



**AN INVESTIGATION INTO SOLID WASTE MANAGEMENT: A CASE  
STUDY OF THE NEW ENGLAND LANDFILL SITE IN  
PIETERMARITZBURG, KWA-ZULU NATAL SOUTH AFRICA**

BY

THABILE KHUMALO

SUBMITTED IN FULFILLMENT OF THE DEGREE OF:

**MASTER OF TOWN AND REGIONAL PLANNING**

SCHOOL OF THE BUILT ENVIRONMENT AND DEVELOPMENT  
STUDIES

COLLEGE OF HUMANITIES

UNIVERSITY OF KWAZULU-NATAL

HOWARD COLLEGE

DURBAN

2018



## DEDICATION

This research is dedicated to my dearest Mother, the queen of my heart, Ntombikayise Jumaima Ngubane and my beautiful, loving and caring siblings Thuli, Dudu, Sindile and Khehla. I also dedicate this study to my nieces Nonkululeko, Zama, Lesedi and my nephew Abongwe. I hope that I have set a good example for you. ‘Let us break the chain, build an empire and invest in further developing ourselves at all times’. Your love, prayers and support have taken me this far. Most importantly, I thank my God, The Almighty for the strength He has given me throughout this journey in order to achieve this goal. I could have given up but Lord, your hand picked me up and led me this far. “UnguJehovah owenza izimangaliso, Umusa wakho ungunaphakade! Ngibonga wena and bless your Holy Name in the wonderful name of Jesus Christ, Amen.”

*“The heart of man plans his way, but the Lord establishes his steps” – Proverbs 16:9*

*~God is good, all the time~*



## ACKNOWLEDGEMENTS

I would like to thank my supervisor, Dr Lovemore Chipungu, for his guidance and support throughout this journey, God bless you Dr, as well as Dr Koyi Mchunu for his insight and encouragement. I also express my appreciation to the Sobantu community, the Ascott Inn co-owner, the Msunduzi Municipal Councillor Thandi Matiwane, editor Ms Deanne Collins, and the Project Manager at the New England Landfill. Finally, I thank the staff of the School of Built Environment and Development Studies for their support.



# COLLEGE OF HUMANITIES

## DECLARATION - PLAGIARISM

I, Thabile Joyful Khumalo, declare that:

1. The research reported in this thesis, except where otherwise indicated, is my original research.
2. This thesis has not been submitted for any degree or examination at any other university.
3. This thesis does not contain other persons' data, pictures, graphs or other information, unless specifically acknowledged as being sourced from other persons.
4. This thesis does not contain other persons' writing, unless specifically acknowledged as being sourced from other researchers. Where other written sources have been quoted, then:
  - a. Their words have been re-written but the general information attributed to them has been referenced
  - b. Where their exact words have been used, their writing has been placed in italics and inside quotation marks, and referenced.
5. This thesis does not contain text, graphics or tables copied and pasted from the Internet, unless specifically acknowledged, and the source being detailed in the thesis and in the References section.

Signed .



## ABSTRACT

This research study examines the impact of solid waste management systems in a residential area through a case study of the New England Landfill in Pietermaritzburg, KwaZulu-Natal. The theoretical framework is based on the Sustainable Livelihood Approach (SLA), Location Theory and Collaborative Planning, while the conceptual framework incorporates concepts such as solid waste and solid waste management (SWM), landfill design and the role of planning, liveable environments, and land use management (LUM). Questionnaires, structured interviews, site visits, photographs and mapping were employed to gather data. This enabled the researcher to obtain unbiased information directly from the source in the field while increasing the study's reliability. The study identified a number of factors in relation to SWM that have a negative impact on the surrounding areas. These include a poor SWM system, the fact that the life expectancy of the landfill has been exceeded, population growth and thus increased waste production, and inadequate security around the landfill site, which enables access by non-employees. Based on these findings, it is recommended that Msunduzi Municipality reviews its SWM bylaws to mitigate the landfill system's effects on surrounding areas. The municipality should also establish a new landfill site as soon as possible. Finally, it is recommended that Msunduzi Municipality establish reclamation centres to process recyclables in order to reduce illegal waste sorting and promote economic growth.



# Contents

CHAPTER ONE: INTRODUCTION .....	1
1.1 Introduction.....	1
1.2 Background/ Motivation for the Study .....	1
1.3 Problem Statement .....	2
1.4 Aims and Objectives of the Study .....	2
1.4.1 Research Question .....	3
1.4.2 Research Sub-Questions .....	3
1.5 Scope of the Study .....	3
1.6 Outline of the Dissertation.....	4
1.7 Chapter Summary.....	5
CHAPTER TWO: LITERATURE REVIEW .....	6
2. Introduction.....	6
A. Section 1: Conceptual and Theoretical Framework.....	6
2.1 Conceptual Framework .....	6
2.2 Theoretical Framework .....	8
2.2.1 Sustainable Livelihood Approach .....	9
2.2.2 Location Theory .....	11
2.2.3 Collaborative Planning .....	15
B. Section 2: Principles of Solid Waste Management in Developed and Developing Countries .....	17
2.3 Introduction .....	17
2.3.2 Stages of Waste Management.....	18
2.4 Conclusion .....	20
C. Section 3 Precedent Studies .....	20
2.5 Introduction.....	20
2.5.1 Precedent Study 1: Solid Waste Management in Brazil: The Case of São Joao Landfill–Sao Paulo) .....	20
2.7 Precedent Study 2: Solid Waste Management in China.....	23
2.7.1 Introduction.....	23
2.7.2 Municipal Solid Waste Production in China .....	23
2.7.3 Waste Production in China .....	25
2.7.4 Cradle-to-Cradle .....	26



2.7.5 Incineration.....	26
2.8.3 The Influence of.....	29
2.9 Chapter Summary.....	29
CHAPTER THREE: SOLID WASTE MANAGEMENT IN SOUTH AFRICA .....	31
3.1 Introduction.....	31
3.2 Factors Influencing Municipal Solid Waste Management in South Africa.....	32
3.3 Institutional Framework Guiding SWM in South Africa .....	33
3.3.1 Roles and responsibilities .....	33
3.4 Policies .....	36
3.5 How can South Africa improve the current status quo?.....	40
3.6 Solid Waste Classification in South Africa .....	40
3.6.1 General Waste .....	41
3.6.2 Hazardous Waste .....	41
3.7 Waste Disposal Methods .....	43
3.7.1 Waste Management Hierarchy.....	43
3.7.2 Cradle-to-Cradle.....	43
3.8 Benefits of Solid Waste Management (SWM) in South Africa.....	44
3.9 Chapter Summary.....	46
CHAPTER FOUR: RESEARCH METHODOLOGY .....	47
4.1 Introduction.....	47
4.2 Secondary Data Collection .....	47
4.3 Primary Data Collection .....	47
a) Preliminary Field Observation/ Site Visits.....	48
b) Questionnaire Survey.....	48
c) Structured Interviews.....	50
d) Mapping .....	50
4.4 Data Analysis .....	51
4.5 Limitations of the Study .....	51
4.6 Chapter Summary.....	52
CHAPTER FIVE: DATA PRESENTATION AND ANALYSIS .....	53
5.1 Introduction.....	53
5.2 KEY FINDINGS .....	53
5.2.1 Sobantu Residents Interviews .....	53



5.2.2	Public Perceptions.....	53
5.2.3	Respondents' Demographic Characteristics .....	54
	<b>Table 3: Respondents' Gender .....</b>	<b>54</b>
5.2.4	Living Conditions .....	57
5.3	Plans to Relocate the Landfill .....	58
5.3.1	Interview with Ascot Inn Co-Owner.....	58
5.3.2	Interview with Municipal Official (New England Landfill Site) .....	59
5.4	The Msunduzi Solid Waste Management System (Landfill site operational legislative framework).....	59
5.4.1	On-site Storage .....	61
5.5	Proposed development plans for the Landfill Site (Mitigation).....	63
5.5.1	IWMP Implementation Program, Monitoring and Review.....	64
5.5.2	Proposed future development plans for the surrounding areas.....	64
5.6	Waste Management in Msunduzi Municipality .....	65
5.6.1	The New England Landfill Site.....	66
5.6.2	Capacity of the Msunduzi Waste Management System (Regulatory Framework) .....	68
5.7	Nature of Land uses surrounding the Landfill Site.....	70
5.8	Impact of the Landfill site on surrounding areas .....	71
5.8.1	Negative Impacts .....	71
5.9	Other related problems.....	75
5.9.1	Property Devaluation.....	76
5.9.2	Positive Impacts .....	76
5.10	Conclusion .....	77
	<b>CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS.....</b>	<b>79</b>
6.1	Introduction.....	79
6.2	Summary of Major Findings .....	79
6.3	Recommendations .....	80
6.3.1	Recycling .....	80
6.3.2	Relocation of the Landfill Site .....	81
6.3.3	Improvement in the existing solid waste management system.....	82
6.4	Chapter Summary.....	83
6	REFERENCES .....	84
7	ANNEXURES.....	89



## List of Figures

Figure 1: Sobantu Residential Locality Map .....	4
Figure 2: The five elements of the SLA .....	9
Figure 3: Job Creation through Landfill Waste Picking .....	14
Figure 4: Stages of Waste Management.....	19
Figure 5: Aerial Map of the São Joao Landfill in Sao Paulo, Brazil.....	21
Figure 6: The volume of MSW in China between 1979 and 2001 .....	23
Figure 7: Composition of Solid Waste in China’s Urban Areas .....	24
Figure 8: Direct and indirect factors that influence MSW in SA and their interdependence .	32
Figure 9: The Waste Management Hierarchy.....	43
Figure 10: Waste sector employment estimates.....	45
Figure 11: Number of Respondents who want the Landfill site to be demolished.....	55
Figure 12: Responses on whether there have been disputes regarding the development of the study area .....	56
Figure 13: Knowledge of Sustainable Development .....	57
Figure 14: The Msunduzi Municipal Demarcation.....	66
Figure 15: Aerial view of the New England Road Landfill Site.....	70
Figure 16 Municipal Solid Waste at the New England Road Landfill Site’s recycling bay for assessment of household solid waste .....	72
Figure 17 : A waste picker at work at the New England Landfill Site .....	73



## List of Tables

Table 1: Composition of Waste in Urban Areas in China in 2002.....	25
Table 2: Primary Data Collection .....	49
Table 3: Respondents' Gender.....	54
Table 4: Number of Respondents who want the landfill to be demolished .....	54
Table 5: Number of Waste Pickers among the Respondents from the Sobantu Residential Area .....	55
Table 6: Employment Rate.....	56
Table 7: Broad goals and objectives for sustainable development.....	62
Table 8 The Gaps and Needs of the New England Landfill Site .....	68
Table 9: Action Plans for Improving the SWM in Msunduzi New England Landfill Site .....	99



## LIST OF ACRONYMS AND ABBREVIATIONS

BRICS	Brazil, Russia, India, China and South Africa
CO <sub>2</sub>	Carbon Dioxide
COGTA	Cooperative Governance and Traditional Affairs
COP	Committee of the Parties
DEAT	Department of Environmental Affairs and Tourism
DSW	Durban Solid Waste
DWAF	Department of Water Affairs and Forestry
EIA	Environmental Impact Assessment
EPA	Environmental Protection Agency
IDP	Integrated Development Plan
IMSW	Integrated Municipal Solid Waste System
IWMP	Integrated Waste Management Plan
KZN	KwaZulu-Natal
LUMS	Land Use Management Schemes
MIWP	Msunduzi Integrated Waste Management Plan
MSW	Municipal Solid Waste
MSWM	Municipal Solid Waste Management
NELFS	New England Landfill Site
NEMA	National Environmental Management Act 107 of 1998
NIMBY	“Not In My Back Yard”
NWMS	National Waste Management Strategy
SEA	Strategic Environmental Assessment



SDF	Spatial Development Framework
SPLUMA	Spatial Planning and Land Use Management Act
SWM	Solid Waste Management
UMDM	uMgungundlovu District Municipality
UNEP/IETC	United Nation Environmental Programme/International Environmental Technology Centre
UNEPA	United Nations Environmental Planning Agency
3 R's	Reuse, Reduce, Recycle

## **CHAPTER ONE: INTRODUCTION**

### **1.1 Introduction**

Section 24 of South Africa's Constitution, Act 108 of 1996 states that everyone has the right to a healthy environment. This calls for protection of the environment and for people to live in harmony with it. Municipalities and other relevant stakeholders should thus work towards an efficient solid waste management (SWM) system that achieves these objectives. This research study examines the impact of SWM in a residential area through a case study of the New England Landfill that is located in close proximity to the Sobantu residential area in Pietermaritzburg, KwaZulu-Natal.

### **1.2 Background/ Motivation for the Study**

Sobantu was one of the first villages to be established in Pietermaritzburg. The term "Sobantu" is derived from the plural (Sa-bantu), which translates to 'we are also people'. Given this name, one would expect a welcoming and pleasant urban environment. However, Wasteline Publications (2007) noted that due to the lack of proper SWM at the Sobantu Landfill (2007:1), this residential area is the complete opposite of a place one would call home.

The study investigates the impact of solid waste landfills on adjacent residential areas. The policies and strategies adopted by the Msunduzi MSWM system are reviewed in order to understand the local waste management strategy and the New England Landfill's impact on the community. The study poses the question of whether the negative impacts of the landfill are due to deficiencies in national and local legislation and strategies, or whether they are attributable to the SWM system itself. Given that a holistic approach is required to address environmental issues, it sought to determine how effective the zoning regulatory framework and the planning laws of the country have been in reducing the negative impacts of waste management in the study area.

The researcher sought to determine whether or not the negative impacts of the New England landfill on the community of Sobantu and surrounding areas are a result of a disjuncture between spatial planning and development and the need to protect certain environments, or to people settling in areas that are easily accessible and poorly regulated. In particular, it



focuses on the relationship between human and environmental health on the one hand, and land use management (LUM) strategies on the other. This is discussed in more detail in Chapters two and three.

Given that the Sobantu area was developed during the apartheid era, the study also investigates whether this accounted for its location.

Despite its numerous negative impacts, this landfill site has also had a positive impact on the economic well-being of the community through, for example, the creation of job opportunities. This is discussed later in this chapter.

### **1.3 Problem Statement**

The study examines how the New England Landfill affects the surrounding residential areas in terms of human and environmental health, LUM, and environmental sustainability. Daskalopoulos et al. (1998) argue that the poor state of SWM in the urban areas of developing countries is a major social handicap apart from being an environmental problem (Igbinomwanhia & Ohwovoriole, 2012). While understanding that the issue of SWM does not only affect the study area, the study therefore focuses solely on the New England Landfill Site as an area of choice and one that the researcher has direct access to.

A report by the Jeffares and Green Engineering and Environmental Consulting Company in 2010 noted that the landfill site had outlived its lifespan. Five years later, it was still operating. Thus, this study set out to establish whether this is the result of poor planning or other factors and how the community has responded to this issue.

### **1.4 Aims and Objectives of the Study**

The main aim of the study was to examine the impact of the New England Landfill site on Sobantu Township and adjacent surrounding areas. The objectives were:

- To trace the historical background of the New England Landfill.
- To explore the regulatory framework (i.e. policies and by-laws) that governs solid waste management in South Africa.
- To analyse the impact of the landfill on adjacent land uses.



- To propose mitigating measures to minimize the negative impacts of the landfill on the community and the environment.

#### **1.4.1 Research Question**

- a) What is the impact of having a landfill site in close proximity to a residential area?

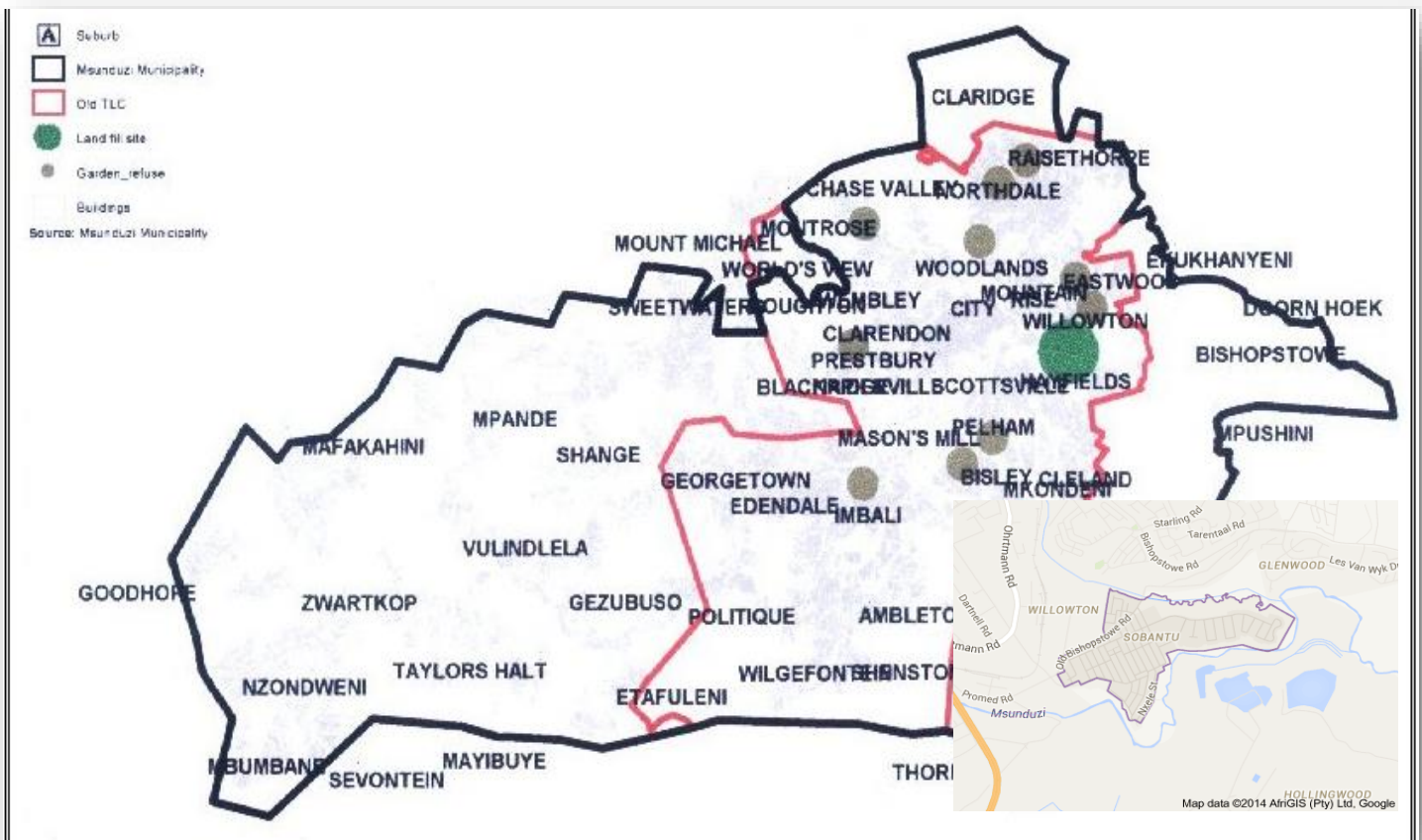
#### **1.4.2 Research Sub-Questions**

- b) When was the New England Landfill site established?
- c) Which existing policies / zoning regulations guide municipal solid waste management in South Africa?
- d) What are the impacts of the New England Landfill site on adjacent land uses?
- e) What strategies are in place to resolve this issue as a mitigation measure?

### **1.5 Scope of the Study**

Sobantu is a peri-urban residential area located on the outskirts of Pietermaritzburg in KwaZulu-Natal, South Africa. According to the 2011 Census, the Sobantu residential area is home to approximately 7 448 people (StatsSA, 2011). The area was established in 1927 in terms of the Natives (Urban Areas) Act No 21 of 1923 in order to move African people from urban areas (Peel, 2010). The map below shows the Sobantu residential area and the landfill site.

Figure 1: Sobantu Residential Locality Map



Source: AfriGIS, 2014

As shown in Figure 1, Willowton Road to the north of the landfill site is the entrance to the Sobantu residential area. Sobantu covers the majority of the land surrounding the landfill site and has therefore suffered the most severe impact. It is therefore for this reason that Sobantu residential area was selected as the area of focus.

## 1.6 Outline of the Dissertation

This dissertation consists of six chapters. Chapter one introduces the study by presenting the background to the study, the problem statement, and the study's aims and objectives as well as the research questions. Chapter two presents a review of the literature relevant to the study as well as precedent studies. It also discusses the conceptual and theoretical frameworks adopted for the study. Chapter three analyses SWM in South Africa. It outlines the current regulatory framework and investigates whether the New England Landfill complies with this framework. Chapter four presents the methodology employed to conduct





the study. Chapter five presents and analyses the data collected and discusses the results. It also highlights the ethical considerations taken into account in conducting this study. Finally, Chapter six summarises the research findings, and presents recommendations and conclusions.

## **1.7 Chapter Summary**

This chapter presented the background to the study, the problem statement, and the study's aims and objectives as well as the research questions. These were presented as a means of providing an understanding of what the research entails and seeks to achieve. Understanding the background and problem statement of the study can be useful in determining the objectives and aim of the research. The following chapter presents a review of the relevant literature and discusses the conceptual and theoretical frameworks that underpinned the study.



## CHAPTER TWO: LITERATURE REVIEW

### 2. Introduction

Solid waste management is a fundamental municipal service that has a major impact on both communities and the environment. This chapter examines the concepts and theories that guided this study.

#### A. Section 1: Conceptual and Theoretical Framework

##### 2.1 Conceptual Framework

###### 2.1.1 *Solid Waste*

Smart Ranger (in Bharat & Jaiswal, 2009) describes solid waste as “useless and unwanted products in a solid state resulting from the activities of and discarded by society, produced either as a byproduct of production processes or arising from the domestic or commercial sectors” (2009: 3304).

