PLANNING FOR DOMESTIC AND COMMERCIAL SOLID WASTE MANAGEMENT IN THE INFORMAL SETTLEMENTS: A CASE STUDY OF LANGAS IN ELDORET MUNICIPALITY

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A THESIS SUBMITTED IN PARTIAL FULFILLMENT FOR THE DEGREE OF MASTER OF ARTS IN PLANNING IN THE UNIVERSITY OF NAIROBI

SEPTEMBER 2004

DECLARATION

This thesis is my original work and has not been presented for a degree in any other university

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DEDICATION

To my parents Lawrence and Margaret, sisters Irene and Emma, and brother Evans whose care, patience and love opened up the world for me.

PROLOGUE

"The discipline of planning is not something to be accepted lightly or shrugged off as unnecessary. If planning itself is not to be a waste of resources, discipline must be firm and enforced. If the discipline is rejected, so is planning and with it African Socialism" (as quoted in Kenya, 1965).

ACKNOWLEDGEMENTS

The completion of this thesis has been made possible through the generous and tireless assistance accorded to me by a number of institutions and individuals, far too many to be mentioned individually.

First and foremost, I would like to express my indebtedness to my supervisor, Dr. Isaac Karanja Mwangi, without whose guidance this work would not have been completed on schedule.

I equally acknowledge the contributions of my fellow students and staff members, in particular Mr. Zacharia Maleche, Prof. Peter Ngau and Prof. Robert A. Obudho, from the Department of Urban and Regional Planning who assisted at various stages of thesis review seminars held in the university.

I am also grateful to the Eldoret Municipal Council for granting me access to useful data and information, especially Mr. S. Musembi (Senior Administrative Officer), Mr. Ratcliffe Nangalama (acting Chief Public Health Officer), Mr. Paul Sekenkei (former Cleansing and Conservancy Officer) and Mr. Stephen Kipseba (acting Cleansing and Conservancy Officer). Special regards also goes to Mr. Kennedy J. Oguya of Physical Planning Department who printed all the maps used in this report.

Similarly, I thank all my friends, formerly of Moi University, who were a source of encouragement throughout my postgraduate studies at the University of Nairobi; I specifically salute Wycliffe Omanya, Justin Odhiambo, Reuben Kyalo, Laban Maiyo, Lilian Achieng', Emmanuel Sande, James Wachira and Peter Ndunda.

Finally, I register my sincere and special appreciation to my aunts Judith Owalla, Janet Ogal and Beatrice Ochola, and uncle Tom Ogal who patiently saw me through "those" trying moments, but as the old saying goes, "tough times don't last, but tough people do." Thanks for your patience.

ABSTRACT

Solid waste management is one of the major responsibilities of local governments world over. The responsibility is complex and depends very much on organization and cooperation between households, private enterprises and municipal authorities. Successful solid waste management also depends on wise identification and application of appropriate technical solutions in waste collection at generation points, transfer, recycling and disposal. Yet still, waste management is an essential task which must be performed, but at the same time expose those involved to causes of ill health.

The first goal of solid waste management is to promote the health of urban population, especially low-income groups. Second, solid waste management aims at promoting environmental quality by controlling pollution. Third, it supports urban economic development by creating demand for waste management services and ensuring the efficient use and conservation of valuable materials and resources. Finally, it aims at creating employment and incomes for those engaged in the sector. In all informal settlements within Eldoret Municipality, solid waste management is inadequate. The insufficient collection and inappropriate disposal of solid wastes represent a source of pollution and a risk to human health in these settlements.

The study is set to investigate the factors limiting an effective domestic and commercial solid waste management in the informal settlements within the municipality, with Langas as a case study. It utilizes both primary and secondary sources of data. Methodological approach adopted for primary data collection involved the administration of questionnaires to the officials of the council as well as sampled households and business operators in Langas.

To find out the factors limiting a sustainable solid waste management in the informal settlements within the municipality, the study begins by systematically investigating the role of Eldoret Municipal Council towards the service delivery. It equally explores the extent of community participation in solid waste management in Langas as undertaken by households and business operators.

The study found out that Eldoret Municipal Council has failed to effectively discharge its duty as the major planning institution responsible for the service delivery in all the informal settlements within the municipality. The council has apparently failed to execute all the major processes within the solid waste management cycle that encompasses storage, collection, transportation, resource recovery, safe disposal as well as financing among others. Similarly, the study established that community participation in solid waste management in Langas, as practiced by households and business operators is limited; hence further compounding solid waste menace.

In view of the major findings, the study concludes that domestic and commercial solid waste management in the informal settlements within the municipality is unsatisfactory. It hence settles down on key policy recommendations that inculcate both institutional and technical planning approaches. These are envisioned as the most critical components for a strategic planning and management for the service delivery in the informal settlements within the municipality.

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ABBREVIATIONS AND ACRONYMS

CAP	Chapter (in the Laws of Kenya)
CCO	Cleansing and Conservancy Officer
CBOs	Community Based Organizations
EATEC	East Africa Tanning and Extracting Company
EMAC	Environmental Management and Coordination Act
GIS	Geographic Information Systems
JICA	Japan International Cooperation Agency
KCC	Kenya Cooperative Creameries
LATF	Local Authority Transfer Fund
MENR	Ministry of Environment and Natural Resources
Kshs	Kenya Shillings (Kenyan currency)
LASDP	Local Authority Service Delivery Plan
PSC	Public Service Commission
RS	Remote Sensing
RVTI	Rift Valley Technical Institute
SWM	Solid Waste Management
UNCHS	United Nations Centre for Human Settlements
UNEP	United Nations Environment Programme
UNTA	United Nations Technical Assistance

CHAPTER ONE

INTRODUCTION

1-1 Background of the Problem

Solid wastes are inevitable output from human activities. Either they are a by-product of primary production or they arise when objects or new materials are discarded after they have been used. Similarly, waste is an inevitable part of the natural process. The growth of world's population, increasing urbanization, rising standards of living and rapid development in technology have all contributed to an increase in both the amount and variety of solid wastes which are generated through production and consumption. This has caused a major challenge in management of solid waste.

Solid waste management is concerned with handling of solid wastes, its storage, collection, processing and disposal. In city environments, this service absorbs a considerable proportion of municipals' budgets and work force. However, governments are increasingly aware that the poor solid waste collection and environmental protection in towns and cities makes it difficult to justify prevailing levels of municipal expenditure in this sub-sector. In this regard, there are increasing demands to improve efficiency in the disposal and management of solid wastes in urban centers, in particular, concerted efforts and urgent measures in the management of solid waste in the informal settlements are required.

Informal settlements, a times referred to as squatter settlements, are dense settlements comprising of communities housed in self-constructed shelters under conditions of informal or traditional land tenure. They are common features of Africa, Asia and South American countries and are typically the product of an urgent need for shelter by the urban poor. As such, they are characterized by a dense proliferation of small, makeshift shelters built from diverse materials. In addition, they degrade the local biophysical and social environment. Informal settlements occur when the existing land administration and planning fail to address needs of the urban population, and are

characterized by unstructutured and unplanned development. On a global scale, informal settlements are a significant problem especially in African, Asian and South American countries. These countries are also known to house the world's most disadvantaged population, in terms of economic development.

A UNCHS (1986) global report on human settlements pointed out that between 30% to 60% of residents of most large cities in Africa, Asia and South American countries live in informal settlements. For majority of the world poor, decent shelter remains a luxury. Currently, over one billion people who comprise a fifth of the world's population are either homeless or live in poor housing characterized by overcrowding and lack of adequate accompanying infrastructure and services. This has a negative impact on their health and productivity. In most cases, they lack secure land tenure and hence they are vulnerable to eviction and social vices. Most governments facing severe resource constraints have long given up on providing their population with better shelter. On the other hand, existing high levels of building standards and development control regulations and rules are way beyond the cost capacity of the majority.

In Kenya, approximately 60% of the urban dwellers live in informal settlements. In the City of Nairobi alone, the urban poor make up 55% of the total population and occupy 5% of the total residential land area (UNCHS, 1986). Due to the proliferation of informal settlements in most urban centres of Kenya, the problem of solid waste disposal is enormous. Wastes that are not removed from neighborhoods not only pose health risks but also degrade the living environment. Even though solid waste collection is costly in terms of human and financial resources, the failure to collect and manage it also has economic costs associated with it. The quantity of solid waste which is not collected is rapidly increasing thus placing a constraint on the disposal facilities. In many informal settlements worldwide, Kenya being no exception, unplanned solid waste disposal results in long-term damage to amenity. The continuity introduction of the new materials to the environment is hence an on going challenge, and there are large numbers of materials used in modern industrial processes that must

be handled, treated and disposed of with great care, if serious pollution is to be avoided. In order to optimize returns from investments in solid waste management in Kenya, there is a need to evolve indigenous waste management systems which addresses the issues of quantity by source, capacities of maintenance of solid waste equipment, energy costs and various physical, social and cultural factors. An efficient solid waste collection service also requires a combination of equipment to provide optimum service to different neighborhoods in the urban areas.

Eldoret Municipality is among the urban centers in Kenya which is facing daunting challenges in solid waste management within its informal settlements. Haphazard municipal boundary extension, increased population, rapid urbanization and poor planning in the areas have aggravated the situation. Unless concrete solid waste management measures are urgently taken, serious long-term pollution to land, air and water could be expected. Currently, careless dumping of solid waste has degraded residential and commercial sections of the informal settlements within the municipality. In addition, soils at many sites have been rendered unusable from continued depositing of domestic and commercial solid waste. Gases generated by the decomposing wastes have equally threatened housing and people near the disposal sites. Furthermore, air is polluted by particulates and smoke from burning of solid waste. This study focuses on Langas informal settlement to explore the pertinent issues of domestic and commercial solid waste management.

1-2 Problem Statement

Several environmental problems are inherent in Eldoret Municipality and other major urban centres in Kenya. These range from overcrowding to lack of clean water supply, proper sanitation facilities and solid waste management among others. In Eldoret Municipality, environmental problems resulting from lack of effective management of domestic and commercial solid wastes in the informal settlements have reached an alarming level as currently evident in Langas. The Municipality is the fifth ranked largest urban center in Kenya after Nairobi, Mombasa, Kisumu and Nakuru

respectively. Since elevated to a municipal status in 1958, Eldoret has had one of the highest population growth rates in Kenya. Increasing population and unplanned extensions of the municipality's area have led to an increase in amount and variety of domestic and commercial solid waste generated. In Kenya, upgrading of local authorities occasioned by boundary extensions is always done without considering whether or not the concerned local authority would cope with new responsibilities including that of managing solid wastes generated by the additional population.

On being declared a township in 1912, Eldoret had an area of 11 km^2. The elevation of the town to a municipality status in 1929 led to an extension of its boundary to 25 km^2. In 1974, the municipality's boundary was again extended to cover 59 km^2. Finally, in 1988, its boundary was further extended to enclose the current massive area of 147.9 km^2. It is these extensions that made Langas and other similar informal settlements such as Huruma, Mwenderi, Kamkunji and Maili - Nne all previously under the rural local government of the County Council of Wareng' to be incorporated in to Eldoret Municipality. Langas was specifically incorporated into the municipality after the 1988 extension (Figure 4–12).

Although Langas and other villages are now under the jurisdiction of Eldoret Municipal Council, the local authority has failed to adequately provide basic services to the additional population in these neighborhoods. Given that land values in these peri – urban informal settlements is lower than of areas near the central business district, they attract immigrants who are mostly low – income earners and cannot afford high rental houses. This together with limited awareness amongst the residents, inadequate financial ability by the council, poor legal and institutional framework and weak development control[1] among others have contributed in inefficiency of domestic and commercial solid waste management in the study area. It is worth noting that although some of the households and businesses in Langas have primary receptacles

[1] Some of the informal settlements within Eldoret Municipality are still under customary use. A study by Agevi (1991) on administration of Eldoret Town revealed that peri – urban areas that are not subject to government urban land ownership or controls are more prone to slum development.

for storing their wastes prior disposal, most of them are forced to dump them in undesignated sites because the council does not provide adequate communal receptacles to effectively serve all the residents. As a lead planning agency, Eldoret Municipal Council is in charge of solid waste collection and transportation in Langas both from the households and commercial generators. Unfortunately, this is always done at irregular intervals at areas which have a collection service hence prompting generators to dispose of their wastes without any regard to environmental management. Likewise, waste is never collected in the interior areas of the settlement due to poor accessibility and inadequate technical and personnel capacity of the council. This further aggravates the problem of illegal dumping. Both domestic and commercial solid wastes are also collected and transported simultaneously despite the fact that the households generate more wastes that businesses due to their large number. Because of this, the amount of waste that is generated exceeds the ability of the council to collect them on time therefore resulting to piles of unattended wastes.

The solid wastes collected and transported from Langas by the council are disposed of at a tipping site near Huruma and Mwenderi. This is a disused quarry site that was not planned for. It is currently full, with wastes disposed of and burnt haphazardly. This not only undermines the public health, but also pollutes River Sosiani. Although Eldoret Municipal Council has the primary responsibility of managing solid waste in Langas as per the Public Health and Local Government Acts of the Laws of Kenya, the community is also expected to play a complementary role; however, this is not the case. Community participation is very minimal in Langas, and is among the factors that undermines solid waste management in the area.

Strong institutional and legal framework, including adequate funding, efficient organization, community participation and skilled personnel among others are necessary if the council is to be effective in domestic and commercial solid waste management in the study area. In summary, inadequate domestic and commercial solid waste management practice in Langas and other similar informal settlements in Eldoret Municipality is the main problem of this study.

1-3 Research Questions

In the view of problem statement, the study addressed the following three research questions with regard to domestic and commercial solid waste management in the study area:-

a) Which are some of the factors limiting an effective domestic and commercial solid waste management in the informal settlements within Eldoret Municipality?
b) What roles does the Municipal Council of Eldoret play in domestic and commercial solid waste management in the informal settlements within the Municipality?
c) What is the extent of community participation in domestic and commercial solid waste management in Langas?

1-4 Objectives of the Study

i) General Objective

The general objective of the study was to investigate the factors limiting effective domestic and commercial solid waste management in the informal settlements within Eldoret Municipality. To achieve this, the following specific objectives were formulated:-

ii) Specific Objectives

a) To find out the role of the Eldoret Municipal Council in domestic and commercial solid waste management in the informal settlements within the Municipality;
b) To find out the extent of community participation in domestic and commercial solid waste management in Langas informal settlement within Eldoret Municipality;
c) To recommend alternative planning strategies for domestic and commercial solid waste management in the informal settlements within the Municipality, and Langas community in particular.

1-5 Hypotheses

The following two hypotheses were developed to address the objectives of the study:-

a) Lack of a comprehensive solid waste management plan has significantly contributed to inadequate management of domestic and commercial solid wastes in Langas and other informal settlements within the municipality,

b) Inadequate planning for domestic and commercial solid waste management in Langas is aggravated by low community participation.

1-6 Justification of the Study

Every person in Kenya is entitled to a clean and healthy environment and has therefore a duty to safeguard and protect it (Kenya, 1999). As envisioned in Sessional Paper No. 6 of 1999 on Environment and Development, Kenya is committed along the ideas of sustainable development. One of these ideas is utilization of the nature to meet survival needs of the current generation without compromising the ability of the resource base to meet those of future generations. The goal of the Government of Kenya is therefore to integrate environmental concerns into the national planning and management system as well as provide guidelines for environmentally sustainable development. Rapid urbanization in Kenya has led to a number of environmental problems such as indiscriminate dumping of solid wastes. Although the Local Government Act, Chapter 265 of the Laws of Kenya, gives the Minister for Local Government the power to establish local authorities, it has failed to come up with the necessary guidelines for deciding how such boundaries should be extended.

When boundaries of towns are extended, agricultural land is incorporated into the urban development process. Population previously in a rural setting is then incorporated in to the urban sector. This gives the concerned local authority more responsibilities to provide urban services including solid waste management, without necessarily creating new economic base. This study is therefore timely because it was conducted when Eldoret Municipal Council was proposing to further have its boundary extended from the current 147.9 km^2 to 656 km^2.

1-7 Assumptions of the Study

To achieve the objectives of the study, the following assumptions were formulated:-

a) The role of the local authorities in Kenya as the key institutions responsible for solid waste management in their areas of local government will continue being relevant in the informal settlements such as Langas in Eldoret Municipality;

b) Currently, the private sector and public institutions, do not play any decisive role in the solid waste management in the informal settlements within Eldoret Municipality as evident in Langas,

c) Future extensions of the boundary of Eldoret Municipality are likely to create the necessary conditions for the proliferation of informal settlements with inadequate solid waste management systems.

1-8 Scope of the Study

The scope of this study in terms of spatial dimension cover Eldoret Municipality, but for data collection and policy prescription focused in Langas informal settlement. Data used in the study covered domestic and commercial solid waste management for the period between July 2003 to April 2004. The study examines the role of Eldoret Municipal Council in domestic and commercial solid waste management in the informal settlements within the municipality. It then explores the extent of community participation in domestic and commercial solid waste management in Langas. It finally recommends interventions that can be adopted towards achieving a comprehensive plan for effective domestic and commercial solid waste management in the informal settlements within Eldoret Municipality.

1-9 Definition of Key Terms

i) Informal Settlements

According to Abrahams (1964), informal settlement is a residential area which has developed without legal claims to the land and/or permission from the concerned authorities to build. As a result of their illegal or semi-legal status, infrastructure and services are usually inadequate.

ii) Solid Wastes and Solid Waste Management

Medina (1997) defines solid wastes as materials discarded in the urban areas for which local authorities by their nature are held responsible for collection, transport and final disposal. Solid waste encompasses household refuse, institutional wastes, street sweepings, commercial wastes, as well as construction and demolition debris. On the other hand, Kiogora (1995) states that solid waste management refers to the control of generation, storage, collection, transfer/transportation, processing and disposal of solid wastes in an efficient, economical and aesthetic manner.

iv) Per Capita Solid Waste Generation Rate

Refers to the amount of solid waste generated per day, per person at a given time within a given urban area. The study assumed an average per capita solid waste generation rate of 0.5 kg[2] for Langas.

This compares well to similar studies conducted in several urban areas of Africa and Asian countries by UNCHS (1986). These include Port Novo (Benin) 0.5 kg, Ouagadougou (Burkina Faso) 0.7 kg, Cairo (Egypt) 0.5 kg, Accra (Ghana) 0.4 kg, Bangui (Gambia) 0.3 kg, Kampala (Uganda) 0.6 kg, Lagos (Nigeria) 0.5 kg, Calcutta (India) 0.5 kg, Lahore (Pakistan) 0.6 kg and Nairobi (Kenya) 0.6 kg.

v) Community and Community Participation

Community refers to a group of users of a service who live in the same area and have access to, and use, the same service[3]. Community participation therefore comprises varying degrees of involvement of the local community that may range from the contribution of cash and labour to consultation, changes in behaviour, involvement in administration, management and decision-making (Yakub, 1995). In the context of this study, households and business operators are taken as the community in Langas informal settlement.

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[2] Kiplagat, W.K. (1999) found out that per capita solid waste generation rate in low-income residential areas within Eldoret Municipality stood at 0.542 kg.

[3] Muthoni, A.M. (1999) also gives an insight into community participation in solid waste management in Kibera informal settlement within the City of Nairobi, Kenya.

1-10 Organization of the Study

This thesis is organized into eight chapters. Chapter one introduces the background of the study problem, specifically, the chapter presents the study objectives, research questions, hypotheses, study assumptions as well as definition of key terms.

Chapter two focuses on the literature review and conceptual framework. Under it, relevant literature pertaining to the study problem have been reviewed with an objective of developing a conceptual model towards a strategic domestic and commercial solid waste planning and management approach in the study area. On the other hand, chapter three presents the methodology used in the study.

Chapter four presents the background to the study area. It thus examines some of the attributes of the study area such as demography, geographic attributes, historical background of Eldoret Municipality, evolution of informal settlements and the future development trends of the municipality.

Chapter five presents the analysis on the role of Eldoret Municipal Council in domestic and commercial solid waste management in the informal settlements within the municipality. It carefully investigates some of the factors limiting the council in effectively discharging its duties as the lead planning institution in charge of solid waste management in the study area.

Chapter six and seven highlights the extent of community participation in domestic and commercial solid waste management in the study area.

Finally, chapter eight concludes the study and settles down on strategic planning approaches that can be adopted for effective domestic and commercial solid waste management in the study area. The thesis terminates with the presentation of references and the appendices.

CHAPTER TWO

LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

2-1 Introduction

The previous chapter gave an introduction to the study problem. In this chapter, the literature review, which examines the existing literature pertaining to the study, has been systematically presented. It equally explores gaps and works already done by others. The chapter culminates in to a conceptual framework for the study.

2-2 Urbanization at the World Stage

A UNCHS (2002) report recently indicated that the world's population reached 6 billion in 1999, and that an overwhelming share of this growth took place in Africa, Asia and South American countries[4]. The population of these countries had also more than doubled in 35 years, growing from 1.89 billion in 1955 to 4.13 billion in 1990.

Significant proportions of population increases in these regions have been and will be absorbed by urban areas. Currently, cities in Africa, Asia and South America are growing five times as fast as those in Europe do and are already experiencing enormous backlogs in shelter, infrastructure and services as they are increasingly overcrowded (UNCHS, 2002).

UNCHS (2000) has similarly noted that cities have taken on significant roles in the globalization of the economy, particularly with regard to financial services, commerce, transport and telecommunication. Larger and larger proportions of the population live in 1,000,000+ cities. In Europe, North America and Australia, 26% of the total population lived in such cities in 1990, compared with 19% thirty years ago[5]. This increase is more startling in the Africa, Asia and Latin American countries, where this proportion more than doubled from 5% in 1960 to 12% in 1990. The concentration of

[4] UNCHS (2002) *Cities in a Globalizing World, Global Report on Human Settlements, 2002*. London: Earthscan.

[5] UNCHS (2000) indicates that at this rate, the world will have seven billion people by 2010.

urban populations in 1,000,000+ cities is becoming particularly characteristic for countries in Africa, Asia and South America. In 1990, for example, 36% of the urban population of these countries lived in such cities, compared to 22% in 1950. By the year 2015, it is projected that 22% of the world's total population and 41% of the world urban population will live in 1,000,000+ cities. From this background, UNCHS (2000) underscores that:

> Increasingly, cities have a network of linkages that extends far beyond their boundaries. Sustainable urban development requires consideration of the carrying capacity of the entire ecosystem supporting such development, including the prevention and mitigation of adverse environmental impacts occurring outside urban areas. The unsafe disposal of waste leads to the degradation of the natural environment: aquifers, coastal zones, ocean resources, wetlands, natural habitats, forests and other fragile ecosystems are affected, as are the homelands of indigenous people.

Poorly managed cities and towns contribute to unsustainable production and consumption patterns. They also generate unmanageable wastes, which negatively impact on land and water resources as well as on the atmosphere. Sustaining healthy environments in the urbanized world of the 21st century represents a planning major challenge for human settlements, development and management, and that a large proportion of the world's population remains deprived of basic services such as water supply and solid waste management. The marginalized population is particularly large in those in the countries in Africa, Asia and South America. In many of these countries, the rates of urbanization exceed the capacity of national and local governments to plan and organize this transformation (UNCHS, 1996).

As a result of rapid urbanization in Asia, Africa and South American countries, UNCHS (2000) upholds that new forms of urban poverty have emerged, manifested through poor housing conditions, insecure land tenure, urban crime and homelessness. Moreover, poorly managed cities have negative impacts on environmental conditions. The absolute level of resources available to local governments in these countries is seldom adequate to provide even the minimal level of services such as solid waste management.

2-3 Urbanization Trends in Kenya

Obudho (1982) observed that although Kenya is still predominantly rural, there is a high tendency towards urbanization. He further reports that the annual rate of increased urban population was 0.2% during 1948-62 and 0.5% during 1969-79. At the time of the first Kenya population census in 1948, there were 17 towns with aggregate population of 276 249. By 1962 census, the number of towns had doubled to 34 and urban population had increased to 670 950, with an urban growth rate of 6.6% per annum. This represented the urbanization level of 7.7%. According to the 1969 and 1979 population censuses, there were 48 and 91 urban centres respectively. During the 1962-69 intercensal periods, the urban population doubled. The population grew from 670 950 in 1962 to 1 082 437 in 1969, increasing at a rate of 7.1% per annum. In 1969, urban dwellers represented 9.9% of the total population. 1979 population census indicated 9 urban centres with an urban population of 2 238 800. The level of urbanization had risen to 14.6% representing more than a doubling of the total urban population in about 10 years. The rate of urban population grew at a rate of 7.9% per annum during the 1969-79 intercensal periods.

It is from the foregoing discussion that Obudho (1982) justified that the rate of urbanization in Kenya is among the highest in the world. He clarified that while the estimated annual rate of growth of the urban population in Kenya is at 7.05% for the period of 1995-2000, the average for African cities is 4.37% and 2.57% for the world. This has over-stretched the capacity of infrastructure and services in the large towns, to the extent that many people have to squat or live in slums.

Kenya (1966) indicated that more than half of the urban residents live in poverty; they dwell in peripheral urban areas, have limited incomes, education, and poor diets and live in unsanitary and overcrowded conditions. Disposal of solid waste, decent housing and transportation are particularly lacking. Poor construction and the unplanned nature of these informal settlements expose dwellers to the effects of landslides and flooding. In many urban areas of Kenya, overcrowding and the unauthorized construction of unplanned dwellings built with unsuitable materials can

be observed. Combined with a lack of basic services such as solid waste management in these spontaneous settlement areas create an unacceptably low standard of living with the danger of epidemic diseases and outbreaks of fire or even violence. However, looking though the history of housing development in Kenya since the beginning of the last century, it would appear that there have been no major shifts in housing policy. Kenya (1979) further subscribes that in the urban areas of the country, the worst housing problems manifest themselves in the form of sprawling slums and squatter settlements which are inhabited by a great percentage of the urban population. Such settlements have been on the increase, especially for low-income housing, has been recognized and attempts have been made to house the urban poor. These attempts have mainly been in the form of site-and-service schemes and upgrading efforts, but so far, these efforts have not succeeded mainly because of poor implementation.

2-4 Evolution of Informal Settlements in Africa

Many cities in Africa grew spectacularly during the 1960s and 1970s through rural-urban migration. Annual growth rates of some African cities were as high as 5 to 7 %, implying a doubling of population every 10 to 15 years (Mabogunje, 1999). Within countries, large cities tended to slow down in their growth and medium sized cities to take over as the main loci for rapid expansion. This was accompanied by deterioration in physical infrastructure and services such as solid waste management as the extension of urban services failed to keep pace with growth in demand[6]. The UNCHS (1986) has noted the impacts of activities within such cities:

> These developments are reflected in the continuous growth of spontaneous, popular housing areas; in the ever increasing numbers of ambulant hawkers and food-sellers on every corner of many downtown African cities; in the increase in the size and number of open-air markets; in the pervasiveness of small-scale, privately owned public transport vehicles that have taken over the market from the monopoly state-regulated bus companies; and in a virtual explosion of small trades and services dealing with almost every facet of life in the city.

[6] For example, since being incorporated into Eldoret Municipality from the County Council of Wareng', basic services, in particular solid waste management, have not been improved in Langas. Mutai (1997) also noted that most of Kenya's municipal boundaries include large areas which are rural in nature. Only Nairobi, Nyahururu, Kisii and Mombasa have large urban areas than rural areas.

According to Mabonguje (1999), not only did informal activities increase the gap between the old, colonial city and the new, often informal areas grew, as did the gap between rich and poor. Such rapid agglomeration, coming at a point in history of these countries when their economies remain largely fragile and not much transformed from what they were under colonial rule, could only mean that whilst a small minority might be easily accommodated both residentially and in terms of employment opportunities, the majority have to fend for themselves as best as they can.

Against the background of the colonial urban planning, African cities became segregated into "European" and "African" areas. The former was fairly protected because of its layout and substantial building but it came to be surrounded by a sprawling and exploding tract of poorly built and inadequately serviced residential quarters which in turn extended into expansive shanty towns providing rudimentary shelter and employment opportunities for the new urbanites and those whose fortunes still keep them at the lower end of the urban economic ladder (Moser, 1998)

2-5 Informal Settlements in Kenya

Syagga (1987) has observed that there are essentially three periods through which the history of housing in Kenya's urban centres can be traced. These include the colonial periods; post-independence period up-to 1974; and the mid-1970s up to now. All these periods have witnessed minor shifts in the housing policy, which has immensely contributed, to the nature and extent of slums and squatter settlements today. Since most of the Kenya's urban centres are a product of colonialism, slums and squatter settlements are also a product of the colonial period.

In Kenya, urban centres such as Nairobi, Nakuru, Eldoret and Kisumu, among others, were 'created' to serve the interests of the expatriate Europeans. The Africans who settled there were often regarded as temporary migrants who only came to supply the much-needed labour. Due to this, there was no comprehensive documented housing-policy to serve them during this period (Syagga, 1987).

Ogilvie (1946) and Syagga (1978) revealed that in 1939, Nairobi, for example, had 40,000 Africans in legitimate employment while the actual housing available then was only sufficient to accommodate 9,000 Africans, the main reason being that employers were not providing housing as expected. They noted that when Kenya attained independent in 1963, it was realized that, there was a serious housing problem. The population influx into the towns was rising at unprecedented rates. With the help of United Nations Technical Assistance (UNTA), a national survey was the finding that Kenya required an additional 44,000 housing units per year between 1962 and 1970 and that of these, 7,600 were needed annually in the urban areas. Thereafter, efforts have been made to prepare national housing requirements. Nevertheless, these requirements have been increasing over the years due to poor performance. To be able to solve this huge problem the UNTA report suggested a number of recommendations, most of which were accepted by the Government of Kenya.

Hake (1977) reported that a comprehensive housing policy was drawn under Sessional Paper No. 5 in 1966-67, and this has remained the blueprint of Kenya's national policy up to now. He further reveals that due to technical and organizational barriers to low-cost construction, almost all the houses were for the middle-income groups yet nearly 70% of the demand for urban housing is from the lowest-income groups. This left the majority of the urban population without housing, and as their numbers increased, so was the proliferation of unplanned urban settlements.

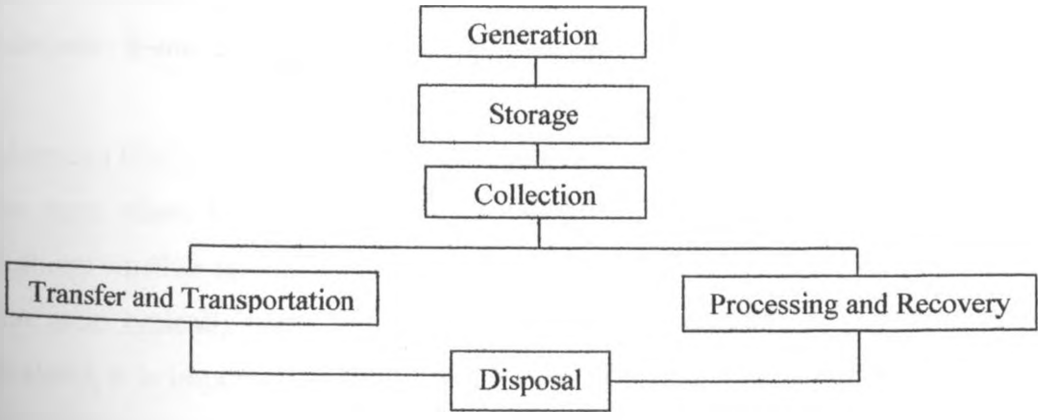
Up to the early 1970s, slum clearance was strongly advocated. For example, in 1970, 39,000 people were evicted from the Eastleigh area in Nairobi, with 6,733 dwellings demolished by order of the Nairobi City Council. The emphasis since the late 1970s has shifted to more pragmatic approaches that consider it viable to upgrade these settlements in addition to encouraging people's own initiatives to provide themselves with housing, through the provision of building sites and basic services (Hake, 1977). However, in spite of these efforts, informal settlements continue to thrive in all major urban centres of Kenya and have been occasioned by lack of basic services such as solid waste management as common in Langas within Eldoret Municipality.

2-6 Process of Solid Waste Management

According to Sunderasen and Bhide (1983), solid waste management involves activities associated with generation, storage, collection, transfer and transport, processing and disposal of solid wastes which are environmentally compatible, adopting principle of economy, aesthetics, energy and conservation. It therefore encompasses planning, organization, administration, financial, legal and engineering aspects involving interdisciplinary relationships.

Syagga (1992) has further documented that solid wastes also include obsolete products discarded by households, markets, institutions, factories and industries. He views that given the fact that a lot of waste is generated through the activities of man, studying the quantity and the quality or components of generated waste is the first step in solid waste management. Method of disposing these wastes is the second stage; collection and transportation are the next steps to be considered. The next step in solid waste management cycle should be either the disposal to the final dumping site or a transfer station. The final step is recycling of minor or major parts of collected household waste into its original form or into it's by products. The rejects of recycling process are then disposed of after transportation to the dumping site. Figure 2-1 outlines the process of solid waste management:-

Figure 2-1: The Process of Solid Waste Management



Source: Kiogora (1995)

2-7 Equity and Solid Waste Management Service Delivery

Inequity in service delivery, in this case solid waste management, occurs for a number of reasons. Sometimes it is because of traditional attitudes or behaviour patterns which have developed, other times it is because of inappropriate technology, and there are occasions of blatant discrimination. Flintoff (1978) has highlighted that in cases where the municipality relies heavily on an informal private sector to perform refuse collection and disposal services; there is the risk that certain populations will not be served. He notes that this type of inequity occurs in Cairo, Egypt. He further reported that in Tunisia, there are thirteen municipalities which form the District of Tunis. In general, within a given municipality, service is fairly equitable. However, there are major differences among municipalities that efficiently provide service, with residents accustomed to having collection vehicles pass by their dwelling two and three times a day and picking up refuse that is placed curb side at any time of the day.

In Onitsha, Nigeria, it was found out by Cointreau (1997) that there were essentially seven services areas for refuse collection identified. The number of trucks assigned to each was a function of the route length and number of vehicles and workers assigned among the service areas, there was a large discrepancy in service level. This was found to be a function of the selection of technology. One method of collection using non-compaction side-loading trucks was attempted citywide. While it worked well in the wealthier neighborhoods that had good roads, little traffic, and residents who obeyed the ordinance requiring curbside placement of standardized household containers - it was unable to meet the needs of the low-income areas.

Cointreau (1982) also underscores that many cities in Africa, Asia and Latin America have areas where the residents are considered squatters. Often, the local government questions whether refuse collection service should be extended to these people. Since these areas typically house the largest portion of population below the urban poverty threshold, it is important to determine whether there are such areas being overlooked and to plan for the extension of service to meet their needs. It is not always readily

apparent that unserviced areas exist; and there are times when the local government is not even aware of the disparities. In Kanpur, India, for example, Cointreau (1982) further states that many low-income people live in privately owned "ahatas", which are tenant communities living on private pockets of land within the city. Within the confines of these "ahatas", it is the responsibility of the landowner to provide refuse service to residents. The refuse is then taken to the periphery of the "ahata", to a municipal collection point. The level of service provided within the "ahata" is largely a function of the owner's sense of responsibility to his tenants.

In most cities where service to the poor is relatively low, it is commonly attributable to accessibility. Local government often provide a system of refuse collection which involves trucks servicing all paved roads; the communal containers, open collection points, and individual household dustbins that are place along them. If an area of inaccessible residents is not very large, residents are likely to bring their refuse to the border to dump it. If the area of inaccessible residents is large, residents are likely to dump the refuse between houses, in drains, and on remote corner lands where it accumulates, and partially degrades. The "kampungs" of Jakarta and Surabaya of Indonesia, were good examples of this. Solid waste projects as part of upgrading these neighborhoods involved the use of pushcarts to provide door-to-door service to residents, and transfer of wastes to metal containers which can be lifted or trailed to a disposal site (Flintoff, 1978).

To solve the problems of inequitable service, it is necessary for local governments to augment their present mechanized collection fleet with labour-intensive systems that can enter into zones of limited accessibility. There tends to be a discriminatory attitude on the parties in power against the people living in these low-income areas, an assumption that their neighborhoods are dirty because the people are dirty and lazy to carry their refuse to a paved route where service is provided. It is essential that projects be designed to address these attitudes *(op cit)*. From the foregoing discussion, inequitable solid waste service delivery is also apparent in the informal settlements within Eldoret Municipality, specifically Langas as evident by irregular collection.

2-8 Community Participation in Solid Waste Management

One of the factors limiting solid waste management in Langas is low community participation. If well organized, community members in the study area can play different roles in the service delivery. They can participate in solid waste management by showing proper sanitation behaviour, by contributions in cash, kind or labour, by participation in consultation and by participation in administration and management of solid waste services. This section gives and overview of this aspect in relation to selected regions in Africa and Asia.

Neamatalia (1980) has noted that each city has its own personality and that many cities of Africa, Asia and South American countries have an informal refuse collection service provided by scavengers. He keenly observes that in Cairo, Egypt, two sets of immigrants to the city control the door-to-door collection of refuse. The Wahis, a Moslem group, have long-term contracts with building owners to provide refuse collection. The Zarrabs, a Coptic Christian group, actually perform the refuse collection for proprietary rights to the wastes recyclables. The key issue is that service is only provided to the upper middle-income and wealthy residents of the city, who have refuse that is rich in recyclable materials. The rest of the city's residents haphazardly discard their wastes.

In Lahore, Pakistan, Kirov (1982) clarifies that 40% of the refuse is picked up by farmers for use as animal feed and soil amendment. He adds that there are reportedly 5,000 scavengers working in approximately 160 hectare open dump for Mexico City's refuse. Each has his own area and works for a leader who defends a group of plots. He is further optimistic that there is numerous pay-offs in this system, with one of them reportedly being to the drivers of the municipal refuse trucks: they may charge a scavenger up to $15 to unload on his plot. In Cairo and Mexico City, Pinnock (1998) contends that middlemen are common to the system of scavenging in Medellin, Colombia. There, they purchase recycled materials from the landfill scavengers and resell them for processing and reuse. A number of these middlemen have grouped

together into cooperatives, to give themselves greater leverage in the market place, as well as some collective funds for buying, sorting, and transportation equipment. In addition to the scavenging activities of the private sector, there are those of the public sector. These may occur even when there is a strong private sector activity. Pinnock (1998) adds that refuse collectors in Bangkok, Thailand provide door-to-door service using large baskets and two-wheeled dollies at the curbside before loading into the trucks the collectors pick through the refuse. Recyclables are sorted and placed in baskets on top of each truck, to be sold en route to the disposal facilities.

Vogler (1984) examined that in Jakarta, Indonesia, the municipal refuse collectors pick through the wastes as they are unloading the trucks at the dump. Scavengers at the dump are also trying to pick out recyclables during the unloading operation. The World Bank's Surabaya, Indonesia, project opened up a new area of scavenging activity: the transfer station, they dump their refuse onto the paved area not into the transfer container. Scavenging is not the only traditional activity, which may influence the refuse management system, even though it is probably the most obvious one. In some places religion or values many a times are a factor. In Kano, Nigeria, for example, Cointreau (1982) found out that the population is predominantly Moslem; most women are in "purdah" and confined to their compounds except for special occasions. The result of this restriction is that children are generally responsible for transporting the household refuse to the pick-up point. If a system of portable metal containers was employed; waste would probably end up on the ground, because the children would not be able to lift the refuse into the container's opening.

In many cultures, women are responsible for keeping the home and its immediate environment clean. So disposal of waste is one of their daily tasks. In this regard, Binamungu (1993) has noted that they carry out education campaigns on sanitation behaviour, preventive health, environmental problems, etc. Examples are in Ivory Coast, and Nepal, in Peru Sometimes operation of a waste collection scheme is combined with education as is the case in Mali, Mexico and Nepal. They also operate and manage a solid waste service as members of a micro-enterprise. Micro-enterprises

for waste collection, street sweeping, etc. are often dominated by women. This is known from Latin American countries such as Bolivia, Costa Rica, Peru and Colombia. Ocampo (1992) further pointed out that woman are sometimes involved in the management of the system as in Indonesia where the system is run by the wife of the local administrative leader and in Mexico where 90 % of women in the community are active in the recycling systems. Most are run cooperatively by them.

2-9 Challenges to Community Participation in Solid Waste Management

An examination of existing literature reveals that the problem of community participation in solid waste management in the informal settlements within Eldoret Municipality is comparable to those of other cities of in Africa and Asia. Some of these challenges have been briefly discussed in the following sections:

i) Low Community Priority for Solid Waste Management

Barrientos (1999) underscored that if solid waste management is not a felt need, this will have consequences in community participation in the service and their willingness to pay. From the Indonesian experiences it has become clear that a felt need is a prerequisite for successful implementation of a community-based solid waste management project.

Usually a real need for an improved collection exists in neighborhoods where population density is high, where little space for storage of garbage is available and where dumping sites are far away. Furthermore, the chance that solid waste management is a high ranking community problem will be higher, when the initiative for a solid waste management project comes from the community itself (Barrientos, 1999). In view of the aforementioned challenges, Baud (1985) has proposed that a possible solution to the problem of lack of community priority for solid waste management is education as was tried in Kathmandu, Nepal where a women's organization tried to convince people of the need of proper solid waste handling via lectures, but it finally achieved a change of behaviour through the provision of buckets and a competition among households for the cleanest environment.

ii) Low Willingness to Keep Public Spaces Clean

Residents of a neighborhood have a sense of responsibility for their home and immediate environment, but public spaces such as streets and drains are considered the responsibility of the state (Furedy, 1991). Often municipalities lack the money and manpower to fulfill this task and sometimes they think the neighborhoods are responsible for this. This has negative consequences for the cleanliness of public spaces, and for the willingness to pay and the behaviour of households. With a lack of social cohesion and control in a neighborhood, this is not a sustainable solution especially in low-income neighborhoods. Hawkings (1989) revealed that in Pakistan, a local women's organization had difficulties in persuading people to pay for street sweeping, a possible solution was to contract street sweepers as part of the solid waste collection system, but there was not enough money to implement this.

