REPUBLIC OF INDONESIA
MINISTRY OF PUBLIC WORKS(DPU)
DIRECTORATE GENERAL OF
HUMAN SETTLEMENT(CIPTA KARYA)

UJUNG PANDANG
WATER SUPPLY DEVELOPMENT PROJECT

VOLUME IV
MAIN REPORT OF FEASIBILITY STUDY
AND
VOLUME V
SUPPORTING REPORTS FOR FEASIBILITY STUDY

NOVEMBER 1985

JAPAN INTERNATIONAL COOPERATION AGENCY

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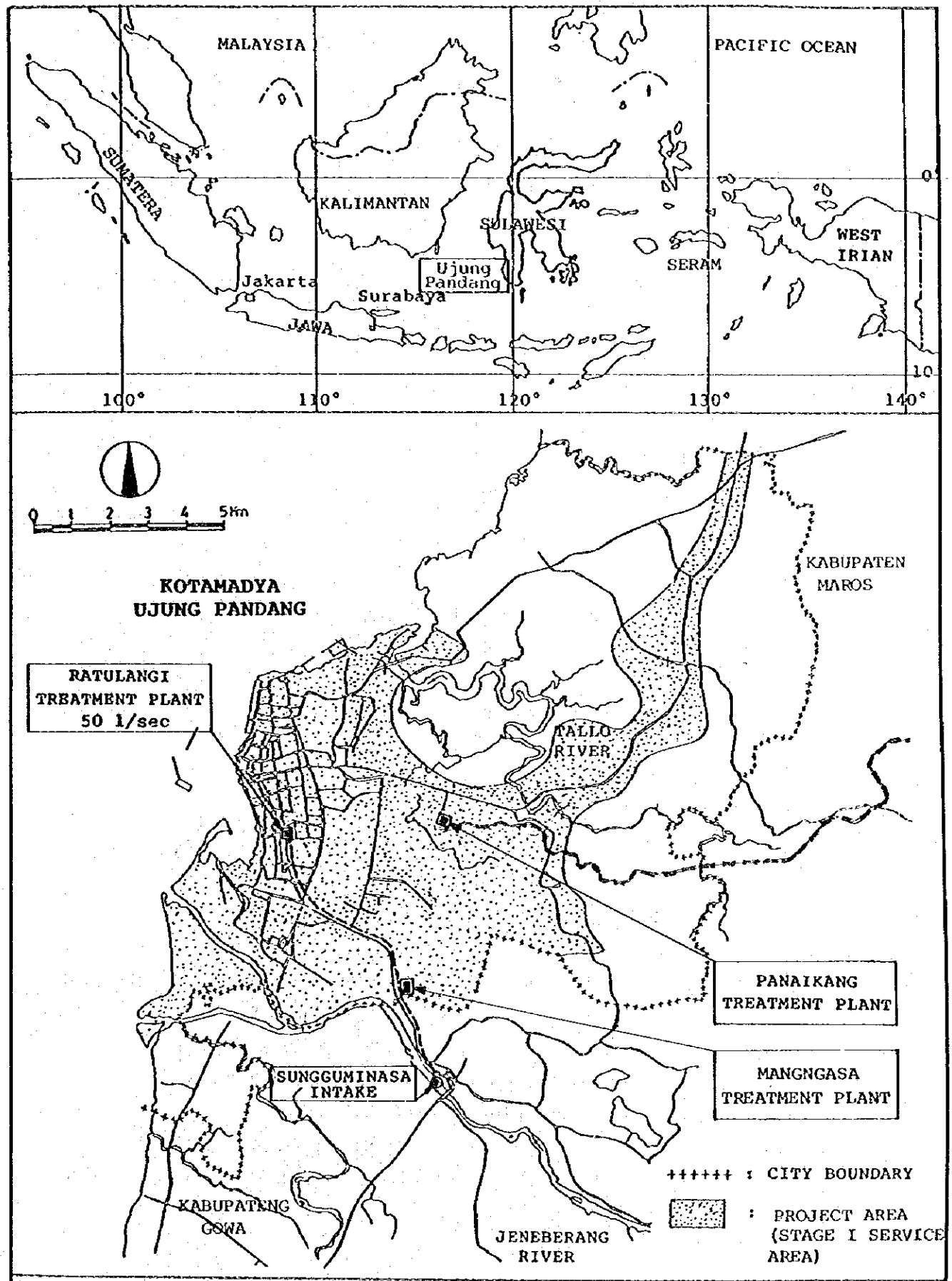

LOCATION PLAN S = 1/30,000,000 , 1/150,000

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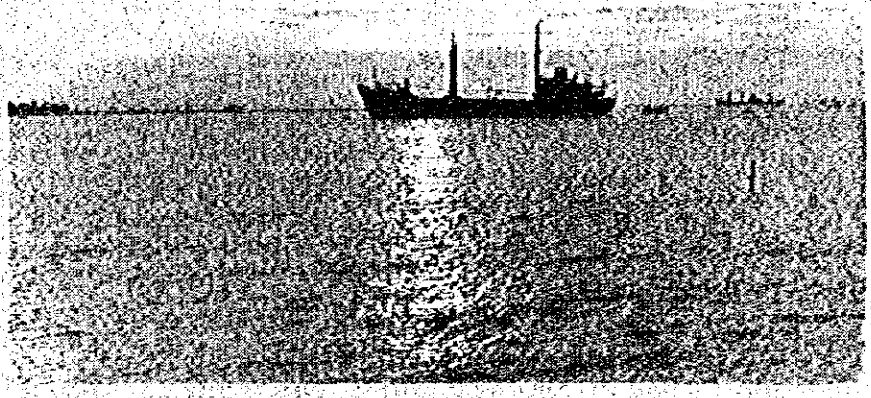
ABBREVIATIONS

GOI	- Government of Indonesia
CIPTA KARYA	- Directorate General of Human Settlement, Ministry of Public Works of the Republic of Indonesia
DAB	- Directorate of Water Supply in CIPTA KARYA
PEMDA	- Municipality Government
PAB	- Project Office of CIPTA KARYA in South Sulawesi
BAPPEDA	- Board of Planning and Development of Ujung Pandang
PDAM	- Ujung Pandang Water Supply Enterprise
JICA	- Japan International Cooperation Agency
OECF	- Overseas Economic Cooperation Fund, Japan
WHO	- World Health Organization
REPELITA IV	- The Fourth Five-Year Development Plan
The Team	- JICA Study Team

mm	- millimeters
cm	- centimeters
m	- meters
km	- kilometers
m2, sq m	- square meters
km2, sq km	- square kilometers
m3,cu m	- cubic meters
cm/sec	- centimeters per second
m/sec	- meters per second
m3/sec, cu m/sec	- cubic meters per second
m3/min, cu m/min	- cubic meters per minute
m3/h, cu m/h	- cubic meters per hour
m3/day, cu m/day	- cubic meters per day
l/sec	- liters per second
l/day	- liters per day
l/c/d	- liters per capita per day
kg/cm2, kg/sq cm	- kilograms per square centimeter
kw	- kilowatt
ha	- hectare

mg/l	- milligrams per liter
μ ℧ /cm	- micromho per centimeter
PH	- potential of hydrogen
°D	- German system of degree of hardness
mm/year	- millimeters per year
PVC	- polyvinyl chloride pipe
ACP	- asbestos cement pipe
CIP	- cast iron pipe
DIP	- ductile iron pipe
GSP	- galvanized steel pipe
SP	- steel pipe
dia.	- diameter
no/nos.	- number/s
IFGL	- Interest Free Government Loan
DLNI	- Domestic Loan at Normal Interest rate

SUMMARY



THE BIGGEST HARBOUR IN SULAWESI,
HANDLING SUGAR, RATTAN, COPRA,
SPICES AND TIMBERS

SUMMARY

On the basis of the future development scheme described in the Master Plan, the present report verified the feasibility of the Stage I Project (from date to 1995) both from the technical and financial viewpoints.

The Project is divided into Phases 1 and 2 with the target years of 1992 and 1995 respectively. Total production capacity will increase from the present 1,150 l/sec to 1,750 l/sec in 1992 and to 2,250 l/sec in 1995. Major works under phase 1 Project are construction of the new treatment plant at Mangngasa and rehabilitation of the existing plants. Under Phase 2, the Mangngasa system will be expanded to produce clear water of 1,000 l/sec in total (500 l/sec in Phase 1 and another 500 l/sec in Phase 2). The planned facilities aim in particular at developing appropriate technology for Ujung Pandang Water Supply. The outline and technical particulars of Phases 1 and 2 are summarized in Figures S.1 and S.2. Total project costs are estimated at Rp. 80.1 billion including construction cost, administrative, and engineering fees, physical and price contingencies, out of which US$ 37.1 million are the foreign portion and Rp. 38.7 billion the local portion as tabulated in Table S.1. As for financial viability, the projection, based on project cost estimated above and water tariff developed within an affordable level of household's income, ensures that the Stage I Project has a financial feasibility on conditions that:

1) Financing for phase 1 will be a combination of IFGL and DLNI with an interest rate 9% and PDAM's own fund, and that for Phase 2 all from DLNI.

2) Composition of IFGL DLNI and own fund under Phase 1 will be 28 %, 62 % and 10 % of local currency portion respectively.

3) As for foreign currency portion BLN will be applied both for Phases 1 and 2.

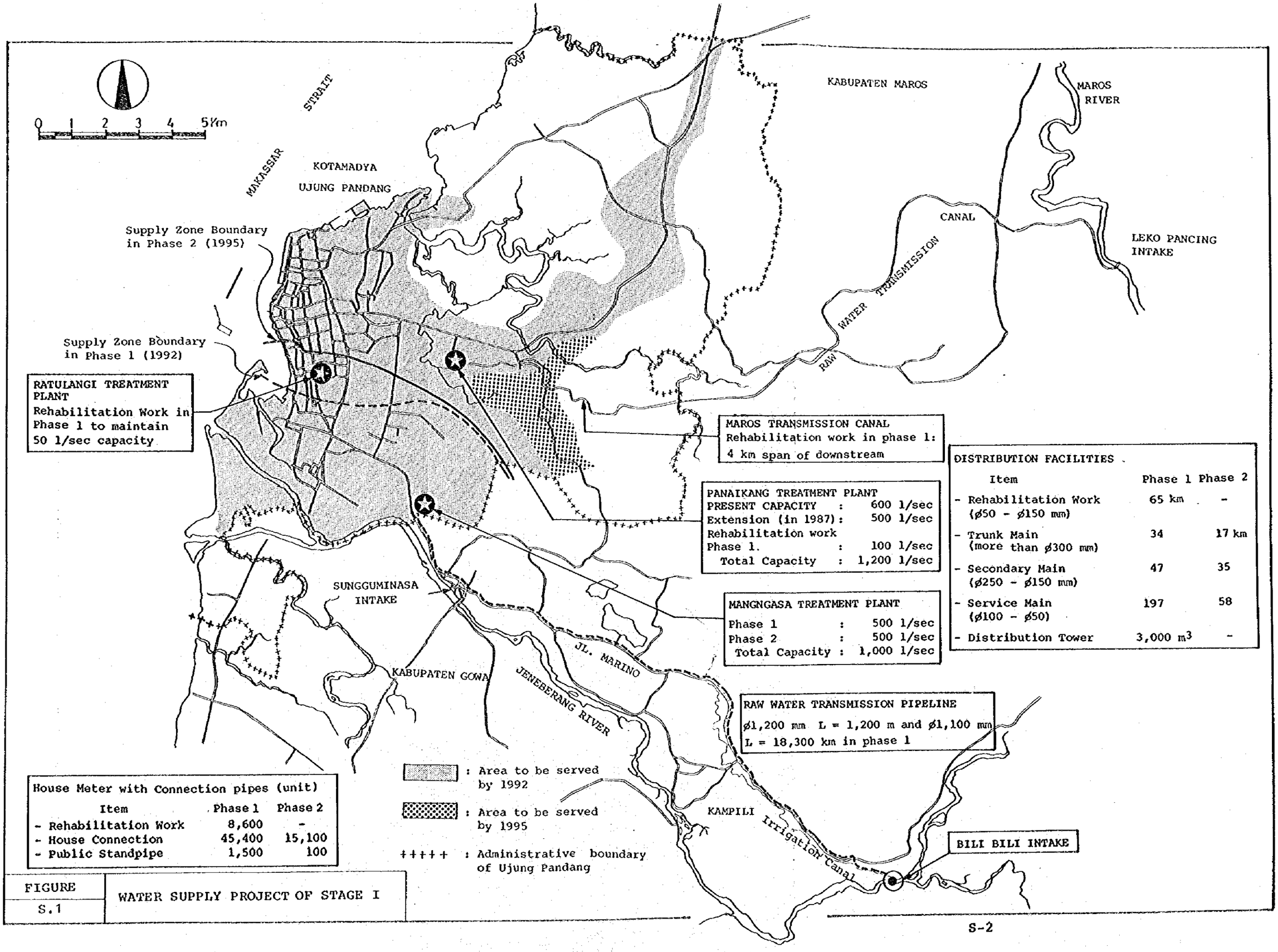
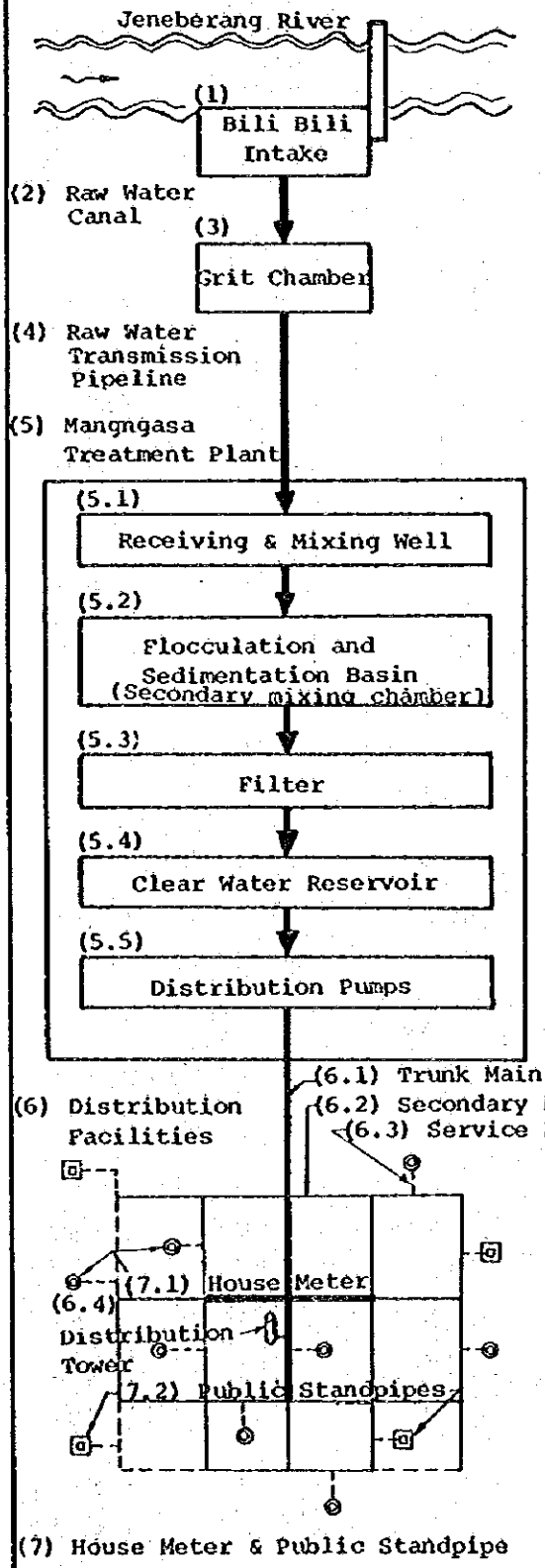


FIGURE S.1 WATER SUPPLY PROJECT OF STAGE I



Item	Phase 1	Phase 2
Intake Facilities		
(1)	1 unit	-
(2)	1,500 m	-
(3)	1 Basin(2units)	-
Raw Water Transmission Pipeline		
(4)	L = 19,500 m	--
Mangngasa Treatment Plant		
(5)	0.5 m3/sec	0.5 m3/sec
(5.1)	1 Basin(2units)	-
(5.2)	1 Basin(2units)	1 Basin(2units)
(5.3)	6 Filter Beds	6 Filter Beds
(5.4)	9,000 m3	9,000 m3
(5.5)	Large Pumps 3units (1 standby)	Large and Small Pumps 1 large 2 small (1 standby)
(6) Distribution Facilities		
(6.1)	34 Km	17 Km
(6.2)	47 Km	35 Km
(6.3)	197 Km	58 Km
(6.4)	3,000 m3	-
(7) House Meter & Public Standpipes		
(7.1)	45,400	15,100
(7.2)	1,500	100

FIGURE S.2	OUTLINE OF STAGE I PROJECT

TABLE S.1 COST ESTIMATE FOR STAGE I PROJECT

DESCRIPTION	Foreign Currency 1,000 US$	Local Currency million rupiah	Total million rupiah
I. PHASE 1 PROJECT			
1) Rehabilitation			
-Maros Transmission Canal	1,348	937	2,440
-Ratulangi Treatment Plant	0	19	19
-Panaikang Treatment Plant	17	48	67
-Distribution Pipelines & House Meters	588	1,778	2,434
SUBTOTAL OF 1)	1,953	2,782	4,960
2) Mangngàsa System			
-Land Acquisition	0	1,166	1,166
-Intake Facilities	0	826	826
-Transmission Pipelines	3,212	2,228	5,809
-Treatment Plant	3,793	3,871	8,100
-Power Receiving	0	48	48
-Distribution Pipelines & House Meters	6,889	6,708	14,389
-Distribution Tower	1,040	0	1,160
SUBTOTAL OF 2)	14,934	14,847	31,498
3) Administration (2%)	0	353	353
4) Engineering Services	2,526	1,360	4,176
5) Physical Contingency (10%)	1,942	1,934	4,099
SUBTOTAL OF 1)-5)	21,355	21,276	45,087
6) Price Contingency	7,006	7,597	15,409
Total of Phase 1 Project	28,361	28,873	60,496
II. PHASE 2 PROJECT			
1) Treatment Plant	1,681	1,793	3,667
2) Distribution Pipelines & House Meters	2,537	2,860	5,689
3) Administration (2%)	0	93	93
4) Engineering Services	875	469	1,445
5) Physical Contingency (10%)	509	520	1,088
SUBTOTAL OF 1)-5)	5,602	5,735	11,981
6) Price Contingency	3,176	4,113	7,654
Total of Phase 2 Project	8,778	9,848	19,635
III. PHASE 1 + PHASE 2			
Total of STAGE I PROJECT	37,139	38,721	80,131

RECOMMENDATION

SURROUNDING AREA OF THE MAROS RIVER
(AT THE UPSTREAM)

RECOMMENDATION

The following are matters, as found by the Team, to be practiced to achieve the project smoothly or make the project more effective.

1) Equipment of the new treatment plant with a capacity of 500 l/sec at Panaikang has already been delivered to the construction site, but its civil works is not yet started. Considering the suffering from water shortage of the people down town of the Municipality, the work should be commenced as early as possible. In this connection, improvement and replacement works of deteriorated pipelines in the afflicted areas are included in the present project under feasibility study.

2) Presently the account receivable reached to a huge amount of Rp. 1.6 billion, endangering the financial stability of the enterprise. One of the causes for this poor collection results is considered to be the inadequate supply condition under extraordinarily low pressure in most part of the served area resulting in delinquency in payment of bills. To rectify this condition, the pumping station which is at present put out of service should be operated in the early stage of the project implementation.

3) It is indispensable to implement the project as planned that provision of necessary local funds is available in time all through the project implementation. Especially the local fund required for rehabilitation work should be provided even before the loan agreement with international financing sources concerned, since a larger portion of the rehabilitation is planned solely under local financing. Considering the present financial capability of PDAM, fund should be sought from the City and/or the central Government.

4) Construction costs of Bili Bili dam allocated to the water supply sector proposed in the 'Feasibility Study on the Jeneberang River Flood Control Project' are US$27.49 million, namely around Rp.35/m3 as of 1983. In comparison with the present water rate, this raw water charge would be a heavy burden on PDAM finance unless some measure be undertaken by Cipta Karya to minimize it.

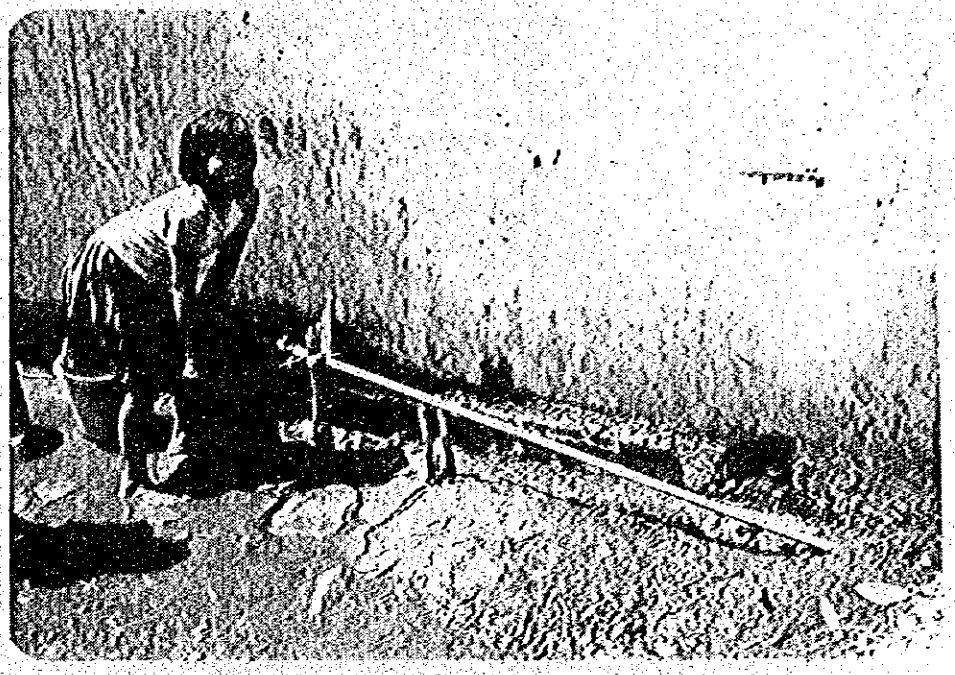
5) The detailed design of Bili Bili dam is expected to start within 1985. According to the 'Feasibility Study on the Jeneberang River Flood Control Project', the impounded water is planned to divert directly into the transmission pipeline. On the other hand, the Team's preliminary survey reveals that it is more economical if the impounded water be once flushed out from the dam and be extracted at Bili Bili irrigation intake after flowing down the Jeneberang River. It is therefore recommended that these alternatives should be studied further in the course of the detailed design of the above project.

6) Study on water resource made so far by the Team suggests that Kotamadya Ujung Pandang and its surrounding area are not necessarily benefited with water resources. The regional development plan defines Ujung Pandang to develop as a national industrial, educational and administrative center of the eastern Indonesia. It is, therefore, recommended to prepare urgently comprehensive water resources development plan including water supply, irrigation, flood control, industry, etc.

7) Reforestation at the upstream of the Maros River is being undertaken by agencies concerned. In this connection, it is recommended that an authority responsible for monitoring the river flow and managing water use among sectors concerned should be established at the earliest possible date.

CHAPTER I

INTRODUTION



SERVICE TAPS ILLEGALY CONNECTED
TO SUPPLY WATER TO THE CONSUMERS

CHAPTER I
INTRODUCTION

1. BACKGROUND

The Government of the Republic of Indonesia has been implementing the water supply projects throughout the nation in the successive Five-Year Development Plans, covering several hundreds of towns/cities in Indonesia. Kotamadya Ujung Pandang, one of the municipalities selected in the First Five Year Plan is a study area of the present Project.

Kotamadya Ujung Pandang is designated by the Government of Indonesia to develop as the industrial, educational and administrative center of the east Indonesia. Under this policy, several development projects of industrial estates, housing estates, road construction, harbour, multi-purpose dam construction and drainage are currently under way in and around the municipality. It is the government's very wish to implement the Ujung Pandang Water Supply Development Project under this policy.

2. OBJECTIVE AND SCOPE OF WORK

Based on the development plan proposed in the Master Plan, this report purports to study and verify the viability of Stage I Project (from date to 1995) both from technical and financial points of view.

The Scope of Work for the present feasibility study covers the following items:

(a) Definition of project area
(b) Estimation of population to be served
(c) Estimation of water demand

(d) Study of improvement of existing facilities
(e) Study of water sources
(f) Design criteria
(g) Layout of facilities
(h) Study for alternative plans
(i) Preliminary design
(j) Study of construction materials, labour force and construction ability of local contractors
(k) Preparation of construction method and procurement method of materials and equipment
(l) Estimation of cost of construction, operation and maintenance
(m) Estimation of benefits
(n) Economic studies and financial analysis
(o) Study of tariff system
(p) Study of organization, operation and management plan
(q) Preparation of implementation schedule

Of the above items, those listed as (a), (b), (c), (d), and (e) are already studied in the Master Plan report. These items will be again studied by this survey as in detail, classified by year and area as to meet the objective. All the cost data, unless defined otherwise, are given at current prices as of May 1985.

3. COMPILATION OF REPORT

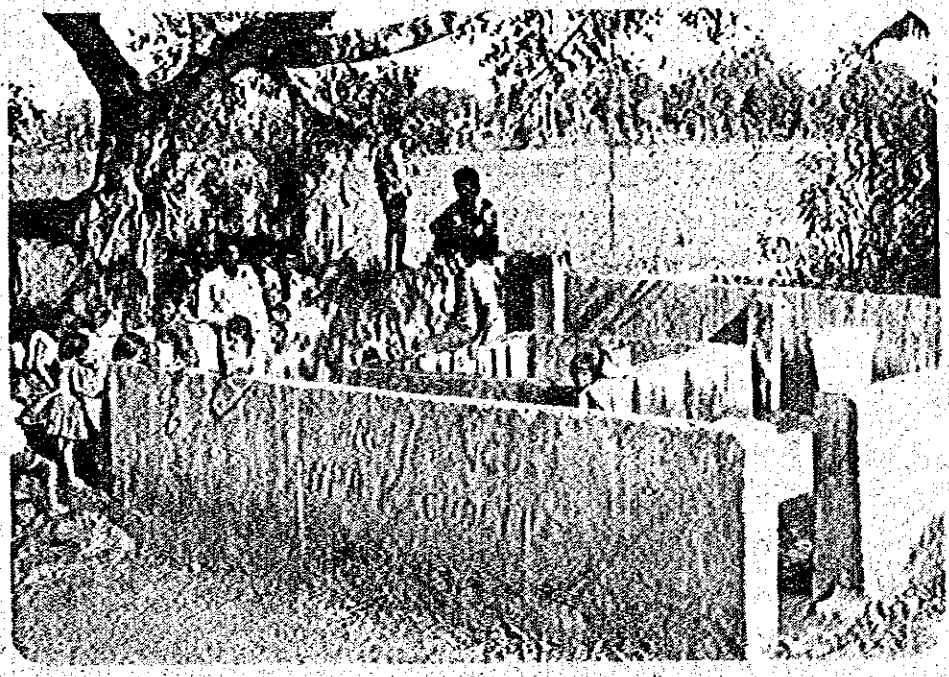
This Feasibility Study report of Ujung Pandang Water Supply Development constitutes a part of the series of reports concerning the Project, which consists of Master Plan Report and the present Feasibility Study Report with respective Supporting Reports. Separate from the Reports mentioned above, an Executive Summary has been prepared in a concentrated and concise manner, covering the long range project and the feasibility study for the use of executives.