###### 2.1.2 *Solid Waste Management*

Waste management can be defined as “the collection, transportation, and disposal of garbage, sewage, and other waste products that encompasses management of all processes and resources for proper handling of waste materials, from maintenance of waste transport trucks and dumping facilities to compliance with health codes and environmental regulations” (Business Dictionary, 2014). It seeks to mobilize initiatives to promote sustainable living.

Many different types of waste are produced on a daily basis by households and businesses across the country. Municipal solid waste (MSW) includes two categories of waste. The first is **general waste** which refers to waste that does not pose an immediate hazard or threat to health or to the environment, and includes:

(a) Domestic waste – produced by households

(b) Building and demolition waste – industrial or commercial waste

(c) Business waste – institutional waste

(d) Inert waste – natural waste material

(NEMA, 2008)

The second category is **hazardous waste** which includes any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment (NEMA, 2008).

### ***2.1.3 Landfill Site Design and the Role of Planning***

The maximum lifespan of a landfill site is about 50 years. The fact that the Sobantu landfill site was established during the apartheid era (around 1965) 50 years ago rendered it an appropriate case study.

Landfill site design is an important factor in the initial planning stages as the location of such a facility may have a major impact on the surrounding areas and the community at large. In the case of the Sobantu residential area, the location of the landfill site has had a significant impact on community members on a daily basis, leading to the expression of “not in my backyard” (NIMBY). This expression, which is common in developing countries, refers to the community’s disapproval of the location and operation of MSW facilities adjacent to their neighbourhood. The UNEP/IETC (1996:424) defined NIMBY as "an expression of resident opposition to the siting of a solid waste facility based on the particular location proposed". According to Domingos (2001), residents express a variety of concerns about the presence of such facilities in their midst. These range from the health and environment risks posed by the facility, to its negative impact on aesthetics in the area, intolerable odours, reduced property values, increased traffic, noise, flies, and dust associated with the facility and the inequity of dumping everyone else's waste in their backyard (UNEP/IETC, 1996).

The structured interviews and Msunduzi Municipality IDP that are discussed in the following chapters were the main sources used to understand the landfill site design and the role of planning in identifying landfill sites.

### ***2.1.4 Liveable Environments***

Planning plays a critical role in the type of development that takes place within a specific area. Creating a sense of place should be a priority in the initial planning stages. The term ‘liveable urban environment’ is used to express the idea of a place that is good to live, work, and play



in, ultimately an urban environment where people enjoy a high quality of life. The researcher examined these characteristics in the study area, paying particular attention to how community members view the issue of the location of the landfill site within close proximity.

### **2.1.5 Land Use Management**

Planning has a major influence on a number of issues nationwide. This study focused on LUM, particularly the role that zoning plays in building a community like the Sobantu residential area. Zoning plays a critical and significant role because it informs all the activities that occur within a particular geographic space. The Land Use Management Act of 2011 introduced a zoning system to regulate land use in a municipality, including a town planning or zoning scheme and policies on how land is used on a plot-by-plot basis (Rural Development and Land Reform, 2011). Therefore, LUM was examined in order to determine why the New England Landfill was established in close proximity to a residential area.

The above-mentioned concepts form the basis for a framework to analyse the issues relating to SWM. These concepts enabled the researcher to understand how SWM should be practiced in order to create liveable communities that promote a harmonious relationship between people and the environment, and to identify the principle objectives that guide SWM.

## **2.2 Theoretical Framework**

Sustainable development requires the integration of social, economic and environmental factors in planning, implementation and evaluation of decisions to ensure that development serves present and future generations as directed by the National Environmental Management Act (NEMA) Act 107 of 1998 (Rural Development & Land Reform, 2011). Municipalities are faced with the challenge of encouraging lifestyle choices that promote sustainable living, perhaps in a more collaborative form. In doing so, the socio-economic, environmental and educational characteristics of communities need to be carefully considered.

When waste is produced it eventually returns to the natural environment, that is, to the land, water or the air. If not properly managed, it causes pollution which can be easily transferred from one part of the environment to another. The environment that receives the waste must be able to assimilate it without becoming degraded or polluted (Department of Rural

Development & Land Reform, 2011). Waste must thus be managed in a way that does not have a negative effect on the environment and in a manner that is affordable, acceptable and as convenient as possible to the people who might be affected by it.

### 2.2.1 Sustainable Livelihood Approach

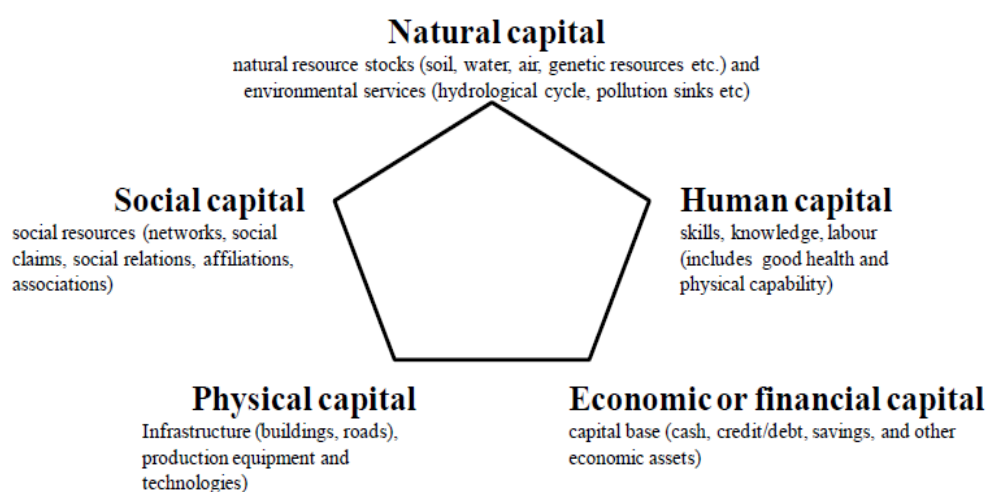
The Sustainable Livelihood Approach (SLA) to development emerged during the 1990s and was the core of United Kingdom's Department for International Development's (DFID) strategy during the early years of the New Labour government (Morse et. al, 2009). As noted in the previous section, sustainable development integrates the social, economic and environmental aspects of development. Morse et al. (2009) notes that 1997 White Paper on international development aimed to:

*"...refocus our international development efforts on the elimination of poverty and encouragement of economic growth which benefits the poor. We will do this through support for international sustainable development targets and policies that create sustainable livelihoods for poor people, promote human development and conserve the environment".* (Refer to Figure 2 for elements of the SLA).

DFID (1997: 6).

Figure 2 below illustrates the five elements of the SLA.

Figure 2: The five elements of the SLA



Source: Morse et al. (2009: 5)

All activities, whether economic or social, should promote sustainable livelihood. Chambers and Conway (1992) defined the SLA as follows:

*“A livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living; a livelihood is sustainable which can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation; and which contributes net benefits to other livelihoods at the local and global levels and in the short and long-term”* Chambers and Conway (1992:7).

Drawing on this definition, there appears to be a synergy amongst the various components. Morse et al. (2009) argue although a livelihood should be able to recover from ‘stress and shocks’, it should also be capable of ‘maintaining and enhancing’ capabilities and assets into the future. This highlights that the diverse elements that comprise livelihoods are key to this process.

Carney (1998) offers a simpler definition that resonates with that of Chambers and Conway:

*“A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living and when merged with sustainability, a livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base”* (1998 pg. 162).

This suggests that development should seek to ensure preservation of the fundamental resource, which is the natural environment. In the case of the New England Landfill site, a development aimed at providing a service in the form of waste management has done so at a particular area’s expense. Because of their proximity to the landfill site, the residents of Sobantu have suffered adverse effects that have negatively impacted their health and the beauty of a place they call home.

Morse et al. (2009) note that the United Nations Development Programme Human Development Report (1990) (UNDP HDR) argues that:



*“The development process should meet the needs of the present generation without compromising the options of future generations. However, the concept of sustainable development is much broader than the protection of natural resources and the physical environment. It includes the protection of human lives in the future.*

***“After all, it is people, not trees, whose future options need to be protected.”***

UNDP HDR (1990: 61-62)

Morse et al. (2009) add that the livelihoods approach places people at the core of development, with people rather than the resources they use or the governments that serve them being the primary concern (Ibid). A situational analysis of the Sobantu residential area will reveal whether or not this principle has been well understood. It may well translate into sound resource management or good governance (Ibid). However, as Morse states, the phrase “it is people, not trees, whose future options need to be protected” could be misleading, as it may imply that the environment is of secondary importance (Ibid). It is important to note that the SLA is opposed to facilitation of human development as the fundamental goal attained at the expense of the environment.

The SLA emphasizes that successful development interventions should begin with a reflective process that draws on sound evidence. A broad vision is required as quick ‘technical fixes’ will not deliver the desired outcomes (Morse et al., 2009). Thus, before any development is introduced, the reasons for the type of development must be clearly defined and communicated, including how it will be carried out. The question is whether or not the City of Pietermaritzburg’s integrated development planning follows such a process. Morse et al. (2009) observe that, all too often, top-down projects are planned to deliver change to a population without consideration of the feasibility and costs that occur when development is unfeasible. Policy and regulatory frameworks therefore need to be reinforced to guide cities’ development plans.

### **2.2.2 Location Theory**

Increased solid waste generation is the consequence of urbanization, industrialization, population growth and improved standards of living (affordability). Solid waste management is regarded as one of the major problems confronting government (Babalola & Busu, 2010).

This calls for planning to be redefined in order to meet the needs of society. The location theory, whose origins lie in studies on the location of plants and industries where availability of raw materials and access to consumer markets are of primary importance, has played a significant role in understanding the spatial distribution of places (Chan, 2011).

### **2.2.2.1 Location versus Population Growth and Urbanization**

Rapid population growth, urbanization and industrialization have led to increased waste generation in developing countries. This calls for effective SWM that promotes environmental conservation and sustainability (Chan, 2011). Chan (2011) notes that, location theory offers new insight into the effects of space on the organization of economic activities due to rapid urbanization. Beckmann (1968) states that it raises the question of where and adds those of what, for whom, how and when. Location theory is thus basically concerned with the geographical location of activities and could be useful in analyzing MSW systems.

However, the theory has been subjected to some criticism. Higgins and Savoie (2009) note that, while, it identifies the factors affecting spatial economic activities and demonstrates their influence, it does not explain the structure of the space economy (Higgins & Savoie, 2009).

Cappello (2011:3) defines the location theory as one that “seeks to explain the distribution of activities in space, the aim being to identify the factors that influence the location of individual activities, allocation of different portions of a territory among different types of production, the division of a spatial market among producers, and the functional distribution of activities in space” (2011:3). Moreover, planning plays a critical role in the long term outcomes of an area as it underpins the critical elements that guide development. The main goal is to understand the factors associated with locational decision making and what makes a suitable location (Murray & Church, 2009).

### **2.2.2.2 Determinants of Location**

- **Technological factors:**

These include the physical characteristics or principles which influence the choice of location, together with infrastructural support such as highways, airports, railroads, a power and water supply and sewers. Technological factors support the establishment or functioning of a



facility, industry or human settlement. One of the key factors that influence people to reside in close proximity to landfill sites, whether or not this is hazardous to health, is the availability of infrastructure that is constructed to accommodate the landfill's operations.

- ***Economic and Geographic factors:***

The choice of location is also determined by the need to minimize transportation costs in line with the principles of agglomeration economies (theories of minimum-cost location), (Capello, 2011). People desire to live in a place that is convenient for both employment and non-employment-related daily activities. This study thus investigated the interdependency between Sobantu residents and the New England Landfill site. In most instances, economic factors lead to spontaneous settlements, with many residents of communities bordering landfill sites depending on the site for employment.

In examining these economic demands, the researcher considered the dependency theory that explains the underdeveloped state of many nations by examining patterns in their interactions and argues that inequality among nations is a fundamental aspect of such interactions (Ferraro, 1996). In the context of this study, dependency theory was used to define the existing relationship between the community of Sobantu and the New England Landfill. Research undertaken by the Department of Environmental Affairs (2016), the Department of Science and Technology (2012) and Wilson et al. (2006) showed that landfill sites address some of the economic challenges experienced in low-income communities by providing raw materials that can be used as a means of economic activity and profit making. The researcher sought to establish whether such dependency exists in the case of the Sobantu residential area.

Figure 3: Job Creation through Landfill Waste Picking



(Source: Groundwork, 2014)



(Source: Chamane, 2011)

Amongst other things, the New England Landfill site has created job opportunities for many waste pickers in the Sobantu area and surrounding communities. News24 (2015) reported that after pictures were posted on Facebook showing waste pickers going through the rubbish to find recyclable goods that they can trade for money, many members of the public criticized them without taking into account that this is their job (News24, 2015). While many community members have protested and continue to protest against the landfill site, it has evidently been a source of income for many disadvantaged households. There may thus be opposing views on whether or not the site should be closed.

Spokesperson for Groundwork in the Pietermaritzburg area, Megan Lewis, stated on News24 that:

*“Waste pickers are provided with safe working conditions in a more formal and organised manner. Waste picking is important to waste management and job creation, as it means items that can be recycled are making more landfill space for non-recyclables, and with such a high unemployment rate, it provides work for the most impoverished” (John, 2015:1).*

In light of the high rate of unemployment in South Africa, landfills can be regarded as major economic drivers, particularly in low-income areas such as the Sobantu residential area. This is discussed further in Chapters 5 and 6.

- ***Political factors:***

As noted previously, the Sobantu residential area was founded as a village for African people that were removed from urban areas (Wasteline Publications (2007)). Political factors thus played a major role in the location of this community.

- ***Social factors:***

The location of facilities determines the long-term sustainability of services and community well-being. Babalola & Busu (2010) note that research has shown that when waste disposal facilities are located some distance from residential areas, they encounter less public opposition. Hence, waste disposal sites should not be located in populated urban or rural areas. Segregation, dominance, gradient, centralization and decentralization, and invasion and succession are social factors that determine geographic location (ibid).

### **2.2.3 Collaborative Planning**

The collaborative approach rests on the belief that administration that is based on communication will satisfy a greater range of the needs of various stakeholders than an oppositional approach in which the most powerful usually prevail (Healey, 2003). Collaborative planning was a crucial issue in this research in terms of the realization of the goals and objectives of multiple stakeholders by ensuring that decision-making is not left in the hands of the authorities. Communication enables the identification of solutions that accommodate the conflicting interests of multiple stakeholders (Pettit, 2005).

The government is the primary role player in ensuring that all communities have access to an effective and efficient solid waste service. However, households also need to participate to ensure the success of the service. Thus, this study sought to determine the level of consistency in the LUM scheme and Msunduzi Municipality's SWM in response to the impacts of the landfill. This required an analysis of the level of participation of all stakeholders in identifying efficient and appropriate mitigation of the threats the landfill site poses to the health of the community and the environment.



According to Naidoo (2009), there have been issues of non-compliance where residents defy solid waste disposal legislation and policies, pointing to poor monitoring and control and resulting in a degraded and unsustainable environment. Many different factors influence MSWM, with economic, social, educational, and institutional issues, among others, determining the types of solid waste found in landfill sites. Many economically challenged communities in informal settlements believe that their localities are targeted for landfill sites, leading to NIMBY, which refers to community opposition to the siting and operation of MSW facilities close to their neighbourhood. This is another reason to plan and implement an integrated solid waste system in a collaborative manner.

Naidoo (2009) argues that responsible SWM requires a shift in mind-set from how to 'get rid' of waste, to identifying reducing, reusing and recycling options (Naidoo, 2009). Table 9 (Annexure 6) illustrates the action plan for Recycling, Recovery, Reuse and Energy Generation Initiatives. This is arguably a more efficient and sustainable means of development that prevents the 'cradle-to-grave' phenomenon. In developing countries in particular, reduction, reuse and recycling should not only be regarded as an intervention for environmental conservation, but also as a way to achieve economic and social sustainability (Arlosoroff, 1985). Waste management has provided a significant number job opportunities and focusing on the positive aspects of the system could assist in resolving some of socio-economic challenges that confront Sobantu residents.

Municipalities are required to adopt integrated development planning in their areas of jurisdiction. The Batho Pele principles (Government Gazette, 1997) that involve "putting people first," provide a framework for the transformation of public service delivery. Consultation is one of these principles. This means that citizens should be able to express their needs when decisions are made on service provision.

## **B. Section 2: Principles of Solid Waste Management in Developed and Developing Countries**

### **2.3 Introduction**

This section examines SWM in developed and developing countries in order to establish best practices and the regulatory framework required to promote a system that ensures that waste is efficiently collected and stored and that landfilling and disposal sites do not impose on the surrounding areas.

#### ***2.3.1 Solid Waste Management in Developing and Developed Countries***

Developing countries confront socio-economic challenges due to population growth and diminishing employment opportunities. Rapid urbanization as well as economic growth impact on SWM (Schwarz-Herion et al., 2008). The public sector in many developing countries has paid little attention to recycling and this tends to be the preserve of the informal sector with little support from municipalities. Srivastava (2014), states that solid waste is becoming a major health and environmental concern in the rural and urban areas of many developing countries (2014: 202). Urban planners are thus called on to identify approaches that promote sustainable development by addressing current waste management conditions with future considerations in mind.

According to Srivastava (2014), most developed countries employ sound management techniques to deal with waste. In Germany, enhanced resolution and mobile sorting has proven effective in processing waste and improving the rate of recycling and reuse (2014). This enabled Germany to increase its rate of recycling to 62% by 2010, with land filling almost reduced to zero. Regulation in the form of a ban on waste with certain organic content being sent to landfill greatly assisted these efforts (Srivastava, 2014: 202).

Waste management practices in developed countries offer many lessons for developing countries. In The Netherlands, 'Lansnik's ladder' (proposed in 1994) encourages households and businesses to avoid producing waste as well as recover valuable components. Srivastava (2014) states that "more than 35 waste categories were banned by 1995 and a landfill tax was



introduced that increased the recycling rate from 45% to 50% in the period from 2001 to 2009, 11 years ahead of the deadline” (2014:202). The Netherlands has made huge investments in recycling, with positive impacts on the economy and on-going efforts are being made to improve waste management. Srivastava (2014) notes that the country adopted thermal waste incineration in 1919 in order to accommodate variations in the composition and calorific value of MSW. By 2012, 12 incineration plants had been built in Amsterdam that enable 50 000 households to obtain 25% of their heat requirements from waste incineration (2014:202).

In contrast, Gumbi (2015) noted that, in 2015 nearly 65% of India’s MSW was disposed of at open dumps and 18% at landfill facilities, while 14% was composted and 5% was incinerated (UNEP, 2002). India has a large population and its waste is poorly managed. Its largest cities are responsible for 70% to 90% of MSW, whereas smaller cities and towns collect less than 50% (Annepu, 2012). In 2011, India sent about 6.7 million tons of MSW to landfill, which could have been recycled and used as secondary raw material in manufacturing industries. This was due to inadequate separation at source (Annepu, 2012). Like most developing countries, the country lacks an efficient and effective SWM system that does not regard landfilling as the first option but considers other forms of waste management such as recycling. Gumbi (2015) adds that, in the same year (2011), approximately 9.6 million tons of MSW which could have been composted was sent to landfill facilities due to the lack of source separation and sufficient composting facilities (2015: 36). However, other methods to deal with MSW are being explored; Srivastava (2014) notes that these include aerobic composting (organic compost as fertilizers), anaerobic composting (biogas as fuel or electricity) and refuse derived fuel (secondary fuel for solid fuel industry).

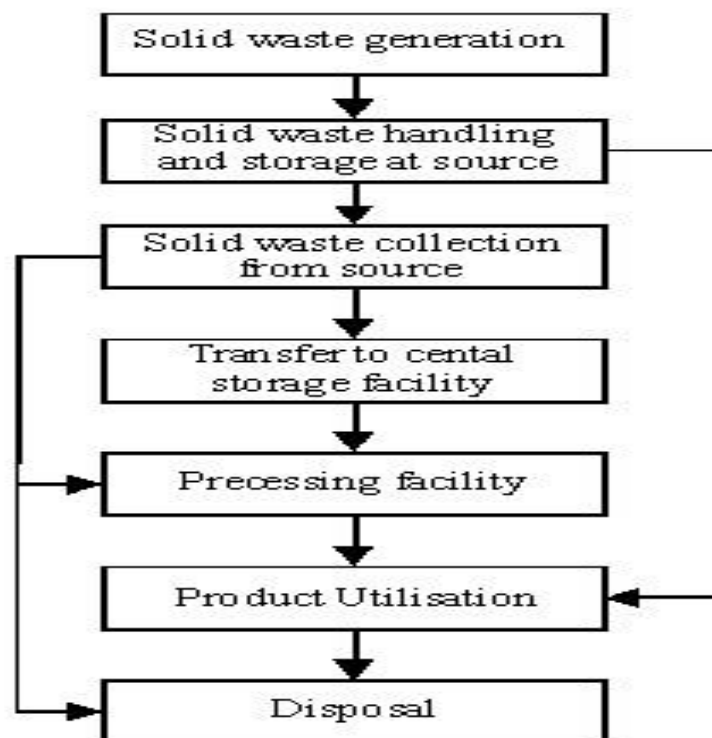
### 2.3.2 Stages of Waste Management

Rajpal (2002:9) identified a distinct process or the stages that inform waste management. These include:

- **Generation**, which marks the origin of waste.
- **Storage** that refers to the waste containers that are made available for use by the public before collection.

