INTEGRATED SOLID WASTE MANAGEMENT WITHIN RURAL DISTRICT COUNCILS: A CASE STUDY OF PFURA RURAL DISTRICT COUNCIL, MOUNT DARWIN.

A Thesis submitted to the Department of Geography, Faculty of Science of the Bindura University of Science Education in partial fulfilment of the requirements of the Degree of Master of Science in Natural Resources Management and Environmental Sustainability

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ABSTRACT

This dissertation’s main objective was to assess the solid waste management system currently used by the Pfura Rural District Council in Mt. Darwin. The researcher in turn considered the possibility of adopting an integrated solid waste management system as an alternative to the current solid waste management system in the Rural Council. The study analysed literature on solid waste management practices internationally, regionally and in the country. It was established that Zimbabwe has comprehensive policies and legislation which need effective enforcement and compliance monitoring. Rural Councils together with their urban counterparts are facing increasing solid waste management challenges despite the existence of clear bylaws. During the study it was noted that the current solid waste management system used by this council is not effective. Recommendations were brought out that sought to address this and allow for adequate and effective environmentally sound solid waste management that allowed for more stakeholders participation in a bid to improve the current solid waste management system. Integrated solid waste management was recommended as a system that will advocate for waste avoidance and reduction through waste recycling, re-use and resource recovery leaning towards reduced waste disposal and treatment. Where the solid waste needs disposal and treatment, environmentally friendly and sustainable practises should be adopted.
DECLARATION

I Prudence Tambura, declare that this thesis is my own work and has not been written for me by any other person(s) and that this work has not been submitted before for any other degree at any other university. All the sources that I have used of published and unpublished work from other persons have been acknowledged by means of complete references.

The undersigned certify that they have read and understood this thesis and have approved its submission and that it conform to the Faculty’s requirements.

Signed: ........................................

Date: ........................................

...........................................

Prof. J. Mapuva

Supervisor
DEDICATION

I dedicate this research to my family, my husband Hilary Matanhire and my three children McO’brien, Ivanka and McClaine who supported me throughout this research. For all those sleepless nights you all put up with I thank you so much. I also dedicate this research to my mum and dad, Mr and Mrs Tambura for your tireless efforts in lighting and fanning the fire and zeal for education. I am continuing from the first degree where you left and I hope I will make you proud. I love you all!!
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I would also like to thank all my colleagues, the Msc NRMES Class of 2014 for being a jolly good bunch of comrades in the struggle. To my family, I am grateful for the all round support financially, physically and emotionally. I am so lucky to have you and “maitiro enyu, munendipasa manyemwe.”

Last but definitely not the least I thank you Lord for your blessings and for giving me the strength to achieve, without you nothing would have been made.
TABLE OF CONTENTS

ABSTRACT ................................................................................................................................................i
DECLARATION ..........................................................................................................................................ii
DEDICATION ...........................................................................................................................................iii
ACKNOWLEDGEMENTS ..........................................................................................................................iv
LIST OF FIGURES ...................................................................................................................................viii
LIST OF TABLES .......................................................................................................................................ix
LIST OF PLATES ......................................................................................................................................x
LIST OF APPENDICES .............................................................................................................................xi
ACRONYMS AND ABBREVIATIONS .........................................................................................................xii

CHAPTER 1: INTRODUCTION .................................................................1
  1.0 BACKGROUND .................................................................................................................................1
  1.1 PROBLEM STATEMENT ....................................................................................................................4
  1.2 JUSTIFICATION ...............................................................................................................................4
  1.3 SIGNIFICANCE OF STUDY ..............................................................................................................5
  1.4 LIMITATIONS ...................................................................................................................................6
  1.5 RESEARCH QUESTIONS ....................................................................................................................6
  1.6 OBJECTIVES ....................................................................................................................................6
    1.6.1 GENERAL OBJECTIVES .............................................................................................................7
    1.6.2 SPECIFIC OBJECTIVES .............................................................................................................7
  1.7 DEFINITION OF KEY TERMS ...........................................................................................................7
  1.8 ORGANISATION OF THE STUDY .....................................................................................................9
  1.9 SUMMARY .......................................................................................................................................10

CHAPTER 2: LITERATURE REVIEW ......................................................11
2.0 INTRODUCTION ......................................................................................................11
2.1 SOLID WASTE: DEFINITIONS AND CONCEPTS ..............................................11
2.2 HISTORY OF SOLID WASTE MANAGEMENT ....................................................13
2.3 SOLID WASTE MANAGEMENT IN DEVELOPING COUNTRIES .........................13
2.4 SOLID WASTE MANAGEMENT IN ZIMBABWE ..............................................15
2.4.1 STATE OF SWM IN CITIES ..............................................................................15
2.4.2 LEGISLATIVE FRAMEWORK ..........................................................................16
2.5 INTEGRATED SOLID WASTE MANAGEMENT ....................................................21
2.6 SUMMARY ...........................................................................................................23

CHAPTER 3: METHODOLOGY ..............................................................................24
3.0 INTRODUCTION ....................................................................................................24
3.1 DELIMITATION .....................................................................................................24
3.2 TARGET POPULATION .........................................................................................25
3.3 RESEARCH DESIGN .............................................................................................26
3.3.1 CASE STUDY ..................................................................................................26
3.3.2 TRIANGULATION RESEARCH PROCESS ......................................................27
3.4 RESEARCH STRATEGIES ....................................................................................29
3.4.1 QUALITATIVE RESEARCH METHOD ..............................................................29
3.4.2 QUANTITATIVE RESEARCH METHOD ............................................................30
3.5 DATA COLLECTION METHODS ..........................................................................30
3.5.1 PRIMARY DATA COLLECTION METHODS .....................................................31
3.5.1.1 QUESTIONNAIRES ......................................................................................31
3.5.1.2 INTERVIEWS ..............................................................................................32
3.5.1.3 FOCUS GROUP DISCUSSIONS ....................................................................34
LIST OF FIGURES

Figure 2.1 Waste Management Hierarchy in the ISWM System .................................. 20
Figure 2.2 Integrated Solid Waste Management Framework .....................................23
Figure 4.1 Employment statuses of respondents .....................................................48
Figure 4.2 Number of families per household across residential areas ......................49
Figure 4.3 Types of waste receptacles .................................................................52
Figure 4.4 Pfura Rural District Council’s SWM System ..........................................53
Figure 4.5 Types of solid waste collected by the council .........................................57
Figure 4.6 Alternative waste disposal methods of uncollected wastes ....................61
Figure 4.7 Respondents’ views towards waste disposal services ..............................64
Figure 4.8 Alternative uses for solid waste ............................................................66
**LIST OF TABLES**

Table 2.1 Guiding legislation and policies .................................................................20
Table 2.2 Elements of ISWM .......................................................................................22
Table 2.3 Integrated Solid Management Framework ....................................................23
Table 4.1 Gender distribution of respondents ...............................................................43
Table 4.2 Gender distribution across residential areas .................................................44
Table 4.3 Tenure status of respondents .......................................................................45
Table 4.4 Age group and gender frequency table ..........................................................46
Table 4.5 Employment statuses of all household respondents ........................................47
Table 4.6 Alternative solid waste disposal methods ......................................................60
<table>
<thead>
<tr>
<th>Plate</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Map of Mt. Darwin</td>
<td>24</td>
</tr>
<tr>
<td>4.1</td>
<td>Waste receptacles used by residents</td>
<td>51</td>
</tr>
<tr>
<td>4.2</td>
<td>Branded metal communal bins</td>
<td>55</td>
</tr>
<tr>
<td>4.3</td>
<td>Open dumping in fields and pits</td>
<td>56</td>
</tr>
<tr>
<td>4.4</td>
<td>Some open spaces dumping areas</td>
<td>62</td>
</tr>
<tr>
<td>4.5</td>
<td>Overflowing community bins</td>
<td>63</td>
</tr>
<tr>
<td>4.6</td>
<td>Burning of waste and ashes in the town centre</td>
<td>65</td>
</tr>
<tr>
<td>Appendix</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>----------</td>
<td>-------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Appendix I</td>
<td>Household Questionnaire</td>
<td></td>
</tr>
<tr>
<td>Appendix II</td>
<td>Interview Guidelines for Council Officials</td>
<td></td>
</tr>
<tr>
<td>Appendix III</td>
<td>Interview Guidelines for EMA Officials</td>
<td></td>
</tr>
<tr>
<td>Appendix IV</td>
<td>Observation Guidelines</td>
<td></td>
</tr>
<tr>
<td>Appendix V</td>
<td>Questionnaire for other service users</td>
<td></td>
</tr>
<tr>
<td>Acronym</td>
<td>Full Form</td>
<td></td>
</tr>
<tr>
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<td>DEAET</td>
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<td>EIA</td>
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<td></td>
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<tr>
<td>EMA</td>
<td>Environmental Management Agency</td>
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<td>GoZ</td>
<td>Government of Zimbabwe</td>
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<td>IETC</td>
<td>International Environmental Technology Centre</td>
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<td>ISWMP</td>
<td>Integrated Solid Waste Management Plan</td>
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<td>LCC-ECZ</td>
<td>Lusaka City Council, Environmental Council of Zambia</td>
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<td>LEAP</td>
<td>Local Environmental Action Plans</td>
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<td>MLGRUD</td>
<td>Ministry of Local Government Rural and Urban Development</td>
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<td>SWM</td>
<td>Solid Waste Management</td>
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<td>UNEP</td>
<td>United Nations Environmental Program</td>
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<td>UNEP</td>
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<td>UNSD</td>
<td>United Nations Division for Sustainable Development</td>
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<td>USEPA</td>
<td>United State Environmental Protection Agency</td>
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<td>WHO</td>
<td>World Health Organisation</td>
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<td>ZELA</td>
<td>Zimbabwe Environmental Law Authority</td>
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</tr>
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1.0 Background

Humans are said to have been producing solid waste since they first formed non-nomadic societies around 10,000 BC (Wilson, 2007). In addition Worrell and Vesilind argue that for solid waste management some small communities buried their solid waste just outside their settlements or dispose it off in nearby rivers or water bodies (Worrell and Vesilind, 2012). Wilson highlights the fact that as population densities increased, these practices became more and more unsustainable resulting in diseases and foul odours spreading a notion shared by many other authors. They also bring out that as waste accumulated in these growing communities, people simply started living amongst their filth (Tchobanoglous et al 1993; UNEP, 1996; Wilson, 2007; Scheinberg et al 2010; Chikobvu and Mukarati, 2011).

This resulted in disease outbreaks which saw public health bylaws being enacted. Public health legislations became the major driver of waste management in many of these communities (Wilson, 2007). UNEP further highlights that this led to the creation of waste management systems and operations in response to the enacted legislations (UNEP-IETC, 2005). Wilson also noted that municipalities were mandated to provide waste management services in the interest of public health and Worrell and Vesilind supports this (Wilson, 2007, Worrell and Vesilind, 2012).

After sometime these municipal solid waste management systems (MSWM) began to fail due to increases in population and improved standards of living in the communities (Wilson, 2007). The UN-HABITAT adds that increases in financial challenges encountered by many municipalities also have become a major challenge in solid waste management (UN-HABITAT, 2010). There was therefore need for the improvement of these solid waste management practices to ensure sustainability. Because of the need for innovations that viewed the waste management processes in their entirety; as an interconnected system of components which depend on each other, integrated solid waste management (ISWM) was
considered (Scheinberg et al 2010; UN-HABITAT, 2010; Wilson, 2007). As a result the concept of ISWM evolved.

ISWM can be defined as a system that combines different waste streams or sources, waste collection, waste treatment and various disposal methods (Wilson, 2007). It is around the 1970s that the Solid Waste Authorities in the USA began to implement waste management practices that integrated solid waste transportation, processing, recycling, resource recovery and disposal. These became the foundations of ISWM (UN-HABITAT, 2010).

The US Environmental Protection Agency (EPA) on the other hand defines ISWM as a comprehensive waste prevention, recycling, composting, and disposal program which consider how to prevent, recycle, and manage solid waste in ways that most effectively protect human health and the environment (US-EPA, 2010). The UNEP also defined ISWM as a system that aims to provide environmental sustainability, economic affordability and social acceptance appropriate for a specific region. The UNEP International Environmental Technology Centre (IETC) highlights that ISWM also involves evaluating local needs and conditions, and then selecting and combining the most appropriate waste management activities for those conditions (IETC/UNEP, 1996).

The Agenda 21 plan of action in chapter 21 highlights that environmentally sound solid waste management must give priority to the safe disposal of waste (UNSD, 1999). It also highlighted in chapter 4 that focus actions which seek to change unsustainable patterns of production and consumption and waste minimisation strategies such as source reduction, waste recovery, reuse and recycling could possibly be adopted if development and environmental protection were to reconcile (UNSD, 1999). Despite the existence of such conventions, sharp rises in solid waste management challenges are being experienced in both developed and developing countries most of which are signatories (Wilson, 2007).

Waste management problems continue to grow and according to the World Bank, the problem is more acute in economically developing countries, where financial, human, and other critical resources generally are scarce. The World Bank estimates a 70% global increase in urban solid waste with developing countries facing the greatest challenges in solid waste management (World Bank, 2012).
Even though waste generation rates available for select cities and regions in Africa shows lower waste generation rates as compared to most cities in developed countries, the disposal of this solid wastes still constitutes one of the most pressing challenges faced by urban authorities in most African Countries (UNEP, 1996; Mondoh, 1995; Zurbruegg, 2003; Scheinberg et al, 2010). Scheinberg et al notes that in recent years there have been considerable increases in illegal waste dumping sites in most urban areas across most countries in Africa. This indicates that throughout the continent urban waste disposal systems are inefficient and environmentally unsafe (Scheinberg et al, 2010).

In Sub-Saharan Africa the management of solid wastes has become an increasingly important environmental issue due to the escalating growth in populations and the changes in life styles which are giving rise to new trends of unsustainable consumption patterns coupled with increases in wastes production (Sanyanga and Masundire, 1999).

Sanyanga and Masundire brings out that in the SADC region solid waste generation exceeds collection capacity (Sanyanga and Masundire, 1999). This is supported by other studies conducted in Botswana, South Africa, Tanzania, Zambia and Zimbabwe amongst others (Amis, 1992; Schübeler, 1996; LCC-ECZ, 1997; Hardoy et al, 2001; UN-HABITAT, 2010, Chikobvu and Mukarati, 2011). While the Department of Environmental Affairs in South Africa agrees to the fact that waste volumes have increased it also brings out that increased complexity of waste streams has further burdened waste management services which are already in short supply (DEAT, 2011).

