

MALAYSIA

MASTER PLAN AND FEASIBILITY STUDY
FOR
SEWERAGE AND DRAINAGE SYSTEM PROJECT
IN
KELANG, PORT KELANG AND ITS ENVIRONS

VOLUME I SEWERAGE

SUMMARY REPORT

NOVEMBER 1982

JAPAN INTERNATIONAL COOPERATION AGENCY

SDS

82-171(1/8)

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PREFACE

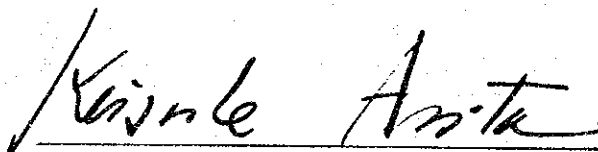
In response to a request of the Government of Malaysia, the Japanese Government decided to conduct a survey on the Sewerage and Drainage System Project in Kelang, Port Kelang and Its Environs and entrusted the survey to the Japan International Cooperation Agency (JICA). The JICA sent to Malaysia a survey team headed by Mr. Hajime Yamada of Tokyo Engineering Consultants Co., Ltd., from March to June and from September to December, 1981.

The team had discussions with the officials concerned of the Government of Malaysia and conducted a field survey in the Kelang and Port Kelang area, Selangor State, Malaysia. After the team returned to Japan, further studies were made and the present report has been prepared.

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

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

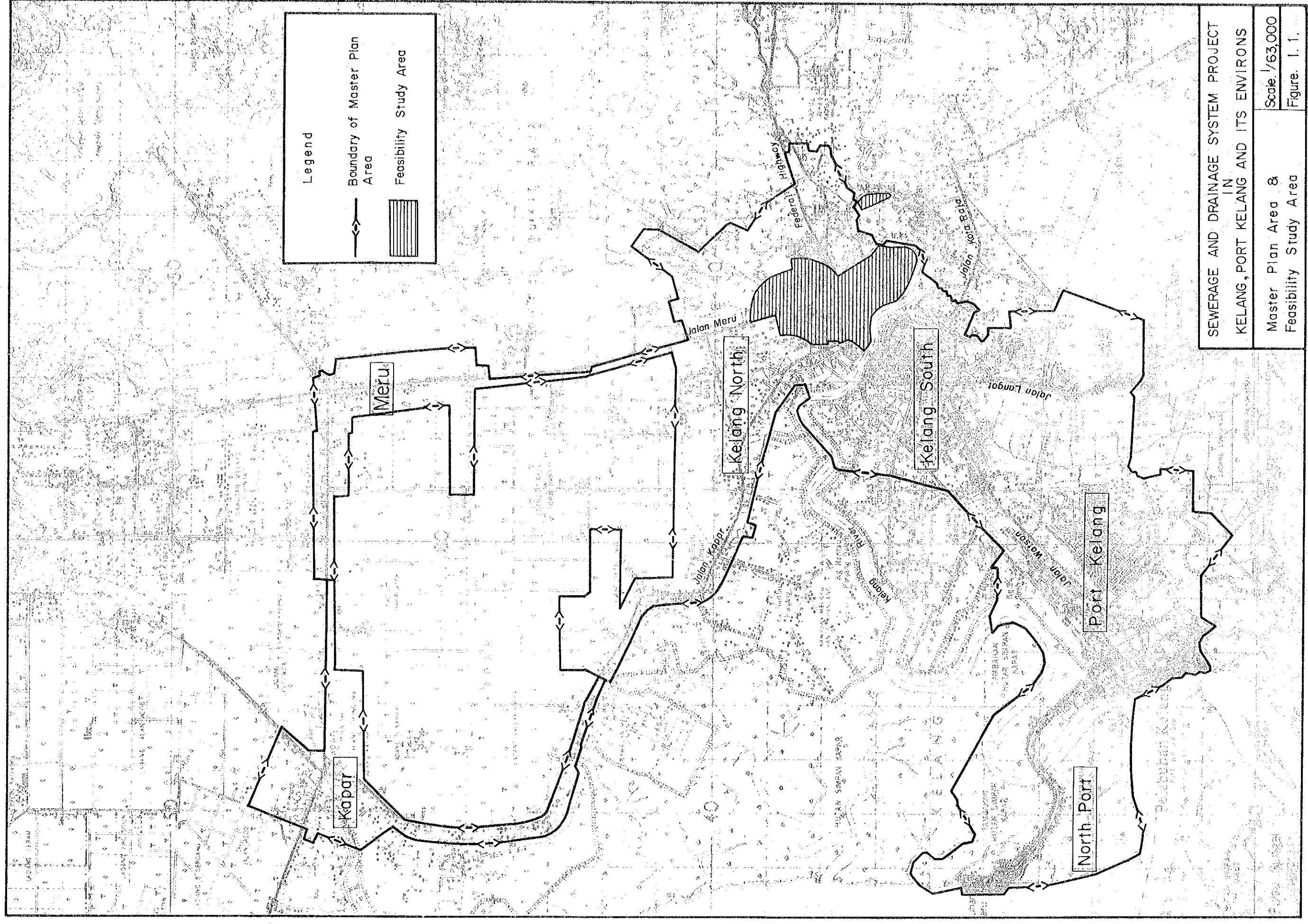
November, 1982

A handwritten signature in black ink, reading "Keisuke Arita". The signature is written in a cursive style and is positioned above a horizontal line.

Keisuke Arita

President

Japan International Cooperation Agency



Legend

Boundary of Master Plan Area

Feasibility Study Area

SEWERAGE AND DRAINAGE SYSTEM PROJECT
IN
KELANG, PORT KELANG AND ITS ENVIRONS

Master Plan Area &
Feasibility Study Area

Scale 1/63,000

Figure 1.1.

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1. Introduction

In view of the deteriorating conditions of sanitation and environmental pollution in Kelang Municipality and its environs, in the midst of its various rapidly burgeoning development, the urgent necessity for implementing the sewerage and drainage system project is self-evident.

