AN INVESTIGATION OF SOLID WASTE MANAGEMENT PRACTICES: THE CASE OF THE CHATSWORTH TOWNSHIP IN METROPOLITAN DURBAN - KWAZULU-NATAL

by

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DECLARATION

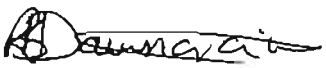
The Registrar Academic

University of KwaZulu-Natal **December 2004**

I, REENA BIPRAJ DAWNARAIN (Reg. No. 9504210) hereby declare that the dissertation entitled:

"An investigation of solid waste management practices: the case of the Chatsworth township in Metropolitan Durban, KwaZulu-Natal"

is the result of my own research and has not been submitted in part or full for any other degree or to any other University



29/03/2005

R B Dawnarain **Date**

DEDICATION

To the Almighty who gave me the strength to complete this research

and

to my three beautiful children: Parun, Giresh and Prakashan
for their endless support, encouragement, sacrifices and patience
throughout my studies.

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ABSTRACT

Solid waste management is a global phenomenon that presents one of the most immediate and serious challenges in developing urban areas. Chatsworth is a formal residential township and is a product of the apartheid system, where solid waste removal was not seen as a priority. The inefficient waste management system has resulted in environmental degradation with solid waste increasingly being disposed off in streets, open spaces and streams etc. Waste heaps are becoming the breeding places of insects and pests and potential health hazards. Moreover, the aesthetics of this formal residential area is lost due to bad odour, unsightly dumpsites and deterioration of the environment.

With most residential areas in South Africa having formal waste removal services, the continued existence of illegal dumps is still a serious problem. In the light of the above, the aim of this study was to investigate the solid waste management practice in Chatsworth and its negative impact on the human and natural environments. The social dimensions, perceptions, attitudes and solid waste practices of households were investigated to examine the relationship between socio-economic status and current waste practices. A survey assessment was conducted by means of a questionnaire designed to get community opinions and understanding of the type of service they received from the municipality. One hundred questionnaires were administered to householders in the study area. The study was complemented with semi-structured interviews with specific people of interest. The Statistical Package for Social Scientists was used for data entry and analysis.

The findings of this study indicated that the waste collection system is inefficient and the attitudes, perceptions and socio-economic characteristics are significant factors contributing to effective waste management practices. Appropriate policy backed by legislation and enforceable regulations must underpin the strategic alternatives selected to deal with waste management in the eThekwini Municipality. The planning of integrated waste management should be seen as part of the solution of waste management and waste management should be appreciated as a public service that provides employment, resource recovery, and safe disposal of hazardous waste, reduced pollution and community development projects.

ACRONYMS

CDW	Community Development Worker
CONNEP	Consultative National Environmental Process
DA&EA	Department of Agriculture and Environmental Affairs
DANCED	Danish Co-operation for Environment and Development
DEAT	Department of Environmental Affairs and Tourism
DEP	Doorstep Environmental Program
DPLG	Department of Provincial and Local Government
DSW	Durban Solid Waste
DWA&F	Department of Water Affairs and Forrestry
EECF	Environmental Education Curriculum
EIP	Educational Institutions Programme
EMA	eThekwini Municipal Area
IPC	Integrated Pollution control
IP&WM	Integrated Pollution & Waste Management
IWM	Integrated Waste Management
KDBA	Keep Durban Beautiful Association
KWANALOGA	KwaZulu-Natal Local Government Association
MSW	Municipal Solid Waste
NEMA	National Environmental Management Act
NWMS	National Waste Management Strategy
NWMSI	National Waste Management Strategy Implementation
PAYT	Pay As You Throw
RCA	Regional Customer Assistant
SWM	Solid Waste Management
SWMP	Solid waste Management Plan
USEPA	United States Environmental Protection Agency
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UCD	Urban Community for Dakar
USN	Urban Sector Network
WM	Waste Management
WRC	Water Research Council
WHO	World Health Organisation

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CHAPTER ONE

INTRODUCTION AND CONTEXTUALISATION OF PROBLEM

1.1 PREAMBLE

The environment is a global concern and its protection is one of the major challenges facing humans today. Some of the persistent environmental issues include: acid rain; ground-level ozone and smog, air borne toxins; groundwater pollution; hazardous waste dumps and solid waste disposal. There is a growing realization that human activities increasingly are threatening the health of the natural systems that support life forms on our planet.

The Exxon Valdez disaster of 1989 sparked public concern over the effects of human activity on vulnerable ecosystems when a thick blanket of crude oil coated the shores and wildlife of Prince William Sound in Alaska. Some of the negative impacts of this incident included: loss and injury off marine life such as fish, dolphins, whales and penguins and damage to cargo ships (Zeff, 1994). Between 1347 and 1357 an estimated 25 million Europeans out of a total population of 80 million perished due to the Black Death Plague. This plague, a consequence of the dumping of disease infected corpses by the Chinese Army, apart from contributing significantly to the death toll, also caused very serious social upheavals. Loss of life, poverty, food shortage, illnesses and diseases, bankruptcy and unemployment were *inter alia*, some of the impacts of the plague. Toxic waste dumped in Malaysia from Western Countries, in exchange for hard cash impacted severely on people residing in close proximity to the nuclear waste dumps. Miscarriages and general ill-health characterized these countries. In the early 1980's the highest infant mortality rate was recorded in Malasia (Weir and Porterfield, 1992). The recovery of mercury from toxic waste by Thor Chemicals (Cato Ridge-South Africa) has impacted negatively on the health of its employees and those living in close proximity to the plant. Many workers were diagnosed and treated for mercury poisoning. In some instances workers did not recover from being in a comma. One third of the workers suffered from pneumonia, tuberculosis, emphysema, and other respiratory sicknesses (Albertyn, 1993).

The developing world is in the middle of a surge in the level of population, with latest UN projections suggesting that global levels might reach thirty billion by the end of the twenty-first

century (Institution of Civil Engineers Infrastructure Policy Group, 1990). Population growth imposes high costs on the environment–the pollution of aquifers; the destruction of wetlands; the crowding of shorelines; the loss of wildlife habitat; and the loss of special places, such as historic structures or areas that give a community a sense of identity. Global environmental issues inevitably have become the principal focus in international relations. The single overriding issue facing the world community today is to achieve a sustainable balance between growing human populations and the earth's natural systems. The expanding human populations of developing countries are seriously weakening the earth's resource base. Rampant deforestation, eroding soils, spreading deserts, loss of biological diversity, the destruction of fisheries, and polluted and degraded urban environments threaten to spread environmental impoverishment, particularly in the tropics, where human population is the greatest (Zeff, 1994).

The environmental problem that comes closest to home for most of the people universally is the problem of waste. Communities, all over the world, are wrestling with the problem of waste disposal. Landfill sites are rapidly filling to capacity. No one wants a trash and refuse dump near their home. Solid waste management is from many perspectives, an international mission. Pollutants and emissions do not know of any borders, they move from one country to other causing environmental problems (Zeff, 1994). Examples of impacts of these pollutants are: Brazil's Atlantic Forest, one of the world's most diverse and threatened ecosystems which were known in the 1980's as the Valley of Death. The river that entered the valley served as a source of water and a convenient place to dump wastes for industries like steel, petroleum, fertilizer, and chemicals to turn imported heavy raw materials into finished products. Industries also spewed out a 1 000 tons of pollutants into the air everyday. The city recorded the highest infant mortality rate in the early 1980's. In 1984, the Cubatao River in Brazil was basically dead from organic pollution. Downstream from Cubatao, tons of heavy metals accumulated in bottom sediments and washed into the sea near Santos. Above the valley, fallout from air pollution began killing the Atlantic Forest, denuding the mountainsides. Finally in 1985, the crisis became a catastrophe, as heavy rainfall broke large ammonia pipelines in Vila Parisi, releasing gas that injured and killed 850 people (Tietenberg and Wheeler, 2003). In Mexico, the burning of waste in brick industries produce smoke from combustion of scrap wood, old tyres, used motor oil, and sawdust laden with toxics. Most brick-makers live near their work sites. Forty

percent of the households reported the death of at least one child. The brick factory posed numerous air pollution hazards for their neighbours, from fine particles and carbon-monoxide and also from volatile organic compounds, nitrogen-oxide, sulphur-dioxide, and heavy metals (Petzinger, 2002).

Solid waste disposal has become a crucial issue emanating from the high level of consumption of the world's resources. Refuse, until fairly recently, was mostly food waste but new materials such as plastics, new packages for products such as beer cans and polystyrene disposable food containers have all changed the composition of municipal solid waste. Industry creates about 2000 new products each year, all of which eventually find their way into municipal refuse and contribute to individual disposal problems (Vesilind and Peirce, 1983). It is only by working together from an international perspective that we can influence the producers to take responsibility for a product throughout its entire life cycle and develop ways of handling produced waste in such a way that the trans-boundary movement of emissions and the negative impact on the environment is minimized (Rylander, 1998).

1.2 INTERNATIONAL WASTE TRENDS

According to Michael (2001), the United States alone produces more than 230 million tons of solid waste a year. More than ninety-three million empty Coke and Pepsi soft drink bottles and cans are thrown away daily rather than recycled in the United States. The massive increase in beverage container waste is often seen in the form of litter on streets, beaches, parks and farmlands. Some of the biggest environmental impacts are due to the energy needed to produce aluminum and plastic from virgin resources, pollution from extracting and refining oil and mineral resources, and disposal of wasted containers (Waste-Not-Want-Not News, 2001).

Solid waste is a problem that is currently drawing a great deal of attention and debate in the United States. Disposing of solid wastes in a safe, efficient and environmentally responsible way is complicated by several factors including economic considerations and increasing legal constraints on state and local governments. Landfills are the most utilized means of waste disposal in the United States. Landfills are highly expensive and can create devastating environmental impacts. Due to the environmental impacts, the Environmental Protection Agency (EPA) has begun implementing stringent standards on the construction of landfill

facilities. These new regulations and standards have a dramatic effect on many countries of the USA. South West Virginia could not comply with the EPA's regulations and had to transport their waste elsewhere, as they were economically unprepared to enhance their waste management systems. This led to an ill-adapted solid waste system (Michael, 2001).

The increasing litter levels in the United Kingdom have detrimental effects on the marine environment. The Marine Conservation Society states that high levels of waste found on beaches could expose wildlife to toxic substances. Results of a litter survey conducted on 150 beaches indicated an overall reduction of 7% of litter. The Marine Conservation Society, however, believes that those levels are still unacceptably high. The Society reported that 185 482 pieces of litter were found, including 9 000 small plastic pieces. Authorities state that these plastic pieces containing toxic chemicals are ingested by wildlife, with disastrous effects. Plastic waste accounted for 55% of all litter discovered in the survey (Waste-Not-Want-Not News, 2001).

In central Portugal, major increases in urban population and subsequent activities have led to increased amounts of municipal solid waste. Municipalities paid much less attention to solid waste disposal as their efforts were mainly devoted to creating modern fleets to collect waste. The municipal solid wastes were disposed off and burnt in open dumps. This was the worst disposable technique in Portugal as it caused air pollution, with subsequent impacts on the health of communities (Antunes, 1999).

Over the past decade Hong Kong has maintained a per capita economic growth rate averaging over 5.5% annually, a rate among the highest in the world (World Bank, 1993). This economic growth has been accompanied by major changes in the physical landscape of Hong Kong. As land has always been and remains so scarce relative to the population size and the needs of the economy, densities in Hong Kong are among the highest in the world. Limited area for urban development, rapid population growth and large-scale industrialization has led to the intensity of environmental pressure. The industrial, commercial and domestic activities produce a wide variety of wastes, which led to many problems such as water pollution, shortage of landfills for disposal of wastes and undesirable levels of air and noise pollution (Williams and Gordon, 1996).

Solid waste management is a growing problem in Nairobi. The continual influx of people from rural areas and small towns to Nairobi has more than doubled the population of the city in the last 10 years (Mwanthi and Nyabola, 1997). Nairobi City Council is faced with the problem of not being able to manage solid waste from the point of generation to disposal. The public in general, appears to have no regard for the aesthetics of the city. Heaps of uncollected garbage, stench from heaps of waste, swarms of flies and the presence of rodents are some of the waste management problems affecting Nairobi. Kinako (1997) indicates that the problem of solid waste disposal has reached a crisis level in Nigeria. Large and uncleared decaying city refuse dumps along the streets and at strategic street corners have resulted in noxious odours emanating from them. The waste dumps have become breeding grounds and food depots for disease vectors such as mosquitoes, houseflies, rats and cockroaches. The wastes have also blocked many major streets and gutters and have caused frequent and serious flooding in parts of Lagos, Ibadan, Port Harcourt, Aba and many other towns during raining seasons.

1.3 NATIONAL WASTE TRENDS

South Africa, the largest economy in Africa, produces some 330 million tons of waste annually (Lazarus and Short, 1997). The average South African person living in urban areas uses products that accumulate up to 2kg of waste every day. The amount of waste being produced in South Africa is on the increase as more people attain higher standards of living. Furthermore the use of products that do not have a long life span leads to an increase in waste generation (Enviro Tech, 1999).

Nel (1991) indicates that many South Africans are familiar with living next to an open space, which is turned into a waste dump overnight. Waste such as animal carcasses, domestic waste, old cars, builder's rubble and paint cans are dumped daily in people's living environment. Besides detracting from the value of open spaces for recreation, dumping poses a number of health risks from bacterial diseases in putrefying meat and kitchen wastes to poisonous substances in paint, paint strippers, thinners and insecticides. Waste disposal has become an increasingly serious problem in urban, densely populated areas where the main reasons for concern are decreasing landfill space and the environmental problems experienced with existing old landfills such as contamination of groundwater, odours and aesthetic deterioration of the environment. According to Lombard (1996) the accumulation of solid waste does not only pose

a serious and growing threat to health and quality of life but also causes infrastructural damage e.g. blocking of storm water drains and sewers by litter which ultimately leads to costly road pavement destruction and an increase in maintenance costs.

Nearly all-solid waste pollution from South African river systems are derived from urban areas although they comprise only 5,6% (approximately 6 000 000 ha) of the surface area of South Africa (CSIR, 1991). Coastal authorities spend an estimated R8 million each year cleaning beaches. Some 50 000km of coastline is cleaned annually, with most efforts focused on urban resort beaches, many of which are cleaned daily throughout the year. It has also been found that the amount of effort spent on cleaning beaches has increased rapidly over the last 30 years, but litter loads on South African beaches continue to increase (Ryan and Swanepoel, 1996).

Lombard (2001) contends that legislation alone is insufficient to control littering. There are insufficient resources available to enforce the law, and the majority of offenders cannot be traced. The situation is serious in townships where solid waste services are often not functioning properly and the inhabitants are more concerned with survival than environmental protection. Studies conducted by the Palmer Development Group (1995) indicate that an estimate of nearly 50% of the urban population of South Africa do not have access to adequate waste collection services. In low-income urban areas the service, if in existence, has generally been poor because of smaller budget allocations and the culture of non-payment for services. According to the 2001 Census, KwaZulu-Natal had 2.1 million households of which 1 million households had a regular refuse removal service, 823 000 households used their own or a communal refuse dump and 216 000 households had no method of refuse disposal (Statistics South Africa, 2004a).

1.4 LOCAL WASTE TRENDS

The city of Durban is the busiest port and has the third largest population in South Africa. The eThekwini municipal area (EMA) currently covers an area of 2 297 square kilometres. The total area of the EMA represents only 1.4% of the entire area of KwaZulu-Natal, it contains just over a third of the population of the province (3 million people) and accounts for 60% of its economic activity. Only 35% of the EMA is urban in character and yet it supports 80% of the population. Durban is characterized by rural, tribal as well as urban communities. Durban is characteristic of the rich and the poor and is challenged by the largest informal settlements in

the country (Environmental Management Branch: eThekwini Municipality and Urban Explorations, 2003). It is a key industrial, commercial and transport center in the southern African region and is an important tourist destination. This development profile, combined with high levels of poverty and unemployment and a large housing backlog places high demands on local ecosystems and impacts negatively on the environment. Durban has the second fastest population growth in the world. This situation presents a number of challenges to the city officials who have to provide services to the residents, in the field of waste management where approximately 1,5 million tons of refuse has to be disposed off per annum at the landfill site in Bissasar Road in Springfield for the eThekwini Municipality (Personal communication, Deputy Head: Plant and Disposal, DSW, 4 November 2004). According to the 2001 Census survey (Urban Strategy Department, 2003) the newly demarcated eThekwini municipal area has a population of approximately 3 090 117 residents and 771 897 dwellings.

Increase in populations together with an increase in urbanization and industrialization has resulted in vast increases in the volumes of waste that are being produced. If solid waste material is not managed properly and effectively, it may be potentially hazardous to human health and the environment. Within the residential areas, when refuse is not collected timeously, there is a tendency for residents to dispose of it in open spaces thereby causing major environmental and health risks. Such piles of refuse as cited by Otieno (1996); form breeding grounds for rats, rodents, flies and even mosquitoes, creating a health problem for the residents.

1.5 CONTEXTUALISING THE PROBLEM

The formal townships of South Africa, products of the apartheid system, were not efficiently serviced. Consequently the townships were characterised by little or no basic services such as waste removal systems. In these low-income urban areas the service, if it exists, has been poor because of smaller budget allocations and the culture of non-payment for services (Lombard, 1996). Ten years have passed since the democratic elections in 1994 and one would expect the townships to be better serviced. The environments in townships are poorer than ever with streets and open spaces cluttered with waste. One such area is the formal township of Chatsworth.

The waste collection systems in the township of Chatsworth has over the years, been referred to as being inefficient. Evidence of the collapse of this basic service in the township of Chatsworth

can, in many instances, be pointed out to heaps of garbage in open spaces, illegal roadside dumping, waste strewn on streets, burning of solid wastes at strategic points and the clogging of drain pipes etc. Chatsworth, being a formal residental area and serviced by Durban Solid Waste is experiencing serious waste problems.

Plate 1.1: Uncontrolled waste dump in the township of Chatsworth

Residents are often forced to burn or dump their wastes in open spaces because they have no other means of disposal. The burning of solid waste contributes to air pollution and open dumping is unsightly and unsanitary. Uncontrolled waste dumps have a negative impact on communities through its appearance, the odours they release and the health risks they pose by encouraging the breeding of flies, rats and mosquitoes. If waste is not effectively managed, it will take its toll on the community by way of disease and environmental degradation.

The main focus of this study was on the negative impacts of solid waste management on the human and natural environment. Solid waste management is a world wide problem that presents one of the most immediate and serious challenges facing communities and local governments in developing urban areas (Poswa, 2000). The problem of solid waste disposal in Africa has, for some time, raised serious concerns, to the point that it is now considered a significant threat to the environment, whereby massive deposits include residential, municipal, industrial/ hazardous, biomedical, agricultural, as well as others such as demolition debris, and sewage

sludge (Adedipe, 2002). The poor and inefficient management of waste is a critical area of anxiety to all levels of Government, the private sector, NGO's, urban researchers, public health managers, environmentalists, and the public at large. Waste management in residential communities has become an urgent issue as the human impact on the environment is reaching critical levels.

One of the major contributors to the difficulties in solid waste management is the social dimension of the solid waste generators. Experience in both developed and developing countries has shown that greater attention has been focussed on the technical aspects of waste management. Consumption and lifestyle patterns have been neglected. Growth of the waste stream, which has caused many problems for local authorities, can be best understood by reviewing the social aspects of communities receiving services. The literature has shown that increasing household waste is attributed to the changing status of families (Poswa, 2000; Mbande, 1998 and Water Research Council (WRC) 1995). Poswa (2000) has pointed out in his study that the increased rate of working women has prompted families to purchase convenience goods, which in turn have created more waste per capita than unprocessed goods because they are so heavily packaged. Strategies to address waste increase and to minimize associated problems require the understanding of culture, attitudes and solid waste practices of the generators, in particular households.

The present study was designed to provide information on local socio-economic conditions of a community and to investigate how these influenced solid waste management services and the negative impacts it has on the human and natural environment. The fundamental belief is that information on the socio-economic status is critical to the solid waste management planning process. To this end, the study assumed that when household waste disposal practices are known, it would be easier to introduce measures to reduce the amount of waste generated by the affected community. Added to this, is the belief that an understanding of the diversity of the local culture of home-owners can assist the planning of a domestic solid waste management system. The ultimate goal of the research initiative was to make a contribution to the improvement of service provision, in particular, solid waste management, to the residents and the local authorities in developing communities.

1.6 AIMS AND OBJECTIVES

1.6.1 Aim

The aim of this study is to investigate the Solid Waste Management Practice in the Township of Chatsworth and its negative impacts on the human and natural environments.

1.6.2 Objectives

i) To review the factors contributing to littering and illegal dumping in Chatsworth;
ii) To determine attitudes and practices with respect to recycling, waste reduction and waste disposal;
iii) To assess people's knowledge about environmental impacts of improperly managed solid waste;
iv) To determine the relationship between waste management practices of households and their social and economic status;
v) To gather information on solid waste management from the authorities of waste departments;
vi) To propose feasible solutions based on the study's findings.

1.7 CHAPTER INVENTORY

Chapter one provides an introduction to the environmental problems of solid wastes and their significance in policy formulation. In this chapter the aims and objectives are tendered. Chapter two entails the theoretical framework of Solid Waste Management procedures focussing specifically on environmental degradation and the impacts of solid waste on human health and development. Chapter three outlines the methodology, which explains the specific research methods, used in conducting the study. A description of the study area also characterizes this chapter. Chapter four presents empirical analysis of data collected using research methods outlined in chapter three. The final chapter encompasses discussion, recommendations and overall conclusions of the study.

1.8 CONCLUSION

Just about everything we do produces waste of one form or another. The way we deal with these wastes has an immediate effect on the way we live and also on our health. It also has serious consequences for the type of world we will be living in tomorrow. Thoughtless or uncontrolled dumping on land, in the sea, or emissions to the air, is dangerous and cause environmental pollution. They also use up the valuable energy and material resources of our planet. We can already see the damage that is being caused to our environment and need to start taking the right actions to stop things from getting worse. The facts are that most of what we call "pollutants" are the products of the way in which we choose to live today, or the result of what people have done in the past.

CHAPTER TWO

SOLID WASTE DISPOSAL–A THEORETICAL REVIEW

2.1 INTRODUCTION

Solid Waste Management is a worldwide problem that presents one of the most immediate and serious challenges facing communities and local governments in developing urban areas (Poswa, 2000). According to the 2002 State of the Environment Report, South Africa generated over 52 million cubic metres of solid waste per annum, equivalent to 0,7 kg per person per day (UK generated 0,73 kg, Singapore 0,87kg and Nepal 0,3 kg per person). In addition, 5 million cubic metres of hazardous waste are generated every year. South Africa's capacity to store and treat these volumes is limited, and it is predicted that five of the nine provinces will have landfill shortages within a decade (Warmer Bulletin, 2003:85). The amount of waste produced places increasing pressure on the country's landfills. Increasing amounts of land set aside for landfill could lead to habitat destruction and loss of species. Lack of appropriate waste management strategies and treatment technologies also have a negative effect on people's health. Although waste management is a local problem, waste management options have global impacts. For example, more waste going to landfills will create more green-house gases such as methane that increases global warming and will affect forests and global climate change and biodiversity.

Solid waste production increases annually due to population growth, economic growth, inadequate services and unsustainable lifestyles. South African cities are growing at an enormous rate (of the order of 3,5% pa). The 2001 census results show that the South African population has increased from 40,5 million people in 1996 to 44,8 million people in 2001, a growth rate of 10% over 5 years. KwaZulu-Natal, one of the 9 provinces in South Africa, had the largest population in both years (8,4 million in 1996 and 9,4 million in 2001). The mid-year population, provincial estimates (embargoed until 27 July 2004), show that KwaZulu-Natal has the largest share of South Africa's population (20,7%) (Statistics South Africa, 2004b). A number of problems associated with solid waste management practices have been observed by authors such as Hardoy, *et al.*, (1992); Water Research Council (WRC) (1995); United Nations Educational, Scientific and Cultural Organization (UNESCO) (1996); Mbande (1998); Poswa

(2000) and Adedipe (2002). Waste, not properly disposed off, may have adverse effects on the ecosystem functioning and on human health. Illegal dumping is a common occurrence in big cities and an expensive drain on municipal treasuries. Refuse is usually dumped on vacant lots, under bridges, in public parks, along railway lines and at other normally unattended locations. Much of the debris is dumped by unscrupulous haulers, who charge to pick up refuse and then dump it illegally, by small contractors looking for an easy way to rid themselves of building wastes, and by residents who are not willing to wait for municipal pickup of household bulk trash, like old furniture (Plate 2.1 and Plate 2.2).

Plate 2.1: Building wastes being dumped illegally in Chatsworth

The problem is often compounded by a lack of public awareness of the issue, a lack of public and judicial understanding of environmental laws and, consequently, low fines and soft sentences. Indiscriminate dumping of waste lowers property values as well. Materials routinely found at dump sites, such as refrigerators, asbestos and other toxic waste, can cause air, ground and/ or water contamination. Dumped tyres, when filled with rainwater, become breeding pools for mosquitoes. Rats and other vermin are attracted to food waste found in dumped residential or business trash. Illegal dumping demotivates residents, reducing their sense of ownership and control over their surrounding. Studies conducted by Poswa (2000); Mbande (1998) and WRC (1995) indicate that illegal dumping sites can become magnets for crime and forms of urban blight, such as abandoned automobiles and graffiti.

Plate 2.2: Wastes dumped in open spaces in an urban area of eThekwini Municipality

Waste management is a subset of the urban management problem that impacts on virtually every other facet of the urban environment (Lombard, 1999). It is therefore regarded as a key element, constituting one of the greatest challenges to human development and the management of natural resources in our urban environment. A sound solid waste management practice encompasses the principle of integrated waste management (IWM), which is a holistic approach, that extends over the entire waste cycle from cradle to grave (DEAT, 2000). Integrated waste management covers prevention, generation, collection, transportation, treatment and final disposal of waste. The objective of IWM is to minimise economic and environmental impacts by employing all possible waste management technologies and to address specific local solid waste problems, based on local resources. Poswa (2000) contends that a combination of approaches can be used to handle targeted areas of the waste stream by employing the IWM strategy. Through this approach waste is dealt with in an environmentally responsible manner, from its generation at source to its ultimate disposal. In some developing countries service providers fail to apply the IWM strategy, resulting in an increase in solid waste problems. UNESCO (1996) indicates that inadequate solid waste problems are localized and not universal. This pattern of localized problems, followed by no universal method for addressing solid waste problems, is

significant in the understanding of specific conditions that exist in the type of communities to which a solid waste management system applies.

2.1 WHITE PAPER ON INTEGRATED POLLUTION AND WASTE MANAGEMENT FOR SOUTH AFRICA

The White Paper on Integrated Pollution and Waste Management for South Africa (DEAT, 2000) serves the following two purposes:

- to inform the public of the government's objectives, and how the government intends to achieve them; and
- to inform government agencies and state organs of these objectives, and their roles in achieving them.

2.2.1 Definition of Integrated Pollution and Waste Management

Pollution is defined as: the introduction into the environment of any substance property (including radiation, heat, noise and light) that has or results in direct harmful effects to humanity or the environment, or that makes the environment less fit for its intended use. Integrated pollution and waste management is a holistic and integrated system and process of management, aimed at pollution prevention and minimization at source, managing the impact of pollution and waste on the receiving environment and remediating damaged environments (DEAT, 2000).

Integrated Pollution and Waste Management for South Africa (DEAT, 2000) represents a paradigm shift from dealing with waste only after it is generated (i.e. "end of pipe") towards:

- pollution prevention;
- waste minimization;
- cross-media integration;
- institutional integration, both horizontal and vertical, of departments and spheres of government; and
- involvement of all sectors of society in pollution and waste management.

2.2.2 Vision of the Policy

The vision of the government is to develop, implement and maintain an integrated pollution and waste management system which contributes to sustainable development and a measurable improvement in the quality of life, by harnessing the energy and commitment of all South Africans for the effective prevention, minimization and control of pollution and waste (DEAT, 2000).

2.2.3 Purpose of the Policy

The Integrated Pollution and Waste Management Policy (IP&WM) (DEAT, 2000) is a subsidiary policy of the overarching environmental management policy, as set out in the White Paper on Environmental Management Policy for South Africa (DEAT, 1998) and further supported by the National Environmental Management Act (NEMA) (NO. 107 of 1998). This IP&WM policy accordingly subscribes to the vision, principles, goals and regulatory approach set out in the environmental management policy and details the government's specific policy for pollution and waste management.

This IP&WM policy applies to all government institutions, society at large, and to all activities that impact on pollution and waste management. One of the fundamental approaches of this policy is to prevent pollution, minimize waste, and to control and remediate impacts. The management of waste will be implemented in a holistic and integrated manner, and will extend over the entire waste cycle, from "cradle to grave', including the generation, storage, collection, transportation, treatment, and final disposal of waste.

The government aims to:

- *encourage the prevention and minimization of waste generation, and thus pollution at source;*
- *encourage the management and minimization of the impact of unavoidable waste from its generation to its final disposal;*
- *ensure the integrity and sustained "fitness for us' of all environmental media, i.e. air, water and land;*
- *ensure that any pollution of the environment is remediated by holding the responsible parties accountable;*
- *ensure environmental justice by integrating environmental considerations with the*

social, political and development needs and rights of all sectors, communities and individual; and

- *prosecute non-compliance with authorizations and legislation* (DEAT, 2000).

2.2.4 The Necessity of an Integrated Pollution and Waste Management Policy

South Africa is emerging from a period of unsustainable and inequitable development, one outcome of which was environmental degradation, which has significant economic and social impacts. Part of effecting a transformation to development that is economically, socially and environmentally sustainable is to redefine the way in which pollution and waste will be managed in South Africa. Much needed economic growth can be supported by more appropriate and efficient use of natural resources, within a framework of integrated pollution and waste management. This will help to protect the people of South Africa and the environment without a continuous degradation of natural resources (DEAT, 2000).

2.3 THE INTERNATIONAL CONTEXT

2.3.1 Global Concern about Pollution

International concern about the phenomenal increase in pollution worldwide has escalated over the past 20 years, particularly in the last decade. This is evident in the many international protocols and conventions, and countless reports and conferences from significant bodies including the report of the World Commission on Environment and Development and the 1992 Rio Conference, where 178 countries agreed on Agenda 21 as a blueprint for sustainable development. The IP&WM policy is part of the South African government's efforts to meet the goals of Agenda 21 (DEAT, 2000). Local Agenda 21 is a city-wide initiative to engage local stakeholders in the pursuit of sustainable development. One such goal of sustainable development is pollution and waste. The aim of the IP&WM policy in South Africa is to ensure that social, economic and ecological concerns are integrated into all planning and development processes within a city. One of the goals of Agenda 21 is to contribute to a sustainable economy and a clean and healthy metropolitan environment through establishing an integrated system of pollution and waste management at local level. The objectives of this goal is to: improve the effectiveness of pollution and waste management activities at local levels in order to improve the quality of the environment and human health; to improve the quality of the environment and human health by minimizing the amount of solid, liquid and gaseous waste generated in and

affecting local areas and to develop an efficient system of reducing and managing substances produced at local levels which are hazardous to human health and the environment.

2.3.2 South Africa as Part of the World Economy

South Africa's reintegration into the global economy necessitates an improvement in pollution and waste management. The country's economic and industrial policy has also turned towards export promotion as a pillar of South Africa's economic development. South Africa, therefore, has growing obligations to meet international commitments relating to environmental issues and to be a globally responsible country (DEAT, 2000).

2.4 THE NATIONAL CONTEXT

2.4.1 The Constitution

The Constitution of the Republic South Africa (Act No. 108 of 1996) is relevant to pollution and waste for two reasons. The Bill of Rights, Section 24 (2) of the Constitution of the Republic of South Africa (Act 108, 1996) contains a number of rights relevant to integrated pollution and waste management. Any particular Act or statutory provision that does not uphold these rights is unconstitutional. The Constitution also provides the legal basis for allocating powers to different spheres of government, and is thus relevant to the institutional regulation of integrated pollution and waste management (Constitution of the Republic of South Africa, 1996).

2.4.2 The Bill of Rights

The most pertinent fundamental right in the context of integrated pollution and waste management is the Environmental Right, Section 24 (2) of the Constitution of the Republic of South Africa (Act 108, 1996)), which provides that:

"Everyone has the right

A) to an environment that is not harmful to their health or well-being; and

B) to have the environment protected, for the benefit of present and future generations through reasonable legislative and other measures that-

1) prevent pollution and ecological degradation;

2) promote conservation; and

3) secure ecologically sustainable development and the use of natural resources while promoting justifiable economic and social development."

This section of the Bill of Rights specifically imposes a duty on the State to promulgate legislation and take other steps to ensure that the right is upheld and that, among other things, pollution and ecological degradation are prevented. To date, a number of steps have been taken, to ensure this environmental right, including the publication of the White Paper on Environmental Management Policy for South Africa (DEAT, 1998) the publication of the White Paper on Integrated Pollution and Waste Management (DEAT, 2000), the promulgation of the National Water Act (1998) and the National Environmental Management Act (1998), and the development of a National Waste Management Strategy (Wiechers *et al.,* 2001). The project of the development of a National Waste Management Strategy (NWMS) for South Africa was initiated during 1997 by the Department of Environmental Affairs and Tourism (DEAT) and the Department of Water Affairs and Forestry (DWAF), with financial support from the Danish Co-operation for Environment (DANCED). The overall objective of the NWMS is to reduce the generation and environmental impact of all forms of waste, to ensure that the health of the people and the quality of environmental resources are no longer affected by uncontrolled and uncoordinated waste management (Weichers *et al.,* 2001).

2.5 THE POLOKWANE DECLARATION ON WASTE MANAGEMENT

The Polokwane Declaration on Waste Management was adopted at the first National Waste Management Summit. The Department of Environmental Affairs and Tourism participated and hosted the summit convened in Pietersburg on 26-28 September 2001. The Polokwane Declaration recognizes that Waste Management is a priority for all South Africans, and the need for urgent action to reduce, reuse, and recycle waste in order to protect the environment. The Declaration further recognizes that we can achieve the vision and the goal contained in it.

2.5.1 The Vision

The implementation of a waste management system that contributes to sustainable development and a measurable improvement in the quality of life, by harnessing the energy and commitment of all South Africans for the effective reduction of waste.

2.5.2 The Goal

Stabilize generation and reduction of waste disposal by 50% by year 2012 and develop a plan for Zero Waste by year 2022. The declaration reaffirms our commitment to the Integrated

Pollution and Waste Management Policy and the National Waste Management Strategy. The final goal of the Polokwane Declaration is the determination to undertake initiatives that will promote appropriate and efficient use of natural resources, and to protect the people of South Africa and the environment (DEAT, 2001a).

2.6 HISTORICAL BACKGROUND OF WASTE MANAGEMENT IN SOUTH AFRICA

Waste is the inevitable product of human communities. Human beings produce waste that needs to be disposed. In earlier times waste was largely bio-degradable and recycled by natural processes. Population growth and technological development has caused waste both to increase in volume and to become more durable. It is estimated that in South Africa today the average person produces one and a half kilograms of solid waste a day (KwaZulu-Natal Local Government Association [KWANALOGA], 1999).