This report consists of six chapters, of which Chapters II and VI recapitulate the results of the Master Plan Study. Those items which are newly discussed in this Feasibility Study are presented with expansions on the approach and process methodologies which were applied to the study.

The data studied in this report are obtained during the periods of survey for master planning, supplemental surveys in the process of feasibility study, and other various surveys.

CHAPTER II

POPULATION AND WATER REQUIREMENT PROJECTED



A COMMUNITY WELL COMMONLY USED
IN THE SUBURBAN AREA

CHAPTER II
POPULATION AND WATER REQUIREMENTS PROJECTED

1. GENERAL

This chapter delineates the projected future population and water demand. The basic ideas for projection and the mainstay of projected figures are already discussed in the Master Plan study. This chapter estimates future population and water demand classified by year and area on the basis of the figures projected in the Master Plan. In making such classified estimates, reference was made to the future plannings of various sectors such as Housing Estate and Industrial Estate as well as to the water supply master plan already formulated.

Section 2 of this Chapter figures the service areas projected for the target years of Phases 1 and 2 and Section 3 estimates future water demand classified by use and year, and future water demand by area.

2. SERVICE AREA AND POPULATION PROJECTED

Figure 2.1 shows the planned service areas for the target years of phases 1 and 2 (1992 and 1995), as quoted from the Master Plan. The Master Plan established an integrated planning of service areas, after taking into account the survey results which have defined such areas (1) where groundwater is not available always, (2) where groundwater is salty or undrinkable and (3) which the City Master Plan designates as areas to be developed urgently. The service areas in the target year for Phase 1 (1992) will include Housing Estates of Kec. Panakkukang and Kec. Tamalate, Store

House of Kec. Tallo and Industrial Estate of Kec. Biring kanaya in addition to the present service areas. The service areas for the target year of Phase 2 (1995) will include in addition Housing Estate of Kec. Panakkukang and Kec. Biringkanaya. With the expansion of water supply, more and more population now depending upon groundwater will turn to piped water. This phenomenon will also be seen in the residents in the service area who are presently using groundwater.

As the water supply zone expands, the service ratio will increase from the present one-third of the total population to 77% by 1992, the target year of Phase 1 and to 80% by 1995, the target year of Phase 2. Population served by use and area are presented in Tables 2.1 and 2.2.

3. WATER REQUIREMENTS

3.1 Water Requirements by Use and Year

Future water requirements by use and year are presented in Table 2.3 in terms of daily maximum, daily average and accounted-for water. Water requirements by year for domestic use are the products of the interpolated figures (per capita demand and population served of each five year) proposed in the Master Plan. As for non-domestic use, water requirements by year are also interpolated. Water requirements thus estimated are shown on Figure 2.2. To compute the daily average water requirements, peak factor of 1.2 (Daily maximum/Daily average) was employed as described in 2. Design Criteria of Chapter III.

Apart from the water requirements on daily maximum and average bases, unaccounted-for water was computed in consideration of the proposed schedule of leakage abatement. The ratio of unaccounted-for water to water requirements employed herein are as follows:

1985	1986	1987	1989	1990 and thereafter
45%	40%	35%	25%	20%

3.2 Water Requirements by Area

As the demand by area has already projected in the Master Plan study, the figures projected in the study are quoted here as shown in Table 2.4. It is to be noted that a remarkable demand increase is projected in Kec. Tamalate and Kec. Panakkukang where Housing Estates will concentrate.

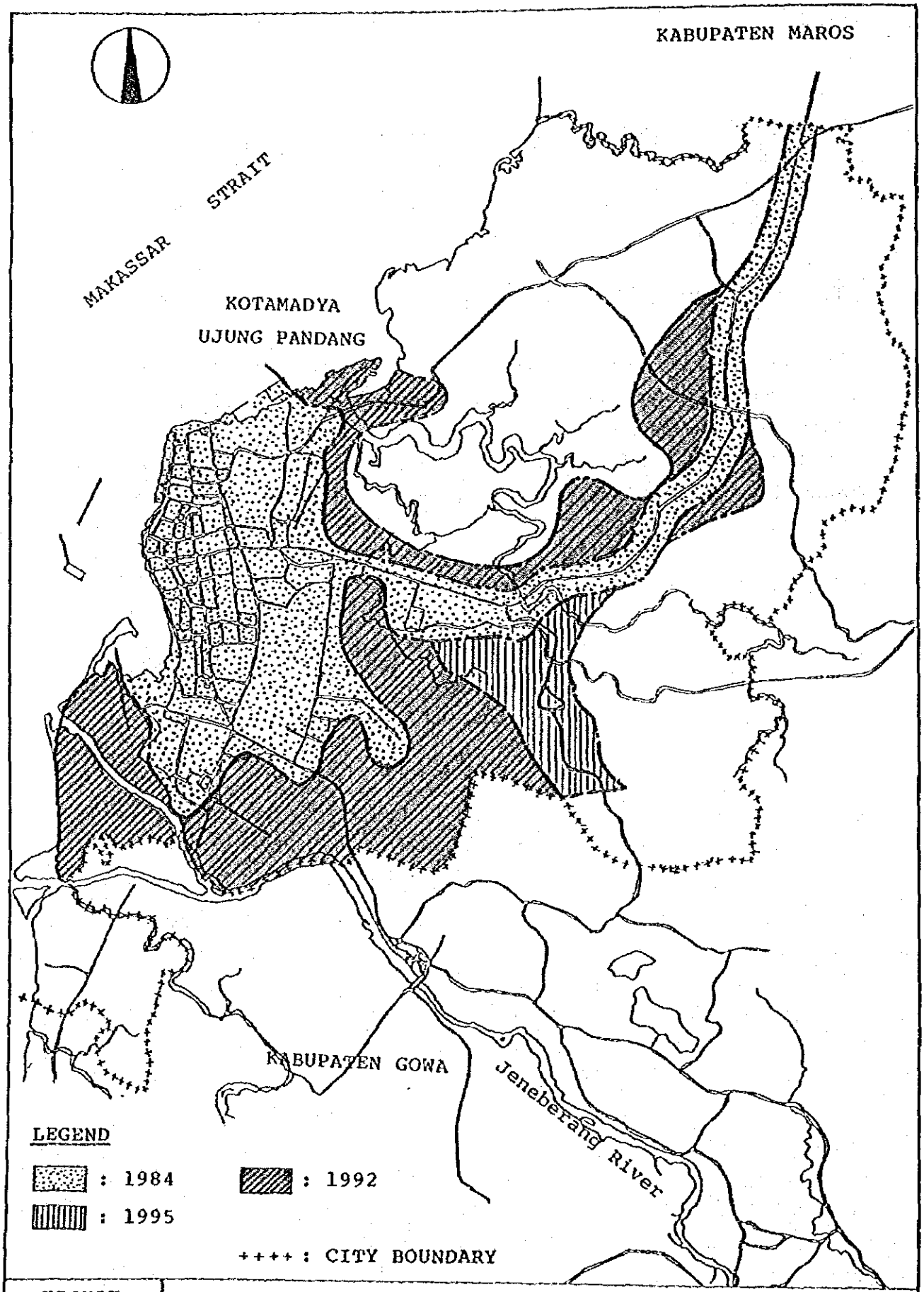


FIGURE	PLANNED SERVICE AREA
2.1	

TABLE 2.1 POPULATION SERVED BY YEAR

Year	Population (x1,000)	Coverage (%)	Composition of Types (%)			Population Served (x1,000)			
			House Connect.	Public Standpipes	Neighbors Supply,etc	Total	House Connect.	Public Standpipes	Neighbours Supply,etc
1983	768	34.1	58.4	12.6	29.0	262	153	33	76
1984	790	36.3	58.6	13.9	27.5	287	168	40	79
1985	812	38.7	59.2	15.3	25.5	314	186	48	80
1986	834	44.0	62.0	17.0	21.0	367	228	63	76
1987	856	50.0	65.0	20.0	15.0	428	278	86	64
1988	879	57.0	67.0	24.0	9.0	501	336	120	45
1989	903	66.0	69.0	28.0	3.0	596	411	166	19
1990	927	75.0	70.0	30.0	-	695	487	208	-
1991	951	76.0	71.0	29.0	-	723	514	209	-
1992	976	77.0	72.0	28.0	-	752	542	210	-
1993	1,000	78.0	73.0	27.0	-	780	570	210	-
1994	1,025	79.0	74.0	26.0	-	810	600	210	-
1995	1,050	80.0	75.0	25.0	-	840	630	210	-

TABLE 2.2 POPULATION SERVED BY KECAMATAN

KECAMATAN	1983	1990	1992	1995
1. Mariso	20,000	43,000	45,000	47,000
	13,000	32,000	33,000	35,000
	1,000	11,000	12,000	12,000
	65%	74%	73%	74%
2. Mamajang	11,000	60,000	64,000	71,000
	7,000	40,000	43,000	49,000
	0	20,000	21,000	22,000
	64%	67%	67%	69%
3. Ujung Pandang	19,000	35,000	35,000	36,000
	13,000	33,000	34,000	35,000
	0	2,000	1,000	1,000
	68%	94%	97%	97%
4. Makassar	37,000	98,000	104,000	111,000
	17,000	63,000	68,000	74,000
	11,000	35,000	36,000	37,000
	46%	64%	65%	67%
5. Wajo	27,000	42,000	43,000	43,000
	17,000	36,000	37,000	38,000
	1,000	6,000	6,000	5,000
	63%	86%	86%	88%
6. Bontoala	34,000	57,000	59,000	62,000
	17,000	36,000	39,000	43,000
	9,000	21,000	20,000	19,000
	50%	63%	66%	69%
7. Tallo	20,000	80,000	87,000	97,000
	12,000	23,000	31,000	42,000
	2,000	57,000	56,000	55,000
	60%	29%	36%	43%
8. Ujung Tanah	18,000	35,000	37,000	39,000
	7,000	13,000	16,000	20,000
	8,000	22,000	21,000	19,000
	39%	37%	43%	51%
9. Panakkukang	24,000	75,000	88,000	113,000
	15,000	65,000	77,000	101,000
	1,000	10,000	11,000	12,000
	63%	87%	88%	89%
10. Tamalate	46,000	155,000	174,000	203,000
	31,000	135,000	152,000	179,000
	0	20,000	22,000	24,000
	67%	87%	87%	88%
11. Biringkanaya	6,000	15,000	16,000	18,000
	4,000	11,000	12,000	14,000
	0	4,000	4,000	4,000
	67%	73%	75%	78%
TOTAL	262,000	695,000	752,000	840,000
	153,000	487,000	542,000	630,000
	33,000	208,000	210,000	210,000
	58%	70%	72%	75%

LEGEND

From top to bottom

1) Served Population
2) Population Served through House Connections
3) Population Served through Public Standpipes
4) Composition Ratio (2)/1))

TABLE 2.3 WATER REQUIREMENTS BY USE AND YEAR

Year	Daily Maximum (x1,000 m3/day)					Daily Average (x1,000 m3/day)				Unaccounted-for Water (x1,000m3/day)	Accounted-for Water (x1,000m3/day)
	Domestic					Domestic					
	House Conne.	Public St.pipes	Neighbors Supply,et	Non-domestic	Total	House Connect.	Public Standpipes	Non-domestic	Total		
1983	16	1	1	10	28	14	1	8	22	12	11
1984	18	1	2	11	32	17	1	9	26	13	14
1985	21	1	2	12	36	19	1	10	29	14	16
1986	26	2	2	14	44	23	2	12	35	15	22
1987	33	3	2	16	54	29	3	13	42	16	29
1988	41	4	1	19	65	35	3	16	51	16	38
1989	52	5	0	23	80	44	4	19	63	17	50
1990	64	6	0	27	97	53	5	23	76	16	65
1991	71	6	0	30	107	59	5	25	84	18	71
1992	79	6	0	32	117	66	5	27	93	20	78
1993	86	6	0	35	127	62	5	29	91	21	85
1994	93	6	0	38	137	77	5	32	109	23	91
1995	101	6	0	40	147	84	5	33	117	24	98

As for the unit consumption by public standpipes, 30 liters per capita is employed constantly.
Unit demand of 20 liters (1983-1984) growing annually by 5 liters annually by 5 liters up to 30 liters is tentatively applied to estimate water requirements of consumers supplied by neighbours.

TABLE 2.4 WATER REQUIREMENTS BY KECAMATAN

KECAMATAN	1983	1990	1992	1995
1. Mariso	20,000	43,000	45,000	47,000
	1,400	4,500	5,100	6,000
	900	1,300	1,500	1,800
	2,300	5,800	6,600	7,800
2. Mamajang	11,000	60,000	64,000	71,000
	700	5,800	6,900	8,500
	1,300	1,900	2,100	2,600
	2,000	7,700	9,000	11,100
3. Ujung Pandang	19,000	35,000	35,000	36,000
	1,400	4,400	5,000	5,600
	800	1,200	1,300	1,600
	2,200	5,600	6,300	7,200
4. Makassar	37,000	98,000	104,000	111,000
	2,100	9,300	10,900	12,900
	900	1,300	1,500	1,800
	3,000	10,600	12,400	14,700
5. Wajo	27,000	42,000	43,000	43,000
	1,800	4,900	5,500	6,200
	1,400	2,100	2,300	2,800
	3,200	7,000	7,800	9,000
6. Bontoala	34,000	57,000	59,000	62,000
	2,100	5,400	6,300	7,400
	500	700	900	1,000
	2,600	6,100	7,200	8,400
7. Tallo	20,000	80,000	87,000	97,000
	1,300	4,700	6,200	8,400
	200	300	400	400
	1,500	5,000	6,600	8,800
8. Ujung Tanah	18,000	35,000	37,000	39,000
	1,000	2,400	3,000	3,800
	300	400	500	600
	1,300	2,800	3,500	4,400
9. Panakkukang	24,000	75,000	88,000	113,000
	1,600	8,800	11,500	16,500
	1,100	2,200	2,600	3,400
	2,700	11,000	14,100	19,900
10. Tamalate	46,000	155,000	174,000	203,000
	3,300	18,200	22,700	29,300
	700	1,900	2,300	3,200
	4,000	20,100	25,000	32,500
11. Biringkanaya	6,000	15,000	16,000	18,000
	400	1,600	1,900	2,400
	1,800	13,800	16,300	20,300
	2,200	15,400	18,200	22,700
TOTAL	262,000	695,000	752,000	840,000
	17,100	70,000	85,000	107,000
	9,900	27,100	31,700	39,500
	27,000	97,100	116,700	146,500

LEGEND

From top to bottom

1) Served Population
2) Domestic Water Requirement (m^3/day)
3) Non-domestic Water Requirement (m^3/day)
4) Total (m^3/day)

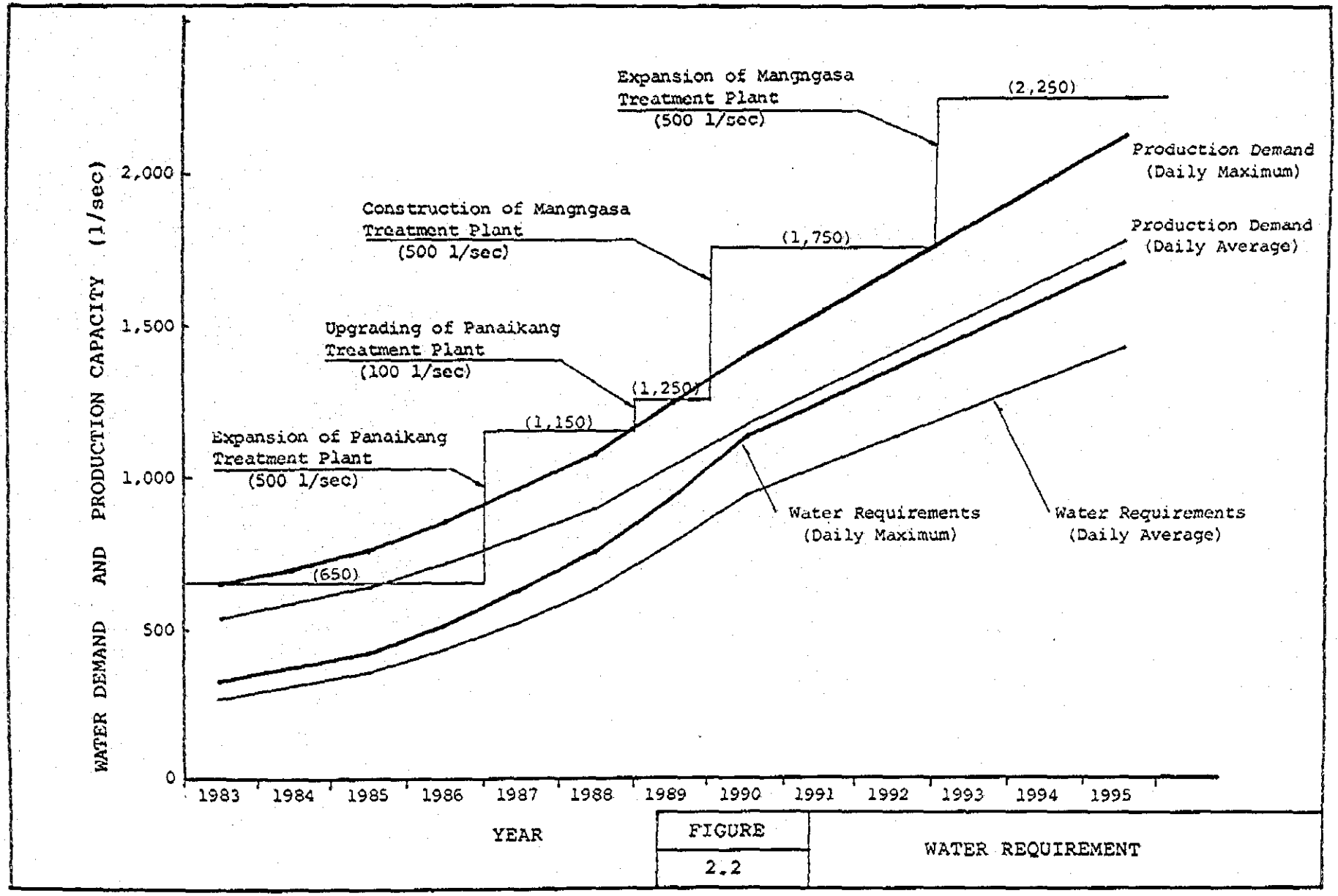
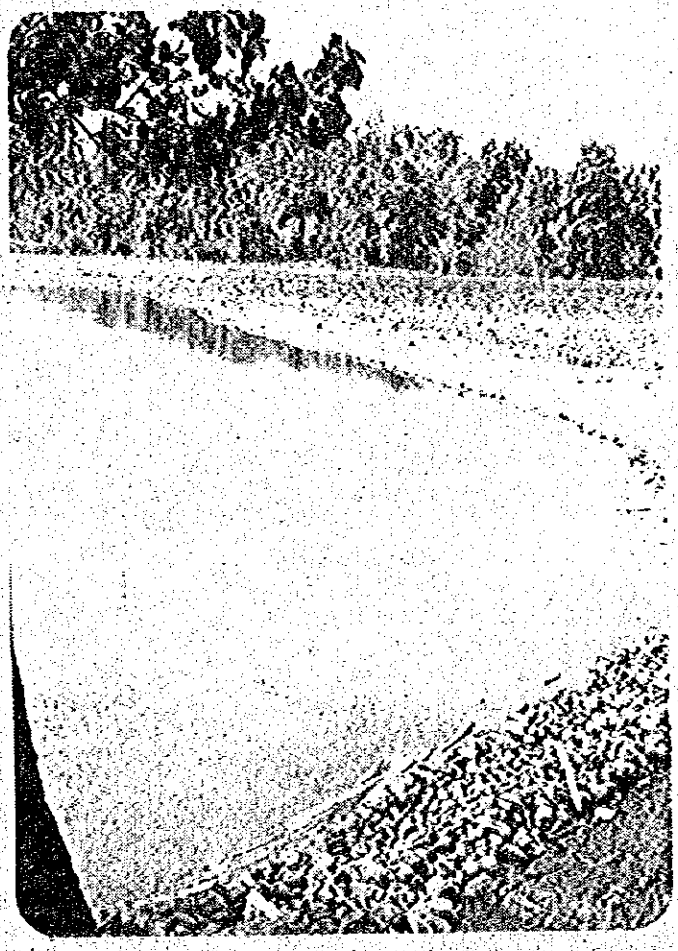


FIGURE 2.2 WATER REQUIREMENT

CHAPTER III

WATER SUPPLY SYSTEM OF STAGE I PROJECT



EXISTING IRRIGATION INTAKE AT BILI BILI, PROPOSED INTAKE SITE OF THE WATER SUPPLY

CHAPTER III
WATER SUPPLY SYSTEM OF STAGE I PROJECT

1. GENERAL

The purpose of this Chapter is to describe water supply development scheme till 1995, the target year of Stage I Project. Master Plan proposes that Stage I Project should be split into two projects, i.e., Phases 1 and 2. Major works under Phase 1 Project are rehabilitation of the existing systems and construction of the new treatment plant with a capacity of 500 l/sec. Phase 2 Project contains the expansion of the system. The newly expanded system produces clear water of another 500 l/sec. Water source for the new treatment plant is the irrigation water at Bili Bili. Water supply systems of Ujung Pandang planned for Stage I Project is shown on Figure 3.1.

First, it describes the design criteria worked out specifically for the Stage I Project. Then, preliminary design of major facilities is dealt with, which is prepared on the basis of the proposed criteria. Finally, method of operation and maintenance of the completed facilities is briefly described. This method has been worked out considering the current practice of PDAM. In addition to the operation and maintenance under normal conditions, it proposes measures to be undertaken in case of abnormal conditions such as scarcity of raw water source during severe dry seasons and suspension of the treatment plant due to power failure.

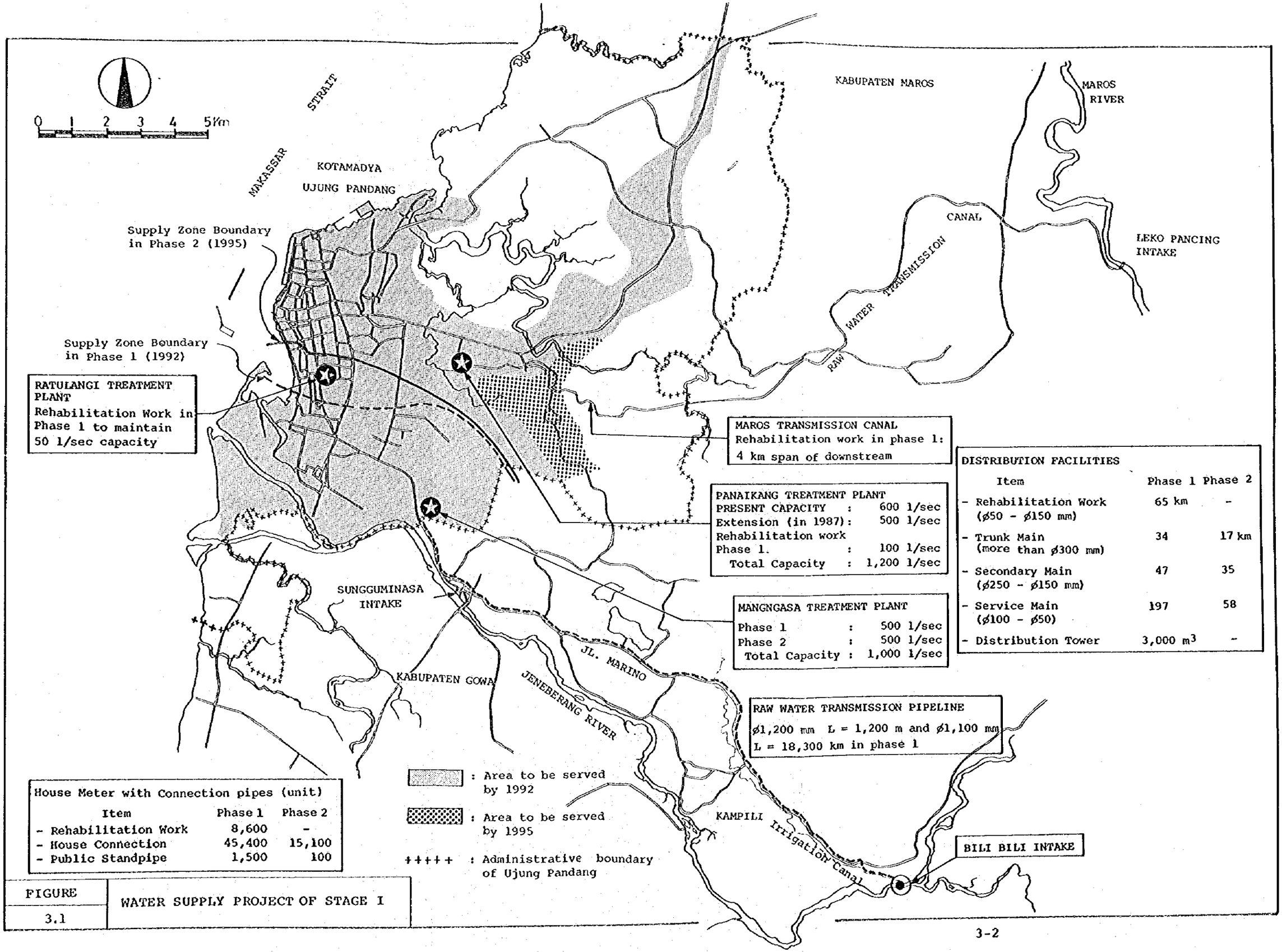


FIGURE 3.1 WATER SUPPLY PROJECT OF STAGE I

2. DESIGN CRITERIA

Design criteria proposed herein are for preliminary design of water supply system to be developed under Stage I Project including rehabilitation of the existing system. Special attentions were paid to the local characteristics of Kotamadya Ujung Pandang such as availability of engineers, contractor's ability, the current method applied for operating the existing facilities and water consumption patterns, and technology generally accepted in the developing countries.