Likewise most major cities in Zimbabwe are also struggling with waste management issues (Mondoh, 1998; Tevera et al, 2002; Masocha, 2004; Muranganwa, 2013). To this effect there are numerous studies conducted which focused on solid waste management (SWM) in most of Zimbabwe’s cities. However the research has concentrated mostly on large cities especially Harare, Bulawayo, Gweru and Chitungwiza with small towns and rural centres being sidelined (Masocha, 2004). Waste management challenges however are not peculiar to urban cities only but small towns and rural centres are also facing similar challenges (Mondoh, 1998; Tevera et al, 2000; Masocha, 2004; Chikobvu and Mukarati; 2011).
Agenda 21 chapter 21 advocates for environmentally sound management of all solid wastes. Chapter 21 section 39c states that governments should by the year 2025 ensure that full urban waste service coverage is maintained and sanitation coverage is achieved in all rural areas (UNSD, 1999). This therefore makes it important to also have research that focuses on SWM in small towns and rural centres. This study therefore seeks to explore the waste management system currently adopted in the rural centre of Mount Darwin which is under Pfura Rural District Council, Mashonaland Central Province, Zimbabwe.

1.1 Problem statement
In Zimbabwe, councils are mandated by the Environmental Management Act to ensure that solid wastes are disposed off in a manner that safeguards public health and minimises environmental pollution. They are mandated to put in place measures that seek to ensure that all solid wastes produced in their jurisdictions are collected, treated and disposed in a safe manner (EMA 20:27; Urban Councils Act 29:15; Rural District Councils Act 29: 13; Public Health Act 15:09). Currently in urban areas, most solid wastes are crudely tipped, openly burnt and/or illegally dumped in undesignated areas such as open spaces and most council authorities are overwhelmed they are failing to cope with SWM (Mondoh, 1998; MLGRUD 1995; Tevera et al, 2000; Masocha, 2004; Chikobvu and Mukarati; 2011).

Given the backdrop of increases in population, growth and expansion of most growth points and centres into vibrant, densely populated areas, rural councils are also facing SWM challenges similar to those experienced by their counterparts in most urban centres (Masocha, 2004). This shows that existing research has been limited in its coverage favouring urban cities. Considering the essentiality of waste management services in public health and environmental protection, it is noteworthy that solid waste management operations be up to standard even in rural areas.

1.2 Justification of the study
Some researchers like Mondoh, Tevera and Masocha tried to satisfy the need for research for solid waste management practices in the small towns of Norton, Bindura and Victoria Falls
respectively (Mondoh, 1998; Tevera et al, 2000; Masocha, 2004). Most rural centres are also growing and some like Mt. Darwin are vying for town statuses (The Herald, 3 March 2007). Research in SWM is not exhaustive and as a result not much has been documented for most rural centres. This study therefore seeks to satisfy this need by focusing on rural centres.

In Mount Darwin the frequency of waste collection in most of the residential suburbs has decreased. Waste is going for weeks without collection and removal. As a result illegal dumping sites have surfaced in most open spaces that surround the residential areas, shops, the vegetable market place as well as the commuter omnibus rank. This study will identify the status of the present solid waste management system in Pfura Rural District. The research will establish the present SWM system in place and consequently bring to light some obstacles, loopholes in the existing practices if any and challenges to an effective SWM system.

In light of the findings of the study the researcher will try to provide some recommendations which will assist the decision makers both at micro and macro levels to formulate an appropriate integrated solid management (ISWM) system.

1.3 Significance of study
This research will try to bridge the gap between urban areas, small towns and rural centres in solid waste management research. The study can provide other Rural District Councils with reference material for improving their solid waste management systems. It can also be a basis for further researches that will help many Rural Districts Councils.

The research will try to provide some suggestions and recommendations which will benefit the authorities to devise better and effective ISWM methods. These suggestions and recommendations will also assist the decision makers to formulate right management systems and the professionals to design and implement effective solid waste management methods that effectively manage solid waste.
Poor disposal of solid wastes is of concern because i) the environment is being polluted and this undermines ecosystem stability, ii) this poses threats to the health of the residents in the event of disease outbreaks like typhoid and cholera and iii) the aesthetic value of the study area also need to be maintained if they are to court more capital investments for growth, expansion and development.

1.4 Limitations
The researcher is likely going to face a number of challenges which includes financial constraints that would limit the researcher to focus on areas easily accessible since the researcher has no external funder to the research. There might also be a likelihood of a bias as some of the information to be provided by the council might be incorrect or under looked. Also given that this is a rural centre some respondents might be illiterate and they might not be able to read the questionnaires. Moreover technical resource limitations might also be encountered on part of the researcher when measuring the extent of environmental problems and associated impacts associated with solid waste management.

1.5 RESEARCH QUESTIONS
The study is going to be guided by the following research questions.

i) What is the current status of the solid waste management system of Pfura Rural District Council, Mt. Darwin?

ii) What are the constraints to, and potential options for enhancing the present SWM system adopted in Mount Darwin rural centre.

iii) What are the opportunities for ISWM and community participation in the SWM system adopted in Mt. Darwin?

1.6 OBJECTIVES
Research objectives are explained to be guidelines or outcomes that the researcher seeks to achieve in the research process. They guide in the formulation of research questions as well
as highlighting the focus, scope and extent of the research (Stake 1995). Objectives can be general or specific. General objectives give the main focus of the study whilst specific objectives spell out the specific intentions of the research.

1.6.1 GENERAL OBJECTIVES
The main objective of the study is to establish the SWM system employed by Pfura Rural District Council in the solid waste management of Mt. Darwin rural centre. The study also seeks to establish opportunities for ISWM as well as community participation within the councils’ SWM system.

1.8.2 SPECIFIC OBJECTIVES
i) To explore the current solid waste management system of Pfura Rural District Council, Mt. Darwin.

ii) To determine constraints and potential intervention strategies and mechanisms to enhance the solid waste management system adopted by the council for Mt. Darwin rural centre.

iii) To determine opportunities for ISWM and community participation in the solid waste management system adopted in Mt. Darwin.

1.9 DEFINITION OF KEY TERMS
This section provides definitions to some key terms used in this study.

WASTE
Waste is viewed as a discarded material, which has no consumer value to the person abandoning it (Cointreau, 1994). The United Nations Environment Program in the Basel Convention of 1989 defines waste as substances or objects which are disposed off or are intended to be disposed off. These are required to be disposed of by the provisions of national law (UNEP-IETC, 2005). Masocha defines waste as something that has no value, useless and that the owner wants to discard (Masocha, 2004). Chikobvu and Mukarati on the other hand defines waste as any material which has been used and is no longer wanted, for example because the valuable or useful part of it has been taken out (Chikobvu and Mukarati, 2011).
SOLID WASTE

Robinson defines solid waste in general as materials which are thrown away or kept aside as worthless elements by their owners. Solid waste is subject to the value judgment assigned by the primary owner or the potential consumer (Robinson, 1986). Masocha states that for most municipalities and councils solid waste generally refers to unwanted or discarded waste material from houses, street sweeping, commercial, industrial and agricultural operations, arising from human beings activities (Masocha, 2004). In most urban areas it is called refuse or garbage; in the countryside it is usually called litter and in general it is called solid waste hence some of these terms are used interchangeably.

MUNICIPAL SOLID WASTE (MSW)

The Ministry of Local Government Rural and Urban Development describes solid waste as a conglomeration of dust, ash, vegetables and organic matter, paper and packaging of all kinds, rags and other fabrics, glass and much other combustible and non-combustible debris (MLGRUD, 1995). On the other hand Robinson defines municipal solid waste (MSW) commonly known as trash or garbage in the US, and refuse or rubbish in the UK is a type of waste consisting of everyday items that are discarded by people and the waste is collected for disposal usually by municipal authorities as part of their mandate (Robinson, 1986).

SOLID WASTE MANAGEMENT (SWM)

Solid waste management refers to the systematic disposal of solid wastes (Masocha, 2004). The Environmental Management Act, in section 70 in terms of solid waste management highlights that no waste should be discharged or disposed in a way which will cause pollution to the environment or ill health to any person. Solid waste management (SWM) according to EMA is the responsibility of local authorities and municipalities (GOZ, 2007).

MUNICIPAL SOLID WASTE MANAGEMENT (MSWM)

Municipal solid waste management refers to the collection, transfer, treatment, recycling, resource recovery and disposal of solid waste in urban areas by municipalities (Masocha, 2004). Mangizvo adds that it involves processes like waste characterisation and sorting, treatment, recovery and disposal in safe and secured landfills (Mangizvo, 2010).
INTEGRATED SOLID WASTE MANAGEMENT (ISWM)

According to the United States Environmental Protection Agency (US-EPA), Integrated Solid Waste Management (ISWM) is a comprehensive waste prevention, recycling, composting, and disposal program. EPA describes ISWM as a system that considers how to prevent, recycle, and manage solid waste in ways that most effectively protect human health and the environment in a sustainable way (US-EPA, 2015). UNEP on the other hand identifies ISWM as a strategic approach to sustainable management of solid wastes covering all sources and all aspects, covering generation, segregation, transfer, sorting, treatment, recovery and disposal in an integrated manner, with an emphasis on maximizing resource use efficiency (UNEP-IETC, 2005).

1.10 ORGANISATION OF THE STUDY

This study is divided into five chapters comprising of different contents.

The first chapter has a general introduction that describes the evolution of integrated solid waste management ISWM systems. This chapter presents the international and regional issues in solid waste management and it also highlights the progress made in ISWM as well its importance in environmental protection and public health issues. The chapter also presents the study area under investigation, the rationale for conducting the study, the set out objectives as well as the limitations to the study.

In the second chapter the origins of solid waste management, the guiding policies and legislative framework, challenges and constraints, intervention strategies and possible solutions to solid waste issues are discussed. The chapter also highlights the current practice of municipal solid waste management in some developing countries as well as in the continent and in sub Saharan Africa. It also focuses on the state of SWM systems in Zimbabwe, in both urban and rural centres.
The third chapter consists of the methodology. It highlights the strategies and procedures used for acquiring and analysis of data. This chapter also highlights the analytical framework, its development and intentions and processes for analysis. This chapter also explains why certain methods like questionnaires, interviews with key informants, focus group discussions and surveys are used by the researcher in this study amongst other things.

In the fourth chapter, collected data is analyzed and the research results are presented and discussed. Implications of the results as well as their limitations are also highlighted in this chapter.

The fifth chapter provides a summary of the main findings and conclusions drawn from this study. Key recommendations that seek to tackle the challenges of solid waste management are presented for adoption. Finally a general conclusion is made based on the findings and recommendations.

1.11 Summary
This chapter gave an introduction to the study. It described the evolution of ISWM systems and solid waste management issues internationally and in the region. The chapter also spelt out the problem statement, justification and the significance of the study. Research questions and objectives that guided the research were also discussed with the definition of key terms and the organisation of the study concluding the chapter.
CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction
This chapter focuses on the basic concepts and issues concerned with solid waste and integrated solid waste (ISWM) system with regard to its origins, evolution, current trends and its applicability to both developed and developing countries’ scenarios. This chapter also examines solid waste challenges facing municipalities in developing countries with particular emphasis on sub Saharan Africa and Zimbabwe where increases in solid waste generation has not been met by increases in the capacity to handle the wastes generated. Solid waste production tends to create huge environmental and health related problems for municipal authorities who manages the solid wastes. These challenges are frequently encountered by both urban city and rural centre dwellers. Most challenges are in waste generation management, collection and disposal.

2.1 Solid Wastes: definitions and concepts
Solid waste in general refers to materials which are thrown away or kept aside as worthless elements by their owners. Solid waste is subject to the value judgment assigned by the primary owner or the potential consumer (Robinson, 1986; Muranganwa, 2013; UNEP-IETC, 2005). Waste is viewed as a discarded material, which has no consumer value to the person abandoning it (Cointreau - Levine, 1994). The United Nations Environment Program in the Basel Convention of 1989 defines waste as substances or objects which are disposed off or are intended to be disposed off. These are required to be disposed of by the provisions of national law (UNEP-IETC, 2005).

The European Union under the Waste Framework Directive defines waste as an object the holder discards, intends to discard or is required to discard (Euroabstracts, 2001). The United Nations Statistics Division defines solid wastes as materials that are not prime products, for which the initial user has no further use in terms of his/her, own purposes of production, transformation or consumption, and of which he/she wants to dispose. Wastes may be generated during the extraction of raw materials, the processing of raw materials into
intermediate and final products, the consumption of final products, and other human activities (UNSD, 1999).

The World Health Organization defines solid waste as useless, unwanted or discarded materials arising from domestic, trade, commercial, industrial and agricultural as well as from public services (WHO, 1971). According to the section 1004 (27) of Solid Waste Disposal Act which is popularly referred to as the Resource Conservation and Recovery Act enacted by United States Environment Protection Agency, solid waste is defined as any garbage, refuse, sludge, and any other discarded material, including: solid, liquid, semisolid or contained gaseous material, resulting from industrial, commercial, mining, and agricultural operations and from community activities (UNEP-IETC, 2005; US EPA, 2010).

Masocha states that for most municipalities and councils solid waste generally refers to unwanted or discarded waste material from houses, street sweeping, commercial, industrial and agricultural operations, arising from human beings activities (Masocha, 2004). In most urban areas it is called refuse or garbage; in the countryside it is usually called litter and in general it is called solid waste hence some of these terms are used interchangeably.

The Ministry of Local Government Rural and Urban Development describes solid waste as a conglomeration of dust, ash, vegetables and organic matter, paper and packaging of all kinds, rags and other fabrics, glass and much other combustible and non-combustible debris (MLGRUD, 1995; Muranganwa, 2013; Chikobvu and Mukarati, 2011). On the other hand Robinson defines municipal solid waste (MSW) commonly known as trash or garbage in the US, and refuse or rubbish in the UK is a type of waste consisting of everyday items that are discarded by people and the waste is collected for disposal usually by municipal authorities as part of their mandate (Robinson, 1986).

MSW primarily comes from households, but also includes wastes from offices, hotels, shopping complexes/shops, schools, institutions, and from municipal services such as street cleaning and maintenance of recreational areas (MLGRUD, 1995; Mapira, 2001 and Masocha 2004).
2.2 History of solid waste management

The Black Death, which struck Europe in the early 1300s, may have been partially caused by the littering of organic wastes in the streets (Louis, 2004; Tchobanoglous et al., 1977; Worrell and Vesilind, 2012). This created favourable conditions for vectors of diseases, solid waste management challenges and environmental degradation (Worrell and Vesilind, 2012).

In colonial America, the urban population lived in similar putrid conditions (Worrell and Vesilind, 2012). Many initiatives were implemented to clean up the streets, but all were short-lived because the poor were focused feeding themselves and the rich were opposed to paying to clean up for the poor (Wilson, 2007). However, scarcity of resources ensured many items were repaired and reused, and the waste stream was thoroughly scavenged (Worrell and Vesilind, 2012). According to Wilson; the late 1830s the sanitation revolution began in London with the appointment of the Sanitation Commission, which established the first clear linkages between disease and poor sanitary conditions. He also adds that during this time interest in public health led to better solid waste management practices through legislation, enforcement, and investments (Wilson, 2007).