In India, as Kamala (1992) found out, experience exists with street-based organizations which organize regular street sweeping and clean-ups. They started with involvement of higher income communities who hired waste collectors and street sweepers to clean the streets. Later on activities were extended to the low-income areas, from where those waste pickers came. A rather frequently returning problem is the fact that people throw the garbage next to the communal container or bin, causing an unhygienic situation.

iii) Low Willingness to Pay for Collection Service

Willingness to pay is central point, because it is important for the success of a community-based solid waste management project and it is related to many other aspects such as the motivation of operators and households and the reliability of the service. Community perception of fees and of the waste collection service is essential for its willingness to pay. If residents think they already pay for collection through taxes, or if they do not trust the service, they refuse to pay (Klundert and Lardinois, 1995). For example, Raman (1994) asserts that in India some households are not willing to pay, because they think property rates should cover solid waste collection[7].

[7] This is also a notable perception by most residents in Langas informal settlement.

The service must be reliable to sustain willingness to pay. Payment according to achievement may be a solution, because households receive an observable benefit. On the other hand, Ouano (1989) argues that a project in Ivory Coast also suffered from declining willingness to pay, because the service was offered to everybody, and because there were no sanctions in case of non-payment and no legal obligations to pay. In view of this inherent weakness, Schmink (1984) is for the opinion that a change in the way of payment might improve willingness to pay. He goes ahead to give a typical example of Surabaya, Indonesia were he observes that waste collection fees are part of a lump sum for social welfare activities, collected during social meetings. This system is rather successful, because people there prefer to pay a big sum now and then, instead of many times a small amount.

From the foregoing literature review, it can be deduced that willingness to pay has to be studied beforehand to conceive acceptable ways of payment and affordable fees. Experience from this review proves that education is needed to maintain community participation, to establish a 'spirit of responsibility' towards environmental problems and the most suitable ways of dealing with them.

iv) Low Willingness to Participate in Collection and Recycling

Households often behave contrary to schedules and rules of effective solid waste management. Sometimes this is caused by a lack of facilities; if a transfer point or dumping site is more than 100 metres away from their house, people tend to throw their waste much more often in streets, open spaces and rivers. More often, however, it is due to households lacking knowledge and incentives to keep to the rules of the collection system, and operators lacking sanctions and authority (Semb, 1993).

Low willingness of community to participate in collection and recycling also depends on the perceived benefits and costs of the system. In India, Stern (1995) discovered that 70 % of the people were against separation of waste at source, because it was considered inconvenient. He admits that some households do not want to participate in separation, because they say it is time consuming and dirty work. In some countries,

notably in Asia he notes that servants, caretakers and watchmen are important agents in waste handling: they bring the waste to communal bins, keep certain items apart, and so forth. These servants are known to be unwilling to cooperate in separation at source, either because they know the value of the recyclables or do not want to sell them to waste collectors, or because they do not like the extra work. Stern (1998) similarly enlightens that solution for this problem was tried in the Philippines where servants were given a certain benefit and thus integrated into the system. The implementing non governmental organization tried to encourage housemaids to engage in recycling by giving them proceeds of the sales of recyclable materials. This is just one example of the provision of appropriate incentives to increase the participation of community members in a solid waste management system.

Aasen and Macrae (1994) acknowledge that in Curitiba, Brazil, an interesting solution is tried to encourage low-income households to participate in solid waste collection. This includes a massive education campaign, involving all media, promoted the separation of garbage at source (the "Garbage that isn't garbage" program). They clarify that this program obtained a participation rate of 70% of all households, which can be qualified as quite successful. This programme was based on the exchange of garbage against free bus tickets and food parcels

v) Unreliable Services

An unreliable service, which does not arrive in time or is not carried out according to the expectations of the community, has consequences for the trust of the community, for their participation and willingness to pay for the service. It may be caused by a lack of performance control, a lack of priority of the service, when waste collection is carried out as a part time job. If operators have formerly been waste-pickers, they may cause additional reliability problems. These people, used to the freedom of the street, are sometimes difficult to train to perform a reliable service involvement in decision-making appears to be an incentive for operators to perform better (Hanafie, 1995). In Bolivia, for example Furedy (1999) cites that members of micro-enterprises have a higher labour productivity and morale than the employees of municipal services, who

collected garbage before, because they are owners-operators of the system and because they are paid according to achievement. Furedy (1999) further indicates that solution born out of necessity to improve the reliability of the service is to relate payment of operators more strictly to performance as was applied in Chad, where households started to pay waste collector per round instead of per month.

2-10 Collection, Transportation and Disposal

Furedy (1991) underscores that many cities have adopted a management system whereby refuse collection is administered under the department of health; disposal is handled by the works or mechanical engineering department; and the fleet is centrally maintained for all city vehicles by the works or mechanical engineering department. He premised that when refuse collection is placed within the health department; it is typically at the bottom of the organizational structure. The problems that have been briefly mentioned in this section have been noted in Africa, specifically Nigeria and some countries in Asia.

In some places (Surabaya, Indonesia), the refuse collection and disposal services have been combined into one organization entity. Low status of the workers and division management makes recruitment and retention of competent personnel difficult. Access to budget is impeded by the low status of the division chief and his reliance on his department head to give priority to his division's needs (Cointreau, 1980).

Kresse and Ringeltaube (1982) explains that condition of the World Bank loan for a solid waste collection, transfer and disposal system in Surabaya was the upgrading of the cleansing division to a department status. They envision that preventive daily maintenance of refuse equipment should be in the hands of the cleansing service agency and those repairs and major overhauls may be appropriately handled by either a workshop under the cleansing service agency or the central municipal workshop. If they are handled by a central workshop, it is important that this facility be well managed and that there are clearly established and reliable procedures for addressing vehicles as they come in. In Bangkok, Thailand, Kresse and Ringeltaube (1982)

observed that there were regular complaints by the cleansing service that their vehicles were given second priority by the central workshop. While they could not establish that this was true, it created a friction and disincentive that was counterproductive to the provision of collection services. In Kano, Nigeria, they further found out that the central workshop was so inadequate that the cleansing agency arranged for maintenance with the equipment suppliers. The costs were high but the equipment was being kept on the road and service was being rendered.

As a final note, Ouano (1991) admits that there are some cities in Africa, Asia and South American countries where no organizational entity is responsible for disposal and that the entire activity of disposal is institutionally non-existent. He gave a typical example of the District of Tunis where each municipality in the District has responsibility for collection. These municipalities have collectively agreed on a couple of locations for disposal and take their trucks there for dumping.

2-11 Financial Resources and Planning

Local governments draw capital for purchasing solid waste equipment and facilities from two basic sources: current revenues and borrowings. Use of current revenues depends on a municipality's ability to raise surpluses beyond those necessary for operation and maintenance of all services. Purchases are made and fully paid as they are needed. This is the common method of financing collection equipment purchases in industrialized countries. However, in Africa, Asia and South American countries, the income base from which revenue are derivable is markedly lower while the cost of equipment is at least comparable and probably higher. Indeed, most specialist equipment will have to be imported, adding freight costs and foreign exchange risks to the financial burden (Toftner and Clark, 1970).

From his findings, Holmes (1984) pronounced that the municipal income base as a function of individual income may be only one-fifteenth to one-twentieth of the base available in industrialized countries. He argues that since people in Africa, Asia and South American countries generate less solid waste per capita than those in

industrialized countries, this discrepancy is somewhat offset and the refuse generation rate may be about one-third to one-half of the rate in industrialized countries. The initial method of finance has limited relevance; all costs are eventually borne from current revenues either directly or as debt service. On the other hand, Cointreau (1982) suggests that borrowing options include: short-term, medium-term, and long-term options. In countries with large revenue generating capacities, short-term and medium-term financing is useful for financing purchases of collection equipment, which is short-lived; and long-term financing is generally reserved for major capital financing events, such as construction of a resource recovery plant.

Randol (1980) indicates that financing through long–term borrowing includes two broad methods: project financing and general obligation financing. He articulates that project financing requires that revenues generated by solid waste project must offset all future operating and capital recovery costs. On the other hand, he advocates that general obligation financing is secured by the "full faith and credit" of the municipality which has the ability to levy and collect taxes.

Cointreau (1982) further creates an impression that there are several problems with general obligation financing which discourage lending in the solid waste sector in Africa, Asia and South American countries where records on personal income and appraisals of property are inadequate. As a matter of course, people do not report all their income. He argues that this results to a lower level of revenue generating ability than is available, and that for a solid waste management project to be financed by general obligation methods, a true appraisal of the municipality's dept limit is essential. Another problem is that revenue raised through taxes becomes a part of the general city treasury, and thus is available to other city expenditures to draw on.

It is worth clarifying that unless these problems are adequately dealt with by fully projecting capital and operating requirements of solid waste project, determining their affordability relative to revenue generating ability of the local government, and then arranging competent institutional and financial mechanism, projects are likely to fail

as apparent in Eldoret Municipality. To avert some of these problems, Cointreau (1982) has recommended that local governments should shift the burden of raising capital to the private sector. This would basically involve contracting with private enterprise for the service, therefore shifting the capital raising burden to the private firm. However, such a capacity is yet to be optimized in Eldoret Municipality.

For solid waste management systems, it is essential that operating and maintenance cost be carefully assessed because the collection equipment is relatively short lived, and that operating and maintenance costs are also substantial (Carrere et al, 1979). On the other hand, Flintoff (1981) substantiated that operating and maintenance costs may be obtained from two sources namely current revenues and user charges. He reveals that originally, the concept of user charges was advanced because of fundamental economic theory that demands for goods or services declines as prices increases, and that direct user charges for solid waste service would limit the generation of waste.

Current practices in Kenya and indeed Eldoret Municipality has not been able to support any significant price elasticity, and shows that user charges as a means of deterring waste generation are not effective. By also drawing experience from the foregoing discussion, it is apparent that one of the problems facing the cities in Africa and Asia is critical lack of adequate financial resources necessary to solid waste management services. In the context of this study, the problem is also a major concern for the Eldoret Municipal Council. It is conceptualized that these problems can be resolved through a well administered system of budgeting control coupled with a sound basis for levying and collecting local taxes.

2-12Global Systems of Urban Solid Management

It is important to compare solid waste management practice from developed countries where the activity is fairly organized, to that of the Africa, Asia and Latin American countries, which Kenya is part of. This may not only reveal some of the factors limiting the service delivery in the latter, but may also illuminate some of the lessons that may be learned to improve the service delivery in these countries.

i) Europe, Australia, Central and North America Regions

Perhaps in no field of solid waste management are the differences between the industrialized countries and the Africa, Asia and South American countries so apparently as in wastes reduction and material recovery. Rising overall living standards and the advent of mass production have reduced markets for many used materials and goods in the affluent countries whereas, in most of the developing world, traditional labour-intensive practices of repair, reuse, waste trading, and recycling have endured. Thus there is a large potential for waste reduction in the former countries, and the recovery of synthetic or processed materials is now being emphasizes. In Africa, Asia and South American countries, by contrast, the greatest potential for waste reduction currently rests with diverting organic and construction wastes (UNEP, 1991).

Medina (1997) on the other hand observed that subsidization of the full range of initiatives for waste reduction by governments and/or private industry is becoming a norm in affluent countries. He further argues that most cities in Western Europe, North America, Australia, New Zealand, Japan, and in Korea have adopted municipally sponsored source separation and collection systems and in some cases, the separation of post-consumer materials by waste generators has been made mandatory. The main motivation, from the point of view of municipal authorities is to reduce materials that must be deposited in landfills, and that at the national level, under the rubric of producer responsibility, governments have crafted agreements and legal frameworks designed to reduce the generation of waste.

Brown and Jacobson (1987) research on solid waste management showed that in many industrialized countries, source separation and curbside collection programs are heavily subsidized by municipal governments' private industries or foundation, and that when municipal funding is withdrawn, the scope of materials recovery may be greatly reduced. These countries have the institutional competence and capacity in urban government to integrate local and regional waste management plans. Citizens are also highly aware of the problems and to cooperate in separation programs.

ii) Africa, Asia and South America Regions

According to Chambers (1995), most cities in Africa, Asia and South America are yet to experience the decline of recovery of recyclables and the corresponding increase in post-consumer wastes, which, together with scarcity of dump space, have led many affluent cities to sponsor materials recovery. He argues that:

> The engines of waste recovery and recycling in the poorer countries include the scarcity of virgin materials, occurrence of absolute poverty, the availability of workers who will accept minimal wages, the frugal values of even relatively well-to-do households, and the large markets for used goods and products made from recycled plastics and metals.

He proceed to give an example that if one takes into account the use of compost from dumps sites as well as materials recovery as he found out in countries like India, Vietnam and China, the majority of municipal wastes of all kinds are ultimately utilized. Given that Eldoret Municipality is principally an agricultural town, the study views that this could as well work in the study area.

UNEP (1991) underpinned that waste reduction that could be achieved by legislation and protocols such as agreements to change packaging is not a priority in these countries, although some are now moving in this direction. Because unskilled labour costs are low and there is a high demand for manufacturing materials, manufacturers can readily use leftovers as feedstock or engage in waste exchange. Residuals and old machines are sold to less advanced, smaller industries. Public health is benefiting from plastic and box board packaging and reduces contamination of foods, and much of the superior packaging is recovered and recycled. At the household level, gifts of clothes and goods to relatives, charities and servants are still significant in waste reduction.

As noted by Medina (1997), all cities have markets for used goods, and the greatest amount of materials recovery is achieved through networks of itinerant buyers, small and medium dealers, and wholesaling brokers. He keenly explores that the extent to which the waste trading enterprises are registered varies in Latin America and Asia where there is more formal registration than in Africa. The system is adaptive to

markets fluctuations, as the lowest level workers form a dispensable labour cushion: they must find other work, if they can, when there is reduced demand for the materials they sell. Because so many people are engaged in the activities of materials recovery, processing, and recycling, and alternative work is scarce, Medina (1997) further concedes that governments and social welfare organizations are often more sensitive to employment needs than to environmental considerations in waste management. Thus, they are prepared to trade off some environmental and public health against employment generations. From the point of view of waste reduction, he appreciates that the traditional practices of repair and reuse, and the sale, barter, or gift of used goods and surplus materials, are an advantage consumer wastes would be higher without them. These societies should be alert to socio-economic changes that threaten resource-conserving traditions.

Cointreau (1982) reveals that profound differences exist between industrialized and countries in Africa, Asia and Latin America in terms of income, standard of living, consumption patterns, institutional capacity, and capital available for urban investments. Conventional solutions usually do not take into account these differences, resulting in less than optimum outcomes. He highlights some of the differences between industrialized and countries of Africa, Asia and Latin America relevant to the design of solid waste management solutions:-

First, whereas industrialized countries enjoy a relative abundance of capital and have high labour costs, Africa, Asia and South American countries on the other hand have a relative scarcity of capital and an abundance of unskilled and inexpensive labour. It makes sense for the former to devise waste management systems intensive in capital and that save in labour costs, but it often does not make sense for the latter to follow the same approach. At this juncture, Meyer (1997) suggested that Africa, Asia and Latin America need low-cost, labour-intensive solutions that reduce poverty, particularly among the most underprivileged segments of society. He also proposed that socially desirable solid waste management solutions in these countries are those that create income opportunities for unskilled workers, particularly the poor.

Second, Cointreau (1982) points out that the physical characteristics of cities in Africa, Asia and Latin America and industrialized countries differ markedly, similarly, as economic prosperity increases, the amount of solid waste produced in the these cities consists mostly of luxury waste such as paper, cardboard, plastic and heavier organic materials. In cities in the south, on the other hand, Meyer (1997) similarly contrast that waste densities and moisture contents are much higher and that the hazardous content is quite high since the regulatory and enforcement system to control such waste disposal are usually non-existent or not operating. These differences mean that waste management systems in each case require distinct planning approaches.

Table 2-1: Patterns of Urban Solid Waste Generation

Solid Waste Characteristics	**Low - Income Countries**	**Middle - Income Countries**	**Industrialized Countries**
Waste generation (kg/capita/day)	0.4 - 0.6	0.5 - 0.9	0.7 - 1.8
Waste densities (wet weight basis-kg/cubic meter)	250 - 500	170 - 330	100 - 170
Moisture content (% weight at point of generation)	40 - 80	40 - 60	20 - 30

Source: Cointreau (1982)

Cointreau (1982) concludes that cities in Africa, Asia and Latin America have also extensive areas with substandard conditions slums with narrow, hilly and unpaved streets. Many immigrants cannot afford to purchase land on which to build their homes. As a result, some occupy vacant land and become squatters. This compares well with Langas within Eldoret Municipality. Cointreau and de Kaadt (1991) also agreed that given the conditions of hilly, unpaved or narrow streets common in informal settlements, it may not be possible for collection trucks to enter those areas. If they do enter those neighborhoods, collection vehicles tend to break down often due to the harsh conditions of streets and roads. It is not uncommon for Mexican cities to have, at any given time, half of their collection vehicles idle in garages awaiting some kind of repair. In the context of this study, this is also an inherent phenomenon in Langas and other informal settlements within Eldoret Municipality.

2-13 Aspects of Solid Waste Management in Kenya

Esho (1997) submitted that solid waste management policies in Kenya have for a long time been unclear because of lack of clear framework on what constitutes waste and lack of accepted methodologies of collection, treatment and disposal for wastes. He is critical that institutional and legal arrangement concerning solid waste management is very incomplete both at the national and local levels.

Kenya (1995) also concurred that the problem of solid waste management in the country's urban areas can be attributed to a variety of problems emanating from malfunctions and management problems of local authorities and the culture and attitude of urban residents. As further documented by Kenya (1995) on garbage collection, 65% of the towns in the country need improved services, only 35% collected garbage at least once a week; most of them being the smaller towns.

i) Legal Framework

Legislation related to solid waste management in Kenya is usually fragmented in several laws. Currently, there is no single legislation that addresses the entire process of solid waste management. The following are some of the legislations that attempt to address the incumbent problem of solid waste management in the country:-

a) The Public Health Act, Chapter 242 of the Laws of Kenya

The Act specifies that it shall be the duty of all local authorities to take necessary measures for maintaining their district at all times in clean condition, and to prevent the occurrence of any nuisance or condition liable to be injurious or dangerous to health. The act further gives the local authorities the duty to collect, investigate, consider and publish the facts as to any overcrowding or bad insufficient housing, and inquire into the best methods of dealing with any overcrowding or bad housing so ascertained to exist. From a planning perspective, proliferation of informal settlements is directly related to the generation of solid wastes because such areas were initially not planned for the service delivery. It is worth noting that local authorities such as Eldoret Municipal Council have not fully implemented these requirements.

b) The Local Government Act, Chapter 265 of the Laws of Kenya

The Act places a duty on all local authorities to provide solid waste management services to their residents. It specifically gives them the powers to establish and maintain sanitary services for the removal of all kinds of refuse. The legal basis for private sector participation in the service delivery is also established and governed by the powers contained in the Local Government Act, which gives all local authorities; including Eldoret Municipal Council, the power to provide solid management services. This indicates that the council is free to contract out solid waste management activities to private companies. However, Eldoret Municipal Council's initiative towards privatization has been minimal. The Act further gives local authorities the powers to make by laws such as those related to maintenance of public health. To fulfill this mandate, Eldoret Municipal Council along side other local authorities such as Thika enacted a solid waste management by-law. However, the by-law only deals with the arrangement for the collection of refuse. It does not cover the entire solid waste management process.

c) The Physical Planning Act, Chapter 286 of the Laws of Kenya

The Act defines "development" as the making of any material change in the use or density of any buildings or land or the subdivision of any land. It clearly states that deposit of refuse; scrap or waste materials on land constitutes development. The Act is however not specific on the types of waste, hence incomplete. From its definition of "development", it is apparent that indiscriminate dumping of solid wastes in Langas also constitutes development, hence need to be controlled. The Third Schedule of the Act further reveals that a local authority in consultation with the Director of Physical Planning can prepare a subject plan that treat a detailed particular planning aspect for example transportation, and water supply. Because an action plan is prepared for a particular planning subject, local authorities, and specifically Eldoret Municipal Council, can therefore prepare an action plan for solid waste management in Langas. In conclusion, although the Act has identified indiscriminate dumping as a form of development and conferred upon all the local authorities enormous powers to control it, they have failed to live to all these expectation as witnessed in Langas.

d) The Local Government (Adoptive by – Laws) Building Order of 1968

The by - law confirms that every domestic and public building shall be provided with approved means of refuse disposal. It notes that before the council issues a certificate of completion in respect to any building, the means of refuse disposal shall be completed, and containers for solid waste storage provided. It further requires that a concrete paved area of approved concrete slabs, or of other approved material and thickness, shall be provided for every refuse bin. However, none of the above provisions have been catered for in most urban areas of Kenya such as Eldoret's Langas settlement. In addition, this by-law does not also acknowledge the process of solid waste management, hence can't be used to provide a policy framework.

e) The Environmental Management and Coordination Act, No. 8 of 1999

The Ministry of Environment and Natural Resources (MENR) formulated the Environmental Management and Coordination Act (EMAC) with the general provisions covering waste management, disposal site licensing, control of hazardous, industrial and hospital wastes and environmental impact assessment. The Act highlights that no person shall transport any waste other than in accordance with a valid license to transport wastes issues by the National Environmental Management Authority, and to a waste disposal site established in accordance with a license issued by the Authority. The Act also emphasize that no person shall operate a waste disposal site without a license issued by National Environmental Management Authority.

Just like other Acts, the EMAC does not address some of the basic aspects of solid waste management such as institutional linkages, training of personnel involved in solid waste management, resource recovery, waste reduction and community participation among others. Moreover, it does not empower the local authorities as the lead planning agencies in solid waste management. For example, the Act states that for a person to transport solid wastes in the country, the transporter must seek permission from the authority. This contradicts the Local Government Act (CAP. 265), which gives the local authorities the sole mandate to enter into contract with anybody for the sake of providing services in their areas of jurisdiction.

ii) Institutional Framework

Several agencies at the national level are usually involved at least partially in solid waste management in Kenya. These include government ministries, non-governmental organizations and community based organizations among others. However, there are no clear and defined roles or functions of these agencies in relation to solid waste management. There is also no single agency designated to co-ordinate their activities. This often results to duplication of efforts, waste of resources, and unsustainability of overall solid waste management programmes in local authorities (JICA, 1998).

Because of low budgetary allocation, the institutional capacity of the local government agencies involved in solid waste management is generally low in Kenya. Local governments are therefore not provided with clear mandates and sufficient resources to effect solid waste management. Formulation of policy and planning for solid waste management is completely lacking at both the national and local levels. No central government ministry or body has been assigned with the responsibility of policy, planning or preparation of national standards and guidelines. These activities should be implemented and coordinated at the national level by the MENR, which should take the leading role in solid waste management policy and planning (JICA, 1998). Similarly, there is little coordination between Eldoret Municipal Council and the Central Government in solid waste management, planning and policy formulation.

iii) Conclusion

Solid waste management in Kenya continues to be inadequate because the legislations are enforced by different government institutions. For example, whereas the Physical Planning Act is administered by the Physical Planning Department within the Ministry of Lands and Settlement, the EMAC on the other hand is administered by the MENR. This result into duplication of responsibilities in the regulatory provisions for the development of effective planning for solid waste management systems. A comprehensive legislation that avoids the duplication of responsibilities, fills in the gaps of important regulatory function, and that is also enforceable is therefore required for sustainable development of solid waste management systems in Kenya.

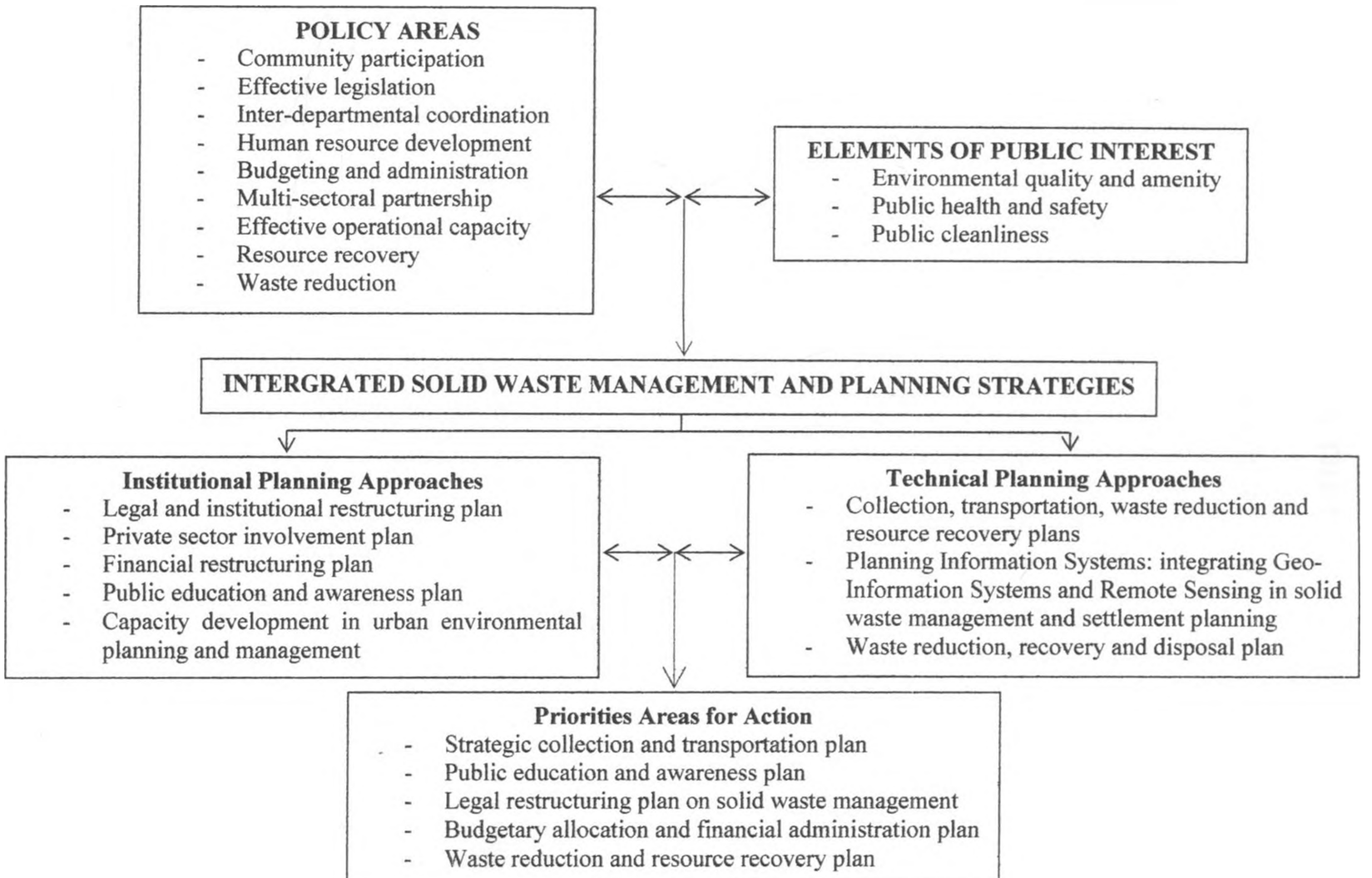
2-14 Conceptual Framework

The foregoing literature review has revealed that rapid urbanization in Africa, Asia and South America tend to be characterized by proliferation of informal settlements as well as the problem of solid waste management. In this regard, Kenya is no exception. Similarly, in the context of this study, and by drawing experience from the pertinent literature already reviewed, rapid urbanization and poor planning in the informal settlements within Eldoret Municipality which is occasioned by inadequate community participation are among the notable factors undermining effective domestic and commercial solid waste management in Langas. This equally reveals the research gap that this study seeks to address.

Because the council provides an institutional link between community and the central government, there is need to adopt a holistic approach in planning policy concerning solid waste management in the study area. This study envisions that the objectives and hence elements of public interests in solid waste management by the council should be three fold: to improve public health and safety, to ensure environmental quality and amenity and finally to improve public cleanliness. To attain efficiency in solid waste management, it is conceptualized that all round policies that would encompass community participation, cross-sector partnership, human resource development, sound legal framework, and adequate operational capacity among others should form the basis of solid waste management by the council within the study area.

A combination of these policies in the context of the aforementioned elements of public interest should be carefully inculcated and entrenched into the solid waste management process. The product of this synthesis would be an integrated solid waste management and planning strategy, which strategically envisions two broad planning approaches namely institutional and technical planning approaches (Figure 2-2). The focus should be to keep wastes generated within the sink capacity of the study area. This would require a concerted set of policies and strategies that are not only socially inclusive, but also capable of ensuring that the benefits of urbanization in the municipality will not be unsustainable in the near and long future.

Figure 2-2: Conceptual Model



CHAPTER THREE

RESEARCH METHODOLOGY

3-1 Introduction

This section describes the procedure that was followed in conducting the study. At this stage, techniques of obtaining data were developed for actual data collection and hypotheses testing. Under the section, the sampling design of the study, sources of data, and data analysis and presentation have been discussed.

3-2 Sampling Design

A detailed reconnaissance survey was conducted in July 2003, the period when questionnaires and interview schedules were also formulated, units of observation and analysis identified and sampling procedures designed. During this stage, questionnaires were also pre-tested to ascertain the validity of various questions.

The sampling design of the study was prepared to ensure that all the units of observation were adequately represented without any anticipated bias. Kiplagat (1999) underscores that stratified sampling, which is known to increase precision especially when the stratifying factor is well defined, can be best applied when studying different sources of solid waste. In studies related to solid waste management, he states that the stratification factor can be identified to be the sources of waste generated.

In the context of this study, commercial and domestic waste formed the main strata (sources of waste in the study area). Simple random sampling was then applied to select the units of observation from each stratum. To randomly select the businesses, an up-to-date list of all businesses was obtained from the Licensing Section within the Treasurer's Department. By the time when the field survey was being concluded, there were 1800 registered businesses in Langas. A total of 35 businesses were randomly selected (representing 2% of businesses) from this stratum to represent the businesses operating in the area.

To reduce costs, simplify management and control the quality of data collection, the sample size was kept within this limit. The randomly selected businesses were identified in the field using their names and specific location as they appeared in the licensing records. Unlike the households, it was fairly easy to identify the location of businesses premises since most of them are located along the major roads traversing the study area.

On the other hand, a total of 50 households were randomly selected from the household stratum. According to the 1999 Population and Housing Survey, Langas had 18 177 households. A series of maps at a scale of 1:1000 were used to determine the location of selected residential plots (Figure 4-3). As per the map series, Langas had 1 742 plots. The parcel numbers (1 – 1742) were used as the sampling frame out of which 50 plots were randomly selected (represented 3% of households). Using the cadastral map, and through the guidance of the roads, of which some have been encroached by illegal structures, the selected plots were visited.

Since the study area is an informal settlement, the housing structures have been put up without any planning consideration. This implied that it was possible to find numerous structures within a parcel of land initially planned to accommodate one or two structures, hence contributing to high densities. Given that most of the structures within the identified plots had certain similar attributes such as housing condition, and that the occupant were likely to be within the same income bracket, the researcher further randomly selected any household structure within the plots.

Suffice it to say that 35 businesses were selected against 50 households because in essence, households are the prime generators of solid waste in Langas[8]. This is justified by the fact that the study area had 18 177 households against 1 800 businesses. In total, the sample size used in the study was 85[9].

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[8] Mugenda and Mugenda (1999) underscores that for greater accuracy in the findings, the number in each stratum should be based on the relative variability of the characteristics understudy rather than proportionate to the relative size of each sub-group in a population.

[9] Gay (1981) has justified that for correlational research, 30 cases or more are required.

3-3 Sources of Data

The study used both primary and secondary data sources. These are briefly described in the following sections:-

3-3.1 Primary Data

Primary data collection methods involved the use of questionnaires, empirical observation and taking of photographs. Questionnaires were administered to the households, businesses and the acting Cleansing and Conservancy Officer (CCO). The questionnaire administered to the CCO was designed to understand the role of the council as the lead agency in the service delivery. On the other hand, household and business questionnaires aimed at finding out the extent of community participation in regard to the subject matter in the study area. The questionnaires used were both in structured and unstructured formats.

A hand-held camera was used to collect and record data on the state of solid waste management in Langas. Likewise, empirical observation made it easier to obtain certain data that was difficult to acquire from the council due to poor record keeping, such as attitude of refuse collectors towards the community, and the attitude of the community towards the refuse collectors and the council in general. The researcher also spent two weeks in the office of the acting CCO to investigate some of the complaints raised on poor solid waste management by the residents of Langas and other neighborhoods within the municipality. To avoid any suspicion by the public, the researcher was advised to disguise as one of the newly recruited officers within the Cleaning and Conservancy Section.

3-3.2 Secondary Data

Secondary data sources involved the systematic identification, location and analysis of documents containing information related to the research problem under investigation. Both published and unpublished information were reviewed. The purpose of reviewing secondary data was to get an overview of the theory on the principles of solid waste

management in the context of informal settlements, and eventually build a sound conceptual framework that would envision the way forward for domestic and commercial solid waste management in the study area. The sources of secondary literature included past theses, journals, municipal annual reports, development plans, and books among others.

3-4 Data Analysis and Presentation

All completed questionnaires were edited to eliminate any error that might have occurred. Analysis of collected data was conducted with descriptive techniques and various maps produced through Geographic Information Systems[10] (GIS) overlay[11]. Cross tabulation was done to get a more detailed analysis between various variables. Whereas the entire GIS overlay relied on Arc View 3.2 software, georeferencing[12] on the other hand was achieved using Arc GIS (Arc View 8.3) software. Data was presented using texts, charts, graphs and plates.

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[10] Refers to a system for capturing, storing, checking, integrating, manipulating, analyzing and displaying data that is spatially referenced to the earth.

[11] Denotes the process of combining two or more spatial data in a GIS environment to produce a new set of spatial data.

[12] In any GIS environment, the term "georeferencing" refers to the process of registering a map to its real geographic coordinate system. It is based on the meridians of longitude and parallels of latitude that normally appear on all charts and small scale maps, and may be rapidly and simply applied to any map or chart regardless of projection.

CHAPTER FOUR

BACKGROUND TO THE STUDY AREA

4-1 Introduction

The previous chapter presented the methodology used in the study. This chapter will concern itself with the background of the study area. The historical development of Eldoret Municipality, its geography as well as the population of Langas in relation to Eldoret Municipality are discussed.

4-2 Historical Background of Eldoret

It is difficult to consider the historical development of Eldoret Municipality in isolation of the wider Uasin Gishu District. The first settlers are believed to have arrived in the Uasin Gishu District soon after 1900. Eldoret is the principle town in Uasin Gishu District and is one of the high potential agricultural districts in the high land region of Kenya. Of its earliest history, little is known, except that in the folklore of the Kalenjin and Maasai it was occupied by a pastoral people, the Sirikwa - described by both tribes as "the people who were here before us".

Kenya (1980) documented that Eldoret began in 1910 as an isolated post office, established for the convergence of farmers who had settled in a large area made accessible by the coming of the railway to Londiani. Farm 64 was selected as the site for the new township because it was a poor, stony piece of ground, which no farmer wanted and it was a compromise among the number of conflicting suggestions. A major trek of Afrikaans-speaking South Africans arrived in 1908 and by 1910; the district had begun to fill up with British settlers. Willy Van Aardt, 64's original owner, turned contractor and built the Post Office. The change of name from "64" was decided when the Governor, Sir Percy Girouard, announced his decision to establish an administrative centre there to serve both the Uasin Gishu and Trans Nzoia Districts. Farmers gathered at "64" from miles around to meet him and many slept under their wagons, on what was then described as a "wind-swept, treeless plain".

The origin of the name Eldoret is the Maasai word "eldore" meaning "stony river" – for the river-bed of the nearby Sosiani is very stony; a "t" was added to make it sound like a Nandi word. The new town was proclaimed "Eldoret" in the Official Gazette of November 14, 1912 with acreage of 2,770. The change of name from "64" to Eldoret and its Township status gave a spur to development. Difficulties were experienced in providing township services to keep pace with the rapid commercial development, responsibility for town services lay with the District Commissioner, helped by a Township Committee, which had no legal authority and no means of collecting funds. April 1929, however, saw the town elevated to the status of a Municipal Board.

The Town Hall was built in 1956 and in January 1958, the town was elevated to Municipal Council status. The first Mayor, J. Wolston-Beard, was elected in November 1959. Eldoret was one of the first towns in Kenya to elect an African Mayor, Councillor A.N. Oloo, who took office on 2nd September 1963. Today, agriculture, manufacturing, commerce and tourism jointly spell prosperity for an ever-increasing population; to raise their standards all round.

The town's boundaries have been extended on a number of occasions. The latest extension was done in 1988, when the town's boundaries were extended from 59 km^2. to 147.9 km^2. This extension appears to be well beyond the existing and future requirements of urban land. The council has in the process engulfed large tracks of agricultural land, some of which have been illegally or legally sub-divided[13].

These extensions led to a high population increase in the municipality and significantly reduced the council's capacity to invest in infrastructure and service delivery - mainly solid waste management within the peri-urban areas. Most of these areas are rapidly developing in to informal settlements such as Huruma, Mwenderi, Kamkunji, Bacon, Kimumu, Langas, Maili-Nne and Kipkeyo Farm.

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[13] Before the 1988 extension, Langas was one big farm. However, after the extension, the owner subdivided the farm and sold out parcels to potential developers. Most of these subdivisions were not approved by the council. In addition, most of the new land owners are yet to acquire title deeds.

4-3 Location

Eldoret is situated in the highlands west of the Rift Valley Province in Uasin Gishu District (Figures 4-1 and 4-2). These highlands rise sharply from the western edge of the Rift Valley. The highest points are in Cherengani Mountains (3450 metres above the sea level) and the Mau Summit (309 metres above the sea level). Between these two highland masses, the level of the western highland drops to an average of 2200 metres above the sea level. Eldoret Town itself lies at an altitude of 2084 metres above the sea level. The town is located 48 kilometers west of Kerio Valley and only 65 kilometers north of the equator. It is situated on the international trunk road linking Nairobi and Kampala. The municipality extends from latitude 0^0 34' north to 0^0 27' north and from longitude 35^0 14' east to 35^0 19' east. Langas informal settlement is located in Pioneer Location, one of the seven sub-locations within the municipality.

4-4 Physiography, Geology and Drainage

According to Kenya (1970), the most extensive single physiographical unit in the area is the Uasin Gishu Plateau, which is solely determined by the present limit of the Uasin Gishu phonolite lavas. In the vicinity of Eldoret, the Plateau is approximately 7200 feet above the sea level. It rises aggressively towards the Rift Valley at Elgeyo some 20 miles to the east of Eldoret. Most parts of the Municipality are located on the southern part of Uasin Gishu Plateau, which is largely below the 2134 m edge of the common southward ridge from the Cherengani Hills.

While a considerable portion of the municipality lies on the lower part of the western slope of the ridge, the northern section is interrupted by the local north-west to South-East trending scarp. River Sosiani, which passes through the municipality, flows approximately from the south-east to north-west, and ultimately joining River Nzoia, which drains in to Lake Victoria. The rivers running over the Plateau form a sub-parallel consequent drainage system incised on the lava surface, their course slightly north of west, indicating the general dip of the flow. The gentle undulating topography of the region around Eldoret Municipality has facilitated mechanization of agriculture.