The required quantity of the raw water to be extracted at Bili Bili is transmitted by gravity to Mangngasa, a site of the new treatment plant. The transmission pipeline also conveys 40 l/sec of the raw water to Sungguminasa City. The treatment processes to be applied to the new plant will reflect characteristics of the raw water. The treated water is pumped into the distribution network, which consists of trunk, secondary and service mains. This network enables to supply clear water to all consumers throughout the planned service area. Major design criteria together with relevant issues are described in the following subsections, all of which are to be used in the preliminary design.

2.1 Design Flow Rate and Peak Factor

Design flow rates of the new treatment plant at the target years of Phases 1 & 2 are:

Item	Phase 1	Phase 2
a. Raw water intake Bili Bili Weir	0.57 m3/sec	1.10 m3/sec
b. Treatment Plant		
- at receiving well	0.52 m3/sec	1.03 m3/sec
- at the outlet of filters	0.50 m3/sec	1.00 m3/sec
c. Distribution		
- at the outlet of the reservoirs (peak hour)	0.65 m3/sec 1/	1.17 m3/sec 1/

1/: These figures show the maximum flow rate on hourly basis, while items a. and b. on daily maximum.

Peak factors, i.e., ratios of maximum to average water demands are determined on daily and hourly water demand bases, as explained below.

a. Daily maximum to daily average demand
Fluctuations of monthly water production and consumption are shown on Figure 3.2. The ratio of monthly maximum to average daily demand is computed at around 1.1. In view of the present water supply condition and ratios adopted for similar towns' water supply projects, it is considered adequate to employ 1.2 as a peak factor (daily maximum/daily average demand).

b. Hourly maximum to daily average demand
Figure 3.3 shows the hourly variation of water production. Peak factor (hourly maximum/average daily) was determined to be at 1.6 in consideration of the above and the figure designed in the similar projects in Indonesia.

2.2 Rehabilitation Work

This aims to restore the originally planned capacity of the existing system by least investment. The rehabilitation work is to satisfy the following conditions.

Work Item	Conditions
Maros Transmission Canal	- Water losses from the canal to be less than 15% of the total flow. - To be free from human contamination.
Ratulangi Treatment Plant	- To continue producing safe and clear water till 1995. - To ensure proper maintenance and operation of the system.
Panaikang Treatment Plant	- The waste water and drain to be reused to reduce water losses in the plant. - The plant with a capacity of 1,100 l/sec to be upgraded to 1,200 l/sec.
Distribution Network and House Meters & Connections	- The water losses and leakage from the distribution network and service connections to be reduced to 20% of the water production.

2.3 Intake Facilities and Raw Water Transmission

Facilities for raw water intake and transmission consist of mainly a weir at the irrigation water intake at Bili Bili, diversion facilities from the irrigation canal at Romanglowe for withdrawal of raw water, a grit chamber and a transmission pipeline, all together with necessary appurtenant equipment and structures. Major conditions to be considered in design are as follows:

Facilities		Design Condition
1) Intake Weir	:	About 0.5 m in height from the bottom of the river.
2) Irrigation Canal Improvement	:	To ensure the design flow rate even in case of maintenance of the canal.
3) Grit Chamber	:	2 units of basin with 10 minutes retention time.
4) Transmission Pipeline	:	To convey by gravity.

2.4 Treatment Plant

The location of the treatment plant selected is at an open space close to the city boundary at Mangngasa. The water treatment will consist of the following processes, that is, water receiving, chemical mixing, flocculation, sedimentation, filtration and storage. As the turbidity of raw water varies widely by seasons, the processes of flocculation and sedimentation will be omitted when the turbidity falls very low. Major conditions to be taken in design are tabulated below.

Facilities	Design Conditions

1) Sedimentation Basin
   - Process required : To be tolerant of quantity and quality variation.

2) Rapid Sand Filter
   - Filtration rate : 120 m/day (5.0 m3/m2/hour) at normal operation.

3) Standby Ratio
   Considering the hourly variation of water demand, availability of spare parts, and time necessary for repair, the following are applied.

   - Distribution pump : Approximately 50% of standby ratio to meet fluctuation of daily water demand,
   - Filter surface wash pump : 100% of standby ratio because of its small capacity,
   - Chemical pumps and other equipments : 50% - 100% depending on its capacity and fluctuation.

4) Clear Water Reservoir
   - Effective capacity: More than 5 hour storage of maximum day demand.

As for method of gauging and controlling flow rates, the weirs/meters installed at the receiving well and at the effluent pipe of pumping station will give sufficient information on volume of raw water and production.

2,5 Distribution System and its Operation

Major factors to be employed in design are as tabulated below.

Further as regards operation of the distribution system, the following will be considered in design, namely, 1) even in case one plant reduces or suspends production, the corresponding service area is to be supplied by the other plant through connecting trunk mains, 2) for energy saving and leakage reduction, measures such as speed control of pumps are to be employed, and 3) for convenience of leakage abatement activities, necessary valves are to be installed.

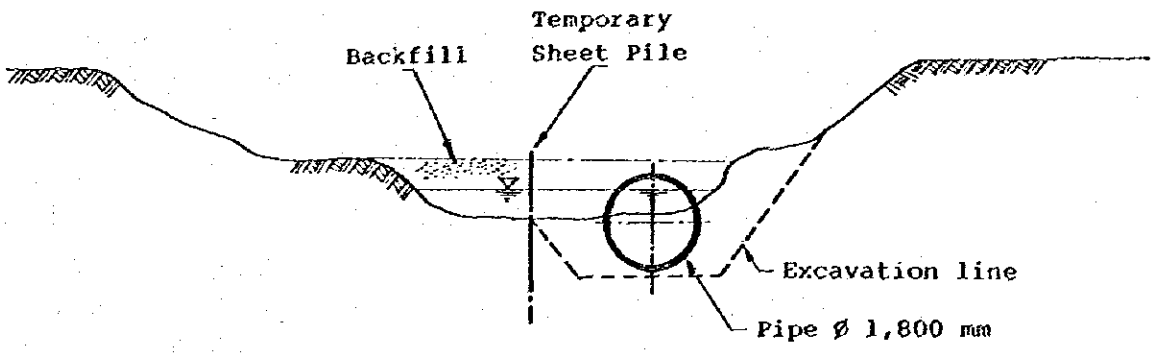
Items		Description
1) Distribution Pipelines (excluding pipelines in the rehabilitation work)		
- Trunk mains	:	More than 300 mm
- Secondary mains	:	250 - 150 mm
- Service mains	:	100 - 50 mm
2) Water Pressure		
- Maximum pump head	:	50 m (5.0 kg/cm2)
- Water pressure at the end of trunk mains	:	15 m (1.5 kg/cm2)
3) Friction Loss Co-efficient		
- Existing pipes	:	C = 110
- Pipes to be installed	:	C = 120

3. REHABILITATION WORK

3.1 Maros Transmission Canal

The raw water diverted into the canal at Leko Pancing decreases its flow rate during flowing down through the canal. Water losses currently account for 30% of the total flow. This occurs chiefly at the downstream of the existing transmission canal, where contamination by human wastes and sewage are remarkable. Furthermore, at the open cut section, plants and algae vegetated in the canal reduce the area of cross section, resulting in the decrease of the conveyance capacity.

Taking duly into consideration the cost effectiveness as well as the above conditions, the Team proposes that 4 km span of the canal from Panaikang be repaired in a way as shown below. Further detailed explanation is given in Appendix-2 Rehabilitation of Maros Transmission Canal.



3.2 Ratulangi and Panaikang Treatment Plants

3.2.1 Ratulangi Treatment plant

Following are proposed in the Master Plan Report as a rehabilitation work of the Ratulangi treatment plant under Phase 1 Project.

a. Replacement of the filter sand,
b. Installation of flow measuring equipment, and
c. Repair work of the alum feeding chamber.

Work items listed above aim at keeping the plant in such condition that it may produce clear and sufficient water continuously until the target year of Stage I Project. (The plant will be abandoned thereafter.) Furthermore, the Team proposes repairs of the existing elevated tank constructed in 1920s to maintain the tank in good working conditions. (Refer to item d.)

a. Replacement of the filter sand

A large portion of the filter media has been lost by backwashing, and proper filtration cannot be expected. To remedy this condition and further to cope with the ever worsening of quality of the Jeneberang River water, all the filter media will be replaced in the rehabilitation work. Concurrently the defective sluice gates of the filters will be repaired.

b. Installation of flow measuring equipment

The plant is not equipped with flow meters. The quantities of raw and treated water are not recorded currently. Water losses at the transmission pipeline, water production and losses of the plant are not known. To remedy this situation, weirs are planned which are to be constructed by placing thin metal plates at the inlet of raw water pumping well and at the outlet of the sedimentation basin.

Installation of flow meters, although desirable for accuracy, is not selected here because they are relatively expensive in cost and the installation work during operating the plant is somewhat difficult as compared to the proposed work.

c. Repair work of the alum feeding chamber and improvement of chlorine feeder

The existing stairs to the alum feeding chamber are broken due to years of use. These will be repaired for safe maintenance. The chlorine feeder located near the pumping house does not have sufficient capacity for continuous dosing. This will be also improved by enlargement of the solution basin and the replacement of the chlorine feeder.

d. Repair work of the existing elevated tank

Water treated at Ratulangi is presently distributed both by gravity flow from the elevated tank and by direct pumping. The elevated tank, although slightly deteriorated, supplies clear water to the customers nearby. It has a storage capacity of 750 m3 or 2 hours of production capacity. The method of distribution using the elevated tank enables to supply water continuously even in the peak hour. Appropriate maintenance ensures that it will function still after the target year of Stage I Project. Hence, its obsolete staircase for maintenance and cracks seen on the surface of the concrete should be repaired and/or reinforced immediately.

3.2.2 Panaikang Treatment Plant

Rehabilitation work of Panaikang treatment plant proposed in the Master Plan Report is an upgrading work to increase production capacity from 1,100 l/sec to 1,200 l/sec. Considering further the shortage of raw water in the severe dry season, the following work items for rehabilitation are included in the project.

a. Upgrading of production capacity

Construction of a new treatment plant with a capacity of 500 l/sec is scheduled to be completed by 1987 under a currently on-going project. This new treatment plant can be upgraded further solely by expansion of the existing chemical feeder. It will increase its capacity to 600 l/sec to meet the water requirements in 1989.

b. Reuse of waste water and drain

Waste water and drain from the plant accounts for 4% of the water production. They flow into the brook near the existing raw water pumping station at present. After expansion of the system in 1987, their flow rate reaches to approximately 50 l/sec; 15 l/sec of backwash water and 35 l/sec of drain from the clarifiers. A thickener to separate sludge and settled water will be constructed for re-use of waste water and drain. The settled water will be put back into the existing raw water channel, and the sludge can be used for land reclamation.

3.3 Distribution Network

As proposed in the Master Plan Report, old and deteriorated pipelines laid 60 years ago will be replaced by new pipelines for the following reasons:

1) Decreased conveyance capacity due to incrustation developed inside the pipes,
2) Poor water quality due to consumption of residual chlorine by incrustation,
3) Water leakage from the pipes, and
4) Increasing gap between water demand and supplied water caused from the above.

Pipelines to be replaced are 65 km in length as referred to in Table 3.1 and Figure 3.4.

Table 3.1 Pipelines to be Replaced

DIAMETER	LENGTH & MATERIALS	PLACE
150 (150)	13,485 m (SP/DCIP/ ACP)	- Jl. Irian, Jl. Andalas, Jl. Jendral Sudirman, Jl. Cendrawasih, etc.
150 (125)	6,890 m (SP/DCIP/ ACP)	- Jl. Somba Opu, Jl. G. Merapi
100 (100)	15,155 m (PVC/GSP)	- The area covered by old pipelines
75 (75)	27,790 m (PVC/GSP)	- The area covered by old pipelines
50 (50)	2,022 m (PVC/GSP)	- The area covered by old pipelines
Total	65,342 m	

Note: ( ) denotes diameter of the existing pipes.

3.4 House Meters and Connections

There are 28,000 connections installed at present, out of which metered connections are 25,000 or 89%. The remaining of 3,000 or 11% are unmetered. Furthermore, there is a number of defective meters. Such meters amount to 5,600 or 20% according to the results of the surveys conducted during the period of Feasibility Study. Hence, such unmetered connections and defective meters including service connections (8,600) will be installed/replaced in the rehabilitation work.

3.5 Benefits of the Rehabilitation

The implementation of the rehabilitation work will bring the following benefits to the system operation and water loss reduction.

Item of Rehabilitation	Description
1) Maros transmission canal	- Recovery of 220 l/sec of raw water being lost by leakage - Saving of chemical costs by reduction of contamination
2) Ratulangi Treatment Plant	- Continuation of production up to 1995 by rehabilitation of major deteriorated facilities
3) Panaikang Treatment Plant	- Reclamation of 50 l/sec of water being thrown away as wastewater - Production increase by 100 l/sec by upgrading
4) Distribution network & Service connections	- Reduction of water losses (from 50% to 20% of water production)

Additional water sales generated by the above rehabilitation work would be sizable, and on the other hand it would contribute to improvement of the present poor water supply condition.

4. PRELIMINARY DESIGN

Based on the design criteria so far described, all facilities of the proposed water supply system are preliminarily designed, as presented in Appendix-3 attached to this report. The designed facilities for Phases 1 and 2 are illustrated on Figure 3.5. This design intends to minimize the use of materials and equipment that require highly sophisticated technology for their operation and maintenance, and to propose simplified facilities that are relatively moderate in initial and maintenance cost. The outline of the facilities in the preliminary design are described hereinafter. The design provides the basis of cost estimates of the project, on which the feasibility thereof will be examined in the succeeding Chapters.

1) Intake facilities

Under Stage I Project, raw water of the Jeneberang River is planned to be diverted at the existing Bili-Bili irrigation intake into the canal. Proposed location of the diversion and the grit chamber is shown in Figure 3.6. Weir formed by gabion as considered moderate in cost will be constructed near the existing irrigation intake to extract the required quantity for water supply. Raw water flows down through the existing irrigation canal. Then, it flows into the grit chamber to be constructed at 1.5 km from the diversion.

2) Raw water transmission pipeline

The proposed pipeline along the road that connects Ujung Pandang with Sungguminasa and Malino is referred to in Figure 3.7. The distance from the grit chamber to the new treatment plant at Mangngasa is about 20 km. Field reconnaissance conducted so far reveals that the route has no influential obstacles for pipe installation.

3) New treatment plant

The site of new treatment plant proposed by the Master Plan Report was confirmed with further field surveys, followed by discussions with PDAM, which is shown in Figure 3.8.

Processes to be applied for the new treatment plant are proposed hereunder, provided that further detailed surveys and analyses be made at the stage of detailed design.

As the raw water at the Bili-Bili irrigation intake does not show any particular human pollution at present, economical and practical processes such as pre-chlorination, horizontal -flow sedimentation and rapid sand filters are considered appropriate. In addition to the above, turbidity of the raw water decreases to a level less than ten degrees in dry seasons. The raw water in such low turbidity does not require any sedimentation process. Hence, the dosage rate of alum could be one-third or one-fourth of the usual dosage, if direct filtration, with rapid mixing immediately befor filters, be employed for treatment.

Power required for the plant will be supplied from the PLN power system, and a standby power generator will be provided at the plant with a capacity sufficient to drive the distribution pumps in addition to the needs for lighting and instrumentation.

Figure 3.9 shows the flow sheet of treatment processes together with the reason for adoption of each unit. Dosage rates of the chemicals are given in Table 3.2.

On the basis of the treatment processes and design criteria described above, layout of the treatment plant and its profiles are prepared as shown in Figures 3.10 and 3.11.

4) Distribution network

Under Stage I Project, the service area is largely divided into two zones as shown in Figure 3.12. This zoning aims:

- to minimize the occurence of turbid water due to changes of water flow direction in the pipes,
- to identify volume of leaked water by zone, and
- to make easy the operation of distribution pumps in order to meet hourly variation of water requirements.

The routes of distribution pipelines for the target year of 1995 were determined through exchange of views with the officials concerned. The planned service area and future road planning envisaged in the City Master Plan were also integrated in developing the distribution network.

As for diameter of each pipeline, a network analysis was carried out at each zone, employing an 'Energy Level Method' 1/. The planned distribution network fully satisfies the design criteria worked out in Section 2 of this Chapter.

As seen in Figure 3.13, Panaikang and Mangngasa (proposed) treatment plants are interconnected by the trunk main that will locate along the main roads of Jl. U. Sumogarjo, Jl. Veteran and Jl. St. Alauddin. Under normal conditions, the plant supplies clear water to the customers in each zone separately. Under abnormal conditions, such as abnormal decrease of source water, unforeseen suspension of water transmission or accidents in the treatment plant, treated water, flowing through the trunk main, is supplied to the area where required. Further, a distribution tower to be constructed in the center of the municipality supplies clear water to the consumers under such conditions. The trunk mains branch secondary mains to distribute water to the whole service area.

1/: This method was employed instead of Hardy-Cross Method for the convenience of detailed design.

5. OPERATION OF THE WATER SUPPLY SYSTEM

The treatment plant at Mangngasa enables to supply safe and sufficient water to the consumers on condition that the plant be accompanied by an appropriate maintenance and operation. To ensure proper operation of the whole system, following works are to be carried out at the treatment plants and the central office at Ratulangi.

Treatment Plant

(1) To gauge and control water flow in the system to produce required quantity of water,
(2) To control water quality by conducting water testing,
(3) To determine dosage rate and to control stock of chemicals,
(4) To maintain the treatment facilities in an adequate condition.

Central Office

(5) To control and manage the whole systems on the basis of data and information given by an operation center at each treatment plant.

The control and maintenance for operation of the water supply system listed above are to be supported by several works further as tabulated in Table 3.3.

To carry out such works effectively, the preliminary design delineated in the former Section proposes the construction of laboratory for water testing, installation of valves and gates to control water flow at the several strategic points of the system, purchase of tools and equipment for pipe installation and leakage reduction, and provision of spare parts for several kinds of pumps and electrical equipment. Project cost estimated in the following Chapter includes all the cost described above.

On the other hand, PDAM is recommended to have following vehicles and equipment to conduct repair work, public campaign and patrol as routine work in addition to the current inventories of the PDAM.

1) Motor Vehicles ---- Pick-ups, truck cranes, mini-buses, tank rollies, and motor bikes,
2) Equipment & tools - Road cutters, tampers, hand rollers, pipe threaders, torque wrenches, etc.
3) Gauges ---------- Water pressure gauges and flow gauges.

