3.3 Estimation of Economy and Finance

3.3.1 Basic economic projection

In pursuance of the government's firm decision to set forth the national development objectives under REPELITA VI (1994/95-1998/99) - Growth, Equity, and Stability - at an accelerated speed, further integrated effort for the government to manage macroeconomy and the sector development policies are called for. The Indonesian economy could be, in principle, robust backed up by the upturn of domestic demand, recent improvement in oil price, a buoyant export sector, spurring recovery in industrial supply, and resultant growth in GDP. Policy dialogues between the government and international lending organizations/bi-lateral aid agencies and associated external support in various forms will further assist the government in promoting policies which aim at fostering the creation of a competitive and efficient economy.

In the light of the past and the current economic performance while keeping the necessary condition for the Indonesian economy to absorb its growing labor force at higher levels of productivity and income in view, the World Bank macroeconomic model (Revised Minimum Standard Model - RMSM) projected the consistent GDP growth path of 5.8 percent and 6.2 percent for the periods of 1990-2000 and 2000-2010, respectively[1]. In compliance with this projection, subject to an external balance and a domestic savings constraints, the economic sizes of the country and the regions concerned in the years of 2005 and 2015 would be as follows

Basic Economic Projection: GDP, GRPs in 2005 and 2015 (Rp. billion)

	1990	1992	1993	2000	2005	2015
GDP	197,721	224,260	302,018	448,159	605,417	1,1048,841
GRP, Sul-Sel	4,241	4,810	6,071	9,008	12,169	22,207
GRP, KMUP	902	1,023	1,339	1,987	2,684	4,898

Source: *Biro Statistik Pusat, Sulsel, KMUP, 1993*

3.3.2 Available and affordable funds

During the field surveys which took place in 1994 and 1994, the Study Team undertook the interview surveys to the residents and the managers of business undertakings/public entities in the city regarding their income level and willingness

to pay for the urban sanitation subsectors concerned. Against the background data obtained, the estimates have been figured out as follows.

(1) Average income and revenue

The weighted average annual incomes for households and institutions have been estimated at Rp.3,034,000[2], or equivalent to about $1,300 with 5.5 family members per household being assumed, and Rp.118,671,000, or about $52,740 as per 1995 price[3]. It would be noteworthy that a household with 2 workers at the minimum wage level in Ujung Pandang could earn Rp.1,934,400, or about two thirds of average households, per year with Rp.3,100 per day. In Jakarta, minimum wage is Rp.4,600 per day, or a little less than 50 percent higher than that in Ujung Pandang.[4] Income distribution in KMUP is shown in *Fig.* 3.9.

Perception of Lurahs on the weighted average household income in their Kechamatan was 7.9 percent lower than that of the residents with the estimate standing at Rp.2,811,000 as per 1995 price.

The maximum amount of willingness to pay for the public solid waste management service has been revealed in terms of the percentage of their income as such that 59 percent of households would pay for the tariff with not more than 2 percent of their household income. Among the institution interviewees, a majority share of a half of the statistical population (cohort) responded "as regulated by the government" irrespective of the amount they are charged while other 20 percent responded with "less than one percent".

As for the sewerage service, the outcome was somewhat obscure with no statistical significance having been confirmed. Nonetheless, 55 percent of households and 31 percent of institutions revealed their preference for enjoying the public sector service concerned in exchange of less than 1-2 percent of incomes.

(2) Estimated Willingness to Pay

In theory, the above "bid prices" preferably revealed by the individuals, households or business entities in the City reveal their maximum amount to pay for the services concerned, with an assumption that people make decisions on how much they allocate their scarce resource under their specific constraints and preference. Provided that the weighted average of income levels of household and institutions are profoundly believed at about

Rp.3 million and Rp.120million, respectively, and further, the willingness to pay parameter for sewerage and solid waste together stands at 2.5 percent for each of the category of beneficiaries, *the maximum likeliness of residents to willingly pay* for the public sanitation services at their required quality and quantity will be Rp.75,000 per annum, or Rp.6,250 per month in average, and Rp.3,000,000 per annum, or Rp.250,000 per month in average for households and business/public entities, respectively. It would be noted that the Project proposed in the Study will create the environment where the city residents could be better off with the new facilities and management, thereby leading to an upward shift in people's utility level (satisfaction) and their "bidding" price for the incremental benefits and value to the maximum extent possible at somewhere around 4.0 percent of their income, inter alia, Rp.120,000 per annum, or Rp.10,000 per month and Rp.4,800,000 per annum, or Rp.400,000 per month for households and entities, respectively.

Part of an affordability analysis, the past experiences of the international lending institutions in the sector investments concerned have been reviewed, where it's been found acceptable for low-income groups (20th - 40th percentile income groups) to spend about 1-3 percent of income in sanitation[5].

(3) Available fund

1) Methodology

As previously noted in 2.2.7 concerning the sector policy and investment, Indonesia faces a serious resource crunch with the sanitation subsectors concerned in particular. At issue in this financial position is that how much of funds be possibly mobilized from the public and the private sectors during the target period up to 2015 in preparation of the prospective urban subsector projects. At the outset, it may be instructive to point out that the focus on the methodological issue herein is initially confined to the "micro" approach pertaining to the disaggregated funding sources by possible donors, vis-à-vis, the central government, external assistance, the provincial government, the local government and the beneficiaries of the prospective projects. The current expenditures by the central government and beneficiaries in the service catchment areas are the basis of the estimates on which the anticipated grants and contributions emanated from these subcategorical fund sources are extrapolated in line with the

hypothetical benchmarks and parameters and further summated to reach the total available fund for the project. It would be noted that the latter part of the estimation herein is in economics sense a "macro" approach such that the fund projection is linked to the intuitive macroeconomic parameters, inter alia, growth of national/regional value added, city population, and benchmarked fund allocation targets to the sectors. This involves making explicit assumption regarding unit supply elasticity of funds available for the sanitation subsectors in the city with regard to these indicators.

Alternatively, a number of other macroeconomic techniques like econometric approach, trend analysis had been considered to rigorously estimate the funds most likely allocated to the subsectors concerned. Of these, a simple macro econometric model relating annual growth of funds available to GDP (at the margin) had been considered appropriate in connection with analogy to the electricity demand forecasting. Nonetheless, the estimates of GDP elasticity of supply of public/private funds for the public services concerned did not fall on the upward sloping linear nor curvilinear supply schedule, and hence, no clear quantitative correlation between the variables have been confirmed. Other hypothetically relevant independent, or explanatory variables such as income level or economic prices of alternative services could not be confirmed given the problems arising from the scarce availability of and non-consistency in data.

2) Framework for estimation

The following financial framework readily presents the possible fund raised for the City of Ujung Pandang for which the lack of affordable credit is considered to be one of the serious constraints to upgrade the urban sanitation services. A summarized financial assumptions and model configurations are forwarded as follows:

(i) Key socio-economic indicators

Real GD/GRP growth per annum	5.5 percent in average
City economy	0.4 and 22.1 percents of the national and provincial economy, respectively
Weighted average household income	Rp.3,034,000 per annum
Annual population growth	3.56 percent in average

(ii) Elasticity

Unit elasticity of fund supply with regard to real GDP growth

(iii) Sources of funds

The two interrelated sectors in economy are considered such that the public sector denotes funds from any governmental bodies (APBN, INPRES, DIPs, APBD I and II) and the private sector funds from beneficiaries in the service areas (Willingness to Pay, Beneficiaries' contribution and Capital works charge). Foreign aid funds are implicitly included in the state fund in the form of sub-loan, equity investment and grant to the local government/prospective executing agencies. Presumably, no external private funds in conjunction with any private sector partnership projects are in sight for the analysis.

(iv) Investment outlays

The investment outlays in the sanitation subsectors concerned commence in 1996 with benefits attributable to the preceding activities in the following year. Meanwhile, the investment in the off-site sewerage system may set forth later years.

(v) Private sector participation

As partly noted in (iii) above, a kind of surcharge, namely, *beneficiaries contribution* and *capital works charge* are requested to the direct beneficiaries of the Project in support of self-reliant and financially sound management of the sewerage service undertaking in the city.

The detailed model configuration and indicative parameters used are given in the Supporting Report.

3) Available fund

In line with the model configuration and indicative parameters as articulated in the Supporting Report, the total *funds available* for the sanitation subsectors in KMUP within the time-slice of 20 years, will be Rp. 237.7 billion (equivalent to $105.6 million as per 1995 price) up to the year 2005, of which about 65 percent of funds (62.8%) emanates from the public sector. In addition, Rp. 663.5 billion ($308.6 million) from the year 2006 up to the year 2015 would arise

from the both of the public and the private sectors, totaling the funds Rp. 728.6 billion ($323.8 million) at maximum.

(4) Affordable fund and indicative financing plan

In anticipation of KMUP further commitment to urban environmental management at a higher level, the need for external financing at an early point in time is pressing. In carrying out a further analysis to give hands with whatever the city administration might require to commission the preparation of the prospective urban sanitation project(s) in 1996, *fund affordable* for the city government and the project as well is estimated in lieu of the available funds above. In view of nature of the fund estimated in due course of analysis, the subsequent financing model and the estimate will present an indicative measurement of loan credibility and budget for the prospective project(s) confining to the limited size, design and procurement. In facilitating the perusal of the analysis herein, the estimates are categorized in a two by two (2 x 2) matrix with the variables of (i) with/without grant, and (ii) loan fund from multi/bi lateral agency. The model configuration and assumptions will be set out to draw the indicative funds affordable for the Project as follows:

1) Model configuration, tool and parameters

Loan credibility (how much you can borrow now for your future income?) and the prospective budget size of the Project will be estimated with the available funds accruable to capital contribution from the public and the private sectors involved over the 10-year period of project implementation.

(i) Financial terms

Loans from international lending institutions assume 20 years of repayment including 5 years of grace period, at the Banks' standard variable interest rate. As for ADB, the current variable interest rate from OCR is set at 6.59%. Japan's financial aide agency assumes 30 years of repayment inclusive of 10 years of grace at the interest rate 2.6%. For both of the agencies, annuity payments will be made twice a year, at the end of the second and fourth quarter. Interest will be payable on the diminishing balance of the outstanding principal. Consequently, interest costs will decrease proportionately as principal is amortized.

Government loan facilities such as Subsidiary Loan Agreement (SLA) or Regional Development Account (RDA) under the US aid agency assume 20 years of repayment including 5 - 6 years of grace period with interest rate at 11.5%[6]. Annuity payments will be made twice a year, at the end of the second and fourth quarter.

(ii) A present factor of annuity factor (a reciprocal of Capital Recovery Factor)

$$a(i,n) = \frac{(1+i)^n - 1}{i(1+i)^n}$$

where i : annual interest rate, n: repayment period

(iii) Equity-Loan-Grant mix

As indicated by *BAPPENAS*, investment requirements of the proposed project(s) will be financed by fiscal transfers from both the central and provincial governments and by loans to the municipality level government unit(s). Proceeds of foreign loan will be split into two components, vis-à-vis, around 65 percent on lent from the central government to the undertaking(s) and the remaining 35 percent grant[7].

While there would be a number of external funds available for the city if the opportunity arises, it is envisaged that the loan proceeds of the external aid agency would most likely to be onlent to the city from the central government in the form of SLA, inter alia, with 20 years of repayment including 5-6 years of grace and 11.5 percent of interest rate. In addition, interest accrued to the disbursements during construction period (IDC) will be capitalized, thereby bearing no obligation of debt service during the initial stage of the Project(s). The current lending conditions of international lending institutions (multi-lateral agencies), such as World Bank, Asian Development Bank and others, also assume this IDC capitalization clause.

2) Affordable fund estimate

In the context of the foregoing, and with an annuity of Rp.13.5-15.5 billion (US$6-7 million), the affordable fund for Ujung Pandang city will be around Rp.75.65 billion (US$ 34 million) in time-slice over the period up to 2005 with the borrowings through SLA. As assumed

above, IDC will be capitalized and hence difficulties will be encountered in borrowing US$45 million equivalent foreign loan where the scheduled annual debt services supersede the annuity funds possibly available for the city. Provided that another Rp.45.0 billion (US$20 million) of fund be granted from the central government taking the above Loan-Grant mix into consideration, the project size would be enlarged combining to the total of Rp.121.5 billion (US$54 million).

Meanwhile, in appreciation of hardship to draw external finance on "multi-lateral funding scheme", it would be considered acceptable to assume that the city would get borrowings on "bi-lateral funding scheme" where the borrower pays back interest charge without debt carry-overs during the disbursement period. Provided this scheme as given, the affordable fund for the city will be around Rp.101.25 billion (US$45 million), thus making it possible for the project to be formulated with the afore-mentioned ceiling without grant and Rp.168.75 billion (US$ 75 million) with grant of Rp.67.5 billion (US$ 30 million) on SLA re-lending terms and conditions.

In summary, the estimated affordable funds by category are shown as follows.

Classification of Affordable Funds in compliance with SLA on-lending scheme

Lending Scheme	Without Grant Fund	Equity-Loan-Grant Mix
Multi-Lateral	Rp.76.6 billion (US$ 34 mil)	Rp.121.5 billion (US$ 54 mil)
Bi-Lateral	Rp.101.3 billion (US$ 45 mil)	Rp.168.8 billion (US$ 75 mil)

(5) Sound management of public finance

1) Change in financial position

The tables and figures as attached indicate the change in financial position of the city (uses and sources of funds) over the period up to 2015 given the borrowings of Rp101.3 billion (US$45 million) and Rp.76.6 billion (US$34 million) on bi- and multi-lateral funding schemes. Not unexpectedly, income continues to lag behind expenses accrued over the period of initial capital investment. Viewed in this light, it will be clear that external fund is in urgent needs to fulfill the investment backlog at the initial point in time.

2) Debt service ratio

It should be noted that financial healthiness of entities is a function of an expense accrued each year but also the share of debt services out of the funds generated in a year. Viewed in this light, this section highlights the debt service ratio (DSR) as an proxy index to represent soundness in financial management.

It is well recognized that in the year 2002 the city may face the highest financial burden in debt payment once the proposed Project(s) be initiated in 1996 on external funds. Financial healthiness of the city as borne out by DSR will be ranging somewhere around zero (0) to 17 percent (multi-lateral scheme) and zero(0) to 12 percent (bi-lateral) over the period up to 2005, as shown in *Fig*.3.10. In keeping with generally acceptable criterion of 20-25 percent of DSR as a mark-up cut-off point of financial healthiness for public administrative bodies, external fund borrowing with these relatively low-end figures of DSR would not undermine the credibility of the city. Given that the city's current financial obligation to cover debt services incurred to the preceding external borrowings be kept at Rp.3.4 billion annually, DSR will grow incremental one (1) to four (4) percent over the same period.

