UNIVERSITY OF KWAZULU-NATAL

AN ASSESSMENT OF MUNICIPAL SOLID WASTE MANAGEMENT

(MSWM) IN INFORMAL SETTLEMENTS IN ETHEKWINI MUNICIPALITY

A CASE STUDY OF CATO CREST INFORMAL SETTLEMENT, DURBAN

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Master of Housing

2016

"An Assessment of Municipal Solid Waste Management (MSWM) in Informal Settlements in eThekwini Municipality. A Case Study of Cato Crest Informal Settlement, Durban"

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Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Housing

University of KwaZulu-Natal

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2016

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II.   ACKNOWLEDGEMENTS

III. ABSTRACT

Waste generated by daily human activities and left to accumulate in ubiquitous, illegal, unregulated dumpsites close to dwellings, is a problem in informal settlements. If not collected and appropriately disposed of, it poses risks to public and environmental health. The quality of life and living conditions of those that already suffer deprivation due to living in informal settlements are further compromised. Waste services provided by local government are generally not adequate in informal settlements. Many municipalities struggle to provide even the most basic services to contain solid waste in these areas due to a lack of infrastructure and financial resources.

This study sought to determine the efficacy of current solid waste management in enhancing living conditions in informal settlements in eThekwini Municipality. The functionalism theory, neoliberalism theory, and communicative planning theory provided the theoretical background for the study and enabled an understanding of the role of different stakeholders in the management of solid waste in informal settlements.

The study employed qualitative research methods, consisting of interviews and participant observation. It established that inhabitants of informal settlements cannot afford to pay for waste management services, nor are they willing to do so. The study found that the main barrier to effective municipal solid waste management and healthy living conditions in informal settlements is a lack of political will and stakeholder accountability in the solid waste management process, as well as the exclusion of these settlements from the provision of formal basic sanitary services. Another key determining factor is prevailing attitudes to solid waste management. To change this mind-set, community members need to be educated on the dangers that inadequate waste management pose to human and environmental well-being. Participation and strong partnerships between different interest groups have been found to be part of the solution to this problem and should be encouraged for effective solid waste management in informal settlements.

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ACP-EC	African, Caribbean and Pacific Group of States – European Communities
AIDS	Acquired Immune Deficiency Syndrome
DEA	Department of Environmental Affairs
DSW	Durban Solid Waste
HIV	Human Immuno-deficiency Virus
KZN	KwaZulu-Natal
MSWM	Municipal Solid Waste Management
NGO	Non-governmental Organization
NUSP	National Upgrading Support Programme
NWMS	National Waste Management Strategy
SWM	Solid Waste Management
UN	United Nations
UNCHS	United Nations Centre for Human Settlements
WEDC	Water, Engineering and Development Centre
WHO	World Health Organization

CHAPTER ONE: INTRODUCTION

1.1 Background

This research emerged from the researcher's interest in sustainable human settlements, particularly informal settlements, and potential interventions that could enhance community members' standard of living and quality of life. The study was based on the assumption that Municipal Solid Waste Management (MSWM) has failed to improve sanitation in informal settlements. It thus aimed to assess the effectiveness of MSWM, focusing on households in informal settlements. The problems associated with solid waste management in such settlements stem from domestic actors who tend to be neglectful in managing their own waste and the municipality that fails to effectively control, manage and dispose of the solid waste in these settlements. Domestic actors should ensure that household waste is packed and appropriately disposed of, i.e., accumulated and stored in a plastic bag and placed in a designated container for mass collection by the municipality. This is the vital first step in ensuring that waste is channeled to the appropriate pick up point. When waste is irresponsibly and sporadically disposed of, it is very difficult for local government to maintain and facilitate the cleaning of the many unregulated dumpsites which result.

Illegal dumping of waste in close proximity to access roads, pathways, water sources and domestic spaces is common in informal settlements, compromising healthy living conditions. Local government's vision of creating better living conditions by promoting community wellbeing and environmental integrity is undermined by a lack of financial capacity and innovative solutions to manage solid waste in informal settlements. This study thus sought to understand the linkages between informal settlements and effective MSWM. Each factor referred to above is discussed in more detail in the chapters that follow.

Increasing urbanization due to rural-urban migration has led to the proliferation of informal settlements, often "characterized by (residents with) low-income profiles, living under extreme poverty conditions, lacking the proper financial means and urban infrastructure to cover their basic needs" (Mels, 2009:110). The lack of affordable housing in inner cities drives people to live in informal settlements in close proximity to employment opportunities. While accommodation is such areas are more affordable, they are characterized by

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unfavorable living conditions. The large quantities of household solid waste produced are difficult for municipalities to manage due to the inaccessibility of informal settlements. Aside from the physical limitations of dense and unplanned settlement, infrastructure such as roads, drains and sanitary facilities is inadequate. This situation is further exacerbated by people's attitudes towards waste. Local residents indiscriminately dump and litter due to the municipality's failure to provide practical waste disposal options (Schubeler et al., 1996:241). This leads to a proliferation of vermin and disease vectors with devastating health implications.

1.2 Problem statement

Overburdened and ineffective solid waste administration frameworks, coupled with rapid population growth plague informal settlements, particularly in urban communities in developing countries. Mull (2005:132) explains that,

"The resulting discrepancy between the current solid waste management systems and the growing need for expanded collection and disposal facilities has left an accumulating amount of solid waste within the urban environment producing unaesthetic and unsanitary conditions".

Domestic and municipal solid waste is found in open spaces in and around informal settlements. The waste is uncovered and spread around. It remains in heaps for a considerable amount of time, causing terrible odours and unsanitary conditions that spread disease. In informal settlements, solid waste is discarded on open dumps, in canals, and at the back of shacks due to deficient solid waste management equipment or delays in its collection by the relevant service provider.

Rapid urbanization resulting in environmental degradation is a major challenge confronting the South African government. The abolition of apartheid meant that people are now free to decide where to live and work (Collins, 2001). Lured by the promise of better employment prospects, many rural unemployed people have moved to the country's cities (Collins, 2001). However, a lack of adequate and affordable accommodation forced them to build and reside in informal settlements on vacant land with no formal tenure.

Durban is one of the major cities in the province of KwaZulu-Natal (KZN) and is a development hub. The city has struggled to cope with rapid urbanization. The levels of waste dumped in the city's informal settlements pose serious threats to human and environmental health (Antwi, 2008: 18). Furthermore, the uncontrolled growth of such settlements renders waste management a major challenge.

More often than not, poor communities living in informal settlements are left to deal with the problem on their own. A lack of knowledge on waste management, as well as inadequate levels of community and service provider accountability lead to indiscriminate disposal of waste, creating unsanitary and unsightly environments in many parts of these settlements. While waste collection and disposal operates efficiently in more well-off suburbs, the areas that are home to the poor are neglected. "This means that there is a need for a comprehensive approach to manage waste by the relevant institutions, which will be efficient for both the rich and the poor areas and takes into account contextual factors operating in rich and poor areas alike" (Antwi, 2008: 16).

1.3 Research objectives

The study's main objective was to assess the effectiveness of current MSWM interventions in informal settlements in eThekwini Municipality in order to evaluate their ability to positively impact living conditions in these settlements.

The following four sub-objectives stemmed from the main objective and were used to focus the research on manageable elements and achieve measurable results:

a) To determine the role played by eThekwini Municipality and local residents in solid waste management in informal settlements.
b) To analyse the provisions of the National Waste Management Strategy (NWMS) with regard to solid waste management in informal settlements as a benchmark for current solid waste practices.
c) To determine whether informal settlements in eThekwini Municipality align with sustainable waste management principles.

d) To investigate the health aspects of solid waste management practices in informal settlements.

1.4 Research questions

The primary question which this research sought to answer was: how effective is MSWM in informal settlements in eThekwini Municipality? This led to the following sub-questions:

a) How is solid waste managed in informal settlements?
b) Who are the major actors/stakeholders in solid waste management in informal settlements?
c) Do current solid waste practices in informal settlements align with the NWMS?
d) What do sustainable solid waste management practices entail?
e) What are the health implications of solid waste management practices in informal settlements?
f) What perceptions of solid waste management do local residents and eThekwini municipality hold?

1.5 Justification for the Study

Squires (2006:104) notes, that, human beings depend on the consumption of material resources for their sustenance and overall existence. This ultimately results in waste. In tandem with improved socio-economic well-being in developing countries, more waste is produced. As the population grows and settlements expand, effective and efficient solid waste management systems (SWMS) are essential. According to Cities Alliance (2006: 4), one of the five key dimensions of informal settlement improvement is access to sanitation that is a critical basic service for human life.

As part of South Africa's commitment to redress the wrongs of the past and to create caring and inclusive cities, one way of addressing burgeoning informal settlements is to acknowledge, accept and improve them. The precarious living conditions characteristic of such settlements are attributed to many factors such as sites that are unsuitable, infrastructure and dwellings that are inadequate and population densities that are uncontrolled and

unhealthily high. Furthermore, the solid waste generated in these settlements is unsustainably and ineffectively disposed of. Ineffective SWMS threatens positive public health outcomes through increasing opportunities for disease spreading vermin to thrive in unregulated local dumpsites. Substantial resources are required to enhance living conditions in informal settlements, particularly in terms of removing refuse and regularly cleaning these areas, which are part and parcel of sustainable waste management.

Solid waste management in South Africa is mainly the responsibility of local government. Section 156(1)(a) of the country's Constitution assigns responsibility for refuse removal, refuse dumps, solid waste disposal and cleansing to local government (Local Government Budgets and Expenditure Review, 2011: 176). Communities depend on local government to help manage solid waste, but informal settlements are not adequately serviced by SWMS run by municipalities. The question that then arises is the extent to which local government can be held accountable for the unhealthy living conditions in informal settlements as a consequence of their failure to provide effective solid waste management in these areas.

Local governments are required to guarantee a certain level of services, subject to national and provincial directives and models in the areas under their jurisdiction. It can also be argued that community members have a responsibility to effectively manage their solid waste. This study therefore sought to find solutions for effective solid waste management in informal settlements. The Cato Crest informal settlement was selected as a case study to demonstrate how the lack of appropriate solid waste management strategies that are essential to curb the rising levels of solid waste in the area, impact living conditions.

People residing in informal settlements bear the brunt of inadequate service delivery. They are marginalized because they live in informal settlements and are further marginalized because these settlements lack the support required to comfortably co-exist with the formal residential sector.

The high levels of litter and unregulated communal dumping of waste that are observed in informal settlements call for further research on this issue. Even where municipalities are actively involved in containing solid waste, some communities are not regularly serviced.

The effectiveness of current interventions is therefore questionable. Pollution control and improved waste disposal are necessary to mitigate threats to human and environmental health. The living conditions in informal settlements could be greatly improved if steps were to be taken to monitor and control solid waste generation and disposal.

1.6 Structure of the Dissertation

Chapter one introduces the research by describing the current state of informal settlements in South Africa and the factors that contribute to poor waste management. It sets out the research objectives and research questions adopted to determine the effectiveness of MSWM in informal settlements.

Chapter two presents the conceptual and theoretical framework for the study and a review of the relevant literature. It discusses the concepts of waste and waste management and related terminology. Municipal solid waste management and informal settlements are defined as dependent variables and local government is defined as an independent variable. The chapter also discusses how sustainable solid waste management in informal settlements could be an important interim solution in improving living conditions, as there is a backlog of decent housing. The literature review includes a case study of waste management in Arppukara Grama Panchayat in Kottayam District, Kerala (India) and draws lessons learnt from current best practice.

Chapter three examines informal settlements in the South African context and presents an overview of conditions in these areas. It shows how the mushrooming of informal settlements has contributed to the solid waste management problem. Legislation and policies relating to solid waste management are discussed as well as the different stakeholders.

Chapter four presents the research methodology employed to conduct this study. It outlines the qualitative approach adopted to achieve the research objectives. A case study, non-participant observation, semi-structured interviews with key stakeholders and a questionnaire were used to gather data. The limitations encountered during this phase of the research are also discussed.

Chapter five focuses on the study area, the Cato Crest informal settlement. It presents an historical background, the socio-economic characteristics of the inhabitants, and waste management in the settlement. The perceived causes of the waste crisis in Cato Crest are discussed from different perspectives. The data collected in the field are presented and analysed. The findings are discussed in terms of the themes, categories, patterns, and relationships that emerged. Similarities and differences in different sets of data are examined and interpreted. This is followed by a summary of the results and a discussion on their implications.

Chapter six presents a summary of the findings, conclusions and recommendations on sustainable solid waste management, and local government's role in supporting such efforts that could result in improved living conditions in informal settlements. Top-down and grassroots waste management strategies are suggested that could improve current conditions in Cato Crest informal settlement. Finally, suggestions are made for future research.

1.7 Summary

This chapter presented the background to the research study and the study context. It highlighted the problem statement that provided a concise description of the issues to be addressed. The study's objectives and the justification for the research topic were outlined. The chapter concluded with the structure of the dissertation.

CHAPTER TWO: CONCEPTUAL AND THEORETICAL FRAMEWORK AND LITERATURE REVIEW

2.1 Introduction

This chapter discusses various theories and concepts relevant to the study with the aim of understanding Municipal Solid Waste Management (MSWM) in the context of informal settlements. It also presents a review of the literature on Solid Waste Management (SWM) challenges in informal settlements, sustainable solid waste management and the role of relevant stakeholders in ensuring that SWM promotes accountability. National and municipal waste regulations are examined to determine the regulatory framework within Cato Crest informal settlement. For the purpose of this research it is also important to understand the working definitions of the variables used in this study. The fundamental concepts are thus defined and the aims and principles that motivate and guide SWM are identified. The theory of citizen participation, functionalism, and the beneficiary pays principle and ability to pay are the three key theories that underpinned this study.

Functionalism, neoliberalism, and the communicative planning theory inform thinking on sustainable and livable settlements. Neoliberalism gave rise to the concept of the beneficiary pays and ability to pay. Citizen participation also emerged from neoliberalism. These theories and concepts are unpacked to understand the role of different stakeholders in the management of solid waste in informal settlements.

2.2 Conceptual Framework

2.2.1 Defining Solid Waste (SW)

The National Environmental Management Waste Act (No. 59 of 2008) (DEAT, 2008: 32) defines waste as "any substance, whether or not that substance can be reduced, reused, recycled and recovered that is surplus, unwanted, rejected, discarded, abandoned or disposed of" (DEAT. 2008: 32). Solid waste is waste that arises from human activity. It consists of everyday items that are thrown away. For the purpose of this research, solid waste is defined as waste produced at household level. Waste (also referred to as rubbish) generated from domestic properties comprises numerous objects which are listed in table 1 below. Solid

waste also includes sludge from human excreta. Municipal waste comprises mostly of household waste collected on behalf of the local authority.