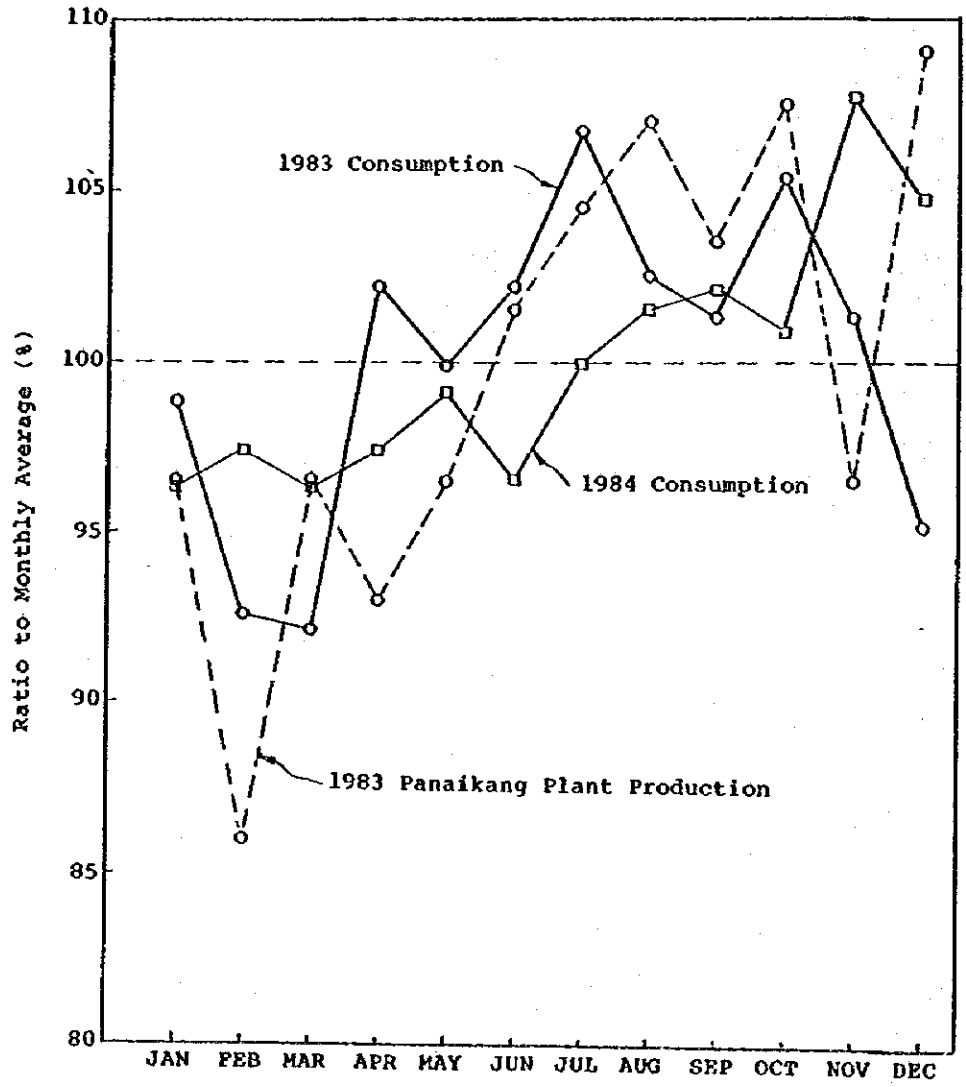


FIGURE	MONTHLY PRODUCTION AND CONSUMPTION DATA
3.2	

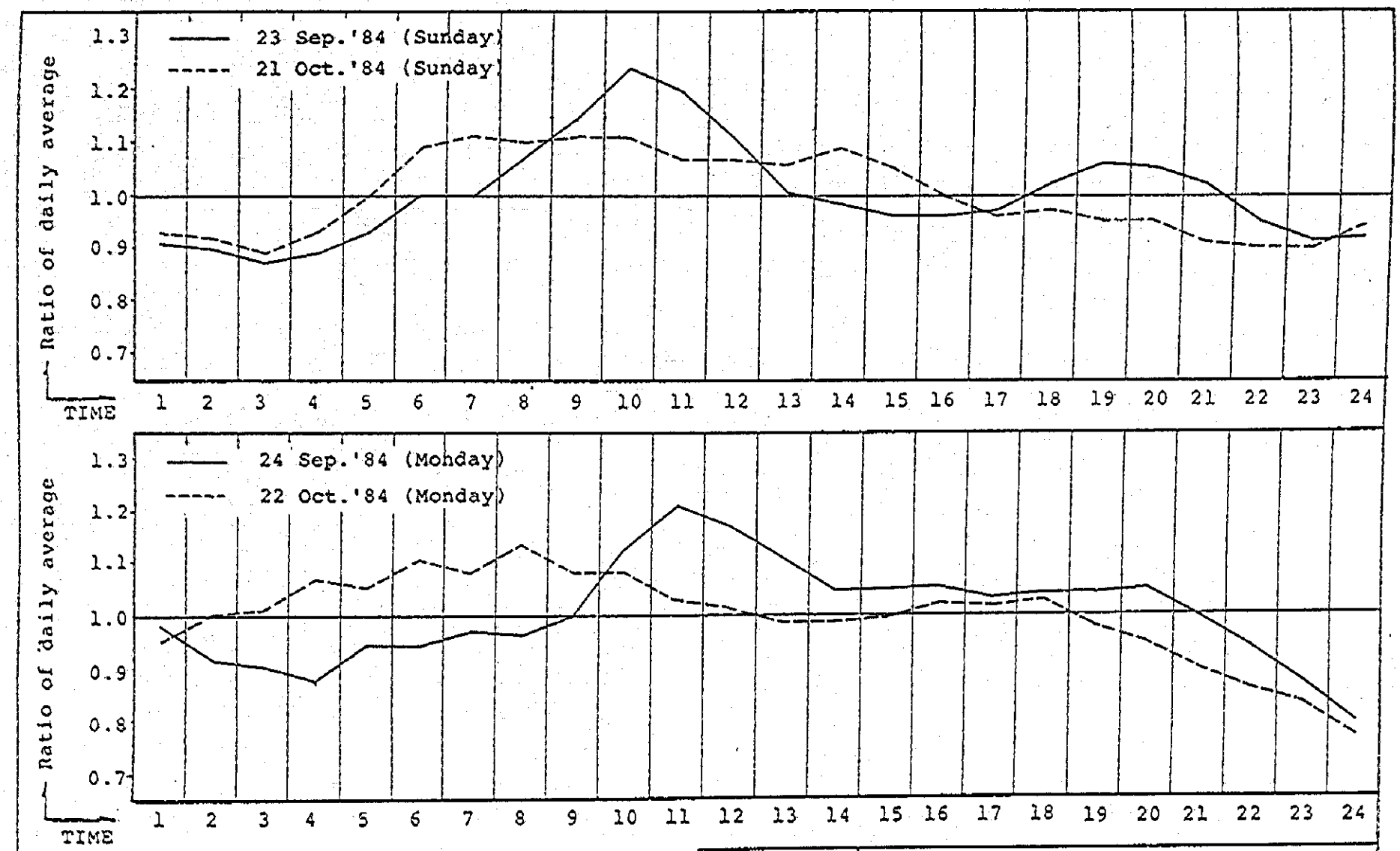


FIGURE	HOURLY FLUCTUATION OF WATER CONSUMPTION (WATER PRODUCTION)
3.3	

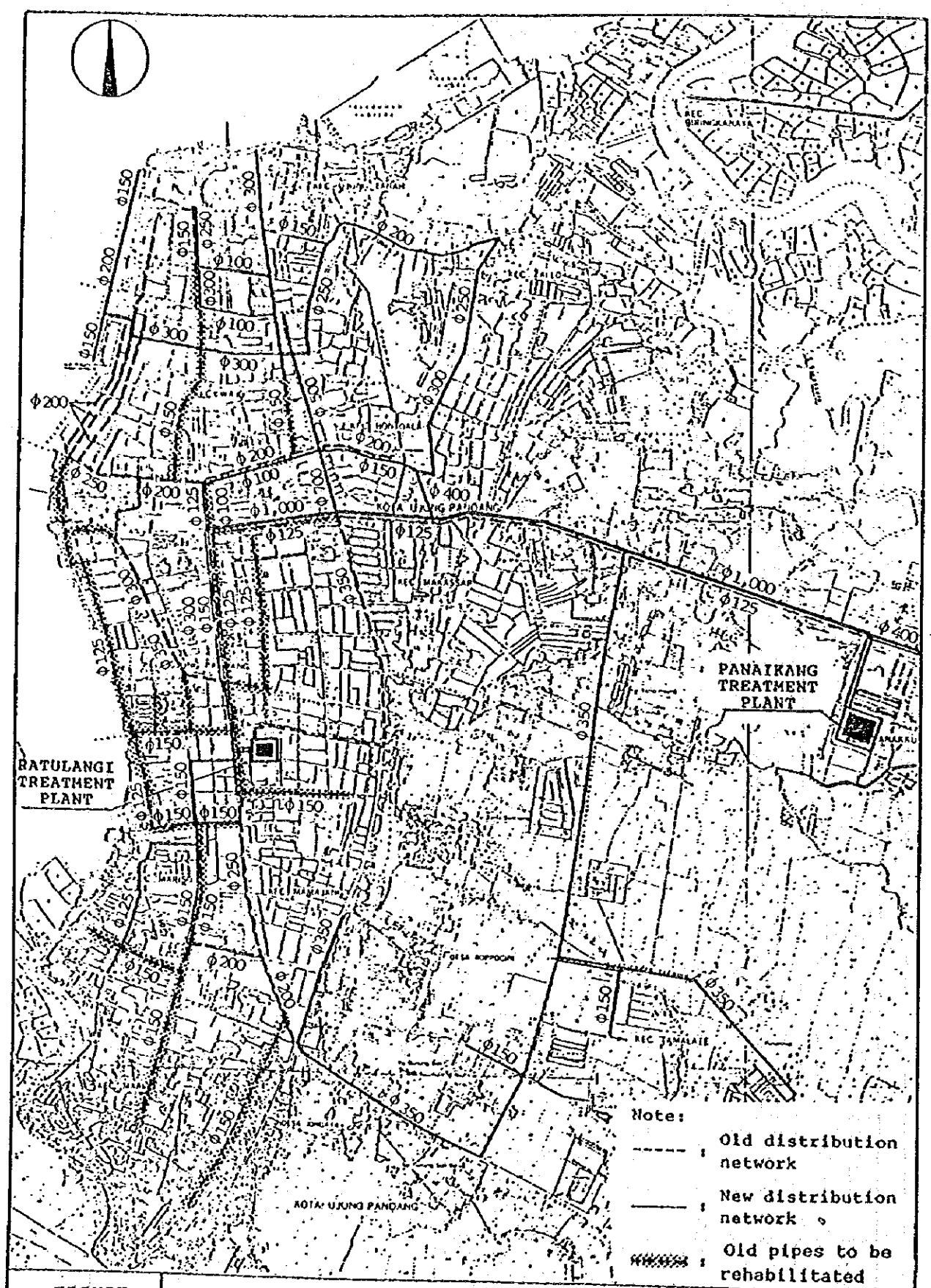
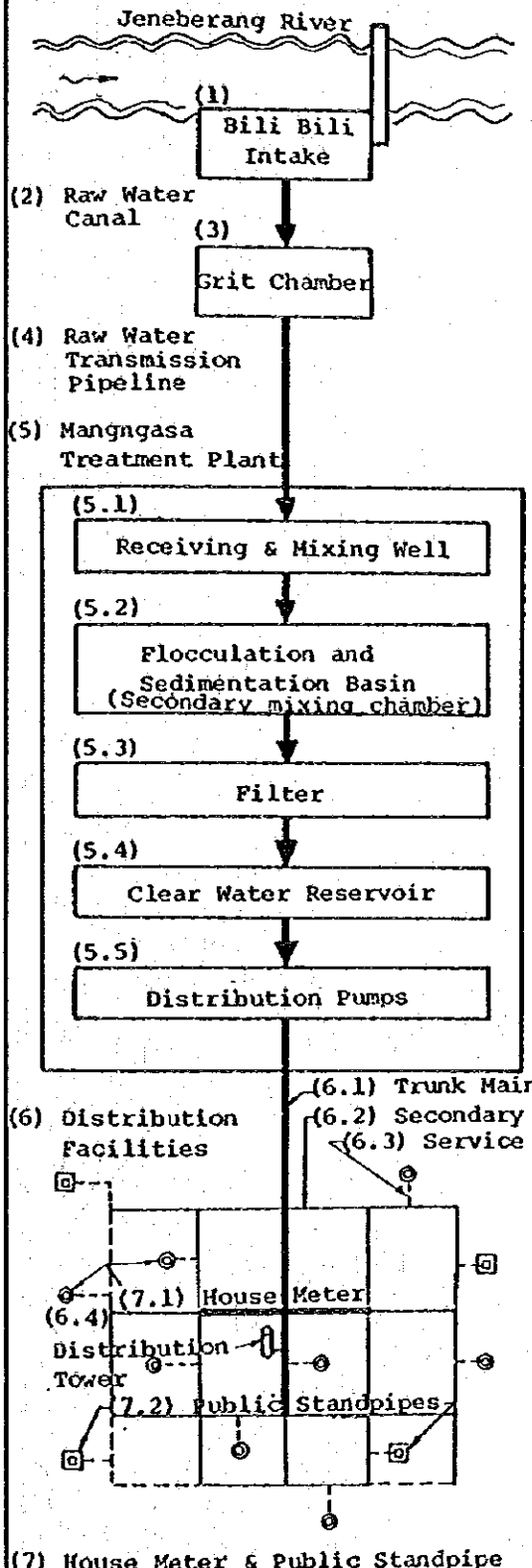
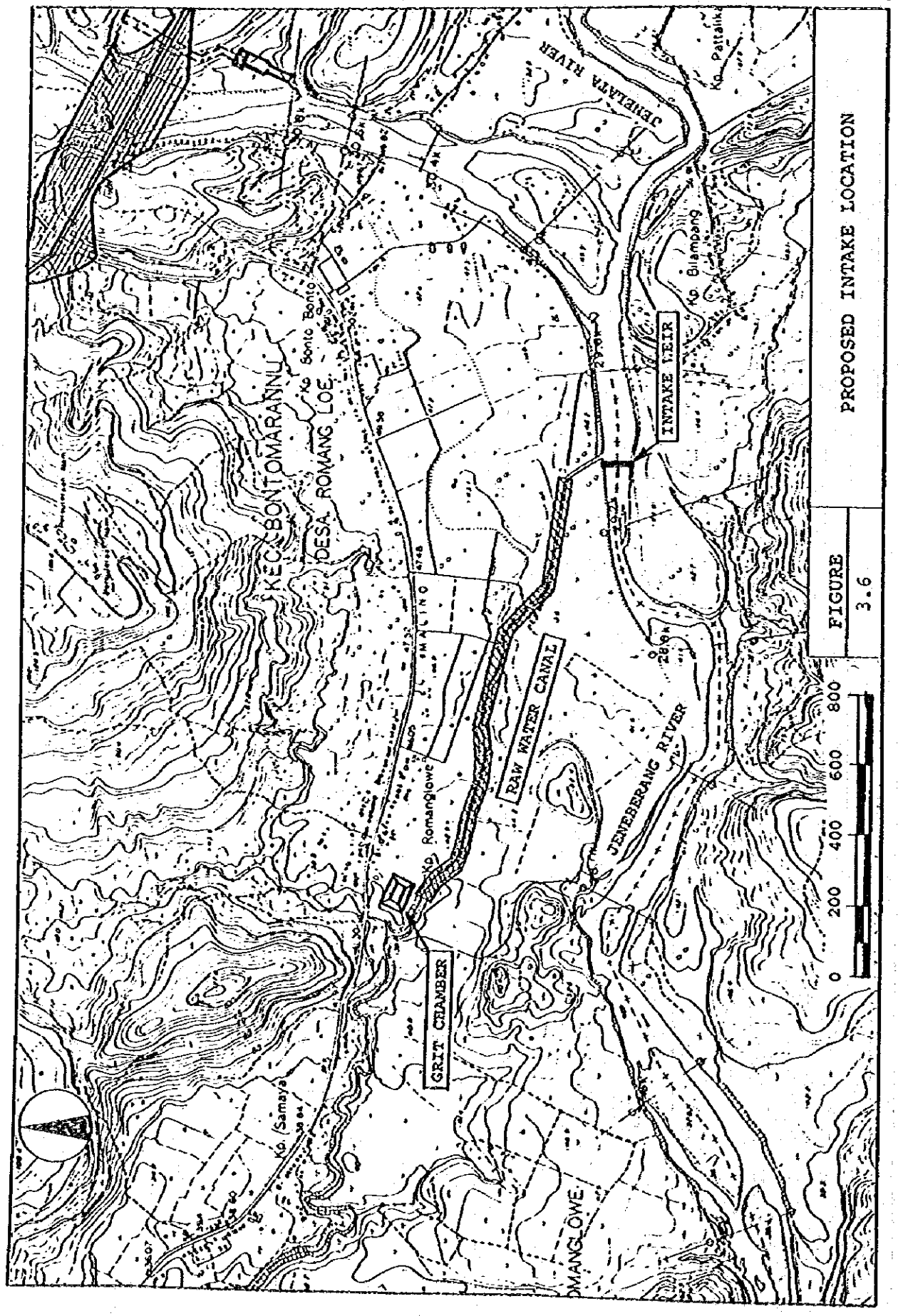


FIGURE	
3.4	OLD PIPES TO BE REHABILITATED



Item	Phase 1	Phase 2
Intake Facilities		
(1)	1 unit	-
(2)	1,500 m	-
(3)	1 Basin(2units)	-
Raw Water Transmission Pipeline		
(4)	L = 19,500 m	--
Mangngasa Treatment Plant		
(5)	0.5 m3/sec	0.5 m3/sec
(5.1)	1 Basin(2units)	-
(5.2)	1 Basin(2units)	1 Basin(2units)
(5.3)	6 Filter Beds	6 Filter Beds
(5.4)	9,000 m3	9,000 m3
(5.5)	Large Pumps 3units (1 standby)	Large and Small Pumps 1 large 2 small (1 standby)
(6) Distribution Facilities		
(6.1)	34 Km	17 Km
(6.2)	47 Km	35 Km
(6.3)	197 Km	58 Km
(6.4)	3,000 m3	-
(7) House Meter & Public Standpipes		
(7.1)	45,400	15,100
(7.2)	1,500	100

FIGURE	OUTLINE OF STAGE I PROJECT
3.5	


PROPOSED INTAKE LOCATION
FIGURE 3.6
JENEBERANG RIVER
RAW WATER CANAL
INTAKE WEIR
GRIT CHAMBER
DESA ROMANG LOE
KEC. BONTOMARANNU
Ko. Romanglowe
Ko. Samaya
Ko. Bontomarannu
Ko. Bontoa
Ko. Bilampang
Ko. Pattalikang
0
200
400
600
800

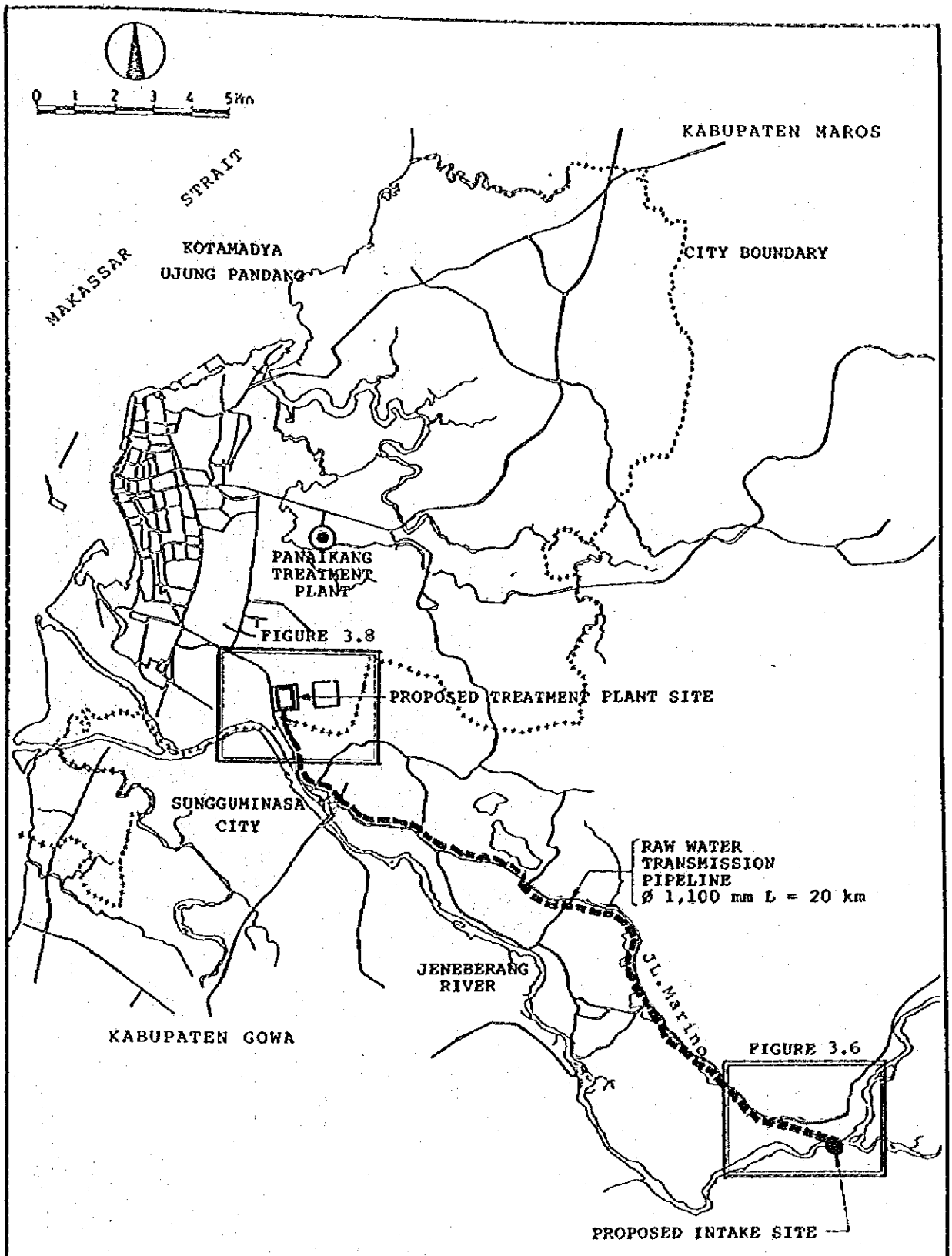


FIGURE	RAW WATER TRANSMISSION PIPELINE ROUTE
3.7	

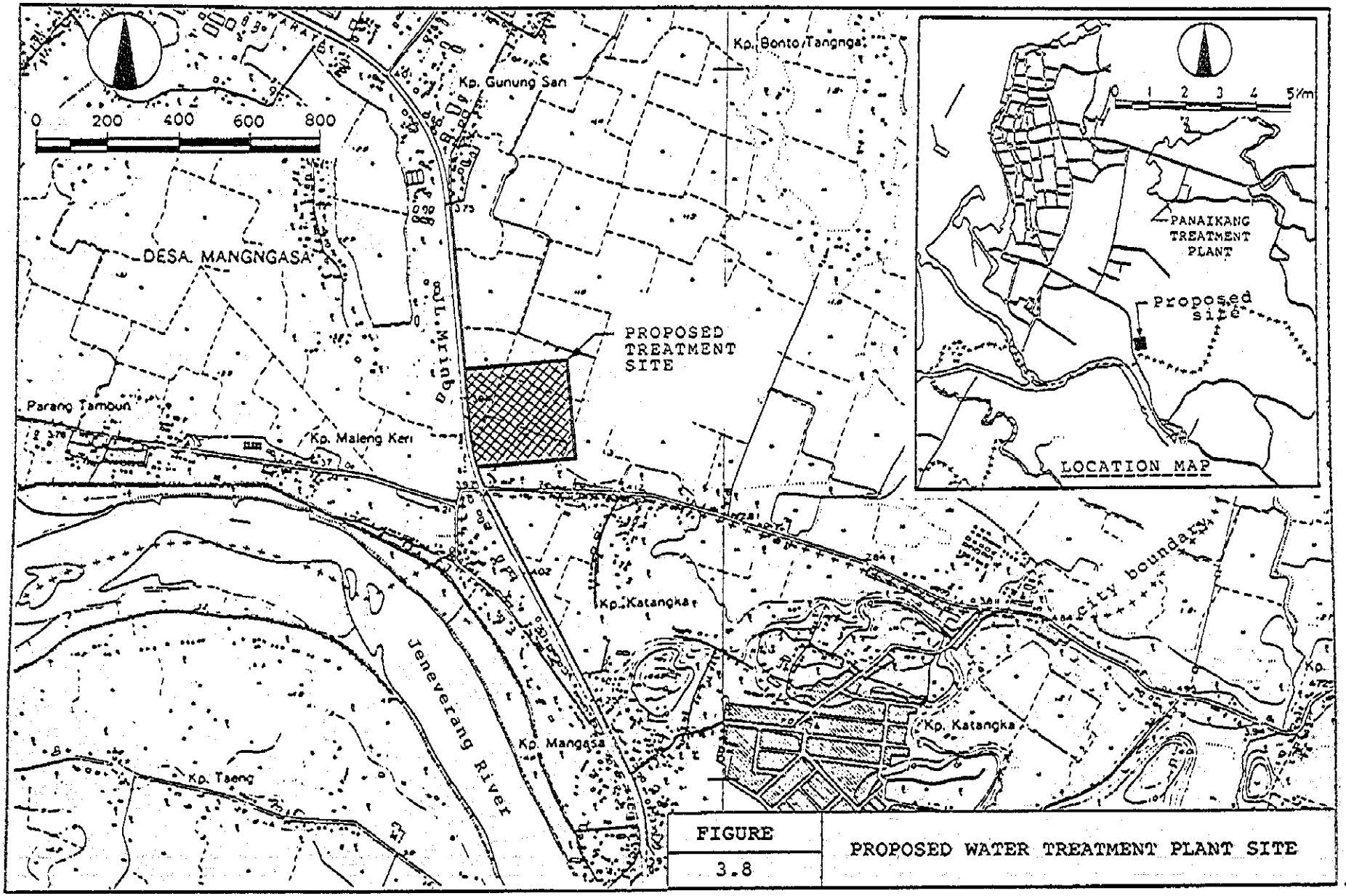
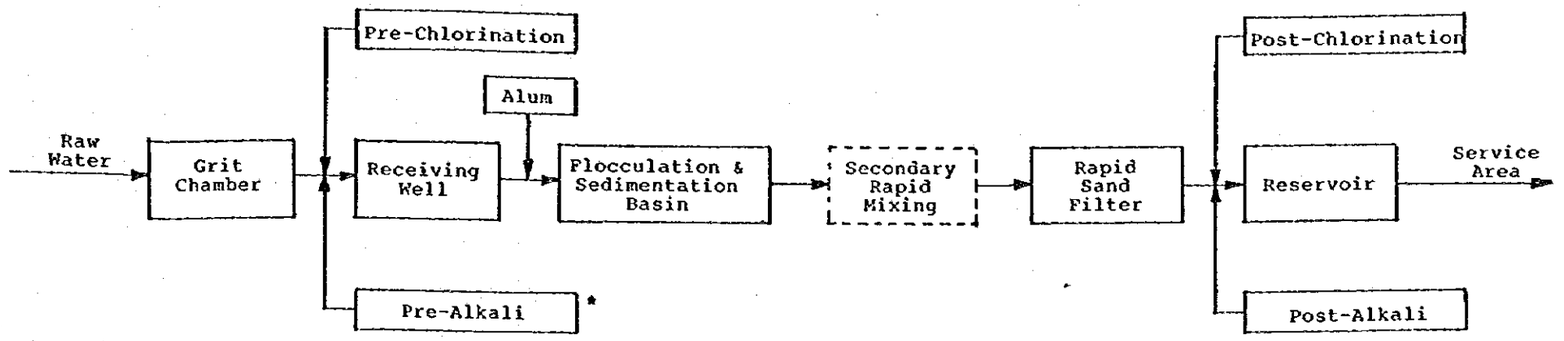


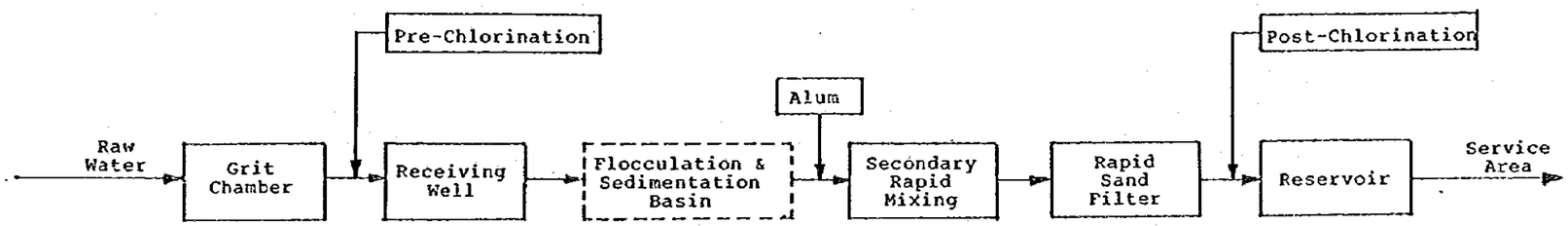
FIGURE	PROPOSED WATER TREATMENT PLANT SITE
3.8	

RAPID SAND FILTRATION
(Normal season)



* ... Pre-alkali should be feeded in case the raw water exceeds to 500 degrees in turbidity.

DIRECT RAPID SAND FILTRATION
(Dry season)



1) Pre-Chlorination : Pre-chlorination will be required to prevent growth of algae in the treatment facilities, kill plankton and remove iron and manganese in the raw water.

2) Pre-Alkali Treatment : Alkalinity in the raw water in the wet season may be 20 to 30 mg/l, when turbidity of source water rises. For treatment of such water, pre-alkali dosage is necessary. In the dry season, alkalinity may be rather high, 50 to 70 mg/l, not requiring pre-alkali treatment.

3) Post-Alkali Treatment : Alum consumes Alkalinity in water treatment, (Alum of 1 mg/l consumes Alkalinity of 0.45 mg/l), and pH value falls accordingly. Therefore, to protect pipe of the water supply system from corrosion, pH value of water for distribution must be raised by alkali treatment.

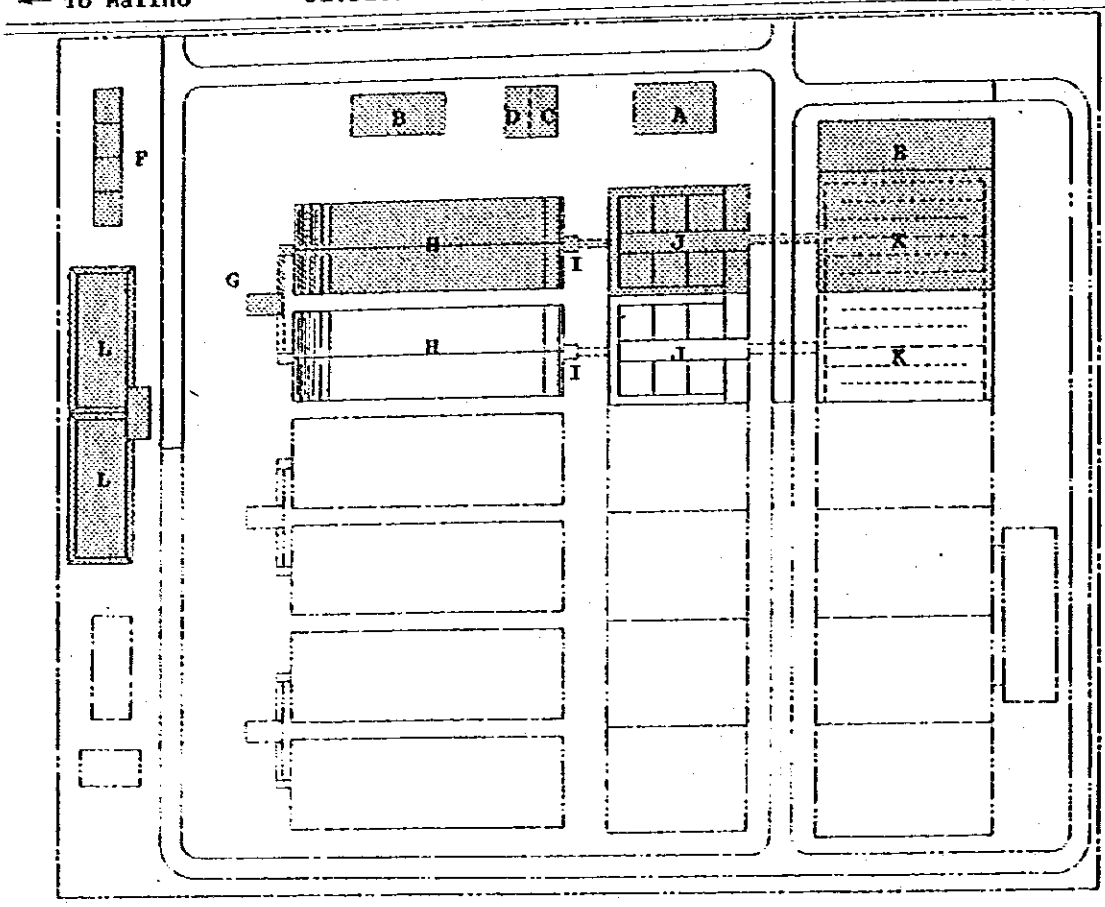
4) Post-Chlorination : To ensure the safety of the treated water, post-chlorination will be needed, even though break-point pre-chlorination should be applied, considering chlorine consumption during treatment processes.

5) Secondary Rapid Mixing : In dry seasons when raw water turbidity decreases to a level of less than 10 degrees, direct filtration without sedimentation process is to be applied to reduce dosage rate of alum, which is rather economical than normal treatment method.