A sanitary sewerage system *per se* for the collection and disposal of both domestic and industrial wastewater is non-existent in the modern sense of the term. What passes for it is mainly direct discharge of wastewater into open drains or watercourses from septic tanks and shops or factories. Also, the frequent floods that bring damage and disrupt the daily lives of the inhabitants are basically caused by the old and dilapidated drainage system presently serving the municipality and its outlying areas.

In order to stem this debilitating condition and provide an appropriate and modern situation in alignment with the advances being made according to the Fourth Malaysia Plan, the establishment of the sewerage system and renovation and modernization of the existing drainage system are proposed.

The proposal for the project is in the form of a Master Plan, which provides the essential groundwork for a comprehensive, long-range plan up to the year 2000. This is followed by a Feasibility Study of a carefully-selected First Priority area for appropriate investigation and analysis of the actual viability of the project. Both Master Plan and Feasibility Study are conducted separately for the sewerage and drainage systems, although the two systems have an interrelationship of working in tandem, although separately, toward the same goal of improving the environment and easing or relieving the Project Area from the losses and hardships caused by flooding.

This report represents the culmination of the Scope of Work as agreed by the governments of Malaysia and Japan, from all aspects of engineering, finance and management.

2. Sewerage Master Plan

2.1. The Project Area

The Project Area covers a total area of 7,669 ha, in which the entire Kelang Municipality and its various environs are included. Kelang Municipality, being located at the mouth of the Kelang River, which flows in an east-westerly direction into the Strait of Malacca through Selangor State, occupies a strategic position of great socio-economic importance.

The existence of the largest port in Malaysia and proximity to the federal capital of Kuala Lumpur and also to the state capital of Shah Alam contribute greatly to the growth and development of the Project Area. As a result, urbanization and industrialization are rapidly progressing in the Project Area.

The present population of the Project Area is estimated to be 205,600 (based on the 1980 Population Census). The annual growth rate during the 1970 to 1980 decade of the Kelang District is recorded as 3.7 percent, which is higher than that of West Malaysia (i.e., 2.4 percent) during the same period.

2.2. Environmental Condition

Although Kelang Municipality has not suffered from serious epidemics, the water quality in its rivers and drains has significantly deteriorated, providing possible health hazards to the public.

The Project Area is completely lacking in a sanitary sewerage system for the collection and disposal of domestic sewage and trade wastewater. Sullage from residences, effluents from septic tanks and industrial wastewater are discharged directly into open drains. This situation is progressively causing serious water pollution in watercourses throughout the Project Area.

The Environmental Quality Act of the Federal Government provides national standards to control pollutants in effluent from factories and sewerage facilities. Accordingly, several factories in the Project Area are constructing their own wastewater treatment facilities to comply with these regulations.

It is evident, however, that measures of considerably more extensive nature are necessary to improve the existing situation, resulting from the rapid urbanization and industrialization in and around the Municipality area, in order to comply with the provisions of the Act, as well as to maintain a satisfactory level of environmental sanitation as one of the major communities in the State of Selangor.

2.3. Planning Basis

Since there is no city planning or land use plan on which to base the sewerage scheme, population projection up to the year 2000 and land use plan are worked out by the Study Team. Urbanized population in 2000 is forecasted to be approximately 500,000. Considering development trends and desirable population density, the extent of the Project Area is considered insufficient to accommodate its entire urbanized population. Therefore, it is expected that about 380,000 will be residing in the Project Area, with the remaining 120,000 inhabiting the surrounding areas by the year 2000. The land use aspect of sewerage system planning is based on the expectation of huge industrial developments and numerous housing developments scattered throughout the Project Area.

Per capita wastewater flow rate is forecasted to be 260 /cap./day (based on per capita water consumption surveyed in the two residential areas in 1981 and that projected in the 1979 State Water Supply Master Plan). For industrial wastewater estimation, the unit flow rates of 56 and 34 m³/day/ha (forecasted in the Water Supply Master Plan) are used for the North Port industrial estate and other industrial estates respectively. The infiltration rate of 7 m³/day/ha is adopted, based on the condition of the Project Area and comparing values adopted in other Malaysian cities.

The quality of domestic sewage is estimated on the basis of field survey results, and BOD and SS concentration are estimated to be 200 mg/ℓ. Insufficient data mainly due to the present stage of industrialization, hinders proper evaluation of industrial wastewater. However, using data obtained from field surveys and practices in other Malaysian cities, average BOD and SS concentration in industrial wastewater are estimated to be 160 and 200 mg/ℓ respectively.

Quantities of wastewater and waste load in the year 2000 are summarized below:

Table 1. Summary of Projected Wastewater and Waste Load in the Year 2000

Source	Wastewater (m ³ /day)	BOD Load (t/day)	SS Load (t/day)
Domestic	132,000	26	26
Industrial	64,000	10	13
Infiltration	45,000	-	-
Total	241,000	36	39

Note: Figures include flows from certain small areas outside the Project Area. Industrial wastewater includes flow from the port area.

2.4. Proposed Sewerage System

The proposed sewerage system is a separate system which handles the sewage and stormwater runoff separately, based on consideration of rainfall in the Project Area and also on the cost advantage compared to a combined system.

