Area in the future. The sewer has a total length of 10,340 m with a diameter of 1,900 mm to 2,900 mm. Its slope ranges from 1.0 m to 1.2 m per thousand meters.

The salient features of the conveyance sewer are shown in Table 5.3. The sewer alignment is shown in Fig. 5.1, and its longitudinal profile is shown in Fig. 5.2.

5.3 Treatment Plant

The aerated lagoon treatment plant will be constructed at Pluit Pond. The pond will be used for a multipurpose of flood control and wastewater treatment. The treatment plant will treat wastewater of the integrated area of the Project Area and JSSP Area by 2000. Design influent wastewater to the treatment plant is determined at 441,000 m^3/d for the target year 2000 and 529,000 m^3/d for the year 2010. This design wastewater discharge includes wastewater of the JSSP Area of 124,800 m^3/d for 2000 and 136,000 m^3/d for 2010 respectively. Design water quality of influent and effluent wastewater is 200 mg/l and 30 mg/l as BOD respectively.

The proposed treatment plant includes inflow pump station, aerated lagoon, facultative pond, disinfection facilities and drying bed. However, disinfection facilities will not be installed until 2000.

(1) Inflow Pump Station

A pump station of capacity 454 m^3/min. will be installed by the year 2000. Additional pumps with a total capacity of 98 m^3/min. will further be provided by 2010. The design pump head is 20 m. The salient features of the pump station are shown in Table 5.4. Layout of the pump station is shown in Drawing.

(2) Aerated Lagoon and Facultative/Anaerobic Pond

The wastewater will be treated initially by aerated lagoon with a storage capacity of 1,075,000 m^3 and a surface area of 21.5 ha, and finally with facultative/anaerobic pond. For aeration, 24 units of

aerator will be installed by 2000, which would be increased to 59 units by 2010.

The aerated lagoon is designed in such a manner that the existing flood control function of the Pluit Pond remain unaffected. Design water level and other structure level of the aerated lagoon are as follows.

		(Unit: P.P.m)
High water level	:	0.90
Normal water level	:	-1.00
Aerated lagoon operation level	:	-1.00
Low water level	:	-1.90
Crown elevation of aerated lagoon embankment	:	+1.50
Elevation of aerated lagoon weir	:	-1.90

The construction of aerated lagoon includes embankment of 1,600 m in length and dredging of 340,000 m^3.

The effluent of aerated lagoon will finally be treated by the facultative/anaerobic pond with a storage capacity of 2,096,000 m^3 having a surface area of 52.4 ha. The settled suspended organic matter in the pond is treated under anaerobic conditions. The accumulated sludge is periodically transferred to drying bed.

The salient features of the aerated lagoon are shown in Table 5.4. Layout of the aerated lagoon is shown in Fig. 5.3. Flow-diagram and design water level of the treatment plant is shown in Fig. 5.4.

Table 5.1 Numbers of House Connection by Sub-zone

Sub-zone	2000			2010		
	Domestic	Others	Total	Domestic	Others	Total
A	16,500	4,500	21,000	18,200	7,000	25,200
B	9,200	2,000	11,200	9,600	3,000	12,600
C	3,100	300	3,400	4,100	400	4,500
D	7,500	1,300	8,800	7,900	1,700	9,600
E	29,100	8,700	37,800	30,000	11,100	41,100
F	8,600	1,600	10,200	9,400	2,200	11,600
G	22,000	600	22,600	22,800	600	23,400
Total	96,000	19,000	115,000	102,000	26,000	128,000

Table 5.2 Proposed Collection Sewer by Sub-zone

(Unit : m)

Sewer Diameter (mm) \ Sub-zone	A	B	C	D	E	F	G	Total
150	31,400	12,400	19,900	20,500	61,200	14,900	43,800	204,100
200	27,200	5,200	8,400	8,700	25,800	6,300	18,500	100,100
250	15,000	5,700	3,900	7,100	35,400	6,300	10,200	83,600
300	10,800	5,200	2,800	6,200	33,500	5,700	8,000	72,200
Secondary/Tertiary	84,400	28,500	35,000	42,500	155,900	33,200	80,500	460,000
350	2,105	275	1,390	735	875	315		5,695
400	1,835	710	450	1,120	2,915	500	1,490	9,070
450	980	1,200		635	5,930	805	800	10,350
500	1,360	360		460	3,320	490	1,370	7,360
600	2,430	1,060		485	4,020	2,445	920	11,360
700	2,535	1,080		1,245	1,605	860	1,620	8,945
800	1,085	250	690	1,470	2,630	360	690	7,175
Main	12,330	4,935	2,530	6,150	21,295	5,825	6,890	59,955
900	1,995	35	1,285	1,150	2,545	85	1,420	8,515
1000				20	2,015		955	2,990
1100					1,525			1,525
1200					120		1,090	1,210
1350					2,780		150	2,930
1500					120			120
Trunk	1,995	35	1,285	1,170	9,105	85	3,615	17,290
Force Main	500						240	740
Total	99,225	33,470	38,815	49,820	186,300	39,110	91,245	537,985

Table 5.3 Proposed Conveyance Sewer

Line No.	Location		Diameter (mm)	Length (m)	Slope 1/1000	Design Wastewater (m3/s)
	Origin	End				
S1	Jl. Madiun	Hotel Indonesia	1,900	1,385	1.2	3.378
S2	Hotel Indonesia	Jl. Kebon Sirih	2,100	110	1.2	4.077
S3	Jl. Kebon Sirih	Jl. Medan Merdeka Utara	2,200	1,460	1.2	4.721
S4	Jl. Medan Merdeka Utara	Jl. Sukarjo Wiryopranoto	2,300	1,300	1.2	5.361
S5	Jl. Sukarjo Wiryopranoto	Jl. Raya Mangga Besar	2,400	1,110	1.2	6.322
S6	Jl. Raya Mangga Besar	Jl. Jembatan Bambu	2,600	1,320	1.1	7.382
S7	Jl. Jembatan Bambu	Jl. Kunir	2,700	560	1.1	8.335
S8	Jl. Kunir	Jl. Pejagalan	2,700	660	1.1	8.534
S9	Jl. Pejagalan	Treatment Plant	2,900	1,435	1.0	9.695
			Total	10,340	-	-

Note : Design wastewater is hourly maximum includung groundwater infiltration.

Table 5.4 Treatment Plant at Pluit Pond

Year	2000	2010
(1) Design Wastewater (including desludge from on site facilities)	441,000 m3/d (190 m3/d)	529,000 m3/d (411 m3/d)
Wastewater Quality in BOD		
Influent	200 mg/l	200 mg/l
Effluent	30 mg/l	30 mg/l
(2) Inflow Pump Station		
Space	2 Station 21m x 37m	2 Station 21m x 37m
Inflow pump	ø900 x 98 m3/min x 20m(H) 3 units + 1 unit standby ø 600 x 40 m3/min x 20m(H) 4 units	ø900 x 98 m3/min x 20m(H) 4 units + 2 units standby ø600 x 40 m3/min x 20m(H) 4 units
(3) Aerated Lagoon	Area; 21.5 ha	Capacity; 1,075,000 m3
Excavation	340,000 m3	
Embankment	1,600 m	
Operational water level	P.P. -1.00 m	
Bottom elevation	P.P. -6.00 m	
Crown elevation of embankment	P.P. +1.50 m	
Elevation of weir	P.P. -1.90 m	
Aerator	24 units x 75 kw	59 units x 75 kw
Retention time	1 day for aerated lagoon and 1.4 days for Facultative pond	2 days
(4) Faculltative pond	Area; 52.4 ha	Capacity; 2,096,000 m3
Operational water level	P.P. -1.00 m	
Effective water depth	4 m	
Retention time	5 days for maturation pond	4 days
(5) Disinfection Building	-------	660 m2
(6) Chlorine Injection	-------	4 units + 1 unit standby 0~3.8 l / min / unit
(7) Drying Bed	2,000 m2	6,000 m2

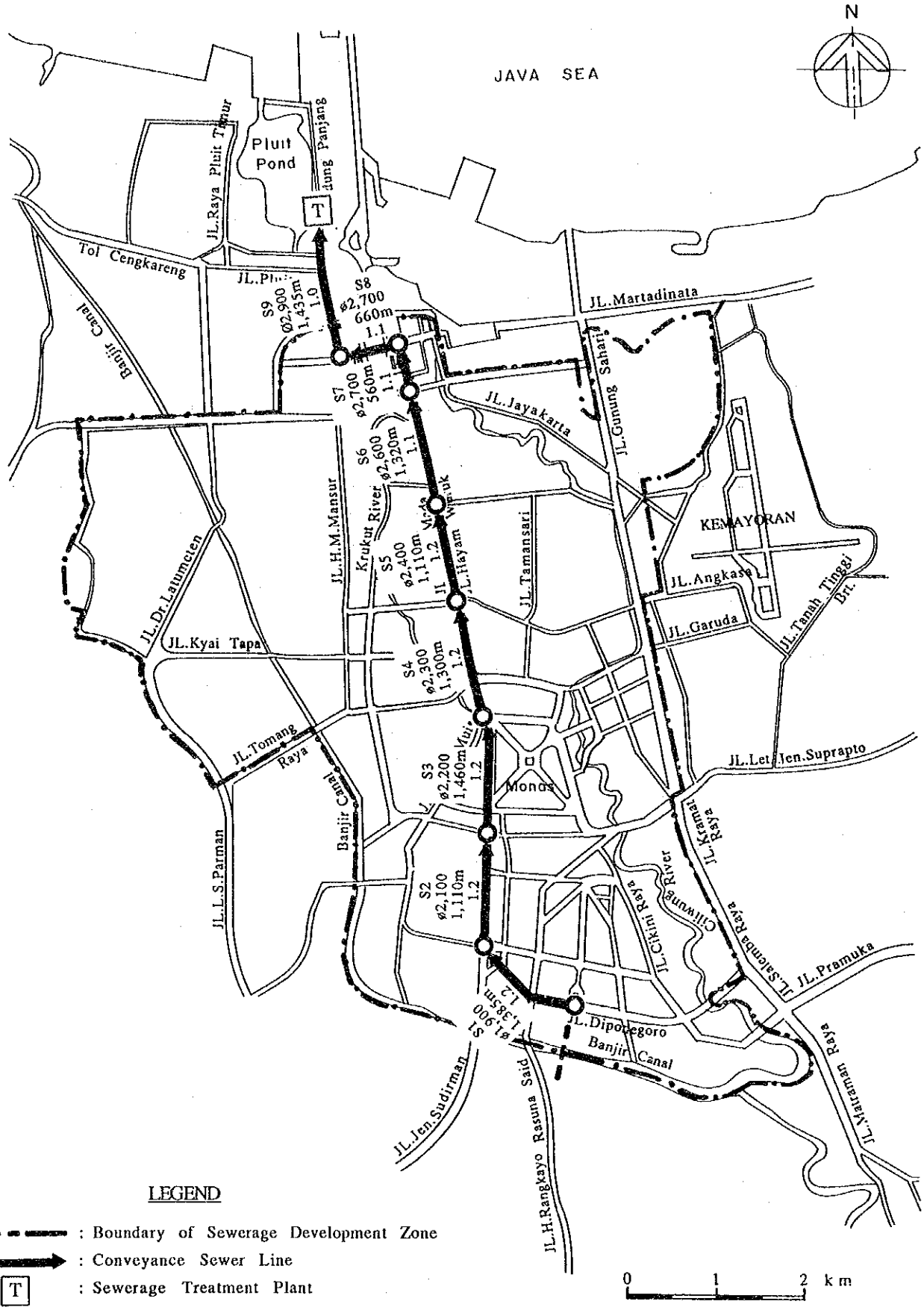
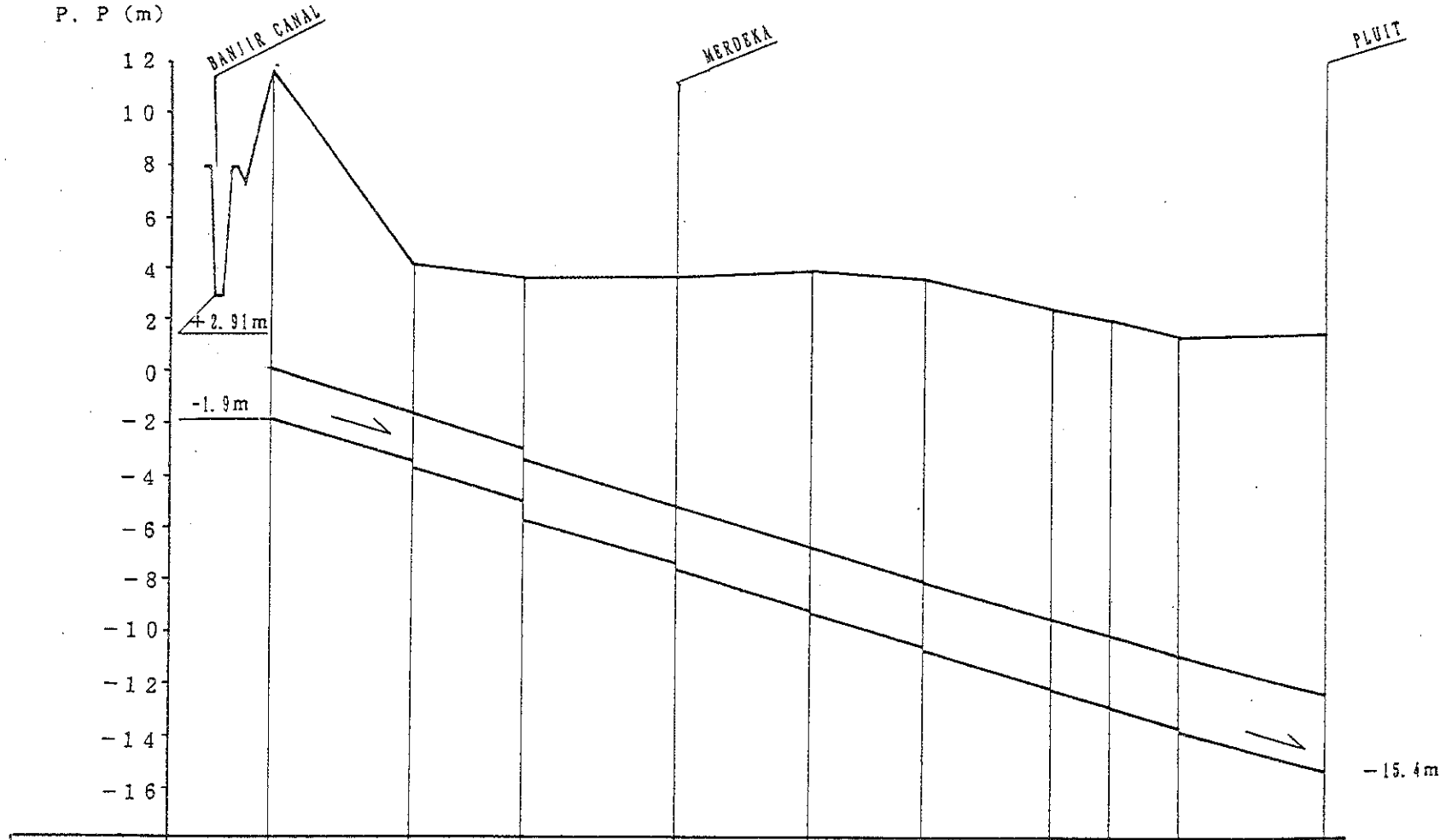