- **Collection**, the process whereby waste is collected for transportation to the actual dumpsite or landfill area.
- **Transport** – the collection system where the waste is collected from specific locations at regular intervals to be taken to a disposal site.
- **Recycling** that refers to the beneficial reuse of products that would be otherwise be disposed of (Kreith, 1994:112).
- **Reclamation**, where materials are reclaimed from the waste stream without undergoing a process of recycling.
- **Reduction** that refers to a process or activity which avoids; eliminates or reduces waste at its source.
- **Disposal** of waste takes place in a controlled or uncontrolled manner with controlled disposal taking place by means of sanitary landfilling or incineration, while the opposite is the case with uncontrolled disposal (Williams, 1998).
- **Sale of recovered resources.**

Figure 4: Stages of Waste Management



(Source: Igbinomwanhia, 2011)

## **2.4 Conclusion**

In summary, the discussion in this section has shown that an efficient SWM system not only reduces threats to the environment, but also decreases the impacts of disposal sites/ landfills on the surrounding areas. It was also shown that, as with other activities, laws and regulations are required to control waste management. Finally, all stakeholders should be involved in decision-making with regard to SWM.

## **C. Section 3 Precedent Studies**

### **2.5 Introduction**

The South African Constitution provides that all citizens have the right to live in an environment that is not detrimental to their health and well-being. Therefore, municipal councillors and officials have a legal duty to ensure that the areas under their control do not become degraded or polluted. The manner in which a municipality controls and manages the waste that is generated within its boundaries has a significant effect on the quality of life of its residents (Rural Development & Land Reform, 2011). However, the literature notes that South Africa has failed to mitigate the impact of solid waste on the population over the years as a result of rapid urbanization and the increasing volume of solid waste produced.

This section presents two case studies, namely, China and Brazil. The main aim is to show how these countries' landfill sites have impacted on the surrounding areas and the lessons that South Africa can learn.

#### **2.5.1 Precedent Study 1: Solid Waste Management in Brazil: The Case of São Joao Landfill–Sao Paulo)**

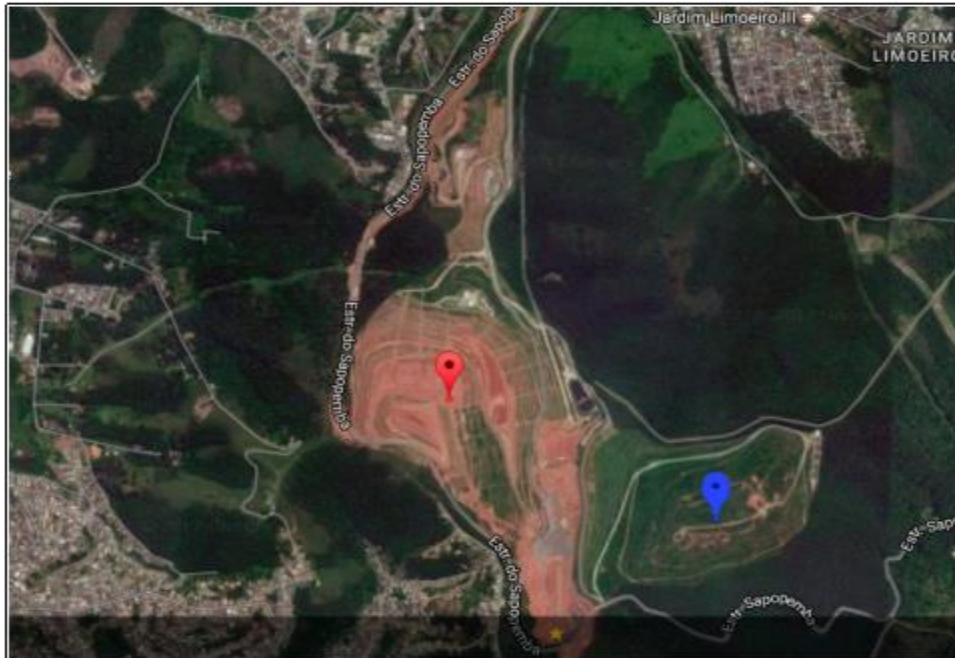
##### **2.5.2 Introduction**

The concept of sustainable development, advocated for at the United Nations Conference on Environment and Development (UNCED 1992), includes solid waste, which involves waste generation reduction, recycling and reuse of all materials, and waste treatment and disposal in an environmentally sound manner.



### 2.5.3 Location of the São Joao Landfill Site

Figure 5: Aerial Map of the São Joao Landfill in Sao Paulo, Brazil



(Source: Tomaszewski, 2017)

The aerial map above illustrates the exact location of the São Joao landfill site in conjunction to the adjacent land uses. The proximity of the São Joao landfill site to residential and business areas can be said to display common elements with that of Sobantu Landfill site. The landfill site is thus highlighted in blue.

### 2.5.4 Economic Benefits of SWM in Sao Paulo

Solid waste management in the form of landfilling offers various economic benefits to surrounding communities. The indirect economic benefits include the creation of private firms for composting, waste-to energy production, and recyclables separation, and private concessions for the operation of landfills, etc. all of which create jobs and promote economic activity in and around the landfill site as well as more positive income distribution (USAID, 1997). However, landfills do pose an environmental threat. Moreover, USAID (1997) highlights a number of potential barriers that could undermine possible environmental and economic opportunities.

*“The primary barriers include (i) the existing institutional capacity, (ii) a lack of effective regulations, (iii) a lack of private sector participation, (iv) the perception of*

*the private sector regarding risks associated with investments in waste management projects, and (v) the availability of attractive financing” (USAID, 1997: 187).*

Government policies with regard to enterprises and private ownership and operation of entities traditionally controlled by government, need to be well understood by the private sector. This sector’s inclusion in MSWM has been seen as a positive paradigm shift in Brazil because it means that municipalities are not working alone to resolve the massive challenge of SWM. Furthermore, their new partners bring new expertise to the table. For example, involving the private sector increases the prospects of using new cleaner technologies for leachate treatment, resource recovery, composting, and waste-to energy generation, all of which will not only result in environmental but significant economic benefits for Brazil (USAID,1997). However, the process needs to be rationalized and simplified and fiscal and financial incentives may be required to persuade private sector entities to participate in the management of municipal waste (Ibid).

### **2.5.5 Current Projects**

Most Brazilian cities have carried out or are implementing projects to prevent, mitigate, correct or compensate for the possible negative impact and maximize the positive impact of SWM (Acuiro et al., 2005). However, while some projects have been successful, others have not been maintained or replicated due to their failure to adopt effective planning, legal, institutional, administrative and financially self-sustaining mechanisms (Ibid). This once again highlights the importance of planning as a fundamental building block of development.

#### **2.5.5.1 Composting**

Composting has been used at the São Joao Landfill to minimize the impacts of landfill. However, failure to conduct feasibility studies resulted in the closure of plants and equipment not being installed (Ibid). Attempts to industrialize refuse have failed due to municipal officials’ lack of knowledge as well as lack of access to sound advice.

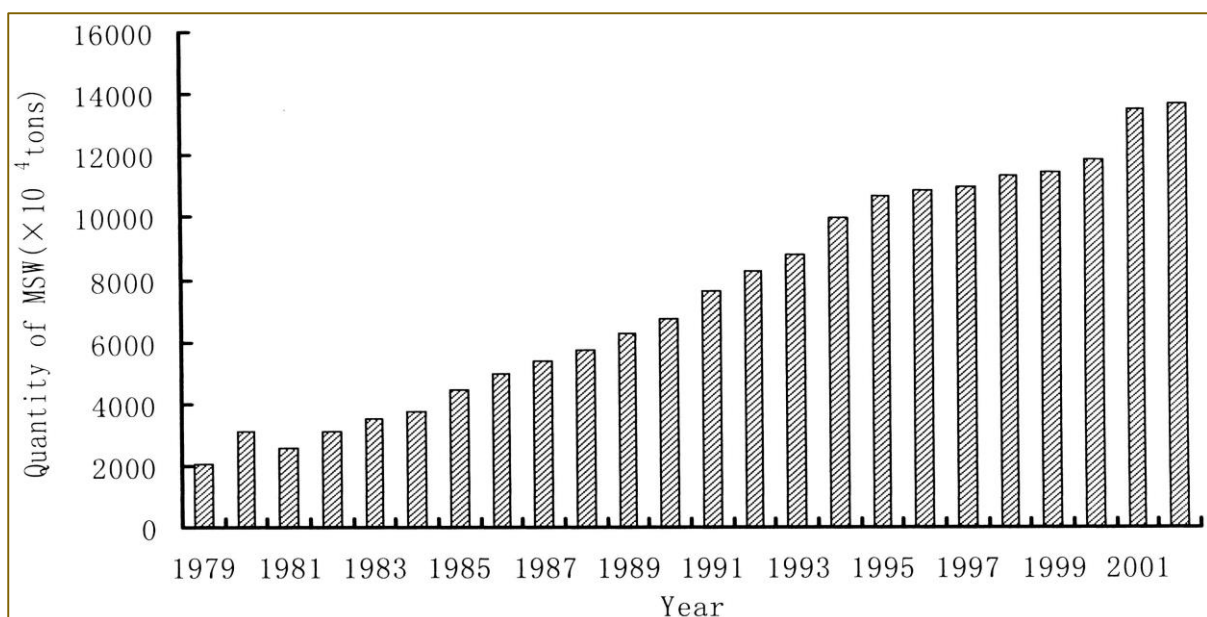
## 2.7 Precedent Study 2: Solid Waste Management in China

### 2.7.1 Introduction

Due to rapid economic development, the volume of solid waste generated in China has increased dramatically, presenting an enormous challenge to environmental management and intensifying solid waste related problems such as pollution. In 2002, 39.1% of the Chinese population lived in cities, and the urban population was 500 million, whereas the largest 660 cities had a population of 350 million (Huang et al., 2005). The composition of MSW was associated with the level of economic development and lifestyle of residents. Huang et al. (2005) note that between 1979 and 2001, the quantity of MSW collected and transported increased on an on-going basis and this trend continues (See Figure 6 below).

### 2.7.2 Municipal Solid Waste Production in China

Figure 6: The volume of MSW in China between 1979 and 2001

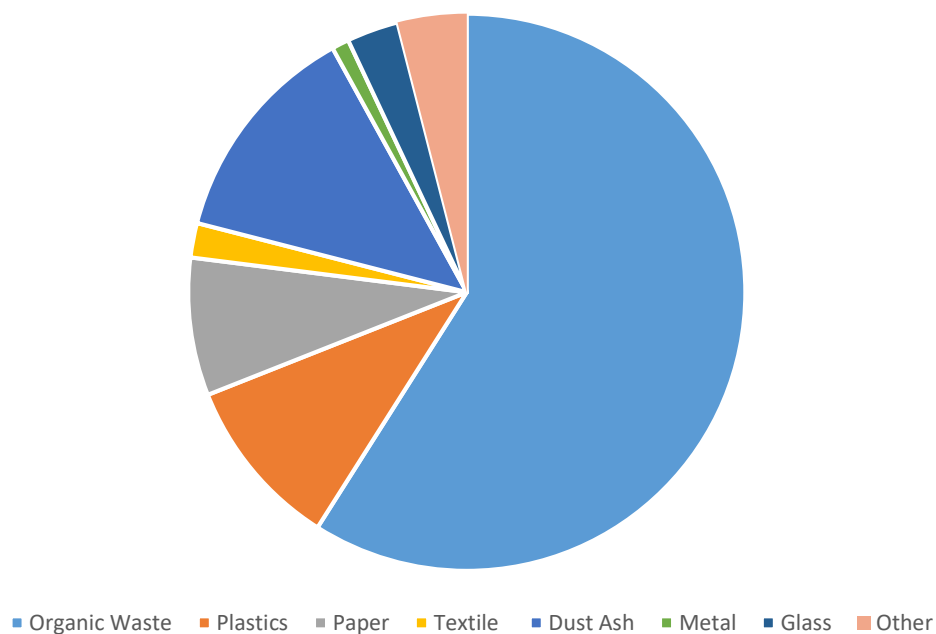


(Source: Huang et al., 2005; 64)

Municipal solid waste has an enormous percentage of useful materials and is sorted three times in China. First, at the domestic level, Chinese people have a tradition of selecting and selling recoverable materials to private collectors. Second, in the collection and

transportation process, some collectors and transporters sort and sell recoverable materials to increase their income. This happens again at transport sites and landfill sites. Liu (2017) notes that the composition of solid waste in cities varies and is directly linked to differences in climate, culture, standards of living, income, dietary habits and consumption. According to Liu (2017), MSW in China has high organic and moisture content which was approximately 60% in the year 2000 (Liu, 2017: 10). This meant that households were producing more solid waste than most other sectors. However, organic waste has decreased to 50% and an increase has been observed in recyclable waste, particularly paper and plastics (Liu, 2017).

Figure 7: Composition of Solid Waste in China's Urban Areas



(Source: World Bank, Tsinghua University 2002:65)

Due to imbalances in economic development, many people make a living from sorting and selling waste material; the result is that few metal materials and plastic bottles are present in MSW in the final landfill site (Huang, 2005) (See Figure 7 above and Table 1 below for the composition and type of waste produced in China and used in waste sorting). It is estimated that between 10% and 20% of MSW is removed and recycled as recoverable material.

**Table 1: Composition of Waste in Urban Areas in China in 2002**

Type of Waste	Percentage
Organic Waste	59%
Plastics	10%
Paper	8%
Textile	2%
Dust and tile	13%
Metal	1%
Glass	3%
Other	4%
<b>Total</b>	<b>100%</b>

(Source: Huang, 2006:65)

### 2.7.3 Waste Production in China

Table 1 above shows the composition of China's waste production in urban areas. This reveals the commonality between the study area and the case study. However, the table and graph also point to another important factor; the level of organic waste production in China. Organic waste is made up of food, and animal and plant biodegradable material which means it can be further broken down and poses less of a threat to the environment. Thus, while China may show similar trends to South Africa in terms of waste generation, the majority of the waste produced in China poses a lower environmental threat. Nonetheless, landfilling organic waste may have a negative impact as it is believed to produce methane.

China encourages businesses to get involved in waste management. McDonald's and Coca Cola are examples of companies that reflect the overall shift towards a consumer society (Urban Development Sector Unit, 1999). This is an effective initiative because it garners the support of companies that are partly responsible for the volume of waste produced globally.



Governments cannot handle waste management alone; companies should work in partnership with them to develop comprehensive waste management programs to address the impacts of solid waste production.

#### **2.7.4 Cradle-to-Cradle**

“Cradle-to-cradle” is designed to put an end to the cycle of use-waste-pollute. It suggests that certain products could be endlessly reused to make similar products (cradle-to-cradle), rather than being recycled into lower-grade products until the last stop is a landfill (cradle-to-grave) (McDonough et al., 2002). These products can be used, recycled, and used again without losing any material quality (Ibid). This could be beneficial in reducing the waste generated from the raw material used to produce new products. Considering the waste hierarchy, it also increases the volume of waste that is reused. This offers much potential in solving the problems of municipal solid waste. “Cradle-to-cradle” is an important aspect of China’s waste treatment hierarchy and results in an effective, sustainable waste management system.

#### **2.7.5 Incineration**

According to the Urban Development Sector Unit (1999), given accelerated urbanization in China and the country’s limited land resources, rather than large landfill areas, waste incineration, which uses less land, has become the preferred option. The UN Environmental Protection Agency states that, “incineration is the process of destroying waste material by burning it” (2006:65). Many countries recognize that waste incineration is significant in conserving land, especially those with limited land mass such as South Africa. It is estimated that Japan is home to nearly 70% of the world’s waste incinerators and nearly three-quarters of the nation’s waste is burned in these facilities (Corliss, 2009). Furthermore, modern processing technology does not cause the secondary pollution that occurs both during and after incineration; 90% of the waste volume and 75% of the waste weight could be reduced and incineration residue can also be reused (Pan, 2009). In Japan, incineration technology is so advanced that pollution is completely controlled and incineration plants are built near residential communities (Ibid).

Finally, China has adopted an integrated SWM system to reduce the problems associated with landfilling. For example, Guangzhou and Ningbo in the country operate high quality, sanitary

landfills and minimum operating standards have been set to improve conditions at Laogong Landfill (World Bank, 2005). With much in common with South Africa, China seems to be a major area of interest for researchers, particularly those attached to the World Bank. The main objectives of a sound waste management master plan are developing a solid waste system that maximizes the benefits of each component through minimizing costs, and maximising environmental protection and public acceptance while being sufficiently flexible to adapt to changing circumstances (World Bank, 2005). This is particularly true for countries like China, whose landfills do not seem to have been properly monitored. It highlights the importance of striking a balance between socio-economic factors and environmental concerns.

The case study of China's MSWM system and its conformance to global expectations show that South Africa's municipal solid waste systems could be improved. It also offers examples of various mitigation policies and legislation that could combat the negative effects of generic solid waste practices. There is an urgent need for management at waste disposal sites to be improved, including more frequent covering of waste. Security at sites also needs to be improved, including restricting access to each site (through a fence or gate) (SIVEST, 2004). The uMgungundlovu District Municipality's waste management plans should also be covered in more detail in IDP documents to reflect plans to improve the City's waste management.

## ***2.8 Lessons from the precedent studies***

A number of lessons can be drawn from the precedent studies discussed above. Practices that have been adopted in Brazil and China that could be replicated in South Africa to ensure a sustainable waste management system and minimize the effects of landfilling are discussed below.

### ***2.8.1 Recovery and recycling***

The 3 Rs (recovery, reuse and recycling) have been used as a viable tool to achieve sustainable development and reduce the quantity of waste generated. Brazilian cities have recorded some progress in this regard, with tangible social benefits. Scavengers have improved their living conditions and are organized in cooperatives as in Colombia, or in other forms of associations as in Mexico and other countries (World Bank, 2005).

The World Bank argues that technical assistance and to a lesser extent, the financial support of NGOs and municipalities have also yielded positive results. Although the quantities recovered remain low at 3% to 8% of the total waste generated (between 10% and 30% of the material that it is possible to recover), scavengers' income has increased due to more efficient and fair marketing of recovered material (Ibid).

Other achievements include the construction of recovery plants, the emergence of a healthy private recycling industry, the creation of waste bags for waste trade (the CETESB, FEEMA and ABIQUIM programs) (Acuiro et.al, 1998) and community members' awareness of and cooperation (although still slow) with regard to in-house waste separation.

It is acknowledged that informal initiatives dominate recycling activities. However, Acuiro et al. (1998) note that more resources need to be devoted to promoting recycling. Castagnari (2005) notes that:

- Policies adopted in reference cities, such as São Paulo, Curitiba and Porto Alegre have resulted in the growth of recycling promoted and managed by government agencies, although informal activities still prevail.
- New legislation based on the polluter pays principle, will generate revenue to support recycling.
- Reduced tax on recyclables, coupled with increased levels of public awareness, will increase demand for such goods and result in the production of a more diverse range of products (Castagnari, 2005).

### **2.8.2 Integrated SWM System**

Integrated management of landfill sites has the potential to deliver both direct and indirect economic benefits to the Brazilian economy. The direct benefits include revenue from resource recovery and utilization, while indirect benefits include revenue generation from (i) sale of compost, (ii) use of on-site waste for incineration of hospital and other toxic waste (currently mostly contracted out), and (iii) utilization of landfill gas for generation of heat and/or electricity (Castagnari, 2005). All these economic benefits will not only enhance the participation of the private sector, but reduce the fiscal burden on the state and municipal



government which must otherwise bear all of the costs of landfill management under tight budgetary constraints.

The notion of integrated solutions is gaining traction amongst managers in the public and private sectors. Solutions already adopted or in the process of adoption by several municipalities indicate increased use of business models that promote integrated management of municipal solid waste, including domestic and industrial waste, healthcare waste and recyclables collection and recycling (Ibid, 2005).

Integration is recommended to ensure sound SWM and reduce wasteful expenditure on landfilling and its associated processes. This would also enhance capacity building, as many municipalities do not have the skilled personnel required to efficiently manage solid waste.

### **2.8.3 The Influence of Planning**

Institutions tasked with SWM in many countries remain weak, and social and industrial relations challenges arising from poor management continue to make front-page news (Ibid). Acurio et al. (1998) add that few national development plans adequately cover solid waste. This is the case in Msunduzi Municipality, where the IDP (2012/17) makes scant reference to this essential service. National development plans and IDPs should lay the groundwork for fundamental structural planning for all development in a city, be it infrastructure or other services. Planning plays a crucial role in the well-being of an area, as it determines which resources are placed where and why. UN Habitat (2009) defines planning “as a self-conscious collective (societal) effort to re-imagine a town, city, urban region or wider territory and to translate the result into priorities for area investment, conservation measures, new and upgraded areas of settlement, strategic infrastructure investments and principles of land use regulation. Planning is now viewed as a largely strategic activity (SACPLAN, 2004:6).” It should thus be an integral part of the regulatory framework that guides MSWM.

## **2.9 Chapter Summary**

This chapter drew on experiences of SWM in developed and developing countries as well as precedent case studies in Brazil and China to identify critical issues that South Africa should consider in formulating an effective and efficient SWM system. These include the need for an integrated system that draws on the experience and expertise of a range of stakeholders that



are committed to preventing environmental degradation and climate change. It is clear that many countries are struggling to identify sound SWM solutions. Developing countries in particular, suffer from a shortage of land as a result of population growth that call for effective strategies to address the impacts of waste generation and disposal. An integrated municipal solid waste system (IMSWs) is thus required to address the problems that most communities in developing countries face on a daily basis. Many of the strategies discussed in this chapter could be replicated in South Africa. However, environmental impact assessments should be conducted to ensure that such solutions do not have long-term impacts such as climate change. The following chapter unpacks SWM in South Africa.

## CHAPTER THREE: SOLID WASTE MANAGEMENT IN SOUTH AFRICA

### 3.1 Introduction

Solid waste regulation is a major step towards the control and reduction of the negative impacts waste has on the natural environment, including climate change and global warming. This section reviews the literature on waste regulation.

According to Shulman (2011), waste management is closely linked to the evolution of human communities, population growth and commercial and industrial development. Population growth and increased disposable income have led to a dramatic increase in the amount of waste generated. *“Municipal solid waste is defined to include refuse from households, non-hazardous solid waste from industrial, commercial and institutional establishments (including hospitals), market waste, yard waste and street sweepings”* (Schübeler et al., 1996: 9). Municipal Solid Waste Management is the system responsible for the collection, transfer, treatment, recycling, resource recovery and disposal of municipal solid waste. In line with resolutions adopted by the BRICS partners and the 17<sup>th</sup> session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (COP 17), it should aim to protect both human and natural environments.