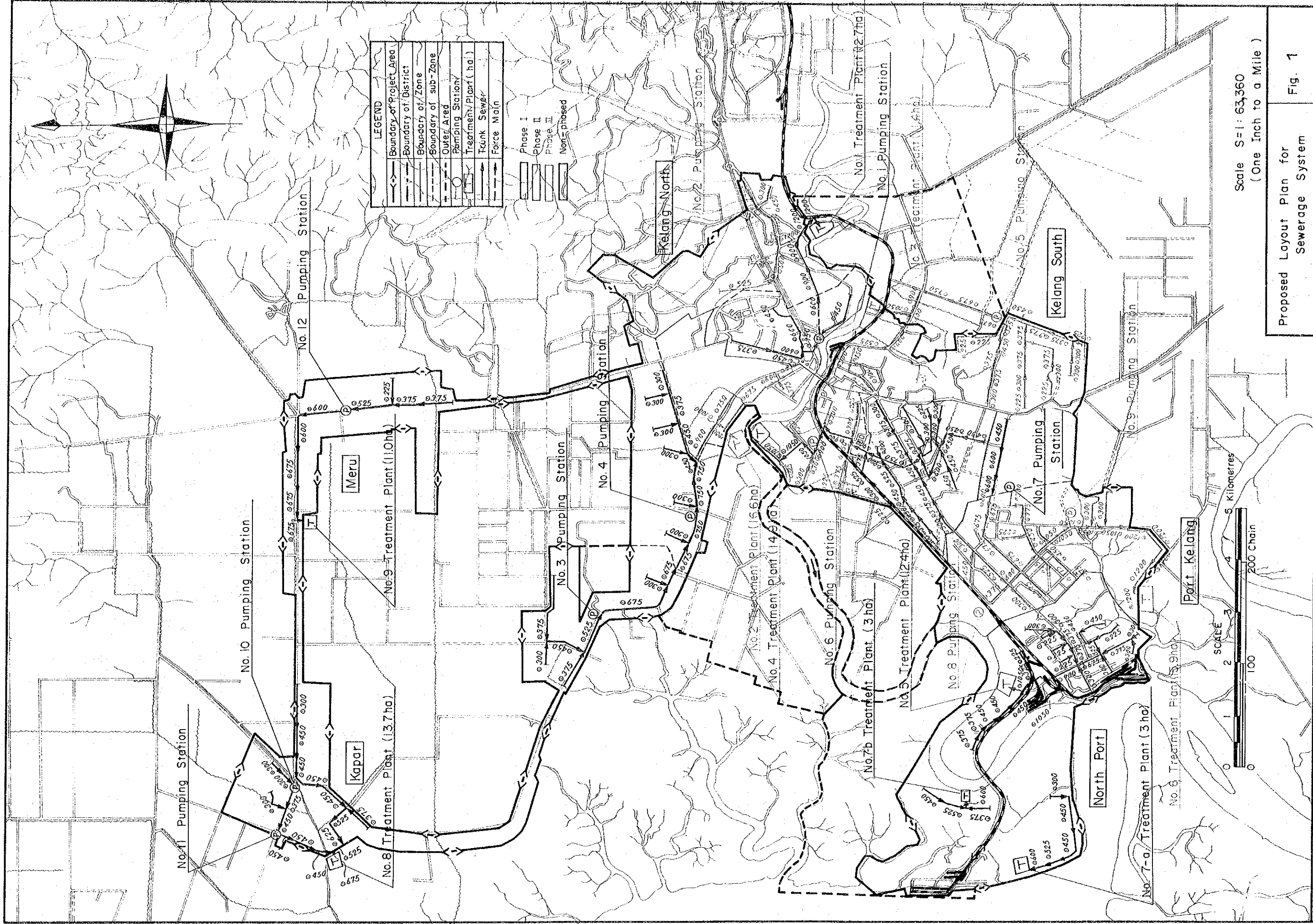
On the basis of an alternative study for a centralized system covering the entire Project Area, as proposed in the previous study report conducted by the Canadian consultants, Proctor & Redfern International, in October, 1968, a decentralized and sub-divided sewerage system is proposed for the following advantageous reasons over the centralized system:

- 1) Design of sewerage facilities suited to the respective local conditions will be possible.
- 2) Implementation of construction plan will be flexible for adjustments according to the degree of requirement and of financial resources, particularly for avoiding heavy initial investment.
- 3) Planning of rural areas, for which urbanization plan is yet to be developed, can remain flexible for future consideration.
- 4) Economical and effective treatment facilities will be provided in each zone/sub-zone, which will ensure improved pollution control over water bodies, compared with the non-treatment disposal suggested for the centralized system.

The entire Project Area is thus divided into six districts for planning purpose; namely, Kelang North, Kelang South, Port Kelang, North Port, Kapar and Meru. They are further divided into 11 zones, taking into consideration geographical, topographical and demographical conditions. Zones are further divided into 19 sub-zones for designating implementation priorities, taking into account development conditions.

The physical facilities recommended for the sewerage system include:

- 1) System of sanitary trunk, branch and lateral sewers
- 2) Pumping stations
- 3) Sewage treatment facilities



Scale S=1: 63,360
(One Inch to a Mile)

Proposed Layout Plan for Sewerage System

Fig. 1

Alternative studies of treatment processes are undertaken to determine the most effective type among the stabilization pond, aerated lagoon and oxidation ditch. Although all three are generally suitable, the stabilization pond is considered the least expensive in the case of low flow rate, whereas the aerated lagoon is the most economical for larger volume of flow. Thus, the aerated lagoon is recommended for Kelang North, Kelang South and Port Kelang districts, while the stabilization pond process is recommended in North Port, Kapar and Meru districts.

Under the Environmental Quality Regulations, factories which produce in excess of a certain amount of wastewater ($60 \text{ m}^3/\text{day}$) or BOD load (6 kg/day) are required to treat their wastewater to meet set standards before discharging into a watercourse. This should be strictly enforced and a monitoring system should also be developed in order to prevent development of hazardous pollution in the water bodies. On the other hand, wastewater of small-scale industries located in the existing developed area, which fall within the set limit will be accepted into the sewerage system.

The proposed sewerage system, showing particularly location of main facilities, is presented in the following Fig. 1.

