

Enhancing The Maintenance Of Septic Systems:  
Case Study Of Septic Tank Maintenance In Jakarta, Indonesia

by

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ABSTRACT

In the absence of a city-wide sewerage system, many households in Jakarta rely on septic tanks to hold and treat their toilet waste. However, many septic systems are not maintained properly, resulting in overflows and contamination of water resources. This thesis examines and evaluates the underlying causes of poor maintenance of septic tanks, and proposes recommendations to solve the problem.

The conclusion indicates that despite its instituted function, Jakarta Sanitation Department has a tendency to be more responsive to solid waste-related services than it is to wastewater management. This tendency is attributed to a number of interrelated factors: its problematic definition of the term "cleanliness," the increasing public awareness of solid waste management, and the department's desire to win the Adipura Award which is focused on solid waste management.

The thesis recommends strengthening the department's role as the service provider, which include revising of existing regulations with respect to construction and maintenance of septic systems, adjusting the tariff structure, and consolidating public campaign materials to reflect the department's established function; involving private companies in producing the service in septic sludge transportation and treatment; and involving community organizations to support the sanitation department's program. Scheduled desludging procedure is the most favorable option with which to solve current deficiencies in operation and maintenance of septic tanks. Nevertheless, its implementation requires a set of preconditions which will be carried out in three stages: immediate measures, medium-term measures and long-term implementation.

Thesis Supervisor: Paul F. Levy  
Title: Adjunct Professor, Urban Studies and Planning

*In loving memory of my parents  
for their lasting devotion and guidance*

Hj.Elly Moersid-Martakoesoemah  
*May 1921 - November 1992*

H.Mohammad Ali Moersid  
*July 1921 - June 1996*

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## GLOSSARY/ACRONYMS

BOD	Biochemical Oxygen Demand
Dinas Kebersihan	Sanitation department
DKI	Daerah Khusus Ibukota Special capital region
GDP	Gross Domestic Product
KPPL	Kantor Pengkajian dan Penelitian Lingkungan Urban and environment study office
LKMD	Lembaga Ketahanan Masyarakat Desa Village Development Council
MCK	Mandi-Cuci-Kakus Public bathing-washing-toilet facility
PBB	Pajak Bumi dan Bangunan Land and Building Tax
PDPAL	Perusahaan Daerah Pengelola Air Limbah Local wastewater management enterprise
PKK	Pembinaan Kesejahteraan Keluarga Family Welfare Organization
PRAMUKA	Praja Muda Karana Indonesian Scout Organization
Rp.	Indonesian Rupiah
RT	Rukun Tetangga Neighborhood association
RW	Rukun Warga Group of neighborhood associations
USAID	United States Agency for International Development

# CHAPTER 1

## INTRODUCTION

### 1.1 Overview

This chapter describes the current situation of wastewater management in several Indonesian cities and focuses particularly on the disposal of human waste in the city of Jakarta. Reports and articles on Indonesia and Jakarta will be reviewed to illustrate the current economic and social changes which have led to environmental degradation. The causes of water resources contamination and its health-related impact will be discussed to describe the extent of the problem. Finally, this first chapter will provide background information on existing septage disposal practices in Jakarta.

Since Indonesia's first Twenty-Five-Year Long-Term Development Plan, the public and private sectors, non-governmental organizations and individuals have made substantial investments in urban infrastructure. Nevertheless, some infrastructure are less developed than others, with domestic wastewater management being perhaps the least developed. In the absence of a conventional sewage collection and treatment system, many households in Jakarta have installed septic tanks to hold and treat their toilet waste. However, many septic facilities are not regularly maintained, resulting in overflows and contamination of water resources. It is estimated that not more than ten percent of the septic sludge reaches the



sewage treatment plants (USAID, 1992, p.D2.5). This situation contributes to environmental degradation and poor health conditions.

## **1.2 Economic Growth and Urbanization**

During the First Long-Term Development program (Pembangunan Jangka Panjang Pertama, 1969/1970 - 1993/1994), Indonesia achieved increased income per capita, reduced the number of its people living under poverty, increased life expectancy and reduced the adult illiteracy rate (Miller, 1995, p.14; World Bank, 1994, p.4). Moreover, since the mid-1980s, the country has shifted its development strategy from a dependence on oil and agriculture sectors to a reliance on rapid industrialization. Non-oil exports doubled between 1986-1989, exceeding the value of oil-related exports for the first time since 1973. In 1982, oil accounted for about 70 percent of government revenues and 72 percent of exports; by 1992 it accounted for only 36 percent of the government revenues and 30 percent of exports. At present, manufactured goods are the fastest growing non-oil export, increasing at an average of 27 percent per annum between 1989 and 1994 (World Bank, 1994, p.5).

The nation's development strategy on the growth of industry has shifted the society from a largely rural to a predominantly urban one.<sup>1</sup> Between 1990 and 1995, the urban population throughout the country increased about 4.5 percent, whereas the growth in rural

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<sup>1</sup> Urban is defined in Indonesian statistical records as an administrative unit that fulfills three criteria: (i) a population density of more than 5,000 people per square kilometer; (ii) 25 percent or less of the households engage in agriculture as the primary source of income; and (iii) more than eight of the following 12 urban facilities: motorized public transportation, movie theater, primary schools, junior and senior high school, health clinic, maternity clinic, public health center, post office, bank, indoor market, shopping place and hotel (Lubis, 1994, p.69)

areas was 0.1 percent. In 1995, the urban population was 35 percent of the total population; it is estimated that by 2025 no less than 61 percent of the people will live in urban areas.

Jakarta, the country's capital, has a total area of 650 square kilometers and a population of 9,341,000 people (KPPL DKI, 1996, p.2).<sup>2</sup> Jakarta has absorbed, and still attracts, a well-educated and experienced labor force from all over the country. Between 1980 and 1990, the population grew by 7 percent per annum.<sup>3</sup> In Jakarta's fringe areas, where industrial output was expanding rapidly, the population grew about 17 percent during that period (The World Bank, 1994, p.67). The development in Jakarta has allowed living standards to improve significantly. The city is the country's center of government, finance, and commerce, and accounts for 7 percent of the country's GDP, 17 percent of its industrial production, and 61 percent of its banking and financial activities. The inhabitants' income per capita is approximately 70 percent higher than the national average (World Resources Institute, 1996, p.6). However, in spite of its importance and share in Indonesia's economic growth, the city currently faces an increasing problem with the condition of its environment.

### **1.3 Environmental Conditions and Health Implications**

Urbanization is often associated with job opportunities, higher incomes, and improved social facilities (Dillinger, 1994, p.6; Cheema, 1988, p.244). Yet along with these benefits, urbanization also raises problems for the municipalities, which must face the rising demand for urban services, including provision of potable water, treatment of sewage and disposal of

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<sup>2</sup> Other source notes that the daytime population of Jakarta is approximately 11 million, whereas its night time inhabitants is about 9.5million (Kompas, 15 December 1997).

<sup>3</sup> In recent years the population growth in Jakarta has leveled of to about 2 percent per year. Between 1995 and 1996, the growth was 1.96 percent (KPPL DKI, 1996, p.2)

solid waste. Despite these urgent needs, municipalities cannot keep pace with the increasing demand due to insufficient resources and complexity in delivery of services (Cheema, 1988, p.248). In addition, the community's awareness of environmental issues is still low. As a result, many large cities are plagued with, among other ills, water pollution.

In Indonesia, industrialization and increased agricultural productivity, accompanied by the rapid population growth begun in the early 1970s, have contributed to the deterioration of water resources in the downstream area where many large cities are located. In Java, the sources of water pollution include agricultural waste, industrial effluent and domestic wastewater. At the end of the 1980s, results of one of the studies in the Clean River Programme showed that the main water contaminants were composed of organic substances and bacteria, indicating domestic origin.<sup>4</sup> This was supported by another study at the Sunter River catchment in Jakarta.<sup>5</sup> The study shows that the major sources of pollution are sullage or grey water (50 percent of the total BOD load) and toilet waste or black water (19 percent), whereas solid waste and industrial effluent are only 15 and 10 percent, respectively.<sup>6</sup> A World Bank report (1993) states that households contribute 75 percent of the BOD level in Jakarta's rivers, whereas industries' share is "only" 15 percent.

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<sup>4</sup> Clean River Programme, or Program Kali Bersih, was initiated by the national government on June 1989 in 11 provinces to reduce pollution load in 24 rivers and improve the quality of water resources. Initially the program was directed to lower the pollution originating from industries (Environmental Impact Management Agency, 1990, p.17)

<sup>5</sup> The Sunter River originates in West Java and discharges its flow into Jakarta Bay. The river passes through agricultural, industrial and (low and high density) housing areas in West Java and Jakarta. The observations started in November 1989 and continued for 12 months. During this period the water level in 20 monitoring stations were measured 3 times a day and hundreds of water quality analysis (such as pH, turbidity, conductivity, BOD, COD, nitrate, heavy metals and coliforms) were carried out. The total amount of organic load was 48 tonnes of BOD per day and it was estimated that approximately US\$85 million would be needed to improve the water quality. (Binnie and Partners, 1990)

<sup>6</sup> Note that another six percent, or approximately three tonnes of BOD per day, could not be identified and, therefore, is labeled as "unknown/unidentified sources". (Binnie and Partners, 1990)

Jakarta's 13 river systems are important natural resources which ideally could be utilized by its inhabitants for recreation or other daily activities. However, increased water consumption, coupled with uncontrolled wastewater discharges from households, industries and agriculture areas, have deteriorated the quality of these resources. A 1996 annual study commissioned by KPPL DKI Jakarta (Kantor Pengkajian Perkotaan dan Lingkungan DKI Jakarta, or the Urban and Environment Study Office of Jakarta) concludes that all of its 75 monitoring locations in the 13 rivers shows that the samples are either contaminated by *Eschericia coli* (29 sampling points ), *Salmonella sp.*(two sampling points), or both (34 sampling points). Furthermore, the results of groundwater monitoring by KPPL DKI Jakarta indicates that 57 out of 60 (or 95 percent) monitoring wells in Central Jakarta are contaminated by Coliforms.<sup>7</sup> The results for other areas of Jakarta, i.e., Northern Jakarta, Western Jakarta, Southern Jakarta and Eastern Jakarta, are 90, 85, 85 and 82 percent, respectively.

This adverse situation, coupled with low coverage of piped water, has resulted in a high incidence of diarrhea-related mortality and morbidity rates.<sup>8</sup> Based on the 1990 Census data for Jakarta, the prevalence of diarrhea among children below the age of five was about 158.6 episodes per 100 children annually, or about 1,440,000 cases per year. The World

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<sup>7</sup> Groundwater is a source of clean water for about 50 percent of Jakarta's inhabitants (EX Corporation, March 1992, p.181).

<sup>8</sup> In spite of a widely understood impact of water pollution on health, it is still difficult to quantify the linkage due to a number of contributing factors associated with the incidence of waterborne diseases. It is still unclear, for example, whether an increase in water quality improvements or a clean water supply alone can significantly reduce the incidence. It is evident, however, that provision of a packaged service, which include high quality drinking water, proper human waste disposal, and education to improve personal hygiene, has a positive impact on incidence of waterborne diseases. A recent study in 30 countries on water quality and quantity, hygiene and sanitation, concludes that improvement of water and sanitation could reduce diarrheal mortality by 55 to 60 percent, and morbidity by 25 percent. (World Bank, 1994, p.257).

Resources Institute (1996) report indicates that diarrhea is responsible for 20 percent of deaths in children under the age of five (p.6).

#### **1.4 Domestic Wastewater Disposal**

Domestic wastewater plays a major role in the contamination of water resources. Sewer systems are used by less than five percent of the urban population and not all of the collected sewage is treated. In the absence of a city-wide collection and treatment system, many households install septic tanks to hold and treat their toilet waste.<sup>9</sup> As a whole, it is estimated that about 42.4 percent of urban households have access to private toilets with septic tanks, and the rest use either private toilets without septic tanks or public/shared facilities (Miller, 1995, p.12).

In Jakarta, Indonesia's capital, whose population is more than nine million, the number of sewer connections for residential and non-residential buildings is only 968 and 56, respectively.<sup>10</sup> In this situation, households rely on on-site disposal methods (e.g., septic systems or leaching pits) to treat toilet waste, the most common being the septic tank. No accurate data on the number of septic systems in Jakarta are available. The 1991 Study on Urban Drainage and Wastewater Disposal Project in the City of Jakarta (hereinafter referred to as the 1991 Jakarta Wastewater Master Plan) by Pacific Consultants International suggests

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<sup>9</sup> Septic tanks in Indonesia are utilized to treat toilet waste or black water only. Grey water or sullage is usually disposed untreated into storm drains. (Miller, 1995, p.99; Pacific Consultants International, 1990, p.F.7; Silver, 1990, p.4.1).

<sup>10</sup> The system is managed by Jakarta Wastewater Management Enterprise (Perusahaan Daerah Pengelola Air Limbah Jakarta or PDPAL DKI Jakarta). The collected wastewater is treated in one of the two aerated lagoons (West and East ponds) with a total capacity of 495 liters per second and the effluent is discharged into Cideng river (PDPAL DKI Jakarta, 1994).

that 68 percent of the population in the study area have individual toilets that discharges their waste into a septic tank.<sup>11</sup> A report by EX Corporation (1992) notes that 50 percent of the inhabitants are served by this facility (p.181). Dillinger (1994) mentions that 800,000 households in Jakarta have installed septic tanks (p.7).<sup>12</sup> In this respect, Dillinger's estimates is close to the number mentioned by Gaymans and Sudradjat (1989), i.e., 600,000 septic tanks (p.29).

### **1.5 Desludging of Septic Tanks and Treatment**

The extent of the use of septic systems in large cities suggests that they may be responsible for part of the current water pollution problem. This is supported by indications that a large number of septic tanks are not properly maintained. Many of them have never been desludged; in some cases, the sludge is allowed to overflow into storm drains and eventually finds its way into the rivers.

A number of studies on wastewater management in Indonesia indicate that many owners do not maintain their facilities properly (Gaymans and Sudradjat, 1988, p.17-20; Miller, 1995, p.97; Silver, 1990, p.4.3). Some people almost never check sludge levels or only react to clogging. In a number of cases, instead of desludging the septic tanks, owners bypass the effluent into storm drains. For example, 60 percent of the septic tanks in the city of Denpasar, Bali, were never desludged, whereas the remaining 40 percent were cleaned every four years or more (Pacific Consultants International, 1993, p.4.2). In the city of

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<sup>11</sup> Other households have private toilets with no treatment (16.6 percent) and some people use public or shared facilities (six percent), while 9.4 percent have no access to any facilities. Toilet facilities which have no treatment usually discharge its waste into rivers or irrigation channels (PCI, 1991).

<sup>12</sup> Assuming that the household size is 4.5 persons (Miller, 1995, p.6).

Manado, North Sulawesi, septic tanks serve about 34 percent of the population of 371,800 people; however, only 20 percent of the tanks are desludged regularly (PT Dacrea Consulting Engineers, 1997).

Similarly, maintenance of septic systems and disposal of septic sludge in Jakarta have not been very effective. A 1992 USAID report on Municipal Finance for Environmental Infrastructure, part of the Project 497-HG-006, implies that only ten percent of the sludge from 68 percent of Jakarta's citizens using septic tanks reached treatment facilities (p.D2.5). However, further analysis suggests that the percentage is even smaller. The 1991 Jakarta Wastewater Master Plan reports that in fiscal year 1989/1990, the Jakarta Sanitation Department (or Dinas Kebersihan DKI Jakarta) served 24,632 households and removed 71,823 cubic meter of septic sludge, thus resulting in an average sludge volume of about three cubic meters per household. The department has 108 vacuum trucks with a total capacity of 332 cubic meters.<sup>13</sup> In addition to the sanitation department's fleet, there were 5 registered private companies which own on average 5 vacuum trucks each. In the same period, 1,717 cubic meters of sludge were transported by these companies to treatment facilities. Assuming the sludge volume per household is 2.9 cubic meters, the privately owned trucks served about 592 households. Assuming that Dillinger's estimation of the number of septic tanks (i.e., 800,000) in Jakarta is relatively accurate, this means that only 3.15 percent of septage actually reaches the treatment plants.

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<sup>13</sup> In 1989/1990, the Jakarta Sanitation Department has 108 trucks with capacities of two-, four- and six-cubic meters and the number of trucks for each are 77, 4 and 27, respectively (Pacific Consultants International, 1991, p.F.14).

The 1996/1997 Annual Report prepared by the Jakarta Sanitation Department states that 117,689 cubic meters of sludge were collected from 34,339 households and treated between April 1996 and March 1997. On average, 3.4 cubic meters are desludged from each household. Neither information on the volume of sludge collected nor the number of households served by the private companies is available in this report. However, based on the revenues collected by the department for provision of septage treatment facilities, it is estimated that the private vacuum trucks transported 7,433 cubic meters of sludge to the treatment plants.<sup>14</sup> In total, about 36,525 households, or 4.56 percent, have their on-site disposal facility cleaned and their sludge brought to the treatment sites.

## **1.6 Outline of Thesis**

The objectives of this thesis are to identify and evaluate the underlying causes of poor maintenance of septic tanks, and to propose feasible solutions to the problem. Firstly, the purpose of this thesis is to evaluate the cause(s) of the situation, which could be attributed to one or more of the following factors: weak institutional capabilities, lack of enforcement of regulation(s), insufficient financial capacity, and low community awareness of the health consequences of poor sanitation. Secondly, this thesis will propose a number of possible solutions to remedy the situation, which could include strengthening the institutional capability of the Jakarta Sanitation Department (Dinas Kebersihan DKI Jakarta), delegating to private firms the rights to provide part of the service, enhancing the community's

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<sup>14</sup> The 1996/1997 Annual Report of Dinas Kebersihan DKI Jakarta indicates that the total revenue from septage treatment fee is Rp.14,866,000. Based on the Local Regulation number 5 of the year 1988, private desludging trucks are required to pay Rp.2,000 per cubic meter to dispose sludge in the septage treatment plants.



awareness through public campaign and involving the community organizations in the implementation of the proposed recommendations.