FIGURE	FLOW SHEET OF TREATMENT PROCESSES
3.9	

Table 3.2 CHEMICAL DOSAGE RATE

	RAPID SAND FILTRATION (Normal Season)		DIRECT FILTRATION (Dry Season)	
	Ave. Rate (ppm)	Range (ppm)	Ave. Rate (ppm)	Range (ppm)
Pre-Chlorination	1.0	0.5 - 3.0	1.0	0.5 - 0.3
Pre-Alkali	-	0 - 30.0	-	-
Alum	25.0	15.0 - 100.0	5.0	5.0
Post-Chlorination	1.0	0 - 2.0	1.0	0 - 2.0
Post-Alkali	10.0	0 - 30.0	-	-



LEGEND

: STAGE I PHASE 1

: STAGE I PHASE 2

: STAGE II

A : ADMINISTRATION BUILDING
B : CHEMICAL BUILDING
C : WORK SHOP
D : STORAGE BUILDING
E : DISTRIBUTION PUMP HOUSE
F : STAFF HOUSE
G : RECEIVING WELL & MIXING WELL
H : FLOCCULATION AND SEDIMENTATION BASIN
I : SECONDARY MIXING WELL
J : FILTER
K : CLEAR WATER RESERVOIR
L : WASTE POND

FIGURE	GENERAL LAYOUT OF MANGNGASA TREATMENT PLANT
3.10	

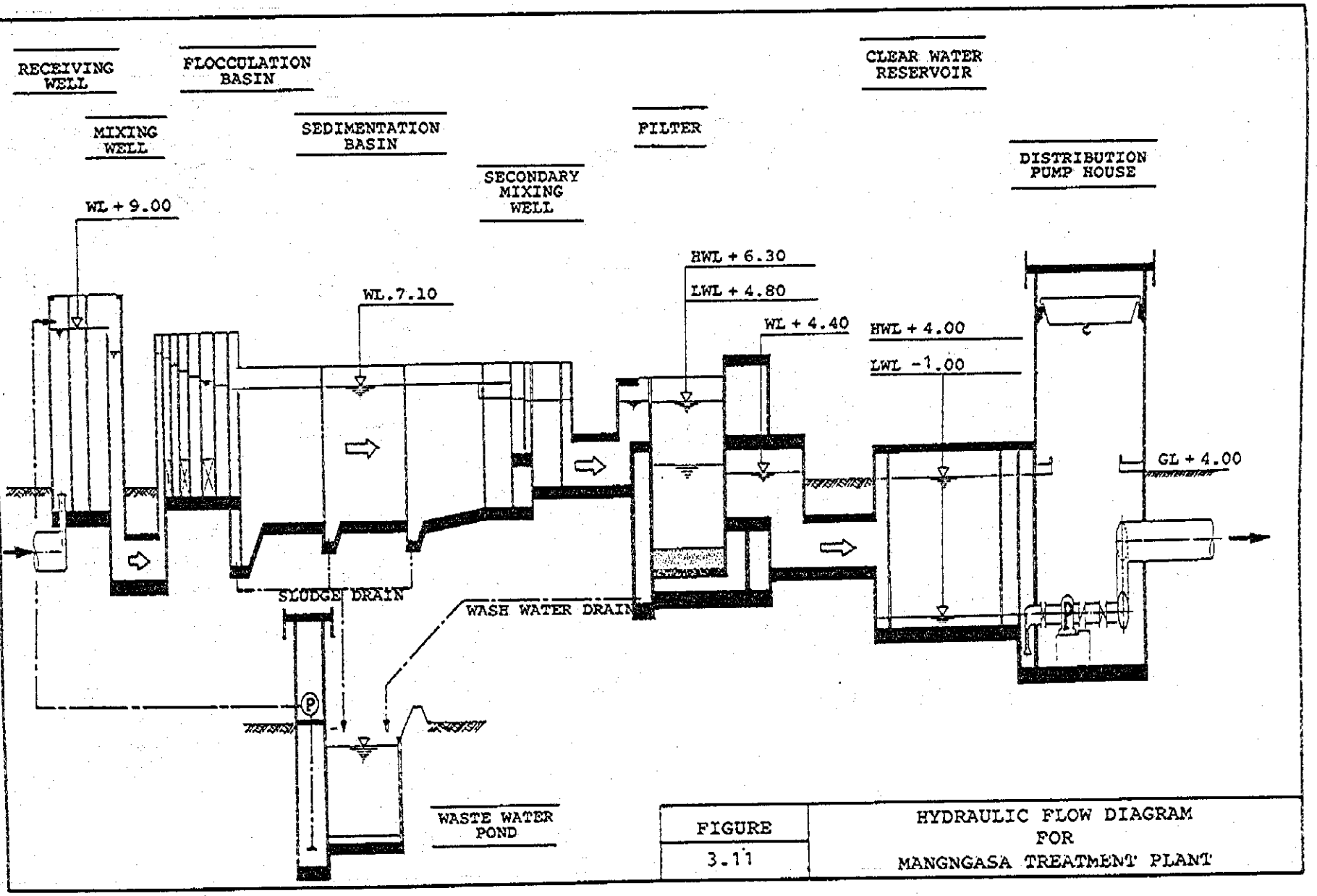


FIGURE 3.11 HYDRAULIC FLOW DIAGRAM FOR MANGNGASA TREATMENT PLANT

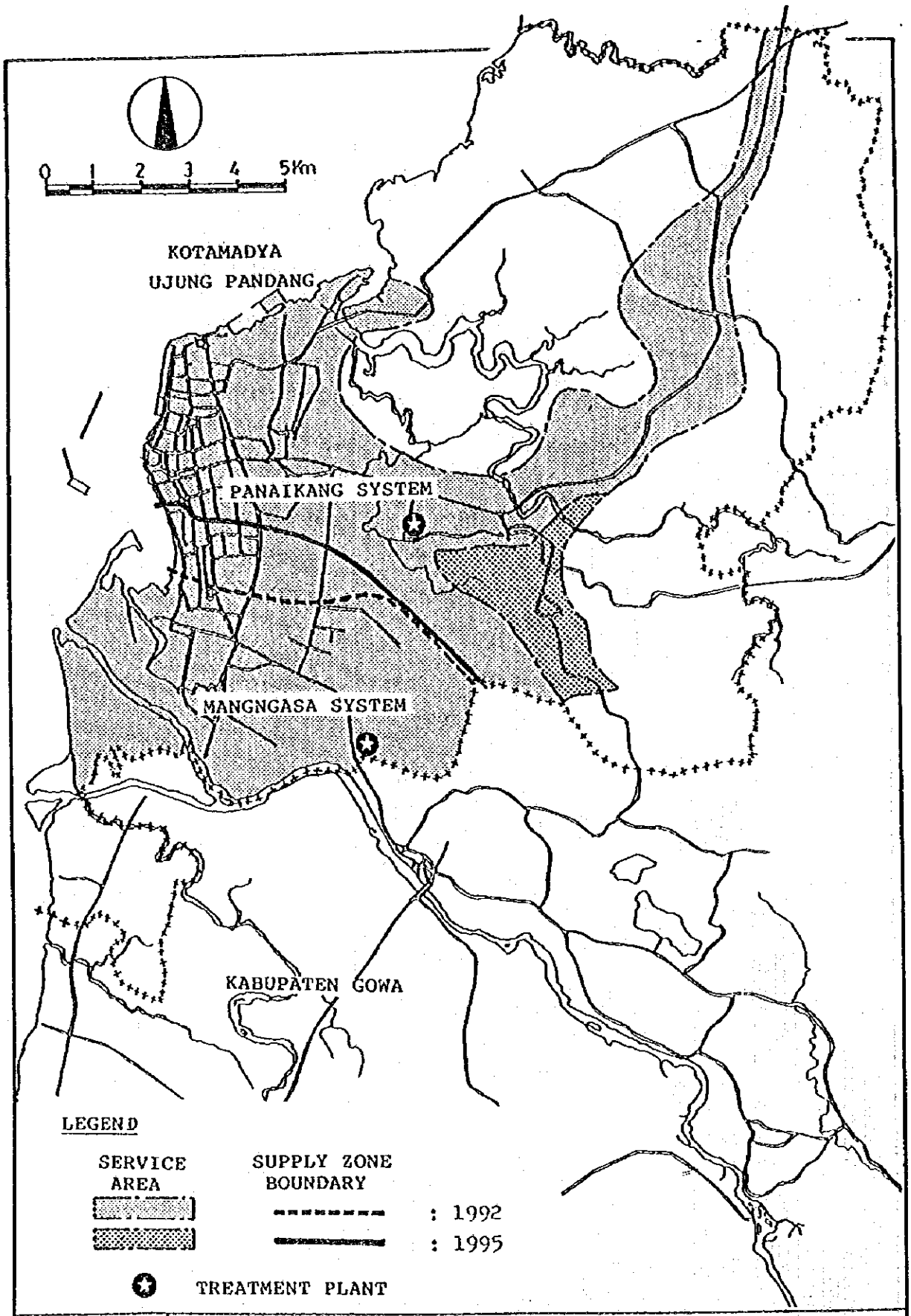


FIGURE	PROPOSED SUPPLY ZONE
3.12	

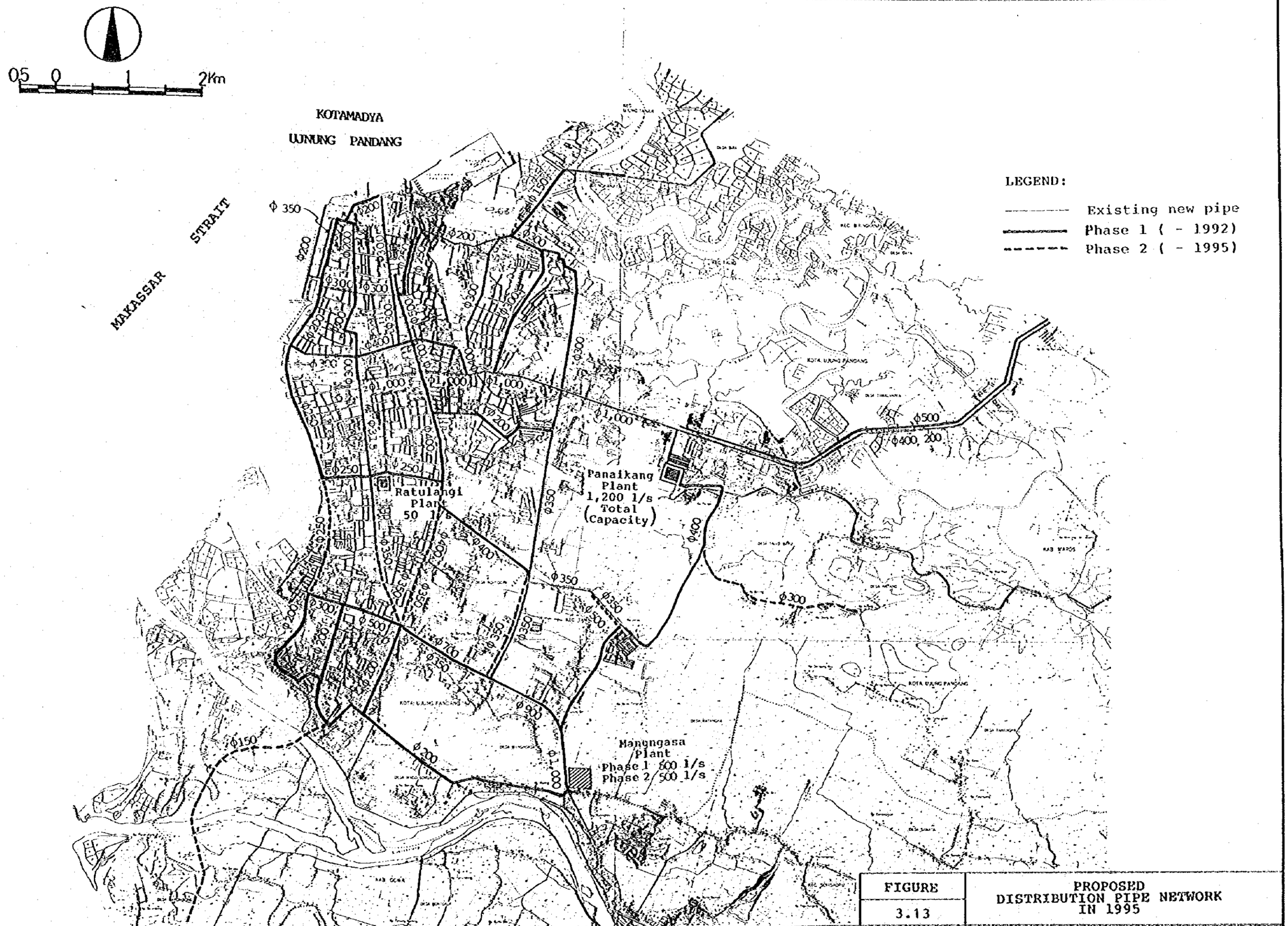


FIGURE	PROPOSED DISTRIBUTION PIPE NETWORK IN 1995
3.13	

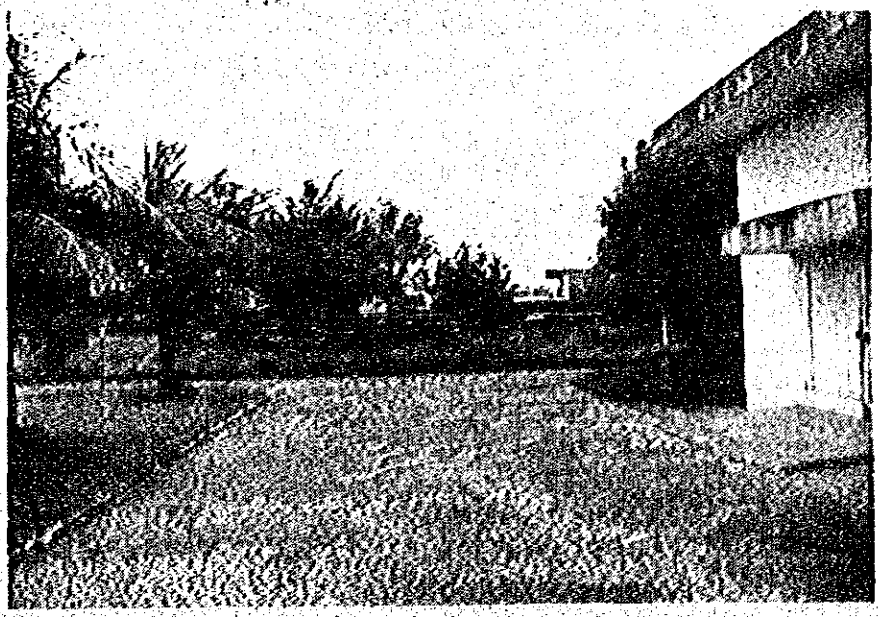
TABLE 3.3 OPERATION OF THE SYSTEM

Facilities	Item No.*	Work Description
1) Intake Facilities	(1)	- Gauging of flow rates at the outlet of grit chamber,
	(1)	- Gauging of water level and discharge at Bili-Bili intake,
	(2)	- Sample testing of the Jeneberang river water and raw water effluent at the grit chamber,
	(4)	- Maintenance of the raw water canal, gabion and the flush gate particularly in rainy season,
	(5)	- Communication with the authorities concerned (Irrigation, industries, etc.)
2) Raw Water Transmission Pipeline	(1)	- Gauging of water pressure and flow rate,
	(2)	- Sample testing of the raw water at the end of pipeline,
	(4) & (5)	- Patrol and maintenance of pipeline, drain pipes and air valves to cope with an unforseen accident,
	(5)	- Collection of information on construction of roads, poles for telecommunication, etc.
3) Mangngsa Treatment Plant	(1)	- Gauging of water level and flow velocity at each facility,
	(1)	- Gauging of water production at the outlet pipes of distribution pumps,
	(2)	- Sample testing of raw water at the mixing well, settled water at sedimentation basin and clear water at the outlet of filters,
	(2)	- Sample testing of drain and waste water,
	(3)	- Complilation of data on the stocks and consumptions of chemicals and their control and handling,
	(4)	- Maintenance of treatment facilities including mechanical and electrical equipment and repair work where required,
	(5)	- Maintenance and control of the stocked materials and survey on availability of materials & equipment,
	(5)	- Communication with electric company regarding schedule of activities, etc.
4) Distribution Facilities	(1)	- Water pressure gauging at the house taps,
	(2)	- Water sampling at the house taps and testing,
	(2)	- Water sampling at the existing wells and testing,
	(4)	- Periodical patrol at the distribution pipelines especially at house connections, public standpipes and pipe bridges,
	(4) & (5)	- Leakage reduction and repair work and data compilation,
	(5)	- Establishment of organization to cope with in case of emergency
	(5)	- Preparation of as-built drawing (service pipes), collection of information on construction of roads, drainage, etc., and communication with authorities concerned.

* --- It shows number of items listed in the context.

CHAPTER IV

COST ESTIMATES AND PROJECT INPLEMENTATION



PVC PIPES PILED UP AT THE STOCKYARD
OF THE PANAIKANG TREATMENT PLANT

CHAPTER IV
COST ESTIMATES AND PROJECT IMPLEMENTATION

1. GENERAL

This chapter first intends to justify appropriateness of the Project such as availability of materials and equipment, contractors' ability, etc. Then, cost estimates of the project will be made on the basis of the proposed facilities in the preliminary design. Results of the cost estimates are to be utilized as an input of financial analysis in the following chapter. Finally, construction schedule will be worked out on the basis of review of actual schedule of on-going projects and the implementation schedule proposed in the Master Plan Report. What is to be stressed in preparing the construction schedule is that the rehabilitation work of the existing system should be initiated at the early stage of the Project.

2. CONSIDERATION ON LABOUR FORCE, MATERIALS, EQUIPMENT, ETC.

2.1 Contractors' Ability and Availability of Labour Force

At present, 778 contractors are registered officially in Kotamadya Ujung Pandang. Most of them are classified into ranks B and C according to the national standard classification of contractors. Contractors ranked A total to merely 20. However, these contractors have undertaken various large and small scaled projects in South Sulawesi province. They are construction of roads, bridges, housing estates, irrigation canal, industrial estate, etc. Construction of a multi-purpose dam at Bili Bili and Bakaru power station will be undertaken in the near future. It should be noted that water supply systems constructed in the past few years are

currently supplying clear water to approximately 1.5 million of population in 22 towns/cities of the province. Construction experience through such projects might be beneficial to the implementation of the present project.

As for labour force, the present surveys show that about 10,000 immigrants enter into Kotamadya Ujung Pandang every year, seeking for employment opportunity. The employment ratio of Kotamadya Ujung Pandang is around 50% to total population in 1983. These figures confirm that numerous number of daily workers are available in Ujung Pandang.

2.2 Considerations on Materials and Equipment

Materials produced in Sulawesi are chiefly raw materials such as cement, sand, bamboo, bricks, etc. All materials produced in Indonesia are also available in Ujung Pandang. Such materials become slightly expensive in cost at Ujung Pandang due to the freight of marine transportation. Major materials locally available are listed in Table 4.1.

TABLE 4.1 LIST OF DOMESTIC MATERIALS AVAILABLE IN UJUNG PANGDANG

Construction Materials :

1) Cement
2) Aggregate including filter sand
3) Form work; wood
4) Scaffolding; bamboo
5) Steel: round bar, deformed bar, angle steel, steel plate, etc.
6) Paint: water paint, oil paint, epoxy paint.
7) Cable and lighting apparatus

Pipe Materials

1) Steel pipe: ϕ 100 - ϕ 2,000 (spiral type)
   - coating: coal tar enamel coating, epoxy and asphalt felt wrapping, polyvinyl tape system, and epoxy coating
   - lining : coal tar enamel lining, cement mortar lining and bitumen lining
2) Asbestos cement pipe: ϕ 80 - ϕ 600
   - Fittings : cast iron, bitumen coating and cement mortar lining (Australian Standard)
3) PVC pipe (bell end & rubber gasket joint) : ϕ 75 - ϕ 300
   - Fittings: bend, tees, reducer, flange socket, double socket, etc.
4) Galvanized iron pipe (GIP):
   - Fittings: elbow, tee, plug, socket, nipple, etc.

3. PROJECT COST

Project cost broken down into foreign and local components are summarized in Table 4.2. Unit costs of major materials, labour, etc. are presented in Appendix-4 and the exchange rates applied herein are US$ 1=Rp. 1,115 and ¥ 1.0=Rp. 4.45.

The cost of the Stage I Project is estimated including construction cost, land cost, physical and price contingencies and engineering fee at the current price as of May 1985. It amounts to Rp.80,131 million out of which the foreign component is US$37,139 thousand (51.7%) and the local Rp.38,721 million (48.3%).

The physical contingency was provided multiplying the construction cost by 0.10 (10 %). As for price contingency, annual escalation rate as shown below was applied.

Escalation Rates Applied

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

4. PROJECT IMPLEMENTATION

4.1 Executing Agency

The executing agency of the present Project is Cipta Karya (Directorate General of Human Settlement, Ministry of Public Works, Republic of Indonesia). Cipta Karya responsible for all works related to the implementation of the Project will undertake the system construction and turn over the completed system to PDAM Ujung Pandang. PDAM operates and maintains the system, supplying clear water to the consumers.

Cipta Karya has a branch office in each province throughout the nation. The branch office in South Sulawesi Province (PAB) is staffed with 80 personnel inclusive of 5 engineers/ experts. If any difficulties occur during system operation, they are usually solved by PDAM under consultation with the officials of PAB, South Sulawesi Province.

4.2 Method of Procurement and Construction

Although special attentions are given to the maximum utilization of local products in the course of the preliminary design, the planned system still requires the materials and equipment which are not locally available. Such materials and equipment will be procured through open international tendering in accordance with the guidelines of international financing agencies concerned.

Civil works for pipe installation and construction of treatment plant are to be carried out in principle by local contractors. With regard to some civil works which require special technology, it is recommended the local contractor associate with a foreign contractor/s. By such association, useful technology transfer will be realized.

Materials and equipment to be procured through international tendering and civil works to be carried out by local contractors are itemized below:

1) International Tendering

a. Procurement for rehabilitation (Phase 1)
   - Pipe materials for rehabilitation of the Maros transmission canal,
   - Chemical feeding pumps and
   - Pipe materials for rehabilitation of the existing pipelines with relatively large diameter.

b. Procurement for construction of Mangngasa system (Phases 1 and 2)
   - Pipes, fittings, valves and jointing materials for transmission pipelines,
   - Pipes, fittings, valves and jointing materials for distribution pipelines,
   - Pipes, fittings, valves and jointing materials for the pipelines to be installed in the plant,
   - Electrical facilities to operate distribution and surface wash pumps, and
   - Generators, valves, gates, distribution pumps, surface wash pump, and chemical feeders.

c. Construction of distribution tower made of prestressed concrete (Phase 1)
   - Designing of the distribution tower,
   - Procurement of materials, and
   - Civil work for construction.

2) Local Tendering

a. Civil work for rehabilitation
   - Maros transmission canal,
   - Ratulangi treatment plant including procurement of filter sand, and
   - Panaikang treatment plant.

b. Civil work of intake facilities
c. Pipelaying work of transmission pipeline and construction of valve chambers
d. Civil work for construction of the treatment plant
   - A receiving well, mixing chamber, flocculation basin, sedimentation basins and filters,
   - Clear water reservoirs,
   - A chemical building, operation center and pumping house, and
   - Landscaping and construction of roads, fence and gates.
e. Pipelaying work of the distribution pipelines including construction of pipebridges

4.3 Construction Schedule

A construction schedule for Stage I Project which is schematically portrayed in Figure 4.1 is developed in consideration of the period actually required for each work, and contractors' ability and experience.

As described in the preceding Chapter, the rehabilitation of the existing system will give great benefit in reducing water losses and operating the system efficiently. In view of the above situation, the rehabilitation of the existing systems should be initiated as expeditiously as possible. Special attentions were paid to the immediate initiation of the rehabilitation work.

An implementation schedule is presented in Figure 4.2. The schedule is worked out adding some modifications to that prepared in the Master Plan. The concept and strategy for the scheduling are same as described in the said report.