2.5. Implementation Program

Careful consideration has been given to establish priorities for implementation of the construction program by using an arbitrary rating procedure for evaluation of each of the 19 sub-zones. The rating elements selected are as follows:

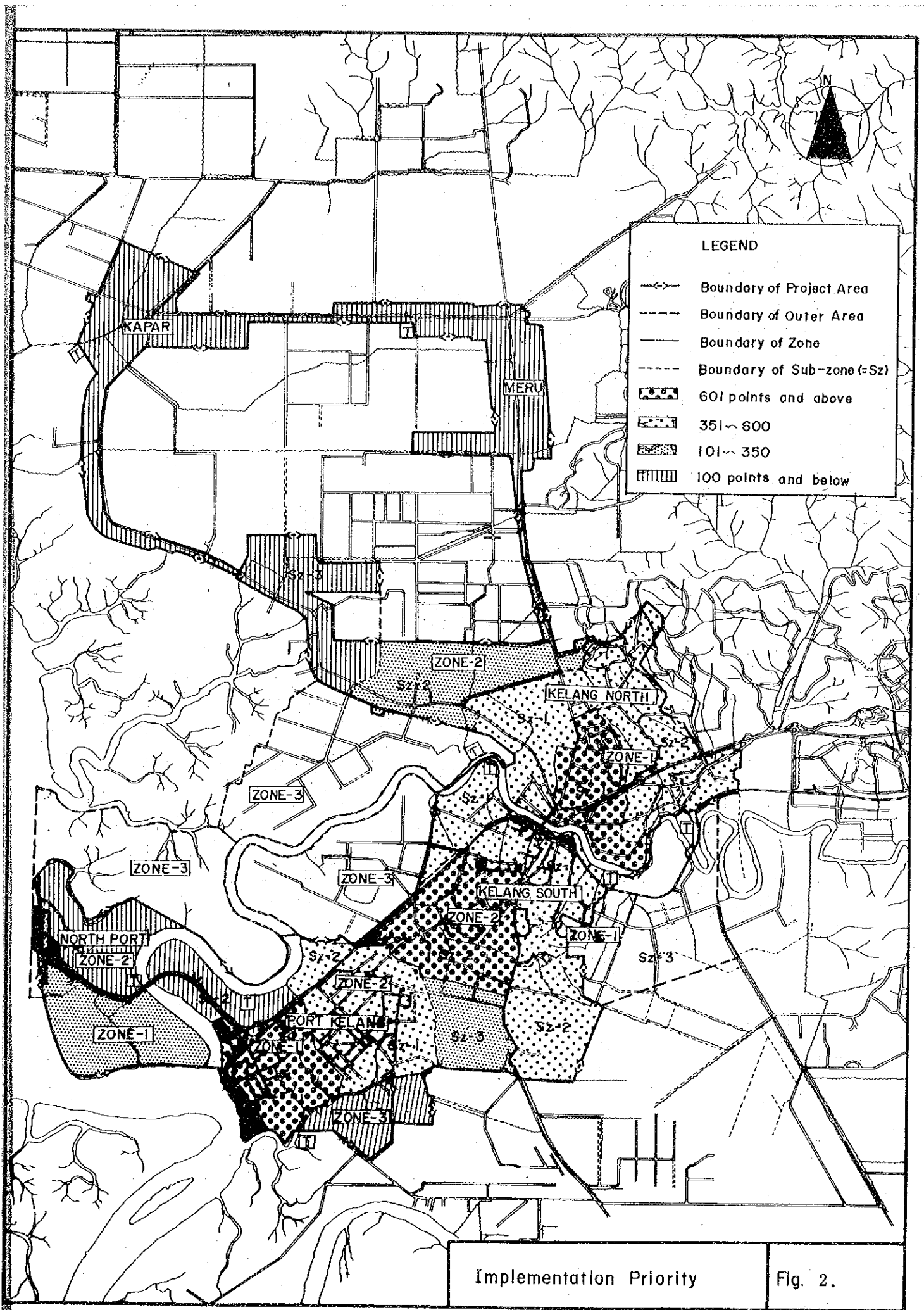
- 1) Population density
- 2) Development condition
- 3) Waste load generation
- 4) Excreta disposal system
- 5) Flood condition

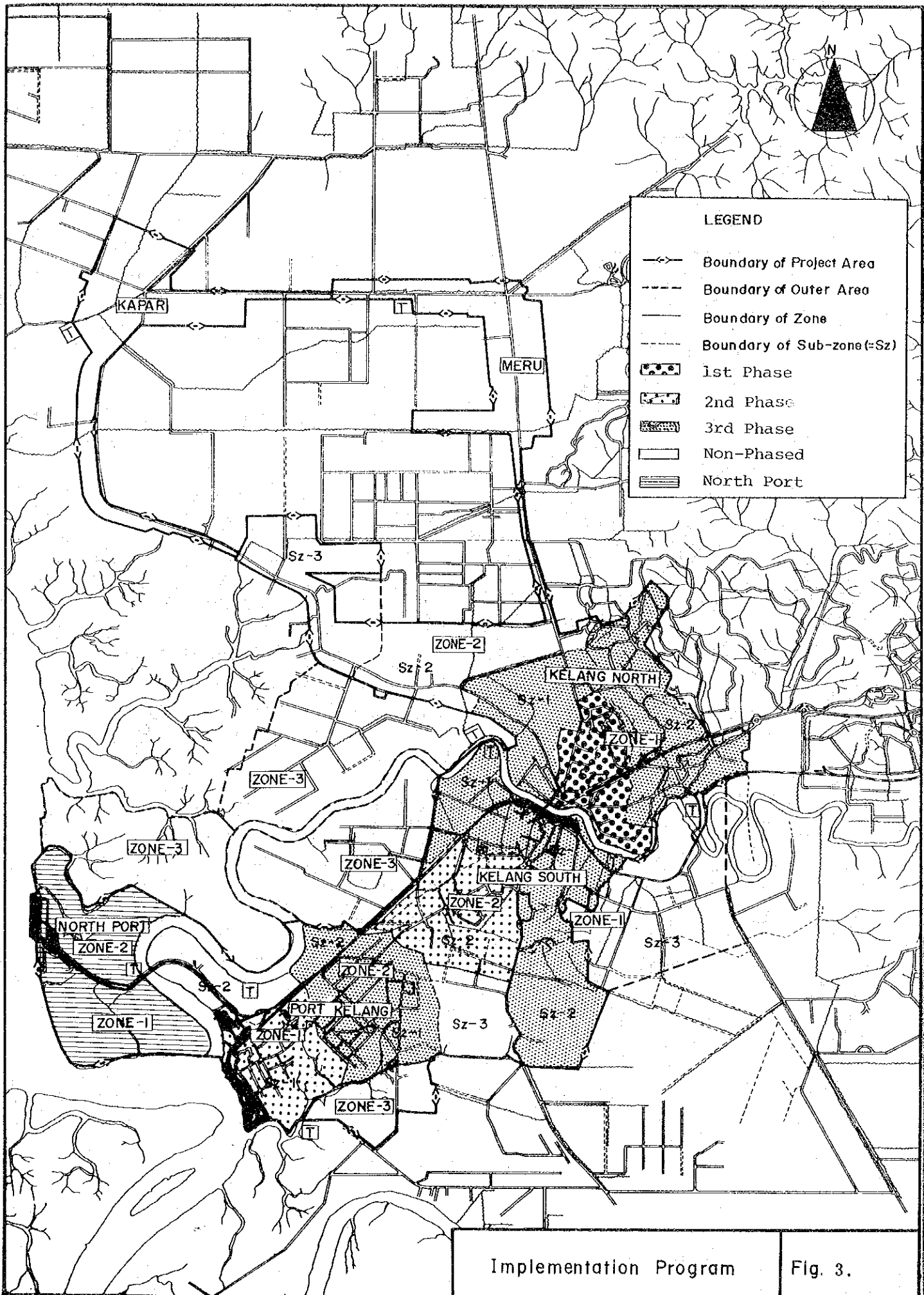
The highest ranking in total points is marked by Kelang North, Zone-1, Sub-zone-1, followed by Port Kelang, Zone-1, Sub-zone-1 and Kelang South, Zone-2, Sub-zone-2. Seven more sub-zones mark relatively high points (Fig. 2.). Taking into account the evaluated points, which indicate the relative needs of the sewerage facilities, 10 sub-zones are selected for implementation up to the year 2000 in order to provide reasonably adequate wastewater facilities for the Project Area. Construction period is provisionally divided into three phases, subject to further review for implementation on the basis of future development and the availability of financial resources, up to 1990 for the first phase, to 1995 for the second phase and 2000 for the third phase. Implementation program for the 10 sub-zones is shown in Table 2 and Fig. 3.