In 1848 and 1875 Public Health Acts were established, the latter of which required households to dispose of their waste in a moveable receptacle, which local authorities were responsible for emptying weekly (UNEP-IETC, 2005; Wilson, 2007). The UNEP highlights that governmental interest in public health drove solid waste management improvements in most American cities as well through legislation and investment in infrastructure. As a result recycling activities increased from mere 6% of total municipal solid wastes generated in the 1960s to about 30% in the Year 2000 (UNEP-IETC, 2005). However Worrell and Vesilind on the other hand also noted that combustion declined from 30% to less than 15% during the same period because of public health issues (Worrell and Vesilind, 2012). Public health legislation continued to drive waste management forward in this century. The first municipal priority became collecting and removal of waste from the immediate vicinity of residential areas (UNEP-IETC, 2005; Wilson, 2007).

2.3 Solid Waste Management in Developing countries

Whilst several publications deal with a variety of topics in the field of solid waste management most of these documents have been published to address the needs of
industrialized nations. Developed countries produce more solid wastes than developing countries. However most industrialised countries have developed adequate facilities and competent institutions hence their solid wastes are efficiently removed and safely disposed off (Masocha, 2004).

According to the UNEP, not much had been specifically written to provide the type of information that is required by developing countries (UNEP, 1991). Masocha also argues that in the developed world most solid wastes generated are recycled and recovered with the remaining waste being treated before disposal at secure landfills. In contrast most developing countries’ cities such as Harare, Lusaka and Johannesburg face challenges of insufficient collection and improper disposal because of various challenges (Masocha, 2004). Zurbruegg argues that waste management solutions need to be developed locally and tailored specifically to meet local needs and conditions. He further states that urban centres throughout Africa collect less than half of the solid waste produced and that 95 percent of this amount is either indiscriminately thrown away at various dumping sites on the periphery of urban centres, or at a number of so-called temporary sites which are usually open spaces (Zurbruegg, 2003).

In the SADC region the generation of solid wastes has become an increasingly important environmental issue over the last decade. SADC identified waste management, pollution, inadequate access to sanitation services and poor urban conditions as some of the major challenges in the region (SADC, 2012). Sanyanga and Masundire argue that few urban areas in the developing world have adequate and sustainable waste disposal systems and litter is a growing problem which has not received much attention in Sub-Saharan Africa (Sanyanga and Masundire 1999). This is true because most countries in the SADC are grappling with the problems of high volumes of waste and high costs involved in the management. SADC highlights that these are exacerbated by lack of proper disposal technologies and methodologies, inadequate manpower and equipment and poor enforcement (SADC, 2012).

For the region information about SADC Member States is not routinely collected and reported at present but the SADC Secretariat is developing a Regional Programme on Waste Management which is still to be finalised (SADC, 2012). Improving solid waste management however is a major challenge in the region because there are many serious problems but no universal answer (SADC, 2012).
2.4: Solid Waste Management in Zimbabwe

2.4.1: State of SWM in cities

The challenge of waste management is a growing concern for the national government, local authorities, environmentalists, researchers and the communities at large throughout Zimbabwe. There has been an increase in the amount of waste generated at household level due to increases in population in most residential areas (MLGRUD, 1995). The situation has been compounded by the rapid urbanisation, which currently stands at 30% for Zimbabwe (Masocha, 2004; Muranganwa, 2013, Tevera et al., 2000).

Muranganwa identified solid waste management as a major challenge confronting almost all urban local authorities in Zimbabwe (Muranganwa, 2013). Sanyanga and Masundire added that local authorities are under pressure and that they are struggling to provide adequate waste management services such as refuse collection and waste treatment and disposal (Sanyanga and Masundire, 2014). They blamed rapid urban population growth in the last decade and the fall in both capital and real budgets of local authorities to be the factors that have placed considerable strain on local authority resources (Sanyanga and Masundire, 2014).

With statistics Mondoh argues that in Zimbabwe about 2.5 million tonnes of both industrial and household waste is generated per annum. He highlights that out of this waste generated only 30% is currently reported to be collected and disposed off in many large towns and cities. Muperi on the other hand noted that this was a huge reduction from the previous case of 80% which was reported in the mid 90s (Mondoh, 1998, Muperi, 2014). In their research Tevera et al, argues that these low waste collection levels have triggered widespread illegal open dumping and backyard incineration (Tevera et al, 2002).

Muperi reported that the Harare City Health department uses 33 refuse trucks instead of 120 trucks to service the city. In Bulawayo on the other hand waste collection by local authorities was as low as 30% of total waste generated in the city (Muperi, 2014). This has created negative environmental impacts and increased the health risk of the residents.
In the Newsday article, Muranganwa noted that open waste dumps have become prime breeding sites for houseflies, rodents, mosquitoes and other vectors of communicable diseases such as fever, dysentery, diarrhoea, cholera and malaria (Muranganwa, 2013). Fumes from burning waste causes acute respiratory infections and the odours make the environment uninhabitable (Masocha, 2004; Muranganwa, 2013, Muperi, 2014). The Herald reported that loose papers and plastics blown by wind resulted not only in an aesthetic intrusion of the surrounding environment but contributed to the blockages of the storm water drains leading to flooding in the cities (Tsivo, 2013).

According to Masocha in rural areas, waste management services are rare and, if they exist, they are reduced to collection and disposal only. He further notes that these services in rural areas are inadequate with a significant portion of the population not having access to waste collection services. Sometimes only a fraction of the generated waste being actually collected (Masocha, 2004).

Since knowledge is power a rural district council without it lacks capacity. This study therefore seeks to equip the council with knowledge of its solid waste management system and equip it with ways and opportunities for improvement. It is against this background that this study becomes relevant hopes and it hopes to make positive changes in SWM IN rural centres.

2.4.2 Legislative framework

Zimbabwe is a signatory to a number of multi-lateral environmental agreements that include Convention on International Trade in Endangered Species on flora and Fauna (CITES); Climate Change; Biological Diversity; Combating Desertification; and the Bamako Convention on the Ban of Transportation and Importation of Hazardous Substances into Africa amongst others ( Mangizvo, 2010). Zimbabwe is also a member of the Municipal Development Partnership for Sub-Saharan African.

Zimbabwe has several pieces of legislation which deal with solid waste management either directly or indirectly. The Environmental Management Act, in section 70 also states that no
generation of waste should discharge or dispose that waste in a way which will cause pollution to the environment or ill health to any person. Municipal solid waste management (MSWM) according to EMA is the responsibility of local authorities and municipalities (Practical Action, 2006). The Environmental Management Act (EMA [20:27]) stipulates that municipal solid waste management services should include collection, transfer, treatment, recycling, resource recovery, and disposal of waste (GOZ, 2007).

The Environmental Management Board is mandated by the Environmental Management Act [20:27] to provide guidelines and recommendations for the handling, storage and transportation, segregation and destruction of any solid waste [EMA 20:27]. In order for councils to effectively apply ISWM strategies and systems in their environmental health division they need to work closely with the Environmental Management Agency. This is because Section 70 of the Act prohibits the discharge or disposal of any wastes generated in a manner that causes environmental pollution or ill health.

Statutory instrument 6 of 2007 CAP 20:27 Environmental Management (Effluent and solid waste disposal) states that every local authority shall designate suitable sites as waste collection sites within its areas of jurisdiction for management of waste and ensure a waste collection frequency that minimizes accumulation and decomposition of waste in collection sites. The Act also stipulates that every person or authority in control of, or responsible for the maintenance of any place shall at all times ensure that containers or places are provided, which will normally be adequate and suitable for the discarding of litter. It further points out that any transport conveyance shall ensure that no litter is thrown from its transport conveyance (GOZ, 2007).

There are also a number of policies and legislative instruments that deal with waste management issues, such as the Environmental Impact Assessment (EIA) Policy, National Sustainable Development Policy, Science and Technology Policy, and the Draft National Environmental Policy, Urban Councils Act [29:15], Rural District Councils Act [29: 13], Water Act [20:22], Public Health Act [15:09] and Municipal By-laws (Masocha, 2004; Muperi, 2014). Section 83 of the Public Health Act of Zimbabwe of 1996 states that it shall be the duty of every local authority to take all lawful, necessary, and reasonably practical measures for maintaining its district, at all times, in a clean and sanitary condition by preventing the accumulation of waste, which may be injurious or dangerous to health (GOZ,
However these challenges in urban waste management in Zimbabwe have continued unabated despite the existence of these policies and legislative regulations and bylaws (Muperi, 2014).

For most, legal obligations spelt out in the Rural District Councils Act [29:13] are not the only drivers of SWM systems but most local governments are also motivated by political interests, user satisfaction with provided services and approval of higher government authorities (GOZ, 2007). However Chikobvu and Mukarati notes that waste management still remains one of the costliest public services as conventional waste management systems are not well suited to deal with increased waste generation rates (Chikobvu and Mukarati (2011)). In response efforts by the Environmental Management Agency (EMA) to create awareness and help in cleaning up the cities have increased. Even in some rural areas EMA has created Environmental Protection Committees in rural councils which helps manage the environment (Muranganwa, 2013).

In Zimbabwe we have an Integrated Solid Waste Management Plan which this country embarked on in 2011 but it still has not been implemented. Validation workshops are still being carried out in some sectors on how best to implement the plan and to find out if it fits perfectly within Zimbabwe’s context (Maranganwa, 2013). The developed Integrated Solid Waste Management Plan emphasizes on two concepts which are separation at source and cradle to grave solid waste management systems (GOZ, 2007; Chikobvu and Mukarati, 2011; Maranganwa, 2013).

The government of Zimbabwe has also responded by making waste management one of the priority issues in the Zim-ASSET. In the social services and poverty eradication cluster, service delivery activities which include waste management have been prioritised (GOZ, 2013).

Interviews with EMA officials indicated that in addition to their Acts (Rural District Councils Act [29:13]) activities of all councils are guided by the EMA Act. The act stipulates that no waste shall be transported without a valid licence. Councils are required to have Local Environmental Action Plans (LEAP) that set targets for recycling and reuse in ISWM. The act stipulates that every person whose activities generate wastes must employ measures
essential to minimise waste through treatment, reclamation and recycling. This then mandates all stakeholders to be involved in some aspects of ISWM.

Rural councils however have limited technical, human and financial resources to effectively implement successful solid waste management systems. This might be mainly due to their poor revenue base (Tevera et al, 2000). The authors however insisted that this is not an excuse and that ISWM systems must be mandatory. They explained that every stakeholder is entitled to participate in waste management to lessen the burden on councils that is why there is advocacy for the integrated approach in solid waste management (Tevera et al, 2000).

ISWM is outlined by EMA as including

- wastes prevention targets
- acceptable waste disposal methods
- reduction of residual wastes to a minimum
- consumption of products so that little waste is produced
- environmental education
- participation by all stakeholders

This therefore signifies that the ISWM system’s guiding principles that govern environmental management must place people and their needs at the forefront of its concerns. However the National Waste Management Policy which should be the guiding policy is still not yet formalised. This affects activities of all the diverse stakeholders which includes the waste generators, those who dispose the waste as well as those who police and monitor compliance amongst others. The ISWM system is summarised by the hierarchy diagram below.
The option of ISWM however is not farfetched and rural districts can effectively implement it. Various guiding policies and legislations listed in the table below can help reshape better integrated solid waste management systems for all service providers.

<table>
<thead>
<tr>
<th>National Legislation</th>
<th>Guiding Policies</th>
</tr>
</thead>
</table>
During the survey the EMA District Officer, Mt. Darwin cited fragmentation of these laws as the major challenges that affect enforcement. Whilst the EMA Act was cited as the one which takes precedence in waste management, the responsible authorities the Environmental Management Agency and the Environmental Management Board officials explained that the organisations are severely undercapitalised and are facing a number of challenges due to the current economic climate.

### 2.5 Integrated Solid Waste Management

According to the United States Environmental Protection Agency (US-EPA), Integrated Solid Waste Management (ISWM) is a comprehensive waste prevention, recycling, composting, and disposal program. EPA describes an effective ISWM as a system that considers how to prevent, recycle, and manage solid waste in ways that most effectively protect human health and the environment in a sustainable way (US-EPA, 2015). UNEP on the other hand identifies ISWM as a strategic approach to sustainable management of solid wastes covering all sources and all aspects, covering generation, segregation, transfer, sorting, treatment, recovery and disposal in an integrated manner, with an emphasis on maximizing resource use efficiency (UNEP-IETC, 2005).
Maranganwa also describes Integrated Solid Waste Management as a system that combines different waste streams, waste collection, and treatment and disposal methods into a practical waste management system (Maranganwa, 2013). Therefore ISWM is not just a technological system with infrastructure and facilities that facilitate handling and disposal of MSW, but it is a management system that considers and deals with many other elements including the socio-economic settings, the physical environment and growth in public demands and management scenarios (Chikobvu and Mukarati 2011). The components of an effective ISWM can be summarised by table below which brings all the elements of waste management together.

<table>
<thead>
<tr>
<th>Pollution prevention, and/or source waste minimization (or reduction) in quantity, volume and/or harm.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resource conservation or environmentally sound reuse and recycling, and recovery e.g. composting or energy recovery.</td>
</tr>
<tr>
<td>Sound treatment of the waste to render it safe for disposal.</td>
</tr>
<tr>
<td>Safe ultimate disposal of the waste e.g. Incineration or landfilling.</td>
</tr>
</tbody>
</table>

**Table 2.2 Elements of Integrated Solid Waste Management (ISWM)**
(Source, ITEC/UNEP, 1996)

ISWM recognises three main dimensions which are stakeholders, elements (shown in table1. above), and aspects which control the whole ISWM process. All these dimensions need to be addressed when developing or changing a solid waste management system so as to achieve sustainability (UN-HABITAT, 2010). These dimensions are shown in the following figure 1. which shows the ISWM framework.
2.6 SUMMARY

This chapter outlined the origins of solid waste management, the guiding policies and legislative framework that shape ISWM systems. It also brought out the challenges and constraints, intervention strategies and possible solutions to solid waste issues as well as highlighting the current practices of municipal solid waste management in some developing countries in the continent and some in sub Saharan Africa. This chapter was concluded by reviewing the state of SWM systems in Zimbabwe, the guiding legislative framework and the challenges faced in both urban and rural centres by responsible authorities.
3.0 Introduction

This chapter covers the study area description, the target population and the research methodology. Research methodology refers to the system of collecting data for research work. Research method is also defined as a planned and systematic approach of investigation that denotes the detail framework of the unit of analysis, data gathering techniques, sampling focus and interpretation strategy and analysis plan (Frankfort-Nachmias and Nachmias, 1996). This chapter therefore outlines the various methods used to collect and analyse primary and secondary data as well as explaining and justifying why these methods were used.

3.1 Delimitation

The study will be done in Mount Darwin business centre which is under the Pfura Rural District Council in Mashonaland Central Province in Zimbabwe. Mount Darwin is 157km north of Harare. Below is a map that shows the location of Mount Darwin in relation to Harare and other cities and towns in the country.