Table 1 Examples of solid waste (rubbish)

Waste category	Waste example
Household (domestic) waste	Empty glass/plastic bottles, food packaging, newspapers and magazines, yard trimmings, compost, disposables, clothing, aluminum cans, books, cardboard, cooking oil, furniture, glass

(DEAT. 2008: 32)

2.2.2 The beneficiary pays principle and 'ability to pay'

The beneficiary (user) pays principle is a pricing method founded on the notion that the most efficient allocation of resources occurs when consumers recompense the full price of the goods or services that they consume (Hanke, 2013:98). Municipal Solid Waste Management could be optimized if people residing in informal settlements pay for services rendered. This does not have to be the commercial value of the service. In contrast, the ability to pay principle states that those who have better financial means should share more of the burden of public services (Hanke, 2013:99). Both principles could be applied in the context of informal settlements.

The beneficiary pays principle is generally adopted in waste management. Local government is authorized to charge occupants and waste holders a fee which covers the whole cost, as this promotes producer responsibility. Waste producers should pay for its reuse, recovery or disposal in an environmentally safe way. In terms of informal settlements, the beneficiary pays principle could be a tool to promote efficient SWM services. Efficiency is achieved when excessive demand on the service is reduced as the beneficiary considers the cost of paying for the service. Research has shown that when the real cost of the service is apparent, this leads to more sparing use (Dafflon, 1998:129) and avoids dependent (free rider) behaviour.

However, this principle raises equity issues. It could be argued that it is not just to expect beneficiaries to pay for services when their economic circumstances do not enable them to do so. Capacity to pay should thus also be taken into account. A contending argument is that if beneficiaries pay, this generates revenue that could be used for redistributive purposes (Dafflon & Daguet, 2012:159).

The neo-liberal approach championed by the World Bank emerged in the early 1970s. Many of its ideas were borrowed from Turner's self-help approach. The theory emerged in a bid to replace the unaffordable and ineffective provision of basic services by governments that was highly dependent on subsidies. The Bank argued that the role of government should be to facilitate rather than be a direct provider of services. It therefore promoted self-help practices (Pugh, 1991: 275-276) and programmes taking into account affordability, cost-recovery and replicability.

In line with this thinking, infrastructure and services should be affordable to the poor. Services should not be based on design standards, but should be driven by the budgetary limits of potential beneficiaries (World Bank, 1973). Cost-recovery appealed to orthodox economists that subscribed to the user-pays principle. Thus, beneficiaries were expected to pay for the services provided to them (World Bank, 1973). This did away with government subsidies that were seen as hand-outs. The replicability variable focuses on the ability to repeat similar projects and practices. It is linked to affordability and cost-recovery in an endeavour to eradicate unsanitary conditions in informal settlements (World Bank, 1973).

2.2.3 The concept of citizen participation

Citizen participation is a basic tenet of democracy that aims to enable community members to participate in decisions that affect them. Cogan and Sharpe (1986:284) note, that it builds cooperation and trust between local government and the public, with positive effects on the planning process. Citizen participation would promote sustainable waste management by ensuring that waste management systems are embraced and proactively implemented by local communities.

Chapter 21 of Agenda 21 highlights the need for environmentally sound management of waste. Principle 10 of the Declaration adopted at the United Nations Conference on Environment and Development held in Rio de Janeiro in January 1992 states that,

"Environmental issues are best handled with the participation of all concerned citizens, on a relevant level. On a national basis, each individual should have appropriate access to information concerning the environment that is held by public authorities, including information on hazardous materials and activities in their communities, and the opportunity to participate in decision-making processes. States should facilitate and encourage public awareness and participation by making information widely available. Effective access to judicial and administrative proceedings, including redress and remedy should be provided".

It is essential that citizens participate in SWM as all human beings generate waste that can be hazardous to people and the environment if not well managed (Squires, 2006:87). Thus, effective and efficient SWM requires that all stakeholders be involved.

Furthermore, SWM can provide employment opportunities that assist in poverty alleviation. Informed and educated residents that are involved in decision making are empowered and their dignity is restored. Full ownership and management of SWM by local government is not the most efficient approach; the private sector and community members should be involved in tackling environmental issue in informal settlements. A holistic and collaborative approach not only minimises the costs and responsibility of local government, but promotes multi-lateral accountability and ownership of SWM processes in their locality.

2.3 Theoretical Framework

2.3.1 Neoliberalism

The theory of neoliberalism states that direct control of economic factors should shift from the public sector. It draws on neoclassical economics to argue for reduced government spending and social subsidies. The neoliberal approach to service delivery maintains that basic human needs should be acquired through sweat equity and other internal resources such

as own savings and labour performed by beneficiaries (Pugh, 1991: 278-280). It thus promotes self-help and grass roots service delivery initiatives.

The theory of liberalism was devised by John Turner. It emerged in a bid to replace the unaffordable and ineffective provision of housing and basic services by governments that was highly dependent on subsidies. Neo-liberalism argues that government should play a facilitating rather than a fundamental role in service delivery. As such, it would provide an enabling environment in which users are responsible for their own basic needs.

Turner emphasized that sweat equity, owner-design and management are important attributes of self-help housing (Harris, 2001: 248). He argued that service provision should be viewed as a verb and not a noun; the first action is taken by the user as part of a process. This explains why self-help is a key element of effective service delivery. It is directly linked to the personal needs and requirements that are unique to each community. Turner believed that the best results are obtained by a user, who is in full control of the design, construction, and management of their own homes (Turner, 1972: 158). He also (1972) stressed the need to enable the key players in self-help housing to actualise their respective roles. Users should control service delivery because it stimulates participation in improving and maintaining their own environment. The beneficiary pays principle and 'ability to pay' stem from neo-liberalism. In order to main an adequate standard of living, 30% of one's income should be spent on housing and services.

2.3.2 The theory of collaborative planning (practice) and communicative action

In this context, there is a need for common understanding among all stakeholders (community and local government) in promoting effective SWM in informal settlements. Collaborative planning is more powerful than other planning models in enhancing stakeholder relationships and knowledge (Gunton et al., 2008: 7). Jurgen Habermas (1984) notes that, communicative action is self-reflexive and open to an exchange in which role players can gain from others and from themselves by reflecting upon their premises and drawing on their knowledge. Communicative action is based on this deliberative procedure, where two or more people collaborate and facilitate an activity based on common understanding of the circumstances.

2.3.3 Functionalism

In developing countries both the private and public sectors are active in SWM. In recent years, the private sector has been encouraged to become involved and efforts are being made to officially connect public and private operators (Anderson and Taylor, 2009:78). Such linkages could promote the efficiency of the entire sector and create new employment opportunities. Functionalism stresses the interdependence of the patterns and institutions of a society and the need for them to interact to survive in a changing world (Ahmeda and Ali, 2004:97). Economists also note that organizations that bring the public and private sectors together have great potential. These hybrid organizations pool the efficiency and knowledge of the business world with the public interest, accountability and government planning. They balance the roles performed by public and private sector organizations (Ahmeda and Ali, 2004:156).

Public-private collaboration has great potential for improving SWM. However, it should be noted that if such partnerships are not carefully structured they could result in further disorganization and corruption in this sector. Proper incentives for both sectors should be built into the design (Ahmeda and Ali, 2004:156; Anderson and Taylor, 2009:78). This arrangement would enable people living in informal settlements to play a meaningful role in taking care of their environment and earning a living in the process. For its part, the private sector would benefit by employing affordable and easily accessible labour. Thus, co-operation among organizations could benefit the lives of millions of most vulnerable and marginalized people in informal settlements as both users and providers of the service.

2.4 Literature Review

Unmanaged solid waste is a global issue that should be managed at an international scale. Unprecedented rates of urbanization have resulted in a massive increase in solid waste creation. The global population reached the 7 billion mark in 2011, with more than half of this number living in urban spaces (Adeniyi et al., 2012). People create more than 1.6 billion tons of solid waste every year; as the populace expands so does our capacity to produce waste (Ahmed and Ali, 2006). More people are buying rather than producing their own goods, creating more waste. While household choices determine the amount of waste created, urban

population growth results in more urban waste. Mismanagement of solid waste has various environmental and social consequences, including water-borne diseases, environmental degradation and contamination and the loss of indispensable natural resources. Due to unjust appropriation and distribution of waste management, these issues are concentrated in specific areas where waste management is not prioritized by local municipalities. As noted by Brunner and Fellner (2007), the primary purpose of SWM is to secure both human prosperity and environmental integrity. This calls for effective, efficient, economical, reliable and equitable waste management practices, including the provision of suitable waste collection receptacles in sufficient volumes; proper use of such receptacles by households and suitable techniques to dispose of solid waste.

There is no universal strategy for effective SWM as different nations and indeed communities face different challenges. Thus, different approaches might differ in viability and effectiveness. The extent of a government's financial resources and how it decides to use such resources also determine the effectiveness of SWM. Developed and developing nations manage solid waste differently (Poerbo, 1991). While local governments in the former are generally able to provide clean water and efficient sewage disposal, in the latter, resources might be diverted to issues deemed 'more important' than waste management (Henry et al., 2006).

Developing nations often struggle to provide efficient waste management due to a shortage of financial and other resources. High levels of rural-urban migration, a lack of maintenance, poor service provision, inability to provide subsidies, and a lack of political will exacerbate the situation (Henry et al., 2006). Brunner and Fellner (2007) conducted a study in three urban communities in countries with different financial profiles to determine how financial capacity (or lack thereof) influences waste management. The study found that, in urban communities in developing countries, the limited financial resources available for waste collection and disposal undermine the effectiveness of this service.

2.4.1 A Case Study of Arppukara Grama Panchayat of Kottayam District, Kerala (India)

The growing volume and complexity of waste in the modern world endangers the environment and human wellbeing. Poor waste management – from inadequate collection to poor disposal – contaminates the air, water and soil. Open and unsanitary landfills pollute drinking water, causing disease.

Arppukara Grama Panchayat was established in 1953. The rising population and modern way of life created SWM challenges. The study centered on ward 7, which suffers waste contamination. The Panchayat covers 2 sq. km with a population of 4 000 (1991 registration). Unhygienic waste disposal by households caused ecological contamination. Mosquitos and other insects abound, causing disease. A study was thus conducted to determine the social, economic and environmental effects of poor waste management practices in Arppukara Grama Panchayat and to identify strategies to rectify the situation.

The urban nature and consumer culture of Arppukara town contributes to the levels of waste produced. This causes diseases within the Panchayat that spread to neighbouring areas. Environmental degradation and health problems arise from the accumulation of waste in the densely populated, contained area. An effective waste management programme is thus essential to enhance public health and protect the environment.

During monsoon season, surface soil is channeled into the drainage system, resulting in blockages. Liquid waste is clogged in the drains, causing unpleasant odour and creating a breeding ground for disease. In the case of the Panchayat liquid waste is more harmful than solid waste (Ashalakshmi1 & Arunachalam, 2010).

According to Patel and Talat (1996), the problem of litter in Arppukara Grama Panchayat can be attributed to a number of social issues, such as inadequate infrastructure and service delivery and inequitable access to such services. Disparities were found between the city centers and outlying areas with regard to adequate waste disposal. There was also a much higher bin to waste generation point ratio in the city centers.

The state of the streets in Arppukara Grama Panchayat could also be the result of the few waste disposal facilities available to pedestrians, as well as the number of times a week these facilities are emptied. The majority of the respondents in both areas stated that waste needed to be removed more frequently because it overflowed from the collection points, resulting in litter (Patel and Talat, 1996). The presence of litter in the outlying areas could have been due to the fact that there are fewer waste disposal areas in these areas. They thus might require more frequent emptying.

McLennan (2012) notes, that equitable distribution of infrastructure and services is a difficult task given that many local authorities either lack the necessary financial and other capacity to achieve this goal or are unwilling to commit resources to do so. However, in a small town such as Arppukara Grama Panchayat, it would have been relatively easy for the municipality to provide all residents with adequate water, sanitation and waste disposal services.

Community members are being encouraged to clean up the area. Several steps are being taken to address the situation described above. Annual cleaning of drains and purification have been adopted to dispose of liquid waste (Ashalakshmi1 & Arunachalam, 2010). At present, manual labour is used to collect and dispose of solid waste from households, and sweep the streets. Waste dumped in open premises is manually cleared at night. While there is no separation of waste, more than 50% of the total sold waste generated is collected and disposed of. However, the local government suffers from inadequate institutional and financial capacity and there is a lack of proper waste disposal sites in the town. These factors are the main reasons for the low level of waste collection (Ashalakshmi1 & Arunachalam, 2010).

The Panchayat Municipality and Corporations are responsible for sweeping the streets, cleaning up after public markets and collecting and disposing of household waste. While it is evident that solid waste collection and management is satisfactory, the major difficulty is the non-availability of suitable land for dumping and inadequate infrastructure to facilitate waste collection (Ashalakshmi1 & Arunachalam, 2010).

The increased volume of solid waste worldwide presents ever-increasing problems for society. Many cities are experiencing difficulty in disposing of mounting levels of waste. Neighboring areas that are suitable for land fill are reluctant to serve as dumps; furthermore, suitable sites are becoming scarce. Burning of garbage pollutes the air and dumping waste in the ocean contaminates marine life and pollute nearby waters and beaches. Moreover the composition of waste is changing, adding to the problem. For example, plastic, which is non-degradable and highly combustible, makes up a large percentage of the waste generated. The problem of solid waste disposal cannot be ignored. It represents a major environmental problem that is likely to grow worse if not effectively addressed (Ashalakshmi1 & Arunachalam, 2010).

Economic growth prompts urbanization that results in increased volumes of waste. Proper waste management requires decent sanitation services and public awareness. The public needs to be educated on the need to hygienically dispose of waste. It is cause for serious concern that the volumes of waste are constantly increasing despite local and global strategies to contain it, with serious environmental, financial and social implications (Ashalakshmi1 and Arunachalam, 2010).

Waste has thus become one of the most crucial environmental issues confronting humanity. Improved insight into its undesirable effects on both people and the environment has meant that waste management has advanced towards the top of the environmental agenda. However, the goal of a clean environment requires effective waste management. Local governments, whether rural or urban, are thus seeking the most appropriate scientific techniques for waste administration (Ashalakshmi1 and Arunachalam, 2010).