Chapter 2 of this thesis will begin by reviewing the current issues relating to the operation and maintenance of septic tanks. This chapter identifies the possible causes of poor maintenance of septic systems based on the findings regarding the institutional, legal, financial and community education-related aspects of the problem. The presentation is based on reviews of reports and articles on, particularly, human waste disposal in Jakarta (and Indonesia) and interviews with officials in the central government (Ministry of Public Works), local government of Jakarta (Sanitation Department, Local Wastewater Management Enterprise, and Urban and Environment Study Office), World Bank representative office, foreign and local consultants, and a number of community organization leaders. Chapter 3 suggests ways to improve current practices by strengthening existing institutions, contracting to private firms, and involving community organizations. To ensure their applicability, the proposed recommendations take into account existing methods available in Indonesia. Chapter 4 presents the issues surrounding implementation of these proposed solutions, and suggests the steps to be followed. Finally, Chapter 5 summarizes the conclusions and recommendations.

## CHAPTER 2

# CURRENT ISSUES ON OPERATION AND MAINTENANCE OF SEPTIC TANKS IN JAKARTA

### 2.1 Overview

This chapter reviews the current issues relating to the operation and maintenance of septic systems in Jakarta. The presentation will be based on the findings regarding the Dinas Kebersihan's institutional capability, legal framework, financial capacity and community education program. This chapter is written based on review of reports and interview with a number of officials in the local government (i.e., Dinas Kebersihan DKI Jakarta, PDPAL DKI Jakarta, and KPPL DKI Jakarta), national government (Ministry of Public Works), several consultants and chair-persons of neighborhood association. Chapter 3 discusses the two sectors which the department is responsible for, i.e., solid waste and wastewater management. Attention will be given to examine whether the department allocates resources differently among the two sectors.

The preceding chapter concludes that each year only a small percentage of septic systems in Jakarta is desludged, and that this practice has contributed to the contamination of water resources. This chapter discusses Dinas Kebersihan's tasks and efforts with respect to wastewater management, especially the desludging of septic tanks. Despite its instituted function in solid waste and wastewater management, the department tends to regard garbage disposal as a higher priority than desludging services, which is explicitly indicated in its

development budget.<sup>15</sup> This tendency to focus on garbage disposal is attributed in part to the fact that the uncollected garbage has caused sedimentation of waterways and blockages of floodgates, which contribute to flooding in the city. The other driving force is perhaps the city administrator's goal to obtain the annual Adipura Award for cleanliness.<sup>16</sup> The department's priority is clearly shown in its institutional performance, existing regulations and budget allocations, which in turn affects its community education program.

## **2.2 Establishment and Main Tasks of Dinas Kebersihan DKI Jakarta**

In December 1967, the Governor of Jakarta established Dinas Kebersihan DKI Jakarta (Jakarta Sanitation Department) as a component of the Local Government of DKI Jakarta to provide services to the community in the field of cleanliness, which encompasses solid waste and wastewater management.<sup>17</sup> In anticipation of the sector's increasing importance, in 1981 a new decree was issued to substantiate the main tasks and function of the department.<sup>18</sup> The latter decree mandates that the department undertake efforts to maintain "cleanliness, orderliness, beauty and well-being." In order to carry out these tasks,

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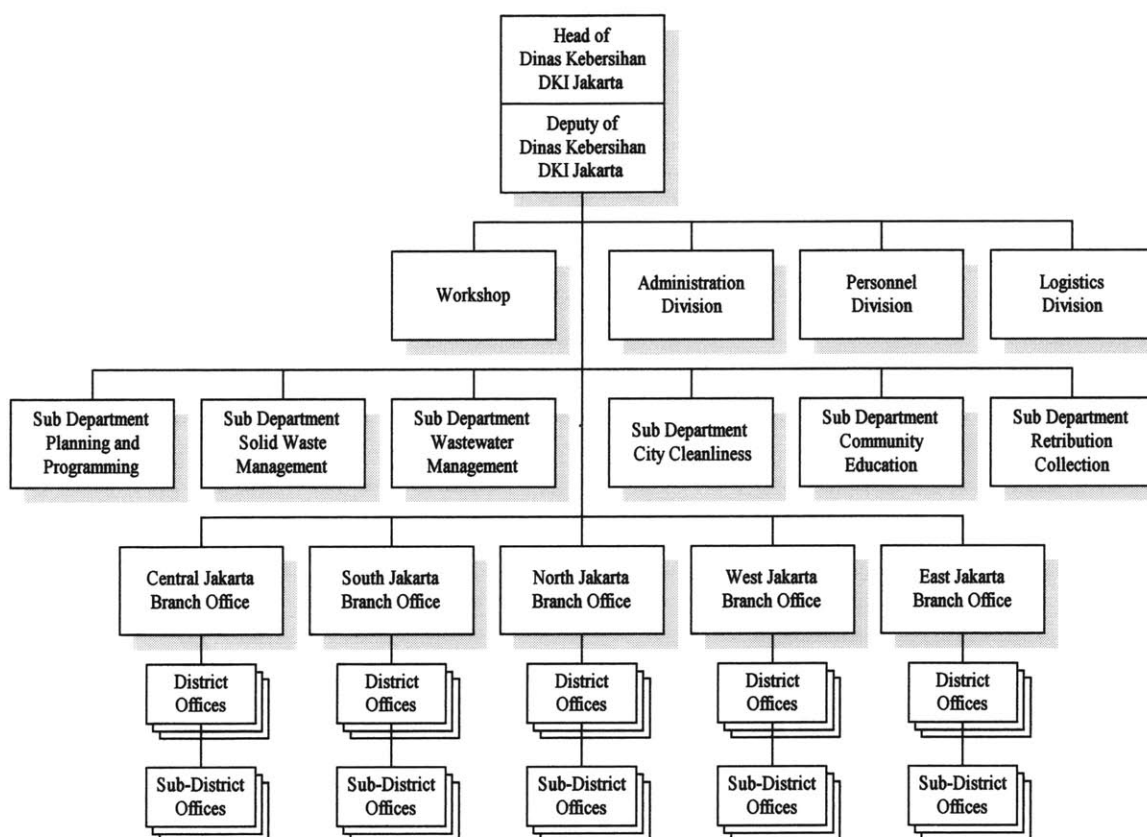
<sup>15</sup> Fox (1994) argues that infrastructure deficiency cannot be resolved by only making new investments (p.1). Furthermore, the Jakarta Sanitation Department's lack of accountability in quality of services and expenditure decisions has led to inefficient allocation of, among others, financial resources (Johnson, 1992, p.21). Nevertheless, the disproportionate budget allocation indicates that the department, based on its goal and strategy, places a higher priority for one particular sector over the other, in this case solid waste over wastewater-related services.

<sup>16</sup> Adipura Award was initialized in 1986 by the national government that consists of the Ministry of Home Affairs, Ministry of Public Works, Ministry of Health, and Environmental Impact Management Agency. Each year, the President presents this award to municipalities based on their achievements in management of cleanliness.

<sup>17</sup> The term "cleanliness" will be used throughout the thesis in place of the Indonesian word "kebersihan". This word, i.e., "kebersihan", is found extensively in various documents and preserving this term will be useful for the subsequent analysis to understand what this term is defined (or referred to) in a number of cases.

<sup>18</sup> On December 7, 1981, the Governor of Jakarta issued Local Regulation number 15 of the year 1981 on Establishment, Organizational Structure and Management of the Jakarta Sanitation Department.

the department is in charge of preparing work plans on cleanliness, implementing solid waste and wastewater management, providing community education on cleanliness, collecting retribution fees (i.e., fees for service), and overseeing the community's compliance on related regulation(s). The organizational structure of the Dinas Kebersihan DKI Jakarta includes three divisions, six sub departments and representative offices, as shown in Figure 2.1.



**Figure 2.1 Organizational Structure of Jakarta Sanitation Department**  
 Source: modified from the 1981 Local Regulation on the Establishment, Organizational Structure and Management of Jakarta Sanitation Department.

The three divisions manage general administration, personnel and logistics, whereas its sub-departments are in charge of planning and programming, solid waste management, wastewater management, city cleanliness, community education and participation, and retribution fee collection. In addition to the divisions and sub departments, Dinas Kebersihan DKI Jakarta also has branches in the city's five municipalities, 43 districts and 272 sub-districts. In total, the department employs about 5,600 people, of which 2,600 work in the headquarters, representative offices, and disposal and treatment sites. The remaining 3,000 persons are field workers, who include drivers, crews, mechanics, street sweepers, and special police.

The Sub-department of Wastewater is in charge of the collection, transportation, treatment and disposal of septic sludge. Sludge collection and transportation is carried out by vacuum trucks that belong to several private companies and to the Dinas Kebersihan DKI Jakarta itself. To date, most of the desludging service has been carried out by the department's 122 trucks, with only a few septic systems being served by the private trucks.<sup>19</sup> For example, between April 1996 and March 1997, of the total volume of 125,122 cubic meters of sludge that were transported and treated in the septage treatment plants, 94 percent was transported by the department's fleet. At present, there are three septage treatment plants in operation with a total capacity of 660 cubic meters per day. Two of them, Pulo Gebang and Kebon Nanas, are located in the eastern part of Jakarta and have a treatment capacity of 300 and 60 cubic meters per day, respectively. The other, Duri Kosambi, a newer treatment plant is constructed in the western part of the city.

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<sup>19</sup> This is based on the total volume of septic sludge that actually reached the treatment plants. No data on the total volume of septic sludge collected by private companies is available.

Between 1987 and 1997, Dinas Kebersihan DKI Jakarta and the private companies managed to increase their services to septic system owners by 46 percent. This is indicated by the increased total number of requests for desludging from 24,961 in 1987 to 36,525 in 1997. In the same period, the total volume of sludge treated also increased from 65,224 cubic meters to 125,122 cubic meters, which means a 92 percent growth in ten years. The department was also successful in involving the private sector in providing septage desludging services. While only five firms were involved in 1987, thirteen companies are registered today. However, in spite of these accomplishments, the service coverage is still very low in absolute terms. In total, in 1997 only 4.56 percent of the city's estimated 800,000 septic tanks were served. In contrast, Dinas Kebersihan DKI Jakarta has provided better delivery with respect to garbage-related services. This is not only indicated by its present coverage ratio of 80 percent, but also by its supporting resources.<sup>20</sup>

In spite of its established objectives, Dinas Kebersihan DKI Jakarta is inclined to be more responsive to solid waste-related services. In the last decade, the department has made significant progress in this sector: collected garbage rose from 60 percent in 1986 to 80 percent in 1997.<sup>21</sup> The department's supporting assets have also been substantially

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<sup>20</sup> Fox (1994) argues that infrastructure deficiency cannot be resolved by only making new investments (p.1). Furthermore, Johnson (1992) states that the Jakarta Sanitation Department's lack of accountability in quality of services and expenditure decisions has led to inefficient allocation of, among others, financial resources. As an example, the department once invested in compactor trucks which were both unsuitable for solid waste with high organic content and unable to access crowded neighborhoods (p.21). Nevertheless, the disproportionate budget allocation indicates that the department places a higher priority for one particular sector (i.e., solid waste-related services) over the other (in this case, transportation and treatment of septic sludge).

<sup>21</sup> A study in 1987 concludes that about 40 percent of the refuse is disposed in informal sites (World Bank, 1994, p.71). The Dinas Kebersihan DKI Jakarta 1996/1997 Annual Report estimates that 80 percent of the waste produced was collected and transported to the sanitary landfill (p.17). Miller (1995) estimates that 84 percent of Jakarta's refuse can be managed by the department (p.94).

expanded. As an example, in recent years, Dinas Kebersihan DKI Jakarta utilized its development budget to add 142 new trucks to its existing fleet of 684 garbage trucks; procured 18 excavators, bulldozers, and mechanical sweepers to complement its existing 83 units of heavy equipment already in operation; purchased more than 3,000 handcarts; and acquired 90 hectares of land in the western part of Jakarta to supplement its existing 108 hectares of sanitary landfill in the eastern part of the city. In addition, it is also constructing a garbage transfer station in the northern part of Jakarta.<sup>22</sup> In contrast, in the same period, the department's effort to improve its services on septage disposal only includes the purchase of four new vacuum trucks to support the 118 it already has and the construction of a new septage treatment plant in Duri Kosambi. Over the years, solid waste management in Jakarta, as well as in other cities, has been improved due to the increasing community awareness and the city's desire to win the Adipura Award.

In recent years, the issue of garbage disposal has received increasing attention from the central and local governments, as well as from the community. Firstly, improper garbage disposal has produced detrimental effects, such as water contamination due to leachates, air pollution caused by garbage burning and gas emission, and the breeding of pests. In addition to its potential health hazards, Jakarta's uncollected garbage is considered one of the main factors that contribute to flooding.<sup>23</sup> In 1990, Binnie and Partners Consultants estimated that

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<sup>22</sup> The Sunter transfer station, in the northern part of Jakarta, is designed to reduce cost by using bigger capacity vehicles to transport garbage to the sanitary landfill. Once completed, refuse collected by smaller trucks will be compacted and transferred into 20 cubic meter trucks in this facility. The larger trucks, then, will bring the garbage to the sanitary landfill. This station will serve trucks from central and northern parts of city (Yachiyo Engineering Co., Ltd., 1992).

<sup>23</sup> In Jakarta, flooding is associated with inadequate conveyance capacity of the existing drainage infrastructure, due to sedimentation, which include accumulated refuse in waterways, and increased impervious area resulting from physical development (Miller, 1995, p.95).

30 percent of the uncollected refuse was finding its way into the rivers and canals (World Bank, 1994, p.71). This has resulted in the reduction of the rivers' flow capacity and in floodgate blockages, causing contaminated water to overflow and spread into the surrounding areas. Secondly, solid waste management is also a determining factor in the highly publicized Adipura Award. This annual award, introduced in 1986, is presented by the President to cities which have made significant achievements in cleanliness with respect to their management and infrastructure.<sup>24</sup> This award has been a driving force for many city administrators to improve their garbage-related services.

### **2.3 Existing Regulations on Maintenance of Septic Systems**

There are two kinds of local regulations regarding wastewater disposal: the first mandates that the sanitation department carry out the services and the second imposes certain responsibilities on the citizens. In the first case, the mandate is provided by the 1981 Local Regulation on Establishment, Organizational Structure and Management of the Jakarta Sanitation Department, authorizing it to manage wastewater and to issue licenses to private companies to perform the service.<sup>25</sup> In addition, the department is also empowered to supervise the community's compliance with existing regulation(s), particularly the 1988 Local Regulation on Environmental Cleanliness in the City of Jakarta. In the second case, the responsibilities of the citizens are specified in the 1988 Local Regulation, which defines

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<sup>24</sup> Although cities are evaluated based on a number of other aspects, but its initial purpose and many of its deciding factors are related to solid waste management. These solid waste related factors include quality of existing facilities, community participation, collection of retribution, and efforts to recycle wastes and/or to produce compost.

<sup>25</sup> The Clarification of Local Regulation no.15/1981 to Article 5 notes that "wastewater" is referred to toilet waste (black water) and sullage (grey water).



obligations on the issues of cleanliness, retribution fees, and sanctions for non-compliance. In addition, there is the 1988 Governor's Decree on Provision of Services and Collection of Cleanliness Retribution in the City of Jakarta, which specifies on request procedure for desludging service.<sup>26</sup>

With regard to on-site treatment facility, Article 5 of the 1988 Local Regulation on Environmental Cleanliness requires that every owner or occupant of a household must provide facilities in which to store wastewater.<sup>27</sup> There are at least two shortcomings with respect to this regulation. First, that the existing regulation does not specify what type of "storage facility" should be used. As a result, people have been able to construct storage basins without due regard to proper technical guidelines (Miller, 1995, p.90; Silver, 1990, p.4.3). Although a national standard for septic tank design was issued in 1989, it has not yet been adopted by the local authorities. The second weakness in the regulation is that it does not require the owner to clean the storage facility. Therefore, desludging of septic systems is not legally regulated. As a result, in many cases desludging is carried out haphazardly, and often desludging is performed only when water from the toilet does not flow easily into the septic tank (Silver, 1990, p.4.3; Gaymans and Sudradjat, 1988, p.19).

The desludging fee is relatively low; however, the procedure is cumbersome. Article 20 of the 1988 Local Regulation on Environmental Cleanliness lists the desludging fee as Rp.5,000 per cubic meter with a minimum of 2 cubic meters.<sup>28</sup> The fee is quite affordable;

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<sup>26</sup> Governor's Decree no.1281 of the year 1988, issued on July 21, 1988.

<sup>27</sup> Neither the term "septic tank" nor "treatment facility" is mentioned in this regulation; it uses the Indonesian phrase "tempat untuk penampungan" which means "storage facility."

<sup>28</sup> In 1988, US\$1.00 was equivalent to Indonesian Rupiah (Rp.) 1,686. The Ministry of Manpower reported that the minimum monthly wages in several sectors for 1989 ranged between Rp.67,000 (about US\$38),

however, the 1988 Governor's Decree on Provision of Services and Collection of Cleanliness Retribution requires that requests for desludging should only be made in designated places and that the fee be paid in advance. This regulation requires customers to come in person to the Dinas Kebersihan's headquarters or to one of its branches. The customers have to fill out a form stating their name, address, estimated volume of the septic sludge, and pay the desludging fee. This request cannot be made by phone and for most people making this trip is time-consuming. Alternatively, customers can also register at one of the district or sub-district representative offices or call a private desludging company. However, the former is also time-consuming, and the latter tends to be expensive. Private companies charge between Rp.100,000 and Rp.150,000 per service (approximately US\$40-65). A widely practiced "solution" is to clean the tank manually and/or to bypass the leaching facility and discharge the effluent directly into the neighboring storm drain (Silver, 1990, p.4.3).