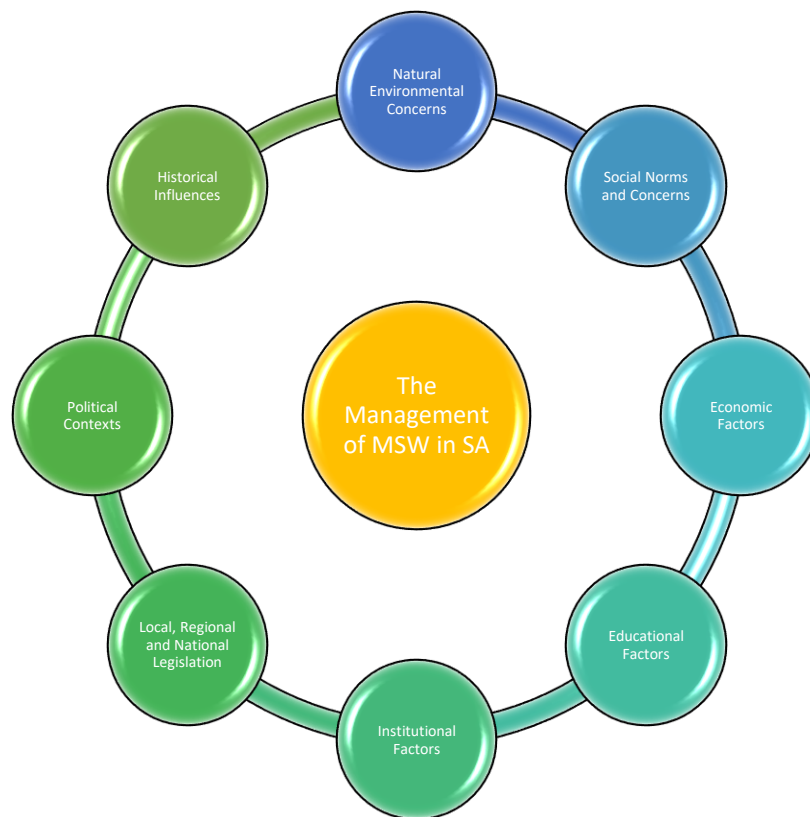
Sustainability remains elusive in many developing countries that are confronted by overpopulation, poverty and increased rural-urban migration. This study thus examined the nature of SWM and how it can be incorporated into a global integrated system that promotes a sustainable natural environment. The focus was the impact of solid waste on human settlements, whilst taking a holistic view of this issue.

In South Africa, population growth as well as economic expansion have been identified as the primary factors that have led to increased waste generation (Blignaut et al., 2004). Cointreau et al. (1990) note that increased population and income levels have led to an increase in the quantity and the value of waste. This can be attributed to consumers' increased purchasing power as well as attractive consumer packaging (Enviromark, 2007). Ultimately, it results in increased demand for landfilling.

### 3.2 Factors Influencing Municipal Solid Waste Management in South Africa

Municipal solid waste management is susceptible to local, national and global influences. Understanding the factors that influence MSWM promotes a better understanding of the system designed to manage solid waste. Umbach et al. (1997) observe that debate continues on whether the systems adopted by municipalities to manage solid waste promote local, national and global environmental sustainability. Figure 9 below identifies the factors that have the most significant influence on South Africa’s MSW, whether directly or indirectly.

Figure 8: Direct and indirect factors that influence MSW in SA and their interdependence



(Source: Umbach et al., 1997:2; Researcher)

It is important that those responsible for service delivery consider these factors when introducing SWM systems. In light of the numerous factors that impact on SWM and their interdependence, Naidoo (2009) argues for a holistic approach.

### 3.3 Institutional Framework Guiding SWM in South Africa

South Africa's legal framework for SWM is one of the most advanced on the African continent. The DEA (2011) notes that, while there is a distinct division of roles, responsibilities, and mandatory obligations among the three spheres of government, the framework provides for an integrated system to ensure a clean environment and a healthy society. The constitutional right to an environment that is not harmful to health or well-being underpins all the country's environmental policies and legislation, particular the framework established by the NEMA Act 107 of 1998.

#### 3.3.1 Roles and responsibilities

##### *a. National government*

National government bears overall responsibility for waste management in South Africa. The DEA (2011; 283) is responsible for:

- Establishing the National Waste Management System (NWMS);
- Setting national norms and standards;
- Establishing and maintaining a National Contaminated Land Register;
- Establishing and maintaining a National Waste Information System; and
- Preparing and implementing a National Integrated Waste Management Plan (IWMP).

The Minister of Environmental Affairs is the licencing authority for hazardous waste activities and is expected to ensure the implementation of the NWMS and national norms and standards.

The DEA is the lead agent for waste management-related functions including:

- Development of policy, strategy and legislation;
- Co-ordination;
- Enforcement;



- Dissemination of information;
- Hearing appeals (against government decisions, authorization, etc.);
- Monitoring, auditing and review; and
- Capacity building.

#### ***b. Provincial government***

In terms of Section 155 (6) of the Constitution, provinces are required to support and monitor local government in order to ensure that municipalities are able to carry out their functions and manage their own affairs (DEA, 2011). Effective waste management requires all spheres of government to play their part in ensuring implementation on the ground. The Presidential Delivery Agreement (COGTA, 2010; DEA, 2011) also mandates provinces to allocate appropriate resources to local government to improve outcomes at local level. Thus, provincial departments' commitments should be incorporated into a municipality's IDP. The DEA (2011: 283) lists the following specific functions of provincial government with regard to waste management:

- Development of provincial environmental implementation plans;
- Reviewing the first-generation IWMPs of municipalities and where necessary, assisting with drafting such;
- Monitor compliance with provincial implementation plans and intervene if necessary;
- Develop provincial guidelines and standards;
- Develop and enforce provincial regulations for general waste collection, and support local government in the implementation of waste collection services;
- Act on environmental hazards as required;
- Ensure that all industries have access to appropriate waste disposal facilities;
- Quality assurance of the Waste Information System;
- Implementing and enforcing waste minimization and recycling initiatives, and in particular, promoting the development of voluntary partnerships with industry;



- Registration and certification of hazardous waste transporters, the waste manifest system and the establishment and control of hazardous waste collection facilities; and
- Support the DEA in planning medical waste treatment facilities, and investigating the feasibility of centralized (regional) waste treatment facilities.

### *c. District municipalities*

Integrated development planning is a cornerstone of SWM systems and calls for all stakeholders to play a role in achieving the desired outcomes. According to the DEA (2011), this includes the development of a framework for IDPs and ensuring that IWMPs inform the IDP process. It can thus be argued that the IDP guides SWM in South Africa.

The DEA (2011) notes that district municipalities have the following responsibilities in relation to SWM:

- Ensuring integrated development planning for the district as a whole.
- Promote bulk infrastructure development and services for the district as a whole. This includes the establishment of regional waste disposal sites and bulk waste transfer stations that can be used by more than one local municipality within the district.
- Build local municipality capacity. Where a local municipality fails to perform its management functions, the district municipality can enter into a Service Level Agreement with it to provide the service for a stipulated period until such time that the local municipality is able to do so; and
- Promote equitable distribution of resources among local municipalities in its area by, for example, ensuring that resources are deployed where they are most needed.

#### ***d. Local municipalities***

The DEA (2011) identifies the following SWM roles and responsibilities of local government and adds that it is important that a dedicated department within the municipality is responsible for these duties:

- Compile and implement IWMPs and integrate these into IDPs;
- Run public awareness campaigns;
- Collect data and report to the Waste Information System;
- Provide waste management services, including waste removal, storage and waste disposal services, in line with national norms and standards. Municipality-specific standards can be set for separation, compacting and storage of solid waste that is collected as part of the municipal service;
- Implement and enforce waste minimization and recycling initiatives (such as encouraging voluntary partnerships with industry and waste minimization clubs).

It is thus clear that South Africa has an effective plan for SWM. What is required now is to address the institutional and technological limitations that hamper effective implementation of this plan.

### **3.4 Policies**

Central and provincial government departments and agencies are responsible for introducing SWM policies and strategies. The Department of Water Affairs states that “municipalities are responsible for general waste management planning and the development of by-laws which include economic incentives to support waste minimization and recycling in their areas” (2002: 8). The main laws that control waste management in South Africa include:

- The Environment Conservation Act (Act 73 of 1989): Section 20 (5a, pg. 9) of this Act states that, with regard to waste management, the Minister of Water Affairs is the authority behind the establishment of any disposal site and is responsible for the control and management of disposal sites in general. This





Act is crucial in analyzing the current status quo of the New England Landfill site.

- The NEMA (Act 107 of 1998) provides for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment, institutions to promote co-operative governance and procedures to co-ordinate the environmental functions exercised by organs of state as well as associated matters (Website 3, 2015).
- The Health Amendment Act (Act 63 of 1977) sets out measures to promote the health of the inhabitants of the Republic. It thus provides for the rendering of health services; defines the duties, powers and responsibilities of certain authorities which render such services; and provides for the co-ordination of these services and incidental matters (Website 3, 2015).

The Act was amended as the Health Act Amendment of 1984 *“so as to replace certain obsolete expressions; to extend the definition of “local authority” so as to include certain Black local authorities; to alter the constitution of the Health Matters Advisory Committee; and to further regulate certain powers of investigation and inspection; and to provide for incidental matters”* (Website 3, 2015).

- The National Environmental Management Act: Waste Act: National Waste Management Strategy (2009).
- The Local Government: Municipal Structures Act (Act 117 of 1998) provides for the establishment of municipalities in accordance with the requirements relating to categories and types of municipality; establishes criteria to determine the category of municipality to be established in an area; defines the types of municipality that may be established within each category; provides for an appropriate division of functions and powers between categories of municipality; regulates the internal systems, structures and office-bearers of municipalities; provides for appropriate electoral systems;

and provides for matters in connection therewith (Website 3, 2015). This Act is pertinent to this study as it speaks to the regulation of internal municipal systems of which waste management is part.

- Constitution of the Republic of South Africa (Act 108 of 1996)

The Constitution is the supreme law of the Republic that enables the above mentioned laws to be adopted. Law or conduct that is inconsistent with the Constitution is invalid, and the obligations imposed by it must be fulfilled (1998:3).

The following section highlights the main components of the structural framework that shapes SWM policies and strategies.

#### 3.4.1 The White Paper on Integrated Pollution and Waste Management

The White Paper (Policy) on Integrated Pollution and Waste Management sets out the principles that reinforce the National Waste Management Strategy (NWMS). Central to the NWMS is the translation of policy principles into strategic plans and action. Municipalities are assigned responsibility for waste collection and disposal (DEAT, 2002).

#### 3.4.2 National Environmental Management Act (NEMA)

The NEMA uses the waste hierarchy as its overarching principle for waste management (DEAT, 2002). This hierarchy focuses on waste minimization, reuse, recycling and recovery in preference to waste disposal. The NEMA also provides for tools across the waste hierarchy in the form of integrated waste management planning, the development of integrated industry waste management plans; identification of priority waste, waste licensing and the development of regulations to manage specific waste streams. Managing waste in line with the waste hierarchy has the potential to create jobs as recycling requires infrastructure and opens new markets (DEAT, 2002), an opportunity that the landfill site has perhaps offered to the Sobantu community. The DEAT's Waste Management Strategy seeks to address the backlog in the provision of waste services in all municipalities, particularly those in urban informal settlements and rural areas.



### 3.4.3 Environmental Impact Assessments (EIAs) and Strategic Environmental Assessments (SEAs)

An Environmental Impact Assessment (EIA) is a systematic process of identifying; assessing and reporting the environmental impacts associated with an activity and includes all basic assessments (Sonjica, 2010). Therefore, an EIA is one of the ways to identify the environmental impacts of a landfill site and to suggest mitigating processes that could promote environmental protection.

A Strategic Environmental Assessment (SEA) is a system that incorporates environmental considerations into policies, plans and programmes (Rural Development & Land Reform, 2011).

### 3.4.4 Integrated Development Plan (IDP)/ Waste Management Act No. 59 of 2008

The Municipal Systems Act requires all municipalities to prepare an IDP. According to the DEAT (2002), an IWMP should be part of the IDP. In terms of the NWMS, this plan must implement the hierarchical management of waste with an emphasis on waste avoidance and minimization, through to responsible disposal.

### 3.4.5 Spatial Development Framework (SDF)

One of the main aims of a Spatial Development Framework (SDF) is to guide overall spatial distribution of current and desirable land uses within a municipality in order to give effect to the vision, goals and objectives of the municipal IDP (Rural Development & Land Reform, 2011). The aims of a SDF are to promote sustainable practical and integrated human settlements, increase resource efficiency, and enhance regional identity and the unique character of a place, creating what is referred to as a 'sense of place' in regional and town planning.

### 3.4.6 COP 17

An important issue for developing countries is that a legally binding climate agreement should not hamper their right to development because issues such as poverty persist that pose a challenge to environmental protection and awareness. COP17 could help to solve climate change issues such as pollution in South Africa (Masters, 2012). The main aim of COP17 was

to deal with global warming issues. However, there is no legally binding framework to address climate change in developing countries, particularly because achieving a green economy that protects the environment is now an industry in its own right.

#### 3.4.7 Regulatory Legal Framework

Issues relating to MSWM cut across different municipal departments such as environment and health, and urban planning / development with a shared City mandate. However, there appears to be overlap, with several laws guiding this process. As in Brazil, this could be resolved by clearly defining the structures accountable for SWM. Acuiro et al. (1998) state that this makes it easier to identify the functions of each authority. A flawed regulatory framework can result in failures at operational level.

### 3.5 How can South Africa improve the current status quo?

To achieve the sustainable development envisaged by Agenda 21, the government, the private sector, and communities should establish policies, programs, and plans where those responsible for service delivery work with the community to ensure a rational SWM strategy (Acuiro et al., 1998).

Increased production of waste in South Africa due to rapid population growth and increased disposable income has had a detrimental impact on the climate. The country's landfill sites need to be carefully managed in order to reduce climate changes. People also need to be informed about the reality of climate change and its impact; this calls for educational outreach programs. Communities should be encouraged to *reuse, reduce and recycle*. Landfill sites are fast reaching the limits of their capacity. The following section discusses various waste disposal methods, the selection of sites and the benefits of SWM.

### 3.6 Solid Waste Classification in South Africa

Chapter two of this dissertation unpacked the two classes of waste used in the municipal classification system. This section examines the forms of waste in each classification, i.e. general and hazardous waste.

### 3.6.1 General Waste

The Department of Water Affairs and Forestry (DWAF) notes that general waste is a generic term for waste that, because of its composition and characteristics, does not pose a significant threat to public health or the environment if properly managed (DWAF, 1998: 32). However, it is important to note that, if not properly managed, it can become an environmental or health hazard. General waste includes domestic and commercial waste, certain industrial waste and builders' rubble (DWAF, 1998:32). Although classified as general waste, waste stored within domestic and commercial premises may be hazardous. Examples include batteries, insecticides, weed-killers and medical waste. General waste may be disposed of in any designated landfill. As noted in Chapter one, such waste can produce leachate with unacceptably high pollution potential which may have resulted from waste decomposition, together with the infiltration and/or percolation of water (DWAF, 1998). It is therefore important that general waste disposal sites have leachate management systems.

### 3.6.2 Hazardous Waste

The health and well-being of an environment and the people residing in that environment should always be prioritised and protected from waste that can have negative impacts. The DWAF defines hazardous waste as any waste which, even in low concentrations, can have a significant adverse effect on public health and/or the environment (1998:33) due to its inherent chemical and physical characteristics, such as toxic, ignitable, corrosive, carcinogenic or other properties.

The following types of waste should be considered as potentially hazardous (DWAF, 1998: 32-33);

- a. *Inorganic waste*
  - Acids and alkalis
  - Cyanide waste
  - Heavy metal sludge and solutions
  - Waste containing appreciable proportions of fibrous asbestos



*b. Oily waste*

- This type of waste primarily emanates from the processing, storage and use of mineral oils.

*c. Organic waste*

- Halogenated solvent residues
- Non-halogenated solvent residues
- Phenolic waste
- PCB waste
- Paint and resin waste
- Biocide waste
- Organic chemical residues.

*d. Putrescible organic waste*

- Waste from the production of edible animal and vegetable oils, slaughter houses, tanneries and other animal and vegetable based products.
- High volume/low hazard waste.
- Waste that contains small quantities of highly dispersed hazardous substances. This waste presents a relatively low hazard. Examples are harbour dredge spoils, sewage sludge, soil and builders' rubble, which are contaminated by heavy metals, oils and other pollutants.

*e. Miscellaneous waste*

- Infectious waste such as diseased human/animal tissue, soiled bandages and syringes, commonly referred to as 'medical waste'.
- Redundant chemicals or medicines.
- Laboratory waste.
- Explosive waste from manufacturing operations or redundant munitions.

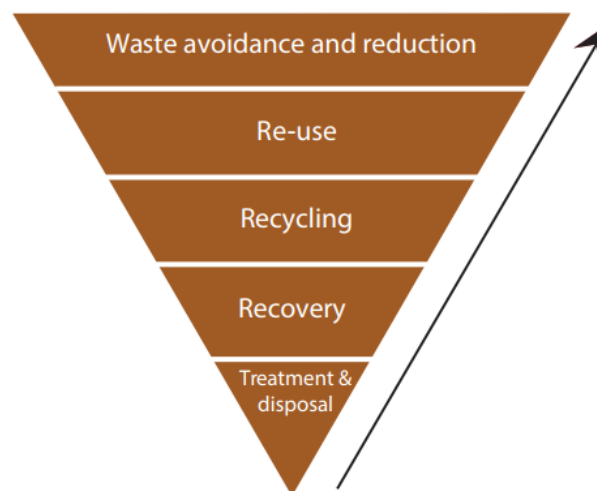
Hazardous waste is grouped into nine classes, based on international danger groups. They are also allocated a hazard rating based on acute mammalian toxicity, ecotoxicity, environmental fate, chronic toxicity and other criteria (DWAF, 1998:33).

### 3.7 Waste Disposal Methods

While economic development is crucial to the well-being of every nation, coupled with a growing population and increased urbanisation, it has led to increased generation of waste. This calls for improved policies and programs to prevent it from becoming an environmental and health hazard. Waste disposal methods currently used in South Africa are defined by the waste management hierarchy as per the National Waste Management Strategy (2012a).

#### 3.7.1 Waste Management Hierarchy

Figure 9: The Waste Management Hierarchy



(Source: DEA, 2012; 279)

The foundation is avoidance and reduction, where goods are designed in a manner that minimises waste components and the quantity and toxicity of waste generated during the production process (DEA, 2011). The next stage of the hierarchy speaks to reusing waste, which removes it from the waste stream for use in a differentiated form. Recycling follows reuse and involves processing waste products as raw materials (DEA, 2011).

#### 3.7.2 Cradle-to-Cradle

The first four stages of the waste management hierarchy (see Figure 9 above) are the foundation of cradle-to cradle waste management, an approach that seeks to re-use or recycle a product when it reaches the end of its lifespan (DEA, 2011). Material is re-used or becomes an input for new products. The cycle repeats itself until as small a portion as possible

of the original product eventually enters the next level of the waste management hierarchy referred to as recovery (DEA, 2011). According to the DEA (2011), recovery involves reclaiming particular components or materials, or using the waste as a fuel.

Although landfilling is commonly considered the most affordable way to manage waste, this does not take into account factors such as its environmental impacts (such as those found at the New England Landfill site in Pietermaritzburg); the costs of developing and maintaining additional landfill capacity to accommodate the increasing rate of waste disposal; and the cost of closing and remediating the landfill which is what South Africa is currently tackling.

### **3.8 Benefits of Solid Waste Management (SWM) in South Africa**

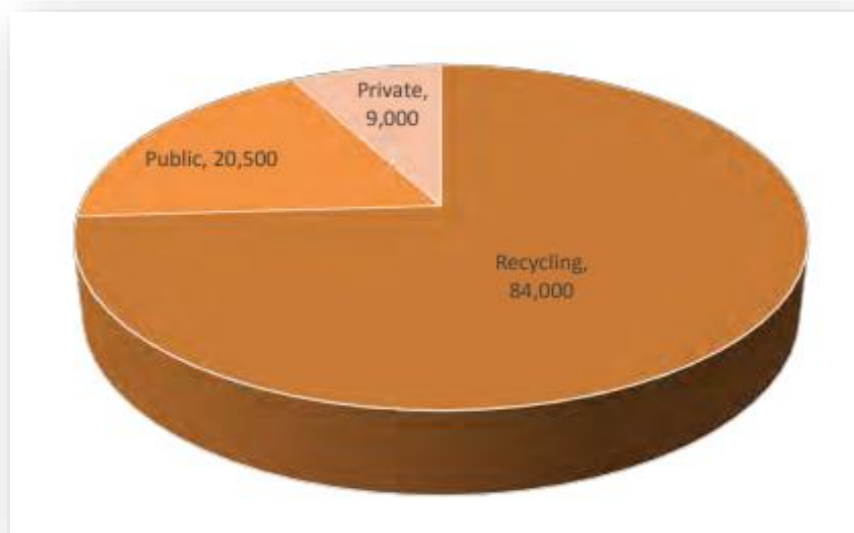
Over the years, efforts have been made in South Africa to promote various alternative waste disposal methods (including waste recycling facilities). However, waste management services have continued to rely heavily on landfills for the disposal of waste, which account for the majority of licenced facilities. Over 90% of all South Africa's waste is disposed of at landfill sites (DEA, 2011).