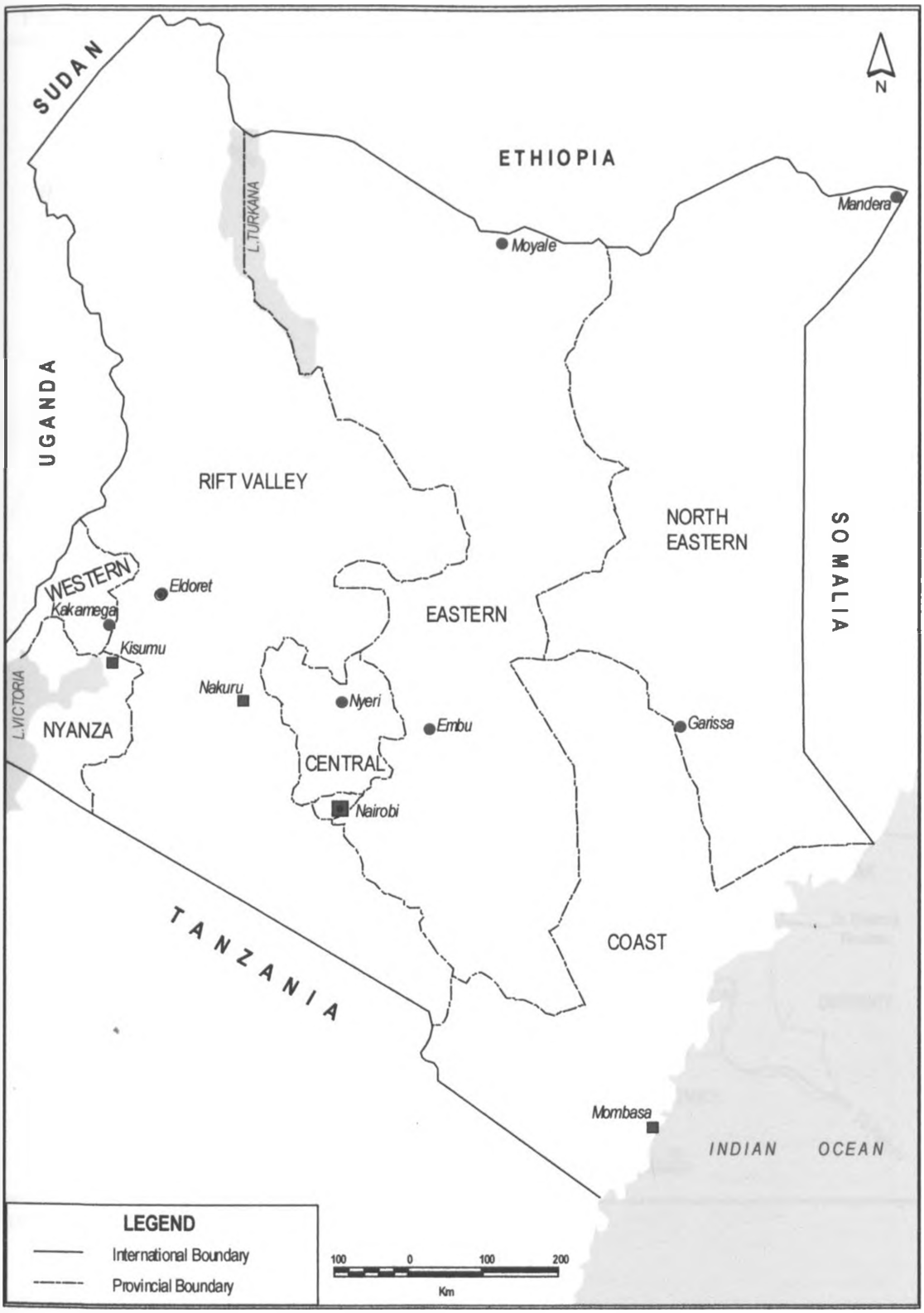
However, there are numerous bottom lands some of which are occupied by seasonal and permanent swamps hence limiting the expansion of agriculture in the environs of Eldoret Municipality. The main drainage system includes the Sosiani and Kipkarren rivers to the south-west and Sergoit River to the north. These rivers together with their tributaries cut into the edge of the lava outcrops so that prominent escarpments overlook the river Nzoia Valley, in the west. River Sosiani, which divides Eldoret town into two parts rises near the crest of the Elgeyo Escarpment and flows westwards through the town to Selby Falls where it plunges from the edge of the Uasin Gishu phonolite onto metamorphic rocks and then follows the tract of the lava escarpment to Turbo eventually joining the Kipkarren River (Kenya, 1970).

4-5 Climate and Soils

Eldoret Municipality falls under modified tropical climate. The average maximum day temperature is 23.4^0 C with an average minimum night temperature of 9.8^0 C. The maximum and minimum temperature extreme during the above period varies from 29.7^0 C to 1.6^0 C respectively. April is the hottest month, while July is the coldest (Figure 4-4) (Kenya, 1980).

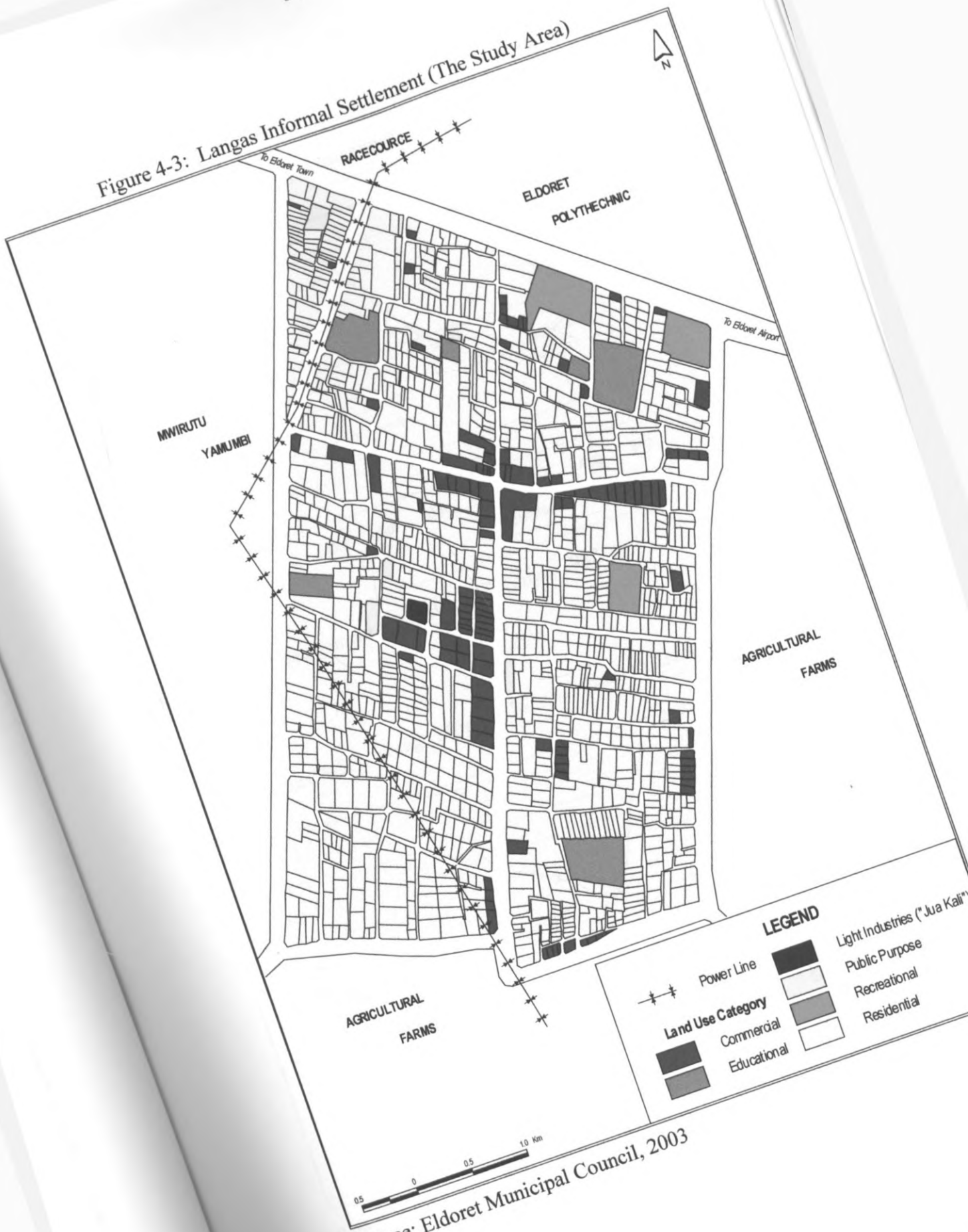
The rainfall distribution during the year is approximately uni-modal, with the first peak in April and the second peak in August. Precipitation occurs mainly during April and May with a short dry period in June, followed by increasing rainfall in July and August. Rainfall declines in September and October a long dry period with scattered showers of four to five months follows, until the following March (Figure 4-5). Rain falls mainly during the afternoons or at night. Most days are generally sunny with a mean sunshine period of 7.5 hours per day. The rainfall averages between 1000 mm and 1250 mm. Evaporation varies from a maximum mean monthly value of 227 mm in March to a minimum monthly value of 119 mm in July. The total annual evaporation varies between 1607 and 2214 mm with a mean value of 2002 mm. Most days are calm with an average wind speed of 5 to 6 knots, from a prevailing easterly direction of the municipality (Kenya, 1970).

Figure 4-1: Location of Eldoret Municipality in Kenya



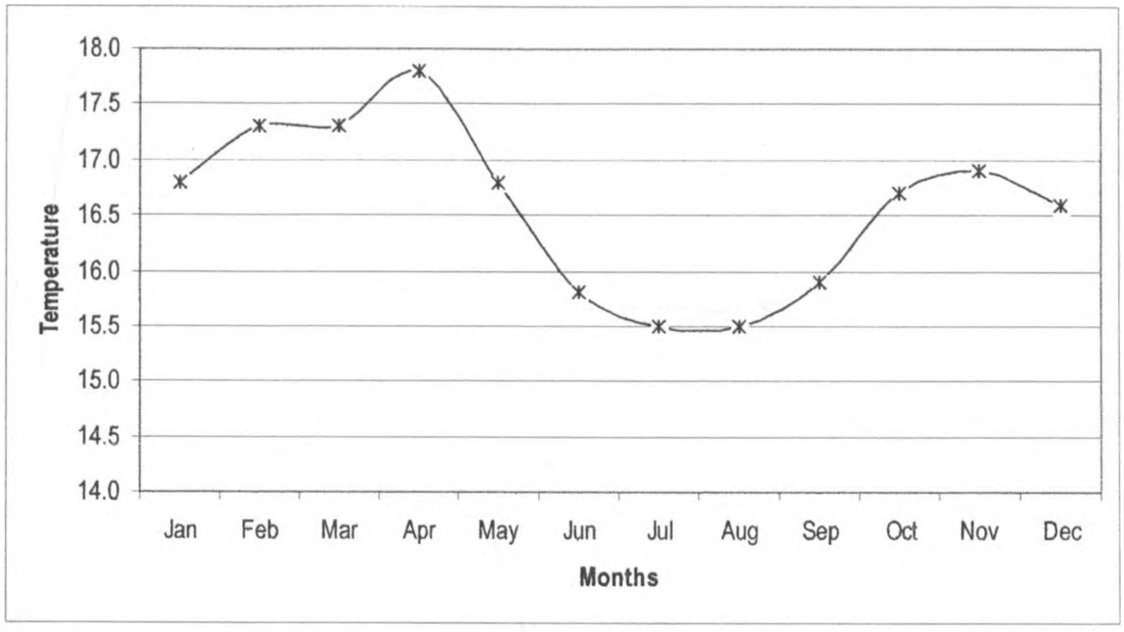
Source: National Environmental Action Plan, 1994

Figure 4-3: Langas Informal Settlement (The Study Area)



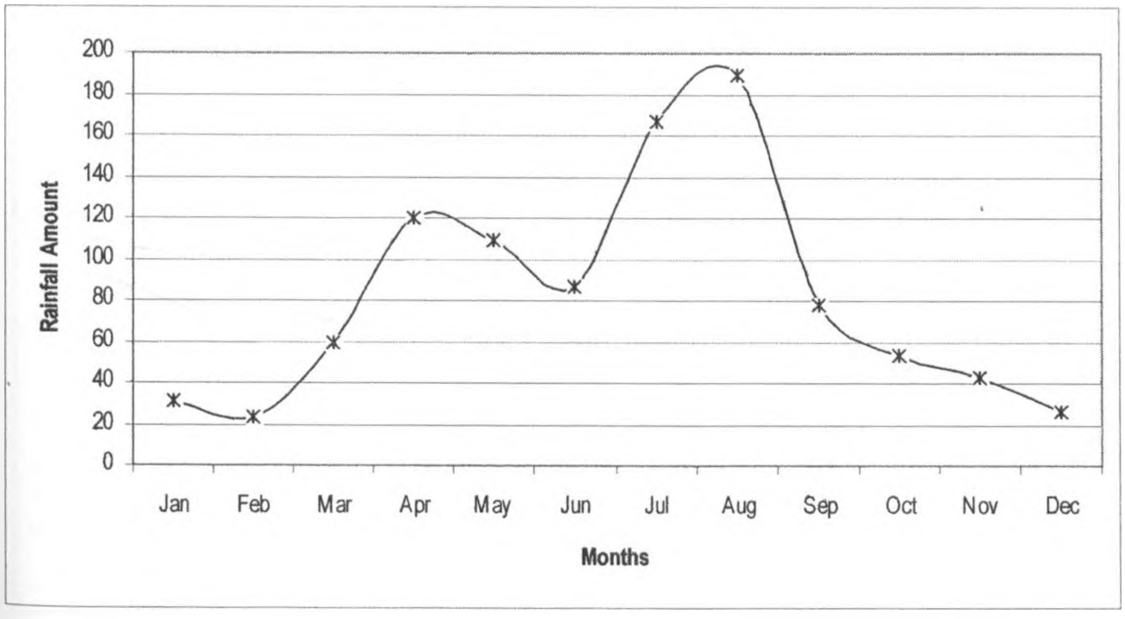
Source: Eldoret Municipal Council, 2003

Figure 4-4: Mean Monthly Temperature (0^{C}) in Eldoret Municipality



Source: Farm Management Hand Book of Kenya, 1983

Figure 4-5: Average Monthly Rainfall (mm) in Eldoret Municipality



Source: Farm Management Hand Book of Kenya, 1983

Table 4-1: Geographic Attributes and Solid Waste Management

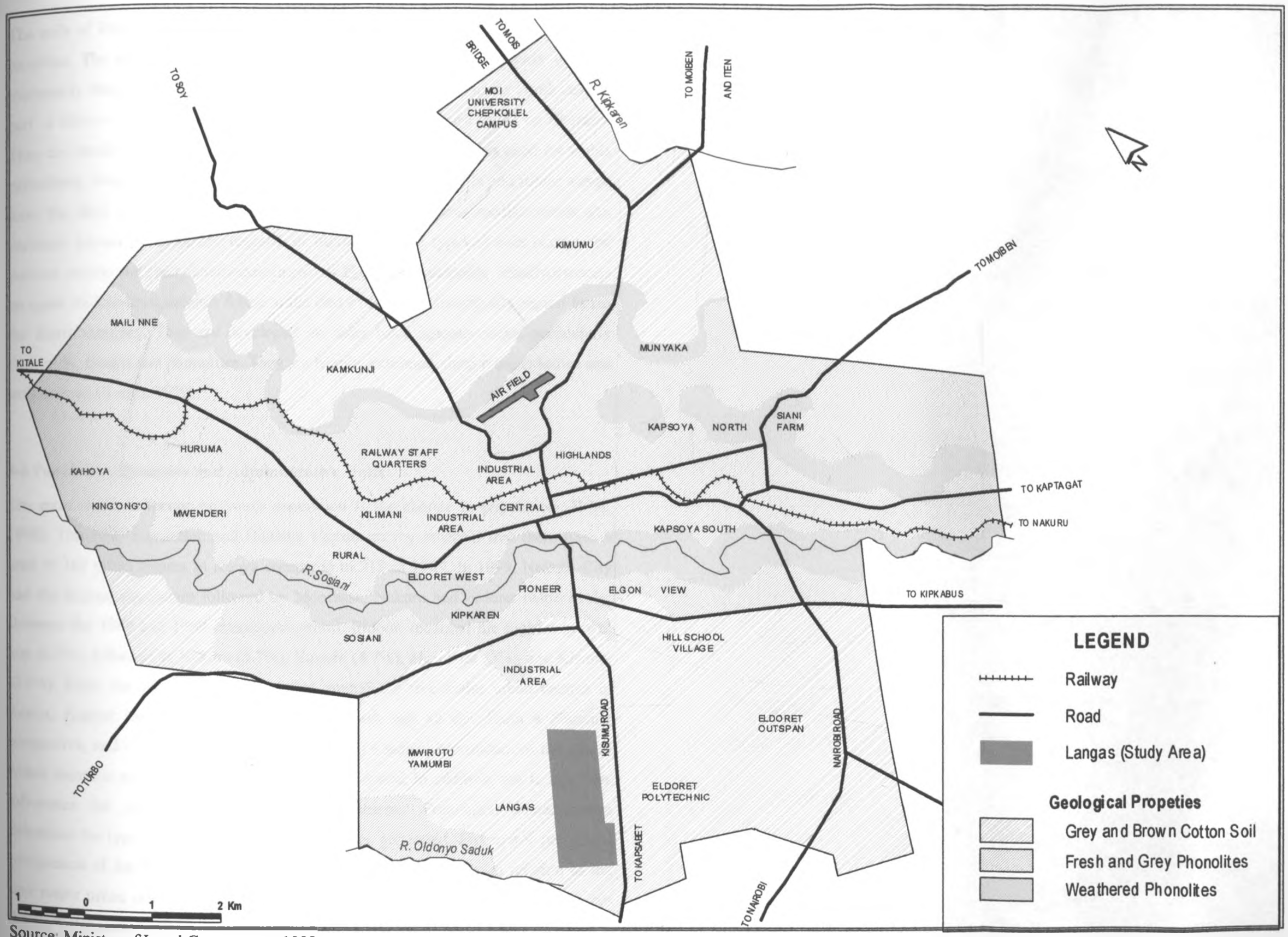
Geographical Attribute	Potential Implications to Solid Waste Management
Geology, soils, topography and drainage	• Determines the location of solid waste disposal sites: poorly jointed rocks would encourage percolation of leachate hence polluting underground water system compared to well jointed rocks • Dumping solid wastes on fertile soils reduces agricultural productivity and land value • Steep topography accelerate surface run off. Wastes dumped on steep slopes are easily transported down slope, hence causing pollution • Locating dumping sites next to natural water bodies increases their chances of being polluted by surface runoff carrying leachate
Rainfall (highest in April and August)	• Heavy rainfall renders most loose surface roads impassable, making it difficult for refuse collection vehicle to access some neighborhoods • Rain increases density of wastes that must be transported and compacted hence refuse trucks must make several trips to clear the piled wastes • Increases leachate from wastes which are easily transported and accumulated in the storm water drains, causing pollution. This equally blocks the drains and attracts pests such as mosquitoes
Temperature (highest between March and April, and October and November)	• High temperatures increase decomposition of wastes due to accelerated chemical reactions, hence foul smell. Also facilitate release of green house gases such as methane, a highly combustible gas • Notably, methane is a major contributor to global warming and ozone layer depletion
Wind (moves towards prevailing easterly direction in the municipality)	• Determine the location of disposal sites. Wind diffuses fouls smell from decomposing wastes if sites are located in the direction of prevailing winds • Disposal sites located in the direction of prevailing winds are likely to cause air pollution as observed in Langas during the field survey

Source: Compiled by Author, 2003

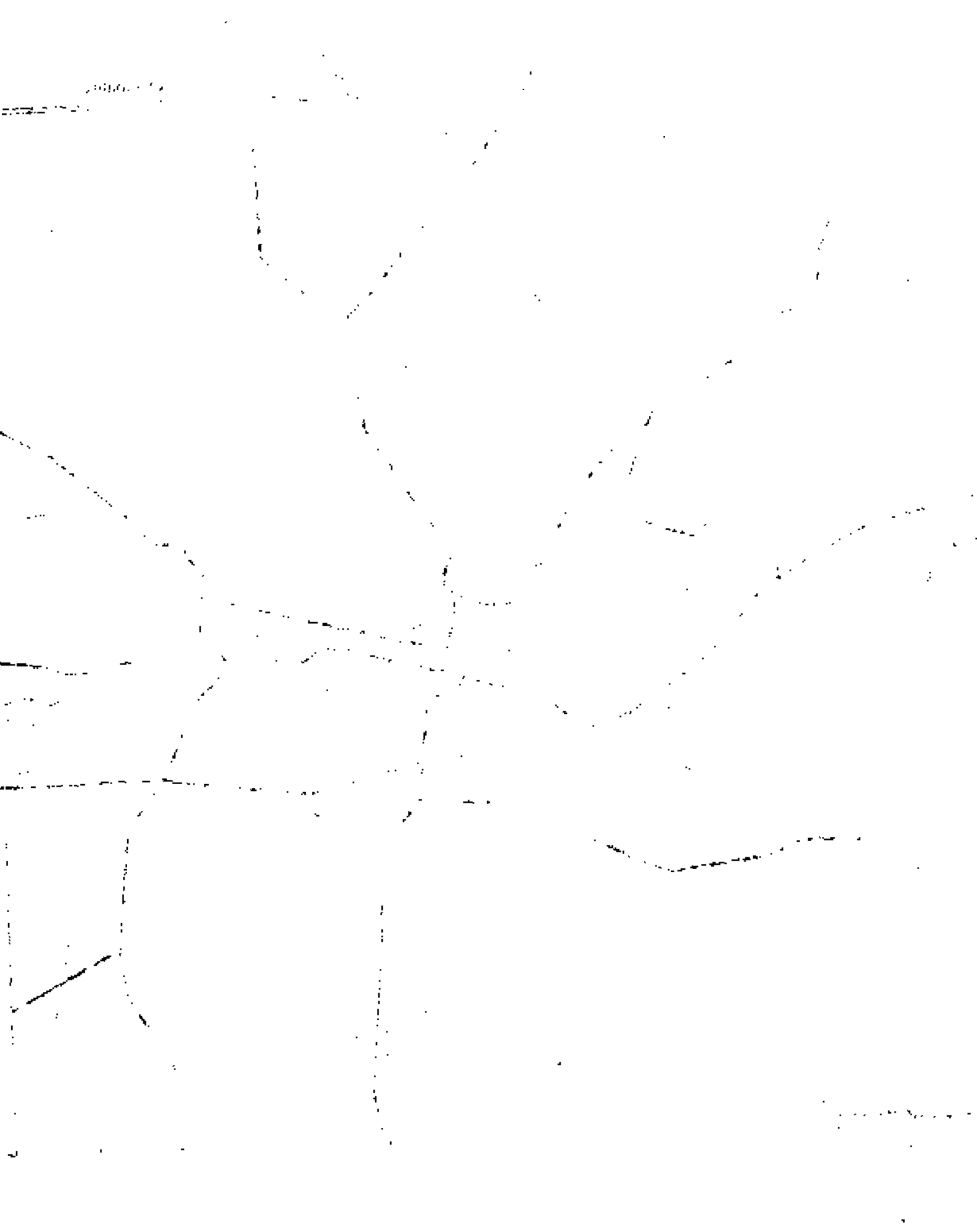
Figure 4-6: Relief and Drainage Pattern of Eldoret Municipality

Source: Ministry of Local Government, 1998

Figure 4-7: Geological Structure of Eldoret Municipality



Source: Ministry of Local Government, 1998

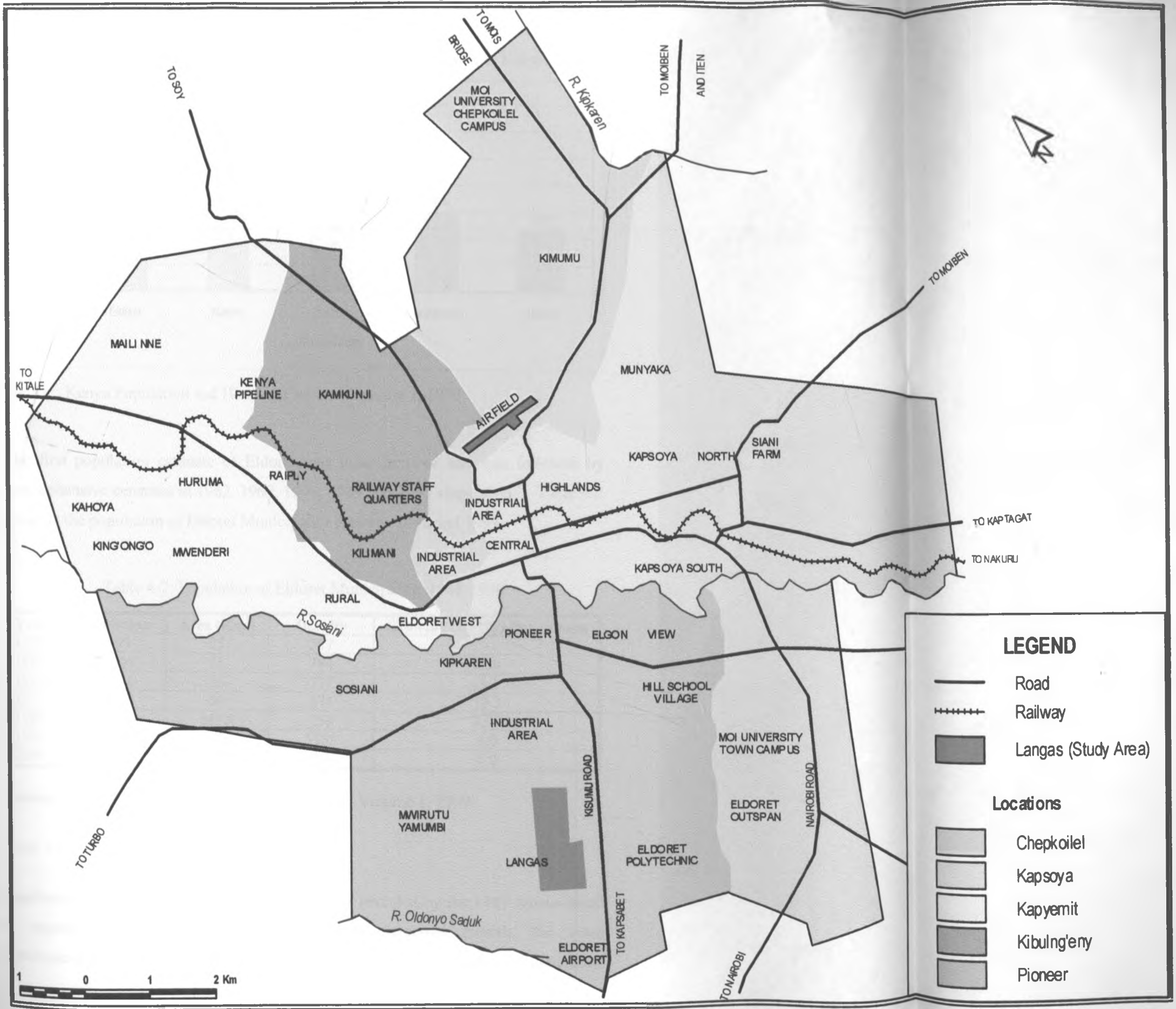


The soils of Eldoret Municipality are categorized into four groups according to their localities. The soils on bottom lands are mainly vertic which are poorly drained, moderately deep and dark grey in color. These are found mainly to the south-eastern part of Eldoret Municipality. The second types of soils are those found on Plateaus. They are ferralsols, which are well-drained, dark red, and dominantly used for arable agriculture, livestock and wattle tree plantations. The soils on hills and minor scarps form the third group of soils. They are well drained, shallow, reddish-brown and variously known as cambisols, regosols or lithosols. These types of soils occupy the western section and partly south-eastern part of Eldoret Municipality. Finally the soils on upper middle-level uplands found to the east of Eldoret Municipality region forms the fourth category. They are developed on older basic igneous rocks, particularly basic tuffs, basalts and phonolites. They are friable, extremely deep reddish brown and well drained (Kenya, 1970).

4-6 Population Dynamics and Administrative Units

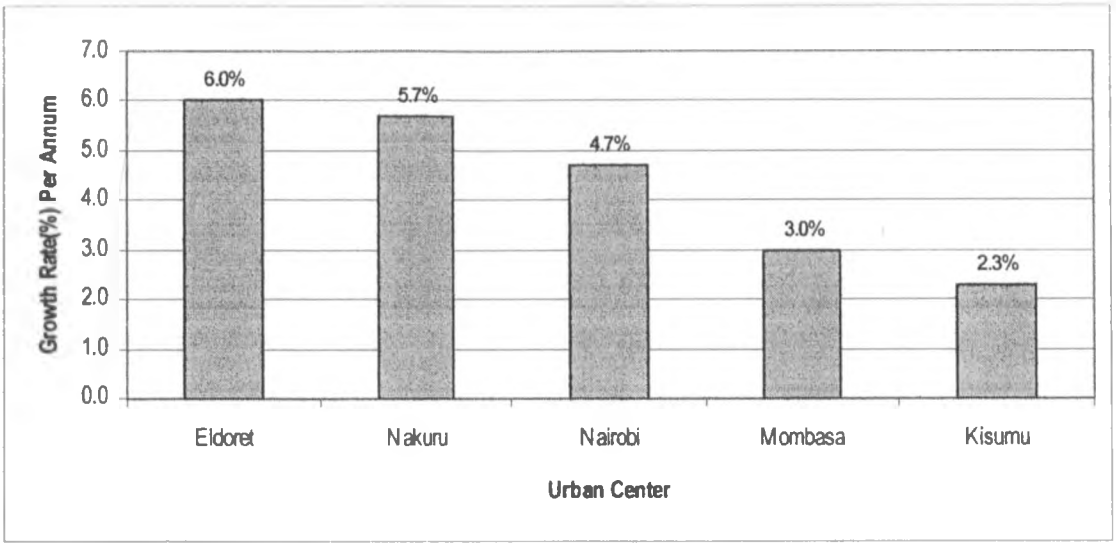
The most direct influence on waste generation is the change in population (JICA, 1998). The 1999 Population and Housing Census survey revealed that there were a total of 288 urban centres in Kenya compared to 218 in 1989. In 1999, Nairobi City had the highest population followed by Mombasa, Nakuru and Eldoret respectively. Between the 1989 and 1999 intercensal period, Eldoret recorded the highest growth rate (6.0%), followed by Nakuru (5.7%), Nairobi (4.7%), Mombasa (3%), and Kisumu (2.3%). From the above, it is evident that among the five major urban centres in Kenya, Eldoret has the highest population growth rate so far. From a planning perspective, and in the context of the study, this is a major determinant of the rate at which domestic and commercial solid waste is generated. In addition, this to an extent influences the proliferation of informal settlements. Population characteristics determine the types, variety and quantity of wastes generated. Figure 4-9 presents a comparison of the population growth rate of Eldoret Municipality in relation to the four major urban centres in Kenya (Nairobi, Mombasa, Kisumu and Nakuru) as per the 1999 Population and Housing Census survey.

Figure 4-8 Administrative Units of Eldoret Municipality



Source: Kenya Population and Housing Census Report, 1999

Figure 4-9 Population Growth Rates of Major Urban Centres in Kenya



Source: Kenya Population and Housing Census - Volume 1, 1999

The first population estimate of Eldoret was done in 1948 and was followed by comprehensive censuses in 1962, 1969, 1979, 1989 and 1999 respectively. Table 4-2 presents the population of Eldoret Municipality between 1948 and 1999.

Table 4-2: Population of Eldoret Municipality, 1948-1999

Year	Population	Area (Km^2)	Density	Growth Rate (%) Per Annum
1948	8 193	25	327	-
1962	19 605	25	784	6.50
1968	18 196	25	727	-1.1
1979	50 503	59	874	10.3
1989	111 882	147.9	756	7.95
1999	197 449	147.9	1335	6.0
2004	*280 085	147.9	1894	6.0

Source: Kenya Population and Housing Censuses - Volume 1, 1999

Note: - * Projection for 2004

Population growth rate of Eldoret Municipality as revealed by the 1989 census stood at approximately 7.95%. Between 1962-1969 intercensal periods, the town experienced a negative population growth rate of –1.1%. This decline of population

growth is partly explained by the fact that shortly before and after Kenya attained her independence; in 1963 some of the Europeans and Asians left the country. In the 1969 and 1979 period, however, Eldoret's urban growth was second highest in the country (10.3%) falling only behind Nakuru, which stood at 16.7%. The population grew as a result of natural increase, the influx of people into the town in search of employment opportunities both in the formal and informal sectors, and the extension of the municipality's boundary. The rapid growth of Eldoret has had serious implications for planning and provision of infrastructure and services such as solid waste management. Langas and other informal settlements such as Huruma, Mwenderi and Maili-Nne were previously within the jurisdiction of the County Council of Wareng'. The three were incorporated in the municipality after the 1988 boundary extension, a year before the 1989 census. This led to the growth of the town's population from 50 503 in 1979 to 111 882 as per the 1989 census, representing a growth rate if 7.95%.

Table 4-3: Administrative Units and Population of Eldoret Municipality

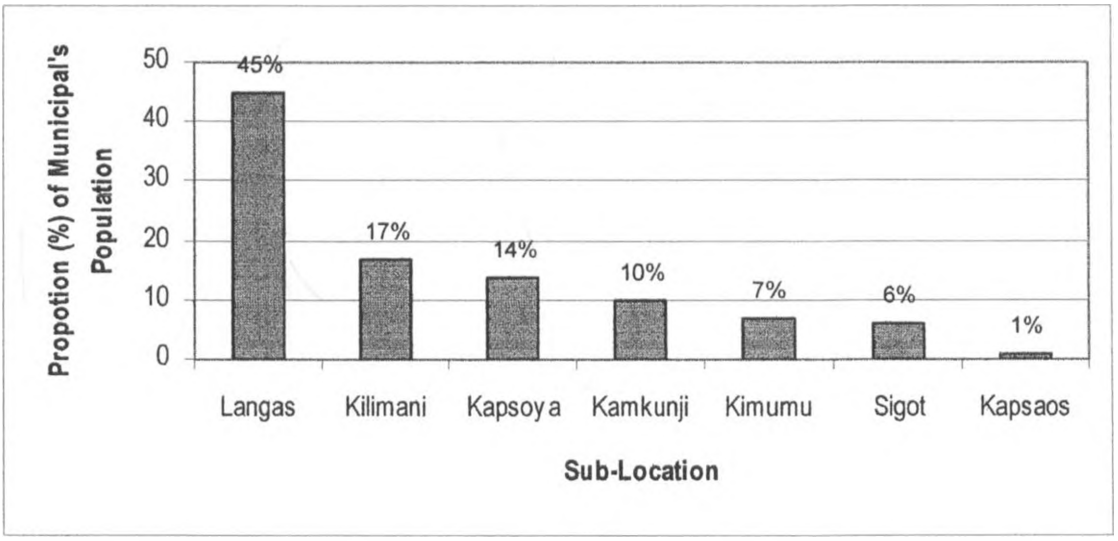
Eldoret Administrative Units		Population	Households	Area (km^2)	Density
Location	Sub-Location				
Kibulng'eny	Kilimani	24777	6940	10.3	2406
	Kamkunji	15376	4846	16.9	910
Chepkoilel	Kimumu	11142	2650	20.0	557
	Sigot	8511	1908	4.1	2076
Kapsoya	Kapsoya	21545	5297	44.0	490
Pioneer	Langas	66973	18177	44.9	1358
Kapyemit	Kapsaos	1454	3780	14.7	990

Source: Kenya Population and Housing Census, 1999 - Volume 1

Administratively, the municipality has five locations namely Kibulng'eny, Chepkoilel, Kapsoya, Pioneer and Kapyemit (Figure 4-8). Kibulng'eny is further subdivided in to two sub- locations: Kilimani and Kamkunji. On the other hand, Chepkoilel is sub-divided into Kimumu and Sigot sub-locations. Kapsoya sub-location falls under Kapsoya location, while Langas sub-location is within Pioneer Location. Finally, Kapsaos sub-location is under Kapyemit Location. In total, the municipality has seven sub-locations. From to the 1999 Population and Housing Census, Langas sub-location

was the most populated administrative area (66973) in the municipality with a density of 1358 people per kilometer square. It was followed by Kilimani (24777), Kapsoya (21545), Kamkunji (15376), Kimumu (11142), Sigot (8511) and Kapsaos (1454) respectively. Figure 4-10 presents the population of Langas in relation to other administrative areas of Eldoret Municipality. It is evident from Figure 4-10 that as per 1999 national census survey 45% of the population in Eldoret Municipality lived in the study area.

Figure 4-10: Population of Langas Compared to other Sub-Locations



Source: Kenya Population and Housing Census, Volume 1 – 1999

The subsequent increase in population density will further intensify land use, hence a possibility of increased environmental degradation, such as those characterized by indiscriminate dumping of domestic and commercial solid waste.

4-7 Evolution of Informal Settlements in Eldoret Municipality

Hayombe (2001) documented that prior to the two major municipality boundary extensions in 1974 and 1988 (Figure 4-12), residential estates in Eldoret Town tended to congregate on the fringes of the central business district. Estates that were in existence or developed immediately after independence were mainly West Indies to

the Western side, Municipal Council low cost housing to the North Western side, and Elgon View and its environs to the South and South Eastern side and other areas such as Eastern Avenue Housing and the residential areas around Moi Girls High School located on the Eastern side. The housing situation by then appeared to have been accorded its rightful place in the overall development of the town. Three mainstreams residential neighborhoods or trends emerged: the low, medium and high-density residential estates. During this period, residential development mainly assumed the "formal" trend with neighborhoods emerging in the serviced areas and being supervised by Eldoret Municipal Council.

However, with subsequent rapid industrialization between 1974 and 1980s, there arose a sharp demand for cheap housing for industrial support. This saw the proliferation of shanty and low quality housing developments on the periphery of the town. The type of development that took place was largely informal and called for urgent attention by Eldoret Municipal Council. With the extensions of the municipal boundary in 1974[14] and 1988, cheap and unserviced land made its way into the municipality thereby, posing new land management challenges to the municipal council. Notably, chunks of this unserviced land have formed part of the new residential creation in Eldoret Municipality.

Development in these areas is unplanned, unsupervised and largely, informal and poses the greatest challenge to decent residential development in the municipality. Currently, all the low cost housing in Eldoret fails to meet the minimum standards of durability, sanitation, space requirement and environmental management in the formal estates in the municipality such as council houses in West, Uhuru, LC (Low Cost) Kidiwa Mwanzo, Old Uganda Road, Mayabi and Kipkaren estates. In these estates houses fail to meet one or several of the minimum standards mentioned above and some revolutionary measures need to be put in place to bring them to the acceptable minimum standards or rejuvenate the areas. The situation in the informal settlements

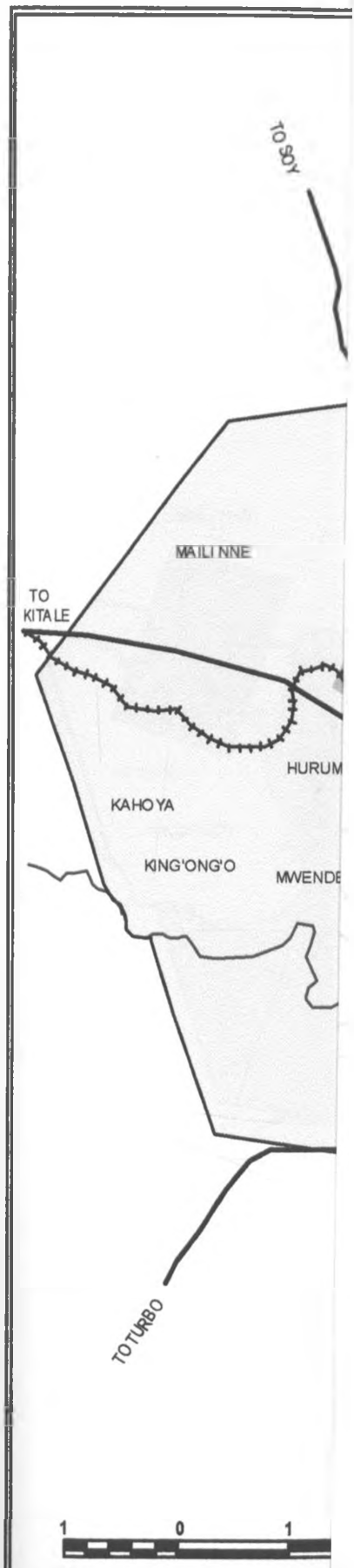
[14] The last physical development plan for the Municipality was prepared to cover the old town (Figure 4-12). Lack a spatial planning framework after the 1988 extension justify why large informal settlements like Langas developed within Eldoret Municipality.

takes the same trend although more aggravated. These areas in include Langas, Munyaka, Huruma, Maili-Nne, Mwenderi, Kamkunji, King'ong'o, and Mwitirithia among others. Since these areas, are unplanned and located on private land (Figure 4-11), they have poor sanitation means, limited circulation space, environmental degradation, and poor housing conditions. Due to poor development control, informal settlements in Eldoret Municipality have continued to expand with poor domestic and commercial solid waste management being portrayed in all of their neighborhoods.

4-8 Future Development Trends of Eldoret Municipality

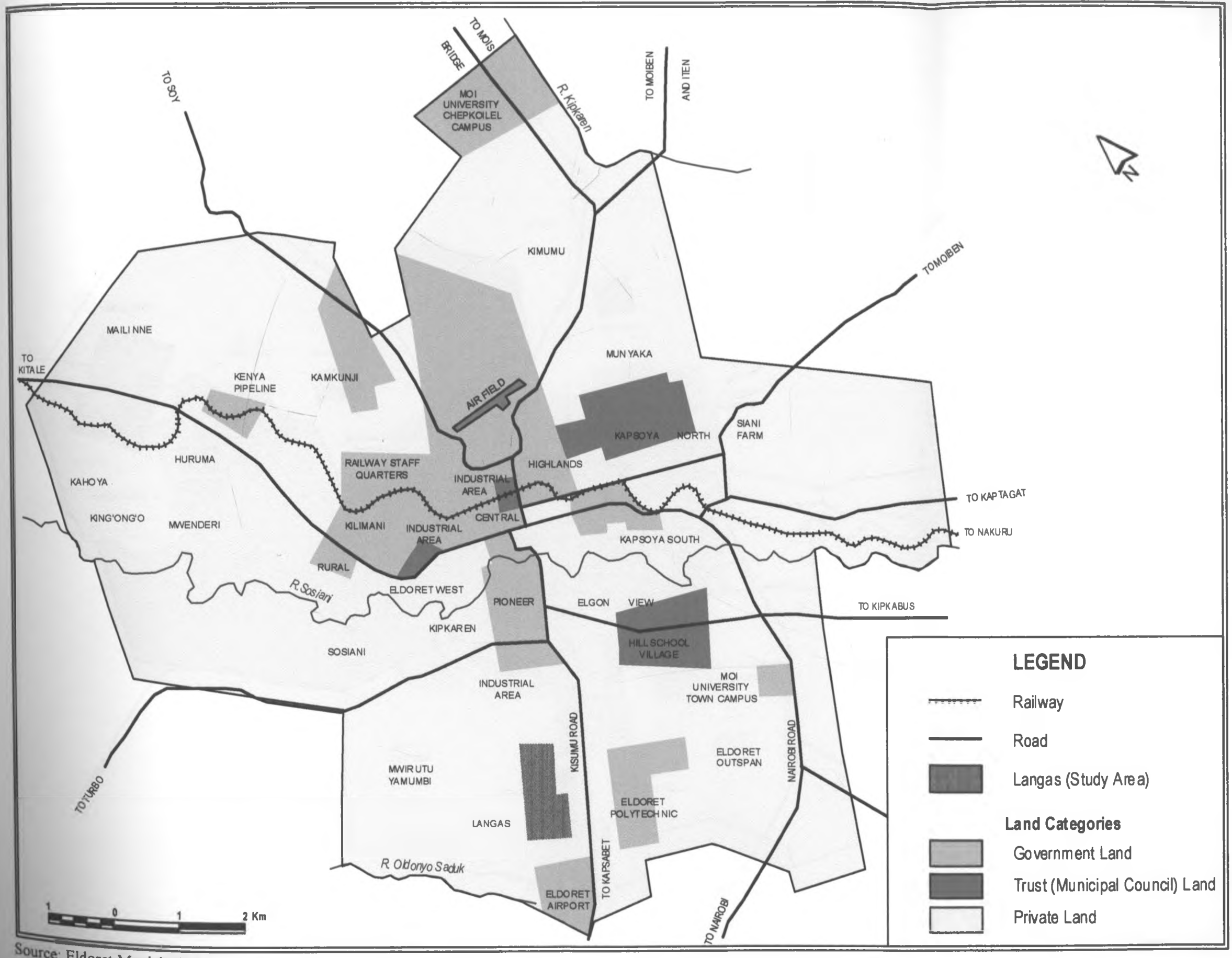
The future development of North Rift and Western region of Kenya will significantly be influenced by Eldoret Municipality. Based on the available data of development applications relating to land subdivisions, it appears that the rapid growth of the municipality is towards the Northern direction at Kimumu area. The concentration of development to the north is attributed to the influence of Chepkoilel Campus of Moi University. In the past, the former East Africa Tanning and Extracting Company (EATEC) farms have inhibited expansion to the South, but with the current rapid parcelation of land and change of user, direction of urban growth will be accelerated towards this Northern part. In the North West, physical development has tended to concentrate along the main corridor at Kitale - Malaba road and thereby forming a ribbon pattern of development. The rate of growth towards this direction is moderate as its expansion is hampered by the vast area and lack of basic services.