FIG. 5.1 PROPOSED CONVEYANCE SEWER ALIGNMENT

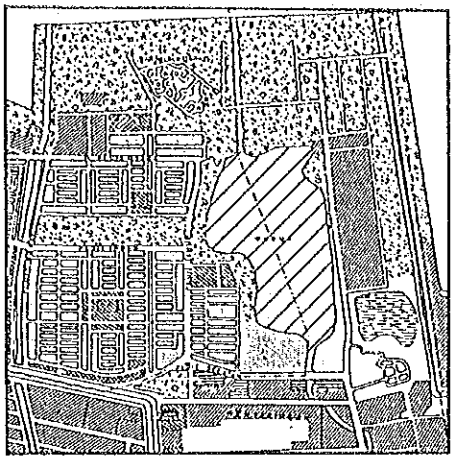
THE STUDY ON URBAN DRAINAGE AND WASTE WATER DISPOSAL PROJECT IN THE CITY OF JAKARTA

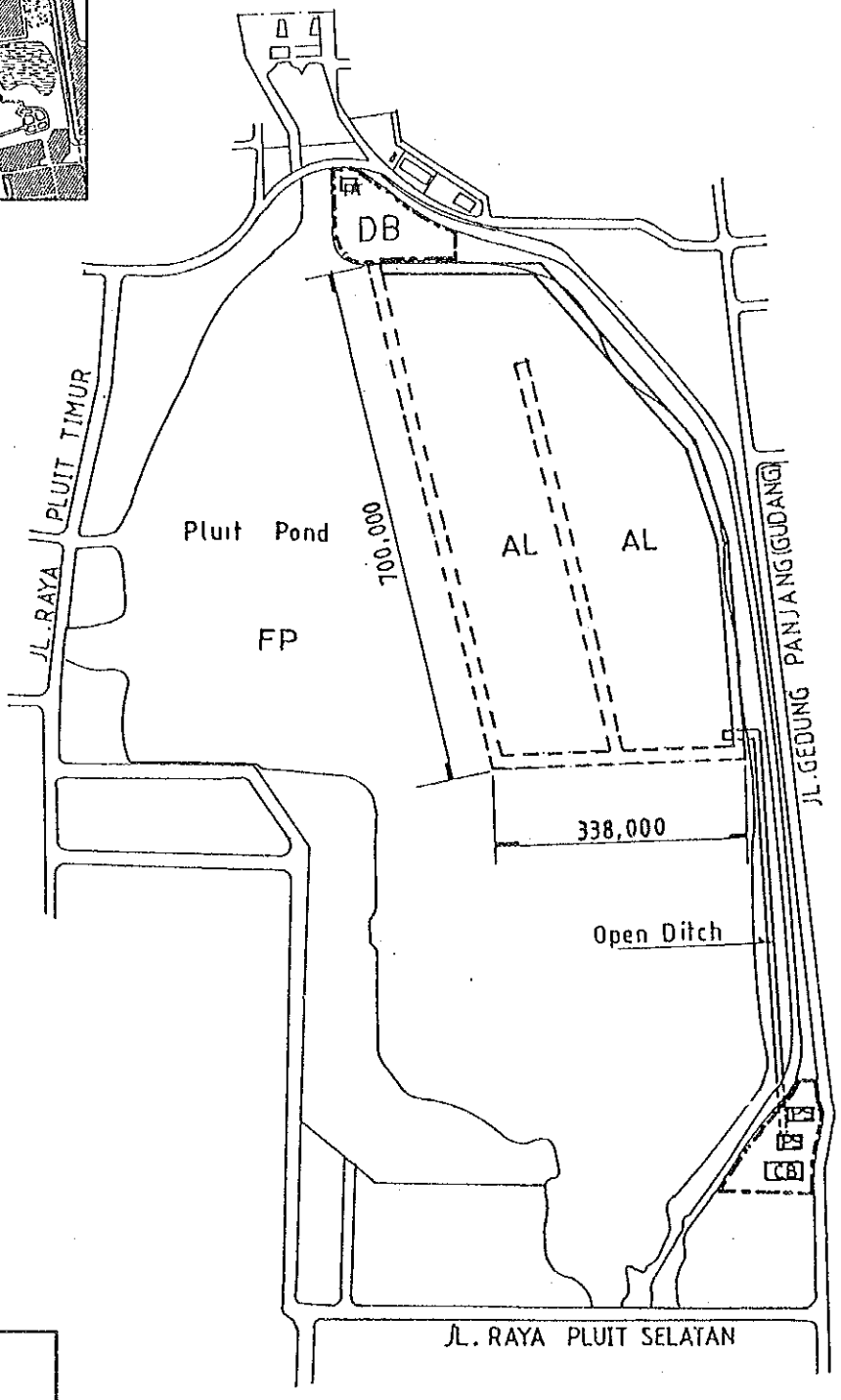


LINE NO	S1	S2	S3	S4	S5	S6	S7	S8	S9
Diameter (mm)	⊙1900	⊙2100	⊙2200	⊙2300	⊙2400	⊙2600	⊙2700	⊙2700	⊙2900
Length (m)	1385	1110	1460	1300	1110	1320	560	660	1435
Slope (‰)	1.2	1.2	1.2	1.2	1.2	1.1	1.1	1.1	1.0

FIG. 5.2 PROFILE OF CONVEYANCE SEWER

THE STUDY ON URBAN DRAINAGE AND WASTE WATER DISPOSAL PROJECT IN THE CITY OF JAKARTA



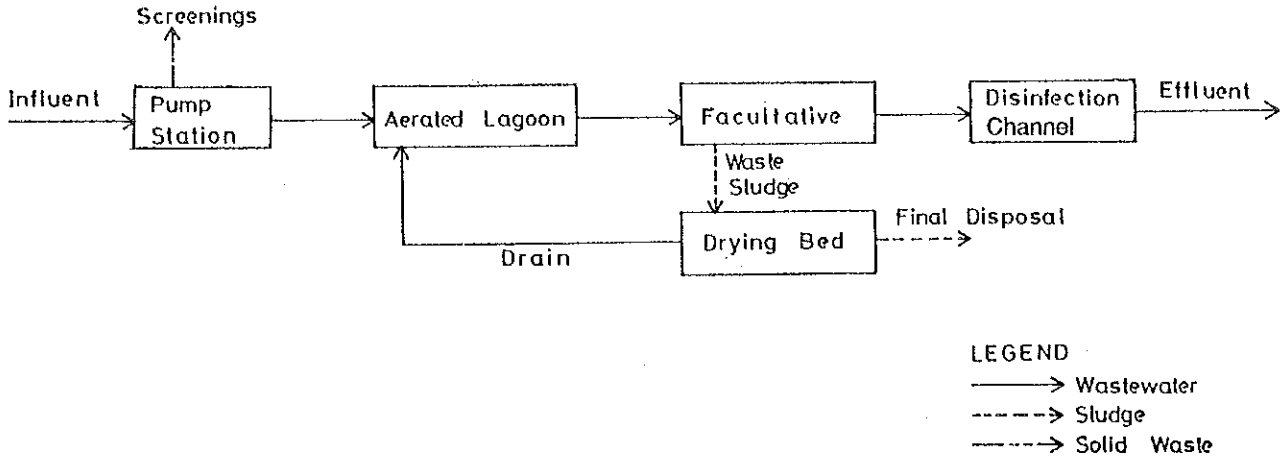


LEGEND

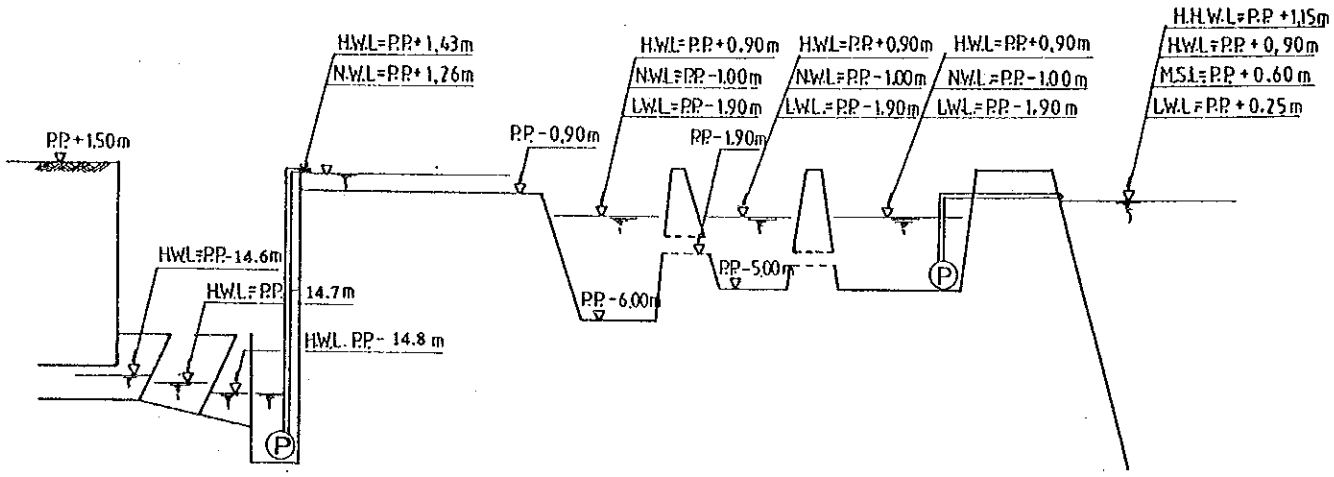
PS	:	Pump Station
AL	:	Aerated Lagoon
FP	:	Facultative Pond
DT	:	Disinfiction Building
DB	:	Drying Bed
CB	:	Control Building

FIG. 5.3 LAYOUT OF TREATMENT PLANT OF CENTRAL ZONE

THE STUDY ON URBAN DRAINAGE AND WASTE WATER DISPOSAL PROJECT IN THE CITY OF JAKARTA



FLOW-DIAGRAM



WATER-LEVEL

FIG. 5.4 FLOW-DIAGRAM AND WATER-LEVEL OF PLUIT TREATMENT PLANT

Chapter 6 CONSTRUCTION PLAN AND COST ESTIMATE

6.1 Construction Plan

6.1.1 Geology and Topography

The Project Area is in the Jakarta Plain, and its geological condition is primarily deltaic. Most of the area is covered by either alluvium or young rocks.