2.6.1 Lack of Priority Afforded to Waste Management

In the past, waste disposal was in many instances a fairly haphazard operation: refuse was disposed off in pits, natural depressions, rivers and the sea (KWANALOGA, 1999). Historically, waste management was not regarded to be a priority issue in South Africa. The waste management that did take place focussed mainly on waste disposal and was reactive, in that it generally addressed pressing needs. Holistic, integrated waste management planning was rarely, if ever, undertaken. The low priority accorded to waste management resulted in waste impacting detrimentally on the South African environment and human health. The growing volume of waste and the awareness of the detrimental effect it has on the environment have meant that its disposal has become much more complex and very much more expensive. (DEAT, DWA&F & DANCED, 1999).

2.6.2 Fragmented Legislation and Ineffective Enforcement

Waste management legislation such as NEMA (1998) is currently fragmented, unfocused and ineffective, with a resultant lack of control in all aspects of waste management. NEMA (1998) is deficient in providing capacity to ensure environmental regulations are followed up, for ensuring an audit of compliance by regulated bodies, and for failing to establish a viable adjudications procedure where civil rights are allegedly violated, but where there are

insufficient resources on the part of victims to prosecute their case. In addition, a lack of government capacity means legislation very often is not enforced.

2.6.3 Unacceptable Safety, Health and Environmental Practices for Pollution and Waste Management

Environmentally and socially unacceptable practices currently characterize many aspects of waste management, particularly in rural areas where waste disposal services are often non-existent. In many of the urban communities, these services generally of a poor quality have collapsed as a result of non-payment and poor financial planning. Examples of socially unacceptable practices include:

- substandard, ineffective or non-existent waste collection and street-cleaning systems;
- illegal dumping and littering;
- waste disposal sites which are poorly sited, designed and operated, and thus impact negatively on both the environment and quality of life. Furthermore, there is often little or no control over their use, and general waste disposal sites are frequently used for the illegal disposal of hazardous waste; and
- the presence of pickers at landfill sites, who disrupt operations and are exposed to hazardous wastes and dead animals, all of which could affect their health (DEAT, 2000).

2.7 WASTE AND ENVIRONMENT

2.7.1 Waste

A legal definition of waste, as per Government Notice No. 1986 of 24 August 1990, is:

"An undesirable or superfluous by-product, emission, residue or reminder of any process or activity, any matter, gaseous, liquid or solid or any combination thereof, originating from any residential, commercial or industrial area, which-

a) is discarded by any person; or

b) is accumulated and stored by any person with the purpose of eventually discarding it without prior treatment connected with the discarding thereof; or
is stored by any person with the purpose of recycling, reusing or extracting a usable product from such matter" (Environment Conservation Act [ECA], 1989 and Department of Agriculture & Environmental Affairs [DA&EA], 2002).

2.7.2 Environment

There is no general agreement on exactly what the concept "environment" encompasses. The terms "ecology" and "environment" are not interchangeable. The former is the scientific study of the interrelationships between living organisms and their habitat, which implies that reference to environmental problems, should indicate impaired interrelationships between human beings and their environment (Fuggle and Rabie, 1992).

Waste has a direct impact on the environment which itself is defined in the National White Paper on Environmental Policy as:

"the biosphere in which people and other organisms live. It consists of:

- *renewable and non-renewable resources such as air, water, land and all forms of life;*
- *natural ecosystem and habitat; and*
- *ecosystems, habitats and spatial surroundings modified or constructed by people, including urban areas, agricultural and rural landscapes and places of cultural significance and the qualities that contribute to their value.*

Culture, economic considerations, social systems, politics and value systems determine the interaction between people and the environment, the use of natural resources, and the values and meanings that people attach to life forms, ecological systems, physical and cultural landscapes and places. People are part of the environment and are at the center of concerns for its sustainability" (DA&EA, 2002).

This definition serves to establish the environmental domain to which environmental policies and legislation are applicable. It is noted that the definition is holistic and takes into account the total environment (Dildar, 1999).

Waste has a direct impact on the natural environment and all other systems mentioned above. Therefore, waste management and environmental issues are addressed holistically in this study.

2.8 ENVIRONMENTAL POLLUTION

The formation of a new philosophical force–the environmental ethic, questions many of our "accepted" ground rules, such as the sanctity of growth and expansion, and the freedom to exploit resources. This ethic is closely tied to the science of environmental pollution control, for only by defining; analyzing and solving the problems of waste production can the ethic be translated to constructive action. Before embarking on the nuts and bolts of environmental pollution control it might be well to discuss just what is meant by environmental pollution and to suggest the reason why it suddenly has become a critical factor in our struggle for survival (Viljoen *et al.*, 1987).

2.8.1 Environmental Pollution

> *"We believe all citizens have an inherent right to the enjoyment of pure and uncontaminated air and water and soil; that this right should be regarded as belonging to the whole community; and that no one should be allowed to trespass upon it by his careless or his avarice or even his ignorance"* (Vesilind, *et al.*, 1983:1)

This resolution, adapted in 1869 by the Massachusetts Board of Health, is the ideal of pollution control. Pollution, for more than a century was regarded as evil. This resolution was an attempt to define the problem. Unfortunately, this definition is only an ideal, since total elimination of pollution would effectively require the elimination of modern civilization. The definition of pollution must be more realistic if it is to be of practical value. It is important to understand that pollution can be defined in many ways, and the specific definition used in a specific case can be important. For example, if an industry spewing forth contaminants into water, air and land, can convince the public and the regulatory agencies that by their definition they are not polluting, pressure to force them to clean up might never materialize even though the results of inadequate waste disposal are obvious. Many professions are critically involved in environmental pollution, and all have defined pollution to fit the specific need (Vesilind, *et al.*, 1983).

The ecologist looks at pollution as something, which upsets the equilibrium of a system. Water pollution is defined as "anything, which brings about a reduction in the diversity of aquatic life and eventually destroys the balance of life," or "any influence on the stream brought about by

the introduction of materials to it which adversely affects the organisms living in the stream." These definitions have value to ecologists since ecologists are more concerned with the effect of outside forces (people) on a stream than with the direct benefits the watercourse might have to humans (Vesiland *et al.*, 1983).

In contrast to the ecologists who consider pollution to be any human made addition, which is not ecologically compatible to the existing environment, the engineers consider these additions as pollution only if and when they precipitate an immediate adverse effect. Engineering definitions have as a core the economic, physical and social well-being of humans. Engineers suggest that since pollution control costs money, the benefits derived from a clean stream or atmosphere must be weighed against the benefits derived by spending the money on hospitals, roads, etc. The implication is that pollution is not bad, provided we do not start killing more people by cholera, typhoid, etc. than we do on the highways. In this respect building of highways should take priority over pollution control (Vesilind, *et al.*, 1983).

2.8.2 The Roots of Environmental Pollution

Early humans spent their entire existence surviving. The procurement of food and shelter for the family took all of the time. With increased specialization humans began to better their life-style. This had two effects: the population and the per capita consumption of goods both increased. Our earth is now crowded with people and all of them consume resources, and create waste. The waste must be returned to the earth in some form, and often this process destroys or alters the ecology. The over consumption of both manufactured and natural resources has increased tremendously and has led to problems of pollution in many countries (Satterthwaite, 1996).

2.9 COMMUNITY PERCEPTIONS AND ATTITUDES TOWARDS SOLID WASTE MANAGEMENT

Blight and Mbande (1994) observed that solid waste management is not considered a priority in developing areas because the majority of people in urban areas struggle for basic needs such as food, paying rent for their shelter, clothing and electricity. Therefore, the community is not sensitive to environmental demands, in particular to solid waste management. Nkosana (1992) reported that during the unrest situations and mass campaigns against apartheid in South Africa,

which normally took the form of stayaways, health workers such as nurses, doctors and sewage workers were usually exempt, but not solid waste collection workers who are generally not considered to be in the health worker capacity. Solid waste collection was not considered a priority. Serrano (1995) commented that most of the attention is given to pollution caused by liquid waste, despite the fact that pollution caused by solid waste surpasses 10 to 20 times that caused by domestic sewage as 52g of sewage is discharged daily by an individual compared with 1 500g to 2 000g of solid waste. Schertenleib and Meyer (1992) reported that inadequate waste collection is a major factor in the spread of gastro-intestinal and parasitic diseases primarily caused by the multiplication of flies and rodent vectors. This can be attributed to the lack of health and environmental awareness of the potential dangers of uncontrolled solid waste.

According to UNESCO (1999), there are several reasons why people litter. These include laziness, carelessness, lack of awareness through little training and education, inadequate litter receptacles, parental influence, disregard for another's property, lack of a sense of responsibility, lack of discipline and lack of incentives. The relationship between the environment and human beings is best understood by examining humankind's attitude towards the environment. Today, the society tends to turn away from waste (Mantel, 1975). The negative attitudes adopted by some members of the community include the "they and us approach", "it's not my problem" and "somebody must do something" (Black, 1999).

Poswa (2000) found that many people are of the view that they have no impact on the decision-making process and as a result do not bother to register complaints with the authorities. This attitude differs among socio-economic groups. The higher socio-economic groups are more likely to complain about environmental problems or become involved in doing something about them because they feel that they have a contribution to make. Viljoen *et al.*, (1987) contend that people of the lower socio-economic groups tend to have less regard for environmental issues on the basis that employment and housing are their main priorities.

The attitudes of people in residential areas range from high concern in the cases where the direct impacts of waste and pollution are felt (e.g. residents near landfills sites, people living near polluting industries, and those without adequate refuse removal services) to one of apathy where these impacts are felt indirectly or not at all (e.g. residents of areas with adequate services who

are not in the immediate vicinity of polluting industries). Those who do not have a sense of ownership for, or pride in, the environment in which they live also show apathy. Within some communities there is reticence amongst the people to come forward and take the lead for an environmental cause. This is probably a symptom of the lack of capacity within those communities who lack the knowledge and self-confidence to do so (Lombard and Associates, 1996). Such attitudes can have implications for issues such as willingness to pay, recycling efforts and the types of service that would be found acceptable by communities. The more disposable income people have, the greater the tendency towards consumption of goods and energy. Very few have any knowledge about, and, therefore, any desire to address the issue of waste minimization/ avoidance, i.e. managing waste before it even becomes waste (WRC, 1995).

Mbande (1998) indicates that when requirements for basic services like food and shelter absorb the attention of communities, then many environmental values are neglected. To this end, Scarlett and Shaw (1999) have stated that when basic survival needs of most people have been met, people become more willing to devote income to greater environmental protection. This premise concurs with the findings of Mbande (1998) where solid waste management is not perceived as a basic need. Consequently people who are struggling to satisfy their basic needs (food, water, shelter and clothing) will be less sensitive to waste management.

The negative attitudes to the environment have serious consequences for authorities and communities themselves (Armitage *et al.*, 1998). Waste entering the drainage system causes serious infrastructural damage e.g. the blocking of storm water drains and sewers by litter ultimately leads to costly road and pavement destruction and an increase in maintenance costs (Lombard, 1996). It costs up to ten times more to remove litter than clearing waste from waste containers (Skarba, 1992). Viljoen *et al.*, (1987) state that it takes 15 workers about a week to restore a large sports stadium to its original state of cleanliness after a major sport game. Moreover, the lack of a sense of responsibility is manifested by the accumulation of huge amounts of litter in public places such as parks, highways and recreational facilities and in private areas such as business places.

Aristotle (undated) cited by Scarlett and Shaw (1999:3) said: "What is common to many is taken least care of, for all men have greater reward for what is their own than for what they possess in common with others". This simply means that people who own property have the incentive to take care of it, unlike the one owned by a large number of people or where there is non-ownership.

2.10 DEFINITION OF SOLID WASTE

Waste is an inevitable part of human activity. It is either a by-product of initial production processes, or it arises when objects or materials are discarded after it has been used. In a similar way wastes are also an inevitable part of the natural world. What is more significant is that all living organisms, when they die, ultimately become waste and despite this, nature appears to be able to deal with its own waste very effectively. The natural world is also the recipient of human waste materials. It appears that most environmental problems arise because the natural world cannot cope with these novel substances produced by human activities. The natural world is therefore a crucial starting point for any understanding of environmental problems that waste materials can cause and the ways they can be treated (Bradshaw, 1992).

There are many different definitions of waste and the types of waste throughout the world. The interpretation of what is meant by waste can also change with circumstances, e.g. what is waste to one can be a useful raw material to another; and waste food for human consumption can be used as animal fodder (Royal Society of Chemistry, 1996). According to Theron (1992) the word "waste" has a negative connotation and it is therefore a pity that the same word is also used to describe materials or matter which can be beneficially and economically re-used or used as feedstock in the manufacturing industry. If such materials are to be regarded as "secondary raw materials", which is apparently happening in certain industrialized countries, then only the residue, which must be disposed of, can be truly classified as waste. Clayton *et al.*, (1973:17) generally speak of waste as "a material that its producer does not want. Although the product may have value to someone (either in its present or in a converted state), if its producer does not ask for reimbursement for its removal, it is considered to be waste, and at some stage, will enter a waste handling system, either private or public."

Solid Wastes, within this context, are defined by:

Clayton *et al.*, (1973) as the non-gaseous and non-liquid wastes that result from the daily activities of community's residential, commercial, and industrial sectors.

The European Commission (Royal Society of Chemistry, 1996:93) defines waste "as any substance or object which the holder disposes of or is required to dispose of pursuant to the provisions of national law in force".

The World Health Organization (WHO, 1991:108) defines waste as being "something which the owner no longer wants at a given place and time and which has no current perceived market value".

Waste according to the American Public Works Association (APWA) (1975:211) are "useless, unwanted or discarded materials, and include solids, liquids and gases." Those wastes, which are solid, are referred to as solid wastes or refuse. The two terms are used synonymously. It is symptomatic of the primitive state of analysis of the subject that this commonly accepted definition is quite inadequate. To begin with, uselessness, like beauty, is in the eye of the beholder. The livelihoods of many South Africans are dependent upon such useless material. Increasingly, useful material and energy are being recovered from it. Furthermore, much useless material is not discarded but remains in attics and garages that are not in the solid waste stream. According to the APWA definition, a typical suburban garage sale could be described as somewhat whimsically as a redistribution of solid waste. As for being "unwanted", it should be noted that parents are forever discarding their children's most prized and wanted possessions, albeit after contemptuously calling it "junk". In counterpoint, much unwanted materials remain undiscarded, simply because the "cost" (usually the effort" of disposal exceeds the "cost": (usually effortless) of retention. In the light of these problems, the following conceptual definition of solid waste is offered "solid material which is discarded". This simple definition ignores the irrelevant issue of the usefulness, value, or desirability of the matter in question, but as much as discarding is an intentional act; it implies that the 'discarder' judges the material to be of relatively little value to him or her (Savas, 1974).

Otieno (1996) contends that since waste, by definition, is of little or no perceived value to the generator, there is little financial incentive to handle it in a careful and secure manner and on the

whole, there is an in-built temptation to relinquish responsibility for it at the earliest opportunity.

2.11 OBJECTIVES OF SOLID WASTE MANAGEMENT

Hall and Ball (1989:15) state that the "aim of waste management is essentially the responsible reintroduction of waste into the environment". He further states that there is a need for a "balance between the lowest costs of actions and their environmental and other implications". The notion of costs and environmental implications indicate two broad aspects to the objectives of a solid waste management system and these are environmental and economic considerations:

i) Environmental considerations

The waste management system must provide environmental benefits through clearance of waste and the hygienic disposal thereof. These benefits come in the form of an aesthetically clean environment and the eradication of disease (Hall and Ball, 1989).

ii) Economic considerations

The waste management system must provide economic benefits through the provision of an effective service that is affordable to those who benefit from that service (Hall and Ball, 1989).

Underlying the environmental and economic aspects would be a philosophy that hinges on the objectives of:

- promoting the minimization of waste generation;
- promoting the maximum possible reclamation and recycling of waste; and
- ensuring economically efficient and environmentally effective-storage, collection, transport, reclamation, recycling and disposal of waste (Hall and Ball, 1989).

2.12 CLASSIFICATION OF WASTE

In modern societies waste is generated during the production of materials and consumer articles that characterize the prevailing lifestyle. Waste is also produced when consumer items are discarded after use. The latter part of waste production represents a vast resource since it essentially still contains all those valuable materials that went into the original production. As a result of soiling and mixing, the non-organic materials in most cases represent only a minor

potential for recycling. On the other hand, the bulk of the refuse comprises a significant exploitable reserve of organic matter, which can be reclaimed for various purposes. The rapid population growth, urbanization and increased public awareness during the last two decades mitigate against indiscriminate dumping of waste. To increase efficiency and prevent environmental pollution, the collection and disposal of these wastes must be properly planned. A knowledge of the type and quantity of the waste to be handled is a pre-requisite for any comprehensive waste management scheme (Tworeck, 1979).

Waste may be classified by its source of origin, since its composition is a function of the waste producing activity. It must be assumed that the rate of waste production of any specific activity is a multiple of that level of activity as measured by population for residential origin, employment for industrial and commercial origin and the surface area or the number of animals per hectare for agricultural activities. In some cases, the wastes produced are highly specific to the industries concerned and the presence of these materials in effluent can be diagnostic. The classification of waste is a complex subject and internationally there are many different classification systems (Theron, 1992).

The Department of Water Affairs and Forestry (1998) classifies waste as either "General" or "Hazardous".

i) General wastes (G)

General waste applies to all urban waste and may include inert building rubble, garden, domestic, commercial, general, dry and industrial waste. These wastes can exert a negative impact when the products of their breakdown, including leachate, pollute the environment.

ii) Hazardous Waste (H)

Hazardous waste is defined as *"an inorganic or organic element or compound that, because of its toxicological, physical, chemical or persistency properties, may exercise detrimental acute or chronic impacts on human health and the environment. It can be generated from a wide range of commercial, industrial, agricultural and domestic activities and may take the form of liquid, sludge or solid. These characteristics contribute not only to hazard, but also are of great importance in the ultimate choice of a safe and environmentally acceptable method of disposal"* (DWA&F, 1998: 14).

According to the Environmental Conservation Act (1989), Urban Solid waste is classified in broad terms as follows:

i) Inert wastes

Builder's rubble, tyres, cover and spoil. These wastes are not regarded as exerting negative impacts on the environment unless they are disposed of in unacceptable disposal sites.

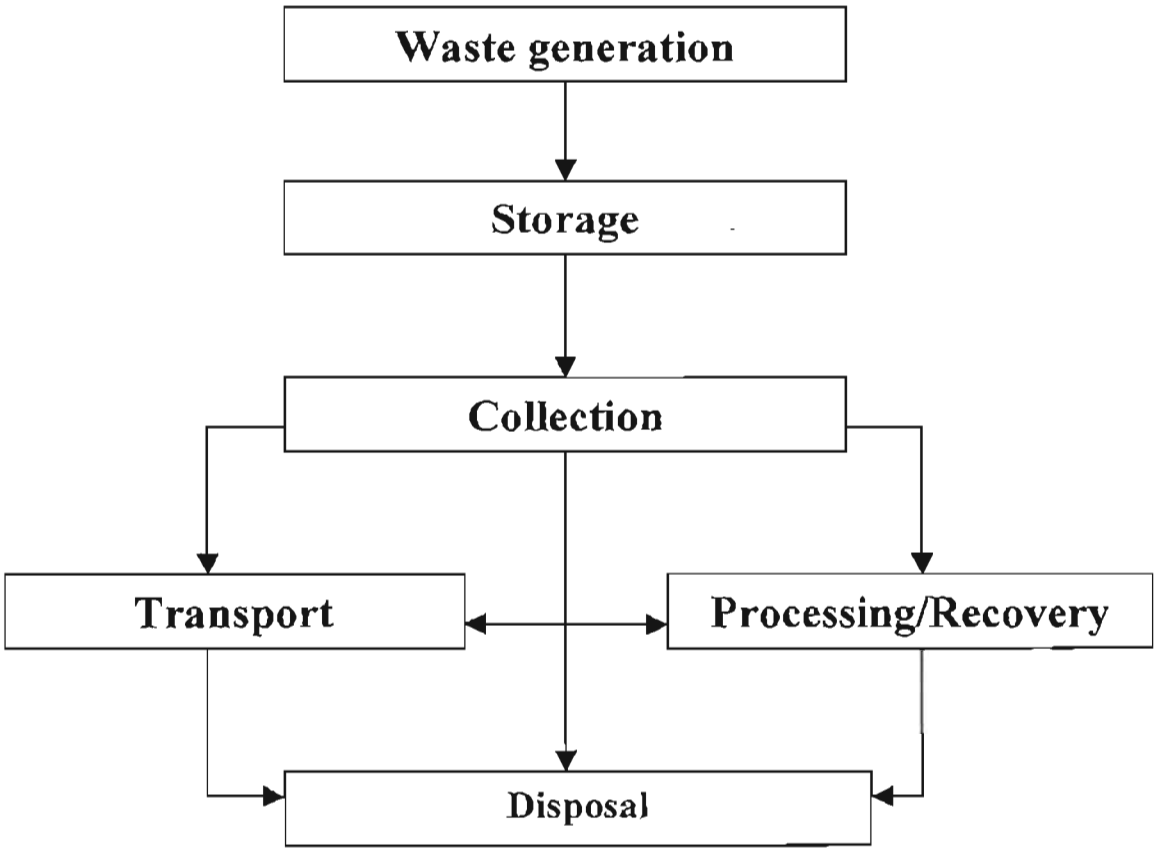
ii) Special wastes

This group of wastes, due to quantity, concentration or physical, chemical or infectious characteristics may cause ill health or increased mortality or may adversely affect the environment. These wastes may also pose an immediate or potential threat when improperly treated, stored, transported, disposed of or otherwise managed, and exhibits the characteristics of corrosivity, toxicity, inflammability, volatility, explosivity or radioactivity.

2.13 STAGES OF WASTE MANAGEMENT

The waste management process involves a range of activities, which encompass: generation, storage, collection, transport, recycling, reclamation, reduction, sale of recovered resources and disposal (Fig 2.1). All of these activities deal with the flow of waste and can take place at different stages of the waste management process. For example waste can be recycled at the source and sold from that point with the remaining waste being collected and transported directly to disposal. Alternatively, waste could be stored, collected, transported to a disposal site at which point reclamation could take place. The process of waste management may be divided into six functional components as shown in Fig 2.1.

Figure 2.1: The Tchobanoglous Model of the Waste Management Process



Source: Hounsome, 1997: 15

2.13.1 Waste Generation

Waste generation is central to the waste management process as it is the origin of waste. The key aspects of waste generation are:

- *Source of waste generated;*
- *Amount of waste generated;*
- *Characteristics of waste generated; and*
- *Waste reduction or minimization*

These are important aspects, as the type of waste will vary according to the source. This will then impact on characteristics such as waste composition and density, which helps the identification of the needs of a waste system. For example, the extent to which resource recovery or recycling can take place. In the same way, the quantity of waste generated is important for establishing the capacity requirements of storage and collection equipment, as well as disposal facilities. The features associated with waste generation are, therefore, central to the waste management process (Fuggle and Rabbie, 1992).

i) Source of waste

The various sources of waste include:

- industrial (iron and steel, saw-dust, chemicals, oil containers etc.);
- commercial (cardboard, plastics, nylon etc.);
- household (kitchen, garden, disposable nappies etc.);
- institutional (office paper, books, old stationery etc.);
- construction debris, and (rubble, broken glass, paint tins etc.) and
- agricultural (fertilizer, manure, compost packages etc.).

This research focuses on waste generated by households, referred to either household or domestic waste. It is acknowledged that waste generated by other sources such as businesses and institutions is often classified as domestic waste. It is estimated that household waste constitutes 75% of all wastes (Habitat, 1993).

ii) Generation rates

The amount of waste that is generated by households tends to vary according to levels of economic development. The higher the income the country generates, the higher the quantities of waste generated (Fuggle and Rabbie, 1992). A household survey conducted in London indicates that more than half of London's households practice little or no recycling. The higher income people interviewed felt that their lives are too busy and that they never have enough time to engage in recycling activities. The study indicates that respondents from high-income groups spend a significant amount of time in supermarkets choosing products that make cooking convenient. Recycling is non-existent in these groups. Product choice is dominated by perceptions of quality and cost and is influenced by the fact that almost all households rely on supermarkets for their main food shop. As a result, special offers are influential and many

people buy more than they need. The majority of high-income earners believed that packaging is impossible to avoid, because their eating, cooking and food shopping habits are largely fixed and organized to deliver maximum convenience. Reduction of packaging was seen by most high-income earners as a job for retailers and manufacturers who should be persuaded by regulation, if necessary (Warmer Bulletin, 2003).

iii) Waste characteristics

The composition of waste also varies according to levels of economic development. There are other influencing factors such as geographical location and the culture of a society. A study conducted by WRC (1995) indicates that the composition of waste in townships contain a large proportion of soil, sometimes as high as 12%. Other constituents of township waste include metal (10%), glass (6%), and paper and paper products seldom exceeding (15%). The remainder of the waste stream consists of organics and unclassified material. Waste content does vary geographically and culturally, hence, low-income areas in Gauteng region have higher ash content in their waste than high-income areas, as more coal is used as a source of energy in low-income areas of Gauteng (Parkin, 1996). In addition to the composition of waste, the density of waste is important. This has implications, for example, for the potential of compaction both at collection and disposal (Fuggle and Rabbie, 1992). Waste density is linked closely to income level, the lower the income, and the denser the waste. According to Lombard (1999) wastes for low income, high-density areas were in the range of 330kg per cubic metre whilst waste for high income, low-density areas was 144kgs per cubic metre.

iv) Waste reduction

It may appear anomalous to include waste reduction as a part of generation; however, increased reduction activity would lead to reduced generation. Householders could minimize generation by, for example, a reduction in the consumption of packaged goods. The activity is best implemented one step back along the generation chain. For example, manufacturers can reduce material such as packaging or they can produce goods that can be recycled more easily. Householders can have a role in this activity with regard to their discretion in levels of consumption and choice of goods consumed (Fuggle and Rabbie, 1992).

2.13.2 Waste Storage

Storing waste properly is important to public health. After generating waste, the household is likely to either store or dispose of it immediately. Immediate disposal could take the form of burial or burning. Poor storage can attract vermin, encourage the spread of disease, hamper collection and in turn increase collection costs. The duration of refuse storage depends on the type of container used, storage capacity, climate and possibility of damage by animals. The type of container used can also determine the type of collection. On site handling refers to activities associated with the management of solid waste until they are placed in the storage containers used for collection. Factors to consider when designing on-site waste storage and processing systems are: type of collection system; the economic radius of operation; and on site processing methods to recover material; reduce volume and treat the waste. In the event of storage before collection or disposal, two basic storage options can be used: the separate unit storage and the communal storage unit (Fuggle and Rabbie, 1992).

i) Separate unit storage

Separate unit storage may be standardized or non-standardized by the service agency. Non-standardized containers can include temporary containers such as cardboard cartons, plastic bags, crates, as well as permanent containers such as plastic or metal bins. Standardized containers tend to be plastic or metal bins as well as plastic bags.

ii) Communal storage

Communal storage units can be either stationery or portable. Stationery units could include enclosures such as four-sided masonry structures, whilst portable units could include large steel drums or liftable metal containers such as "skips". There is a degree of overlap between the storage options as a household may initially use a separate storage unit on site, which is then emptied into a communal storage unit.

2.13.3 Solid Waste Collection

According to Habitat (1993) the objective of a waste-collection system is to transport wastes collected from specific locations at regular intervals, to a disposal site at minimal cost. Collection deserves careful consideration because it can be the most expensive phase of the

refuse handling process. Refuse collection is labour intensive and amounts to 60% of the total disposal cost in South Africa.

Waste collection can be categorized as either primary or secondary. The former involves the collection of waste from the household to a secondary place where it will be transported to a disposal site. Secondary collection is where the domestic waste is transported from a disposal site or a transfer station. The planning of domestic waste collection has evolved along with the development of modern infrastructure and includes the consideration of: collection vehicle systems; human power; collection routes; public health by-laws and regulations, and aesthetics (Weichers *et al.*, 2001).

Industrial waste collection and storage has been highly mechanized in developed countries because of the bulk materials handling problems created by industrial wastes. Factors that must be considered in the choice and location of an industrial waste collection system include: the type of container and size; the transport and collection vehicle system; human-power; space constraints and internal logistics peculiar to the premises producing the waste; public by-laws and regulations, and aesthetics (Royal Society of Chemistry, 1996).

Municipal solid wastes can be removed from the premises where it is generated in several ways:

- can be grouped up by disposal units "garbage grinders" into a slurry and discharged into the waste- system;
- it can be conveyed pneumatically through tubes to a central collection point (this is a recent technological development, particularly applicable to densely situated multiple dwellings); or
- it can be placed in suitable containers, which are emptied into or carried away by an appropriate vehicle (street sweeping fits into this category, if one considers the hopper of a mechanical sweeper as the container in question) (Habitat, 1993).

The first two methods are not applicable in South Africa because of high costs attached to the method and non-payment for services. In South Africa and most other countries, solid waste is collected by trucks. In some instances these are open-bed trucks, which carry trash or bagged refuse. The usual vehicle, however, is the packer, a truck that uses hydraulic rams to compact

the refuse to reduce its volume and thus is able to carry larger loads. Each truck consists of one driver and two loaders. These workers fill the truck and then drive it to the disposal area. To avoid traffic hazards in big cities like Johannesburg, solid waste is collected in the central areas at night.

Commercial and industrial collections are facilitated by the use of containers, which are either emptied into the truck using a hydraulic mechanism, or where the entire container is carried by the truck to the disposal site. Vesilind *et al.*, (1983) estimate that 80% of the total cost of waste management is spent on collection.

2.13.4 Waste Transfer/ Transportation

There are various types of transfer stations. The capacity requirements, materials handling system, vehicles, containers and the nature of the waste are important in the design of a transfer station. Transfer stations cut the haul mileage considerably by eliminating the time the collection crew spends going and coming from the landfill. They reduce person power and equipment needs as well as fuel and maintenance costs. A transfer station also has another advantage in that the landfill has to shut down temporarily, the station may be able to absorb the surge for a short time, and so collection can continue. Waste can be transferred in the following ways:

- in a one-level system, trucks dump onto a flat, concrete floor. Material is push loaded into a container, which uses a hydraulic ram to load trucks;
- in a two-level system, trucks dump onto a flat floor. The trash is then pushed to an open-top trailer, which is positioned on a lower level to receive the material. In a direct-dump system a collection truck dumps by gravity into a funnel shaper hopper. A big-top trailer is positioned under the hopper to receive the material; and
- a three-level (composition pit) system uses a dumping pip into which the trucks drop their loads. In this pit, a truck-type tractor or truck loader crushes the material before feeding it into the hopper. From there it goes into the trailer where the hydraulic excavator may be used to distribute the load. The compaction pit is not practical in transfer stations where big volumes make the additional machines economical (Habitat, 1993).

2.13.5 Processing/ Recovery Methods

On-site processing and the sorting of waste at source have the following goals: recovery of usable material; volume reduction; treatment of the waste in order to transform it so as to facilitate cheaper transport and disposal (e.g. processing and recovery-chemical, biological); isolation (fixation, encapsulation); destruction (incineration), and landfill. This is further explained below.

2.13.5.1 Processing/ Recovery Techniques

i) Thermal Treatment

This consists of various methods of heat treatment of wastes and includes the following:

- **Incineration**

  Incineration is the thermal destruction of waste.

- **Low-technology incineration**

  Is based on the controlled open dumping of small daily inputs (5-10 tons per day) at small waste-disposal sites.

- **High-technology incineration**

  Uses purpose-built equipment such as double-chamber incinerators, rotary kilns, fluidized bed combustors, plasma arc furnaces or even mobile incinerators. The benefits of high-technology incineration are the reduction of waste volumes (which conserves land filled space), the reduction in transport costs, and the destruction of intractible wastes. The disadvantages include the high costs of the incinerator and of sophisticated gas cleaning and monitoring equipment (Du Plessis and Nero, 1991). Strictly controlled and monitored high-technology incineration may be environmentally safe but there is always the risk that a point source of pollution may be converted into a general source of pollution through stack fallout (Fuggle and Rabie, 1992). Incineration has a place in waste management for the treatment of organic chemical wastes where the high costs associated with the process and its control is justified (Lubie, 1990).

- **Pyrolysis of wastes**

  Is the heating of waste material in an oxygen deficient atmosphere in order to convert the waste, by processes of thermal cracking and condensation, into gaseous, liquid, and solid fractions which may be used as energy sources (Fuggle and Rabbie, 1992).

ii) Isolation from the Environment

This definition of the process is largely self-explanatory and includes a number of methods of dealing with intractable wastes that are not amenable to thermal treatment or physio-chemical methods. These including the following:

- **Encapsulation**

  Involves the sealing of selected wastes in reinforced concrete. This method is currently used in South Africa to deal with wastes that cannot be landfilled e.g. hazardous medical waste (Fuggle and Rabie, 1992). The method was specified by the Pollution Control Division of the Department of Water Affairs in co-operation with Waste-Tech. Encapsulation offers an alternative to incineration but is also relatively costly.

- **Stabilization, solidification and chemical fixation of wastes**

  Involves the blending of selected wastes with fly ash under high voltage e.g. explosives. The residue that becomes unreactive is then landfilled (Fuggle and Rabbie, 1992).

2.13.5.2 Recycling/ Resource Recovery

This traditionally involves the recovery of plastics, glass, paper, cardboard, metal and rubber from the waste stream. The recovery of these materials will achieve significant volume reduction (up to 30-40% of domestic waste), but should be economically viable and produce marketable goods. Recycling occurs when materials from the waste stream are recovered and serve as "raw material" input for the manufacture of a new product. Hence, recycling is not merely the separation of materials from the solid waste stream but occurs when such materials are incorporated into those products that enter the market place. The recycling process has two basic approaches. One is that recyclable materials are seperated at the point of generation by the waste generator, and these materials are collected seperately and transported to recycling markets. The second approach is to collect mixed wastes or co-mingled recyclable materials and separate them at a central processing facility. Recycling activity can take place at various stages, ranging from at source (in this instance the household) through to pre-disposal, be it landfill or incineration (Fuggle and Rabbie, 1992).

2.13.5.3 Biological Treatment/ Bioremediation

A rapidly growing field of research is bioremediation technology, initiated in the late eighties (Lawson & Alston, 1989). These include: composting (an-aerobic process). Composting is a form of recycling organic waste and includes: sewage and waste-water treatment, activated sludge, rotary biological contractors (aerobic and anaerobic), land farming (aerobic) e.g. petroleum wastes; clean ups e.g. oil spills, and contaminated ground water and landfill. As with other forms of recycling, this can take place at source, on the land of the householder, or in a composting plant prior to disposal (Lawson and Alston, 1989).

2.13.5.4 Reclamation

Reclamation of wastes can be distinguished from recycling in that materials, which are reclaimed from the waste stream, can have use or value without undergoing a process of recycling. Reclamation can take place at source or just prior to disposal. Pickers on landfills are examples of agents who reclaim waste prior to disposal (Skinner, 1994).

2.13.5.5 Reduction

Waste reduction activities help to minimize the rate of waste generation. Waste reduction has various aspects:

- **Toxicity Reduction**

  The nature of waste is changed by reducing a manufacturer's use of toxic materials in consumer goods.

- **Volume Reduction**

  This involves the use of less material initially. For example by reduced packaging in consumer goods.

- **Production Changes**

  Other methods of reducing waste include the production of goods that can be recycled more easily, such as changing from multi-material packaging; redesign of products; and restriction on specific product types.