It is worth noting that Yamumbi and Kipkenyo on the Western side are experiencing low growth because the area is purely agricultural. This study envisions that the rapid development of Eldoret Municipality will not only lead to the expansion of the existing informal settlements, but also establishment of new ones and subsequently compounding the prevailing problem of domestic and commercial solid waste management. Figures 4-11 to 4-13 presents land categorization, boundary extensions over time, major informal settlements as well as the future direction of spatial development of Eldoret Municipality.



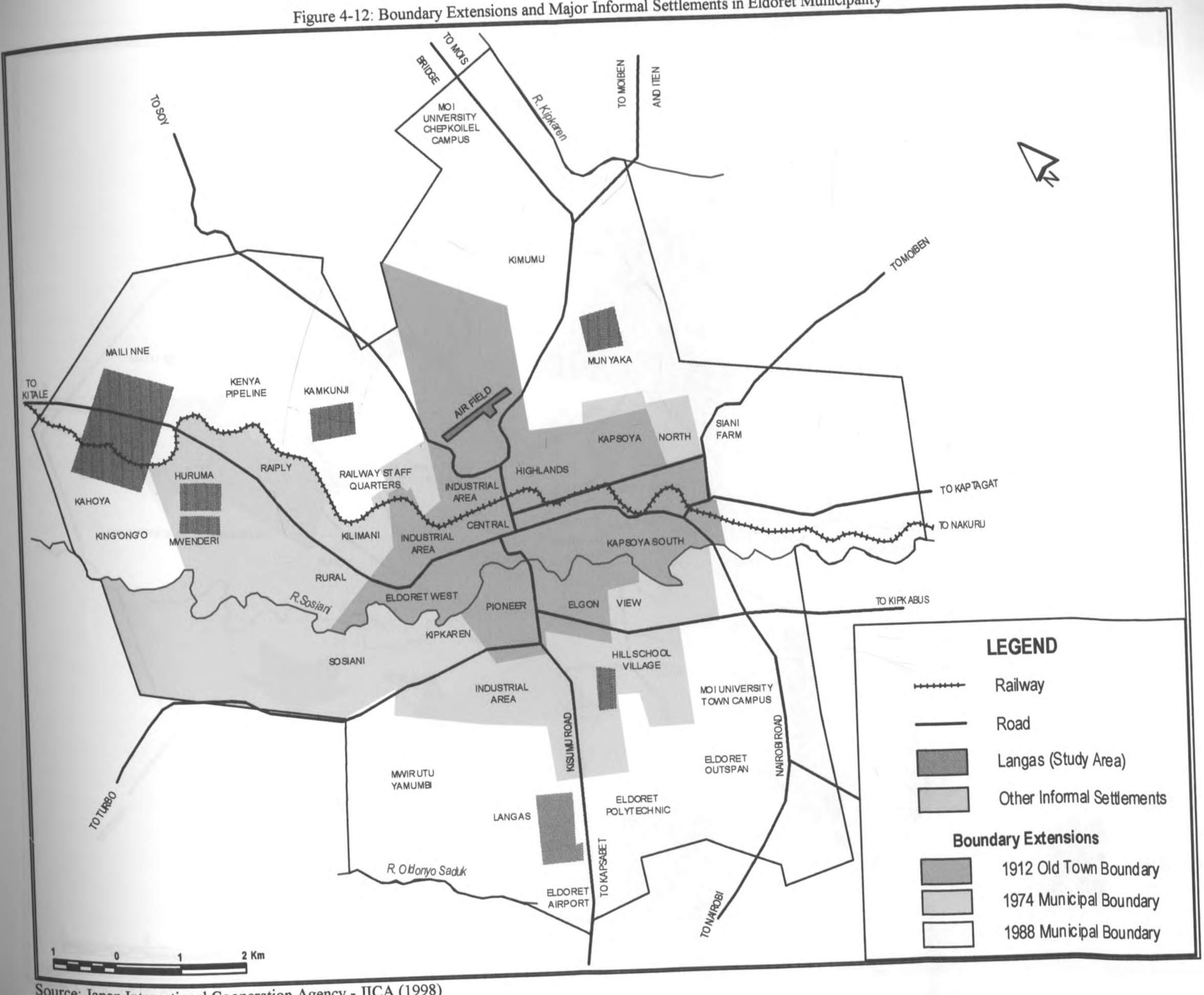
Source: Eldoret Municipal Co

Figure 4-11: Land Categorization in Eldoret Municipality



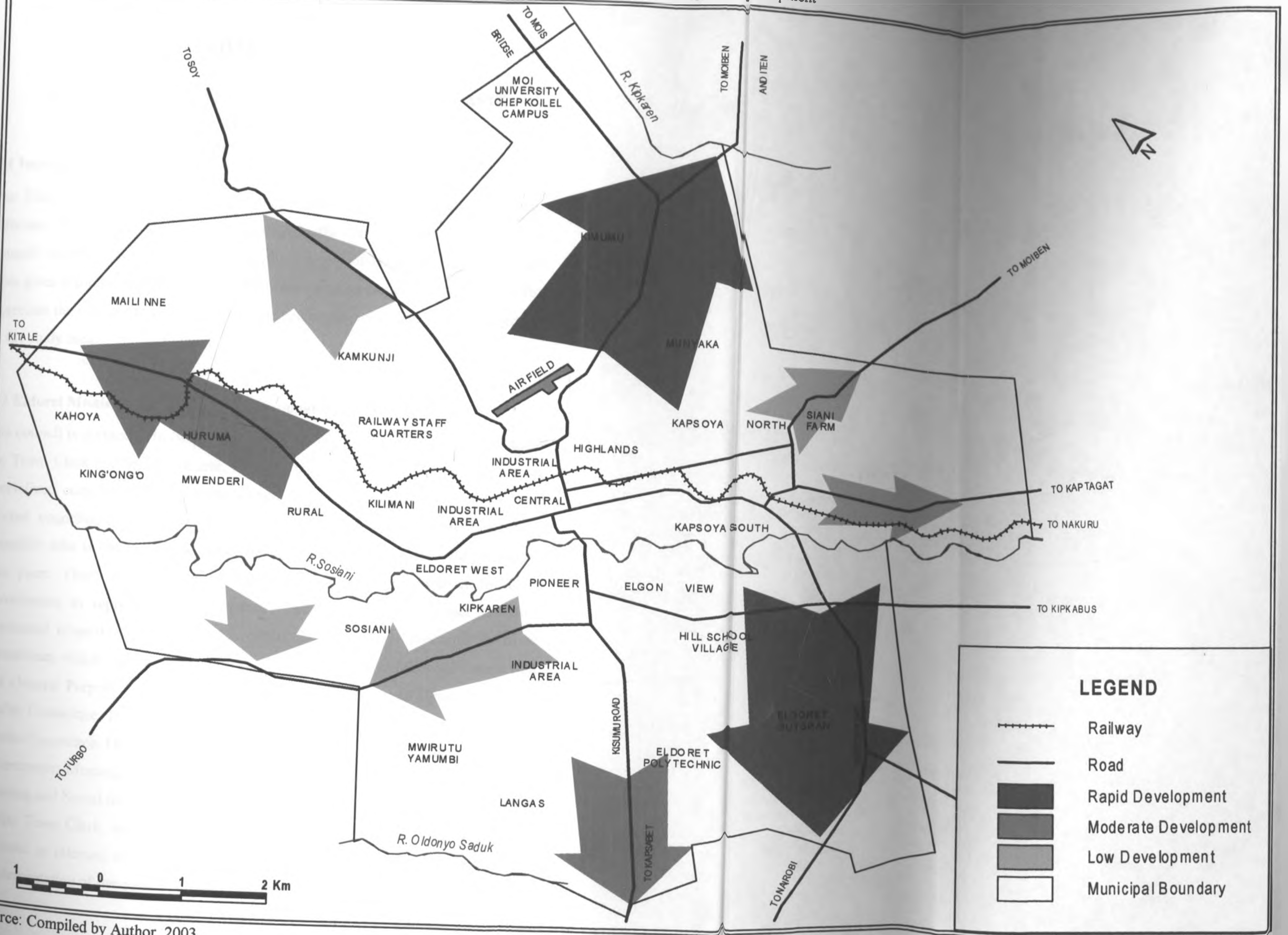
Source: Eldoret Municipal Council, 2003

Figure 4-12: Boundary Extensions and Major Informal Settlements in Eldoret Municipality



Source: Japan International Cooperation Agency - JICA (1998)

Figure 4-13: Eldoret Municipality – Future Directions of Spatial Development



Source: Compiled by Author, 2003

CHAPTER FIVE

ASPECTS OF DOMESTIC AND COMMERCIAL SOLID WASTE MANAGEMENT BY ELDORET MUNICIPAL COUNCIL

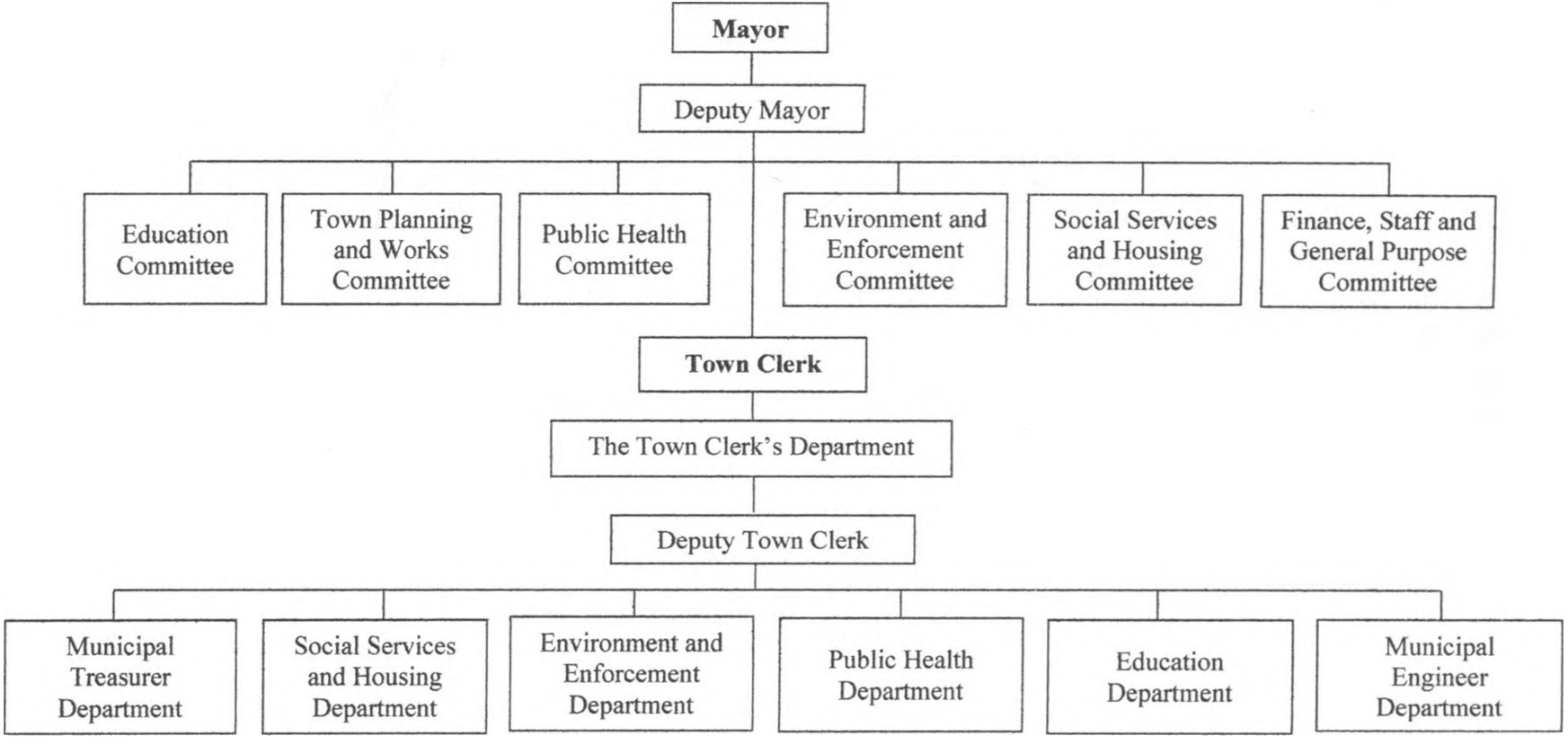
5-1 Introduction

The Eldoret Municipal Council is the major planning agency in Langas and other informal settlements within the municipality. In the context of this framework, the council interprets its mandate to include the delivery of infrastructure and services. This gives it formal responsibility for solid waste management. This chapter therefore examines the role of the council in domestic and commercial solid waste management in the study area.

5-2 Eldoret Municipal Council's Organizational Structure

The council is divided in to two sections namely the executive arm, which falls under the Town Clerk and legislative arm, which is under the Mayor. Legislature arm has specialized committees that run the council and are constituted of nominated and elected councilors. The council has ten electoral wards, each represented by a councilor who is elected by the public during the general elections held after every five years. There are also four nominated councilors by the Minister for Local Government to represent special interests. The District Commissioner is also a nominated councilor by virtue of his office. The council is structured in to six committees, which fall under the umbrella of the full council as follows: Finance, Staff and General Purpose Committee, Environment and Enforcement Committee, Public Health Committee, Housing and Social Services Committee and Town Planning and Works Committee. On the other hand, the council is also organized into six technical departments: Municipal Treasurer, Municipal Engineering, Public Health, Education, Housing and Social Services, and the Environment Departments. Directors, who report to the Town Clerk, head these departments. They also represent their departments/ sections in relevant committees as advisors during the committee proceedings and implementation of the council's resolutions (Figure 5-1).

Figure 5-1: Eldoret Municipal Council Organizational Structure



Source: Eldoret Municipal Council – Town Clerk's Department, 2003

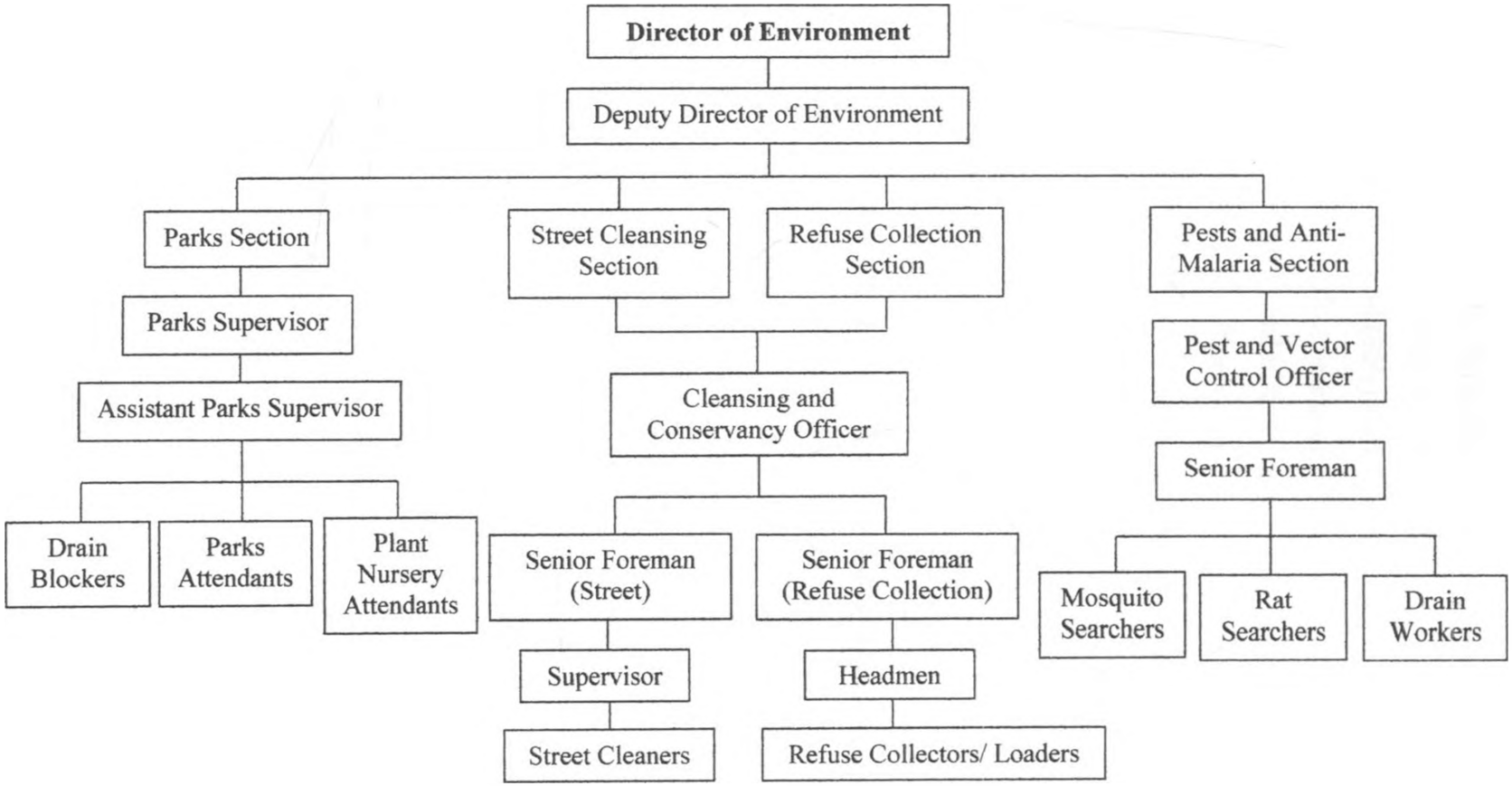
5-3 Organization and Capacity for Solid Waste Management

Solid waste management in the study area and other similar informal settlements is principally executed by the Department of Environment and Enforcement. However, because the Department of Public Health is also concerned with sanitation as mandated by the Public Health Act, Chapter 242 of the Laws of Kenya, it complements the Department of Environment in certain aspects (Appendix IV). Unlike the Department of Public Health whose main focus is on general sanitation, the Department of Environment and Enforcement specifically oversees the daily operations of storage, collection, transportation and disposal of solid waste, staff supervision and management. It also addresses consumer complaints, public education and legal aspects pertaining to solid waste management among others. It does these through its various sections (Figure 5-2).

As a department of the council, its operations are regulated by the Local Government Act, Chapter 265 of the Laws of Kenya. The Department is headed by a Director of Environment assisted by a Deputy Director. All specific aspects of solid waste management: storage, collection, transportation, and disposal are supervised by Cleansing and Conservancy Officer. The specific functions of the Cleansing Section are waste collection and transportation, street cleansing, roadside and estate drain cleaning, refuse disposal, supply households with refuse bins, dead animal collection, and destruction of condemned foods and other goods.

Although Enforcement Section is within the Department of Environment, it is not under the authority of the Director of Environment: it is directly controlled by the Town Clerk. The section has security officers (locally known as *council askaris)* whose main mandate is to enforce legislations such as those pertaining to solid waste management. Given that the Director of Environment works with personnel from Enforcement Section who he has no control over, this undermines his span of control in the department. The section is headed by the Senior Inspector who is supposed to be deputized by the Deputy Senior Inspector.

Figure 5-2: Organizational Structure for the Department of Environment



Source: Eldoret Municipal Council – Cleansing and Conservancy Section, 2003

The main factor that distracts the Enforcement Section from effectively executing its responsibility is the critical shortage of personnel. Most of the positions within the section are vacant. It has only 34 (60%) staff, against the required 56, hence a vacancy of 22 (40%). This limits the effectiveness of the section in ensuring that the council's by laws are enforced. Another notable factor undermining the operations of the section is low education levels of its officers. An overwhelming 81% of the staff in this important section lacks professional training which is paramount for their operation.

With this background, it is difficult to fully participate in policy formulation and implementation as well as appraisal of solid waste management projects. For instance, out of the 853 offences reported in the study area in 2003, 5% involved construction of illegal structures, 16% indiscriminate solid waste disposal, 33% hawking and 46% keeping of straying animals. Indiscriminate solid waste disposal accounted for just 33% of the total number of offenders apprehended in Langas, yet the area is characterized by a lot of illegal dumping sites as witnessed during the field survey. This poor performance has been accelerated by the fact that it is constraining for 34 officers to enforce council's laws considering that they have to police over 200 000 residents within the municipality. This represents a ratio of one officer for every 50000 people for the entire municipality, or one officer for every 1200 people in Langas.

It is also worth noting from Figure 5-2 that although the Parks and Pest, and Anti-Malaria Control Sections are also within the Department of Environment, it is the Cleansing and Conservancy Section which executes the cycle of solid waste management that encompasses storage, collection, transportation and disposal. The Department of Environment is supposed to have four administrative personnel to oversee all the aspects pertaining to solid waste management in the study area. However, by the time the field survey was being concluded, all these positions were vacant. The positions of the Director of Environment and that of the Cleansing and Conservancy Officer were held by officers on acting capacities. The implication of this arrangement to solid waste management is that these officers are less motivated to

work. If the posts were to be advertised, they must send formal applications to the Public Service Commission of Kenya (PSC), and vetted alongside other potential applicants. Most of these officers have ended up retiring in their acting positions. Table 5-1 present the distribution of administrative personnel involved in solid waste management within the Department of Environment of the council:-

Table 5-1: Administrative Personnel Involved in Solid Waste Management

Designation of Officer	**Recommended**	**Present**	**Vacancy**
Director of Environment (acting)	1	-	1
Deputy Director of Environment	1	-	1
Administrative Officer	1	-	1
Cleansing and Conservancy Officer (acting)	1	-	1
Total	**4 (100%)**	**-**	**4 (100%)**

Source: Eldoret Municipal Council -Town Clerk's Department, 2003

Table 5-1 reveals that although four personnel are recommended to administer the department, all their positions are currently vacant. On the other hand, as Table 5-2 reveals, out of the 313 recommended technical personnel in Cleansing and Conservancy Section, only 42% are present, reflecting a deficit of 58%. The most affected cadres are those of refuse collectors/loaders and street sweepers/cleaners. Although 200 sweepers are recommended by the council, only 54 are available. Similarly, the section has a shortage of 24 refuse loaders/collectors.

Table 5-2: Technical Personnel Involved in Solid Waste Management

Designation	**Recommended No.**	**Present No.**	**Vacancy**
Senior Foremen (streets cleaners)	1	1	-
Supervisor (street cleaners)	1	2	1
Senior Headmen (refuse collection)	1	1	-
Headmen	5	5	-
Drivers	5	5	-
Loaders/ Refuse Collectors	80	56	24
Sweepers/ Street Cleaners	200	54	146
Drain Blockers	20	10	10
Total	**313(100%)**	**134(42%)**	**181 (58%)**

Source: Eldoret Municipal Council -Town Clerk's Department, 2003

Because the number of available technical personnel is not adequate to effectively serve the entire municipality, it is only the central business district that is covered on a daily basis in terms of solid waste collection. This explains why the service delivery in Langas and other informal settlements is not satisfactory, resulting to several unattended dumping sites. It is therefore clear that Eldoret Municipal Council does not have the capacity to effectively manage solid waste generated in the study area.

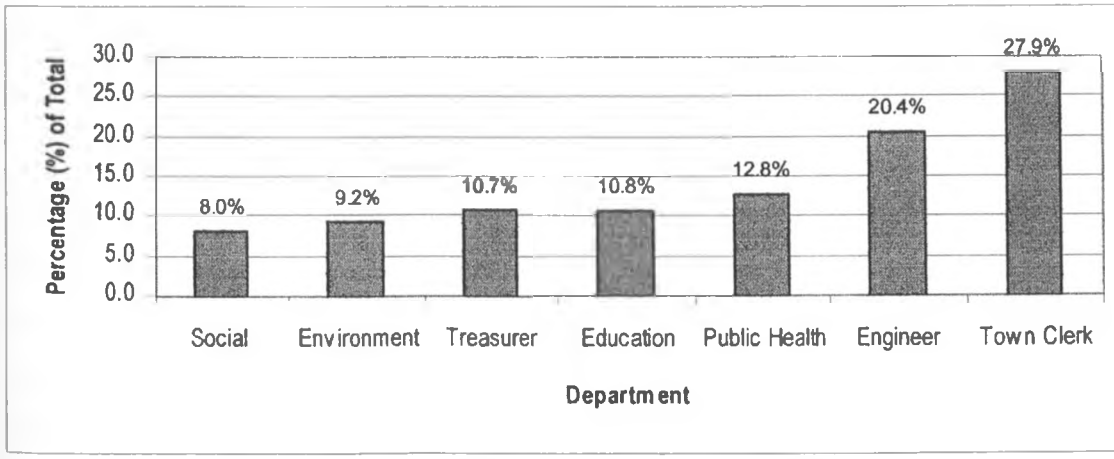
5-4 Financial Aspects of Solid Waste Management

Adequate funding is crucial for any local authority to sustain its service delivery. Eldoret Municipal Council is equally expected to generate adequate income to sustain solid waste management in the municipality, specifically within the study area. This section presents the financial aspects of solid waste management by the council.

5-4.1 Budgetary Allocation to Council's Departments

Each of the six departments of the council prepares budget drafts of their departments where the past performance and the future projections are presented. The drafts are approved by Finance, Staff and General Purpose Committee, and then forwarded to Ministry of Local Government for final approval. Figure 5-3 presents the percentage of total budgetary allocation to each department during 2002/2003 financial year:-

Figure 5-3: Budgetary Allocation to Council's Departments



Source: Eldoret Municipal Council Annual Budget Report, 2002/2003

As Figure 5-3 reveals, during 2002/2003 financial year, out of Kshs. 225 838 085 budget allocated to all the council's departments, the Department of Environment, which is in charge of solid waste management received a scanty 9.2% of the total compared to 12.8%, 20.4% and 27.9% allotted to Public Health, Municipal Engineer and Town Clerk's Departments respectively. If the expenditure of all the six departments is further considered, they recorded a deficit of Kshs 25 million (Appendix X). Candidly, low budgetary allocation to the Department of Environment has significantly undermined the extent to which it can be relied upon as the key department responsible for solid waste management in the study area.

5-4.2 Budgetary Allocation to Solid Waste Management

During 2000/2001 financial year, 70% of the total expenditure for the Department of Environment was approved for personnel salaries, but the actual expenditure on this later increased to 91%. On the other hand, 25% of expenditure was approved for operations, only to decline to 4% of the total actual expenditure. Similarly, maintenance represented 5% of both approved and actual expenditure.

Table 5-3: Expenditure (Kshs.) on Refuse Management, 2000/2001

Aspect of Management	Approved Expenditure	% of Approved Expenditure	Actual Expenditure	% of Actual Expenditure
Personnel	213640	70%	3709574	91%
Operations	75180	25%	147782	4%
Maintenance	16300	5%	207590	5%
Total	**305120**	**100%**	**4064946**	**100%**

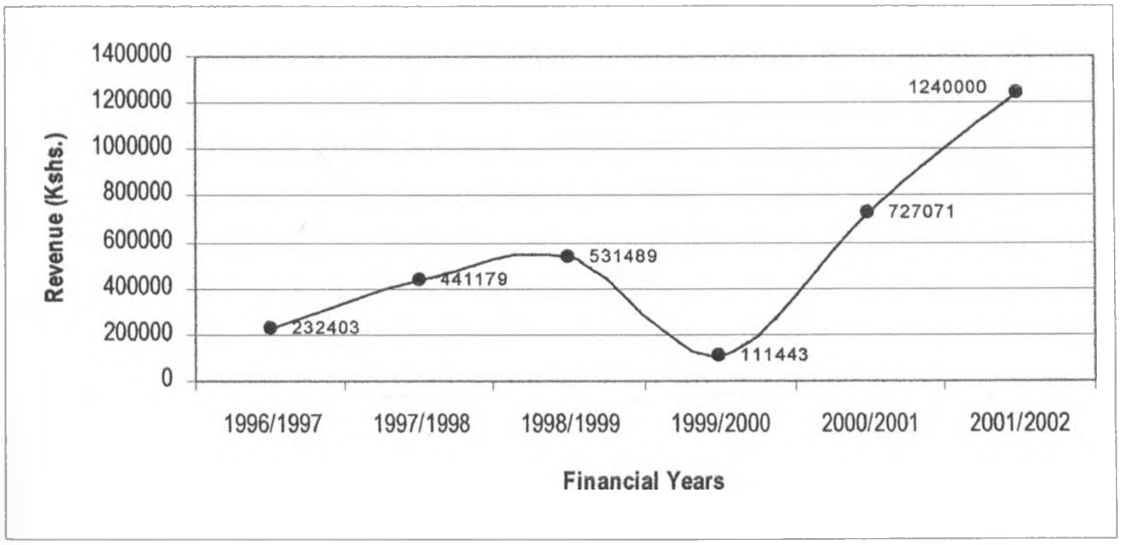
Source: Eldoret Municipal Council - Annual Budget Report, 2000/2001

It is evident from Table 5-3 that much of the council's actual expenditure is allotted to financing personnel salaries (91%) as opposed to operations and maintenance – actual solid waste management (9%). This is far much below the Africa, Asia and South American countries average of 95% and that of developed countries which is 70%. This arrangement characterized poor budgeting further limits the Department of Environment from improving solid waste management services in the study area.

5-4.3 Revenue Collection from Solid Waste Management

As Figure 5-4 presents, the revenue realized by the council from solid waste management service declined significantly between 1997/1998 and 1999/2000, with the greatest decline recorded in 1999/2000 financial year. This occurred when the Department of Environment was still under the Department of Public Health, an indication that many people were not paying conservancy fees. Revenue collection however increased remarkably in 2000/2001 financial year, with a further increase recorded during the 2001/2002 financial year when Environment Department was established, and the by–law on solid waste management subsequently enacted.

Figure 5-4: Revenue Collection from Solid Waste Management



Source: Eldoret Municipal Council – Municipal Treasurer's Department, 2003

Despite the achievements in revenue collection between 1999/2000 and 2001/2002 financial years respectively, the revenue collected by the council from conservancy service is still below the expectation and cannot be relied upon to effectively sustain the service delivery in the study area and the greater municipality in general. Many residents are still not paying for the service, especially within the informal settlements such as Langas where average incomes are relatively low. It is apparent that if revenue collection from conservancy service offered can be improved, then solid waste management in the municipality can be self sustaining.

5-4.4 Local Authority Transfer Fund

Local Authority Transfer Fund (LATF) transfers 5% of the total income tax revenues from the central government as grants to local authorities in Kenya for development purposes. As a condition for receiving LATF, all local authorities are required to clearly elaborate their Local Authority Service Delivery Plans (LASDP) in consultation with the local community. This provides an opportunity for integrating greater community participation in the local planning process and is the basis of the government's evolving policy on decentralization.

Although the Eldoret Municipal Council is expected to integrate community in the identification of the priority projects for LASDP funding, it has never prepared such a plan, yet it continues receiving LATF. This is a positive indication that council gives community participation a scanty attention when identifying priority projects such as those related to solid waste management especially in the study area. Table 5-4 presents a summary of the council's LATF budget for 2001/2002 financial year.

Table 5-4: Eldoret Municipal Council's LATF Budget (Kshs.) for 2001/2002

Priority Development Project	Project Priority Rank	Development Cost (millions)
Computerization	1	1
Wholesale market wall	2	2
Revenue collection vehicle	3	12
Cemetery	4	1
Refuse collection vehicle	5	5
Three (3) ton lorry	6	2
Street lighting and installation	7	1

Source: Ministry of Local Government – Department of Urban Development, 2003

As Table 5-4 reveals, during 2001/2002 financial year, out of the seven capital projects funded by LATF allocated to the Eldoret Municipal Council, solid waste management was given a low priority rank of 5 out of 7, with computerization scoring the highest rank of 1. This further articulates that the council does not view solid waste management as a major planning priority.

5-5 Solid Waste Storage

Ideally, Eldoret Municipal Council should be providing residents in Langas with receptacles which are of two types: individual (primary) and communal (secondary). The facilities are also of different sizes and made of different materials, but expected to be animal proof, insect proof and weather proof, washable and robust enough to meet the exigencies of normal use. A variety of temporary facilities are used in the study area. Twenty liters dustbins were initially provided by the council, but were susceptible to theft and vandalism by scavengers who tried to recover materials for sale. As observed during the field survey, most of these temporary facilities do not protect against the breeding of insects and rodents. The council has further set out the standard requirement for receptacles used within the municipality. It stipulates that every dustbin shall be of size and pattern approved, and must be of not greater than 39 m^3 feet or $1.1m^3$, and not less than 2.5 m^3 or $0.07m^3$, provided by suitable handles, provided with close fitting water and fly proof lid, or any other refuse container of the type and pattern approved by the council. Contrary, most of the residents in the study area use a variety of materials such as polythene bags, metallic and plastic buckets which do not conform to these standards.

5-5.1 Distribution of Secondary Receptacles

The council hires out to the owner or occupier of any premise approved refuse bins at a specified charge in the study area. Table 5-5 presents the distribution of "din" standard containers ($1.1m^3$) (Plate 5-2) in the residential areas within the municipality.

Table 5-5: Distribution of "Din" Standard Containers

Residential Area	No. of Receptacles	% of Total	Residential Area	No. of Receptacles	% of Total
Kahoya	14	9	Elgon View	3	2
Kamkunji/Bacon	19	12	Munyaka	1	1
West Indies	10	6	Huruma	57	37
Pioneer	16	10	Kapsoya	3	2
Langas	23	15	Race Course	9	6

Source: Eldoret Municipal Council – Cleansing and Conservancy Section, 2003

The council has a total of 155 "din" standard containers, which it hires out at a fee of Kshs 280 per month. As indicated in Table 5-6, although Langas has the highest population in Eldoret Municipality, it has only 15% of the total standard containers supplied by the council. This encourages most of the residents to resort to indiscriminate dumping of solid wastes, which pollute the environment. Another reason why Langas has fewer receptacles is that the area is a low-income settlement; this limits most of the residents from hiring them and instead concentrates on meeting basic necessities, preferably food and rent.

By referring to the council's regulations, if a user default paying the rental fees for a hired receptacle, an extended period accompanied by a warning notice is given after which if he or she does not further comply, the receptacle is immediately withdrawn. Table 5-6 therefore presents the number of "din" standard containers withdrawn from various residential areas within the municipality as well as the amount due in 2002.

Table 5-6: Amount Due from "Din" Standard Containers Withdrawn in 2002

Residential Area	Amount Due	% of Total	Residential Area	Amount Due	% of Total
Huruma	34200	9	Kapsoya	60000	16
Elgon View	45000	12	Munyaka	15000	4
Langas	62000	17	Road Block	32000	9
Race Course	30000	8	West Indies	90000	24

Source: Eldoret Municipal Council – Cleansing and Conservancy Section, 2003

Generally, out of the Kshs. 368 200 owed to the council by defaulters from various estates, 17% of this amount was due from Langas. This position has made it difficult for the Eldoret Municipal Council to improve its capacity in solid waste management as a result of less revenue collected from receptacles hired. A further impact of withdrawing the receptacles is that many residents resort to crude open dumping without consideration to environmental quality. Evidently, this is among the factors that have plagued poor domestic and commercial solid waste management in Langas.

Plate 5-1: A Full Bulk Storage Container ($11m^3$)

Note that the traders dispose of their wastes on the ground because the receptacle is full; this not only degrades the environment, but also threatens public health.

Plate 5-2: A Cow Feeding from a full "Din" Standard Container ($1.1m^3$)

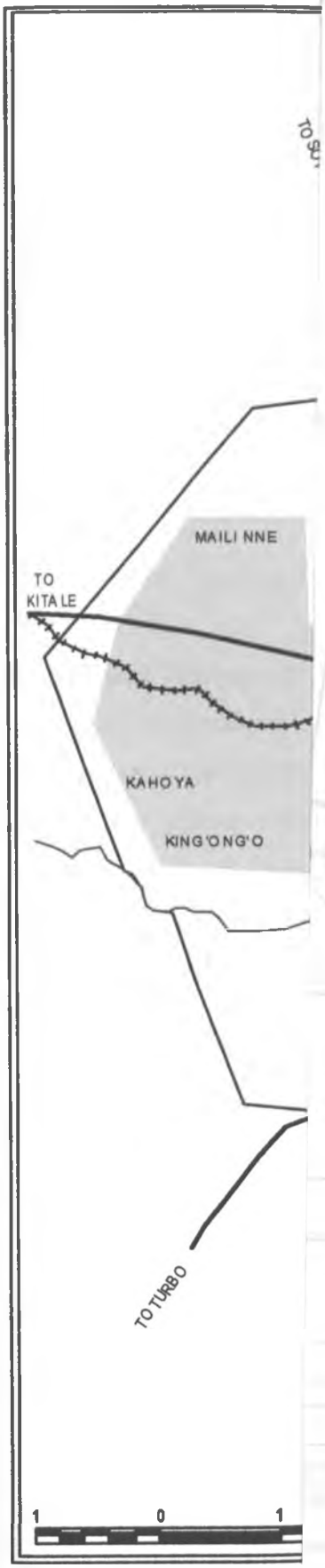
Lack of regular waste collection encourages scavenging animals to feed on wastes. Currently, it is illegal to keep such straying animals within the municipality. The receptacle has no cover; this represents poor maintenance of equipment by the council

Whereas the council hires the "din" standard containers at Kshs. 280 per month, it on the other hand hires the bulk containers ($11m^3$) (Plate 5-1) at Kshs. 960. These containers are normally placed at market places (no fee charged since all the markets are owned by the council), hired by institutions and industries. Langas previously had one bulk container, but was withdrawn. In total, the council has 20 bulk containers. Just like the "din" standard containers, the number of bulk containers in Eldoret Municipality has never been increased since 1989 when they were donated by the Italian Government. This not only exhibits inadequacy in solid waste management considering that the municipality currently requires over 250 bulk containers, but also represents a deficit of 92%. Similarly, though the council requires over 1000 "din" standard receptacles, it has only 155.

5-6 Solid Waste Collection

The council has the responsibility of collecting wastes from the study area. It does this through its Cleansing and Conservancy Section within the Department of Environment. Given that the number of available personnel is not adequate to effectively serve the entire municipality, it is only the central business district that is covered on a daily basis in terms of solid waste collection. This justifies why solid waste collection service in Langas is not adequate, resulting to several unattended dumping sites as observed during the field survey.

Solid waste collection in Eldoret Municipality is conducted five days a week - Monday to Friday. Saturdays are normally used for follow-ups: to assess the performance registered in the course of the week (Figure 5-5). All the residential areas, including Langas are supposed to be covered once a week, except the central business district, which is covered on a daily basis due to its high day time population density. However, the field survey revealed that solid waste collection in Langas is always irregular. The council's collection crew covers an average of 10 residential areas per day. Before the current refuse collection programme was adopted in the year 2001, the municipality was divided into 10 refuse collection zones. The system was however replaced with the current programme presented in Table 5-7.