In addition to the potential contamination of waterways from poorly maintained septic systems, Dinas Kebersihan DKI Jakarta does not have any regulation to prevent illegal dumping of sludge by private companies. Both regulations that were issued in 1988 only provide opportunities for private firms to perform desludging services; however, they do not anticipate potential haphazard disposal either by the companies or by their drivers. At present, there are about 13 private companies operating in Jakarta and they have to compete with Dinas Kebersihan DKI Jakarta, a non-profit-oriented organization with a large number of vacuum trucks operating at subsidized rates. In such a competitive situation where the

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in plantation sector, and Rp.213,000 (about US\$120), in banking and insurance. Whereas, the average minimum monthly wage in manufacturing was Rp.130,000 (about US\$73).

regulation is not stringent and the treatment plants are located far away, it is highly possible that a large volume of sludge is dumped in the waterways.<sup>29</sup>

The 1981 Local Regulation on the Establishment, Organizational Structure and Management of the Dinas Kebersihan DKI Jakarta empowers the department to supervise the citizens' compliance with existing regulations; however, most, if not all, legal measures taken to date are related to solid waste disposal. The local government has enforced the 1988 Local Regulation on Environmental Cleanliness since 1990, the number of fines it issues is growing.<sup>30</sup> In fiscal year 1990/1991, there were 414 violations with total fines of Rp.1.278 million (about US\$693); in 1996/1997, the number of violations and total fines reached 1,534 and Rp.11.777 million (about US\$5,100), respectively. However, the report does not mention the nature of the violations.<sup>31</sup> The 1997/1998 monthly reports of sub department of wastewater management document no violations in this sector, which suggests that they are related to solid waste management. Further examination of a 1994 report by the Office of the Mayor of South Jakarta indicates that the violations are related to garbage disposal. The mayor's letter of instruction to conduct "Operasi Yustisi Kebersihan dan Ketertiban" (enforcement on cleanliness and public order) in October 1993, for example, only targets stores which lack garbage disposal facilities, dispose refuse or discharge wastewater

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<sup>29</sup> In 1988, Gaymans and Sudradjat estimate that 75 percent of the time is spent driving between septic tanks and the treatment plants and that only 25 percent of the sludge actually reaches the treatment facilities (p.33-34).

<sup>30</sup> Legal measures are usually carried out as part of "Operasi Yustisi Kebersihan dan Ketertiban", or enforcement on cleanliness and order, to enforce the Local Regulations no.5/1988 on Environmental Cleanliness and no.11/1988 on Public Order.

<sup>31</sup> The Jakarta Sanitation Department's 1996/1997 Annual Report only lists the number of violations and total fines from fiscal year 1990/1991 to 1996/1997 (p.40-41).

haphazardly, or have not paid their retribution fee. It also targets unlicensed peddlers and people who litter.

## 2.4 Sources of Revenue and Allocation of Expenditures

The Dinas Kebersihan DKI Jakarta is assigned to provide services in the field of cleanliness and is not designated as a profit-oriented institution. Article 46 of the 1981 Local Regulation on Establishment, Organizational Structure and Management of the Dinas Kebersihan DKI Jakarta clearly states that the budget for the department is provided by the local government budget, or subsidy and/or assistance from the central government or other organizations. Its status is clearly illustrated by its financial statement. For example, in fiscal year 1996/1997, while its total revenue was only about Rp.9,711 million (approximately US\$4.2 million), the department's total expenditure reached more than Rp.138,000 million (about US\$60 million).<sup>32</sup>

With regard to revenues and budget allocations, the financial statement clearly shows that Dinas Kebersihan DKI Jakarta gives a higher priority to solid waste management than it does to wastewater management. The sources of revenue for the Dinas Kebersihan Jakarta are solid waste retribution (which includes retribution for households, shops and stores, and industries), desludging fees, solid waste disposal and septic sludge treatment fees, and license fees.<sup>33</sup> The total revenue in 1996/1997 was Rp.9,711 million (about US\$ 4.22 million), of

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<sup>32</sup> Johnson (1992) calculates that the cost recovery (ratio between tariff revenues and expenditures) for Jakarta Sanitation Department between 1985/1986 and 1991/1992 ranges from 2.87 to 18.21 (p.79).

<sup>33</sup> Based on 1988 Local Regulation on Environmental Cleanliness, private trucks are required to pay a fee when disposing sludge into the treatment plants (i.e., septic sludge treatment fee) or garbage in the sanitary landfill (i.e., solid waste disposal fee).

which 93.6 percent was obtained from solid waste-related services, while wastewater retribution and treatment fees account for only 6 percent. Table 2.1 illustrates this distinction.

1.	Solid waste retribution from households	Rp.	3,661	
2.	Solid waste retribution from stores and shops	Rp.	366	
3.	Solid waste retribution from Industries	Rp.	319	
4.	Solid waste disposal fee	Rp.	4,743	
sub total for solid waste retribution				Rp. 9,089
5.	Desludging fee	Rp.	586	
6.	Septic sludge treatment fee	Rp.	15	
7.	Toilet rentals	Rp.	19	
sub total for wastewater retribution				Rp. 620
8.	Licenses	Rp.	2	
sub total for licenses				Rp. 2
total revenue				Rp. 9,711

**Table 2.1 Sources of Revenue for Fiscal Year 1996/1997 (in Rp.million)**

Source: 1996/1997 Annual Report of Dinas Kebersihan DKI Jakarta

Budget allocation is subdivided into two categories: routine and development expenditures. Routine spending for solid waste and wastewater management cannot be differentiated; however, the discrepancies between the two sectors are clearly shown in the development budget. The routine budget includes regular annual expenditures such as salaries, procurement of office equipment, and maintenance of vehicles and treatment/disposal facilities. This budget was Rp.29,500 million (approximately US\$ 12.82

million), of which half was spent on maintenance of vehicles and treatment/disposal facilities. The development budget, on the other hand, encompasses expenditures for construction of new facilities and procurement of vehicles and equipment. The funds for this budget come from local and central government, and bilateral and/or multilateral loans which, in fiscal year 1996/1997, amounted to Rp.106,600 million (about US\$ 46.35 million). About Rp.101,000 million (about US\$ 44 million) was allocated for refuse-related services, whereas wastewater was provided with only Rp.3,000 million (approximately US\$ 1.30 million) for completion of the department's third septage treatment plant and procurement of four vacuum trucks.

## **2.5 Community Education and Public Awareness**

As part of the delivery of the services, Dinas Kebersihan DKI Jakarta needs to conduct public education and encourage the community to participate in maintaining cleanliness, as stipulated in Article 5 of the 1981 Local Regulation on Establishment, Organizational Structure and Management. Each year, the sub-department of Community Education and Participation organizes public campaigns realized through speeches, entertainment and audio-visual programs. Dinas Kebersihan DKI Jakarta conducts a variety of activities to encourage the community's awareness on the importance of cleanliness, through direct and indirect means. Direct public campaigns are carried out through meetings held in sub-district offices, schools, with women's organizations and other informal groups. Indirect activities are organized through the department's music groups, theater groups, exhibitions, contests, leaflets and mass media. Unfortunately, public campaign materials tend

to focus on solid waste. This is partly a result of the unclear definition of “cleanliness” and the increasing attention given to solid waste management.

The word “cleanliness” is used extensively and found in many documents; however, there seems to be lack of unanimity as to its definition. The 1981 Local Regulation on Establishment, Organizational Structure and Management of the Dinas Kebersihan DKI Jakarta mentions two definitions of cleanliness: (i) “beauty, shade, comfort and environmental conservation” (Article 3); and (ii) “solid waste and wastewater” (Articles 14 to 16). The 1988 Governor’s Decree on Strategies to Maintain Environmental Cleanliness, on the other hand, refers to cleanliness only in the context of solid waste management. There are indications that the ill-defined terminology is susceptible to misinterpretations. For example, a decree issued by the Mayor of South Jakarta on Guidelines on Integrated Implementation of Cleanliness does not even mention the citizens’ responsibility to install wastewater storage facilities. It lists in detail, however, the community’s obligation to provide trash bins, to sweep the gardens and clean the storm drains near the house, and to dispose of garbage properly. This failure of the public education campaign materials to address the wastewater problem contributes to a lack of awareness of the health hazards of septic tank effluent.<sup>34</sup>

The topics given in the public campaigns are concerning the issue of cleanliness, and they are primarily related to garbage disposal. For example, a report from the head of the sub-department to his superior noted that information dissemination on cleanliness in twelve elementary schools had been accomplished. However, the highlights of the program were to provide an awareness of the importance of cleanliness, refuse disposal, and reprimanding

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<sup>34</sup> A survey by Gaymans and Sudradjat (1988) reports that 32 of their 68 subjects responded that septic tank effluent has no or has somewhat potential danger to health.

people who throw garbage haphazardly. It does not deal at all with the problem of wastewater. Similarly, while an evaluation sheet for a contest on cleanliness in elementary schools in Jakarta asks whether the schools have facilities to store garbage, it does not, however, inquire about the existence of a facility to store wastewater.

## **2.5 Conclusion**

Despite its established function to deliver services in both sectors, Dinas Kebersihan DKI Jakarta gives solid waste management a higher priority than it does wastewater management. Substantial resources, as shown by its expenditures and assets, are allocated in an attempt to improve collection, transportation and disposal of the city's refuse. The department's present focus on solid waste-related services is likely to be a result of a number of interrelated factors: its problematic definition of the term "cleanliness," an increasing public awareness of solid waste issues, and the department's desire to see Jakarta win the Adipura Award which focuses on garbage disposal. First, while the term "cleanliness" is used extensively in many documents, there is lack of unanimity as to its definition. This predicament has led to a disproportionate emphasis on solid waste management in the materials disseminated to the public, which affects the community's understanding of cleanliness, especially with regard to potential hazard of septic tank effluent. Second, the local regulations do not specify appropriate types of wastewater facilities and they do not require them to be regularly desludged. This could account for the poorly designed and maintained septic tanks which contribute to environmental pollution. Third, due to the increasing awareness of its potential health hazards and contribution to flooding, solid waste



management has attracted public interest. This situation has pressured Dinas Kebersihan DKI Jakarta to further improve its garbage-related services. Finally, the introduction of the Adipura Award has been a driving factor for sanitation departments to improve management and infrastructure, since winning the award reflects not only the achievement of the department, but also the accomplishment of the city administrator.

Following this chapter's identification of potential issues which have resulted in poor maintenance of septic systems in Jakarta, Chapter 3 discusses options to address these shortcomings. Improvement will be realized through various means, including strengthening the existing capability of the Jakarta Sanitation Department, and increasing the participation of both private companies and community organizations.

## CHAPTER 3

# ALTERNATIVE SOLUTIONS TO ENHANCE MAINTENANCE OF SEPTIC TANKS

### 3.1 Overview

This chapter presents potential solutions with which to resolve the problem of poor maintenance of septic tanks and to ensure proper disposal of sludge.<sup>35</sup> Alternative solutions designed to alleviate the problems that were identified in the preceding chapter will also be addressed. The discussion will include the need for strengthening the existing capability of the Dinas Kebersihan DKI Jakarta, the prospect of inviting the private sector to produce the services, and the possibility of involving community organizations. Ultimately, scheduled desludging will be found to be a the most favorable solution to the problem of poor maintenance of septic tanks. However, a number of prerequisites have to be fulfilled to ensure successful implementation of the program. This chapter discusses the solutions and addresses the required synergy among various parties needed to ensure successful implementation.

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<sup>35</sup> Despite a possibility of transfer of desludging service from Dinas Kebersihan DKI Jakarta to the Jakarta Wastewater Management Enterprise (PDPAL DKI Jakarta), this thesis will refer its recommendations to the Dinas Kebersihan DKI Jakarta. However, they are also applicable for PDPAL DKI Jakarta when the transfer takes place. During the field study, an official in PDPAL DKI Jakarta and another in the Jakarta Sanitation Department mentioned that the local government is deliberating to transfer the task of wastewater management from the department to PDPAL DKI Jakarta. Decision is likely to be made in the near future. In this case, possibilities of recovering (at least) operating expenditure would be beneficial to the enterprise. Unlike Dinas Kebersihan, PDPAL DKI Jakarta is a local government enterprise and, therefore, could not neglect revenue collection.

Scheduled desludging is the best option with which to address the current deficiencies in operation and maintenance of septic systems. This procedure is expected to increase the demand for the service, prevent potential illegal disposal of septic sludge, and generate revenue for the service producers. However, the implementation of scheduled desludging requires that certain preconditions be met. To ensure its success, it requires the concerted efforts of the Dinas Kebersihan DKI Jakarta itself, the private companies and the community organizations. Each party plays an important role in this endeavor: the department must improve its service delivery to the public and, at the same time, facilitate a favorable environment for the private companies to produce the services; the private firms will need to play greater role and make adequate investments to support the department in the production of the services; and the community organizations will need to administer financial assistance to enable low income people to construct and maintain septic systems.

### **3.2 Strengthening of Existing Institutions**

The proposed solutions are aimed at increasing the Dinas Kebersihan's efficiency in using existing resources and, if possible, in generating revenue to recoup (at minimum) its operating costs.<sup>36</sup> The main objective of the recommendations is to prevent haphazard disposal of human waste either by septic tank owners or vacuum truck drivers. The

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<sup>36</sup> While the Jakarta Sanitation Department has received unconditional financial support from the Local Government of DKI Jakarta (Johnson, 1992, p.21), this kind of assistance cannot be sustained in the near future. Jakarta Local Government has been concerned of its dwindling revenue from its major source, i.e., automobile tax. (Kompas newspaper, June 7, 1997). In addition, the enactment of the new 1997 Law on Regional Tax and Retribution requires local governments to reexamine their revenue sources. While 42 taxes and 192 retributions were accessible in the previous laws, only 9 taxes and 30 retributions (including retributions for cleanliness service, desludging and treatment of wastewater) are allowed by the 1997 Law (Kompas newspaper, July 8, 1997).

recommendations will include introduction of alternative desludging procedures, revision of existing regulations and consolidation of public education material to incorporate information on the new procedures and options.

The ultimate solution is to implement scheduled desludging procedure. In order to reach this goal a number of steps must be taken to improve existing practices and, in addition, intermediate measures must be taken to meet future needs. The introduction of a phone reservation system to supplement existing procedures will have to be undertaken immediately to increase the level of demand. In order to serve its potential customers by phone orders, the Jakarta Sanitation Department will be required to amend the related governor's decree on request procedure and payment method and to establish a dedicated phone line to ensure ease of access by its customers. Also, existing regulations on human waste disposal will have to be revised to ensure that certain standards are met in the design of septic systems. In addition, the sanitation department will need to adjust its retribution fee for desludging to generate sufficient revenue for the department itself and to maintain the private companies' involvement in the service. Direct means of information dissemination should be undertaken to facilitate cooperation by the community. The Dinas Kebersihan DKI Jakarta should also consider the possibility of providing financial assistance for construction and maintenance of septic systems.

### **3.2.1 Introduction of Alternative Options for Desludging Request Procedure**

It is evident that the current procedure is cumbersome and inefficient. Because of time constraints or transportation problems, many customers cannot come in person to the

department's headquarters (or one of its five branch offices) to request the service. As result, the department has been hindered in providing wastewater management services for all citizens. This situation suggests that options should be sought to complement the existing procedure. Ultimately, a scheduled desludging service would be a favorable solution to poor maintenance of septic tanks and its environmental implications. This option could serve to increase the Dinas Kebersihan's level of services and, thus increase its revenue base. Moreover, scheduled desludging would also prevent potential haphazard discharges of septic sludge by septic tank owners and vacuum truck drivers. However, scheduled desludging would require that certain preconditions be met, namely, properly designed septic tanks, a sufficient number of vacuum trucks and adequate septage treatment facilities. Until such time, intermediate measure should be undertaken in order to prevent further contamination of water resources. Desludging request by telephone is one such measure.

The procedure for receiving and processing desludging orders by phone is likely to increase the department's level of service.<sup>37</sup> A phone reservation system for such services has been implemented by the Bandung Water Enterprise in West Java and by private companies in Jakarta. The advantages of this procedure are that instead of having to make the trip in person to the department's offices, customers can easily request cleaning of their septic tanks by phone. Moreover, the department can then utilize for other purposes the space that would otherwise be used for service windows, waiting rooms and parking spaces. The phone order system, however, would require the department to set up a communication

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<sup>37</sup> Kotler and Roberto (1989) state that a telephone serves as a means to reduce the physical distance to just between the person and his/her handset. It also decreases the psychological distance as it does not require the person to be among unfamiliar people and procedures (p.12).

network between its customers, the dispatchers, and its drivers. A dedicated communication line should be operated to enable customers to access the dispatchers with ease. In addition, there should also be a system that enables the dispatchers to communicate directly with the drivers. This will serve as a monitoring means to ensure that sludge is transported to one of the treatment plants, and to determine a truck's location should there be an urgent request. Communication between dispatchers and supervisors of the septage treatment plants is also required to monitor sludge disposal by the department's vacuum trucks. With such a system, the supervisors will be well-informed of the incoming trucks and, hence, will be able to reduce the potential for illegal sludge disposal.