- **Behavioural Changes**

  A number of economic factors can contribute to the reduction of waste; industries in the production of goods; individuals and commercial enterprises can use their purchasing power to create a demand for low waste products or items produced from

recycled materials; governments can influence producers through economic or other incentives, and can influence consumers through education and information dissemination (Skinner, 1994).

2.13.5.6 Sale of Recovered Goods

Whilst this activity might seem out of place as an activity in the waste management process, its importance is worth noting in the light of the discussion on recycling. Without markets for recovered or recycled goods, the activities of recycling and reclamation become redundant (Skinner, 1994).

2.13.5.7 Cost recovery

The issue of cost recovery in solid waste management revolves around whether the service provided is regarded as a public or private service. The extent of various activities within the solid waste management framework of public services varies according to the type of service offered e.g. street cleaning as opposed to household collection; and level of service provided e.g. curbside versus communal collection (Skinner, 1994).

2.14 DISPOSAL AND LANDFILL

Disposal of waste can take place in a controlled or uncontrolled manner. Uncontrolled disposal could take the form of dumping of waste or open burning of waste. Controlled disposal of waste usually takes place by means of sanitary landfilling or incineration. Landfill-based disposal is currently the most cost-effective method and still appears to be the most forgiving of all the established disposal methods (Knox, 1988). A landfill that is well designed and managed can operate with minimal adverse environmental impacts and, as a bioreactor, can produce utilizable landfill gas. Thus, it is inherently the most appropriate method for a developing economy. A sanitary landfill is not a dumpsite. It is a scientifically selected, designed, engineered and managed refuse-disposal operation where the daily input of waste is spread, compacted and covered with soil to a pre-planned development programme. The development programme specifies the types of waste that are acceptable and those that are unacceptable to the site and also the way in which the site will be managed.

2.15 ROLE OF LANDFILL IN THE WASTE MANAGEMENT SYSTEM

The term "landfilling" refers to the deposition of waste on land, whether it is the filling in of excavations or the creation of a landfill above grade, where the term "fill" is used in the engineering sense. Historically, both general and hazardous wastes have been disposed of on the land. This is because landfilling is the cheapest and the most convenient method of waste disposal. It is estimated that more than 95% of the waste generated in South Africa is disposed of in landfills, while the world figure is estimated to be in excess of 80%. Irrespective of the type of waste minimization technologies being implemented, waste will continue to be generated, and even if volume reduction or resource recovery is implemented, some form of residue always remains. Landfilling, therefore, represents the most commonly used method for the ultimate disposal of waste that cannot be eliminated by the waste minimization techniques or by processing (DWA&F, 1998).

2.15.1 The Environmental Impact of Landfill

Landfilling is environmentally acceptable if managed efficiently. Improper landfilling can have adverse impacts on the environment. Such impacts may be divided into short and long term.

2.15.1.1 Short Term Impacts

Flies, odour, unsightliness and windblown litter, are nuisances and can be a health hazard if close to residential areas, which are generally associated with a waste disposal operation. Residents of Belhar (Cape Town), for instance, complained of bad smells from a refuse dump sited only 100 metres away from some homes, and flying ash from occasional burning (Cape Times, 5 March 2003). These should cease with the closure of the landfill.

2.15.1.2 Long Term Impacts

Pollution of the water regime are generally associated with incorrect landfill site selection, design, preparation or operation. These may persist long after the landfill site has been closed. In 1991 a survey of sites commissioned by the Presidents's Council revealed that 62% caused water pollution, 65% caused air pollution and 71% posed a problem for nearby communities. They also established that most of the sites were inadequately designed,

supervised and monitored. Ongoing pollution problems at these sites were left unattended (President's Council, 1991).

The general objective of environmentally acceptable landfilling, therefore, is:

- to avoid the degradation of the environment in which the landfill is located.

More specific objectives are:

- to prevent pollution of the surface and ground water by any leachate produced; and
- to ensure public acceptance by ensuring environmental acceptability.

The above can be achieved by ensuring, proactively, that use is made of cost-effective means of protecting water quality, the environment and public health from both the short and long term adverse impacts of waste disposal (Hounsome, 1997).

2.15.2 Classification of Landfill Sites

Landfill sites are initially classified according to types of waste that they are permitted to accept (i.e. general or hazardous):

2.15.2.1 General Waste Landfill Sites

General waste sites are classified according to the projected maximum annual rate of waste desposition during the expected life of the landfill, expressed in tons per day. Table 2.1 presents the landfill size classification based on the Maximum Rate of Deposition. From this table, it can be seen that general waste landfills are divided into four size categories; communal, small, medium, and large. In cases where the Maximum Rate of Deposition (MRD) provides a borderline situation, the responsible person must use the higher class.

Table 2.1 Landfill size classification based on the Maximum Rate of Deposition (MRD)

Landfill Size Class		Maximum Rate of Deposition (MRD) (Tones per day)	
Communal	C		<1
Small	S	>1	<25
Medium	M	>25	<500
Large	L	>500	

General landfill sites are further classified according to whether they are likely to generate significant volumes of leachate (water that has percolated through solid waste or other material and carries matter that has extracted in solution or suspension management. This classification is based on the Climatic Water Balance (B), which is determined from the difference between rainfall (R), and evaporation (E). A site is classified as B+, if the climatic water balance is positive for more than one year in five, and B, if the climatic water balance is positive for less than one year in five. Because of the rainy weather conditions in Durban and the immediate hinterland, all general landfill sites in this region are classified as B+. All B+sites, with the exception of communal sites, are required to have leachate management systems (Hounsome, 1997).

2.15.2.2 Hazardous Landfill Sites

Hazardous landfill sites are classified according to the hazard rating of the hazardous waste that they are permitted to accept. Landfill sites which accept all types of hazardous waste, including high hazardous wastes with Hazard Ratings 1 and 2, are classified as "H:H" sites. Such landfills have to be designed, engineered and operated to the most stringent standards. High hazardous waste even in low concentrations, have significant adverse effects on public health and/or the environment. This would be because of its inherent chemical and physical characteristics, such as toxic, ignitable, corrosive and carcinogenic. Examples of wastes that are potentially hazardous are:

Inorganic waste

- Acids and alkalis;
- Cyanide waste; and
- Heavy metal sludge and solutions

Oily waste

- Wastes primarily from processing, storage and use of mineral oils.

Organic waste

- Halogenated solvent residues;
- Paint and resin waste;
- Biocide waste; and
- Organic chemical residues

Landfill-sites which receive less hazardous wastes with a hazard rating of 3 and 4 are termed H:h sites. These sites are permitted to receive specific loadings of hazardous wastes. The design standards for H:h sites are less stringent as opposed to H:H sites. The site accepts high volume/low hazard waste such as waste that contains small quantities of highly dispersed hazardous substances. This waste presents a relatively low hazard. Examples are:

High volume/ low hazard waste

- Harbour dredge spoils;
- Sewage sludge and
- Soils and builder's rubble which are contaminated by heavy metals, oils and other pollutants.

Miscellaneous waste

- Infectious waste such as diseased human/animal tissues, soiled bandages and syringes (medicinal waste);
- Laboratory waste;
- Redundant chemicals or medicines; and
- Explosive waste from manufacturing operations (DWA&F, 1998).

2.16 LANDFILL DISPOSAL IN THE DURBAN UNICITY (ETHEKWINI)

Durban Solid Waste (DSW) and Durban Metro Water Services (1999) contend that sanitary landfill is the most economical and satisfactory means of disposal of domestic solid waste generated in the DMA, provided that suitable land is available to develop such landfill sites within an economic transportation range. It is also estimated by DSW and Durban Metro Water Services that collection and transportation account for 60% to 75 % of the total cost of the solid waste disposal process as a whole. According to the Deputy Head of the Plant and Disposal Unit of DSW, 1,5 million tons of solid waste per annum, is received at the Bisasar Road Landfill site in Springfield from the eThekwini Municipality (Personal communication, 4 November 2004).

Currently Durban Solid Waste (DSW) operates 3 general waste types (G) facilities for the disposal of the solid waste fraction generated throughout the region namely Bisasar Road in Springfiled, Marianhill and Tongaat landfill sites. The two privately owned and operated H:H landfill sites of Bulbul Drive and Shongweni are responsible for the disposal of high hazardous wastes generated in the DMA. The Marianhill Landfill Site, a new facility established in July 1997, is situated approximately 6km from Pinetown and some 400 metres from a residential area. The Tongaat Landfill Site is situated amidst the sugar cane fields some 15km from Tongaat with the nearest rural dwelling located approximately 5 km away. The Inanda Landfill is the Metro's most recent site closure. The Bisasar Road Landfill site, one of the busiest country-wide, established in May 1980, is most opportunistically situated some 10 km from the City Centre, located in the heart of a residential area called Springfield (Strydom, Strachan and Parkin, 1998).

It has been reported that the Durban Municipal authorities will have to find more than R300 million within three years to finance new dump sites, or the city would face the prospect of starting to "Choke on its own rubbish" (Daily News, 9 May 2001). According to Metro Beat (15 May-15 June, 2001) the city's monthly magazine, the Unicity plans to build a new transfer facility to cater for the city's needs. Mark Glasson, the Operations Manager at DSW says a new landfill site; North of Hazelmere Dam in Verulam will also be built together with the waste transfer facility. The transfer station of the Bisasar Dump in Springfield will cost between R45-million and R50-million. The transfer station will handle 1 500 tons of waste a day with expansion to 2 000 tons a day. The closure of the Bisasar Dump in Springfield will ensure that

only garden cuttings and rubble are accepted there and no other food or toxic waste. The new transfer station in Springfield will be installed with ultra modern equipment. Trucks bringing in foodstuff and toxic waste will enter the transfer station where the rubbish will be off-loaded into a truck. It will be compressed to about one-fifth of its size. Councillor Yakoob Baig of Springfield reported that the transfer station would be a unique feature in South Africa (Weekly Gazette, 14 June, 2001).

The natural growth and development of the Durban Unicity results in an increase in solid waste generation, and at the same time results in increasing demands that landfill sites within the area be closed, firstly due to public perceptions, and secondly due to sites reaching airspace capacity. The ability to identify new suitable sites within an economic transportation range has become increasingly difficult especially with the "NIMBY" syndrome (Not In My Back Yard) pervading the attitude of the general public. Politics and land use ignorance also play a major part in the difficulty of placement of new sites, reports the DSW and Durban Metro Water Services (2000).

Due to these factors, landfill sites are being established further away from the source of waste generation and beyond the present economic transportation range. Thus, there is a need to transfer the solid waste collected from existing collection type vehicles to long haul vehicles. The additional cost of long haul systems can be limited by the reduction of the volume/mass of material that needs to be transported to disposal sites. The volume of material can be reduced by the minimisation of waste generated at source, or by the recovery of material through recycling and composting (DSW and Durban Metro Water Services, 2000).

2.17 THE IMPACTS OF SOLID WASTE ON THE ENVIRONMENT

The generation of substantial quantities of waste is an inevitable consequence of modern-day urban living. These wastes impact on the human and natural environment. The nature and extent of the impact depends on a number of factors, including the quantity and composition of waste, the adequacy of collection services and the methods of disposal. The extent of recycling and re-use is also significant, as this affects both the quantity and the composition of the matter that needs to be absorbed into the environment. On the national level, issues such as toxic build-up in soil and water from inadequately managed landfill sites are important, and will eventually

affect the population and the economy as a whole (WRC, 1995). However, in inadequately serviced and generally overcrowded low-income urban areas there are far more immediate concerns. In urban townships the major problems are those that result from uncollected waste and informal dumping sites and the negative impacts on the human and natural environments. These problems are the main focus of this study, with reference to both the human and natural environments, both within neighborhoods and further afield. Problems caused by poor waste management are listed below.

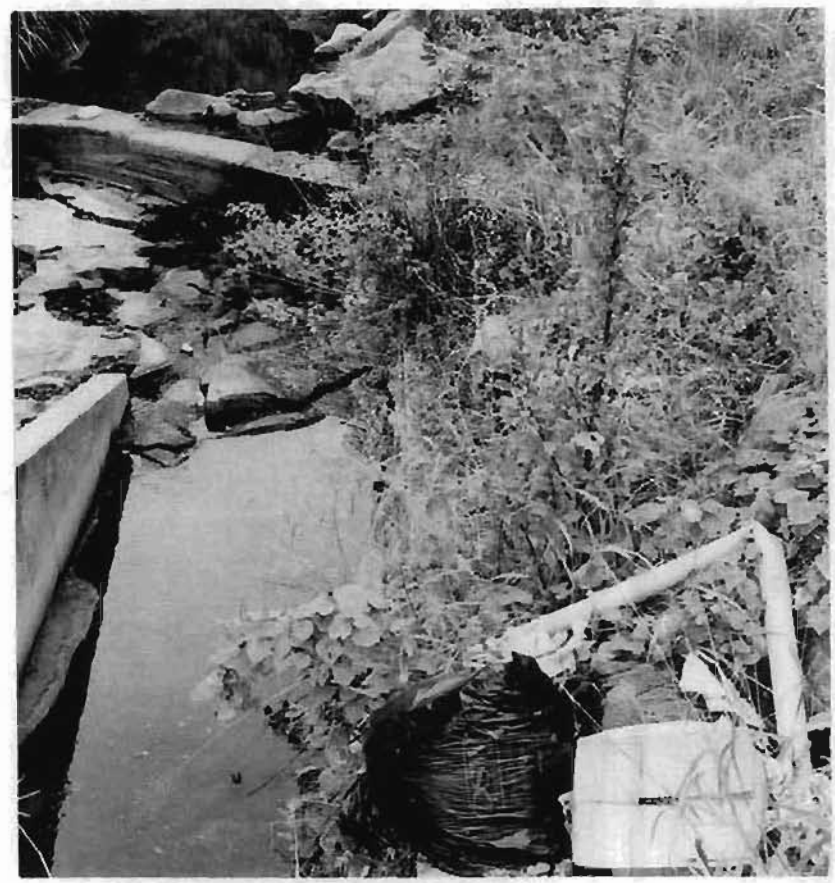
i) Health problems

For people living in areas where waste collection services are either inadequate or totally absent, uncollected household waste makes life not only unpleasant, but also more hazardous. Such waste poses a health risk both directly and *via* its effects on water supplies and drainage systems. Waste matter, together with loose soil, can lead to blockages in the storm water drainage system. Standing water becomes contaminated with pathogens from decaying wastes. Contaminated standing water exposes residents to the risk of many "faecal-oral" diseases, cholera, typhoid, intestinal parasites and diarrhoeal diseases. People may become infected if standing water contaminates their hands, eating utensils or water supplies. Children who play in the water are at particular risk. Standing water also encourages mosquitoes to breed, and can cause diseases such as malaria and yellow fever to spread. Bilharzia in vulnerable areas is a further potential hazard, if standing water allows snails that host the parasite to breed. All that is required is for the faeces of one infected person to contaminate the water for large numbers of people to be placed at risk (WHO, 1991).

ii) Impact on water quality (Human life)

Water quality problems arise from stagnant water in storm-water channels, streams and rivers. A study of the quality of the water flowing into the Juksie River from Alexandra revealed very high levels of pollution. The major source was identified as human and animal excreta, with uncontrolled waste a secondary source (Wimberley, 1993). Contaminated water can thus pose a health risk to people both within the immediate area and further afield. For instance, people coming into contact with the water in the storm water canals in Khayelitsha, such as children swimming, are at serious risk of contracting diseases such as diarrhoea and cholera (Wright *et al.*, 1992).

Plate 2.3: Waste dumped on river bank in Bulbul Drive-Chatsworth



According to the Daily News (1 February 2000:4), "mountains of rubbish, including toxic substance containers, used tyres, building material and domestic waste, litter the Umkhumbane River banks and its narrow tarred roads, making it look like a town in the midst of a civil war". According to Umkhumbane Residents' Association chairman "businesses and people from Westville and Pinetown are dumping loads of rubbish in the area because it has vacant land still earmarked for development". In one instance residents have dumped a pile of rotten meat in the river. Umkhumbane residents fear that during the rainy season, the heaps of rubbish will be washed into the river, causing more pipe blockage and polluting the river supply (Daily News, 1 February 2000).

iii) Impact on water quality (Aquatic life)

Large proportions of uncollected waste end up in watercourses and eventually the sea, and this has a detrimental effect on the ecology of the areas concerned (Plate 2.3). Decaying organic matter and bacteriological activity use oxygen, thereby reducing the amount available for

aquatic life. The presence of nutrients in the water, as a result of the process of decay, leads to the undesirable growth of aquatic weeds, algae and macrophytes. This in turn affects water quality, is unsightly, can interfere with recreation and poses a potential health hazard (Wimberley 1993; CSIR 1991). Plastics can be a particular problem for river marine life (CSIR, 1991). According to Stander and Benade (1990), large numbers of marine and freshwater birds, fish and animals die every year after ingesting or becoming entangled in plastic. Plastic can pose a similar problem for animal and bird life on land.

iv) Pests and diseases

Organic waste attracts pests such as flies, rats and cockroaches. These pests, besides being a nuisance, can be carriers of diseases such as hepatitis A, trachoma and diarrhoeal diseases (Hardoy *et al.*, 1992). The chances of contracting pest-related diseases are also that much greater among children due to their greater exposure and the unlikelihood of them practising good hygiene.

v) Injury

Children playing in and around uncollected garbage are at risk of injury from, for instance, broken glass and rusty tins. Animals are also at risk of injury by searching for food from cans such as tinned sardines. According to a personal interview with a resident from Chatsworth, "a stray cat was seen with it's neck stuck in an open sardine tin can in search of food close to a waste dump in Chatsworth" (Personal communication, 13 July 2004). Another example of animals at risk from injury by irresponsible waste disposal was observed by a householder where "a wild monkey was injured by a piece of rusty wire. The monkey was in search of food from a waste dump and entangled its paw in rusty wire that was discarded" (Personal communication, 18 December 2003).

vi) Air pollution

Uncollected waste is often burned and this can give rise to air pollution. Burning can lead to the release into the air of both toxins (e.g. from certain plastics) and suspended particles e.g. ash. These, in turn, may cause or at least aggravate respiratory problems and skin and eye irritations, (Hardoy *et al.*, 1992). Burning of wastes is a fairly common practice in South Africa. For instance in Alexandra and Soweto, a large proportion of uncollected waste is burned (WRC,

1995). A study conducted by Dawnarain (1999) has shown that residents suffered from respiratory problems due to large amounts of waste that was burned by the informal settlements on the banks of the Palmiet River in Durban.

vii) Aesthetic effects

Uncollected waste is aesthetically objectionable, both visually and due to smell from rotting waste; this affects both the resident population and the wider community. According to Hardoy *et al.*, (1992: 69) many "psychosocial disorders" are associated with poor living conditions, with such disorders including depression, drug and alcohol abuse, suicide and violence of many kinds. While inadequate solid waste collection is only one among a number of perhaps more serious environmental problems, it nevertheless remains a significant and certainly very visible, factor in the creation of a stressful environment. On the wider front, uncollected waste is unsightly and offensive to both residents and visitors. Much of this finds its way into rivers, dams and the sea, causing aesthetic problems in these areas. This litter problem can have an economic impact, as it may reduce the viability of the affected areas as tourist/ recreational destinations (WRC, 1995).

2.18 KEY ACTORS IN COMMUNITY PROJECTS ON WASTE MANAGEMENT

i) The roles of Traditional and Informal leaders in new initiatives

In rural areas traditional leaders are the wise men, the notables, district leaders and religious figures. They play an important role in the success of an activity and act as mediators between residents and community structures. They benefit from their image of respectability due to their social rank (their age and their religious status) and they are vested with traditional powers. Being well acquainted with residents and younger people at a neighbourhood level, they often have control over social life, solve problems, centralize requests and approach the local authorities. They may also become personally involved in the activities, providing associations with backing and lending them moral support. They act as leaders in conflict resolution between residents, associations, micro-enterprises and local authorities. In Dakar, women are compelled to ask traditional leaders to act as intermediaries and to intervene on their behalf before they were accepted by residents to participate in clean-up campaigns (Obasi, 1999).

In urban areas social informal leaders (leaders, teachers, leading politicians) are more involved at the management level, although they may have a certain influence at a neighbourhood level. They often help to initiate projects, setting-up committees and clean–up campaigns. Political leaders in Karachi conducted an urban regulation project for people threatened with eviction, thereby gaining their confidence whereby they became involved in the waste collection programme. In Ouagadougou, two young district leaders together with the church community successfully co-ordinated a waste management project. In San Nicolas Batak in Cebu City, political leaders that formed the local council mobilized themselves on environmental matters, and for the representation of underprivileged people in local decision-making. The local council, as the political and administrative authority in the district, is now strongly involved in the clean-up campaign (Obasi, 1999).

ii) The roles played by the youth

Young people are reported to be the motors behind projects. Since they know their district and attach great importance to sanitation and health care issues, they long for a change and set themselves apart from political structures or traditional meeting places in order to organise their own community projects. They act very efficiently in their tasks as community health workers, communicating with residents and participating as voluntary workers in clean-up campaigns. Neighbourhood associations are often composed of young people, who are unemployed and thus available for voluntary activities and unpaid work. Participation in a collective action represents an opportunity to demonstrate their abilities, to put them in the service of a district or a sanitary project and hopefully to get jobs as community health workers. educators and sweepers etc. In Ouagadougou, the founding of the Bao Manegre Association gathered 150 young people, attracted by job prospects (Arsens, 1998).

iii) The roles played by women in community participation

Bulle (1999) indicates that women are the first ones to be affected by deterioration in the environment and the urban framework. Scheinberg *et al.,* (1999) concluded that participants from all areas of the world shared a general observation that women are responsible for cleanliness and hygiene within the home and that this responsibility extends to the areas around the home, compound and neighbourhood etc. They bear the brunt of the daily load of unhealthy situations on a domestic level: infectious diseases and childhood diseases lack of clean water,

accumulating waste and lack of sanitation. Since they are responsible for the maintenance of domestic space and the health of children, they are endowed with a sense of civic responsibility and a desire to improve their living conditions and health situation. This is the reason for their strong involvement in solidarity networks, where they seek collective solutions for improving the environment. They are found at the root of many initiatives on health care, supply of drinking water or awareness about environmental sanitation, and they exert pressure on the authorities to obtain representation for the most underprivileged people.

According to Bulle (1999) two-thirds of the members of the Basak Urban Poor Co-ordinating Council (BUCCP) in Cebu City are women. This committee is composed of associations and works in conjunction with local authorities on the clean up of public spaces and waste collection. The environmental surveillance committees in the city are mainly composed of women as well. However, even if they are becoming more involved in public spheres, women face numerous difficulties in gaining better representation, having their advice listened to and becoming involved in decision-making: they are up against religious barriers, social hierarchies and the weight of traditions. Gender is, therefore, a factor in community decision making, since the composition of committees and the procedure for selecting representatives to higher-level committees has a great influence on whether women's interests are voiced and taken account of at appropriate levels.

iv) Women as Waste System Clients and Supervisors

The household is, in many ways, the most important, as well as the smallest, economic unit in an urban environment. Urban services, as well as taxes, are based on the household as the primary unit of activity. Scheinberg *et al.*, (1999) indicate that women are most often the household managers and the ones who, within the household, are charged with managing the practical aspects of daily life: getting and preparing food, supplying water, assuring cleanliness and maintaining the physical spaces. Given the well-acknowledged role that women play within the household, and the lack of formal acknowledgement of the role of women as the primary clients of urban service systems is perhaps surprising. Women, as household managers, represent the largest body of waste system clients. In terms of the formal planning process, gender analytic tools are important (and generally neglected) in any waste management or recycling diagnostic, assessment, or planning process.

v) Women work for free, men work when there is pay involved.

Women work for free and men work when there is pay involved. Women "have to" handle waste in their homes: it is part of the definition of who they are and what they do and may relate to their lower economic and social status. An important aspect of this is that women who are able to afford it may pass this responsibility to servants. Women do not get paid for this activity, even when these activities extend beyond the home to community cleaning. Men, on the other hand, tend only to handle waste when they are paid for it, or when it is specific to their activities. The experience with community-based activities tends to reinforce the insight that women may often be involved with waste management, community clean-ups, or even street sweeping, at a civic activity level. It is overwhelmingly men who are selected for paid labour when there is an opportunity to institutionalize the volunteer activities even when there are NGO interventions that attempts to safeguard women's positions (Scheinberg *et al.*, 1999).

In Quagadougou (Burkina Faso), the community organization at first only employed men, arguing that garbage collection was a "typical man's job. It was only when the high turnover of male collectors began to diminish the effectiveness of the collection service that the CBO agreed to employ women. It turned out that women were very reliable employees. These women from situations of extreme poverty were bent on doing good work, as they saw this as their only opportunity, given their lack of employment skills (Scheinberg *et al.*, 1999).

In many Southeast Asian countries women are traditionally responsible for household waste, sweeping the streets and compound, and take pride in keeping the environment clean and tidy. As soon as any of the tasks become paying jobs, men were either targeted for the jobs for various reasons or ended up dominating the structures and decision-making systems. The volunteer unpaid work of women at the household and community level ends up being on a lower status because it was taken for granted that these women are responsible for keeping their environment clean (Waste ILO Mission, 1998).

vi) Position of women and gender relations in waste management

Khabeer (1994) indicates that because of women's status as household managers and their greater familiarity with the practicalities of solid waste, women in positions of authority in community or city government may exhibit different preferences for waste management

strategies than their men counterparts. Female employees of the collection services generally have difficult family circumstances and difficulty in the community as well, so they are forced to use survival strategies. Women see themselves obliged to take jobs outside their home that can bring in an income for their family. They are less hesitant than men when it comes to accepting a job which is menial (waste loaders, sweepers) or which is merely formal. The behaviour of residents can be discriminatory towards women municipal waste loaders by paying them less respect than men. Discrimination is also manifest in the division of roles within the community. Because they have little education, and in fact are often illiterate, women carry out duties that do nothing to improve their status (loading a truck). They are assigned work belonging to the domestic and private sphere (cleaning). Business dealings and public decisions (bookkeeping, management) remain male prerogatives. Women are not really involved in decisions about the management of the service they provide because they are not always available (on account of their double working day), and furthermore they lack proper training. Their poor educational background limits their access to key responsibilities such as treasurer or responsible chairperson of the management committee. Being in charge of the family budget at the domestic level, they are concerned about the utilization of the funds, the expenditures and the financial transparency of the projects (Bulle, 1999).

According to Arsens (1998) in some instances women demand the right to appropriate training and in many cases they put pressure on project executives to grant them genuine involvement in the decision-making process to improve the quality of the projects and especially to aspects giving people responsibilities in respect of environmental waste management. In Cebu City there has been a change in management methods since women have been involved in it. In all the projects women are partners when it comes to awareness raising and motivating others and to their pragmatic knowledge of the environment. Two-thirds of the members of the public hygiene surveillance teams set up by community organizations are women.

2.19 THE SOUTH AFRICAN LITTER PROBLEM

Ryan and Swanepoel (1996) define litter as solid waste that is discarded, not recycled, incinerated or stored in landfills. According to Du Plooy (1997) litter can be defined as waste materials which are not disposed by means of the provided waste management systems e.g. waste that has not been deposited in the litter bins provided by municipal cleansing services.

Litter is waste materials strewn all over the countryside, along the roads, in parks and fields, in sport stadiums, pavements and beaches. Litter is the uncontrolled part of the waste stream and has detrimental effects on the environment.

Many different types of litter have been identified by researchers e.g. Allison *et al.*, (1996) and Island Care New Zealand Trust (1996). A simple classification system is proposed below.

- **Plastics**: e.g. shopping bags, wrappings, containers, bottles, crates, straws, polystyrene blocks, straps, ropes, nets, music cassettes, syringes and eating utensils;
- **Paper**: e.g. wrappers, newspapers, advertising flyers, ATM dockets, bus tickets, food and drink containers and cardboard;
- **Metals**: e.g. foil, cans, bottle caps and number plates;
- **Glass**: e.g. bottles and broken pieces;
- **Vegetation**: e.g. branches, leaves, rotten fruit and vegetable;
- **Animals**: e.g. dead dogs, cats and sundry skeletons;
- **Construction Material**: e.g. shutters, planks, timber props, broken bricks and lumps of concrete; and
- **Miscellaneous**: e.g. old clothing, shoes, rags, sponges, balls, pens and pencils, balloons, oil filters, cigarette butts and tyres.

Hall (1996) indicates that the most common sources of litter are the following:

- the anti-social behaviour of individuals in dropping litter on footpaths, throwing it from vehicles, and dumping household wastes;
- the imposition of unwanted packaging on unwilling consumers;
- the failure of street sweeping services to rid pavements and public areas of litter;
- inadequate disposal facilities, including a breakdown in litter collection practices or
- the provision of inappropriate bins. Open bins and collection vehicles may provide an opportunity for litter to be blown into the public domain; and
- failure by the authorities to enforce effective penalties to act as a deterrent to offenders.

From the above it is obvious that litter is a problem associated with human habitation (CSIR, 1991). Statistics show that the average South African person living in urban areas uses products, which cause up to 2 kg of waste every day. South Africa has to get rid of about 65 000 tons of waste per day, or about 24 million tons per year (UNESCO, 1999). We have to manage this waste carefully otherwise it can become litter or cause pollution. Litter is a specific waste problem. Litter is waste in the wrong place. Litter just does not happen since is created by humans.

A soft drink can in itself is not litter–it is a very useable item. It only becomes litter when a human being drops it on the grass or leaves it at a picnic spot or throws it out of a car window. It is very common for people to throw their litter out of the car whilst travelling. Once litter is discarded carelessly it may be moved around. It is moved by wind, water, people, cars and animals. As litter moves, fences, walls, plants, water, parks and roofs may trap it. Research conducted by UNESCO (1999) indicates that litter is very difficult and expensive to collect and can also pose a source of ill health which contributes to the spread of infection. Below are the sentiments and view points of residents in Durban.

2.19.1 Disadvantages Attached to Littering

It costs a lot of money to collect waste, but it costs even more to collect litter because it is just thrown anywhere. Litter defaces the environment and it causes pollution. Materials like paper, plastics and other inflammables are fire hazards. Plastic bags or cartons can be road safety hazards, blowing around and landing on moving vehicles' windscreens. Litter, like broken glass and rusty cans, are safety hazards. Litter is harmful to wildlife. Litter may entangle or injure animals, and if swallowed, even suffocate or kill them (Ryan and Swanepoel, 1996).

Litter degrades the neighbourhood as well as being a health hazard. Tourism has been identified as the sector that can attract much needed revenue and foreign exchange. Litter is unsightly and discourages tourists to visit the country. South Africa's beaches are an important facet of the country's tourism potential. Coastal authorities spend an estimated eight million rand each year cleaning beaches. More than 50 000km of coastline is cleaned annually, with most effort focused on urban resort beaches, many of which are cleaned daily throughout the year. The amount of effort spent on cleaning beaches has increased significantly over the last 30 years, but

litter loads continue to rise. Over the last 50 years the sea has accumulated a vast amount of litter, primarily plastic (Ryan and Swanepoel, 1996).

Litter in the sea has a variety of impacts, both ecological (for example, entangling or being ingested by animals) and economic (reducing the value, both aesthetic and fiscal, of a valuable recreational resource). In South Africa, beaches are important to the tourism industry, which was estimated to generate R12 billion and directly supported 4 million jobs in 1994. One of the main appeals of South Africa is the relatively unspoiled nature of its environment. However, the amount of litter on our beaches is increasing rapidly. A total of 34 authorities estimated the annual cost of their beach cleaning operations at R5.5 million. The largest spenders were coastal cities with Cape Town spending the largest amount of money (>R3.5 million) (Ryan and Swanepoel, 1996).

2.20 THE RELATIONSHIP BETWEEN POVERTY AND WASTE

The significance of the environment as the engine of life is the primary concern of people all over the world. If the environment is abused both health and development suffer, people become ill from environmental diseases and development, which depends on the correct use of environmental resources (Rodda, 1991). Detwyler (1979) contends that the three words namely air, water and soil, evoke some of the deepest, most ancient, and most lasting emotions of mankind. However, the imbalance in the ecosystem is created when humans strive to undertake the economic demands of the world. According to Detwyler (1979) there are six basic causes for the deterioration of the human environment namely: ignorance, attitude, population, technology, economics and synergism. Perhaps it would be best to add vulnerability to the list, as this is the key enemy of the environment in Third World countries such as South Africa.

Third World countries are characterized by poverty, unemployment, and in most instances landlessness of the deprived masses. According to Blaikie *et al.*, (1994), vulnerability is the characteristic of a person or group in terms of their capacity to anticipate, cope with, resist and recover from the impact of natural hazards. Some groups in society are more prone to damage, loss and suffering. It may be argued that, poor people do not exploit or degrade the environment because they are "stupid" or ignorant, but it is due to their vulnerability.

South Africa is experiencing a burgeoning population growth with a need for food, water, shelter, warmth, land and employment. Government provides health care, education, social services, roads and infrastructure, and many other services needed by the community. According to Kgaogelo and Otieno (1999) education can have a direct impact on the behavior towards the environment. It is expected that people with higher education levels will be well informed of the negative impacts of wastes on the natural and human/animal environment. As a result the more educated people will behave more responsibly towards their environment with regard to waste management issues. Lack of education combined with high levels of unemployment, can be regarded as a major factor in determining the quality of life of individuals, families and communities. It has been revealed by the Poverty and Inequality Report (PIR, 1998a and Urban Foundation, 1990) that unemployment is one of the major contributors to poverty, with the estimate for that time being between 25 and 40 percent. As a consequence of poverty, homelessness and unemployment, it is inevitable that the priorities of the poor will continue to revolve around issues of survival, with environmental issues often being perceived as peripheral, and thus of little relevance to their lives. Job creation is no doubt the solution to alleviation of poverty (Khan, 1998).

Durban has carried the major part of the increase in informal housing and contains the greatest part of the freestanding informal settlements (Cross *et al.*, 1997). Informal settlement areas are characterized by poor and unhealthy housing, with a very low standard of living. Residents also experience poverty, inadequacy or inaccessibility to services such as water, electricity, sewerage, and sanitation as well as refuse collection systems, to meet their basic needs (Kgaogelo and Otieno, 1999). Inadequacy in the provision or lack of domestic waste management contributes mainly to the accumulation of wastes. Wastes remain uncollected for longer periods whereby some squatters either bury or burn their waste. The remaining waste exists as open dumps, situated near residential areas and covered with soil infrequently, or as litter lying on the streets (Cross *et al.*, 1997).

It is frequently said that the poor have to bear the burden of environmental degradation. There are marked inequalities inherent in South African urban areas. According to the World Bank (1995), black residential areas are four times more crowded than those of whites. Health and environmental impacts due to inadequate housing and essential services like waste have become

a major issue in the developing world. More than 600 million people live in sub-standard and health-threatening neighborhoods and millions of South Africa's urban inhabitants do not have adequate waste removal services, sanitation, treated water and rely on wood or coal as domestic sources of energy.

The links between economic growth and the environment are complex (Serageldin, 1996). Unemployed people are not concerned with issues regarding waste and a clean environment as they have more pressing problems such as taking care of their basic needs for their survival. As a result the environment gets neglected due to the economic problems associated with unemployment. The dynamics of poverty, demography and economics are diverse and interrelated. The protection of the environment is essential for development and forms part of a national agenda to reduce waste. At a community level, issues such as health impacts of inadequate waste management systems predominate, while landfill problems are usually addressed at the provincial or metropolitan level. Environmental awareness, vested interests and levels of community participation no doubt influence the appropriateness, and accuracy of any attempt to assess or prioritize the environmental issues and impacts pertaining to certain urban areas or urban developments (Poswa, 2000).