Source: Eldoret Municipa

Table 5-7: Solid Waste Collection Programme

Day	Area Covered in the Municipality
Monday	West Indies, Ndalat, Bondeni, Railways, Steel Mills, Unga Area, Mitaa Road, Railways and Kithuga Square
Tuesday	Uhuru Estate, Kidiwa, Old Uganda Road/Bacon, Rural Housing, Raiply, Mwenderi, Huruma, King'ong'o, Road Block, Baringo and Maili-Nne
Wednesday	Pioneer A, Eldoret Polytechnic, Race Course, Kemboi Farm, Elgon View, Pioneer Estate, Kipkaren, Langas, Hill School, Eldoret International Airport
Thursday	Kapsoya A, Moi Girls School, Kenya – Re, Kimumu, Hawaii, Kapsoya Site and Service, Jerusalem, Marura, Munyaka, Muthirithia and Cyrus Farm
Friday	Kapsoya B, Lochab Quarters, Ken – Knit, Nandi Road, RVTI, KCC, Moi Referral Hospital Area, Sungunanga, and other busy estates
Saturday	Weekly follow ups

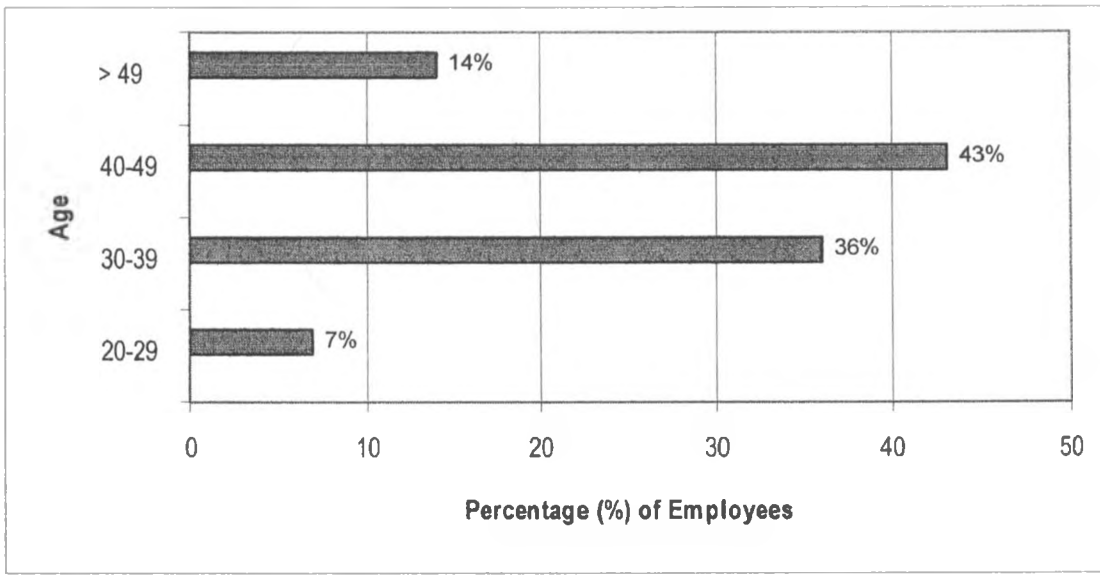
Source: Eldoret Municipal Council – Cleansing and Conservancy Section, 2003

In retrospect, the major limitation of the above programme is that since it covers an average of 10 neighborhoods per day, it assumes that population is equally distributed in these areas. According to the current population projection, over 40% of the residents in Eldoret Municipality live in Langas. The contention is that because Langas harbours the highest number of people in the municipality, it also has the highest solid waste generation rate. Low and irregular solid waste collection frequency is hence among the factors affecting the council's solid waste management initiatives, particularly in Langas. In the year 2000, for example, the average amount of solid waste collected by Eldoret Municipal Council was 1278 metric tons, compared to 1433 and 1598 metric tons in 2001 and 2002 respectively.

Other factors precluding solid waste collection service as offered by the council in the study area are unprogrammed leaves and off, and unwarranted absenteeism recorded by refuse collectors. In general, 88, 98 and 131 days were lost through leaves, absenteeism and offs respectively between January and July 2003 when the field survey was concluded. If this trend is not pre-empted, the operational capacity of the council as the major planning agency in charge of solid waste management will continue being inadequate in Langas and other similar informal settlements

An examination of the age distribution of the personnel involved in refuse collection within the Environment Department further revealed that the average age of the 56 personnel was 41 years. From a planning perspective, delivery of solid waste management service in the study area should be envisaged as a long term planning strategy. The council should ensure that it has enough technical personnel to sustain solid waste management projects in the long term. Figure 5-6 presents the age distribution of refuse collection personnel within the Department of Environment.

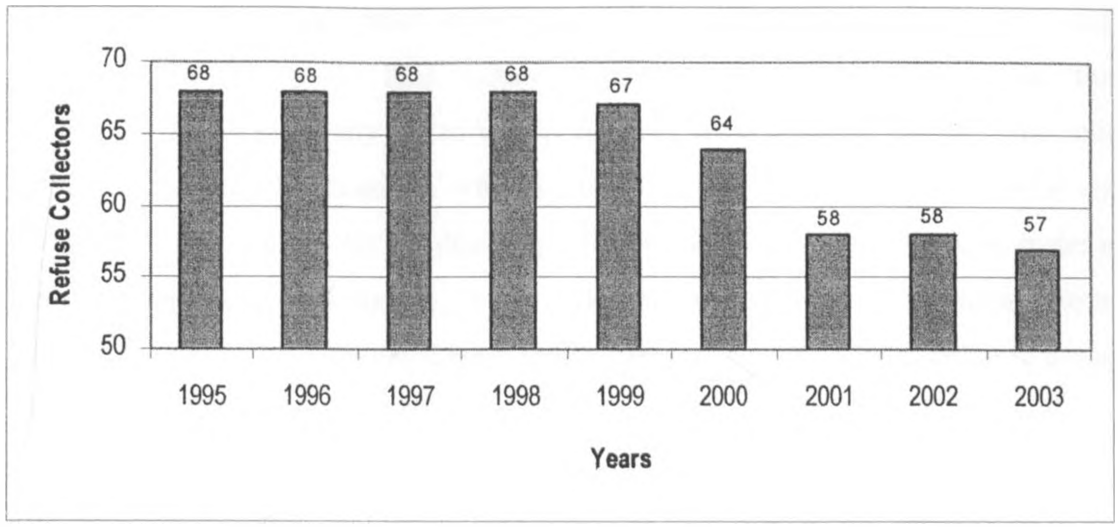
Figure 5-6: Age Distribution of Refuse Collectors



Source: Eldoret Municipal Council – Cleansing and Conservancy Section, 2003

In reference to the refuse management, it is clear from Figure 5-5 that in the next 15 years, 57% of employees will have retired from service after attaining the mandatory age of 55. As already observed, when such vacancies occur, it normally takes too long before new employees are recruited. This is mainly due to the council's weak financial base, and equally represents another factor that is likely to accelerate poor solid waste management in Langas. As also presented in Figure 5-7, the number of refuse collectors within the Department of Environment has been declining tremendously since 1995. If the trend were also to continue in the next 15 years with little or no replacements, then total workforce for the department will further decline.

Figure 5-7: Number of Refuse Collectors, 1995 - 2003



Source: Eldoret Municipal Council – Cleansing and Conservancy Section, 2003

As the Figure depicts, in 1995, the Department of Environment had 68 refuse collectors, compared to 57 in 2003. This represents a decline by 19% in a span of nine years, and can be partially attributed to retirements, but more so to lack of regular recruitments by the council. In conclusion, if solid wastes are allowed to rot due to irregular collection, they pose health hazards by creating breeding grounds for disease carrying vectors. Due to irregular solid waste collection in Langas, the records from the Public Health Department revealed that 433 patients were diagnosed to be suffering from various diseases related to poor solid waste disposal and sanitation in 2002. Out of these patients, 91% were diagnosed to have contracted malaria parasite, 8% tapeworms and 1% bilharzia respectively.

5-7 Solid Waste Transportation

The objective of solid waste collection system in Langas is to transport wastes collected from specific locations at regular intervals, to a disposal site at a minimum cost. The transportation of solid waste in the study area is primarily the mandate of the council and is largely governed by its by-laws which determine the legal and administrative arrangements for collection and disposal. Collection of waste stored in "din" standard containers ($1.1m^3$) is done using a 4 ton compacting truck (minimatic).

The minimatics load into themselves mechanically and empty bins put in the same place. When minimatics have collected enough garbage, it hauls it to a self-compacting stationary 20 tons transfer container (pactainer). This means that minimatics do not make any trip to the tipping site, but discharges the collected solid waste into the transfer container. When pactainer is full, it is lifted by a multilift and transported to the refuse tip for discharge. Minimatic trucks are suppose to make at most two trips to transfer station per day, while the transfer station is supposed to be taken to the tip once in two days, but in some cases it stays for a week or more owing to the frequent breakdown of multilift.

The bulk containers ($11m^3$) are hauled when full by multilift and transported to the tipping site (Plate 5-5) and the empty container returned to the same place. A multilift does a dual purpose of hauling the transfer container and the bulk container. The bulk container is carried to the dump site for refuse discharge, once in two or three days (in market place) or when it is full of garbage in other areas. The trucks go round the study area where the solid wastes are expected to be brought by generators or street cleaners to where the vehicles are. Collection crews then empties dustbins into trucks and the empty bins are given back to the owner. In some cases, the collection crew picks the dustbins from the curb and empties them into their truck. The crew is supposed to follow a set schedule, but because of inadequate vehicle and the wider area to be covered, the schedule is never adhered to, with the informal settlements such as Langas being the most affected neighborhoods.

Side loader (non – compacting) and rear compactors make at most two trips a day to the tip site. In 1989, the Italian Government in cooperation with the Kenyan Government undertook a solid waste management study, which resulted in the funding of storage, collection and transportation of solid wastes in Eldoret Municipal Council among other towns. Eldoret was given a loan of Kshs. 32 million. This enabled the council to procure various equipment for solid waste transportation, however, transportation and collection of solid wastes in the Langas is still being hampered by lack of enough equipment as presented in Table 5-8:

Table 5-8: Solid Waste Transportation Vehicles and Related Equipment

Equipment	Required	Available	In Good Condition	In Bad Condition
Minimatics	8	4	1	3
Compactors	4	2	2	1
Side-loads	8	5	4	1
Multilifts	2	1	1	-
Pactainers	4	4	1	3
Shovels	2	1	-	1
Total	**26 (100%)**	**18 (69%)**	**9 (50%)**	**9 (50%)**

Source: Eldoret Municipal Council – Cleansing and Conservancy Section, 2003

To enable it efficiently deliver solid waste management service, the council requires a total of 26 transportation and related equipment. However, it currently has 16% of this, out of which 50% are in good working condition and 50% grounded.

5-7.1 Attributes of Solid Waste Affecting Transportation

With a reference to the council's reports on solid waste management, solid waste generated in Langas constitutes over 60% organic content, and that due to its high moisture content, on average, the waste density recorded is over 500 kg/m^3, making it very heavy for transportation. Likewise, road sweepings from inadequately surfaced roads as the case of Langas generate a considerable quantity of inert abrasive materials. Given that all solid waste collection vehicles used by the council were imported from Europe, they are totally inappropriate for the high density and heavy loads of solid waste generated in the study area. This is one of the factors that contribute to the frequent breakdown of the compactor trucks used by the council, hence a decline in the amount of solid waste collected from Langas.

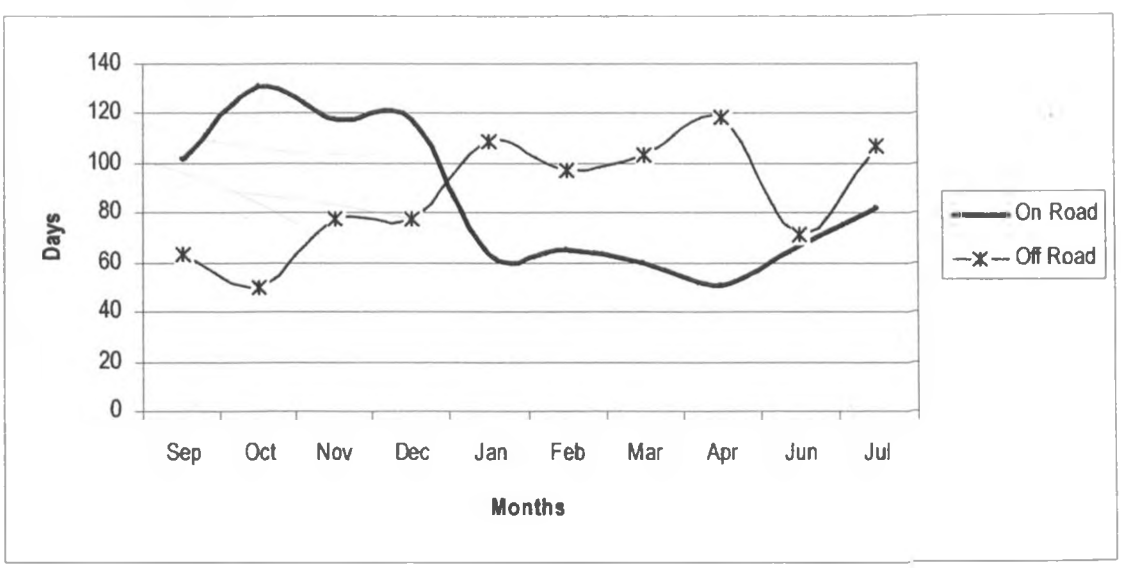
The council's records further indicated that solid waste generated in the study area contains high percentage of putrescible materials (54%), such as vegetable and other foods. During hot seasons, they decompose yielding acidic compounds which corrode collection vehicles. This equally reduces the number of years in which the vehicles could be used, leading to a decline in refuse collection. Frequent breakdown of the refuse trucks also makes them expensive to maintain.

In case of break downs, the spare parts must be imported because they are not readily available locally (Plate 5-3). Moreover, the procedure to follow in acquiring funds to purchase the spare parts takes too long. This is because the full council, which do not meet regularly, must approve such an activity, and when it does, there is always no guarantee that it will approve the proposal. Consequently, dilapidated roads (Plate 5-4), which also contribute to breakdown of refuse collection vehicles; have also made it difficult to access informal settlements such as Langas.

5-7.2 Working Days Lost Due to Equipment Breakdown

The council's records revealed that the number of working days lost by solid waste collection vehicles due to breakdowns has been increasing more that the number of days spent on the road. Between September and December 2002, for example, the vehicles spent 269 days on the road compared to 469 days spent in the garage for repairs. Similarly, in 2003 (January to July) 606 days were lost in garage against the 469 days spent on the road. Figure 5-8 shows the trend of days spent on road, as well as those lost due to breakdown of refuse collection vehicles between September 2002 and July 2003. This limits the council's initiatives towards the service delivery.

Figure 5-8: Days Lost and Spent on Road by Collection Vehicles



Source: Eldoret Municipal Council – Cleansing and Conservancy Section, 2003

Plate 5-3 Grounded Solid Waste Collection Vehicles

Most of these vehicles were imported from Europe, hence unsuitable for the local conditions such as poor roads in Langas.

Plate 5-4: A Road in Poor Condition

Note the illegal dumping site located on the road reserve and a big pothole on the road. Such roads contribute to the frequent break down of collection vehicles.

5-8 Solid Waste Disposal by the Eldoret Municipal Council

Open disposal is the technique used by the council to dispose of solid wastes collected from Langas and other informal settlements. Disposal is done at a 20-year-old discarded quarry, which was adopted without conducting an environmental impact assessment (Plates 5-5, 5-6 and Figure 5-9). Far from the site being full, the roads to it are always rendered impassable during the rainy seasons. This prompts many truck drivers to dispose of wastes in undesignated locations. Another factor that also discourages the truck drivers from disposing of wastes at the main tipping site is the foul smell that emanate from the decomposing and burnt wastes.

During the survey, it was observed that truck drivers at the dumping site are not provided with necessary equipment such as masks, gloves and other clothing relevant for handling wastes. This exposes them to dangers of contracting respiratory diseases, as well as sustaining physical injuries. Controlled tipping used to be done by a shovel to level and compact wastes at the site; however, this is no more since it broke down several years ago. This has made wind to easily carry wastes to the neighborhood. The disposal site is also not fenced, and is located on the riparian reserve of River Sosiani. The arrangement not only undermines public health at the nearly residential neighborhood, but also pollutes River Sosiani (Figure 5-9).

Crude dumping is still dominant at the site, despite the fact that the council's personnel manage it. Owing to the exhaustion of the quarry tip, the council authorities proposed a new dumping site at *Maili-Nne*, but faced a strong opposition from the public. This is a natural depression, which if constructed will cost less compared to an engineered flat land. Considering the density of development, public opinion and the general wind direction, the place is unsuitable for such type of development. Other proposed sites are old quarries within the jurisdiction of the municipality and within economic distances. Considering the current disposal option used by the council, there is a need to explore for an alternative site that would be used for a longer period so as to sustain solid waste management in the study area.

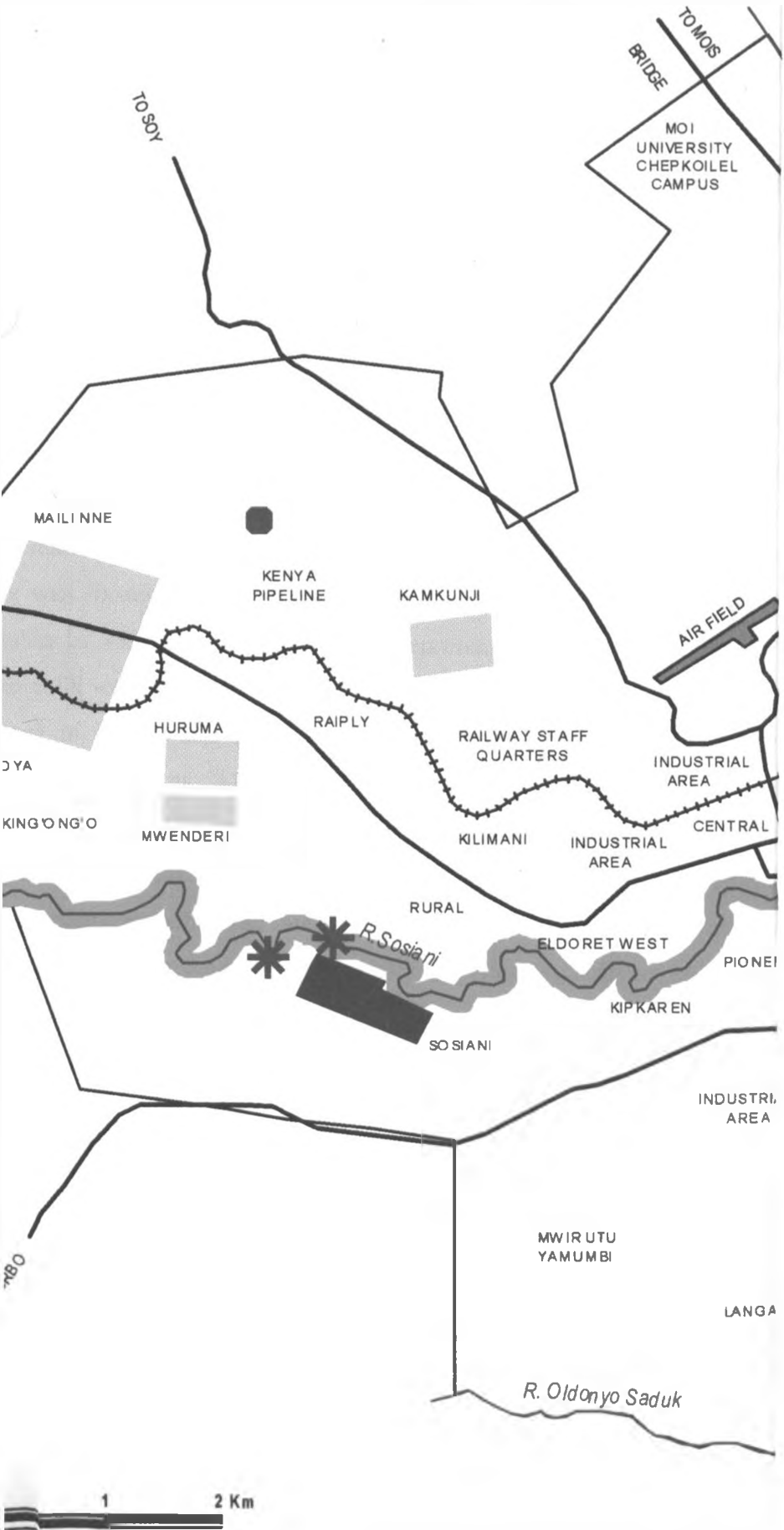
Plate 5-5: Crude Dumping at the Council's Disposal Site

Refuse collection vehicles are stationed on top of the cliff and wastes hauled down the slope. Prevalence of plastics at the site indicates lack of initiative in resource recovery

Plate 5-6: Extension of the Disposal site on Riparian Reserve

The council's tipping site is located on River Sosiani's riparian reserve. At the background are the sewage works. Note the scavengers at the right hand foreground.

Figure 5-9: Location of C



urvey, 2003

5-9 Status of Eldoret Municipal Council in Multi-Sector Partnership

As the major planning agency, Eldoret Municipal Council has a central role of establishing viable partnership with other sectors and institutions within the municipality, with an objective of enhancing solid waste management in Langas. However, the survey found out that the council never integrates any institution: non-governmental organizations, community based organizations and central government agencies, which include various government departments and ministries based in the municipality, in its initiatives towards policy formulation and project implementation. None of these sectors is represented during the environmental committee meetings where pertinent issues pertaining to solid waste management are discussed. An extensive examination of the records at the Department of Environment revealed that although there was six-registered community based organizations in Langas with a total membership of 135; none of them has a representation during the council's deliberation on solid waste management. This underscores why they do not engage in activities related to solid waste management; instead they concentrate on socio-economic activities such as AIDS (Acquired Immune Deficiency Syndrome) awareness campaigns and loaning schemes. Since Eldoret Municipal Council has failed to integrate other institutions in its endeavors towards solid waste management in the informal settlements within the municipality such as Langas, it is expected that the problem of solid waste management, especially in policy formulation and project implementation, would continue being prevalent.

5-10 Summary

It is apparent from the foregoing analysis that Eldoret Municipal Council has failed to effectively discharge all its responsibilities pertaining to solid waste management. Some of these include storage, collection, transportation, processing and recovery, disposal and budgetary allocation among others. The chapter has validated the first hypotheses set that lack of a comprehensive solid waste management plan has significantly contributed to inadequate domestic and commercial solid waste management in Langas and other informal settlements within the municipality.

CHAPTER SIX

HOUSEHOLDS PARTICIPATION IN DOMESTIC SOLID WASTE MANAGEMENT IN LANGAS

6-1 Introduction

The previous chapter examined the role of Eldoret Municipal Council in domestic and commercial solid waste management in the informal settlements within the municipality. This chapter examines some of the aspects of household participation in domestic solid waste management in the study area. Since households are the prime generators of solid waste in Langas, in order to understand their level of participation in the subject matter, the chapter begins by examining their socio – economic profile.

6-2 Household Socio – Economic Profile and Solid Waste Generation

The field survey revealed that the average household size in Langas was four. From the sampled household, 6% had attended some tertiary college, 30% high school, 58% primary school, while 6% had no formal education. It can therefore be deduced that literacy level in Langas is approximately 86%. However, given that 64% of the respondents have either not attained any formal training, or attained primary education, it is apparent that their capacity to conceptualize some of the basic principles of solid waste management is limited.

It was also found out that the average household income per month in the study area was Kshs. 4076 (US$ 1.72 per day) compared to an average expenditure of Kshs. 3857(US$ 1.66 per day)[15]. Much of the households' income in Langas is oriented towards paying house rent and buying food. These are perceived as the most basic needs that must be prioritized. Needless to add that since their propensity to save is very minimal, this underscores why most of the households in Langas do not pay or are not willing to pay for an improved solid waste collection service as offered by Eldoret Municipal Council.

[15] By the time the survey was concluded in September 2003, 1 US $ was exchanging at Kshs. 78. The balance after expenditure is less than 1 US $ per day.

The study assumed that the income affordability for solid waste management by households in Langas was 1% of the total monthly income. This compares well to that of other cities in Africa and Asia and South America. With an average income of Kshs. 4076 per month, the affordability limit for solid waste management of the households in the study area is estimated to be Kshs. 40. This is a clear indication that privatization of household solid waste management may work in Langas given that most of the private entrepreneurs operating in middle and high-income residential areas within the municipality do not charge less than Kshs. 100 per month.

In addition, this is an indication that Eldoret Municipal Council will continue to be the major institution responsible for solid waste management in Langas and other informal settlements. It is also apparent that the council may not be in a position to increase refuse collection fees from the current Kshs. 40 charged in low-income neighborhoods because it is likely to be beyond the affordability limits of the households.

Apart from the income and expenditure pattern, the study found out that in Langas, 82% of residents were tenants; this implies that most of the structure owners do not reside in the study area. Having structure owners who are absentees is a major planning challenge to household solid waste management in Langas because it is difficult to involve them in issues pertaining to the subject. For instance, the council's by-law on solid waste management is specific that it is the duty of the landlords to supply their structures with receptacles; however, this is not the case in Langas. The problem is further aggravated by the fact that most of the structures in the study area have been put up without development permission from Eldoret Municipal Council.

By assuming a per capita generation rate of 0.5 kg per day, a forecast for domestic solid waste generation is estimated in Langas as presented in Table 6-1. With a projected household population of 107860 in 2003, a total of 54 metric tons was generated in the area. This represented 44% of domestic solid waste generated in Eldoret Municipality, and projected to increase to 225 metric tons, or 71% of solid waste generated in the municipality towards the year 2017.

Table 6-1: Forecast for Household Solid Waste Generation in Langas

Item of Solid Waste Projection	Years				
	1999	2003	2007	2012	2017
Projected Population of Langas	66973	107860	173709	279760	450556
Solid Waste Projection (tons)	33	54	87	140	225
Proportion of Eldoret Municipality	44%	41%	49%	59%	71%

Generally, 79% of the households generate food waste, 15% paper waste, and 1% plastics and textile waste respectively. However, because food and paper waste easily biodegrade, plastic waste tends to be prevalent in household solid waste stream. Since much of the solid waste generated in Eldoret Municipality is likely to originate from Langas, Eldoret Municipal Council will have to consider revamping its planning initiatives towards the service delivery in the area so as to protect the environment and at the same time enhance public health.

6-3 Household Perception on Solid Waste Menace

The household were requested to rank in order of priority, the service that the council should deliver to the study area. This is an important aspect because appreciating that solid waste management is a felt need readily defines the extent to which the community is willing to participate in its management initiatives. The survey revealed that 58% of the respondents identified solid waste management unlike 9% who proposed improving of roads, 6% water reticulation, 18% building of a market, 3% provision of septic tanks and installation of street lights respectively.

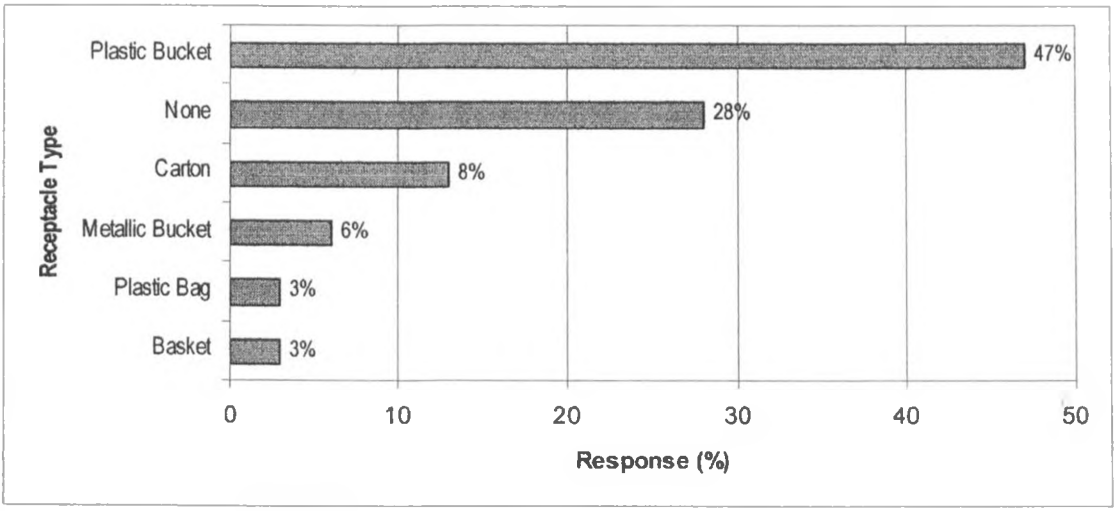
Generally, it can be deduced that 30% of the respondent do not view solid waste management as an immediate felt need for planning. Similarly, most of the respondents were not satisfied with solid waste management service as currently offered by council in the study area. Because of this, 85% of the households identified solid waste menace in Langas to be very serious in contrast to 9% and 6% who ranked the same to be moderate and non existent respectively. The 6% who ranked the menace to be non-existence seemingly represents those less willing to participate in mitigating the problem, hence a barrier to participatory planning.

6-4 Domestic Solid Waste Storage

The storage volume required for household solid waste is a function of the number of premises served, rate of waste generation, family size and frequency of waste collection. A variety of facilities are used for primary storage of household solid waste in the study area. These include plastic bags, woven baskets, metallic buckets, plastic buckets, and cartons.

During the field survey, it was established that the vast majority of households (47%) in Langas used plastic buckets for solid waste storage. On the other hand, 13% opted for cartons, 6% metallic buckets and 3% plastic bags and woven baskets respectively. As Figure 6-1 articulates, plastic buckets are predominant because they are cheap to acquire, easy to carry around and do not rust, unlike the metallic option.

Figure 6-1: Types of Receptacles Used by Households in Langas



It is worth noting that none of the above receptacles used by the households meet the specified standard by the council such as being weather and insect proof. These primary receptacles are used either before solid waste is transferred to the communal receptacles, or before they are illegally disposed of at undesignated sites. Considering that 28% of the respondents do not have individual receptacles, this is a likely indication that they illegally dispose of waste in unofficial sites, hence aggravating environmental degradation in the study area.

Location of individual receptacles is also a major determinant of household solid waste management in the study area. Receptacles which are strategically located can be easily identified and emptied by the refuse collectors, compared to those that cannot be easily sighted. The survey revealed that 62% of the households place their receptacles in front of their houses, compared to 38% who keep them indoors.

The failure by some households to strategically place their receptacles for easy identification is among the causative factors to poor household solid waste collection in the study area. Although 62% of the households place their receptacles in front of the houses, most of them still do not receive regular collection service from the council mainly due to poor accessibility to their housing structures.

Only 12% of the households in Langas use communal receptacles (hired by landlords at Kshs 280 per month) provided by the council for storing their wastes. In other words, 88% of the households do not have access to these receptacles, usually "din" standard containers. It is also likely that the households who are not served by communal containers either resort to open dumping, or other crude techniques such as burning and burying which are prohibited by the council's by-law on solid waste management. Bearing in mind the households with an access to communal receptacles were not prepared to walk for more that 29 meters to any discharge point; this could be used as a planning basis for locating communal receptacles in the area.

An overwhelming 75% of the residents in Langas discharge their waste at fixed times in the morning. Similarly, it was further revealed that 50% discharge their waste once a day, 25% twice and thrice a day respectively. Since most of the households discharge their wastes once a day in the morning (8pm – 11pm), it is arguable that domestic solid waste in the study are should be best collected in the evening when most households have discharged them. This is contrary to the council's current practice of collecting wastes in the morning hours when most of the residents are still discharging them. Time of household solid waste generation and frequency of discharge should equally form a basis for household solid waste collection in Langas.

6-5 Domestic Solid Waste Collection

The main method of household solid waste collection in Langas is communal collection offered by the Eldoret Municipal Council. Under this system, households are ideally expected to discharge their wastes at predetermined locations containing some form of communal discharge points. Refuse collection vehicles visit these sites at frequent intervals, usually once a week to remove the accumulated waste.

However, this is not the case in the study area. It was found out that 85% of the households in Langas are not served by the council's solid waste collection service, a positive indication that most of them do not pay the stipulated conservancy fees. This equally denies the council essential revenue for undertaking capital projects in solid waste management. Out of those residents who do not have a collection service, 86% were on consensus that council should extend the service to their neighborhood compared to 14% who objected. When those without the collection service were accorded an opportunity to suggest the type of collection service they merited, it emerged that 67% favored kerbside collection, 17% door-to-door collection, 13% preferred both types of collection, while 3% were not certain on the best option.

Table 6-2: Preferred Solid Waste Collection Methods by Households

Preferred Method Suggested	Percentage (%) Household of Response
Kerbside (station type) collection system	67
Door-to-door collection system	17
Both door-to-door and kerbside systems	13
Not certain on appropriate method	3

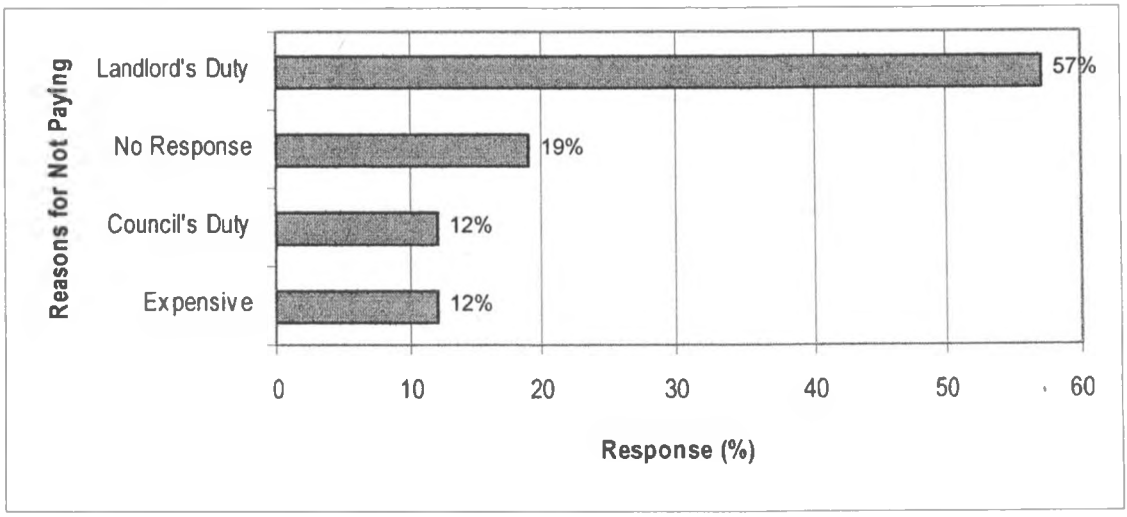
In kerbside collection, the crew would collect bins, bags and other containers at fixed intervals. This system would require a very regular and well organized collection service, so that households know where to leave their wastes. However, due to irregular collection in Langas, wastes are likely to be scattered by scavenging animals, as observed during the survey. On the other hand, in door-to-door collection, the crew would enter each premise, takes out the container, and sets it back after emptying the waste into collection vehicle.

This approach may also not be feasible in the study area since most structures have poor accessibility occasioned by dilapidated roads; in addition, the method would be time consuming.

6-6 Willingness to Pay for Collection Service

Another important aspect of household participation in solid waste management in Langas is financing. Out of those not served by the council's collection service, 56% were not willing to pay a conservancy fee even if petitioned to, only 33% were prepared to do so, with 11% not giving any response. Similarly, reasons for not willing to pay conservancy fees varied (Figure 6-2): 57% contended that it was the duty of the landlord, 12% viewed that it was the council's responsibility, 12% advocated that the current fee was too high, while 19% that gave no response.

Figure 6-2: Reasons for not Willing to Pay for a Collection Service



Important however, is the perception that it is the landlords' duty (since they do not own the structures, they feel that the landlords should use part of the rent collected to fund the service) to pay for refuse collection, and that the Eldoret Municipal Council should be offering the service at no charge. The end result is a manifestation of poor household participation in solid waste management considering some residents are not willing to take any responsibility regarding the subject matter.

However, since the average household income in Langas is low, this could on the other hand exemplify why some of them are not willing to pay for a collection service. Among those without a collection service, but were prepared to pay, the average amount they proposed was Kshs. 46 per month. This may not be viable for an improved service considering that a majority of the households are already not willing to cooperate. Since financing solid waste management has been identified as cardinal aspect of household participation in complementing the council's initiatives towards the service delivery, it was similarly established that most of the households who have a collection service were not willing to pay an additional fee for an improved collection service. This is because they were pessimistic that though they would continue paying for conservancy service, there would be no positive indication that the service, as currently offered by the council, is likely to improve in a near future. They hence underscored that the council has no justification whatsoever to increase the current refuse collection fee. This stand point further elaborates why some households have lost confidence in the council owing to poor service that they receive.

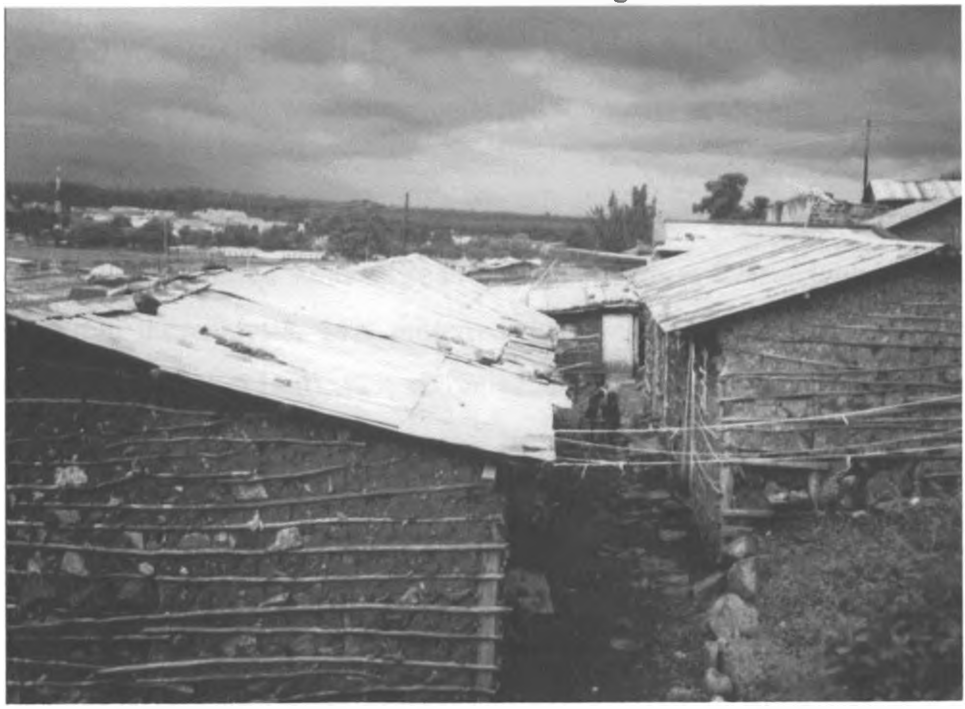
6-7 Reporting Solid Waste Menace to the Council

Although most of the households identified solid waste management menace to be prevalent in Langas, it is notable that very few of them have petitioned the council to improve the service delivery. For example, 90% had never requested the council to collect the piling wastes in their neighborhoods, compared to a mere 10% who had attempted to do so (Appendix V). This poor performance as exhibited by the households positively contributes to ineffective solid waste management. They should be at the forefront of identifying the environmental problems they are experiencing, and similarly articulating them to the council since they are the primary stakeholders as far as solid waste management is concerned in the study area. The small percentage that had reported complained of lack of any commitment taken by the council towards improving the service. Because the council always takes too long to respond to such complaints, this may partially explain why some respondents are reluctant to approach it to clear the piles of accumulating household solid waste.

Plate 6-1: Traditional Land Use in Langas

Land in some parts of Langas is still under customary use. Similarly, they do not have a solid waste collection service offered by the council. It is difficult to subject such households to the council's by laws, such as for solid waste management.

Plate 6-2: Poor Access to Housing Structures



Poor accessibility of some structures makes it difficult to extend service delivery to them. Since most structure owners did not seek development permission, this questions the planning capacity of the council as the major planning agency in the area

6-8 Frequency of Household Solid Waste Collection

As alluded earlier, just 15% of the households in Langas are served with the council's solid waste collection service. Generally, 17% of them reported that their waste is collected once in two weeks and once a month respectively. On the other hand, 83% could not precisely state the frequency of their waste collection by the council. In other words, they perceive solid waste collection service in their residential area by the council to be unreliable. Because of irregular waste collection, this prompts most of the households to resort to crude dumping techniques.

When requested to rank the performance of the council in regard to solid waste collection in their neighborhood, it was not surprising that 80% of the households purported the service offered to be very poor compared to a scanty 20% that registered satisfaction. It is worth noting at this point that although Langas is facing a serious solid waste management problem as evident by high level of environmental degradation, some respondents could still consider the council to be efficient in the service delivery. On the other hand, among the factors that made the respondents to view the service offered by the council to be poor included low collection frequency and irregular waste collection. In some instances, the households complained that the solid wastes they generate were either collected too early, or too late.

All the household categories (those served and not served) suggested various time of the day that they preferred solid waste to be collected from their neighborhood by the council. From the analysis, 44% preferred their wastes to be collected during the morning hours (9am – 11am), 12% recommended afternoon (12pm – 3pm) and 12% in the evening (4pm – 6pm). On the other hand, 29% were not sure of the best time that the council should collect their waste. Similarly, 3% were optimistic that council could collect their wastes at any time of the day. From the analysis presented in Figure 6-3, it is clear that some households' perception on solid waste management is relatively low. For instance, although solid waste management is an inherent problem in Langas, 29% of the respondents were unable to recommend the best time that their wastes could be collected by the council.