Table 4.2 COST ESTIMATE FOR STAGE I PROJECT

DESCRIPTION	Foreign Currency 1,000 US$	Local Currency million rupiah	Total million rupiah
I. PHASE 1 PROJECT			
1) Rehabilitation			
-Maros Transmission Canal	1,348	937	2,440
-Ratulangi Treatment Plant	0	19	19
-Panaikang Treatment Plant	17	48	67
-Distribution Pipelines & House Meters	588	1,778	2,434
SUBTOTAL OF 1)	1,953	2,782	4,960
2) Mangngasa System			
-Land Acquisition	0	1,166	1,166
-Intake Facilities	0	826	826
-Transmission Pipelines	3,212	2,228	5,809
-Treatment Plant	3,793	3,871	8,100
-Power Receiving	0	48	48
-Distribution Pipelines & House Meters	6,889	6,708	14,389
-Distribution Tower	1,040	0	1,160
SUBTOTAL OF 2)	14,934	14,847	31,498
3) Administration (2%)	0	353	353
4) Engineering Services	2,526	1,360	4,176
5) Physical Contingency (10%)	1,942	1,934	4,099
SUBTOTAL OF 1)-5)	21,355	21,276	45,087
6) Price Contingency	7,006	7,597	15,409
Total of Phase 1 Project	28,361	28,873	60,496
II. PHASE 2 PROJECT			
1) Treatment Plant	1,681	1,793	3,667
2) Distribution Pipelines & House Meters	2,537	2,860	5,689
3) Administration (2%)	0	93	93
4) Engineering Services	875	469	1,445
5) Physical Contingency (10%)	509	520	1,088
SUBTOTAL OF 1)-5)	5,602	5,735	11,981
6) Price Contingency	3,176	4,113	7,654
Total of Phase 2 Project	8,778	9,848	19,635
III. PHASE 1 + PHASE 2			
TOTAL of STAGE I PROJECT	37,139	38,721	80,131

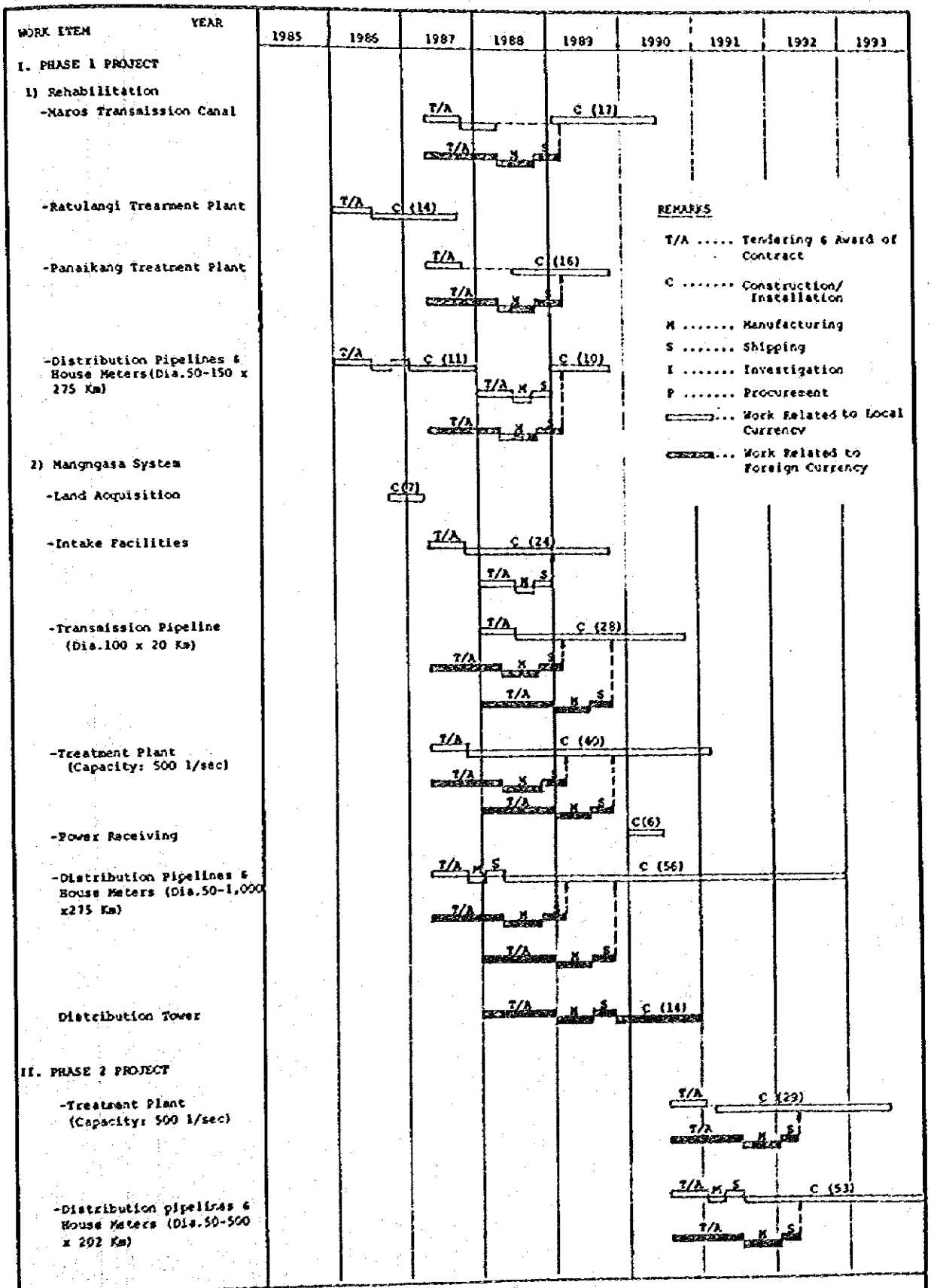


FIGURE	CONSTRUCTION SCHEDULE
4.1	

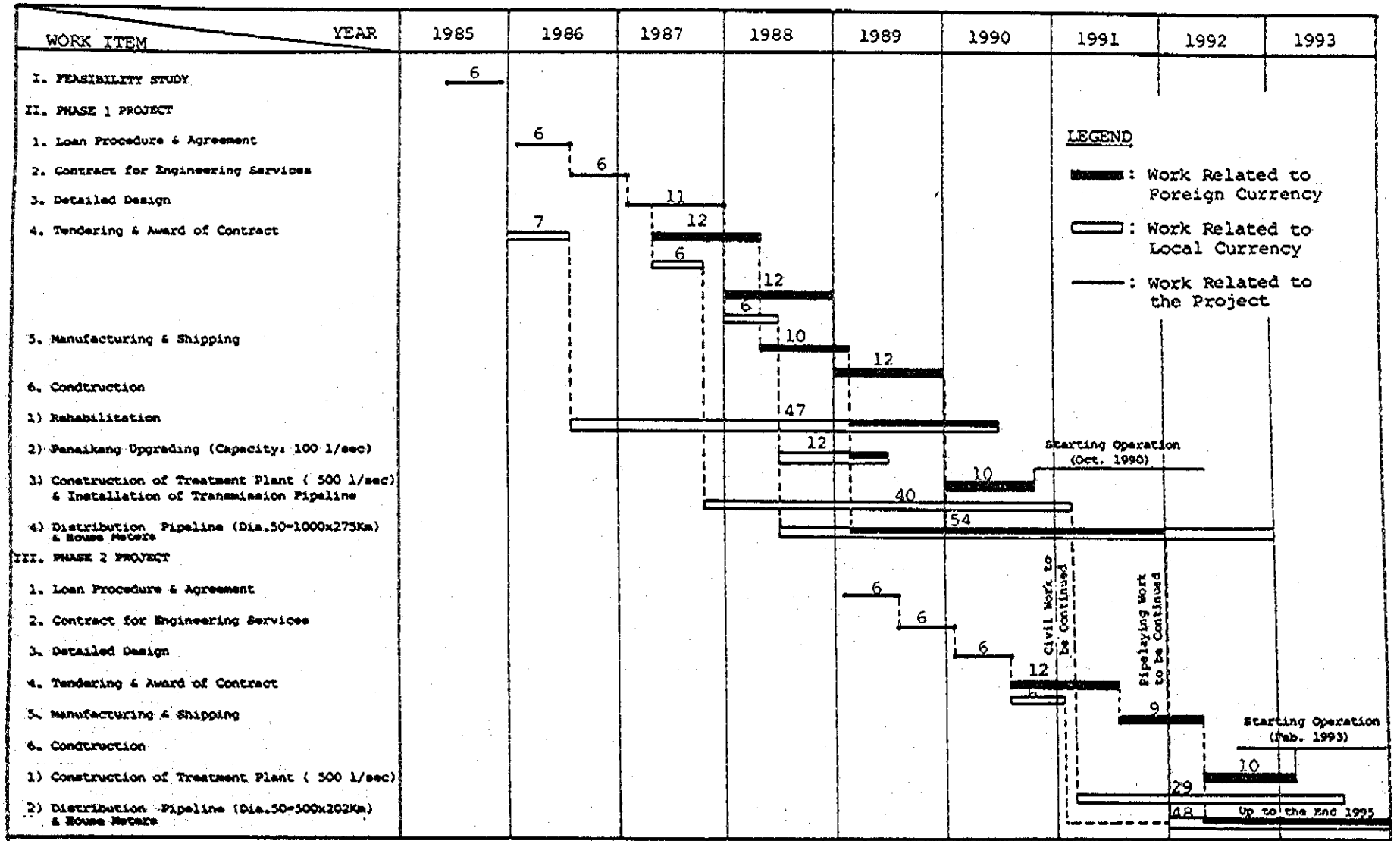
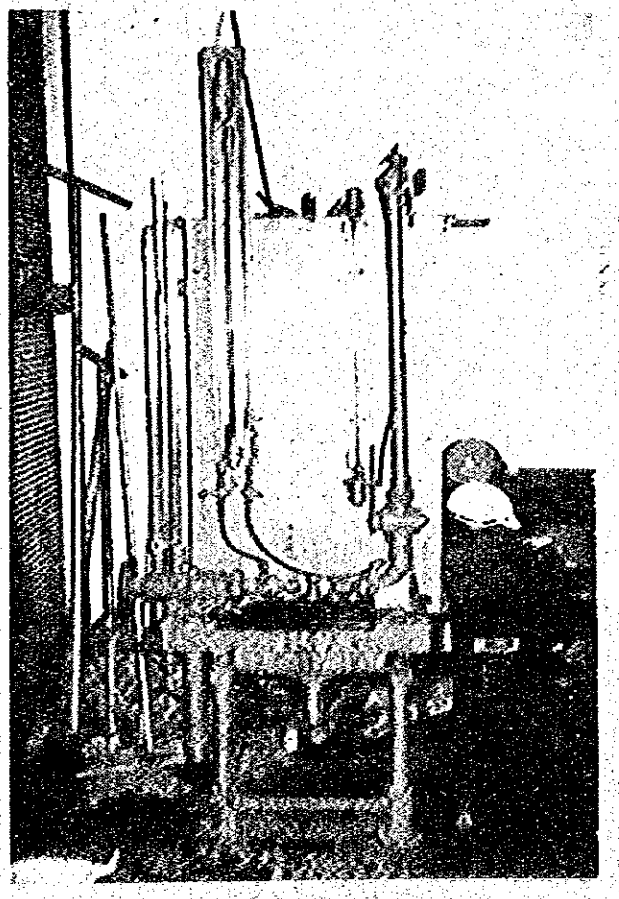


FIGURE 4.2

IMPLEMENTATION SCHEDULE

CHAPTER V

FINANCIAL ANALYSIS AND SOCIO-ECONOMIC BENEFITS



EQUIPMENT FOR METER REPAIR

CHAPTER V
FINANCIAL ANALYSIS AND SOCIO-ECONOMIC BENEFITS

1. GENERAL

This chapter examines the feasibility of Stage I Project consisting of Phase 1 and Phase 2, details of which have been described in the preceding chapters, and, in addition, describes socio-economic benefits to be derived from the Project.

The approach taken for analysis is shown in Figure 5.1, and all details of the analysis and data are presented in the Appendix 5 to this report.

2. FUND REQUIREMENTS AND FINANCING SOURCES

2.1 Fund Requirements and Disbursement Schedule

It goes without saying that the Project is to be appraised on the marginal basis, namely, marginal costs and returns of the Project. In reality, however, the financial conditions of PDAM must also be studied as a self-supporting business. From this standpoint, projects or investments, realization of which is a precondition for the present project, will be considered in the financial analysis. For, without such investments, the proposed Project will not achieve its objective.

The above-mentioned investments are shown in Table 5.1 and their disbursement schedule in Table 5.2. As seen in Table 5.2, the disbursement concentrates around 1990 when Mangngasa Plant starts operation, and the maximum investment ammounts to Rp. 20 billion. Annual investments to be provided by local funds ranges from 1 billion to 7 billion, seemingly within the capacity of PDAM and PEMDA.

2.2 Financing Sources

Regarding the financing for water supply projects, the Government has established the following principle and been applying to all water supply projects so far undertaken.

1) Government grant to be provided to water supply projects to supply not more than 60 l/c/d, which is the basic human need.
2) Equity (interest free loan) together with government loan to be provided to water supply projects to supply 60 to 125 l/c/d.
3) Government loan to be provided to water supply projects exceeding the above supply capacity.

Current financing sources are:

1) Approved Project List Fund (DIP):
   Normally for grant finance
2) Interest-free Government Loan (IFGL)
   e.g., State Capital Participation Fund (PMP)
3) Domestic Loan at Normal Interest (DLNI)
   e.g., Investment Plan Fund (RDI)
4) Foreign Aid Fund (BLN)

Current unit consumption in Ujung Pandang is estimated as about 60 l/c/d, and the proposed unit consumption is 113 l/c/d in 1992, the target year of Phase 1 and 127 l/c/d in 1995, the target year of Phase 2. According to the above-mentioned Government policy, financing for Phase 1 will be combination of IFGL and DLNI, and that of Phase 2 fully from DLNI. For foreign currency portion, BLN will be applied for, and its fund source will, it is expected, be a loan from OECF.

For the present financial analysis of the project, the financing plan as described in the following Section 3 is adopted as most practicable and recommendable one.

3. FINANCING PLAN AND FINANCIAL PROJECTION

3.1 Recommended Financing Plan

Financing plan which is selected as most realistic considering the present and future conditions of PDAM management is shown in Table 5.3. The whole foreign currency portion, as shown in the Table, relies on BLN, and a part of local currency portion of Phase 1 is expected to utilize IFGL and PDAM's own funds which will be generated by the operation of water supply system. The remaining portion of Phase 1, together with the whole local currency portion of Phase 2, is obtained from DLNI.

PDAM's own funds of Rp.2.8 billion will be used for rehabilitation of distribution pipelines and house meters, and IFGL fund of Rp. 8.2 billion for other rehabilitation works, land acquisition and construction of intake and transmission facilities.

The employed interest rate of BLN and DLNI is 9% per annum, which is the lower figure given by the Government.

3.2 Financial Projection

Using the financing plan as described in Subsection 3.1 and applying the average water rate which will be explained in Section 4, future financial positions are projected. Major preconditions and assumptions for financial projection are listed below:

1) Financing Conditions and Interest Capitalization
   The repayment period of BLN, DLNI and IFGL is thirty-year, twenty-year and twenty-year respectively and each of them includes six-year grace period. Interest during construction is capitalized and repaid together with the principal after grace period on the basis of flat rate.

2) Assets Revaluation
Revaluation of fixed assets in the future in made every year using the rate of domestic inflation.

3) Accounted-for Water
Accounted-for water ratio of 50 percent in 1984 rises by 5 percent each year to 80 percent in 1990.

4) Tax
Tax is paid according to the government regulation.

In the meantime, it is considered appropriate to cancel out the contribution to PEMDA Ujung Pandang for profit sharing after 1985.

The results of the projection are shown in Table 5.4. As seen in the Table, rate of return (ROR) is rather low and sometimes negative in the early period of projection and in a period 1994 to 1997, but in average the ROR is around 2 % (revalued cost basis). The reason for the low ROR in the early period is due to depreciation made on the revalued assets. Further, the drop of ROR in 1994 is due to the payment of interest. Meanwhile, the interest before that year will be included in the capital cost. Four years after, the ROR rises to the former level.

As regard cash flow, except the early period, certain amounts of cash accumulation will be attained. In the early period when cash is not sufficient, such measures as collection of delinquent bills, exemption of tax or borrowing from banks are to be taken. In case the above measures are not sufficient to cover such deficit, some disbursement for the rehabilitation works is to be put off to the succeeding years.

4. WATER RATE AND TARIFF STRUCTURE

4.1 Consumers' Affordability

In the case of domestic use of water, affordability of households is considered dependent on their income. Among such domestic consumers, the largest ones are households which rely on house connections instead of public standpipes. From this viewpoint, the water rate to be charged within the affordability is estimated as shown in Table 5.5.

As seen in the Table, the affordable water rate of lower-income household does not show much rise in the future. The reason for this is considered that along with the development of water supply, the majority of the inhabitants including low-income class will be supplied through house connections.

4.2 Water Rate by Use Category and Revenue Plan

Relation between domestic use and other category uses are as follows. According to 1983 records, house connections consumed 60 % of total consumption, and raised 30 % of total water sale income. It implies that the water rate for house connections is about 1/4 of non-domestic uses.

In the meantime, the water rate guidelines established by the Government set the water rate for non-domestic uses at the level 3 to 8 times higher than that for domestic use. The present domestic water rate of Ujung Pandang is in the range prescribed by the guidelines.

The water rate for public standpipes is set lower than house connection in the guidelines and observed by PDAM. For the study, a ratio of 1 to 0.8 is taken for household connection to public standpipe.

In accordance with the above consideration, revenue from house connections, public standpipes and non-domestic uses is estimated as shown in Table 5.6. In this estimation, more than half of total revenue is assumed to be derived from the non-domestic uses. Under this condition, the calculated average water rate for 1992, 1995 and 2000 is 211, 223 and 240 Rp/m3 respectively.

4.3 Proposed Water Rate and Average Incremental Cost

The average water rate calculated according to the consideration in Subsection 4.2 is more or less sufficient to cover the estimated costs, only except for a short period. Therefore, this average rate is taken for further financial analysis.

Total debt service calculated based on the financing plan described in Subsection 3.1 and its impact on the water rate is shown in Figure 5.2. The average water rate is obtained by adding other cost items shown in Figure 5.3. In the analysis, a part of depreciation reserve and some contingency are alloted to the repayment of loan. The financing plan presented in Subsection 3.1 is prepared based on the above consideration. The financial projection in Subsection 3.2 is made using the following water rate.

(Unit: Rp./m3)

Water Rate	1985	1986	1987	1988	1989	1990	1991
Real Term	178	178	183	188	194	200	206
Nominal Term	178	198	217	239	264	291	321

1992	1993	1994	1995	1996	1997	1998	1999	2000
211	215	219	223	227	231	234	237	249
352	383	418	455	496	540	585	634	687

Average Increase of Wate Rate

2.0 % in real term

9.4 % in nominal term

Long-term marginal unit cost, a basis in determining the feasibility of a project, was calculated using the average incremental cost method as shown below:

	Discount Rate			(Unit:Rp./m3)
	6 %	8 %	10 %	12 %
Phase 1 Project	227	254	282	310
Phase 2 Project	175	182	210	230

(1985 Constant Price Basis)

This table indicates that Phase 2 Project is economically more efficient than Phase 1 Project and, furthermore, that proposed water rate is on the same level as these marginal costs and, for this reason, appropriate.

4.4 Tariff Structuring

A tariff structure which satisfies the average water rate as described in the foregoing para is worked out in the following.

The current tariff structure classifies all the consumers into 8 categories of use, and the charge is made by metering. Household use belongs to the category of lower rate, and public standpipe and mosques belong to the lowest rate category. Other six categories have higher rates, among which the category for non-commercial and small business is rather low. The non-commercial is considered to be a representative of all these six categories, since its share in total consumption is large and consumption per connection is about the average.

To determine future tariff structure, two categories, i.e., household, and non-commercial, are taken as representative ones. The recent revision of the said categories' rate is shown below.

Category	Water Consumption (m3/month)	1985 Revision	1983 Revision	Increase Ratio
Household	a. up to 10 m3	Rp. 600	Rp.500	20 %
	b. 11 to 20 m3	Rp. 75/m3	Rp. 75/m3	0 %
	c. 21 to 40 m3	Rp. 125/m3	Rp.125/m3	0 %
	d. 41 to 60 m3	Rp. 200/m3	Rp.150/m3	33 %
	e. over 60m3	Rp. 250/m3	Rp.200/m3	25 %
Non-Commercial	a. up to 30 m3	Rp. 3,000	Rp.3,000	0 %
	b. 30 to 50 m3	Rp. 250/m3	Rp.150/m3	66 %
	c. over 50 m3		Rp.200/m3	25 %

As the setting of progressive water rates and corresponding brackets of consumption is considered appropriate, the same concept is employed for the future water tariff structures, with revisions in water rates so as to satisfy the future average water rates, which are shown in Figure 5.4 and also tabulated below:

Category	Water Consumption (m3/month)	1992	1995	2000
Household	a. up to 10 m3	Rp. 900	Rp. 1,000	Rp. 1,100
	b. 11 to 20 m3	Rp. 125	Rp. 125	Rp. 125
	c. 21 to 40 m3	Rp. 225	Rp. 250	Rp. 250
	d. 41 to 60 m3	Rp. 275	Rp. 300	Rp. 325
	e. over 60 m3	Rp. 350	Rp. 375	Rp. 400
Non-Commercial	a. up to 30 m3	Rp. 6,750	Rp. 6,750	Rp. 7,500
	b. over 30 m3	Rp. 450	Rp. 475	Rp. 500

5. SENSITIVITY AND RISK ANALYSIS

5.1 Sensitivity Analysis

The financial conditions projected in Subsection 3.2 may be influenced by unforeseen changes of various factors. In order to know the degree of influence or in other words financial viability, the influence of the following factors is checked.

1) Operation cost
2) Depreciation cost
3) Water rate
4) Tax
5) Project cost

The last item out of the above five will be treated later in Subsection 5.3. The results of study are shown in Figure 5.5. Tax has the biggest sensitivity on rate of return, and other three items follow in the order of water rate, depreciation and operation cost. From this analytical results, tax reduction or exemption is expected to be an effective measure for resolving financial difficulty, if any, in the future.

5.2 Demand Elasticity

It is generally known that demand elasticity by price variation is small, and a tariff raise does not bring about a significant fall of volume sold. However, to know whether a revision of water tariff will produce an increase of revenue as projected, considerations on demand elasticity are made as described below.

Although the demand elasticity is small, especially the demand of domestic use, no detailed studies on this matter are available, not to mention the non-domestic use. Generally accpeted value of the elasticity is -0.1 to -0.3. Assuming the value as -0.2, the increase of net earnings by revision of water rate is calculated as shown in Figure 5.6. The results indicate that the water rate revision does not much influence on the net earnings in consideration of demand elasticity.

5.3 Risk Analysis

Delay of construction work is considered a risk, and delay may be caused by 1) delay of work and 2) delay of establishing the required organization. These delays are considered to cause impact, coupled with each other, on the project, as shown in Figure 5.7. Setting the circumstances as one year delay, which includes a delay in the rise of accounted-for water rate, for each Phase and 10% increase of project cost, probable results are simulated, as shown in Figure 5.8.

This figure indicates PDAM is still able to manage the enterprise if the loan repayment is also delayed by one year, although rate of return and cash reservation are not necessarily unsatisfactory.

6. SOCIO-ECONOMIC BENEFITS

Construction and operation of Stage I Project will bring about various direct and indirect benefits to the Municipality and the region. Among others the following are to be stressed.

1) When the project is completed, a population of over 800,000 will be supplied with safe and clean water, although presently merely 300,000 are supplied and other people are obliged to take unsafe water from underground.

2) Many families will be released from the hard labor of taking water from a long distance, and further they will be able to use water as they need.

3) By the project, industrial estates, harbour and other projects planned under the master plan of the City will be supplied with water, thus contributing to the development of the Municipality.

4) Employments will increase during the construction work and the operation period.

5) Water-borne diseases will be decreased by use of safe water.

6) Fire fighting water will become available under sufficient pressure.

Considering all these benefits, the project is to be given high priority in implementation.

7. CONCLUSION

Conclusively, the financial and economic feasibility of the project is proved as described so far in the foregoing Sections, with the following findings.

1) PDAM will be able to meet the financial obligation of the project after paying taxes as required by the regulations with a raise of the average rate from the present Rp.178/m3 to Rp.223/m3 toward 1995.
2) The financial situation in 1) will not much be affected if the situation such as operation cost, project cost is slightly changed.
3) In 1987, some cash shortage is expected but will not seriously affect the financial projection in 1). This deficit will be fully recovered in 1988.
4) The rate of return on average net fixed assets in operation lowers after 1994 when the debt service for Phase 1 increases, but it again rises in 1998 and stays in reasonable range thereafter.
5) The proposed average tariff of Rp.223/m3 in 1995 and thereafter is located midway between the two long-term marginal costs of water supply, i.e., Rp.282/m3 for Phase 1 and Rp. 210/m3 for Phase 2, which are computed using the average incremental cost method at 10 percent discount internal rate.
6) The tariff for domestic use will be affordable, for the payment of households is lower than 4 percent of their income.
7) The financial internal rate of return computed is at a higher level, as a water supply project, of 6.0 percent for Phase 1 and 12.3 for Phase 2.

The above findings endorse the conclusion of this chapter that the project is recommended to be implemented as planned and scheduled.

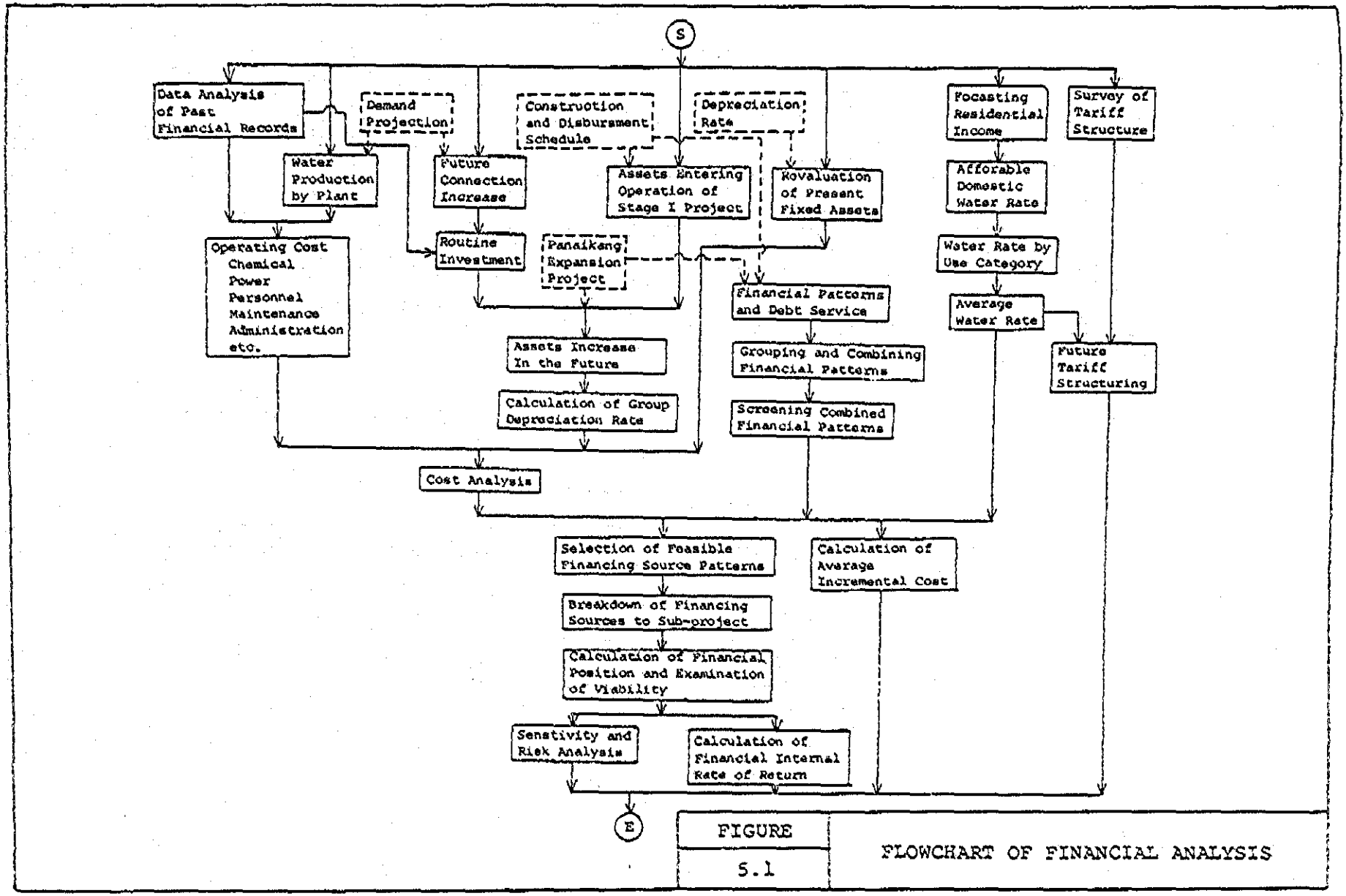


FIGURE 5.1 FLOWCHART OF FINANCIAL ANALYSIS

TABLE 5.1 SUMMARY OF PROJECT COSTS

Project	Period	Foreign Currency (1,000 US$)	Local Currency (million Rp.)	Total (million Rp.)
1) Panaikang Extension	1983-1986	963 (1,074) 1/	1,275	2,349
2) Stage I Phase 1	1986-1992	28,361 (31,622)	28,873	60,495
3) Stage I Phase 2	1991-1995	8,778	9,848	19,635
4) Routine Investment	every year	-	17,099	17,099

Note ;
1/ : Figures in the parenthesis express million Rp. amount.
(1 thousand US$ = 1.115 million Rp.)