At the northern part of Project Area, the ground surface is almost flat with a low elevation, that declines toward north with a slope in the range of 0.2 m ~ 0.3 m per thousand meters. The level of groundwater table is high. While in the southern part, the ground slope is rather steeper with the surface slope of one (1) to two (2) meters per thousand meters.

At the estuary of Pluit Pond, the topsoil with thickness of 7 m is sandy silt with N-value of zero (0). The subsoil strata between P.P. - 5.50 m and P.P. - 16.50 m is predominantly clay with gravels and silty clay having an average N-value of five (5). At depth deeper than P.P. - 16.50 m, the strata is of very hard silty clay with N-value of more than 50.

The geologic conditions along the proposed conveyance sewer are as follows.

- The uppermost layer of 0.5 to 1.5 meters thickness has a variety of soils; organic humus, silty sand, claycy silt, sandy silt and sandy clay. The soil consistency varies from very soft to soft.

- The thickness of subsoil layer at the southern part of the Project Area ranges from 9 to 13 m. However, it increases to more than 30 m between KH. HASYIN ASYHARI Rd. and the southern edge of the Pluit Pond.

- The subsoil strata consists of silty clay, silty sand, organic clay, sandy clay, sandy silt and tuffaceous silt. Consistency of subsoil is soft with N-value of seven (7) in an average.

- Bearing strata at the southern part consists of tuff, tuffaceous silt and tuffaceous sand. N-value varies from 60 to more than 100.

6.1.2 Construction Method

(1) Sewer Pipe Installation

Open trench method is adopted for installation of secondary & tertiary, main and trunk sewers in principle. All the secondary & tertiary sewers of 460 km is installed by open trench method. The portions of main and trunk sewers with a total length of 2,650 m those cross rivers, main roads and railways at 47 locations will be constructed by micro tunnelling method. The remaining 74.6 km of main and trunk sewers be constructed by open trench method. Conveyance sewers of 10.34 km in length with diameter ranging from 1,900 mm to 2,900 mm are constructed by shield tunnelling method.

(2) Treatment Plant

Proposed treatment plant of aerated lagoon is constructed at Pluit Pond. The baffle and partition wall embankments of aerated lagoon and facultative pond, inside the Pluit Pond, will be constructed with broken stones and clay core. The underwater excavation works of aerated lagoon will be conducted after the completion of embankments.

6.1.3 Construction Schedule

(1) Workable Days

Annual workable days is estimated to be 240 days based on the following considerations:

Sunday per annum	:	12 months x 4 days = 48 days
National holiday per annum	:	about 20 days
Rainy day per annum	:	57 days (more than 10 mm/day rainfall)
Total work suspension days per annum	:	125 days

(2) Work Time

Sewer installation works by open trench method along main roads be conducted during night time only. Trench is covered by steel deck in day-time for traffic use. Construction of conveyance sewers by shield tunnelling method is conducted all day with three (3) shifts, each of eight (8) working hours in order to ensure a continued work pace.

Construction works of pump station and treatment plant is conducted for eight (8) hours during day time only.

6.2 Project Cost Estimate

6.2.1 Basis of Cost Estimate

Based on facility plans, the project costs are estimated under the following conditions.

(1) It is assumed that all construction works will be contracted to general contractors by international tender.

(2) All base costs are expressed under the economic conditions that prevailed in August, 1990.

(3) Overhead is assumed at 20% of the total cost of equipment and civil works and incorporated in the direct construction cost.

(4) Engineering service and administration costs are assumed respectively at 7% and 1.5% of the total direct construction cost.

(5) Physical contingency allowance at 10% of the direct construction cost is assumed.

6.2.2 Estimated Project Cost

The total project cost, consisting of direct construction cost, land acquisition cost, administration cost, engineering cost and physical contingency, amounts to Rp. 445.3 billion at 1990 price as given below.

	Cost Item		Amount (Rp. billion)
A.	Direct Construction Cost		375.3
	(1) Collection Sewer Lines		217.8
	(2) Conveyance Sewer Line		117.0
	(3) Lift Pump Station		4.1
	(4) Treatment Plant at Pluit Pond		36.4
B.	Land Acquisition Cost		0.6
C.	Administration Cost	(1.5%)	5.6
D.	Engineering Cost	(7%)	26.3
E.	Physical Contingency	(10%)	37.5
	Total		445.3

Break-down of the direct construction cost is shown in Table 6.1.

6.2.3 Estimated Operation and Maintenance Cost

The annual operation and maintenance cost for the Project Area in 2000, consisting of sewer maintenance, O&M of lift pump station and treatment plant, is estimated at Rp. 3.6 billion at 1990 price. The annual O&M cost for the Central Sewerage Zone covering JSSP Area is estimated to be Rp. 7.0 billion at the year 2010. The cost breakdown is shown below.

	Amount (Rp. million/annum)	
	2000	2010
Project Area	3,589	6,902
Sewer Lines	164	164
Lift Pump Station	114	126
Treatment Plant	3,311	6,612
JSSP Area	-	76
Sewer Lines	-	76
Total	3,589	6,978

Table 6.1 Break-down of Direct Construction Cost

	Item	Quantity	Unit Cost	Direct Construction Cost (million Rp.)	Remarks
	Secondary/Tertiary Sewer (ø150 ~ ø300)	460,000 m	116,000 Rp./m ~ 318,000 Rp./m	84,150	
	Main Sewer (ø350 ~ ø800)	60,455 m	217,000 Rp./m ~ 4,739,000 Rp./m	71,627	including force main of ø300
	Trunk Sewer (ø900 ~ ø1500)	17,530 m	1,041,000 Rp./m ~ 5,635,000 Rp./m	62,069	including force main of ø1,000
	Conveyance Sewer (ø1,900 ~ ø2,900)	10,340 m	9,700,000 Rp./m ~ 13,300,000 Rp./m	117,000	
(1)	Sub Total of Sewer Line	548,325 m		334,846	
(2)	Lift Pump Station (capacity 72 m^3/min)				
	Civil Work	1 ls		1,500	
	Mechanical/Electrical Work	1 ls		2,600	
	Sub-total			4,100	
(3)	Treatment Plant				
	Split Manhole	1 ls		379	
	Pump Station (capacity Q=178 m^3/min)	2 stations	11,248,000,000 Rp./St.	22,476	
	Aerated Lagoon (civil work)	1 ls		8,088	
	Aerator	18 set	195,000,000 Rp./set	3,510	
	Drying bed	2,000 m^2	120,000	24	
	Office	3,000 m^2	300,000	900	
	Others	1 ls		980	
	Sub-total			36,357	
	Total			375,303	

Chapter 7 IMPLEMENTATION PROGRAMME

7.1 Project Phasing

7.1.1 General

The proposed sewerage system is planned to not only serve 1,659,000 people in the Project Area but also receive the wastewater of 663,900 people in the JSSP area in 2000. It is because the capacity of the existing Setia Budi aerated lagoon treatment plant is only 34,000m^3/d and will be overloaded after 1993. Hence, the wastewater of the JSSP area will be introduced to Pluit Pond aerated lagoon treatment plant soon after completion of the whole conveyance sewer.

The design wastewater discharge of the Project Area in the year 2000 is estimated at 316,200 m^3/d. While, that of the JSSP area in 2000 is estimated to be 124,800m^3/d.

The proposed sewerage development project will be implemented in two (2) phases since it requires a large cost of Rp. 445.3 billion at 1990 price and a long construction period of eight (8) years. The first phase will be completed in 1996. The second phase will subsequently be implemented to complete in 2000.

The following two (2) alternative plans are considered for phasing the Project.

(1) The whole distance of the conveyance sewer will be completed along with the collection sewers of some areas located along the conveyance sewer, in the first phase. This plan is in expectation of a high cost recovery of the conveyance sewer construction cost by potential connection to high rise buildings located along the route of conveyance sewer. Moreover, this plan is of advantage to early settlement of the overload of the Setia Budi treatment plant.

(2) The proposed project will be developed from the lowermost area towards upstream in accordance with normal implementation

method. Sewerage system of the lower part area will be completed in the first phase.

Based on the above considerations, two (2) alternative plans for the first phase are compared in the following sections.

7.1.2 Alternative Plan A

The whole conveyance sewer of 10.3 km with a diameter ranging from 1,900 mm to 2,900 mm will be completed.

In the Project Area, 920 ha or 24% of the total area located along the conveyance sewer is covered by sewerage system. As a result, 350,100 person and 112 high rise buildings (building with more than four (4) floors) will receive sewerage service in 1997. Among the 112 high rise buildings, 62 are existing and the remaining 50 are expected to be built until 1997. The service area according to the first phase program is shown in Fig. 7.1.

The wastewater discharge of the first phase of this Alternative Plan-A, that enter the sewer system from the Project Area is estimated to be 63,990 m^3/d.

While in the JSSP area, wastewater of 645,600 person and 64 high rise buildings will be collected by the JSSP sewerage system in 1997. Among the 64 high rise buildings, 55 are existing and the remaining 9 are future ones.

The collected wastewater discharge of 121,400m^3/d will be introduced to the Pluit Pond treatment plant through the completed conveyance sewer in 1997 when the first phase project will start operation.

Hence, the first phase system of this Alternative Plan A will serve 995,700 person and treat the wastewater of 185,390 m^3/d in total in 1997. As a result, pollution load of 30,170 kg/d as BOD will be reduced.

Half of the total inflow pump capacity, whole aerated lagoon structures and 10 units of aerator will be installed in the first phase.

Total direct construction cost of the first phase plan is estimated at Rp. 204.5 billion with its break-down of collection system of Rp. 64.7 billion, conveyance sewer of Rp. 117.0 billion and treatment plant of Rp. 22.8 billion.

Construction cost recovery by Alternative Plan A of first phase project by high rise buildings is estimated based on the following assumptions.

- The maximum affordable cost of a high rise building is equivalent to the construction cost of substitutional individual treatment facility.

- All high rise buildings which will be built in the future (59 buildings) bear the cost equivalent to substitutional individual facility.

- 70% of the existing high rise building which are equipped with only toilet waste treatment units (117 x 0.7 = 82 buildings) bear the cost under the same condition on that of future buildings.

- 25% of the existing high rise building which are not equipped with proper individual treatment system (117 x 0.25 = 29 buildings) bear 50% of the cost of that of substitutional facility.

The total construction cost recovery by high rise buildings by Alternative Plan A (first phase) is estimated at Rp. 22.0 billion at 1990 Price.

7.1.3 Alternative Plan B

The conveyance sewer will be extended over 6.4 km towards Pluit Pond from upstream. The downstream project area of 1,824 ha, which can be connected to this conveyance sewer or 47% of the total area, will be covered by sewerage system in the first phase. As a result, 910,700 person and 59 high rise buildings will be served in 1997. Among the 59 high rise buildings, the existing ones account for 33 and future ones 26. The sewerage service area according to the first phase project of Alternative Plan B is shown in Fig. 7.2.