Once the phone order procedure is implemented, the Dinas Kebersihan DKI Jakarta should consider replacing current procedures with scheduled desludging. This will ensure that septic tanks are cleaned regularly regardless of whether requests are made or not. For example, every three years, following a written notification, the department will dispatch a vacuum truck to a house and to desludge its septic tank. The advantages of this procedure are that it will eliminate the possibility of owners' neglect, which has often led to prolonged septage overflow into the leaching facility. In the same way, this procedure will hinder substandard systems or improper disposal so that effluent will no longer be discharged into waterways. Other benefits of this procedure include the possibility for the Dinas Kebersihan DKI Jakarta to assess the real demand for the service and then to make efforts to improve it.<sup>38</sup> Nonetheless, a number of prerequisites have to be fulfilled if this system is to be implemented. First, septic tanks must be constructed and operated according to certain

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<sup>38</sup> Fox (1994) argues that fulfilling the demand for services should be the first priority in infrastructure policy decisions and investments should only be made if demand has been determined (p.11).

design specifications, and second, they must be installed in areas with low ground water level as required by the Standard Design of Septic Tanks (this guideline is summarized in Appendix A). Scheduled desludging also requires that the Dinas Kebersihan DKI Jakarta set up a customer database system and provide an alternative payment scheme. A database will be essential for storing information such as a customer's address, septic tank size and required desludging period. This system will enable the dispatchers to plan the delivery of the service and inform customers in advance of the date of the service. Mandatory desludging will require that every household have its septic tank desludged and that it pay for the service. However, since not all owners will be able to pay for the service in one payment, a scheme should be introduced that allows people to pay in installments. Such a scheme could be arranged between the customer and the Dinas Kebersihan DKI Jakarta, possibly with the assistance of a related community organization.

### **3.2.2 Revision of Existing Regulations**

Desludging procedures as stipulated by the 1988 Governor's Decree on Local Regulation on Provision of Services and Collection of Cleanliness Retribution should be revised to accommodate the alternative procedures discussed in the previous section. The revised decree would include options that allow customers to make phone requests, pay the drivers directly in full or pay in installments through the community organizations, and it should incorporate the available technical guidelines on wastewater disposal. The Jakarta Sanitation Department must also enact a regulation requiring citizens to maintain their septic systems properly and preventing vacuum truck drivers from disposing of sludge haphazardly.

The Dinas Kebersihan DKI Jakarta must revise the existing decree so that customers can make phone orders. In this respect, the statement in the 1988 Governor's Decree requiring customers to come in person to the designated registration offices should be amended to accommodate alternative procedures.<sup>39</sup> Modification of desludging procedure will also affect the payment scheme.<sup>40</sup> In addition to the payment arrangement currently recognized by the existing decree (i.e., full payment in advance), the revised decree should also include options that will allow people either to pay in full to the drivers after the service has been performed or to pay in installments. While direct payments to drivers are likely to be a simple procedure, payment in installments will be more complicated and will require collaborative arrangements. The latter scheme will involve administrative agreement and arrangement between the customers and the Jakarta Sanitation Department. In this respect, the customers and the department could benefit from the community organizations' involvement in administrative matters. A credit scheme for desludging will be beneficial to people who cannot afford to pay the service cost in full.

In addition to these amendments to the 1988 Governor's Decree, the 1988 Local Regulation on Environmental Cleanliness in the City of Jakarta must be revised to include the latest guidelines on household wastewater treatment and regulations against illegal disposal of septic sludge. The existing local regulation, which only requires households to install a

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<sup>39</sup> Current desludging procedure is specified in the Annex I (Guideline on Cleanliness Services in Jakarta) of the Governor's Decree no.559 on Provision of Services and Collection of Cleanliness Retribution (issued on March 25, 1988). The guideline explains that potential customers must register in designated places and that they will be given a signed receipt (that should be shown to the assigned vacuum truck driver).

<sup>40</sup> Mode of payment is regulated in Annex II (Guideline on Cleanliness Retribution Collection in Jakarta) of the 1988 Governor's Decree on Provision of Services and Collection of Cleanliness Retribution. The guideline specifies that payment in advance will be applied to transportation of septic sludge.



“wastewater storage facility,” should be modified to take into account the 1989 Standard Design of Septic Tanks. This standard design explicitly describes the type of on-site wastewater treatment that homeowners have to install in the absence of a conventional sewerage network and thus will prevent them from constructing inadequate storage facilities for human waste disposal. The new, modified regulation should explicitly stipulate that septic tanks are only to be designed and operated based on their intended usage, a design which by definition must take into account the number of users and desludging period.

Bearing in mind that some people cannot afford to install a private septic tank, the regulation should allow groups of households to share collective septic systems. A collective or communal septic tank is a feasible option for neighboring households which either cannot afford or do not have sufficient land on which to construct individual systems. The 1989 Design Standard allows septic tanks to be utilized by a maximum of 25 persons which, depending on the household size, could be shared by four to five neighboring houses.

As mentioned in the previous chapter, there are no regulations concerning the desludging of septic tanks. Thus, in addition to requiring the latest standard of septic tank design, the revised regulation will also require that regular maintenance and timely desludging be carried out. The regulation will also require that owners ensure that their systems not be a nuisance or cause harmful effects to health, and that adequate access will be provided to enable desludging.<sup>41</sup>

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<sup>41</sup> An official at the Dinas Kebersihan DKI Jakarta mentions that some septic tanks are too far away from the parking space and, therefore, could not be serviced due to limited hose length (40-80meters) and/or limited suction capacity of the vacuum trucks.

Transportation of sludge should be regulated to prevent illegal disposal by the vacuum truck crews. Whereas disciplinary action could be imposed on the department's drivers, there are no legal means to discourage negligence by private vacuum trucks. The 1988 Local Regulation on Environmental Cleanliness states only that the governor has the right to revoke a company's license when deemed necessary. It does not, however, specify that sanctions and/or fines will be imposed on the company in question. The Dinas Kebersihan DKI Jakarta should anticipate this, since the service will become more competitive once the alternative request procedure, i.e., phone ordering, is introduced. Once the Dinas Kebersihan DKI Jakarta has streamlined its services, it is likely that more private companies will attempt to cut costs to remain competitive, possibly through improper disposal procedure. The revised regulation should, therefore, include a clear statement that septic sludge should be disposed of only in septage treatment plants and that violators (in this case, the companies) will be fined accordingly.

### **3.2.3 Consolidation of Public Education Program**

The Dinas Kebersihan DKI Jakarta has an extensive community education program which delivers information using both direct and indirect methods. Using these methods, information on the design of septic tanks, maintenance and desludging procedure should be disseminated to the public. The department should also organize special programs to accommodate citizens who cannot afford to build and maintain septic systems.

The Jakarta Sanitation Department has extensive experience in conducting well-organized public campaigns. Over the years, the department has delivered its program

through direct (i.e., meetings with members of the community) and indirect means (e.g., organizing exhibitions and advertisements in the mass media), and to various community groups, which include students, women's organizations and other informal groups.<sup>42</sup> The department should continue to utilize these means to disseminate its program on wastewater disposal. Initially, the Dinas Kebersihan DKI Jakarta must inform the citizens that requests for desludging service can be made by telephone. This could be realized through indirect means, such as advertisements in newspapers, television broadcasts, and pamphlets in sub-district offices. Vacuum trucks could also be operated as an advertisement medium to deliver the messages, in this case by marking the phone number(s) of the dispatchers and the fee for service on its vehicles. In order to expand its dissemination network, the department should establish a relationship with, among others, universities, professional organizations (such as the Indonesian Society of Architects) and the Indonesian Scouts. These groups can help the department publicize information regarding standard septic tank design and construction and scheduled maintenance procedure.

Following the initial dissemination program, the Dinas Kebersihan DKI Jakarta must design and implement a direct public campaign to disseminate information about the new desludging procedure and to prepare the community for its implementation. The campaign materials will also include information about credit opportunities for construction and desludging of septic tanks. With respect to the implementation of the credit program, priority

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<sup>42</sup> Kotler and Roberto (1989) reminds that social change campaigns require organizers to know their subjects' "socio-demographic characteristics (social class, income, education, age, family, and size), psychological profile (values, motivation, and personality), and behavioral characteristics, which includes patterns of behavior, buying habits, and decision-making characteristics (p.27).

should be given to low income community groups. Information on financial assistance program should be presented and discussed thoroughly, with priority given to low income groups. The community as a whole must be well-informed of the benefits of desludging, the application and delivery procedure, and the repayment mechanism. Financial assistance programs have already been implemented in a number of cities, providing aid to individual families or groups of families to construct or upgrade sanitation facilities.<sup>43</sup>

### **3.3. Involvement of Private Companies**

Privatization is another possible option to improve service delivery, since it encourages a competitive environment and provides an efficient means of meeting demand. The involvement of private firms in urban service delivery will also provide an opportunity to reduce costs and increase efficiency (Miller, 1995, p.66). Nonetheless, in sectors such as sewage disposal, the public sector must maintain a role, because the “private sector does not adequately provide for externalities unless government financing is involved” (Fox, 1994, p.58). Furthermore, Rondinelli and Kasarda (1993) caution that, in spite of evidence which suggests that the involvement of private companies and non-government organizations has improved service delivery, not all public services can be privatized (p.136).

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<sup>43</sup> Financial assistance will enable citizens to construct (or upgrade) their sanitation facilities (i.e., toilets and septic tanks/leaching pits) that otherwise could not afford (or would not) pay the full construction cost in advance. This program was implemented in Jakarta, Bogor and Sukabumi in West Java, Semarang and Solo in Central Java, and Surabaya in East Java (Silver, 1990, p.6.1). These program were administered by specially-established groups that include the community organizations. While financial assistance was provided for constructing and upgrading sanitation facilities, this program could also be extended to assist people in making installments for maintenance service.

For some time, private companies have been involved in the desludging service. To date, their involvement has increased from five companies in 1987 to thirteen in 1997. Nevertheless, the total sludge volume they transport to septage treatment plants is still very low compared to that of the sanitation department. The department should encourage private firms to invest in vacuum trucks to meet future demand and, at the same time, relieve the department of its financial burden. Once the scheduled desludging procedure is implemented, private firms will have the opportunity not only to play a bigger role in sludge transportation, but also to expand their involvement to include the operation (and possibly construction) of septage treatment plants. Operation of treatment plants is a viable option, since scheduled desludging will guarantee a predictable volume of incoming sludge and will also present opportunities for companies to utilize and market treated sludge.

### **3.3.1 Transportation of Septic Sludge by Private Companies**

At present, private companies are not the main actors in the desludging service; they only transport about six percent of the incoming total volume of sludge. Nonetheless, the Dinas Kebersihan DKI Jakarta should seriously consider the option of expanding the role of private firms in desludging service and transportation of septic sludge. This is particularly feasible once scheduled desludging is implemented. Assuming that each year there are 200,000 septic tanks that have to be desludged and that the average sludge volume is 2.75 cubic meters per household, this would generate about 550,000 cubic meters of sludge each year, or about 2,290 cubic meters of sludge, all of which must be transported.<sup>44</sup> This is more

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<sup>44</sup> This example is based on the assumption that there are 600,000 septic tanks on the city and that the desludging period is 3 years. Therefore, 200,000 septic tanks have to be desludged annually. The sludge

than four times the department's fiscal year 1996/1997 level of service, which was 117,689 cubic meters, or 490 cubic meters, per day (Appendix B presents a scenario of scheduled desludging)

It is unlikely that the Dinas Kebersihan DKI Jakarta could exclusively carry out such an undertaking alone. More than 380 units of four-cubic meter trucks or 760 units of two-cubic meter trucks would have to be operated each day.<sup>45</sup> The department would have to increase its budget to purchase the vacuum trucks, finance their operation and maintenance costs, hire more drivers and mechanics, and provide sufficient space for parking and workshops. Greater involvement of private companies in desludging could relieve the Dinas Kebersihan's financial strain. However, some issues must be resolved first. These include adjusting desludging fees, ensuring private companies' compliance in proper sludge disposal, and deciding the role these companies will play in the future.

The introduction of telephone reservation system by the Dinas Kebersihan DKI Jakarta is likely to affect the private operators' revenues because the highly subsidized department could charge much less for the service. This unfair competition could result in a higher incidence of illegal desludging and less private investment in sludge transportation. In this respect, there are, at least, three issues that the department must resolve. First, the sanitation department must review and adjust its obsolete tariff structure. If necessary, private companies should be invited to contribute suggestions on the matter. Retribution fee

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volume is based on the average volume of sludge collected per household between 1985 and 1989, i.e., 2.6-2.9 cubic meters (Pacific Consultants International, 1990, p.F.13). The Jakarta Sanitation Department's 1996/1997 annual report suggests that the average volume is 3.4 cubic meters (p.26).

<sup>45</sup> Supposing that each day 2290 cubic meters of sludge need to be transported and in average each truck makes 1.5 trips (i.e., some trucks could manage to make 2 trips or more, while others only make 1 trip or less).

adjustments will enable the department to sustain its service delivery and, more importantly, will ensure private companies' involvement. The second issue would be to require the private companies to deliver the septic sludge to the septage treatment plants, with sanctions and/or fines being imposed for non-compliance. Finally, the department and private companies should decide on their future roles. Clearly, the sanitation department alone will not be able to cope future demand once scheduled desludging is in effect.

Private companies will benefit from scheduled desludging once the demand for the service (and hence, the revenue) is assured. By then, the private operators are expected to have a greater role in sludge transportation. Private trucks would be assigned to septic tank owners who could afford full payment, whereas the department's fleet would be restricted to those customers who have arranged payment by installment and public sanitation facilities.<sup>46</sup> Such distribution of responsibility, however, would require centralized coordination. In this respect, the Dinas Kebersihan DKI Jakarta would function as a coordinator to ensure delivery of the service, appropriate disposal of septic sludge, and equal vehicle assignment.

### **3.3.2 Treatment of Septic Sludge by Private Companies**

Privately companies will find operation of septage treatment plants a feasible option once the level of demand has increased and scheduled desludging procedures are implemented. In addition to the continuous sludge inflow, there will also be opportunities to

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<sup>46</sup> Jakarta has numerous public facilities (known by its Indonesian abbreviation as "MCK" or "Mandi-Cuci-Kakus", they are shared bathing-washing-toilet facilities) and they are usually located in densely populated parts of the city where people have insufficient parcel to construct private toilet. These facilities usually require more frequent desludging due to relatively large number of users. Silver (1990) reports that one "MCK" in North Jakarta is used by 60 persons every day (p.2.4). Pacific Consultants International (1991) estimates that more than 6 percent of the population in Jakarta use "MCKs" (p.F.2).

market dried sludge for agriculture purposes. The potential daily sludge generation of 2,290 cubic meters would require, at least, another five treatment plants with a capacity of 300 cubic meters each to complement the existing ones.<sup>47</sup>

The Dinas Kebersihan DKI Jakarta should begin to consider and solicit the participation of private companies. The existing septage treatment plants, with a total capacity of 660 cubic meters per day, will not be sufficient to cope with the increasing demand. Even at the current level of service, the three treatment plants are already receiving a total of 521 cubic meters per day, or about 87 percent of their design capacity. Private participation in construction and operation of septage treatment plants is a thus feasible option. In addition to the revenues generated by charges imposed on incoming vacuum trucks, there are also potential revenues from the sale of treated dried sludge.<sup>48</sup> Since the end of December 1997, the Sanitation Department in Magelang, Central Java, has produced compost from its septage treatment plant. Its 20-cubicmeter treatment plant is able to produce 560 kilograms of compost per day, which is sold at a rate of Rp.7,000 per ten kilograms.

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<sup>47</sup> This assumption is based on required volume of sludge to be treated to supplement the existing septage treatment plants operated by Jakarta Sanitation Department with a total capacity of 660 cubic meters per day.

<sup>48</sup> In 1997, the Bogor Institute of Agriculture studies the effect of treated dried sludge application on chili pepper plants. The result indicates increases in the number of chili peppers per plant (by 132%), the weight of the peppers per plant (by 184.2%), the weight of the peppers from the studied garden bed (p.5.1).



### 3.4. Involvement of Community Organizations

Community organizations are informal institutions currently involved in coordinating government programs. In the proposed plan, they could assist the Dinas Kebersihan DKI Jakarta in organizing and disseminating education programs on standard design and proper maintenance procedure of septic systems. Furthermore, community organizations could play a major role in administering the financial assistance program for construction and maintenance of septic tanks. They could function as a link between the Dinas Kebersihan DKI Jakarta and its customers to ensure that information about the program is disseminated to members of the community, that inquiries are communicated to the department, and that the financial assistance program is well administered.