Figure 6-3: Suggested Time for Household Solid Waste Collection

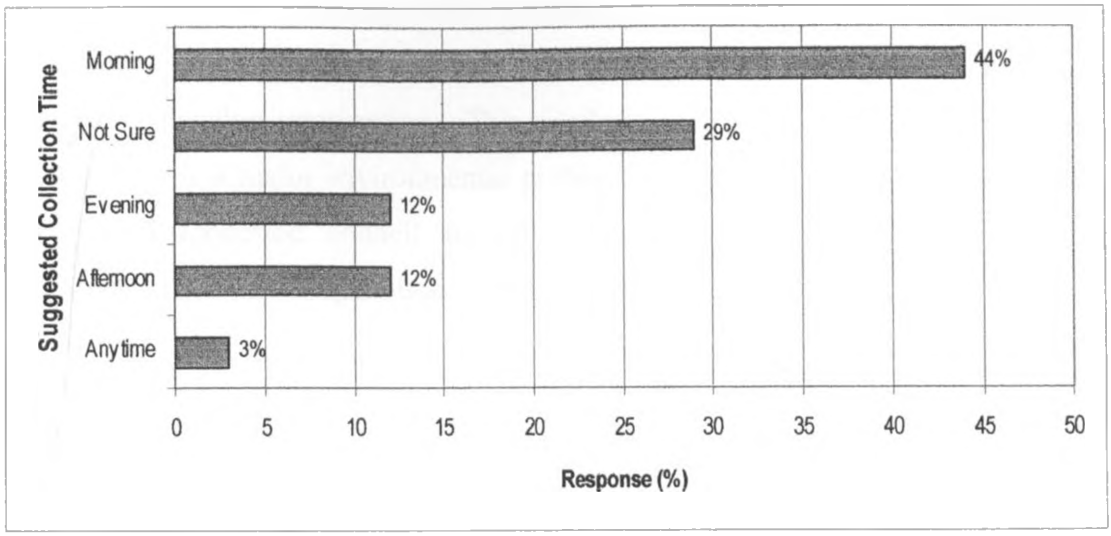


Figure 6-3 further illustrates that 3% of the households equally proposed that their wastes can be collected any time. This is not practical. It is for example not feasible to collect wastes very early in the morning, such as 6am, or as late as 7pm. Very early collection may not be effective since most households discharge their wastes between 8am-11am, on the other hand, late collection may not work either because the area is not served by street lights hence presenting a security threat.

It was found out that most of the households in Langas (37%) desired their wastes to be collected once a week, 30% three times a week, 9% twice a week, 6% once in two weeks and 3% once and twice a month respectively. However, 12% were not sure on the number of times in which wastes should be collected from their neighborhood. This could also be an indication of low perception on solid waste management, hence further limiting decision making capacity in regard to the service delivery.

Critically looking at the households' responses, some of the interventions proposed concerning the desired frequency of waste collection may not be viable for effective solid waste management in Langas, for example once a month, once in two weeks or even twice a month. This is because Langas has the highest number of households in Eldoret Municipality; hence, it equally records high solid waste generation rates.

This is also a positive indication on how the households' understanding of the key strategic solid waste management components is relatively low; hence further constraining the extent to which they can effectively participate in proposing alternative planning interventions. This similarly reveals why although solid waste management is a major environmental problem in the area, most of the households have never requested council to collect the accumulating wastes from their neighborhoods, hence illegal disposal continues unabated.

6-9 Households' Institutionalization of Solid Waste Management

To further investigate the community's perception on solid waste management, the households were requested to suggest the institutions that they thought could effectively manage solid waste in their neighborhood. This is an important aspect in solid waste management because it readily reveals those institutions that the households are likely to cooperate with through complementary partnership. Despite the inefficiency exhibited by Eldoret Municipal Council, 80% of the households recommended it as the lead institution that can effectively deliver the service in the study area, compared to 3% who objected, hence favoring the private sector. However, 13% were not sure of the institution which they could best rely upon.

It is peculiar that although community based organizations and non-governmental organizations are best known to be capable of improving infrastructure and service delivery in urban areas, such as solid waste management, none of the households in the study area acknowledged them as potential actors. This reveals why no community based organizations in Langas engage in solid waste management. Furthermore, an indication that 13% of the households were not sure on who can be best relied upon in managing solid waste in the study area is a manifestation of limited capacity in decision making. As noted before, since the households are the prime generators of solid waste in Langas, they should be instrumental in suggesting the potential alternatives for the service delivery in their neighborhood. However, this is not the case in Langas as observed during the field survey.

6-10 Household Resource Recovery Initiatives

Resource recovery includes all activities of waste segregation, collection and processing, which are carried out by taking into consideration the economic viability of the material. Re-use and recycling specifically provides an opportunity to capture some of the values from solid waste. There are various materials often recovered from the household solid waste stream in Langas. Some of these materials include, but not limited to papers, glass and plastic bottles.

During the household survey, it was found that 82% of the respondents were aware of recycling and re-use as methods of waste minimization and resource recovery, compared to just 18% that were not. From this background, the study set to find out some of the materials that the households had recycled or re-used in the past six months before the household survey commenced.

It was evident that the rate of reuse in Langas is fairly high and these materials enter the waste stream only when they are no longer fit for domestic use. It was specifically found out that 38% of the respondents acknowledged having re-used newspapers, 46% glass bottles and 4% plastic (polythene) bags. It was similarly established that glass bottles are predominantly being re–used because after their contents have been exhausted, they can be used for storing liquids.

In addition, old newspapers, as observed from the households in the study area, are mainly used for lighting the energy saving stoves *(jikos)*, and packaging, while some households use selected pages as wall papers since most of their structures are temporary. Households in Langas do not buy the newspapers on regular basis due to their high cost. Some also sell old newspapers papers to scavengers. Of great concern however, only 15% of the respondents indicated that they re-use plastic bags that they directly acquire after buying commodities from shops, where they are used as major packaging materials by business operators. Evidently, this could justify why most areas in Langas are prevalent with plastic bags. Since they are non – biodegradable, when plastics are disposed of by the households, they tend to remain on the ground for

along time, and are frequently swept by wind from one location to another. Plastic bags are not commonly re-used by households because they are less durable compared to other materials such as glass bottles. Furthermore, 18% of the respondents indicated that scavengers *(mali kwa mali)* sometimes visit their homes to collect old newspapers, plastic or glass bottles. Most of them, according to the households, prefer collecting glass bottles as opposed to newspapers and plastic bottles. This is because the value of glass bottles is much higher when sold to a third party industry compared to other materials such as polythene bags and newspapers.

Since an effective solid waste management in the informal settlements within Eldoret Municipality will be dependent on community participation, the survey also attempted to explore the extent to which households in Langas were willing to participate in establishing community based organizations for collecting as well as recycling solid wastes generated in their neighborhood. A majority, 70% of the respondents, agreed to support the proposal, compared to 24% and 6% who objected and gave no response respectively. However, when those who were willing to support the initiative were asked to clarify how they could potentially complement this initiative, 70% were on consensus in providing labour, compared to 30% who never responded.

Surprisingly, none of the households was willing to commit any financial resource to sustain the operations of the envisioned community based organization. As seen earlier, most of the respondents in Langas perceive financial obligation to solid waste management as a responsibility of the council, hence are not willing to participate in similar related activities.

Another related facet of household solid waste management that was extensively investigated in the study area was source separation. This refers to the separation of recyclable, compostable, or other materials by the households prior to collection by the council. The main objective of source separation is to ensure that various types of household solid waste are not combined, making it easier to recycle, store, collect, transport and dispose of the respective wastes.

The survey revealed that all households in Langas do not practice source separation. This implies that different types of wastes are either disposed of on the ground, or partially collected by the council for final disposal. Because plastics are non biodegradable, they conspicuously remain littered on the ground. Lack of source separation increases the amount of waste that must be stored at the generation point, therefore making the receptacles to fill quickly. It also increases the amount of waste that the council must transport to the tipping site. The survey however found out that 78% of the households would be willing to support source separation. This is an opportunity that the council should seek to explore.

6-11 Household Solid Waste Disposal Techniques

Inherent to all the informal settlements within the municipality, unplanned solid waste disposal is one of the significant environmental problems in Langas. It was apparent from the field survey that 85% of the households in Langas who did not have a collection service relied on various solid waste disposal techniques. As summarized in Figure 6-4, whereas 54% reckoned that they rely on open dumping, 38% preferred burying their waste in pits. Similarly, 4% practiced composting and burning respectively. None of these techniques are approved by the council's by-law on solid waste management; the council's capacity to enforce its by-laws is hence inadequate.

Figure 6-4: Household Solid Waste Disposal Techniques

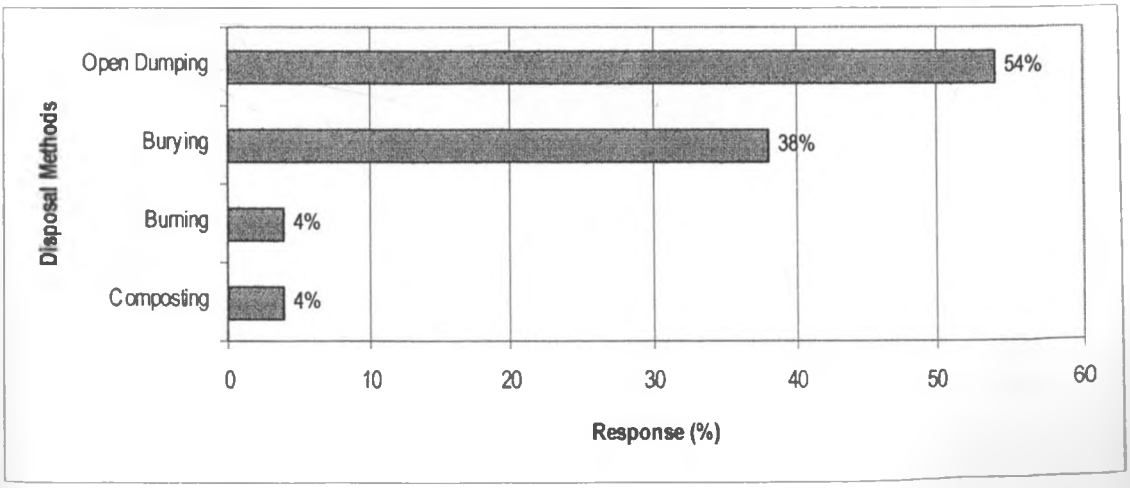


Plate 6-3: Open Disposal by a Household Member

Note that the council had just cleared wastes that accumulated at this site. Also note the poultry scavenging at the site. The site does not also have a communal receptacle, hence encouraging open dumping as practiced by the above resident.

Plate 6-4: A Pit Dug for Solid Waste Disposal

Note that solid waste disposed of at this illegally dug pit is mixed with water; hence producing leachate which pollutes the environment. Because the pit is dug next to the wall, it can weaken the foundation of the house.

It was also observed that due to irregular collection by the council, illegally dumped household waste are sometimes scattered by dogs, poultry, goats and cattle (Plate 6-1). Children were also observed playing and scavenging among the rotting solid wastes. Uncontrolled domestic waste that frequently accumulates in Langas presents permanent risks of pollution, infection and injury. Such risks could typically be carried through waste scavengers, like dogs, rodents, fly etc., and surface and underground routes of risk transmission. The submission is that the council can do very little to control these crude disposal techniques since it has failed in its responsibility of solid waste collection in the study area. This leaves the households with no alternatives, other than adopting unsustainable methods, typically open dumping.

There were a variety of environmental problems acknowledged by households in Langas as a result of unplanned solid waste disposal. In this context, 64% identified diseases such as malaria, which are common during heavy rains when uncollected solid wastes create breeding ground for the disease parasite, 24% complained of foul smell from the decomposing waste, while 3% reported loss of aesthetics. Only 9% were content that unplanned household solid waste disposal presented no public health and environmental concern. This typically exposes those households whose perception on strategic solid waste management in the study area is limited, hence affecting their potential to participate in a collective decision making.

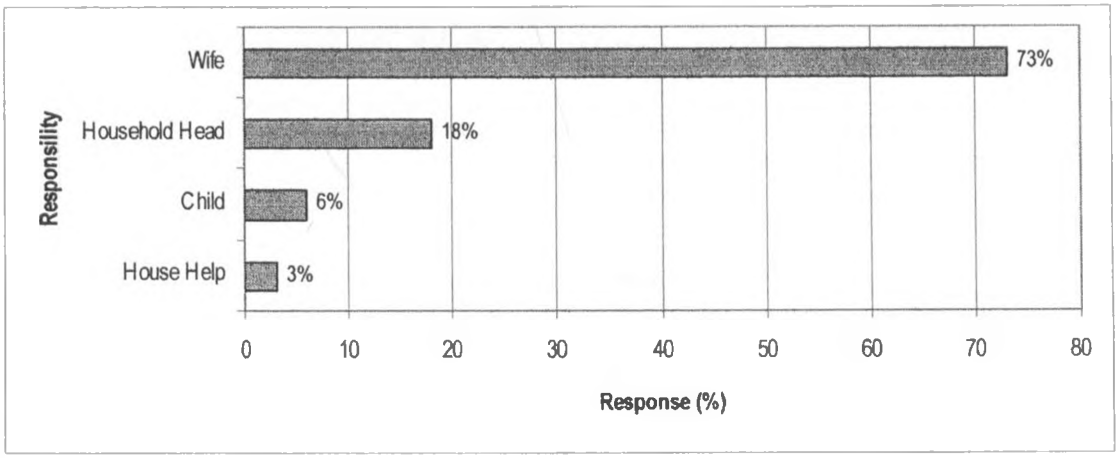
6-12 Gender Dimensions of Household Solid Waste Management

Management of solid waste is a complicated task in view of its close relation and direct relationship with the behaviour of the people. It is now widely accepted that incorporating gender perspectives in development efforts is necessary for the successful implementation of development programs. The focus on gender rather than women makes it critical to look not only at the category "women" but at women in relation to men. Among many Kenyan societies, domestic activities such as provision of water for general household use, maintaining a clean environment in the house by disposing of household solid wastes and maintaining sanitation facilities, have been delegated to the women.

During the survey, 57% of the households admitted that they uphold customs related to gender consideration in waste management. They asserted that since it is the women who do most of the household chores such as cooking, washing and general sanitation, it is also their responsibility to oversee solid waste management.

To be critical, the survey set to investigate who specifically remove solid wastes from the house. As Figure 6-5 presents, 73% of households' solid waste in Langas is handled by women, 18% men (who are mostly head of households), 6% children (female) and 3% house helps.

Figure 6-5: Household Responsibility for Solid Waste Management



Among the households whose solid wastes were handled by men, it was keenly noted that these were household where the man was either staying alone, or where both household members were males. Similarly, only 3% of the households have their wastes managed by house helps. This represents a typical household where both the husband and wife are working and never at home till late in the evening.

It is therefore unfortunate that men spend very limited time participating in decisions pertaining to solid waste management. It was further found out that men were less willing to participate in solid waste management even if they are at home. This is because they perceive the activity as purely a woman's dominion, hence further limiting the extent to which they can be integrated in decision making process.

Plate 6-5: Indoor Concrete Receptacle

This is a common indoor concrete receptacle provided by landlord. Because it is not covered, it is not only exposed to rain, but also to vermin and insects such as mosquitoes, which equally cause diseases. Note leachate flowing from the receptacle.

Plate 6-6: A Poorly Drained Compound

Note how household solid wastes are floating on water. Since the structures were not planned, their drainage system is poor. Such a scene presents a public health risk to affected households. Also note the poor condition of the houses.

6-13 Sensitization, Awareness of Laws and Preference for Privatization

The key to changing solid waste management practice at the household level is to facilitate their awareness through public education. In this case, an informed community can do much to improve the effectiveness of waste management programs. The household survey established that in Langas, 97% of the households have never been advised by the council on alternative solid waste management strategies.

From the council's records, institutions such as Eldoret Polytechnic, Moi University, and Lions Club of Eldoret occasionally participate in community clean up campaigns in various residential neighborhoods, including Langas. To find the magnitude of their participation in these social activities, the survey set to establish if the households were aware if clean up campaigns are sometimes held in their neighborhood. It revealed that 53% were not. Only 17% acknowledged that they have at one time observed such campaigns being conducted, but never participated, while 30% accepted that they were not certain whether such campaigns are normally conducted. This indicates that although such campaigns are sometimes held by these institutions, they never strive to ensure that most of the residents are involved. In addition, they only concentrate in certain busy areas such as markets, while paying little attention to the interior sections occasioned by poor accessibility. Among the households who were aware that such campaigns are sometimes held in Langas, 60% appreciated that at least they have participated once, compared to 40% that readily submitted that they have witnessed the campaigns being conducted, but never bothered to participate. With this kind of background, comprehensive household solid waste management in Langas is anticipated to continue being ineffective.

The survey similarly investigated if the households were aware of the existence of any planning legislation that prohibits illegal dumping of solid waste in the municipality. Notably, a majority (87%) was not. It is equally evident that most of the households cannot effectively participate in solid waste management if a majority are not aware that there are laws that regulate the activity, more so the council's by-law on solid

waste management. This could further expound why some of them resort to crude disposal techniques, and similarly suggest why most of the residential structures in Langas were put up without regard to development permission, hence making them difficult to be accessed by solid waste collection vehicles. As Table 6-3 reveals, although Langas has many unplanned housing structures, the council's records indicates that between 1997 and 2002, only 95 development applications were approved by the Town Planning and Works Committee[16].

Table 6-3: Development Applications in Langas, 1997– 2002

Year	Development Applications Received	Approved	Rejected
1997	9	7	2
1998	22	18	4
1999	25	18	7
2000	20	12	8
2001	13	13	-
2002	23	18	5
Total	**123**	**95**	**28**

Source: Eldoret Municipal Council – Municipal Engineer's Department, 2003

The problem is further compounded since 71% of structure owners in Langas never sought for development permission. The survey finally requested the households to indicate their willingness to support privatization of solid waste management, a majority (70%) did not support the idea; they perceived private companies to be expensive. This indicates that the council will continue being the principle institution responsible for the service delivery to the informal settlements such as Langas.

6-14 Summary

Given that most of the households in Langas do not effectively appreciate solid waste management aspects such as storage, disposal, financing, gender aspects, concern to planning laws and other critical areas which defines solid waste management continuum, the chapter concludes that their participation as a community in the activity is inadequate. All these present utmost planning challenges to the council.

[16] Like most local authorities in Kenya, Eldoret Municipal Council does not have a Department of Town Planning; instead, it is a small section with no planners under the Municipal Engineer's Department.

CHAPTER SEVEN

COMMERCIAL SOLID WASTE MANAGEMENT INITIATIVES BY BUSINESS OPERATORS IN LANGAS

7-1 Introduction

A well managed and governed urban center is one where there is representation and inclusion of all groups of stakeholders; with accountability, integrity, and transparency of government actions in pursuit of shared goals. Whereas the previous chapter presented the aspects of household participation in domestic solid waste management, this chapter focuses on commercial solid waste management as practiced by business operators in Langas.

7-2 Business Socio – Economic Background

During the survey, it was established that most of the businesses in Langas were at any time run by an average of two operators. In addition, the survey found out that the average income realized by the business operators in the study area was Kshs 6044.50, compared to an average expenditure of Kshs 3780. This means that the absolute income obtained after all expenditure have been considered, mainly rent, license fees and stock, is approximately Kshs 2264.50, and has a significant bearing towards commercial solid waste management.

If the absolute incomes are low, then participation in solid waste management, especially in financing for an improved service is likely to be limited. The study also found out that over 80% of the businesses in Langas are under sole proprietorship, which are mainly run by men, and in most cases assisted by their spouses.

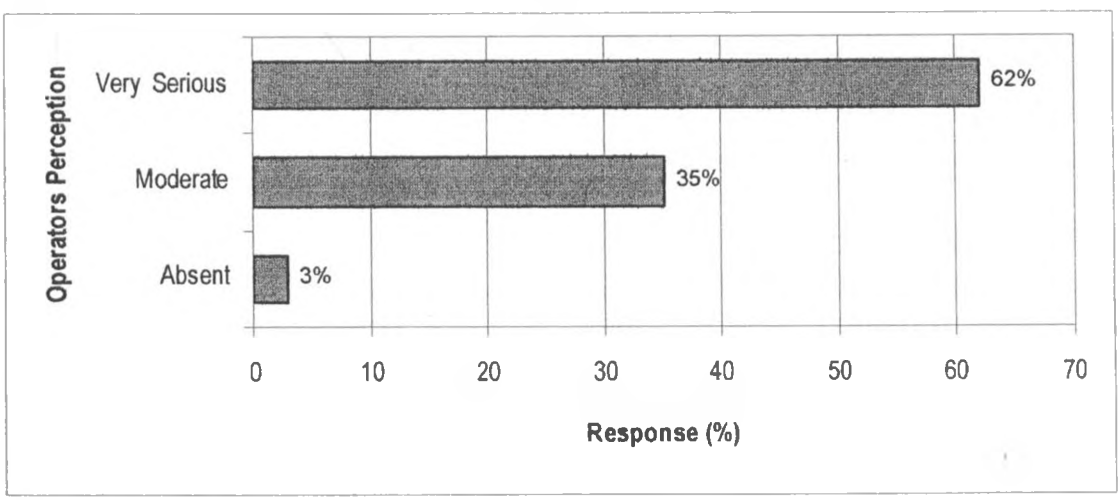
It is clear that unlike the average household expenditure, which may at some instance exceed the average income, in the case of business operators, the average income/ profit realized must exceed average expenditure, the reason being that the motive of any entrepreneur is to make profits.

7-3 Perception of Solid Waste Menace

Like the case of households, business operators also indicated that solid waste management is a felt need that should be urgently addressed. In general, 56% ranked efficient solid waste management as the most important service desired, 14% improvement of roads, 11% sewer reticulation, 6% opening of the blocked drains, and 3% water reticulation and electricity respectively.

On the other hand, 8% of the operators prescribed that the level of infrastructure and service delivery was satisfactory, hence no need for improvement. Similarly, as Figure 7-1 reveals, 62% of operators perceived solid waste menace in Langas to be very serious, 35% moderate and 3% non-existence respectively.

Figure 7-1: Operators' Perception of Solid Waste Menace in Langas



This analysis forms the basis for business operators' participation in solid waste management in Langas. For instance, those respondents who rank solid waste management as the service that the council should primarily deliver in the area are likely to contribute positively towards initiatives aimed at improving the service delivery, than those who consider the problem to be absent. In the context of planning, need assessment survey should be the preliminary stage in studies related to solid waste management. This affords a platform where felt needs of the community are inculcated to ensure that once the project is initiated, it will receive their full support.

However, in the past, attempts by the Eldoret Municipal Council to improve infrastructure and service delivery in Langas have failed due to lack of adequate community participation in critical areas of decision making. Inadequate solid waste management is just one of them; however, its improvement may also not necessarily be a priority to the council. If solid waste management is not a felt need, the attitude registered may negatively impact on its delivery in the study area

7-4 Commercial Solid Waste Generation Trends and Characteristics

By also assuming a per capita generation rate of 0.5 kg, Table 7-1 presents the projection for commercial solid waste generation in Langas. The methodology and assumption used in selecting the forecast model for commercial solid waste generation in Langas is based on the number of shops, which will increase in proportion to the increase in population. In the year 2003 when the survey was being conducted, it was estimated that businesses in Langas generated 0.91 tons per day, and anticipated to progressively increase to 6.31 tons by the year 2017.

Table 7-1: Forecast for Commercial Solid Waste Generation in Langas

Item of Solid Waste Projection	Years			
	2003	2007	2012	2017
Projected number of businesses in Langas	1810	3510	6508	12618
Commercial solid waste projection (tons/day)	0.91	1.76	3.25	6.31
Household solid waste projection (tons/day)	54	87	140	224
Total waste generated (domestic and household)	54.91	88.76	143.25	230.31
* Proportion of commercial waste to total waste	1.65%	1.99%	2.27%	2.74

Note: *- Represents the proportion of commercial solid waste generated in relation to total commercial and domestic solid waste generated in Langas.

Considering that households generate more solid waste that their businesses counterparts, it is projected that in 2003, commercial solid waste accounted for 1.65% of total solid waste generated in relation to domestic solid waste, and is expected to increase to 1.99%, 2.27% and 2.74% in 2007, 2012 and 2017 respectively.

It is evident that the amount of commercial solid waste generated in Langas will continue increasing, hence presenting an ongoing planning challenge to Eldoret Municipal Council. Given that the council's capacity to manage the current 54.91 tons generated per day (domestic and commercial) in Langas is limited, it must adopt a broad based planning approach that would ensure that poor handling of solid wastes is controlled to promote a more sustaining environment, thus creating a conducive environment for economic development. Forecast for commercial solid waste generation will therefore continue being an important aspect of solid waste management in the study area.

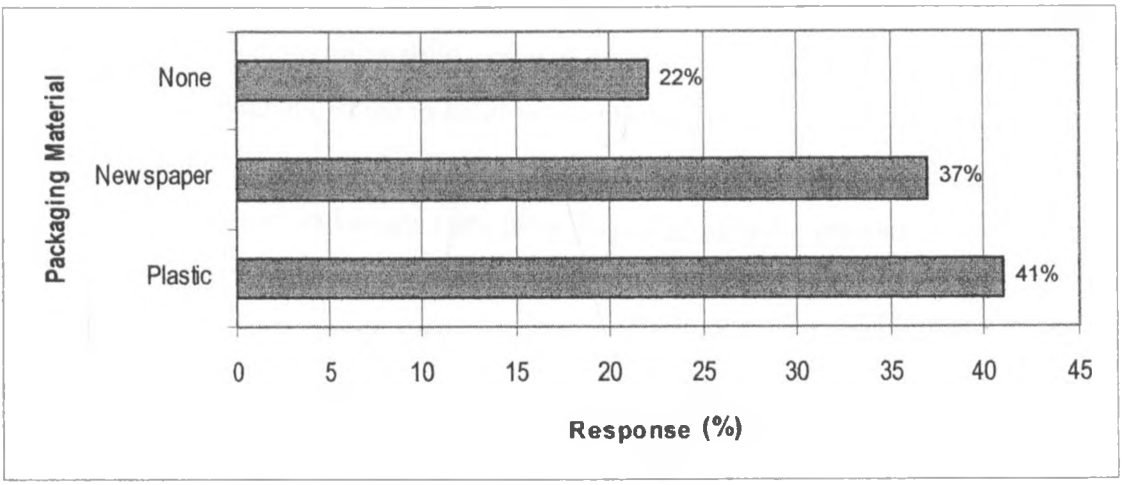
Like in residential neighborhoods, commercial waste generated in Langas differs significantly in composition according to the type of business. In *jua kali* (informal business), a business unit produces homogenous waste. Food kiosks for example produce food related waste while carpentry produces wood wastes such as saw dusts. Retail businesses generate dust (from sweepings), organic waste and papers. Bones plastics and rugs also form a minimal proportion. Restaurants generate food waste, paper, glass (from broken glass utensils) and ash. Open air markets generate wastes unique to the business operation undertaken at the market. The open air markets in the study area generate waste whose composition is almost homogeneous in nature: vegetable waste. Others produce papers, textiles rubber plastics glass and metals.

Unlike 79% of households who mainly generate food waste, the field survey found out that 35% of the businesses in Langas mostly generate paper wastes, 23% food waste, 21% plastics, 9% wood and textile respectively and 3% hair/ shavings. Since paper and food wastes are easily biodegradable, plastics dominate commercial solid waste stream in Langas.

In addition, because of their lighter weight, plastic are easily carried around by wind or scavenging animals, hence scattered to cause visual intrusion. It was also observed during the survey that most of the storm water drains in Langas were blocked due to plastic wastes that were either dumped in them by business operators, or transported

by wind. Related to the type of solid waste generated by businesses in Langas are the types of packaging materials used by the business operators. This is important because after these materials have been used, they are normally disposed of, hence increasing the amount of solid waste that must be collected by the council. Generally, 41% of the businesses in Langas use plastic polythene bags for packaging, 37% use old newspapers, while just 22% do not rely on any packaging materials.

Figure 7-2: Packaging Materials Used by Business Operators



The operators who do not use any packaging materials include those businesses, which sell bulky goods such as furniture. Plastics are the preferred packaging materials for most businesses in Langas because they are cheap to buy and last longer than other materials such as newspapers.

Although plastic wastes have been from time to time identified as among the leading pollutants in the municipality because they are non biodegradable, Eldoret Municipal Council is yet to arrive at a policy towards controlling their generation. The contentious issue is that companies, which manufacture plastics and their allied products, for example the Akay Plastics Company in Eldoret, employ thousands of the town's residents. Limiting the production of these plastic manufacturing companies, or closing them all together would culminate to a massive loss of jobs, hence negatively impacting the already fragile local economy. Currently, the council's by-law on solid

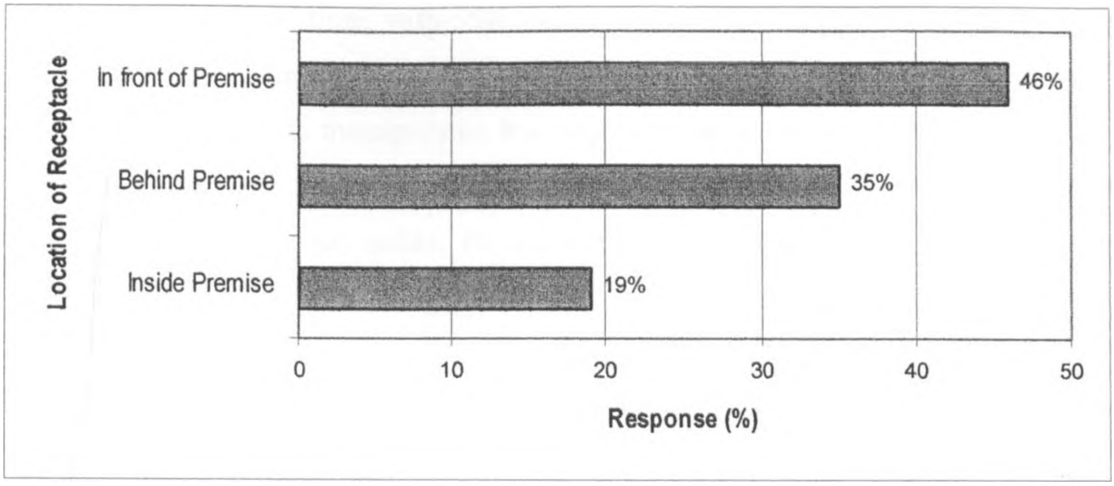
waste management does not also give any policy towards the manufacturing, use and disposal of plastic wastes. With Eldoret Municipality hosting several industries manufacturing and using plastics, a long lasting planning intervention that would ensure that the impacts of industrialization and economic development do not compromise the goal of achieving a sustainable environment would be of utmost importance.

7-5 Commercial Solid Waste Storage

Storage refers to maintaining solid waste at an interim site prior to recycling or final disposal. It is the second stage in solid waste management, after generation within the solid waste management cycle. During the field survey, it was found out that 14% of the business operators in Langas use plastic bags and metallic buckets respectively for storing their wastes before they either dispose of them illegally, or legally to the communal discharge points served by receptacles. On the other hand, 31% use plastic buckets and 11% cartons, while 26% do not own individual receptacles. Given that some operators do not have primary receptacles, this is a likely indication that they illegally dispose of their wastes at undesignated sites, notably near their premises. The practice renders both public health and environmental quality at stake.

Although the council's by-law on solid waste management stipulates that each premise shall have a 20 liter dustbin to facilitate waste storage before collection, it was established that most of them do not comply to this regulation. This is a clear manifestation that Eldoret Municipal Council's capacity to enforce its by-laws is quite limited. In addition, ownership of an individual receptacle is also a prerequisite set by the council before it could license any business. Contrary to this, it was evident from the field survey that many unlicensed businesses continue to operate Langas without prescribed the receptacles. Out of those business operators who have individual receptacles, it was found out that 46% keep their receptacles in front of the premise, 35% behind the premise and 19% inside the premise. This has been summarized in Figure 7-3.

Figure 7-3: Location of Primary Business Receptacles



In the context of solid waste management, it is essential to know where business operators keep their receptacles because this eventually determines the efficiency of refuse collection by the council. Generally, if the collection crew cannot easily identify the receptacles, they might be skipped. In totality, 54% of the operators have their receptacles not easily accessible as a result of either being placed at the backyard or inside the premise. This might make refuse collectors to not easily identify them during their operations which are always irregular.

Apart from primary receptacles, the survey also revealed that a majority of the business operators in Langas (68%) do not have access to the communal receptacles provided by the council, usually "din" standard containers, at a fee of Kshs 280 per month. This is a further indication that they are likely to resort to unacceptable disposal techniques such as open dumping or burning of wastes, hence accelerating the incumbent problem of solid waste management in Langas.

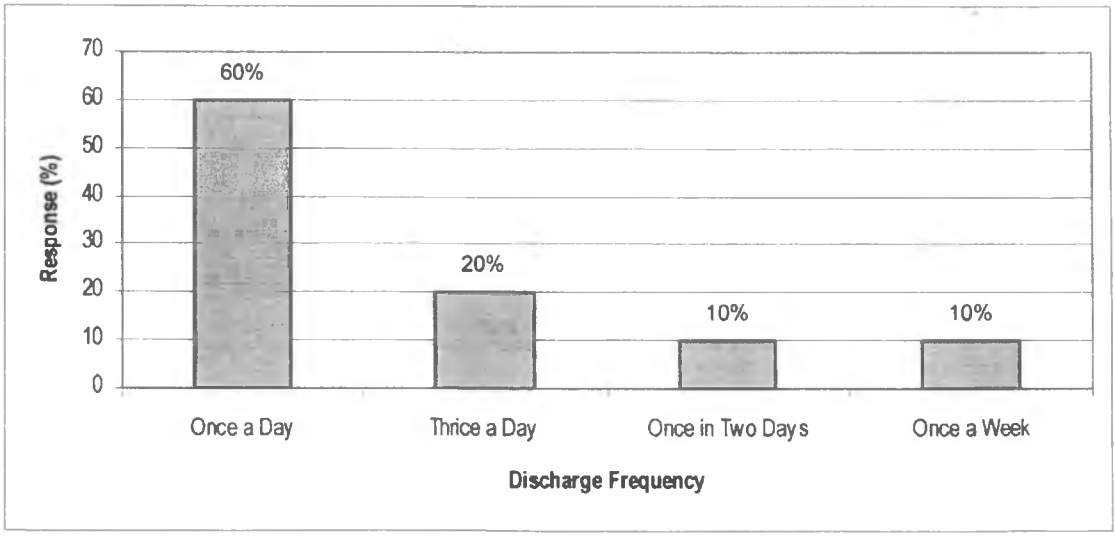
Despite the fact that 32% of business operators have an access to the communal receptacles, lack of regular collection by the council has made many of them resort to open dumping. Since it is the council, which has failed to collect solid waste from the premises on a regular basis, it is apparent that those who indiscriminately dump their wastes cannot be reprimanded because the council has no legal basis for this.

Among the operators who had an access to the communal receptacles, 99% discharge their wastes at a fixed time, with 55% doing so in the evening, 27% in the morning and 18% in the afternoon respectively. From this analysis, and in the context of commercial solid waste management, it is arguable that since commercial solid waste is mainly discharged to the communal receptacles in the evening, this could be the best time for collecting them, unlike the current system adopted by council where it collects the wastes in the morning hours when generation rates are still high.

The implication of this arrangement is that both the households and businesses have different solid waste discharge time: since businesses operators mainly discharge their wastes to the communal points in the evening, it would be prudent if the two could have their wastes collected at different times of the day. It is worth mentioning that business operators in Langas mainly discharge their wastes in the evening because this is the time when most of them close down.

Closely related to discharge time for commercial solid waste in Langas is the frequency at which operators take them to discharge points. As Figure 7-4 indicates, majority of the business operators (60%) discharge their wastes once a day, 20% three times a day, while 10% once in two days and once a week respectively.

Figure 7-4: Discharge Frequency of Solid Waste by Business Operators



Discharge frequency is therefore another important aspect that the council should consider when planning for solid waste collection services. Since most operators discharge their solid wastes once a day, it implies that the frequency of collection should be increased to avoid unnecessary accumulation of solid wastes.

7-6 Aspects of Commercial Solid Waste Collection

Solid waste collection implies either picking up the waste at curbside or backdoors or gathering it from drop-off locations. The analysis of commercial solid waste collection service in Langas requested the operators both with and without collection service to rank the Eldoret Municipal Council's performance in regard to solid waste collection from their neighborhood. A majority, 77% subdued that the council's service was poor, 16% moderate, while just 6% were satisfied.

The study further revealed that a majority of the businesses in Langas are served by the council's collection service, compared to 31% who are not. Most of the businesses in the study area are served by the council's collection service because they are located along the major roads, which are fairly accessible. This is contrary to 85% of households not served, notably due to the poor accessibility of their structures, which is aggravated by poor condition of roads.

In addition, since paying for a conservancy fee is a prerequisite for licensing any business operating within the municipality; most of the operators are usually prepared to make a follow up at the council to ensure that the service delivered is comparative to the fees that they pay. This similarly predicates why a majority of business operators in Langas have a collection service. However, some licensed operators have always paid conservancy fees as part of trade license agreement, yet they receive no collection service from the council. This clarifies that obtaining a trade license from the council is not a guarantee to receiving a conservancy service. Among the operators with a collection service, 39% reported that their wastes were collected once a month compared to 30% who could not estimate the frequency of the council's attendance.

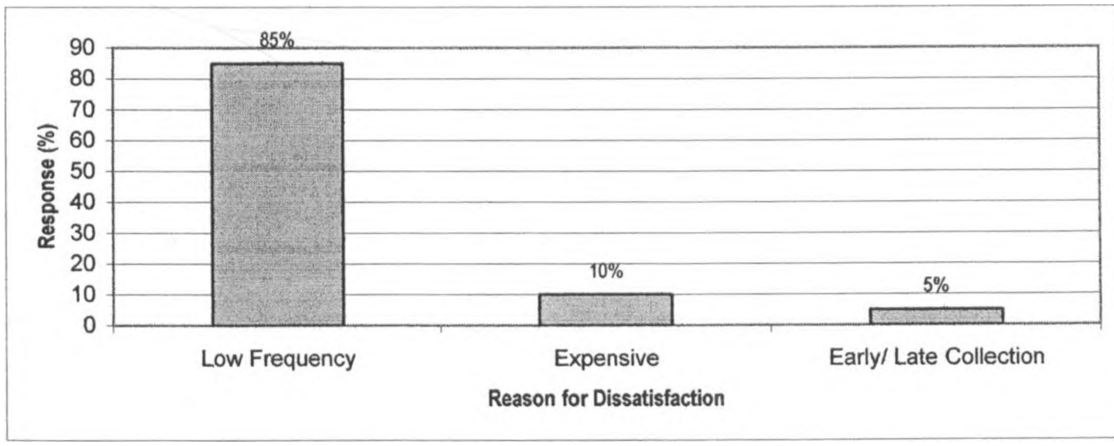
On the hand, 17% acknowledged that their waste is collected once a week, with 4% receiving the service once in two months, once in six months and three times a week respectively. From this expression, it can further argued that poor solid waste collection frequency as offered by council is one of the major factors that encourage operators to resort to poor solid waste management techniques such as open dumping.

When requested to state the time that the council collects their wastes, a majority of the operators represented by 35% indicated morning hours, though irregular, 22% in the afternoon, 17% in the evening, while another 26% stated that the collection time was completely irregular.

This justify why 99% of operators in Langas were not satisfied with the collection service offered by the council, and hence 74% of them ranked the service to be poorly delivered. As Figure 7-5 indicates, the reason for not being satisfied with the collection service also varies among these business operators.

An overwhelming majority (85%) indicated that they were not satisfied because of low collection frequency. On the other hand, 10% expressed that the collection fee imposed by the council is too high, compared to 5% that complained of too early or too late collection time.

Figure 7-5: Reasons for Dissatisfaction with Council's Collection Service



Given that most of the operators are not satisfied with collection service, 55% revealed that they have requested the council to clear the accumulating waste at the proximity of their premises. However, they were not successful: their complaints were simply ignored by the authority. Suffice it to say that a majority of these operators have taken the initiative of requesting the council to collect wastes from their neighborhood because they pay for conservancy service, hence anticipates a better service. On the other hand, it is equally contentious that those households that have never registered such complaints could represent those who do not pay a conservancy fees; hence do not have a strong case to justify their complaints.

By further considering that 31% of the business operators in the study area do not have a collection service, the field survey found out that all of them would certainly like the service to be extended to their premises. As a result of this, 81% recommended for curbside collection system, compared to 11% that proposed door-to-door system. Unlike the households, door-to-door collection method can work in the case of business enterprises because they are easily accessible by the virtue of being located along the major roads.

However, this is limited to those businesses located along well tarmaked roads. Where the roads are in a dilapidated state, especially during the rainy seasons, the method may not work after all. The favorable option would hence be kerbside collection where the operators would discharge their wastes at the provided communal receptacles, and where the crew would collect them at a specified time frequency.

Some of the operators who did not have a collection service and never wanted the council to extend the service to their premises gave several reasons for their apparent stand off. Whereas 75% contended that the collection fee imposed by the council was likely to be too high, 25% formed an opinion that the tax would be misappropriated at the expense of public interest. Laxity by such operators to finance refuse collection service will therefore continue presenting an obstacle to the council's solid waste management initiatives, unless a planning intervention is put in place.

The survey on commercial solid waste management equally investigated two cardinal aspects of decision making by business operators in solid waste management. These were preferred time of collection and frequency of collection. Notably, 65% preferred their waste to be collected in the morning, compared to 21%, 9%, and 6% who suggested afternoon, evening and night respectively. It is worth noting that most of the operators prefer their waste to be collected in the morning because they discharge them in the morning. Bearing in mind that some of the operators also preferred their waste to be collected at night; this may not work in Langas due to absence of street lighting system as well as inadequate collection crew from the council.