TABLE 5.2 DISBURSEMENT SCHEDULE

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

Project	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1) Panaikang Expansion (500 l/sec.)																		
a. F/C (BLN)		963																
		(1,074)																
b. L/C (DIP)	15	130	280	850														
2) Phase 1 Project																		
a. F/C (BLN)				-	1,359	450	8,822	11,379	6,351	-								
				(-)	(1,515)	(502)	(9,837)	(12,688)	(7,081)	(-)								
b. L/C (Total)				735	4,838	4,347	7,303	6,396	4,814	440								
3) Phase 2 Project																		
a. F/C (BLN)								558	365	3,244	2,642	1,969	-					
								(622)	(407)	(3,619)	(2,946)	(2,195)	(-)					
b. L/C (Total)								324	1,786	2,731	3,086	1,537	384					
4) Routine Investment																		
b. L/C (Own Funds)	249	159	445	926	1,239	291	341	383	430	500	529	609	934	1,647	1,959	2,211	2,358	2,597
Total(million Rp.)	264	1,363	725	2,511	7,592	5,140	17,481	20,413	14,518	7,288	6,561	4,341	1,318	1,647	1,959	2,211	2,358	2,597

TABLE 5.3 PROPOSED FINANCING PLAN FOR STAGE I PROJECT

Sources of Financing	Percent		In Million Rp.	In Thousand US Dollars
	Total	In Sub-Category		
1) Phase 1 Project				
For Foreign Currency				
Foreign Aid Fund (BLN) 1/	52	-	31,623	28,361
For Local Currency				
Domestic Loan at Normal Interest (DLNI) 1/	29	62	17,839	15,999
Interest-fee Government Loan (IFGL) 2/ 4/	14	28	8,211	7,364
PDAM's Own Funds 3/ 4/	5	10	2,823	2,532
Subtotal	100	-	60,496	54,256
2) Phase 2 Project				
For Foreign Currency				
Foreign Aid Loan (BLN)	50	-	9,787	8,778
For Local Currency				
Domestic Loan at Normal Interest (DLNI)	50	-	9,848	8,832
Subtotal	100		19,635	17,610
3) Phase 1 and 2 Project				
For Foreign Currency				
Foreign Aid Loan (BLN)	52	-	41,410	37,139
For Local Currency				
Domestic Loan at Normal Interest (DLNI)	34	72	27,687	24,831
Interest-fee Government Loan (IFGL)	10	21	8,211	7,364
PDAM's Own Funds	4	7	2,823	2,532
Total	100	-	80,131	71,866

Note; 1/ : Interest Rate : 9 %

2/ : This fund becomes the sources for Rehabilitation of transmission canal and treatment plants, Land acquisition, Intake facilities, and Transmission pipelines.

3/ : This fund is used for Rehabilitation of distribution pipelines and house meters.

4/ : The disbursement of these funds are scheduled as :

Year	1986	1987	1988	1989	1990
IFGL	735	1359	1224	2793	2100
Own Funds	-	2253	-	570	-

(Unit: million Rp.)

TABLE 5.4 SUMMARY OF FINANCIAL PROJECTION

(Unit: million Rp.)

Item	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Operating Revenues	2.073	2.890	4.306	5.598	7.337	10.066	11.712	13.431	16.152	18.581	21.283	25.555	28.923	32.361	35.441	38.633
Operating Expenses	1.356	1.643	2.232	2.684	3.264	3.840	4.488	5.187	5.947	6.990	8.180	9.570	11.178	12.989	15.000	17.472
Depreciation (Revalued)	755	854	1.108	1.263	1.509	3.066	4.043	4.754	5.913	6.702	7.413	8.038	8.632	9.273	9.962	10.704
Interests	0	0	0	97	97	97	93	89	85	5.728	5.411	5.094	7.034	6.581	6.128	5.676
Tax	0	132	332	538	857	1.066	1.075	1.185	1.467	0	92	993	722	1.225	1.517	1.667
Net Income	-38	261	634	1.016	1.609	1.997	2.014	2.217	2.742	-840	188	1.860	1.358	2.293	2.834	3.114
Change in Cash	335	240	-2.159	1.914	1.632	4.158	5.043	5.226	3.146	647	2.327	1.485	1.748	3.001	4.050	4.689
Rate of Return (%) 1/																
Historic Cost :	1.5	3.4	4.2	4.6	6.0	3.3	2.1	2.0	2.2	0.4	1.0	2.1	2.0	2.8	3.3	3.8
Revalued Cost :	-0.2	1.2	2.4	3.2	4.6	3.4	2.2	2.1	2.2	-0.6	0.1	1.2	0.9	1.4	1.7	1.8
Working Ratio (%) 2/	65.4	56.9	51.8	48.0	44.5	38.1	38.3	38.6	36.8	37.6	38.4	37.5	38.6	40.1	42.3	45.2
Operating Ratio (%) 3/																
Historic Cost :	80.3	68.7	64.3	58.6	54.5	59.3	62.5	62.5	61.4	60.6	59.3	55.3	54.6	54.6	55.7	57.6
Revalued Cost :	101.8	86.4	77.6	70.5	65.1	68.6	72.8	74.0	73.4	73.7	73.3	68.9	68.5	68.8	70.4	72.9
Debt/Debt & Equity 4/ Ratio (%)	4.7	6.9	18.1	26.6	44.7	55.4	58.0	57.1	55.0	52.5	49.0	44.8	40.3	35.9	31.7	27.8
Debt Service Coverage 5/	-	-	-	30.1	42.1	44.0	52.6	11.5	2.4	1.2	1.4	1.5	1.4	1.6	1.7	1.9

Note;
Ratios and index as from 1/ to 5/ is defined as :

1/ Rate of Return = $\frac{\text{Net Income after Tax}}{\text{Average Net Fixed Assets in Operation}} \times 100\ (\%)$

2/ Working Ratio = $\frac{\text{Operating Expenses}}{\text{Operating Revenues}} \times 100\ (\%)$

3/ Operating ratio = $\frac{\text{Operating Expenses + Depreciation}}{\text{Operating Revenues}} \times 100\ (\%)$

4/ Debt/Debt & Equity Ratio = $\frac{\text{Long-Term Debt}}{\text{Long-Term Debt + Equity}} \times 100\ (\%)$

5/ Debt Service Coverage = $\frac{\text{Internal Cash Generation}}{\text{Total Debt Service}}$ (times)

TABLE 5.5 AFFORDABLE WATER RATE OF HOUSE CONNECTION

(1985 Constant Price Basis)

	Item	1992	1995	2000
(A)	Average Income of Household with Consumption of Average Rate	104,000 Rp./month	110,000 Rp./month	121,000 Rp./month
(B)	Income Level of a Household	middle	low-middle	low
(C)	Affordable Ratio of Income for Water Service	3.2 %	3.5 %	3.8 %
(D)	Affordable Expenditure per Month	3,330 Rp.	3,850 Rp.	4,600 Rp.
(E)	Monthly Water Consumption	22.1 m3	24.3 m3	27.5 m3
(F)	Meter Rent & Connection Charge	500 Rp./month	500 Rp./month	500 Rp./month
(G)	Affordable Water Rate (Average)	128 Rp./m3	138 Rp./m3	149 Rp./m3

TABLE 5.6 REVENUE PLAN AND AFFORDABLE WATER RATE

			House Connection	Public Standpipe	Non-Domestic	Total / Grand Average
(A)	Ratio of Average Water Rate to House Connection	(1992)	-	0.8	3.4	-
		(1995)	-	0.8	3.3	-
		(2000)	-	0.8	3.2	-
(B)	Volume Sold (x1,000 m3/day) and Percent	(1992)	66 (67%)	5 (5%)	27 (28%)	98(Total)
		(1995)	84 (69%)	5 (4%)	33 (27%)	122
		(2000)	116 (69%)	5 (3%)	47 (28%)	168
(C)	Percent of Planned Revenue	(1992)	41 %	2 %	57 %	100 %(Total)
		(1995)	43 %	2 %	55 %	100 %
		(2000)	43 %	1 %	56 %	100 %
(D)	Ratio of Average Water Rate to Grand Average	(1992)	0.606	0.485	2.059	1.0(Grand Ave.)
		(1995)	0.620	0.496	2.045	
		(2000)	0.621	0.497	1.988	
(E)	Affordable Water Rate of House Connection User	(1992)	128 Rp/m3	-	-	-
		(1995)	138 Rp/m3	-	-	-
		(2000)	149 Rp/m3	-	-	- (Grand Ave.)
(F)	Affordable Average Water Rate of Other Users and Grand Average	(1992)	-	102 Rp/m3	435 Rp/m3	211 Rp/m3
		(1995)	-	110 Rp/m3	455 Rp/m3	223 Rp/m3
		(2000)	-	119 Rp/m3	477 Rp/m3	240 Rp/m3

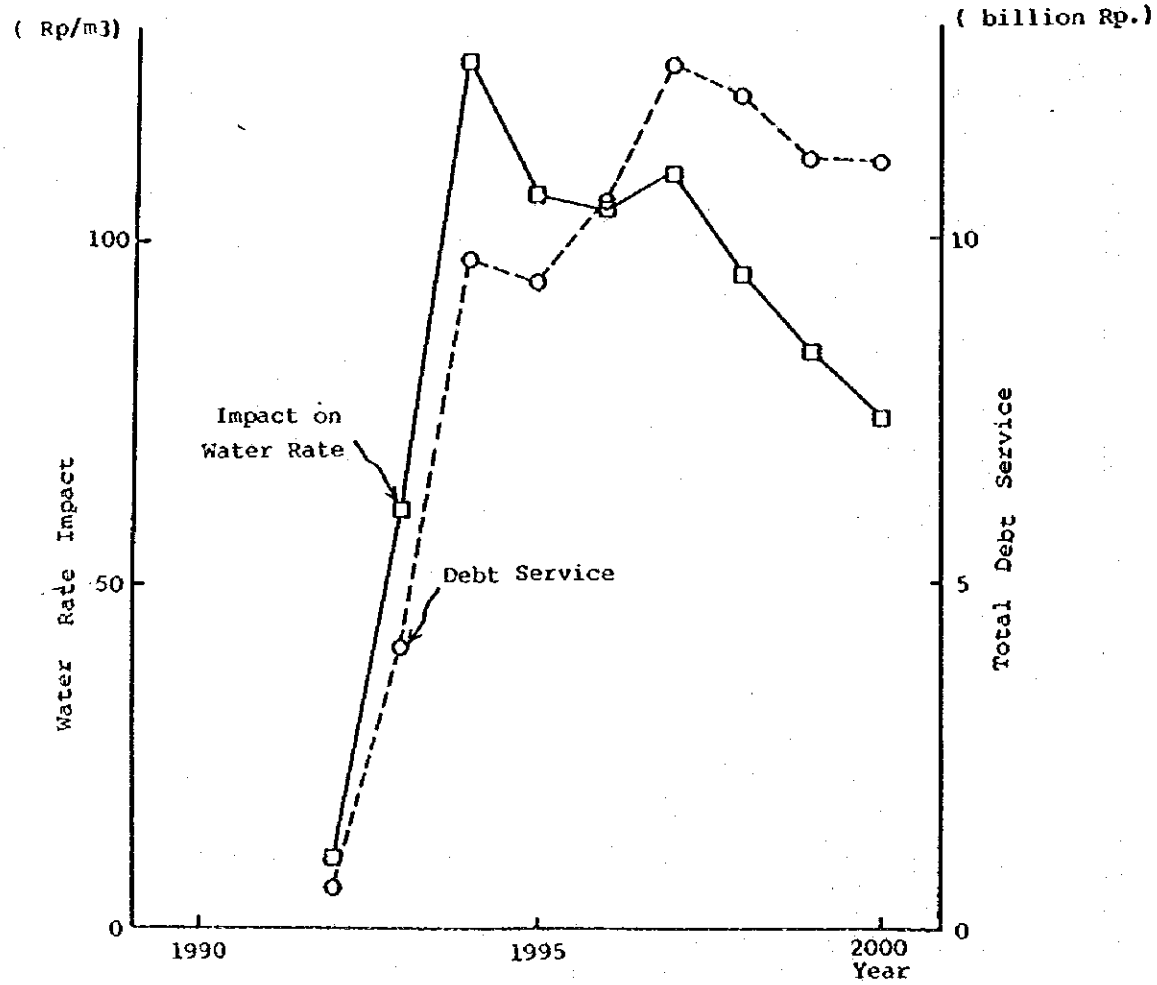


FIGURE	IMPACT OF DEBT SERVICE ON WATER RATE
5.2	

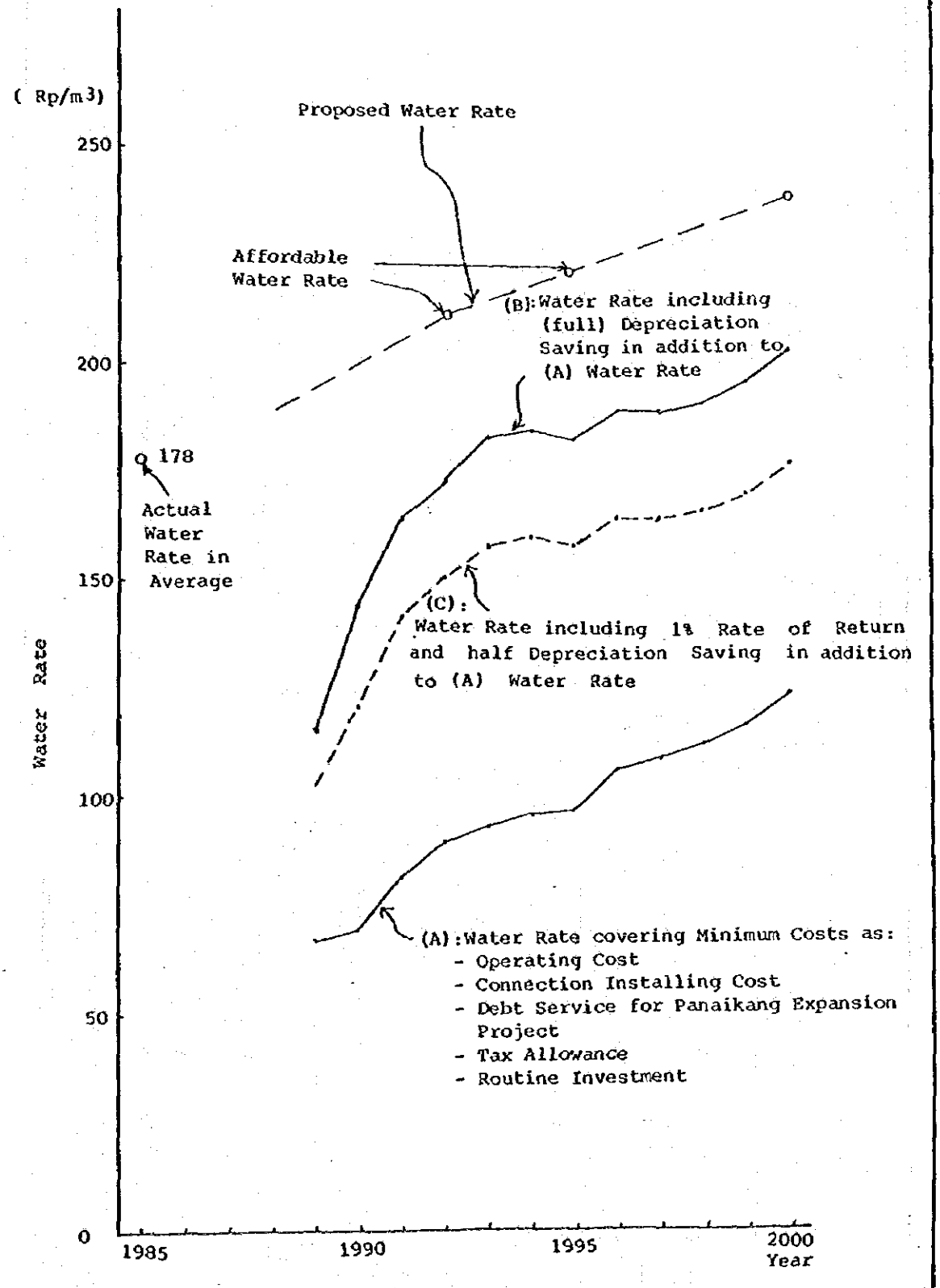


FIGURE	REQUIRED WATER RATE EXCLUDING
5.3	DEBT SERVICE OF STAGE I PROJECT

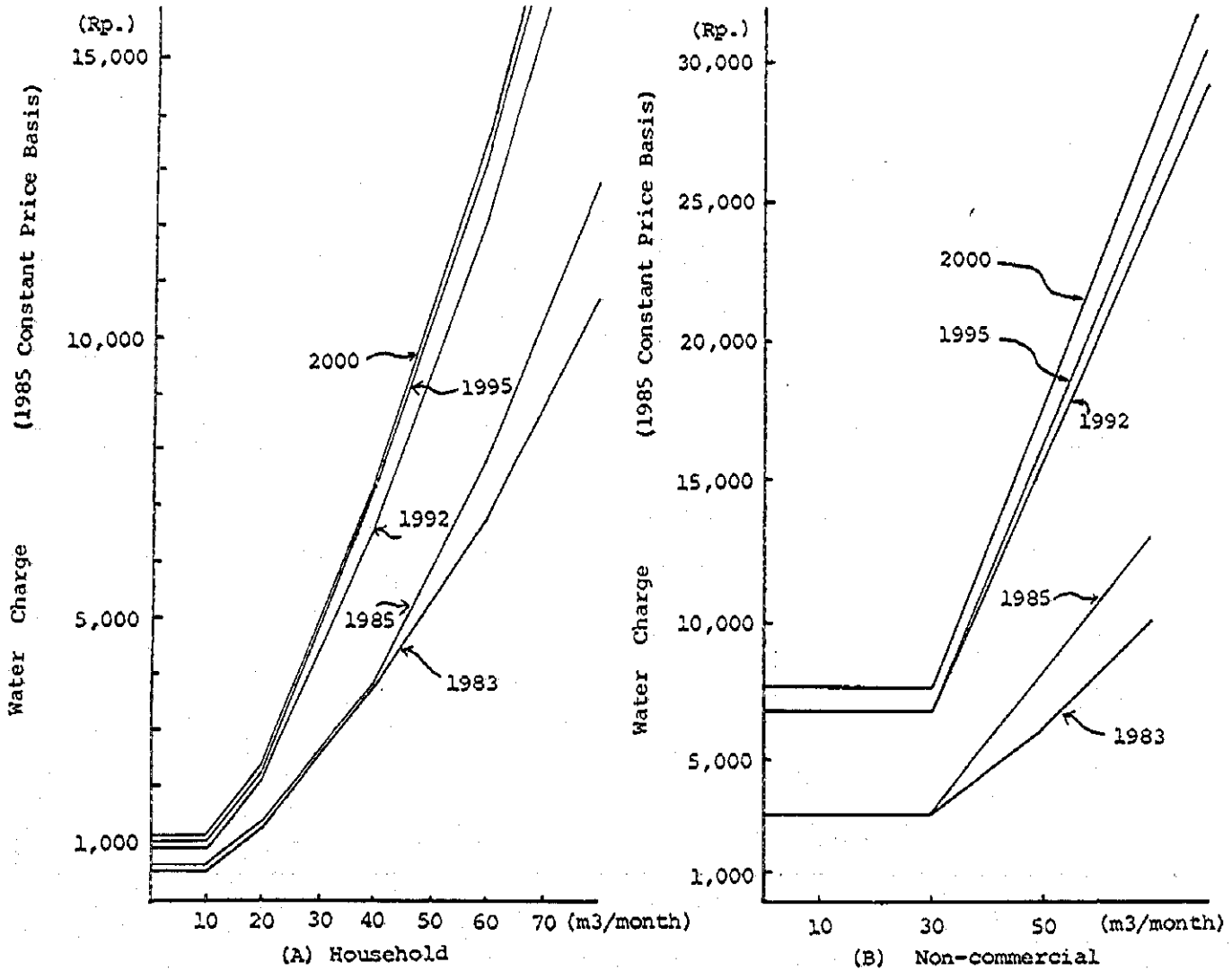
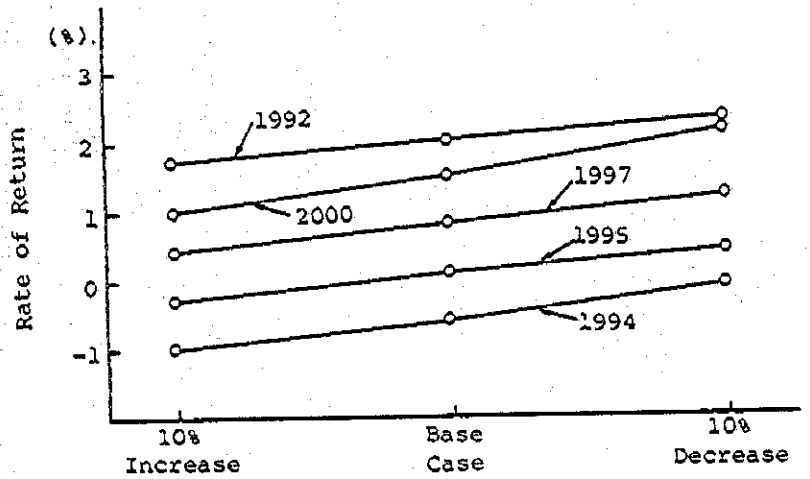
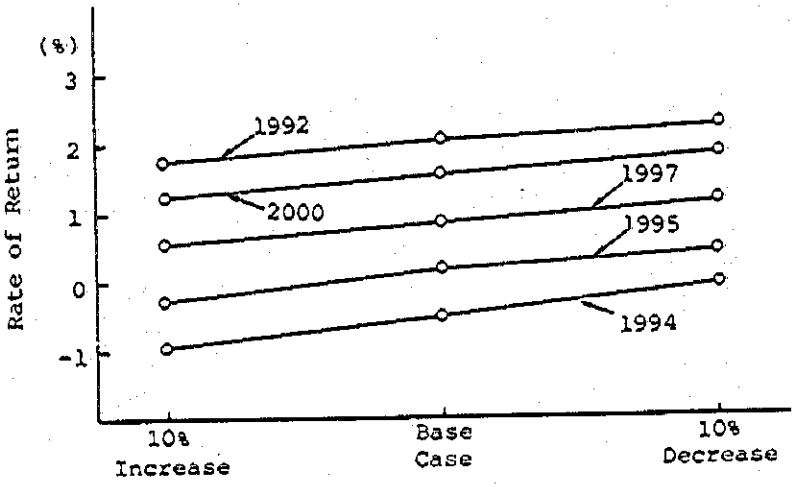


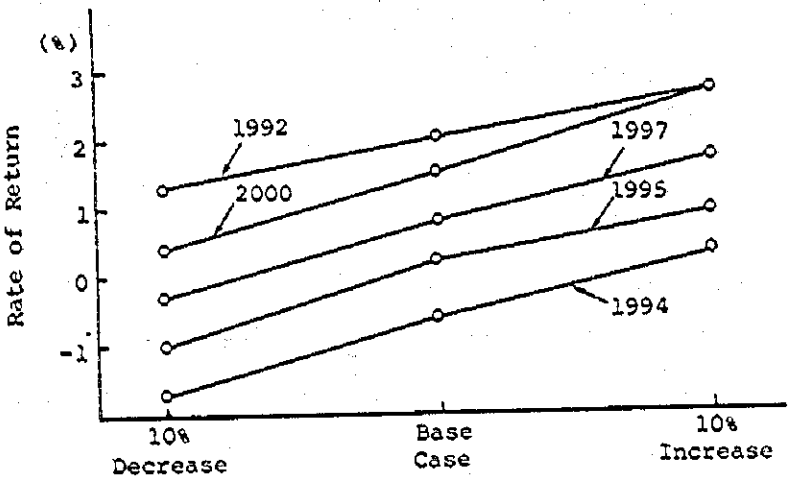
FIGURE 5.4 RESTRUCTURING OF WATER TARIFF



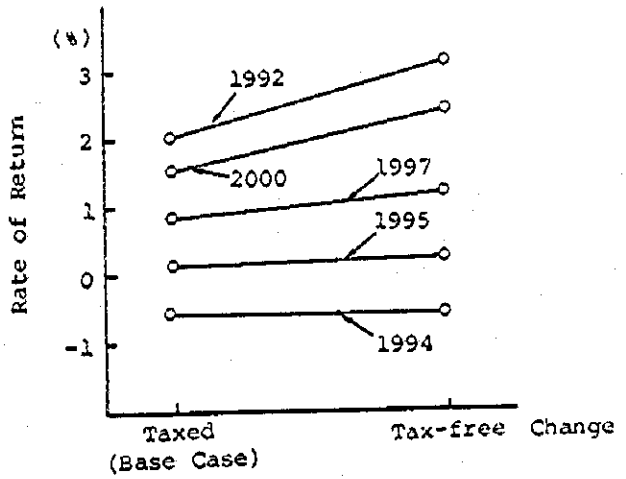
(A) Sensitivity on Operating Cost Change