Plate 2.1 Map showing the location of Mount Darwin in Zimbabwe

(source: Maps of the world.com, 2011)
Mt. Darwin rural business centre is in ward 26 in the Mount Darwin South constituency. The parliamentary profile describes this constituency as an urban constituency whose livelihood is mainly depended on commercial farming and small scale gold mining. Mount Darwin business centre is surrounded by large-scale commercial farms, mainly A1 and A2 farms. Small scale gold mining is very popular in the Mukaradzi area as well as in other areas dotted around this business centre (Mt. Darwin South Constituency Profile, 2011; pg 3).

3.2 Target Population

Stake defines a population as a defined set or class containing a finite number of elements. The target population is described to be the exact group of elements, people or respondents in the study or research area (Stake, 1995). The target area of the research was Mount Darwin town business centre and the target population were the residents as well as the business owners in the central business centre. Mt. Darwin has 4 residential areas namely Camperdown; a low density residential area, Ridgeview; medium density and Kandeya and Pfura townships which are both high density residential areas. In the central business districts there are a number of supermarkets, pharmacies, banks, commuter omnibus rank, small scale informal traders and government offices’ complex housing the district’s administration (the D.A) and many governmental institutions (Mt. Darwin South Constituency Profile, 2011).

Employees at Pfura Rural District Council were also part of the targeted key informants for interviews. The officials outlined the solid waste management systems used by the Council. The Pfura Rural District Council is responsible for the provision of all solid waste management services to all the above mentioned areas. The Council has temporary offices in this ward but the main offices are in Dotito which is in Mount Darwin West Constituency (Mt. Darwin South Constituency Profile, 2011).

EMA officials were also targeted as the key informants during interviews. The officials were chosen because EMA is the environmental management regulatory authority mandated to deal with waste management issues in Zimbabwe.
3.3 Research Design

Frankfort-Nachmias and Nachmias describe the research design as a structure that guides the execution of a research method and analysis of the data collected (Frankfort-Nachmias and Nachmias, 1996). Whilst Smith concurs that a research design brings out the pathway and execution guidelines, he adds that it should have a realistic time frame as well as major milestones that the research process needs to achieve (Smith, 2008). There are so many various types of research designs and examples include experimental research, cross sectional research and case studies amongst many others. For the purposes of this research the research design chosen was a case study.

3.3.1 Case Study

Cohen et al defines a case study as a specific instance that is designed to illustrate a more general principle of an instance in action (Cohen et al, 2005). Yin concurs and defines a case study as an empirical inquiry that investigates a contemporary phenomenon in depth and within its real life context especially when boundaries between phenomenon and context are not clearly evident (Yin, 2009). Farquhar highlights that a case study allows the researcher to look at the phenomenon in context and he adds that it also allows for the investigation of single or multiple units of study (Farquhar, 2012). Stake adds that case studies are important in that they allow for particularization which leads to a better understanding of the case itself (Stake, 1995). A basic case study entails a detailed and intensive analysis of usually a single case but however it is versatile and can use several sources of data. This allows for the research findings to be strengthened (Smith, 2008). Creswell concurs and notes that a case study portray, analyse and interpret the uniqueness of real individuals and situations in their natural context whilst allowing for interpretive, inferential and in-depth detailed analysis from a wide data source (Creswell, 2003).

However Remenyi 1998, in Farquhar argues that the main disadvantage of a case study is that it lacks objectivity and rigour (Farquhar, 2012). Authors who agree with him argue that because a case study seeks an understanding of a phenomenon in context it is subjective and therefore lacks objectivity. Most critics of the case study design are of the view that generalisation is not usually possible. They question the value of studying single events and experimental and cross sectional research designs are usually favoured to be the ones which are more objective and consistent than case studies (Denzin and Lincoln, 2005; Babbie, 2010;
Smith, 2008). However Best and Khan suggested that this can be solved by using multiple methods of collecting data at a single phenomenon. This process commonly referred to as the triangulation process can enhance the validity of the case study findings (Best and Khan, 1993). This triangulation process enables the researcher to combine qualitative and quantitative research strategies which complement each other for more appropriate data collection and data analysis (Yin, 2009).

The case study research design was chosen for this study because the research questions that frame the study are closely connected to their phenomenon which is a rural council. The case study method allowed for the question of the current status of solid waste management system, constraints and potential options to be addressed whilst exploring opportunities for integrated solid waste management in the study area. However to make this research design more effective a mixed methods approach was adopted. This mixed methods approach helped in the generalisation of the findings to the population under study. It also helped develop a detailed view of the solid waste management system adopted in the study area.

The mixed methods approach appreciates that all methods have limitations but the triangulation process can help in finding a balance between qualitative and quantitative analysis (Creswell 2003). However there is no general consensus on the approach to triangulation. Tashakkori, 1998 in Denzin and Lincoln brings out that some authors insist that the mixed methods approach can be any study with both qualitative and quantitative data collection methods, whereas others argue that a mixed approach must have mixed method questioning techniques in data collection, both qualitative and quantitative analyses in data analysis as well as integrated inferences (Denzin and Lincoln, 2005). Cohen et al simplifies this by explaining that the use of two or more methods of data collection in a study can be termed triangulation and that it becomes a mixed methods approach since it uses more than one method of data collection (Cohen et al, 2005). This definition was adopted in the study because it was simple to comprehend and it allowed the researcher to explore and use both qualitative and quantitative methods in a triangulation research process.

3.3.2 Triangulation Research Process

Creswell defines the triangulation research process as a method of enquiry in which the researcher bases the enquiry on the assumption that collecting diverse types of data best
produces an understanding of the research problem (Creswell, 2003). He adds the researcher begins a broad survey in order to generalise results to a population and then focuses on detailed interviews so as to collect detailed views from participants. Farquhar defines the triangulation research as a process in which the researcher mixes or combines quantitative and qualitative techniques, methods, approaches and concepts into a single study. He adds that the researcher takes an eclectic approach to method selection and conduct of research. An eclectic approach involves selecting what appears to best in various methods or styles which are drawn from various sources (Farquhar, 2012).

Authors who support this approach appreciates that all methods have limitations and they advocate for triangulating data sources as a means of convergence between qualitative and quantitative research methods (Cohen et al., 2005; Farquhar, 2012; Yin, 2009). Denzin and Lincoln, add that a triangulation design is useful to capture the best of both qualitative and quantitative approaches. They stresses that triangulation improves the chances that threats to inferences will be controlled through consistence in findings (Denzin and Lincoln, 2005). Most authors who support triangulation describe this approach as an expansive and creative form of research which is inclusive and complementary (Cohen et al., 2005; Creswell, 2003; Stake, 1995). Yin adds that triangulation is a powerful way of demonstrating concurrent validity particularly in qualitative research. He highlights that reliance on one method can lead to bias but triangulation can overcome method boundedness (Yin, 2009).

Critics of this approach argue that mixed methods are inappropriate because of the incompatibility of the world view or belief system, underlining qualitative and quantitative methods (Creswell, 2003). They argue that in mixed methods approach qualitative methods in most cases are left in a position of being secondary to quantitative methods (Yin, 2009). Others argue that research paradigms are different, independent and not compatible therefore a mixed methods approach is usually not effective (Creswell, 2003).

Despite these arguments the triangulation process was adopted in this study because this approach can allow the researcher to reap benefits from both qualitative and quantitative methods. It enabled the researcher to explain more fully the differences in human behaviour towards solid waste management by studying it using more than one study method. The triangulation approach also increased credibility of findings in this study by avoiding bias and distortion of perceptions during surveys. The researcher adopted a number of qualitative and
quantitative methods as research strategies of the mixed method approach in a bid to achieve triangulation.

3.4 Research Strategies
Farquhar describes that a research strategy takes on different meanings in different studies. Most authors who agree explains that in one study a research design can reflect the entire process from conceptualisation, literature review, research questions, methods and conclusions whilst in another it only refers to the methodology of study (Cohen et al, 2005; Farquhar, 2012; Stake, 1995). In this study the latter definition was adopted. The research design describes the data collection methods which were used in the study. This was chosen because it explains the information about key methods and features of the study. The research design used adopted both qualitative and quantitative research methods in the study so as to achieve triangulation.

3.4.1 Qualitative Research Method
Smith notes that qualitative researchers usually collect facts and that qualitative research studies the relationship of one set of facts to another (Smith, 2008). Best and Khan concurs and adds that qualitative research involves intensive data collection, over a long period of time, on many variables in a naturalistic setting that is without a researcher’s manipulations of the events or the environment in which the events take place (Best and Khan, 1993).

Farquhar describes qualitative methods as exploratory in nature and that they are used to gain an understanding of underlying reasons, opinions and motivations. He adds that qualitative data collection methods vary using structured or semi structured techniques (Farquhar, 2012). Frankfort-Nachmias and Nachmias highlights that there are four leading methods of data collection that are widely used in qualitative research namely survey of documents and other secondary sources; observations; questionnaires; and structured schedules used in primary data collection (Frankfort-Nachmias and Nachmias, 1996).

To this effect data from the study area was collected through administering various qualitative data collection instruments such as structured interviews, observations, focus group discussions, field surveys and questionnaires. More qualitative methods were used for most data collection parts in the study.
3.4.2 Quantitative Research Method

Quantitative methods are used to quantify the problem by way of generating numerical data that can be transformed into usable statistics (Farquhar, 2012). According to Smith, quantitative research uses objective measurement and numerical analysis of data. It tries to explain the causes of changes in social phenomena with emphasis being on collecting and analysing numerical data (Smith, 2008). Quantitative analysis research methods were used in data collection and mostly in data analysis in this study.

Babbie further adds that quantitative research concentrates on measuring the scale, range frequency and other statistical data received from the field work. This then is used to test hypotheses and also to answer the research question stated in the study (Babbie, 2010). Other authors also adds that quantitative methods are important in increasing not only the reliability and validity of the results obtained in a research but also important in ensuring that the research is systematic and reproducible (Best and Khan, 1993; Stake, 1995; Yin, 2010).

The quantitative methods used during data analysis ensured that the study was systematic in that the researcher was not just picking out answers from interviewees and that the data collected was not biased towards that data which only supported pre-existing ideas about waste management practices in rural districts.

Since this was a triangulation process with both quantitative and qualitative methods, various data collection methods were adopted and used. The data collection methods allowed for data analysis in a manner which ensured that anyone can use the same data collection methods and generate their own data thus ensuring that the research could be reproducible.

3.5 Data Collection Methods

Since this study used both qualitative and quantitative methods of inquiry, to get the best out of these two methods various data collection methods were used. The two main categories of the data collection methods used were primary and secondary data collection methods.

Primary data refers to the information one gets from findings on the ground after conducting the actual research whilst secondary data usually comprises of content analysis on the subject
matter one intends to research on usually documented by other authors (Cohen et al., 2005; Farquhar, 2012; Smith, 2008). For primary data collection, this researcher used questionnaires, focus group discussions, direct observations and structured interviews as methods for gathering empirical evidence. Secondary data collection in this research was achieved by collecting information from diverse sources such as documents, journals, books, newspapers and electronically stored information on the internet.

### 3.5.1 Primary Data Collection Methods

#### 3.5.1.1 Questionnaires

In this research the major primary data collection tool from various stakeholders was the questionnaire. Best and Khan suggests that a questionnaire is a useful tool that facilitates the collection of data from large, diverse and broadly sprinkled groups in a community (Best and Khan, 1993). Smith defines a questionnaire as a form that people fill out and it is used to obtain demographic information, views and interests of those being questioned (Smith, 2008).

Cohen et al. explain that a questionnaire asks the same questions to all the individuals in a given sample. He highlights the importance of the questions being prepared beforehand (Cohen et al., 2005). Frankfort-Nachmias and Nachmias also define a questionnaire as a method for the elicitation, recording and collecting of information (Frankfort-Nachmias and Nachmias, 1996). They both argue that questionnaires are very effective instruments if used properly when collecting and gathering information and data from various respondents (Frankfort-Nachmias and Nachmias, 1996; Smith, 2008). Stake describes the advantages of a questionnaire to be that it is straightforward to complete, easy to code and analyse and that comparisons can be made across, He adds that it can also allow for free responses that allows for the additions of remarks or explanations (Stake, 1995). As a result of their effectiveness in data collection if properly administered, questionnaires were used as the main data collection tool in this study.

Critics of the questionnaire however argue that participation is voluntary therefore for it to be a successful tool in data collection; it has to be designed with expertise in ways that help engage the respondents’ interest (Cohen et al., 2005; Smith, 2008; Stake, 1995; Yin, 2010). Other critics add that different respondents in a study can interpret the same words differently from what the researcher intended; interpretation challenges therefore maybe experienced
(Cohen et al., 2005; Yin, 2010). During the research process the greatest disadvantage and challenge with questionnaires was that the respondents in most instances controlled the data collection process. Some respondents simply chose not to answer some questions which were of paramount importance to the findings of the study. The researcher overcame this by being very patient and persistent. The researcher also had to personally administer all the questionnaires so as to ensure goods returns.

The researcher used mainly structured questionnaires which contained definite and concrete questions. However at times non-structured questionnaires were used only as a guide during some interviews. This was necessitated by the fact that some of the respondents were illiterate and the researcher had to interview them so as to get information. In the structured questionnaires the questions were mixed. Open ended questions and closed questions in which respondents chose answers from a set of provided options were both used. This tool was the most appropriate for households and other service users such as supermarkets and governmental institutions and private companies which were found in the Mt. Darwin Business District.

The Statistical Package for the Social Sciences (SPSS) software package was used to process and analyse the data collected from the questionnaires. Responses on the questionnaire were numerically coded and inputted into the SPSS data editor and analysed. Several data analysis functions were used to generate frequency tables, cross tabulations and other descriptive statistics.

3.5.1.2 Interviews

Another data collection instrument used in the research were interviews. Best and Khan suggests that interviews are very popular research methods because they are very flexible and participatory. They are said to be flexible because the interviewer in addition to explaining the purpose of the study to the interviewee he or she has the freedom to change some questions or the asking order of the questions according to the reactions of the interviewee so that the researcher will get as much information as is possible from the whole interview process (Best and Khan, 1993). They also added that if a good rapport is achieved an interviewee can freely give information in an interview that they would not normally put in writing for example if they were they were responding to a questionnaire.
On the hand Cohen et al defines an interview as a two-person conversation initiated usually by the interviewer for a purpose of obtaining information for research objectives, systematic descriptions, predictions and/or explanations. Smith brings out that interviews consist of oral questions by the interviewer and oral responses by the research participants. Interviews can either be structured or unstructured, guided or non-guided and they also allow the interviewer to be creative using all these methods interchangeably so as to get desired information out of the interviewee (Cohen et al, 2005).

The main disadvantage with interviews is that the researcher controls the data collection process. To get much from an interview the researcher has to ask relevant and appropriate questions and this requires skill and practice (Best and Khan, 1993). This however can also lead to bias and subjectivity on the part of the researcher. Another challenge might be that the researcher might be biased towards expected responses omitting or diluting responses which he or she deems inappropriate thus misrepresenting the interviewee’s responses (Babbie, 2010; Best and Khan, 1993; Stake, 1995).