Revenue and Debt Services of KMUP, 1990/91 - 1994/95

(Unit: Rp. million)

	FY 1990	FY 1991	FY 1992	FY 1993	FY 1994
City Revenue	8,766.1	11,021.9	11,719.3	13,681.7	15,062.9
Public Saving	6,325.8	6,858.8	4,496.6	4,645.5	4,610.0
Debt Services	98.0	194.7	2,901.9	947.2	3,422.1

Source: BAPPEDA II, KMUP

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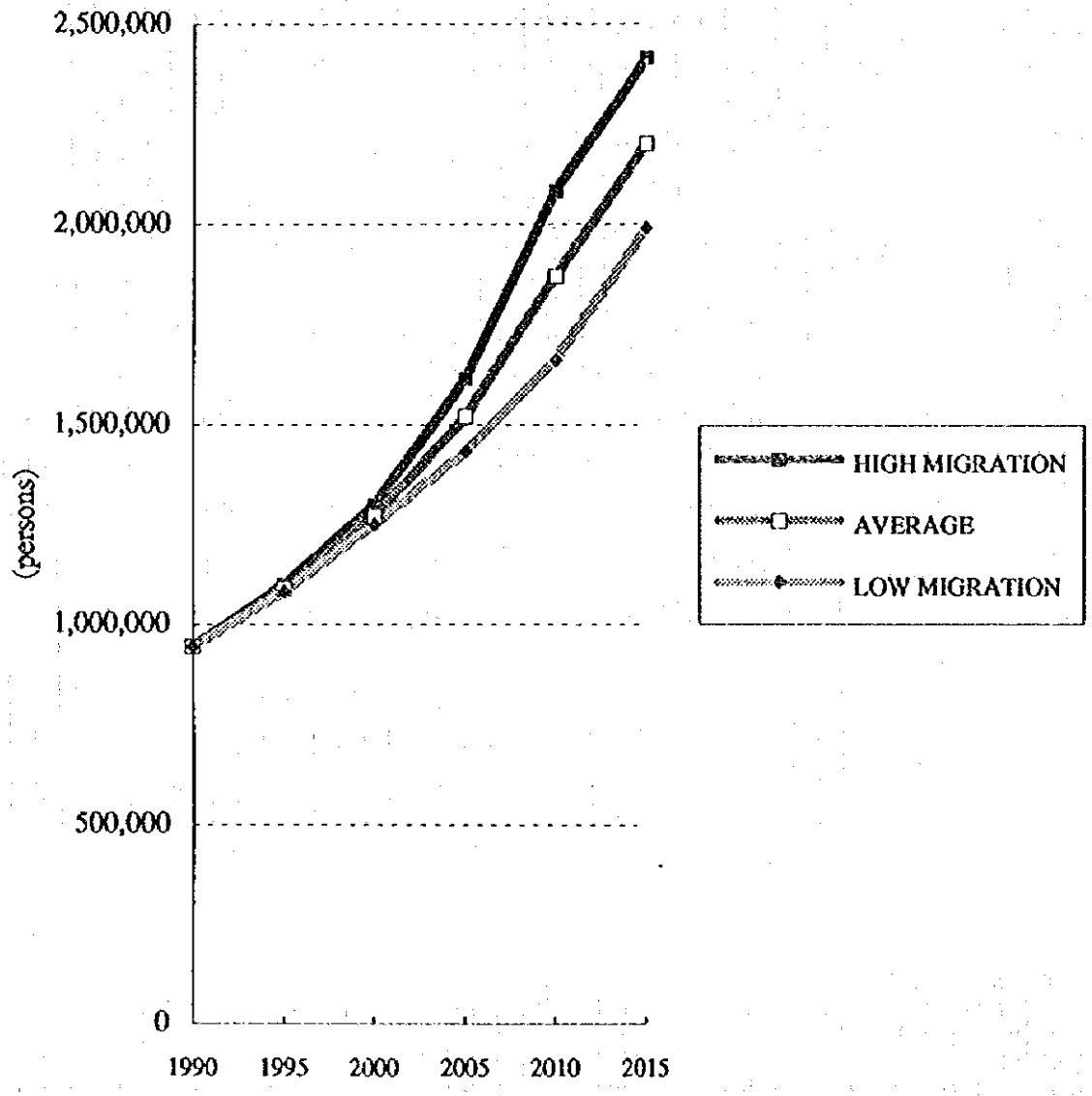
[1]WB: *Indonesia Environment and Development: Challenges for the Future*, 1994, p. 239
[2]This estimate of household income seems to be reasonable given that the 1993 regional income per capita amounts up to Rp.1.1 million in Ujung Pandan, of which around 50-60 percent is a share of personal income.
[3]Average incomes for households and institutions are weighted by income levels and institution categories, respectively.
[4]Formula of this calculation is as follows: Rp.3,100 x 2 workers x 26 days x 12 months
[5]Ref: BAPPENAS *Institutionalization of Integrated Urban Development (Phase I)*, Final Draft, 1995, p.12
[6]Source: Ministry of Finance, BAPPENAS
[7]Source: BAPPENAS

Alternatives	1990	1995	2000	2005	2010	2015
HIGH MIGRATION	944,372	1,098,000	1,298,000	1,614,000	2,080,000	2,415,000
annual increase ratio	-	3.06%	3.40%	4.45%	5.21%	3.03%
AVERAGE	944,372	1,090,000	1,270,000	1,520,000	1,870,000	2,200,000
annual increase ratio	-	2.91%	3.10%	3.66%	4.23%	3.30%
LOW MIGRATION	944,372	1,082,000	1,248,000	1,433,000	1,660,000	1,990,000
annual increase ratio	-	2.76%	2.90%	2.79%	2.99%	3.70%



Source : JICA Study Team

FIG. 3.1 Alternative Population Projections

MASTER PLAN AND FEASIBILITY STUDY ON WASTEWATER AND SOLID WASTE MANAGEMENT FOR THE CITY OF UJUNG PANDANG IN THE REPUBLIC OF INDONESIA

JICA A.D. 1995

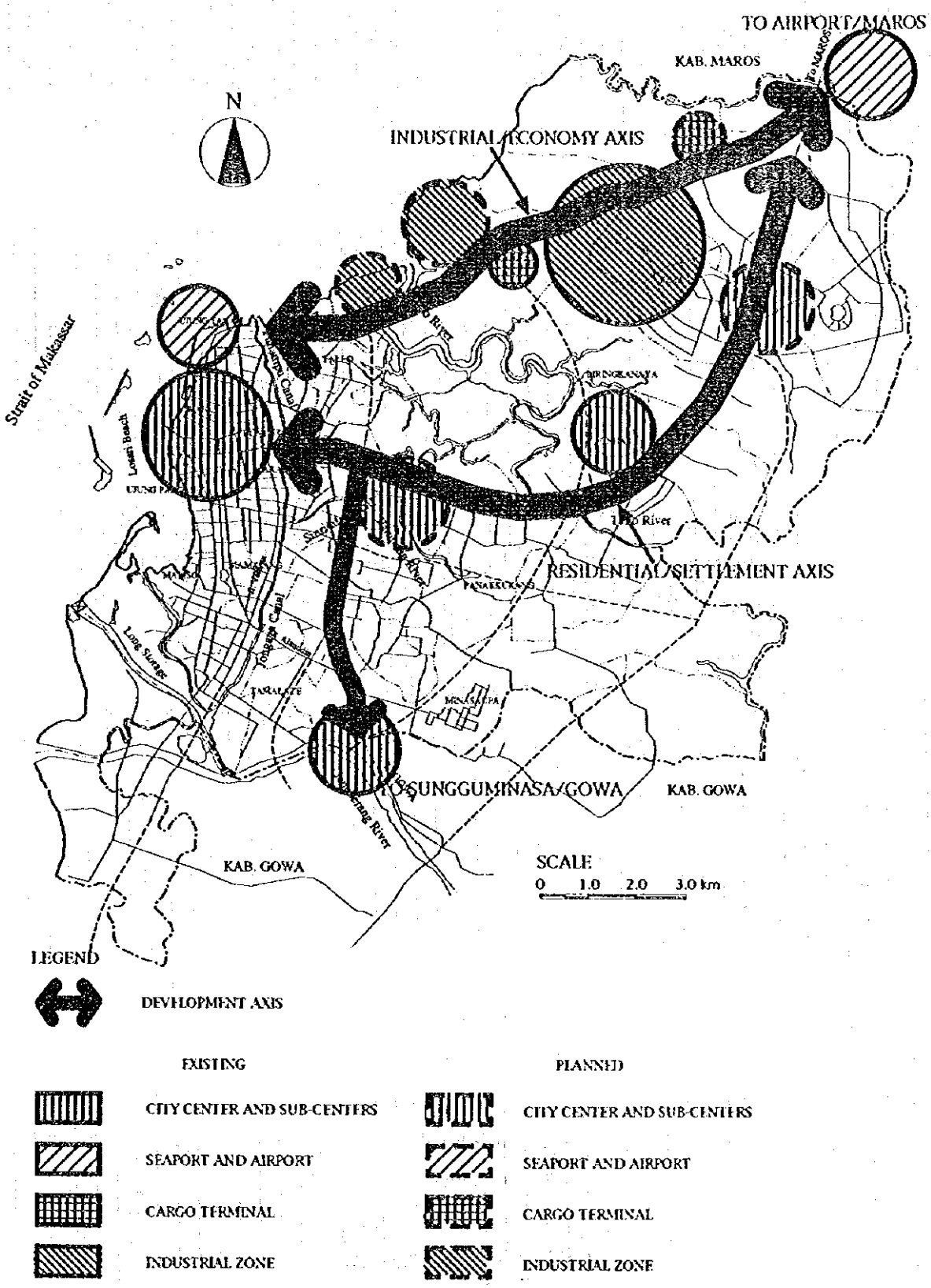
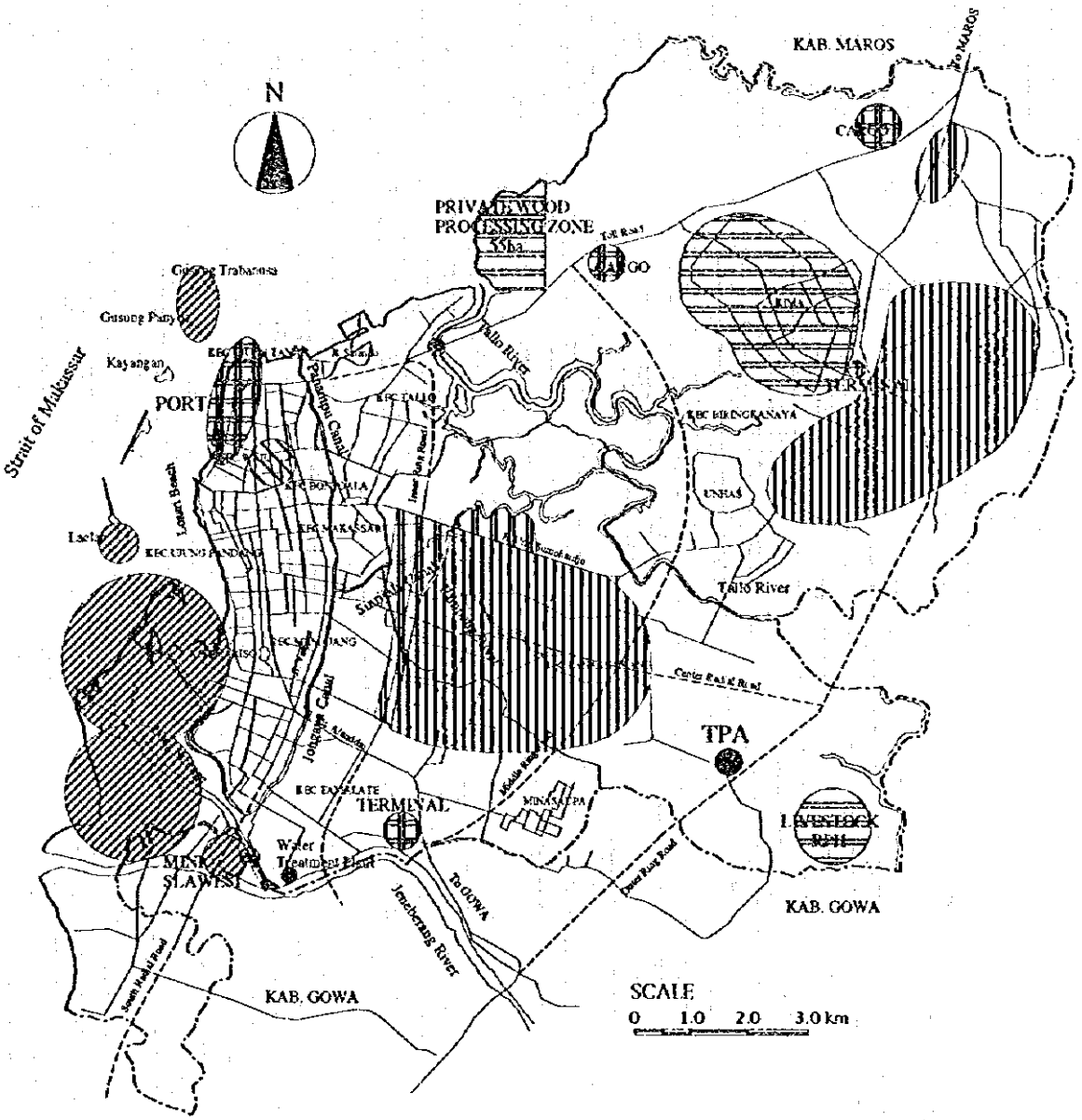


FIG. 3.2 Concept of Spatial Development Plan of KMUP

MASTER PLAN AND FEASIBILITY STUDY ON WASTEWATER AND SOLID WASTE MANAGEMENT FOR THE CITY OF UJUNG PANDANG IN THE REPUBLIC OF INDONESIA