Community organizations exist in all of Indonesia's cities and villages. These organizations assist the lowest formal local government administrative unit, the sub-district, in delivering government programs. The head of the sub-districts (Lurah) are appointed civil servants who coordinate formal government tasks such as community health services, family planning, garbage collection, distribution of notifications for the Land and Building Tax, storm drainage cleaning and neighborhood watch/security (Johnson, 1992, p.12-13). There are three units of community organizations under the supervision of a sub-district: the village development council (Lembaga Ketahanan Masyarakat Desa or "LKMD"), groups of neighborhood associations (Rukun Warga or "RW"), and the neighborhood associations themselves (Rukun Tetangga or "RT").<sup>49</sup> The village development council is headed by the

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<sup>49</sup> The RW/RT system exists since the early 1940s. In 1943, the system was introduced in Bandung (West Java) and Yogyakarta (Central Java) and by mid 1994, it is estimated that more than 500,000 RWs/RTs was established in Java (Infratama Yakti, 1995, Annex I). Whereas the LKMD is relatively a new organization (established in March 1980) designed to assist formal village and sub-district government in

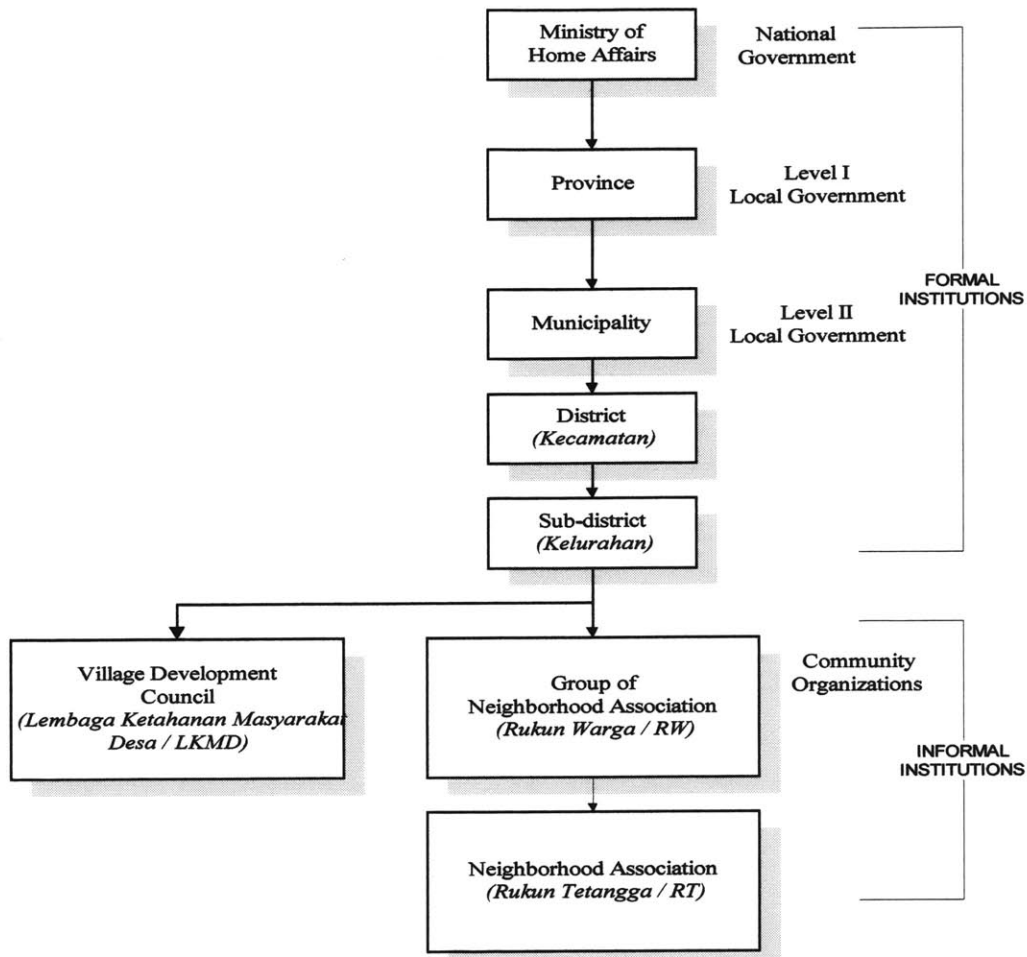
Lurah (or, head of a sub-district); its members include the chairpersons of RW in the related sub-district. The head of the neighborhood association (head of RT) is an elected person among candidates in the neighborhood, whereas the chairperson of the group of neighborhood association (head of RW) is elected by the RT leaders (Fritschi, Krisyanti and Steinberg, 1993, p.220). Johnson (1992) concludes that the role of LKMDs and RWs/RTs varies across Indonesia's cities: while LKMDs assume greater roles in many cities in Sumatra, the RWs/RTs in Java's large cities, including Jakarta, are relatively more active (p.13). Fritschi, et al. (1993) argues that community participation program would be best fostered by involving the head of the RTs, for they are directly elected by their community and, thus, are considered more accountable to the people (p.220). Nonetheless, the public education and financial assistance program for the improvement of human waste disposal could benefit from the working association between the three community organizations.<sup>50</sup>

Figure 3.1 describes the existing formal and informal institutions in Jakarta.

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delivering government program, encouraging local initiatives and community self-help (Kansil, 1985, p.345).

<sup>50</sup> In this thesis, "community organization" will apply to both the RW/RT and LKMD. In spite of RWs/RTs' favorable relationship with the community, the LKMD has the benefit of having formal affiliation with local government institutions, such as the Sanitation Department.



**Figure 3.1 Existing Formal and Informal Institutions**

Source: modified from Johnson, 1992, p.12

Community organizations in Jakarta have long been involved in the implementation of various government programs; Dinas Kebersihan could benefit from their experience. The community organizations, especially the RWs/RTs, have the ability to mobilize and coordinate their citizens to participate in neighborhood watches, parliamentary elections, and health programs. To date, the Jakarta Sanitation Department has established a working relationship with community organizations through garbage-related services. The

neighborhood organizations are in charge of indirect service, i.e., collection of garbage from households and transporting it to the temporary disposal sites.<sup>51</sup> They also have the responsibility to collect refuse retribution from the community and deposit it through the sub-district office.<sup>52</sup> This existing mechanism place could well be expanded for wastewater-related services.

There are several advantages to including community organizations in wastewater-related services. Community organizations, particularly the head of the RTs, already have basic information on the people living in their areas. They have data on names, addresses, family size and occupations of the people living in each house. Thus, the heads of RT could also make preliminary assessment of the owners' socio-economic conditions. Such information would be useful in estimating potential demand for the service and possible beneficiaries of financial assistance. Other advantages include the accountability of the heads of the RTs. Chairpersons of an RT are elected among those living in the same neighborhood and hence are considered more trustworthy than the members of the LKMD, for example. RTs are also familiar with fiscal patterns of the homeowners. The sanitation department could access such information to ensure successful implementation and prevent defaults on payments.

The community organizations could provide a link between the Dinas Kebersihan DKI Jakarta and the citizens to ensure dissemination of information about the program,

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<sup>51</sup> The 1988 Governor's Decree on Implementation Program for Environmental Cleanliness (no.1281 dated July 21, 1988) assigns the RTs/RWs to carry out indirect collection service.

<sup>52</sup> Mechanism for solid waste retribution collection is promulgated in the 1988 Governor's Announcement on Cleanliness Retribution Collection (no.2 dated June 1, 1988), and supplemented by the 1996 Governor's Decree on Guideline for Cleanliness Retribution Collection (no.1543 dated October 25, 1996).

communication between the involved parties, and administration. In this respect, the first task of the community organizations would be to assist the department in informing the public about alternative desludging procedures, standard design of septic systems and possibilities for applying for a credit scheme to construct and maintain septic tanks. Their second task would be to aid community members in applying for financial assistance and in communicating requests to the Dinas Kebersihan DKI Jakarta. Meetings should be organized to discuss payment by installment for desludging fees (payment mechanism, amount of installments, and penalty on defaulters) and financial assistance for construction of individual or communal septic tanks (type of assistance, amount of financial assistance, interest rate, repayment period/installments, criteria of beneficiaries/priorities, and penalty on defaulters). The third task of the community organizations would be to maintain good bookkeeping on the program. This record would be required by the Dinas Kebersihan DKI Jakarta for accounting and administrative purposes, and by the communities themselves to prevent or solve disputes.

### **3.5 Conclusion**

Despite the advantages of preventing of potential illegal disposal of septic sludge and securing a revenue base to sustain the production for the services, scheduled desludging cannot be readily implemented. A number of preconditions have to be fulfilled to ensure successful execution of the program. These include the provision of a sufficient number of vacuum trucks to undertake timely desludging, adequate volume in septage treatment plants to treat the collected septic sludge, and properly designed and maintained septic systems to

prevent overflowing. This can only be achieved if the Jakarta Sanitation Department makes efforts to improve its service to the community, encourages private companies' involvement in the transport (and, possibly, treatment) of septic sludge, and provides opportunities for the community to apply for financial assistance for construction and maintenance of septic tanks. Private companies will be expected to provide a sufficient number of vacuum trucks to transport the sludge and to deliver the sludge to the septage treatment plants. Private firms will also have the opportunity to expand their role to include septic sludge treatment. Lastly, active participation of community organizations will be needed to liaise between the sanitation department and the community first to introduce the program and later to facilitate requests for assistance. Clearly improved maintenance can only be achieved through a concerted effort between the involved parties.

The following chapter presents the implementation stages and discusses the foreseeable constraints on them. Some of the alternative solutions presented in this chapter cannot be readily implemented due to the absence of some preconditions. Consequently, the proposed program will have to be implemented in three stages: immediate measures, medium- term measures and long-term implementation. Constraints on the alternatives will also be discussed in order to anticipate and resolve potential problems.

## CHAPTER 4

### IMPLEMENTATION STAGES AND ISSUES

#### 4.1 Overview

Chapter 4 discusses the implementation stages involved in improving septic systems in Jakarta. The three stages of implementation, i.e., immediate measures, medium term and long term implementation, will be addressed to describe various activities to be undertaken as part of the whole program. This chapter will elaborate activities to be carried out by the involved parties to ensure successful implementation of the recommendations. Introduction of alternative procedure for desludging, dissemination of consolidated public campaign materials, revision of existing regulations on wastewater disposal and tariff structure, provision of financial assistance, and providing greater involvement of private companies are among the issues that will be presented. The proposed recommendations will require a concerted effort among the sanitation department, the private companies, and the community organizations.

The proposed recommendations would be first implemented through the immediate measures. This initial program introduces request by telephone to provide potential customers with a less cumbersome procedure. Following the immediate measures, the sanitation department should begin a medium-term program to prepare favorable conditions for implementing the long-term recommendations. The implementation of intermediate measures is perhaps most critical to ensuring the department's long-term goals. Public

campaigns to enhance the community's awareness on proper design, operation and maintenance of septic systems, as well as personal hygiene and environmental sanitation; adjustment of current tariff structure for sludge transportation and treatment to encourage the involvement of private companies; and provision of financial assistance for people who cannot afford to pay in full for construction and maintenance of septic tanks, are among the activities that Dinas Kebersihan DKI Jakarta has to undertake prior to the implementation of its long-term program. The final program itself consists of substituting current procedures with scheduled desludging and expanding the role of the private companies to include sludge treatment. The objectives of scheduled desludging would be to reduce potential (prolonged) overflows of septic sludge or effluent due to owners' neglect and to prevent haphazard sludge disposal by vacuum truck drivers. Private companies could also benefit from regular desludging due to increased level of demand for the production of the service. In this respect, there are opportunities for companies to be involved not only in sludge transportation but also in septic sludge treatment.

#### **4.2 Immediate Measures**

In this first stage of the program, Dinas Kebersihan DKI Jakarta must introduce an alternative desludging procedure to the public and consolidate its public campaign materials to suit its medium and long-term implementation of the program. The main objective of the immediate measures is to simplify the desludging procedure by enabling potential customers to register by telephone. This initial undertaking will determine the success of the whole program, since performance of the Dinas Kebersihan DKI Jakarta will be judged by its



accomplishments during this stage of the program, and the public will have high expectations that the department will be responsive to their needs. One critical issue is the phone registration itself. People are easily disappointed by busy phone signals or being kept on hold; the Jakarta Sanitation Department should carefully plan the phone system needed to prevent this situation.

Secondly, as a service producer, the department must ensure that the dispatchers are well-trained in communication skills. Unlike private companies who realize that they can easily lose customers to competitors, the sanitation department has little experience in “serving” its customers.

Thirdly, in addition to the importance of politely receiving calls and appropriately registering requests, it is essential to deliver the service at the agreed time. This is to prevent customer dissatisfaction brought on by having to wait or to reschedule. Timely service delivery would also prevent financial losses caused by fuel consumption during times when a vacuum truck has to make a second trip to the same house due to scheduling problems.

The sanitation department should also consolidate its current public campaign materials to disseminate its program to impose proper design, construction, operation and maintenance of septic systems in Jakarta, as well as to promote personal hygiene and environmental sanitation in general. Building such awareness is essential to ensuring community participation and educating the community to see the value of the service, which will be expressed to their willingness to pay for it (Miller, 1995, p.184). In planning its campaign program, Kotler and Roberto (1989) note that other community education programs have failed when they have targeted the wrong audience, delivered an unmotivating

message, or failed to promote the proper interaction between the change agents and the target adopters (p.5).<sup>53</sup> Furthermore, Kotler and Roberto point out that lack of funding has also historically been a problem.

#### **4.2.1 Introduction of Alternative Desludging Procedure**

The first important step in improving current poor septic tank maintenance practices is to streamline the existing request procedure. Customers should be allowed to file their requests by telephone and pay the fee to the drivers, so that they do not have to come in person to the sanitation department or one of its branch offices. Private firms are already using such a service effectively. Requests for desludging by telephone will increase demand for Jakarta Sanitation Department's service and ensure that citizens will use the service rather than disposing of waste on their own. To some extent the demand for desludging already exists, which is indicated by the increasing number of private companies for desludging service that are registered in the sanitation department.

In order to implement the telephone reservation system, however, the Dinas Kebersihan DKI Jakarta must install communication equipment and create a customer database. Ultimately, the Dinas Kebersihan DKI Jakarta should have a communication center equipped with a specialized phone system that will allow customers to reach the dispatchers easily, and should install two-way radios in vacuum trucks that will enable the dispatchers to communicate with the drivers. In the initial stage, however, the department could install one

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<sup>53</sup> Kotler and Roberto (1989) use the term "change agents" to describe the persons whose role is to persuade a group of people or the public (i.e., "target adopters") to accept, modify, or abandon certain ideas, attitudes, practices and behavior (p.6).

or more phone lines dedicated to receiving the requests. This would be a favorable option, for regular phone lines are relatively inexpensive to install and they should be sufficient to accommodate the customers' needs. It should be noted that between April 1996 and March 1997 there were, on average, 140 requests per day. Assuming that all customers would prefer calling the department to coming in person, it is likely that one phone line will be insufficient.<sup>54</sup>

Once the customer database has been completed, requests could be readily registered. By this time, a caller will have only to mention his/her phone number to the dispatcher. Then, using the number to query the database, the dispatcher will be able to access the stored information on the customer quickly in order to arrange for the date of the service. The computerized customer database is an essential component of the scheduled desludging procedure; truck assignment and desludging will rely primarily on the information that is available in the database. The customer database should be installed and operated at the beginning of the program. The database would include information on the name of the houseowner/tenant, address, estimated volume of septic tank, desludging period, last and next desludging dates, distance between parking area and the tank, and estimated street width.<sup>55</sup> As noted above, the dispatchers will make these data entries in the early stage of the program. Despite the Dinas Kebersihan's responsibility to maintain and update the computerized database, the customers will also be required to report, for example, any changes in septic tank size or phone number.

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<sup>54</sup> Based on assumptions that in one day the working time is 8 hours, or 480 minutes, and average number of requests is 140, which means that a dispatcher has less than 3.5 minutes to file one request.

<sup>55</sup> Information on the width of the street will be useful to make vacuum truck assignment, e.g., houses in narrow streets could not be served by six-cubicmeter trucks; two-cubicmeter trucks should be used.

To support this request system, the sanitation department should revise the 1988 Governor's Decree on Provision of Services and Collection of Cleanliness Retribution. The Decree currently requires that registration for desludging be made only in designated places and that the fee be paid in advance.

Finally, the Dinas Kebersihan DKI Jakarta should organize a public campaign to introduce the telephone request procedure to its potential customers. At this stage, the new procedure and the existing retribution fee can be disseminated through indirect means such as advertisement in mass media and pamphlets. Recall that the objective of the immediate measure is only to provide existing septic tank owners with less cumbersome request procedure; it is not aimed to improve septic tank design. Therefore, the information dissemination should be designed accordingly. The alternative request procedure and its fee should be listed in the Yellow Pages and, for a limited period, advertised in several newspapers and on television stations. Pamphlets can be placed on announcement boards in the sub-district offices, health centers and other appropriate locations. Community organizations can assist the department in affixing the pamphlets and even distributing them in their neighborhood. Another effective means of advertisement would be to utilize vacuum trucks as "mobile billboards." Marking the trucks with phone numbers of the dispatchers and the amount of the desludging fees would increase the coverage of the information dissemination.

#### **4.2.2 Consolidation of Public Campaign Materials**

Over time, public campaign materials should be revised to include the sanitation department's program to implement improved design, construction, operation and maintenance of septic systems. Furthermore, campaign materials should be expanded to include personal hygiene and environmental sanitation. The community at large still needs to be introduced to the importance of proper human waste disposal and be shown how the quality of water resources are affected by haphazard waste disposal. This public campaign is a critical undertaking and may require considerable time in which to build awareness in both the citizens and the service deliverers themselves.

Preparation of public campaign materials is a relatively complicated task. Specific campaign materials should be prepared for specific audiences. First, the sanitation department should identify the groups of people who will benefit from this campaign, i.e., its target adopters. The department should know the socio-economic condition of each of these groups and fully understand which aspects of the program will benefit them.

More than one method of communication can be used to drive the points home. Information dissemination can be accomplished, for example, through entertainment such as sketches/plays for all the people in a particular community and complemented by meetings (direct means) with formal and informal groups within the community.

Another critical issue for the Jakarta Sanitation Department is how to train its change agents so that they fully understand the campaign material and, more importantly, are able to communicate effectively with their audience. With this skills, the change agents could better interact with their audience and enable the target adopters to respond constructively. In sum,

the variety of target adopters and number of means to disseminate information suggests that Dinas Kebersihan DKI Jakarta must prepare a number of public campaign materials to meet a spectrum of needs, and must prepare its change agents to be proficient in delivering its message.

### **4.3 Medium-Term Implementation**

The main objective of medium term activities will be to prepare favorable conditions for the long-term implementation of the new program. If scheduled desludging is to be implemented, there are preconditions that have to be met. These include properly designed and operated septic systems that do not contaminate groundwater or overflow into waterways; sufficient capacity of both vacuum trucks to transport the generated sludge and septage treatment plants to treat the incoming septic sludge; regulations requiring households to have well-designed, constructed, operated and maintained septic systems, in order to prevent potential haphazard sludge disposal either by the septic tank owners or the vacuum truck drivers; and, perhaps most importantly, a developed community awareness of the potential health hazard of septic sludge and effluent from septic tanks (and other human waste disposal facilities).