To avoid this Best and Khan suggests making recordings during the interviews which the researcher can play back over and over again so as to obtain accurate information (Best and Khan, 1993). This researcher however found out that most of the interviewees were not comfortable with being recorded, so the interviewer only wrote down the given responses to the best of her abilities.

Another challenge was that most interviewees were busy. The researcher had to choose her questions carefully so as to shorten the interview sessions whilst trying to get as much information as was possible in that short period of time. In comparison to questionnaires interviews were a bit more challenging to conduct for the researcher.

In this study interviews were conducted with EMA officials and Council officers both at the Mt. Darwin district office where most of the junior personnel responsible for daily solid waste management in the Mt. Darwin Business District were stationed and at the Dotito head office where most of the senior personnel who oversaw solid waste management operations for the whole constituency were stationed.
The interview schedule had questions that sought to find out the solid waste management systems currently used by the rural council, guiding rules and regulations that shape their solid waste practices, beneficiaries and users of their services and the challenges and constraints they are encountering when providing these services amongst many other questions. The interviewer also sought out the possibility of introducing other solid waste disposal options such as land filling, composting, source segregation of waste before disposal, provision of colour coded bins for waste separation, establishing recycling centres and community based recycling organisations amongst others as ways of initiating Integrated Solid Waste Management (ISWM) in the constituency. These interviews were very fruitful for the researcher as they yielded information that was crucial to the research.

3.4.1.3 Focus Group Discussions

Frankfort-Nachmias and Nachmias explain that focus group discussions are purposeful meetings of five or more people organised with the sole intention of discussing a particular topic. They highlight that focus group discussions should not be biased and people should freely give their opinions on the subject matter to be discussed without fear of being victimised for their opinions if they are to be effective (Frankfort-Nachmias and Nachmias, 1996).

Smith concurs and he adds that focus groups should be held in an open and relaxed atmosphere so that participants openly express their views and feelings on the topic under discussion. He further explained that focus groups are effective for bringing views, opinions, perceptions, feelings and attitudes of a number of people during a short period of time than with one on one interviews or when administering questionnaires (Smith, 2008). Most supporters of focus group discussions add that new insights critical to a research might be brought up in focus groups which would never have been raised if people were to be individually questioned (Farquhar, 2012; Stake, 1995).

The main disadvantage of a focus group is that it requires expertise to conduct if the researcher intends to achieve desired outcomes. This is because when people are in groups they tend to want to discuss issues that they think are more crucial and critical at that particular time. This means they may deviate from the main subject matter and focus on other
social issues they think require immediate attention (Best and Khan, 1993). An experienced moderator is therefore needed to continuously stir the discussion towards the subject matter relevant to the study. The researcher overcame this by soliciting the help of two respected councillors in the community who moderated some of the discussions.

Another challenge for the researcher was getting different groups to be well presented in the group so as to achieve homogeneity. The researcher had to hold more than one meeting in a bid to try and have every type of participants represented and this was time consuming. Another challenge was that the focus group meetings held did not have a fixed number of participants. Some sessions had more whilst others had fewer participants.

Focus group discussions were held mostly with the residents only but at one occasion the service providers turned up. Most of these discussions were held at the community hall and a few were held at a local church. The ones held at church proved to be more fruitful since many women were present. The researcher noted that in most households it was the women who were responsible with the general cleanliness of the house as well as with the disposal of solid waste generated at household level. Most women had so much to contribute on the solid waste disposal challenges faced in the district.

3.4.1.4 Observations

Observations were defined by Smith to be a type of research which is concerned with naturally occurring events observed in their natural contexts. He added that observations are supposed to be realistic and less biased if they are to be effective in research (Smith, 2008). Cohen et al also explains that observations have an advantage in that the researcher is given the opportunity to look at what is taking place in situ rather than second hand as with questionnaires and interviews (Cohen et al, 2005).

Although Frankfort-Nachmias and Nachmias agree with Smith and Cohen et al they added that observational research usually brings out rich information which is usually unbiased if done without prejudice. However they noted that the disadvantage with them is that for them to achieve satisfactory results they usually depend mainly on personal discretion (Frankfort-Nachmias and Nachmias 1996).
In this study observations were done with the help of a number of techniques like use of concrete short notes at the site, recording personal feelings, recording information as soon as possible during interviews and focus group discussions and taking photos on areas of concern. The researcher managed to use personal discretion in a manner that will not bias the results of the study and she had a note book and recorded all important aspects in relation to the topic during the data collection process.

The researcher also managed to take pictures on the ground of some areas which showed poor waste management practices underway in the Mt. Darwin study area. During interviews with the Council officials the researcher also had a chance to see some photos taken when the officials were carrying out their own investigations and during their monitoring and evaluation sessions. The officials showed these photos as proof of their claims that they have functional environmental health division. They also highlighted that some of these photos were used during reporting back on environmental issues and also used for environmental monitoring and that they were stored in their data base. These were quite helpful since they helped the researcher understand the day to day activities and mode of operations within the council as far as waste management was concerned. All this helped the researcher make valuable and sensible analysis and recommendations at the end of the study.

3.4.2 Secondary Data Collection Methods

Smith explains this to be a data collection method which involves gathering information from existing resources (Smith 2008). Babbie on the hand describes secondary data collection to be a method in which data that have been already collected from other sources is collected and made readily available for use by others (Babbie, 2010). He adds that secondary data is cheaper and more readily available for use than primary data. Stake adds that secondary data collection is useful when conducting inquires for information that has been gathered and often interpreted by other researchers and recorded in books, articles and other publications (Stake, 1995).

Supporters of this method argue that this method is very effective and that information is readily available because secondary data always exists as secondary sources or accounts created by others on specific issues written at some distance in space or time (Best and Khan,
Secondary data can provide up to date information which can support or refute theories, arguments or pre-existing ideas. This is crucial in the dynamic field of research (Cohen et al., 2005; Yin, 2010).

In this study the researcher collected secondary data from sources like books, pamphlets, published reports and research papers, newspapers, the internet and from journals amongst many other sources. Secondary data collection was also widely used by the researcher when she was at the district council offices. The researcher had access to the internet, hard copies activities like field visits, workshops and trainings minutes. This helped in giving out information some officials might have omitted during the interview process. This therefore made secondary data collection very useful and informative in this study.

For the researcher, secondary data also proved to be easily accessible, widely informative and less costly since it did not involve a lot of travelling. Secondary data allowed for comparisons of ISWM practices adopted locally in the country with those in the region as well as those practiced internationally. This gave a road map which clearly showed where we are, what we needed to achieve and how we could possibly achieve complete ISWM so as to minimize solid waste management challenges. Most recommendations brought out by the researcher at the end of the study were guided by secondary data collected.

The researcher even though equipped with various data collection tools could not collect data from the whole population due to a number of challenges which included feasibility issues, lack of funding, time constraints and shortage of resources. Data was collected from smaller groups or subsets of the total population. A number of sampling methods were adopted and used in the study.

3.5 Sample and Sampling Methods

Best and Khan defines sampling as the method of selecting a few items from the universe for the study purpose so as to draw a conclusion about the universe or population. Generally a researcher cannot be able to communicate directly with every individual in the total population that he/she is studying because of an array of challenges and limitations and ideally the sample corresponds to the larger population on the characteristic(s) of interest (Best and Khan, 1993). Smith defines sampling as the process of selecting part of the whole
targeted population because it might not be feasible to use the whole population in the research. Smith explains that this might be as a result of feasibility issues, time constraints, finances, accessibility amongst other reasons for sampling (Smith, 2008).

Cohen et al add that a sample should be well selected from the parent population so that the information obtained from the subset is a true representation of the total population. He adds that sampling is important in a study because it affects the quality of statistical analyses that can be done to the data collected and inferences drawn (Cohen et al 2005). There are two main types of sampling methods, probability and non probability sampling.

Probability sampling techniques draws randomly from a wider population. There are several types of probability sampling which includes simple random, systematic, stratified, cluster, stage and multi phase sampling methods amongst others (Smith, 2008). Non probability sampling on the other hand involves the researcher targeting a specific and a particular group with the full intention that it might not present the whole population but in that it represents itself (Cohen et al, 2005). Examples of non probability sampling methods include convenience, quota, dimensional, purposive and snowballing sampling (Smith, 2008). In this research a mixture of probability and non probability sampling methods were used. Simple random sampling, stratified sampling, purposive sampling, convenience sampling and snowballing sampling methods were all used in this study.

3.5.1 Simple Random Sampling

In simple random sampling each member of the population under study is randomly selected and each respondent has an equal chance of being selected. The probability of a member of the population being selected is unaffected by the selection of the other members of the population. This ensures independence of samples (Cohen et al, 2005). Most residents at households were randomly selected as respondents for the household questionnaire. Simple random sampling was chosen so as to increase validity. This method was used because it allowed for the researcher to randomly draw respondents from the wider population of Mt. Darwin residents. The researcher also sought to achieve representativeness through using this sampling method.
3.5.2 Stratified Sampling

Stratified sampling involves dividing the population into groups that have similar characteristics. Cohen et al describe it as a useful blend of randomisation and categorisation which allows for both qualitative and quantitative methods to be used in the research (Cohen et al, 2005). 5 streets were selected in each of the four residential areas. Streets were used as sampling grids with at least 10 households being interviewed per street.

3.5.3 Purposive Sampling

Purposive sampling is described to be involving the researcher hand picking the samples so that they fit a particular and specific purpose (Babbie, 2010; Best and Khan, 1993). Smith adds that the sample should be satisfactorily chosen for a specific need in order to increase validity (Smith, 2008). Residents were purposively selected on the basis of the residential area they resided in. This was done so as to obtain data on solid waste disposal services in their specific residential areas. Since there were four residential areas, each residential area had 50 residents interviewed and these interviews were conducted through questionnaires on a household level. Purposive sampling was also used in the central business district where informal traders who used the councils’ solid waste management services like those who offer catering services and fresh produce traders were specifically selected for interviews. EMA and Council officials were also purposively selected as key informants during interviews.

3.5.4 Convenience Sampling

Convenience sampling is also known as opportunity sampling. In this type of sampling the researcher chooses the nearest individuals to serve as respondents and this process is continued until the required sample size is achieved (Best and Khan, 1993). Babbie adds that in this type the researcher can simply choose those respondents to whom he / she has easy access to and this sample does not represent any other group apart from itself (Babbie, 2010). Simple convenience sampling was used when selecting households to interview in a particular street. Most residential suburbs in Mt Darwin are small with a limited number of roads, so respondents were chosen on availability at the time of study.
3.5.5 Snowballing Sampling

In snowball sampling the researcher identifies critical or key informants in which the researcher is interested in. These respondents are used as informants who in turn identify others who also qualify for inclusion in the sample and the process goes on until the desired sample is achieved (Babbie, 2010; Cohen et al, 2005; Smith, 2008). Snowballing was mainly used during focus group discussions and during the process of administering household questionnaires.

The data collected from the residential suburbs from the samples represented some of the views from users of the solid waste disposal services provided by the Pfura Rural District Council. The findings were used to make inferences about the entire population.

3.6 Data Presentation and Analysis

Data was collected from 200 households 50 from each of the four residential suburbs namely Camperdown low density suburb, Pfura high density township, Ridgeview middle density suburb and Kandeya high density township commonly referred to as “KwaMadondo”.

10 questionnaires in total were administered to private companies, shop owners, employees at the government complex and other stakeholders. Employees and officials were interviewed at both the Mt. Darwin and Dotito offices. Focus group discussions were held in the council’s hall and at a local church.

Responses from the questionnaires, interviews and focus groups were pre-coded parameters. They were analysed using the SPSS package and various descriptive statistics generated. After analysis these parameters together with observations and documented evidence gave a reflection of the outcomes and the current status of solid waste management in the study area. These results are discussed in detail in the next chapter.

3.7 Research Ethics

Research ethics refers to the application of important principles that must guide the research process (Stake, 1995). Cohen et al describes ethics to be encompassing individual and communal codes of conduct based upon adherence to a set of moral principles. Research
ethics maintain prohibitions against fabricating, falsifying, or misrepresenting research data. Ethics in research help in the promotion of the truth and when avoiding errors. The ethical aspects discussed in this section highlights objectivity, integrity, privacy, confidentiality, informed consent and voluntary participation amongst other ethical issues.

### 3.7.1 Objectivity and Integrity

Objectivity is described to be the ability to express or give facts or conditions as perceived without distortion by personal feelings, prejudices or interpretations (Cohen et al, 2005). Integrity describes a firm adherence to a code of moral values and proper conduct in research (Stake, 1995). In this study the researcher tried to objectively and accurately record all the responses from respondents without being biased. The researcher did not intentionally falsify or misrepresent research data.

### 3.7.2 Privacy, Confidentiality and Anonymity

During the survey respondents were assured of privacy and confidentiality. The introduction on the questionnaire explained to the respondent that the information supplied was confidential and that it would be used solely for research. Respondents were coded to maintain anonymity. This was important because the research contains information whose unauthorised disclosure could be prejudicial. Freedom from unauthorised use of the respondents’ information therefore was guaranteed.

### 3.7.3 Informed Consent and Voluntary Participation

Respondents voluntarily participated in the research. They had the freedom to decide for themselves if they wanted to respond or not. Informed consent was sought from individuals since the researcher first explained to the respondents the nature and purpose of the study. Personal attitudes, opinions, habits, doubts and fears were freely communicated without coercion.
3.8 Summary

This chapter laid out the methodology used in the study. It also gave descriptions of why some methods like questionnaires, interviews with key informants, focus group discussions and observations were used by the researcher in this study instead of others. The chapter also highlighted the analytical framework, the research design, its development and intentions and the processes used for data analysis amongst other things. It also brought out the strategies and procedures used for acquiring and analysing the collected data. Last but not least ethical considerations were also brought out in the final section of this chapter.
CHAPTER FOUR: PRESENTATION AND ANALYSIS OF DATA

4.0 Introduction
Whilst the previous chapter outlined the geographical location of the study area, the research design, research strategies and data collection methods used in the study, this chapter will do data presentation and analysis. The results are presented and analysed following the order in which research questions and objectives were stated in chapter one.

4.1 Socio-economic profile of respondents in households
The socio-economic aspects discussed here are gender distribution, the status of respondents in a household, the age group categories of respondents, employment statuses of respondents and the number of families that reside at a given house.

4.1.1 Gender distribution of respondents
Both males and females participated in the survey but most of the respondents were females. 67 respondents were men whilst 133 were women. The frequency table below shows the distribution of the male and female respondents in all the residential areas. Females had a higher percentage of 66.5% whilst men constituted only 33.5%.

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>female</td>
<td>133</td>
<td>66.5</td>
<td>66.5</td>
</tr>
<tr>
<td>male</td>
<td>67</td>
<td>33.5</td>
<td>33.5</td>
</tr>
<tr>
<td>Total</td>
<td>200</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 4.1 Gender distribution of respondents
(Source: Survey results, August 2013)

This might have been caused by the fact that during the afternoon when the survey was conducted most men were at work or not at home at that particular time. Below is also cross
tabulation that also shows the gender distribution of respondents in the various residential areas under study. Ridgeview medium density suburb had the most female respondents when compared to other residential areas.