2.21 PUBLIC PARTICIPATION AND ENVIRONMENTAL DECISION MAKING IN SOUTH AFRICA

The history of South Africa has been one in which the vast mass of the population has, until recently, been excluded from participation in the political decision making mechanisms of society. Lacking a tradition of democracy and public involvement, especially at a grassroots level, the consequence has been that broad-based public participation in environmental decision-making has been minimal. It is a widely accepted principle, that broad-based community involvement is essential for responsible and accountable environmental planning and resource management. Given South Africa's history of marginalizing the majority of the population from decision-making mechanisms of society, it is especially important to ensure that public participation in decision-making with regards to environmental laws and waste managements issues are truly all embracing (Khan, 1998).

Socio-economic factors such as low levels of education and widespread illiteracy among poor, pose considerable obstacles to public participation, since the extent of public participation in environmental issues is largely dependent on the existence of an informed, environmentally aware public. According to the 2001 Census Survey in South Africa, literacy rates (defined by a number of people who have completed Standard 6), have been estimated at 43% for Africans and 56% for Coloureds). Twenty-two percent of Africans aged 20 years and above have received no education whilst 8,3% of the Coloured population aged 20 years and above were illiterate (Statistics South Africa, 2003). The problem of illiteracy severely restricts the extent of public participation (Khan, 1998).

With regard to inappropriate public participation techniques, too often, techniques more suited to a "first world" approach are applied indiscriminately in poor communities, usually with negative results (Lombard, 1999). Such techniques include "knock and drop" questionnaires requiring respondents to return completed questionnaires by post; lengthy questionnaires; public documents written in academic or scientific jargon; public documents in a language not commonly understood by the target community; public meetings held in inaccessible venues or at inconvenient times; public meetings conducted in a language not commonly understood by local communities; and public meetings in which the official proceedings are dominated by academic or scientific jargon not easily understood by the general community. Inappropriate public participation techniques are extremely harmful, often either intimidating or antagonizing the very communities they are attempting to involve (Khan, 1998).

2. 22 WASTE MANAGEMENT FOR SOCIO ECONOMIC DEVELOPMENT

Mbande (1998) reported that the attitude towards waste has a socio-economic perspective. The more affluent the community, the more sensitive the community is about problems concerning solid waste management. Examples of such communities in Durban are residents in Umhlanga and Durban North where illegal-dumping is not a common problem yet communities in townships such as Umlaas, Cato-Manor, Chatsworth, Phoenix and in several informal settlements in and around Durban experience major problems of illegal dumping and littering (Personal Communication, Deputy Head: Plant and Disposal, DSW, 4 November 2004). This makes waste management easier in an affluent community due to the co-operation of the

community that puts pressure on the local authority. The poorer the community, the less emphasis and sensitivity towards solid waste management.

This phenomenon can be better explained by Maslow's hierarchy of needs, which are basic needs, safety, social, esteem and self-actualisation. Some communities in developing areas are poor and in search of basic or survival needs such as food and water. These basic needs can be defined as human requirements needed for a person to survive. There is no human function, which absolutely requires solid waste removal for its survival, and that solid waste management is definitely not a basic need for the poor and as such would be at the bottom of their priority list (Mbande, 1998).

In South Africa the main motivation for implementing community participation has not only been to ensure a clean and healthy environment, but has also been economic upliftment as follows:

- optimise community involvement in the design of the system and its implementation;
- optimise the socio-economic benefits such as skills, entrepreneurial development and job creation;
- ensure the most appropriate, affordable and sustainable system; and
- improve the local environment (Mbande, 1998).

2.23 ILLEGAL DUMPING

Solid waste has become a problem in South Africa. The problem is clearly visible, for example, litter in our streets, roads and open spaces, abandoned motor vehicles and appliances, and many open dumps all over the country. Although certain aspects of the problem are less visible, such as the contamination of water, the danger of hazardous residues, and especially the depletion of natural resources, they are at least important as the more visible impacts. In certain instances solid waste disposal is interrelated with air pollution (burning of wastes and odours from open dumps), water pollution (contamination of ground water and the dumping of waste into rivers, lakes and the sea), and even with noise (collection of refuse) (WRC, 1995).

Many South Africans are familiar with living next to an open space, which is turned into a waste dump overnight. Domestic refuse and hazardous waste-anything from animal carcasses, domestic rubbish, old cars, builder's rubble and paint cans are daily dumped in people's living environment. Besides detracting from the value of open spaces for recreation, dumping poses a number of health threats: from bacterial diseases in putrefying meat and kitchen wastes to poisonous substances in, paint strippers, thinners and insecticides. Apart from quite a lot of waste being hazardous, open spaces are threatened by hazardous wastes from industry as well. It is believed that only 50% of hazardous waste actually reach the formal waste stream (Nel, 1996). It is also believed by local communities that certain waste authorities like Durban Solid Waste (DSW) encourage illegal dumping in a way by exorbitant rates for removal of garden wastes (Metro Beat, 2002). Recent reports of medical wastes being dumped illegally in urban residential areas from nearby medical centres show the culture of irresponsibility amongst interested parties in the harmful effects of waste (Natal Mercury, 18 April, 2003).

Local government has traditionally been responsible for the management, collection and disposal of urban domestic and commercial waste, while industry has been responsible for its own waste. However, illegally dumped industrial waste is frequently observed on undeveloped land, particularly near industrial areas. According to DEAT (2000) the disposal of both general and hazardous waste by landfill is considered the most cost-effective disposal option for South African conditions. However, illegal dumping and the creation of informal landfills (often in the form of burning of waste on open dumps) is a major problem in the lower socio-economic communities, often due to the lack of organized waste collection and exacerbated by a lack of adequate resources. Medical waste is at times disposed of at these sites, and informal salvagers, as well as the general public (especially young children), are at risk of contracting Tetanus, Hepatitis and other diseases from this practice (Poswa, 2000).

Fullerton and Kinnaman (1996) indicate that when no enforcement measures are taken, illegal dumping can constitute 28 percent of the total reduction in garbage at the curb. According to Poswa (2000), fighting for stricter penalties as part of the NMWS to address the problem of illegal dumping in urban open spaces will not be implementable because South Africa does not have the regulatory capacity to enforce these penalties. A culture of environmental responsibility must be encouraged among all the interested parties and all parties must get away

from the "not in my backyard" attitude (Nel, 1996:11). Studies conducted by Fulleton and Kinnamon (1996:978) indicate that "one of the biggest concerns that policy makers have when they consider going to a unit-based refuse system is illegal dumping. As residents realize that they will be charged for the waste they set out on their curb, some will illegally dump or burn trash to avoid the extra expense. However, illegal dumping does not always result from a change in refuse systems". The United States Environmental Protection Agency (USEPA, 1997a) cited three cities and their reaction to illegal dumping after they switched refuse systems:

In Mansfield, Connecticut, officials report that illegal dumping did not increase significantly with the introduction of a "Pay As You Throw" (PAYT) system. To prevent illegal dumping, Mansfield has relied primarily on public education. When necessary, however, the solid waste department has also worked with the police department to track license plates and identify violaters (USEPA, 1997a).

Seattle, Washington has also found no association between implementation of PAYT and an increase in illegal dumping. Sixty to eighty percent of the illegal dumping incidents in the city are associated with remodeling waste, old refrigerators, and construction debris-waste that the city suspects comes from small contractors who do hauling on the side (USEPA, 1997a).

The city of Pasadena, California reports similar findings. A survey conducted at the city's landfill indicated that Pasadena was disposing of one-third more trash than was indicated in a waste generation study completed in the city. Pasadena suspects that this waste is made up of construction and demolition debris dropped off by small contractors (USEPA, 1997a).

2.24 SCAVENGING AS AN ALTERNATE SOURCE OF INCOME GENERATION

Scavenging has often been the sole source of income for many of the waste pickers who live within the vicinity of the landfill sites, but poses a health and safety risk to the people concerned. While recovery and separation on the disposal sites can be successful, so called scavenging has often been the sole source of income for many of the waste pickers who live within the vicinity of the landfill sites, but poses a health and safety risk to the people concerned. Attempts by health authorities to stop the activity and threat of closure of sites by

formal residents in the area, have sometimes met with great opposition from the pickers with the threat of violence. It is estimated that on the Bisasar Road Landfill Site in Springfield, pickers represent some 200 families who earn a total of R300 a month per family. If the authorities stop this activity, an alternative source of income generation will have to be found for the pickers (Freeman, 1999).

Urban waste may be viewed as a health and environmental hazard or as an economic resource from which marketable products can be derived. The level of waste recycling is generally higher in Third World cities where "recuperative production" is an integral component of the urban informal economy. Pacione (2002) revealed that in Bangalore, India's sixth largest city (with 4.1 million inhabitants within the municipality), between 40 000 and 50 000 people make a living by waste recovery or recycling. This represents between 1.6% and 2.0% of the workforce. The low levels of resource use and waste generation and high levels of waste reuse or recycling are indicative of the inadequate incomes and poor living standards of a large proportion of the population. High levels of reclamation and recycling are the result of tens of thousands of people eking out a precarious living on city waste dumps, often with serious health risks. Despite the example of cities such as Bangalore, most city authorities in the Third World give little consideration to the current or potential role of those who make a living picking saleable, items from waste. Some urban authorities have combined social and environmental goals in their solid-waste collection system by recognizing that the people previously regarded as scavengers and waste pickers are in fact recyclers and reclaimers who can be incorporated into city-wide waste management schemes in ways which benefit them and the city environment (Vincentian Missionaries, 1998). In Bogota waste pickers have formed co-operatives that have bid successfully for some municipal waste collection contracts (Pacheco, 1992).

The Indonesian city of Bandung has developed an innovative integrated resource recovery strategy for waste management based on co-operation between the municipal authority, a non-governmental organization and a local community of scavengers. Over a three-year period a pilot project enabled the community to achieve a number of significant economic and social advances on the basis of waste recycling activity. These included the use of profits to establish employment (in, for example, urban agricultural activities such as rearing seedlings for sale) as well as installing sanitation, education and health care facilities. The longer-term (10-15 years)

aim is to extend the system to cover the metropolitan area with a network of local composting and waste recycling modules. This would be facilitated by government initiatives such as tax incentives for industries using recycled waste materials and direct purchase of compost, for example, government reforestation schemes (Pacione, 2002).

2.25 SUSTAINABLE WASTE MANAGEMENT

There is a strong link between sustainable living and the manner in which society manages its waste. In keeping with global trends, far reaching changes in Southern Africa in environmental and waste management policy and the associated development of the new laws are moving us away from profligate waste generation and indiscriminate disposal towards more sustainable minimization of waste, material recovery, integrated management of wastes, and disposal technologies which do not cause long term adverse environmental effects (Lombard, 2001).
Sustainable development is a concept that has received increasing acceptance in recent years and has become the cornerstone of many government policies. The United Nations endorses sustainable development as the philosophy that should guide nations in the conduct of their commercial and industrial activities. Since waste management activities are a subset of the overall industrial undertaking of society, it is important that they should also be governed by this philosophy. The concept of sustainable development can be viewed as the integration of economic, social, and environmental systems. Conventional economics maximizes the goals of the economic and social systems, but sustainable development maximizes the goals of all three systems (Lombard, 2001).

The United Nations World Commission on Environment and Development defines sustainable development as follows (World Resource Institute, 1997:147): "Sustainable Development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs". The sustainable development concept is generally applied to the "front end" of the industrial cycle with the aim of ensuring that humans can feed, clothes, house, and entertain themselves (Tammemagi, 1999). It is particularly relevant to preserving our diminishing stock of natural resources such as forests, minerals, oils and gas, and fish stocks. Although the United Nations World Commission emphasizes decreasing the pollution discharged by industrial plants, it does not mention improving waste disposal practices. This "blind spot" is typical of our society's "out of sight, out of mind" attitude towards landfills.

Sustainable development must also be applied to the "back end" of the consumer cycle, like the management and disposal of wastes. For example, leaking landfills degrade surface water and ground water, some of the most basic and valuable natural resources we have. The space occupied by thousands of landfills displaces millions of acres of land from other uses, such as agriculture and urban development. Leaving a legacy of leaking landfills will require our grandchildren to utilize their intellectual effort, their time and their resources to provide ongoing repairs and maintenance. These are not examples of sustainable development. It is simply ignoring the problem and, through procrastination, deferring it to future generations. Instead of convenience, we need to seek methods of waste disposal that do not impair our environment, use up valuable resources, or place limitations on future resources. Changing engrained habits is not an easy task. We need a revolution that sweeps aside the old ways and introduces new concepts and technologies that are in accord with philosophies that value and protect our environment. Lombard (1999) indicates that although the gravity of the situation is becoming recognized, and some positive steps, such as street side recycling programs are being implemented, there is still an enormous amount to be done.

2.26 INTEGRATED WASTE MANAGEMENT

The objective of an Integrated Waste Management Strategy (IWMS) is to minimise impact on the environment by employing all possible waste management technologies. An Integrated Waste Management plan follows the life cycle of consumer products from cradle to grave, seeking to maximise the useful life of the resources (Tammemagi, 1999). The techniques of Integrated Waste Management are: waste minimisation (or source/ waste reduction), composting (and vermiculture), recycling (including re-use) and disposal (incineration and landfill). The above techniques are termed "integrated" as it is important to promote all options in tandem. Not all waste can be composted, and recycling in isolation cannot deal with all waste generated. Freeman (1999) further states that countries worldwide are discovering to their cost that recycling targets of 25% and above cannot be achieved without embracing an integrated waste management plan, which includes a patchwork of techniques.

2.27 SOURCE REDUCTION AS A PREVENTATIVE TECHNIQUE TO WASTE REDUCTION

Source reduction–reducing the amount and/ or toxicity of waste actually generated, offers promising environmental and economic opportunities. It means that communities need to collect, process, and dispose of less waste, thereby reducing both their waste management costs and the environmental impacts of these activities. It requires no waste management facilities. Source reduction is a case of prevention rather than remediation.

The USEPA's list below is a hierarchy which does not just present options but establishes an order of priorities, placing source reduction before recycling, and recycling before disposal. Source reduction however, remains neglected in practice, as dramatized by the ever-growing per capita waste generation rates by most states and localities.

1. Source reduction and reuse;
2. Recycling of materials, including composting of yard and some food waste;
3. Waste combustion; and
4. Landfilling (Fishbein and Gelb, 1992).

2.27.1 The Source Reduction Challenge

The preventative strategy agreed to be the top priority has been treated like a poor relative in the planning process of waste management. The reason for the above lies in the experience of most solid waste managers and the nature of source reduction itself. Local solid waste planners, engineers, and managers are fully aware of the steps involved in designing and operating landfills, incinerators, and collection systems. They know that recycling involves collection, separation, and marketing of materials. However, while acknowledging source reduction as the most important priority, most have only a vague idea of how to get business and citizens to produce less waste. Most are uncertain about what steps municipalities can take on their own and what steps can most effectively be taken at state level (Fishbein and Gelb, 1992).

Source reduction can also seem in many ways like a "non-event" because it is less tangible than disposal and recycling. While building incinerators, landfills, and recycling centres involves definable activities, preventing the generation of garbage implies facilities that are not built and materials that are not collected, not marketed, and not sold. Focusing on these issues has been

more difficult for planners accustomed to dealing with more tangible materials and activities (Fishbein and Gelb, 1992).

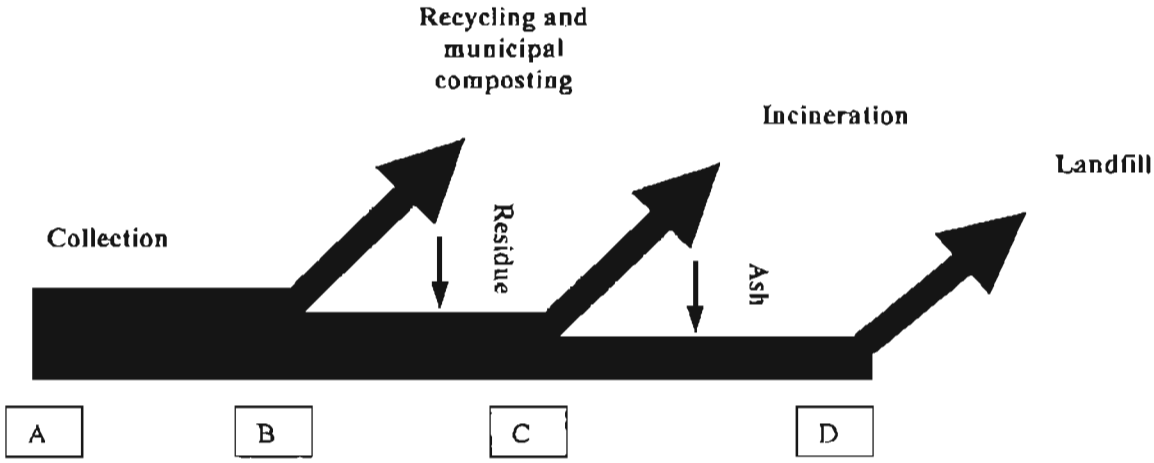
The increasing amounts and toxicity of municipal solid waste, increasing disposal costs, and increasing opposition to locating waste management facilities all point to source reduction (reducing the waste generated) as a solution to the waste problem that deserves serious consideration. Yet surveys indicate that only about one in five people in the United States have any idea of what source reduction means (Fishbein and Gelb, 1992).

2.27.2 Source Reduction

According to Fishbein and Gelb (1992) much confusion exists as to what source reduction is and if and how it differs from waste reduction and recycling. Source reduction refers to a reduction in the amount and/ or toxicity of waste entering the waste stream or waste prevention.

Figure 2.3 below represents a simplified version of the municipal waste stream. Waste is generated at "source" (A), the point where it enters a waste collection system. Parts of the waste stream are diverted to composting and recycling (B) incineration (C), with the remainder flowing to point (D) where it is sent to a landfill. Residues from both recycling and incineration re-enter the waste stream. Only initiatives that reduce the amount of waste at point (A) are source reduction; anything that happens to waste beyond point (A) is not source reduction because the waste has already been generated and must be collected and processed.

Figure 2.3: Simplified Waste Stream Continuum (Source reduction before point A)



Source: Fishbein and Gelb, 1992:17

There are, however, some grey areas in defining source reduction, which generally relate to use. Activities that require some collection outside the public collection system and that lead to reuse without manufacturing can be considered source reduction. For example, reuse of clothes and equipment through donations to charitable organizations or swaps are source reduction since no remanufacturing is required, as is returning beverage bottles for refilling (but not recycling) (Fishbein and Gelb, 1992).

Reduction at the source in the amount and/ or toxicity of municipal solid waste can be accomplished in many ways; through manufacturer redesign of products and packages; through consumer purchases of less wasteful products and reuse of products; and through institutional changes in practices (such as using paper on both sides) and purchases of more durable and less toxic products. Extending product life accomplishes source reduction because, for example, a refrigerator that lasts 20 years creates half the waste of a refrigerator of the same size that lasts 10 years. Product life can be extended through design and manufacturing processes as well as through better maintenance and repair. In setting source reduction, the first priority is elimination; the second, reuse or increased intensity of use (Fishbein and Gelb, 1992).

2.27.3 Source Reduction Versus Waste Reduction

To implement effective policy, determining what source reduction is not is as important as determining what it is. Source reduction is not recycling or buying products with recycled content. It is not municipal composting, not household hazardous waste collection and not beverage container deposit and return systems. While "source reduction" is a term referring specifically to the generation of waste, "waste reduction" is an all-encompassing term that can be measured at different points on the waste stream continuum shown in Fig 2.3. Using the terms "source reduction" and "waste reduction" interchangeably, as is frequently done, causes confusion as to what source reduction really means and fails to properly distinguish it from recycling. Nevertheless, some states and communities define the goals of their waste programs as "waste reduction". Their concern is with reducing the amount of waste entering some or all of their waste disposal facilities (Fishbein and Gelb, 1992).

Recycling is a strategy for managing materials that would otherwise be treated as waste, but it does not reduce the amount of waste generated. It reduces the amount of materials requiring disposal and is a vital strategy for conserving energy and natural resources. But recyclables must be collected, processed, and remanufactured into new materials or products. These processes incur costs and may, themselves, cause pollution. Packaging provides an example of how the implications of source reduction policy differ from those of recycling. Manufacturers often claim that a package is "environmentally friendly" because it is made of recycled content or is recyclable. Recycling cannot justify over packaging if the hierarchy that puts source reduction before recycling is taken seriously. Following the hierarchy would require that packaging be reduced as much as possible before moving to a recycling strategy (Fishbein and Gelb, 1992).

For example, consider a product such as shampoo or a bath gel that is sold in a bottle that is wrapped in corrugated paper and then inserted in a box that, in turn, is shrink-wrapped. A source reduction strategy would aim to eliminate the three excess layers of packaging-the box, corrugated papers, and the shrink wrap-leaving the product in a single container. A recycling strategy alone would require that all the layers be recyclable or made of recycled materials, but would not eliminate them. Composting also illustrates the distinctions between source reduction and recycling. Municipal composting is a form of recycling. It requires the collection and

processing of grass clippings and leaves, and sometimes marketing as well. Backyard composting, however, is source reduction. When individuals keep grass clippings and leaves in their own backyards and then reuse the decomposed material, nothing has entered the recycling system or waste stream. The municipality has not collected, processed, or disposed of the material, so source reduction has been achieved (Fishbein and Gelb, 1992).

2.28 RECYCLING AS A WASTE MINIMISATION TECHNIQUE

Recycling is an integral activity within the waste management hierarchy. The intention of the recycling component of the Integrated Waste Management Policy (IWMP) (2000) is to present a realistic and practical approach to promote recycling and to further extend the current recycling situation The Recycling Plan recognises that recycling is not a panacea for environmental problems and should not be pursued to the point of diminished returns or at any cost. The objective of this plan is to recover the maximum quantity of recyclable material most cost effectively. No single collection system will be suitable in all areas of the city, as the local conditions will place widely different demands on a system. Ball and Associates Consortium (2001) state that studies undertaken to review the driving forces around recycling have demonstrated that monetary incentives are of prime importance in the lower income groups with environmental concerns driving recycling behaviour in the middle to upper income groups.

According to the Official newsletter for the Plastics Environmental Initiative known as (Email, 2004:5) South Africa is far ahead in plastic recycling than the rest of the world. South Africa already mechanically recycles some 14% of all new plastics used i.e. 150 000 tons pa. This percentage figure is 5 times higher that the 1995 figure in the USA and Europe. All recycled plastics are again used in the RSA. Most of the recycled waste plastics come from plastics packaging items, especially packaging films and bottles. Approximately 30% of plastics used for packaging is recycled and included in the above figures.

Plate 2.4: Plastic waste collected for recycling in eThekwini Municipality

2.28.1 Recycling Objectives

Recycling may be pursued for a number of reasons that include:

- Waste reduction: the volumes of waste requiring transport and disposal are reduced and environmental impact is thereby reduced;
- Re-use: where useful items can be taken directly out of the waste stream and re -used without reprocessing;
- Reprocessing: where an object is processed again, such as taking nuclear fuel and subjecting it to chemical processes which produce further useful materials (such as plutonium);
- Raw material conservation: by recycling waste, raw materials are reprocessed and further exploitation of raw materials is reduced;
- Lower costs: recycling waste may produce a cheaper product than manufacturing from raw materials, although this is very often not the case in the South African context due to a lack of demand for the recycled product;
- Energy conservation: less energy may be required for reprocessing than for the manufacturing process (e.g. aluminium); and
- Lower pollutant emissions: recycling and reprocessing may cause less pollution than the initial manufacturing process (Freeman, 1999).

2.28.2 Pros and Cons of Composting

Composting is an attractive process because:

- a large amount of landfill air-space is conserved;
- the leachate generated from the decomposition process is rendered less hazardous; and
- the product, compost, is readily marketed for use by the agricultural industry and gardeners.

Composting of Municipal Solid Waste (MSW) on a large scale however, produces an inferior product because of the presence of pieces of glass, plastic etc. which is unattractive to the market place. The volume of compost also generated by this process is usually too large to be absorbed by the local markets. The collection of organics can prove problematic in Durban due to high temperatures experienced. As refuse is collected only once a week, the high temperatures lead to the organic materials decomposing significantly before they reach the transfer station or disposal site. This decomposition upsets the delicate balance of bacteria, which has to be maintained if composting on a large commercial scale, is to be successful. If this option is pursued for Durban, organics from MSW will have to be collected more frequently, or the composting process will have to concentrate on garden waste, which decomposes at a slower rate. Commercial composting, on a large scale can also generate unpleasant odours (Freeman, 1999).

Plate 2.5: Organic waste used by local resident in the process of compost making for vegetable gardens

2.28.3 CASE STUDIES: Success Stories of Recycling in Developing Countries

i) Calcutta (India)

It is estimated that 40 000 people make a living from recovering and using or selling resources picked from wastes. Thousands more make a living from intensive farming using recycled household wastes, and fish rearing in ponds fertilized by city sewage (Furedy, 1990b).

ii) Bogota (Columbia)

An estimated 30 000 to 50 000 earn a living as cart drivers, small-scale waste dealers, workers reclaiming materials from street waste and the employees of the municipal waste disposal and street-cleaning department (Pacheco, 1992).

iii) Cairo (Egypt)

In Cairo, the city government failed in an attempt to introduce first world municipal collection. Trucks broke down, compactors failed, the streets were too narrow, and the system was too expensive. The municipal authority then began to work with private waste collection contractors and with the Zabbaleen, the community of scavengers who traditionally have collected reusable wastes. This approach enabled the city to introduce some mechanization and to improve the solid waste collection service while maintaining the Zabbaleen's livelihood and the flow of recyclables (paper, metal, glass, bone etc.) to small workshops throughout the city (Jensen, 1991).

iv) Harare (Zimbabwe)

According to Keeling (1991), there is an extensive recycling industry in Harare. The system is supported by collectors who pick up scraps from industries and scavengers who sort waste from tip sites and sell materials to contractors' representatives at the site. Co-operation between the contractors and the municipality has allowed scavengers to operate at city dumpsites and ensured the continued operation of the system (Keeling, 1991).

v) Curitiba (Brazil)

A system has been introduced in Curitiba known as the "garbage that is not garbage" recycling programme which encourages city residents to separate organic and inorganic refuse. Once a week, "garbage that is not garbage" lorries collect the materials which households have sorted. Over 70% of the community now participates in the programme and its success is largely due to a city wide environmental education programme, which highlights the benefits of recycling. Approximately 150 tons of recyclable material is collected daily–30 tons a day by the municipality and the rest by entrepreneurs (150 tons represents a volume of 3 000 cubic metres

a day which is not being dumped on the landfill). Since its inception, some 13 00 tons of refuse have been recycled. The paper recycling alone saves the equivalent of 1 200 trees a day. Apart from the environmental benefits, this recycling programme has generated other positive side effects, including support for social programmes, since the income earned through the sale of the recyclable garbage is reinvested in local social programmes (Muller, 1992).

vi) Shanghai (China)

Since 1957 the Shanghai Municipal Environmental Sanitation Administration has developed into a complex entity involved in the retrieval and marketing of reclaimed products, and now have some 29 000 full time and many more part time employees. A network of 502 purchasing stations and 1 500 purchasing agents in rural areas acquires material for reclamation or recycling. The agents are paid commission. Twenty-six integrated recycling centres reclaim or recycle materials from industrial and consumer wastes and a network of sales departments and retail shops sell reclaimed products. Over 3 600 people are employed to work directly with factories–for instance advising them on setting up containers for wastes and establishing systems by which the company can collect them (Gunnerson, 1987).

Furedy (1990a) has documented the ways and means by which the recovery, recycling or reuse of materials from city waste provides for livelihoods for poorer people, whether as individuals, households or informal groups. She asserts that the city and municipal governments can make such activities a central part of their waste management programme with cost advantages to themselves, better returns and working conditions for those who make a living from the waste and the retention by the city of the environmental advantages. She has shown that alternative approaches to waste management can include social goals since the process of resource utilization and waste recovery in Third World cities is usually driven by poverty. She has observed that in Asian cities, the poorer or less equal in the society, the greater the range and volume of waste, which have value and are re-used or recycled. The individuals or households who use or collect resources rarely obtain an adequate return relative to the number of hours worked. They undertake this work in the absence of a better alternative and it provides a livelihood, usually for the poorer groups in society.

vii) Dakar, Senegal (Participatory approaches to waste disposal)

Dakar has nearly two million people with almost twenty-one percent of the country's population. The Urban Community for Dakar (UCD) is responsible for strategic planning and service delivery for the Dakar region. Over the last two years the city has been growing rapidly and the Urban Community for Dakar (UCD) has been struggling to develop and maintain an effective waste management system. Only a quarter of Dakar's households were connected to the sewerage system, and, until recently, solid wastes were collected from only two-thirds of the city's households. As a result unhealthy conditions spread across the city (Gilbert *et al.*, 1996).

In early 1995, UCD took action and teamed up with a consortium of Canadian and Sengalese companies to set up a comprehensive and participatory new waste management system. The consortium invested a total of 7.6 million US dollars to purchase equipment. The new management system lowered costs for waste collection and improved sanitary conditions. Thousands of youth have been employed in the new waste management programme. Local communities were involved to ensure the active participation of citizens. Economic interested groups, staffed by local people, were responsible for street cleaning, garbage bins, gathering garbage from inaccessible areas and community education on waste management. The innovative feature of the new Dakar waste management system is that it addressed several issues. It eliminated the waste management monopoly, created employment for low-income residents, and included a public education component. By introducing competition, collection costs were kept down. With the new system in place, changes in waste management technology have been adapted without much difficulty. The newly employed youth have gained respect in their community, which improved the social sustainability of the city. Privatization has contributed to the creation of new businesses in the city. The project has offered an example of good governance as well as creating the basis for a healthy and more sustainable city (Gilbert *et al.*, 1996).

viii) Ecological Waste Management in Manila (Gilbert *et al.*, 1996)

The city of Manila is one of seventeen municipalities and has 9 million people. Metro Manila has 13% of the population of the Philippines and produces a third of its GNP. Past efforts at setting up a comprehensive waste system failed for various reasons: commitment to

environmental protection was low; programmes provided inadequate training; and the potential role of the informal sector was ignored. Pollution by waste became a big problem for the city.

Manila's Ecological Waste Management Project was modelled on a successful project near the town, Santa Maria. It was designed and implemented by a partnership of organized hawkers and vendors in co-operation with the government and the private sector. The emphasis on training and community participation made a major contribution to the success of the project. A private sector company initiated the scheme: Unilever Phillippines had become concerned about the waste accumulating in the Paca Canal that runs through its facility. A study showed that 40% of the refuse in the canal originated from the local market, another 40% from local low-income and squatter communities, and the rest from uncontrolled dumping upstream (Gilbert *et al.*, 1996).

The problem was compounded by the unreliable waste collection system and lack of sanitary infrastructure in the city. To come to grips with the problem, an ad hoc committee was formed to tackle the waste problem consisting of various affected parties and exploratory meetings were held in the communities. Meetings were then organized in all affected parts of the city and most concerned individuals attended. As a result, drafts of local environmental management plans were formulated. A waste collectors' cooperative was established, and local waste collection and separation was organized on a community basis. Non-biodegradable materials were sold for recycling. A composting plant was set up and owned by more than 1 000 members. Organic materials were sold as soil conditioners. The multiple benefits of the project are obvious as waste pollution is minimized, and poor households are getting income. Since the wastes are being recycled and composted rather than dumped, Manila is making efficient use of resources, reducing its environmental impacts. Meanwhile the media publicity has led to the adoption of similar schemes in other cities in the Philippines (Gilbert *et al.*, 1996).

2.29 DEVELOPED COUNTRIES SUCCESS STORIES

i) Tompkins County, New York Backyard composting and leave-on-lawn programmes

Tompkins County, New York, started a volunteer technical assistance program in the fall of 1991. Upon request, staff from the county' solid waste division provided free waste assessments

to business. The assessment consisted of a questionnaire followed by a walk-through of the site during which county staff pointed out opportunities to reduce waste. Offices, stores, restaurants, gas stations, and schools have all taken part in the program.

Yard waste, which consists of leaves, branches, and grass clippings, is the second largest material category in the waste stream, 17.6% in 1988 (after paper 40%) according to the US Environmental Protection Agency (1991). Yard and some food waste present some of the greatest source reduction opportunities through backyard composting and leaving grass clippings on the lawn or mulching them. In addition to reducing waste, keeping these materials out of the waste stream reduces pollution from disposal systems since yard and food wastes create oxides of nitrogen when burned, and methane gas, leachate, and settling problems when landfilled.

Approximately 16 states and many cities throughout the country have banned yard wastes from incinerators or landfills. The choice then becomes municipal composting or source reduction. Municipal composting involves collection and processing at public expense and, therefore, is a recycling strategy. Municipalities in many localities have also to deal with complaints about odours from composting sites from neighbours of these facilities. Municipalities that choose to promote backyard composting, by contrast, are promoting source reduction since the materials are handled on-site and never enter the waste stream. Backyard composting and leaving or mulching grass clippings on the lawn are the most efficient way to manage yard waste. Two cities now successfully promoting reductions in yard waste are Seattle and New York City (Fishbein and Gelb, 1992).

ii) Lille, France (A new waste management system)

Lille is a major manufacturing centre that has recently become a centre for service industries. Since 1991 the Lille Metropolitan Area Authority has begun to revolutionize its waste management with the objective of recycling and composting its waste stream in the most cost-effective manner possible. Lille consisting of 86 municipalities and a total population of over 1 million is in the process of replacing its current waste disposal system with a new waste system with an emphasis on recycling. Until recently, Lille's wastes were simply dumped in landfills or incinerated (Gilbert *et al.*, 1996).

The current programme is changing much of that, establishing among waste contributors a culture and daily practice of waste separation at source. Each household received two partitioned waste containers, one for clean and dry refuse (paper/cardboard and glass/metal/plastics) the other for organic wastes and all remaining refuse. Some 100 000 people have participated in the project. Dry wastes have been separated in an intermediate-processing centre, into paper and cardboard on the one hand, and bottles and cans on two separate conveyor belts. Fermentable, organic wastes have been treated in a composting facility capable of processing 130 000 tons per year. A new waste to energy incineration plant has also been constructed for combustible waste that cannot be recycled. Only remaining non-combustible wastes have been landfilled (Gilbert *et al.*, 1996).

The purpose of the programme was to ensure conservation of natural resources, to develop environmental awareness among the population, and to develop a comprehensive approach to waste treatment. To date Lille has been able to demonstrate the feasibility of recovering 50% of its wastes, by composting 25% and recycling a further 25% of the total waste stream. Lille has demonstrated the value of public education and participation by involving the public at all stages of the project and ensuring that the individual needs of the citizens are addressed (Gilbert *et al.*, 1996).

2.30 SOUTH AFRICAN SUCCESS STORIES

i) Rose (Recycling Oil Saves The Environment) Foundation

The ROSE Foundation exists through the commitment of many of the lubricant companies ensuring "Cradle to Grave" recycling. The goals of ROSE include greater community involvement, particularly in rural areas, education at school level concerning the hazards of used oil, and other pollutants, and their ambitions to use their success to teach many neighbouring countries that supports the NEPAD initiative. The Ministry of Environmental Affairs has applauded ROSE and its internationally recognized work.