The remaining sub-zones are excluded from the implementation program because of relatively low rating points which mean that these sub-zones will not be fully developed by the year 2000.

Table 2. Implementation Program up to the Year 2000

Phase	Sewerage District, Zone and Sub-Zone	Area (ha)
First Phase (- 1990)	Kelang North, Z-1, S-1	338
Second Phase (1991 - 1995)	Kelang South, Z-2, S-2	512
	Port Kelang, Z-1, S-1	410
Third Phase (1996 - 2000)	Kelang North, Z-1, S-2	589
	Kelang North, Z-2, S-1	401
	Kelang South, Z-1, S-1	306
	Kelang South, Z-1, S-2	353
	Kelang South, Z-2, S-1	315
	Port Kelang, Z-2, S-1	445
	Port Kelang, Z-2, S-2	186
Total		3,855





Implementation Program

Fig. 3.

2.6. Project Cost

The total construction cost, including engineering fees, contingency cost and land acquisition cost up to 2000, is estimated to be approximately M\$327 million at 1981 price level, of which land acquisition cost is M\$20 million. Cost estimates by phases are shown in Table 3. It is assumed that all land required for the proposed sewerage system up to 2000 will be purchased within the First Phase and the local currency portion will be 70 percent of total cost.

Operation and maintenance cost is assumed to be comprised of payroll, electricity supply, repair, and administrative cost. Operation and maintenance cost in each phase is shown in Table 3. After completion of the Project, approximately M\$5.7 million at 1981 price level will be required for operation and maintenance of the sewerage system.

Table 3. Estimated Cost by Phases

(Unit: M\$ million at 1981 price level)

Phase	Construction Cost			Operation and Maintenance Cost
	L.C.	F.C.	Total	
First (- 1990)	(20.4) 46.7	11.3	(20.4) 58.0	2.0
Second (1991-1995)	54.5	23.3	77.8	5.1
Third (1996-2000)	133.5	57.2	190.7	11.6
Total	234.7	91.8	326.5	

Note: 1) L.C. means local currency portion and F.C. means foreign currency portion.

2) () indicates land acquisition cost.

2.7. Financial Plan

Financial analysis is performed for the purpose of exploring the various means of financing the sewerage project and determining reasonable charges against the beneficiaries in order to make the sewerage service viable.

The costs of the construction and operation/maintenance of the sewerage system, including debt service, are assumed to be financed by the following sources:

1) Construction Cost

The construction cost is financed by loan and grant from the Federal and/or State Government and by loan from international lending agencies.

2) Operation and Maintenance Cost, Including Debt Service

Operation and maintenance cost, including debt service, is financed by the sewerage user's charge and the property surcharge tax for the sewerage service. Contribution from MPK's general revenue can also supplement expenditures required.

Users and/or beneficiaries of the sewerage system should pay in accordance with their respective use of the system and/or accrued benefits in the form of the sewerage user's charge and the property surcharge tax for the sewerage service. The charging systems are proposed as follows.

A system of raising revenue from the direct users, based on a percentage surcharge on the water bill, is proposed. The advantages of this system are as follows:

- i) The volume of waste discharge is closely related to water consumption.
- ii) Application of established water supply billing and collection procedures provides ease of administration.

- iii) Non-payment of sewerage charge can be counteracted by mandatory cutting off of the water supply.

Also, a sewerage surcharge tax system based on rates proportionate to the currently applied property tax rate within MPK's territory, is proposed from the concept of income redistribution.

Financial alternatives are set up to determine how to cover the capital cost. These alternatives are categorized into the following two groups, with each group further divided into several alternatives according to grant conditions.

- (A) Where the foreign currency portion of the construction cost is assumed to be financed by the foreign lending agencies and the local currency portion by the Federal Government.
- (B) Where the entire construction cost is assumed to be financed by the Federal Government.

All alternatives are summarized in Table 4.