JICA A.D.1995



LEGEND

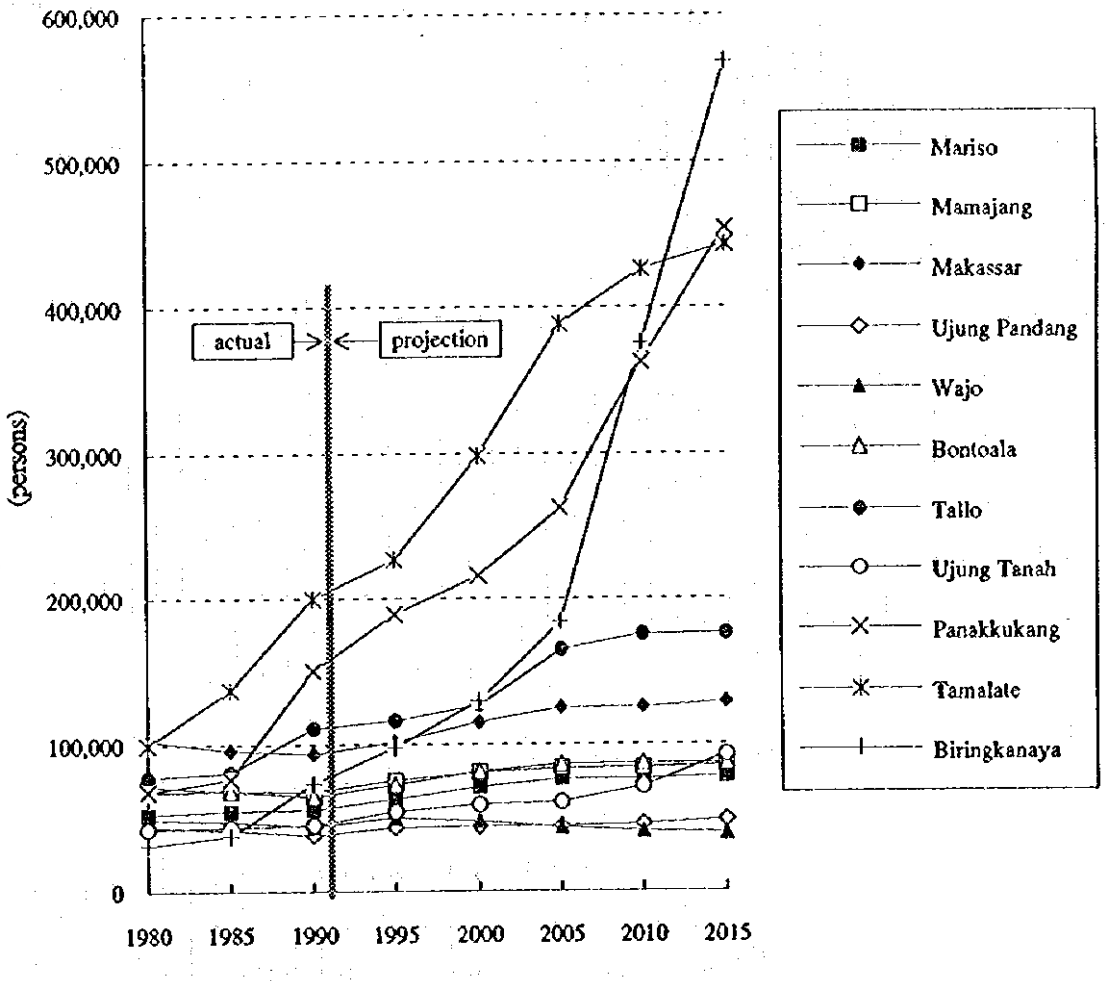
- Settlement
- Recreation
- Transportation
- Industry
- Government
- CBD
- TPA and Water Treatment
- Planned Arterial Road

FIG. 3.3 On-going Plans and Projects

MASTER PLAN AND FEASIBILITY STUDY ON WASTEWATER AND SOLID WASTE MANAGEMENT FOR THE CITY OF UJUNG PANDANG IN THE REPUBLIC OF INDONESIA

JICA A.D.1994

Kecamatan	1980	1985	1990	1995	2000	2005	2010	2015
Mariso	52,685	54,892	55,607	62,833	70,887	76,106	76,483	77,912
Mamajang	71,560	68,325	67,929	75,269	81,012	83,515	84,030	85,677
Makassar	102,973	96,065	93,513	101,412	115,606	125,175	125,744	129,225
Ujung Pandang	44,102	41,729	38,192	43,385	44,245	44,316	45,533	48,469
Wajo	49,186	47,514	44,391	50,142	47,796	43,538	40,695	39,387
Bontoala	68,073	68,511	64,560	72,729	81,299	86,617	86,701	86,796
Tallo	78,193	80,845	111,182	116,490	126,755	164,811	175,196	175,865
Ujung Tanah	42,514	43,897	45,229	54,230	59,155	60,733	70,814	92,534
Panakkukang	68,022	76,118	150,758	188,744	215,285	262,647	362,820	453,560
Tamalate	99,502	137,466	199,650	226,821	298,252	388,526	426,098	442,592
Biringkanaya	31,655	38,000	73,361	97,945	129,708	184,016	375,886	567,983
Total	708,465	753,362	944,372	1,090,000	1,270,000	1,520,000	1,870,000	2,200,000



Source : JICA Study Team

FIG. 3.4 Population Distribution by Kecamatan

MASTER PLAN AND FEASIBILITY STUDY ON WASTEWATER AND SOLID WASTE MANAGEMENT FOR THE CITY OF UJUNG PANDANG IN THE REPUBLIC OF INDONESIA

JICA A.D. 1995

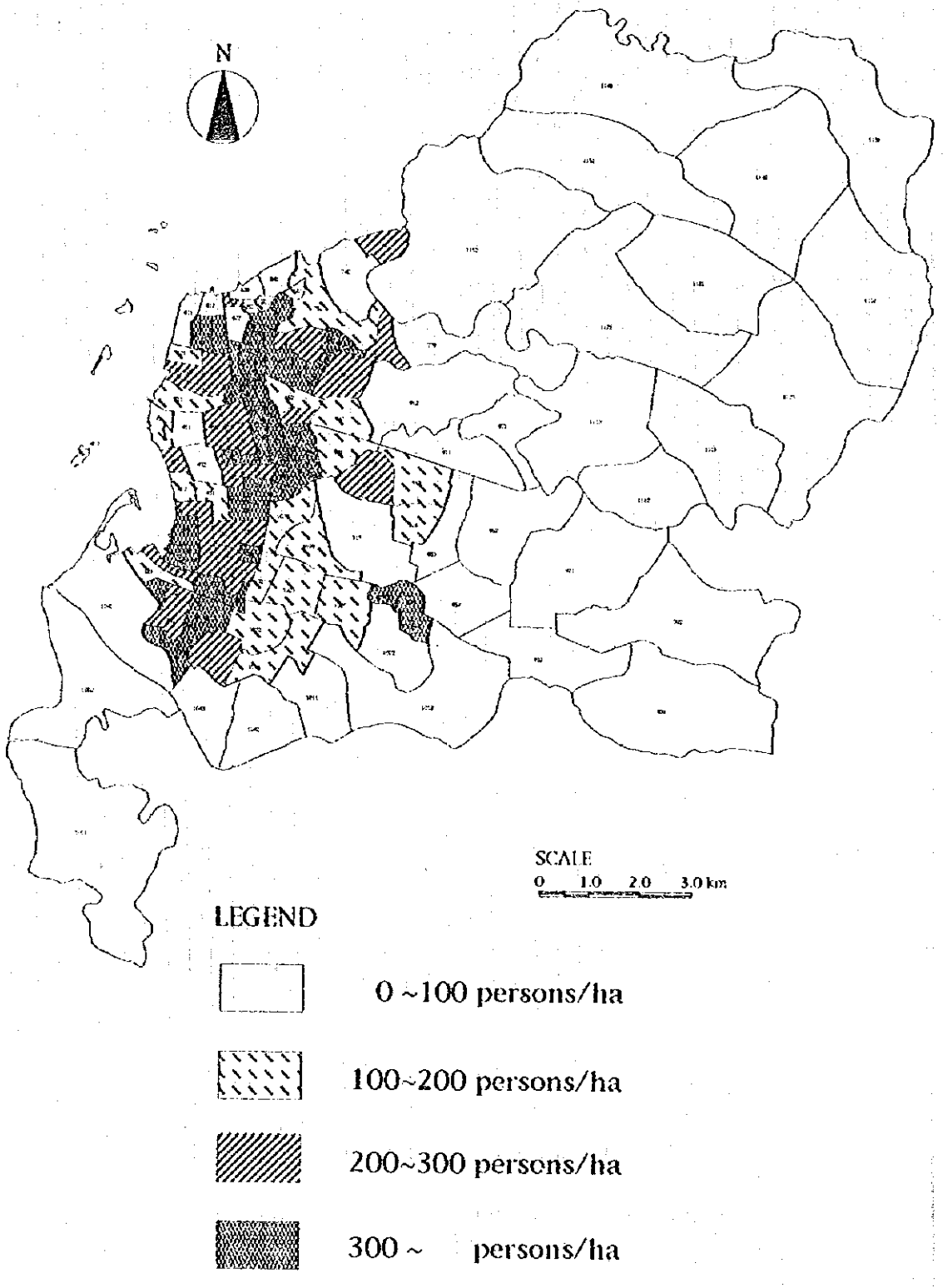


FIG. 3.5 Distribution of Population Density in 1993

MASTER PLAN AND FEASIBILITY STUDY ON WASTEWATER AND SOLID WASTE MANAGEMENT FOR THE CITY OF UJUNG PANDANG IN THE REPUBLIC OF INDONESIA

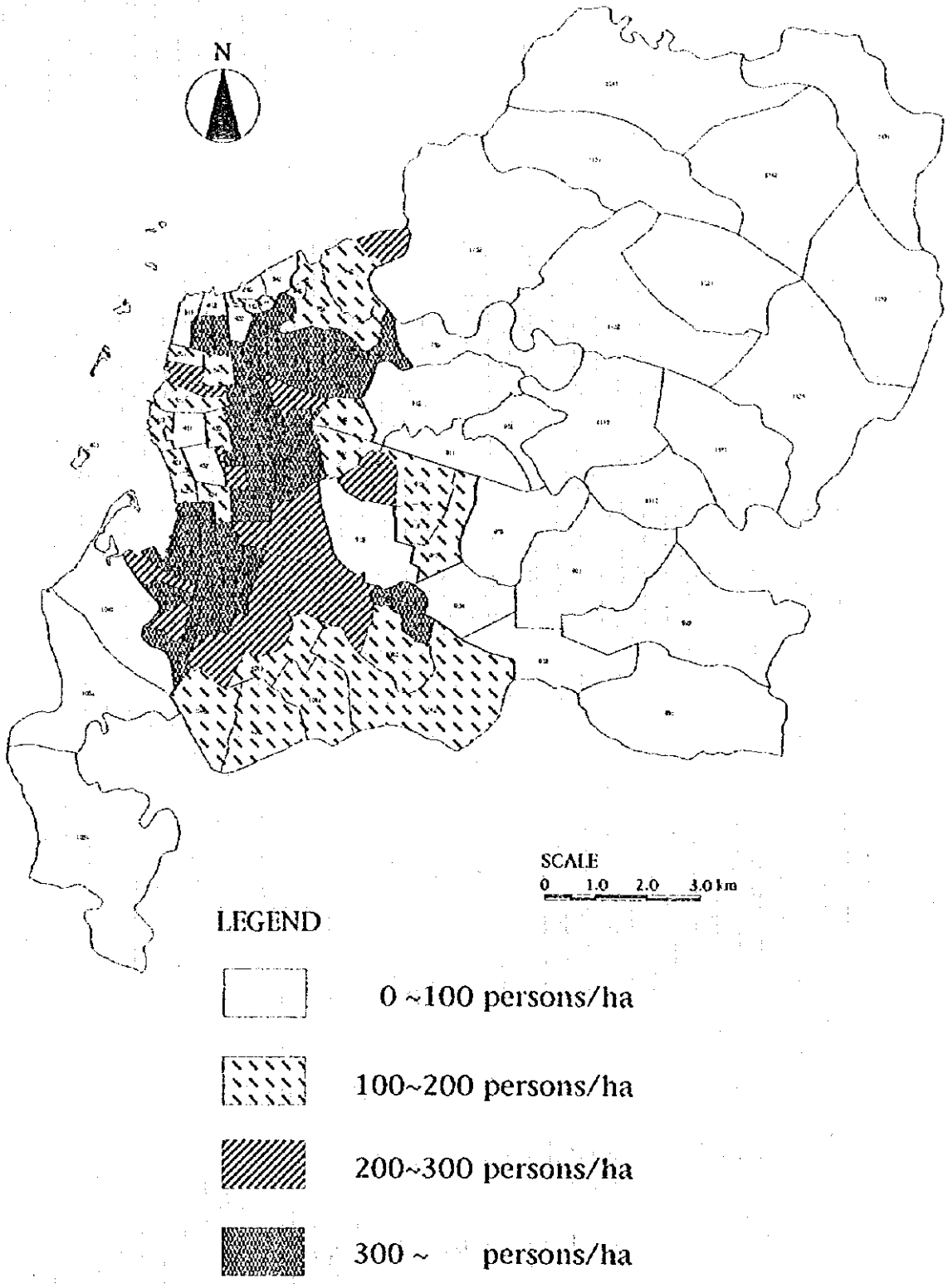


FIG. 3.6 Distribution of Population Density in 2005

MASTER PLAN AND FEASIBILITY STUDY ON WASTEWATER AND SOLID WASTE MANAGEMENT FOR THE CITY OF UJUNG PANDANG IN THE REPUBLIC OF INDONESIA