ROSE has embarked on a drive to partner garages in the collection of oil containers and the results were such that ROSE is expanding the programme. Since the start of the project in November 2003, about 400 garages participated in the pilot project in the greater Cape Town area. Approximately 21 000 kgs of metal cans and 2 800 kgs of plastic bottles have been

collected. The project cost is funded by both the Rose Foundation and Collect-A-Can (ROSE Report, 2004).

ii) Green Cage Project

The Green Cage Project is a successful plastic environmental initiative, which entails the placing of large green cages in conveniently situated sites around the country. These provide environmentally conscious communities with a facility in which to place all plastic waste. The collected waste is given to new one-person businesses at no charge for sorting and grading to add value. These entrepreneurs then sell the different types of plastics to specialist recyclers.

There are a number of advantages associated with this project. It provides a convenient method for the disposal of used plastic items for the public at large, it creates an improved image of plastics and it increases recycling awareness. It is also hoped that the availability of these cages will assist in reducing litter, particularly of plastic items since plastics are not biodegradable. For entrepreneurs, it provides job creation and financial gain, and for the local authorities it assists in extending the life of the landfill sites. Green Cages are sponsored not only by the plastic industry but also by local authorities and private companies who see the project as an ideal way of assisting the community by addressing the problems of plastic litter. There are currently about 80 cages placed nationally at major cities (Email-Official Newsletter for the Plastics Environmental Initiative, 2004).

2.31 LESSONS FROM INTERNATIONAL EXPERIENCE

2.31.1 Holistic approach to waste management

Hardoy (1992) indicates that local climate, physical, economic and social factors must be taken into account when waste management systems are being developed as these factors determine the type of waste management systems that will be implemented in a particular community and country. Rushbrook *et al.*, (1988) also stressed that waste management is not only a technical problem but is strongly influenced by cultural, social and economic circumstances. The need for a holistic approach should be the central principle upon which any waste management is based. WRC (1995) also indicates that a holistic approach to waste management is relevant to both developed and developing countries.

2.31.2 Institutional Arrangements for Waste Management Systems

- A thoroughly considered waste policy, legislative framework and management plan are essential (Rushbrook *et al.*, 1988);
- A balance is needed between incentives for private sector involvement and the authorities' responsibility to the public for a universal and reliable service (Meyer, 1993); and
- While locally designed and contractor operated systems seem to be the most successful in developing countries, appropriate incentives and overall control must be sustained by the authorities – coordination is thus the key (Smit and Nasr, 1993).

2.31.3 Appropriate Systems for Waste Management

- It must be physically sustainable in local conditions–physical and climatic;
- Technology must be appropriate to the capacity of local human resources–from labour to management;
- Labour intensive systems tend to offer the best opportunity for important social, environmental and economic benefits to the community (Kalbermatten and Middleton, 1992); and
- Financial analyses must not underestimate the comparative advantage of locally fabricated vehicles and labour–intensive systems (Kalbermatten and Middleton, 1992).

2.32 PROBLEMS FACING SOLID WASTE MANAGEMENT IN DEVELOPING URBAN AREAS

2.32.1 Rapid Urbanization

The provision of household infrastructure and services is one of the greatest challenges facing urban local governments, to ensure healthy and stimulating environments for their inhabitants. Hardoy *et al.*, (1992) and the Department of Constitutional Development (DCD) (1999) indicate that these services include refuse collection, adequate water supply, sanitation, local roads, storm-water drainage and essential health services. In practice more often than not local governments are unable to meet this responsibility due to, among other issues, rapid urbanization and population growth (Poswa, 2000).

Rapid urbanization (which primarily involves poor people) taking place in developing areas has resulted in solid waste management being considered to be one of the most serious environmental problems confronting urban governments (Schertenleib *et al.,* 1992). There are a number of reasons that cause urban population growth and these vary from country to country according to socio-economic development (Poswa, 2000). Population growth trends have shown a higher degree of urbanization in developing countries than in developed countries. Miller (1998) states that the number of people living in the world's urban areas have increased almost 13–fold from 200 million to 2,5 billion between 1950 and 1996.

Plate 2.6: Impact of urbanization on waste management in eThekwini Municipal Area

2.32.2 Increase in Population Growth

It is projected that by 2025 the population growth will reach 5,5 billion and about 90% of this urban growth is expected to occur in developing countries. Miller (1998) estimated that every day roughly 150 000 people are added to the urban population of developing countries. The population of KwaZulu-Natal (KZN) is the biggest of all the nine provinces and approximated 8.55 million people in 1996 (Lombard, 1996). In KZN, 3.6 million people are urbanized and of these 3 million live in the Durban Functional Region. Growth rates of 3,0% per annum for formal settlements in the Durban Functional Region and 4.1% per annum for informal areas

were reported in 1992 (Hindson *et al.*, 1994). This growth in population was associated with a concomitant increase in the quantities of waste generated in the area. Population statistics indicate the highest domestic waste generation rate to be in the Durban Metropole (Lombard, 1996; Mayet, 1993).

White suburban areas have amongst the lowest population density in the world, and black low-income areas have been developed mainly through site-and-service schemes on the periphery of urban areas, all leading to horizontal development and urban sprawl (Urban Foundation, 1990). This has caused inefficiencies in provision of services, with increases in social and environmental costs, for example through increased transport distances to and from work, and increased distances for provision and maintenance of basic services. Poswa (2000) pointed out that the complicating factor to the urban population growth is the fact that the growth occurs in cities which already have trouble in supplying their residents with water, food, housing, jobs, sanitation and basic services.

Urban population growth is generally caused by the migration of people from rural to urban areas with the aim of enjoying better employment opportunities, improved food supplies, better sanitation, higher incomes, access to health care and emergency services and educational opportunities (Poswa, 2000). As a result, towns and cities find difficulty in creating infrastructure and services that can keep pace with the fast growing urban population. The World Bank has estimated that 25% of the urban population of developing countries lives in absolute poverty (Tannerfeldt, 1995).

Poswa (2000) indicates that experience in many developing countries has shown that cities are encountering solid waste problems largely due to increased urban population (Plate 2.6). In China, the massive population growth has resulted in the generation of more than 300 000 000 tons of total municipal solid waste per year. Gies (1996) demonstrates that the Canadians generate 20,3 million metric tons of refuse and recyclables annually of which 56% of the waste generated comes from the residential sector, which amounts to 1, 908 kg per household. In Africa, Hardoy *et al.*, (1992) and WRC (1995) have reported that in Dar es Salam (Tanzania) two-thirds of all solid waste from both residential areas and commercial enterprises remains uncollected. In Uganda 90% of households have no formal disposal facilities and in Nigeria,

67% of households dump their refuse. According to the 2001 census survey (Statistics South Africa, 2003) more than half of the 44,8 million people who lived in South Africa in places where waste disposal practices were unsatisfactory. Just over half (55,4%) of households received once weekly refuse removal services at the time of the national census. The merger of the previously divided population into municipalities with no corresponding resources has contributed to the massive increased urban population in South Africa. The largest challenge that municipalities face is the creation of service delivery systems appropriate for the population densities and economic base to meet the levels of affordability of households.

2.32.3 Insufficient Resources

Most small and medium sized municipalities have little or no resources to hire staff dedicated solely to solid waste management. As a result the provision of efficient solid waste management services is hindered (USEPA, 1997b). It is, therefore, not surprising that there is a commonly held belief that solid waste planners in developing countries do not take into account the local patterns of living when planning, designing and implementing a solid waste management system. While the developed countries have a wide spectrum of highly qualified personnel, the developing countries do not have training programmes to equip indigenous workers with professional skills to ensure a self-sustaining supply of human power (UNESCO, 1996).

2.32.4 Lack of Skills and Training

The unskilled solid waste manager lacks skills and knowledge of equipment, personnel management, cost accounting, demographics, choice of equipment, operational and maintenance and replacement costs for waste collection (Glasson, 2000). The untrained personnel do not have the ability to identify, predict and rectify problems timeously. Experience has shown that despite people's rating of waste management as a high priority need, metropolitan authorities rate these services as relatively low priorities in relation to other services in the municipality. This perception has resulted in the allocation of insufficient funds and human resources to waste management, and consequently long-term planning has been hindered (Lombard, 2000).

2.32.5 Waste Management not Seen as a Priority Issue.

DEAT, DWA&F and DANCED (1999) have confirmed that up to 1997, waste management was not regarded as being a priority issue in South Africa. The waste management that took place

focused mainly on disposal and was reactive only to address pressing current and urgent needs on an *ad hoc* basis. The low priority given to waste management has consequently resulted in waste impacting detrimentally on the South African environment and human health. Exacerbating the problem of poor planning is the general lack of capacity to fully enforce legislation where it is.

2.32.6 Lack of Community Participation and Poor Planning

The absence of legislation to enforce or promote recycling in South Africa has led to the non-existence of recycling in the industrial sector. This is usually explained as a result of the cost of recovered materials being higher than the cost of transporting raw materials (DANCED, 1996). A contributing factor to poor planning is the lack of community participation in public policy making. This has resulted in situations where service providers do not have the support of the stakeholders and do not provide acceptable services. The WRC (1995) has pointed out that in the past, waste management in South Africa was largely treated as a technical issue and the participation and co-operation of the households were overlooked. The outcome of non-participation of communities in waste management is manifested in careless and irresponsible disposal of waste in public places, along the roads and highways and around communal bins for residential waste. A problem of this kind highlights the need for the implementation of vigorous programmes of public education.

2.33 LEGAL AND INSTITUTIONAL FRAMEWORK

Pollution is caused by the waste products produced by people and animals as well as mining, industries, business and agriculture. As urban areas and industries grow bigger, the amount of waste products increase and pollution becomes worse. All over the world, the health and natural environment of people is being affected more and more by pollution. South Africa faces an added problem. Apartheid policies located many historically disadvantaged communities close to industrial areas and waste dumps, for example, the South Industrial Basin in Merebank and the Bisasar Road landfill site in Springfield. These sites are causing communities to suffer from severe health problems for example, from air pollution in the Merebank area and intolerable smells from the Bisasar Road landfill site in Springfield.

South Africa, like many countries all over the world, has had a fragmented policy to control pollution and waste. The past South African governments did not involve people at grassroots level in decision–making and did not encourage them to take action to solve their problems. Prior to the new constitution the Environmental Management Policy for South Africa was fraught with shortcomings. The shortcomings of the past policies have led to a waste crisis in South Africa. This can be reaffirmed by the Sunday Times (24 February 2002) where major cities like Johannesburg, Cape Town, Pietermaritzburg, Ulundi and Mafikeng (North West Province) are fighting a loosing battle with littered streets and open spaces thereby impacting negatively on the tourism potential of the cities and towns. Since the new dispensation came into effect in 1994, the government has followed a path of policy development, which reflects the progress towards achieving sustainable development.

An integrated and holistic system aimed at pollution prevention and waste minimization was developed in the White Paper on Integrated Pollution and Waste Management for South Africa (DEAT, 2000) by the Department of Environmental Affairs and Tourism and interested and affected parties. The new policy is aimed at waste and pollution prevention as a priority and the focus was largely on waste minimization and recycling. This contrasts sharply with the retrospective nature of existing legislation that focuses on impact remediation, and does not address the root of the problem.

Since the development of IP&WM policy (DEAT, 2000) with the financial support of DANIDA, the National Waste Management Strategy Implementation (NWMSI) project have been launched at the beginning of 2004 (DEAT, 2004). One of the main elements of the project is the area of recycling. A series of Provincial workshops are currently being conducted to discuss and consult on the project recycling component for the following purposes:

- Raise awareness at provincial and local level of the NWMSI project;
- Report on progress thus far;
- Consult with provinces and local authorities to establish their recycling needs, requirements and priorities;
- Identify existing provincial and local recycling initiatives; and
- Identify potential projects, which may be considered for incorporation as part of the NWMSI Recycling Pilot Projects (DEAT, 2004).

2.33.1 Who Should Attend

The workshop is aimed at the key role-players/ stakeholders in the provinces and local authorities who are involved with waste recycling or who are affected or impacted by recycling. This could include representatives from the following institutions:

- Provincial waste and pollution management departments;
- Local authority waste and pollution management departments;
- Commercial concerns and businesses dealing with waste management and recycling;
- CBOs and NGOs involved in recycling initiatives; and
- Recycling companies (e.g. paper, tins, plastics, glass and tyres).

On a functional basis the following stakeholder groupings should be represented:

- Consumers (e.g. householders, retailers, industries, SMMEs and institutions);
- Waste collectors (e.g. Municipalities, private organizations and the informal sector, i.e. salvagers and reclaimers);
- Waste processors (e.g. private sector companies and the informal sector);
- Waste broker–who buy and sell recyclable materials;
- Waste (resource) converters–who buy recyclable material and alter them into a form that is readily useable by a manufacturer, e.g. recycled plastic pellets to be used by plastic extruders;
- End-use market representatives–who purchase recovered/ inverted materials to make new feedstock;
- Waste disposal, e.g. private sector and municipalities;
- Policy makers, e.g. different government departments; NGOs, Community and Consumer Groups; and
- Research groups (DEAT, 2004).

2.33.2 National Waste Management Strategy Implementation (NWMSI) Project

Capacity constraints within government have limited the implementation of the NWMS. A project to address the three focus areas that need to be addressed in the short-term, namely recycling, waste information systems and health care waste, has been initiated with financial support from DANIDA. DEAT will manage and implement the project with support from international and local consultants.

The overall objective of the project is to reduce generation and environmental impacts of all forms of waste, so that the socio-economic development of South Africa, the health of its people, and the quality of its environmental resources are no longer adversely affected by uncontrolled and uncoordinated waste management. The immediate objectives of the project are:

- Improved health care waste management;
- Waste information system established and in use;
- Recycling of waste increased and extended; and
- DEAT capacitated to take full control of NWMS.

The implementation of the project will involve the three spheres of government (National, Provincial and Local), with input from non–governmental organizations and other interested and affected parties. The inception phase of the project was completed on 15 June 2004 during which an inception report and updated project document were compiled. A stakeholder workshop was held to obtain suggestions and inputs to the project. It is envisaged that each technical component of the project will include one or two pilot projects within certain specified geographical or subject areas. Where technically feasible and appropriate, the pilot projects will be integrated and implemented in one or two geographical areas. Initiatives that would be suitable for developing into pilot projects will be identified during the design phase. The project will run for a period of three years (DEAT, 2004).

The "Consultative National Environmental Policy Process" (CONNEP) was the first step in a series of environmental policy initiatives undertaken by DEAT (DEAT, 2001b). The CONNEP process culminated in the promulgation of the National Environmental Management Act 107 of (1998) (NEMA) and the development of the IP&WM Policy (DEAT, 2000). In order to give effect to the waste management and pollution control policy, government has developed a National Waste Management Strategy (NWMS). The NWMS consists of a combination of actions, supporting technology, infrastructure and human resources to continuously improve the safety and quality of the environment (Bredenhann *et al.*, 1996). The implementation of the NWMS has accelerated the adoption of integrated waste management in South Africa. It is anticipated that this DEAT/ DANCED project will take integrated waste management forward. It is clear that the new policy will expose South

African society to a challenging and exciting future. However, the success of the policy depends on cooperation and sound implementation that can only be judged retrospectively.

2.34 CONCLUSION

In the developing urban areas of South Africa, uncontrolled household waste poses the most immediate problem. It adversely affects the human environment due to the health hazards posed, the wasteful use of open space and the increased potential for flooding due to blocked storm-water drains. Uncollected waste is also aesthetically unpleasing to both residents and visitors, and adds to the general level of stress in under-serviced areas while reducing the tourist and recreational potential of adjacent areas. Uncollected waste also poses a problem for the natural environment and in particular, aquatic-systems, since, large quantities of the waste find their way into watercourses. Waste in landfills and collection methods can also pose environmental problems. Environmental issues relating to landfills are of major importance, but this is a fairly specialized area and not dealt with at any length in this study.

Whether we look at the environment from a global perspective or from a local one, the relationship between waste, health and poverty, is one, which challenges us to look at the issues of development in a broader context (Albertyn, 1993). Central to this relationship is a sustainable environment, which is important because the resources of a country are in effect, a parallel budget, to that of the financial resources and needs similar oversight and control. A good environment does not only build a healthy nation, but is also a potential vehicle for economic growth as jobs get created through tourism and conservation industries.

However, all over the world, but especially in poorer countries, vulnerable people often suffer repeated, multiple, mutually reinforcing shocks to their lives, their settlements and their livelihoods (Blaikie *et al.*, 1994). Vulnerability, however, does not necessarily equal poverty, Wisner *et al.,* (1994) contend that all persons at the same level of income do not suffer the same way in times of disaster. Vulnerability is highly stratified by age, race/ ethnicity, and income/ education. It has been contended that disadvantaged people do not exploit the environment because they are stupid, but adverse or disastrous times create circumstances of desperation and loss which force people to exploit their environment (Blaikie *et al.*, 1994).

CHAPTER THREE

STUDY AREA AND METHODOLOGY

3.1 INTRODUCTION

Research is a systematic process of collecting and logically analysing information (data) for some purpose. This definition is general because there are many methods available to investigate a problem or question. Research methodology is the way one collects and analyses data. These methods were developed for acquiring knowledge by reliable and valid procedures. Data collection may be done with measurement techniques, extensive interviews and observations, or a collection of documents. Research methodology is systematic and purposeful whereby the researcher selects data collection and analyses procedures to investigate a specific research problem (McMillan and Schumacher, 1993).

3.2 IMPORTANCE OF STUDY AREA AND RESEARCH METHODOLOGY

A clear statement of the research methodology and study area should be an integral part of any investigation. A detailed description of the study area is important to the reader and future researchers. It informs the reader of the location where the study was carried out, what type of study has taken place and choice of that particular area for the investigation. Maps serve as an important tool to geographical locations. This allows the reader and future researchers to better understand the geographic location of the study area in relation to other areas.

This chapter deals with methods that were used to collect the appropriate data for this research. It deals with the sampling procedure, fieldwork and interview by the use of questionnaires. A map providing a picturesque description of the geographical location of the study area is also presented in this chapter.

3.3 STUDY AREA

Chatsworth lies approximately twenty-six kilometres to the south of Durban and is a former exclusively Indian township. Chatsworth is an old English name; a town in Derbyshire in England, but here in KwaZulu-Natal, it is one of the largest townships. The total area of the Chatsworth housing scheme is slightly in excess of 2 000ha (Metro Housing, 2002). It is bounded to the north and south by the steep Umhlatuzana and Umlaas Valleys respectively and is undulating in character. The topography has had a considerable effect on the planning of the town, creating steep road verges thereby affecting access to properties and roadside parking, placing restrictions on the siting of certain types of activities such as active recreation. Chatsworth was laid out on either side of a ridge many kilometres long. According to Desai (2000:3) "There is a never-ending Highway and railway line running the length of the ridge on its plateau. There are numerous roads leading down steep slopes on either side of the Highway. Each of these side roads, in turn, are intersected by streets which run parallel to the Highway, so giving Chatsworth its sprawling, elongated feel and creating an urban space which is both like a maze and yet also like a grid". The town centre is the strongest node in Chatsworth and has been identified as a city node, in the North and South Central Council's Integrated Development Plan for Chatsworth (Metro Housing, 2002).

The target population for this study was households or residents on formal stands or properties. According to Poswa (2000) the term household/ s refers to a person or group of persons, whether related or not, who normally reside in a residence or a section thereof. Respondents included residents whether they were owners or family members or tenants who resided on the property.

The rationale for the selection of households was based on a number of reasons. Households are one of the most important institutions in a society and within which the gender norms are expressed, reinforced and reflected in larger institutions of society. It is a basic unit of society where individuals both co-operate and compete for resources (World Bank, 1999). Added to this, the World Bank describes the household as a primary place where individuals confront and reproduce societal norms, values, power and privilege. Therefore, the understanding of effects of social factors on service programmes can be examined through households. For the purpose of

this study, households were deemed to be the ideal population group that would best reflect the nature and the effectiveness or inadequacy of a domestic solid waste programme. As generators of domestic waste, the lifestyle within the household was critical for evaluating the quality and quantity of waste and therefore householders could provide the best evaluation of the service programmes. Their expressed views could serve as the benchmark for developing appropriate and sustainable solid waste management strategies.

3.4 HISTORICAL BACKGROUND

Chatsworth is a low-income township, which came into being with the passing of the Group Areas Act. According to a survey conducted by Oosthuizen and Hofmeyr (1979:4), the Indian people have been affected more than any other group in South Africa by the Group Areas Act. By 1970, about 37 653 Indian families had been required to move which represented over 300 000 of the total Indian population of about 624 000 at that time. The artificial pattern of mobility was the highest in Chatsworth, where 70 percent of heads of households had been required to move. These families were mainly in Metropolitan Durban, which contained in 1970, 73,9% of the total urban Indian population of Natal and 83% of all Indians in the Republic.

In 1958 a report on "The Indian Housing Problem" stated that it was the greatest single responsibility confronting the City Council (Metro Housing, 2002). In response to this challenge the concept of mass public housing was introduced for the lower income group. Thus it was in 1960 that the Councils housing programme for Indians gained real impetus with the commencement of work on the Chatsworth Housing scheme, originally designed to accommodate 160 000 people. Up to 1980 approximately 22 000 units had been built in Chatsworth. In 1983 some sixty percent of Indians in Durban lived in public housing, the majority of whom resided in Chatsworth. Over the years there have been widely differing estimates of the population in Chatsworth. In 1977 the City Engineers Department (CED) estimated the population to be in the region of 160 000. In 1980, 159 000 people were enumerated during the Census. In March 1983, an investigation revealed a population of 145 000.The population in Chatsworth was less than in 1980 possibly due to the draw -off factor created by the development of the Phoenix Township.

3.4.1 CURRENT STATUS OF THE WASTE SYSTEM IN CHATSWORTH

Chatsworth is a formal residential township and is a product of the apartheid system, characterized by an inefficient waste removal system. According to John Parkin (Deputy Head: Plant and Disposal, DSW), the Township of Chatsworth generates approximately 24 640 tons of solid waste pa (Personal communication, 4 November 2004). The waste collection systems in the township of Chatsworth has over the years, been referred to as being inefficient. Ten years have passed since the democratic elections in 1994 and one would expect this formal township to be better serviced. However, the environment in this township, with respect to waste removal is poorer than ever. Evidence of the collapse of this basic service can, in many instances be pointed out to the heaps of garbage in open spaces, illegal roadside dumping, wastes strewn on streets, burning of solid wastes at strategic points and clogging of drainage pipes etc. Chatsworth, being a formal residential area and serviced by Durban Solid Waste (DSW), is experiencing serious waste problems. Residents are often forced to burn or dump their waste in open spaces because they have no other means of disposal. In addition to the domestic waste volumes, waste is also generated from commercial and industrial properties and garden refuse sources. Most of the general waste generated in the area is transported to the Bisasar Road landfill site. Waste Tech a private contractor, is employed by the Chatsworth Parks Department to maintain trees and grass on streets, verges and public open spaces.

According to the Manager, Parks and Recreation Department (Personal Communication, 18 November 2003) open spaces in Chatsworth are often characterized by illegal dumping which is unsightly and pose a threat to the surrounding environment. Due to the housing backlog in KwaZulu-Natal tenants occupy many basements, garages and outbuildings. Household refuse is stored in black plastic bags, stamped with the DSW sign on it. DSW provides two refuse bags per household per week. Often, landlords use the refuse bags and tenants are expected to purchase their own. Black refuse plastic bags stamped with DSW on it is used for domestic waste collection. Blue garden bags can be purchased from retail store and garages for garden waste. Bin bags other than mentioned for the waste type will not be collected by DSW refuse removal trucks. Garden and domestic waste is collected once weekly and starts at 5 o' clock in the morning. If waste is not brought to the roadside on time for collection, then the bags of waste are left to lie on street verges for a few hours if not days, until the Parks and Recreational Department removes it (Plate 3.1).

Plate 3.1: Waste strewn on street in township of Chatsworth

If for some reason the Parks and Recreational department fail to have the waste removed, it remains on the street verges till the next collection day. These plastic bags are often torn or damaged by dogs and by rough handling of reclaimers and waste collectors, which spills on the streets. Much of the litter-strewn streets in Chatsworth are the result of inadequate or unaffordable services. The odour emanating from these sites together with the potential for diseases can have serious implications on the health of residents as well as on the aesthetic nature of the environment. It is not yet understood why such a situation exists within a formally serviced area. This provided the motivation for the study.

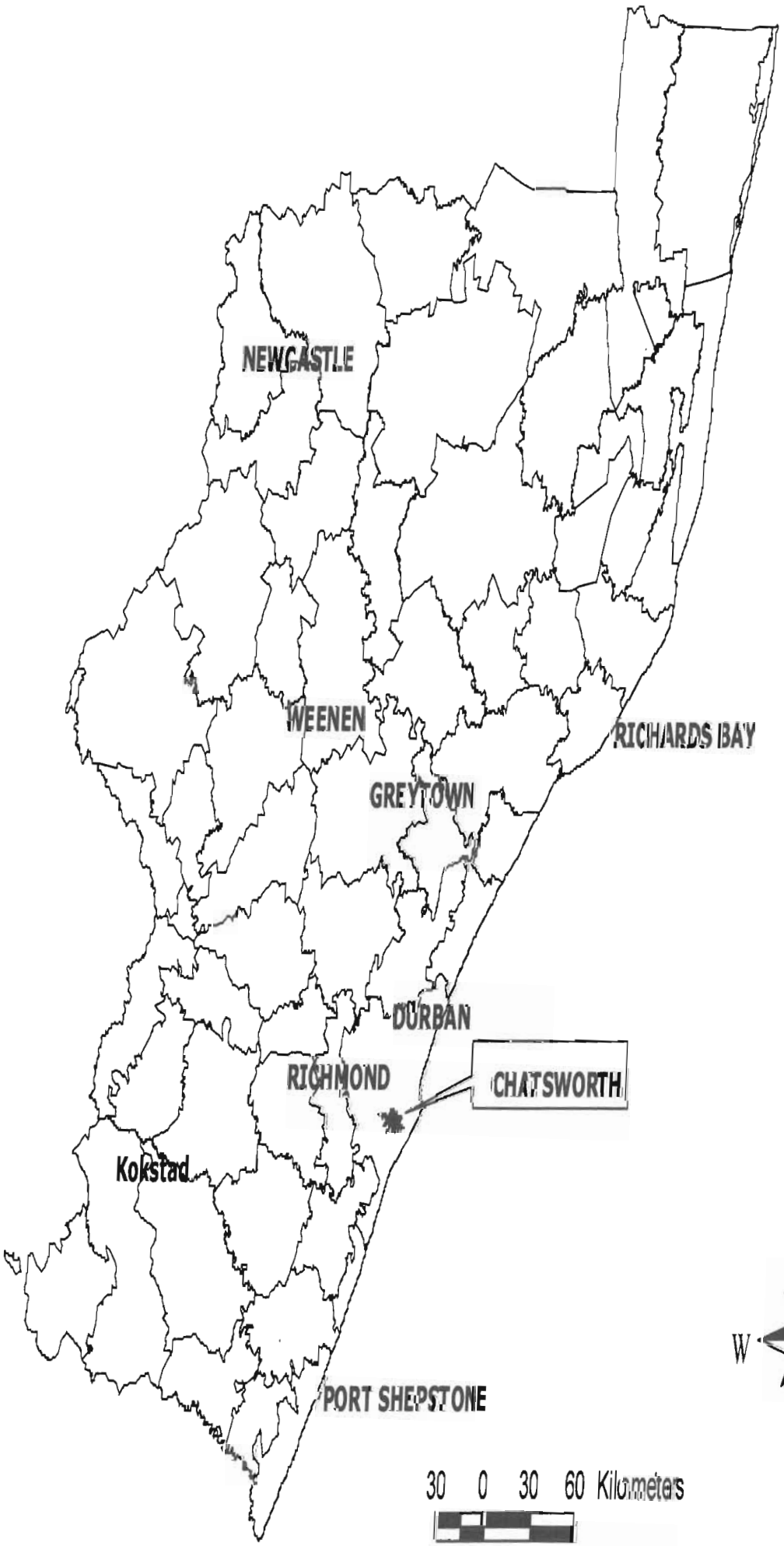


Fig 3.1 Location of Chatsworth within KwaZulu Natal

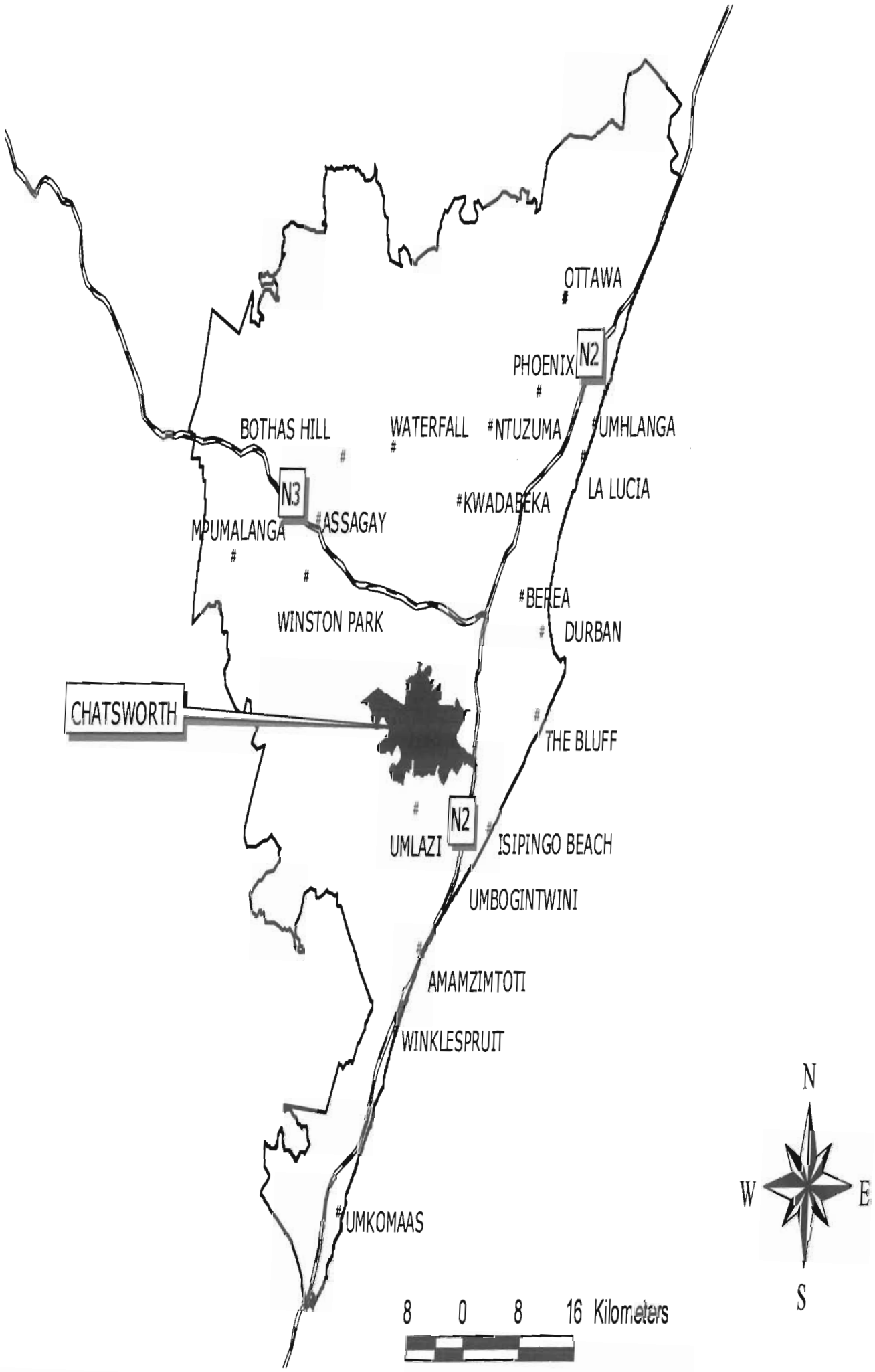


Fig 3.2 Location of Chatsworth within eThekwini Municipality

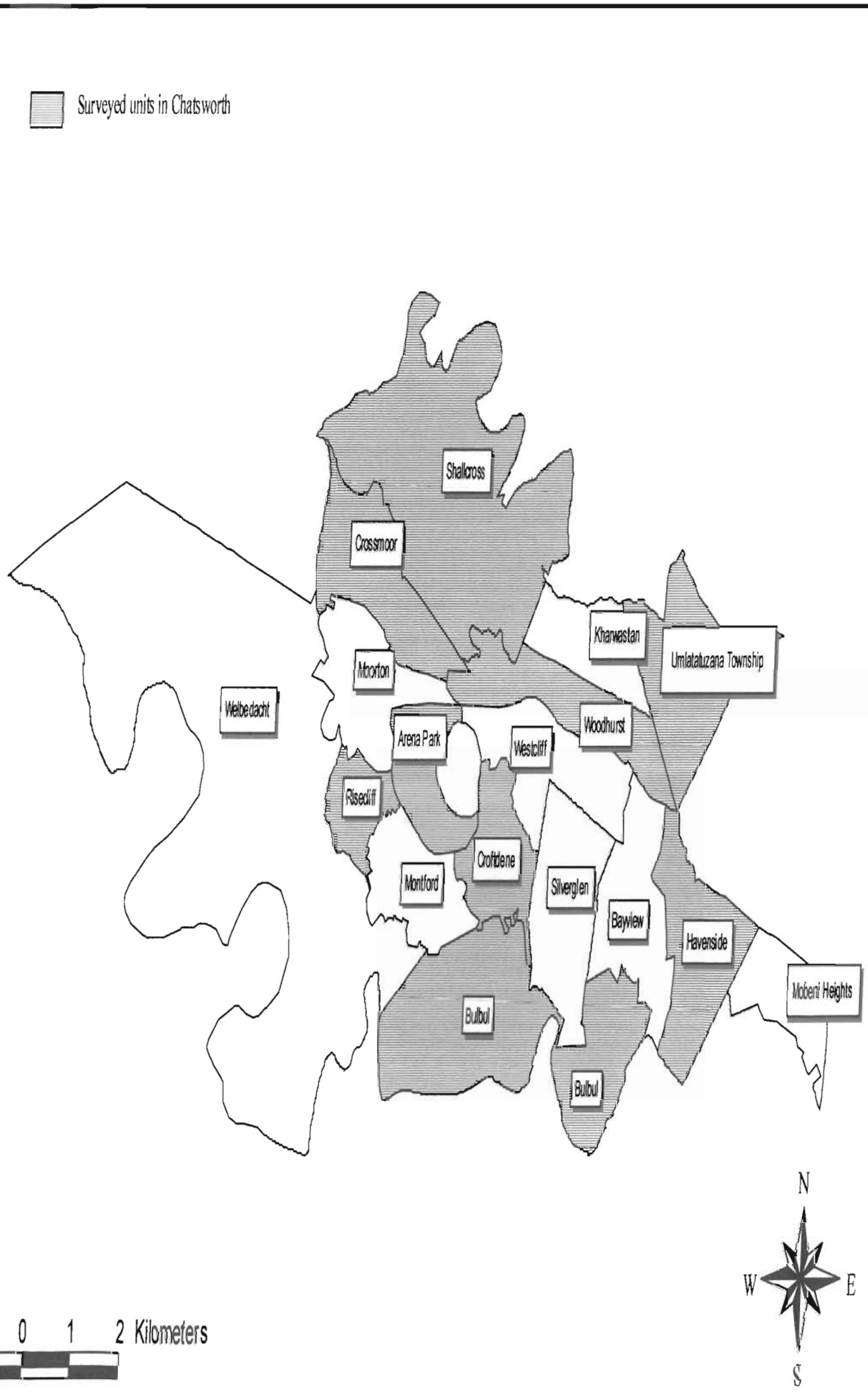


Fig 3.3 Study Areas within Chatsworth

3.5 RESEARCH METHODOLOGY

Leedy (1989:139) contends that it is an acceptable fact that the nature of the data and the problem for research dictate the research methodology. The data for the investigation in question are both verbal and numerical and thus the use of a combination of qualitative and quantitative methodologies. Dey (1993) points out that the two methods are mutually dependent in that measurement at all levels embraces both a qualitative and a quantitative aspect. Below are the reasons why the two data sets were selected for the purpose of this study:

The understanding of resident's perceptions and attitudes towards waste requires a qualitative approach. According to Sapsford and Jupp (1996) the qualitative method enables one to probe and explore people's interpretations of waste management practices and to obtain descriptions of what people observe and experience. It also allows participants and/ or respondents to express their opinions and the researcher to hear and incorporate such opinions/ views in the research. The qualitative method also focuses on events, interactions and other observed behaviour as well as allowing for the recording of direct quotations from participants (Casley and Kumar, 1998). The qualitative method was therefore relevant to this study, primarily for obtaining the socio-demographic data. This enabled the collection of data including social and economic variables using a structured questionnaire. Secondly, the quantitative method was also used because part of the structured and semi structured surveys designed for this study dealt with numerical data. The waste generation rates required the use of quantitative methods to derive numerical values. This method was also relevant in quantifying the attitudes, beliefs and perceptions of the target population towards waste management.