Despite South Africa's positive economic trajectory, unemployment remains pervasive amongst skilled and unskilled people, calling for urgent interventions. The government has encouraged all sectors to create job opportunities (DEA, 2011). There are many hidden employment opportunities within the waste sector. However, strategies need to be formulated to capitalize on such opportunities and ensure that they capacitate citizens with the right skills. The DEA (2011) states that these opportunities need to be examined in order for this sector to contribute to job creation (2011: 281). This will require collaboration across the different spheres of government. While no accurate data is available on the waste management sector's contribution to the South African economy, a conservative assessment can be made based on government and the private sector's investment in the delivery of waste services (DEA: 2011). It is estimated that about 70% of solid waste expenditure occurs through the public sector, largely local government, while the private sector is responsible for 30% (StatsSA, 2007). Thus, the public sector in particular, could play a significant role in creating job opportunities in the waste sector.



National Treasury has identified MSWM as one of the municipal functions with the greatest potential for job creation, particularly with respect to unskilled or semi-skilled labour (National Treasury 2008). Within the sector in general, labour intensive waste recycling activities have great potential to create new employment opportunities. Therefore, current government efforts to encourage recycling should be stepped up. Figure 10 below shows the number of people employed in the public and private waste sectors and in recycling between the 2005 and 2006 financial years (DEA,2011: 281).

**Figure 10: Waste sector employment estimates**



(Source: DEA, 2011: 281)

The Figure clearly shows the significant employment opportunities within the recycling component of waste management, while the public sector has also created an appreciable number of jobs. According to the DEA (2011), municipalities are expected to create more employment opportunities relating to cleansing and general waste collection and disposal.

However, the number of jobs in refuse removal services within waste departments in municipalities seems to be decreasing, possibly due to improved remuneration packages for qualified personnel at local government level (DEA, 2011: 281). This is cause for concern



because the waste management sector is vital to the overall functioning of a country. Furthermore, according to the DEA (2011), where jobs are available, about 12 to 14% of the posts remain unfilled. This figure rises to 15 to 17% in metropolitan municipalities (National Treasury 2008). Building reclamation centres and initiating revenue generating/self-sustaining methods of waste management could also create jobs.

### **3.9 Chapter Summary**

In summary, South Africa has a solid SWM system and comprehensive plans for waste management. As is true of many other policies and programs in the country, the challenge lies in implementation. Technical and administrative capability is required across the spheres of government in order to ensure that policies are implemented and that the systems that are adopted are efficient and effective. On-going research is also necessary to identify the best methods to manage waste.

## **CHAPTER FOUR: RESEARCH METHODOLOGY**

### **4.1 Introduction**

This chapter discusses the research methodology employed to answer the research questions and achieve the study's objectives.

A questionnaire, structured interviews, site visits, photographs and mapping were used in progressive stages of the research. This enabled the researcher to obtain unbiased information directly from the source. The questionnaire and interviews were carefully planned beforehand. This ensured that the researcher played a non-participative role and facilitated the collection of reliable information from relevant stakeholders that was not biased or based on personal feelings. The main research questions were used to guide the interviews and questionnaires.

### **4.2 Secondary Data Collection**

Secondary data refers to already existing information that a researcher uses for their own investigation (Church, 2001). This type of data was obtained from books, journals, maps, photographs, and municipal reports. The information obtained from the literature review informed data analysis and the study's recommendations.

### **4.3 Primary Data Collection**

This study adopted a qualitative approach and gathered non-numeric data using a survey approach (Naidoo, 2009), as well as quantitative analysis. According to Neuman (2000), qualitative research allows one to gain insight into the fundamental aspects of the investigation thus enhancing one's understanding of the themes and facets under study. The questionnaire survey and the assessment of municipal solid waste systems guiding landfilling were the two main primary data collection processes. These are further explained below. Mkhize states that "qualitative studies often try to understand human behaviour from the subject's or participant's point of view" (2011; 14). Thus, the study aimed to achieve a comprehensive understanding of the problems experienced by the Sobantu community thus far.



### **a) Preliminary Field Observation/ Site Visits**

Primary data includes all forms of data gathered by the researcher directly through observation guided by a checklist, or first-hand experience such as site visits to the study area. This enables the researcher to determine the participants' cognitive and emotional state. The field observation involved visiting the New England Landfill site to assess the following:

- Profile of the site (history, relationship due to adjacent residential area, etc.)
- Impacts of the site (positive and negative)
- The existing SWM system

Photographs were taken of the varied types of solid waste as well as the surrounding areas. These were included in the data analysis to reflect the information gathered in the field. This process helped to highlight and weigh the problems as it depicted the impacts of the site and guided the formulation of the questionnaire survey and interview schedule.

### **b) Questionnaire Survey**

The household data was collected through a questionnaire survey based on the following variables:

- Impact of the landfill site,
- Adjacency to the landfill site,
- Efficiency of the existing solid waste system and waste collection.

A simple random sampling technique was used. The study area is home to approximately 250 households. The target population was 10% (both male and female), comprising a sample size of 25 households. Therefore, every Sobantu household that was willing to participate in the survey had an equal opportunity of being selected. Participation was not limited to heads of households, but was open to family members over the age of 18. It was also recognised that some women were heads of families and breadwinners and they were given an opportunity to participate in the survey. The sample thus increased from an estimated 25 households to 76 respondents. Table 2 below shows the primary data collection for this study.

**Table 2: Primary Data Collection**

Target Population	Data Collection Method	Data Required	Number of Respondents
<b>Women</b>	Simple Random Sampling	<ul style="list-style-type: none"><li>• Age</li><li>• Occupation</li><li>• Views on the impacts of the landfill site (positive and negative)</li><li>• Period of residence in Sobantu</li><li>• Possible solutions to the issues</li></ul>	48
<b>Men</b>	Simple Random Sampling	<ul style="list-style-type: none"><li>• Age</li><li>• Occupation</li><li>• Period of residence in Sobantu</li><li>• Views on the impacts of the landfill site (positive and negative)</li><li>• Possible solutions to the issues</li></ul>	28
<b>Msunduzi Municipality Officials</b>	Face-to-face Interviews / Email Correspondence	<ul style="list-style-type: none"><li>• History of the residential area and the New England Landfill site</li><li>• Initial plans for the site as documented in the SDF, Land Use Plans and IDP documents</li><li>• What sustainable measures are in place to ensure a sustainable relationship between the people and the environment</li><li>• Future land use development plans for the landfill site and the surrounding residential areas</li></ul>	1
<b>Ascot Inn Owner</b>	Face-to-face Interviews	<ul style="list-style-type: none"><li>• Impact of the New England Landfill on surrounding businesses</li></ul>	1

(Source: Researcher's Construction)



### **c) Structured Interviews**

Structured interviews were conducted where the participants were asked the same questions in the same order and given the same time to respond. Participants were also given an opportunity to voice their concerns at the end of the interview. The key informants included community leaders and the municipal official in charge of the New England Landfill site. The researcher had intended to record the interviews so as to promote full understanding of the study area and address time constraints; however, consent was not granted and the answers were therefore recorded in writing (See Addendum B for the community questionnaire and Addendums C & D for surrounding areas and municipal manager's structured interview).

On the first day (Saturday) interviews were conducted from 09h00 to 17h00 and the same period was used the following day (Sunday). The respondents voluntarily engaged with the researcher and were eager for their voices to be heard through sharing their experiences of the study area.

### **d) Mapping**

Realizing that maps are a method on their own, the researcher sought to utilize them in such a way that they would introduce the study area in a more visual and relative manner, allowing for depiction of the exact proximity of the Sobantu New England Landfill site to the residential area as well as neighbouring land-uses.

It is important to consider the reliability and validity of the interview/questionnaire process as they form the basic elements that shape one's research. The use of specific software (Microsoft, GIS, Aerial Maps etc.) helped to make the research findings more reliable as it is not affected by any form of bias. The researcher is also responsible for ensuring the reliability, validity and rigor of the qualitative data obtained. Hence simple, straightforward language was used in the questionnaires and no personal assumptions were made about the respondents.

Methodological triangulation (the use of more than one method to gather data) was used to validate the researcher's interpretation and to link it with other sources which ascertains the need to also employ mapping as an additional method of data representation. In terms of authenticity and reliability, the researcher gained reliable information from the municipal

official who guide the development of the area as well as other relevant stakeholders. Reliability means that the data obtained can be re-used consistently and repeatedly over long periods with no form of bias being uncovered. At the beginning of the interview process each respondent was required to give their informed consent to participate in the study.

#### **4.4 Data Analysis**

Data collection is an important part of research because it allows for all the useful data to be gathered before it can be made readily available for further use. Ijasa et al. (2012) identify two types of data, namely, primary data and secondary data which are fundamental elements of data collection depending on the time available for the research, and the target sample as well as its location. Thus, the questionnaire survey targeted residents of Sobantu who are located no more than a kilometre from the landfill site.

The research questionnaire focused on gaining information on when and why the landfill was zoned in the area within close proximity to a residential area, and the SWM processes employed by the municipality. It also investigated the livelihoods of the community and the environment in which they are based.

#### **4.5 Limitations of the Study**

The following limitations were experienced during the course of the study:

##### **Access to information**

Successful research is highly dependent on access to information, whether through respondents, organizations or other stakeholders, as well as available resources (books, etc.). The researcher ensured access to information by building relationships with relevant stakeholders and gaining their trust through communication and clearly outlining the study's objectives. However, access to the site was limited to the periphery as the researcher was not allowed on site. The researcher overcame this limitation by taking photographs from the periphery of the site and obtaining information via the internet and emails.

##### **Time**

It was envisaged that the availability of key respondents might be a challenge as many worked and others were engaged in other economic activities. The researcher allocated a longer period of time to administer the questionnaire during weekdays and on weekends. For example, the business owner was given the interview questionnaire two days in advance of the interview as she could only allocate an hour to the researcher. The municipal official was also given the questionnaire beforehand.

### **Language barriers**

The researcher intended to interact with mainly Zulu-speaking people; therefore, the questionnaires were translated into isiZulu, which may have been problematic as meaning might have been lost in translation. To overcome this limitation, the researcher translated the responses into English. A language professional was engaged to assist with the translation.

### **Lack of Commitment from the Community**

The interviews were conducted during community protests, which resulted in some potential participants not being interested in the study as they suspected political affiliation. The researcher engaged the services of a trusted community member to facilitate access.

## **4.6 Chapter Summary**

This chapter discussed the methodology employed to conduct this study, including the research approach, the sampling method and the tools employed to gather primary and secondary data. It also highlighted the limitations encountered in conducting the study and how these were overcome.

The following chapter presents and analyses the data gathered for this study and discusses the results.



## **CHAPTER FIVE: DATA PRESENTATION AND ANALYSIS**

### **5.1 Introduction**

This chapter presents, analyses and discusses the data gathered to examine the impact of the New England Landfill on the surrounding residential community.

Solid waste management is one of the factors that influence economic development, particularly in developing countries. Rapid urbanization, population growth, rural-urban migration and technological advancements have resulted in an alarming increase in the volume of solid waste generated.

As with any strategy, planning is a critical first step in developing a solid waste management system. This study thus examined the role of zoning in building the community in the Sobantu residential area. Zoning informs all the activities that occur within a particular geographic space. South Africa's Land Use Management Act of 2011 regulates land use in a municipality (Rural Development and Land Reform, 2011).

### **5.2 KEY FINDINGS**

#### **5.2.1 Sobantu Residents Interviews**

The interviews with Sobantu residents were conducted in February 2015. In order to accommodate those that worked or were studying during the week, they were held on a Saturday and Sunday. As noted in Chapter four, the household heads included men and women as well as adult children. In some cases, parents with no formal education opted for their children (18 years and older) to participate in the study.

#### **5.2.2 Public Perceptions**

It was found that the respondents understood the concept of SWM. Furthermore, most expressed concern at the location of the landfill site and a sewerage depot in their backyard.

### 5.2.3 Respondents' Demographic Characteristics

**Table 3: Respondents' Gender**

<b>Gender</b>	<b>Total (Number of People)</b>	<b>Total (Percentages)</b>
<b>Male</b>	28	37%
<b>Female</b>	48	63%
<b>Total</b>	<b>76</b>	<b>100%</b>

(Source: Researcher's Construction)

Table 4 above shows that 37% of the respondents were male and 63% female. This was not only limited to the willingness of respondents to participate however it was also influenced by the fact that most of the Sobantu population available at the time of questionnaire surveys, were found to be females.

**Table 4: Number of Respondents who want the landfill to be demolished**

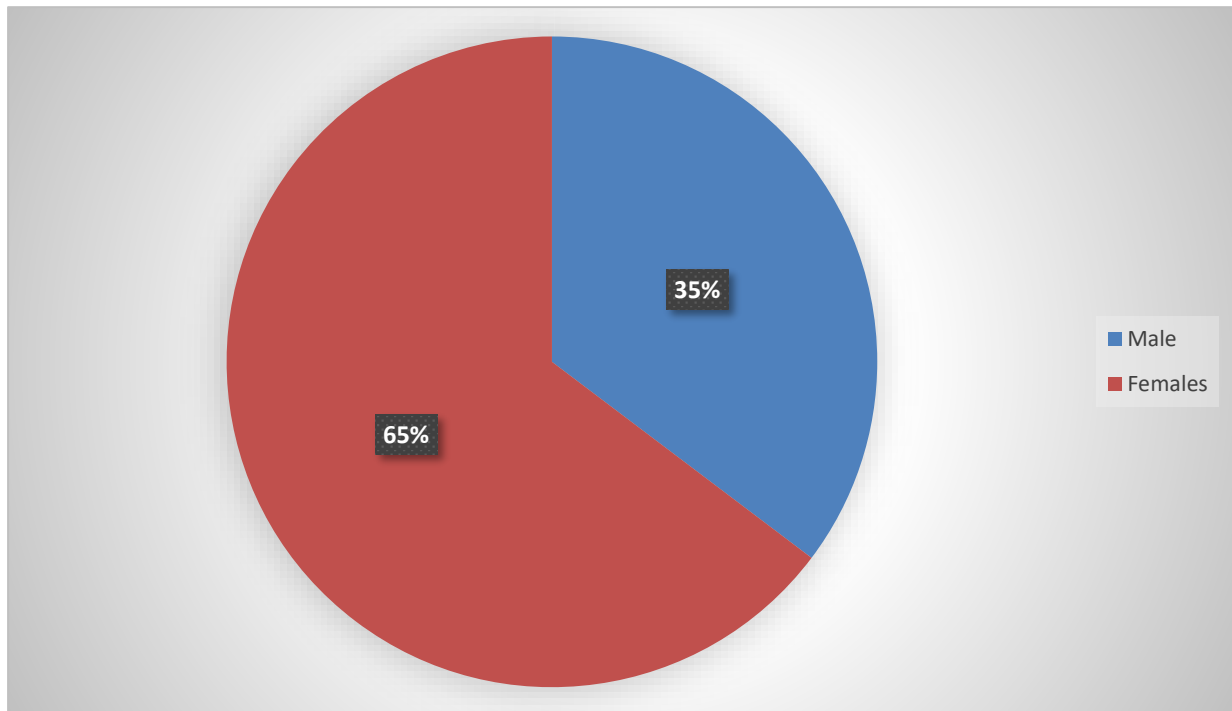
<b>No.</b>	<b>Male</b>	<b>Female</b>	<b>Total</b>
<b>1.</b>	24	44	68

(Source: Researcher's Construction)

Table 5 above indicates the number of residents who supported the demolition of the New England Landfill site. Most were not waste pickers and thus saw no need to prolong the lifespan of this facility.

Figure 11 below shows that, 35% of the respondents that want the landfill to be demolished were male and 65% were female.

Figure 11: Number of Respondents who want the Landfill site to be demolished



(Researcher's Construction)

Table 5 and Figure 11 above show that about 90% (68 respondents) of the 76 interviewees in the Sobantu residential area and surrounding businesses called for the demolition of the landfill due to the negative impacts of the facility that serves the entire municipal area of uMgungundlovu District Municipality.

Table 5: Number of Waste Pickers among the Respondents from the Sobantu Residential Area

	Male	Female	Total
	3	5	8

(Source: Researcher's Construction)

Around 10% of the 76 respondents felt that, while the landfill site has negative impacts, it also has positive effects and that removing it would rob waster pickers of their livelihood.

It was found that many of the waste pickers at the New England landfill site live in Sobantu. As noted in Chapter one, the area has a high unemployment rate. It was also noted that landfill sites have the potential to create jobs as they require labor for their day-to-day operations. Table 7 below shows that 55% of the respondents were unemployed; they are thus likely to recognize the landfill’s potential to offer economic opportunities.

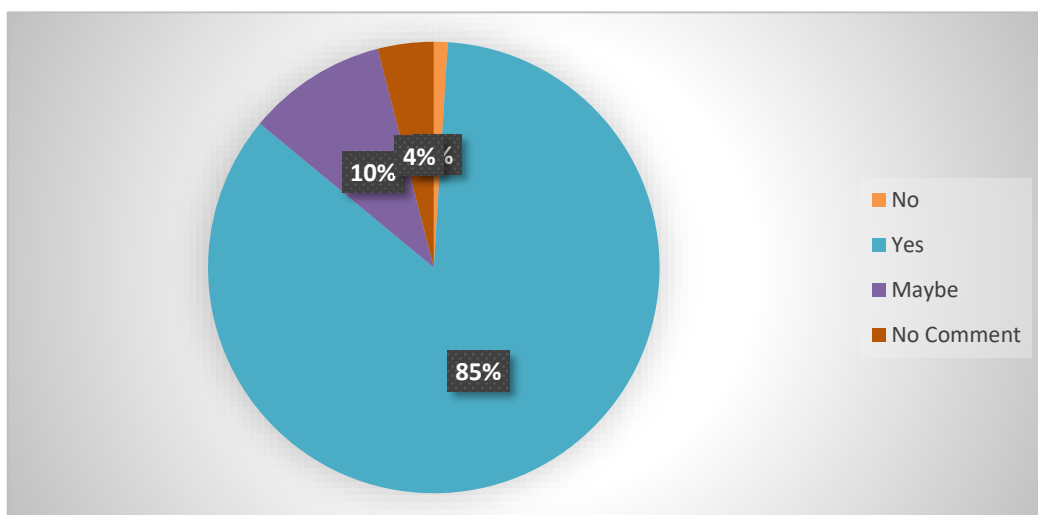
Table 6: Employment Rate

	Male	Female	Total
	13	29	42

(Source: Researcher’s Construction)

Turning to levels of community dissatisfaction, during a visit to Sobantu to administer the survey, the researcher observed hundreds of people gathered outside the Ward Councilor’s office. Their grievances ranged from a lack of housing to sanitation issues and the unbearable odor that engulfs the Sobantu area. The researcher used this opportunity to ask community members about levels of development in the area. Figure 12 below shows that around 86% of those approached stated that there had been no development for almost a decade.

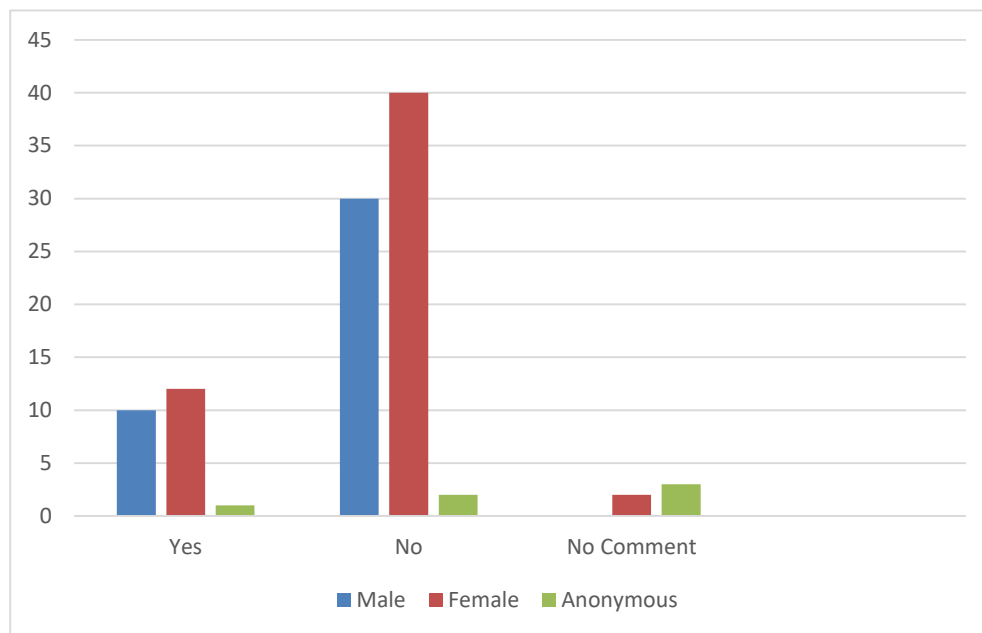
Figure 12: Responses on whether there have been disputes regarding the development of the study area



(Source: Researcher’s Construction)

The respondents were also asked questions relating to their knowledge of sustainable development and recycling/re-using (Refer to Annexure 1). Around 70% of the respondents indicated that they had no knowledge of sustainable development, although they were familiar with recycling and reusing, having learnt about it from books, family members, friends or the media. A holistic approach to sustainable development is essential to meet the needs of today's generation and those of the future. Figure 13 below indicates the number of respondents that were familiar with sustainable development.

Figure 13: Knowledge of Sustainable Development



(Source: Researcher's Construction)

#### 5.2.4 Living Conditions

As noted earlier in this chapter, Sobantu residents are dissatisfied with their living conditions. The researcher had an opportunity to witness these conditions firsthand when she visited the area. The first thing one notices when one enters Sobantu is the unpleasant smell. Business co-owner, Mary-Ann said that the area is not a good place to live or run a business. She added that the adverse conditions have had a major negative impact on her business.