Wastewater of 172,360 m^3/d will be collected and treated by the first phase project, resulting in reduction of BOD load of 27,590 kg/d.

In the first phase, half of the total pump capacity, whole aerated lagoon structures and 10 units of aerator will be constructed.

Total direct construction cost of the first phase Alternative Plan B is estimated to be Rp. 206.1 billion. It is broken down into collection system of Rp. 106.6 billion, conveyance sewer of Rp. 76.7 billion and treatment plant of 22.8 billion.

The total construction cost recovery by high rise buildings for this Alternative Plan B (first phase) is estimated to be Rp. 7.4 billion at 1990 price in the same manner as Alternative Plan A.

7.1.4 Comparative Evaluation

The above two (2) alternative plans are comparatively evaluated as follows.

	Alternative A	Alternative B
Construction Cost (Rp. billion)	204.5	206.1
Served Area (ha)	2,758	1,824
Served Population	995,700	910,700
Treated Wastewater Discharge (m^3/d)	185,390	172,360
BOD Load Reduction (kg/d)	30,170	27,590
Const. Cost per Served Population (Rp./person)	205,000	226,000
Const. Cost per Treated Wastewater Discharge (Rp. million/m^3/d)	1.10	1.20
Construction Cost per Unit BOD Load Reduction (Rp. million/kg/d)	6.8	7.5
Recovery Cost of High Rise Building (Rp. billion)	22.0	7.4

As evident from the above table, Alternative Plan A is more economically efficient than Alternative Plan B.

Furthermore, Alternative Plan A has the following noticeable advantages.

(1) Pollution load reduction in the upper reaches contributes to river water quality improvement more than that in the lower reaches even when the amount of reduction remains the same.

Both alternative plans treat almost the same amount of wastewater. The sewage collection area of Alternative Plan A extends from the lowermost reaches of the Project Area to JSSP area, while that of Alternative Plan B is limited to the lower reaches of the Project Area.

Hence, contribution to river water quality improvement of Alternative Plan A is higher than that of Alternative Plan B.

(2) The whole conveyance sewer will be completed in 1996 in case of Alternative A, four (4) years earlier than in case of Alternative B. Hence, the overload of the existing Setia Budi aerated lagoon treatment plant will be settled earlier.

The following volume of wastewater in the JSSP area will be discharged into the Banjir Canal with no treatment before full completion of the conveyance sewer.

Alternative Plan A: discharge pollution load of 18,637 ton as BOD during 1994 - 1996

Alternative Plan B: discharge pollution load of 44,355 ton as BOD during 1994 - 2000

(3) The first phase project of Alternative Plan A covers the most important institutional and commercial areas of Jakarta city.

(4) Once the whole conveyance sewer is completed, collection system can be optionally developed areawise and timewise.

7.2 Implementation Programme

The proposed sewerage development project will be completed within nine (9) years from 1992 to 2000. The implementation programme of the project

is prepared based on the phasing policy discussed in the previous Section 7.1 and conforms to Alternative Plan A, as follows.

The first phase project will be completed within five (5) years from 1992 to 1996. The detailed design will be completed in 1992. The construction works will be commenced in 1993 and be accomplished in 1996. The included major construction works are:

- whole conveyance sewer of 10.34 km
- sewerage collection system of 920 ha in Sub-zones A, B, C, D and E along the area of conveyance sewer
- connection pipe between JSSP area and conveyance sewer (0.5 km)
- half capacity of inflow pump station (218m^3/min.)
- open ditch connecting inflow pump station and aerated lagoon
- aerated lagoon structure including embankment, excavation, etc.
- 10 units of aerator

The second phase project will be completed within five (5) years from 1996 to 2000. The detailed design will be accomplished in 1996. The construction works will be commenced in 1997 and be completed in 2000. The included major construction works are:

- sewerage collection system of 2,927 ha in Sub-zone A, B, C, D, E, F and G
- lift pump station (63.1 m^3/min.)
- remaining capacity of inflow pump (256m^3/min.)
- remaining aerators (14 units)
- dying bed (3,000m^2)

The proposed implementation programme is shown in Table 7.2.

7.3 Disbursement Schedule

The proposed disbursement schedule of the project cost is shown in Table 7.3.

Table 7.1 Implementation Programme of Sewerage Development

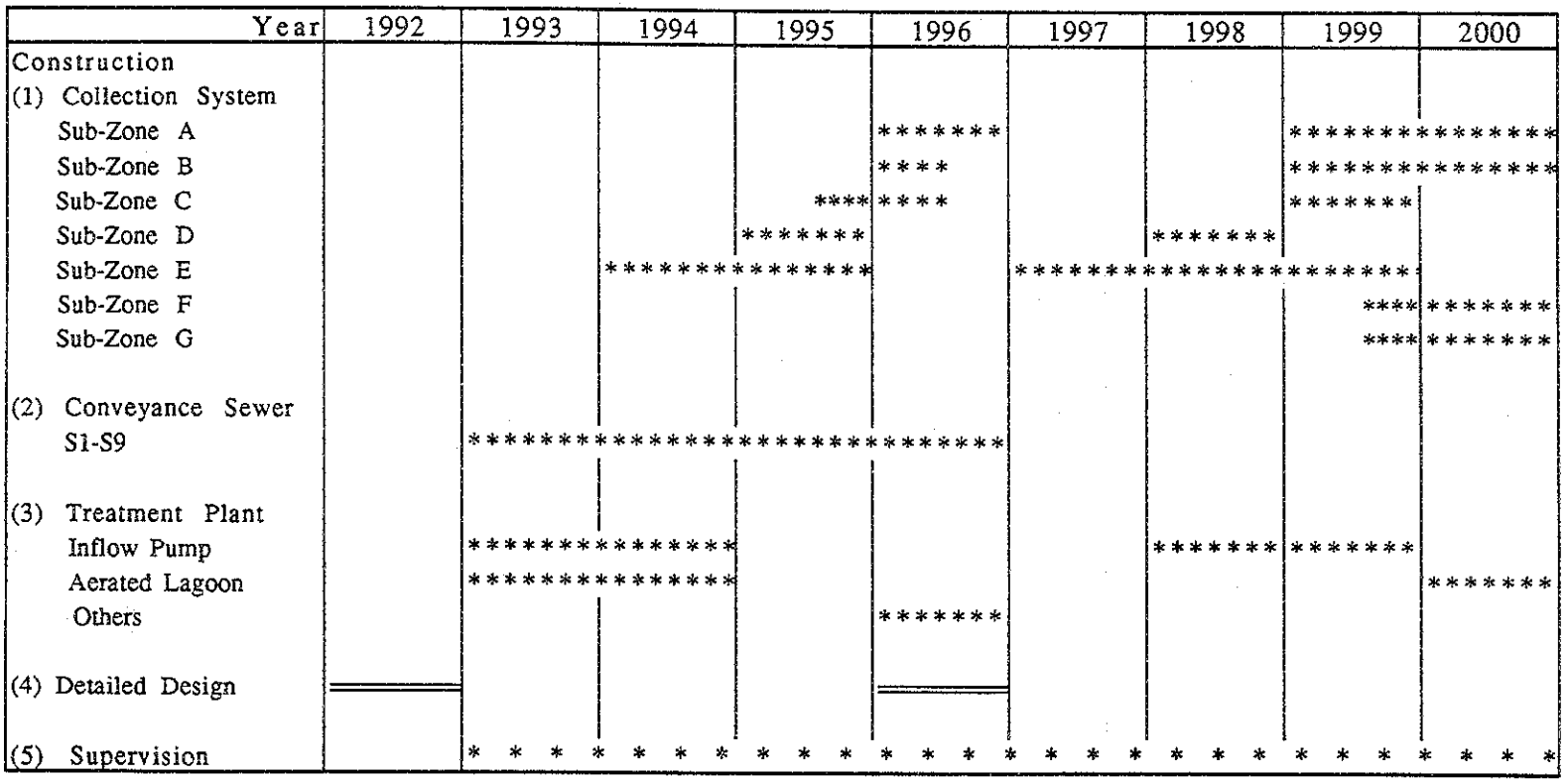


Table 7.2 Disbursemsnt Schedule

(Unit: Rp. billion)

Year	1992	1993	1994	1995	1996	1997	1998	1999	2000	Total
1. Direct Cost		29.2	49.1	66.8	55.3	19.0	30.3	65.0	60.6	375.3
(1) Collection System										
Collection Sewer			15.0	32.6	17.1	17.0	27.9	62.0	46.2	217.8
Lift Pump Station									4.1	4.1
(2) Conveyance Sewer		29.2	29.2	29.2	29.4					117.0
(3) Treatment Plant			4.9	5.0	8.8	2.0	2.4	3.0	10.3	36.4
(4) Connection Pipe										
2. Land Acquisition & Compensation	0.6									0.6
3. Administration Cost	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7	5.6
4. Engineering Services	8.3	2.0	2.0	2.0	6.0	1.5	1.5	1.5	1.5	26.3
5. Physical Contingency		2.9	4.9	6.7	5.5	1.9	3.0	6.5	6.1	37.5
6. Total	9.5	34.7	56.6	76.1	67.4	23.0	35.4	73.7	68.9	445.3