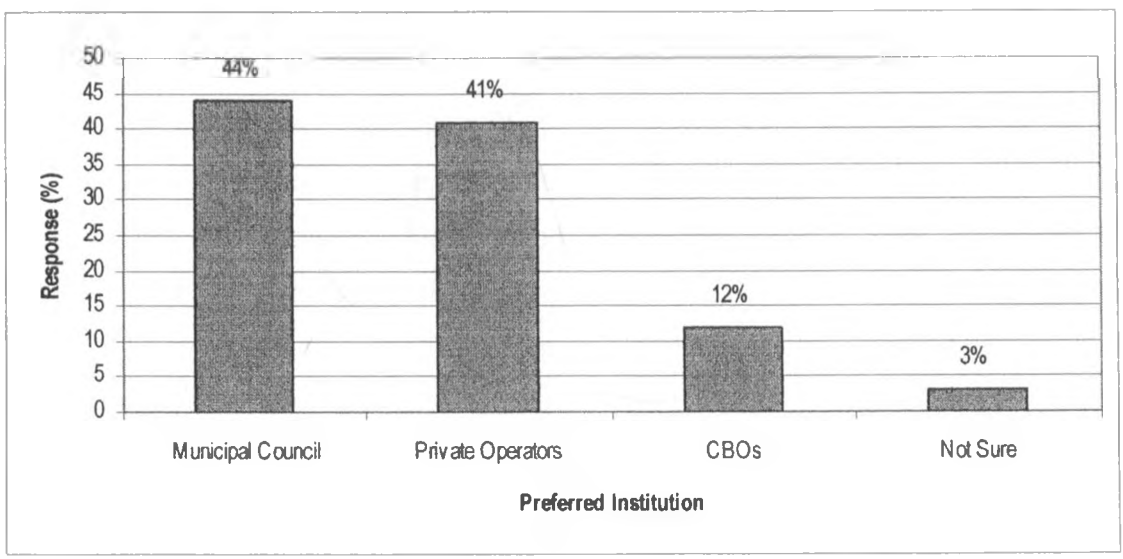
Just as they proposed the time for collection, the operators also gave mixed opinions on their preferred frequency of solid waste collection in the study area. A majority, 29%, suggested that their wastes be collected at least three times a week compared to, 23% who advocated for twice a week, 21% seven days a week and 12% four times and once a week respectively. Considering that most of the households prefer their wastes to be collected once a week, and business operators three times a week, it is evident that the council may have to consider designing different alternatives for collecting wastes from these two sources in Langas.

7-7 Institutional Perspective of Commercial Solid Waste Management

Institutional arrangement is among the conceptual variables of effective solid waste management. From this background, the study aimed at finding out from the business operators in Langas the institutions that they felt can be relied upon to effectively deliver the service in their area. As presented in Figure 7-6, this is an important aspect of analysis since it reveals the extent to which the operators would be willing to cooperate with the potential actors. It was apparent that 44% of the them attested that despite the poor performance registered by Eldoret Municipal Council, it is still the institution that can be best relied upon, compared to 41% who envisioned private companies, while 12% proposing community based organizations (CBOs). Finally given the poor performance already exhibited by the council, 3% were not certain of

the institution that they could depend on. Because most of the business operators acknowledged Eldoret Municipal Council as the major institution capable of revamping the service delivery, this is an opportunity that the council should seek to explore. In this particular respect, the evidence that some operators appreciate the importance of community based organizations is a positive indication that such institutions, if constituted, can be relied upon to complement the council in certain aspects of commercial solid waste management in the study area.

Figure 7-6 Suggested Institutions for Commercial Solid Waste Management



At this juncture, it is worth noting from Figure 7-6 that although most of the operators preferred private operators, most of them were adamant to pay for their service. Instead, they underpinned that since the council has failed to effectively deliver the service, it should bear the responsibility of contracting a private company to collect solid waste generated in the area.

By further considering that the council has a weak financial base; it is clear that this proposition may not after all work in Langas. Generally, the proposal presented by the business operators tends to differ from households' because the former mostly pay for conservancy service unlike the latter, hence presents critical planning challenge that the council will have to contend with.

7-8 Financial Aspects of Commercial Solid Waste Management

The business operators who had a refuse collection service were further probed to find out if they would support the council's proposal to increase its conservancy fees. A majority (55%) detested the proposition and was not convinced that an increased collection fee would make the council to be more efficient. On the other hand, the operators who supported the idea were willing to forego between Kshs 30 and 800 above the current minimum fees of Kshs 40 (Appendix X). However, this is not feasible in Langas considering that most of the households and business operators are against the proposal. The council is therefore left with just one option: improve its performance if it anticipates winning the residents' support.

The survey established that the willingness to pay for commercial solid waste management in Langas is principally a function of income. Data on the relationship between two the variables: income and willingness to pay were correlated to determine the extent to which the business operators were willing to participate in financing waste management. Two categories of business operators: those without collection service and those with collection service were separately analyzed. The analysis of the former group was aimed at finding out if there was a relationship between income and willingness to pay for a collection service, while the latter aimed at investigating if an increase in income is anyhow related to willingness to pay for an improved collection service by the council.

Pearson correlation analysis indicated that there was a negative correlation between the income levels of those respondents who did not have a collection service (31% of business operators) and their willingness to pay for the same. In this case, even if their incomes improve, still they would not be willing to pay for a collection service. This presents a major constraint to Eldoret Municipal Council. It will have to strategize and sensitize the operators on the importance of paying for collection service, and at the same time having their businesses licensed. On the other hand, there existed a positive correlation between income levels of those business operators with a collection service and willingness to pay for extra fees to improve solid waste management in the study

area. In other words, an increase in the incomes of operators creates an additional disposable income that could be further spent in funding solid waste management. Since the majority of businesses fall under this category, it is an opportunity that the council could take advantage of. However, this may not work given that most of the households who are the prime waste generators in the municipality were not willing to pay for an improved service delivery.

7-9 Commercial Solid Waste Disposal

Ethically, proper waste management is among the most important tasks of the Eldoret Municipal Council in keeping the study area clean and healthy. During the survey, it was found out that due irregular collection, business operators resort to various crude disposal techniques most of which are unsustainable to the environment. Generally, 36% practiced open dumping, 27% used dug out pits, compared to 18% that burnt and composted their wastes respectively.

As Figure 7-7 presents, the operators were requested to state some of the key problems they experience due to irregular solid waste collection. Unlike the households who overwhelmingly identified diseases, 61% of the business operators were resentful of blocked storm water drains, 9% diseases, 27% foul smell and 3% loss of potential clients due to unsanitary conditions.

Figure 7-7: Impacts of Irregular Commercial Solid Waste Collection in Langas

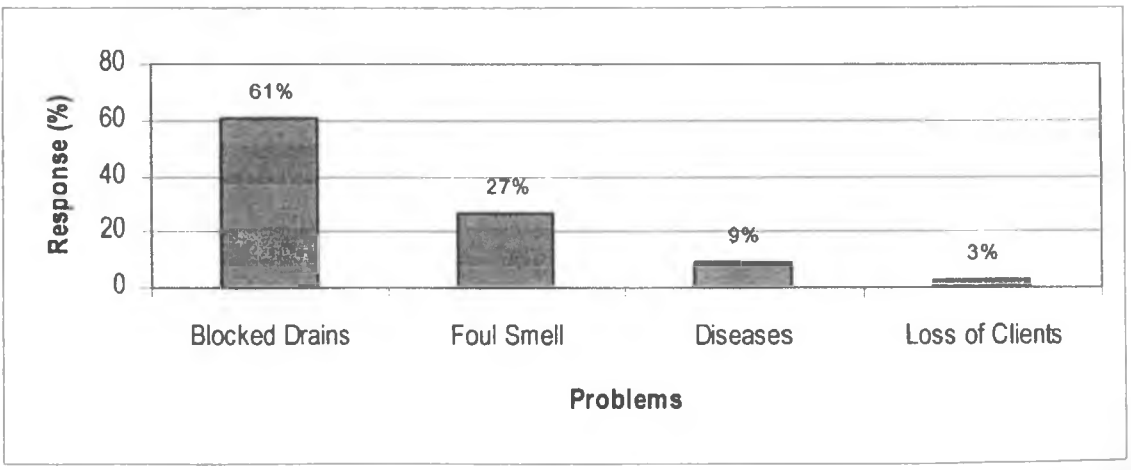


Plate 7-1: A Blocked Storm Water Drain

Note the stagnant water in the drain: this creates breeding ground for mosquitoes and other pests. Also note the unplanned business premises along the road reserve.

Plate 7-2: A Disused Open Dumping Pit

Although the above pit was dug for commercial solid waste disposal, it is rarely used; instead wastes are dumped outside it. Also note the scavenging pig and the proximity of the pit to the nearby foot path.

From the analysis presented in the preceding chapter, it was noted that none of the households identified blocking of storm water drains as a problem related to poor solid waste management. This is because most of the business structures in Langas are located along the major roads served by storm water drains unlike the residential structures. From the foregoing analysis, it could be argued that residents of a neighborhood to some extent have a sense of responsibility for their homes and immediate environment. In the context of the above statement, since most businesses are often affected by blocked storm water drains as Figure 7-7 and Plate 7-1 indicates, the study set to investigate the behaviour of the operators in regard to sweeping of road shoulders to prevent wastes from being transported to the drains, and actual cleaning of the drains incase of blockage during rainy seasons.

The survey established that 82% of the operators take the initiative of sweeping the road shoulders in front of their premises to avoid the accumulation of wastes, similarly, 75% acknowledged clearing of drains if they block. It is likely that most of the operators readily participate in sweeping the road shoulders and clearing the blocked storm water drains to avoid losing their clients.

7-10 Resource Recovery and Solid Waste Prevention

Waste reduction is the most effective means for meeting the council's goal of reducing the dependence on landfilling. The business survey in Langas revealed that a majority of the operators were aware of recycling as a means of reducing the generation of wastes, hence an opportunity that the council should anticipate to take advantage of. Just 15% of the operators indicated that scavengers, locally known in Swahili as "*mali kwa mali*", occasionally visit their premises to collect old newspapers and plastic bottles. Moreover, 99% of the operators pronounced their willingness to participate in local associations to raise money for a solid waste recycling project in the area. Still in the perspective of waste reduction and prevention initiatives, the study further set to investigate operators' willingness to support source separation. Initially, all the operators asserted that they have never practiced source separation.

However 77% were willing to cooperate if requested to by the Eldoret Municipal Council. Considering that periodical clean-ups may have a temporary positive effect on the cleanliness of streets and public spaces, the study discovered that 65% of the business operators were aware that clean up campaigns are sometimes held in Langas, but only 35% of them had taken initiative to participate in such campaigns. It was further revealed that 62% of the operators admitted that they have never been advised on alternative solid waste management initiatives by any institution, including Eldoret Municipal Council.

Out of those operators who had received some advice on solid waste management, 46% got the advice from non-governmental organizations, 39% from the council, 8% from educational institutions, and 7% from the private clinics. It is therefore evident that the council has done very little in advising the business community in Langas on how they can manage their solid waste. It also emerges that non-governmental organizations and community-based organization if well coordinated can be relied upon to complement the council in solid waste management. This may be practical considering that 79% of the business operators indicated that are willing to participate in social activities aimed at improving the service delivery in Langas.

7-11 Perspectives on Solid Waste Management and Planning Legislations

The extent to which a community understands and interprets the legislations pertaining to environmental planning, and hence solid waste management significantly influence their ability to participate in a collective responsibility towards improving the service delivery. This expression was validated in the study area when it was found out that 68% of business operators in Langas were not aware of the existence of the council's by-law on solid waste management, not to mention basic legislations such as the Public Health Act, Chapter 242 of the Laws of Kenya. It also arguable that because most of the respondent do not acknowledge the existence of some of these basic legislations, they are not only likely to dispose of their wastes without knowing that it is illegal, but it further exhibits that the council's initiatives towards public education is very ineffective within the informal settlements such as Langas.

The records available at the council's Licensing Section revealed that although 1468 applications were made for trade licensing in Langas, 32% of the potential applicants failed to pay the stipulated fees. Because the council never makes a follows up to establish whether or not the rejected applicants do not put up structures without permission (Table7-2), it is possible that they could still go ahead and put up unplanned structures without the council's prior notice. For example, given that 71% of businesses operating in Langas are not licensed, this prevents the council from collecting the required fees it could use to enhance solid waste management.

Table 7-2: Applications for Business Licensing in Langas

Year	Total Applications Made	Number that Paid	Number that did not Pay
1999	455	300	155
2000	450	300	150
2001	355	250	105
2002	208	154	154
Total	**1468 (100%)**	**1004 (68%)**	**564 (32%)**

Source: Eldoret Municipal Council – Licensing Section, 2003

Furthermore, it was found out that although 76% of the respondents were aware of the existence of development control[17] as a legal provision, only 38% had constructed their structures with approval of the council. It is also clear that there are a lot of premises licensed to operate by the council in Langas, yet the owners never sought for development permission. This further underscores that the council's main focus is to collect revenue with little attention paid to commercial solid waste management.

Generally, among the operators who never sought for development permission, 56% alleged that the application fee was too high, compared to 44% who complained of long and tiring procedures that must be followed before the final approval could be granted. As a result of poor development control, which is prevalent in Langas, most operators have sited their structures haphazardly, with most of them on road reserves.

[17] The Physical Planning Act (Fourth Schedule, Section B), Chapter 286 of the Laws of Kenya, is clear that before permission for development is granted, the developer must specify the intended method of refuse disposal.

To conclude the foregoing discussion, it can be inferred among others that low participation in solid waste management by business operators are attributed to their ignorance of existing legislations on solid waste management. It also justifies why illegal solid waste disposal still continues unabated in the study area. Secondly, it can be reckoned that because most of the business structures in Langas were put up with out regard to development control, it further undermines solid waste management in Langas. The implication of this to the service delivery is that roads are rendered impassable thus preventing solid waste collection trucks from accessing some premises. This similarly applies to most residential units.

Finally, the current practice by Eldoret Municipal Council where it readily license businesses which it never approved and/ or rejected their applications for development will continue presenting an ongoing planning challenge to commercial solid waste management in Langas and other similar informal settlements within the Eldoret Municipality.

7-12 Summary

Just like the case of households, the chapter ultimately concludes that solid waste management by business operators in Langas is unsatisfactory as it exhibits an array of problems. Chief among these include, but not limited to poor primary storage prior collection by the council, adopting crude disposal techniques, not paying for conservancy fees, inadequate participation in activities aimed at sustaining solid waste management and putting up of illegal structured among others.

From a wider perspective, and by considering the limitations portrayed both by the households and business operators, the second hypothesis set in the study that inadequate planning for domestic and commercial solid waste management in Langas is aggravated by low community participation has been validated. There is therefore a need to inculcate planning alternatives aimed at strengthening the households and business community participation towards an integrated service delivery in Langas.

CHAPTER EIGHT

CONCLUSION, SUMMARY OF THE MAJOR FINDINGS AND PLANNING POLICY RECOMMENDATIONS

8-1 Introduction

The purpose of this chapter is to illuminate strategies towards a comprehensive planning for domestic and commercial solid waste management in the informal settlements within Eldoret Municipality. It is systematically structured into three sections. Whereas the first section highlights the major findings as well as conclusion of the study, the second section settles down on planning policy recommendations. Finally, the third section recommends a potential area for further research.

8-2 Conclusion and Summary of the Major Findings

In view of the analyses presented in the three preceding chapters, the study ultimately concludes that domestic and commercial solid waste management is ineffective in the informal settlements within Eldoret Municipality. In this context, the following were some of the major factors found to be limiting an effective delivery of the service in Langas and other similar informal settlements within the municipality:-

i) Lack of Eldoret Municipal Council's Inter-Departmental Partnership

Although solid waste management in Eldoret Municipality is principally planned and managed by the Department of Environment, other five departments of the council are also expected to complement it. Unfortunately, this is not the case. Solid waste management in the informal settlements within the municipality is still being perceived as a sole responsibility of the Department of Environment.

ii) Under Staffing and Lack of Skilled Personnel

The Department of Environment is understaffed with all its employees lacking professional training in urban environmental planning and management. It is characterized by understaffing both at the upper and lower cadres of management.

From this perspective, it is clear that no comprehensive solid waste management policy can be conceptualized, successfully implemented and eventually appraised if most of the officers lack the critical theoretical orientation towards the subject matter. The department also lacks a clear recruitment policy for potential employees.

ii) Poor Budgetary Allocation and Administration

It was evident that a large proportion of the budgetary allocation to the Department of Environment is used to pay the personnel salaries compared to a mere 9% set aside for operations and maintenance (actual solid waste management). This has been further aggravated by poor revenue collection. Currently, most of the business operators and households in Langas are not paying conservancy fees.

iii) Poor Conduct by Eldoret Municipal Council's Staff

Given that the council is already understaffed with personnel, this position is further compounded by a lot of working days lost through unprogrammed leaves as well as unwarranted absenteeism. In some instances, cases of corruption, drunkardness and poor customer relations to clients have been equally reported.

iv) Defective Legal Framework and Poor Enforcement Mechanism

Solid Waste Management by-law used by the council to facilitated solid waste management in the study area does not comprehensively address the subject matter. The by-law mainly concentrates on revenue collection, solid waste storage and reprimanding of offenders. It has critically failed to entrench other pertinent issues such as transportation, resource recovery, and community participation. Similarly, its enforcement mechanism is very weak as evident in Langas.

v) Inadequate Solid Waste Storage Facilities

There is a severe shortage of communal receptacles supplied by the council for solid waste management in Langas. This is a likely indication that most people resort to unacceptable solid waste management techniques such as open dumping which is prevalent in the study area.

vi) Irregular Waste Collection and Transportation Plan

Eldoret Municipal Council is yet to embrace a comprehensive collection and transportation plan for solid waste generated in the informal settlements within its jurisdiction. Most of these settlements either receive irregular or no collection at all. Similarly, lack of adequate refuse collection vehicles occasioned by persistent breakdowns is the major hindrance to efficiency in solid waste transportation in the study area. In case of breakdowns, repairing the vehicles normally take a lot of time since their spare parts are not readily available.

vii) Lack of Initiative Towards Waste Reduction and Resource Recovery

Currently, Eldoret Municipal Council has no policy towards waste reduction and resource recovery strategies Given also that the council's initiatives towards community education in regard to waste reduction at the community level is absent, we anticipate to continue witnessing an increase in the variety and sheer volume of solid waste illegally disposed of in the informal settlements within the municipality.

viii) Lack of Multi-Sectoral Partnership

Lack of cordial relationship between the council and other prospective partner institutions such as governmental, non-governmental and community based organizations overburdens the council, which is already cash stripped, hence further compounding the problem of solid waste management in the study area. Furthermore, it has not been made clear to these potential partners on how they can effectively complement the council in its initiatives towards the service delivery.

ix) Poor Development Control by Eldoret Municipal Council

The survey found out that most residential and business structures were put up without development permission from the council. Due to poor development control, a lot of unplanned structures are continuing to sprawl at a higher rate than the council could serve them. Given that the council's capacity to regulate development due to lack of a town planning department is limited, proliferation of informal settlements is expected to continue presenting a major planning challenge to solid waste management.

x) Absentee Landlords in Langas

The survey revealed that over 80% of the landlords are non-residents in Langas. It was further established that Eldoret Municipal Council does not have a record of the structure owners in the study area. In this context it becomes difficult to locate the landlords, since most of them immensely contribute to the problem of solid waste management by illegally putting up structures without regard to development control. Since most of them do not pay land rates, this becomes another avenue for revenue loss to the council.

xi) Low Residents' Income

Because Langas is essentially a low-income neighborhood, the propensity to save for most residents is very low. As a result, they mainly concentrate on meeting the basic needs: food and shelter. This justifies why some residents without a collection service are not prepared to pay for one. Similarly, a majority of those with a collection service are not willing to have the council increase the conservancy fees. Low incomes have also to an extent made most of the residents not to afford primary receptacles that conform to the specifications stipulated by the council. Furthermore, this justifies why most residents do not support privatization of the service delivery.

x) Low Community Participation

Although solid waste management was identified as a service that the council should primarily deliver in the study area, it was evident that most residents do not participate in the initiatives towards improving its management. For instance, the study found out that all the community based organizations registered in the area do not by any means engage in solid waste management activities, instead, most of them narrow their scope in concentrating on socio-economic activities. In addition, although some community members were aware of the negative impacts of poor solid waste management techniques such as open dumping, it was observed that the vice was still prevalent. It was noted that some residents disposed of their waste on the ground even at sites that had empty communal receptacles. These are among several factors identified to be limiting effective community participation in solid waste management.

8-3 Planning Policy Recommendations

This section prescribes strategic policy recommendations towards planning for domestic and commercial solid waste management in the informal settlements within the municipality. Whereas the first subsection presents the institutional restructuring strategies, the second subsection focuses on technical planning strategies:-

8-3.1Institutional Restructuring and Planning Strategies

The proposed institutional restructuring strategy in reference to solid waste management in the study area has three core strategic objectives: (a) to strengthen the council's capacity so that it can effectively plan for deliver the service, (b) to strengthen the Department of Environment so that it has the institutional capacity to sustain solid waste management projects proposed and (c) to propose a strategy for the future role and structure of the department as a whole.

i) Recommendations for a Policy on Solid Waste Management

Given that planning for service delivery at local levels in Kenya takes place in the context of relevant sectoral policies, the central government should prepare a policy on solid waste management. This would provide a framework for enhancing the service delivery at local levels, but more so within the informal settlements. It should include, but not limited to: articulating roles of the central and local governments and private sector in planning for the service within informal settlements such as Langas, and setting performance standards and strategies for building the capacity of local authorities. This should encompass technical, personnel and financial reforms as well as broad strategies for entrenching community participation.

ii) Proposed Structure for the Council's Department of Environment

A clearly defined organizational structure should be the first priority towards improving the efficiency of solid waste management in the study area. From this premise, it is recommended that the Department of Environment's functions should be two fold: to enforce regulations pertaining to solid waste management, and deliver solid waste management services. By focusing on these functions, the study is

proposing that the department be structured into four divisions: Environmental Planning, Finance, Solid Waste Management and Administration (Figure 8-1). Each division is to be headed by a Senior Deputy Director, who shall be responsible to the Deputy Director of Environment. The study is also recommending for the abolishment of the posts of Cleansing and Conservancy Officer. It shall be replaced by Assistant Operations Officer (Figure 8-2).

In addition, it is recommended that Pests and Anti-Malaria Section should be promptly transferred to the Department of Public Health since it has more to do with general sanitation as apposed to solid waste management. The position of drain workers is also to be abolished since it duplicates the duties of drain blockers under Parks Division, which shall be incorporated within Solid Waste Management Division, Refuse Collection Section.

Figure 8-1: Proposed Organizational Structure for the Department of Environment

Considering that there is currently little coordination between the Department of Environment and other four departments of the council, it is proposed that Administration Division be established within the Department of Environment. The functions of the division shall not only be to liaise with other departments, but also to appraise daily activities within the Department of Environment. The following sections present the proposed structures of each division in details:-

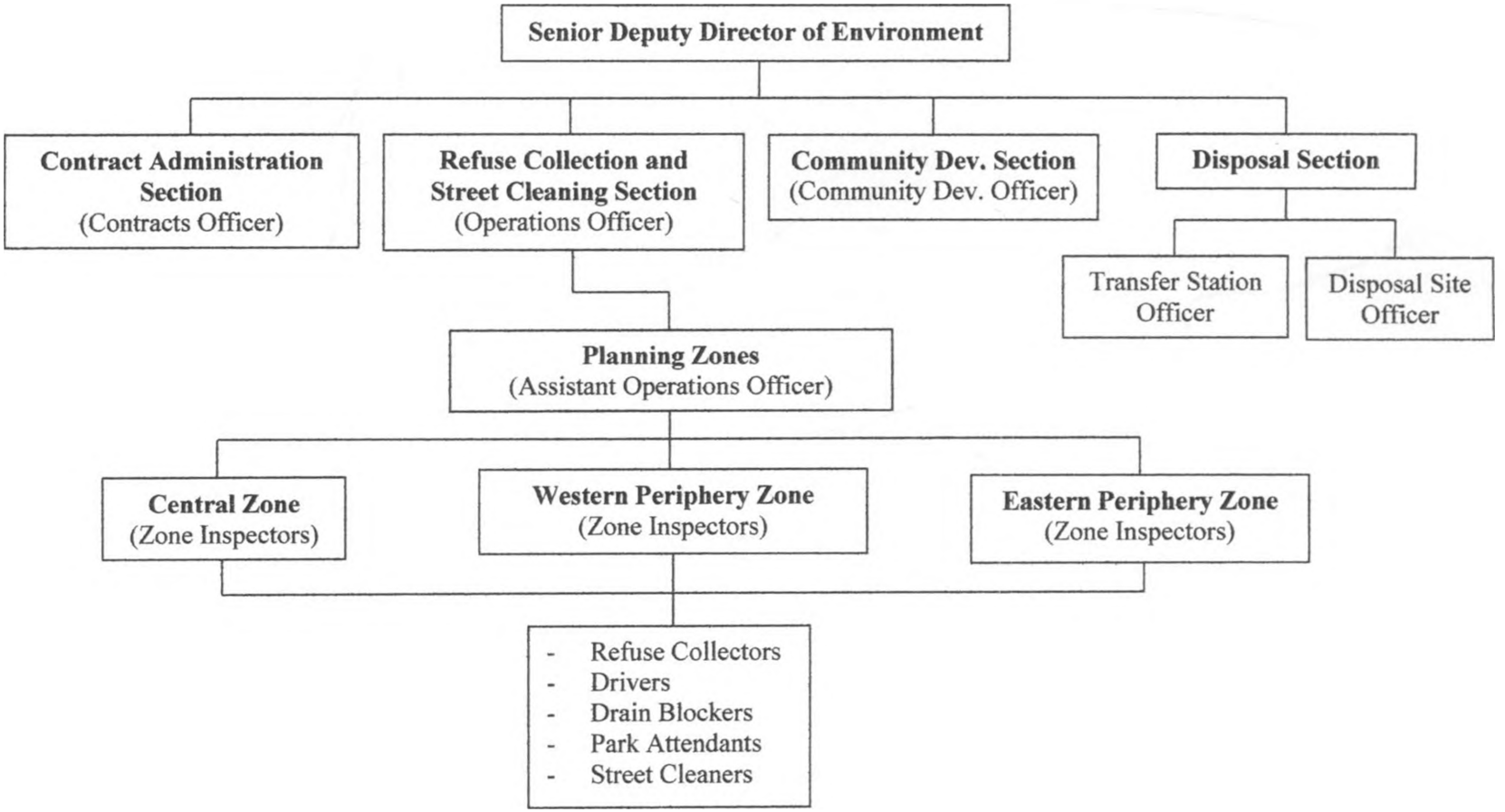
a) Proposed Structure for Solid Waste Management Division

The Division's main functions will be to provide storage, collection, transportation, attending parks, street cleansing, drain blocking and disposal services. It will also award contracts to private companies (through proposed Contracts Administration Section) such as those pertaining to solid waste management, or supply of new equipment, as well as liaise with the community through the proposed Community Development Section. Each Section shall be headed by an officer directly responsible to the Senior Deputy Director for the division (Figure 8-2). It is equally proposed that the positions of Transfer Station and Disposal Site Officers be established to manage various transfer stations and the council's final disposal site respectively.

It is further proposed that for administrative convenience the municipality should be divided into three planning zones: Central, Western Periphery and Eastern Periphery (Figure 8-3). Assistant Operations Officer will coordinate the activities within these zones. Each zone shall have an inspector to inspect all the neighborhoods under his authority, and ascertain that service delivery measures to the set standards. In addition, as a long term planning strategy, each of the three zones will have own refuse collectors and street cleaners directed by respective headmen. It is recommended that the offices of the zone inspectors should be located within their respective zones, and not at the Town Hall. This will not only increase the effectiveness of inspection, but will also facilitate the interaction between the inspectors and community in general.

As presented in Figure 8-3, decentralization of solid waste management into three planning zones is meant to enable the council efficiently concentrate on solid waste management within the informal settlements, including Langas. As per the proposed solid waste planning zones, each informal settlement will either fall within the Western or Eastern Periphery. Since the Central Zone consists mainly of high and middle-income residential estates, as well as major institutions and businesses, it is a potential zone for privatization, unlike low-income areas. Because each zone will have decentralized inspectors, refuse collectors and street cleaners, efficiency in solid waste management within the study area is envisaged to improve.

Figure 8-2: Proposed Organizational Structure for Solid Waste Management Division



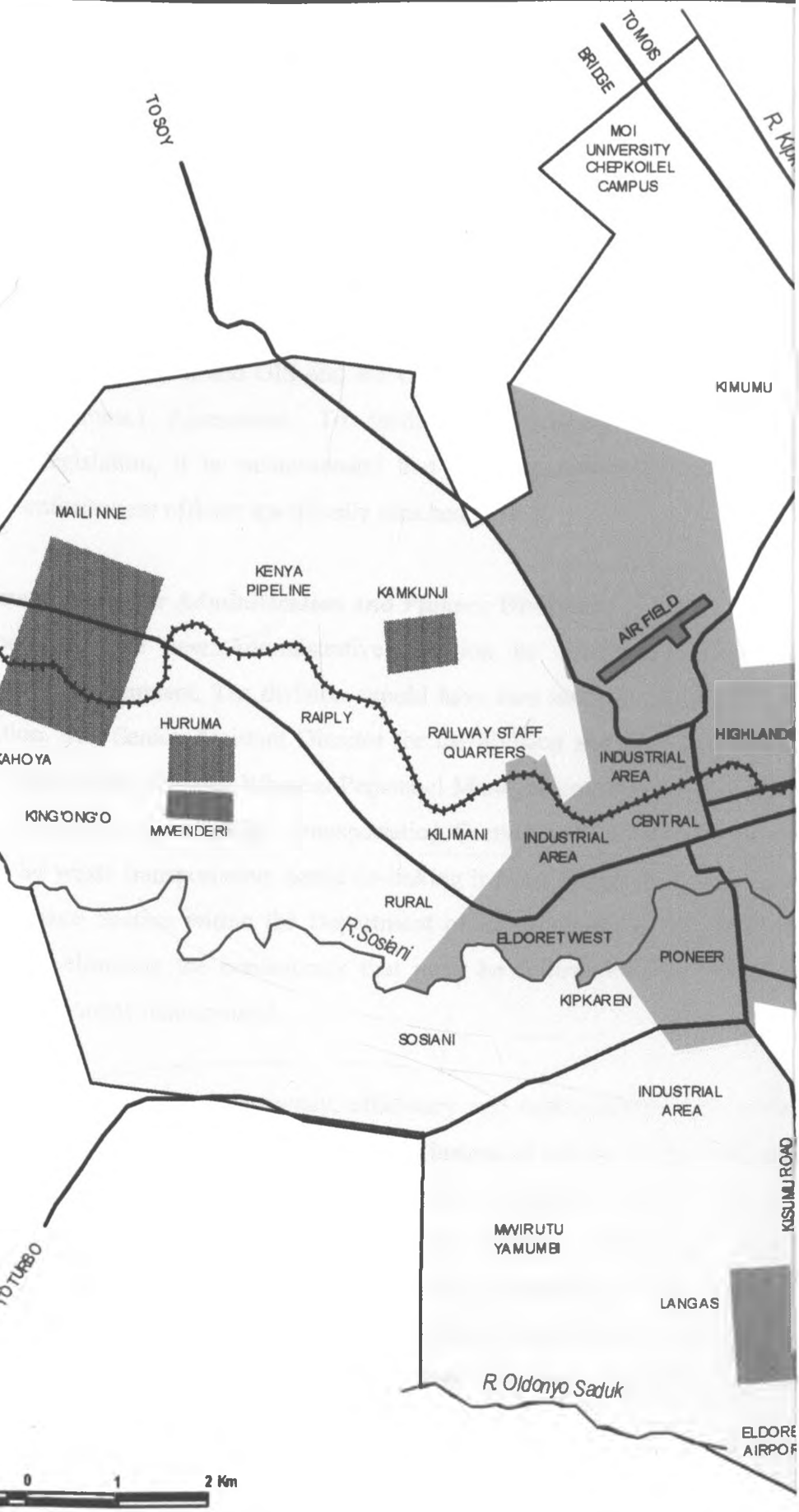
Note:

i. Community Dev. Officer - Community Development Officer

ii. Community Dev. Section - Community Development Section

iii. Langas (the study area) will fall under the Western Periphery Zone (Figure 8-3)

Figure 8-3: Proposed



b) Recommendations for Environmental Planning Division

It is recommended that Environmental Planning Division be established within the Department of Environment. Its mission would be to enforce legislations pertaining to solid waste management, maintain environmental information systems, prevent, minimize and mitigate the effects of environmental pollution in the municipality, and finally, prepare environmental action/ subject plans such as those pertaining to solid waste management. The Division shall specifically consist of Environmental Planning, Environmental Enforcement and GIS and RS Officers, who should be competent in Environmental Impact Assessment. To facilitate enforcement of solid waste management legislation, it is recommended that the Department of Environment should have enforcement officers specifically attached to it.

c) Recommendations for Administration and Finance Divisions

It is proposed that a new Administrative Division be established within the Department of Environment. The division should have two sections: Personnel, and Transportation. The Senior Assistant Director for the division should possess strong managerial and analytical skills. Whereas Personnel Management section will address all aspects pertaining to personnel, Transportation Section will oversee all matters related to solid waste transportation, hence de-linking it from Engineer's Department. Having a Finance Section within the Department of Environment is recommended because it will eliminate the bureaucracy that must be followed before funds are released for solid waste management.

It is also proposed that for transparency, efficiency and accountability, the section should be in charge of collecting conservancy fees instead of relying on the Municipal Treasurer's Department. The Finance Section will be headed by Finance Officer, whereas Personnel Section will be under Personnel Officer. Likewise, Transport Section will under the docket of a Transport Officer. In conclusion, restructuring of the responsibilities of the Department of Environment should encompass a clear definition and functional responsibilities throughout the new organization to all divisions and sections.

iii) Clarifying Complementary Roles of the Council's Departments

Currently, responsibilities pertaining to domestic and commercial solid waste management in the study area that can be best handled by other departments are solely executed by the Department of Environment. There is therefore an urgent need to clarify potential areas where five other council's departments can play a complementary role alongside the Department of Environment. For instance, whereas Education Department can facilitate environmental education, Housing and Social Services on the other hand can initiate the establishment of community based organization focusing on solid waste management in the study area.

The Department of Environment should be allowed to focus on planning and policy prescription for solid waste management, by specifically executing all the processes within solid waste management continuum. There is also a need to establish a committee that shall coordinate the activities of the council's departments towards domestic and commercial solid waste management within the study area.

iv) Multi-Sectoral Plan

Despite the fact that government ministries such as Environment and Lands and Settlement are expected to complement the council in policy formulation on solid waste management in Langas, such initiatives are always non-existence. Similarly, all potential non-governmental organizations and community based organizations tend to focus narrowly on socio-economic aspects as opposed to environmental concerns. In essence, it has not been clarified how these institutions can collaborate with the council towards the service delivery in the study area. Likewise, there is also no coordination mechanism between them. It is therefore recommended that a working group involving officials from various sectors should be set up in the municipality to appraise their potential roles and responsibilities towards improving the service delivery in the study area. The group should then be upgraded later to an administrative committee or task force. This would ensure a better coordination between various institutions that can potentially complement the council in solid waste management, specifically in the study area and other similar informal settlements.

v) Capacity Building on Solid Waste Management

To improve the service delivery through proper recruitment, promotion, discipline and training, the ongoing public sector reform should be extended to the council to phase out the roles of Public Service Commission and Ministry of Local Government in staffing matters. The move should be towards strengthening the council to become more autonomous in deployment, supervision and payment of salaries and allowances, as well as dismissing incompetent officers. This is the only way forward for filling the vacant positions within the Department of Environment. In addition, with the current changes occurring in local authorities, the Local Government Act, Chapter 265 of the Laws of Kenya, should be reviewed to empower them in areas such as hiring qualified personnel in urban planning and management. It is further proposed that the Act should allow the positions of the Directors of Environment and their deputies to be held by only qualified personnel with professional background in planning[18]. Through this, such positions will attract an array of professionals who can competently run the department, hence improving the service delivery in the study area.

vi) Public Education Plan

As a matter of urgency, the council in conjunction with potential partners should embark on an extensive public education campaign within the study area. Such campaigns should be held regularly, and should not just be conducted at busy areas such as markets; but also the interior sections within the settlements that are not served by the council's collection service. Such campaigns can be popularized by civic leaders, and should be coordinated by Community Development Officers within the proposed Solid Waste Management Division. This is likely to change the perception of residents who are not willing to pay for a conservancy service in the study area. Community education will also gradually eliminate suspicion that the community has towards the council as a non-efficient institution that is there to collect revenues, but never to deliver the service as anticipated. The study similarly recommends that community education campaigns should also aim at bridging the gender gap: solid

[18] The Local Government Act (CAP 265) clarifies that the positions of the Municipal Engineer, Medical Officer of Health, Treasurer and Town Clerk, shall be held only by officers recognized by relevant professional bodies. The Directors of Environment are however exempted from such requirements.

waste management should not be considered just as a woman's role at the household level. Finally, the council, through the proposed Community Development Section should encourage the establishment of community based organizations in the study area that would not only facilitate solid waste management, but also inculcate community education. To achieve this, the council will need to facilitate training of group members, who shall be used to train other community members (training of trainers). This activity can be well complemented by the council's Department of Education as well as other local institutions such as Moi University's School of Environmental Studies. It is also proposed that the council should take full cognisance of community participation when designing its LASDAP for LATF funding, such as those related to solid waste management.

vii) Financial Planning and Budgetary Administration

There is a need to improve financial planning and control for an effective solid waste management in Langas. This would ensure that funds intended for the service delivery are not misappropriated. The council's books of accounts have not been audited for many years. These accounts, as per the Local Government Act, are supposed to be audited by Auditor General. It is recommended that the council should be assisted to prepare auditable accounts. The support should facilitate the preparation of income and expenditure statements and abstracts of accounts. This would promote transparency and accountability in financial management, hence ensuring that revenues collected are efficiently utilized in facilitating solid waste management.

The council should similarly revamp its revenue collection. It is worth noting that if the council can attain at least 80% revenue collection, solid waste management can be self-sustaining, and further used as a local multiplier to accelerate development of other infrastructure and services such as water and sewer reticulation in Langas. Revenue collection in form of conservancy fees should be accompanied by an increased collection from other areas that the council has a mandate over, for instance annual land rates. It is recommended that conservancy fees should be collected directly by the Department of Environment through the proposed Finance Section.

viii) Policy Recommendations on Upgrading of Local Authorities

Informal settlements within Eldoret Municipality, such as Langas developed due to unplanned boundary extensions. If not pre-empted, more informal settlements are likely to be incorporated into the municipality from the Wareng' County Council. To avoid such uncertainties in future, it is proposed that Section 9 (1) of the Local Government Act (CAP. 265) that gives the Minister for Local Government powers to amend the boundaries of local authorities be repealed. After this, a policy on upgrading of local authorities that encompass the following should be prepared:-

1. Local authorities in Kenya should only have their boundaries extended if they have a sound economic base to warrant the investment in infrastructure and services, in this case solid waste management, to the newly acquired land and/or population.
2. For a local authority in Kenya to merit boundary extension, it must have an adequate capacity to control development within the newly acquired land.

The above strategic components would provide a viable framework to ensure that in future, informal settlements characterized by poor service delivery, in particular, solid waste management such as Langas, do not develop in Eldoret Municipality.

ix) Legal Restructuring Plan

Solid waste management is ineffective in urban areas of Kenya, but more so in Langas due to lack of a complete legislation. In view of this, the study is recommending for the establishment of solid waste management legislation. The legislation will address the inherent weaknesses exhibited by some current legislation, especially the Public Health Act (CAP. 242), Local Government Act (CAP. 265) and Environmental Management and Coordination Act, No. 8 of 1999. This would confer upon local authorities, such as Eldoret, a clear legal mandate to regulate solid waste management activities within the informal settlements such as Langas as well as the greater municipality. The legislation should explicitly cover all the processes of solid waste management, including financing, waste reduction and resource recovery, privatization, professional qualification of personnel and polluter pays principle among others. It should equally confer upon the community *locus standi*: if the

council fails to protect the environment at the expense of public health, the community can have a legal basis for suing it for non-service delivery. When enacted, the legislation will be enforced by the Environmental Enforcement Officers within the proposed Environmental Planning Division, Department of Environment. It is worth retaliating that community education within the informal settlements would be paramount for the enactment of the envisaged legislation, especially in Langas.