### 5.3 Plans to Relocate the Landfill

Pietermaritzburg's designation as the capital of KwaZulu-Natal accelerated the city's growth and increased demand for services for the growing population (Mkhize, 2011). This has increased pressure on the nearly exhausted capacity of the New England Road Landfill site (Ibid). The municipality requires a functional and well-managed waste disposal facility to deal with increased waste volumes without causing harm to the environment and the locality (Ibid). However, the process of establishing a new landfill site is protracted and costly as geotechnical assessment must be conducted of all potential sites before they are declared suitable (Ibid). Msunduzi Municipality might be relieved of this pressure by on-going attempts by uMgungundlovu District Municipality to establish a new regional landfill site. The landfill site manager, Mkhize (2011) stated that, in his view, the municipality should identify a viable landfill that is closer to town and will be more convenient and less costly for businesses.

The overwhelming majority (99%) of the respondents indicated that they would not consider moving from Sobantu. However, they were of the view that sound development plans need to be formulated for the area. As noted earlier, the researcher witnessed protest action arising from the lack of development in Sobantu. Around 10% of the respondents stated that, although the landfill has adverse effects, Sobantu is close to job opportunities and the transit route. However, they felt strongly that they should not be subjected to the impact of the landfill for the rest of their lives. Furthermore, the New England site has outlived its lifespan. In response to such sentiments, the municipal official stated that the authorities are doing their best to lessen the effects of the landfill site.

#### 5.3.1 Interview with Ascot Inn Co-Owner

Asked about the impact of the landfill site on her business, the co-owner stated that "the landfill site is smelly and unbearable and has impacted negatively on the business as there is now a ... decline in the influx of visitors". She added that she is more concerned about the impact on the residents of Sobantu, particularly children.

Asked if she would encourage other businesses to develop in or around the area, the business co-owner stated that she "would not dare to encourage other businesses, because it is a very

bad area for businesses especially those relating to leisure”. She added that she looked forward to the day the landfill site would close. While it has helped her to dispose of the waste from her business, the negative impacts outweigh the benefits.

### **5.3.2 Interview with Municipal Official (New England Landfill Site)**

Asked when the landfill site was established, the municipal official stated that “the landfill site had been in existence for over 50 years, initially as a dump but since the early nineties it has been engineered to the specifications of a landfill site, and is in line with environmental legislation”. He added that the site is licensed and approved as a disposal facility for general waste.

The municipal official added that “the site has a lifespan of seven years remaining after which it will be rehabilitated and its end use will likely be a recreational area.” He claimed that the landfill predated the Sobantu residential area.

Asked whether problems have arisen due to the landfill’s close proximity to Sobantu, the municipal official said: “concerns [have been] raised by the surrounding neighbors ... but they have to accept that the site was there when they decided to develop alongside. Management of the site is to a high standard in order to ensure that there is minimal nuisance to the neighbors.” He was of the view that there will always be a resistance to the site no matter how well managed it is and attributed this to the sentiment of NIMBY discussed earlier.

## **5.4 The Msunduzi Solid Waste Management System (Landfill site operational legislative framework)**

As noted previously, municipalities and local authorities have the responsibility to ensure that the areas under their supervision are well maintained and functional. It is thus important that local authorities, including their representatives as well as community leaders and other stakeholders, are familiar with the legislation on waste management. This is essential in order to render affordable services in accordance with environmental standards. The municipal official stated that the New England landfill site has been in existence for more than 50 years,

initially as a dump, but in the early nineties it was engineered to the specifications of a landfill site in line with environmental legislation. This suggests that the New England Landfill complies with environmental regulations.

Municipal IWMPs should set out the measures that will be employed to ensure that waste is managed in a sustainable manner using the waste management hierarchy approach (uMgungundlovu District Municipality et al., 2009). Diverting waste is regarded as a priority and the government set a target of divert 25% of recyclables away from landfill by 2015.

The Waste Act that came into effect on 1 July 2009 formalizes waste activities and requires all generators of waste to ensure that they minimize their waste streams as far as possible. The Act provides for:

- *Extended Producer Responsibility that requires waste minimization programs, awareness programs to inform the public of the impact of waste, percentages of products that must be recovered, and life cycle assessments in accordance with waste standards.*
- *A Waste Information System for recording, collection, management and analysis of data and information. It must include data on the quantity and type or classification of waste generated, stored, transported, treated, transformed, reduced, recycled, recovered and disposed of.*
- *Generators' responsibilities, including waste avoidance, minimization of the toxicity and amount of waste generated, and reducing, reuse, recycling and recovery of waste.*
- *Collectors and transporters' responsibilities, including registration with the waste management officer in the municipality, preventing any spillage of waste or littering from a vehicle, ensuring that the facility or place to which the waste is transported is authorized to accept such waste prior to offloading; and obtaining written notification that the waste has been accepted, as well as incentives to promote waste collection and recycling.*





- *Storage Facilities and Depots must ensure that the containers in which any waste is stored are intact and measures should be taken to prevent accidental spillage or leaking and pollution of the environment or harm to health.*
- *Processors: Every person who undertakes a waste management activity must, before undertaking the activity, ensure that the reuse, recycling and recovery of the waste uses less natural resources than disposal, and as far as possible, is less harmful to the environment than disposal (uMgungundlovu District Municipality, 2009:182).*

The Waste Act provides that municipalities should:

- *Include an IWMP in their IDP.*
- *Appoint a Waste Management Officer.*
- *Develop waste management bylaws that set standards and targets for waste minimization.*
- *Comply with national and provincial norms and standards for specific waste activities.*

*(Ibid)*

The Act also provides for increased penalties for non-compliance and incentive mechanisms.

The Waste Information Regulations regulate reporting on waste information for protection of the environment and management of waste. Anyone conducting an existing listed waste management activity must register on the South African Waste Information System and comply with the reporting and record keeping requirements laid out in the regulations (Ibid). It is important that businesses and landfill site structures comply with this legislation in order to prevent environmental degradation at any level.

#### **5.4.1 On-site Storage**

According to News24, Pietermaritzburg is literally up to its elbows in rubbish with the New England Landfill overflowing with a mix of un-recyclable and recyclable material, building rubble, industrial waste, household food waste and household garden waste (News24, 2015). This raises the question of whether the city has failed to adopt appropriate SWM. Inadequate

on-site storage and collection systems account for the bulk of illegally dumped refuse in a large percentage of communities like the Sobantu residential area. The method used for on-site storage has a substantial effect on the collection system that should be implemented. It is important to plan and decide on the appropriate means of on-site storage in conjunction with transport options before implementing any system. While the respondents agreed that waste collection on prescribed days is efficient, they added that the municipality should work just as hard to remove and relocate the landfill.

As noted previously, the municipal official noted that, while concerns have been raised in relation to the landfill, people knew it was there when they decided to settle in the area. He added that the site is well-managed in order to ensure that there is minimal nuisance to the neighbors. While the landfill site was zoned for the location in which it exists, people cannot be forced to move.

Table 8 below sets out the broad goals and objectives for sustainable development for Umgungundlovu District to which Msunduzi Municipality belongs.

**Table 7: Broad goals and objectives for sustainable development**

Goals	Strategic Objectives
1. Avoiding and minimizing the generation of waste	<ul style="list-style-type: none"><li data-bbox="523 1317 1385 1420"><input type="checkbox"/> Facilitate cooperation within the business and industry sectors to promote processes that avoid or minimize waste generation</li><li data-bbox="523 1464 1394 1568"><input type="checkbox"/> Explore mechanisms to discourage waste generation through cost reflective and volume-based tariffs</li><li data-bbox="523 1612 1315 1644"><input type="checkbox"/> Increase consumer awareness of waste minimization issues</li></ul>
2. Reducing, re-using, recycling and	<ul style="list-style-type: none"><li data-bbox="523 1720 1155 1751"><input type="checkbox"/> Increase reuse and recycling rates of products</li><li data-bbox="523 1796 1305 1827"><input type="checkbox"/> Reduce the quantity of recyclable material going to landfill</li></ul>



recovering waste	<ul style="list-style-type: none"><li><input type="checkbox"/> Ensure separation at source</li><li><input type="checkbox"/> Encourage the establishment of Material Recovery Facilities (MRFs) where appropriate</li><li><input type="checkbox"/> Investigate waste-to-energy options</li></ul>
3. Treating and safely disposing of waste as a last resort.	<ul style="list-style-type: none"><li><input type="checkbox"/> Promote the regionalisation of waste treatment and disposal facilities where feasible</li><li><input type="checkbox"/> Stabilise quantity and investigate the reduction of the pollution potential of waste disposed to landfill as well as reduce this volume</li></ul>
	<ul style="list-style-type: none"><li><input type="checkbox"/> Improve landfill management to comply with legislation</li><li><input type="checkbox"/> Recover waste disposal tariffs to generate revenue so that landfill sites become profitable enterprises that are financially self-sustaining</li><li><input type="checkbox"/> Investigate conversion of waste to energy and clean development mechanisms</li></ul>

(Source: uMgungundlovu District Municipality, 2009)

This demonstrates that a plan is in place to address the waste management issues in uMgungundlovu and ensure that sustainability measures are adopted.

### **5.5 Proposed development plans for the Landfill Site (Mitigation)**

Plan 3 of the Msunduzi IDP document refers to the Environmental Planning and Social Services' mission to ensure a safe, healthy and secure environment (Msunduzi IDP, 2011-2016). It is crucial that the proposed development plans for the New England landfill site and surrounding areas address the negative impacts experienced for the 50 years since the establishment of the landfill. The Msunduzi landfill site manager stated that one of the plans involves rehabilitation of the site, with its end use likely to be a recreational area. This is in accordance with the Msunduzi IDP Plan 6: Integrated, Sustainable Spatial Planning and Development (planning, SDF, EMP) with the following set of strategic objectives:



- To ensure that all communities have access to social services
- To contribute towards a health, safe and secure environment with a special focus on children, youth, women and people with disabilities
- To promote sports and recreation, and arts and culture
- To promote a long term development vision and harmony in planning

(Msunduzi IDP, 2011-2016).

### **5.5.1 IWMP Implementation Program, Monitoring and Review**

The IWMP implementation program for the Msunduzi New England Landfill Site set out below comprises a set of Action Plans linking the strategic objectives of the plan. Associated with each of the action plans are estimated costs and the steps that need to be taken together with possible partners, as well as the benefits. The action plans begin with the establishment of a waste information system in recognition of the fact that without real data, no effective planning will be possible (refer to Annexure F for the municipal action plans to ensure an effective and efficient SWM in the Msunduzi New England Landfill site). The technical aspects follow, then the institutional arrangements. The institutional arrangements are key to successful implementation because without people to manage the landfill and systems, nothing will happen.

Mkhize (2011) stated that despite sporadic efforts by Msunduzi Municipality to introduce recycling, re-use and recovery as modern waste management strategies, the default option for waste management in this municipality remains the landfill site disposal method (Mkhize, 2011:4). The IWMP seeks to promote waste reduction, which may represent a turnaround plan for the entire City.

### **5.5.2 Proposed future development plans for the surrounding areas**

Msunduzi Municipality's vision 2035 is to be "The City of Choice". It aims to become a safe, vibrant city in which to live, learn, raise a family, work, play and do business (Msunduzi IDP, 2011-2016). This is best described as the creation of a sense of place, which is in line with the

Msunduzi's landfill site manager's claim that future plans have been developed to ensure that the voices of the Sobantu residents are not neglected.

The municipal official maintained that groundwater, surface water and air quality in the areas surrounding the site are monitored on a regular basis to ensure that there is no contamination or threat. However, the Ascott Inn co-owner stated that the landfill has negatively affected her business for many years, and that she thus incurs high maintenance costs. Community members also expressed dissatisfaction with the odor that negatively impacts their lifestyle and business activities.

## **5.6 Waste Management in Msunduzi Municipality**

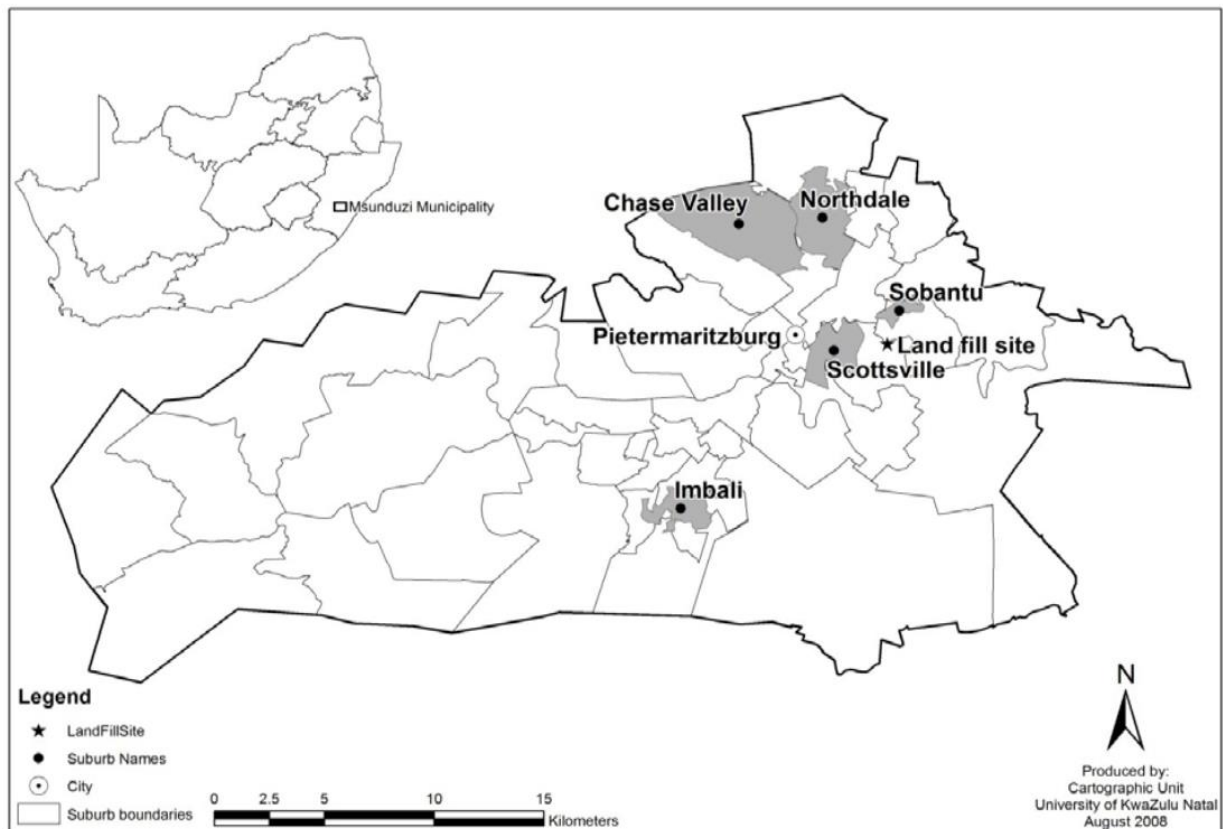
One of the objectives of the Msunduzi Integrated Environmental Management Policy is to provide an effective and efficient waste management system (SRK Consulting, 2010) by:

- Ensuring enforcement of waste management bylaws and other relevant legislation
- Introducing an integrated approach to waste management
- Developing a waste management plan for the Msunduzi area
- Ensuring the implementation of policies and strategies that affect waste management
- Initiating, developing and promote recycling projects and programs
- Ensuring the efficiency of the waste management business unit by providing adequate resources
- Being responsible for the collection of refuse
- Applying the polluter pays principle
- Educating citizens about waste-related issues

The researcher perused the municipal IDP and SDF documents to determine whether there has been any progress in achieving these objectives. The following subsections unpack the findings.

Figure 14 below shows the Msunduzi Municipal Demarcation.

Figure 14: The Msunduzi Municipal Demarcation



(Source: Naidoo, 2009: 84)

### 5.6.1 The New England Landfill Site

Chapter one briefly described the New England Landfill site and its location. This subsection examines the site in relation to the SDF encapsulated in the IDP document. Chapter 5 of the Municipal Systems Act, 2000 states that, the IDP should set out spatial, institutional, social, economic, infrastructural, environmental and technological solutions to the City's challenges (Msunduzi IDP, 2011-2016). Section 34, Chapter 5 of the Local Government Systems Act, Act 32 of 2000 states:

*“Annual review and amendment of integrated development plan.*

*A municipal council –*

*(a) Must review its integrated development plan;*

*(i) Annually in accordance with the assessment of its performance measurements in terms of section 4; and*

*(ii) To the extent that changing circumstances so demand; and*

*(b) May amend its integrated development plan in accordance with the prescribed process.”*

*(Ibid).*

The Mzunduzi IDP should thus provide socio-economic and environmental solutions to the challenges emanating from the New England Landfill site. The main concern is whether this includes the areas adjacent to the site and if so, what interventions are planned. For years, residents living in the surrounding areas have challenged the location of the New England landfill site due to the negative impacts it has had on their daily lives, despite offering some economic benefits.

Msunduzi Municipality's vision states that, by 2020 the City will:

- *Be a safe, clean and hygienic environment with an integrated open space system adding balance to the urban and rural environment.*
- *Have environmentally responsible citizens that are well informed about the environmental issues and who will be part of an innovative team that contributes to a sustainable living environment.*
- *Have achieved legislated minimum ambient air quality standards and waste management practices will ensure that the streets, open-spaces, rivers and streams of the City are clean and well maintained.*
- *Have minimum pollution by industries brought about by the implementation of policies and the practicing of measures that ensure compliance with legislation.*
- *Have a variety of approaches to ensure environmental sustainability for all citizens to benefit from their natural environment.*
- *Achieve a balance between economic, social and environmental factors and a balance between conservation and the use of natural resources which will protect the environment for future generations.*
- *Fully develop the City's tourism potential making Pietermaritzburg the trendsetting City of Choice (Dladla et al., 2015).*

It is hoped that this will result in the people of Sobantu and surrounding areas experiencing change for the better.

### 5.6.2 Capacity of the Msunduzi Waste Management System (Regulatory Framework)

The municipal official argued that the landfill site is efficient in that proper SWM is employed, guided by environmental legislation.

According to the Msunduzi IWMP (Msunduzi Municipality, 2015), a new organizational structure has been approved which will require suitably qualified and competent personnel. However, the Landfill Manager lacks administrative support (refer to Annexure F). Filling this post is critical in order to ensure that budgets are monitored and that there are proper records of the activities of the Landfill site.

The Waste Act dictates that each municipality must appoint a Waste Management Officer. Msunduzi Municipality needs to appoint such an official to co-ordinate the activities set out in the national waste management strategy (Msunduzi Municipality, 2015). Table 9 below shows the gaps and needs that need to be addressed to ensure a sustainable waste management system.

**Table 8 The Gaps and Needs of the New England Landfill Site**

Gaps and Needs	Comment	Priority
<b>1. Service Delivery Needs</b>		
<b>1.1 Waste Recycling, Recovery and Energy Initiatives</b>		
Materials Recovery Facility	MRF to be constructed at the Landfill Site	High
Organic Waste Composting Facility	OWCF to be constructed at the designated Site in Msunduzi	High
Gas-to-Energy	Extraction of methane gas and convert to energy	High
<b>1.2 Disposal</b>		
Landfill	Improved security required	High
	Situation with reclaimers must be resolved	High





Infrastructure Upgrade	Annual infrastructure upgrade to be undertaken	High
Plant/Vehicles	Compactors must be serviced and maintained so that compaction of waste is done on a daily basis	High
	Bakkies must be purchased and existing ones must be serviced and maintained to ensure effective supervision of operations	Medium
<b>1.3 Waste Information System</b>		
Equipment	Existing weighbridge computers and weighbridges to be backed up by installation of standby generator to avoid loss of information	Medium
	Information to be submitted to SAWIS quarterly	Medium
<b>2. Organisational Needs</b>		
<b>2.1 Institutional</b>		
Staff	Approved structure to be staffed with suitably qualified personnel	High
	Waste Management Officer must be appointed	High
<b>3.0 Environmental Compliance</b>		
<b>3.1 Permit Requirements</b>		
Auditing	Quarterly internal audits and one annual external audit to be conducted	High
Monitoring	Bi-annual monitoring of gas, ground water, surface water and leachate monitoring to be conducted	High

(Source: Msunduzi Municipality, 2015)

## 5.7 Nature of Land uses surrounding the Landfill Site

The land uses that surround the landfill site include industry, holiday getaways (Ascot Inn), residential areas and a high volume transit route (N3) to the south. According to the Msunduzi SDF, these land uses have been properly examined and zoned for the purpose. However, there appears to be a conflict as they exist within close proximity and thus have diverse impacts on one another. Could this suggest a lack of proper planning for land-use management in the Msunduzi Municipality? The research suggests an in-depth evaluation is done and immediate interventions are introduced. Figure 15 shows the relationship amongst the land uses.

Figure 15: Aerial view of the New England Road Landfill Site



(Source: Naidoo, 2009: 154)

## 5.8 Impact of the Landfill site on surrounding areas

Population growth is a major concern in most developing countries and is one of the reasons for the shortage of land for landfilling. The reasons include rapid urbanization, rural-migration (urban sprawl) and many others. This is an important factor to consider because the more people there are, the more waste is produced and SWM systems will be hard pressed to respond adequately.

### 5.8.1 Negative Impacts

This sub-section examines the negative impacts associated with the New England Landfill site. Muzenda et al. (2012) notes that “the insufficient collection, utilization and inappropriate disposal of solid waste causes water, land and air pollution thus negatively impacting on human health and the environment” (Muzenda et al. 149:2012).

#### *Odour and Flies – Air & Land Pollution*

The odours that are produced as a result of landfills or dumpsites can contribute to air pollution that affects the people in the surrounding areas and also contributes to climate change. The researcher thus investigated if this is true for the study area and how it could be prevented.