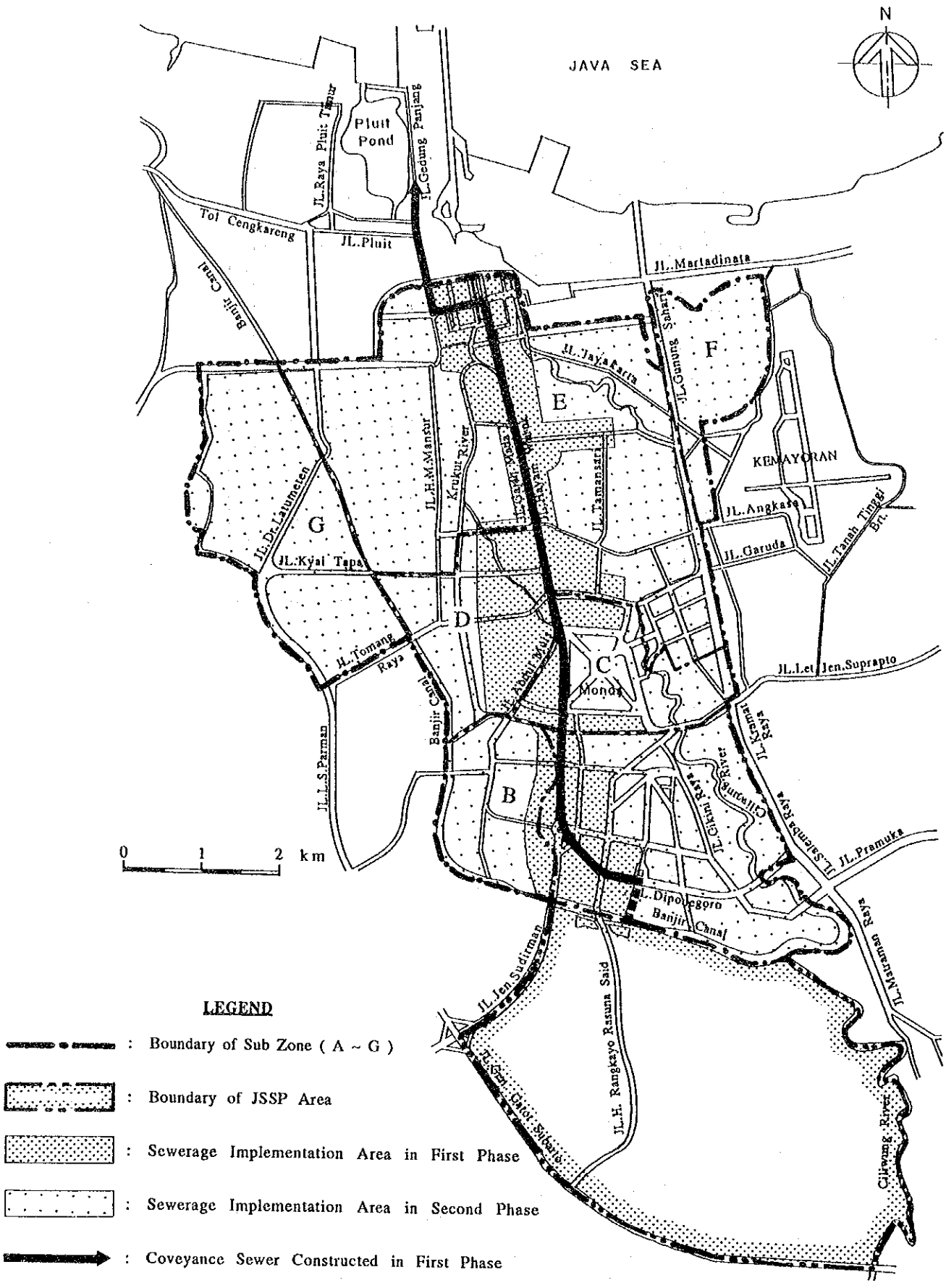


FIG. 7.1 SERVICE AREA IN THE FIRST PHASE OF ALTERNATIVE A

THE STUDY ON URBAN DRAINAGE AND WASTE WATER DISPOSAL PROJECT IN THE CITY OF JAKARTA

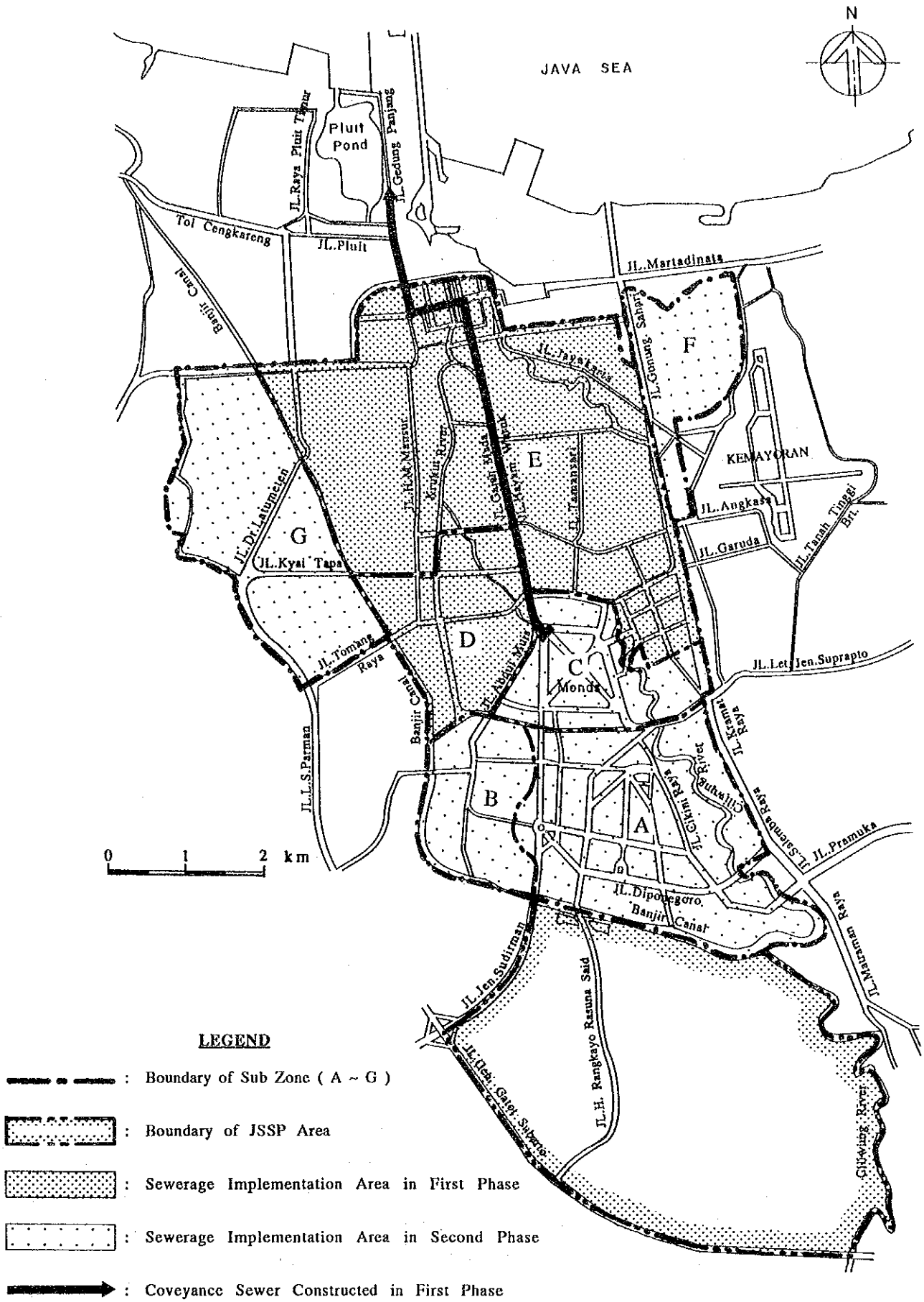


FIG. 7.2 SERVICE AREA IN THE FIRST PHASE OF ALTERNATIVE B

THE STUDY ON URBAN DRAINAGE AND WASTE WATER DISPOSAL PROJECT IN THE CITY OF JAKARTA

Chapter 8 ECONOMIC, SOCIAL AND ENVIRONMENTAL EVALUATION

8.1 Nos. of Beneficiaries

Beneficiaries of sewerage services were divided into 11 categories of houses, shops, factories, hotels, restaurants, hospitals, offices, schools, religious institutions, others and high rise buildings.

Shops, factories, hotels, restaurants, private hospitals, private offices and some of "others" and "high rise buildings" can be classified as commercial establishments, while public hospitals, government offices, schools, religious institutions and some of "others" and "high rise buildings" can be categorized as social institutions.

A high rise building is defined as a building having more than four (4) stories, the categorization of which became necessary as it would be a potential source of revenue for sewerage enterprise.

The total number of beneficiaries of sewerage across the entire categories in the Project Area works out to 203,818 for 1988 and 225,773 for 2000, of which houses account for respectively 95% and 91.5% in 1988 and 2000. Shops and offices occupy the second and third places respectively with the share of 2.0% and 1.0% for 1988, and 3.7% and 1.7% for 2000. High rise buildings account for 0.04% (89 buildings) for 1988, and 0.08% (264 buildings) for 2000.

The number of commercial establishments is expected to grow by 95.2% from 6,752 in 1988 to 13,180 in 2000. Likewise, the number of social institutions is expected to increase by 68.9% from 3,494 to 5,000 and that of houses by 12.4% from 193,572 in 1988 to 217,627 in 2000.

However by the year 2000 as the JSSP Area would also be integrated into the Project Area, the total number of beneficiaries of all categories would expand to 312,147 by the year 2000 and 338,605 by the year 2010. Out of these houses account for 93% in 2000 and 91% in 2010, shops for 3.2% in 2000 and 4.1% in 2010 and offices for 1.3% in 2000 and 1.6% in 2010.

The number of properties in the Project Area and in the JSSP Area on a Kelurahan basis is shown in Table 8.1.

8.2 Reduction of Pollution Load

8.2.1 Existing and Future Pollution Load without Project

(1) Existing Pollution Load

Existing pollution load as BOD in the Project Area is estimated to be 44,572 kg/d, and the breakdown is shown in Table 8.2 .

The share of pollution load from resident is 71.3%, from commerce and institution is 24.8% and from industry is 3.9%. The total pollution load from resident is 31,762 kg·BOD/d, of which toilet waste accounts for 4,690 kg·BOD/day and gray water the remaining 27,072 kg·BOD/d.

(2) Future Pollution Load

Future pollution load discharge of the Project Area without project in the year 2000 is estimated to be 59,145 kg·BOD/d under the following assumptions.

- The ratio of sanitary disposal of toilet waste by households in septic tank/leaching systems remains the same as existing conditions with a 74%.

- Gray water, commercial and institutional wastewater and industrial wastewater are discharged to the public water bodies under the same conditions as existing.

Future pollution load as BOD, discharged from each pollution sources are as follows:

(Unit: kg·BOD/d)

Domestic Waste		Commercial & Institutional	Industry	Total
Toilet Waste	Gray Water			
4,852	33,663	19,016	1,614	59,145

8.2.2 Reduction of Pollution Load by Sewerage Development

Reduction of pollution load by sewerage development is estimated assuming the following conditions.

- All domestic and commercial and institutional wastewater in conventional sewerage areas are collected, treated and discharged to the rivers and canals nearby treatment plant with a BOD of 30 mg/l.

- All gray water discharged by domestic, commercial and institutional sources in interceptor area is collected, treated and discharged with a BOD of 30 mg/l.

- All toilet wastewater in interceptor area is treated by on-site sanitation facilities.

Accordingly, it is estimated that the pollution load of 59,145 kg/d as BOD discharged from the Project Area will be treated to 9,486 kg/d by the proposed wastewater treatment plant at Pluit Pond with a not pollution load reduction of 49,659 kg/d. This implies that sewerage development would contribute toward a BOD removal efficiency of 84% in the year 2000. Furthermore, the pollution load of 24,960 kg/d as BOD discharged from JSSP Area in the year 2000 will be also treated to 3,750 kg/d with a reduction of 21,210 kg/d by the proposed Pluit Pond treatment plant. Consequently, the total pollution load reduction by the proposed sewerage system comes to 70,869 kg/d as BOD in the year 2000.

8.3 Reduction of Waterborne Disease

8.3.1 Disease Contraction Ratio

Based on field investigation, questionnaire survey and statistical data of disease contraction, waterborne disease contraction ratio in the project area and JSSP Area is determined to be 72.34 and 40.55 per 1000 person respectively. Moreover, the correlation between water color/smell of river/canal and disease contraction ratio for each area is represented by the following equations:

$Y_1 = 32.9602 + 0.1907X_1 + 0.82926X_2$ (Project Area)
$Y_2 = 27.3599 + 0.1907X_1 + 0.82926X_2$ (JSSP Area)

Where

X_1 : Percentage of respondents who replied that water color of near-by rivers/canals was black (%)

X_2 : Percentage of respondents who replied that water smell of near-by rivers/canals was strong (%)

Y : No. of those who contracted major water-borne diseases in the last three years (cases/1,000 population)

After the completion of sewerage development, disease contraction ratio of the project area and JSSP area will be reduced to 32.96 and 27.36 per 1000 person respectively.

8.3.2 Medical Costs

Medical costs consist of medication cost and economic losses resulting from unworkable days and death of patient, on the basis of each patient. Medical cost of waterborne disease per patient ranges from Rp. 60,000 for Cholera to Rp. 460,000 for Tuberculosis, with an average of Rp. 229,000 (Ref. Table J.20 of Appendix J, Supporting Report of Master Plan).

Reduction of medical costs is estimated from the difference in the total medical costs between the "without" and "with" project cases.

Accordingly, the medical cost reduction in the integrated area of both the Project Area and JSSP Area is estimated to be Rp. 16.1 billion per annum in the year 2000, which would increase to Rp. 17.1 billion in 2010.

8.4 Environmental Assessment

A preliminary environmental assessment is made to identify the potential environmental impacts by project implementation and to conceive and propose suitable remedial measures to minimize such impacts.

The environmental impacts anticipated are classified into two (2) categories. They are:

(i) Environmental impact of short term

These impacts are of temporary in nature and are restricted for the construction period only.

(ii) Environmental impacts of long term

These impacts of more concern, as they are permanent, and essentially due to the operation of wastewater treatment system.

8.4.1 Environmental Impacts of Short Term

The significant impacts identified due to construction activities are as follows:

- Vibration and vibration induced noise pollution during sewer pipe installation works, especially due to sheet piling of sewer trenches.

- Lowering of groundwater table caused by dewatering of trenches during sewer pipe installation, in shallow groundwater table zones, especially in the northern coastal zones of the project area.

- Deterioration of water quality of Pluit Pond due to increased turbidity caused by earthworks involving excavation of aerated

lagoon portion of the pond and embankment construction, especially the baffle and partition walls of aerated lagoon and facultative pond.

- Noise pollution due to construction works in Pluit Pond, especially caused by soil compaction of baffle and partition wall embankments of aerated lagoon and facultative pond.

These short term impacts due to construction activities could be minimized by planning the construction programme with due consideration to these adverse effects as well.