Table 4. Alternative Financial Projections for Sewerage System

(Unit: M\$1,000 at 1981 price level)

Alternative Financial Plan	Type and Source of Funds				
	Loan			Grant (For each Phase, except where otherwise noted)	
	Foreign Lending Agencies	Federal Govern- ment	Total	Federal or State Government	Remarks
A-1	91,849 (28.1%)	234,760 (71.9%)	326,609	0	(None)
A-2	91,849 (28.1%)	214,313 (65.6%)	306,162	20,447 (6.3%)	For land acquisition in 1st Phase (State Govt. grant)
A-3	91,849 (28.1%)	125,890 (38.5%)	217,739	108,870 (33.3%)	Including land acquisition in 1st Phase
A-4	91,849 (28.1%)	71,455 (21.9%)	163,304	163,305 (50.0%)	Including land acquisition in 1st Phase
A-5	91,849 (21.8%)	93,003 (28.5%)	184,852	141,758 (43.4%)	Differs for each phases as follows: 1st: (6.3%) for land acqui- sition (from State Govt. grant) 2nd: (33.3%) 3rd: (50.0%)
B-1	0	326,609 (100.0%)	326,609	0	(None)
B-2	0	306,162 (100.0%)	306,162	20,447 (6.3%)	For land acquisition in 1st Phase (State Govt. grant)
B-3	0	217,739 (66.7%)	217,739	108,870 (33.3%)	Including land acquisition in 1st Phase
B-4	0	163,304 (50.0%)	163,304	163,305 (50.0%)	Including land acquisition in 1st Phase
B-5	0	184,852 (56.6%)	184,852	141,758 (43.4%)	Differs for each phases as follows: 1st: (6.3%) for land acqui- sition (from State Govt. grant) 2nd: (33.3%) 3rd: (50.0%)

Note: 1. () indicates the percentage proportion of the total consruc-
tion cost.

2. All alternatives propose acquisition of land required up to the
Year 2000 in the 1st Phase.

In order to find viable financial plans in each alternative, financial statements are calculated based on the various combinations of the sewerage surcharge rate and the property surcharge tax rate. The feasibility of the financial plan is judged from the following conditions:

- 1) The sewerage surcharge tax rate is within 100 percent of the water bill, according to the ability-to-pay.
- 2) The sewerage surcharge tax rate is within 5 percent of the property assessment value, according to the Local Government Act, 1976.
- 3) The amount of MPK's contribution is within M\$20 million up to 2005, according to the size of MPK's current general revenues.

The financial analysis clearly indicates the necessity of some amount of grant for the sewerage construction because these alternatives which are not provided any grant are not viable. However, it is not expected that a large amount of grant by the Federal and/or State government will be provided to the local governments in the near future.

Therefore, Alternative A-5, with 70 percent of the sewerage surcharge rate on water bill and 4 percent of sewerage surcharge tax rate, is proposed as the most viable financial plan from the viewpoint of the necessity of providing and gradually increasing the grant, as follows:

First Phase -- grant for acquisition of total land required up to 2000

Second Phase -- grant for one-third of the construction cost

Third Phase -- grant for half of the construction cost

In this alternative, MPK should compensate the deficit (about M\$15 million up to 2005) derived from the sewerage services. Alternative A-5 is summarized as follows:

Alternative A-5

Foreign Loan (M\$ million)	Federal/State Gov. (M\$ million)		Sewerage Surcharge Rate on Water Bill (%)	Property Surcharge Tax Rate (%)	MPK's Contribution (M\$ million)
	Loan	Grant			
92	93	142	70	4	15

2.8. Institutional Organization and Legal Aspect

The Engineering Department of Kelang Municipality was expanded to conduct a feasibility study for the sewerage and drainage systems under the Sewer and Drain Section, indicating MPK's intention of undertaking the sewerage and drainage activities, based on Local Government Act, 1976. However, the existing Sewer and Drain Section is engaged in Work Shop duties as well as the numerous small projects including sewerage and drainage. Therefore, it is proposed that the Sewer and Drain Section of the Engineering Department separate the duties for the Work Shop and devote itself to sewerage and drainage activities. This approach provides the advantage of minimizing initial cost and effort.

In order to carry out the sewerage and drainage activities, the following reorganization of the Sewer and Drain Section is proposed: Three units: 1) Design Unit, 2) Construction Unit, and 3) Operation and Maintenance Unit should be set up. Also, an Accounting Unit for the sewerage service should be set up in the Treasury.

The staffing estimates total 11 in the initial year of 1983, 26 in 1990 at the end of the First Phase, and 28 in 1995 at completion of the Second Stage program and thereafter for operating and maintaining the sewerage system.

A training program should be considered for those recruited in order to raise their level of qualification/experience for satisfactory per-

formance of their assignment. However, at present, there is no organization for training sewerage engineers and other related personnel in Malaysia. Due to the importance and urgent necessity of providing efficient sewerage service, it is recommended that a training organization be set up in Malaysia as soon as possible under the leadership of the Local Government Division, Ministry of Housing and Local Government, which is responsible for carrying out urban engineering activities, inclusive of sewerage and sanitation. For this purpose, the following are recommended:

- (a) On-the-job training program will be arranged with foreign engineering consultants for training sewerage engineers and other related technical staff during the period when consulting services are provided in planning, designing and construction supervision, including procurement procedure, etc.
- (b) In particular, plant operators will be sent for an agreed period of time to receive training at existing plants elsewhere in Malaysia, where technical knowhow and accumulated experience on sewerage operation and management have been gained.

Concerning legal aspects of the project implementation, a review of The Local Government Act (1976), The Street, Drainage and Building Act (1974), Town and Country Planning Act (1974), and Environmental Quality Act (1974) and interviews with relevant officials, both in Federal and State agencies, confirm that there are no legal problems in implementing the sewerage projects under the existing laws and regulations.

2.9. Project Evaluation

Provision of the sewerage system is expected to substantially benefit the served population directly, which includes those of households, factories, shops and institutions. There will also be significant indirect benefits, such as the improvement of the general environment which will affect even those who are not served by the system directly.

The following benefits are quantified:

1) Environmental Improvement

Total estimated BOD load of about 36 t/day can be reduced by the year 2000 to about 12 t/day (a reduction of 66 percent) by the sewerage system. Through provision of the sewerage system, effluent BOD concentration can be lowered sufficiently by modification of treatment facilities to meet a more stringent environmental requirement as envisioned in the future.