The climate and local weather in Msunduzi are strongly influenced by topography; the higher lying areas in the north and west of the municipality are colder and receive more rainfall than the lower lying areas in the south and east (SRK Consulting, 2010). The Pietermaritzburg city is located in a hollow formed by the valleys of the uMsunduzi River and its tributaries. On clear winter nights, cold dense air flows down the slope into the city bowl, much like water (Ibid). The valley floor is filled with cold, dense air that creates inversion which prevents pollutants from escaping. The air movement also brings pollutants from the entire municipal area into the valley where it remains trapped by the inversion layer. Most industries within Msunduzi are located within this inversion layer as this land is both flat and in close proximity to road and rail transport routes (Ibid). As a result, the city suffers short-term peaks in pollution regardless of the fact that it is home to comparatively few heavy industries. The New England Landfill site is situated in close proximity to industries as well as residential

areas. Figure 16 below shows municipal solid waste at the New England Road Landfill's recycling bay for the assessment of household solid waste.

**Figure 16 Municipal Solid Waste at the New England Road Landfill Site's recycling bay for assessment of household solid waste**



(Source: Naidoo, 2006:132)

Air quality, particularly during winter, is strongly influenced by the local topography. Katabatic flow (cool air draining into the valleys) induces temperature inversion which traps pollutants over the city. They include sulphur dioxide, nitrogen oxides, carbonaceous soot and hydrocarbons that have a significant, direct impact on the health of residents (Msunduzi IDP, 2011-2016). Limited monitoring and management of pollutants and pollution levels is currently undertaken and additional monitoring stations are necessary to ensure coverage of the entire city (Ibid). There is also an urgent need to upgrade and expand the equipment required to monitor pollutants in the Msunduzi area. In addition, the National Environmental

Management: Air Quality Act, section 14(3) states that each municipality must designate an air quality officer from its administration to be responsible for coordinating matters pertaining to air quality management in the municipality. The New England Landfill's impact on air quality should be carefully measured and monitor as envisaged in the Msunduzi Integrated Environmental Management Policy.

### ***Harmful Substances***

Waste pickers and children in the vicinity of landfill sites are exposed to harmful substances that could endanger their lives. The image below illustrates the process waste pickers utilise during waste sorting with no proper clothing gear increasing exposure to harmful substances.

**Figure 17 : A waste picker at work at the New England Landfill Site**



(Source: Ian Carbutt (News24), 2018)

As noted in Chapter one, while landfill sites offer a variety of economic benefits, they often contain chemicals that could be life threatening as well as detrimental to the environment. These include gases produced by such sites, including methane, carbon dioxide (CO<sub>2</sub>), benzene and vinyl chloride that are highly toxic to human life as well as the environment. Leachate, which is produced by landfill sites through decomposition of organic matter, can also contaminate water sources. This is discussed below.

## ***Water Pollution***

The landfill site is located right next to a stream of the Msunduzi River. Given that waste produces a liquid toxin called 'leachate', this is a major environmental concern because it can wash into the river. Leachate is a "liquid (which may be partly produced by decomposition of organic matter) that has seeped through a landfill or a compost pile and has accumulated bacteria and possibly harmful dissolved or suspended materials" (le Roux, 2014). If not controlled, as in the case of open dumps, or in some controlled dumpsites, it can contaminate both groundwater and surface water. According to the environment and town planning division of the company, SIVEST, leachate production is the main source of pollution caused by landfill sites (Environment and town planning division, 2002). The quality of water is most affected because the landfill leachate that seeps directly through the soil contaminates the underlying groundwater as well as the surrounding water supply (Armstrong, 2001). Ensuring optimum water quality should thus be a priority because water is an essential resource for all life on earth.

South Africa's eastern escarpment receives much more rainfall than its western regions; hence the higher landfill leachate in the eastern parts of the country (Strachan, 2005). If climate change alters this rainfall pattern, the quantity and composition of landfill leachate will change and the occurrence of geotextile liners will be altered. The CSIR postulated in its Climatic Future for Durban Report (2006) for the eThekweni Municipality that flooding and erosion caused by global warming, especially the melting of icebergs, will result in the devastation of South Africa's East Coast and consequently its major trade ports, ultimately affecting the entire province (McCloy et al., 2005).

Umgeni Water is responsible for monitoring water quality in Pietermaritzburg. Many residents depend on water harvested from highly polluted streams and rivers for drinking, cooking and irrigation which has direct, and on occasion, severe health implications (Msunduzi IDP, 2011-2016). Furthermore, pollution and degradation of water courses also has a substantial negative impact on indigenous biodiversity including aquatic organisms, riverine vegetation, animals, birds and insects (Ibid). Sections 3(a) and 4(2)(a) of the National Environmental Management: Biodiversity Act state that all organs of state at national and

local government level must manage, conserve and sustain South Africa's biodiversity and its components and genetic resources (Ibid).

### ***Land Pollution***

Land pollution can be defined as contamination of land through the dumping of waste and garbage and the introduction of toxins into the environment that result (Sheid, 2006). Although landfill sites operate in accordance with environmental requirements that are in line with global standards, they always have a negative impact on the land where waste is disposed of. Waste takes different forms, including plastic, paper, and rubber, etc. and many of these substances are non-biodegradable (cannot be broken down), with negative impacts on land. Toxins are released from these substances into the environment, degrading the land. Furthermore, trampling on soil surface by workers and the use of heavy duty equipment such as trucks and bulldozers causes soil erosion in the surrounding area, further contributing to degradation of the land (Dickson, 2012).

## **5.9 Other related problems**

### **Housing Encroachment**

Sobantu still comprises apartheid-era housing settlements and infrastructure. This has led to encroachment and an increase in informal housing. Housing encroachment refers to "A situation in real estate where a property owner violates the property rights of his neighbour by building something on the neighbour's land or by allowing something to hang over onto the neighbour's property" (Investopedia, 2014). Population growth can be argued to have contributed to increased housing encroachment in the study area and, in turn, increased generation of solid waste. Research shows that the landfill was established prior to the Sobantu residential area. The municipal official was of the view that the Sobantu community has to come to terms with its existence. He added that the municipality is doing all it can to ensure that the negative impacts are minimized if not totally controlled.

However, the piles of rubbish visible on the borders of the landfill site suggest a lack of effective management and control. This problem is often associated with the rapid growth of informal settlements as well as illegal dumping (Mkhize, 2010).

### **5.9.1 Property Devaluation**

Reichert et al. (1991) state that property values may be affected by the presence of landfill sites in two ways i.e. the demand and supply sides. On the supply side, investors may be reluctant to commit to projects near such sites and creditors may hesitate to advance funds for properties near landfills. On the demand side, buyers avoid purchasing properties situated in close proximity to landfill sites unless they are offered at low prices. However, landfill sites also have positive impacts that can be a catalyst for development. Infrastructural development and transit routes are often key factors in development. The infrastructural development associated with landfill sites enables industries and other businesses to operate around these sites and in turn provide employment opportunities for communities. The following sub-section examines the positive impacts that can be linked to the presence of landfill sites.

### **5.9.2 Positive Impacts**

It was established through first hand observation and interviews that the New England Landfill site has created employment opportunities for residents of Sobantu and its surrounding areas. Waste management requires much manual labour for its daily operations. Given that they live close to the landfill, Sobantu residents are usually the first to hear of any job vacancies.

The Minimum Requirements for Waste Disposal by Landfill is part of the Department of Water Affairs and Forestry's (DWAFF) Waste Management Series. It lays down guidelines for waste disposal by landfill, among other methods (Komane, 2014). According to Komane (2014), uncontrolled waste reclamation at the working face of the landfill poses a danger to waste reclaimers, interferes with the proper operation of the landfill and makes it difficult to compact and cover waste. The Minimum Requirements acknowledge that landfills represent an important resource base for a section of the population. They add that, while informal waste reclamation cannot be eliminated, where possible, it should be controlled to minimize safety and health risks (Ibid).

The guidelines seem to contradict the Integrated Pollution and Waste Management Policy (2000) (IP&WM) which seeks to phase out waste reclamation at landfill sites as a long-term



objective. However, the Minimum Requirements document stipulates that, although the DWAF and the Department of Environmental Affairs strongly support waste separation at source for further re-use, recycling and recovery, they recognise that waste salvaging takes place at landfills in South Africa and that this may be the only form of livelihood for local families (Ibid, 2014). As a developing country, South Africa confronts numerous social and economic challenges and many families resort to whatever means possible in order to survive. Controlling waste salvaging practices aims to protect the dignity and health of salvagers until salvaging is phased out (Ibid, 2014).

The policy requires that any waste reclamation operation be formalised in the operational plan of the landfill by the operator; this is the case at the New England Landfill site. Komane (Ibid) argues that this should include regular consultation with, and registration of reclaimers, appropriate safety measures such as separation of reclaimers from waste compaction and provision of appropriate protective clothing, among others (Ibid).

According to Percival and Clesceri (2002), the positive impacts of landfill sites should be acknowledged as they have attracted human scavenging throughout history. As noted previously, 10% of the study respondents were against the demolition of the landfill. This is due to the fact that waste pickers rely on their pickings from the site to feed themselves and their families. In most developing countries scavenging is regarded as an informal way of recycling that helps to support and sustain many poor communities (Ibid).

Percival and Clesceri (2002) add that waste pickers are usually not in search of food, but material that can be sold or reused in their own households. In some cases, waste picking offers a better income than certain jobs in urban areas. It is thus important that waste pickers are legalised and protected when entering landfill sites.

## **5.10 Conclusion**

This chapter presented, analysed and discussed the study's findings on the impact of the New England Landfill site on the Sobantu residential area. It also discussed the land-use management strategies and development controls adopted by Msunduzi Municipality in order to assess whether these facilitate mitigation of the impacts of the landfill and promote a sustainable environment.



The following chapter summarizes the study's key findings and presents recommendations arising from the results

## **CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS**

### **6.1 Introduction**

Rapid urbanization, industrialization, population growth, and an increase in disposable income have resulted in a phenomenal increase in the volume of waste generated, particularly in developing countries. Carefully formulated, sound policies and systems are required to addressing the risks to the health of both people and the environment posed by waste disposal. Communities that reside in close proximity to landfills are particularly at risk. This research study examined the impact of solid waste management systems in a residential area through a case study of the New England Landfill in Pietermaritzburg, KwaZulu-Natal and reviewed national and local policies and legislation in order to understand Msunduzi Municipality's waste management strategy.

### **6.2 Summary of Major Findings**

The findings presented in Chapter five revealed that the community of Sobantu and its surrounding areas are aggrieved by the impact that the New England Landfill has on their lives. The mushrooming of informal settlements near to the landfill site and illegal dumping have exacerbated the problems. However, given the high rate of unemployment in the area, some respondents noted that the landfill offers economic opportunities. As the community protest witnessed by the researcher illustrated, residents feel that there is a need to improve overall service delivery in the township.

The review of Msunduzi Municipality's SWM system in Chapter five revealed a lack of capacity and resources. The ISWM plans adopted at national level need to be incorporated into the municipality's IDP and communities should participate in the planning process. Finally, waste management plans are of no use if they remain on paper; implementation is required.

Given that the New England Landfill is nearing the end of its lifespan, Msunduzi Municipality has embarked on plans to identify a new site. However, finding space has been a major challenge. Once the landfill is shut down, an inclusive and collaborative approach should be adopted to guide the area's future development.

South Africa's SWM system is among the most progressive on the African continent. As noted in Chapter three, the roles and responsibilities of the three spheres of government are clearly spelt out. However, improved collaboration among different government departments and agencies, as well as with other stakeholders, is required to achieve the framework's objectives of a healthy citizenry and environment.

### **6.3 Recommendations**

Based on the study's findings, it is recommended that Msunduzi Municipality step up its efforts to identify a new landfill site that will serve the whole city. Alternative waste treatment methods should also be given greater attention. These recommendations are discussed in more detail below.

#### **6.3.1 Recycling**

Recycling has been used in many developed and developing countries to enable the reuse of waste material to produce new products. This would reduce the volume of solid waste for disposal and create job opportunities. The three Rs (reduction, reuse and recycling) of MSW have been incorporated into the waste hierarchy to manage waste in South Africa. The fourth R, recovery, is often combined with reduction and reuse.

Developing countries are faced with challenge of identifying suitable land for recycling following waste collection. Transportation of waste from the landfills or collection areas also poses a challenge. However, the benefits of such activities outweigh the challenges. The waste hierarchy's preferred route is waste prevention, followed by minimization, reuse, recycling, energy recovery and disposal as the final and least preferred route in the interests of sustainable waste management (Mkhize, 2011). Adopting this strategy would significantly reduce the volume of waste disposed of in South Africa and thus the adverse environmental impacts and risks to human health associated with such disposal.

It is also recommended that Msunduzi Municipality move from reliance on out-dated 'cradle-to-grave' waste management techniques to integrated approaches that promote the reuse and recycling of waste. Recycling can introduce a high level of economic benefits while also lessening the impacts of climate change through environmental protection. Employment still remains one of the rapid socio-economic challenges the country faces today, therefore

investing in small business within the recycling field to address issue of SWM may be a feasible exercise.

### **6.3.2 Relocation of the Landfill Site**

In February 2010, Jeffares and Green, the company tasked with investigating a new landfill site for UMgungundlovu District, reported that the eight sites which had been identified in Msunduzi Municipality were all unsuitable, “leaving no suitable areas within the Msunduzi Municipality’s Boundaries” (Ibid). UMgungundlovu District has thus been forced to follow a strict process plan which will ensure that the new landfill site meets all key criteria. This is a slow process punctuated by mandatory consultative processes.

Residents of Sobantu and surrounding businesses have had to live with a landfill site in close proximity for decades. It is recommended that the landfill site should be relocated as soon as possible, preferably to an area not adjacent to a residential area. While it was claimed that the site complies with environmental regulations, the odor and flies were experienced firsthand by the researcher. Living in a clean and safe environment is a constitutional right that cannot be compromised. Given that the municipal official noted that the landfill was established before the residential area, it is important that bylaws are enforced to prevent the same thing happening when a new landfill is built. A recommendation to relocate the people would effectively minimize the impacts where the health of the people is compromised. Relocating the landfill site itself would also result in the minimization of these impacts. It is important to note that the provision of housing during the establishment of the Sobantu residential area was developed during the Apartheid regime which implemented poor planning interventions and inadequate housing which did not cater for the entire Sobantu community. This has thus resulted in the mushrooming informal settlements. With that, it is recommended that the housing backlog is effectively addressed as a service delivery issue which may be relocate or provide proper housing for the community at large.

The country is in need of space, particularly with rapid population growth and an influx into urban areas due to the need for employment and recently due to affordability associated with moving towards more developed areas. While landfilling is much needed, the research



suggests that it is not the immediate resort, however more sustainable avenues should be explored. This suggests that should a new site be found, the operational structure of the site should be designed in such a way that it incorporates elements of recycling and re-using materials to efficiently decrease the amount of waste stored at the site. This can be done through a collaborative approach to incorporate the ISWM plans adopted at national level into the municipality's IDP in consultation with communities to encourage inclusiveness in the planning process.

### **6.3.3 Improvement in the existing solid waste management system**

An IWMP should be adopted as soon as possible to mitigate the effects of waste generation in South Africa. Environmental compliance that is in sync with international standards is essential. As noted earlier in this chapter, the three R's are an effective tool towards waste minimization. Education is the key. Waste disposal should not be the first option and ways to minimize such disposal should be vigorously pursued and integrated into the existing SWM system.

The IWMP sets out strategies to respond to the growing demands of waste management. It is recommended that Msunduzi Municipality adopts these strategies in order to address the gaps and needs identified by this study. The New England Landfill site should be properly managed in order to prevent illegal dumping and burning of waste. The landfill uses a number of systems to quantify the waste that enters the system. This information should be used to improve SWM.

For example, a proper leachate monitoring system would prevent pollution of groundwater in the area while spreading, compacting and covering waste with soil could prevent the heaping of waste in the landfill. The Environmental Protection Agency (EPA), which is the regulatory authority for sanitation, should ensure routine monitoring of management of the landfill site and support its relocation due to its negative impacts on the nearby community and the environment. To ensure the above takes place, a proper monitoring and evaluations system should be established and reported on regularly in order to effectively respond to any shortfalls timeously.

## 6.4 Chapter Summary

The national institutional framework for environmental protection that is guided by the National Environmental Management Act (NEMA Act 107 of 1998) and the other regulatory frameworks described in Chapter three provide the foundation for sustainable development in South Africa. Recycling initiatives should become part of daily life in order to combat the negative effects of waste disposal, including global warming. This requires municipalities to invest more in visible containers for the public to deposit their sorted waste. Managed correctly, it could be a source of employment for members of the community and propose effective mitigating measures to minimize the negative impacts of the landfill on both the community and the environment. Given that the Pietermaritzburg region is growing at a rapid rate, planning a proper waste management system should be a priority. The municipality appears to have faced challenges in managing the New England Road landfill site effectively and in implementing an integrated waste management system with recycling as a key component. Of concern is the fact that the municipality has not finalised the issue of the relocation of the landfill site as the current site has reached the end of its lifespan. This has negatively impacted on the adjacent land-uses and its capacity to process the waste produced by the city is thus diminishing. The problems faced by the Sobantu community as a result of their proximity to the landfill are of grave concern. No human being should have to contend with such issues. While the municipal official stated that the municipality is doing everything in its power to mitigate these challenges, the community should be consulted before any decisions are taken to encourage inclusiveness and transparency. This has not taken place since and indicates that there is an evident shortfall with the institutional framework and policy implementation at the New England Landfill site to effectively address the challenges of the site relative to the neighbouring community and businesses as a direct response to the objectives of the study. Furthermore, communities should be educated about proper waste management practices and should work with the municipality to reduce the negative impacts of waste management and optimize the benefits.

## 6 REFERENCES

Annepu R.K., 2012: Sustainable Waste Management in India. Masters Dissertation. University of Columbia.

Armstrong, M., 2001, Solid Waste Disposal in Southwest Virginia: A Regional Solution. **International Social Science Review**. Vol. 76, No.1. Pp 3 – 11.

Bharat, A., Jaiswal, A., 2013. Developing the idea of Zero Solid Waste City for Boupal, India. **International Journal of Engineering Research & Technology(IJERT)**. ISSN 2278-0181. Vol. 2, Issue 2, November 2013.

Blignaut, J., De Wit, M., 2004. **Sustainable Options: Development lessons from applied environmental economics**, 124, 316 - 393. University of Cape Town Press, South Africa.

Brown, D.M., 2013. **Introduction to Urban Economics**. Academic Press Inc.

Chambers R., Conway GR. 1991. **Sustainable Rural Livelihoods: Practical Concepts for the 21st Century**. IDS Discussion Paper 296, IDS (Institute of Development Studies), UK.

Church, RM. 2001. **The Effective Use of Secondary Data**. Department of Psychology, Brown University. Washington, DC.

Corliss, M. 2009. Japan Times: Dioxin: Levels high in Municipal Solid Waste Management in China. 87 Incinerator. Japan

Cointreau, S.J., Gunnerson, C.G., Huls, J.M. and Seldman, N.N., 1990. Integrated Resource Recovery: Recycling from Municipal Refuse. A United Nations Programme and World Bank Technical Paper: 30. South Africa.

Daniel, H. (1999). **What a waste: solid waste management in Asia**. Washington DC.

Department of Environmental Affairs, (2011). Draft Municipal Waste Sector Plan. Department of Environmental Affairs, Pretoria.

Department of Environmental Affairs, (2012a). National Waste Management Strategy. Department of Environmental Affairs, Pretoria.



Department of Environmental Affairs and Tourism. 2002. Integrated Environmental Management Information Series: Vol 6: Ecological Risk Assessment. Pretoria, South Africa.

Department of Rural Development and Land Reform. Guidelines for the Development of Spatial Development Frameworks. Republic of South Africa. 2011.

Department of Science and Technology. South Africa Waste Sector. An Analysis of the formal private & public waste sectors in South Africa. Phase 1: Status Quo. Pretoria. 2012

Department of Water Affairs and Forestry Republic of South Africa. 1998. Minimum Requirements for Waste Disposal by Landfill. ISBN 0620-22993-4. CPT Book Printers. Cape Town

Dickson, E. 2012. Municipal Solid Waste Management in Grahamstown. Republic of South Africa Degree Thesis for a Bachelor of Natural Resources Degree Programme in Integrated Coastal Zone Management. Raseborg.

Dolk, M. 1997. **Residents near waste landfill sites and risk of non-chromosomal congenital malformations**. Eurohazcon: Collaboration study group, New York.

Ferreira, A. et al. 2009. Planning Theory or Planning Theories? The Hydra Model and its Implications for Planning Education. **Journal for Education in the Built Environment**, Vol. 4, Issue 2, pp. 29-54 (26) ISSN: 1747-4205. University of Liverpool, United Kingdom.

Groundwork. 2014. Environmental Justice Action: Msunduzi Municipality Puts Job Creation Project on Back-Burner. Friends of the Earth South Africa.

Gonzales, E. M., 2003. From Wastes to Assets: The Scavengers of Payates. International Conference on National Assets. Conference Paper Series No. 7.

Healey, P. 2003. 'Collaborative Planning in Perspective.' **In Planning Theory** Vol. 2(2): 101-123. SAGE Publications.

Huang, Q. Wang, Q, Dong. Xi, L. Zhou, B. 2005. The current situation of solid waste management in China. **J Mater Cycles Waste Management** (2006) 8:63–69. Springer-Verlag. DOI 10.1007/s10163-005-0137-2. China.



Igbinomwanhia, D.I. 2011. Status of Waste Management. Environmental Engineering. Integrated Waste Management. Volume II, book edited by Sunil Kumar, ISBN 978-953-307-447-4. University of Benin, Benin City, Nigeria.

Imbach, A. and Dudley, E. 1997: An Approach to Assessing Progress towards Sustainability Tools and Training Series, 9-11. The World Conservation Union (IUCN) International Assessment Team. IUCN Publication Services Unit. Cambridge. United Kingdom.

Integrated Development Plan. 2013-2017 and Beyond. Msunduzi District Municipality.

Integrated Waste Management Plan. 2009. Phelamanga Joint Venture. uMgungundlovu District Municipality in 2009, and further reviewed in 2011.