8.4.2 Environmental Impacts of Long Term

Anticipated long term impacts are as follows:

- Effects on water quality of Pluit Pond

- Effects on surrounding environment of Pluit Pond due to odour, foams and noise predominantly caused by the operation of acrators in the aerated lagoon.

The cause and effect of environmental impacts and the required mitigatory measures, if any, are identified below.

(a) Water Quality of Pluit Pond

Beneficial effects of improvement in water quality of pond effluent and reduction of solid waste pollution are identified.

With the operation of, aerated lagoon and facultative pond, wastewater treatment plant in Pluit Pond the effluent water quality will be enhanced to a BOD level less than 30 mg/l in contrast to the existing one of about 50 mg/l. The provision of screening facilities and the availability of operation and maintenance personnel of the plant would help in elimination of solid waste pollution, and hence enhancement of pond aesthetics.

Hence, no mitigatory measures are required.

(b) Odour, Foam and Noise Pollution

The existing Pluit Pond emanates an offensive odour. The proposed project will improve water quality of the pond, resulting in mitigation of the existing odour. However, the pond will still emit an odour inherent to the aerated lagoon treatment plant. Hence, it is proposed to institute a green belt around the pond as a buffer zone. The area around the pond having a width in the range of 50 m to more than 100 m is a reserved green area which is sufficient for green belt.

Noise pollution due to operation of pumps and aerators is considered minor.

Foam pollution due to operation of the aerated lagoon treatment plant will be minimized by the above green belt. Moreover, water and/or chemical spraying and net fencing around the pond will be considered, if necessary.

A detailed environmental impact analysis is recommended to be conducted during the detailed engineering design stage in order to quantify objectively the requirements and effects of these proposed mitigatory measures.

Table 8.1 Properties in the Project Area and JSSP Area

Number of Properties in the Project Area

Year	House	Shop	Factory	Hotel	Restaurant	Hospital	Office	School	Religious Institution	Others	High Rise Building	Total
1988	193,572	4,072	274	72	411	245	2,089	865	1,205	924	89	203,818
2000	206,693	8,457	264	201	684	517	3,735	1,346	1,974	1,718	184	225,773
2010	217,627	12,111	256	309	911	743	5,106	1,747	2,614	2,380	264	244,068

Number of Properties in the JSSP Area

Year	House	Shop	Factory	Hotel	Restaurant	Hospital	Office	School	Religious Institution	Others	High Rise Building	Total
1988	73,823	1,186	87	5	109	100	146	338	487	246	55	76,582
2000	82,970	1,477	54	6	148	133	193	420	591	302	82	86,376
2010	90,593	1,720	26	6	180	160	233	489	677	349	105	94,538

Chapter 9 FINANCIAL EVALUATION

9.1 Peoples' Willingness to Pay

The monthly average willingness to pay for sewerage service in the Project Area for nine (9) categories of beneficiary in the year 1988 was estimated, based on sampling survey, as given below.

Beneficiary Category	Willingness to Pay (Rp./month/beneficiary)
Household	1,846
Shop	5,394
Factory	6,050
Hotel	10,332
Restaurant	5,328
Hospital	8,047
Office	6,670
School	7,783
Religious Institution	6,235
Average	6,409

The total amount of willingness to pay by households and the rest of establishments/institutions in the Project Area for the year of 1988 is shown in the table given below. Those in the integrated sewerage area of both the Project Area and JSSP Area in 2000 and 2010 are also shown in the same table.

Item	Total Willingness to Pay (million Rp./annum)		
	1988	2000*	2010*
Household	6,227	13,297	17,195
Establishment/Institution	948	3,454	5,267
Total	7,175	16,751	22,462

* Includes both Project Area and JSSP Area

The breakdown in total willingness to pay according to property and area, Project Area and JSSP Area, is shown in Table 9.1.

The willingness to pay by households accounts for 86.7% in 1988, 79.4% in 2000, and 76.6% in 2010.

9.2 Sewerage Service Charge of JSSP

The underlying philosophy of JSSP regarding cost recovery is to redeem O/M cost at the least. Based on it, official tariff of sewerage discharge services to be applied for beneficiaries with direct connections to the sewers was legalized in 1989 by the decree of the Ministry of Public Works. The tariff structure is based on the floor area of the client's house/building and the quantity/quality of wastewater.

Clients are classified into five (5) categories, Residents, Small Commerce, Large Commerce, Industry and Social Institution. Each category is further broken down to specific types of customers. Unit price per m^2 varies in accordance with the nature of effluent. The unit price is Rp. 28 for Resident, Rp. 50 for Small Commerce, Rp. 182 for Large Commerce, Rp. 108 for Industry and Rp. 56 for Social Institution on simple average basis (Refer to Table 9.2).

Indirect charges are being contemplated for those without direct sewer connections. Discharge License Fees may be levied to the non-domestic beneficiaries and Environmental Charges to the PDAM customers. Also, inspection/cleaning fees will be collected on request basis.

The ultimate number of clients BPAL now envisages is 3,327 for Resident, 217 for Small Commerce, 56 for Large Commerce, 69 for Industry and 16 for Social Institution, adding up to 3,681 in total. With this number of clients, BPAL expects to raise an annual revenue around one (1) billion rupiah.

9.3 Affordability and Contribution of High Rise Building

High rise buildings which have more than four (4) stories are concentrated especially along M.H. Thamrin Rd., H. Rangkayo Rasuna Said Rd. and Jend. Sudirman Rd. The total number of existing high rise buildings in Central Sewerage Zone covering Project Area and JSSP Area is

144 (See Fig. 9.1). Based on the land use plan for 2005 and economic growth forecasted, the number of high rise buildings in 2010 is projected at 370.

It is considered that high rise buildings can shoulder a portion of the capital cost, an amount equivalent to the construction cost of individual household treatment plant, at most. Based on questionnaire survey the average unit construction cost of individual household on-site package treatment plant of high rise building is estimated at Rp. 12,873 per m^2 floor area of building. Hence, Rp. 10,000 per m^2 floor area is considered affordable by a high rise building as capital works charge for sewerage service.

The cumulative revenues from beneficiaries in Central Sewerage Zone for 30 years from 1992 to 2021 were estimated in present value at the annual discount rate of 9% based on the assumptions that:

- Sewerage Service Charge of JSSP (See Table 9.2) will be levied on all the beneficiaries directly connected to sewers.
- Above Capital Works Charge will be collected from high rise buildings at the time of the construction of connection.

They are 55,497 million for the high rise buildings and Rp. 109,742 million for the entire beneficiaries in terms of present value. The revenues from high rise buildings account for 50.6% of the total revenues.

On the other hand, the cumulative O/M and capital costs over the 30 years come to Rp. 391,621 million. Cost recovery rate is therefore calculated at 28.0%. Contribution of high rise buildings to the cost recovery works out at 14.2%.

Further, cumulative revenues from Capital Works Charge to be paid by high rise buildings over the 30 years reach Rp. 16,899 million in present value, while cumulative capital costs to be incurred over the same period amount to Rp. 357,361 million. Thus, the involvement of Capital Works Charge of high rise buildings in the recovery of capital costs works out at 4.7%.

Break-down of the above revenues and costs into Project Area and JSSP Area are shown in Table 9.3

9.4 Financial Analysis

9.4.1 General

Sewerage facilities in some portions of JSSP area have already been constructed and an interim organization named BPAL (Badan Pengelola Air Limbah) has taken charge of operation and maintenance of the facilities. Furthermore, BPAL has commenced collecting sewerage charge from beneficiaries.

BPAL is expected to become a permanent enterprise in 1991 under the name of PDAL Jakarta (Perusahaan Daerah Air Limbah Jakarta). The construction of sewerage facilities in the Project Area will start in 1993, ending in 2000. Sewerage construction in the JSSP areas will start again in 1997 succeeding the on-going JSSP pilot project and will finish in 2000. In the financial analysis it is assumed that PDAL Jakarta will continue to remain as an entity and be in charge of all these sewerage developments.

Though the provision of public sewerage is essentially a social service similar to that of public road in nature, it can not be denied its provision demands enormous financial resources. Hence, as far as possible, both the public and private sectors shall share the cost burden. The private sector shall entirely bear at least the O/M cost.

The sewerage enterprise will be a self-supporting financial entity with its own bank and account. It will conduct daily activities seeking its own benefits and profits. At the same time, it is essentially a social entity serving the general public. In this light, the government, the sewerage enterprise and the beneficiaries shall be involved in the disbursement and recovery of the costs in a well-balanced manner. The most reasonable cost sharing among the above three (3) parties is obtained through the following alternative financial analyses of the sewerage enterprise.

9.4.2 Financial Sources

The following five (5) financial conditions are considered for comparative financial analysis of the sewerage enterprise.

(1) Alternative Plan A

The central government grants 60% of the initial costs and remaining 40% is provided by the central government or DKI Jakarta government as loan at the annual interest rate of 9.0% with the repayment period of 25 years and the grace period of five (5) years. Replacement costs and O/M costs will be entirely financed by the sewerage enterprise out of its own coffers.

(2) Alternative Plan B

Regarding financial sources of initial costs, 90% will be granted by the government, of which 60% will be borne by the central government and 30% by the DKI Jakarta government. The balance 10% will be loaned by the central government at the annual interest rate of 9.0% with the repayment period of 25 years and the grace period of five (5) years. All replacement and O/M costs will be borne by the sewerage enterprise.

(3) Alternative Plan C

Initial costs will be entirely granted by the central government and/or the DKI Jakarta government. But, replacement and O&M costs will be borne entirely by the sewerage enterprise.

(4) Alternative Plan D

The entire initial costs will be lent by the central government at the annual interest rate of zero (0)% with the repayment period of 25 years and the grace period of five (5) years. However, replacement and O/M costs will be self-financed by the sewerage enterprise.

(5) Alternative Plan E

Regarding initial costs, 15% will be granted by the central government. The remaining 85% will be loaned by the central government at the annual interest rate of 2.5% with the repayment period of 30 years and the grace period of 10 years. As regards replacement and O/M costs, the entire amount will be internally financed by the sewerage enterprise.

9.4.3 Sewerage Charge

The following three (3) types of sewerage charge are considered for recovery of the costs borne by the sewerage enterprise.

(1) Sewerage Service Charge

The charge will be applied to all types of properties having direct connections to the sewer based on the floor area of buildings. Properties are classified into the following 11 types for the sake of convenience.

- Residence, Shop, Factory, Hotel, Restaurant, Hospital, Office, School, Religious, High Rise Building and Others

(2) Environmental Charge

This charge will be levied on beneficiaries having no direct connections to the sewer within the area covered by interceptor system in case the cost recovery by sewerage service charge is insufficient. It will be applied to all types of properties in a lump sum payment on monthly basis.

(3) Capital Works Charge

This charge will be imposed on high rise buildings and/or ordinary establishments/institutions in case the required cost recovery can not be achieved only by sewerage service charge. It will be applied

to them at the time of the construction of their buildings in a lump sum payment.

Furthermore, this charge will be applied to the existing high rise buildings as well. The full rate of 100% will be applied to those with low level on-site sanitation facilities. Likewise, the rate of 50% will be applied to those with medium level on-site sanitation facilities. The high rise buildings with high level on-site sanitation facilities will be exempted from this charge.

The above sewerage charges will be cross-subsidized so that institutional and commercial enterprises are charged higher than those of residents.

9.4.4 Financial Evaluation

The minimum sewerage charge required to recover the costs shouldered by the sewerage enterprise are estimated for the afore-mentioned five (5) alternatives of financial sources. The financial calculations are done based on the following assumptions.

- Financial calculation period : 30 years from 1992 to 2021
- Financial objective area : whole central sewerage zone including Project Area and JSSP Area
- Collection rate of sewerage charge : 90%
- Annual rate of price escalation : 6%
- Rate of corporate income tax : 35%
- Depreciation
  - Facilities : 50 years
  - Pumps & aerators : 15 years

The required sewerage service charge, environmental charge and capital works charge according to the properties for each alternative plan of financial sources are shown in Table 9.4. As evident from the above table, Alternative Plan C is the most economical one for beneficiaries, while Plan A and D are the most burdensome. Plan B and E impose medium charges on beneficiaries.