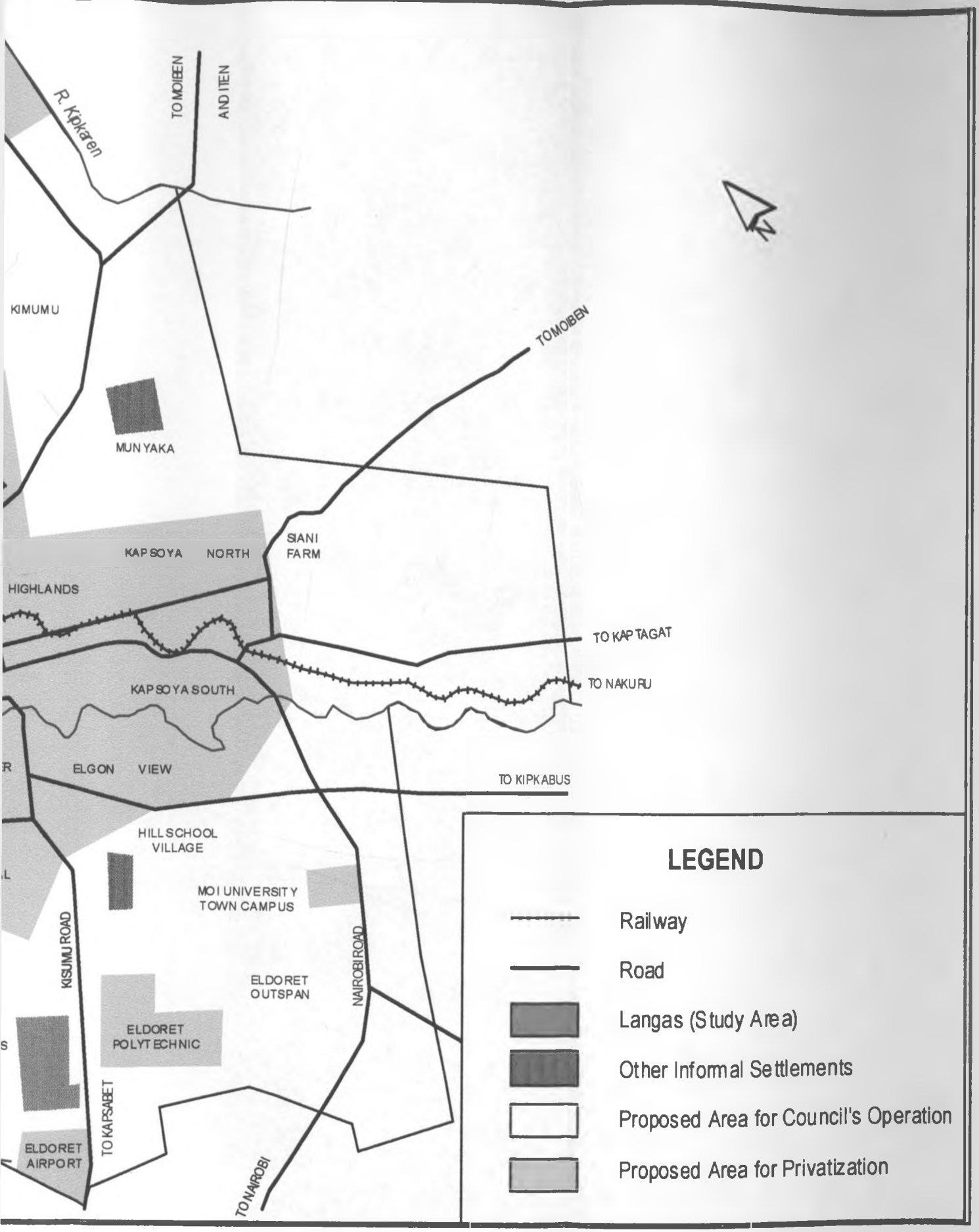
x) Development Control

Poor development control is among the core factors that have exacerbated the proliferation as well as expansion of informal settlements such as Langas within Eldoret Municipality, hence the emergence of solid waste menace. This situation is further aggravated by the fact that the council does not have the capacity to control development. It is therefore recommended that a fully fledged Department of Town Planning should be immediately established, and staffed with professional planners. Similarly, the Local Government Act (CAP. 265) should be reviewed to make it mandatory for all local authorities to have town planning departments, the way it acknowledges the departments of Public Health and Municipal Engineering.

xi) Private Sector Involvement Plan

The study is not recommending for the service privatization in Langas due to low-incomes of its residents. There are essentially no economies of scale that could attract private operators in Langas and other similar informal settlements. This implies that the council will continue being the major institution in charge of the service delivery in these neighborhoods, typically Langas. To improve solid waste management within the informal settlements, it is proposed that the council should consider privatizing the service in all the high and medium income residential neighborhoods including the central business district and all major institutions. The overall goal is to enable it concentrate on the service delivery within low-income residential neighborhoods that constitute the major informal settlements within the municipality, which Langas is part of (Figure 8-4). All cases related to privatization and other contracts shall be handled by proposed Contracts Administration Section.

oposed Spatial Model for Privatization Zones



8-3.2 Technical Planning Strategies

The preceding section (8-3.1) presented institutional restructuring approaches towards an improved solid waste management in the informal settlements within the municipality. This section focuses on the technical restructuring planning strategies. Under it, storage, collection and transportation plan, environmental information systems, waste reduction and resource recovery plan have been discussed.

i) Solid Waste Storage Plan

It is recommended that all the residents in Langas must have individual receptacles for storing solid wastes prior disposing them to communal receptacles for collection. This would minimize open dumping and other unacceptable techniques in solid waste management. The council should also set the minimum standard for primary receptacles that residents must have. It is equally proposed that the council should provide communal containers ("din" standard) at a reduced fee. This is because the current rental fee of Kshs. 280 per month is way beyond the affordability limits of the majority. Given that the restructured function of the Department of Environment is expected to increase efficiency, it is similarly anticipated that this would increase revenue collection from the study area. In case a structure is occupied by a tenant, then it should be the responsibility of the tenant to pay for the conservancy fees, not the landlord; hence, the tenants should buy the primary receptacles. Finally, the council should increase the number of communal receptacles proportionately to population; likewise, they should be strategically sited to discourage illegal dumping.

ii) Solid Waste Collection Plan

By considering the rates of solid waste generation in the study area, it is proposed that the council should collect solid waste three times a week and not once, as currently practiced. This should be done in the afternoon (between 2-3 pm) when much of the waste has been generated. Due to poor accessibility of most structures, the council should adopt station type collection where it would collect wastes discharged at communal points, instead of using door-to-door system which is both time consuming

and expensive. As indicated in the proposed zones for solid waste collection (Figure 8-3) whose objective is to decentralize solid waste management in the municipality, it is recommended that each of the zones representing informal settlements (Western and Eastern Peripheries) should have transfer stations. These would be used to temporarily store wastes before being transported to the final disposal site. The proposed transfer stations will not only reduce the number of trips that must be generated to and from the council's disposal site, but will also increase the frequency of collection. In addition, it will make it easier for potential community based organizations to engage in waste collection, since there will be no need to transport wastes to the council's disposal site, which is far from the study area, hence a reduction in operation costs.

To ensure that solid waste management is efficiently executed, the offices of all zonal inspectors (Figure 8-2) should be physically located within the respective planning zones, and not at the Town Hall. This will make it easier to assess the performance of refuse collectors. It will also facilitate the interaction with community. As a long-term planning strategy, each zone representing informal settlements such as Langas is proposed to have own stationed refuse collectors and street cleaners. This will be a departure from the current practice where they serve all neighborhoods at the same time, despite the fact that a majority of the population in the municipality reside in Langas. Suffice it to say that Eldoret Municipal Council, through the proposed Community Development Section, will have to undertake extensive sensitization campaigns to enlighten the community on its collection programme.

iii) Transportation and Vehicles Maintenance Plan

Sound solid waste management practice in the study area will require preventive maintenance of equipment, including vehicles, containers, transfer stations, and tools. Poor maintenance of collection equipment is a well-documented problem in Eldoret Municipality. It is not uncommon for half or more of the council's fleet to be out of service at any one time. In addition, main causes of failures such as brakes, puncture, and gear require long duration in the current workshop due to not only lack of spare parts, but also long bureaucratic procedure that has to be followed for the procurement

of the same. Currently, all spare parts and equipment must be purchased through the Municipal Treasurer's Department. The Department of Environment cannot deal autonomously with the procurement of spare parts and the required equipment. It is this bureaucratic system, which inhibits timely supply for replacement and repairs of solid waste management equipment, hence affecting the service delivery in the study area, and indeed the entire municipality.

To solve the problem, it is recommended that a small workshop fully managed by the Director of Environment, through the Transport Officer within the proposed Transport Section be constructed. The workshop will cover all preventive maintenance and collection vehicles on a daily basis, hence de-linking it from the Municipal Engineer's Department. It was also found out that most of the vehicles used by the council were imported, and therefore are not only expensive to purchase and maintain, but also inappropriate for the local environment, notably the dilapidated roads in Langas. To overcome this, it is proposed that the council should:-

1. Consider purchasing locally assembled vehicles that can withstand deplorable conditions such as those presented by poor roads and high density of wastes generated in the study area;
2. Ensure that other related equipment, such as communal receptacles are also manufactured locally. This would save costs and increase the number of containers available for secondary storage within the study area and other similar informal settlements;

iv) Developing of Geo-Information Systems (GIS) and Remote Sensing (RS)

Accurate and timely information is paramount for urban planning, specifically in service delivery. In this case, it is recommended that Eldoret Municipal Council should developing GIS and RS techniques to enhance its technical capacity in solid waste management in Langas and other informal settlements. The aim of this strategic planning component would be to restructure the entire system of solid waste storage, collection, transportation, transfer and disposal by integrating both GIS and RS.

The following are some of the benefits envisaged to accrue if the techniques are carefully entrenched into a planning information system for solid waste management in the study area, as well as other similar informal settlements:-

1. The council would easily monitor and document changes pertaining to solid waste in terms of spatial and temporal dimensions;
2. Through the system, the GIS database would enable the municipal planners to appreciate the location of each undesignated disposal site as well as their potential implications to the physical environment and public health;
3. The system would make it easier to site the communal receptacles and determine the optimum and least cost path for routing of refuse collection vehicles;
4. The techniques would enable a rapid and repeated analytical testing of conceptual models about the nature of solid waste disposal. This will in turn allow the evaluation of both the scientific and planning policy criteria of large areas within a short periods of time;
5. More important, GIS would maintain both spatial and aspatial data. By eventually integrating RS and GIS, a database would be maintained on all the structure owners. This would be critical in tracking down absentee landlords because the system would be queried to retrieve details pertaining to each structure owner[19], for example area of residence, national identification number and contact address;
6. Other pertinent information such as housing condition, accessibility mode to the structure and whether or not the structure (a) has an access to secondary receptacle, (b) receive regular refuse collection service, (c) has a primary receptacle, (d) was put up with development permission, and (f) the household size within each structure would all be quickly and cheaply obtained hence facilitating prompt as well as timely decision making.

As noted earlier, GIS and RS will be designed and maintained by the GIS and RS officers within the proposed Environmental Planning Division.

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[19] Use of GIS and RS techniques has been successfully used by the Physical Planning Department within the Ministry of Lands and settlement, Kenya, to upgrade Kibera informal settlement. The project also included keeping a database with records pertaining to all the structure owners.

v) Proposed Waste Prevention, Recycling and Composting Strategies

To handle increasing volumes of solid wastes, techniques that would reduce pollution, maximize recovery of reusable and recyclable materials, and protect human health and the environment are recommended. These include:-

v-i) Solid Waste Prevention

Solid waste prevention, in particular the generation of non-biodegradable wastes such as plastics, should be accorded the highest priority by Eldoret Municipal Council. This would seek to reduce the amount of non-biodegradable wastes that households and business operators in the study area generate. Given that plastics used in Langas originate from other parts of the municipality (or outside the municipality), there is a need to pursue a policy aimed at minimizing the generation of such non-biodegradables. The policy should set to reduce the amount of plastic wastes that dominates household and commercial waste stream in the study area. From the above premise, it is proposed that as a planning strategy:-

1. The central government, through the Ministry of Trade and Industry, should seek to formulate a policy that would encourage the production and sale of reusable or recyclable products not only in Eldoret Municipality, but also in other regions in the country. This can be achieved by awarding tax concessions[20] to such industries[21]. The specific objective would be to encourage the industries that manufacture plastic packaging materials to venture into paper packaging materials.
2. Eldoret Municipal Council should encourage business operators in Langas and other informal settlements within the municipality to avoid using plastic materials for packaging their products; instead, they should be sensitized to consider using recyclables and biodegradables such as paper bags.

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[20] Concessions in this case may include lowering tax on paper products (biodegradables), specifically those used in manufacturing of packaging materials.

[21] Plastics manufactured in the municipality by companies such as Arkay Plastics are easily marketed to businesses operating in Langas. Similarly companies based outside the municipality that also manufacture plastic packaging materials can equally market them to the municipality. These reveal the avenues through which plastics can be easily introduced in Eldoret Municipality, and eventually Langas and other informal settlements.

v-ii) Recycling

Recycling, as a resource recovery technique, would equally reduce the amount of solid waste that need to be collected, transported and disposed of from the study area. It would similarly extend the life of storage and disposal facilities. The field survey found out that most of the residents in the study area were aware of recycling as a method of resource recovery, and were willing to form community based organizations aimed at facilitating the activity.

It is recommended that the council should seek to explore this opportunity by encouraging the establishment of such community based organizations. The proposed Community Development Section should not only conduct public education campaigns, but also train community leaders, who shall then be used as agents of disseminating information to other community members.

This defines the new emerging concept of "training of trainers". Through community based organizations, "redemption centres", defined as waste trading enterprise that buys recyclable materials and sell them to brokers, should be established as a long term strategy in the study area. Community should be sensitized to sell their recyclables, such as bottles at these centres. Since Langas and other informal settlements are inhabited by low-income earners occasioned by unemployment, such centres will not only earn income to the potential sellers, but also create employment opportunities to the operators themselves.

Related to recycling is source separation, which the study equally recommends as a feasible strategy in the study area. In this type of proposal, community would be encouraged to store recyclable materials in different containers so that they are not mixed with non-recyclable wastes. Since this method would require use of two primary receptacles for recyclables and non-recyclables, it is proposed that it be considered as a long-term planning strategy because it would premise that extensive sensitization campaigns be conducted to enlighten the community on the value of the exercise. The principle objective of source separation would be to capture non-

biodegradable wastes such as plastics before they could be disposed of. The final recommendation for recycling within the study area is that the council should initiate marketing programs that would create demand for recycled products as one of the strategies towards resource recovery within the informal settlements. To achieve this, the council should strive to form a strategic alliance with local industries such as Arkay Plastics, Eldoret Steel Mills, Raiply, Kenknit, and Eldo Plast as potential companies that could be used to market some of the recyclables, especially plastics.

v-ii) Composting

Because Eldoret Municipality is predominantly agricultural, and given that some residents in Langas and other similar peri-urban informal settlements practice urban agriculture, it is recommended that the council, through the envisioned community based organizations, should encourage such residents to practice composting, instead of using crude techniques such as open dumping to dispose of their organic (non – recyclable) wastes. The proposed Community Development Section should assist the community groups to market their compost to the local urban farmers within the municipality and the wider Uasin Gishu District. This is also inculcated to create employment opportunities as in the case of recycling.

In conclusion, the vision of domestic and commercial solid waste management in the study area and other informal settlements should be structured within the principle of waste management hierarchy. The focus of the strategic plan will be to move from a dependence on disposal to an emphasis on resource conservation and recovery. A sound and effective regulatory framework will be necessary to support the initiatives in waste management practices towards resource recovery and environmental protection. Monitoring and review will equally be essential to track progress towards resource recovery and waste reduction strategies. Measurable targets and actions for data collection and analysis should be the component of the strategic plan. Monitoring and review process will enable Eldoret Municipal Council to map programs of resource recovery and at the same time make adjustments to its strategic solid waste management initiatives.

vi) Planning Proposals for a New Disposal Site

The council's current dumping site, where solid waste collected from Langas and other similar informal settlements is disposed of, is unplanned with unstructured solid waste operation, which does not meet many of the requirements of a standard sanitary landfill. Adjacent to the site is Huruma and Mwenderi informal settlements. No facilities are provided to prevent secondary pollution. The site, which was once a quarry, is full; this implies that solid waste collected from the informal settlements such as Langas and other areas within the municipality will soon not have a site for final disposal. It is therefore recommended that the site should be closed as soon as possible, and a new one identified.

In planning for and eventually selecting a sanitary landfill site to replace the current one, consideration should be given to not only the requirements of a good sanitary landfill design, but must equally encompass public concerns, public relations, political acceptance, and planning and health laws, the availability of sewers, roads, water for fire control, potable drinking water, telephone and electricity. The design of the new landfill must consider the volume of material to be compacted and amount of cover material to be utilized.

As part of the design, studies should be made of the property description and location, topographic description, soil types and suitability, bed rock elevations and rock types, estimated ground water Table elevation, water surface location, prevailing winds, annual rainfall predictions, temperature variations and the distance from collection sites and proposed transfer stations. The plan must include avoidance of erosion, establishing natural windbreaks, green belts, permanent and temporary roads, types of buildings to be erected and fencing to be utilized. Control of surface water will be an important part of the plan. Therefore, the plan must encompass the techniques to be used to divert surface water. These techniques include pipes, gulley, canyons, drainage ditches and sump pumps. The plan must also account for controlling the movement of methane gas, which is highly explosive in high concentrations in the presence of oxygen.

In site selection, it will be necessary to determine the land requirements, zoning restrictions, accessibility, hauling distance, cover material, climate, fire control facilities, future growth direction of the council, legal aspects involved, political considerations and the ultimate land use. More so, the new site must be easily accessible to major roads where trucks can normally travel without causing complaints. The roads to the landfill site should be wide enough and constructed of all-weather materials to handle necessary tuck traffic.

Finally, it is proposed that the new disposal site should have an office run by proposed Disposal Site Officers (Figure 8-2). This would prevent crude dumping by truck drivers, and ensure that landfill does not contribute to environmental pollution. The officer will also control the activities of scavengers at the dumping site.

8-4 Recommended Area for Further Research

Although strategic policy recommendations for domestic and commercial solid waste management in the study area and other similar informal settlements within Eldoret Municipality have been presented, some aspects were not covered because they were beyond the scope of the study.

There is a need to conduct an exhaustive study on underground water quality in Langas. The objective will be to find out if numerous unplanned disposal sites contribute to the pollution of underground water, hence a prescription of strategic policy measures.

This was not covered in the study, however, solid wastes were acknowledged as potential pollutants of underground water system as evident with uncontrolled leaching especially during the rainy seasons.

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APPENDICES

Appendix I: Questionnaire – Eldoret Municipal Council

I kindly request for your assistance by answering the questions below. Your response will be helpful in recommending a sustainable solid waste management strategy in the informal settlements within the municipality, and shall be treated as **highly confidential**.

---

1. Which factors have accelerated the problem of solid waste management in the informal settlements within the municipality, e.g. Langas?.....
2. Which problems do you experience in managing solid wastes in the informal settlements within the municipality?.....
3. How are you addressing the above problems?.....
4. Approximately how much solid waste is generated in the municipality in Kgs./ tons per year, and how much is collected?.....
5. In total, how many vehicles/ equipment for refuse management does the council currently have? (Please indicate the required number, available number, number in good working condition and number in bad working condition) .....
6. How many receptacles have the council had between 1998 and 2002 for solid waste storage? .....
7. What is the distribution of the above refuse receptacles/ communal containers in residential areas within the municipality?.....
8. What were the estimated and actual expenditures for slid waste management during 2001/02 and 2002/03 financial years?.....
9. What is the composition of waste management labour force in the cleansing section?.....
10. What is the highest level of education attained by the employees in the Department of Environment?.....
11. Do you conduct regular workshops or seminars aimed at sensitizing employees on some of the current issues on solid waste management? i. Yes [ ] ii. No [ ]

12. Do you hold clean up campaigns in the informal settlements within the municipality? i. Yes [ ] ii. No [ ]
13. If yes to above, approximately how many times a year does the clean up days occur in Langas?.....
14. Who are some of your partners as far as solid waste management is concerned in the municipality's informal settlements?.....
15. Which areas do they complement in solid waste management?.....
16. In your view, what is the future prospect of solid waste management in the informal settlements within Eldoret Municipality?.....

Thank you very much for your anticipated assistance. I hope I might call again in future incase I still need more of your help. Stay well.

Appendix II: Questionnaire – Households

I kindly request for your assistance by answering the questions below. Your response will be helpful in recommending a sustainable solid waste management strategy in the informal settlements within the municipality, and shall be treated as **highly confidential.**

Part A: Household Socio-Economic Profile

1. Type of respondent: (Head of household/man, wife, house keeper, others.....)
2. (a)How many people live in your house? ..... (b). Occupation.....
3. What is your average monthly income (Kshs.)?.....
4. On average, how much do you spend in the following items per month (Kshs.)?
   i. Electricity ..... ii Water.....iii Food.....
   iv Transport ..... v. Rent.....v. Others (specify).....
5. (a) Are you the owner of this house or a tenant? i. Owner [ ] Tenant [ ]
   (b) Tax paid if owner (total ground rent and rates).....
   (c) Rent paid if tenant (Kshs).....
   (d) If owner, did you sought for development permission before putting up the structure? i. Yes [ ] ii. No [ ]

(e) If 'no' in 'd' above, what are the reasons for not seeking development permission?.....

6. Building utility/ use: i. Fully residential [ ] ii. Commercial/residential [ ]

Part B: Household Solid Waste Collection and Storage

7. Which service should the Council immediately deliver to your area?.....
8. How serious is the solid waste menace in your area? .....
9. Who is responsible for collection and disposal of solid wastes in your neighborhood?..... .....
10. What are some of the problems you experience due to unplanned disposal of solid wastes in your neighborhood?.....
11. What types of wastes do you commonly generate?.....
12. How would you rank the performance of the Municipal Council regarding garbage collection in your area?.....
13. (a) What type (s) of container (s) do you use for holding wastes in your house?
14. Where do you dispose of wastes from your house?

i.	To own dustbin [ ]	iii.	Around the house [ ]
ii.	To a communal receptacle [ ]	iv	Others (specify).....

If the answer to **14** is (i) go to question **15**, else if (ii), go to question **16**

Question for Respondents with own Dustbins:

15. (a) Where do you keep the dustbin? .....(b)How many do you have?.....
(c) Where do you take the dustbin for collection by collection service?.....

Questions 16-17 for Respondents Using a Communal Discharge Point

16. How far is the communal container/ receptacle or discharge point from your house?.....
17. (a) Do you discharge wastes at a fixed time? i. Yes [ ] ii. No [ ]
(b)If yes, please specify (morning, mid-day, afternoon, evening, night).
(c) How often do you take wastes to the discharge point?.....

18. Does any one in your house sweep the road shoulder or public area in front of your house? i. Yes [ ] ii. No [ ] iii. Don't know [ ]
19. Does any one in your house clean the open drain in front of your house?.....

Part C: Household Solid Waste Collection Services

20. Is there waste collection in your area? i. Yes [ ] ii. No [ ]

Questions (21-25) for respondents without a collection service

21. Would you like to have collection services? i. Yes [ ] ii. No [ ]
22. If yes above, what type of collection service would you like?.....
23. Would you be willing to pay for a collection service? i. Yes[ ] ii. No [ ]
24. If yes, how much would you be willing to pay?.....
25. If no, give reasons for not wanting to pay for collection services.....
26. (a) Have you ever complained to the council about removal of wastes from your neighborhood? i. Yes [ ] ii. No [ ]
    (b) If yes, give details.....

Questions (27-31) for respondents with a collection service

27. (a) If you have a collection service, how frequently is your waste collected?.....
    (b) Specify the time of collection .....
28. Who is responsible for collection and disposal of solid wastes in your house?.....
29. If Eldoret Municipal Council, how would you rank its performance?.....
30. How much do you pay for the collection service per month.....
31. (a) Are you satisfied with the collection service? i. Yes [ ] ii. No [ ]
    (b) If no, what are the reasons?.....
    (c) Would you be willing to pay more for improved service in your area?.....
32. What time would you prefer wastes to be collected from your neighborhood?.....
33. How many times would you like wastes to be collected from your neighborhood per week?.....
34. In your opinion, which institution can be relied upon in effective collection and disposal of wastes in your neighborhood?.....

Part E: Resource Recovery

35. Are you aware that newspaper etc can be recycled?.....
36. Do collectors come to your house to collect or buy waste materials?.....
37. If a local residents' association were to raise funds to improve waste collection in your area by collecting and recycling your wastes, would you be willing to participate? i. Yes [ ] ii. No [ ]
38. If yes, how would you be willing to contribute?.....
39. Would you be prepared to separate kitchen and garden wastes from other wastes if separate collection service is to be available? i. Yes [ ] ii. No [ ]
43. Which materials have you recycled/re – used in the last six months? .....

Part F: Gender Considerations in Household Solid Waste Management

40. Are there any particular customs or habits that influence the disposal of wastes in your household? i. Yes [ ] ii. No [ ]
41. If yes, please explain.....
42. Have you ever participated in social activities for improving sanitary conditions in your area? Yes [ ] ii. No [ ]
43. If yes, how frequently do you participate?.....
44. If no, would you be interested in participating in such activities? .....

Part G: Public Education, Law and Privatization

45. Have you ever been advised on alternative method (s) of disposing of your domestic wastes? i. Yes [ ] ii. No [ ]
46. (a) Are you aware of the existence of any law which prohibits indiscriminate dumping of solid wastes? i. Yes [ ] ii. No [ ]
    (b) If yes, please name some of them.....
47. Are clean up days held in your area? i. Yes [ ] ii. No [ ] iii Don't Know [ ]
48. If yes, do you participate in such activities? i. Yes [ ] ii. No [ ]
49. Are you willing to support privatization of solid waste management?..... .. ..

Thank you very much for your anticipated assistance. I hope I might call again in future incase I still need more of your help. Stay well.

Appendix III: Questionnaire – Business Operators

I kindly request for your assistance by answering the questions below. Your response will be helpful in recommending a sustainable solid waste management strategy in the informal settlements within the municipality, and shall be treated as **highly confidential**.

Part A: Background Information

1. Age of respondent [ ] 2. Sex ..... 3. Highest level of education.....
4. Type of business (service, manufacturing, or trade) (b) No. of employees.....
5. When did you establish your premise in this area? .....
6. (a) Do you own this business? i. Yes [ ] ii. No [ ]
   (b) If yes, on average, what is your monthly returns? .....
   (c) What is your monthly expenditure in the following items:-
   i. Electricity.....ii. Water.....iii. Transport.....
   iv. Rent.....v. Stock of goods.....vi. Others (specify).....

Part B: Business Solid Waste Management

7. Which service should the council immediately deliver to your area?.....
8. How serious is the problem of solid waste management in your area?.....
9. Who is responsible for collection and disposal of solid wastes in your neighborhood?.....
10. If personal initiative, how do you dispose of these wastes?.....
11. Which packaging materials do you use?.....
12. What types of solid wastes do you generate?.....
13. Do you sweep the road shoulder or public area in front of your premise? .....
14. Do you sweep the road shoulder or public area in front of your premise?.....
15. Does any one in your premise clean the open drain in front of your premise?.....
16. How would you rank the performance of the Municipal Council of Eldoret regarding garbage collection from your premise?.....

17. Have you ever participated in social activities for improving sanitary conditions in your area? i Yes [ ] ii. No [ ]
18. If no, would you be interested in participating in such activities? Yes [ ] No [ ]
19. In your opinion, which institution can be relied upon in effective collection and disposal of wastes for your premise?.....
20. What are some of the problems you experience due to unplanned disposal of solid wastes in your neighborhood?.....

Part C: Business Solid Waste Storage

21. What types of container (s) do you use for holding wastes in your premise?.....
22. If you have an individual receptacle, where do you keep it? .....
23. Do you have access to communal receptacle? i. Yes [ ] No [ ]

Questions for respondents using a communal container or discharge point

24. How far is the communal container from your premise?.....
25. Do you discharge wastes at a fixed time? i. Yes [ ] ii. No [ ]
26. If yes, please specify (morning, mid-day, afternoon, evening, night).
27. How often do you take wastes to the discharge point?.....

Part C: Business Solid Waste Collection Services

28. Is there waste collection in your area? i. Yes [ ] ii. No [ ]

Questions (29-33) for respondents without a collection service

29. Would you like to have a collection service? i. Yes [ ] ii. No [ ]
30. If yes, which method would you prefer?
    i. Waste collected from house and taken to communal point [ ]
    ii. Waste collected from communal discharged point and your neighborhood kept clean [ ]
    iii Others (specify).....
31. Would you be willing to pay for a collection service? i. Yes [ ] ii. No [ ]
32. If yes, how much are you willing to pay?.....

33. If no, give reasons for not willing to pay?.....
34. Have you ever complained to the authorities about removal of wastes from your area? i. Yes [ ] ii. No [ ]
35. If yes, give details.....

Questions (36-45) for respondents with a collection service

36. If you have a waste collection service, how frequently is your waste collected?.....
37. Please specify the time of collection (morning, mid-day, afternoon, evening, night)
38. Who is responsible for collection and disposal of solid wastes in your premise?....
39. If Eldoret Municipal Council above how would you rank the performance of the Municipal Council in regard to waste collection in your area?
40. How much do you pay for the collection service per month.....
41. Are you satisfied with the collection service? i. Yes [ ] ii. No [ ]
42. If no, what are the reasons for not being satisfied?.....
43. Would you be willing to pay more for improved service in your area?.....
44. If yes, how much would you be willing to pay per month?.....
45. How many times would you like wastes to be collected from your premise per week?.....

Part D: Resource Recovery and Waste Reduction

46. Are you aware that newspaper, bottles etc can be recycled? i. Yes [ ] ii. No [ ]
47. Do collectors come to your premise to collect or buy waste materials?.....
48. If yes, what materials are collected?.....
49. If a local residents' association or club were to raise funds to improve waste collection in your area by collecting and recycling your wastes, would you be willing to participate? i. Yes [ ] ii. No [ ]
50. If yes, how would you be willing to contribute?.....
51. Would you be prepared to separate plastic wastes and other non-biodegradable if separate collection service were to be available in your area? Yes [ ] ii. No [ ]

Part E: Law, Public Education and Privatization

52. Is your business licensed? i. Yes [ ] ii. No [ ]
53. If no, give the reasons why.....
54. Are you aware of the existence of development control/ permission?.....
55. If yes, did you seek one prior the establishment of your premise?.....
56. If no above, why was development permission not sought?.....
57. Are you aware of any legislation prohibiting indiscriminate dumping of solid wastes? i. Yes [ ] ii. No [ ]
58. If yes, please list some of them.....
59. Have you ever been advised on alternative method (s) of disposing of your wastes? i. Yes [ ] ii. No [ ]
60. If yes, where did you get this advice? .....
61. Are clean up days held in your area? i. Yes [ ] ii. No [ ]
62. If yes, do you participate in these clean up activities? i. Yes [ ] ii. No [ ]
63. Are you willing to support privatization of solid waste management?.....
64. If yes above, how much would you be willing to pay per month?.....

Thank you very much for your anticipated assistance. I hope I might call again in future incase I still need more of your help. Stay well.

Appendix IV: Statutory Notice – Department of Public Health

Eldoret Municipal Council

Notice Ref. No.....

To:.....

Public Health Department
Town Hall
Tel. No: 31326 and 31327
P.O.Box 40,
Eldoret

Statutory Notice

TAKE NOTICE that under the provisions of:-

The Public Health Act (CAP 242 of Laws of Kenya) and Subsidiary legislation made hereunder;

The Local Government Act (CAP 265 of Laws of Kenya), and Subsidiary legislation made hereunder;

The Medical Officer of Health being satisfied of nuisance under the said Act/ the local authority being satisfied of nuisance under the said regulations/ the Local Authority being satisfied of contravention of the said Regulations or the Subsidiary legislation at:-

Block No. ..... Plot No. ..... Rd/St.....

ARISING FROM:-

1. causing a nuisance on premises owned or occupied by him or her which is liable to endanger public health (Vide Sec. 115 of CAP 242 Laws of Kenya)
2. any premises which is so dirty as to pose danger or risk to public health (Vide Sec. 118 (I) and (B) of CAP 242 Laws of Kenya)

DOES HEREBY REQUIRE YOU WITHIN 7 (seven) days from the date of service of the notice to abate nuisance/prevent a recurrence of the contravention, and for that purpose to execute such works and do such things as may be necessary, namely:-

1. provide adequate dustbins in your premise for storage of waste until collected,
2. place a standard dust bin at frontage of your premise for your use and clients' use all the time,
3. stop contributing towards mismanaging the environmental cleanliness by not taking care of wastes in and around your business premises.

DATED this ..... day of .....20.....

Medical Officer of Health **Chief Public Health Officer**

If you require advice in respect of this notice the Chief Public Health Officer may be seen by appointment during the office hours at the Town Hall.

I hereby certify that I have received Statutory Notice No.....and that this is true copy of the said Notice.

Signature:..... Date:.....

Appendix V: Clients' Refuse Collection Complaints Form

Eldoret Municipal Council - Department of Environment

Name: .....

Account Number: .....

Location: .....

Complaint: .....

Action Required.....

Date:.....

Appendix VI: Movement of Trucks Log Book

Eldoret Municipal Council - Department of Environment

To: Director of Environment:..... Date:.....

Movement of Trucks in Refuse Collection Section

Eldoret Municipal Council No.	Registration Number	Driver's Name	Time Out	Time In	Remarks

Sign: .....

Cleansing and Conservancy Officer

Sign: .....

Senior Foreman

Remarks: .....

Appendix VII: Refuse Collection Rates (Kshs.) - 2002

Category	High-Income	Middle-Income	Low-Income
Residential Areas	100	60	40
Commercial, Industrial, Institutional:-			
- Tea room	100	80	40
- Café	100	80	40
- Restaurant	150	100	80
- Guest house	150	100	60
- Dispensary (domestic waste)	100	80	60
- Health centres (domestic waste)	150	100	80
- Hospital (domestic waste)	200	150	100
Small Industries:-			
- Sawing mills (per trip)	2500	2500	2500
- Furniture making (per month)	2500	2500	2500
- Metal workshop (per month)	2500	2500	2500
- General workshop (per month)	1000	1000	1000
- Industries (light waste per trip)	2500	2500	2500
- Industries (heavy waste per ton)	500	500	500
Shops:-			
- Wholesale shop (general)	200	150	100
- Retail shop (food & other items)	100	60	40
- Supermarkets	1000	800	500
- Tailor	50	40	40
- Salon	100	80	40
- Groceries	100	80	40
- Bars	100	80	40
- Pharmacy/ chemists	100	80	40
- Markets	1000	800	500
- Stalls (per Table)	10	10	5
- Food vendors	400	200	100
- Mosque/ Churches	100	80	40
- Dry cleaners	100	80	40
- Carpenters	50	40	40
- Shoe makers	40	30	30
- Electronic gadgets	80	60	40
- Petrol stations	200	150	100
- Fuel depots	200	150	100
- Storage warehouse/ go down	200	150	100
- Charcoal stores	50	40	40
- Hardware	200	150	100
- Insurance agency	100	80	60
- Travel agency	100	80	60
- Photo studio	80	60	40
- Driving school	100	80	40
- Garage/motor vehicle dealer	100	80	40
- Building constructor	200	150	100

...Shops (continued)			
- Auctioneer	100	80	80
- Mobile phone accessories	100	100	80
- Butchery	100	80	60
- Cinema theatre	100	80	60
- Bakery	800	500	400
- Newspaper distributors	80	60	40
- Sales of *miraa* (khat)	50	40	30
- Flower vendors	50	40	30
- Slaughter slabs	200	150	100
- Medical laboratory	100	80	60
- Night clubs	200	150	100
- Hides and skin dealers	1000	800	500
- Scrap metal dealers	200	150	100
- Security guard companies	80	60	40
- Saw mills	200	150	100
- Furniture making	200	100	50
- General workshop	200	100	50
- Industries/ manufacturers	1000	800	500
Schools:-			
- Day primary	80	60	40
- Boarding primary school	100	80	40
- Day secondary school	80	60	40
- Boarding secondary school	100	80	40
Institutions:-			
- College	300	200	100
- University	500	500	400
- University (with bulk container)	5000	-	-
(with din container)	560	-	-
Hotels:-			
Rooms 01 – 10	200	150	100
11 – 20	300	250	200
21 – 30	400	350	300
31 – 50	500	450	400
51 – 100	800	600	500
101 – above	1000	1000	800
Office:-			
Staff			
01 – 10	200	60	60
11 – 20	300	60	60
21 – 30	400	60	60
31 – 50	500	60	60
51 – 100	800	60	60
101 – above	1000	60	60

Source: Eldoret Municipal Council, Solid Waste Management by – Law, 2002

Appendix VIII: Waste Disposal License

Solid Waste Management by – Law 2001

Hereby grant waste disposal license, pursuant to an application dated:.....

in respect of the following:-

Full Name and address of the license holder:.....

Full Names and address of local representatives (if any) of license holder:.....

Form of deposit/disposal to which this license relates:.....

Type of waste of which deposit/disposal is authorized and any limitations to quality:....

This license is granted subject to the following conditions:.....

As per the schedule

Date:..... Signed:..... Designation:.....

The License holder should read carefully the following notes:-

Conditions Attached to Waste Disposal License

1) The license holder shall notify Municipal Council of Eldoret of any proposed change in the actual conduct of operations from proposals shown in the operational plan as altered by any previous notified changes at least one (1) month before proposed change is implemented.
2) Quantities of waste accepted for treatment at the plant shall not exceed the limits of its operational and storage capacity as stated in the application.
3) The gates and fencing provided at the site shall be maintained to the same height and kept in a good state of repair. All reasonable precautions should be taken to prevent unauthorized access to the site.
4) An identification board of durable material and finish shall be displayed at the entrance. This shall show the hours of operation and shall give the name of facility, the name, address, and telephone number of the operator (and his local agents), it shall show the name and address of the waste disposal authority

responsible for licensing the facility VIZ – "Licensed by Municipal Council of Eldoret, Environment Department".

5) A record shall be kept of the types and quantities of waste delivered to and the residues removed from the facility and the records shall be kept available for inspection by authorized officers of the Municipal Council of Eldoret for eighteen (18) months.
6) The terms of the disposal license shall be made known to any person who is given responsibility for the management or control or the facility and the copy of the license be displayed at the prominent point within the facility.
7) Operational instructions shall be kept available and shall be displayed at the facility
8) Tanks used for the storage of liquid waste shall be bonded and areas surrounding them shall be controlled to ensure that spillage area either contained or drained into intermediate buffer vessels. They shall be of the type and constructions suitable for the wastes they contain and shall be suitably marked to show their content.
9) Adequate management and technical supervision shall be provided at the plant throughout operation hours.
10) All temporary cessations of which requires a transfer or diversion of waste delivered at the facility to facilities elsewhere shall be notified forthwith to the Municipal Council of Eldoret, Environment Department
11) Wastes and residues shall not be allowed to accumulate unnecessarily of the facility
12) Facilities shall be made available for sampling by Municipal Council of Eldoret of waste materials entering or leaving the site
13) Storage vessels, pipelines, valves, etc, shall be clearly identified
14) The facility shall at all times be managed and operated so as to avoid creating a nuisance to the inhabitants for the neighborhood.

Appendix IX: Population Projection Model

To forecast the population growth in the study area, the following model advanced by Lucey (1983) was used: -

$$P = Pn\ (1+r/100)^{n}$$

Where **P** represents the future population, **Pn** the current base population being projected towards the planning horizon, **r** the rate of population increase and **n** the number of years towards which the population is projected.

Similarly, to determine the annual population growth rate for the wider Eldoret Municipality and Langas settlement in particular, the growth rate **(r)** was made the subject of the formula as follows:-

$$r = [(Pn/Po)^{1/n} - 1] * 100$$

Where **r** denotes rate of population growth, **Pn** the current population, **Po** previous population, and **n**, the number of years towards which population growth is projected (the planning horizon).

Appendix X: Summary of Eldoret Municipal Council, 2002/2003 Budget

Income	
Department	**Kshs.**
Town Clerk	19 994 000
Municipal Treasurer	21 526 400
Municipal Engineering	4 348 000
Public Health	13 520 000
Environment	3 800 000
Education	21 181 000
Housing and Social Services	20 045 056
Total Income	**85 414 958**
Expenditure	
Department	**Kshs.**
Town Clerk	65 095 835
Municipal Treasurer	25 387 270
Municipal Engineering	48 801 074
Public Health	34 312 866
Environment	21 208 448
Education	30 650 153
Housing and Social Services	18 412 048
Total Expenditure	**243 412 048**
Net Result	
Department	**Kshs.**
Town Clerk	45 101 835
Municipal Treasurer	3 860 870
Municipal Engineering	44 453 074
Public Health	20 792 866
Environment	17 408 448
Education	28 468 653
Housing and Social Services	1 633 008
Net Result	**158 452 738**
Less (Kshs.)	
Rates	67 000 000
Contributions from Water Fund	30 000 000
Housing Fund	6 000 000
Interest on Rates	30 000000
Budget Deficit	**25 452 738**

Source: Eldoret Municipal Council Annual Budget Report, 2002/2003

Note:-

Net Result = Total Income ***less*** Total Expenditure

Budget Deficit = Net Result ***less*** Rates, Water Fund, Housing Fund and Interest Rates

Appendix XI: Proposed Implementation Matrix

Core Strategic Planning Components	Implementation Target		
	Short Term Plan	Medium Term Plan	Long Term Plan
Legal Restructuring , Development Control			
Public Education, Capacity Building			
Financial Planning and Budgetary Administration			
Storage, Collection and Transportation Plan			
Vehicles Operations and Maintenance			
Waste Reduction and Resource Recovery Plan			
Interdepartmental and Multi-Sectoral Plan			
Final Disposal Site, Restructuring Department of Environment			
Policy on Solid Waste Management			
Policy on Upgrading of Local Authorities in Kenya			
Private Sector Involvement Plan			
GIS – RS Planning Information Systems			

Appendix XII: Research Authorization

MUNICIPAL COUNCIL OF ELDORET

TELEPHONE: 32601/6

OUR REF. EMC/PH4/II/II/175

YOUR REF .....

TOWN HALL,
P. O. BOX 40,
ELDORET.
KENYA.

20th August, 2003

Wilfred Ochieng,
P.O. Box 5724,
ELDORET

RE: REQUEST FOR RESEARCH AUTHORIZATION IN URBAN SOLID WASTE MANAGEMENT

This is to acknowledge your letter of 14th August, 2003 on the above subject.

Your request has been accepted on condition that you avail a copy of the thesis report to this office and you are therefore authorized to interview the relevant officers in the Council.

S.N. Musembi
FOR: TOWN CLERK

CC
Director of Environment
Medical Officer of Health
Assistant Town Clerk
Municipal Treasurer
Director of Social Services & Housing

To read on file.