2) Sanitation and Health

Presently within the Study Area, 23 percent of the households still use the bucket system and/or pit privies. The benefit from the proposed sewerage system will be the savings of the cost required for desludging the septic tanks and for the bucket system collection of night soil from the households. These savings are presented in Table 5 below.

Table 5. Amount of Reduced Expenditure from Elimination of Septic Tank and Bucket System

(Unit: M\$1,000)

	1990 - 1995	1996 - 2000
Septic Tank	328	545
Bucket System	491	1,350
Total	817	1,895

Due to the rapid socio-economic development in Malaysia, the mean monthly household income of the lowest income group, comprising 40 percent of the population, increased from M\$76 in 1970 to M\$186 in 1979, according to the Fourth Malaysia Plan. This represents a rise of 145 percent, compared with the 66 percent increase in consumer price index.

As income increases, the civil minimization level becomes higher. Considering that provision of sewerage service is recognized internationally as a form of civil minimization service, with income level in Malaysia becoming increasingly higher, the desirability for sewerage service is expected to increase and come to be considered necessary.

The field survey for the sewerage system in the Project Area shows a high level of willingness-to-pay by the residents, compared with their ability-to-pay, which indicates the residents' strong desire for the sewerage service. Therefore, the construction of the sewerage system is considered to be justified.

2.10. Interim Measures

Implementation of practical yet effective interim measures is considered necessary, since immediate improvement of the environmental condition is desired, pending completion of sewerage system in the Project Area.

Taking into account the major causes of pollution, the following interim measures are proposed:

- 1) Intensification of desludging from septic tanks by MPK.
- 2) Modification of existing night soil disposal facilities to a digestion tank system or joint treatment at a wastewater treatment plant.
- 3) Installation of pour flush toilet system in rural areas.
- 4) Installation of sedimentation tanks at public markets.
- 5) Installation of oil separator tanks at gas stations.
- 6) Installation of sedimentation tanks at poultry processing houses.
- 7) Installation of sewerage system with temporary treatment facilities in new housing developments.

3. Sewerage Feasibility Study

3.1. Study Area

The Feasibility Study Area of 338 ha, which is included within the Kelang Municipality boundary and is located in the Kelang North District, forms approximately 35 percent of Sewerage Zone-1.

The Study Area is one of the most developed and densely inhabited areas in the Kelang Municipality, comprising mostly residential and commercial areas. Various housing and commercial developments are now underway so that the Area is expected to be fully developed in the near future. However, no industrial development is expected in the Area.

The present population in the Study Area, estimated at 20,000 in 1980, is expected to increase to 36,000 by the year 2000.

3.2. Proposed Sewerage Facilities

Sewerage facilities proposed in the First Phase program consist of the following:

- 1) Trunk Sewers (diameter 375 - 1,200 mm, total length 6,660 m)
- 2) Branch and Lateral Sewers (diameter 225 - 375 mm, total length 56,985 m)
- 3) Kg. Kuantan Intermediate Pumping Station
- 4) Connaught Wastewater Treatment Plant, including three series of stabilization ponds

3.3. Implementation Schedule

One of the first steps to be taken in the First Phase program will be acquisition of land for the intermediate pumping station at Kg. Kuantan and wastewater treatment plant near Connaught bridge. The work schedule of the program shown in Table 6. includes preparatory works of detailed design, tender documentation and contract awards.

Actual construction work of the sewerage facilities are expected to start in 1985 and be completed by 1990 within the six-year period. Connaught wastewater treatment plant will be in operation in 1989; therefore, enabling services to begin in 1989, one year prior to completion of the construction work.

3.4. Cost for the First Phase

The cost of the First Phase program is estimated to be approximately M\$41 million at 1981 price level, and M\$56 million at the escalated price (annual escalation rate of 6.5 percent estimated in the Fourth Malaysia Plan), of which 70 percent (M\$38 million) is local currency portion and 30 percent (M\$18 million) represents the foreign currency, as shown in Table 7. The total cost of the Project includes costs for land acquisition, engineering service, construction, and 10 percent contingency allowance.

The estimated annual operation and maintenance cost is based on requirements for labor, electricity and repair, with the same escalation rate. In 1990, about M\$1 million will be required annually for full operation of the proposed sewerage system, as shown in Table 7.

Table 6. First Phase Implementation Schedule

Item	First Phase Program							
	1983	1984	1985	1986	1987	1988	1989	1990
I Preparatory Works								
Land Acquisition		////						
Detailed Design	////							
Tender Documents		///						
Tender Invitation, Evaluation and Contract Award		///						
II Sewer Collection System								
1) Trunk Sewers			////	////				
2) Branch and Lateral Sewers								
Unit-1 (56 ha)					////			
Unit-2 (59 ha)						////		
Unit-3 (86 ha)				////				
Unit-4 (56 ha)			////					
Unit-5 (81 ha)							////	
3) Kg. Kuantan Pumping Station								
Civil Works					////			
Mech. & Electrical Works						////		
III Connaught WTP								
Civil Works				////	////			
Architectural Works						////		
Mech. & Electrical Works						////		

Table 7. Estimated Cost for the First Phase

(Unit: M\$1,000)

Year	Construction Cost			Operation and Maintenance Cost	Total
	L.C.	F.C.	Sub-total		
1983	2,558	1,119	3,677	171	3,848
1984	4,146 (24,699)*	-	4,146	183	4,329
1985	6,546	3,376	9,922	233	10,155
1986	10,446	5,490	15,936	249	16,185
1987	8,566	3,128	11,694	288	11,982
1988	4,354	4,103	8,457	457	8,914
1989	688	164	852	930	1,782
1990	721	555	1,276	1,028	2,304
1991	-	-	-	1,131	1,131
1992	-	-	-	1,239	1,239
1993	-	-	-	1,326	1,326
1994	-	-	-	1,426	1,426
1995	-	-	-	1,528	1,528
Total	38,025 (58,578)*	17,935	55,960		

Note: L.C. represents local currency portion and F.C. represents foreign currency portion.