Alternative Plan B is recommended as the financial and revenue sources for the sewerage enterprise based on the following facts and considerations.

(1) The sharing of the costs between public sector and private sector is well balanced. The public sector shares most of the initial costs, considering that the provision of public sewerage is essentially a social service. While, the private sector shoulders the entire replacement and O/M costs.

(2) The sewerage service charge is almost the same as that of JSSP and is the closest to that of willingness to pay by beneficiaries.

(3) The amount of sewerage service charge is equivalent to 1.0% of the household income. It is considered reasonable in comparison with 4.0% of water supply charge (Refer to Section 9.5).

(4) The capital works charge to high rise buildings is determined based on the substitutional construction cost of on-site sanitation system.

9.5 Proposed Sewerage Charge

The proposed sewerage charge of this Study consists of sewerage service charge to all beneficiaries having direct connections to the sewer and capital works charge on high rise buildings receiving direct service of sewerage system.

Regarding sewerage service charge, almost the same charge of JSSP is proposed as discussed in the previous Section. It will be levied on all types of properties based on the floor area of building. The concept of this charging system in itself is logical and also supported by the relationship between floor area and willingness to pay established by the Study Team. However, it is to be noted that this sewerage charge is not directly related to the actual quantity/quality of wastewater discharged by beneficiaries.

Hence it is proposed to switch over to a sewerage charging system, eventually, that is directly based on the quantity of wastewater discharge, once piped water supply is made available for the entire Central Sewerage Zone in future. In such a case, the recommended charge per m^3 of wastewater is, Rp. 133 for a residential unit, Rp. 232 for an establishment/ institution (other than high rise building) on average, and Rp. 350 for a high rise building with an average charge per m^3 of wastewater of Rp. 167.

According to this sewerage charging system, an establishment/institution and a high rise building is charged respectively 1.7 times and 2.6 times higher than that of a residential unit, a cross subsidy system.

Based on questionnaire survey, the charge per m^3 of piped water supply for a residential unit becomes Rp. 523. This water service charge is about four (4) times that of the proposed wastewater charge of Rp. 133/m^3. An average piped resident (household) consumes 19.8 m^3 of water per month, resulting in a monthly water charge of Rp. 10,347. This water charge corresponds to 4% of the monthly average household income of Rp. 261,167. Hence, the proposed wastewater charge would be 1% of the household income, as the water charge is 4 times that of wastewater, resulting in a combined water supply and wastewater charge equivalent to 5% of household income.

The average unit construction cost of individual household on-site package treatment plant of high rise building is estimated at Rp. 12,873 per m^2 floor area of building. Hence, the capital works charge of Rp. 10,000 per m^2 floor area will be imposed on high rise buildings in a lump sum payment at the time of the construction of building.

The existing high rise building will be charged as well at the time of connection to the sewer. The charging rate varies, depending on the existing on-site treatment level. The full rate of 100% will be applied to those with low level on-site treatment facilities and the half rate of 50% to those with medium level on-site treatment facilities. The high rise buildings with high level on-site treatment facilities will be exempted from this charge.

The proposed sewerage charge is shown below.

Sewerage Service Charge	
Resident	Rp. 28/m^2/month
Shop, Office, School and Others	Rp. 40/m^2/month
Restaurant	Rp. 60/m^2/month
Factory, Hotel and Hospital	Rp. 100/m^2/month
High rise building	Rp. 50/m^2 ~ Rp. 200/m^2/month
Capital Works Charge	
High rise building	Rp. 10,000/m^2

Table 9.1 Total Willingness to Pay for Sewerage Service by Type of Properties

(Unit: Rp./annum)

Northern Central Zone (F/S Area)	1988	2000	2010
Household	6,227,138,000	9,435,197,273	12,108,580,000
Shop	263,572,400	850,155,091	1,338,974,000
Factory	19,892,400	26,289,867	31,621,090
Hotel	8,554,896	39,350,536	65,013,570
Restaurant	26,021,950	66,033,905	99,377,200
Hospital	22,692,540	77,248,827	122,712,400
Office	158,639,300	452,715,391	697,778,800
School	78,732,840	187,626,273	278,370,800
Religious Institutions	89,559,560	224,665,618	337,254,000
Others	66,960,910	190,980,359	294,329,900
High Rise Building	213,088,800	690,208,364	1,087,808,000
Total	7,174,853,596	12,240,471,504	16,461,819,760

Southern Central Zone (JSSP Area)	1988	2000	2010
Household	2,392,595,000	3,862,082,818	5,086,656,000
Shop	76,767,410	138,618,241	190,160,600
Factory	6,316,200	4,697,245	3,348,115
Hotel	619,920	974,849	1,270,624
Restaurant	6,969,024	13,830,185	19,547,820
Hospital	9,656,400	18,783,682	26,389,750
Office	12,166,080	22,830,333	31,717,210
School	31,567,850	56,811,628	77,848,110
Religious Institutions	36,437,340	63,754,047	86,517,970
Others	17,861,060	31,563,549	42,982,290
High Rise Building	131,684,100	296,303,973	433,487,200
Total	2,722,640,384	4,510,250,550	5,999,925,689

Table 9.2 Tariff of Sewerage Discharge Services based on Floor Area

(Unit : Rp./m2/month)

Classification of Customers	Class A	Class B	Class C	Class D
I. Residential	28			
II. Small Commercial				
1 Shop or Retailer	40	-	-	-
2 Office	40	-	-	-
3 Building Materials	40	-	-	-
4 Hair Dresser	-	44	-	-
5 Catering	-	-	56	-
6 Restaurant	-	-	-	60
7 Motel	-	-	-	60
8 Others	-	-	-	60
III. Large Commercial				
1 High Rise Building	140	-	-	-
2 Offices including Restaurant and Fitness Centre	-	154	-	-
3 Apartment	-	-	210	-
4 Amusement Centre	-	-	-	224
5 Private Hospital	-	-	-	224
6 Hotel	-	-	-	224
IV. Industry				
1 Home Industry	40	-	-	-
2 Craftmen	40	-	-	-
3 Pharmaceutical Industry	-	44	-	-
4 Ice Making Plant	-	-	168	-
5 Beverage Factory	-	-	-	172
6 Fabric Industry	-	-	-	172
7 Fishery Industry	-	-	-	172
V. Social Institution				
1 Mosque, Church, Kuil	40	-	-	-
2 School	40	-	-	-
3 Public Swimming Pool	40	-	-	-
4 Government Institution	40	-	-	-
5 District's Clinic	-	44	-	-
6 Other Government Institutions	40	-	-	-
7 School Including Dormitory	-	-	68	-
8 Public Clinic	-	-	-	72
9 Public Hospital	-	-	-	72

Definition :

Class A = Basic Tariff

Class B = Wastewater Quality > Domestic Waste Quality (BOD 5 = 300 mg/l)

Class C = Wastewater Quantity > Domestic Waste Quantity (Q = 40 m3/month)

Class D = Wastewater Quality & Quantity > Domestic Waste Quality & Quantity

Source : BPAL

Table 9.3 Cumulative Revenues and Costs in Present Value

(Unit : Rp. million)

	Central Sewerage Zone	Project Area	JSSP Area
Cumulative Revenue			
Sewerage Service Charge	92,843	69,951	22,892
High Rise Buildings	38,598	24,052	14,546
Other Beneficiaries	54,245	45,899	8,346
Capital Works Charge	16,899	12,286	4,613
High Rise Buildings	16,899	12,286	4,613
Other Beneficiaries	-	-	-
Total Charge	109,742	82,237	27,505
High Rise Buildings	55,497	36,338	19,159
Other Beneficiaries	54,245	45,899	8,346
Cumulative Cost			
O&M Cost	34,260	23,861	10,399
Capital Cost	357,361	260,482	96,879
Total	391,621	284,343	107,278

Note: Cumulative revenues and costs for 30 years for 1992 to 2021
Discount rate of 9% per annum.

Table 9.4 Sewerage Service Charge & Other Charges by Type of Properties

	Alternative Plan				
	A	B	C	D	E
Service Charge					
Residence	35	28	17	35	28
Shop	50	40	24	50	40
Factory	125	100	60	125	100
Hotel	125	100	60	125	100
Restaurant	75	60	36	75	60
Hospital	125	100	60	125	100
Office	50	40	24	50	40
School	50	40	24	50	40
Religious	50	40	24	50	40
Others	50	40	24	50	40
High Rise Building					
Commercial	250	200	120	250	200
Institutional	63	50	30	63	50
Average	175	140	84	175	140
Environmental Charge					
Residence	1,000	0	0	1,000	1,000
Shop~Others	2,500	0	0	2,500	2,500
High Rise Building	50,000	0	0	50,000	50,000
Capital Works Charge					
Residence	0	0	0	0	0
Shop~Others	12,000	0	0	12,000	12,000
High Rise Building	20,000	10,000	0	20,000	20,000

Unit : Unit: Rp./m2/month for sewerage charge
Rp./month for environmental charge
Rp./m2 for capital works charge

Note : In Alternative Plan C, no depreciation of assets is exceptionally considered

Chapter 10 INSTITUTIONAL ASPECTS

10.1 Existing Status of Institutional Aspects of JSSP

An interim organization in charge of the operation and maintenance of the sewerage system now being constructed under the Jakarta Sanitation and Sewerage Project was established in 1989 by a decree of Directorate General of Human Settlements. This organization named BPAL (Badan Pengelola Air Limbah), located in the vicinities of the Setia Budi Treatment Ponds has now three (3) departments, Administration and Finance Dept., Maintenance Dept., and Control Dept. BPAL is manned by 65 personnel in total.

Along with the decree of Directorate General of Human Settlements (Ministry of Public Works), stipulating the organizational structure and functions of BPAL, a decree of DKI Jakarta Government was issued setting forth the provisions of wastewater management in the City of Jakarta. It is aimed to support and reinforce the functioning of BPAL.

It stipulates that every owner/inhabitant of houses/buildings that are located in the areas with the sewerage system is obliged to build and maintain connection, that he is prohibited to dispose garbage, chemicals and others that may impair or destroy sewerage facilities, that the wastewater to be disposed into the sewerage system must meet the fixed quality standard, that every connection to the sewerage system shall have prior confirmation from the authorities, that connections have to be constructed by the contractor owning the license, that every owner/ inhabitant of houses/buildings having an advantage of the sewerage facilities is charged a fee and others.

The collection of fee based on the tariff of sewerage discharge services has been legalized. Other related charges such as environmental charge, discharge license fees and inspection/cleaning charge are being contemplated. The cost recovery goals are to redeem all civil works cost as well as O/M cost.

BPAL is scheduled to become a permanent enterprise in 1991 and be renamed as PDAL Jakarta (Perusahaan Daerah Air Limbah Jakarta). The creation of PDAL Jakarta will entail the enforcement of new laws centering on the PDAL Jakarta Charter and the Sewerage Decree. The former will stipulate the organizational structure and job descriptions of the new organization, and the latter will deal with legal aspects of the use of sewerage facilities. Both of them will be based on the corresponding decrees now in force.

10.2 Basic Philosophy of PDAL Jakarta

World Bank recommends the creation of a new independent sewerage enterprise under DKI Jakarta Government after examining the merits and demerits of several alternatives for the sewerage organization. It appears that things are proceeding in this direction.

The Bank is convinced that the sewerage organization to be created must be financially self-sufficient. This forms the very basis of the Bank's philosophy.

If an organization is to be profit oriented, it must be able to decide out of its own volition on matters directly related to its own interest. But, at the same time wastewater management is essentially a public affair. Thus, PDAL Jakarta will be an independent enterprise having its own bank and accounting, but under the control of DKI Jakarta Government.

PDAL Jakarta as a successor of BPAL will want to recover not only annual O/M cost, but also capital cost. Various types of charges and fees will be legalized to ensure that the costs be recovered. However, charges must be within the affordability of beneficiaries.

10.3 Proposed Institutional Aspects

The JICA Study Team essentially follows the recommendations of World Bank on the legal and organizational aspects of the sewerage enterprise. However, there are certain issues that are to be clarified and reconfirmed.

10.3.1 Legal Aspects

PDAL Jakarta will be able to expand, reinforce and strengthen to control the entire Central Sewerage Zone. Eventually, it will become the sole organization in charge of wastewater management over the entire Jakarta area. The necessary legal provisions to facilitate the growth of PDAL shall be made.