John, N. 2015. Concerns over Waste Pickers. **Groundwork (Friends of the Earth South Africa)**. Msunduzi Municipality Puts Job Creation Project On Back-Burner. [groundwork.org.za](http://groundwork.org.za).

Kirkwood, D. 2009-2014. Global Environmental Centre. Small Ranger. Harvard University, America.

Komane, K. 2014. Waste Declaimers and South African Environmental Law. Potchefstroom Campus of the North-West University. South Africa

Kreith, F. (1994). Handbook of Solid Waste Management. United States: R.R Donnelley and Sons Co.

Labaree, R. 2013. **The Conceptual Framework**. College of Education. Alabama State University. USA.

Le Roux, G. 2010. Department of Water Affairs. Guidelines for Leachate Control. Vol. 35, Issue 7. Pg. 17-18. South Africa

Marc, J. (2006). Urban infilling impacts on solid waste facilities. Retrieved from: <http://www.forester.net/mw-0506-urban.html>.

Mc Donough, W. et al. 2002. **Cradle to Cradle: Remarking the Way We Make Things**. North Point Press; 1st edition (April 22, 2002).

Msunduzi Spatial Development Framework Review – Executive Summary. August 2009.

Muzenda, E., Ntuli, F., and Pilusa, T.J. 2012. Waste Management, Strategies and Situation in South Africa: An Overview. **World Academy of Science, Engineering and Technology** (68). South Africa.

Naidoo, K. 2009. An Analysis of the Municipal Solid Waste Management in South Africa Using the Msunduzi Municipality as a case study. School of Geography, Faculty of Science and Agriculture. University of Kwa-Zulu Natal.

Neuman, W.L., 2000. **Social Research Methods**. Qualitative and Quantitative Methods and Approaches. 4th Edition. Allyn and Bacon. Boston, United States of America

Palmer, V. 1996. **Evaluation of Solid Waste Practice in Developing Urban Areas of South Africa**. Water Research Commission (WRC). South Africa

Palys, T. 2008. Purposive Sampling. In L. Given (Ed), **The SAGE Encyclopedia of qualitative research Methods**. (pp.689-699). Thousand Oaks, CA, Vol 2. USA

Pan, B. 2009. The Vice Director of Environment Protection Agency of Hunan Province. Member of the National Committee of CPPCC. China.

Percival, A. M, and Clesceri, N. L. 2002. **Waste Sites as Biological Reactors: Characterization and Modeling**. CRS Press. New York.

Pettit, CJ. **Environment and Planning B: Planning and Design**, Vol32 (4). (pp 523-545): Australian Urban Research Infrastructure Network, The University of Melbourne. Australia.

Tomaszewski, D. 2017. **Environmental Justice & Waste Management**. Location of Landfills and Socioeconomic Conditions in Sau Paulo (SP, Brazil). LUCSUS

Samson, M. 2015. **Reclaiming Livelihoods: The Role of Reclaimers in Municipal Waste Management Systems**. ISBN 978-0-620-42715-9. Groundworks. South Africa.

Schwarz-Herion, O., Omran, A. Rapp, H. 2008. A Case Study on Successful Municipal Solid Waste Management in Industrialized Countries by the Example of Karlsruhe City, Germany. **Journal of Engineering**, 6 (3): 266-273.

SiVEST- Environment and Town Planning Division. 2004. A Report for the Assessment of Waste Disposal Sites in the Province of KwaZulu-Natal. 4 Pencarrow Crescent. La Lucia Ridge Office Estate, Umhlanga, South Africa.



Sonjica, B.P. 2010. Department of Water and Environmental Affairs. National Environmental Management Act, 1998 (act no. 107 of 1998) Environmental Impact Assessment regulations. South Africa. Pg. 8.

Srivastava, R. 2014. Waste Management: Developed and Developing Countries. **International Journal of Science and Research (IJSR)**. ISSN (Online): 2319-7064

United Nations Environmental Programme (UNEP). Environmental Data Report, 2002: A Report for Environmental Monitoring System in Brazil. Blackwell, Oxford.UK.

Urban Development Sector Unit East Asia and Pacific Region. 1999. What is Solid Waste Management in Asia? The International Bank for Reconstruction and Development. The World Bank. Washington D.C. 20433,U.S.A.

Vaughan, R. (2008) **Conceptual framework in the structure of a presentation**. UK

Wasteline, 2007. Environmental Group Criticize Pietermaritzburg Landfill. A Publication of the KZN Branch of the Institute of Waste Management Southern Africa.

William, P.T .1998. **Waste Treatment and Disposable**. England: John Wiley and Sons.

Wrensh, M. (1990). Hydrogeological assessment of exposure to solvent contaminated drinking water. New York: Archives of environmental health.

## Websites

[Http://www.businessdictionary.com/definition/waste-management](http://www.businessdictionary.com/definition/waste-management). Accessed 20 May 2016.

<http://www.google.com/investopedia.com>. Investopedia US, A Division of IAC. Accessed 20 May 2016.

<http://www.google.com/Government> gazette and waste management laws. Accessed 24 July 2017

John, N. (2015). 'Concerns over waste pickers'. News24 Online. 01 July. P.1. Accessed 24 July 2017

The national solid waste strategy for Swaziland. (2003). Retrieved from: [www.Unep.or.jp/ietc/issues/urban.asp](http://www.Unep.or.jp/ietc/issues/urban.asp). Accessed 24 July 2017

United Nations Environment Program. Agency (2006). Informal Solid Waste Management.

<http://www.unep.org?PDF/Kenyawastemngntsector/sector/chapter1.pdf>.

<https://www.news24.com/SouthAfrica/News/grand-plan-for-the-citys-waste-20181111>. Accessed 25 April 2019



## 7 ANNEXURES

### 7.1 Annexure 1: A Informed Consent Form

*(To be read out by researcher before the beginning of the interview. One copy of the form to be left with the respondent; one copy to be signed by the respondent and kept by the researcher.)*

My name is Thabile Khumalo (student number 210519079). I am doing research on a project entitled 'An investigation into solid waste management : A case study of the New England Landfill in Sobantu, Pietermaritzburg, Kwa Zulu-Natal South Africa.. The research project is supervised by Dr Lovemore Chipungu at the School of the Built Environment, University of KwaZulu-Natal. I will be managing the research project and should you have any questions please do not hesitate to contact me. My contact details are:

School of the Built Environment, University of KwaZulu-Natal, Durban Howard College Cell: 076 3085 957 Email: tkhumalo226@gmail.com or [210519079@stu.ukzn.ac.za](mailto:210519079@stu.ukzn.ac.za). HSSREC Contact details: Ms. Phumelela Ximba 031 260 3587, Email : [ximbap@ukzn.ac.za](mailto:ximbap@ukzn.ac.za)/ Premlall Mohun, Research Office, Tel: 031 260 4557, Email: [mohunp@ukzn.ac.za](mailto:mohunp@ukzn.ac.za)/ Supervisor Dr L. Chipungu Contact details: 031 260 3801 Email: [Chipungu@ukzn.ac.za](mailto:Chipungu@ukzn.ac.za).

Thank you for agreeing to take part in the project. Before we start I would like to emphasize that:

- your participation is entirely voluntary;
- you are free to refuse to answer any question;
- you are free to withdraw at any time.



The interview will be kept strictly confidential and will be available only to members of the research team. Excerpts from the interview may be made part of the final research report. Do you give your consent for: *(please tick one of the options below)*

Your name, position and organisation, or	
Your position and organisation, or	
Your organisation or type of organisation <i>(please specify)</i> , or	
None of the above	

to be used in the report?

Please sign this form to show that I have read the contents to you.

----- (signed)      ----- (date)

----- (print name)

Write your address below if you wish to receive a copy of the research report:


**7.2 Annexure 2:**  
**DECLARATION**

**B**



I..... (full names of participant) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participating in the research project.

I understand that I am at liberty to withdraw from the project at any time, should I so desire.

***Additional consent***

I hereby provide consent to:

Video-record my interview

YES

NO

Use of my photographs for research purposes

YES

NO

SIGNATURE OF PARTICIPANT

DATE

.....

.....

**7.3 *Annexure 3:***  
**Residents Interview Sheet**

***C***

**An investigation into solid waste management: A case study of the New England Landfill in Sobantu, Pietermaritzburg, Kwa Zulu Natal South Africa.**

**Questionnaire**



This questionnaire serves to investigate the impact of solid waste management on residential areas using the Sobantu residential area as a case study.

**Interview Information for residents**

Date of interview

--	--	--	--	--	--	--	--

Name of the area or ward

---

**1. Personal Information**

**1.1 Gender**

Male

Female

**1.2 Age**

Under 25 years

25-35 years

36-45 years

46-55 years

Over 55 years

**1.3 Marital Status**

Single

Married

Divorced

Widowed





#### 1.4 Home Language

English	Afrikaans	Sepedi	IsiXhosa
IsiZulu	Sesotho	Tshivenda	IsiSeswati
Xitsonga	IsiNdebele	Setswana	

#### 1.5 Number of people in your household, including you.

- 1
- 2-3
- 4-6
- Over 6

#### 2. Perceived Land Rights

##### 2.1 How long have you resided on this particular piece of land?

- Under 1 year
- 1-2 years
- 3-5 years
- 6-10 years
- 11-20 years
- 21-30 years
- Over 31 years

##### 2.2 Do you own the land on which you reside?

- Yes
- No



No Comment

**2.3 If yes, how did you acquire this land?**

Traditional Council

Traditional Authority

Local Municipality

District Municipality

Inherited

Other

If other, please specify \_\_\_\_\_

**2.4 Do you feel the New England Landfill site impacts negatively on the community?**

Yes

No

No comment

**2.5 Do you feel the landfill should be demolished?**

Yes

No

No comment

If other, please specify \_\_\_\_\_

**2.6 Have you ever re-used or recycled any of the material found in the landfill site?**

Yes

No

No comment

**2.7 Do you know what sustainable development is?**



Yes

No

No Comment

**3. Process of formalization**

**3.1 Is there any relationship between the municipality and the residents?**

Yes

No

No comment

If yes, was there any forward movement? \_\_\_\_\_

**3.2 Do you receive a proper solid waste service weekly?**

Yes

No

No comment

**3.3 Do you like residing in this area?**

Yes

No

No comment

**3.4 Are there any disputes that arise regarding the development of the area?**

Yes

No

No comment

If yes, how do you feel they should be solved? \_\_\_\_\_

---



**3.5 Are you employed?**

Yes

No

No comment

**3.6 If there is one thing you could change in your residential area what would it be?**

---

**7.4 Annexure 4:****D**

Interviews: Gate Keepers/ Department officials (Msunduzi Municipality)

1. Where does the name Sobantu come from and what does it mean?
2. When was the study area built? Why?
3. How long is/was the landfill site expected to last in this area (lifespan)?
4. Was the residential area built before the landfill site or vice versa?
5. Has there been any problems with having the above mentioned within close proximity to each other?
6. What are the impacts related to having a landfill site near a residential area like that of Sobantu?
7. Have there been any complaints brought forward by the community members regarding the location of the landfill site?
8. How would you describe the relationship between the community and the landfill site?
9. What role do you serve in the promotion of sustainability measures that are undertaken to ensure the people and the environment (landfill site) live in harmony with each other?
10. What are the Departments future plans within which development in the study area is guided and properly implemented?

**7.5 Annexure 5:*****E***

Interviews: Escort Inn lodge and surrounding Businesses (Questionnaire was proposed to done through a video streaming event to save time and allow for respondent to extend brief)

1. How long has your business been running near the study area?
2. How has the landfill site influenced your business? (Positively/ Negatively)
3. What were some of the main problems that you encountered with having your business located in this area?
4. How do you think your company/business impacts on the development of the Sobantu residential area and the city as a whole?
5. Do you feel that the landfill site marks a significant component to your business and the community as a whole?
6. What purpose does the landfill site serve with regards to your business?
7. How do you ensure that your business practices sustainable measures that promote the well-being of the living environment?
8. Would you encourage other businesses to run near/within this area? Why?



7.6 Annexure 6:

F

**Table 9: Action Plans for Improving the SWM in Msunduzi New England Landfill Site**

<b>1. Waste Information System</b>					
<b>Strategic Outcomes</b>	Waste information available for planning and budgeting	<b>Strategic Objectives</b>	To maintain a Waste Information System		
<b>Issues Addressed</b>	Accuracy of information, poor planning and budgeting	<b>Responsible Organisation</b>	Msunduzi Landfill Site, Waste Management		
<b>Tasks</b>		<b>Timing</b>	<b>Responsible Individual</b>	<b>Potential Partners</b>	<b>Estimated Cost</b>
Liaise with IT specialist and link to National SAWIS		Short Term	LM; IT; WMO	IT, DEA	In-house
Link weighbridge data to billing system that facilitates cost recovery for waste disposal service		Short Term	LM;IT; PM Income	IT, Finance	R200 000
Link to Provincial Administration vehicle database via vehicle registration numbers		Short Term	LM; IT	Prov. Traffic Authorities	R50 000
Continuously update all information associated with waste generation, minimisation, recycling, treatment and disposal		Short Term and On-going	LM; WBC	DEA	In-house
Continuously monitor weighbridge operation and waste acceptance tonnages/volumes		On-going	LM; WBC	DEA	In-house
<b>Total Cost</b>					<b>R250 000</b>
<b>Key Performance Indicators</b>	Waste Information System set up and monthly data recorded in correct format	<b>Target</b>	Waste data submitted to DEA in correct format by December 2013		



2. Waste Recycling , Recovery and Energy					
<b>Strategic Outcomes</b>	Recovery and recycling of waste	<b>Strategic Objectives</b>	Increase recovery and recycling rates of material Reduce quantities of recyclable material going to Landfill Ensure separation at source Establish Materials Recovery Facility and Organic Waste Composting Facility Investigate gas to energy options		
<b>Issues Addressed</b>	Reduction in waste to Landfill Promote separation at source Capture and convert methane gas	<b>Responsible Organisations</b>	Msunduzi Municipality Landfill, Waste Management uMgungundlovu District Municipality Energy Consultant		
<b>Tasks</b>		<b>Timing</b>	<b>Responsible Individual</b>	<b>Potential partners</b>	<b>Estimated Cost</b>
Establish low-tech mixed waste MRF		Medium Term	Proj.Man Landfill; WMO	UMDM, COGTA	R30 000 000 (COGTA)
Formalise waste pickers at NELFS – establishment of co-operatives		Short Term	PM ED&G; WMO	UMDM	R200 000
Establishment of waste recycling collection system in wards by promoting SMMEs and job creation		Short term	PM ED&G; WMO	Prov. Dept of ED&G	R10 000 000 (Prov. ED&G)
Establish OWCF for the treatment of organic waste		Medium Term	Proj. Man Landfill; WMO	UMDM, GDB	R10 000 000 (GDB)
Enter into PPP for the management and operation of MRF and OWCF		Medium Term	PM ED&G; WMO	Recycling/composting companies	In-house
Upgrade existing garden sites for storage and transport of organic waste to OWCF		Medium Term	Proj. Man Landfill; WMO	UMDM, GDB	R5 000 000 (GDB)





Implementation of project	Gas-to-Energy	Medium Term	Proj. Man Landfill; WMO	Electricity Dept, Eskom, Consultant	No cost to Council
<b>Total Cost</b>					<b>R200 000</b>
<b>Key Performance Indicators</b>	Reduced quantities of waste to Landfill  Recovery of recyclable waste increased  MRF and OWCF exists	<b>Target</b>	Reduction of waste to Landfill by 30% in 2014, 45% by 2015, 60% by 2016  MRF and OWCF established and operating		

<b>3. Environmental Compliance</b>					
<b>Strategic Outcomes</b>	Conducting regular monitoring for water quality, gas and leachate  Undertaking quarterly and annual audits	<b>Strategic Objectives</b>	Improve Landfill management to comply with legislation  Reduce pollution potential of waste disposed to Landfill		
<b>Issues Addressed</b>	Responsible waste disposal  Compliance with permit  Compliance with environmental obligations	<b>Responsible Organisation</b>	Msunduzi Landfill Site		
<b>Tasks</b>		<b>Timing</b>	<b>Responsible Individual</b>	<b>Potential Partners</b>	<b>Estimated Cost</b>



Facilitate appointment of environmental consultant to undertake sampling of ground/surface water, leachate and gas emission and submit report on findings		Short Term	Proj. Man Landfill	DEA	R500 000
Plan and undertake internal bi-annual Landfill compliance audits in liaison with Monitoring Committee		Short Term	LM	DEA, Monitoring Comm	In-house
Plan and undertake external annual Landfill compliance audit		Medium Term	Proj. Man. Landfill	DEA, Consultant	R100 000
<b>Total Cost</b>					R600 000 annually
<b>Key Performance Indicators</b>	Bi-annual monitoring conducted – report available  Landfill audit reports – internal and external	<b>Target</b>	Waste disposal and treatment fully compliant with legislation and license conditions		



4. Institutional					
<b>Strategic Outcomes</b>	Ensuring the effective delivery of services by ensuring institutional aspects are addressed	<b>Strategic Objectives</b>	Ensure that organisational arrangements relating to Landfill activities function cohesively in cooperation with district, provincial and national structures  Develop additional capacity to deal with norms and standards, industry regulation and remediation  Expand Waste Management Officer capacity to implement the NERM Waste Act		
<b>Issues Addressed</b>	Lack of capacity to deliver effective service  Enforce new legislation and policy	<b>Responsible Organisation</b>	Msunduzi Municipality Landfill Site, HR		
<b>Tasks</b>		<b>Timing</b>	<b>Responsible Individual</b>	<b>Potential Partners</b>	<b>Estimated Cost</b>
Appoint/designate a Waste Management Officer as required by NEM Waste Act		Short Term	DMM, HR		In-house
Ensure that organisational arrangements relating to Landfill activities function cohesively in cooperation with UMDM, provincial and national structures		On-going	Proj. Man Landfill  WMO  LM	UMDM, DEA	In-house
Develop administrative capacity to ensure achievement of efficiencies		Short Term	DMM; HR		In-house



Training and refresher courses for staff with focus on management and compliance	Short Term	LM; HRD	UMDM, External Service Providers	In-house
<b>Total Cost</b>				<b>To be determined</b>
<b>Key Performance Indicators</b>	Organogram of Landfill Site revised and posts filled Landfill training conducted WMO designated and capacitated in terms of NEM Waste Act	<b>Target</b>	Revised organisational structure of Landfill Site approved, funded and implemented by 2013 Landfill staff at all levels trained and capacitated by 2014 WMO appointed and effective	



5. Disposal					
<b>Strategic Outcomes</b>	Extend lifespan of the Landfill Site  Minimise environmental nuisances  Address safety issues  Responsible disposal of waste	<b>Strategic Objectives</b>	Improve Landfill management to comply with legislation  Maintain sufficient airspace for the disposal of waste  Ensure the safety of staff and members of the public		
<b>Issues Addressed</b>	Inadequate management of Landfill  Future airspace availability  Safety	<b>Responsible Organisation</b>	Msunduzi Landfill Site, Public Safety		
<b>Tasks</b>		<b>Timing</b>	<b>Responsible Individual</b>	<b>Potential Partners</b>	<b>Estimated Cost</b>
Improve Landfill Site operations to comply with legislation and license conditions		On-going	LM		In-house
Optimise airspace utilisation by undertaking annual infrastructure upgrade		Short-Term	Proj. Man Landfill; LM	Consultants, DEA	R10 000 000
Ensure that the security plan developed is effected and is sustainable		On-going	LM; Manager:Public Safety	Private Security Services	R1 000 000



Plant/vehicles to be serviced as per service schedule		On-going	LM; Fleet Manager	External Service Providers	R1 500 000
Plant /vehicles to be replaced as per Fleet replacement program. Additional plant/vehicles to be purchased		Short-Term	LM; Fleet Manager	External Service Providers	R7 500 000
<b>Total Cost</b>					R20 000 000
<b>Key Performance Indicators</b>	Adequate Landfilling space created  Plant/vehicles fully operational  Annual infrastructure upgrade undertaken  Compliance with license requirements	<b>Target</b>	Ensure sufficient budget allocation annually for acquisition of plant and resources  Infrastructure upgrade project to be registered annually with MIG and funding secured  Co-ordinate security functions on a daily basis		



			2013				2014				2015				2016				2017			
Item	Task	Responsible	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
	<b>Short Term Implementation Plan</b>																					
	<b>Short Term Plan – Waste Information System</b>																					
1	Liaise with IT specialist and link to National SAWIS	LM; IT;WMO				█	█	█														
2	Link weighbridge data to billing system that facilitates cost recovery for waste disposal service	LM; IT;PM In					█	█	█													
3	Link to Provincial Administration vehicle database via vehicle registration numbers	LM; IT					█															
	<b>Short Term Plan - Waste Recycling, Recovery, Reuse and Energy Generation Initiatives</b>																					
4	Formalise waste pickers at NELFS – establishment of co-operatives	PM ED&G; WMO				█	█	█														
5	Establishment of waste recycling collection system in wards by promoting SMMEs and job creation	PM ED&G; WMO				█	█	█														
	<b>Short Term Plan – Environmental Compliance</b>																					







	Medium Term Plan – Waste Recycling, Recovery, Reuse and Energy Generation Initiatives																			
13	Establish low-tech mixed waste MRF	P.M.Landfill; WMO																		
14	Establish OWCF for the treatment of organic waste	P.M.Landfill; WMO																		
15	Enter into PPP for the management and operation of MRF and OWCF	PM ED&G; WMO																		
16	Upgrade existing garden sites for storage and transport of organic waste to OWCF	P. M Landfill; WMO																		
17	Implementation of Gas-to-Energy project	P.M Landfill; WMO																		
	Medium Term Plan – Environmental Compliance																			
18	Plan and undertake external annual Landfill compliance audit	P.M. Landfill																		

(Source: uMgungundlovu District Municipality et al, 2009)