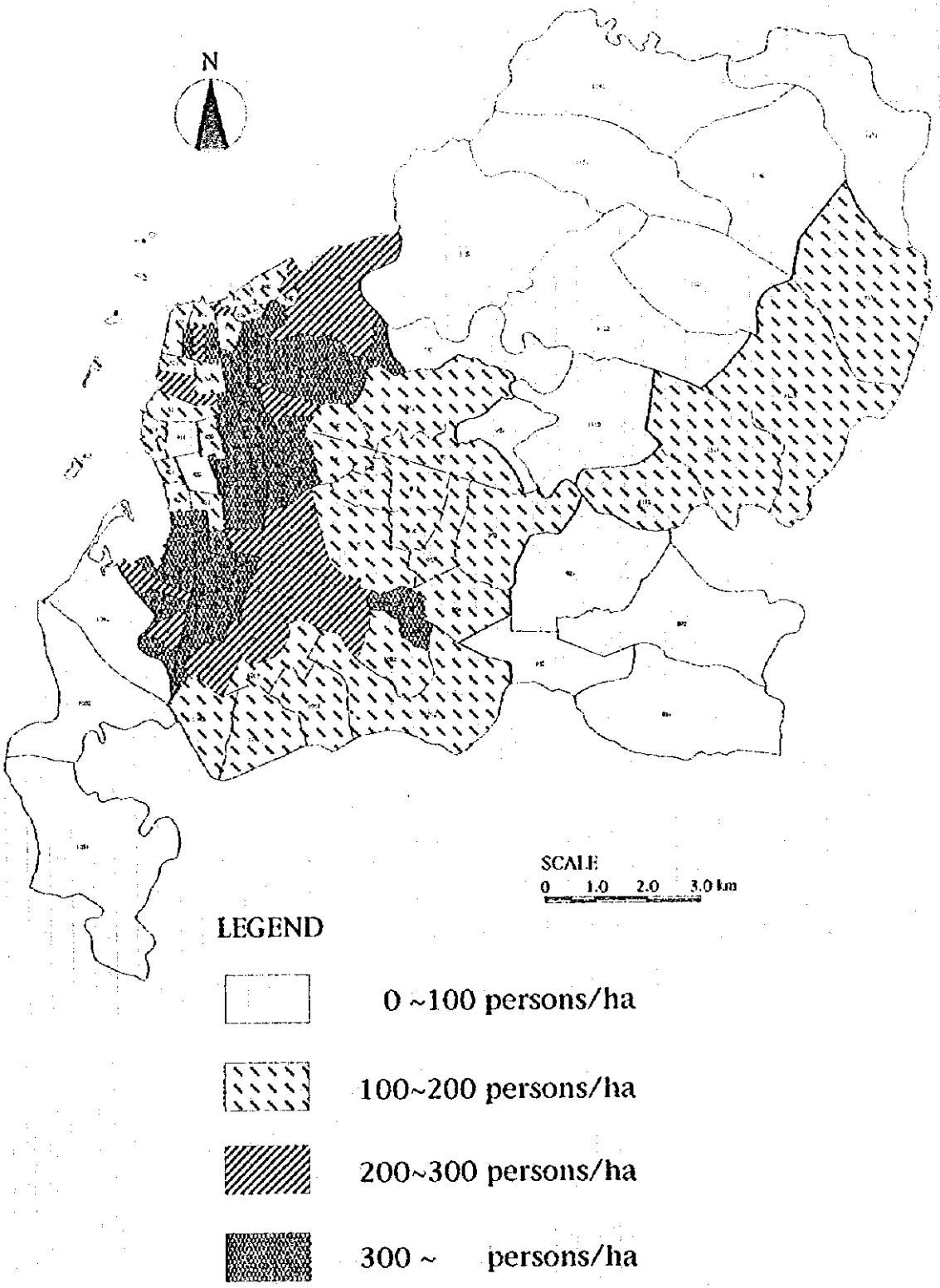
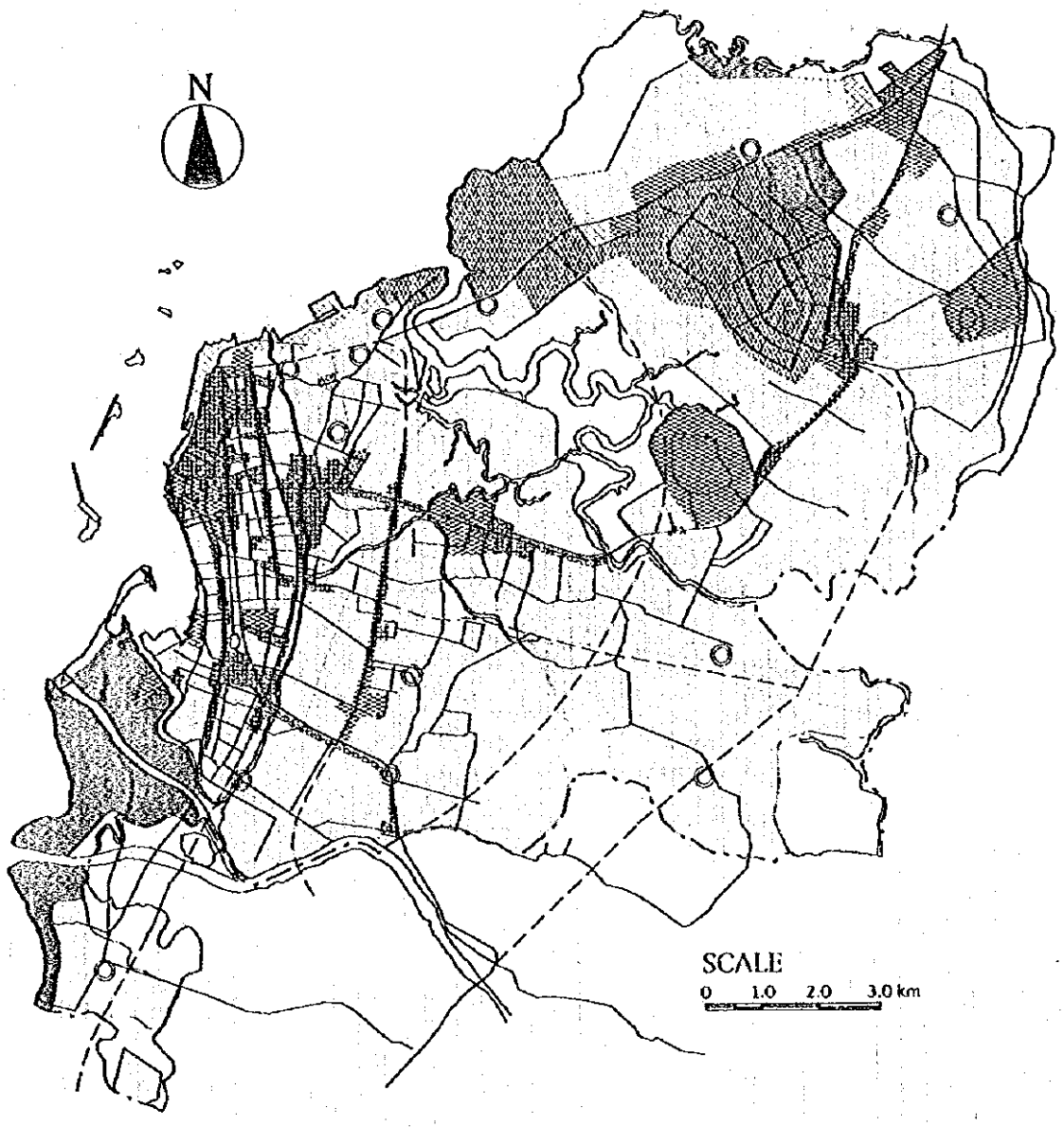


FIG. 3.7 Distribution of Population Density in 2015



LEGEND

- Residential Area
- Commercial Area
- Institutional / Service Area
- Industrial Area
- Transportation Area
- Vacant Area / Recreational Area
- Non Urban Area
- Community Center

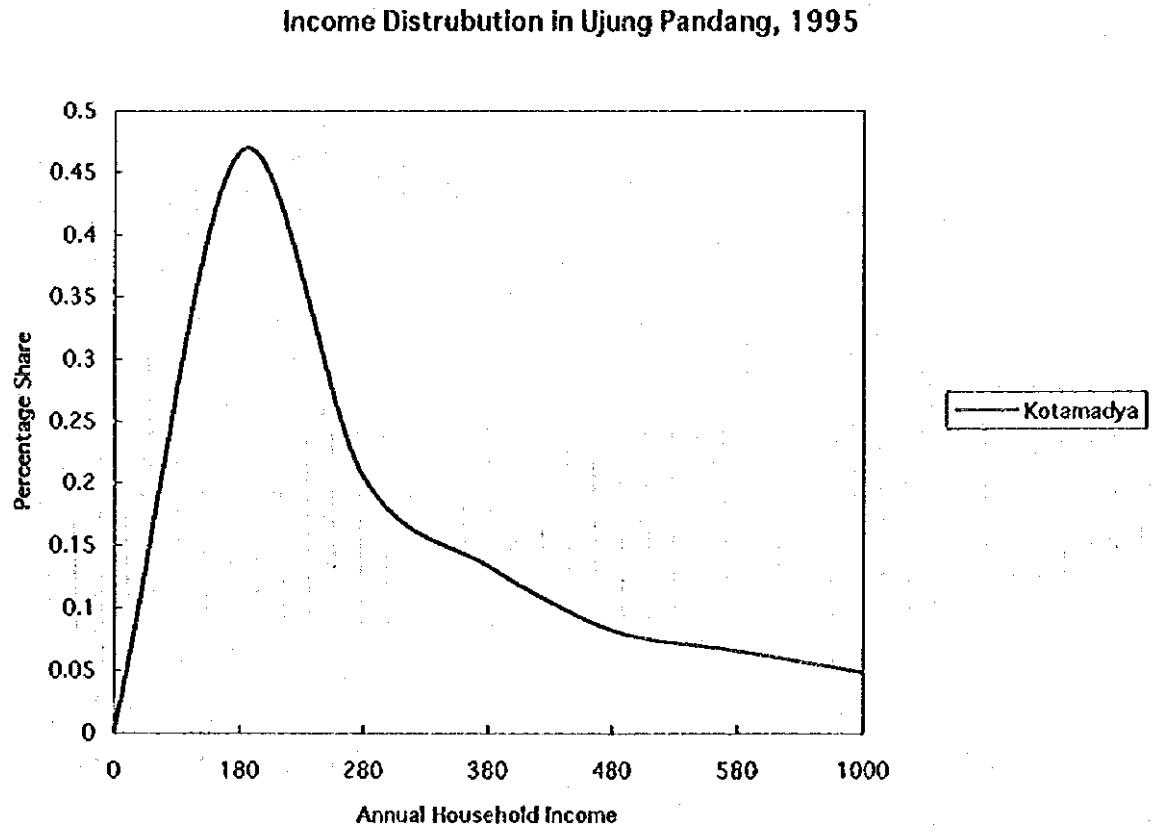
Source : JICA Study

FIG. 3.8 Future Land Use of KMUP in 2015

MASTER PLAN AND FEASIBILITY STUDY ON WASTEWATER AND SOLID WASTE MANAGEMENT FOR THE CITY OF UJUNG PANDANG IN THE REPUBLIC OF INDONESIA

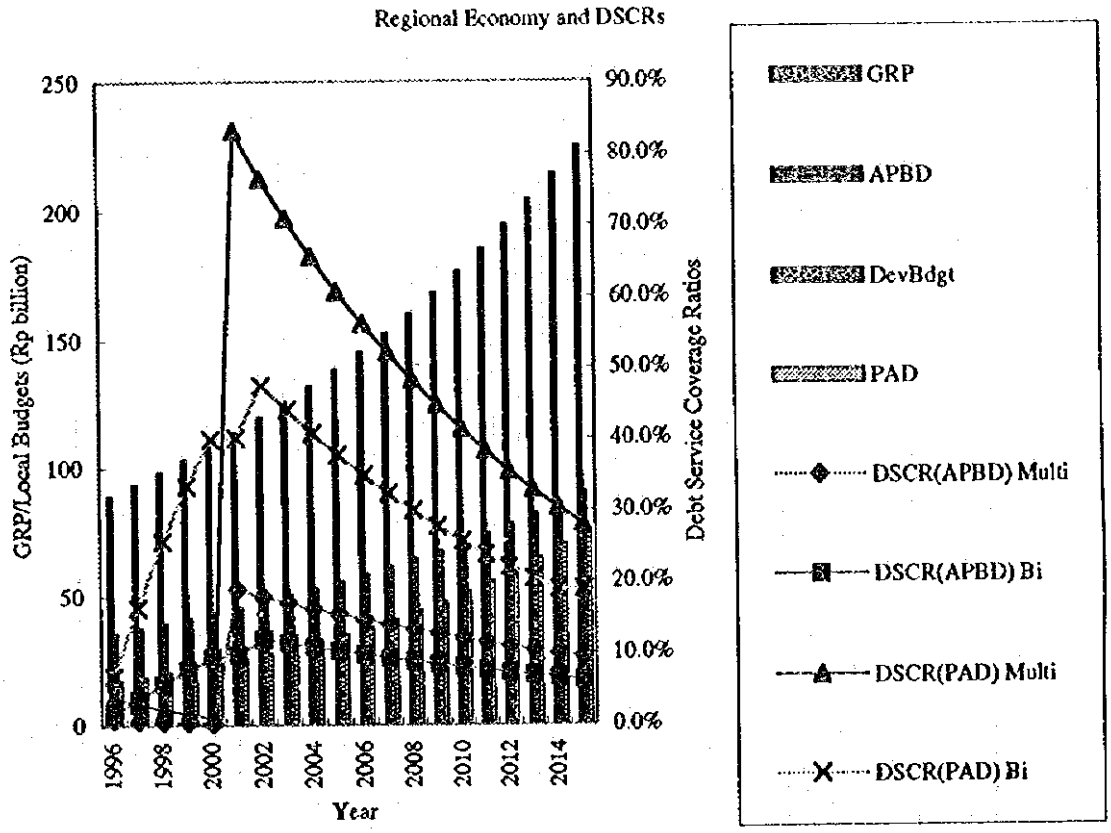
JICA A.D.1995

	180	280	380	480	580	1000	WAI	Pop.	WAI/Pop
Mariso	0.49	0.19	0.14	0.09	0.06	0.03	267.6	62,833	15.4
Mamajang	0.46	0.19	0.16	0.10	0.05	0.02	249.2	75,269	17.2
Makassar	0.54	0.22	0.13	0.06	0.03	0.01	238.6	101,412	22.2
Ujung Pandang	0.29	0.25	0.18	0.08	0.11	0.13	224.3	43,385	8.9
Wajo	0.14	0.18	0.19	0.15	0.15	0.19	219.9	50,142	10.1
Bontoala	0.41	0.18	0.10	0.11	0.11	0.08	222.2	72,729	14.8
Tallo	0.49	0.24	0.13	0.09	0.03	0.01	248.6	116,490	28.6
Ujung Tanah	0.57	0.22	0.12	0.05	0.03	0.02	232.2	54,230	11.6
Panakkukang	0.57	0.24	0.09	0.04	0.06	0.01	221.2	188,744	38.3
Tamalate	0.51	0.22	0.13	0.07	0.04	0.02	239.4	226,821	49.8
Biringkanaya	0.66	0.13	0.19	0.05	0.04	0.02	214.9	97,945	19.3
Total	0.47	0.21	0.13	0.08	0.07	0.05	231.6	1,090,000	234.2



Source : JICA Study Team

FIG. 3.9 Income Distribution in KMUP, 1995



Source : JICA Study Team

FIG. 3.10 Regional Economy and Debt Service Coverage Ratio

CHAPTER 4

TARGETS AND POLICIES OF MASTER PLAN

CHAPTER 4 TARGETS AND POLICIES OF MASTER PLAN

4.1 Targets of Master Plan

The level of environmental sanitation can be classified and defined in following three (3) levels with the order of priority.

(a) Minimum Level (ML)
The level that should be maintained to secure the minimum health requirements.

(b) Comfort Level (CL)
The level that should be maintained to secure health requirements and cleanliness of living conditions.

(c) Amenity Level (AL)
The level that all residents can enjoy healthy and clean living conditions and environment.

Achievement of above levels can not be accomplished without comprehensive improvement program including safe drinking water supply, wastewater and solid waste management, air pollution control and public health education, etc.

Nevertheless, the Scope of Works of this study was formulated based on the recognition that improvement of the wastewater and solid waste management are the most important and urgent issues considering the present situation of KMUP. From the view point of institutional aspect it is to be noted that Dinas Kebersihan has jurisdiction over septage collection service as well as solid waste collection service.

Taking these facts into account, this study shall pursue the improvement of wastewater and solid waste management simultaneously, as the means to realize overall environmental improvement.

The above environmental sanitation levels can be interpreted in wastewater and solid waste management as follows:

(a) ML
All residents in whole Study Area have access to toilet facilities with sanitary disposal of blackwater.

Solid waste collection service on regular basis (at least once a week) shall cover the area with population density more than 50 persons/ha and collected solid waste shall be disposed of at control landfill site.