Furthermore in order to ensure that PDAL Jakarta may perform its duty and functions smoothly and thoroughly, it must have the power and authority allowed and protected under the law.

Under PDAL Jakarta Charter this sewerage enterprise shall prepare a long-term corporate plan on sewerage facilities, finance and personnel in accordance with the Master Plan.

Under the Charter the Board of Directors headed by President Director shall set up the broad corporate policy and targets, and be responsible for corporate accomplishments; the Board of Commissioners led by the Governor shall regulate the policy of the Board of Directors so that it meets the general policy of DKI Jakarta Government.

Under the Charter the annual budget of PDAL Jakarta shall be approved by the Governor; the functions, salaries and retirement benefits of PDAL Jakarta shall be based on the "Regional Government Regulations on Employee's Status, Salary and Retirement".

Along with PDAL Jakarta Charter Sewerage Ordinance is required to support, reinforce and accomplish the tasks stipulated by the Charter.

Under the Ordinance, in the conventional sewer service area, all wastewater, domestic, commercial & institutional and small industrial, shall connect to a public sewer wherever and whenever such a sewer is provided; property owners who are required to connect to the sewerage system and contractors wishing to carry out any sewerage works follow authorized procedures; contractors shall be licensed for executing construction works on sewers, property sewer connections and other

disposal facilities; inspectors of PDAL Jakarta will be authorized to inspect, observe, measure and sample wastewater discharged to the public sewers and watercourses; fees and charges shall be paid to PDAL Jakarta for connection to the public sewers on lump sum basis and for operation and maintenance on regular basis; penalties shall be enforced upon persons violating any of the regulations included in the Ordinance.

The Study Team is convinced that financial self-sufficiency forms the very basis of the raison d'etre of PDAL Jakarta. Hence it is recommended the maximum possible autonomy allowable within the jurisdiction of DKI Jakarta Government be bestowed to PDAL Jakarta in order to facilitate its financial self management. The authority to revise sewerage tariff shall also be allowed to PDAL.

10.3.2 Organizational Aspects

It is proposed that PDAL Jakarta be composed of five (5) departments, Corporate Planning Dept., New Works Dept., Water Pollution Dept., Sewerage Operation Dept., and Administration and Finance Dept. under the Board of Directors as shown in Fig. 10.1. The Board of Directors will be placed under the influence of the Board of Commissioners.

Of these five (5) departments, four (4) departments other than the Corporate Planning Dept. have already been proposed by the World Bank and under consideration by BPAL. The addition of Corporate Planning Dept. is to ensure the financial viability and financial self management of PDAL as pointed out in the foregone section 10.3.1.

The total number of personnel in the year 2010 is assumed to be 1,000. Annual personnel expense in that year is expected to reach Rp. 1,943 million based on the per capita expense of Rp. 1,943,000 at 1990 prices.

The Board of Commissioners will be composed of ten (10) members, functioning as the top most authorative link between PDAL Jakarta and DKI Jakarta Government. It will ensure that PDAL Jakarta conduct its activities conforming the broad framework of DKI Jakarta.

The Board of Directors will be staffed by ten (10) members, functioning as a decision making organ regarding the future policy and immediate conduct of business of PDAL Jakarta.

Functions of proposed five (5) departments along with their staffing requirement are shown in Fig. 10.1 and explained in details in Chapter 10 of Supporting Report.

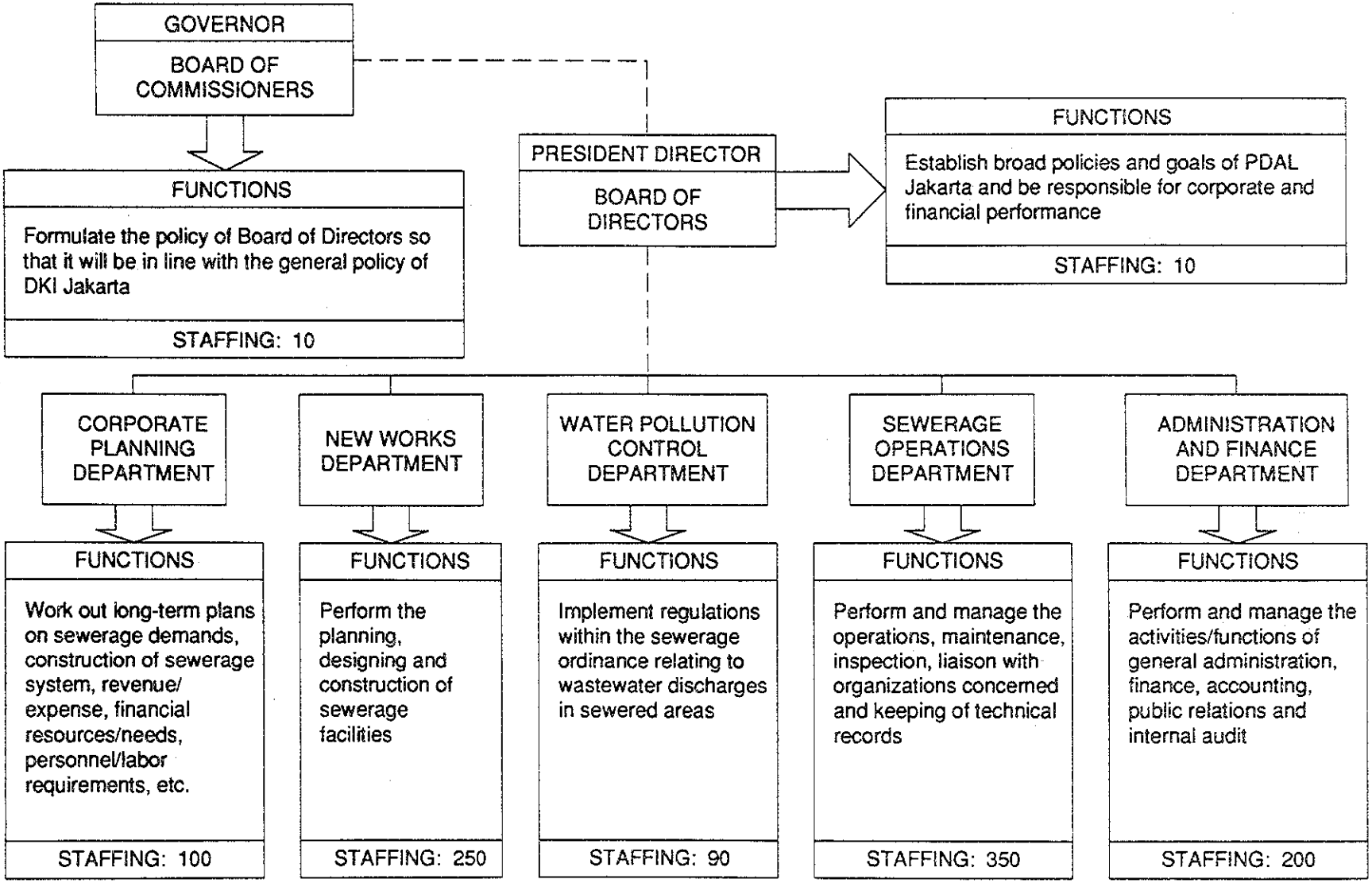


Fig. 10.1 PROPOSED ORGANIZATIONAL STRUCTURE OF PDAL JAKARTA

Chapter 11 RECOMMENDATIONS

11.1 Immediate Project Implementation

The water quality of rivers in the Project Area is aggravated due to disposal of untreated wastewater from human activities and reaches even up to a BOD level of 180 mg/l. The groundwater is also contaminated to a COD level of up to about 40 mg/l.

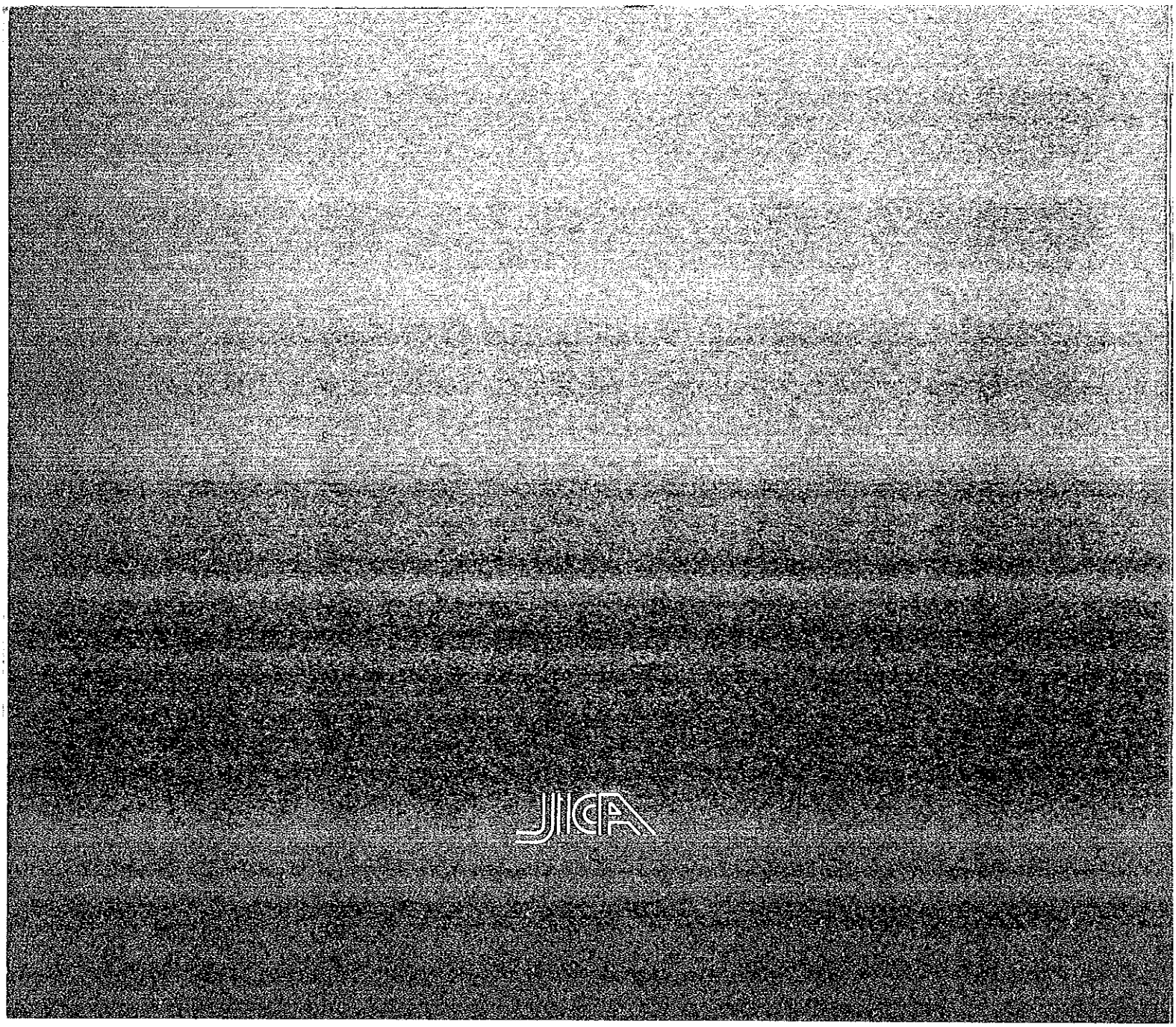
An immediate implementation of project is necessary for both the river water quality and overall sanitary improvements of the Project Area. Hence it is recommended to commence the necessary financial procurement, at the earliest.

The negotiation for procurement of foreign loan shall be completed by 1991 so that the project could be implemented on schedule from 1992.

11.2 Strengthening of PDAL Jakarta

PDAL Jakarta is recommended to be the executing agency of the Project along with that of JSSP Project by IBRD. Hence, it is necessary to strengthen the institutional and financial management of the organization so that it can take over this project implementation smoothly and to eventually become capable to conduct the feasibility studies for subsequent sewerage developments as proposed in the Master Plan.

It is also recommended by the JICA Study Team that PDAL shall conduct regular water quality monitoring of surface and groundwaters to confirm the effectiveness of sewerage on water quality improvement.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