3.6 STRENGTHS AND WEAKNESSES OF SURVEY RESEARCH adapted from (Babbie and Rubin, 1997)

Survey research is a popular social research method and a survey is the administration of questionnaires to a sample of respondents selected from some population. Survey research is especially appropriate for making descriptive studies of large populations. The survey data can be used for explanatory purposes as well.

Questionnaires may be administered in three different ways:

1. The respondents themselves may complete self-administered questionnaires;
2. Interviewers may administer questionnaires in face-to-face encounters, reading the items to respondents and recording the answers; and
3. Interviewers may conduct telephone surveys.

Strengths of survey research

1. Surveys are useful in describing the characteristics of a large population.
2. Surveys especially self-administered ones make very large samples feasible. As a result their findings may be more generalizable than the results of experiments.
3. Survey research has advantages in terms of economy and the amount of data that can be collected.
4. The standardization of the data collected represents a special strength of survey research.
5. Surveys also enable one to analyse multiple variables simultaneously.
6. Surveys are also flexible. Many questionnaires may be asked on a given topic, giving the researcher considerable flexibility in the analysis.
7. Survey research is strong on validity.

Weaknesses of survey research

1. Sandardized questionnaire items often represent the least common denominator in assessing people's attitudes, orientations, circumstances, and experiences. By designing questions that will be at least minimally appropriate to all respondents, the researcher may miss what is most appropriate to many respondents.
2. Survey research has the weakness of being somewhat artificial and potentially superficial. It is difficult to gain a full sense of social processes in their natural settings through the use of surveys. Although questionnaires can provide information in this area, the survey researcher can seldom develop the feel for the total life situation in which respondents are thinking and acting as compared to the participant observer.
3. Surveys are subject to the artificiality in connection with experiments.
4. Survey research is generally weak on validity.

3.7 SAMPLING TECHNIQUE

In conducting research there is a need to select a sample from the total population. This need arises out of the fact that it is normally difficult to study the total population due to constraints of time and financial resources. Since in any research situation it is not possible to collect all data (a universal study), this study will use a sample.

According to Nachmias and Nachmias (1992), empirically supported generalizations are usually based on partial information, and further precise inferences on all units (a set) based on relatively small number of units (a subset) can be drawn when subsets accurately represent the relevant attributes of the whole set.

According to data supplied by Statistics South Africa (2003), which was based on the Population Census of 2001, Chatsworth had a population of 197 781 and a dwelling unit (household) count of 29 462. Chatsworth is further divided into 17 smaller homogenous operational units (Ref to Fig 3.3). This survey is in two parts.

The total population (the universe) for the first part of the study, in this case consisted of operational units within Chatsworth. The total population is 17 units, and the sample chosen for analysis was 9.

For the second part of the study, the total population consisted of households within the nine operational units, and the sample chosen for analysis was 100.

The following table shows the breakdown of the population and households per unit:

Table 3.1 Table showing breakdown of operational units, population and dwelling units.

NO.	OPERATIONAL UNITS	POPULATION	DWELLING
1	Arena Park	7 734	1 251
2	Bayview	16 285	2 350
3	Bulbul	590	37
4	Croftdene	14 337	2 044
5	Crossmoor	16 703	1 931
6	Havenside	9 540	1 781
7	Kharwastan	4 818	868
8	Mobeni Heights	4 264	837
9	Montford	19 323	3 324
10	Moorton	13 315	2 195
11	Risecliff	9 339	1 547
12	Shallcross	22 279	3 415
13	Silverglen	7 913	1 327
14	Umhlatuzana Township	8 049	1 431
15	Welbedacht	15 428	825
16	Westcliff	19 327	2 879
17	Woodhurst	8 537	1 520
	TOTAL	**197 781**	**29 462**

To select the required sample the random sampling technique was used. In order to obtain a sample that was both reliable and practically manageable, a sample population of approximately half, which is 9 of the 17 operational units, was selected for the study. The 9 operational units were selected using the random-number table. The procedure was repeated 10 times, as the sample size was relatively small. Different random samples from the same population, which in this case is 17 homogenous operational units, have yielded different results. The results of the ten different samples revealed a clear pattern. The most common mix of operational units was from the periphery as well as centrally located. The following nine operational units were selected for the study: Arena Park, Bulbul, Croftdene, Crossmoor, Havenside, Risecliff, Shallcross, Umhlatuzana Township and Woodhurst.

The second part of the survey entailed mini samples being drawn from each operational unit and this was randomly spread out across the entire study area. The number of dwellings or households in each operational unit is reflected in Table 3.2 below. The sample size, which was 100, was derived by preparing a complete list of households or residence addresses in each operational unit to get a sampling frame from which the sample was drawn (Bailey, 1982). A table of random numbers was used to pick house numbers at random. The process was continued until the desired sample size was attained for each operational unit.

The number of questionnaires per operational unit was calculated as a percentage of the number of households in the operational units in relation to the total number of households in the study area.

$$\text{No. of questionnaires per Oper.Unit} = \frac{\text{Number of households in Operational Area}}{\text{Total number of households in the study area}} \times \frac{100}{1}$$

After applying the above criteria and formulas the following sample was derived for each operational unit.

Table 3.2 Distribution of sample size for each operational unit in the study area.

NO	NAME OF UNIT	POPULATION	DWELLING	SAMPLE
1	Arena Park	7 734	1 251	8
2	Bulbul	590	37	4
3	Croftdene	14 337	2 044	14
4	Crossmoor	16 703	1 931	13
5	Havenside	9 540	1 781	12
6	Risecliff	9 339	1 547	10
7	Shallcross	22 279	3 415	19
8	Umhlatuzana Township	8 049	1 431	10
9	Woodhurst	8 573	1 520	10
	TOTAL	97 198	14 957	100

The global view of sampling divides it into two major categories: non-probability sampling and probability sampling.

3.7.1 Non-probability Sampling

In non-probability sampling, there is no way of forecasting, estimating, or guaranteeing that each element in the population will be represented in the sample. The disadvantage of non-probability sampling is that, since the probability that a person will be chosen is not known, the investigator generally cannot claim that his or her sample is representative of the larger population. This greatly limits the investigator's ability to generalise his or her findings beyond the specific sample studied. In addition, the researcher is unable to estimate the degree of departure from representation (sampling error). The advantage of non-probability sampling is that it is much less complicated, much less expensive, and may be done on a spur-of-the-moment basis to take advantage of available respondents without the statistical complexity of a probability sample. A non-probability sample may prove perfectly adequate if the researcher has no desire to generalize his or her findings beyond the sample, or if the study is merely a trial run for a larger study. Non-probability sampling can also be divided into two types: convenience or accidental sampling and quota sampling (Bailey, 1994).

3.7.2 Probability Sampling

In probability sampling, the researcher can specify in advance that each segment of the population will be represented in the sample. This is the distinguishing characteristic that sets it apart from non-probability sampling. The composition of the sample is derived by selecting units from those of a much larger population. The components of the sample are chosen from the larger population by a process known as randomisation. Such a sample is known as random sample. Randomization means selecting a sample from the whole population in such a way that the characteristics of each of the units of the sample approximate the characteristics of the total population. The word random has special meaning in mathematics. It refers to a process that generates a mathematically random result; that is, the selection process operates in a truly random method (e.g. no pattern), and a researcher can calculate the probability of outcomes. In a true random process, each element has an equal probability of being selected. Random samples are most likely to yield a sample that truly represents the population (Leedy, 1989).

In view of the nature of the data used in this research, the probability sampling known as the simple random sampling technique was used. According to Neuman (1997) the simple random sample is one on which other types are modelled. In simple random sampling, a researcher develops an accurate sampling frame, selects elements from the sampling frame according to a mathematically random procedure, and then locates the exact element that was selected for inclusion in the sample. The advantage of random sampling is that every member of the population has an equal and independent chance of being selected. The simple random sample is used when the population texture is relatively homogenous with respect to the questions of interest.

Random sampling does not guarantee that every random sample perfectly represents the population. Instead, it means that most random samples will be close to the population most of the time, and that one can calculate the probability of a particular sample being inaccurate.

In addition to the above, semi-structured questionnaires were administered as well as personal communications and discussions were conducted with various authorities and stakeholders in solid waste management, using the convenience type of non-probability sampling known as snowball technique. According to Bailey (1994) the term snowball stems from the analogy of a snowball, which begins small but becomes bigger and bigger as it rolls downhill. Snowball sampling is thus conducted in stages. In the first stage some people having the requisite characteristics of the population under consideration are identified. These then act as informants, who tell the researcher where to find their colleagues, these colleagues, in turn, lead the researcher to others. The chain of identification goes on and on until the researcher gets the appropriate sample.

3.8 DATA SOURCE

Data was acquired by means of questionnaire surveys. A literature survey as detailed in chapter one and two was also conducted. This literature did not only provide the basis of the major contention of the study, but also for the development of the interview survey. A survey assessment was conducted by means of a questionnaire designed to get community opinions and understanding in connection with the type of service they receive from the municipality and their awareness in terms of solid waste management.

3.9 USE OF QUESTIONNAIRE

According to Leedy, (1989: 187) "Appropriate data for research sometimes lie deep within the minds, attitudes, feelings or reactions of people. To get the data it is necessary to devise a mechanism to probe below the surface. A common instrument for observing data which is beyond the physical reach of the observer is the questionnaire". Bob (1999) states that questionnaire based surveys are the most common methodology used to gather information which is directed to specific individuals. Both researchers argue that the questionnaire is the simplest and most widely used instrument to gather information. The questionnaire is also an efficient and cost effective method of gathering data. In questionnaires, anonymity can be guaranteed so respondents feel comfortable and answer questions more freely.

Bob (1999) contends that using the questionnaire methodology is useful in gathering a wide range of information that can be easily quantified and used for statistical analysis. A standardised questionnaire, a basic investigative tool in social science research, was used to obtain the necessary data for this study. The structure and design of the questionnaire was influenced by the aims and objectives of the study. The type of questions included in the study was:

i) Closed Ended Questions: These types of questions were aimed at eliciting certain specific information from the respondents in the simplistic way through answering yes or no.

ii) Forced Choice Questions: The questions are meant to minimize the choice of the respondents by making available to them suitable alternative answers to choose from. Respondents were to base their choice on the alternative view that was nearest to the view of the particular respondent.

iii) Open Ended Questions: These questions were meant to encourage respondents to state their personal opinions with respect to the questions. This was to minimize the effects of the researcher's perceptions and to enable her to get to know about the process by which the respondents arrived at a particular point of view in making suggestions to their problems.

The questionnaire consisted of nine parts (See Appendix A):

1. **Socio-demographic characteristics:** Variables in this section include sex, marital status, level of education, type of occupation and income.

2. **Dwelling characteristics:** Variables included type of home, housing/ property density and respondents duration of stay on the property.
3. **Issues in general:** Variables included issues regarded as most problematic and needing urgent attention. Issues included electricity, telephones, housing, waste removal, street cleaning, improvements of roads, development of a shopping center and creation of jobs.
4. **Domestic solid waste:** Issues in this section included types of solid wastes disposed, waste storage in the home, and how different wastes were disposed off.
5. **Illegal dumping, litter and its impacts:** Issue examined in this section was the respondent's attitude towards illegal dumping, litter in terms of its impacts on the environment and health. The respondents were also asked to describe the environmental impacts present in the area, who do they think was responsible for illegal dumping, and if residents could play a role in stopping illegal dumping.
6. **Recycling and waste reduction:** This section sought to establish the level of organisation around waste reduction and recycling initiatives and also to gauge the willingness for participation in these initiatives. This section also attempted to examine the attitudes of residents and municipality with regard to waste minimisation and recycling.
7. **Community Participation:** Issues examined in this section sought to establish the level of community participation around environmental issues and organisations in the area.
8. **Level of waste management services:** Variables included frequency of waste removal, waste generation rates, knowledge about garden refuse bags, refuse transfer stations, reclaimers and scavengers. Issues examined in this section attempted to assess the resident's perceptions and attitudes towards the waste removal services.
9. **Knowledge of solid waste management policies:** This section sought to establish the level of knowledge about environmental policies with regard to solid waste management. This section also included resident's opinion and suggestions towards improving the waste management system.

3.10 INTERVIEW TECHNIQUE

Only heads of household, decision makers or their spouses and adults that were familiar with domestic waste practices were allowed to participate in the interviews. Briefing sessions were conducted with the respondents about every aspect of the questionnaire. The interviews were conducted during the day, evenings and on weekends, as many home executives were available during the week. In cases where the household head or the decision maker with regard to waste practices were not available, a call back was necessary. During the interview the household head was given a copy of the questionnaire for his/ her reference.

If the household head was unable to read, the researcher assisted in explaining the questions simply and without bias. Although the confidential nature of the study was emphasised, few respondents were reluctant to answer questions about the disposal methods that they employed other than bins. It was impressed upon the respondents that their truthful answers would promote positive recommendations to those in authority. In this way, they were informed that they could contribute towards the improvement in the quality of their lives. Overall, respondents were hospitable with the exception of a few. The response to the questionnaires was very good and there was a hundred percent return. The questionnaire took an average of thirty-five minutes to complete and extended over a period of three weeks in April 2003. In order to ensure a good quality of fieldwork, the researcher conducted interviews.

The semi-structured interviews were conducted by the researcher to specific people of interest. These interviews were semi-structured because in depth and historical information had to be extracted (See Appendix B). Authorities in different waste management departments were interviewed. Interviews were held with councillors of different operational units to establish their roles in environmental issues and find out what they had done to promote a cleaner community. Members of the Municipality such as DSW, Inner West City Council, Chatsworth Parks and Recreation and Chatsworth Garden Refuse Transfer Site were interviewed for input into local initiatives and for co-ordination and implementation of the waste management plan at local levels. Interviews were held with officials from the Keep Durban Beautiful Association (KDBA) to establish the educational role of the different communities in waste management. The following

people were interviewed: Marie Van Der Merwe-Co-ordinator for Education and Waste Minimisation and Acting Business Manager of DSW, Sara Freeman-Waste Minimisation Officer, Lezzi Ngqulunga-Education Officer and Roy Sookdoe-Education Officer. Ten schools were visited to establish the role of children and educators in environmental awareness and curriculum development in waste management. Ten reclaimers were interviewed on waste collection days to establish reasons for their collections (See Appendix C).

3.11 OBSERVATION

According to Haralambos and Holborn (1990) research involves observation of some sort. But there are considerable numbers of social situations which prohibit an observer, for when observation is allowed, the presence of a researcher is likely to influence the behaviour of those being observed. Despite this, in certain situations a researcher might judge that some useful and valid information can still be obtained (Geyevu, 1997).

The researcher during, the process of interviewing observed the immediate surroundings of residential households. This was to ascertain the validity of some of the answers to the questions in the questionnaire. For example, the researcher was able to identify or access the wastes that have been dumped on open spaces and verges close to their residence. Some of the factors affecting the community and damaging the environment to some extent are the consequences of poor solid waste management prevailing in the Chatsworth Township.

The factors noted during the survey were that:

- Rivers banks and streams that run through the area are highly polluted with garbage disposed by dwellers;
- Large bulks of refuse accumulated along the streets and pathways and in some parts are blocking the roads and drainage systems;
- Bad odour resulting from littered environment;
- No dumping signs were damaged or removed in certain areas;
- Reclaimers rummaged the bins on waste collection days for valuables, food and cardboard, sometimes spilling the waste; and

- After waste collection by authorities on collection days, wastes that were spilled from damaged bags were left unattended on streets and pavements.

3.12 DATA ANALYSIS

The Statistical Package for Social Scientists (SPSS) was used for data entry and analysis. All questionnaires were checked resulting in one hundred correctly completed questionnaires and a spreadsheet was prepared for recording all variables. Information was arranged and categorised according to topics and open-ended questions were grouped together for each topic.

The demographic characteristics (Section one of the questionnaire) (Appendix A), in particular educational level, income and employment status of respondents, were used as indicators of socio-economic status. The perceived problem of illegal dumping, litter and its impacts, level of waste management services and issues in general (Section 3, 5 and 8 of the questionnaire) were measured in two ways. Firstly, respondents were asked to rank issues regarded as most problematic and needing most attention among a list of issues such as electricity, telephones, housing, improvements of roads, development of a shopping centre and creation of jobs.

Secondly, respondents were questioned about their perception about litter and illegal dumping. To this end, they had to indicate whether they saw illegal dumping as a problem and to state reasons why they engaged in such practices. Added to this, respondents were requested to state the role of residents in curbing littering and illegal dumping.

Asking respondents how they stored and/ or disposed of solid waste at their homes assessed the current domestic solid waste management handling practice (Section 4 of the questionnaire). Specifically, respondents were requested to choose the method they used among a list provided for storage and disposal methods. Knowledge of respondents about recycling and their willingness to reduce waste was examined by first asking them if they were aware of any recycling projects in the area and if the projects were working. Secondly, they were asked to state how they disposed of the recyclable waste materials. They were further requested to state whether they would participate in a recycling programme and what type of system they preferred. (Section 6 of questionnaire).

Perceptions of the current waste management service system in the study area were also investigated (Section 8 of the questionnaire). Respondents were asked to indicate the frequency of collection, waste generation rates, whether they were aware of blue bags used for garden waste removal, if they had street cleaning services and who provides the service, awareness and satisfaction of the refuse transfer station and how they felt about the waste collection system (whether they described it as poor, adequate but poorly managed, good, very good or not sure).

Respondents were also questioned about their roles and awareness in community organizations (Section 7 of questionnaire). Specifically, respondents had to indicate whether there were any organizations in the area dealing with solid waste related problems and if these organizations had been successful in solving the problems. Respondents were asked to state their level of community participation in formulating present waste policies.

Asking respondents if they were aware of solid waste management policies assessed their knowledge of waste practices especially with regard to illegal dumping and burning of wastes (Section 9 of questionnaire). Residents were also requested to give their opinions and to make suggestions on how to improve the waste management system in the area.

The use of the SPSS program was significant in providing descriptive statistics, cross tabulations and possible correlations or relationships, frequencies and percentages for all variables. It would have been impossible to manage the large amount of data without this computer programme.

3.13 POBLEMS ENCOUNTERED

The notable problems during data collection were the reluctance of some respondents to participate in the investigation especially those that lived close to dumping sites. The major problem encountered was trying to convince the respondents that the research was solely for academic purpose. Respondents showed fear that information sought would be used against them. This was evident with respect to questions pertaining to other methods of disposal of waste except for refuse bins and if they engaged in illegal dumping. As a result there was a high percentage of no response to these types of questions. Often respondents were reluctant to welcome the researcher in the

evenings, as it was a busy time of the evening for the working class. Due to this the researcher had to return on weekends or find a new respondent. As a result of this the survey took longer than expected.

Time constraints were an important limiting factor as the questionnaire completion took between 35-40 minutes. In many instances respondents were busy with housework and did not want to complete the survey. Respondents sometimes got bored with the topic of discussion, if not irritated. Another problem of the interview technique was illiteracy. Scientific terms had to be explained as older members of the community could not understand what was being said. Linked to the problem of illiteracy was the fact, that no one had done research on environmental and development issues in the area before, and people looked confused, terrified and some looked suspicious. Since the researcher had explained the reasons and details of the study, respondents became more amicable and relaxed. There was a big sigh of relief by many of the inhabitants as they thought the interviews were intended to bring about immediate changes to their quality of life. It was difficult to explain that the survey was merely an educational one.

3.14 CONCLUSION

This chapter has considered the methodology applied in the collection of data for the study under consideration. It has indicated the need to use both qualitative and quantitative methods of data gathering and why the random method of sampling together with the snowball method has been deemed appropriate. The interviews elicit more information and even deepen the understanding on some of the questions in the questionnaire. It has also looked at how the fieldwork was carried out, the problems encountered and how they were minimized. The use of questionnaire interviews, semi-structured interviews and informal personal communication were used to gather information, which is statistically analysed in the next chapter.

CHAPTER FOUR

DATA ANALYSES AND RESULTS

4.I NTRODUCTION

The focus in this penultimate chapter is on a detailed analysis and interpretation of data obtained from the implementation of the technique described in the previous chapter on methodology. This exercise will enable the researcher to identify any trends that may emerge from the study. The data will be presented graphically as well as through tabulations to enable a better understanding of the empirical evidence.

According to Bailey (1994), statistical analysis is the culmination of the long process of hypothesis formulation, instrument construction and data collection. To culminate any study it is appropriate to analyse and interpret the data so that the researcher can properly test his/ her hypotheses, and be able to present the results of the study in an understandable and convincing way. Data may be interpreted and presented in entirely verbal or statistical terms. The aim of statistical analysis is to further the overall goal of understanding social phenomena, through the process of description, explanation and prediction (Geyevu, 1997).

The analysis begins with the socio-demographic characteristics and its impacts on waste management. This is undertaken to reveal whether there is any relationship between socio-demographic variables and waste management and the context in which waste management is either practiced or not. The analysis then progresses to the knowledge, attitudes and practices of households towards domestic waste management to obtain an understanding of the behavioural patterns of residents. Additionally, the level of waste management services, illegal dumping and its effects, community participation and respondents opinions and suggestions on waste management are analysed. To complement the empirical data from the questionnaire survey, the qualitative analysis of the semi-structured interviews and personal communications are also discussed.

The research findings are therefore organized to reveal an understanding of waste management practices of selected residential areas in the Durban eThekwini Municipality. The statistical analysis was generated by the use of the Statistical Package for Social Sciences (SPSS) and where possible visual presentations are undertaken in the form of graphs and tables.

4.2 SOCIO-DEMOGRAPHIC CHARACTERISTICS AND IT'S INFLUENCE ON WASTE MANAGEMENT

4.2.1 Period of Residence and Illegal Dumping

Table 4.1 Period of residence and perception of illegal dumping as a problem

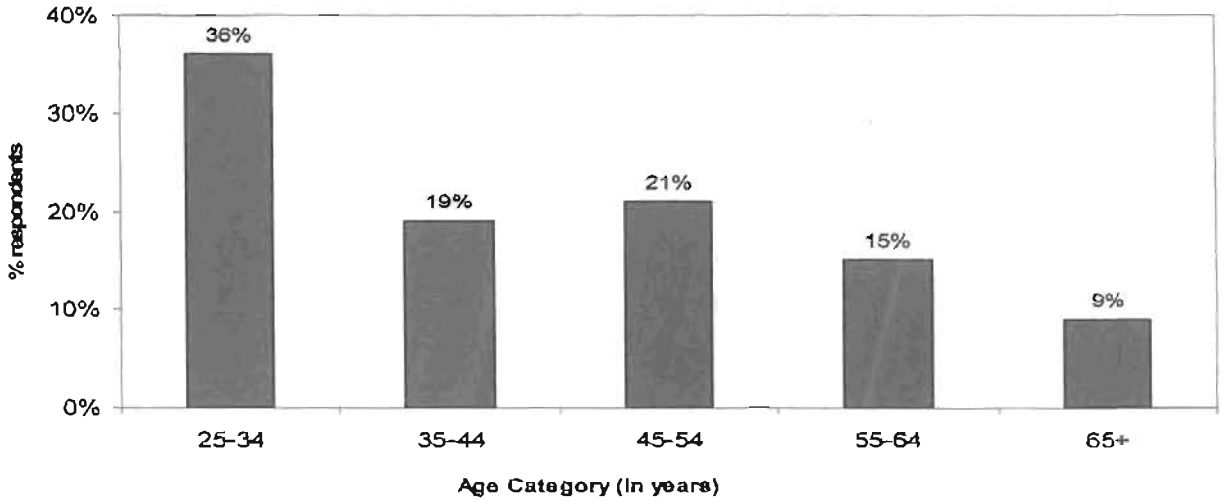
Period of residence (years)	Regard illegal dumping as a problem				Total
	Yes		No		
	Frequency	%	Frequency	%	%
1-5	19	68	9	32	28
6-10	13	77	4	23	17
11-15	7	64	4	36	11
16-20	7	78	2	22	9
>21	29	83	6	17	35
Total	**75**		**25**		**100**

Table 4.1 illustrates that the period of residence of respondents ranged from one year to over 21 years with a significant proportion (35%) living in the area for over 21 years. Forty-five percent of the respondents lived in the area from 1-10 years, 11% from 11-15 years and 9% from 16-20 years (Table 4.1). The average number of years that respondents lived in the area was 13.3 years. With regard to the relationship between length of stay in the area and the problem of illegal dumping, it is evident that length of stay in the area did to a certain extend impact on respondent's perceptions of illegal dumping. The highest proportion (83%) was found amongst those who lived in the area for over 21 years. However, over 60% to 78% of those who lived in the area from 1-20 years also considered

illegal dumping as a problem. It can, therefore, be concluded that illegal dumping was a serious problem to all residents no matter what their length of stay.

4.2.2 Age of Respondents

Fig 4.1: Age distribution of respondents in study area



The age-structure of a community is important in the study because often people of differing ages view issues differently. The overall age profile of respondents depicted in Figure 4.1 shows that the majority (36%) of respondents belonged to the 25-34 year age category. The rest of the respondents fell into the 35-44 (19%), 45-54 (21%), 55-64 (15%) age categories and the lowest figure of (9%) appeared in the 65-74 year age group.

4.2.2.1 Relationship between Age and Illegal Waste Disposal Practices

Table 4.2 Age and illegal waste disposal practices

Age groups (years)	Response to illegal waste disposal				Total
	Yes		No		
	Frequency	%	Frequency	%	%
25-34	21	58	15	42	36
35-44	11	58	8	42	19
45-54	11	53	10	47	21
55-64	6	40	9	60	15
65-74	5	56	4	44	9
Total	**54**		**46**		**100**

Although some respondents were reluctant to answer this question at first, for fear of being prosecuted, they eventually responded. It was clearly evident that respondents in every age category were engaged in illegal waste practices with percentages ranging between 40-58%. Moreover, 60% of those in the age category 55-64 years stated that they did not practice illegal dumping and this indicates that with age people have realised that they should not dump waste illegally and pollute the environment.

4.2.2.2 Relationship between Age and Awareness of Recycling Projects in the Area

Table 4.3 Age and awareness of recycling

Age group (years)	Awareness of recycling projects				Total
	Yes		No		
	Frequency	%	Frequency	%	%
25-34	16	44	20	56	36
35-44	11	58	8	42	19
45-54	9	43	12	57	21
55-64	9	60	6	40	15
65-74	3	33	6	67	9
Total	**48**		**52**		**100**

All age categories of respondents were aware of recycling but the majority of respondents were in two categories i.e. the 35-44 (58%) and the 55-64 (60%) year age categories. Significant proportions of respondents in the 25-34 (56%), 45-54 (57%) and 65-74 (67%) were unaware of any recycling projects in the area. This finding clearly indicates that the majority of respondents in most age categories had very less interest in recycling as a means to improve their environment.

4.2.2.3 Relationship between Age and Concern for the Environment

Fig 4.2: Age and concern for the state of the environment

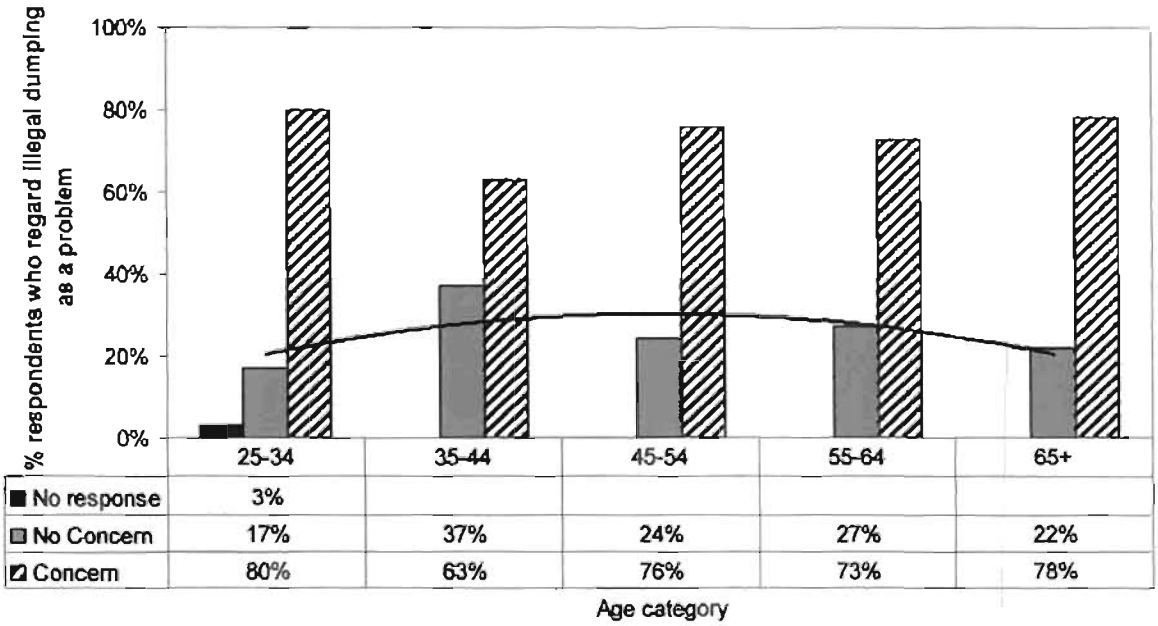


Figure 4.2 indicates that all groups showed great concern for the environment with proportions ranging from 63% (35-44 years) to over 70% in the rest of the age categories. It is clearly apparent that the younger respondents and those in the older age groups (45-60+) showed a greater concern for their environment.

4.2.3 Gender and Illegal Dumping

4.2.3.1 Relationship Between Respondent's Sex and Perception of Illegal Waste Disposal

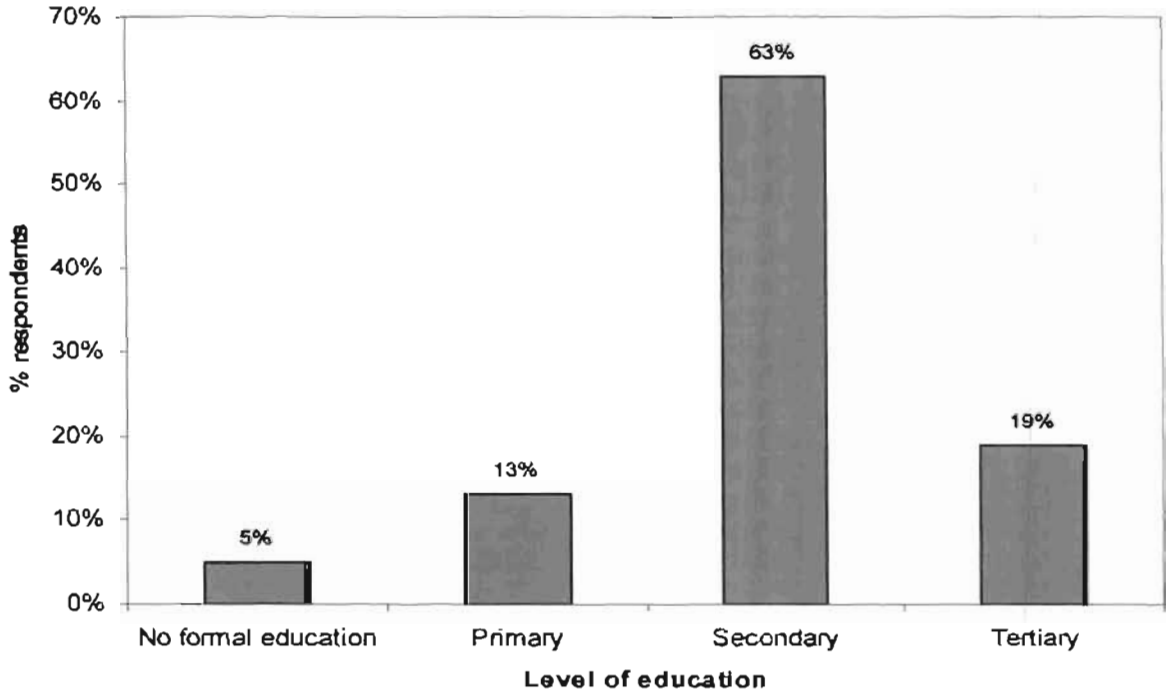
Table 4.4 Sex and perceptions of illegal waste disposal

Sex	Perception of illegal dumping as a problem				Total
	Yes		No		
	Frequency	%	Frequency	%	%
Male	15	68	7	32	22
Female	60	77	18	23	78
Total	**75**		**25**		**100**

The choice of respondent's sex as a variable was important as the division of household labour is biased towards women and waste disposal is one of the household duties. Most of the respondents were female (78%). This was due to the fact that women were available to be interviewed and were also knowledgeable about waste management in the household. The majority of females (77%) regarded illegal dumping as a problem in the area with a minority (18%) not considering it a problem. A majority of males (68%) were also of the view that illegal dumping was a problem. The findings therefore indicate that the sex of respondents did not impact on their perceptions of illegal dumping as both sexes had a common view.

4.2.4 Education Level and Illegal Waste Disposal

Fig 4.3: Education qualification of respondents



Education levels of respondents ranged from those who had no formal education to those who had tertiary education (Fig. 4.3). The majority of respondents (63%) had a secondary education with 19% having a tertiary qualification. Five percent and 13% of respondents had no formal education and a primary education, respectively.

4.2.4.1 Relationship between education levels and practice of illegal waste disposal

Table 4.5 Education and illegal disposal of waste.

Education Status	Disposal of wastes illegally				Total
	Yes		No		
	Frequency	%	Frequency	%	%
No formal education	1	20	4	80	5
Primary	5	39	8	61	13
Secondary	37	59	26	41	63
Tertiary	11	58	8	42	19
Total	**54**		**46**		**100**

It was surprising to find that 80% of those who did not have a formal education did not dump waste illegally whilst the majority who had a formal education tended to dump illegally. Thirty-nine percent of those who had a primary education, 59% (secondary) and 58% (tertiary) education dumped waste illegally. There was, therefore, a strong relationship between education levels and illegal waste disposal.