Disposal of solid waste is the most visible aspect of waste management. There are increasingly restricted choices. Waste poses threats to the environment, calling for effective waste management. No nation is immune to air and water contamination. The issues relating to solid waste emerge at three phases: 1. gathering, 2. transport and 3. disposal. Gathering and transportation are interlinked. The kind of receptacles used to store waste before it is transported, and the stacking/emptying arrangements in the vehicle and the number of vehicles are critical. Disposal is a much more challenging issue, as it prompts soil

contamination if dumped in landfills, water contamination if dumped in seas and air contamination if burnt (Ashalakshmi1 and Arunachalam, 2010).

2.4.2 Solid Waste Management: Current Status

The collection of waste in the Panchayat is restricted to the 2 sq. km township. Waste from commercial activities and community centres is stored behind the Panchayat transport stand and is collected once a week. Household waste is not collected at present. Waste is dumped on the sides of streets and in some cases is partially burnt (Ashalakshmi1 and Arunachalam, 2010). There is no solid waste treatment plant in the Panchatyat. The inhabitants of the town are reluctant to have a plant in their locality, while traders are indifferent to the programme. This is due to perceptions that the collection and removal of waste is the sole responsibility of the Panchayat (Ashalakshmi1 & Arunachalam, 2010).

In the past waste management in the town was carried out by local residents. However, they withdrew due to the low wages paid and a tender was awarded to private agencies for the Panchayat's waste treatment programme. This resulted in weekly collection and disposal of waste by Municipal Solid Waste (MSW). There have been outstanding results, and collection efficiency has increased by more than 50%.

The Panchayat does not have its own landfill site for the disposal of solid waste. The private agency collects waste for various waste sites and dumps it on the riverbank and/or other isolated surrounding areas. This occurs between 11 pm and 4 am. The community is severely affected by the environmental pollution caused by the putrefied waste dumped in very close proximity to their dwellings. This resulted in the formation of a community action group to agitate against the dumping of waste in the locality. The MSW's response was to dump waste in private abandoned paddy land in Kumaranallor Panchayat, which is more or less isolated. This interim solution still provokes protest by the people of Panchayat (Ashalakshmi1 & Arunachalam, 2010).

Waste collected in the town is normally transported in open trucks once a day. The waste collectors manually transfer it from the roadside into the trucks. Both organic and inorganic wastes are collected and sent to the same dump. There is little concern for the sanitary

implications for both the waste collectors and the environment (Ashalakshmi1 & Arunachalam, 2010).

Severe environmental pollution is caused by waste being dumped and accumulated in huge heaps out in the open. Rodents multiply, bad odours abound and the dumps are a breeding ground for flies and maggots. The quality of the well water in the nearby areas is also affected, due to waste seepage in the rainy season. This has also prompted protests by residents living in the vicinity of the dumpsites (Ashalakshmi1 & Arunachalam, 2010).

This case study showed that all stakeholders have a strong tendency to dump waste carelessly in the open spaces of the town. It also revealed that the community is not satisfied with the existing waste collection system in the Panchayat. The burning of waste needs to be curbed, especially in the case of plastics, the disposal of which remains a difficult problem (Ashalakshmi1 & Arunachalam, 2010).

2.4.3 Lessons learnt

This section highlights the most important issues emerging from the case study and the lessons learnt.

2.4.3.1 Willingness to participate

It is evident that the community's level of participation in waste management is low. Many communities feel that it is solely the municipality's responsibility to manage the collection, transportation and disposal of waste. Education on the health and environmental benefits of efficient waste management would promote appreciation of the relationship between waste collection and improved health (Meyer, 1993: 11). Community workshops involving all groups concerned with SWM would promote a sense of ownership of waste collection.

2.4.3.2 Links with the municipality

It is virtually impossible to sustain waste collection schemes without solid links between the municipality and the community. In most cities households contribute to the cost of waste collection and disposal through municipal taxes as waste collection is a statutory function. Community-based collection schemes could become part of the municipal function if the

links between municipalities and communities were to be addressed in the initial stages of the schemes. Legislation should be adopted that clearly sets out the roles, obligations and responsibilities of different stakeholders. This would promote the effective running of SWM services and schemes at community level.

2.4.3.3 Finance

Cost recovery and access to finance are important in community-based waste collection programmes and should be addressed not only at community but city level. Incentives for fee collectors are a possible solution. This could include resalable recyclable items given by householders; or receiving a percentage of the collected fees. Respected members of the community should be entrusted with fee collection rather than the waste operators. This would ensure that community-based collection schemes are able to collect adequate fees on a regular basis. All accounts should be transparent.

2.4.3.4 Ability of the poorest to pay for the service

Living in extreme poverty, some households in low-income areas have very limited ability and willingness to pay for waste collection. A potential solution is to encourage daily or weekly fee collection for community-based solid waste management initiatives. This would be a more appropriate approach in low-income areas where wages are less likely to be paid regularly at the end of each month (Bartone & Bernstein, 1993). In informal settlements, waste collection is accorded low priority compared to other household needs. It is therefore important to first address the issues that are not directly related to waste collection. Expenditure on food, clothing, housing, education and electricity receives higher priority. Community members' confidence will be gained by focusing on the other activities that relate to their health and welfare to create awareness of waste collection issues. While not covering the full costs, token payments create a sense of ownership. Waste should also be promoted as a potential source of income. Providing recycling collection points close to where waste is dumped would enable the poor deal to with their own waste, as well as benefit economically (Ali, Coad & Cotton, 1996). Schemes could also be introduced that enable low-income communities to produce and sell compost.

2.4.3.5 Equipment

Primary waste collection initiatives require appropriate equipment for collecting, loading and transporting the waste. It is important to use affordable equipment that is appropriate to the topography of the area and to the characteristics of the waste for efficient waste collection.

2.4.3.6 Transfer and transportation of waste

A reliable primary waste collection scheme is dependent on the design and location of transfer points and subsequent haulage by the municipality to different disposal sites. A timely and regular secondary waste collection service is vital for the effective operation of primary waste collection schemes (Furedy, 1992). This calls for active co-ordination and enforcement of procedures by the municipality to improve the links between primary and secondary collection services.

2.5 Summary

This chapter presented and discussed the theoretical concepts that underpinned this research study. It defined the terminology related to waste and waste management. The literature on MSWM in the context of informal settlements was reviewed. Finally, a case study of Arppukara Grama Panchayat of Kottayam District, Kerala (India) was presented and the lessons learnt were discussed.

CHAPTER THREE: THE SOUTH AFRICAN CONTEXT

3.1 The evolution of informal settlements

This chapter focuses on informal settlements in the South African context, from their emergence to a detailed overview of their situation. It examines how the proliferation of such settlements has contributed to SWM challenges. Informal settlements in and around towns emerged in response to the ongoing housing shortage in South Africa. Migrants from rural areas have for decades displayed initiative and ingenuity by creating their own solutions, building houses at least on an interim basis (Malinga, 2000). Informal settlements will thus exist for as long as the shortage of affordable housing persists.

According to Malinga (2000), a number of factors have contributed to the rapid growth of free standing informal settlements in South Africa since the 1970s. Increased rural-urban migration resulted in a growing number of poor urban people whose only option was to reside in a shack. These areas became further saturated with the building of backyard shacks. Other factors include perceptions that the democratic government's response to unauthorized settlements would not be as hostile as the apartheid regime and that housing would be provided to the homeless (Malinga, 2000). Thus, building a shack is sometimes perceived as a way of gaining access to an authorized stand and formal tenure.

3.2 Health implications of current solid waste management practices in informal settlements

In many cities in Southern Africa, 30-60% of the urban population lives in informal settlements (Hardoy et al., 2001: 143). Informal settlements have the following characteristics:
-   They are often overcrowded with high levels of insecurity for residents and poor or informal housing
-   They do not receive most public services, such as pavements, roads, water and sewage; street cleaning, standard housing, and municipal waste collection
-   They are often forgotten or abandoned by city management.

Household solid waste collection and disposal in informal settlements is more often than not ignored by the city management and public waste collection services (Freduah, 2004: 89).

A lack of safe and adequate sanitation services to deal specifically with solid waste is associated with deaths resulting from diarrhea and skin and other infectious diseases. The health risks associated with unsanitary conditions and poor environmental hygiene in polluted areas in close proximity to shacks are the greatest threat in informal settlements. The lack of sanitation services can be attributed to high levels of poverty. Unregulated communal dumps are used by several households and are badly maintained, due to a lack of resources to safely dispose of solid waste. Overcrowding and high densities make the removal of waste from informal settlements difficult, as suitable access roads are lacking.

Infrequent removal of waste results in the spread of infectious diseases. Uncollected solid waste in communal dumps increases the risk of injury, and infection. Organic household waste, in particular poses a serious threat, since it ferments, creating conditions favourable to the survival and growth of microbial pathogens (EduGreen, 2014:85). Exposure of this waste to heat and wind can affect human health, with children most vulnerable. Uncollected solid waste is hazardous as it can also obstruct storm water runoff which results in the formation of stagnant water bodies that are breeding grounds for disease. There is also a risk of contamination of a water body or the ground water source when waste is dumped near the water source.

3.3 Healthy living conditions

A "habitable" place can be defined as one that is adequately comfortable and clean for a person to live safely (HAP Housing, 2014:23). While they are renowned for their precarious conditions, informal settlements can be transformed into habitable areas if solid waste is managed in a sanitary manner. Accumulation of rubbish and filth which may provide a food source or shelter for rodents and pests, causing the spread of disease, endangers health. Where we reside affects our health and chances of living productive lives. According to the WHO (2014:43), the daily conditions in which people live have a strong influence on their health. Access to quality housing and clean water and sanitation are human rights.

Improper disposal of solid waste is one of the major risk factors that affect the health and comfort of the inhabitants of informal settlements where municipal or onsite facilities do not exist, or are not functional (Hardoy, 2001:65). Poor handling and disposal of waste can lead to pollution, encourage the breeding of disease-vector insects, rodents and animal scavengers which results in a range of diseases. These can contaminate food grown in back yards and, consequently, a new susceptible human host. Smoke pollution arises from burning waste in the open and odours, gaseous emissions and water pollution are caused by the accumulation of solid waste accumulations and unregulated dumping. These undermine healthy living conditions in informal settlements.

3.4 Municipal Solid Waste Management (MSWM)

Management refers to the consistent procedure of setting targets, formulating plans, designing and executing programmes and projects and monitoring and evaluating progress. It also involves cost control (Taboada-González et al., 2001: 130). South Africa's Constitution (1996) requires that local government provide all South Africans with satisfactory sanitation. Complementary pieces of legislation set out municipalities' responsibilities in more detail. Local government is expected to work hand-in-hand with the private sector and communities to carry out these responsibilities.

Municipal Solid Waste Management involves the accumulation, exchange, treatment, reuse, asset recuperation and transfer of solid waste in urban zones. The term thus covers every aspect of the management of waste.

The main objective of MSWM is to ensure the wellbeing of the urban population, especially in low-income areas that experience the ill effects of poor waste management. Other specific goals of MSWM are to (i) protect environmental health; (ii) promote the quality of the urban environment; (iii) support the efficiency and productivity of the economy; and (iv) generate employment and income (Taboada-González et al., 2001: 131).

To accomplish these objectives, strong, financially viable waste management is required in all areas, including those that are home to the urban poor. This calls for community commitment and involvement (Hardoy, 2001: 211). Waste management frameworks must

respond to the specific conditions and issues of the city and area, and work with all stakeholders at local, provincial and national level.

Waste management incorporates the entire cycle of material use which includes the creation, circulation, utilization of a product, and waste collection, transportation and disposal (Freduah, 2004: 231). While efficient and regular collection and disposal of waste is important, the long-term goals of decreasing the volume of waste produced and reuse should also be given priority. Effective waste management cannot be accomplished by government alone. Sustainable waste management rests on both efficient administration and partnerships with all role players.

3.5 Solid waste management in informal settlements: problems and best practices

This section presents a review of the literature on SWM, focusing on the problems associated with inefficient MSWM in informal settlements. Most informal settlements are engulfed in refuse (Freduah, 2004:213). They are not well-served by local government. The lack of effective waste management systems in these areas means that people literally live on, and sometimes off, waste. Waste is indiscriminately dumped and accumulates over time, posing risks to community members' well-being (Spatial Collective, 2014:74).

There is a rich literature on the challenges confronting SWM in informal settlements. According to a United Nations Conference on Human Settlement (UNCHS) report of 2012, almost half of the solid waste generated within cities in developing countries, including South Africa is not collected. Uncollected garbage is illegally dumped on streets, open spaces, and waste land (UNCHS, 2012:13). According to Malombe (1993:145), the irregular services rendered by municipal authorities compel local residents to adopt alternative and cost effective methods to dispose of their waste. These include burning, composting, or indiscriminate dumping. Unsanitary conditions are created due to weak capacity to sustainably handle solid waste.

The poor environmental conditions in informal settlements can be partly ascribed to improper management of solid waste. Informal settlements are unregulated human settlements that are often located on unsuitable sites. Similarly, there is a lack of suitable sites for the disposal of

solid waste. The complex and erratic nature of such settlements requires that local government plans ahead and puts mitigation measures in place. Karley (1993:109) argues that the main problem is the failure of social and economic development to keep pace with natural population increase and rural-urban migration.

A lack of sanitation in densely populated low-income areas leads to indiscriminate disposal of refuse into drains, gutters, and sidewalks, sometimes clogging the drainage channels and natural watercourses. Songsore (1992:81) observes that waste producers generate large volumes of waste but do not dispose of it in an acceptable manner. People's attitude towards their own waste management is a significant part of this problem. The public tends to have the view that local waste departments should be solely responsible for managing waste. Many sites designated as refuse dumps do not take into consideration the distance to be covered by residents. Siting these dumps too far away discourages inhabitants from using them (Freduah, 2004:214). They then resort to littering their own surroundings. The unacceptable habit of indiscriminately disposing of waste is attributed to the public's lack of a waste disposal culture as well as the inadequacy of waste disposal facilities. This underlines the importance of people's attitudes in waste management.

Agbola (1993:90) maintains, that people's values, convictions, and mind-set can be changed through training; thus attitudes to the disposal of solid waste can be altered. Pacey (1990:156) posits, that training women in the community strongly influences a change for the better in terms of sanitation behavior. Community members need to be made aware of the dangers that poor waste management could pose to their health and well as that of the environment (Freduah, 2004:213). While local government struggles to dispose of growing volumes of solid waste, community members are not always aware of the consequences of poor waste management, as they are often not immediately apparent (Mull, 2005:85).

Stirrup (1965) notes that waste management should take into account the characteristics of the community receiving the service, financial constraints, the kind of waste produced, climatic conditions, and the possibility of re-use and recycling. The viability of the selected framework will depend on rapid, efficient and safe disposal (Freduah, 2004:213).