<table>
<thead>
<tr>
<th>Residential Area</th>
<th>Gender</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>female</td>
<td>male</td>
</tr>
<tr>
<td>Pfura</td>
<td>32</td>
<td>17</td>
</tr>
<tr>
<td>Ridgeview</td>
<td>35</td>
<td>14</td>
</tr>
<tr>
<td>Kandeya</td>
<td>32</td>
<td>20</td>
</tr>
<tr>
<td>Camperdown</td>
<td>34</td>
<td>16</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>133</td>
<td>67</td>
</tr>
</tbody>
</table>

Table 4.2 Gender distribution across residential areas
(Source: Survey results, August 2013)

However during the study the researcher also noted that even when a male head of households was available most men referred the questionnaire to their spouses or their daughters.

Respondent 12 [15 August (2015)] substantiated this by explaining that “girls and women are the ones who deal with solid waste in most households. It is the job for us women not men to always make sure that the yard is cleaned. Usually after sweeping as a smart woman you have to make sure that the dirt you collected is properly disposed.”

In this regard it was also noted that the 33.5% male respondents who participated in the survey were mostly students and not the heads of households. This highlights the importance of gender mainstreaming in effective solid wastes management issues because mostly women and young girls are the ones who deal with solid waste disposal and its management at household levels on a daily basis (Jha et al, 2011).
4.1.2 Status of respondents

The status of the respondents described the position of the respondent in the family. Labels included the heads of households, their spouses and children or lodgers who were all labelled as “senior knowledgeable member”. During the survey the researcher asked for the most senior respondents. This was done to increase validity. Most mature and older respondents usually took the researcher more seriously and they gave valuable information. In all the residential areas most respondents were the most senior knowledgeable members of the households as shown in the table below.

<table>
<thead>
<tr>
<th>Status of respondent</th>
<th>Residential area</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pfura</td>
<td>Ridgeview</td>
</tr>
<tr>
<td>Head of household</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>Spouse</td>
<td>15</td>
<td>16</td>
</tr>
<tr>
<td>Senior knowledgeable member</td>
<td>28</td>
<td>24</td>
</tr>
<tr>
<td>Total</td>
<td>49</td>
<td>49</td>
</tr>
</tbody>
</table>

Table 4.3 Tenure status of respondents
(Source: Survey results, August 2013)

Only 19.5% of the total respondents were the heads of the households and 28% were their spouses. 52.5% of the total respondents were senior knowledgeable members. Most heads of households and their spouses at times were not available during the survey because they did not stay at the premises. The houses of most absent landlords were usually leased to tenants and lodgers who pay monthly rentals. Of the 66.5% respondents who were females most of them were female tenants or lodgers whilst some were young maids and school children.

The respondents were grouped into three age categories which were young adults 16 – 24, 25 -34 and the middle aged 35 -49 and the elderly 50 – 64 years category. There were no respondents in the above 65 years old category. Respondent 61 [19 August (2015)] explained this by bringing out that “Mt. Darwin is a town where people come specifically to escape challenges in the communal lands. To survive you have to work because life is tougher nowadays. Most of the elderly go back to their communal areas where they came from when they retire leaving us the young ones working and sending them money to survive in communal areas”.

The 25 – 34 age categories had more respondents compared to other age groups. This category constituted 41.5% of the total respondents. However 59.3% of these respondents were women. The 16 – 24 and the 35 – 49 age groups almost had the same number of total respondents, 27% and 26.5% respectively. The 16 – 24 age categories had more females, 63% whilst the 35 – 49 age category had only 53% female respondents. Below is a cross table that shows gender and the age distribution of respondents in the survey.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Age groups</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>16 - 24 years</td>
<td>25 - 34 years</td>
</tr>
<tr>
<td>Female</td>
<td>32</td>
<td>65</td>
</tr>
<tr>
<td>Male</td>
<td>22</td>
<td>18</td>
</tr>
<tr>
<td>Total</td>
<td>54</td>
<td>83</td>
</tr>
</tbody>
</table>

Table 4.4 Age group and gender frequency table
(Source: Survey results, August 2015)

Respondent 81 [19 August (2015)] explained that “young women are usually married early here in rural communities so they become young spouses. Some girls after failing school usually become maids. These young women and maids are the ones who are usually responsible for household chores. Household chores like washing dishes, cleaning the house and the yard are highly linked to household solid waste generation and management. This is because these activities in most cases are the ones which generate solid waste at household levels.

4.1.3 Employment Status

The employment statuses of the respondents were labelled as employed for those formally employed, self employed for those who were involved in some informal activities that generated income for the respondent, homemakers for full time housewives, students, pensioners and the unemployed who did not have anything that generated income for the respondent.
<table>
<thead>
<tr>
<th>Employment status</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employed</td>
<td>47</td>
<td>23.5</td>
</tr>
<tr>
<td>self employed</td>
<td>80</td>
<td>40.0</td>
</tr>
<tr>
<td>Homemaker</td>
<td>49</td>
<td>24.5</td>
</tr>
<tr>
<td>Student</td>
<td>15</td>
<td>7.5</td>
</tr>
<tr>
<td>pensioner / retired</td>
<td>2</td>
<td>1.0</td>
</tr>
<tr>
<td>Unemployed</td>
<td>7</td>
<td>3.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>200</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Table 4.5 Employment statuses of all household respondents
(Source; Survey results, August 2015)

40% of the respondents were self employed, 24.5% were homemakers, and 23.5% were formally employed with 7.5% being students. Only 3.5% were recorded for the unemployed respondents. According to the statistics from the parliamentary portfolio of Mt Darwin South Constituency, Mt Darwin which is ward 26 is highly populated and is considered to be a fairly urban area which is surrounded by large scale commercial farming areas, communal lands as well as small scale mining activities which are undertaken in the Mukaradzi area which is very close to the business centre (Mt. Darwin South Constituency Profile, 2011; pg 3). People migrate from these commercial farming areas and the communal lands in search of employment in the town centre whilst some come for the small scale gold mining activities. Most people come to Mt Darwin for employment and in search for a better lifestyle than the one that they would normally have in most of the communal areas that surround Mt Darwin. This can help explain why most of the respondents had some form of employment with only Kandeya and Pfura having higher figures for unemployed respondents.

Respondent 17[15 August (2015)] brought out that “we all came to Darwin to look for work. Here in Pfura and Kandeya both being high density suburbs accommodation is fairly cheaper as compared to other residential areas which are medium and low density areas. The unemployed prefer to stay here in Pfura because the rentals are affordable and it very close to town. One can choose whether you want electricity or not. The new houses which have no electricity are always cheaper.”
Figure 4.1 below on the next page shows the employment statuses of the respondents across all the residential areas. The employment statuses closely follow that of a modern suburb in a city where most of the residents are in some form of employment with only a few being unemployed or in search of formal employment.

Figure 4.1 Employment statuses of respondents in residential areas
(Source: Survey results, August 2015)

In addition to the employment statuses following that of an urban style of living, the survey showed that most of the responses at a household in most cases had more than one family residing at a given house. This trend was common for most of the residential areas even in Camperdown a low density suburb. In high densities and medium densities residential areas this was mainly because most of the respondents were tenants and lodgers whilst some were home owners who shared their houses with lodgers. Although most respondents in Camperdown had single families at a house some had lodgers who lived in cottages at their residences.
Kandeya Township had the highest number of households that housed two families whilst Camperdown had almost equal numbers of single and two families living at a household. Ridgeview and Kandeya were the only residential areas that had respondents which had five families or more living at particular house. This was mainly due to the fact that these two residential areas are new and with most residential stands still under construction. These residential areas have some houses which have no electricity because they are not yet connected to the main electricity lines. These two suburbs are also the furthest residential areas from Mt Darwin town centre which houses most crucial services like banks, supermarkets, district offices, schools, vegetable markets and the commuter omnibus rank. As a result of this accommodation in these areas is fairly cheaper for tenants and lodgers when compared to other residential areas. Figure 4.2 below shows the number of families per household in all the residential areas.

![Bar chart showing number of families per household across residential areas](Source: Survey results, August 2015)
The number of families at a household can affect the total quantities of solid waste produced at a household. Waste quantities in turn greatly affect waste disposal methods and strategies employed at household levels. The higher the solid waste quantities produced the more the need for alternative waste management options for disposal (Mapira, 2001). The demographic information collected in the survey showed that Mt Darwin town centre is experiencing high population increases due to migration in search of employment opportunities from surrounding rural communities. A growing population usually translate to increased volumes of waste production thus more waste needing management. This puts pressure on waste management services and facilities which in some cases will be inadequate and already be in short supply (Tevera et al., 2000). The next section looks at the solid waste management system used by the council as well as status of the services available to residents.

4.2 Solid waste management system in Mt Darwin

Statutory instrument 6 of 2007 for Environmental Management (Effluent and Solid Waste Disposal) highlights that those responsible authorities must develop waste management plans that guide their operation in waste management (GOZ, 2007). Pfura District Rural Council is the responsible authority for solid waste management in Mt Darwin. The council is mandated by the Rural District Council Act [29: 13] and the Environmental Management Act [20:27] to provide these services (GOZ, 2002).

The catchment area for the council is wide covering the whole Mt Darwin district which has 40 wards in three constituencies namely Mt Darwin South, Mt Darwin East and Mt Darwin West. According to council officials solid waste management services are provided for some business centres in Mt Darwin West and Mt Darwin South constituencies. This study only focused on ward 26 in Mt Darwin South constituency which house a number of urban like residential areas. Information from council officials indicated that ward 26 is the process of meeting the final requirements needed for it to be formally awarded town status though most residents already refer to it as Mt Darwin Town Centre.

Pfura Rural District Council has a formal solid waste management system that uses curbside collection services. Curbside waste collection involves the collection of wastes at sources where it is generated (Halla and Majani, 1999). In most residential areas respondents
indicated that they place their wastes in bins at the gate of their residence awaiting collection by refuse collection crews. This is usually referred to as curbside waste collection. This is the formal solid waste management system adopted by the council. The cycle highlights the flow pattern or pathway that solid waste follows once generated at source until it is finally disposed. During the survey photographs were collected which showed a variety of waste receptacles used by respondents. Below is a collage of photographs which shows the various types of waste receptacles used by residents.
Council officials indicated that the environmental health division is responsible for solid waste disposal and its management. During interviews with the officials it was established that waste is collected at least once per week in all the four suburbs. Respondents from the household survey confirmed that the council collects waste once a week using curbside waste collection method. The curbside method of collection involves service users having bins which they place at gates or by the roadside for collection by refuse collection teams (Masocha, 2004).
Results from the survey showed that despite the council using this curbside system some residents had no bins at all at their residences. Respondents with no bins at their residences were recorded in all residential areas. Some indicated that they had pits instead, whilst others indicated that their liners were torn awaiting replacements. Others however agreed to illegally dumping paper bags full of wastes in street corners and open spaces. Figure 4.3 below shows the most common type of waste receptacle or refuse bins respondents had at their residential places.

Figure 4.3 Types of refuse bins across all residential areas
(Source: Survey results, August 2015)

As shown on the graph some respondents did not have bins at their residences. Respondent 32 [15 August (2015)] explained that “because we do not have bins, we cannot keep waste at our households we look for areas to dump the waste. We at times openly dumped the waste in open areas and on street corners”.

This creates an informal waste disposal system which is illegal. The supervisor of the environmental health division however did not validate nor deny the existence of such a solid waste management system. Figure 4.4 below shows the solid waste management system used
by the Pfura Rural District council as well as the existence of a parallel informal illegal dumping system.

During the survey the existence of this parallel informal waste collection system was evidenced by the mushrooming of illegal dumps and practices of waste burning as alternative disposal options by service users.

At residences where respondents indicated the availability of bin, the types of bins or waste receptacle available were mostly substandard. Sacks, bin liners and broken buckets were the most common types of bins available at most households. Across all residential areas sacks were the most common type of refuse bins used by most residents. This was despite the fact that council officials provided black bin liners used as bins to almost all the residents. Respondents 34 [15 August (2015)] complained that “the council officials do not change the liners soon enough and their waste collection is erratic so the liners get torn before we get
replacements. We then use our sacks as alternatives. Sacks are much stronger, more durable and can be washed unlike their flimsy bins they give us.”

Respondent 97 [19 August (2015)] added that “the bin liners are not strong and we use them for storage of grains like sugar beans or maize after treatment. Sometimes if we receive many liners we sell them to the tobacco farmers who use them when grading their cured tobacco. Mount Darwin is surrounded by many farming settlements and rural communities and our bin liners are cheaper than those plastic rolls available in shops or at flea markets.”

In Camperdown however most of the respondents had plastic bin liners. This might have been because they have single or only two families residing at each house. Volumes of waste generated might be low compared to other suburbs which house more families at a given residence. Metal and plastic refuse bins were also only found in this residential area. Respondent 168 [21 August (2015)] explained that “most of the residents here in Camperdown are in company houses. It is the employer who owns the houses or they pay rentals on behalf of the employee. The employee in turn is obliged to keep the house in pristine condition. I for example am using the original metal bin used in the 1980s by the whites who used to stay here.”

During the survey it was also noted that the council had a few communal bins or skip bins in the town area though plans were underway to erect some at the new proposed site for the commuter omnibus taxi rank. Officials from the treasury department explained that funding challenges were the ones slowing down the processes of acquiring state of the art community skip bins which will allow for waste segregation. Most of the community bins were made from metal drums and only a few were made of plastic.

One shop owner interviewed in the city centre commended the council for having such metal bins. He explained that “metal bins are durable than the bin liners they used to give us. These bins are better because they are durable can last longer. We need more of them because we produce high volumes of wastes.”

During interviews with council officials the researcher noted that some private companies and other stakeholders had provided the council with these waste receptacles. Some private companies donated these metal bins to the council and this showed the existence of some
private stakeholders’ participation in solid waste management. Labelling of bins also proved to be some good form of advertisements for these companies (Cointreau-Levine, 1994). Partnerships are very important when establishing an effective ISWM since it is not the mandate and responsibility of the council alone, but all stakeholders must participate to ensure the sustainability of ISWM system (Muranganwa, 2013). Field surveys also confirmed the existence of such partnerships and below are photographs of some of the communal bins dotted around the town which bore company logos.

Plate 4.2 Branded metal communal bins in the town area
(Source: Survey results, August 2015)

Most of these communal bins were in the town centre and near the commuter omnibus taxi rank. However during the survey the researcher noted that some areas behind the flea markets, vegetable stalls and some restaurants had no bins so open dumping in open fields and pits was prevalent. Below are some photographs which showed these practices.
4.3 Solid waste collection services in Mt Darwin

The waste collection routes and collection days obtained from the council showed that waste is collected weekly mainly on Mondays, Tuesdays and Thursdays for various residential areas and business centres. However some responses from residents of suburbs like Kandeyya and Ridgeview showed that waste collection is erratic and it does not follow the outlined council’s schedule.