#### **4.3.1 Implementation of Public Campaign Program**

Establishing a priority for investing in human waste disposal facilities can be achieved only if people are aware of the benefits of personal hygiene and environmental sanitation. A public campaign is perhaps the most important precondition to increasing the demand for

human waste disposal facilities and ensuring successful implementation of scheduled desludging. While immediate measures only involve indirect means to disseminate the program, the implementation of the intermediate measures requires both direct and indirect information dissemination. Dinas Kebersihan DKI Jakarta should also elicit the help of community organizations to facilitate campaign events and, more importantly, to disseminate campaign materials. Partnership with community organizations will enhance the information dissemination process because the members of these organizations are more accessible to the community on a day-to-day basis. Therefore, in addition to its own public campaign instructors, the sanitation department should train the members of the community organizations to become change agents.

The Dinas Kebersihan DKI Jakarta should also seek alternative methods to enhance its program. This could include the involvement of the Indonesian Scout Organization (Pramuka). Pramuka, a well-established organization with members from elementary, junior and senior high schools, would be a good vehicle through which to disseminate specific programs (i.e., design, construction and maintenance of septic systems) as well as promote personal hygiene and environmental sanitation issues. Members of Pramuka can also be trained to design and construct septic tanks, which eventually could be involved in self-help projects to assist low income communities to construct septic systems. The sanitation department should also intensify its interaction with the Family Welfare Program (PKK).<sup>56</sup> PKK is a women's organization which could be a primary agent for promoting good family

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<sup>56</sup> The Family Welfare Organization (well-known by its Indonesian abbreviation of PKK or “Pembinaan Kesejahteraan Keluarga”) is a women's organization that exist in every sub-district (for urban areas) or village (in case of rural areas). PKK was established to accommodate village or sub-district activities in enhancing family welfare, health and skill.

hygiene and sanitation and, particularly, for underscoring the importance to dispose human waste properly.

#### **4.3.2 Revision of Regulation on Waste Disposal and Tariff Structure**

The 1988 Local Regulation on Environmental Cleanliness in the City of Jakarta, which requires homeowners/tenants to install wastewater storage facilities and enumerates retribution fees, must be revised to accommodate the long-term plan. While decrees can be readily issued by the governor, enactment of local regulations requires lengthy deliberation by the Local House of Representatives. The new local regulation should regulate the design, construction and maintenance of septic systems, accommodate the option to install communal septic tanks, include revised retribution fees for desludging and treatment of septic sludge, and enable low-income people to apply for financial assistance.

Issues of design, construction and maintenance of septic systems as well as communal septic tanks could be readily incorporated into local regulations; however, revision of retribution fees and provisions for financial assistance are likely to require some time to prepare. The revised local regulation should refer to the 1989 Standard Design of Septic Tanks. This standard explicitly describes, among other things, the dimensions of individual septic tanks based on the number of users and the desludging period of each (see Appendix A). The option to install communal septic systems should also be allowed either to enable groups of houses with limited space to share a facility or to help families that could not afford



to build their own private septic tank.<sup>57</sup> A collective system is likely to be cheaper to construct and maintain, as the costs are divided among several beneficiaries. There are, however, issues that have to be resolved when sharing a communal septic system, including payment of construction and/or maintenance costs, and issues regarding operation and maintenance. Clearly construction or maintenance costs should be shared, but beneficiaries should decide how they would divide the costs, e.g., by number of households or family size. In the first case, the costs would be divided evenly among the families sharing the facility, whereas in the latter, cost sharing depends on the number of persons in a family, larger families being expected to contribute more. The community organizations, especially the neighborhood associations, could mediate this deliberation to accommodate the beneficiaries' needs and prevent possible disputes.

The outdated retribution fee should be adjusted to accommodate current prices of delivering the service. The tariff structure, which was enacted at the end of the 1980s, cannot be sustained if the Jakarta Sanitation Department is to improve its desludging service; operational costs have gone up since then, which means that an increased demand would actually strain the local government's financial resources. At present, the department is relying on the Local Government of Jakarta for its operating expenditures. The previous chapter indicates that in 1996/1997, while Dinas Kebersihan's total revenue was only about Rp.9,711 million (about US\$ 4.22 million), its vehicle operating and maintenance costs alone (excluding salary and other spending) reached about Rp.15,663 million (approximately US\$

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<sup>57</sup> Communal septic systems are especially suitable for densely populated areas. For example, due to limited land, a neighborhood in Ujung Pandang (South Sulawesi) installed a shared septic tank under a footpath.

68 million). If the initial program (i.e., immediate measures) is a success, it is likely that the expenditures will rise even more due to increased consumption of fuel and replacement of spare parts as vacuum trucks are operated more frequently. In light of the increased competition for financial resources among agencies within the Local Government of Jakarta, combined with the enactment of the 1997 Law on Local Government Taxes and Retribution, which eliminates a large number of revenue sources, Dinas Kebersihan DKI Jakarta is expected to be more active in seeking ways to generate revenue to cover its costs.

The 1997 Law on Local Government Taxes and Retribution still allows local governments, in this case the Jakarta Sanitation Department, to impose retribution on desludging and sludge treatment. It prohibits, however, imposing license fees (e.g., license fee for private vacuum trucks) that were provided for in the previous laws.<sup>58</sup> The enactment of the 1997 law has eliminated significant sources of revenue for local governments in Indonesia, including the Local Government of Jakarta. While 42 taxes and 192 types of retribution were accessible in the previous laws, only 9 taxes and 30 types of retribution are allowed by the 1997 Law. Some local governments have disclosed that their potential revenue for fiscal year 1998/1999 will be reduced by 50 percent as a result of the new law.<sup>59</sup> Unfortunately, there are no data on potential losses to the Local Government of Jakarta. Nonetheless, it will be a challenge for the sanitation department to improve its efficiency in generating revenue as well as in making investments.

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<sup>58</sup> The 1957 Laws numbers 11 (on Collection of Taxes and Retribution and Emergency Laws) and 12 (on General Guidelines on Retribution).

<sup>59</sup> The Local Government of Aceh disclosed that their revenues in fiscal year 1998/1999 will be reduced by 51 percent as a result of the 1997 Law on Local Government Taxes and Retributions (Kompas newspaper, March 12, 1998). Other local government such as Maluku will lose 40 percent of its revenues (Kompas, August 21, 1997).

Assessment of the new retribution fee is likely to cause controversy among stakeholders; on the one hand, the tariff should be affordable for all homeowners/tenants, while on the other, it should provide enough revenue for private companies to remain in the service production. Ideally, the tariff should be able to recover the producers' investment and operating costs; however, this fee might not be affordable for most households. As a result, septic tank owners who either cannot afford or are unwilling to pay might resort to haphazard means of disposal, as has happened before. There is also a possibility that some private companies might charge less than the new retribution fee, but dispose of the septic sludge in illegal sites in order to gain profit. However, members of the House of Representative are likely to require that retribution must be affordable to the public regardless of the investment and operating expenditures.

One possible solution is to set up two different tariffs which would be applied to different group of customers: a full price would be imposed on regular customers, whereas a subsidized price would be available for those who opt to pay by installment. As stated in the previous chapter, scheduled desludging for owners who could afford full payment would be served by private vacuum trucks, whereas the sanitation department's trucks would serve both those who had arranged payment by installment and public toilet facilities, which usually exist in densely populated areas and traditional markets.

The retribution fee that regular customers now pay to the drivers consists of transportation and treatment fees; in the proposed system, the transportation fee would be collected by the private desludging companies as compensation for its service, whereas the treatment fee would be paid by the drivers to the person in charge in the septage treatment

plant. Still, the proposed full price should be discussed thoroughly by the Local Government of Jakarta, Jakarta Sanitation Department and the private companies. The private companies should be aware of the positive externalities of wastewater management which would prevent them from charging a profitable amount; at the same time, the local government must realize that the involvement of the private firms would ease the strain on the local government's financial resources and, possibly, would help to improve the production of the services.

### **4.3.3 Provision of Financial Assistance for Construction and Maintenance of Septic Systems**

In addition to the tariff structure adjustment, new local regulations should also enable potential customers to apply for financial assistance for construction or/and maintenance of septic tanks. As mentioned earlier, to avoid groundwater pollution from infiltration of raw sewage and surface water contamination from overflows of septic effluent and sludge, implementation of scheduled desludging requires preconditions that include properly designed and operated septic tanks. People will not be allowed to construct and operate sub-standard septic systems that are potentially unsafe to the environment. A septic system that conforms to the standard design is relatively more expensive than many of the commonly constructed ones, since the tank has to be watertight (many existing tanks have an unlined bottom that allows raw sewage to infiltrate into the soil) and its dimension must be appropriate to the family's size (currently, many of them are constructed without due regard to the number of

users).<sup>60</sup> One must expect that some people will not be able to afford to construct a standardized septic tank; the Jakarta Sanitation Department should anticipate this dilemma.

Financial assistance for construction of toilet facilities has been implemented in various areas in Indonesia, and the Dinas Kebersihan DKI Jakarta can benefit from these experiences in order to successfully implement the program. Forms of assistance, source(s) of initial funds, interest rates (operational charges), and repayment period(s) are some of the factors that have to be carefully considered in designing the program (Silver, 1990, pp.6.1-6.11).<sup>61</sup> Observations in various cities suggest that recipients prefer cash credit schemes rather than materials or complete units.<sup>62</sup> When assistance has been provided by supplying construction materials, many beneficiaries have been dissatisfied because either the condition and/or volume of the materials did not meet their expectations, or they felt the value of the delivered construction materials was not equal to the amount of the credit. In addition, people have not fully accepted that delivered materials (which they did not select, or which did not their expectations) have to be repaid with money. Similarly, some beneficiaries have been disappointed with complete unit schemes because they have not been involved in the design process. This has lead to a diminished sense of ownership and, hence, an

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<sup>60</sup> Based on preliminary cost estimates, the cost of standardized septic system for 5 persons (desludging period every 3 years and volume is 1.85 cubic meters) is approximately Rp.750,000, whereas a sub-standard one (unlined tank base, unproven construction material, and no leaching facility) only costs less than one-third. (cost estimates based on 1996 prices).

<sup>61</sup> Silver (1990) examines financial assistance program for on-site sanitation in a number of cities in Indonesia, such as Jakarta; Bogor in West Java; Semarang and Solo in Central Java; Yogyakarta; and Surabaya and Malang in East Java (pp.6.1-6.11).

<sup>62</sup> Silver (1990) observed three types of assistance: (i) cash credit scheme, where beneficiaries are given money to construct toilet facilities and have to repay also in cash; (ii) material provision scheme, where construction materials are delivered to the beneficiaries, and they have to construct the facility themselves and repay with money; and (iii) complete unit scheme, which is similar to turn-key project, where the facilities are constructed by contractors and once completed, the unit is handed over to the recipient. For either type of assistance, the recipient has to repay in cash.

unwillingness to pay. Consequently, a cash credit scheme offers the best potential for cost recovery, because beneficiaries derive a sense of ownership by having a clear understanding of the value of the credit, control over purchase of the materials, and involvement in construction of their sanitation facility. Furthermore, recipients of cash credit are likely to contribute greater amounts of their own resources for additional improvements, such as the construction of a larger septic tank or improvements on their existing bathroom.

In addition to the possibility of using its budget for this program, Dinas Kebersihan DKI Jakarta needs to encourage non-government organizations and private companies to contribute in generating “seed capital.” With increased competition for a share of the local government budget, the department is expected to be more resourceful in generating sufficient funds to start and sustain this credit scheme. A number of non-government organizations and private companies have been involved in the provision of public toilets for low income communities in various parts of the city. Such an endeavor could perhaps be coordinated with the sanitation department’s financial assistance program. This program would require “seed capital” to fund the first groups of recipients, whereas construction of septic tanks for the later groups could be financed from the repayment collected from the previous beneficiaries. Consequently, repayment performance is critical to the continuity of the program. Experience with other projects suggests that willingness to repay is dependent on the degree of satisfaction, and on collection efficiency.

An interest rate, or “administrative charge,” could be applied to cover administrative and operational expenses, as well as to provide incentive for the community organization to

become involved.<sup>63</sup> Observations of earlier projects found no evidence that imposing an administrative charge (i.e., between 1%-2% per month) adversely affected either repayment performance or demand for credit. People seemed to understand that a portion of money would be needed for administrative and operational purposes. In fact, in one case, repayment performance and sense of responsibility diminished in the absence of an “interest rate.” In this financial assistance program, the administrative charge could be used to cover expenses and to provide incentive for the community organizations who assist the Jakarta Sanitation Department in administering the program. In addition to the administrative charge, the sanitation department should also consider a repayment period that is both affordable for the recipients and manageable for the department (and the community organizations) to sustain the program. As a general rule, a repayment period between 2 and 3 years is considered reasonable. A shorter repayment period would make the monthly installment unaffordable to some beneficiaries, whereas a longer period is likely to reduce repayment performance.

In addition to financial assistance for construction of septic tanks, Dinas Kebersihan DKI Jakarta should also provide the opportunity for citizens to pay the desludging fee in installments. The department should anticipate that not all of its customers can afford (or are willing) to pay the retribution in full. For example, payment could be made in installments over three years, with the desludging being performed following the last installment.

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<sup>63</sup> In certain cases, the term “administrative charge” would be more appropriate, since imposing interest rate could generate controversy due to religious and cultural reasons.

#### **4.3.4 Private Companies' Role in Sludge Transportation and Treatment**

Private companies are potential partners of Dinas Kebersihan DKI Jakarta in producing wastewater-related services. In the future, their involvement in sludge transportation (i.e., septic tank desludging) could be expanded to include treatment. This would be a viable option, in light of the increased competition for financial resources among Jakarta Local Government's agencies and of the potential increase of demand for septic sludge desludging and treatment once the long-term program is implemented. By then, private companies' vacuum trucks are expected to serve most of the households, whereas the department's fleet would only serve public facilities and customers who have a payment by installment arrangement. In the future, private involvement in septic sludge treatment would also be attractive to private companies due to what is sure to be an increased volume of incoming sludge and the potential market for dried sludge.

As a service provider, Dinas Kebersihan DKI Jakarta has the responsibility of assessing the real demand for the production of desludging-related services and encouraging private participation. The department, for example, has to estimate the number of septic tanks in Jakarta and the volume of sludge generated so that it can assess the total volume and number of vacuum trucks needed to transport it, as well as the total capacity of septage treatment plants required to treat it. Once the quantity of sludge is known, the services can be delivered by the private companies. Preliminary estimation in the previous chapter suggests that scheduled desludging procedure would require about 380 units of four-cubic meter trucks or 760 units of two-cubic meter ones per day. This would provide an attractive opportunity for private companies to invest in vacuum trucks. The sanitation department



should also encourage private companies to operate existing septage treatment plants or even to make investment themselves. Estimates for septage treatment plants show that implementation of scheduled desludging would require about five new treatment facilities in addition to the three existing ones. With a total sludge volume of 2,290 cubic meters per day, there is a potential revenue of Rp.45 million (about US\$ 19.5 million) per day from the production of about 64,000 kilograms (64 tonnes) of compost.<sup>64</sup>

#### **4.4 Long -Term Implementation**

Following the initial stage of improving desludging service and the intermediate program of preparing favorable conditions for the next stage, this final phase of the program aims to implement scheduled desludging and to ensure a greater role by private companies in septic sludge transportation and treatment. Scheduled desludging implies that septic tanks are desludged regularly without the owners having to make requests. This procedure is designed to prevent overflowing of septic sludge into the leaching facility because of owners' neglect or overloading caused by an increased number of users. In addition, the procedure could also serve as a means to monitor desludging and transportation of septic sludge and, therefore, to prevent illegal waste disposal. Nevertheless, the procedure requires a centralized coordination to ensure that the services are delivered on time and that septic sludge is disposed in one of the treatment plants. In this respect, in spite of greater

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<sup>64</sup> This estimate is based on the septage treatment plant in Magelang, Central Java. Its 20-cubicmeter treatment plant could produce 560 kilograms of compost daily and the compost is sold for Rp.7,000 per 10 kilograms. (Gatra Magazine, 13 December 1997, p.112).

participation by private companies, Dinas Kebersihan DKI Jakarta should retain its role as service coordinator.

Once this program is implemented, preliminary estimation suggests that 2,290 cubic meters of septic sludge will have to be transported and treated every day. This undertaking will require, at least, 380 units of four-cubic meter trucks or 760 units of two-cubic meter trucks or, most likely, a combination of both types (Appendix B describes a scenario of scheduled desludging). This is a massive undertaking and, therefore requires that certain preconditions be successfully met. Not only must the supporting infrastructure be in place (such as computerized database, and well-designed and constructed septic systems), but Dinas Kebersihan DKI Jakarta, private companies and community organizations must perform exceptionally well to sustain the scheduled desludging procedure.

First of all, as the service provider, the sanitation department has to assess the actual demand for service. This is a crucial issue for the department in determining the total number of vacuum trucks needed to transport septic sludge and the total capacity of septage treatment plants needed to process it. In addition, the department has to ensure that private companies are interested in making investments in vacuum trucks and septage treatment plants. Both private companies and community organizations should be provided with the right incentives to sustain their participation. Secondly, the private companies must be committed to producing good service. Their commitment is needed because due to the regulated fees, the service might not be very profitable for private firms. However, investment in septage treatment plants is likely to generate some profit once the market for dried sludge/compost is established. Finally, the community organizations must assist the

department in administering financial assistance programs, and in disseminating public information about septic tank design and construction, and in distributing notifications of dates for desludging.

#### **4.4.1 Implementation of Scheduled Desludging Program**

The main objective of scheduled desludging is to prevent contamination of water resources caused by improper disposal of human waste. Substandard septic systems and other poor methods of human waste disposal have contributed to adverse health consequences such as water-borne diseases. This situation has been aggravated by illegal sludge disposal which has also contributed to the contamination of surface water in Jakarta. The implementation of scheduled desludging is expected to prevent future deterioration of the living environment. This program requires exceptional overall planning on the part of Dinas Kebersihan DKI Jakarta, commitment of the private companies to remain in the production of the service, and capability of the community organizations to ensure that this mechanism is well implemented.