(B) Sensitivity on Depreciation Rate Change



(C) Sensitivity on Water Rate Change



(D)Sensitivity on Taxation

FIGURE	SENSITIVITY OF RATE OF RETURN (REVALUED COST BASIS)
5.5	

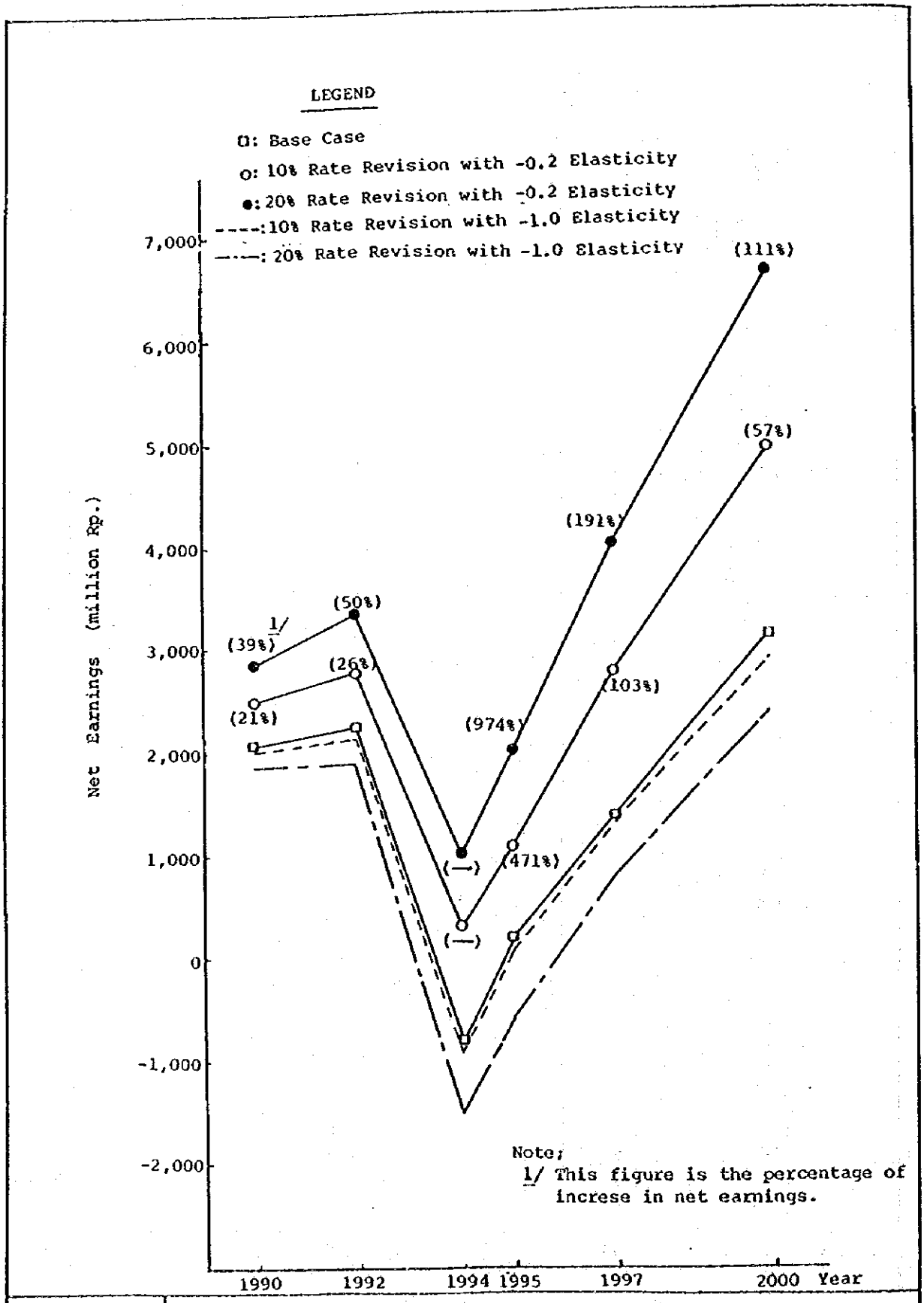


FIGURE	CHANGE IN NET EARNINGS INCLUDING DEMAND ELASTICITY
5.6	

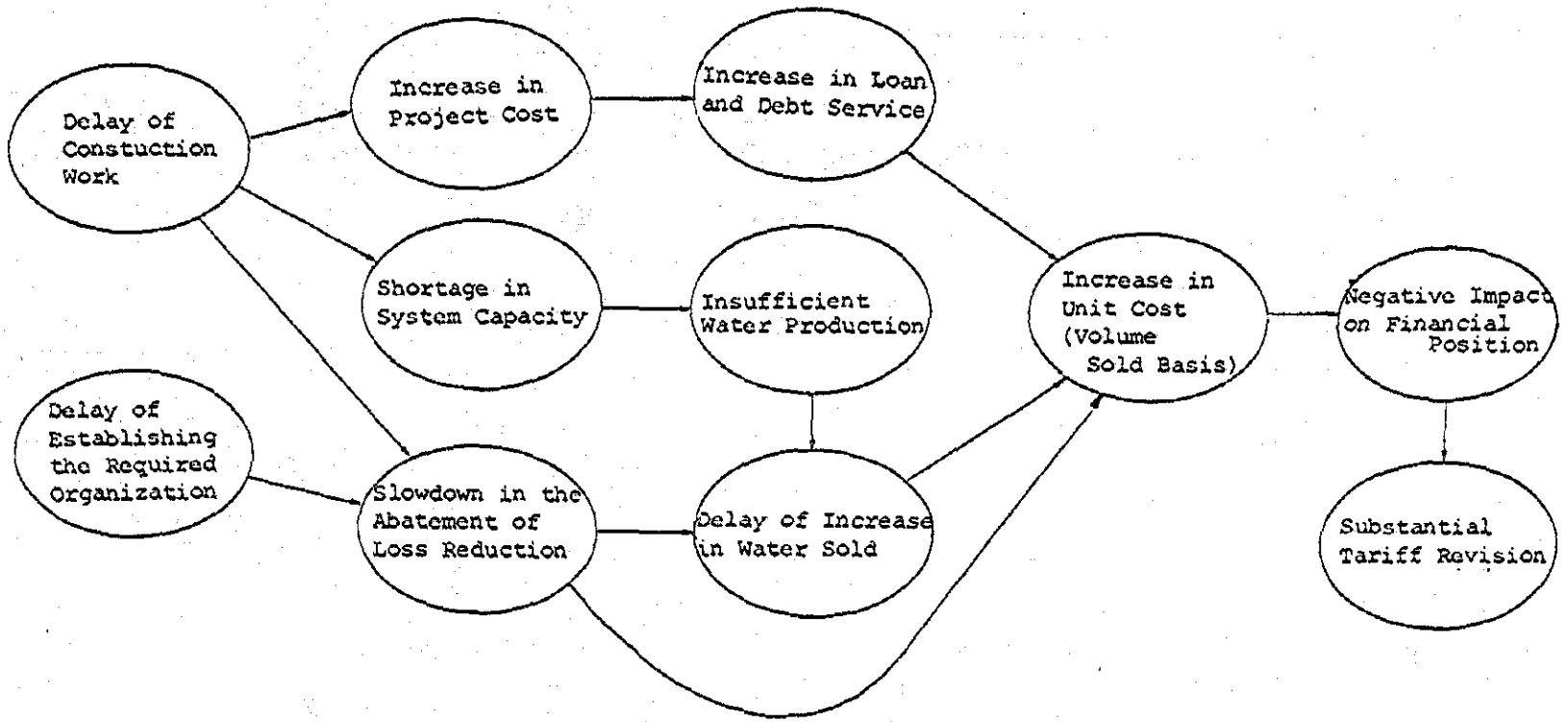


FIGURE 5.7 IMPACTS OF DELAY OF CONSTRUCTION

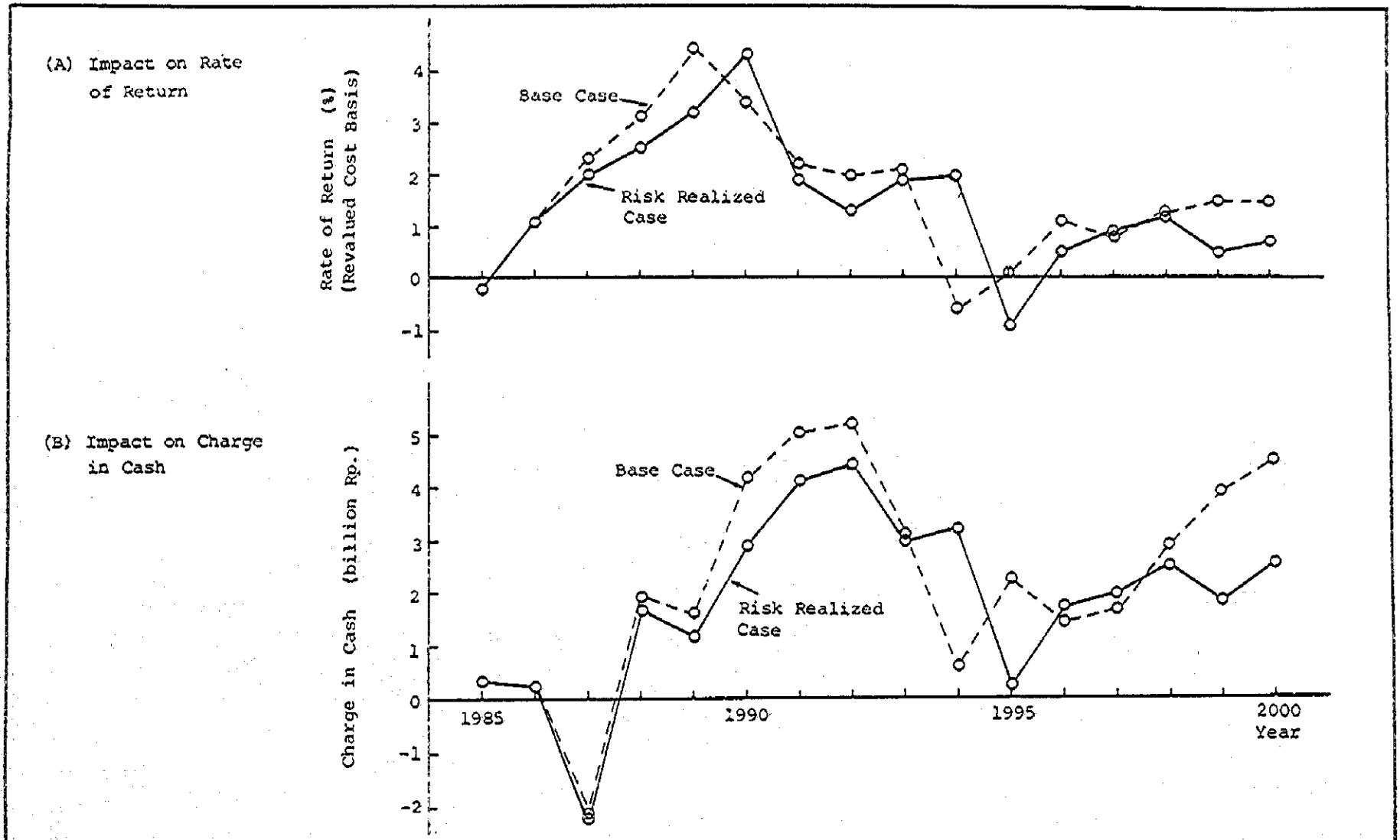


FIGURE 5.8 IMPACT OF RISK REALIZATION

CHAPTER VI

ORGANIZATION AND MANAGEMENT

TRAINING OF PDAM STAFF

CHAPTER VI
ORGANIZATION AND MANAGEMENT

1. GENERAL

The Master Plan has disclosed the whole aspects of the PDAM institution including organization and its staffing, findings on daily activities and operation of the PDAM, current practice adopted for meter reading, billing and accounting, and present financial standing. Based on these findings, it has also proposed the future organization and the staffing requirement, aiming at proper operation and management of the whole systems. Major findings stated above includes several managerial and operational difficulties, which are shown on Figure 6.1. Interviews with the officials concerned in the PDAM reveal that countermeasures to overcome such difficulties are largely grouped into following:

1) Training of staff and personnel,
2) Revision and modification of the present structure,
3) Purchase of tools and equipment for routine work, and
4) Campaign and establishment of the public relations.

In the following Sections, future organization, first, will be focussed on related to the item 2) listed above, and then an emphasis will be placed on training program and establishment of the public relation in connection with items 1) and 4) respectively. As for item 3), tools and equipment to be purchased for the routine work were already discussed in Section 5. of Chapter III.

2. FUTURE ORGANIZATION

The organization for short-term future is given on Figure 6.2. Highlighted herein are the strengthening of task force for operation and maintenance of the system and the up-grade of level of the water services so as to cope with the rapid increase of customers. Establishment of water meter section and data processing section, and strengthening of operating and maintenance division and branch offices are major revision for those purposes.

The service area will be expanded toward the suburban area along with the system development. All the activities related to the water service to the customers is to be strengthened.

The central office at Ratulangi manages and controls the whole systems. Accounting, bookkeeping, planning, design, data compilation, administration, legal and public works are all functions performed by the central office. Several crews organized for the repair, pipe installation, and leakage reduction work are always stationed at the central office. They take the necessary actions in reply to the requests and complaints made by customers. The central office also coordinates the activities of the branch offices and controls water production of each treatment plant. In case that unforeseen accidents take place at transmission, treatment plants and/or distribution network, the central office will give adequate directions to the treatment plants.

The two branch offices located at Kec. Panakkukang and Kec. Ujung Pandang conduct meter reading, bill collection at the customers of the service area concerned, playing an important role in raising the service level. The staff stationed at these offices may carry out temporary work

against the happening on the distribution network and take immediate action for the consumers' request. All the works carried out in the branch offices are informed to the central office.

The staff and personnel responsible for operation and maintenance of the treatmet plants operate the system and give periodically the necessary information to the central office.

A staffing plan is proposed on the basis of the present and future requirement of task force as shown in Table 6.1, keeping in mind that the present organization is staffed with a relatively large number of personnel. This table shows an annual development of staffing from 1985 to 1995, classified into division and position. Distinctive increase of staff is seen in the divisions of Operation and Maintenance and Finance.

3. STRATEGY TO DEVELOP ORGANIZATION'S ABILITY

Even if a planning based on appropriate technology will be worked out to attain proper operation of the system, the completed facilities will not function as initially planned, unless the quantity and quality of staff are far behind the required level. Some examples are seen in supply facilities in Ujung Pandang constructed in 1977: Treated water are supplied by gravity with a remarkable low pressure although originally planned to distribute by pumping, and flow meters once damaged are no more in use due to lack of spare parts. The facilities planned in the foregoing Chapter, needless to say, are simplified and unsophisticated ones, using the materials and equipment locally available so that repair work may be easily done by the PDAM staff without high technology and spare parts. However, the above considerations are fruitful only in case that abilities of staff in technology and engineering are maintained and upgraded continuously.

Technology to be acquired through training proposed hereunder relates to the daily job performed by PDAM as well as to the engineering for planning and design.

Apart from the training, present situation such as low efficiency of bill collection, unsanitary conditions around the public standpipes, and many leaks at service connections may be all attributable to the somewhat poor performance in maintenance and management. It is important to improve level of water services by intensive campaign to the public which aims at establishment of the good relation with customers and the public understanding regarding water supply.

Considering all the above, following subsections lay stress on developing training program and public relations so as to increase project's viability.

3.1 Training of Staff and Personnel

Findings on organizational and managerial aspects of the PDAM through interviews with staff and personnel are listed below:

1) Insufficient communication between sections/divisions and somewhat deferred procedures to give data and information to the section/division concerned sometimes make the information flow worse.

2) Tasks charged on each section and the responsibility of staff and personnel are not specified in a written form. Daily activities of each personnel are sometimes far from the intended.

3) Due to shortage of staff, PDAM cannot take immediate action in reply to the customers' complaints and requests. Service connections installed/repaired seldom meet the requirement defined in the standard design of the PDAM, resulting in the unsanitary conditions around the service connections.

4) Only a few experts/engineers are available in accounting and technical divisions.

In view of the above situation, the trainees and issues to be focussed in the course of training are as follows:

1) Water supply management for directors and section chief.
2) Water treatment and maintenance of the plant for operators.
3) Accounting and management for staff involved in finance and budget.
4) Pipelaying for staff concerned.
5) Water supply technology for directors and section chiefs.

The long-term training does not necessarily produce successful results. It is recommendable to reiterate short-term training in the case of the PDAM and to clarify how much extent technology are actually transferred and practiced in the daily job. Such training will give the basis for wide spread of technology over the PDAM staff.

Taking into consideration the capacity of existing national training center, it is desirable that the present project undertakes training so as to transfer technology and knowledge to the PDAM. Training plan is shown in Table 6.2.

TABLE 6.2 TRAINING SCHEDULE

Item	1987	1988	1989	1990	1991	Total (month)
Water Supply Management	1.0	-	1.0	-	1.0	3.0
Maintenance	1.5	1.5	1.5	1.5	1.5	7.5
Accounting & Management	1.0	1.0	1.0	1.0	1.0	5.0
Pipelaying	1.0	1.0	1.0	1.0	1.0	5.0
Water Supply Technology	1.5	-	1.5	-	1.5	4.5

3.2 Public Relation

Public supports and cooperation are indispensable for water supply enterprise to attain the purpose of supplying potable and sufficient water to the consumers. Meter readers, labourers for installation of house connections, staff assigned for billing are ones who often meet and communicate with the customers.

If they do not have any knowledge about purpose and responsibility for their tasks, they might give a biased impression on the customers. If PDAM does not take any adequate actions to the requests by customers, the situation would become worse. As described in the former subsection, it is considered appropriate to reform organization and strengthen the task force through training and mobilization of staff and personnel under such circumstances. It is highly desirable if intensive campaigns are conducted by PDAM to establish favourable relations with the customers and to receive supports from the public. Materials to be dealt with in such campaign are listed hereunder:

1) Ways of protecting water from contamination at the house connections and public standpipes,
2) Ways of reducing waste and re-using water,
3) Standard design of house connections,
4) Water treatment plant and its process, and
5) Necessity of the public supports and understandings.

As to the methods for such campaign, visual aids of all sorts such as posters in public areas, wall-charts in schools and other public utilities, and editorial features and pictures in newspaper may contribute to the wide spread of continuing public attention. When visits can be arranged, it is desirable to send officials of the PDAM to talk to women's group, community meetings, schools and student groups.

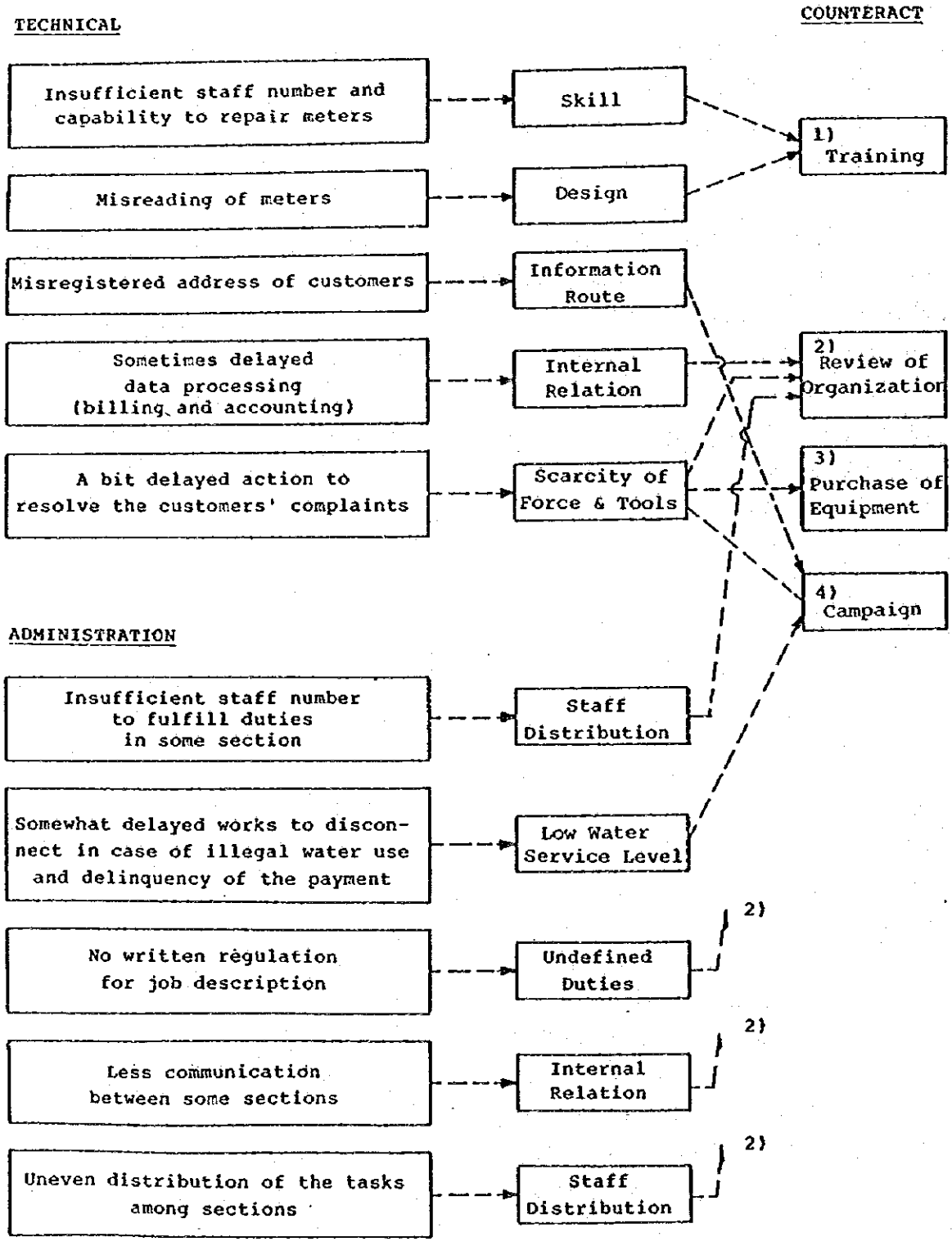


FIGURE	MEASURES TO BE TAKEN BY PDAM (Institution and Management)
6.1	

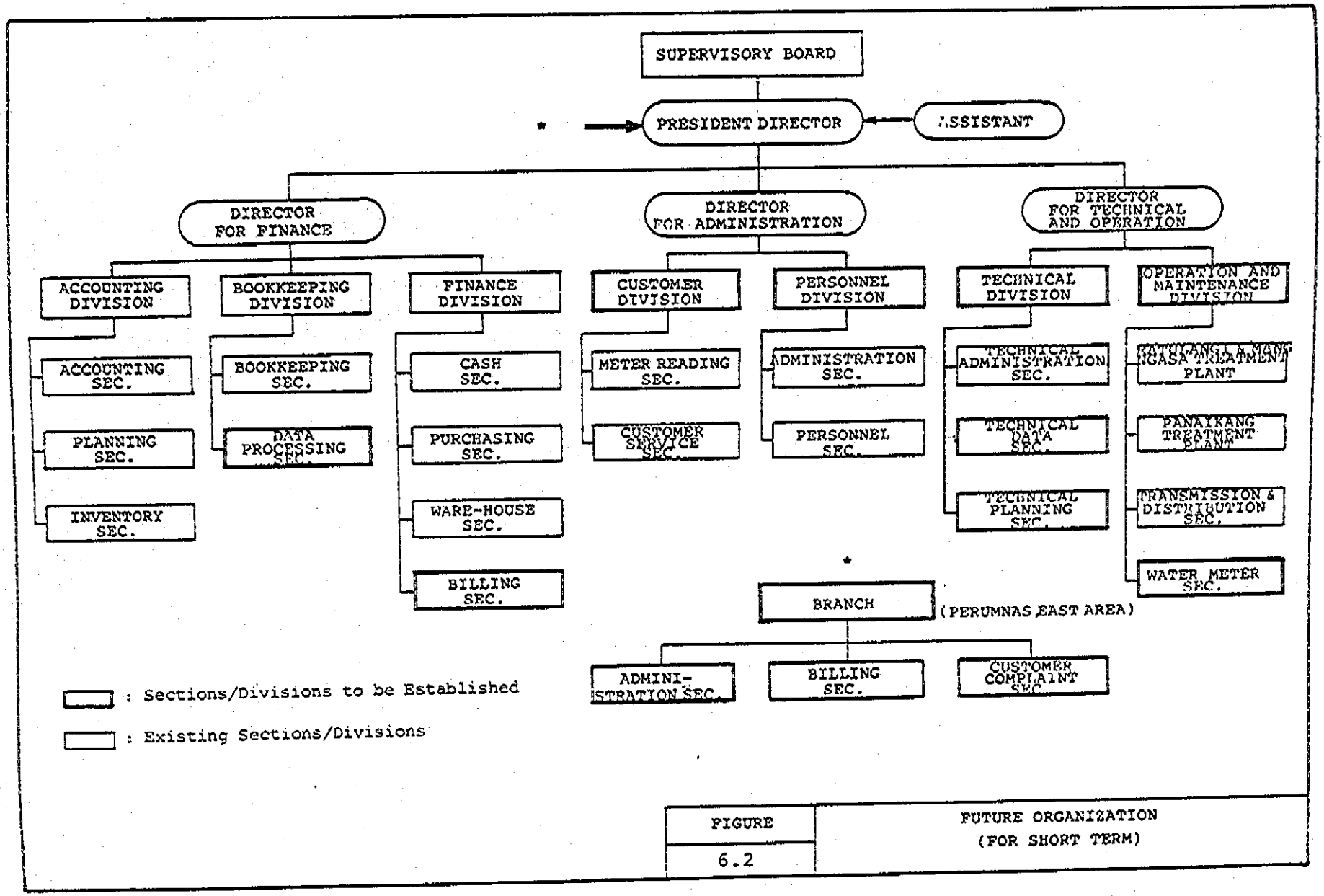


FIGURE	FUTURE ORGANIZATION (FOR SHORT TERM)
6.2	

TABLE 6.1 STAFFING PLAN

Year	Accouting Division		Book keeping Division		Finance Division		Customer Division		Personnel Division		Technical Division		O & M Division		Total
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	2)	(1)	(2)	
1985	4	41	3	12	7	78	3	42	3	18	4	20	5	160	400
1986	4	44	4	13	7	81	3	45	3	19	5	21	5	166	420
1987	4	46	4	13	8	84	4	48	3	19	5	21	5	176	440
1988	5	49	4	14	8	86	4	51	3	20	6	22	6	182	460
1989	5	51	5	14	8	89	4	54	3	21	6	22	6	192	480
1990	5	54	5	15	9	92	4	57	4	22	7	23	6	197	500
1991	5	56	5	16	9	95	5	60	4	22	7	24	7	205	520
1992	6	59	6	16	10	98	5	63	4	23	7	24	7	212	540
1993	6	61	6	17	10	100	5	66	4	24	7	25	8	221	560
1994	6	64	6	17	11	103	5	69	4	24	7	25	8	231	580
1995	6	66	6	18	11	106	5	72	4	25	7	26	8	240	600

Note ;

(1) : Engineer / Technician (Director, Division & Section Chiefs)

(2) : Office Staff