(b) CL

Blackwater and graywater shall be treated so as to keep satisfactory living conditions in whole study area. The water quality standard for satisfactory living condition can be determined at 30 mg/ℓ as BOD considering the minimum water quality standard of DKI Jakarta.

Solid waste collection service on regular basis (more than once a week) shall cover the area of which population density is more than 50 persons/ha and collected solid waste shall be disposed of at sanitary landfill site.

(c) AL

Blackwater and graywater shall be treated so as to realize the amenity of waterfront in whole study area. The water quality standard for amenity of waterfront can be determined at 10 mg/ℓ as BOD considering the permissible water quality level for drinking water source according to the water quality standard of DKI Jakarta.

Solid waste collection service on regular basis (more than once a week) shall cover whole study area and collected solid waste shall be disposed of at sanitary landfill site. Some type of solid waste, like hazardous waste, shall be treated adequately then disposed of.

The target of Master Plan is set in CL to secure public health and living environment improvement following the achievement of ML.

4.2 Policies of Master Plan

4.2.1 Stepwise approach

Considering the socio-economic and financial conditions of KMUP, it may require rather long time to reach CL for whole study area. Hence the Master Plan would pursue a stepwise approach. It means that not only "should be image" but also "on-the-way image" should be thoroughly analyzed.

In this report "on-the-way image" is delineated as Short Term Plan up to 2005, which is formulated based on urgent demand, quickness of benefit generation and practicability of implementation, as well as to be in conformity with the "should be image" of the Master Plan up to 2015.

4.2.2 Financial sustainability

The service to be provided by the project will be priced on a financially rational basis to guarantee the cost recovery. The project will be limited within the affordability of the governments and users (residents), because even foreign funds, except grants, will have to be repaid after a grace period.

4.2.3 Beneficiary cross - subsidization

The tariff to cover the investment cost and O/M cost will need to be socially justifiable, with due consideration to the low-income people, because they can not afford to contribute to the full cost recovery. Especially for the slum areas, a certain level of financing will be possible from the government, conforming the Indonesian government policy of poverty alleviation.

On the other hand commercial and business entities can be expected to make larger contributions, though their number is much smaller than that of households.

In principle, the minimum target of a tariff system shall be to cover the entire O/M cost, and at least a portion of the investment cost with cross-subsidization.

4.2.4 Community participation

For improving environmental sanitation people's awareness of the issues is quite important. As a matter of fact the residents have a great interest in improvement of their environments based on the result of field survey. But they are not well informed about what to do for the purpose, in spite of their high willingness to contribute for improvement of their environment. Therefore the public education of environment promoted by the government shall be stressed to guide them how to work together for environmental sanitation improvement.

4.2.5 Private sector participation

Examination of existing conditions of KMUP shows that it is necessary to involve private sector for improvement of wastewater and solid waste management as well as to strengthen the role of public sector. Especially initiating a comprehensive wastewater management program is very big burden for municipality without private sector participation, because there are no existing responsible institution.

In order to formulate effective and practicable wastewater and solid waste management plan incentives and enforcement to stimulate private sector participation is a very important requirement.

CHAPTER 5

MASTER PLAN FOR WASTEWATER MANAGEMENT

CHAPTER 5 MASTER PLAN FOR WASTEWATER MANAGEMENT

5.1 Planning Conditions

5.1.1 Water consumption

(1) Domestic water

The estimation of future per capita water consumption of the residents who are served with house connection is based on the estimation of domestic water use by purpose from Water Supply Development Plan (PDAM, 1985). On the other hand, the per capita water consumption of people without house connection is assumed to be same even in the year 2015, considering labor of carrying water, and toilet flushing water is assumed to be constant also. The present and future per capita water consumption are as follows.

Domestic Water Consumption with House Connection

	Present (1992)	Year 2005	Year 2015
Toilet	3 lcd	8 lcd	14 lcd
Others	153 lcd	207 lcd	216 lcd
Total	156 lcd	215 lcd	230 lcd

Domestic Water Consumption without House Connection

	Present (1992)	Year 2005	Year 2015
Toilet	3 lcd	3 lcd	3 lcd
Others	46 lcd	46 lcd	46 lcd
Total	49 lcd	49 lcd	49 lcd

The future coverage ratio of house connections is estimated based on Water Supply Development Plan (PDAM, 1991). The present and future house connection coverage ratios by Kecamatan are as follows.

	Present (1992)	Year 2005	Year 2015
Mariso	16%	50%	57%
Mamajang	17%	50%	57%
Makassar	14%	75%	80%
Ujung Pandang	33%	90%	90%
Wajo	36%	90%	90%
Bontoala	32%	65%	70%
Tallo	13%	40%	45%
Ujung Tanah	16%	42%	45%
Panakkukang	20%	44%	48%
Tamalate	15%	51%	55%
Biringkanaya	23%	25%	30%
Total	19%	50%	49%

(2) Commercial water

The present ratio of commercial water consumption to the domestic one is 14.7% and is assumed to be constant in the future. Based on this assumption the future commercial water consumption is estimated by multiplying future PDAM domestic water supply with the above ratio.

(3) Institutional water

The present ratio of institutional water consumption to the domestic one is 15.3% and is assumed to be constant in the future. Based on this assumption the future institutional water consumption is estimated by multiplying future PDAM domestic water supply by the above ratio.

(4) Industrial water

The city of Ujung Pandang is now promoting big industries to be centralized into the KIMA industrial estate. KIMA has its own wastewater treatment plant and this plant will treat all the industrial wastewater generated inside KIMA. Therefore the industrial wastewater generated inside KIMA would be excluded from this Study.

The present industrial water consumption is assumed to remain the same even in future because of large scale industries moving into KIMA.

5.1.2 Wastewater generation

The wastewater generation is assumed to be same as the water consumption even in future similar to that of existing condition.

The total future wastewater generation is estimated at about 237,000 m^3/d in 2005 and 362,100 m^3/d in 2015. Breakdown of wastewater generation is as follows.

	Present (1992)	Year 2005	Year 2015
Blackwater	3,001 m^3/d	8,361 m^3/d	18,576 m^3/d
Graywater	66,488 m^3/d	192,314 m^3/d	286,290 m^3/d
Commercial	3,779 m^3/d	17,601 m^3/d	27,823 m^3/d
Institutional	3,933 m^3/d	18,319 m^3/d	28,959 m^3/d
Industrial	457 m^3/d	457 m^3/d	457 m^3/d
Total	77,657 m^3/d	237,052 m^3/d	362,105 m^3/d

5.1.3 Unit pollution load

(1) Domestic wastewater

The present unit pollution load of toilet wastewater is estimated at 10.5g as BOD based on previous studies in Indonesia, and is assumed to be same in the future.

The present wastewater quality of gray water is estimated at 168 mg/ℓ as BOD based on the pollution load survey conducted by the Study Team. The future unit pollution load from gray water is estimated to be in proportion to increase in wastewater generation. As a result, the quality of graywater is assumed to be constant. The present and future unit pollution load of domestic wastewater is shown below.

Pollution Load Generation with House Connection (unit : BOD)

	Present (1992)	Year 2005	Year 2015
Toilet	10.5 gcd	10.5 gcd	10.5 gcd
Gray	25.7 gcd	34.8 gcd	36.3 gcd
Total	36.2 gcd	45.3 gcd	46.8 gcd

Pollution Load Generation without House Connection (unit : BOD)

	Present (1992)	Year 2005	Year 2015
Toilet	10.5 gcd	10.5 gcd	10.5 gcd
Gray	7.7 gcd	7.7 gcd	7.7 gcd
Total	18.2 gcd	18.2 gcd	18.2 gcd

(2) Commercial wastewater

The present water quality of commercial wastewater is estimated at 266 mg/ℓ as BOD, based on the pollution load survey of the Study Team.

The future unit pollution load from commercial wastewater is estimated to be in proportion with increase in wastewater generation. As a result, the quality of commercial wastewater is assumed to be constant.

(3) Institutional wastewater

The present water quality of institutional wastewater is estimated at 142 mg/ℓ as BOD, based on the pollution load survey of the Study Team.

The future unit pollution load from institutional wastewater is estimated to be in proportion with increase in wastewater generation. As a result, the quality of institutional wastewater is assumed to be constant in future.

(4) Industrial wastewater

The future water quality of industrial wastewater are assumed to be same as present one. Therefore present and future average water quality is estimated at 1,152 mg/ℓ as BOD.

5.1.4 Pollution load generation

Present and future pollution load generation as BOD from domestic wastewater is estimated by multiplying total population with unit pollution load as BOD. Present and future pollution load generation as BOD from commercial, institutional and industrial wastewater is estimated multiplying wastewater generation with respective water quality.

The total pollution load generation as BOD is estimated at about 56,200 kg/d in 2005 and 83,200 kg/d in 2015. Breakdown of pollution load generation as BOD is as follows.

	Present	Year 2005	Year 2015
Blackwater	10,503 kg/d	15,960 kg/d	23,100 kg/d
Graywater	11,196 kg/d	32,386 kg/d	48,097 kg/d
Commercial	1,005 kg/d	4,682 kg/d	7,401 kg/d
Institutional	558 kg/d	2,601 kg/d	4,112 kg/d
Industrial	526 kg/d	526 kg/d	526 kg/d
Total	23,790 kg/d	56,155 kg/d	83,236 kg/d

Regional distribution of the existing and future pollution load generation as BOD by Kelurahan are shown in *Fig.* 5.1 through *Fig.* 5.3.

5.1.5 Potential sites for wastewater treatment plant

Following seven (7) sites have been listed up by the study team and counterpart team. Location of these sites is shown in *Fig.* 5.4.

	Location	Existing Land Use	Area	Land Owner
No.1	Kel. Buloa Kec.Tallo	fish pond	10 ha	Public
No.2	Kel. Maccini Sombala Kec.Tamalate	fish pond	> 20 ha	
No.3	Kel. Pampang Kec.Panakkukang	fish pond/vacant	38 ha	
No.4	Kel. Lakkang/Rappo Kalling Kec.Tallo	fish pond/vacant	96 ha	
No.5	Kel. Gunung Sari Kec.Panakkukang	vacant	50 ha	
No.6	Kel. Panampu Kec.Tallo	facilities of Navy	8 ha	Navy
No.7	Kel. Lembo Kec.Tallo	fish pond/swamp	8 ha	Private

The evaluation of all sites were made based on the following aspects:

a. Technical aspects
b. Financial aspects
c. Institutional aspects
d. Social aspects
e. Environmental aspects

Through the evaluation the site No.1 was eliminated because of the possibility of interference with Inner Ring Road develpment. The site No.6 was also eliminated because of the dificulty of land acquisition from Navy.

The feasibility of land acquisition of remaining sites have been examined carefully by the Study Team and counterpart team, and consequently these sites are selected as potential alternative sites for wastewater treatment plant.

5.2 Technical Options

It is essential to select appropriate technologies as technical options for formulating a plan applying stepwise approach. An appropriate technology is required to be cheap, simple, and acceptable for residents. In general a system which has been widely used and also satisfies these requirements can be regarded as technically appropriate.

The Study Team selected four (4) treatment systems and three (3) collection systems as technical options through evaluation based on above viewpoint and technical aspect.

5.2.1 Treatment systems

(1) Leaching pit

Leaching pit is a natural soil treatment system typically consisting of two pits designed to facilitate wastewater infiltration into soil. This system is very simple, maintenance free and widely used as an on-site blackwater treatment facility in the Study Area. The unit construction cost is quite low, about Rp. 200,000/household. But there is possibility of groundwater contamination in a high groundwater table area. Moreover, a minimum distance between the leaching pit and well needs to be ensured (at least 10 m).

Considering these characteristics, this system can be regarded as the most suitable technical option for the areas with low population density and where the possibility of groundwater contamination is negligible. The criteria of selecting such areas is established as follows based on Indonesian guidelines for leaching pit.

Groundwater table level is deeper than 4 m from ground level.
AND
Population density is less than 100 persons/ha.

(2) Septic tank with leaching field

Septic tank with leaching field is a treatment facility consisting of septic tank and leaching/infiltration field. This system is simple and easy for operation and maintenance. The unit construction cost is about Rp. 400,000/household. The system can be applied even for high groundwater table area. But this system requires quite bigger space than a leaching pit,

and also periodical desludging is required to ensure good function of septic tank. Required space for leaching field of a typical household is about 10 m^2 for blackwater treatment and about 100 m^2 for both graywater and blackwater treatment.

(3) Stabilization pond

Stabilization pond is a treatment system in which wastewater is retained in rectangular earthen basins for a relatively long retention time. Stabilization ponds are classified as anaerobic ponds, facultative ponds and maturation ponds, and a combination of these types can obtain high BOD removal efficiency of about 80%~90%. This system is simple and easy for construction, operation and maintenance, though large space is required.

If enough land area is available, this system can be recommended as the most suitable technical option for wastewater treatment plant of even large scale off-site system.

(4) Aerated lagoon

Aerated lagoon is a treatment system in which mechanical surface aeration is used. In all other aspects it is similar to a stabilization pond. Still, compared with stabilization pond, smaller space is sufficient but construction and O&M cost is relatively higher.

When available land area is not adequate for stabilization pond or as the means of upgrading the existing stabilization pond, this system could be recommended as the most suitable technical option.

5.2.2 Collection systems

(1) Ordinary sewer

Ordinary sewer is a separate or combined collection system which is constructed under road at more than 1 m depth to protect sewer pipe from external loading. Wastewater is basically collected and conveyed by gravity, therefore if topography is flat the depth would increase with distance. In order to limit the depth of sewers lift pump need to be employed, periodically.

(2) Small scale sewer

Small scale sewer is a separate wastewater collection system from each household to main sewer, constructed under foot path or housing lot at a shallow depth less than 1.0 m. This system can reduce construction cost, especially for tertiary sewers.

This system can be applied for an area where houses have enough space, with width between the front of houses and the road is more than 3 m.

(3) Interceptor sewer

Interceptor sewer is a collection system that receives graywater from road side ditch during dry weather. This system is equivalent to ordinary sewer without house connection, therefore construction cost can be reduced. However, it may be very difficult to collect service charge from beneficiaries.

This system is suited for an area with temporary housing, an area of potential redevelopment or an area of poor accessibility (road width less than 3 m). Also the system could be developed as the initial (first) stage of a conventional sewerage system.

5.3 Determination of Short Term Plan up to 2005

5.3.1 Basic strategy

As already mentioned in chapter 4, short term wastewater management plan up to the year 2005 shall be formulated based on urgent demand, quickness of benefit generation and practicability of implementation.

The most urgent demand of wastewater management shall be elimination of no-toilet population considering Basic Human Needs. Therefore the highest priority shall be given to provision of basic toilet facilities for no-toilet people living in slum areas.

Consequently basic strategy for formulating short term wastewater management plan consists of following five (5) steps.

i) To identify the no-toilet areas and find out appropriate schemes for providing basic toilet facilities for such areas.

ii) To demarcate the most recommendable technical options according to the characteristics of each area.

iii) To find out schemes for each area to be served by the most recommendable technical option.

iv) To optimize public sector project schemes so as to maximize private sector participation.

v) To determine the priority projects which will be completed until 2005 as public sector project schemes.