South African municipal by-laws state that, local government is responsible for clearing illegal dumps when the waste producer cannot be identified. If identified, the producer is bound by law to remove the waste. In the case of informal settlements the waste producers are the inhabitants themselves. Given the fact that waste collection services are lacking, it is incumbent on local government to come up with solutions. Globally, municipalities play a major role in waste management and are traditionally the key local actors with prime responsibility for waste collection and management. They are tasked with improving living standards in communities while at the same time creating employment opportunities (South African Cities Network, 2014).

3.6 National Waste Management Strategy (NWMS): influence in informal settlements

The National Waste Management Strategy (NWMS) guides waste management in South Africa. It sets out the strategies required to accomplish the objects of the Waste Act (No. 59 of 2008). The NWMS promotes an integrated approach to waste management in order to uphold the country's commitment to sustainable development. The policy aims to enable South Africa to balance the broader socio-economic challenges of a developing and unequal society while protecting human health and environmental resources.

The NWMS is structured around a framework of eight strategic goals [see table 2]. For the purpose of this study, goals 2 and 4 are of particular importance: to ensure the effective and efficient delivery of waste services; and ensure that people are aware of the impact of waste on their health, well-being and the environment (DEA, 2011:25). As noted previously, waste services involve collecting waste from households and safely disposing of it. They are the constitutional responsibility of municipalities that are the primary interface between civil society and government.

While 61% of South African households had access to curbside waste services in 2007 (DEA, 2011:26), provision remains extremely skewed, with rich and urban groups receiving superior service. Goal 2 of the NWMS aims to progressively expand access to waste services from a basic level. This objective seeks to address historical backlogs and unequal access to waste services, and improve the quality of life by providing cleaner, more habitable environments (DEA, 2011: 24). Expanded waste services will also result in job creation, contributing to the

realization of Goal 3 [see table 2]. Goal 2 speaks specifically to the provision of basic service levels such as basic refuse removal for indigent households. These include pensioners, the unemployed and child-headed families who are unable to pay for municipal services (Mogale City Local Municipality, n.d.:1). The state grants received by such households are not considered as income. The majority of inhabitants of informal settlements are indigent due to their impoverished and marginalised circumstances.

Goal 4 aims to create awareness of waste management issues. The extent of littering across different communities shows that there is a gap in knowledge of the impact of waste on human health, well-being and the environment. Strong partnerships with local stakeholders, including labour, business, civil society and NGOs should be used to promote awareness of waste in informal settlements. This should result in visibly cleaner environments and a reduction in illegal unregulated dumping (DEA, 2011: 28). A key focus is participatory processes to inform the planning of SWM systems. Participation can be facilitated by public education and awareness.

Goal 8 is to monitor and evaluate compliance with the Waste Act (No. 59 of 2008). While the Act provides for a far reaching system for waste management, implementation is all-important. Government cannot do this alone. Business and civil society should monitor implementation and report any inconsistencies. The monitoring process includes compliance with the Waste Act's provisions on licenses and industry waste management arrangements. Finally, effective monitoring will require the strengthening of the environmental management inspectorate (DEA, 2011: 33).

The reporting arrangements set out in the Waste Act (No. 59 of 2008) promote consistent monitoring. Apart from setting out the procedures for waste management licenses and standards and benchmarks, the Act requires the drawing up of Integrated Waste Management Plans that are subject to scrutiny by the relevant authorities. Moreover, Environmental Management Inspectors (EMIs) and Waste Management Officers can ask for a Waste Impact Report where they identify non-compliance with the Act, permit conditions or exclusion conditions. The national hotline for waste-related misdemeanors and the whistle blower provisions in NEMA will expand the reporting system. The data from these reporting systems

will be used to design a system to investigate any violations of the Waste Act (No. 59 of 2008). The objectives for 2015 were a 50% increase in authorizations, and 800 EMIs (DEA, 2011: 33).

These provisions are important as sustainable solid waste management calls for compliance with the law.

Table 2 The eight strategic goals of The National Waste Management Strategy

Goal 1	Promote waste minimization, re-use, recycling and recovery of waste.	Focuses on implementing the waste management hierarchy, with the ultimate aim of diverting waste from landfill.
Goal 2	**Ensure the effective and efficient delivery of waste services.**	**Promotes access to at least a basic level of waste services for all and integrates the waste management hierarchy into waste services, including separation at source.**
Goal 3	Grow the contribution of the waste sector to the green economy.	Emphasizes the social and economic impact of waste management, and situates the waste strategy within the green economy approach.
Goal 4	**Ensure that people are aware of the impact of waste on their health, well-being and the environment.**	**Seeks to involve communities and people as active participants in implementing a new approach to waste management.**
Goal 5	Achieve integrated waste management planning.	Creates a mechanism for integrated, transparent and systematic planning of waste management activities at each level of government.
Goal 6	Ensure sound budgeting and financial management for waste services.	Provides mechanisms to establish a sustainable financial basis for providing waste services.
Goal 7	Provide measures to remediate contaminated land.	Addresses the massive backlog of public and privately owned contaminated land in South Africa.
Goal 8	**Establish effective compliance with and enforcement of the Waste**	**Ensures that everyone adheres to the regulatory requirements for waste management, and builds a culture of compliance.**

	Act.	

To implement the Waste Act (No. 59 of 2008), government must draft enactments, regulations, principles and Integrated Waste Management Plans; control waste management activities through licenses; conclude multilateral agreements and guarantee appropriate import controls; extend access to an essential level of waste management; encourage re-use and recycling initiatives across the country; and rehabilitate degraded areas. All of these strategies will require a close working relationship with the private sector and civil society.

The private sector must accept responsibility for the waste it produces through its products' life cycles. This would include cleaner production techniques, waste minimization and recycling and re-use at the end of the lifecycle. Furthermore, companies should ensure that any waste produced is disposed of in compliance with the law. The conditions attached to permits should be rigorously adhered to.

At community level, households should separate their waste, conform to the waste regulations, and avoid littering. They should also participate in awareness campaigns and recycling activities.

3.7 Sustainable solid waste management practices in informal settlements: viable options to solve the solid waste dilemma

Sustainability can be defined as the process of being conscious of resources (such as land, water, plants, humans and animals) in all activities that threaten their current growth and development on the planet. Resource-conscious consumption takes into account the future availability of the resources that exist today, so that the future generations may benefit from them. Recycling on its own will not will ensure sustainability; resource management and the management of waste are essential to preserve our world.

Waste management consists of three important facets: how waste is recycled, how it is disposed of, and not creating waste in the first place. It therefore speaks to reduced waste production by using material assets more productively. Furthermore, when waste is created, it

needs to be managed in a way that adds social, economic and environmental value. The ultimate objective is to reduce the effect that waste materials produced by human activity have on health and the environment.

Sustainable SWM can be achieved by creating awareness among inhabitants of informal settlements about the need to segregate solid waste. Local residents should lead the way in efficient management of solid waste in their communities.

3.8 Stakeholders in solid waste management in informal settlements

Effective SWM depends on coordinated action by stakeholders. In the context of informal settlements specific interest groups include households, local businesses, community organizations and local government. These stakeholders should be involved in planning and arranging waste management, including selecting locales for SWM offices, waste picking, reusing, treating the soil, and collecting and transporting waste (Squires, 2006:232). This would create a sense of ownership of SWM activities in their locality.

Schedule 5B of the Constitution provides that local government is responsible for waste management services, which include waste storage, collection and transfer. Private service providers play a key role in all phases of waste management, from transport to reuse. These organizations will play a crucial role in extending services to previously un-serviced communities, complementing government's efforts. UN-Habitat (2014:34) notes that the ACP-EC Joint Parliamentary Assembly observed that,

> *"The waste management 'value chain', which includes the collection, treatment, reuse, disposal and recycling of various waste streams, provides economic incentives that allow for the private sector to be an effective partner in environmental management, given an enabling environment for private sector investment in waste management activities"* UN-Habitat (2014: 34).

Family units also play a critical role in waste management. As end clients, they should reduce the amount of waste generated, reuse where possible and discard the rest in a responsible manner. They should educate themselves on the ecological effect of the items that they

purchase, and honour their obligation to their families and society at large to protect the environment.

There is thus a need for common understanding among stakeholders (for the purpose of this study, the community, eThekwini Municipality and service providers) to achieve effective solid waste management in informal settlements. Collaborative planning is more powerful than other methods in promoting debate, catering for the needs of all parties and coming up with the best solutions (Gunton et al., 2008: 7).

3.9 Local government people-centered approach to solid waste management: Batho Pele Principles

The Municipal Systems Act (32 of 2000) sets out how municipalities are to deliver waste management services. All communities deserve to be treated with respect; the South African public service has adopted the Batho Pele (People First) principles to ensure that citizens' interests come first and that they are treated with dignity. However, the principles cannot be enforced by law and depend on the goodwill of municipal officials. All people including disadvantaged communities should have equal access to services and be treated with consideration and respect. The community should be given full and accurate information on the level and quality of services they are entitled to receive from the municipality. There is to be proper redress; municipalities can be held accountable for not fulfilling their mandate and weaknesses should be addressed. Municipal officials should welcome complaints as an opportunity to improve service delivery.

3.10 Informal settlements and poverty

Informal/unconventional settlements have also been referred to as illegal/irregular in the literature (Keivani & Werna, 2001: 8). Unconventional means not bound by traditional ways or beliefs. Unconventional housing production or housing delivery does not follow government rules and regulations and the approach is highly informal and incremental (Keivani & Werna, 2001: 9). The National Upgrading Support Programme (NUSP) in South Africa has developed a toolkit to better understand informal settlements. Part 1 states that,

"Informal settlements are generally characterized by inadequate infrastructure, poor access to basic services, unsuitable environments, uncontrolled and unhealthy population densities, inadequate dwellings, poor access to health and education facilities and lack of effective administration by the municipality".

An informal settlement exists where housing has been created outside authorized channels without official development permits and does not conform to land use and subdivision regulations (Drakakis-Smith, 1981:188; Baross and Van der Linden, 1990:127). This mode of housing production mainly caters for low-income groups as it is costly to meet specified standards, and to procure high quality and professionally designed and constructed housing. Unconventional housing production mainly employs traditional forms of production which are fairly labour intensive, utilizing self-help labour and indigenous materials (Drakakis-Smith, 1981:188).

Informal modes of housing provision in developing countries mainly occur due to the inability of low-income groups to pay for the high quality and professionally designed and constructed housing provided by the conventional sector. This situation is brought about by capitalist development's failure to accommodate the growing urban population in formal sector employment on the one hand or to provide adequate remuneration to large sections of those that are employed on the other (Keivani & Werna, 2001:10). This is one of the causes of the housing problem in developing countries.

As a result, the unconventional mode of housing provision has become an indispensable element of urban growth and development in developing countries. Governments in these countries are thus likely to tolerate and accommodate a certain level of illegality and irregularity (Keivani & Werna, 2001:10).

3.11 Poor service delivery in informal settlements

The high density and compact layout of the shacks in Cato Crest informal settlement means that municipal waste collection trucks and municipal workers do not have easy access to the inner areas of the settlement, where most of the illegal dumpsites are located. Solid waste management is thus limited to the settlements located along the main road that runs through

and to the north of the settlement. The community blames the municipality for not doing enough to deal with the waste crisis, which has left community members with no choice but to indiscriminately dump their waste. Illegal dumpsites have become a permanent feature of this dense settlement.

Another contributing factor is the fact that black refuse bin bags are not supplied to this community, which invariably affects their participation in sustainable solid waste management. The majority of residents earn low incomes and cannot afford to pay the municipal fees for refuse removal. The fact that Cato Crest is a low-income / indigent community should not mean that inhabitants do not have the right to a good quality life. They are also entitled to environmental justice and sustainable development. Poor service delivery is seen to be a consequence of the environmental and social injustices inherited from the apartheid government. The precarious nature of solid waste management in Cato Crest poses a threat to health in this disadvantaged community.

3.12 Lack of sustainable waste management in informal settlements

The community of Cato Crest alleges that throwing their waste on the streets is the only way to bring their grievances to the attention of the local authorities. It can be implied that the level of community involvement in waste management in Cato Crest is directly linked to residents' level of satisfaction with service delivery. The dumping of waste appears to be part of the rebellion against the perceived lack of waste services. The people of Cato Crest feel that the municipality is not concerned about their human and environmental health. They have thus adopted a "why should we care?" attitude about their environment. There is a breakdown in trust between the local authority and the community, which commenced with the municipality's broken promise to build houses in the area.

A lack of education on sustainable waste management has also caused the community's neglect. There is also a general lack of pride in the environment because of how it looks and smells. Awareness campaigns are essential to enhance public health and environmental quality. Education would promote sound waste disposal practice and attitudes and instil individual responsibility for the environment.

3.13 Development and economic growth as a tool towards sustainable solid waste management

Development connotes positive growth that creates improved living conditions, whereby basic human needs are met. Education, adequate shelter, health and food are basic human needs that are essential attributes of development. People's living conditions can be improved by means of economic growth coupled with economic efficiency. Development should directly impact on the quality of lives of individuals, reduce inequality and unemployment, eradicate poverty, promise sustainable development and enhance human development. It should create a milieu that allows people to have equal access to resources and developing countries to move out of their stagnant situations to more prosperous ones that can carry the nation in a sustainable manner.

Although this powerful proposition is cause for optimism that a better world is possible, development has also been linked to controversy. The gap between the rich and the poor has grown, the capitalist system (propelled by development) has come to be viewed as an iniquitous one and free market systems have exacerbated poverty and inequality. Markets cater only for the elite and bypass the masses that have limited if any access to benefits and resources. They are excluded from development as there are cost implications in meeting development standards. This vicious cycle marginalizes and deprives the poor.

3.14 Summary

In implementing the Waste Act (No. 59 of 2008), the NWMS provides comprehensive guidelines for efficient waste management across all sectors of society. South Africa confronts unique challenges in managing waste that call for strong commitment from government and cohesive partnerships with all stakeholders. Given the limitations posed by the country's status as a developing nation, the lingering effects of the apartheid legacy and competing demands on the public purse, this will not be easy. However, effective waste management is vital to ensure a healthy standard of living for the current and future generations.

CHAPTER FOUR: RESEARCH METHODOLOGY

This chapter presents the methodology employed to conduct this study. It also provides an overview of Cato Crest informal settlement, the case study used in this research project. Qualitative primary data was the main source of information, as the study relied heavily on the views of the study participants.