Plate 4.3 Open dumping in fields and pits in the town centre
(Source: Survey results, August 2015)
Sources of the solid waste collected by the council are from various different sources. Household wastes in residential areas, supermarkets and their warehouses, vegetables and the fruit market near the bus terminus and offices and institutions like the district attorney complex which house many government offices being the major sources of solid waste. However acquiring accurate waste quantities of the waste collected by the council was a challenge since both the council and service users do not quantify their waste. Council officials did not have an up to date waste quantification system in place therefore only estimates given by the council officials were used. Below is a pie chart which shows the approximate quantities of solid waste and the types of waste collected from the various sectors that use the council’s solid waste services.

![Waste characterisation and approximate quantities collected](image)

**Figure 4.5 Types of solid waste collected by the council**

(Source: Survey results, August 2015)

The council describes that food waste and paper, cardboard and plastics are the main types of waste they handle during solid waste collection. A large chunk of waste collected was identified to be consisting of paper and cardboard material. This might have been because of the fact that most entities in Mt Darwin provide social services which generates a lot of paper. Supermarkets, banks, district offices, schools and households were identified to be the
highest producers of paper. Food wastes was attributed to the vegetable market, households restaurants and small scale operations that include road side caterers who are very common in the central parts of the town and near the commuter omnibus rank. Most plastics were attributed to be coming from the packaging material from supermarkets, their warehouses, butcheries and households. Very low quantities of metals, rubber and leather were noted. This might have been because there are no industries in Mt Darwin. Industrial activities are usually responsible for large quantities of wastes which include rubber, leather and metals during industrial operations and also during production.

Most of the respondents did not answer the section which asked for solid waste quantities produced at their households. Respondent 153 [20 August (2015)] informed the researcher that “people do not usually quantify our waste at households. Here we can only help you with the estimate number of sacks that we produce per week. In Mt. Darwin collection is weekly so quantities vary from half a sack to a full sack per week depending on our monthly provisions that I buy; but remember things are hard so not much is to be wasted. People do budget their meals in order to survive nowadays.”

The type of waste and the quantities produced can also be used to determine the lifestyle of the owner of the waste receptacle. Many people shun away from quantifying their waste for fear of being labelled as poor or struggling (Senkor, 2013). This together with the fact that others on the other hand are also afraid of being labelled as extravagant or wasteful most respondents therefore did not want to quantify their wastes.

During the survey the researcher noted that only a single tractor is responsible for all the solid waste collection. This shows that low quantities of waste are currently being collected by the council. Environmental health division officials who were part of the refuse collection team confirmed that only one vehicle currently services the whole area of Mt Darwin. During the interviews council officials indicated that there are plans to acquire a new state of the art refuse collection truck to replace the tractor which is old and always in constant need for repairs. Financial constraints and shortages of spares for repairs were cited as the major challenges that rocked the environmental division.

Safety, Health and Environment officials at the council agreed that intervention strategies might be successful if adopted now for lower quantities than to wait until the council handles
larger solid waste quantities. She added that measures should be adopted that ensure efficient solid waste management because the population of the town is projected to increase and pressure is set to be exerted onto the already strained SWM system.

Across all the residential areas it was noted that instead of open dumping some respondents preferred to burn their wastes if it was not collected. 26.5% of the total respondents preferred to burn their waste if it was not collected. They indicated that they burnt their waste once their receptacles were full. Most of these respondents were from Kandeya and Pfura townships. Respondent 27 [15 August (2015)] highlighted that “here in high density areas the stands are so small and so most houses do not have a pit at their residences. As soon as the bin is full we burn the waste to prevent rodents.”

45% of the respondents across all the residential areas had pits dug for temporary storage. These pits were also said to be frequently burnt as a way of managing the waste. Residents from Camperdown and Ridgeview on the other hand indicated that they have pits at their residences. Since these are low and medium density residential areas one might conclude that spaces are available at their houses to construct pits. However the practice of burning waste causes air pollution because it affects the quality of air in the area (Tevera et al, 2000).

The total number of houses that had pits was high for all the respondents. This shows that this is the most preferred method of disposal if waste is not collected. The table below shows the total number of respondents across all residential areas and the alternative methods they preferred to dispose of waste when their garbage was not collected.
Table 4.6 Alternative solid waste disposal methods of uncollected waste
(Source: Survey results, August 2015)

<table>
<thead>
<tr>
<th>Residential area</th>
<th>Method of disposal if not collected</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Burn</td>
<td>open space dumps</td>
</tr>
<tr>
<td>Pfura</td>
<td>20</td>
<td>11</td>
</tr>
<tr>
<td>Ridgeview</td>
<td>8</td>
<td>19</td>
</tr>
<tr>
<td>Kandeya</td>
<td>15</td>
<td>21</td>
</tr>
<tr>
<td>Camperdown</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>53</strong></td>
<td><strong>57</strong></td>
</tr>
</tbody>
</table>

Open space dumping was the second most preferred way of disposing off uncollected waste. Kandeya and Ridgeview had the highest numbers of respondents who openly dumped their wastes. This might be because these are new residential areas with many incomplete stands as well as many open spaces. In these areas open spaces dumping might have been easier because it was common to see that some houses were near unconstructed spaces which were either left open or used for cultivation as maize fields during the rainy season.

Field observations also confirmed the existence of such a parallel informal solid waste management system that involves open dumping of solid waste. This parallel system was responsible for the mushrooming of illegal waste dumping areas which were noted in a number of areas across the study area. Even though pits were the most preferred method of disposal by most residents, open space dumping however was also noted across all the residential areas and the number of respondents who used this system of waste disposal was quite significant. Figure 4.6 below shows the alternative waste disposal methods preferred by the respondents across all the residential areas.
During the survey and field observations also confirmed the existence of open dumping. Dumps in open spaces were noted by the researcher across some street corners and intersections as well as in some open spaces behind some shops. Some wastes were dumped under the bridge just outside Mt Drawin on the Mt Darwin – Dotito main road. Most residence that lives in Ridgeview and Kandeya use the dust roads that pass through the bridge area on their way to town and back. Consequently these dumping areas are easily accessible but most residents in these suburbs. Many respondents in Kandeya and Ridgeview admitted to openly dumping their waste in these open spaces if it was not collected.

During interviews council officials acknowledged the existence of some illegal dumping areas but they maintained that the situation was not out of control. However survey results and field observations showed that the existence of illegal dumps is a wide spread
phenomenon even in the central parts of the town area. Areas of concern were behind the vegetable markets, road catering spaces and behind most of the shops. Below is a collage of some of the photographs collected by the researcher during field observations which showed illegal open dumping of solid wastes in some open spaces near residential areas and behind some supermarkets.

Plate 4.4 Some open space dumps in Mount Darwin
(Source: Survey results, August 2015)

Residents were not the only ones affected by erratic waste collection but shop owners and other service users also in the town area complained that most of the community bins at their premises were not regularly collected. Most of the respondents revealed that they end up burning their wastes. Below are photographs which show some overflowing communal bins full of waste not being collected.
In the light of the survey results, the solid waste disposal system currently used by the council leaves a lot to be desired. A lot of improvements are needed so as to achieve a proper and efficient solid waste management system. 41.5% of the respondents described the services
offered by the council as very dissatisfactory 38% described the services as being fairly satisfactory. Figure 4.6 below shows that most of the respondents regarded the council’s services as very dissatisfactory and fairly satisfactory whilst a smaller proportion indicated that it is satisfactory. This then puts pressure on the council as service providers to improve their services if effective waste management is to be achieved.

Figure 4.7 Respondents’ views towards the services offered by the council

(Source: Survey results, August 2015)

More than 50% of the respondents in the town area indicated that because the waste collection services offered by the council are not satisfactory they end up burning their waste to avoid litter. During the survey it was noted that most of the burning is done at night because during the day people usually complain about pollution and this can affect their customers so they prefer burning the waste at night. Respondents 119 [21 August (2015)] a restaurant owner highlighted that “unlike our counterparts the supermarket and shop owners who can burn their waste organic waste is difficult to burn so we end up disposing our waste in pits or in the open spaces where the waste can decompose. However this has led to increases the challenges of mosquitoes, rodents, vermin and odours but we do not have a choice because the council is letting us down by not collecting the waste.”
Below are some photographs which show some of the waste being openly burned in the community bins and in illegal dumps and open spaces in the town area.

Plate 4.4 Ashes in open spaces and burning of waste in the community bins
(Source: Survey results, August 2015)

4.4 Prospects for ISWM

Almost all of the respondents indicated that they do not have alternative uses for their wastes. Discussions during focus groups also showed that residents did not employ any alternative methods of solid waste disposal such as resource reuse and recycling. Apart from waiting for the council to collect all of their waste some respondents however indicated that they are eager to learn proper composting since they have vegetable gardens at their residences.

Less than 10% of the participants in focus group discussions indicated that they had tried composting but the composts ended up producing bad odours from the decaying materials. More than 35% indicated that they end up burying the waste when their pits fill up instead of making composts because they do not how to properly compost their waste. Less than 3% indicated that they recycle. Most of those respondents who recycled explained that they mainly recycle plastic bags. They attributed this to the fact that most of the supermarkets are
now selling plastic bags to consumers therefore to save money they reuse plastic bags. There were no respondents recorded who sold paper or plastics as alternative uses for waste. Figure 4.7 below shows that most respondents do not recycle or reuse their wastes.

Figure 4.8 Alternative uses for solid waste
(Source: Survey results, August 2015)

Most of the respondents were open to the idea of generating income from their waste through the sale of paper and plastics. They however expressed that they need to be linked to the market and the buyers and that the services need to be very efficient since keeping paper and plastics at their residences for long periods might be a challenge.

It was noted that the council mostly preferred waste disposal over other options. The council had no recycling or resource recovery infrastructure. Availability of such equipment would have enabled the separation of waste at source and before final disposal. The disposal system used by the council did not allow for the diversion of waste streams in a way that can aid material recovery during waste collection or during final waste disposal (Robinson, 1986).

The waste collected was not segregated before collection. It was all mixed in the truck and compacted before disposal. Crude tipping and open burning were the most preferred methods they used in their solid waste management system. Crude tipping is a method in which waste
collected is merely mechanically tipped or dumped. Since most of this waste is left in the open, this is the cheapest method for waste disposal (Masocha, 2004). The head of the environmental health department however indicated that they have a designated area for a proposed landfill. Environmental Impact Assessments for the landfill area have already been done and the council is in the process of acquiring licensing from the Environmental Management Agency. He cited financial constraints to be hampering progress. He explained that they still have to meet some of the legal obligations and requirements that are needed to acquire the licence.

Land filling is a better option that involves spreading waste into thin layers and then compacting the waste. The waste is compacted to reduce its volume. The compacted waste is periodically covered with soil at regular intervals. This method can successfully prevent odours whilst at the same time posing minimum environmental damage (Masocha, 2004).

The council CEO indicated that they might consider partnerships with paper or plastic recycling companies or stakeholders who will establish waste buy back facilities. They however insisted that the companies should be stationed in Mt Darwin or their processing plants so that the locals could get employment instead of sending delivery trucks which only collects the waste with residents not benefitting much from such endeavours.

4.4 Summary

This chapter gave a detailed analysis and description of the collected data in the survey. The research results are presented in various forms that include photographs, tables and graphs amongst others. Quotes from some of the respondents’ interviewed in the study were also included so as to give insights and explanations into the results obtained during the survey.

Whilst this chapter succeeded in giving a detailed analysis of the survey’s results, the next chapter seeks to highlight the major findings, give possible recommendations for an effective ISWM and the conclusion to the study.
CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

This chapter provides conclusions drawn from the survey results analysed and discussed in the previous chapter. It also gives recommendations for adoption that might help in effective implementation of ISWM systems for solid waste management.

5.1 Conclusion

The study sought to establish the status of the current solid waste management system employed by the Pfura Rural District Council, constraints and potential options for enhancing the SWM system and the opportunities for ISWM and community participation in the SWM system adopted in Mt. Darwin.

The solid waste management system currently used by the council involves curbside collection of household waste as well as community bins in the town area. This system leans towards waste generation by service users, collection by the council refuse collection team, transportation and disposal in an open dumpsite which is not fenced. Compacting of the collected waste and open burning are the most common methods employed to manage the dumpsite.

This system is effective if implemented correctly. However during the survey it was noted that the council is riddled with a number of challenges which are making the waste management system unreliable and unsustainable. This has given rise to an informal illegal parallel system which involves open space dumping and uncontrolled burning of the waste.

As a rural district council the challenges peculiar to them included inadequate skilled personnel, insufficient budgetary allocations, poor revenue collection strategies and shortages of appropriate equipment such as refuse trucks as well as spare parts to fix those which are grounded. Currently a refuse tractor is being used for waste collection and transportation. Few waste treatment options are also being employed to manage the collected waste. Compacting and open and uncontrolled burning without resource recovery is currently being used by the council. Other options are more expensive and plans to construct a proper landfill
are still a costly pipe dream for the rural district council which is struggling. Growing pressure on outdated infrastructure and refuse collection trucks is also a major challenge.

The main shortcoming of this system is that it does not give much attention to solid waste management at the source. Waste reduction and recycling options can be made available to the consumers so much that they can make conscious decisions to reduce or segregate their waste at source before it is collected. Another challenge was that the waste receptacles provided by the council were black bin liners which were not durable. Replacement took longer so much that the residents had to use alternatives such as sacks, broken buckets and plastic bags which were usually thrown off at the open space dumping areas.

In as much as the council had a clear SWM system it was tarnished by inconsistencies and irregular collection which again contributed to open waste dumping and open uncontrolled burning of community bins in a bid to avoid litter. Inadequate waste services lead to unpleasant living conditions and a polluted and unhealthy environment. Given that a growing population trend and increased economic activity is expected once the study area achieves town status this means that increased volumes of waste are going to be generated. This puts more pressure on the already in short supply waste management services and facilities. Also there is increased complexity of the waste streams because of increased economic activities and urbanisation. This creates the need for waste to be segregated at the source hence the adoption of the ISWM system which focuses on stakeholders participation.

Findings from the study also showed that most of the respondents were mere consumers of waste disposal services. There is little stakeholder participation in the current SWM system. The fact that consumers pay for waste management means that they have a right to demand better service delivery. In addition participation by the stakeholders who are generators of the waste is vital for waste reduction initiatives and waste segregation as well as promoting behavioural change that promotes recycling and reuse of wastes at source. These are important aspects of an effective ISWM system. RDCs cannot do it alone; their actions alone cannot be effective. It requires coordinated action by many players, including households, businesses, community organisations, NGOs, parastatals, the government and other major stakeholders like EMA. This means that a consultative and partnership based approach is essential for realising an effective ISWM system.
5.2 Recommendations

After the study the researcher identified several gaps which can be filled through the following recommendations.

