :	Construction and/or Pipelaying works	T/A :	Advertisement, Tendering, Evaluation and Approval
(P) :	Procurement of pipe materials	C :	Construction and/or pipelaying works
		M :	Manufacturing
(E) :	Procurement of mechanical equipment	S :	Shipping, Handling, Local transportation
		I :	Installation of equipment
(EL) :	Procurement of electrical equipment	TR :	Test run

Table 5 CONSTRUCTION SCHEDULE

JAKARTA WATER SUPPLY DEVELOPMENT PROJECT | JICA

ITEMS	1984				1985				1986				1987				1988				1989				1990				1991				1992				1993			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Improvement of Pejompongan Plant I			Phase 2				Phase 3				Phase 4																													
Rehabilitation Work/Leakage Abatement																																								
1. Distribution Pipes																																								
2. Replacement of Defective Meters																																								
3. Replacement of Service Connections																																								
4. Leakage Abatement Study																																								
5. Training																																								
6. Leak Detection And Repair																																								
Extension Project of Distribution Pipes																																								
1. Secondary Mains																		Procurement		C																				
2. Tertiary Mains														Procurement																										
															C																									
Short Term Improvement Project																																								
1. Pre-chlorination System in Pejompongan Plants																								Procurement																
2. Strengthening of Chlorination											Procurement			C·I										C·I																
Immediate Project																																								
1. F/S and Loan Negotiation																																								
2. D/D and Tendering						S				D/D		T		E/A																										
3. Procurement and Delivery																			I			T/R																	
4. Construction/Pipelaying Works/Test Run										T/E/A						C																								
1st Phase of Second Stage Project																																								
1. F/S and Loan Negotiation																																								
2. D/D and Tendering										S				D/D				T		E/A																			
3. Cisadane System																																								
- Procurement and Delivery																																								
- Construction and Test Run																												T/R												
- Distribution Pipelaying Works																																								
4. WTC System																																								
- Procurement and Delivery																																								
- Construction and Test Run																														T/R										
- Distribution Pipelaying Works																																								

Note: F/S; Feasibility study, S; Selection of Consultants, D/D; Detailed design engineering
T ; Tendering, E/A; Bids evaluation and award of contract
I ; Installation of Equipment, T/R ; Test Run, C ; Construction

Table 6 IMPLEMENTATION SCHEDULE

JAKARTA WATER SUPPLY DEVELOPMENT PROJECT | JICA

VII FINANCIAL AND ECONOMIC ANALYSIS

The financial and economic analyses have proved the viability of the proposed 6.0 m3/sec expansion project. The sensitivity analysis has showed that cash shortage in the PDAM's funds flow is not foreseen even if risks in realizing the projected revenues were considered to a certain extent. Nevertheless, it is suggested that PDAM be precautions in determining a tariff level and designing a tariff structure

7.A Analyses Conducted

The major components of the analyses conducted were as follows:

- Projection of PDAM's future financial position
- Analysis on projected tariff level/structure and affordability of water users
- Computation of internal rate of return
- Sensitivity analysis on the financial projection and the internal rate of return
- Analysis on implications of price elasticity and groundwater use on the viability of the project.

7.B Findings

The analyses have found the followings:

(1) PDAM will be able to meet the financial obligations of the proposed project after paying taxes and making contributions to DKI budget if the average water tariff is raised to Rp.292/m3 toward 1993 in terms of the end 1983/84 constant price from the 1983/84 level of Rp.252/m3.

(2) The finding (1) will not seriously be changed even if slightly unfavorable assumptions are introduced, e.g., an improvement in accounted-for water ratios ended up with only half of the target rate of 20 percent between 1983 and 1995.

(3) Some cash shortages are expected between 1984 and 1990; however, this will not seriously change the finding (1), either, even if the shortages are financed by outside borrowing.

(4) The cash shortages will be disappeared if tax payments and contributions to DKI are exempted or if revenues are increased by 10 percent by eliminating bad debts or by raising the tariff level, although minor drawing-down of cash at hand has to be allowed.

(5) Rates of return on average net fixed assets in operation after 1991, when the debt-service of the proposed project starts, will be within a reasonable range of 5-10 percent on a historic cost basis and 3-6 percent on a revalued cost basis.