5.3.2 Demarcation of Study Area

First of all, all the slum areas in the Study Area are delineated where basic sanitation system is inadequate. For these areas Small Modular System (B) (hereafter called as SMS(B)) / public toilet is most recommendable. If the physical condition is suitable for installing house connection sewer, SMS(B) could be recommendable on the condition that user could provide ones own water closet, otherwise public toilet shall be recommended.

Except for slum areas, demarcation of the most recommendable technical options consists of following two (2) steps.

i) To separate out the areas where leaching pit can be applied.

ii) To separate out the areas where septic tank with leaching field can be applied.

The criteria for leaching pit are that population density is less than 100 persons/ha and critical groundwater table level is deeper than 4 m from ground level, as already mentioned in section 5.2.

The criteria for septic tank with leaching field are established based on the required water quality level. From the viewpoint of quickness of benefit generation and practicability of implementation, a septic tank with leaching field for blackwater treatment is recommendable because of easiness of installation and relatively low construction cost. On the other hand, this system can not contribute to mitigate heavy water pollution in highly urbanized and densely populated areas.

The result of field survey shown in *Fig.* 5.5 indicates that in an area with specific pollution load generation from all sources other than blackwater less than 2.7 kgBOD/day/ha, water quality level of 60 mgBOD/ℓ can be obtained with only blackwater treatment by septic tank with leaching field. Water quality level of 60 mgBOD/ℓ does not satisfy the minimum standard of water quality of 30 mgBOD/ℓ, however, considering existing water quality of most of main canals that exceed 100 mgBOD/ℓ, 60 mgBOD/ℓ seems reasonable as an intermediate target.

For remaining area where neither leaching pit nor septic tank with leaching field can be applied, off-site system with secondary treatment is the most recommendable technical option considering the difficulty of land acquisition and necessity of mitigating heavy water pollution.

The result of demarcation of the most recommendable technical option is shown in *Fig.* 5.6.

5.3.3 Schemes for each area

Provision of SMS(B)/public toilet for the slum areas will be completed by public sector urgently until the year 2000.

In order to apply the most recommendable technical options for each area, it would be crucial to maximize the role of private sector considering the existing financial condition of KMUP and lack of wastewater management institution.

Concerning the new construction of on-site facilities, residents' self-support could be expected because the benefit is clear. Actually almost all people except for slum residents have already installed their own toilet by themselves. Therefore for the on-site system development area utilization of self-support of residents to provide ones own treatment system (septic tank/leaching pit) accompanied with appropriate guidelines and stimulants like a public campaign and legal enforcement shall be relied upon.

Installation of off-site system can be done by public sector or private developer, in other words, utilization of private sector is possible at least for housing estates.

Replacing or improving existing system is very difficult not only due to the difficulty in identifying malfunctioning systems but also the benefit will be not so clear for residents. Consequently, improved desludging at regular frequency shall be conducted by public sector.

Following table shows schemes of recommendable technical options for each area.

<table>
<tr><th colspan="4">Characteristics of Area</th><th colspan="2">Schemes of Wastewater Management</th></tr>
<tr><th>Specific Type</th><th>Ground water</th><th>Population Density</th><th>Specific BOD</th><th>Private Sector</th><th>Public Sector</th></tr>
<tr><td colspan="4">Slum Area</td><td>No schemes</td><td>Provision of SMS(B)/Public Toilet</td></tr>
<tr><td rowspan="3">Non Slum Area and Non Housing Complex</td><td>Deeper than 4 m</td><td>Less than 100 persons/ha</td><td>Less than 2.7 kg/d/ha</td><td>Residents should provide Leaching Pit when they construct or renew their housing.</td><td>Establishment of Guidelines and Regulations. Monitoring.</td></tr>
<tr><td rowspan="2">Shallower than 4 m</td><td></td><td></td><td>Residents should provide Septic Tank with Leaching Field satisfying standard when they construct or renew their housing.</td><td>Establishment of Guidelines and Regulations. Monitoring.</td></tr>
<tr><td>More than 100 persons/ha</td><td>More than 2.7 kg/d/ha</td><td>No schemes</td><td>Off-site system with secondary treatment shall be installed so far as conditions permit.</td></tr>
<tr><td>Housing Complex</td><td colspan="3"></td><td>Housing Developer should provide Developer Modular System satisfying standard in their own housing estates.</td><td>Establishment of Guidelines and Regulations. Monitoring.</td></tr>
</table>

The area located beyond housing estates and needs to be covered by off-site systems is the most difficult area to be improved. Moreover, it is obvious that pollution load generation in such an area causes severe water quality deterioration.

Therefore it is very important to find out the implementable solution for improving environmental condition in this area up to 2005. For this purpose it is necessary to study this area in more detail. Accordingly, hereafter this area is called as the priority area. The priority area is shown in *Fig.* 5.6.

5.3.4 Demarcation of the priority area

Following (3) systems are selected as technical options for the priority area.

a. Small Modular System (B/G) using Package Wastewater Treatment Plant (hereinafter called as SMS (B/G) using PWTP)

b. Large Modular System using stabilization pond (hereinafter called as LMS)

c. Conventional Sewerage System using stabilization pond (hereinafter called as CSS)

Among these three (3) technical options, SMS (B/G) using PWTP is very unique in the sense of quick benefit generation and high flexibility of selecting service area. However some disadvantages of this system, like lack of sufficient experiences in Indonesia, high unit cost for both construction and O&M, requirement of high level maintenance service to keep its high performance, difficulty of cross subsidy and the requirement of enormous number of units make it difficult to be applied as a principal countermeasure for the priority area.

On the other hands, large scale off-site systems, equivalent to LMS or CSS, can be regarded as optimum countermeasure for this area from the socio-economic, financial and technical aspects in spite of its disadvantages like the necessity of large initial investment, relative long construction period and low flexibility of selecting service area. To illustrate in detail, the advantages of LMS/CSS are as follows.

- Socio-economic aspect
  Cross-subsidy is possible.

- Financial aspect
  Per capita unit construction cost is cheaper than SMS(B/G) using PWTP

- Technical aspect
  Practicability of this system has been well demonstrated.

With careful consideration to the potential problems that include house connection and cost recovery, LMS/CSS are selected as optimum countermeasures for the priority area. Nevertheless, according to experiences of off-site system development in many countries and considering the financial condition of KMUP, it seems to be infeasible to cover the entire priority area with large scale off-site systems completely by the target year 2005.

As a conclusion the strategies for the priority area are as follows.

i) To determine the optimum LMS/CSS development plan based on the result of prioritizing and consideration of topographic condition and cross-subsidy

ii) To introduce SMS (B/G) using PWTP in pilot scale as an effort to investigate its practicability, especially with respect of O&M requirement

iii) To improve O&M of existing sanitation facilities for the non-served area of off-site system

Basically the priority of environmental sanitation improvement has to be determined by the demand, and this principle is exactly applied to select the priority area. But in order to determine the priority of LMS/CSS development inside the priority area, other two (2) factors, affordability of residents and accessibility to treatment facility, have to be considered. Affordability of residents is crucial factor to evaluate the financial feasibility and accessibility to treatment facility is important factor to evaluate the quickness of benefit generation.

The prioritizing method consists of following steps.

i) Selecting data for ranking of each Kelurahans

The data which are selected for ranking of each Kelurahans are as follows.

a. Population density
b. Public land use ratio (commercial and institutional)
c. Average income level
d. Average distance from potential site of treatment facility

note)

For calculating average income level, households with monthly income level less than Rp. 200,000 are excluded, because cost recovery from such low income households is considered infeasible.

ii) Classifying each data for ranking

The classification of each data along with the score of ranking is determined based on the deviation as shown in following table.

score	Population Density (persons/ha)	Public Land Use Ratio (%)	Ave.Distance from WTP (m)	Average Income Level (Rp/month/hh)
1	0~160	0~ 6	4,250~	0~ 85,000
2	160~250	6~13	3,600~4,250	85,000~120,000
3	250~340	13~20	3,100~3,600	120,000~170,000
4	340~430	20~26	2,400~3,100	170,000~205,000
5	430~520	26~33	1,800~2,400	205,000~250,000
6	520~590	33~40	1,200~1,800	250,000~290,000
7	590~680	40~45	800~1,200	290,000~330,000
8	680~790	45~55	400~ 800	330,000~400,000
9	790~870	55~60	0~ 400	400,000~440,000
10	870~	60~		440,000~

iii) Setting coefficients of weighting to integrate each score of ranking

Weighting coefficients are set as follows.

10% Population density
10% Public land use ratio (commercial and institutional)
50% Average income level
30% Average distance from potential site of treatment facility

The result of prioritizing is shown in *Fig.*5.7. Selection of LMS/CSS service area is based on result of prioritizing, topographic condition and the possibility of cross-subsidy. In addition to these factors, maximum pipe length for avoiding pumping station is also considered as a selection factor of LMS service area. As a result, LMS/CSS service area is determined as shown in *Fig.*5.7.

In short term plan cross-subsidy is pursued with applying interceptor sewer for low income area from which cost recovery can not be expected. Average income level of each Kelurahan is shown in *Fig.*5.8.

5.3.5 Zoning of wastewater management in 2005

As a conclusion of this section, *Fig.*5.9 shows the zoning for short term wastewater management plan until the year 2005.

5.4 Proposed Short Term Plan up to 2005

5.4.1 Sanitation improvement plan for slum area

(1) Utilization of existing facilities

Based on the result of field survey conducted by the study team, there are about a total of 200 public toilets. Most of these public toilets are located in the slum areas. It became evident from the survey that about 30 % of these public toilets malfunctioned, or not used. Moreover, 36 public toilets did not have any organization for users.

Accordingly, as the first step to ensure proper use of public toilets once repaired, an appropriate operation and maintenance (O/M) organization shall be established at basic level. In this regard, it is recommended that an operation and maintenance system shall be established under the direct responsibility of RW or Kelurahan in cooperation with Dinas Kebersihan.

(2) Provision of SMS (B) / public toilet for no-toilet people

Considering very low affodability of slum residents and the fact that they do not have any toilet facilities at present, it is infeasible to expect no-toilet people constructing individual toilets with adequate facility by themselves. Accordingly provision of basic toilet facility by public sector becomes essential to eliminate the risk of direct defecation into public water bodies. Then following two (2) technical options are recommended as appropriate basic toilet facilities.

a. SMS (B)
b. Public toilet

Both systems employ septic tank with leaching bed designed for 20 households. The difference is whether with house connection from individual toilet or not. SMS (B) is more recommendable than public toilet because the user of SMS (B) can enjoy the convenience of individual private toilet located within ones housing. However, applicability of SMS(B) is restricted by physical conditions like topographic elevation. For example, if the elevation of available space for treatment facility is higher than housings to be connected, SMS (B) can not be regarded as an appropriate solution.

On the other hand, it is to be noted that once the feasibility of SMS (B) is guaranteed physically, residents can choose between either systems based on their affordability to provide their own water closets and connection pipes to treatment facility.

From the viewpoint of public sector that provides these systems, there is no necessity for separate plans since the difference between the two (2) systems is insignificant.

Based on Kelurahan interview results conducted by the study team, 66 SMS (B) / public toilets were requested, where the site area is prepared by Kelurahan. Accordingly, 66 SMS (B) / public toilets are planned to be constructed within the next two (2) years.

Many experiences of public toilets shows that responsible organization for O/M is crucial for proper functioning of public toilets. In this regard, following organization is recommended.

(a) Responsible person shall be selected from among the users. The administrative management is under Kelurahan office.

(b) User shall pay a fixed amount for using the public toilet. One (1) caretaker will work between 5am ~ 11pm as payment collector, cleaner and manager. The door of the toilet be locked at night time. The key is kept by responsible person or neighbor of the public toilet between 11pm ~ 5am.

(c) The organization is responsible for both O/M and collection of revenue user charge. The cost of O/M include caretaker wage, desludging cost and repair cost.

(d) The user hold a meeting, in case of any matters to be discussed.

In the case of SMS (B), caretaker and key holder are not necessary, hence the required organization for O/M is very simple. Still, service charge and the organization responsible for overall management of the septic tank and its desludging shall be established.

(3) Software measures

The role of software measure is important to eliminate the risk of direct defecation into public water bodies. Without public health education or

campaign about the risk of direct defecation into public water bodies, it is no wonder if people prefer open defecation to public toilet. In addition, it is required to make regulation to discourage direct discharge of human wastes into public water bodies and the effectiveness of this regulation shall be endorsed by the proper monitoring system.

For the purpose of establishing responsible organization for O/M of SMS (B) / public toilet, explanation of these system is also important for users or community in order to ensure their effective cooperation.

5.4.2 Improvement and development plan of on-site system

(1) Establishment of monitoring system

For improvement of on-site facilities, it is essential to estabish monitoring system. The database of on-site facilities developed by the JICA Study Team can be applied for the purpose. As a short term plan up to 2005, this monitoring system shall cover at least the priority area.

At the same time, a certain monitoring effort shall be given to illegal or undesirable facilities and actions. The authority in charge with wastewater management shall have meetings with those residents using such facilities, and educate or propagate the necessity of adequate sanitation facilities.

(2) Improvement of septage collection

It is recommended to introduce new system for septage collection, called as visiting system, instead of existing system called as request system in which dispatching vacuum truck is based on the user's request. In the request system residents will use the facilities until to the last moment, and this may spread the contamination to environment. In visiting system responsible organization for desludging will make a plan of septage collection service based on the record of all previous desludgings. The database of on-site facilities can be applied to make the plan for visiting system of desludging. With applying visiting system, the volume of septage to be desludged will increase due to both the increase in desludging frequency and population toward the short term planning frame of the year 2005. Accordingly, new vacuum trucks will need to be purchased to meet the increasing demand.

(3) Improvement of septage management

The wastewater treatment plants of sewerage system constructed under the short term plan (refer to *Fig.* 5.9) could be used for septage treatment, in addition to the existing septage treatment plant in Antang. This would economize the septage collection and transportation.

Moreover, improvement of access road of existing Antang septage treatment plant is recommended in order to facilitate efficient transportation of septage.

(4) On-site system development plan

In leaching pit development area, following guidelines shall be effective for all new houses and any renovation of on-site facilities.

1) Twin leaching pit shall be provided instead of single leaching pit.

2) A minimum distance of 10 m between leaching pit and well shall be ensured.

3) Leaching trench or irrigation usage shall be introduced as the means of graywater disposal.

In septic tank with leaching field development area, following guidelines shall be effective for all new houses and any renovation of on-site facilities.

1) Septic tank which has water tight structure with leaching field shall be provided.

2) The area of leaching field shall be at least 10 m^2 for blackwater only and 100 m^2 for blackwater and graywater treatment.

3) Graywater shall be treated in leaching trench or used for irrigation, so far as conditions permit, if septic tank treats only blackwater.