Scheduled desludging will involve several steps. Prior to the date of desludging, the department should notify the homeowners/tenants that the service will be performed. The notification should include the date of desludging and the estimated price. The sanitation department will then dispatch a vacuum truck to a house to desludge its septic systems. The truck will then directly transport the sludge to one of the septage treatment plants; larger capacity vacuum trucks could serve more than one house before disposing of the sludge at the treatment plant.

The dispatchers in Jakarta Sanitation Department will have an important role in this process. Their duty will be to ensure that written notifications are sent to the customers on time and to coordinate assignment of vacuum trucks. The first duty of the dispatchers will be to inform houseowners/tenants of the upcoming desludging service by accessing such information in their computerized database. The written notification itself can be sent to the customers through the sub-district office where the sanitation department has its representatives. Staff members of community organizations will then distribute the notifications to the people in their neighborhoods.

The purpose of community organizations to deliver the notifications is (i) to ensure that the customers receive the notification in time to be able to make the necessary arrangements, such as having someone in the house to expect the visit and/or sufficient money to pay the retribution fee, and (ii) to re-examine the notification letter if any of the customers has a credit arrangement for desludging service, in which case the person(s) should be served by the department's truck(s). The community organizations should receive the written notifications two weeks in advance in order to have time to check them (and make re-arrangements, if deemed necessary), and the customers must receive their notification one week in advance.

The second task of the dispatchers is to notify the private companies of dates of service and to monitor its delivery. For example, one week prior to the service (after ensuring that there are no re-arrangements from the related community organizations), the department will notify the assigned private company of the upcoming desludging and provide it with a list of customers' names, addresses, estimated sludge volume and retribution fee. In

addition, the department will inform the company of the final destination of each truck, based on the service area or proximity to one of the septage treatment plants. This will enable the sanitation department to monitor sludge transportation. The dispatchers will also send a list of incoming trucks for a particular day to the supervisors in each septage treatment plant so that the supervisors are able to monitor truck assignment.

Public toilets and credit scheme participants will be served by the sanitation department's trucks. The procedure for households served by the sanitation department will be similar to those served by private companies, i.e., they will receive written notification through the community organizations prior to the service. However, instead of making direct payment to the drivers, they will pay monthly installment through the organizations, who will either submit the collected money directly to the sanitation department representative in sub district offices or deposit them in a special account in the Jakarta Local Government's bank (Bank DKI). In this procedure, the drivers have only to sign or stamp the notification letters to indicate that the septic tanks have been desludged.

Whereas desludging in households is relatively predictable, i.e., it can be carried out according to regular desludging periods, septic systems for public toilets will have to be checked often to prevent overloading. Some public toilets in Jakarta, for example, will have to be desludged every 6 months. Both public toilets and credit scheme participants could benefit from a subsidized desludging fee.

#### **4.4.2 Involvement of Private Companies in Sludge Transportation and Treatment**

Private companies will need to play a bigger role once scheduled desludging is implemented and will be invited to invest in septage treatment facilities. A large number of vacuum trucks will have to operate daily once scheduled desludging is implemented. Desludging should be performed in time on a day-to-day basis to prevent disrupting the whole schedule; a delayed desludging in a number of households in a given day could affect the delivery of the service in the following weeks or even months. This only can be prevented if the involved private companies and vacuum truck drivers fully understand the importance of timely service. They have to realize that their performance affects the whole production of the service. In addition to involvement in sludge transportation, septage treatment plants offer a potential investment opportunity for private firms. The implementation of scheduled desludging will require additional septage treatment plants with a total volume of 1,500 cubic meters per day to supplement the existing three facilities with a total daily treatment capacity of 660 cubic meters. Despite their relatively high investment costs, septage treatment plants could produce marketable products such as dried sludge for fertilizer/soil conditioner.

Private companies interested in delivering the service should register with the Jakarta Sanitation Department, who will record the size of each vacuum truck (e.g., two-cubic meter or four-cubic meter truck) and assign each truck a number. The information on truck size is needed to prevent assigning large trucks to houses located in narrow streets. To provide sufficient time for assigned vacuum trucks to undergo repairs, private companies will receive written notification one week prior to desludging. The written notification will list the

customers' name, addresses, estimated sludge volume and retribution fee, and disposal sites. Once desludging is performed, the customers will pay the specified amount on the receipt directly to the drivers.

Investment in septage treatment plants is a viable opportunity for private companies to do additional business, since implementation of scheduled desludging will result in predictable incoming sludge volume and, therefore, revenue. In assessing the possibility of investing in treatment plant, the company should also consider the potential revenue from marketing dried sludge as plant fertilizer or soil conditioner. A cost-sharing arrangement between Dinas Kebersihan DKI Jakarta (or the Local Government of Jakarta) and the private company is another possible option. In this case, the sanitation department would provide the land, whereas the private company would invest in construction and operate the treatment facility.

#### **4.5 Conclusion**

The first stage of the program, i.e., immediate measures, will be implemented as a preliminary solution to the problem of poor maintenance of septic systems. The telephone reservation system is expected to increase the level of demand for the desludging service. Nevertheless, the sanitation department would not be able to sustain the delivery of the service if the tariff structure remains at current level; as a result of increased operation and maintenance costs of the vacuum trucks, the outdated retribution fee would outstrip the local government's financial resources. Proposal for tariff structure adjustment is one of the activities that would be undertaken during the intermediate program. The intermediate

measures are designed to prepare favorable conditions to implement the long-term program. In addition to adjustment of retribution fee, the medium-term implementation program also includes revision of existing regulations, dissemination of public campaign materials, and provision of financial assistance. To ensure its success, these activities require a concerted effort among the sanitation department, the community organizations and the private companies. The implementation of the long term program, i.e., scheduled desludging, would depend on the achievements of the immediate and, more importantly, intermediate measures.

There are a number of issues that could threaten the implementation and the sustainability of the program. First, the implementation of the immediate measures is critical to the whole program. It is likely that customers will assess Dinas Kebersihan's ability to deliver the service based on the success (or failure) of the introduction of desludging request by telephone. Second, in addition to delivering a public campaign through indirect and direct means, the campaign material itself should be designed to accommodate the needs of each particular group of target adopters. Third, financial assistance is an important part of the whole program. The sanitation department should generate sufficient "seed capital" to initialize this program and, assisted by the community organizations, encourage repayment of the credit to ensure its continuity. Fourth, the department should enable groups of households to construct shared septic systems. Communal septic tanks are potential solution for densely populated areas and/or low income communities. Fifth, the private companies should have a greater role in the production of the service. The Dinas Kebersihan DKI Jakarta should consider incentives that would encourage private companies to remain in the service delivery.



## CHAPTER 5

### CONCLUSIONS AND RECOMMENDATIONS

#### 5.1 Overview

In the absence of a city-wide sewerage system, many households in Jakarta rely on septic tanks to hold and treat their toilet waste. However, many septic systems are not maintained properly, resulting in overflows and contamination of water resources. Some people almost never check sludge levels or only react to clogging. In a number of cases, instead of desludging the septic tanks, owners bypass the effluent into storm drains. This thesis examines and evaluates the underlying causes of poor maintenance of septic tanks, and proposes recommendations to solve the problem.

The conclusion indicates that in spite of its established function, Dinas Kebersihan DKI Jakarta is more responsive to solid waste-related services than it is to wastewater management. This tendency is attributed to a number of interrelated factors that include its problematic definition of the term “cleanliness,” the increasing public awareness of and emphasis on solid waste management, and the department’s desire to win the Adipura Award.

The recommendations include strengthening the department’s role as the service provider in desludging-related services along with revising of existing regulations on construction and maintenance of septic systems, adjusting of retribution fees, and consolidating of public campaign materials to reflect the department’s legal function; encouraging the involvement of private companies in transportation and treatment of septic

sludge; and enhancing the community organizations' participation to support the program. A scheduled desludging procedure is a favorable option to solve current deficiencies in operation and maintenance of septic systems. Nonetheless, its implementation requires certain preconditions which would be undertaken in three consecutive stages: immediate measures, medium-term measures and long-term implementation.

## **5.2 Summary of the Conclusions**

Part of the problem of poor maintenance could be attributed to the sanitation department's tendency to be more responsive to solid waste-related services than it is to wastewater management. In spite of its instituted responsibility to manage both solid waste and wastewater issues in Jakarta, the department tends to regard garbage disposal as a higher priority than desludging-related services. This predicament is attributed to a number of interrelated factors, which include the lack of unanimity as to the definition of "cleanliness," the increasing public awareness of potential health hazards of poor management of solid waste, and the department's motivation to win the Adipura Award.

First, the unclear definition of "cleanliness" has resulted in disproportionate emphasis on solid waste management in many legal documents and materials disseminated to the public. This has contributed to the community's limited understanding of cleanliness, especially with regard to potential hazard of septic tank effluent.

Second, the issue of garbage disposal has received increasing attention from the central and local governments, as well as from the community. In recent years, the public is increasingly aware that inappropriate garbage disposal could cause detrimental health effects.

In addition to its potential health hazards, Jakarta's uncollected garbage is also considered one of the main factors that contribute to flooding.

Lastly, the introduction of the Adipura Award in 1986 has been a driving force for the sanitation departments, including that of Jakarta, to improve their management and infrastructure in solid waste-related services. This is a highly publicized award to municipalities that receives extensive attention from the central government agencies and the community.

### **5.3. Summary of the Recommendations**

The main objective of the program would be to implement scheduled desludging as a means of preventing potential illegal disposal of septic sludge and at the same time securing a revenue base with which to sustain the production of the services. This program could only be implemented once certain preconditions are satisfied, including strengthening the department's role as the service provider in desludging-related services. To accomplish this, firstly, the sanitation department must amend the existing regulations on request procedure for desludging services so that people may register by phone; it must also revise the payment scheme so that customers may pay through the drivers or community organizations; and it must adopt the Standard Design of Septic Tanks as a guideline for homeowners to design, construct, operate and maintain their septic systems. In addition, the department must adjust the current tariff structure so that the department can sustain its service delivery once the phone reservation system is introduced and, more importantly, so that private company involvement is assured.

Another important precondition is to enhance the community's awareness of family hygiene and environmental sanitation, particularly with regard to disposal of wastewater. The sanitation department must consolidate the public campaign materials to reflect its mandate to manage both wastewater and solid waste-related services.

Secondly, Dinas Kebersihan DKI Jakarta should encourage the involvement of private companies in the transportation and treatment of septic sludge. It is likely that the department alone would not be able to cope with the future demand for desludging service and the treatment of septic sludge. Preliminary estimates suggests that scheduled desludging would generate a sludge volume that is at least four times larger than the department handles today. Greater involvement of private companies would relieve the department's financial resources that would otherwise be needed to operate and maintain vacuum trucks and septage treatment plants. Moreover, involvement of private firms could increase efficiency in the production of the service.

Lastly, the community organizations could be trained as change agents to disseminate public campaign materials on the design, construction, operation and maintenance of septic systems as well as on personal/family hygiene and environmental sanitation. Furthermore, as intermediaries between the beneficiaries and the sanitation department, they could assist in administering the financial assistance program.

Scheduled desludging is a favorable option to solve current deficiencies in the operation and maintenance of septic systems. Nonetheless, its implementation requires certain preconditions, which will be undertaken in three consecutive stages: immediate measures, medium-term measures and long-term implementation. In order to simplify the

request procedure, immediate measures will include introducing requests for desludging by telephone. Intermediate measures are designed to prepare favorable conditions prior to the implementation of the long-term recommendations. The medium-term activities include implementation of an improved public campaign program, revision of the regulation(s) on waste disposal and adjustment of retribution fees, provision of financial assistance for construction and maintenance of septic systems, and deliberation on the future role of private companies in sludge transportation and treatment.

#### **5.4 Other Issues of Implementation**

This thesis attempts to identify possible causes of poor maintenance of septic tanks in Jakarta, provides recommendations for how to deal with the identified shortcomings, and presents the phases in which the program could be implemented. The whole program is mainly aimed at preventing both haphazard disposal of human waste by homeowners and illegal disposal of septic sludge by vacuum truck drivers. The ultimate objective is to improve community health and environmental condition which could eventually lead to increased productivity of the people and improved quality of water resources in the city. Nevertheless, the implementation of this program is highly dependent on one or a combination of other factors, including the community awareness of the urgency of improving management of wastewater disposal and the commitment of the decision maker(s) to implement a long-term program to improve human waste disposal practices.

Community awareness would be an important factor in making the decision to undertake the program. Demand for better human waste disposal facilities could only be

achieved if people fully understand their benefits. Enhanced community awareness could be accomplished by means of public campaigns to disseminate information on the proper design of septic tanks and the necessity of regular desludging, and on the potential hazards of septic sludge and effluent. Nonetheless, access to information alone would not be sufficient to initiate and sustain this program. Desludging must be mandated by law, so that all citizens participate and so that non-compliance is dealt with appropriately.

Another important element is leadership. Since it will take some time to implement the proposed recommendations, this program would benefit from person(s) that have both leadership abilities and commitment. The success (or failure) of the program will be highly dependent on the commitment of the decision makers. In order to try ensure regular desludging, decision maker(s) would have to enact regulation to impose mandatory desludging. The regulations would serve as a coercive device to force owners to design and construct their septic tanks based on standard design and to desludge their septic systems regularly. The main problem, however, is to monitor the more than one million households and commercial and business premises in Jakarta.

In this respect, a potential solution is to link this program with the payment of the property tax, i.e., the Land and Building Tax (Pajak Bumi dan Bangunan, or “PBB”).<sup>65</sup> Each year, all homes and property owners have to pay PBB in designated banks. Taxpayers are usually given six months to make payments, and payments are accepted only if taxpayers show the previous year’s receipt. If an owner decides to sell or to let a property, the

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<sup>65</sup> The Land and Building Tax, enacted in 1986, is a central government tax shared with provincial and local governments. Provincial and local governments receive a large portion of the revenue; only ten percent is retained by the central government and another nine percent used to cover administrative costs (Smoke and Bastin, 1994, p.6).

potential buyer(s) and the notary office (which will prepare the legal documents) will ask the owner to show the receipt to ensure that the tax has been paid. This same mechanism could be used to monitor desludging of septic tanks. The Local Government of Jakarta, for example, could require homeowners not only to show the receipt of PBB, but also to enclose the receipt for desludging. This would be an effective monitoring mechanism to ensure that homeowners regularly desludge their septic systems.

# APPENDIX A

## STANDARD DESIGN OF SEPTIC TANKS

### 1. Introduction

The Standard Design of Septic Tanks was issued in 1989 by the Ministry of Public Works as a guideline for construction of these facilities in order to ensure protection of community health. This guideline is to be used to maintain minimum requirements for households in the construction and maintenance of septic systems. In this respect, standard septic tanks are only appropriate for areas with low groundwater level (1.2 meters or more from ground level on wet seasons) and a specified number of users (between 5 and 25 persons).

### 2. Background

In spite of the fact that many of Jakarta's inhabitants use septic tanks to dispose and treat their toilet waste, their exact number in the city is unknown. Several reports on this issue produce a spectrum of estimates. The 1991 Jakarta Wastewater Master Plan submitted by Pacific Consultants International suggests that 68 percent of the population in the study area have individual toilets that discharges their waste into a septic tank (p.F.2). Another report by the EX Corporation on Indonesia's resources and environment (1992) notes that 50 percent of the people are served by septic systems (p.181). Also, regarding the number of septic tanks, Dillinger (1994) states that 800,000 households in Jakarta have installed septic systems, whereas Gaymans and Sudradjat (1989) estimate that this number is approximately



600,000. Notwithstanding the likelihood of differences in methods of data collection and analysis, the wide range of results could also be attributed to the citizens' (and the enumerators') technical definition of what constitutes a "septic tank".<sup>66</sup>

There are indications that many people regard "septic tank" simply as on-site treatment facility, a definition that also could include a leaching pit or any of its variations.<sup>67</sup> In the study on septic tanks in Jakarta, Gaymans and Sudradjat (1989) record that many of their subjects use the term "septic tank" to indicate any on-site disposal facility, such as septic tanks, leaching pits, or "any container for temporary storage of human waste" (p.8). This misconception is also noted by Binnie and Partners (1990) during their study on the Sunter River catchment area in East Jakarta. A number of their respondents use the term "septic tank" to refer to their disposal pits which are actually unused shallow wells into which they discharge human waste.

### **3. The Standard Design of Septic Tanks**

In 1989, as the national agency responsible for providing technical guidance to the local governments, the Ministry of Public Works issued a Standard Design of Septic Tanks.<sup>68</sup>

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<sup>66</sup> Gaymans and Sudradjat (1989) state that their study on septic tanks in Jakarta was hindered by the fact that many respondents were not familiar with the type and actual size of their facility, and many affluent people were unwilling to participate in the survey (Gaymans and Sudradjat, 1989, p.3-4).

<sup>67</sup> Technically, leaching pits are designed as either a single pit or twin pits, and receive (and treat) raw sewage. Like septic tanks, leaching pits also rely on favorable soil condition to infiltrate the liquid portion of wastewater, while the solids are retained to undergo anaerobic digestion. The sludge from both leaching pits and septic tanks have to be removed (Silver, 1990, p.4.1). A properly designed leaching pit is constructed of a unlined honey-combed brick wall and concrete cover. Its variations range from a simple dug-hole pit to a bamboo-covered wall with woodboard top.

<sup>68</sup> The Standard Design of Septic Tanks was among 31 guidelines in public works sector that was issued by the Minister of Public Works (Decree no.306/KPTS/1989 dated July 6, 1989) as a draft national standard. The standard was deliberated, among others, by representatives from the Ministry of Public Works, Ministry of Health, Ministry of Housing, universities (Bandung Institute of Technology and University of Indonesia), and professional organization (Indonesian Society of Sanitary and Environmental Engineers).