In order to keep within the key focus of the study, a structured methodology was required. The first step was to review the literature on SWM in the context of informal settlements in eThekwini Municipality. Special emphasis was placed on SWM in the Cato Crest community at large, specifically the beneficiaries and non-beneficiaries of MSWM services. The qualitative research tools included in-depth semi-structured interviews, questionnaires consisting of open-ended questions, non-participant observation and the Cato Crest informal settlement as a case study. Qualitative research is commonly used to explore the perceptions and values that influence the behavior of the target population, and is used to identify unmet needs (ISURAS Market Research, 2012:121). The main research question was to assess the effectiveness of current SWM practices in informal settlements. The extent to which solid waste is managed in informal settlements in relation to sustainable waste management practices was a benchmark to assess such effectiveness. It was therefore important to understand the main stakeholders' perceptions on this issue. Qualitative research allows for textual descriptions of how the target population experiences the research issue (Denzin and Lincoln, 2000:88).

4.1 Historical background

Cato Crest informal settlement is part of the greater Cato Manor Township. Cato Estate was named after George Cato, who was the first Mayor of Durban. In 1845, he was granted 1800 hectares of land in Cato Crest in compensation for having his beachfront property expropriated for military purposes (Maylam, 1983). Cato and his relatives cultivated and lived in the area for some time until it was subdivided into smaller homesteads and sold to other white agriculturists (Leclerc-Madlala, 2004).

From 1900 to the 1930s, a large portion of the area was sold to Indians who remained in South Africa after completing their period of indentured labour (Makhatini, 1994). They practiced subsistence agriculture. At the same time, African people who had migrated from rural areas in search of job opportunities in Durban moved into the area. Landowners leased portions of their property to these migrants who built shacks on the land (Popke, 1997).

In 1932, Cato Manor was incorporated into Durban Municipality and shack occupants were proclaimed unlawful. Despite the Influx Control laws, the flood of African inhabitants continued. Cele (2010) maintains that the authorities deliberately ignored these laws. Indian landowners found that letting out shacks was more profitable than growing vegetables and also set up shops and transport stops.

In the 1940s, it was estimated that Cato Manor's population had reached 50,000 (Makhathini and Xaba cited in Leclerc-Madlala, 2004: 3). Living conditions were those of an urban ghetto, with much congestion and a lack of electricity, potable water and sanitation. These conditions fuelled conflict between Indian and African inhabitants, which culminated in the so-called Cato Manor Riots in 1949. The Riots were supposedly triggered by an Indian man assaulting a 14 year-old African near Durban's Indian Market (Maylam, 1983).

The violence lasted for two days, leaving one white, 50 Indians and 87 Africans dead and more than 100 people injured. Much property was destroyed (Maylam, 1983). This caused many Indians to leave the area. It also resulted in neighboring white communities putting pressure on the city authorities to use the Native's Urban Areas Act 21 of 1923 to remove illegal tenants from Cato Manor to designated areas.

During the 1950s, Indian proprietors returned to collect rent. Some continued to rent whole plots to Africans. More shacks were built and this led to further sub-letting (Cele, 2010). With the promulgation of the Group Areas Act 41 in 1950, both landowners and occupants were removed from Cato Manor Indians were moved to Merebank, Phoenix and Chatsworth, while Africans were housed in Chesterville, Umlazi and KwaMashu (Maylam and Edwards, cited in Cele, 2010: 10). The removals were vigorously resisted, with clashes between the inhabitants and the authorities leading to some deaths (Pithouse, 2006).

By the late 1960s, Cato Manor was to all extents and purposes empty; all that remained were a couple of houses, the beerhall, a couple of Hindu sanctuaries and avocado, litchi and mango trees, once the pride of Indian farmers (Popke, 1997; Leclerc-Madlala, 2004). The few remaining occupants established the Cato Manor Residents' Association to oppose further evictions.

In the 1980s, formal houses were built at Wiggins in Cato Manor (Singh, 2012). At the same time, Africans gradually began to move back, building informal shelters. An informal settlement developed in the area today known as Cato Crest (Leclerc-Madlala, 2004). In the democratic era, the abolition of influx control and racial segregation increased migration of previous and new tenants to the area.

Post 1994, Cato Manor experienced numerous land invasions. The Cato Manor Development Agency (CMDA) was established to create a framework for the zone. In 1995, Cato Manor was selected as one of the biggest lead ventures, reflecting its significance (Cato Manor Social Development Strategy Review cited in Cele, 2010: 10). Once reserved for "whites", it was now regarded as a vital area for coordinated development and improvement.

The Cato Crest settlement is thus informed by the rich history of Cato Manor that includes removals and population movement. This has left a legacy of contending land claims, attacks and disputed settlement rights. Through different pieces of legislation (including the Group Areas Act 41 of 1950) "the politically-sanctioned racial segregation government increased influx control, set out on mass evacuations and implemented stricter private control on blacks and along these lines upheld private isolation" (Motladi, 1995: 57).

Today, landowners in Cato Crest continue to illegally lease shacks or rooms to individuals (Motladi, 1995). Hence, access to land and land markets is mainly informal. Consequently, the settlement exhibits all the characteristics of an informal settlement.

4.1 Location

Cato Crest is one of six informal settlements in Cato Manor and is situated on the edge of the settlement between Vusi Mzimela Road (previously Bellair Road) and Mary Thiphe Street

(previously Cato Manor Drive) (Leclerc-Madlala, 2004). Cato Crest is a popular location due to the fact that it is around five kilometers from Durban's CBD and is close to national roads, the N2 and N3. This means that inhabitants have easy access to economic opportunities. The settlement in within walking distance of schools, health care facilities and shops (Patel, 2009) and is well served by different modes of transport.

Figure 1 Locality Map: Study Area - Cato Crest informal settlement part of ERF 961

Source: Researcher; 2014

4.2 Case study: Cato Crest Informal Settlement

Cato Crest informal settlement was used as a case study to examine the impact of ineffective SWM practices on beneficiaries and local government and how the lack of accountability on both sides of the spectrum has impacted on sustainable development. This case study was useful as it enabled the researcher to examine data at the micro level. Case studies gather data on a real-life phenomenon through detailed contextual analysis and provide better insight into real-life situations (Zainal, 2007: 1).

A case study was appropriate for this study as it is a robust research method that enables a holistic, in-depth investigation of a research problem. For the purpose of this research, it enabled the researcher to understand the health and other consequences of inefficient SWM. The detailed accounts provided by the respondents showed that residents have no choice but to live side by side with mismanaged dumps. Thus, the case study revealed the complexities of real life situations which may not be captured through experimental or survey research (Hauser, 1975:103).

4.3 Interviews

According to Brynard and Henekom (1997: 32), an interview allows a researcher to acquire knowledge from an expert on the topic, as it is the "meeting of two minds"; those of the interviewer and the interviewee. Interviews also allow for the flexibility to probe initial responses (Creswell, 1994: 5). The researcher conducted personal semi-structured in-depth interviews with the main stakeholders to obtain their views and insights. Stakeholders included officials from eThekwini municipality and 40 residents of Cato Crest informal settlement. The interviews focused on waste collection and disposal and community involvement. The in-depth interviews revealed individuals' personal perspectives, and experiences on SWM and grassroots participation. The qualitative data collected provided insight into how people in interpret SWM, the meanings they bring to it and whether and how it is being sustainably implemented.

4.3.1 Interview guides for key informants: outline of themes and topics

What people learn from research will depend on what they already know and on their values and beliefs. Therefore, the researcher posed questions on the study participants' views on MSWM in order to contextualize the research. The questions were as concrete as possible in order to ensure that key informants talked about real practices rather than generalizations. The quality of the responses was enhanced by informing the key informants of the questions in advance of the interview, giving them some time to think about them. The main questions covered the following:

- Part A: Establish the key informants' views on the current state of MSWM in informal settlements.
- Part B: Ineffective solid waste management has a direct negative impact on healthy living conditions in informal settlements. It is mainly the poor that carry the burden of this problem. This issue was discussed in order to establish the key informants' views.
- Part C: Identify remedies or mitigation methods that are the key in solving the waste management problem in informal settlements.
- Part D: Establish the roles and responsibilities of each actor (community and local government) in the SWM process, and whether it is effective.
- Part E: Solicit informants' opinions on the most viable collaborative SWM option and what the model would look like.

Table 3 Key Informants Interviewed

Name	Designation and Organization	Information Obtained
1. Mr. Aaron Mzimela	Secretary General for Abhlali baseMjondolo Shackdwellers' Movement South Africa and Chairperson of Cato Crest informal settlement	A tour of the settlement was facilitated and conducted. Access to the settlement and an introduction to each household were facilitated through the organization. Information was provided on the settlement's struggle with local government to secure properly managed solid waste.
2. Ms. Lynette Marx	Durban Solid Waste (DSW) Senior Supervisor. eThekwini Municipality	The role local government plays in the settlement was explained. The challenges confronting local government due to a lack of community support were revealed.
3. Ms. Bunjiwe Guwebu	Project Executive: Special Economic Zones at LIEDA. Former Programme Manager: Community Development at CORC – contact person for Cato Crest informal settlement.	Firsthand experience and current insight into the settlement's SWM dilemma that informed many of the findings of this research. It was noted that

		community buy in will only occur when local government adequately services the settlement, without cutting corners.

Source: Researcher; 2014

4.4 Questionnaires

Two questionnaires with both open- and closed-ended questions were drafted. The open-ended questions stimulated detailed qualitative accounts and responses. They not only helped to describe the real-life situation but the complexities of this situation which may not have been captured through the use of close-ended questions (Zainal, 2007: 4). The open-ended questions allowed participants to respond in their own words rather than choosing from fixed responses. The qualitative approach also enabled them to respond in greater detail. In turn, the researcher was able to respond to what the participants said and probe further. Open-ended inquiries provide rich, illustrative data.

Questionnaire 1 [see appendix 2] was for officials in charge of waste management in/and/or eThekwini Municipality. They are classified as service providers. Questionnaire 2 [see appendix 4] was for residents of Cato Crest informal settlement that are classified as beneficiaries or end-users.

4.5 Purposive sampling

Purposive sampling was used to select the study participants. Individuals were chosen based on their prior experience of the issue under study and their willingness to participate (Galloway, 1997:19). The advantage of purposive sampling is that the researcher can select individuals that possess information that is pertinent to the research problem (Williams, 1978: 3). The researcher was able to engage and interact with the participants during interview sessions.

Three major role players in SWM, including one official of eThekwini municipality, one official from an informal settlement social movement and 40 residents of Cato Crest informal settlement, were individually interviewed. They were best suited to answer the research questions as they were directly involved in designing, rendering, receiving, monitoring and/or

administering SWM or were otherwise affected by it (Given, 2008:88). The interview questions were centered on waste collection and disposal, community involvement, and role players and their perceptions of SWM.

4.6 Participant observation

Data collection also involved participant observation of respondents during visits to the study area to conduct interviews. This enabled the researcher to observe naturally occurring behaviour in its typical context, providing greater insight into the research problem. The observation was conducted as an outsider, gathering firsthand information by observing people as they responded to the questions. The mood and tone of responses were also taken into consideration.

The reasons for the lack of sustainable waste management in the settlement were discussed and the participants' perceptions helped to determine whether local government has dealt with the issues confronting residents. Field notes were taken during participant observation. A checklist [in appendix 3] was used to record observations during the site visits.

4.7 Field Visits

Bechhofer and Paterson (2000:49) note that field work is an important form of data collection and observation that enables a researcher to establish a close, and sometimes intimate, acquaintance with respondents. The principles suggested by Bechhofer and Paterson (2000:49) were adopted for the field work for this study. These include the researcher striking a careful balance between being a researcher and becoming acquainted with some people in the area.

Three field visits were made to the case study area. The purpose of the first visit was to meet the two research assistants who worked with the researcher to administer the household questionnaires and to undertake a brief tour of the study area. During the second field visit, open illegal dumps within the settlement were identified and the researcher observed how waste was disposed of in the settlement. Photographs were taken and the findings were recorded on the observation checklist [in appendix 3]. During the other visit, interviews were conducted with households.

4.8 Secondary and Primary data collection

The study also drew on secondary data in the form of books, news websites, articles, presentations, conference and seminar reports, theses and government reports. This provided a larger database than would have been possible to collect on one's own. Finally, it focused the primary data collection as it identified gaps and deficiencies and the additional information required (Nkwi *et al*., 2001: 128).

Extensive use was made of primary data observed and collected first-hand by the researcher, during interviews and participant observation. The primary data was collected from semi-structured interviews, field notes, and observation. The advantage of primary data is that it is short, precise and original.

4.9 Data analysis

The subjective procedures of thematic and content analysis were used to analyze the data, for example, member perception, top to bottom talking and report investigation. Mouton (1996: 168) notes that this type of analysis uses a range of techniques to provide comprehensive interpretation of the data. The researcher read through the transcripts of the interviews and responses to open and close-ended questions in the questionnaires and drew connections between discrete pieces of data. The responses were organized question-by-question and the data was categorized. The data was read with an eye for themes, categories, patterns, and relationships. Similarities and differences in different sets of data were scrutinized as well as for what different groups were saying. Finally, a summary of the results was developed. The questionnaires were summarized question-by-question to illustrate the key themes in each question. Similarly, the key themes that emerged across the set of interview transcripts were summarized. Finally, the data was processed and synthesized by interpreting and discussing the results that are presented in Chapter Five.

4.10 Ethical considerations

The identity of the researcher was revealed and accurately represented. The participants were informed of the purpose of the study and of the fact that participation was voluntary. Voluntary participation "refers to the participants' rights to freely choose to subject

themselves to the scrutiny inherent in the research" (Dane, 1990: 39). The participants were not coerced into taking part in the study and they were informed of their right to withdraw at any time.   Confidentiality "exists when only the researchers are aware of the participants' identities and have promised not to reveal their identity to others" (Dane, 1990: 51). The wishes of participants that wished to remain anonymous were respected. The information obtained was reported as accurately as possible.

4.11 Limitations to the study

Some key respondents were not willing to give of their time to sit through an interview. The researcher had to be accommodating and schedule a time that was suitable. Most of the interviews were conducted in isiZulu as the majority of the respondents did not speak English. The language barrier was overcome by employing the services of two high school pupils residing in Cato Crest informal settlement who administered the questionnaires. Only one municipal official works in the area of SWM in Cato Crest informal settlement. She provided sufficient information on the role and extent of the municipality's SWM activities in the study area.

4.12 Summary

This chapter presented the research methodology employed to conduct this study. It discussed the methods and procedures used to collect and analyse the data in order to answer the research questions. Qualitative methods were used to collect data. The chapter also outlined the limitations of the study that might have influenced its outcome and the measures taken by the researcher to overcome the challenges encountered. The following chapter presents and analyzes the data collected on SWM in Cato Crest informal settlement.