5.4.3 Developer modular system development plan

The provision of developer modular system to treat together both blackwater and graywater by all newly developing housing complexes is an important aspect of the Master Plan, requiring urgent enforcement.

The gist of the necessary guidelines for the provision of communal wastewater treatment system by housing developer (hereafter called as developer modular system) is as follows.

(1) Basic consideration

All housing estates with population more than 100 persons including PERUMNAS shall provide developer modular system to treat together both blackwater and graywater. The location of wastewater treatment plant shall be easily accessible from a public road.

(2) Wastewater treatment criteria

For a large scale housing complex with population more than 300 persons (or 50 households), the treated effluent quality shall conform to a secondary treatment level as follows:

- BOD:	not to exceed 30 mg/l
- SS:	not to exceed 30 mg/l
- FC (fecal coliform):	not to exceed 1000 No./100 ml

The recommended alternative wastewater treatment systems for a large scale housing complex are given below:

a. Extended aeration activated sludge process including its variations such as oxidation ditch process
b. Rotating biological contactor (RBC) process
c. Anaerobic-aerobic contact process (Package Wastewater Treatment Plant system)
d. Aerated lagoon
e. Stabilization pond

For a small scale housing complex with population not more than 300 persons (or 50 households), an effluent quality with intermediate treatment level would be admissible as follows:

- BOD:	not to exceed 80 mg/l
- SS:	not to exceed 60 mg/l
- FC:	not to exceed 2000 No./100 ml

The recommended alternative wastewater treatment systems for a small scale housing complex, in addition to those mentioned above, are given below.

a. UASB (Up flow anaerobic sludge blanket)
b. Septic tank with leaching/infiltration field

It is noted that septic tank with leaching/infiltration field would be limited strictly to a small scale housing complex only in order to mitigate potential groundwater pollution due to leaching/infiltration field.

In principle, a wastewater treatment system that discharges treated effluent to receiving waters would require disinfection to meet the above effluent criteria concerned to FC. The possible exception to disinfection requirement is when a maturation pond is provided as the final treatment prior to disposal to receiving waters. Hypochlorite of chlorine (NaOCl or Ca(OCl)2) is recommended as the disinfectant. Due to safety consideration and small scale of the treatment system, gaseous chlorine would not be permitted as the disinfectant.

(3) Sludge management

1) Solid waste from an inlet screen to the wastewater treatment system shall be periodically removed and disposed sanitarily. Disposal along with municipal solid waste or controlled incineration is permissible.

2) A wastewater treatment system shall be provided with drying bed or storage tank as a temporary storage facility. Any such temporarily stored sludge shall be regularly transported and disposed in a septage treatment plant. Potential reuse of sludge as fertilizer or soil conditioner is recommended to be given due consideration.

(4) Operation, maintenance and monitoring

The operation, maintenance and monitoring of the treatment system shall incorporate, in addition to ensure the proper functioning of the treatment system, regular self monitoring of the treated effluent quality at least with respect to the three water quality parameters of BOD, SS, and FC. The frequency of water quality monitoring shall be at least once in two months.

Septic tank with leaching/infiltration field is exempted from the requirement of effluent quality monitoring, as the effluent is infiltrated into natural soil.

(5) Evaluation and monitoring checklist for the concerned government agency of KMUP

The required action programs and the related aspects to be followed by the concerned government agency in charge of approval and the subsequent monitoring of wastewater treatment system constructed and operated by a private housing developer are as follows:

1) Ensure technical effectiveness of the proposed wastewater treatment system by the housing developer.

2) Ensure an operation and maintenance and monitoring plan for the proposed wastewater treatment system is provided by the housing developer.

3) Formulate a monitoring program to inspect the functioning wastewater treatment systems at a frequency conforming the available resource limitation of the agency.

4) Formulate and execute an environmental water quality monitoring program.

(6) Promotion measures of developer modular system

1) Enforcement at basic site plan

At present TATA KOTA is the agency responsible for assessing the basic site plan of a housing complex.

Accordingly TATA KOTA is the most appropriate agency for assessing the provision of developer modular system by a housing complex developer.

TATA KOTA shall ensure that the layout plan of a housing complex incorporates developer modular system. Inclusion of such a developer modular system, in the overall layout plan itself, shall be a prerequisite for gaining approval of any housing complex development.

2) Campaign on quality of life

TATA KOTA, as the representative organization of KMUP, shall organize and conduct public campaign targeting both housing developers and prospective tenants, the living environmental

improvement and hence the enhancement in quality of life, that could be realized with the provision of developer modular system treating both blackwater and graywater, instead of simple individual systems treating only blackwater.

Moreover, the intended purpose of ditches and surface drains as facilities to convey storm water (rain fall) run-off to mitigate flooding, in other words an urban drainage facility, rather than to convey untreated graywater shall be emphasized.

5.4.4 Sewerage system development plan

The short term sewerage development plan consists of two (2) conventional sewerage systems in central and southern area of the old city, and one (1) large modular system in northern area of the old city, as shown in *Fig.*5.10. The measure to promote house connection of sewerage system plays very significant part and is included in this plan.

(1) Central sewerage system

The central city area that covers the major commercial and institutional development of the city of Ujung Pandang is targeted as the service area. The location of treatment plant is in Pampang.

In principle, the sewerage service area will be covered by three (3) sewerage collection system, namely small scale sewer system, ordinary sewer system and interceptor sewer system. Technical criteria of applicability of collection system is shown below.

- Small scale sewer system
  The area where houses have enough space, with width between the front of houses and road is more than 3 m or the road has pedestrian walkway of at least 1 m width.

- Interceptor sewer system
  Area with temporary housing, area of potential redevelopment or area of poor accessibility (road width less than 3 m).

In addition, interceptor service area is not expected to contribute to cost recovery.

The existing land use of the proposed site for treatment plant is fish pond. Accordingly, stabilization pond system is adopted as the simple appropriate wastewater treatment technology.

(2) Southern sewerage system

The service area of this sewerage system in the southern portion of the priority area with predominant residential developments. The coastal part of this area is planned to be developed as a large scale commercial area.

Wastewater collection system would be simple with no pump facility.

The location of treatment plant is in Maccini Sombala. At present, the proposed treatment plant site remains as a wetland (swampy area). Accordingly, similar to that of central sewerage system, stabilization pond is adopted.

(3) Northern sewerage system

Wastewater collection system of this area is also simple with no pump facility. The capacity of Lembo wastewater treatment plant is very limited and consequently this plant will be abondoned with the expansion of service area according to the master plan. Therefore this system is regarded as a large modular system and integation into central sewerage system would be required beyond the year 2005. With this integration the land used as the treatment plant in Lembo will be relieved for other uses like residential /commercial development. Still, it is necessary to install a pump facility in this treatment plant location in Lembo.

As the simple appropriate wastewater treatment method and also with due consideration to the temporary nature of the treatment plant, stabilization pond system is adopted.

(4) Measure to promote house connection

Experiences of sewerage development in other Indonesian cities shows that the number of house connection to sewerage system is still far from satisfactory inspite the strenuous efforts of responsible organization including interest free loan scheme. To avoid this undesirable situation house connection sewers will be implemented by the public sector as a direct project component. In parallel with this hardware measure, campaign and

enforcement for promotion of house connection shall be executed in order to get consensus of construction work inside housing lot.

5.4.5 Introduction of SMS (B/G)

About 50 households comprising about 250 people is planned to be served by SMS (B/G). Blackwater and graywater from households are carried through small scale sewer collection system to a septic tank or PWTP.

Installation of SMS (B/G) can be faster way in wastewater management, comparing large modular system or conventional sewerage system, though the service area is limited. The system seems an attractive option for wastewater management, however, it has not yet been introduced and demonstrated in Indonesia. Therefore introduction of the system shall be first conducted as a pilot project. The result will be studied in both technical and managerial aspects including operation and maintenance. If it could be well organized and operated successfully, introduction of SMS (B/G) project in a wider scale could be promoted.

(1) Pilot project of SMS (B/G) using septic tank

SMS (B/G) using septic tank will be studied for installation at five (5) sites as shown in *Fig.* 5.10. Required area for septic tank is about 10 m x 20 m.

Organization in charge of operation and maintenance shall be ascertained with agreement before the implementation of this pilot project. Service charge of beneficiary and responsible organization for operation and maintenance shall be established and the agreement shall be contracted. The responsible organization for O/M may be the beneficiaries in cooperation with LKMD and/or NGO.

(2) Pilot project of SMS (B/G) using PWTP

SMS (B/G) using PWTP will be studied for installation at one (1) site as shown in *Fig.* 5.10. Required area for PWTP is about 4 m x 15 m.

The conditions related to organization responsible for O/M are same as SMS (B/G) using septic tank.

The system is planned in a high income residential area and the PWTP treatment system is planned to be placed at Tamang Safari park. The treated

effluent (a secondary treatment level) can be reused at the park for irrigation or other non potable uses.

It would serve as a good demonstration for not only wastewater treatment but also reuse of treated wastewater.

5.5 Determination of Master Plan up to 2015

5.5.1 Basic strategy

As already mentioned in chapter 4, master plan for wastewater management up to the year 2015 shall be formulated to achieve CL in the whole Study Area.

Since short term wastewater management plan up to 2005 is determined and described in foregone section, this section describes wastewater management plan from the year 2006 until 2015 as a second stage plan.

Based on the result of field survey shown in *Fig*.5.5, required water quality standard for CL, 30 mg/ℓ as BOD, can be obtained where specific pollution load discharge is less than 1.8 kg BOD/day/ha.

Consequently basic strategy for formulating master plan for wastewater management consists of following three (3) steps.

i) To demarcate the most recommendable technical options, based on the characteristics of each area, which can reduce pollution load discharged to environment to a level less than 1.8 kg BOD/day/ha.

ii) To find out schemes for each area to be served by the most recommendable technical option.

iii) To optimize public sector project schemes so as to maximize private sector participation.

5.5.2 Demarcation of Study Area

The criteria for demarcation of short term plan can still be applied to formulate master plan with the inclusion of additional criterion that the specific pollution load discharge shall be less than 1.8 kg BOD/day/ha. Accordingly, even with proper treatment of blackwater in on-site system of leaching pit/septic tank with leaching field, this criteria of achieving CL can only be met when the specific pollution load generation from all sources other than blackwater less than 1.8 kg BOD/day/ha. For those areas exceeding the sepecific pollution load generation of 1.8 kg BOD/day/ha form all sources other than blackwater, in principle, further treatment of this wastewater is necessary. Such further treatment can be practicallly achieved with secondary treatment of whole wastewater.

It is noted that the rapid increase of population in suburban area will be caused by development of large scale housing estates. In other words, most of population in such an area will be confined to large scale housing estates. As already mentioned in short term plan, large scale housing estates shall be covered with developer modular systems, which treat both blackwater and graywater to secondary treatment level. Accordingly, demarcation of areas suited for leaching pit and septic tank with leaching field can be based on the data excluding the estimated large scale housing estates.

Based on the estimation of pollution load generation as BOD in 2015 and the considerations mentioned above, leaching pit or septic tank with leaching field treating only blackwater can be applied in quite large part of suburban area.

It is noted that in such a suburban area with specific pollution load generation from all sources other than blackwater is less than 1.8 kg BOD/day/ha, the population density is less than 100 persons/ha. Accordingly, demarcation of the area between leaching pit and septic tank with leaching field could be made entirely based on the critical depth of groundwater table level, as per the short term plan described in section 5.3.

On the other hand, remaining area shall be served with off-site system to obtain a secondary treatment level thereby attaining the CL.

5.5.3 Schemes for each area

Basically the schemes of master plan are continuous development of the short term plan. The short term plan has already provided the basis of wastewater management like a responsible institution, necessary guidelines and regulations and wastewater treatment plant which is applicable even in long term.

The entirely new scheme is the integration of modular system into conventional sewerage system. This integration will be necessary for all modular systems located within the conventional sewerage system development area.

Following table shows schemes of master plan after completion of short term plan.

Characteristics of Area			Schemes of Wastewater Management	
Specific Type	Groundwater	Specific BOD load	Private Sector	Public Sector
Non Housing Complex	Deeper than 4 m	Specific BOD load except for blackwater is less than 1.8 kg BOD/d/ha	Residents should provide **Leaching Pit** when they construct or renew their housing.	**Monitoring.**
	Shallower than 4 m		Residents should provide **Septic Tank with Leaching Field** satisfying standard when they construct or renew their housing.	**Monitoring.**
		Specific BOD load except for blackwater is more than 1.8 kg BOD/d/ha	No schemes	**Off-site system with secondary treatment** shall be installed.
Housing Complex			Housing Developer should provide **Developer Modular System** satisfying standard in their own housing estates.	**Monitoring.** For the area enclosed sewerage system, **Integration into Conventional Sewerage System** shall be done.

5.5.4 Zoning of wastewater management in 2015

The proposed off-site system development area is determined considering land use and geographical and topographical conditions in addition to demarcation mentioned above.

As a conclusion of this section, *Fig.* 5.11 shows the zoning for wastewater management master plan.

5.6 Proposed Master Plan up to 2015

5.6.1 Improvement plan of on-site system

(1) Monitoring system

As a second stage of master plan, the monitoring system introduced in the priority area of short term plan shall be extended to the whole Study Area.

(2) Septage collection

Required number of vacuum trucks each of capacity 3 m^3 is estimated as follows based on the quantity of septage to be desludged. Frequency of operation is assumed to be five (5) days/week. The rate of depreciation of a truck is assumed to be once in five (5) years.

- 22 units in year 2010
- 18 units in year 2015

(3) Septage treatment

All wastewater treatment plants for conventional sewerage systems and Antang septage treatment plant can treat desludged septage.

(4) Development of on-site system

For leaching pit development area and septic tank with leaching field development area, the guidelines same as short term plan shall be still effective for all new houses and any renovation of on-site facilities.

5.6.2 Developer modular system development plan

Basically, same guidelines as short term plan shall be still effective. Nevertheless, if there is a network of conventional sewerage in the vicinity, developer shall directly dispose the entire wastewater (blackwater and graywater). Hence the installation of ones own treatment plant is not necessary.

To facilitate integration of developer modular system with conventional sewerage, it is recommended that responsible institution of wastewater management shall show the total facility plan of conventional sewerage system to a developer before the approval of construction of housing estate. Approval of the developer modular

system shall be made only when the proposed modular system is in conformity with the sewerage development plan.

5.6.3 Sewerage system development plan

(1) General development plan

The objective sewerage development area for the year 2015 covers 5,564 ha with a total population of 1,341,000. This area is divided into five (5) zones for alternative study of collection system alignment. Design wastewater discharge of each zone as of the year 2015 is as follows.

Sewerage Zone	Design Wastewater Discharge
Northern zone	53,600 m^3/day
Central zone	63,400 m^3/day
North-eastern zone	26,300 m^3/day
Southern zone	41,000 m^3/day
South-eastern zone	77,700 m^3/day
Total	262,000 m^3/day

Based on the proposed short term plan, the most compatible development plan would include the following.