Table 4.6 Educational status and respondent's perception of illegal dumping

Education Status	Thoughts on whether illegal dumping is a problem					Thoughts on whether illegal dumping can be stopped				
	Yes		No		Total	Yes		No		Total
	Frequency	%	Frequency	%	%	Frequency	%	Frequency	%	%
No formal education	4	80	1	20	5	4	80	1	20	5
Primary	12	92	1	8	13	9	69	4	31	13
Secondary	45	71	18	29	63	41	65	22	35	63
Tertiary	14	74	5	26	19	17	89	2	11	19
Total	**75**		**25**		**100**	**71**		**29**		**100**

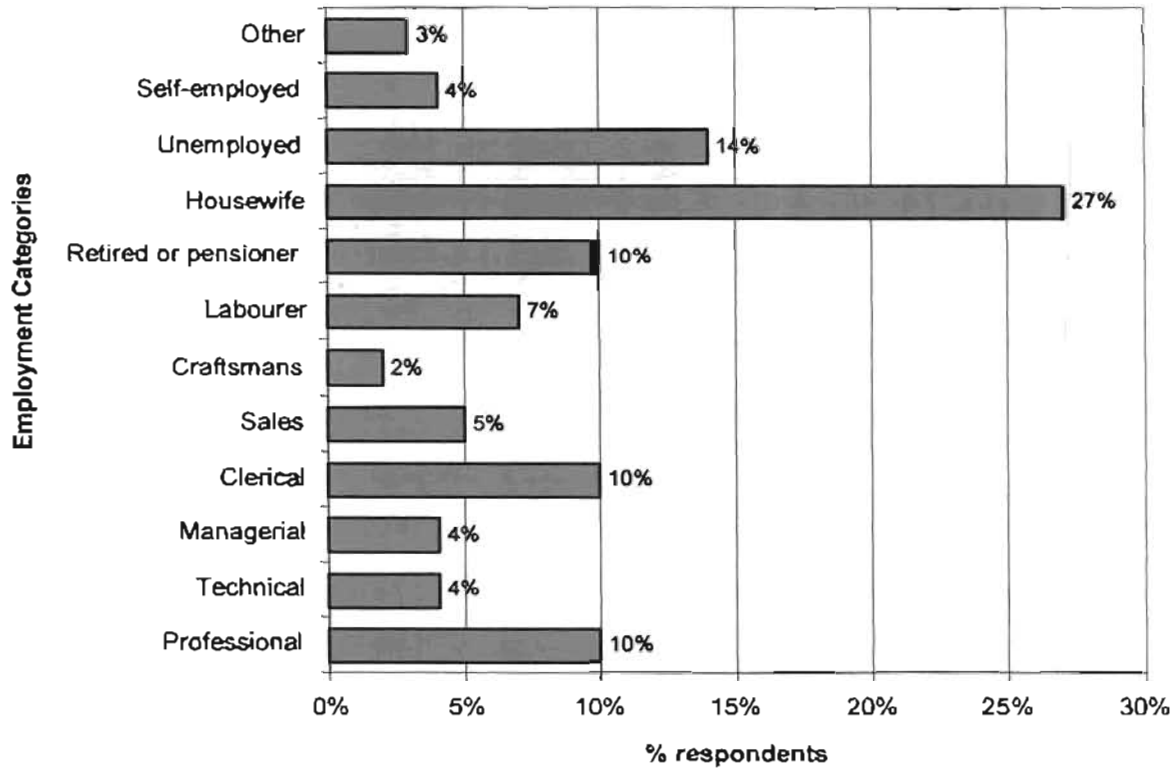
Table 4.6 above shows that 75% of the respondents from all educational levels have a good understanding that illegal dumping is a problem in the area and 25% believed that illegal

dumping is not a problem. A significant number (71%) of respondents overall, indicated that illegal dumping can be stopped whilst 29% were of the opinion that illegal dumping cannot be stopped.

4.2.5 Employment and Income of Respondents

4.2.5.1 Employment of Respondents

Fig 4.4: Employment categories and distribution

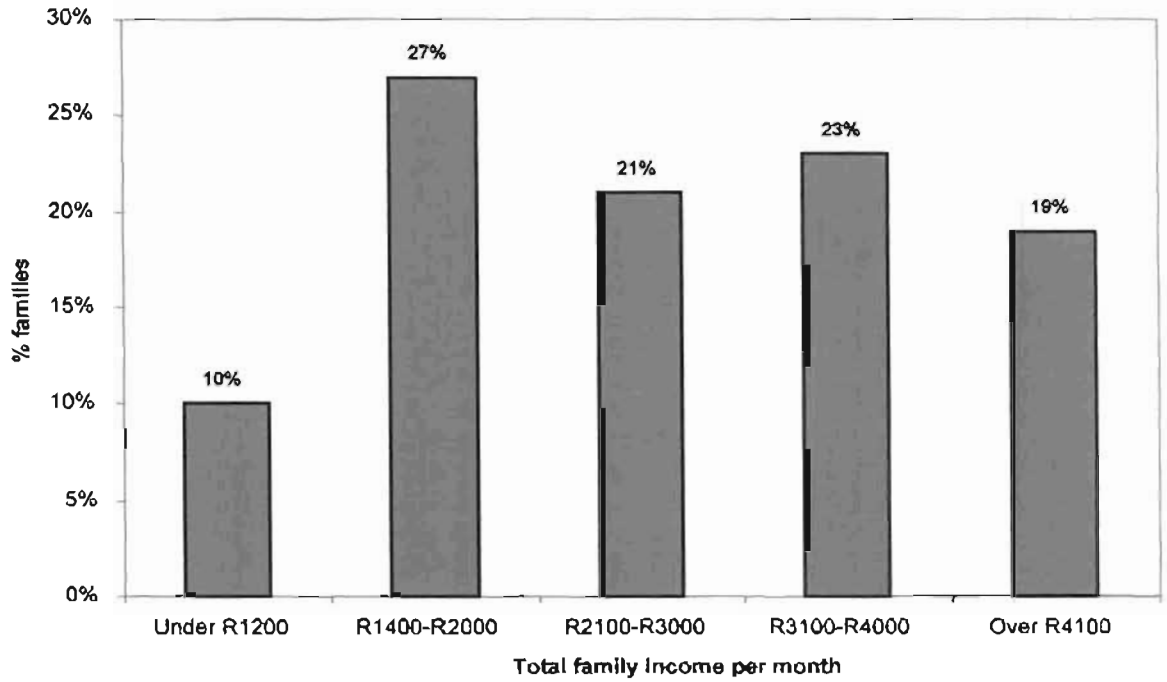


Employment and income status of the households are important indicators in assessing domestic waste management. They determine the roles played by households in waste management related issues as was indicated in the literature review chapter. Figure 4.4 above clearly illustrates the range of employment categories of respondents. The majority of respondents (27%) were housewives, followed by the unemployed 14%. Retired/ pensioners 10%, clerical workers 10%, labourers 7%, sales 5% and craftsmen 2%

comprised the balance of the occupational categories. Those who did not earn any income (housewives and the unemployed) made up 41% of respondents and this is indicative of a high level of unemployment in the area. Those with high status occupations such as professionals and managers formed a minor proportion amongst respondents (Fig 4.4).

4.2.5.2 Household Income

Fig 4.5: Family income distribution



The income distribution in this study was limited to the household. Studies done by Whiteford and Mcgrath (1994) revealed that household income is a more accurate income-receiving unit than individual respondent's income in assessing waste practices. The data indicates that three income categories were prominent i.e. R1400-R2000 (27%), R2100-R3000 (21%) and R3100-R4000 (23%). These household income categories comprised (71%) of all household incomes. The majority of the respondents (58%) earned an income of less than R3000. Only 19% earned more than R4100 per month.

4.2.5.3 Relationship Between Household Income and Illegal Dumping

Table 4.7 Income and illegal dumping

Income	Illegal waste dumping				Total
	Yes	%	No	%	%
< R1200	7	70	3	30	10
R1400-R2000	12	44	15	56	27
R2100-R3000	14	67	7	33	21
RR3100-R4000	14	60	9	40	23
>R4100	9	47	10	53	19
Total	**56**		**46**		**100**

The highest proportions of perpetrators dumping illegal waste were the households that earned less than R1200. These households were followed clearly by the middle-income categories earning R2100-R3000 (67%) and R3100-R4000 (60%). All income categories admitted to dumping waste illegally.

4.3 COMMUNITY PROBLEMS NEEDING URGENT ATTENTION

Table 4.8 Issues regarded as most problematic and needing urgent attention

Issue	No concern	Little concern	Strong concern	Total %
Electricity	76	16	8	100
Telephones	68	23	9	100
Housing	33	13	54	100
Waste removal	22	29	49	100
Rd. T/port	56	25	19	100
Shops/ Center	77	15	8	100
Employment	6	10	84	100

Table 4.8 illustrates issues that were regarded as problematic and needing urgent attention in the study area. Each issue was expressed by all 100 respondents and in so doing the severity of the issue was highlighted by the highest count. The highest amount was

expressed for employment (84%); housing was seen as the second issue of concern (54%) and waste removal (49%). Waste removal was rated as the third issue of concern. It is significant that a high number of respondents (49%) were concerned about waste removal in the area. Issues such as road/ transport, telephones, electricity and shops/ centres were rated by minority respondents as problematic and needed urgent attention.

4.4 PRACTICES, ATTITUDES AND KNOWLEDGE OF HOUSEHOLDS TOWARDS DOMESTIC WASTE MANAGEMENT

The behaviour of residents towards domestic waste management was investigated by analyzing their practices, knowledge and attitudes of waste composition, generation rates, storage, disposal, waste reduction, separation and recycling of wastes.

4.4.1 Composition of Wastes Generated

Table 4.9 Type of waste generated by household-Multiple Responses

Type of Waste	Food	Paper	Garden	Sanitary	Building	Other	%
							56
							24
							10
							9
							1
Total							**100**

Type of waste generated

Type of waste not generated

The above table shows that multiple types of wastes were generated per family. The waste stream comprised of food, paper, garden, sanitary, building and other. Food wastes comprised of vegetables/ organics/ putrescibles and comprised mainly of perishables such as vegetable peels, meat, poultry, fish off-cuts and left over food. The category paper

included cardboard and plastic and comprised of items such as carton containers, polystyrene food and beverage containers, convenience food wrappers/ boxes, plastic shopping bags, furniture and household appliance packaging. Garden waste comprised of lawn mowing clippings, tree branches, leaves and yard debris. Sanitary waste comprised of disposable nappies and sanitary towels. Building material was made up of rubble, plastic, steel, damaged building equipment and off cuts such as wood etc. The category other comprised of scrap metal, tyres, batteries, glass bottles and tin containers. Fifty-six percent of families responded that they generated all waste types of the waste stream. Twenty-four percent generated food, paper, garden and other wastes. Ten percent generated food, paper and sanitary wastes. Nine percent generated paper, garden and building wastes. One percent generated food, paper and other waste types (Table 4.9).

4.4.2 Quantity of Waste Generation

Table 4.10 Household size and quantity of waste generated

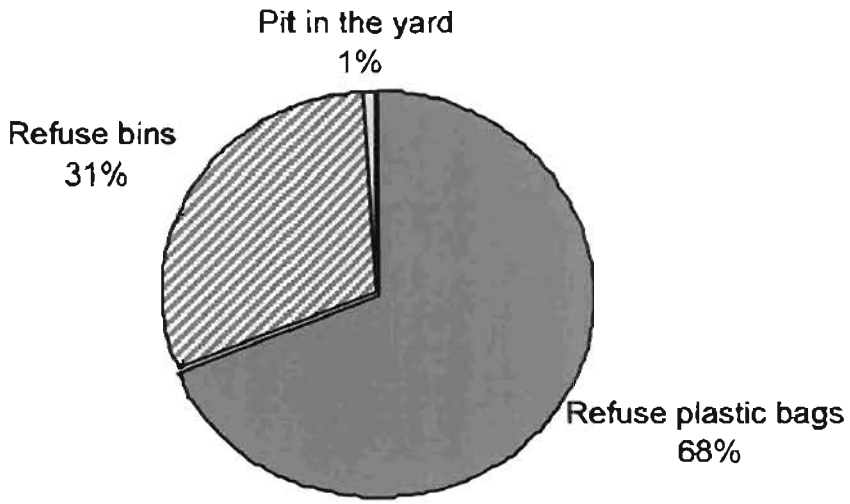
No of members per family	Amount of waste generated per family			Total %
	1 bag	2 bags	3 bags	
1-3	23	63	14	**100**
4-5	34	44	22	**100**
6-7	6	38	56	**100**

Table 4.10 illustrate household size and the quantity of waste generated in bags per week. The frequency of waste collection for the entire township was once weekly. It was noted during the survey that if a household missed the collection truck for any reason, the waste would only be picked up the following week. Twenty-three percent of smaller families that comprised of up to three members generated one bag of waste while 14% of up to three members generated approximately 3 bags of waste. Thirty-four percent of 4-5 members generated one bag waste while 44% of 4-5 members generated 2 bags of waste and 22% with 4-5 members per family generated 3 bags of waste. Six percent with families of 6-7

members generated one bag waste, 38% with 6-7 members generated 2 bags and 56% with 6-7 members generated 3 bags of waste. However, as reflected in Table 4.10 and the multiple correlation computed using the Chi Square test, no relationship was found between family size and the amount of waste generated by households. The correlations between family size and the number of bags of waste generated with different family sizes was weak with the following results, P=0.024 and P=0.029, respectively. The most common methods used for storing wastes in the household are shown in Fig 4.6 below.

4.4.3 Household Waste Storage Methods

Fig 4.6: Methods used for storing waste in the household

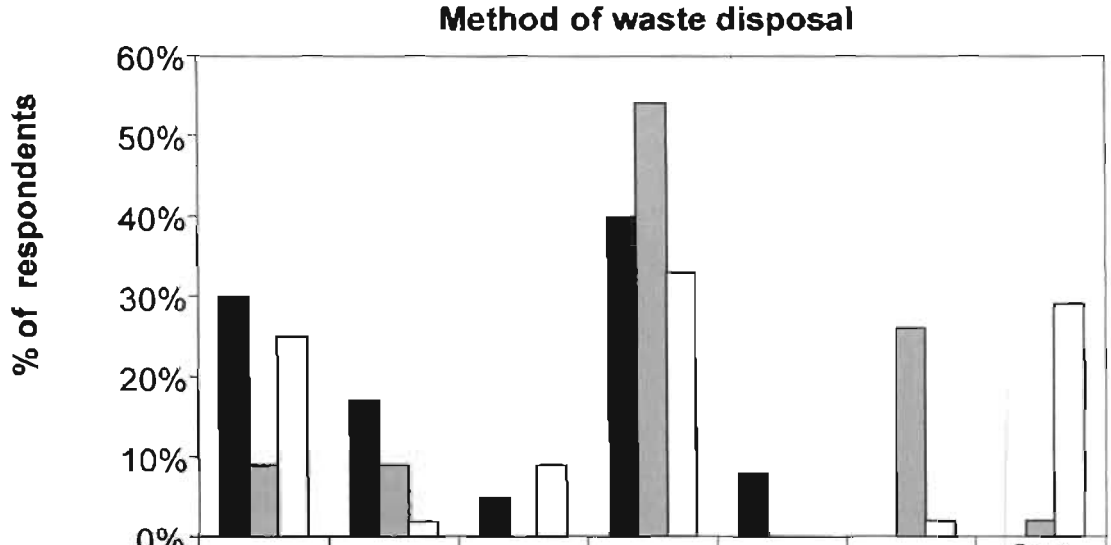


Sixty-eight percent of the respondents used refuse plastic bags (bin liners) and 31% used refuse bins for storing waste in the home. A very small fraction of respondents (1%) stored

waste in the yard in a pit (Fig 4.6). Respondents also indicated that they used various methods to dispose of different waste types as is illustrated in Fig 4.7 below.

4.4.4 Household Waste Disposal Methods

Fig 4.7: Methods employed to dispose waste



	Dump	Burn	Bury	Refuse bag	Animal feed	Recycle	Scrap dealer/give away
Food,Garden,Sanitary	30%	17%	5%	40%	8%		
Paper/plastic	9%	9%		54%		26%	2%
Scrap metal/Tin, batteries & tyres,appliances	25%	2%	9%	33%		2%	29%

It is clearly evident that residents engaged in several waste disposal practices for different waste types. Moreover, it was evident that very little source separation took place in the households. The majority of the households (40%) disposed off food, garden and sanitary wastes in the refuse bins. Some respondents (30%) dumped garden and food waste in their back yards or on open spaces whilst (17%) burned waste such as food, garden and sanitary. A minor proportion (8%) used leftover food and meat off-cuts to feed animals. Only 28% of respondents practiced recycling, of which paper and plastic made up (26%) and scrap/ dealer/ give-aways (2%). Twenty-nine percent gave scrap metal to collectors. Glass and tin

containers such as purity bottles, pickle, source, and peanut-butter bottles, jam tins, canned fruit, tin fish, etc (categorized under tin) contributed to (33%) and these were put into refuse bags. A majority (54%) of respondents disposed off paper and plastic in refuse bags. However, 9% burnt whilst the other 9% dumped paper and plastic waste (Fig 4.7).

4.5 KNOWLEDGE, ATTITUDES AND PRACTICES OF HOUSEHOLDERS TOWARDS ILLEGAL DUMPING OF SOLID WASTES

Resident's opinions, suggestions and views towards littering and illegal dumping was assessed and provided the basis for understanding why such behaviour existed.

4.5.1 Views and Opinions on Illegal Dumping

Table 4.11 Respondents views and opinions of illegal dumping

Respondents views of illegal dumping	Response		No response	Total %
	True	False		
I'm paying my rates therefore I'm not responsible	11	76	13	100
If we don't dump the Municipality workers will not have work	6	77	17	100
It is the responsibility of residents to catch illegal dumpers and report to the Municipality.	75	16	9	100
Industries from the area are responsible for illegal dumping.	46	44	10	100
Responsibility of the Municipality to stop illegal dumping.	77	13	10	100
Residence from nearby dump their waste here	74	15	11	100

Views expressed by respondents revealed that (74%), being the majority, were of the opinion that residents were the main contributors of littering and felt that this practice was unacceptable. Seventy-five percent reported that residents should be responsible for

reporting illegal dumpers to the municipality whilst (16%) believed it was not a resident's responsibility. Moreover, 46% of residents stated that industries were also responsible for illegal dumping in the area and 44% did not blame industries for illegal dumping. Seventy-seven percent of respondents were of the view that it was the duty of the municipality to stop residents from illegal dumping. A small proportion 11% were of the opinion that they paid rates and they could dump illegally while 76% indicated that although they paid rates for their property, it did not give them a reason to dump illegally. Six percent believed that if they did not dump the municipality workers would not have work to do. However, 77% of interviewees considered the above view to be false (Table 4.11).

4.5.2 Viewpoints on Illegal Dumping

Table 4.12 Illegal dumping as a problem

Illegal dumping as a problem in the area						**Percent (N=100)**
Yes						75
No						25
Total						**100**
Disposed off waste illegally by respondents						**Percent (N=100)**
Yes						31
No						46
No response						23
Total						**100**
Reasons why illegal dumping is a problem (Multiple response)	Unsightly to the eye	Brings down value of property	Releasenast y smells	Attract pests/ disease	Dogs carry waste into household/ property	**%**
						32
						5
						25
						30
						8
TOTAL						**100%**

Reasons selected by respondent

Reasons not selected by respondent

The study has indicated that illegal dumping was a major concern. Seventy-five percent of the respondents stated that illegal dumping was a problem in the area whilst the other (25%) did not view illegal dumping as a problem. Table 4.12 also revealed that (31%) of households admitted that they contributed to illegal dumping and (23%) did not respond.

The no responses could be attributed to respondents being afraid to admit their guilt for fear of being reported to the authorities. Forty-six percent of the respondents did not engage in illegal dumping according to the survey. Below are the reasons why illegal dumping was considered a problem.

Table 4.12 indicates that (32%) of the respondents viewed illegal dumping as problematic because it was unsightly to the eye, brings down value of property, releases nasty smells, attract pests and diseases and dogs carried waste into household/ property. Five percent stated that it led to problems such as being unsightly to the eye, brings down property values, released nasty smells and attracted pests and diseases. Twenty-five percent experienced problems such as nasty smells, pests and diseases being attracted and dogs carried waste into households and property. A significant proportion (30%) stated that illegal dumped wastes are unsightly, released nasty smells and it attracted pest and diseases. Eight percent stated that it brought down the value of property, released nasty smells, attracted pests and diseases and dogs carried waste onto properties and into households.

4.5.3 Composition of Waste Disposed Illegally

Table 4.13 Types of wastes disposed off illegally (Multiple responses)

Types of wastes disposed illegally	Unwanted furniture/ broken appliances	Garden	Building/ Rubble	Metal/ tin/ oil gallons	Bottles	%
						26
						31
						10
						24
						9
Total						**100**

Waste disposed off illegally

Waste not disposed off illegally

Table 4.13 illustrates some of the common types of wastes dumped illegally by respondents. Respondents had given multiple responses to this question. Twenty-six percent of the respondents stated that they disposed off unwanted furniture/ broken appliances, garden waste, metal/ tin/ oil gallons and bottles. Thirty-one percent disposed off all waste types above. Ten percent disposed off garden waste, building rubble, and bottles illegally. Twenty-four percent discarded unwanted furniture/ broken appliances, garden waste, metal/ tin/ oil gallons and bottles while 9% disposed off unwanted furniture/ broken appliances, garden waste, building rubble and bottles.

4.5.4 Consequences of Improperly Managed Wastes on Human/ Animal Health

Table 4.14 Health impacts of improperly managed wastes (Multiple responses)

Impacts of improperly managed wastes on health	Attracts pests eg. flies, rats,worms, cockroaches and ants.	Results in germs/ diseases	Injuries result from (broken glass, open cans), sharp objects	Unpleasant smells cause nausea and headaches	%
					37
					21
					14
					28
Total					**100**

Impacts selected by respondents of improperly managed wastes on health

Impacts not selected by respondents of improperly managed wastes on health

Table 4.14 illustrates multiple responses on the negative impacts of improperly managed wastes on human/ animal health and the natural environment. Thirty-seven percent of the respondents stated that all the impacts (pests e.g. flies, rats, worms, cockroaches and ants), germs/ diseases, injuries from (broken glass, open cans and sharp objects) and unpleasant smells that caused nausea and headaches) were consequences of improperly managed

wastes and impacted on human and animal health. Twenty-one percent reported that impacts such as pests being attracted e.g. (flies, rats, worms, cockroaches and ants), results in germs/ diseases and unpleasant smells caused nausea and headaches were attributed to improperly managed wastes and resulted on poor health on their families and pets. Fourteen percent of the study population viewed pests such as flies, rats, worms, cockroaches and ants, injuries especially to children and animals that used open spaces such as play grounds and unpleasant smells were common impacts of improperly managed wastes on health. A significant number (28%) of the respondents viewed germs/ diseases, injuries (broken glass, open cans, sharp objects) and unpleasant smells as main impacts of improperly managed wastes on health systems of humans and animals.

4.5.5 Perpetrators of Illegal Dumping

Table 4.15 Perception of persons responsible for illegal dumping (Multiple response)

Person responsi /ble for illegal dumping	Neigh /bours	Gar /den work /ers	Munici /pal street cleaners	Factor /ies & indust /ries	Building contractor in the area	Nearby flat dwel /lers	Respo n /dents	Project contract workers	Squat /ters	Other	%
											47
											10
											8
											7
											9
											15
											4
TOTAL											**100**

Persons responsible for illegal dumping

Persons not responsible for illegal dumping

Empirical evidence obtained in this study indicates that several persons were responsible for illegal dumping. Forty-seven percent of the respondents indicated that all categories of people responsible for illegal dumping as shown in Table 4.15 above as perpetrators of illegal dumping. Ten percent indicated that, neighbours, garden workers, municipal street cleaners, factories/ industries, building contractors in the area, nearby flat dwellers, respondents, project contract workers, and squatters were responsible for dumping illegally. Fifteen percent perceived neighbours, garden workers, and municipal street cleaners, building contractors, nearby flat dwellers, respondents, project contract workers and squatters as main culprits of dumping wastes illegally. These groups comprised a significant portion of illegal dumpers. A minority (4%) of the study population perceived garden workers, neighbours, nearby flat dwellers, respondents, and project contract workers as the main perpetrators of illegal dumping.

4.5.6 Reasons for Illegal Dumping

Table 4.16 Reasons for littering and illegal dumping (Multiple Responses)

Main reasons for littering/illegal dumping	Lack of facilities	Once weekly service (decomposition of organic waste)	Apathy/ uncaring attitudes	Lack of education	%
					10
					25
					60
					5
TOTAL					**100**

Reasons selected by respondents for illegal dumping

Reasons not selected by respondents for illegal dumping

Householders provided multiple responses to this question, and these are presented in Table 4.16. A significant number of (60%) of the respondents stated that the main reasons for littering and illegal dumping were because of a lack of facilities, once weekly service,

apathy/ uncaring attitudes and a lack of education. Ten percent viewed lack of facilities, apathy/ uncaring attitudes and lack of education as main reasons. Twenty-five percent reported that lack of facilities, once weekly service and apathy/ uncaring attitudes as their main reasons for the practice. Five percent were of the opinion that due to apathy/ uncaring attitudes and lack of education, residents dumped waste illegally. The above results also indicated that (100%) of the residents viewed apathy and uncaring attitudes to be one of the main reasons for littering and illegal dumping.

4.5.7 Suggested Solutions for Litter Reduction and Illegal Dumping

Table 4.17 Suggestions for litter reduction and illegal dumping (Multiple Responses)

Suggest /ions for litter reduction & illegal dumping	Enforcement of laws and fines	Inc waste collect /ion to twice wkly	Educat /ion and aware /ness	Munic to clean up open spaces & regular street clean- ups	Provide more bin bags for hsehold wastes	Provision of bags for garden waste	Signage & bright lights in open spaces	Report offend/ ers	Place /ment of skips recycling domes at strategic points	Transfer station to be centrally located	Com/ munity watch	Munic to collect garden wastes once mthly	%
													51
													10
													8
													7
													6
													4
													4
													3
													3
													2
													1
													1
TOTAL													100

Suggestions selected by respondents for litter reduction and illegal dumping

Suggestions not selected by respondents for litter reduction and illegal dumping

Solutions to the problem of illegal dumping and littering were suggested by respondents to improve the situation. Householders provided multiple responses to this question, and these are outlined in Table 4.17 above. These suggestions indicate that respondents are not satisfied with the waste system in the area. More than half (51%) of the respondents indicated that enforcement of strict laws and fines, waste collection days should be increased to twice weekly, promotion of education (awareness programs, extensive media coverage, environmental campaigns and clean-ups), municipality to clean up open spaces and regular street clean-ups, provision of more bin bags for household waste collection, offenders should be reported, placement of skips/ recycling domes at strategic points, a community watch should be set up in the neighbourhood and the municipality should collect garden waste once monthly at no cost to householders. The above findings from the majority of respondents being (51%) had also suggested the most number of solutions for litter reduction and illegal dumping. The remainder (49%) of the respondents had also indicated multiple solutions to curb the problem of litter and illegal dumping and is shown in Table 4.17 above.

4.6 AWARENESS AND PARTICIPATION OF HOUSEHOLDERS TOWARDS ENVIRONMENTAL WASTE PROGRAMS

The behaviour of residents towards domestic waste management was investigated by analyzing their awareness towards environmental waste programs and participation in waste reduction, separation and recycling initiatives.

4.6.1 Environmental Waste Programs

Table 4.18 Organization and description of environmental program

Who runs the program	%	Description of program
Keep Durban Beautiful Association (KDBA)	3	Adopt A Spot
Mondi	2	Paper recycling
Sathya Sai Movement	1	Paper recycling
Municipality	1	Metro Beat-Environmental Programme promotion
No Response	93	N/A
Total	100	

The awareness and knowledge of waste minimization of residents was investigated by asking them if they were aware of any environmental awareness programs in the area. They were also asked who ran the program if any existed, and to describe the program. Table 4.18 has revealed that only 7% of the respondents were aware of any environmental programs in the area.

The above table describes the organization that runs the program and a short description of the program is given. Only 3% of the respondents knew that the Keep Durban Beautiful Association (KDBA) program, one which ran the Adopt-a-Spot campaign, existed in the area. Two percent stated that Mondi ran a recycling program in the area. One percent each indicated that paper recycling was organized by the Sathya Sai Movement and the municipality. One percent of the respondents were aware that the Metro Beat Magazine promoted environmental programmes (Table 4.18).

4.7 KNOWLEDGE, ATTITUDES AND PRACTICES OF HOUSEHOLDERS TOWARDS RECYCLING

4.7.1 Recycling Projects

Table 4.19 Type of recycling projects available in the area

Type of Recycling Project	Percent
Scrap Metal/ Tin	23
Reclaimers	15
Glass/ Bottles	13
Paper	9
Mondi Domes	6
Schools	5
Cardboard	4
No response	25
Total	**100**

Table 4.19 shows the different types of project that residents were aware of and participated in. The above table indicates that thirteen percent of the study population was aware and participated in door-to-door glass and bottle collection. Twenty-three percent engaged in

door-to-door scrap metal and tin collection. Nine percent stated that they were aware of paper collection and four percent indicated that cardboard collection was available. Six percent of the respondents were aware of placement of Mondi's domes at strategic points and 5% was aware of recycling initiatives. A significant proportion (15%) revealed that waste reclaimers also recycled paper, cardboard and plastic obtained from refuse bins.

4.7.2 Waste Separation

Fig 4.8: Willingness to separate household waste and participate in household recycling programs

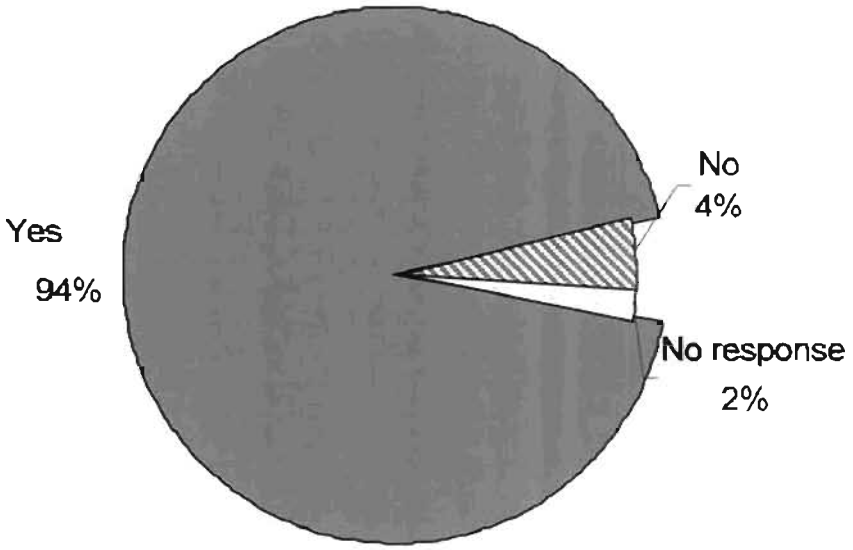


Fig 4.8 illustrates that the majority of the respondents (94%) are willing to separate their household waste and participate in waste recycling programs. Four percent are not willing to separate their waste and 2% did not respond.

4.7.3 Success Rate of Recycling

Table 4.20 Reasons for success of recycling projects

Perception of recycling	**Percent (N=100)**
Successful	35
Don't know	65
Total	**100**
Reasons for success of recycling projects	**Percent (N=35)**
Accessibility of door-to-door metal/ glass collection	17
Reduced waste quantities	40
School recycling initiative reduced waste and generated income for school	17
Willingness of residents to participate in projects	14
Streets are clean	12
Total	**100**

Respondents were asked whether the recycling projects were working in the area. Thirty-five percent were of the view that the projects were successful whilst the majority being 65% did not know (Table 4.20). Those who perceived recycling to be a success forwarded various reasons. Seventeen percent of the respondents believed that door to door metal and glass collection was very accessible to people and another seventeen percent indicated that school recycling projects reduced waste and generated an income. Forty percent stated that the recycling initiatives did reduce waste quantities. Fourteen percent perceived that the willingness of residents to participate, cooperate and support recycling initiatives, made it successful. Twelve percent indicated that recycling initiatives ensured the cleanliness of the streets.

4.7.4 Expansion of Recycling Projects

Table 4.21 Reasons for expanding recycling projects in the area

Reason	**Percent (N=100)**
Reduces the waste quantities	47
Creates employment	24
Reduce illegal dumping	29
Total	**100**

All respondents indicated that recycling projects should be expanded in the study area, as there were multiple benefits from this type of initiative. Some of the reasons why recycling projects should be expanded in the area are illustrated in Table 4.21 above. Forty-seven percent of respondents believed that waste quantities are reduced whilst 24% said it created job opportunities. Twenty-nine percent were of the opinion that it reduced illegal dumping.

4.7.5 Preferred Option of Recycling Program

Table 4.22 Preferred recycling programs

Type of programme	Percent (N=100)
Drop off recycling program	36
Door to door collection program	43
Special bags to pre-sort waste for collection	15
No response	6
Total	**100**

Respondents were asked to state the type of recycling program they preferred and this is shown in Table 4.22. It is clear that the majority of respondents (43%) desired a door-to-recycling program. Thirty-six percent preferred a drop off recycling program, whilst 15% preferred to be supplied with special bags to pre-sort waste for collection.

4.7.6 Purchasing of Recyclable Shopping Bags

Table 4.23 Reasons for purchasing/not purchasing recyclable shopping bags (Multiple Responses)

Reasons for purchas/ ing of recycled bags	Decrease quantity of inferior quality shopping bags that adds to waste stream.	Will be enviro-friendly	Will be biodegrad /able	Bags purchased will be of better quality and longer lasting	Bags can be reused	N=58	Reasons for not purchas /ing bags	Too costly	Addit/ ional cost to shop /ing budget	Would add to economic problems experienced by unemployed & poor.	If bag is not carried to the store, a new one will have to be Purchased.	Free bags served the needs of the customers previously	N=42
						5							12
						90							75
						1							8
						4							5
TOTAL						100	TOTAL						100

Reasons selected by respondents for purchasing/non purchasing of recycled bags

Reasons not selected by respondents for purchasing/non purchasing of recycled bags

Respondents were questioned about the purchasing of recyclable shopping bags. Fifty-eight percent responded positively to purchasing of shopping bags while the balance of 42% were not keen on purchasing bags. Table 4.23 illustrates the reasons for willingness and non-willingness to purchase shopping bags. Those who were willing to purchase recyclable shopping bags forwarded their reasons. A majority (90%) of those that were willing to purchase shopping bags stated all reasons in Table 4.23 indicating that recyclable bags will be enviro-friendly, decrease quantity of inferior quality shopping bags that adds to the waste stream, recyclable bags will be biodegradable, bags will be of better quality and longer lasting and bags can be reused. The balance being a minority (10%) indicated their reasons, which is shown in Table 4.23 above.