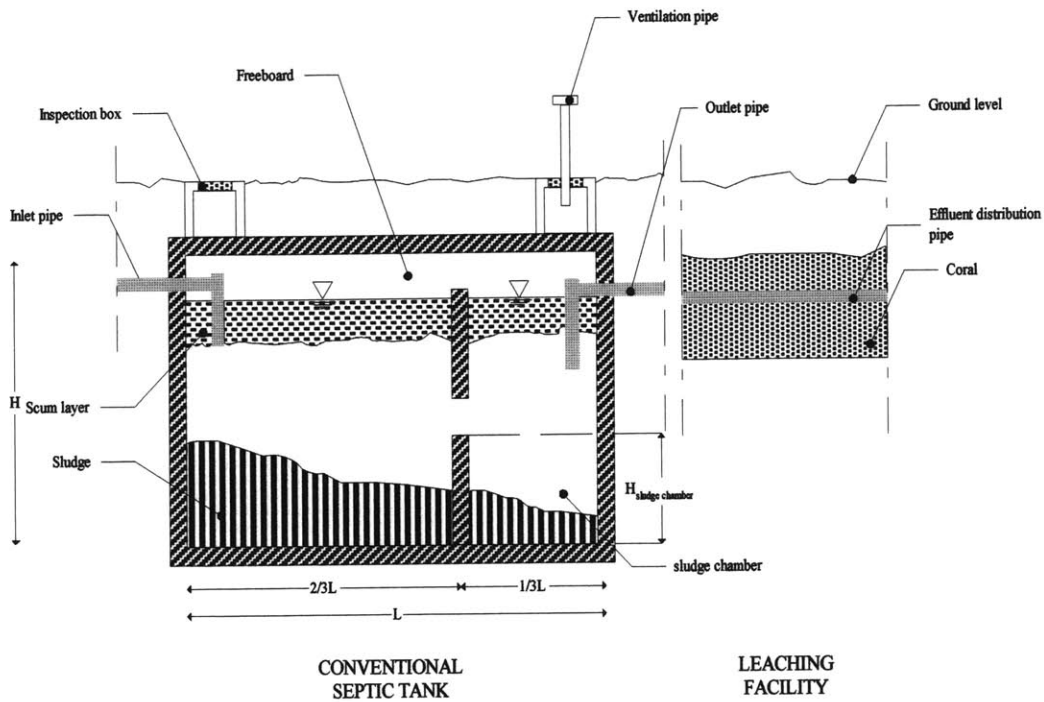
This guideline defined a septic tank as a watertight chamber in which to retain and treat domestic wastewater, which includes both toilet waste and sullage, by means of biodegradation. The effluent of septic tanks still carries dangerous microorganism and, therefore, should be further treated. A properly designed septic tank should include a watertight container with a specific dimension (to provide a favorable environment for decomposition of raw sewage, sufficient room to store septic sludge temporarily, and prevent soil and groundwater contamination) and a leaching facility (to ensure further treatment of effluent).

#### **4. Design of Septic Tanks**

The layout of a septic system includes a watertight container (i.e., septic tank) and a leaching facility (which could either be a leaching field or a pit). The tank consists of two chambers to prevent short-circuiting of raw sewage, which could be constructed by using either lined brickwork or reinforced concrete. The cover is usually made of reinforced concrete with inspection boxes.<sup>69</sup> The guidelines describe two types of septic tanks, i.e., a conventional and a modified one. The difference lies in the design of the bottom: while the bottom of a conventional septic tank is flat, that of a modified tank is sloped for ease of desludging. Figure A.1 illustrates a conventional septic tank and Table A.1 lists dimensions that are applicable for both tank variations.

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<sup>69</sup> The Standard Design lists also other alternative construction material that could be used for the tank, such as concrete bricks and “river stones” (large round and smooth stones often found in the rivers). A metal sheet could be an option for the cover.



**Figure A.1 Layout of a Conventional Septic Tank**

Source: Ministry of Public Works, The Standard Design of Septic Tanks, 1989

No.	No. of Users (persons)	Volume of sludge chamber (m <sup>3</sup> )		Total volume (m <sup>3</sup> )		Dimensions (m)					
		2 years	3 years	2 years	3 years	2 years			3 years		
						L	W	H	L	W	H
1	5	0.4	0.6	1.65	1.85	1.60	0.80	1.30	1.70	0.85	1.30
2	10	0.8	1.2	3.30	3.70	2.20	1.10	1.40	2.30	1.15	1.40
3	15	1.2	1.8	4.95	5.55	2.60	1.30	1.50	2.75	1.35	1.50
4	20	1.6	2.4	6.60	7.40	3.00	1.50	1.50	3.20	1.55	1.50
5	25	2.0	3.0	8.25	9.25	3.25	1.60	1.60	3.40	1.70	1.60

**Table A.1 Dimensions of Septic Tanks**

Source: Ministry of Public Works, The Standard Design of Septic Tanks, 1989

## APPENDIX B

### A SCENARIO FOR SCHEDULED DESLUDGING

#### 1. Introduction

This section gives an overview on the implementation of scheduled desludging. It describes the extent of the undertaking had it been implemented in 1990. The data and prices are based on the 1991 Jakarta Wastewater Disposal Master Plan and other available information on the matter. The scenario analyzes the required infrastructure to undertake the scheduled desludging (number of vacuum trucks and septage treatment facilities), presents the employment opportunity generated by the program and determines the fee for sludge transport and treatment to sustain the program.

#### 2. Scheduled Desludging

Scheduled desludging is perhaps the best option to address the current deficiencies in operation and maintenance of septic systems. The main objective of scheduled desludging is to prevent contamination of water resources caused by improper disposal of human waste. This procedure is designed to prevent overflowing of septic sludge into the leaching facility because of owners' neglect or overloading caused by an increased number of users. In addition, the procedure could also serve as a means to monitor desludging and transportation of septic sludge and, therefore, to prevent illegal waste disposal.

### **3. Implementation of Scheduled Desludging**

Scheduled desludging requires the sanitation department to play its role as a centralized coordination to ensure that the services are delivered on time and that septic sludge is disposed in one of the treatment plants. The dispatchers in the sanitation department will have an important role in this process. Their duty will be to ensure that written notifications are sent to the customers on time and to coordinate assignment of vacuum trucks. The first duty of the dispatchers will be to inform homeowners/tenants of the upcoming desludging service by accessing such information in their computerized database. The written notification itself can be sent to the customers through the sub-district office where the sanitation department has its representatives. Staff members of community organizations will then distribute the notifications to the people in their neighborhoods. The second task of the dispatchers is to notify the private companies of dates of service and to monitor its delivery. The department will notify the assigned private company of the upcoming desludging and provide it with a list of customers' names, addresses, estimated sludge volume and retribution fee. In addition, the department will inform the company of the final destination of each truck, based on the service area or proximity to one of the septage treatment plants. This will enable the sanitation department to monitor sludge transportation. The dispatchers will also send a list of incoming trucks for a particular day to the supervisors in each septage treatment plant so that the supervisors are able to monitor truck assignment.

Scheduled desludging implies that septic tanks are desludged regularly without the owners having to make requests. This procedure will involve several steps. Prior to the date of desludging, the department should notify the homeowners/tenants that the service will be performed. The notification should include the date of desludging and the estimated price. The Dinas Kebersihan DKI Jakarta will then dispatch a vacuum truck to a house to desludge its septic systems. The truck will then directly transport the sludge to one of the septage treatment plants; bugger capacity trucks could serve more than one house before disposing of the sludge at the treatment plant.

#### **4. A Scenario for Scheduled Desludging**

This scenario is based on 1989-1991 data on desludging service in Jakarta. The calculations herein only include households and public facilities. Attachment B-1 indicates that there were approximately 1.2 million households in Jakarta generating an estimated sludge of 1,778.78 cubic meters per day. In addition, there were about 675 public toilets generating septic sludge of 13.75 cubic meters per day. Therefore, the total volume of sludge that had to be handled each day was about 1,791.53 cubic meters. This would require approximately 312 vacuum trucks of various sizes to serve households and public toilets, assuming that each truck will make two trips per day (Attachment B-3). In addition to the existing three septage treatment plants (with a total treatment capacity of 660 cubic meters per day), the sanitation department needed to construct four new 300-cubic meters per day septage treatment plants.

This scenario results in employment opportunities for 409 persons as vacuum truck crews and 80 people to manage the septage treatment plant workers (Attachment B-4).

The estimated revenues from the service if scheduled desludging were implemented would be approximately Rp.9 million per day (about US\$ 5,000 per day at 1990 exchange rate, which was Rp.1,800 to US\$1). This revenues are from sludge transportation, i.e., Rp.5.4 million per day (US\$ 3,000), and treatment, i.e., Rp.3.6 million per day (US\$ 2,000). As a comparison, the actual daily revenues from sludge transportation and treatment were only Rp.1 million (US\$561) and Rp.10 thousand (US\$5.5), respectively (Attachment B-3).

Attachment B-5 presents the proposed retribution fee to enable the sanitation department to sustain the service and to ensure private companies to participate in the program. The preliminary analysis indicates that the minimum retribution fees for sludge transportation and treatment should be Rp.13,900 and Rp.3,500 (US\$7.72 and US\$1.94), respectively.

**ATTACHMENT B-1****No.of Households**

	No.of HH	Desludging (no.of mos.)	Sludge Vol. (m3)	Avg.Sludge (m3/day)
<b>T o t a l</b>	1,200,000	36	1,920,000	1,777.78

**No.of Public Toilets****1 Central Jakarta**

District	No.of Toilets	No.of users (per day)	Average (user/toilet)	Desludging (no.of mos.)	Sludge Vol. (m3)	Avg.Sludge (m3/day)
Gambir	25	1,084	43	21	200	0.32
Sawah Besar	27	1,323	49	18	216	0.39
Kemayoran	66	3,926	59	15	528	1.16
Senen	49	6,106	125	7	392	1.81
Cempaka Putih	89	4,773	54	17	712	1.41
Menteng	38	3,608	95	9	304	1.07
Tanah Abang	69	8,309	120	7	552	2.46
<b>T o t a l</b>	<b>363</b>	<b>29,129</b>			<b>2,904</b>	<b>8.63</b>

**2 North Jakarta**

Kecamatan	No.of Toilets	No.of users (per day)	Average (user/toilet)	Desludging (no.of mos.)	Sludge Vol. (m3)	Avg.Sludge (m3/day)
Penjaringan	5	272	54	17	40	0.08
Tanjung Priok	17	500	29	31	136	0.15
Koja	20	1,495	75	12	160	0.44
Cilincing	13	395	30	30	104	0.12
<b>T o t a l</b>	<b>55</b>	<b>2,662</b>			<b>440</b>	<b>0.79</b>

**3 West Jakarta**

Kecamatan	No.of Toilets	No.of users (per day)	Average (user/toilet)	Desludging (no.of mos.)	Sludge Vol. (m3)	Avg.Sludge (m3/day)
Cengkareng	42	2,471	34	26	336	0.42
Grogol	28	1,340	63	14	224	0.52
Taman Sari	7	366	58	16	56	0.12
Tambora	30	2,236	53	17	240	0.47
<b>T o t a l</b>	<b>107</b>	<b>6,413</b>				<b>1.54</b>



**No.of Public Toilets - continued**

**4 South Jakarta**

Kecamatan	No.of Toilets	No.of users (per day)	Average (user/toilet)	Desludging (no.of mos.)	Sludge Vol. (m3)	Avg.Sludge (m3/day)
Tebet	58	2,977	64	14	464	1.10
Setiabudi	50	2,967	64	14	400	0.95
Mampang	6	516	60	15	48	0.11
Kebayoran	2	80	50	18	16	0.03
<b>T o t a l</b>	<b>116</b>	<b>6,540</b>				<b>2.18</b>

**5 East Jakarta**

Kecamatan	No.of Toilets	No.of users (per day)	Average (user/toilet)	Desludging (no.of mos.)	Sludge Vol. (m3)	Avg.Sludge (m3/day)
Matraman	19	1,062	54	17	152	0.30
Jatinegara	16	616	64	14	128	0.30
<b>T o t a l</b>	<b>35</b>	<b>1,678</b>				<b>0.61</b>

**Total Daily Sludge Volume (m3/day)**

-- Households	1,777.78
-- Public facilities	13.75
	<b>1,791.53</b>

**ATTACHMENT B-3**

**Required No.of Vacuum Trucks and Septage Treatment Plants**

1	Vacuum trucks:			
	Assumption:	Each truck makes 2 trips daily		
	Daily sludge volume:	Households	1,777.78	m3/day
		Public fac.	13.75	m3/day
		T o t a l	1,791.53	m3/day
	-- 2m3 trucks	(50% households)	222	units
	-- 4m3 trucks	(20% households)	44	units
	-- 6m3 trucks	(30% households + public toilets)	46	units
		T o t a l	312	units
2	Septage treatment plants			
	-- 300 m3/day	(in addition to existing ones)	4	units

<b>Estimated Potential Revenues (1990 prices)</b>		Exchange rate: US\$1 = Rp.1,800		
1	Sludge Transportation			
	Assumption:	Fee = Rp.	3,000 /m3 (based on 1988 Local Regulation)	
	Total sludge/day:	1791.53 m3	5,374,590 Rp./day	2,986 US\$/day
2	Sludge Treatment			
	Assumption:	Fee = Rp.	2,000 /m3 (based on 1988 Local Regulation)	
	Total sludge/day:	1791.53 m3	3,583,060 Rp./day	1,991 US\$/day
3	Potential Total Revenues		8,957,650 Rp./day	4,976 US\$/day

**Actual Revenues (Sanitation Dept., 1989-1990)**

1	Actual Revenues			
	-- sludge transportation	72,793 m3	363,965,000 Rp./year	1,455,860 Rp./day
	-- sludge treatment	1717.00 m3	3,434,000 Rp./year	13,736 Rp./day
		T o t a l	368,854,860 Rp./year	1,475,419 Rp./day
				820 US\$/day

**Employment Opportunities**

- 1 Sludge Transportation
  - Total trucks needed: 312 units
  - Existing trucks: 108 units (san.dept.+private companies)
  - Additional vacuum trucks: 204 units
  - No.of crews (2 pers./truck) 409 persons
  
- 2 Sludge Treatment
  - for additional STP (4 units):
    - 20 persons/STP 80 persons

**Estimated Expenditures (1990 prices)**

1 Sludge Transportation					
-- Investment cost:	Required	Existing	Add.needed	Price/truck	Total Price
	(nos.)	(nos.)	(nos.)	(Rp.)	(Rp.)
2m3 trucks	222	77	145	30,000,000	4,350,000,000
4m3 trucks	44	4	40	40,000,000	1,600,000,000
6m3 trucks	46	27	19	50,000,000	950,000,000
T o t a l	312				6,900,000,000
				eq.to US\$	3,833,333

-- Operating costs: Assumption: 1% of investment price (for O&M costs only)

	O&M costs	Salary,crew	Per truck	Total
	(Rp./month)	(Rp./month)	(Rp./month)	(Rp./month)
2m3 trucks	300,000	250,000	550,000	122,100,000
4m3 trucks	400,000	250,000	650,000	28,600,000
6m3 trucks	500,000	250,000	750,000	34,500,000
			T o t a l	185,200,000
			eq.to US\$	102,889

- 2 Sludge Treatment
  - Investment cost 1,000,000,000 Rp.
  
  - Annual O&M costs for P.Gebang STP (300m3/day):
    - 72,000,000 Rp/year
    - Salary for 20 pers.@Rp.150,000/mo. 36,000,000 Rp/year
    - T o t a l 108,000,000 Rp/year
  
  - Costs per day: 300,000 Rp/day  
167 US\$/day
  
  - Costs per m3: 1,000 Rp./m3  
0.56 US\$/m3

**ATTACHMENT B-5**

**Estimated Expenditures - continued**

3	Total Estimated Expenditures (for O&M only)			
	-- Sludge Transportation	1791.53 m3/day	185,200,000 Rp./month	
			102,889 US\$/month	
			7,408,000 Rp./day	
			4,116 US\$/day	
		Per m3 transported:	4,135 Rp./m3	
	-- Sludge Treatment	1791.53 m3/day	1,791,530 Rp./day	
			995 US\$/day	
		Per m3 treated:	1,000 Rp./m3	

**Proposed Sludge Transportation and Treatment Fees**

1	Sludge Transportation					
	-- Investment cost:	Trucks	Tot. Vol.	Price/truck	Total Price	
		(nos.)	(m3)	(Rp.)	(Rp.)	
		2m3 trucks	222	444	30,000,000	6,660,000,000
		4m3 trucks	44	176	40,000,000	1,760,000,000
		6m3 trucks	46	276	50,000,000	2,300,000,000
		T o t a l	312	896		10,720,000,000
				eq.to US\$	5,955,556	
		-5 yr.loan @ 12% p.a.		Rp.	17,152,000,000	
		for 204 trucks:		Rp./month	285,866,667	
		average/truck		Rp./month	1,401,307	
				Rp./day	56,052	
		average volume		m3/truck	3	
		(assume: 2 trips/day.truck)		Rp./m3	9,759	
	-- O&M costs			Rp./m3	4,135	
	-- Proposed fee for sludge transportation:			Rp./m3	13,894	
2	Sludge Treatment					
	-- Investment costs	300m3/day STP:		Rp./unit	1,000,000,000	
		- 10 yr.loan @12% p.a.		Rp./unit	2,200,000,000	
		Repayment		Rp./month	18,333,333	
				Rp./day	733,333	
				Rp./m3	2,444	
	-- O&M costs			Rp./m3	1,000	
	-- Proposed fee for sludge treatment			Rp./m3	3,444	
3	Total Proposed Retribution Fee			Rp./m3	17,339	

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