(6) The assumed average tariff of Rp.292/m3 in 1993 and thereafter is below the long-term marginal cost of water supply, i.e., Rp.379/m3 which was computed using the average incremental cost method at 10 percent discount rate.

(7) The average tariff will be affordable by residential users. The percentage of income which an average middle income family has to expend for piped water will be 2.5 percent which is lower than usually used rule of thumb for estimating the maximum affordability, i.e., 4 percent.

(8) The finding (7) is based on the schedule of revising the present tariff table for residential users by 33 percent and that for non-residential users by 35 percent in real term for ten years. Tariff revision at this rate does not appear to give a significant adverse economic, financial, and political impact to water users.

(9) The financial internal rate of return computed is at a moderate level, as a water supply project, of 5.8 percent.

(10) Although PDAM's loan repayments would be assured, the revenues from residential users might be largely different due to effects of price elasticity and tariff structure unless tariff level and structure are carefully selected/designed.

(11) The projected increase in number of connections might not be realized if current groundwater users were not appropriately encouraged to switch to piped water.

(12) Projected future PDAM's funds flow is summarized as Table 7..

7.C Major Assumptions

The major assumptions for the foregoing findings are as below:

(1) Average Tariff

Year		1983	1984	1985	1986	1987	1988	1989
Tariff:	Real	252	219	218	227	235	243	253
	Nominal	252	252	279	310	334	381	423

1990	1991	1992	1993	1994	1995	1993/1983	Averge Annual Increase (%) 1983-1993
262	271	281	292	292	292	1.159	1.5
469	520	577	641	685	733	2.544	9.8

Table 7 Summary of Projected Funds Flow

(Unit : Rp. million)

	1984 - 90		1991 - 95	
	Amount	Percent	Amount	Percent
Sources				
Internal Cash Generation	157,567	30.6	502,209	81.0
1st Phase/2nd Stage	248,105	48.2	118,181	19.0
Others	109,014	21.2	-	-
Total Borrowings	357,119	69.4	118,181	19.0
Total Source	514,686	100.0	620,390	100.0
Requirements				
1st Stage	71,878	14.0	-	-
Immediate	37,136	7.2	-	-
1st Phase/2nd Stage	248,105	48.2	118,181	19.0
Rehabilitation/Pipe Extension	49,501	9.6	12,188	2.0
Routine Construction	23,083	4.4	18,811	3.0
Total Investment	429,703	83.4	149,180	24.0
1st Phase/2nd Stage	-	-	175,050	28.3
Others	43,504	8.5	74,471	12.0
Total Debt Service	43,504	8.5	249,521	40.3
Working Capital	18,044	3.5	37,857	6.1
Tax	17,547	3.4	34,419	5.5
Contribution to DKI	13,682	2.7	106,681	17.2
Increase in Cash	- 7,794	- 1.5	42,732	6.9
(Finance Required)	(7,794)	(1.5)	(-)	(-)
Total Requirements	514,686	100.0	620,390	100.0

(2) Financing Conditions for the Proposed Project: Thirty-year repayment period including 6-year grace period at 11 percent interest rate. Here, following the arrangement of the past loans, interests during construction are not charged.

(3) Accounted-for Water: Twenty percent improvement from 47 percent in 1983 to 67 percent in 1995.

(4) Raw Water Charge to Jatilhul Authority

Year	Raw Water Charge
1984-1987	Rp. 10/m3
1988-	Rp. 15/m3

(1984 constant price)

(5) Tax: To be paid from 1984 according to the government regulation.

(6) Constribution to DKI Budget: To be paid according to the existing regulations.

(7) Equity from DKI: Not considered with the reasons that the analysis should be conservative and that the level of equity receipt should be determined taking account of the result of the analysis without equity.

(8) Connection Charges: The present rate be gradually reduced so that the charge will be equal to the actual cost of connection in 1995.

7.D Conclusion and Recommendation

It has been concluded, based on the analyses and their findings, that the proposed 6.0 m3/sec expansion project is feasible from the financial and economic viewpoint. Therefore, it is recommended to implement the project.

It is also recommended, for ensuring the proved viability, that PDAM should pay due attention to the financial issues raised in the master plan report and to the followings:

(1) Relevant and accurate data should be collected and analysed for determining the degree of revising the water rate table and designing its structure. Otherwise, unpremeditated tariff revision may lead to unexpected shortfall in planned revenues due to effects of price elasticity and tariff structure.