An ISWM system should be adopted by the council. This system offers an integrated and holistic approach which can easily regularise the waste collection process. Councils are the primary providers of waste collection and disposal services, establishing an effective system of ISWM system at local level must be a priority. ISWM is effective and it favours waste avoidance, reduction, resource reuse and recycling as main objectives with little treatment and disposal. This not only can greatly reduce financial constraints for the council but can generate income for it through recycling.

Community and stakeholders’ participation is also recommended. The council can hold awareness campaigns as well as educational activities and initiatives that teach service users source segregation, waste reduction and the 3R practices (reduce, reuse and recycling). All solid waste services users need to see waste management as their responsibility as well not just the mandate of the council. Partnerships around effective waste management must be encouraged and strategies and initiatives to improve solid waste management adopted by all. Some cleanup campaigns should also be encouraged to promote the removal of litter as well as in fostering responsible behaviour in the community.

The Pfura Rural District Council also requires adequate infrastructure to enable re-use, recycling and proper land filling. Material recovery facilities and buy-back centres can be established in different areas in Mount Darwin for example in front of all the major supermarkets, the people’s vegetable market and at the commuter omnibus taxi rank. The Council can also provide spaces to sort waste into re-useable and recyclable waste or provide labelled community bins for recyclable materials like plastics, cans and paper. Community based organisations can be established for managing the bins. This can create employment for the community as well as generate revenue for the council through rentals, taxes and service charges.
For waste types that cannot be re-used or recycled, various options exist for energy recovery which can include biogas projects since the town is surrounded by communal areas, communal composting of organic wastes from restaurants and vegetable markets and methane gas recovery from landfills.

Pfura Rural District had no clear set out regulations set out for solid waste management and disposal. They also did not quantify their waste. Council by-laws are important in that they set service standards for separating, compacting, and storage. On the other hand a viable waste quantification system is important because solid waste management planning requires accurate information on waste flows. The council should have a comprehensive ISWM plan that have realistic set targets and goals set out as indicators which can be changed from time to time. This can help in measuring progress made towards ISWM as well as highlighting challenges and areas of improvement.

Better enforcement of existing bylaws locally by the council as well as at national level should be a must for better enforcement. The SWM plan of the council did not include measures to remediate contaminated land in the current dumpsite after they have finished constructing the new landfill. Remediation plans are a must for effective ISWM and compliance monitoring by EMA and other stakeholders is also very important for proper and reliable ISWM system. The formulation process of a national ISWM Policy should be expedited so that all stakeholders will have a blueprint for action.

5.3 Summary

This chapter gave a short summary of the findings and conclusions drawn from this study. Finally it gave recommendations for adoption by the Pfura Rural Council which are drawn based on the general findings and conclusions. These recommendations seek to tackle the challenges of solid waste management currently experienced in the study area.


**Internet sources**


**Journals and Articles**


Documents


**Reports**


APPENDIX I

QUESTIONNAIRE FOR HOUSEHOLDS

A SURVEY ON SPATIAL, ENVIRONMENTAL AND SOCIAL ECONOMIC IMPACTS OF SOLID WASTE DISPOSAL IN MOUNT DARWIN, PFURA RURAL DISTRICT COUNCIL.

My name is Prudence Tambura, I am a Msc in Natural Resources and Environmental Sustainability student with the Bindura University of Science Education. As part of my studies I am required to undertake a research study in partial fulfilment of the requirements of the above mentioned degree program. The title of this study is INTEGRATED SOLID WASTE MANAGEMENT WITHIN RURAL DISTRICT COUNCILS: A CASE STUDY OF PFURA RURAL DISTRICT COUNCIL, MOUNT DARWIN.

The information supplied will be treated with confidentiality and used for academic research purposes only. Please feel free to participate in this research.

Residential suburb ...........................................................................................................................................

Status of the respondent in the household

| Head of household | | |
| Spouse | | |
| Senior knowledgeable member | | |
| Other (Specify) | | |

SECTION A. DEMOGRAPHIC AND SOCIO – ECONOMIC DATA

16 – 24
1. Gender of respondent

| Male | Female |

2. Age Category

| 25 – 34 | 35 – 49 | 50 – 64 | 65+ |

3. What is the tenure status of your household?

| Owner / Purchaser | Tenant | Lodger | Tied accommodation | Other (specify) |

4. Employment status of respondent

| Employed | Self employed | Homemaker | Student | Pensioner / Retired | Unemployed |

5. How long have you lived in this town?

…………………………………………………………………………………………………………………………

6. How many people usually live in this household?

……………………………………………………………………………………………………………………………………

**SECTION B. QUESTIONNAIRE DATA**

7. Do you have a bin at your house?

| Yes | No |

8. If yes what type is your bin?


9. How much waste do you produce in your household?

……………………………………………………………………………………………………………………………………

10. How often is the waste collected?

……………………………………………………………………………………………………………………………………
11. What do you do if your waste is not collected? ..................................................

.................................................................

12. Do you have alternative uses for your waste? Yes / No.  ............................

13. Do you earn an income from selling your waste?  

| Yes | No |

(Please indicate the estimated weekly volume / quantity of solid waste that you generate.)

<table>
<thead>
<tr>
<th>Type of waste</th>
<th>Estimated volume</th>
<th>Other uses</th>
<th>Average weekly income raised (if sold)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. food waste</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. paper/ cardboard</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. plastics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. glass</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. metals</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. ceramics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. rubber / leather</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. wood</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. other (specify)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

14. How would you describe the quality of solid waste disposal services provided by the council? (Please give reasons.)

<table>
<thead>
<tr>
<th>Description</th>
<th>Reasons</th>
<th>For official use 1.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very satisfactory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfactory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dissatisfactory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very dissatisfactory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neither satisfactory nor dissatisfactory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do not know</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
15. If you are not satisfied with quality of solid waste disposal offered, what do you suggest should be done to improve solid waste management by the authorities and / or service providers?

…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………

16. What are the key environmental problems associated with solid waste disposal in your area? (Please rank in order of importance)

<table>
<thead>
<tr>
<th>Environmental problems</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. odours</td>
<td></td>
</tr>
<tr>
<td>2. visual blight (litter)</td>
<td></td>
</tr>
<tr>
<td>3. water contamination (leachate)</td>
<td></td>
</tr>
<tr>
<td>4. solid contamination</td>
<td></td>
</tr>
<tr>
<td>5. other (specify)</td>
<td></td>
</tr>
</tbody>
</table>

17. Would you consider other methods of treating your waste before disposing it?
   b). if yes what are you prepared to do as your alternative waste treatment methods?

…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………

THANK YOU FOR YOUR TIME AND FOR THE INFORMATION
APPENDIX II

INTERVIEW GUIDELINES FOR PFURA RURAL DISTRICT OFFICIALS

1) What do you understand by the term solid waste management?
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   ....................................................................................................................................................
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2) What is your catchment area in terms of the provision of solid waste disposal services in Mt.
   Darwin and how much do you charge for these services?
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3) Do you have solid waste management system in Mt. Darwin? If yes how does it work and
   how is it financed?
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   ....................................................................................................................................................
   ....................................................................................................................................................

4) How is solid waste collected and how often is it collected?
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   ....................................................................................................................................................

5) What constitutes the solid waste that you collect and do you separate if before final
   disposal?
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   ....................................................................................................................................................

6) How many are employed for refuse collection and their qualifications?
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7) Does the RDC have a designated & licensed area to dispose off the collected solid waste?
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   ....................................................................................................................................................

8) How is the area managed?
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   ....................................................................................................................................................

9) Do you understand the option of ISWM?
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   ....................................................................................................................................................

10) What ISWM practices or initiatives have you adopted as council?
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   ....................................................................................................................................................
11) Are these ISWM initiatives effective? If YES explain how, and if NO, why not?
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12) What are the guiding legislation, policies and bylaws that govern your activities as a provider of solid waste disposal services?
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13) Are you meeting all the requirements of the above mentioned legislation, policies and bylaws? If YES how are you managing this and if NO, why?
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14) Are there any regulations or policies in Zimbabwe that specifically govern ISWM?
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15) Are you implementing those policies? Why or Why not?
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16) What are the strengths, weaknesses and/or gaps of these guiding policies?
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17) What SWM challenges are peculiar to you as a rural council, when you compare your operations against those of your urban counterparts?
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18) Which measures have you taken to combat these solid waste disposal challenges in your area?
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19) How are these measures beneficial to the management of solid waste and the environment in Mt. Darwin?
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20) Which stakeholders do you work with in solid waste management (current and potential stakeholders)?
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21) How have these stakeholders been involved in solid waste management issues?
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22) Are these partnerships effective? If NOT what do you think should be done to make them effective?
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23) Do you carry out campaigns to raise awareness towards waste management?
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24) How are women and children involved in these campaigns?
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25) What are your future plans as a council towards solid waste management?
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26) Additional information or comments.
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THANK YOU FOR YOUR TIME AND COOPERATION
APPENDIX III

INTERVIEW GUIDELINES FOR EMA OFFICIALS

1) How do you define solid waste management?
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2) What is your catchment area in terms of the provision of solid waste disposal services and what kind of services do you provide?
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3) Does the Pfura Rural District have a solid waste management system in Mt. Darwin? If yes do you know how it works?
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4) How is solid waste collected in Mt. Darwin and how often is it collected?
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5) Do you know what constitutes the solid waste collected in Mt. Darwin (waste types)?
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6) Does the RDC have a designated & licensed area to dispose off the collected solid waste?
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7) Is the place properly managed to sustainably fulfill its purpose?
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8) Does the Solid Waste Management system conform to EMA standards?
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9) If No, what are your recommendations?
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10) Are these ISWM initiatives effective? If YES explain how, and if NO, why not?
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11) What are the guiding legislation, policies and bylaws that should govern activities of solid waste disposal service providers?
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12) Are they meeting all the requirements of the above mentioned legislation, policies and bylaws? If YES how are they managing this and if NO, why?
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13) Are there any regulations or policies in Zimbabwe that specifically govern ISWM?
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14) Are these policies being implemented? Why or Why not?
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15) What recommendations would you give for ISWM to solid waste disposal service providers?
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THANK YOU FOR YOUR TIME AND COOPERATION
APPENDIX IV

Observation Guidelines

Is there waste dumped in alleys or in open spaces?
Is waste left on the streets corners or vacant land?
Is there waste dumped in water bodies or streams?
How far are the waste dumps from residential areas?
Do people try to avoid the waste heaps?
Are there waste scavengers on illegal waste disposal sites?
Do children play around the illegal waste disposal sites?
Do dogs and other pets scavenge for food on these illegal waste heaps?
Are there communal waste collection areas?
Is waste regularly collected in these communal waste disposal sites?
Do people burn their waste? if yes Why?
What are the main components of the waste dumped in the open spaces?

Field notes and photographs will be used to record or capture some observations.
# APPENDIX V

**QUESTIONNAIRE FOR OTHER SOLID WASTE DISPOSAL SERVICES USERS**

**A SURVEY ON ENVIRONMENTAL AND SOCIAL ECONOMIC IMPACTS OF SOLID WASTE DISPOSAL IN MOUNT DARWIN.**

*Name of service users / entity*  
………………………………………………………………………………………………………………

*Status of the respondent in the entity*

<table>
<thead>
<tr>
<th>Status</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Head of entity</td>
<td></td>
</tr>
<tr>
<td>Spokesperson</td>
<td></td>
</tr>
<tr>
<td>Senior knowledgeable member/ employee</td>
<td></td>
</tr>
<tr>
<td>Other (Specify)</td>
<td></td>
</tr>
</tbody>
</table>

## SECTION A. DEMOGRAPHIC AND SOCIO – ECONOMIC DATA

1. *Gender of respondent*  
   
2. *Age Category*  
   
<table>
<thead>
<tr>
<th>Age Category</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>16 – 24</td>
<td></td>
</tr>
<tr>
<td>25 – 34</td>
<td></td>
</tr>
<tr>
<td>35 – 49</td>
<td></td>
</tr>
<tr>
<td>50 – 64</td>
<td></td>
</tr>
<tr>
<td>65+</td>
<td></td>
</tr>
</tbody>
</table>

3. *What is the tenure status of your entity?*

<table>
<thead>
<tr>
<th>Tenure Status</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Owned / Purchased</td>
<td></td>
</tr>
<tr>
<td>Tenant</td>
<td></td>
</tr>
<tr>
<td>Other (specify)</td>
<td></td>
</tr>
</tbody>
</table>

4. *Brief description of activities undertaken by the entity*

 ....................................................................................................................................................
 ....................................................................................................................................................
 ....................................................................................................................................................

5. *How long have you been operating at this premises?*

 ....................................................................................................................................................

....................................................................................................................................................
SECTION B. QUESTIONNAIRE DATA

6. Do you have a bin at your premises?  

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

7. If yes what type is your bin?  


8. Approximately how much waste do you produce at your premises?  

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9. How often is the waste collected?  

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10. How do you dispose of your waste if it is not collected?  

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........................................................................................................................................................................................................

11. Do you have alternative uses for your waste? Yes / No.  

(If yes complete the other uses section in the table below)

12. Do you earn an income from selling your waste?  

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

(Please indicate the estimated weekly volume / quantity of solid waste that you generate.)

<table>
<thead>
<tr>
<th>Type of waste</th>
<th>Estimated volume</th>
<th>Other uses</th>
<th>Average weekly income raised (if sold)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. food waste</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. paper/cardboard</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. plastics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. glass</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. metals</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. ceramics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. rubber/leather</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
12. How would you describe the quality of solid waste disposal services provided by the council? (Please give reasons.)

<table>
<thead>
<tr>
<th>Description</th>
<th>Reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very satisfactory</td>
<td>1.</td>
</tr>
<tr>
<td>Satisfactory</td>
<td>2.</td>
</tr>
<tr>
<td>Dissatisfactory</td>
<td>3.</td>
</tr>
<tr>
<td>Very dissatisfactory</td>
<td>4.</td>
</tr>
<tr>
<td>Neither satisfactory nor dissatisfactory</td>
<td>5.</td>
</tr>
<tr>
<td>Do not know</td>
<td>6.</td>
</tr>
</tbody>
</table>

13. If you are not satisfied with quality of solid waste disposal offered, what do you suggest should be done to improve solid waste management by the authorities and / or service providers?

…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………

14. What are the key environmental problems associated with solid waste disposal in your area? (Please rank in order of importance)

<table>
<thead>
<tr>
<th>Environmental problems</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. odours</td>
<td></td>
</tr>
<tr>
<td>2. visual blight (litter)</td>
<td></td>
</tr>
<tr>
<td>3. water contamination (leachate)</td>
<td></td>
</tr>
<tr>
<td>4. solid contamination</td>
<td></td>
</tr>
<tr>
<td>5. other (specify)</td>
<td></td>
</tr>
</tbody>
</table>

16. Would you consider other methods of treating your waste before disposing?

b). If yes, what are you prepared to do?

THANK YOU FOR YOUR TIME AND FOR THE INFORMATION