() * Cost in case total land required up to 2000 is purchased in the First Phase.

3.5. Financial Plan

According to the study of financial planning in the Master Plan Report, financial projections are developed on the following basis:

- 1) The initial investment for the First Phase work must be financed by loan, to be provided most likely by the Federal Government and/or international lending agencies.
- 2) The required revenue for the operation and maintenance of the sewerage system should be raised through appropriate charges (sewerage surcharge rate on the water bill and property surcharge tax rate) against those who will benefit from its service.

This financial plan differs from that for the Master Plan as follows:

- 1) The annual price rate of 6.5 percent is considered for the cost of construction and operation and maintenance.
- 2) Financial plans in which the construction cost includes only the land acquisition cost required in the First Phase are also examined.
- 3) The three cases of interest rate; i.e., 10, 12 and 5.75 percent, are examined as the loan conditions from multilateral and bilateral lending agencies.

Various financial projections were made under the above basis, in order to determine the most viable financing schedule, taking into consideration loan conditions, sewerage surcharge rate, surcharge tax rate, price escalation rate and extent of financial burden on MPK.

The following alternatives are set up to determine how to cover the capital cost, as explored in the Master Plan. These alternatives are categorized into the following two groups, with each group further divided into several alternatives according to grant conditions.

- (A) Where the foreign currency portion of the construction cost is assumed to be financed by the foreign lending agencies and the local currency portion by the Federal Government.
- (B) Where the entire construction cost is assumed to be financed by the Federal Government.

All alternatives are summarized in Table 8.

Table 8. Alternative Financial Projections for Sewerage System Feasibility Study

(Unit: M\$1,000)

Alter- na- tive	Fund Source			Interest Rate of Foreign Loan (%)	Remarks
	Loan		Grant		
	Foreign Lending Agencies	Federal Govern- ment	State Govern- ment		
A-1	16,816	39,144	0	10	Including land cost required up to 2000
A-2	16,816	59,697	0	10	
A-3	16,816	34,998	4,146	10	
A-4	16,816	39,144	0	12	
A-5	16,816	34,998	4,146	12	
A-6	16,816	39,144	0	5.75	
A-7	16,816	34,998	4,146	5.75	
B-1	0	55,960	0	--	Including land cost required up to 2000
B-2	0	76,513	0	--	
B-3	0	51,814	4,146	--	

In order to develop viable financial plans for each alternative, financial statements are prepared, based on various sewerage surcharge rates and property surcharge tax rates.

Based on the criteria of the sewerage surcharge rate on the water bill within 100 percent, the sewerage surcharge tax rate within 5 percent, and the amount of MPK's contribution within M\$5 million up to 1995, viable financial plans for each alternative can be selected.

According to the recommended financial plan for the proposed sewerage system in the Master Plan, some amount of grant should be supplied to MPK. In the First Phase period, a grant for the land acquisition cost is recommended since land never depreciates and continues to be useful into the future.

Judging from this point and the softer loan conditions from the international lending agencies, Alternative A-3 (with 70 percent sewerage surcharge rate and 3 percent property surcharge tax rate) is proposed. In this alternative, MPK should compensate the deficit (M\$2.6 million up to 1995) derived from sewerage activities. Alternative A-3 is summarized as follows:

Alternative A-3

Foreign Loan (M\$1,000)	Federal/State Gov. (M\$1,000)		Sewerage Surcharge Rate on Water Bill (%)	Property Surcharge Tax Rate (%)	MPK's Contribution (M\$1,000)
	Loan	Grant			
16,816	34,998	4,146	70	3	2,586

4. Conclusions and Recommendations

- (1) In the light of existing conditions and rapid development taking place, the urgent necessity for provision of a modern sewerage system to serve the entire Project Area is recognized.
- (2) Based on technical considerations and financial analysis, the sewerage project is considered to be both feasible and viable.
- (3) The overall capital cost of implementing the proposed Master Plan up to the year 2000 is about M\$327 million, which will provide sewerage services to about 300,000 people. All commercial and industrial premises, except those in North Port District, will also be served in the sewered areas.
- (4) Proposed sewerage system should be a separate system, which deals with wastewater and stormwater runoff separately.
- (5) A decentralized sub-divided sewerage system is proposed; consequently, ten (10) wastewater treatment plants are proposed of which six (6) plants should be constructed by the year 2000.
- (6) For wastewater treatment method, adoption of the stabilization pond and aerated lagoon is proposed. Land required for treatment plants should be acquired as soon as possible.
- (7) Implementation of the Project is divided into three phases up to the year 2000; i.e., first phase up to 1990, second up to 1995 and third up to 2000.
- (8) The area selected for the First Phase is Kelang North Zone-1, Sub-zone-1, for which Feasibility Study was conducted.
- (9) Implementation program for the Second and Third phases should be reviewed later for adjustments and/or changes to adapt to changes in development conditions.

- (10) For the overall Master Plan period, a grant for construction of the sewerage system is proposed to be provided and gradually increased by the Federal and/or State Government as follows:

First Phase -- grant for acquisition of total land required
up to 2000

Second Phase -- grant for one-third of the construction cost

Third Phase -- grant for half of the construction cost

The basic financial plan proposes a 70 percent sewerage surcharge rate on the water bill and 4 percent property surcharge tax rate. However, revision of these charging rates will be required phase by phase, since it is a long range plan.

- (11) For the Feasibility Study period, a grant for the land acquisition cost is proposed to be provided by the State Government. A more detailed financial plan, confined to the facilities constructed in the First Phase, proposes a 70 percent sewerage surcharge rate on the water bill and 3 percent property surcharge tax rate.
- (12) Enlargement of the existing Sewer and Drain Section of the Engineering Department is proposed. The number of required staff (excluding laborers) is 11 in 1983, 26 in 1990, and 28 in 1995 up to the year 2000.
- (13) The Local Government Division the Ministry of Housing and Local Government, is recommended to take leadership in setting up a training program for sewerage engineers in Malaysia.

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