CHAPTER FIVE: CASE STUDY OF CATO CREST INFORMAL SETTLEMENT

5.1 Introduction

This chapter presents a brief history of Cato Crest, and its current socio-economic and environmental status. Cato Manor Township is made of six informal settlements that share similar characteristics. The discussion on these characteristics sheds light on the multi-faceted dynamics of SWM in such settlements. Furthermore the case study area offered an opportunity to explore various ways of improving living conditions in such settlements.

The findings gathered from the field work are presented under different themes. These themes were derived from the research questions that collectively sought to explain how SWM in informal settlements can improve residents' living conditions.

5.2 Cato Crest

Cato Crest occupies 97 of the 1800 hectares that make up Cato Manor (Patel, 2009). It is made up of two wards (wards 30 and 31), divided into 12 "regions" (Community Pioneer, 2014). Each "region" has an Area Committee that is part of the Community Development Committee, also called the 'Ward Committee' or "board of trustees" by occupants. These structures are very important as they are the first point of contact and a rich source of data for inhabitants and the ward representatives.

Cato Crest is a densely populated territory and is home to an estimated 17,856 people (StatsSA, 2010). Given rapid rates of urbanization, there is a high rate of population growth. Residents are part of numerous ethnic groups and are mostly Africans of Zulu, Xhosa, Ndebele and Sotho extraction. Migrants from other African countries, such as Zimbabwe, Burundi, and Malawi, to name but a few, also reside in Cato Crest. However, the predominant dialect is isiZulu, the dialect of the province (Leclerc-Madlala, 2004).

Patel (2009) notes, that Cato Crest is characterized by three types of dwellings: RDP houses constructed by eThekwini Municipality; shacks and transit camps for individuals that are waiting for their formal houses to be completed. Occupants include landowners, proprietor

occupiers and squatters. Cato Crest thus has a range of residence types with different levels of security and uncertainty.

People settle in Cato Crest for different reasons. The primary attraction is access to economic opportunities as it is close to the Durban CBD. A few grew up in the settlement. Others opted to live in Cato Crest because it offers extremely modest rentals, while others came to stay with family member(s) or inherited homes. Finally, some people live in the area because they hope that by doing so they will become eligible for formal housing.

The location of Cato Crest is of significance to the study. Patel (2011) notes that it is surrounded by white working class areas that have voted for the Democratic Alliance (DA) since 1994. In contrast, most inhabitants in Cato Crest have voted in favor of the African National Congress (ANC). Moreover, changes in legislation led to the redrawing of wards that has affected voting patterns. Around 2006 and 2011, the settlement was separated into wards 30 and 31. The thirst for land and housing has strongly impacted residents' political affiliations and rivalries.

5.3 Social character of Cato Crest community

StatsSA (2010) notes, that around 77% of the Cato Crest's population is younger than 35. Only 24% of the population is in formal employment, with an unemployment rate of approximately 45%. This suggests that many residents are not able to sustain themselves. Educational levels are low, with only 0.07% of the inhabitants having a post-matric qualification, 45% secondary schooling and 34% primary schooling.

Cato Crest offers various amenities within walking distance. These include meeting places, educational facilities (including two multi-purpose facilities comprising a school, library, hall and sports fields), clinics, libraries, municipal offices, religious establishments, a police station, sport fields, a strip mall, the Bellair Market and the recently built Intuthukho intersection.

5.4 Socio-economic characteristics

Cato Crest informal has an estimated population of 20,000 people (SA Census 2001). The area is mainly inhabited by Africans who represent a rich diversity of ethnic groups with Zulu predominating, followed by Xhosa, Sotho and Ndebele amongst others (Madlala & Jonowski, 2004:5). The 2001 census also revealed that 81% of Cato Crest residents live on less than R20 000 per year. Residents between the ages of 15 and 65 (constituting 54% of the total population) have educational qualifications of grade 7 and above. More than half (56%) of Cato Crest residents live in informal dwellings (Ikamvayouth, 2010:11). These socio-economic realities account for the SWM crisis in the informal settlement that is examined in detail under various themes in this chapter. While there is evidence of MSWM interventions, unregulated dumpsites are regularly used by local residents. This study thus investigated the effectiveness of the current SWM interventions in this informal settlement. It is important to understand this phenomenon, as many informal settlements in KwaZulu-Natal share the same characteristics.

## 5.5 Delivery of waste removal services in Cato Crest

Cato crest informal settlement presents a huge SWM challenge for the municipality. The nonexistence of proper waste removal services has implications for the environment and the health of the community. Charlton (2006:14) notes that, while informal settlements have been part of the South African urban landscape for decades, they receive insufficient attention in municipal strategies. Service delivery problems have accumulated over the years (from the apartheid regime to the new democracy), which has resulted in tremendous waste management challenges in informal settlements. The more such settlements mushroom, the greater the problem becomes.

The study found that none of the respondents have easy access to the main road, where waste is collected on a regular basis by the contracted waste removal company. The convenient alternative is the open communal dump in the settlement. All of the respondents expressed dissatisfaction with the fact that the municipality is not willing to extend its services deeper into the settlement to reach those in the community who are practically living on their own waste. This issue is explored in greater detail later in this chapter.

5.6 The waste management cycle in Cato Crest informal settlement

Water, electricity, waste management and housing are all basic human needs. They are part of a package of services that enhance the quality of life and are required for a basic standard of living. The respondents were asked to rank (on a scale of 1 - 4, with 1 being less important and 4 being very important) the basic human needs that are of most importance to them. As was expected, adequate housing was ranked first, with waste management second. It is clear that waste management is important to this community and residents are aware of the need for waste removal.

Graph 1 Order of importance of electricity, water, waste and housing to the respondents
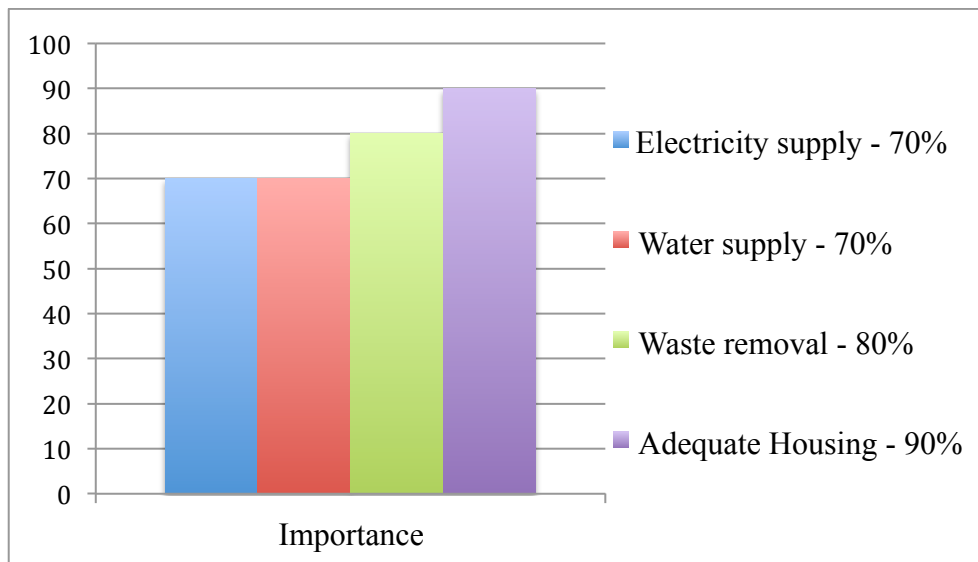
Source: Researcher; 2014

Plastic, paper, spoilt food, glass, and cans are examples of the types of waste each household generates. The respondents revealed that paper is the most generated waste followed by plastic and spoiled food. The fact that spoiled food made up 28% of the total waste generated is due to most residents not having electricity. Without refrigeration, many foodstuffs spoil at a faster rate. Site visits revealed that most household rubbish was packed and disposed of in small plastic shopping plastic bags. Once the bag was full, it would be disposed of in the nearest dump.

Graph 2 Waste generated by the respondents in a single day

Paper - 30%
Plastic - 28%
Spoiled Food - 28%
Glass - 3%
Cans - 3%
Other - 8%
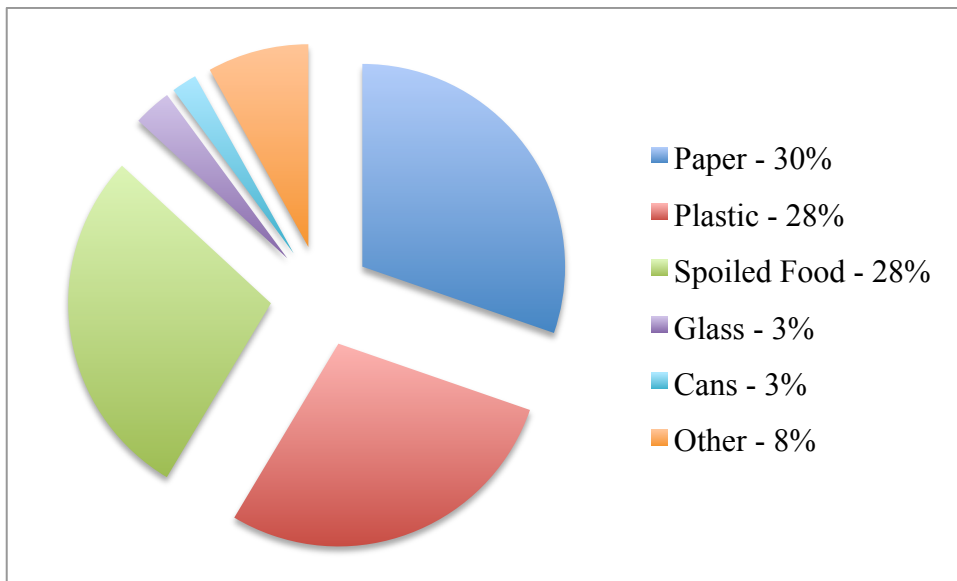
Source: Researcher; 2014

Figure 2 shows the deliberate dumping of large quantities of waste by the inhabitants of the Cato Crest informal settlement

Figure 2 An unregulated solid waste dump in Cato Crest informal settlement

Source: Researcher: September 2014

Graph 3 shows that only 20% of the respondents separate their waste into recyclables and non-recyclables. The kind of items set aside for recycling include plastic, glass, paper and cans with plastic at the top of the list as it is used on a daily basis. However, 80% of the residents mix their waste. This reflects a lack of awareness of the benefits and necessity of recycling in order to manage waste. It could also be an indication of the poor education levels among residents of Cato Crest.

Graph 3 Percentage of respondents that separate their waste into recyclables and non-recyclables

■ Yes, the household separates waste at disposal - 20%

■ No, the household does not separate waste at disposal - 80%
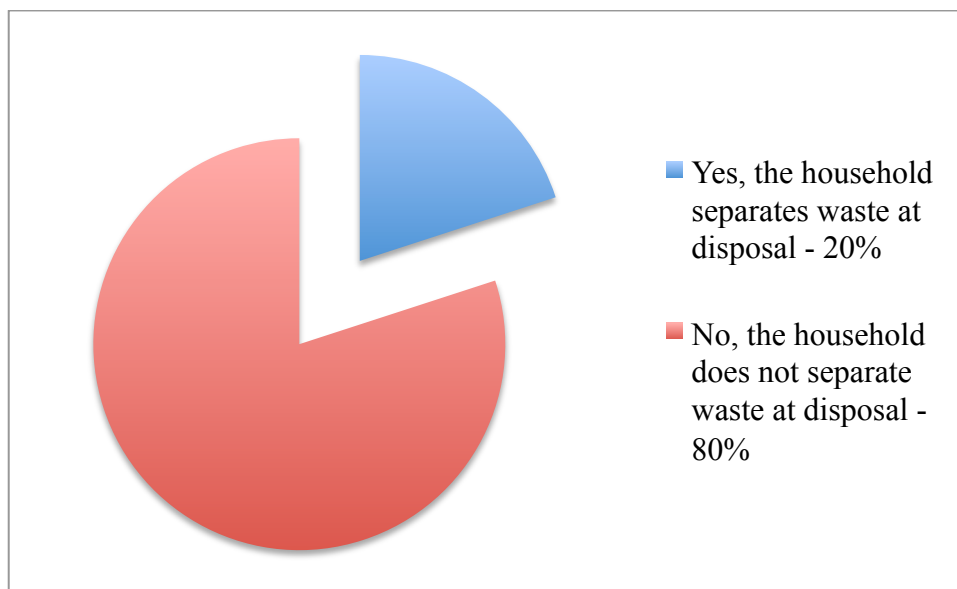
Source: Researcher; 2014

The data show that the respondents use various methods to dispose of their waste, with the majority dumping it on the side of the road or burning waste. Some residents use their long-drop (make shift toilet) to dispose of waste. 'Other' refers to anywhere else in the vicinity of the individual's home. The communal disposal sites are used less frequently than expected. This results in very high levels of litter in this settlement as most residents are not making use of the collection point designated by the municipality for waste disposal.

Graph 4 Respondents' solid waste disposal methods

Legend:
- Dumped in long drop (make shift toilet)
- Dumped on the roadside
- Burn (incinerate)
- Dumped in close vacinity to shack dwelling
- Dumped in communal waste disposal site
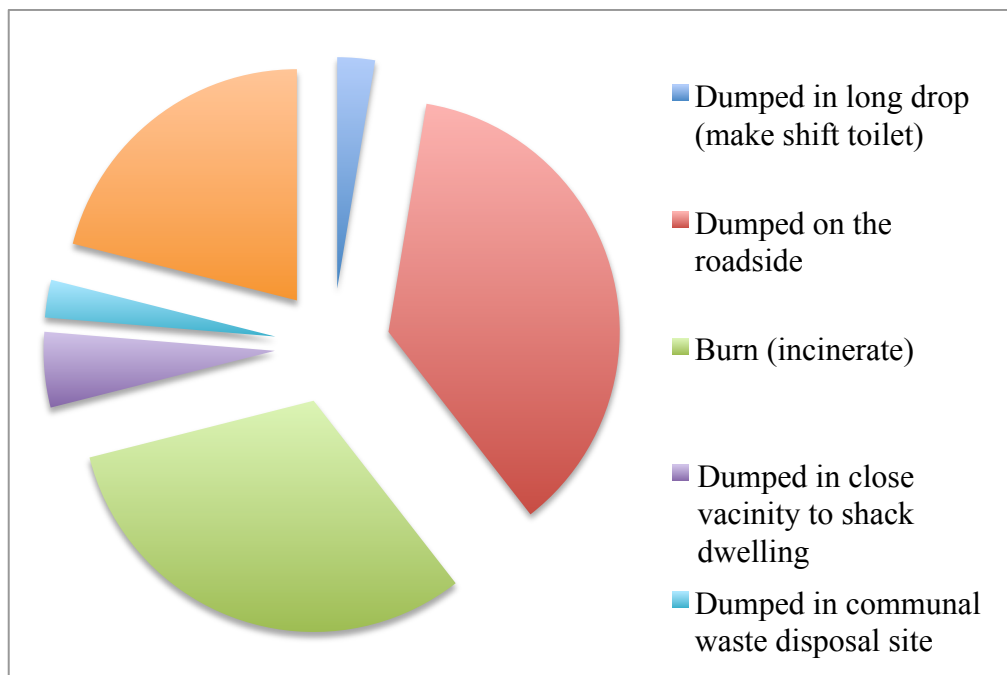
Source: Researcher; 2014

The respondents that disposed of their waste by burning it or dumping it on the roads stated that they resorted to these methods because the municipality does not collect waste at the collection point, resulting in a build-up in and around their shacks. Others said that the municipal disposal site was too far from their homes. This suggests that the municipality is not providing suitable, accessible disposal collection points. On the other hand, it could be argued that residents are indiscriminate in disposing of their waste. Asked why this was the case, some respondents answered that it is their way of forcing the municipality to collect waste.