- Northern and Central zone will be served with Pampang wastewater treatment plant. Lembo wastewater treatment plant will be discontinued and integrated into Pampang due to its limited capacity for further expansion of service area.

- Southern zone will be served with Maccini Sombala wastewater treatment plant.

It is to be noted that the long term plan or "should be" image is essential to formulate appropriate sewerage development plan, because the flexibility of sewerage development plan is quite low due to application of pipe network installed underground for the conveyance of wastewater. Accordingly, an alternative study of sewerage development plan was conducted as mentioned below, independent of proposed short term plan up to 2005, from the view point of long term.

Following three (3) combination of zones are examined as alternatives of sewerage development plan.

Alternative 1: Singe large scale sewerage system

The whole sewerage development area will be served with Pampang/Lakkang wastewater treatment plant.

Facility alignment is shown in *Fig.* 5.12.

Alternative 2: Two (2) medium scale sewerage systems

Northern, North-eastern and Central zones will be served with Pampang /Lakkang wastewater treatment plant. Southern and South-Eastern zones will be served with Maccini Sombala wastewater treatment plant.

Facility alignment is shown in *Fig.* 5.13.

Alternative 3: Three (3) sewerage systems of medium and small scale

Northern, North-eastern and Central zones will be served with Pampang /Lakkang wastewater treatment plant. Southern zones will be served with Maccini Sombala wastewater treatment plant and South-Eastern zone will be served with Gunung Sari wastewater treatment plant.

Facility alignment is shown in *Fig.* 5.14.

The construction cost and O&M cost of above three (3) alternatives are compared as follows.

	Construction Cost (billion Rp.)	O&M Cost (billion Rp./year)
Alternative 1 (Single large scale system)	664.3	13.3
Alternative 2 (Medium scale system)	669.0	13.4
Alternative 3 (Medium and small scale system)	667.6	13.4

It is evident from the above, that the difference in cost among the three(3) alternatives is insignificant. Consequently Alternative-3 is proposed based on the following reasons.

- Compatibility with the short term sewerage development plan

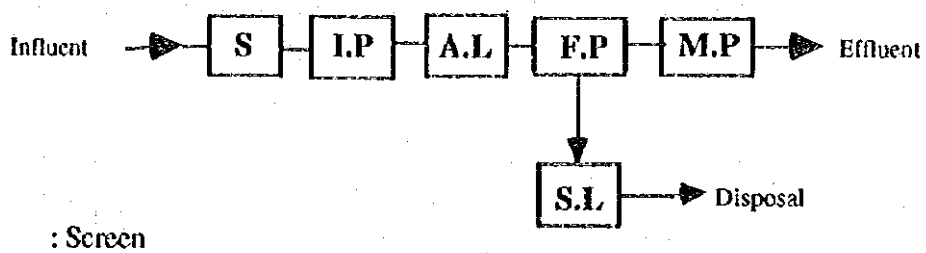
- Advantage of sewer networks (from the view points of lower earth covering depth and smaller number of lift pump stations)

(2) Treatment system

Because the volume of wastewater to be treated will rapidly increase during the second stage of master plan, aerated lagoon will be the most recommendable treatment system. Especially for existing stabilization pond constructed within short term plan up to 2005, upgrading to aerated lagoon is very easy by means of installation of aerator.

With applying aerated lagoon, the capacity of wastewater treatment plant can afford against rapid growth of water consumption and further extension of sewerage service area.

The flow diagram of the proposed treatment process is shown below.



S : Screen
I.P : Inflow Pump
A.L : Aerated Lagoon
F.P : Facultative Pond
M.P : Maturation Pond (minimum of two ponds in series)
S.L : Sludge Lagoon (minimum of two cells)

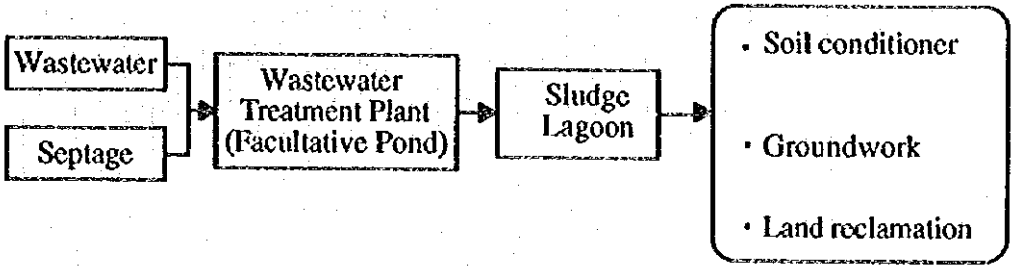
(3) Sludge management

One of the major advantages of aerated lagoon concerned to sludge management is the low amount of sludge generation in comparison to similar aerated treatment processes.

The volume of sludge generated in wastewater treatment plants is estimated to be 160,000 m^3/year. Sludge is desludged every 2 years and dried in sludge lagoon. Water content will decrease to 65% with this process and volume of sludge is reduced to be 23,000 m^3/year.

The characteristics of dried sludge can be considered to be safe and stable because toxic and hazardous waste is not included and sludge has been matured for long time. Therefore it is recommended to utilize dried sludge as soil conditioner, groundwork of building construction and land reclamation.

The flow of sludge management is shown below.



(4) Measure to promote house connection

House connection ratio will be still essential to guarantee the effectiveness of sewerage system. Therefore same efforts as mentioned in short term plan, campaign and enforcement or direct construction of house connection sewer by public sector, shall be continued to avoid undesirable situation with low house connection ratio.

5.7 Cost Estimation

5.7.1 Total investment cost

Total investment cost for overall wastewater management plan up to 2015 is estimated at Rp. 550 billion at 1995 prices, which includes the cost incurred both by public sector and private sector. In this study installation cost of house connection shall be included in project cost of public sector on condition that this cost, in addition to that of operation and maintenance cost, could be recovered with user charges. The breakdown of total investment cost is shown below.

Unit : Million Rupiah

Component	1996~2005	2006~2015	Total
Public Toilet / SMS(B)	360	0	360
Septage Management	2,080	4,774	6,854
SMS (B/G)	2,268	0	2,268
Sewerage System	71,638	470,166	541,804
Total	76,346	474,940	551,286

It is noted that the investment cost for sewerage system development by public sector during a second stage from 2006 to 2015 could be reduced if all the potential large scale housing estates have already been covered with developer modular system before the integration with conventional sewerage system. On such an assumption the total project cost of Master Plan becomes 484 billion Rupiah, thereby resulting in reduction of public sector investment.

5.7.2 Operation and maintenance cost

Annual operation and maintenance cost consists of electric consumption, fuel for vacuum trucks, chemical consumption, personnel, repairing and replacement cost. Annual operation and maintenance cost is estimated to be Rp.2,445 million in the year 2005 and Rp.9,750 million after the year 2015. The breakdown of annual operation and maintenance cost is shown below.

Unit : Million Rupiah / year

Component	2005	After 2015
Public Toilet / SMS(B)	540	0
Vacuum Truck	766	531
SMS (B/G)	26	0
Sewerage System	1,113	9,219
Total	2,445	9,750

5.8 Institutional Plan for Wastewater Management Sector

5.8.1 Comprehension of the present situation

(1) Wastewater management institution

No wastewater management institution has even been set up and existed in KMUP.

(2) Night soil desludging work

The activity has been delt with by Dinas Kebersihan, KMUP in compliance with Perda No.11/1987 of KMUP.

(3) Regulation

Although no specific regulation exists for wastewater in KMUP, Law No.20 of the year 1990 stipulates the control of water pollution particularly in Article 27(1) providing that disposal of domestic wastewater shall be regulated by Perda/Regional Law.

(4) Case of water supply institution

A project unit had been set up with the fund of and under the control of and was reorganized into BPAM (Badan Pengelola Air Minum/water supply management body) by Cipta Karya, PU. After 5 years (2 experimental & 3 strengthening / stabilizing years), BPAM is converted to PDAM (Perusahan Dearah Air Minum / water supply public enterprise) by Perda No.6/1974 of KMUP upon legalization by Governor of South Sulawesi Decree No.253/VI/1975 and inplementable by Mayor Decree No.21/P/II/1976.

5.8.2 Wastewater management institution for the Master Plan

(1) Establishment of project unit

KMUP shall take the very first step for planning a project as soon as possible, determining the undermentioned factors of the project according to its intention, policy and strategy based on the results of a Feasibility Study (F/S) in this Study and referring to the cases of PDAM (KMUP), the PD PAL JAYA (Jakarta), the PDAM (Bandung) etc.

A proposal document has to be prepared for the project, consulting with Cipta Karya, its KANWIL PU: Kantor Wilayah PU (representative office of the PU), the provincial government TK I of South Sulawesi and other necessary authorities such as sections and/or departments in charge of the Ministry of Home Affairs pursuant to the necessity.

The proposal had better be submitted to Cipta Karya as soon as possible by or in 1996.

Organizational structure is referred to *Fig.* 5.15.

(2) Establishment of a transitional unit

It is essential to set up a transitional unit from the project unit to PD (public enterprise)

The proposal shall be submitted to Cipta Karya when the completion of the implementation of the project unit can be foreseeable in order to establish the transition unit like BPAL (Badan Pengelola Air Limbah/wastewater management body) and the like as early as possible by the year 2005.

Upon the establishment, the transitional unit shall be handed over the work of night-soil collection to by Dinas or PD Kebersihan.

Concerning the fund for the traditional unit, following two (2) cases are considerable.

(i) In case of BPAM, the fund is provided the unit/body with by the central government.

(ii) In case of PD PAL JAYA, Jakarta, a source of the fund is same as above case (i).

These cases for a transitional unit shall be determined in the discussion by and between the central and local governments because the source is still uncertain, though the cases (i) and (ii) are delt with by the central government as before mentioned.

Organization chart is shown in *Fig.* 5.16. Required number of personnel is 259 persons in total.

- Head of unit (BPAL) 1 person
- Head of division 2 persons

- Financial affairs section	10 persons
- General affairs section	10 persons
- Personnel affairs section	6 persons
- Customers relation section	20 persons
- Operation & transport section	75 persons
- Treatment plant section	80 persons
- Pump station section	14 persons
- Technical equipment section	15 persons
- Construction sub section	21 persons
- Planning sub section	5 persons

(3) Alternatives of wastewater management institution

It can be envisaged that the transitional unit like BPAL will independently be converted to PDAL (Perusahan Daerah Air Limbah/local wastewater public enterprise), as Alternative I, and be merged with the existing PDAM (Local water supply public enterprise) of KMUP, as Alternative II.

1) Alternative I (PDAL in 2015)

Legal procedure is as follows.

a. The Mayor shall issue a new Perda (local regulation) for the establishment and its implementation of a local wastewater public enterprise (PDAL) by the year 2015 pursuant to the local autonomy.

b. The governor of South Sulawesi shall promulgate the said Perda for the legislation.

Required number of personnel is 377 persons in total.

- Presidential room (President Director/staff)	3 persons
- Supervision council (counselors)	3 persons
- Internal auditing unit/Research department	8 persons
- Data processing/Security guard	15 persons
- General and financial directorate	79 persons
- Technical directorate	249 persons
- Housing service units	20 persons

Fig. 5.17 shows the organizational structure of PDAL in 2015.

2) Alternative II (PDAM in 2015)

Concerning legal procedure, revision of Perda No.6/1994 of KMUP is essential. It seems not difficult to revise it based on the decision of the Mayor of KMUP and the approval of the Governor of South Sulawesi province.

Required number of personnel in 2015 is estimated at 1,910 persons in total referring to the case of PDAM Bandung.

- Presidential room (President Director/staff)	8 persons
- Supervision council (counselors)	7 persons
- General and financial directorate	395 persons
- Others (other administration/housing service units)	350 persons
- Water supply directorate	900 persons
- Wastwater directorate	250 persons

Fig. 5.18 shows the organizational structure of PDAM in 2015.

5.9 Implementation Schedule

Implementation of the Master Plan shall be commenced in the year 1996 and completed until the year 2015. In this study the overall master plan aims "should be image" of wastewater and solid waste management in the Study Area. Accordingly, it is required to enhance the public sector investment for this plan, especially during the second stage of the plan from 2006 to 2015. Hence, implementation schedule would depend on the availability of fund on a priority basis.

As already mentioned in section 5.3, the most urgent component of this plan is sanitation improvement for the slum areas and this component is recommended to be implemented until the year 2000.

Study Team recommends that the implementation of pilot project shall be commenced as soon as possible considering its potential to contribute to sanitation improvement not only for the Study Area but also for other areas in Indonesia.

Sewerage development would be implemented based on the availability of foreign funds since it requires high initial investment cost. The priority sequence for implementation of sewerage development during the short term plan was identified from the aspects of demand, benefit and cost efficiency. As a result, the highest priority is given to Central zone, followed by Southern zone and Northern zone. The priority sequence for expansion of service area during a second stage of Master Plan can be determined later based on the actual condition as of completion of short term plan.

Proposed implementation schedule is shown in *Fig.* 5.19.

5.10 Cost Recovery

5.10.1 Cost recovery for sewerage development

In general, it is very difficult to recover the entire investment cost of sewerage development only with user charge, especially in developing countries where the affordability of residents is low. On the other hand, it is crucial to recover at least operation and maintenance cost (O&M cost) with user charge for the financial viability of independent wastewater management organization like PDAM or PDAL. Between these two levels of cost recovery, following alternatives could be considered.

a. O&M cost shall be recovered.

b. Depreciation cost of house connection and O&M cost shall be recovered.

c. All cost excluding depreciation cost of wastewater treatment plant and main sewer shall be recovered.

d. All cost shall be recovered.

Considering affordability of residents and also to be in compatible with other public service charges, the acceptable level of cost recovery is considered as follows.

- Until the year 2005, monthly user charge shall cover whole O&M cost and depreciation cost of house connection. Depreciation cost other than that of house connection shall be covered with capital works charge collected from commercial and institutional entities.
- From the year 2006 to 2015, all cost excluding depreciation cost of wastewater treatment plant and main sewer shall be covered with monthly user charge and capital works charge collected from commercial and institutional entities and high income residents.

Recommendable user classification for tariff system in descending order is as follows:

- Department stores and large hotels
- Shops, hotels, restaurants and commerce
- Institutions

- High income residents
- Middle income residents
- Low income residents

In determination of the tariff for each classification, cross-subsidy shall be pursued to the maximum possible extent.

5.10.2 Cost recovery for septage management

Concerning septage management, full cost recovery would be acceptable because total cost of septage management is smaller than the O&M cost of sewerage development. Moreover, it is recommended that desludging charge can cover total cost of public toilet / SMS (B) in addition to that of septage management.

User classification for tariff system is same as tariff of sewerage system. In determination of the tariff for each classification, cross-subsidy shall be pursued to the maximum possible extent.