(2) Appropriate management system of groundwater use should be pursued in order to encourage present groundwater users to switch to the piped water from expanded water supply facilities.

VIII ORGANIZATION AND PERSONNEL DEVELOPMENT

8.A PDAM Future Organization

Proposed Organization PDAM is required to improve its organization and to upgrade management system for sound business operation as well as operation and maintenance of facilities to be expanded in the Second Stage. Alternative structures were studies and evaluated in the light of the following natures:

(1) Improvement of organization structure with an appropriate number of staff.
(2) Improvement and strengthening of the divisional make up for sound operation.
(3) Upgrading of water service for customers

Modification Required The organization and management structure proposed for PDAM is designed to strengthen its operational undertakings capable of carrying out all technical, operational, planning and administrative functions, focussing at;

(1) Attainment of technical competence through provision of safe and reliable potable water.

(2) Integration of overall activities of the Central Office, Branch Offices, Units and Installation, with economy and efficiency.

(3) Provision of planning capability of medium and long term water supply expansion and investment programs with an aim to upgrade operational function to provide basic water supply service for customers.

The proposed structure can be implemented in stages and modified to meet future requirements in order to justify the major programs of expansions and rehabilitation.

Restructuring of Line of Function and Division In the recommended organization structure, an additional function of "Engineering" Directorate was newly provided after separated from Technical and Production. PDAM technical function has been restructured into "Engineering" and "Production" in order to carry out independently engineering activities of technical planning and design and project implementation, and production activities of water treatment plant and distribution. New function has been created, and divisions and sections have been created, and divisions and sections have been regrouped and shifted for more effective coordination and control.

Improvement of Organization Modification Modification and improvement of PDAM organization and management should be initiated with the start of the detailed design and be implemented during the design and completed at the end of 1987 so that PDAM can arrange necessary set up well ahead of the actual operation and maintenance of the newly expanded system. This will ensure PDAM to participate in planning and design stage and to assign engineering staff during construction stage of the proposed project implemented by the Central Government.

8.B Personnel Development and Training

Personnel Development Staff requirements for PDAM in the Second Stage Project was proposed considering,

(1) To strengthen engineering forces by recruitment of engineers and technicians so that imbalance of the present manpower structure will be improved.

(2) To increase manpower in production and also operation of the systems to remedy imbalance of the overall distribution of staff.

(3) To increase manpower in Branch Offices, Units and Rayons in order to improve operation capacity of field activities to meet PDAM's policy of decentralization.

Training Vigorous recruitment of new entrants is needed and continuous upgrading of PDAM's personnel's skill and knowledge is essential. To cope with this, there is a need for training of the existing personnel as well as new entrants should be developed. Personnel program and their area of training are proposed from top management to operaters at all levels and areas of operations.

SCOPE OF THE STUDY

1. Study Area

(1) The service area of the Master Plan should be of Jakarta City.

(2) The study area of the feasibility Study will be selected from the result of the Master Plan Study.

(3) The Study will touch on those facilities in the immediate environs of Jakarta City which are related to the water supply project in Jakarta.

2. Outline

(1) Master Plan
- a. Data collection and analysis
- b. Definition of served areas for planning
- c. Estimation of population
- d. Estimation of water demand
- e. Study of present status of water works including losses and intak problem
- f. Study of water sources
- g. Planning of water supply system
- h. Rough estimation of cost for construction, operation and maintenance
- i. Preparation of implementation schedule
- j. Socio-economic study
- k. Study of organization, operation and management plan

(2) Feasibility Study

- a. Definition of project area
- b. Estimation of population to be served
- c. Estimation of water demand
- d. Study of improvement of existing facilities and proposed program of immediate action
- e. Study of water sources
- f. Study of required facilities and layout of facilities
- g. Study of design criteria
- h. Preliminary design
- i. Preparation of construction schedule
- j. Study of construction materials and labour force and study of construction ability of local constructors
- k. Preparation of construction method and procurement method of materials and equipment
- i. Estimation of costs for construction, operation and maintenance
- m. Estimation of benefits
- n. Financial analysis
- o. Study of alternatives of organization operation and management plan
- p. Preparation of implementation program