Graph 5 Reasons for various solid waste disposal methods

- Lack of accessible designated municipal waste disposal sites - 52%
- No collection of waste by municipality 33%
- Municipal waste collection - 15%
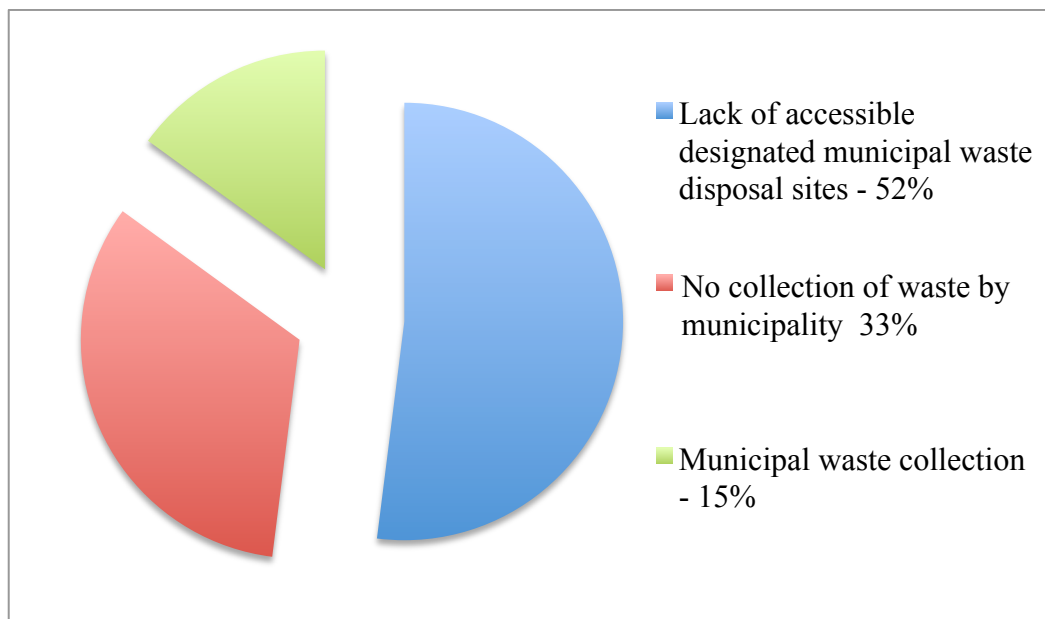
Source: Researcher; 2014

5.7 Dumpsite characteristics from observations made on site visit

There are 12 unregulated dumpsites within the study area. They are commonly found near make-shift long drops, behind individual shacks, in open spaces within the settlement and on very steep terrain. As noted earlier, most of the waste is disposed of in a plastic shopping bag, while some is simply thrown into the dump, e.g., a single used disposable nappy or leftover food scraps. There are also regular cases of residents defecating in plastic bags, and dumping it in the open communal dump. During the field visits, it was also evident that residents defecate in open ground, especially at night [see figure 4].

Figure 3 illustrate some of the many unregulated dumpsites within Cato Crest informal settlement.

Figure 3 Various illegal and unregulated communal dumpsites

Source: Researcher; 2014

Figure 4 show the extent to which human excrement is part of the solid waste management problem in Cato Crest informal settlement.

Figure 4 Exposed human feces in a dilapidated make-shift long drop facility (1) and on a pedestrian foot path (2) in the informal settlement

Source: Researcher; 2014

It was encouraging to see that some residents in the settlement made an effort to clean and maintain their immediate environment. This shows, that a collective decision to not resort to throwing waste in inappropriate places can make a difference [see figure 5]. The photos show that some residents in the informal settlement take pride in cleaning and maintaining the area in which they live.

**Figure 5 Clean living environments in Cato Crest informal settlement**

Source: Researcher; 2014

5.8 Perceived causes and risks of the waste crisis in Cato Crest informal settlement

The respondents were asked whether they agree that there is a waste management problem in their settlement. The majority agreed that there is a problem. They added that the problems are mainly caused by the fact that the municipality does not collect the waste they generate on a regular basis. However, some noted the community's lack of knowledge when it comes to waste management and its appropriate handling. Others felt that the community does not make an effort to ensure that solid waste is not carelessly disposed of.

According to most of the respondents, the municipality never collects solid waste in Cato Crest informal settlement. Some added that this is because the government hates the settlement because some residents worked at Marikana mine.

Graph 6 Perceived consequences of poor solid waste management in the informal settlement

Poor health - 53%

Accumulation of pests and disease ridden rodents - 12%

Bad smell in the air - 21%

Unsightly pollution - 12%

No municipal waste collection - 2%
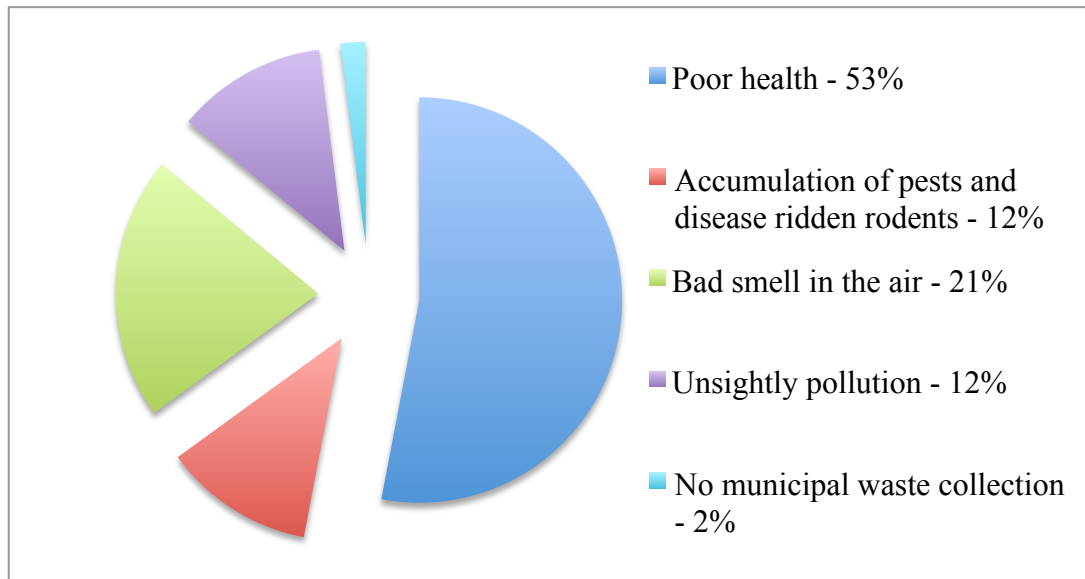
Source: Researcher; 2014

The pie chart shows the perceived consequences of poor waste management in the Cato Crest community. The respondents cited pollution, bad smells, poor health and the accumulation of pests (such as flies, maggots and fleas) and disease ridden- rodents (such as rats and mice).

Graph 7 Perceived health implications as a result of poor solid waste management in the informal settlement

Asthma - 9%

Tuberculoses (TB) - 28%

Malaria - 2%

Skin irritations (rashes, sores) - 15%

Sinuse - 6%

Diahorrea - 16%

Other - 24%
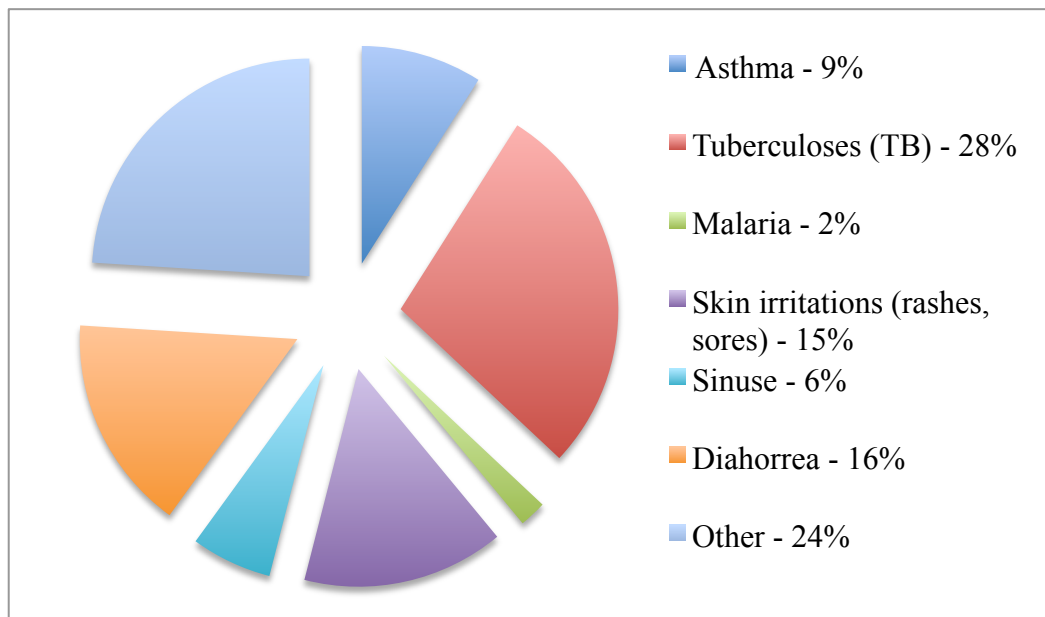
Source: Researcher; 2014

Asked about kinds of health problems caused by poor waste management, residents listed asthma and tuberculosis is the worst consequences, followed by malaria, skin irritations, sinus problems and diahorrea. Some included HIV/AIDS, flue and cholera. These results point to poor levels of education in this community as some of these illnesses, such as HIV/AIDS, flu and asthma, are not caused by poor waste management. Female respondents also expressed concerns about their children's safety when they play outdoors. Children are particularly vulnerable, as they are more susceptible to illnesses and other conditions caused by the environments in which they live, learn and play.

Figure 6 illustrates children playing in areas with exposed solid waste and wastewater (1). Their quality of life is negatively affected by the poor state of their environment.

Figure 6 Children playing in an unhealthy environment

Source: Researcher; 2014

5.9 Community perceptions of municipal waste management: levels of satisfaction

Asked whether the municipality is doing a good job in terms of waste management, the majority of the respondents stated that the municipality is only visible when elections draw near and even then it fails to effectively handle waste. Those that answered in the negative stated that they never see solid waste collected from the area where they live. They added that their waste should be collected every day. Most of the respondents do not have their own indoor bins and dispose of rubbish about every three hours. Due the large volumes of waste produced, daily collection is regarded as a necessity.

The respondents were also asked if they feel that the municipality is doing enough to contain the waste in the area. More than 95% were adamant that it is not doing enough. This suggests that there is a major problem with waste management in Cato Crest informal settlement.

Importantly, the majority of the respondents expressed keen willingness to partner with the municipality to address these problems. However, some stated that they would only do so if paid. Others added that they would gladly collaborate with the municipality if it provided receptacles to store waste and transport it to the collection point, allocated disposal sites and

provided collection services. Some even so far as to say, that they would be willing to educate fellow community members about the proper way to dispose of waste. This suggests that Cato Crest residents want to live in a clean environment and are willing to play their part with assistance from the municipality.

Finally, the residents were asked if they would be willing to pay to have their waste removed or if they would rather do it themselves. Around 90% said that they would rather remove their own waste. This is due to the fact that most are unemployed and depend on government grants for survival. This highlights the level of poverty in Cato Crest informal settlement.

5.10 Officials' perceptions of solid waste management: similarities and differences

According to the municipality, Amadwala Projects is contracted to collect waste in Cato Crest. The company is responsible for door-to-door, roadside and communal dump waste collection. Cato Crest has pockets of developing and developed areas. The latter have new low-cost housing and door-to-door waste collection. In the high-rise low-income housing projects, rubbish is collected from designated communal dumpsites. People residing in the informal settlement can use any of these temporary waste storage facilities.

The municipality is responsible for clearing illegal dumps, but does not have sufficient resources to do so regularly. It is also responsible for ensuring that all the waste in Cato Crest is removed on Monday mornings. However, due to constant population growth in Cato Crest informal settlement, weekly waste removal is no longer feasible. The Durban Solid Waste (DSW) Senior Supervisor noted that plastic bags full of household waste, including human excrement are dropped off at the waste collection point every 10-15 minutes. There is a constant pile of dumped rubbish on the roadside.

Each shack in Cato Crest informal settlement is home to an average of five individuals. The waste generated by the household cannot be stored in the shack, especially personal waste such as used sanitary towels and disposable diapers and left over food. The close proximity of the shacks does not allow for waste to be left outside each shack's door. In order to keep their immediate environment healthy and clean, residents have to place it elsewhere, which results

in waste being placed on the roadside and communal dumps. Whenever households generate waste, they have to get rid of it.

While such practices violate the sustainable waste management protocol set by local government, it could be argued that residents have no other option. A question was posed, as to whether the provision of more black bin bags as opposed to just one per shack and mobile rubbish bins would make a difference in reducing the number of unregulated dumps, and improving the appearance of the settlement.

In the past the municipality used to provide 'skips'. These large metal containers were for the temporary storage of waste, and were mainly placed on main roads in low-income areas. The municipality would empty the skips once a week at the landfill. With the dramatic escalation of crime in these areas, it was found that the skips were being used to dump the bodies of murder victims. The skips are very high and wide, making it hard for the average person to reach into them or see the bottom. Thus the bodies were only discovered when the skip was taken to the landfill. This resulted in them being phased out.

There is also a common tendency to send young children to throw away household waste. They cannot reach high enough to throw rubbish in the skip and simply place it on the ground. According to the DSW Senior Supervisor, it is not the municipality's responsibility to collect rubbish accumulated around the skip. This has caused even more problems as waste is left to accumulate on the roadside.

5.11 Unhygienic and unhealthy conditions in Cato Crest informal settlement

An article published in the *Daily News* in Durban on July 23, 2014 (Daily News, 2014:2) titled "No rubbish collection since the election" paints a clear picture of the extent of the solid waste crisis in Cato Crest informal settlement. Nontando Ngema (age 20) expressed fears for the health of her unborn child. She said that she lived next to piles of uncollected refuse, and had to tolerate the strong stench of rubbish (Daily News, 2014:2). She added that the rubbish threatened children's health on a daily basis (Daily News, 2014:2. The article noted that residents had threatened to barricade the N3 with burning tyres if the municipality did not

clean up the rubbish. The community felt that the municipality was deliberately neglecting them.

The Abahlali baseMjondolo Shackdwellers' Movement told the *Daily News* (2014:2) that the last time rubbish had been collected by the municipality was before the national elections in May 2014. Resident Mzamo Majozini said that "the municipality used to pick up the garbage, but they stopped cleaning after the elections…" Majozini claimed that he often had to take his children to the clinic because the rubbish made them sick. Residents had to walk past large piles of rubbish to get to their homes. He added that residents felt that their votes had gone to waste as they were still living in squalor. Majozizi also said that the community would welcome the provision of black bin bags to help keep their environment clean. He further stated that the community is not looking for handouts, but support for their efforts to improve their environment that is engulfed in unsightly waste. The community is tired of a life of hardship. They expect the local authorities to deliver on their promises to provide services.

According to the *Daily News* (2014:2), the ward councilor for the area Mzimuni Ngiba argued that rubbish was not collected because residents were not leaving it in the designated place. Furthermore, it was impossible for the contractor's truck to reach the illegal dumping site, due to the lack of appropriate access routes into the settlement. Agencies contacted to remove waste also argue that cleaning an illegal dump is not part of their mandate. Durban Solid Waste collects domestic waste once a week (usually Monday mornings). Residents within the Cato Crest area leave their rubbish along the main road on a daily basis and as a result there has been an accumulation of waste. The threat of a service delivery protest indicates that the Cato Crest community is angry with the municipality.

This particular community will most likely not succeed on its own in improving waste management practices. A positive relationship with the municipality is of fundamental importance. At the most basic level, the municipality and the community have to find common ground. While communities might in theory be correct in asserting that waste management should be undertaken by the public authorities, they fail to recognize that in practice it is precisely because of the failures of these authorities that community

organizations have emerged. As long as no credible waste management alternative is put in place by the community of this informal settlement, only the barest of essential services will be provided. Municipal services should not be turned into club goods that are only enjoyed by a few. Finally, informal waste management initiatives do not have even the most basic capabilities of properly disposing of residual trash or transporting it to the nearest landfill. Wishing this problem away will not solve it; dialogue will. During the interviews a municipal representative expressed willingness to collaborate on condition that communities accept and uphold certain standards – mainly by agreeing to dispose of rubbish in authorised, designated areas and in proper bin bags.

A certain level of pragmatism and optimism is needed. Informal governance initiatives within the settlement will unquestionably remain the key for the provision of certain vital – and often life-sustaining – services for the foreseeable future. Such initiatives will continue to serve their communities in the areas of public health, education, water delivery, security, and many others. We believe that this will also remain the case for waste removal. Yet, there is no reason why improvement should not be sought. On the one hand, informal groups should seize opportunities for recovery and recycling, thus increasing their revenue and ensuring greater sustainability. On the other hand, the city authorities should do more to support some of their activities and enter into a constructive partnership to address the above-mentioned failures. It is important to keep in mind that, at the end of the day, the goal of both parties is to improve the lives of communities in some of the poorest settlements. Solving the problem of waste is a matter of urgency and will serve as an indication of whether Cato Crest can ensure long-term sustainability and healthy living conditions.

5.12 Summary

This chapter presented and analysed the data collected using the research objectives as themes. The analysis reveals that the challenges confronting municipal waste management are defined differently by community members and municipal officials. This not only highlights the extent of the problem but poses further challenges to coming up with viable solutions. It is clear that implementation challenges are a manifestation of a much bigger problem. Clear disparities are evident in the information obtained from residents of Cato Crest informal settlement and the officials that were interviewed. There seems to be a

tendency to shift the blame for the causes and effects of the solid waste management problems in the area. Residents are still living with and on top of their waste and the municipality's efforts to make the informal settlement a clean and habitable space have failed.

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

This research study set out to assess a variety of issues relating to the effectiveness of MSWM in informal settlements, and to explore sustainable alternatives that could improve the standard of living in these areas.

In Cato Crest sustainable waste reduction has failed due to a low level of commitment on the part of role players. Local government has a key role to play in this regard. Not only could the municipality assist in clearing and managing solid waste in the settlement, but it could put measures in place for community upkeep of their environment. Sharing responsibility would relieve the burden on the municipality and also address the apathy and despondency evident among local residents.

The study identified a number of challenges that have adversely affected waste management. These include a lack of authorised dumping facilities and black bin bags to temporarily contain the waste and the long walking distance to the main road where waste is collected on a regular basis. Illegal, unregulated dumping and littering is a perpetual challenge that will become more pronounced if the community and municipality do not work together. The challenges expressed by municipal officials included the difficult terrain and winding, narrow roads and passages between households within the congested settlement that restrict access to remove waste, most of which is found at the heart of the settlement.

In Cato Crest informal settlement unemployment and resultant poverty have hampered progress in effective SWM. These residents are unable to pay for municipal services, calling for subsidized services. As a poor community, Cato Crest is a victim of the negligence that manifests in limited basic services. Yet, the community expects the municipality to deliver the same quality services provided in the formal areas of Cato Crest. On the other side of the coin, if local government were to charge these residents for waste removal, it would be difficult to collect fees from these clustered and densely populated stands. The inhabitants are not registered and do not have title deeds and, for the most part, addresses to which bills could be delivered.

The findings of this study suggest that if informal settlements are to be transformed into sustainable human settlements, MSWM should be strengthened. If local government fails to facilitate adequate and sustainable access to waste management services, the objective of creating sustainable livelihoods is trounced. Current efforts in this regard are not contributing to improved living conditions in informal settlements.

6.2 Recommendations

The study's findings could serve as a basis for improvement in Cato Crest and other informal settlements with similar solid waste management problems. There is an urgent need for research on context-specific action plans (including suitable facilities and strategies) to manage waste in informal settlements in South Africa. While not exhaustive, the following recommendations represent a coordinated, integrated, holistic and innovative approach to MSWM in informal settlements. They are based on the research results, observations, discussions and the literature review.

With regard to the high-density living conditions that are impeding the smooth running of waste management activities in Cato Crest informal settlement, the municipality should provide more central waste collection facilities. Unemployed local residents could be employed to clean the dumpsites and take the rubbish to these points for collection. Wheelbarrows are easy to maneuver between household dwellings and can hold a substantial amount of rubbish. This would enable the community to participate in SWM in their locality and would create jobs. In turn, it could instill a sense of ownership of the environment. It will decrease the heavy reliance on the municipality to service the community.

There is also a need for a change in mind-set among all stakeholders directly or indirectly responsible for SWM. The management of waste should be a collective responsibility with united goals.

The municipality would benefit from reaching out to its constituency by hosting more frequent public consultations on issues affecting the provision of SWM services in Cato Crest informal settlement. Collective decision-making is tantamount to efficient service delivery.

The community should be given a platform to state their needs and their willingness to pay, and their different suggestions should be incorporated into a plan of action to solve the waste management problem in Cato Crest in the long term. Since only 40 residents were interviewed for this study, it is therefore recommended that the municipality involve the whole community in a future participatory approach. The design, location, and management of waste collection facilities should be done in consultation with the community.

This study established that most residents cannot afford to pay for waste removal services, nor are they willing to pay. This is obviously a problem for the municipality because its budgets determine the scope of its operations. It would be beneficial for the municipality to meet with residents to present the financial implications involved in waste management. Information can break down the walls of misunderstanding.

The municipality is encouraged to place larger, easily accessible waste bins within the settlement and not only on the roadside. This should be complemented by information and education campaigns on how to best utilize the facilities. Waste management education would teach community members why it is important to dispose of waste in a responsible way even when there is no monetary reward. The community as a whole needs to be informed about the health risks they are exposing themselves to by mishandling waste. This could prove invaluable, especially for community members that are illiterate.

Finally, a buy back center should be established in close proximity to the settlement. This recycling facility would recover bottles, paper, cans, tins, plastic and the like. A small amount of money to meet immediate expenses is gained from recycling, and does make a short-term difference in the lives of the poor who are over-represented in Cato Crest.

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APPENDICES

Appendix 1 Letter of Informed Consent

University of KwaZulu Natal

School of Built Environment and Development Studies

Faculty of Humanities

University of KwaZulu Natal

Date _____

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Title of the study: An Assessment of Municipal Solid Waste Management (MSWM) In Informal Settlements in eThekwini Municipality. A Case Study of Cato Crest Informal Settlement.

Dear _____

You are invited to participate in a research project aimed at undergoing an assessment of Municipal Solid Waste Management (MSWM) In Informal Settlements in eThekwini Municipality. I hereby ask your kind permission for an interview in which your responses to questions relevant to the topic of the study can be recorded.

Your experience and expertise in the field are of critical importance to the success of this research project. Your views will enable me to document solutions for issues relevant to solid waste management in informal settlements and the betterment of living conditions in these settlements.

Before the dissemination of data, your recorded views will be carefully transcribed to ensure that the data accurately reflect the views expressed during the interview.

Should you wish to remain anonymous, your anonymity will be respected. You may decide to withdraw at any stage should you wish not to continue with the interview. The recorded interviews will be stored digitally for a period of 5 (five) years in the School of Built Environment and Development Studies of the University of KwaZulu Natal. According to the tradition of this type of study, participation is voluntary and no remuneration is offered for contributions made to this research project.

I undertake to share the outcomes of the research via e-mail after completion of the study. It is my sincere hope that this research project will contribute towards streamlining important aspects of municipal solid waste management and that each participant will benefit from a fountain of shared knowledge and creativity.

If you are willing to participate in this study, please sign this letter as a declaration of your consent.

I, _____, give permission that my responses to the interview may be used for the purpose of research and education. I am fully aware of the nature of the research and acknowledge that I may withdraw at any time and that my participation in this research is voluntary. The information that I will disclose during the interview is not regarded as being sensitive. However, should I wish to remain anonymous, my anonymity and confidentiality will be adhered to. I understand that this research is for the an assessment of Municipal Solid Waste Management (MSWM) In Informal Settlements in eThekwini Municipality, that will aim to improve living conditions of the people residing therein.

Participant signature: _____

I wish to remain anonymous: (tick the appropriate box)

Yes		No	

Researcher signature:_____

Date: _____

Appendix 2 Interview questions for municipal officials in charge of waste management in the eThekwini Municipality (service providers)

What waste collect methods does the department use in Cato Crest Informal Settlement?

Door to door	
Road curb side	
Communal dumpsite	

1. What do you think are the most frequently/persistent problems with regards to solid waste management in informal settlements? If any.
2. What do you think can be done to solve these problems?
3. What are the hindering factors that impinge on effective solid waste removal in informal settlements?
4. What disposal approach by informal settlements is acceptable by the municipality?
5. Do the beneficiaries co-operate with solid waste collection disposal protocol?
6. Why do you thing unregulated communal dumping is so rife in most informal settlements?
7. What is the current municipal waste regularity framework?
8. What are the goals and objectives of the municipality in relation to solid waste management?
9. Apart from the municipality, who are the other stakeholders involved in solid waste management at a local level?
10. Is waste management only meant for the planned city?
11. What is the municipal plan regarding solid waste management in informal settlements?
12. How has the municipality extended services to the informal sector?
13. Why is it Important to extend services to and integrate the informal sector?
14. What form of cooperation does the municipality expect from the informal settlements?
15. Does the municipality have enough resources to embrace solid waste management in informal settlements?
16. What does the municipality require from informal settlements with regards to waste collection and disposal?
17. How would the municipality like informal settlements to contribute towards their waste management?
18. What role would the municipality like the informal settlements to play in regards of solid waste management?
19. What measures have been out in place by the municipality to ensure that wasrte disposal and collection is done in an evironmentally friendly manner?
20. What measures have been out in place by the municipality to ensure that wasrte disposal and collection align to sustainable waste management principles?
21. What measures have been out in place by the municipality to ensure that wasrte disposal and collection?
22. What are health aspects of solid waste management practices in informal settlements?

Thank you for your consideration

Appendix 3 Site observation checklist

Points of observation	Notes
1. How many unregulated dumpsites are located per 100sqm	
2. Where are these dumpsites commonly found	
3. How is the rubbish disposed	
4. What type of solid waste do you see in the dumpsites	

Appendix 4 Questionnaire for residents of Cato Crest informal settlement (beneficiaries/end-users)

General information

Household/sample number	
Number of people in the household	
Main occupation	
Highest level of education	

1. How long have you been staying in this locality?
2. Give the order of importance to the following.
   1- Less important to 4- Very important.

Electricity supply	
Water supply	
Waste removal	
Adequate housing	

Waste characteristics

1. List the type of waste you generate in a single day.
2. Do you separate your waste into recyclables and non-recyclables?
3. What waste items do you recycle?
4. How do you dispose of your waste?
5. Why do you dispose of your waste in this way?
6. How often do you dispose of your waste?
7. Where do you dispose of your waste?
8. How far is your waste disposal site from your house?
9. Do you believe that your locality have a waste management problem?
10. If yes, in your opinion what are the cases of this problem?
11. What problems do you notice in your area with regards to solid waste and waste removal?
12. How often is your waste collected?
13. Is all of the waste at the disposal site collected?
14. Have you noticed any changes in waste collection since you moved here?
15. What bothers you the most about the solid waste situation in your locality?
16. What do you think are the health implications of solid waste management practices in informal settlements?

Municipal Involvement

17. Is the municipality involved in solid waste management in this locality?
18. Please provide reasons from your answer.
19. If yes, do you feel that the service is sufficient and effective?
20. Is the municipality doing enough to contain solid waste in your locality?

21. Would you be interested in a collaborated solid waste management effort between yourself and the municipality?
22. If yes, what sort of contribution would you make in to ensure effective and democratic collaboration?

Satisfaction

23. How many times a week would you like your waste to be removed?
24. Would you rather pay more to have the services improved or would you rather remove your own waste?

Thank you for your consideration