Seventy-five percent of the respondents were not keen on purchasing bags as they felt it was too costly, it would be an additional cost to their shopping budget, would add to economic problems experienced by unemployed and poor, if bags were not carried to the store, new bags would have to be purchased and free bags served the needs of the customers previously. The remainder (25%) had differing reasons as is indicated in Table 4.23.

4.8 PERCEPTIONS OF RESPONDENTS TO ACCESSABILITY OF REFUSE TRANSFER STATION AND RATING OF WASTE MANAGEMENT SYSTEM

4.8.1 Refuse Transfer Station

Table 4.24 Awareness, adequacy and accessibility of refuse transfer station

Awareness of refuse transfer station in the area	**Percent**
Yes	45
No	55
Total	**100**
Adequacy/accessibility of transfer station for solid wastes	**Percent (N=45)**
Yes	49
No	51
Total	**100**
Reasons for positive responses on adequacy/accessibility	**Percent (N=49)**
Solid Wastes received at no cost	45
Facility opened during weekends for convenience	32
Facility accepts garden, scrap metal and domestic wastes.	23
Total	**100**
Reasons for negative responses on adequacy/accessibility	**Percent (N=51)**
Does not accept all types of waste e.g. building rubble	22
Station is too busy over weekends	17
Station is not centrally located	22
No transport available to transfer wastes from home to station	39
Total	**100**

Table 4.24 above indicates that 45% of the respondents stated that they were aware that a garden refuse transfer station existed in Chatsworth whilst 55% were unaware. Forty nine percent of the 45 respondents who were aware considered the transfer station to be

adequate and accessible. They furnished the following reasons for their positive response. These were:

- No cost implications (45%)
- Facility opened on weekends (32%)
- Acceptance of garden, scrap metal and domestic waste (23%).

The main reasons why the transfer station was considered inadequate and inaccessible were that it:

- Did not accept all waste types (22%)
- Station is too busy over weekends (17%)
- Was not centrally located (22%)
- The non-availability of transport to the station (39%).

4.8.2 Perception of Refuse Collection System

Table 4.25 Rating of refuse collection system

Rating	Percent (N=100)
Poor	17
Adequate but poorly managed	27
Good	52
Very Good	2
Not sure	2
Total	**100**

Respondents were asked to rate the refuse collection system in their area. Over 50% of the respondents indicated that the waste system was good whilst 27% were of the opinion that it was adequate but poorly managed. A further 17% rated the system to be poor. Only a minority (2%) found the collection system to be very good.

4.9 NEGATIVE AND POSITIVE IMPACTS OF RECLAIMERS/ SCAVENGERS ON WASTE REMOVAL DAYS.

Table 4.26 Problems experienced on waste removal days due to reclaimers/ scavengers and benefits to reclaimers.

Are they a problem?	**Percent (N=100)**
Yes	48
No	52
Total	**100**
Problems experienced	**Percent (N=48)**
Reclaimers spill waste and create mess	79
Dogs/cats tear bags in search of food	21
Total	**100**
Benefits to reclaimers	**Percent (N=52)**
Reduced waste stream by paper, cardboard, plastic and glass collection	92
Reclaimers make a living	8
Total	**100**

Residents were asked if waste reclaimers and scavengers searched bins that were put out on collection days and if was a problem. Table 4.26 shows that 48% of the respondents were of the view that wastes reclaimers and scavengers are a problem and 52% stated that they were not a problem. Of those who considered it a problem, the majority (79%) stated that reclaimers spilt waste and created a mess. Additionally 21% of respondents viewed dogs and cats as causing a mess because they tore refuse bags in search of food. Respondents who stated that they did not have a problem on waste removal days (52%) mentioned that there were two benefits of having reclaimers and these were:

- Reduce the waste stream (92%)
- Reclaimers make a living (8%).

4.10 COMMUNITY PARTICIPATION

Table 4.27 Committee dealing with environmental problems

Type of Committee	Percent (N=100)
City Council	3
Metro Club	1
KBDA	1
Chatsworth Rising Sun	3
Sathya Sai Centre of SA	2
Scara Rates association	1
Don't know	89
Total	**100**

Table 4.27 above indicates that the majority of respondents (89%) did not know of any committees that dealt with environmental problems. However, 11% of respondents cited the City Council, Metro Club, KBDA, Chatsworth Rising Sun, Sathya Sai Centre and the Scara Rates Association.

Table 4.28 Community participation in dealing with solid waste problems

Mobilization of community to deal with solid waste problems	Percent
Yes	8
No	92
Total	**100**
Membership of any committee dealing with solid waste issues	**Percent**
Yes	6
No	94
Total	**100**
Name of committee	
City Council	2
Environment Steering Committee	1
Rates Association	2
Sai Centre	1
No response	94
Total	**100**
If no, provide reasons for not participating	**Percent**
Time constraints	2
Lack of awareness of committee	1
No response	97
Total	**100**
Name problems above committees helped to resolve	**Percent**
Maintenance and provision of street lights, sewerage/street drainage systems	3
Provision of no dumping signs	3
Provision of extra refuse bags	3
Maintenance of open spaces and clearance of illegal dumping	2
Total	**11**
Community involvement in workshops to formulate present waste policies	**Percent**
Yes	2
No	70
No response	28
Total	**100**
Reasons for non-participation in workshops	**Percent**
Unaware of workshops to formulate wastes policies	12
No response	88
Total	**100**

It is clear from the data in Table 4.28 that the majority of respondents (92%) have not mobilized to deal with the solid waste problem in their area. The study indicates that only a few residents (8%) have mobilized to deal with solid waste issues in the study area with only 6% of respondents being members of committees dealing with solid waste issues. It is clear from the data in Table 4.28 that the majority of respondents (92%) have not mobilized to deal with the solid waste problem in their area. The committees that they were involved in were the City Council, Environment Steering Committee at Provincial level, Rates

Association and the Sai Centre. Respondents were further asked to provide reasons for non-participation in waste committees and the few respondents indicated that they had time constraints and others were not aware of the committees in the area. According to 11% of the respondents, the committees mentioned above solved the following problems in the area:

- Street lighting;
- Provision of dumping signs;
- Sewage problems;
- Provision of refuse bags; and
- Maintenance of open spaces.

In terms of workshops to formulate the present waste policies it was also evident that the majority of residents (70%) were not involved. Moreover only 12% of respondents provided a reason for non-participation and this was because they were unaware of workshops to formulate waste policies.

4.11 ENVIRONMENT POLICY ON SOLID WASTE MANAGEMENT

Table 4.29 Knowledge of Solid Waste Management Policy

Awareness of present Solid Waste Management Policy (SWMP)	**Percent (N=100)**
Yes	8
No	92
Total	**100**
Explanation of policy	**Percent (N=8)**
Dumping is illegal	38
Burning of wastes is illegal	25
Offenders of illegal dumping can be prosecuted	37
Total	100
Where did you hear about the SWMP	**Percent**
Media	3
Friends/relatives	2
Community meetings	1
Other	2
No response	92
Total	**100**
Do you think that the solid waste management system has improved or become worse?	**Percent (N=100)**
Improved	8
Become worse	63
Not sure	29
Total	**100**
Do you think the environment has improved with the present SWMP in place?	**Percent (N=100)**
Improved	4
Remained the same	5
Not sure	4
Don't know	14
No response	73
Total	**100**

The results presented in Table 4.29 reveal that very few (8%) were aware of the present solid waste management policy. The majority (92%) indicated that they had no idea that a policy existed on waste issues. Those who knew about the policies were asked to explain what it was about and they mentioned that dumping was illegal 38%, burning of wastes was illegal 25% and offenders of illegal dumping will be prosecuted 37%.

Respondents heard about SWMP from the media 3%, friends and relatives 2%, community meetings 1% and from other sources 2%. When respondents were asked whether the solid waste management system had improved or became worse, 63% were of the opinion that it has become worse whilst 29% were not sure.

The majority of respondents (73%) did not respond to the question on whether the environment has improved with the present SWMP in place. This is understandable, as they did not hear about SWMP. However, some respondents mentioned that the environment has improved 4% whilst 5% stated that the environment remained the same.

4.12 OPINIONS AND SUGGESTIONS ON THE WASTE MANAGEMENT SYSTEM

Table 4.30 Respondents opinions of the waste management system (Multiple responses)

Opinions on waste management system	Poor/ can improve	Adequate	Communities have negative attitudes in managing their waste	Communities and authorities to work together to solve waste management problems	%
					30
					52
					10
					8
TOTAL					**100**

Opinions selected by respondents

Opinions not selected by respondents

Respondents were asked to give their opinion on the waste management system and this is indicated in Table 4.30. Only 52% of respondents forwarded a positive response on this issue and stated that it was adequate. Thirty percent of the respondents were of the opinion that the waste management system is poor and can improve. Ten percent of the respondents were of the view that it was poor and could improve, communities had negative attitudes in managing their waste and that the community and authorities need to work together to solve waste management issues. Eight percent were of the opinion that the waste management system was poor/ could improve and communities/ authorities need to work together to solve waste problems.

Table 4.31 Suggestions from residents to improve the solid waste management System (Multiple responses)

Sugges /tions	Twice weekly waste collect /ion	Enforce/ ment of law and strict fines	Provision of more bin bags for hsehold & garden wastes	Signage & bright lights	Educa /tion, camp /aigns work/ shops	Placement of recycling banks at strategic pnts for hsehold & garden wastes	Munic to clean open public spaces.	Strict & regular street clean-ups	Supervi /sion of street cleaners by munici /pality	Transfer station to Be centrally situated	Cost of garden waste collection nd refuse bags to be incl in rates fees	Comm /unity watch	Comm & authrity to work together	Report offend /ers to authori /ties	%
	■	■	■	■	■						■		■	■	10
		■			■		■	■				■	■	■	6
	■		■		■	■				■	■		■	■	18
		■		■			■	■		■		■	■		4
	■	■	■	■	■	■	■	■	■				■	■	20
	■	■			■	■	■	■	■		■	■	■		16
	■	■	■			■	■			■		■	■		14
	■	■	■	■	■	■				■				■	12
TOTAL															100

■ Suggestions selected by residents

□ Suggestions not selected by residents

The results from Table 4.31 indicate that residents have provided multiple suggestions to improve the solid waste management system in the study area. It is clear from Table 4.31 hat the most important suggestions were:

- twice weekly waste collection;
- provision of more bin bags for household and garden wastes;
- education, campaigns and environmental workshops;
- municipality to clean open spaces;
- communities and authorities to work together;
- enforcement of law and strict fines; and
- placement of recycling banks at strategic points for garden and household waste disposal.

4.13 RESULTS OF SEMI-STRUCTURED INTERVIEWS AND PERSONAL COMMUNICATIONS OF TARGET GROUPS

In an attempt to obtain an in-depth understanding of the solid waste management system of the study area, semi-structured interviews as well as personal communications and discussions were conducted with specific target groups. Authorities in different waste management departments such as Durban Solid Waste, Inner West City Council, Enviro Serve, Chatsworth Parks and Recreation, Chatsworth Garden Refuse Transfer Site and the Keep Durban Beautiful Association (KBDA) were interviewed for their input into local initiatives and for co-ordination and implementation of waste management plans at the local level. A MPP member who represented the Steering Committee for the Environment at the Provincial level was also interviewed. Additionally four councillors of different wards were interviewed to find out what they had done to improve the solid waste management system in their area.

An interview with a local resident that embarked on the Community Gardens and Urban Agriculture projects started by the Keep Durban Association was also undertaken. Ten schools were visited to establish the role of children and educators in environmental awareness and curriculum development on waste management. Ten reclaimers were also interviewed on waste collection days to establish reasons for their collection. The Branch Manager of Collect-A-Can, The Public Relations Officer (PRO) of Arayan

Benovelent Homes (ABH) and the PRO of the Chatsworth Shopping Centre have also been interviewed to see levels of waste recycling initiatives practiced.

4.13.1 Councillors and MPP Member of Parliament Representing the Steering Committee for the Environment

4.13.1.1 Community participation

All councilors were aware of committees in the area that dealt with environmental problems. The type of committees ranged from NGOs, Civic Bodies and the Rate Payers Association. The persons interviewed indicated that the community did not mobilize to deal with solid waste issues in the area. None of the councillors were members of any environmental organization. Organizations like the Civic Bodies dealt with solid waste problems such as illegal dumping of medical waste in Bul-Bul Drive. The MPP member of the Steering Committee did mention that assistance from Local Government and Provincial Government had been sought in terms of solid waste related problems (Personal Communication, Charmaine Rajbansi, 4 November 2003). Councillors did approach the Solid Waste Department for assistance at times when communities experienced problems. One of the problems that were posed to the council was to look at increasing the refuse collection to twice a week, especially during the summer season. It was revealed that residents found it difficult to manage their refuse since the unusual summer weather experienced resulted in an increased maggot breeding period and posed severe health risks to the communities (Personal Communication, Councillor Paris Singh, 5 November 2003). The study indicates that the municipality has been approached by councillors to look at well-structured management systems such as in Singapore and other cities to model Durban for control of domestic waste. The interviews also indicated that problems have been successfully resolved by Parliament and at Council level due to engagement of the community in annual anti-litter campaigns and Adopt-A-Spot programmes. The MPP member acknowledged that a Waste Management Imbiso was held in September 2001, where communities were invited to workshops to formulate the waste policy.

4.13.1.2 Recycling and Waste Reduction

None of the councillors were aware of any environmental awareness programs in the area, only the MPP member-representing Parliament indicated that media articles for awareness have been written. Waste Recycling projects have been cited by all interviewed. Some of the waste recycling projects were initiated by schools, Sai groups, Mondi Paper, Scout groups and the Sri Ram Temple. However, it was indicated that waste recycling should be done on a more extensive level. The main problem with recycling projects was that collection banks, containers etc. were not readily available to all people in the community. Recycling projects were seen as the only solution to domestic waste minimization.

4.13.1.3 Councillors and Members Input to Help Resolve Problems that Include Illegal Dumping, Insufficient Solid Waste Bags and Provision of Free Garden Refuse Bags in the Area.

Councillors of the area indicated that residents played an essential role to help curb problems such as illegal dumping. Residents were asked to provide proof of culprits of illegal dumping and to appear in court with affidavits. This measure was seen as problematic as residents from the area would rather not get involved since the process of implementation of the law was quite a tedious one. Councillors stated that education on a one to one basis had been conducted with residents guilty of illegal dumping. It has been suggested by all interviewed that landlords incorporate the cost of bin bags in the rentals of tenants, and that landlords were to supply tenants with bin bags. Meetings with authorities concerning maintenance of verges, street sweeping and the issue of funding had taken place. It was also indicated that not much rates had been generated in the area for funding of services for street maintenance. Health officers had been sent to specific owners with vacant property or unoccupied property and notices to clear up had been served. Property owners had been given 30 days notice to clean up the land or contractors would resolve to clean up at the cost of the property owner.

4.13.1.4 Knowledge of Solid Waste Management Policy

All councillors and the MPP member were aware of the present waste management policy. They heard of the policies *via* community meetings, environmental meetings and

parliament. All were aware how the policy worked and stated that the SWMP system as well as the condition of the environment had become worse. Some of the reasons for the poor quality of the environment were that residents had negative attitudes towards the environment. The environment had worsened due to informal settlements and poor planning of housing in the past.

4.13.1.5 Opinions and Suggestions on Waste Management

It was suggested that a lot could be done to bring the community on board to take care of their environment. The following suggestions were highlighted:

- Local government should review and amend policies according to global standards;
- Review and design a proper modern SWMP with proper consultation with all communities in the area;
- Proper recycling awareness, better drainage systems, frequent waste removal, pro-active parks and recreation department, municipal refuse removal and sewerage services;
- Services should be outsourced;
- The need for pro-active environmental committees;
- Education of the masses for ownership of suburbs and beauty of the surroundings, signage etc; and
- Residents should be responsible for higher payment of waste management services.

4.14 KEEP DURBAN BEAUTIFUL ASSOCIATION (KDBA) AUTHORITIES INTERVIEWED:

Mari Van Der Merwe-: Education Co-Ordinator (KDBA) and Acting Business Manager (Durban Solid Waste) (DSW)

Lezi Ngqulunga-: Education Officer (KDBA)

Roy Sukdhev-: Education Officer (KDBA)

Sara Freeman-: Waste Minimisation Officer (KDBA)

4.14.1 EDUCATION CO-ORDINATOR: MARI VAN DER MERWE (KDBA)

Results of the semi-structured interviews with the Keep Durban Beautiful Association have revealed that KDBA is 23 years in progress this year and the Education and Waste Minimisation Division is 10 years in progress (Personal communication, Mari Van Der Merve, 10 February 2003). KDBA is the Education and Waste Minimisation unit of Durban Solid Waste (DSW). KDBA has moved from being an anti-littering programme in a few communities to an organization that deals with the total sphere of waste management in all communities. People from all over South Africa come to learn from KDBA and vice-versa. Mari Van Der Merwe represents both DSW and KDBA on the Standards Generating Body for Waste Management, which is part of the overall South African Qualifications Authority (SAQA) process. It is her belief that there will be many positive opportunities for the association in the formalizing of training in the waste management industry. KDBA also has programmes such as Adopt-A-Spot/ Adopt-A-Verge where residents, business people etc, can adopt a vacant piece of land and take care of it by maintaining it. Another very informative exercise is the Photmetric Index survey, which shows the profile of the litter survey of Durban for the last 20 years. Thirty-nine surveys have now been completed since 1983.

According to Mari Van Der Merwe, Chatsworth was one of the first Indian neighbourhoods that had achieved success through the establishing of community co-ordinating committees. The personalizing of projects in terms of specific handouts, posters and bins had increased participation and motivation at community level. In September 1984, Westcliff and Bayview in Chatsworth, great achievements were realized through community action projects. Activities included a garden competition, tree planting which residents officially adopted, bin painting by pupils of the local secondary school and trench gardening demonstrations by the City Health Department. Following this hierarchy at community level, the schools that heard about the initiative had taken the lead to initiate similar programmes. In 1985 Woodhurst Secondary received a commendation at the Keep South Africa Beautiful (KSAB) Award ceremony.

The Keep Havenside Clean Association set up in May 1986 undertook one of the most intensive anti-litter projects for the year. The Mobeni Heights Environmental Action

Group had as a prime objective, the improvement of the environment. Their project was officially launched in September 1986. This was followed by door-to-door visits to all businesses in the area. The group had set up a neighbourhood watch to identify the culprits who continue to dump on the many vacant lots in the area. The Keep Havenside Clean Association and other environmental action groups in Chatsworth were only sustained for a few years. However, it passed that some of those attending the meeting felt that there were more pressing problems to be addressed and were therefore unwilling to participate. It was decided that a programme in this area be shelved, until it received the full support of the community.

4.14.2 EDUCATIONAL OFFICER: LEZI NGQULUNGA (KDBA)

The results of the semi structure interview with Educational Officer, Lezi Ngqulunga revealed that the following Educational Institutions Program forms part of the KDBA (Personal Communication, Lezi Ngqulunga, 15 July 2004).

4.14.2.1 The Education Committee

The Education Committee is the body that regulates all activities taking place within the educational institutions component of KDBA. It is comprised of dedicated full-time teachers who voluntarily offer their services to promote the program and projects of the Association outside of their official school schedules this including weekends and or late afternoons. This committee is driven by the desire to enhance the quality of education by ensuring that the needs of the educator are met, school support material is developed according to expected standards and that service delivery is consistent.

4.14.2.1.1 Educational Institutions Programme (EIP)

The KDBA aims to be up-to-date with its education resource material and has taken the responsibility to reach out to schools and communities to help them maintain a clean, healthy and beautiful environment. Invitations were sent out to schools to participate in their programme, to inform them of the selection of activities contained in their Waste Management Education Programme for Educational Institutions (See Appendix D), which has the full approval of the KZN Department of Education and Culture.

In this program the Waste Management Education Kit offers Learner Support Material made up of activities educators can use from School Readiness to Senior Phase levels. The Learner Support Material resource pack is entitled "Waste Management Learner Support Material for Environmental Policy" (Association of Clean Communities, 2003). According to (Personal communication, Lezi Ngqulunga, 15 July 2004) educational institutionals have continued to value the services provided by the KDBA.

4.14.2.1.2 The Environmental Education Curriculum Forum (EECF)

The KwaZulu-Natal Department of Education and Culture, Environmental Education Curriculum Committee (KZNDEC-EECF) is affiliated to KDBA. This committee is the official advisory body for the KZN Department of Education and Culture on Environmental Education matters. KDBA sees it as a privilege to be part of this body and to carry out its functions within the ambit of its operations. At present the following organizations are members of the committee:

- The Wildlife Society;
- Durban Environmental Education Centre;
- Dundee Environmental Education Centre;
- Eshowe Environmental Education Centre;
- Sea World;
- SPCA;
- Umgeni Water;
- Wastewater Management Department of the eThekweni Municipality;
- Keep Durban beautiful Association;
- Department of Environmental Health;
- Natural Science Museum;
- South African National Defence Force; and
- Department of Agriculture and Environmental Affairs.

4.14.2.1.3 Pre-Primary Schools Waste Management Program

Pre-schools form an integral part of the EIP and enjoy programmes that get them started on how to handle waste correctly. The intention of this program is that its practical approach to waste management will serve as an introduction to an understanding of the

importance of correct waste management. The Pre-school manual consists of activities that can be used in introducing the topic of litter and waste management to pre-scholars.

4.14.2.1.4 Doorstep Environment Program (DEP)

The DEP addresses waste management issues that provides life skills and equips learners with leadership qualities. The DEP offers a structured program for environmental education with particular emphasis on litter abatement and solid waste management. This program is designed to be implemented by schools, youth organizations and environmental groups such as Wild Life Society, Land Service, Scouts, Girl Guides, School Clubs etc. The program can complement existing activities or it may be used for a club on its own.

i) Objective of the DEP

- To develop a sustained environment awareness in participants;
- To assist leaders in running an effective environmental programme; and
- To develop practical skills for environmental management.

ii) Target Audience of the DEP

The DEP has been implemented through existing groups which offer environmental youth programmes. These groups may be within schools, Wildlife Societies and other youth groups. When a group affiliates to the DEP a liaison officer will be appointed. The children will then join the group. The liaison officer supervises the programme, using support material provided by the DEP.

iii) The Programme

The programme consists of a number of graded activities to be completed. The activities are grouped into various levels, which are grade applicable. On completion of the required number of activities recognition certificates are awarded.

The DEP has four levels:

LEVEL	GRADE
One	1-3
Two	4-6
Three	7-9
Four	10-12

At each level there are three grades, which can be achieved. On completion of the 5 activities a bronze certificate is awarded, for 12 completed activities, a silver certificate and for 18, a gold certificate. Refer to Appendix E and F for example of an Application for Membership Form and Membership Record Card Form.

4.14.2.2 Presentations and Workshops

This initiative is taken by educators to invite KDBA to workshops and presentations, which they themselves have arranged. Materials supplied at these workshops are professionally presented. Subject matter with layout and presentations are educator and learner friendly.

4.14.2.3 Waste Minimisation

Waste Management Education endorses the principles of Integrated waste Management and teaches alternate waste handling techniques before final disposal. Summarised as the four "Rs" recycle, reduce, reuse, and restore, learners are passionate at the final products of being creative with waste.

4.14.2.4 Landfill Site Tours

Interested group guided tours are offered on Thursdays by staff of the Durban Solid Waste Landfill Site in Bisasar Road, Springfield and staff of KDBA. That growing interest in these visits signal that the larger community cares about what finally happens to their waste and its impact on the environment.

4.14.3 Education Officer: Roy Sukdhev (KDBA)

The results of the interview indicate that the Local Government Committee met once a month (Personal Communication, Roy Sukdhev, 10 July 2003). The committee experienced low attendance at these meetings due to unfilled vacancies and the integration and transfer of staff within departments.

On-going projects identified were:

- WOODEN PALLETS PROJECT;
- PAMPHLET DISTRIBUTION CONTROL;
- TAG-A-MOTORIST;
- RUBBLE PROJECT; and
- ENVIRO FORUMS

The Enviro Forum is in existence for over three years and provides an efficient service to address environmental concerns of the community. Enviro Forums encourage and coordinate inter-departmental efforts to address specifically identified environmental problems. There are now three Forums serving the Chatsworth, Phoenix and Newlands East areas respectively. The Forum has implemented Education and Awareness Programmmes and Adopt-A-Spot Projects in Chatsworth.

4.14.4 WASTE MINIMISATION OFFICER: SARA FREEMAN (KDBA)

The results of the interview indicate that Integrated Waste Management projects are undertaken (Personal communication, Sara Freeman on 08 January 2003). These projects are diverse as establishing recycling drop-off and buy-back centers to conducting waste minimization audits for businesses, industries and institutions. The aim is to divert waste from landfills and create jobs in waste minimization, recycling and composting.

Orange banks sponsored by Mondi for the collection of cans and papers have been placed in strategic points such as schools etc. Co-ordinators are allocated and are responsible for the banks. The proceeds of the waste are collected by the co-ordinators and are distributed to charity organisations such as the Aryan Benovelent Homes and

Scout Groups etc. One of the current Waste Minimization Office Projects is the Communities: Investigating Waste Minimisation Initiatives. In this project Bottlebrush (an informal settlement in Chatsworth) has been identified as one with high levels of littering. This is an area of low socio-economic status. The office is currently arranging for educational and awareness programmes on proper waste handling; amongst other program to be established.

4.14.5 Resident who Embarked on the Community Garden and Urban Agriculture in Havenside-Chatsworth.

Local resident Mr Sandy Pillay (Personal Communication with Mr Sandy Pillay, 7 July 2004) of Havenside Chatsworth stated that the Community Gardening Project was started by the Keep Durban Beautiful Association in conjunction with community groups that were interested in gardening. The community gardening project was set up to drive clean environment projects such as Adopt-A-Spot. Mr Sandy Pillay identified the open space opposite his residence that was used as an illegal dumping ground by local residents three years ago and obtained permission from the council (Parks Department) to use the land for gardening purposes. The open space was rehabilitated and converted for garden and composting purposes.

Mr Pillay indicated that his project is part of the bigger Community Gardens and Urban Agriculture Project in the Central Areas of Durban. The above project sets up committees to select people with potential to run the gardening projects, and the City Health and KDBA assist with crop rotation education and provision of start-up seeds to the group respectively. The council policy for the project states that the allocation of land for gardening purposes should mainly take place where it can be determined that there is going to be a productive use of the land. In this process, first preference is given to local residents in the allocation of land for community gardening, and these lands are normally available at a nominal rental rate as per regulations of the council. The department assists with giving training courses on composting to people who are interested in starting composting and gardening projects, mainly to promote community gardening i.e. people are taught the diversified nature of cultivation in relation to relevant soil types. The vegetable grown from these projects are supposed to be used by

the group for both subsistence and income generation at the markets in Durban and surrounding areas. The Parks Department helps in the sustainability of these projects by doing the maintenance work on them. The results of the interview indicate that Mr Pillay is the only resident in the area that has embarked on a project of the above nature. The project has been very successful since it helps him save on grocery bills, promotes a clean environment and encourages a sense of responsibility in the community. Mr Pillay mentioned that one of the problems experienced by this project is vandalism and he hopes that with the co-operation from the community this problem can be dealt with more effectively. According to the Annual report of the Association of Clean Communities (2004). Gardening projects continue to be a major extension of the Adopt-A-Spot programme. The Department of Agriculture and Environmental Affairs has started to provide big gardening projects with seeds and equipment. One of the gardening projects in KwaMashu H section, Vukuzibambe was nominated for Mayoral Awards for Excellency.

4.14.6 Schools

Interviews have been conducted with ten schools in the study area. Interviews were conducted with the following schools: Crossmoor Secondary, Highlands Secondary, West Park Primary, Tyburn Primary, Wingen Heights Secondary, Crossmead Primary, Southlands Secondary, Alencon Primary, Marklands Secondary and Montford Primary. All the above-mentioned schools have participated in some form of environmental management programs to promote a greener environment and environmental awareness. All schools interviewed have responded to the Doorstep Environmental Program (DEP) Crossmoor Secondary, Highlands Secondary and West Park Primary have engaged in the DEP since inception of the programme in 1990. Southlands Secondary have been very active with regard to promoting Environmental issues and have integrated an Environmental Policy in their curriculum. All schools contribute to a waste minimization programmme where paper is collected and used in the school or is sent to paper pick up companies such as Mondi. Mondi Paper banks have been placed in Wingen Heights Secondary and Marklands Secondary schools, and the schools use the proceeds. Crossmead Primary and Alencon Primary have engaged in Permaculture whereby learners are taught alternate waste handling techniques before final disposal.

4.14.7 Waste Reclaimers

Ten reclaimers who collect products from waste disposed by residents have been interviewed. Sixty percent of the informal collectors of waste came from Chatsworth and its surrounding areas. Twenty percent came from Shallcross, (10%) from Burlington and (10%) from Malvern. Ninety percent of the collectors were African whilst (10%) were Indian. Informal collectors were put into four age categories. Twenty percent of the collectors fell in the 17-20 age category, 40% were in the 21-25 age category, 30% in the 26-40 age category and 10% were of the 41-60 age category. Seventy percent of the collectors were female and 30% were male. Eighty percent had families to support and 20% collected to support themselves. Of the 80% that had families to support, 60% had between six and eight members, 30% had five members to support and 10% had three to four members to support. The majority 80% of the informal collectors had been reclaiming waste products from residential wastes for 2-3 years and 20% have been in the process for a year. The peak and most productive collection time for most of the collectors is between four o' clock and eight o' clock in the morning. However, collection does take place throughout the day. Products that were reclaimed were cardboard, paper and plastic from the waste disposed. On average each reclaimer collected between 25-30 kg's of cardboard, 15-20 kg's paper and 40 kg's plastic daily. The average cost of cardboard is forty cents per kg, paper (thirty cents per kg) and plastic (eighty cents per kg). The collected items are sold to Waseem's Waste Paper in Chatsworth. Each reclaimer earned between R42-R50 daily. The waste materials were collected and carried mainly by hand and on the head. Two collectors used a supermarket trolley to collect goods. Goods are carried to the collection point and often a distance of 15-20 km is covered before goods are taken to the collection point. The results indicate that the collection of goods takes place even on rainy days and includes weekends and holidays.

4.14.8 Authorities from the Chatsworth Transfer Station Plant and Disposal Centre

Interviews were conducted with Mr Trevan Govender, the Area Cleansing Officer and Mr M. Naidoo who is the Transfer Station Operator on (3 June 2004). Domestic wastes of the study area were transported to the Chatsworth Transfer Station. Domestic waste is collected in twenty-five cubic metric tons refuse compactors, which is compressed and then taken to the Transfer Station in Chatsworth. Three, twenty-five cubic metric tons of waste fill one container. A horse and trailer transports two filled containers to the landfill site to Springfield at a time. Five collectors and one driver are allocated to each refuse compactor. The waste collection takes place during the five-week days. Each day a different area of Chatsworth is serviced. Private garden waste can be deposited into the Garden Hopper Site at the transfer station by residents themselves.

A supply of twenty-six black bin bags for domestic waste is given to each home owner every thirteen weeks. Beige coloured bags are used for collection of street sweeping. Yellow bags are distributed to informal settlement for waste collection. Blue bags are used specifically for garden waste, which may be purchased from service providers such as Quick Shops and petrol stations. Garden waste must be put out on the day of normal collection. The cost of blue bags includes the service pick-ups and disposal to landfill sites. Garden waste put into black bin bags is illegal and resident can be charged a fine for this practice. Authorities indicated that garden refuse bags cannot be provided by Durban Solid Waste (DSW) since it has a major cost implication. The rates paid by homeowners do not cater for garden waste collection services but only domestic waste collection. The study has revealed that the use of different coloured bags helps to monitor the amount of waste produced by different sectors such as waste generated by informal settlements etc. On a micro scale a Regional Customer Assistant (RCA) is appointed in a community. The duty of the RCA includes education of the community with regard to correct waste disposal practices and to ensure that communities dispose waste at allocated points on the day of collection. At a macro level Community Development Workers (CDW) are appointed in formal and informal communities with regards to waste education and awareness. Organisations such as the KDBA which is

part of DSW appoints CDW's to target schools and different working groups on a macro scale to educate and inform communities of waste issues.

4.14.9 Authority From Parks And Recreation Department Of Chatsworth

Mr Suresh Singh, Manager of The Parks and Recreation Department (18 November 2003) was interviewed. The Parks and Recreation Department's role is to provide recreation for activities such as sport, parks and open spaces. Their primary role is to provide a safe environment in terms of controlling encroached bush etc. Their other functions include monitoring of open spaces, monitoring undeveloped spaces and tree planting. The Parks and Recreation Department assist DSW to collect waste that was not picked up. Results indicate that if authorities do not pick up this dirt then experience has shown that the waste is dumped on open land. Waste Tech a private contractor is responsible for the maintenance of verges by cutting trees and grass.

4.14.10 Authorities from Durban Solid Waste (DSW)

Interviews were conducted with Mr Plucky Govender (Area Cleansing Officer and Peace Officer) of DSW Garden refuse Site and Mr Don Erwin (Environmental Co-Ordinator) of DSW (15 September 2004). The interviews indicated that media and marketing concerning waste awareness is conducted through the use of pamphlet distribution, local newspaper (Chatsworth Rising Sun), Talk Shows on Radio (Radio Lotus, East Coast Radio) and the presence of twenty-four hour staff on the beaches including holidays. Perpetrators are given a fine of R300 upon proof of illegal dumping. A summon is issued and culprits are given seven days to clear up their illegal waste. If the waste is not cleared within seven days then the culprit is charged another R1500. If the fine is not paid up then the culprit has to appear in court. DSW is responsible for clearing up waste disposed illegally if offenders are not caught or seen or if there is no proof of dumping. According to Mr Don Erwin (Personal communication, 15 September 2004) illegal dumping together with clearing of garden refuse costs the City of Durban R1.8 million a year.

4.14.11 Head of Municipality's Cleaning and Solid Waste Department

An interview with the Director Mr Raymond Rampersadh, Head of the Municipality's Cleaning and Solid Waste Department (15 September 2004) indicate that councillors have approached his department with regards to increasing the waste collection days from once to twice weekly as residents were finding it difficult to manage their refuse which had resulted in the breeding of maggots, flies, worms and nasty odours. His response was that the municipality's priority is to those communities that don't have any refuse collection at all, since 70 000 households do not have any refuse collection in the Etekwini Municipality. He also stated that budgetary constraints are a major factor when considering increasing collection days from once to twice weekly. He stated that every R10 million increase in his department's operations budget constitutes a (1%) increase in municipal rates and this would have to be borne by the ratepayer. His appeal was that residents need to form partnerships with the council so that the councils can provide a meaningful service to all their ratepayers.

4.14.12 Branch Manager of KZN Collect-A-Can, PRO Of Chatsworth Shopping Centre and PRO of the Arayan Benevolent Home

Mr Vincent Zwane, Branch Manager of Collect-a-Can (15 August 2004) indicated that the economic benefits of can collection is increasing due to waste minimization efforts. Collect-A-Can recovers used beverage cans, and tin-bearing industrial scrap off-cuts from Iscor, and the can manufacturers. They also collect aerosol, food, and paint cans. Collect-A-Can pays cash for cans. Of all steel beverage cans consumed in 1992, Collect-A-Can collected a modest 4%, or 4000 tons. In their 1999/ 2000 fiscal they recovered over 63%. In 1993 they had 15 000 registered collectors, and in 1999 the figure increased to nearly 38 000. In 1993, there were 5 can recovery branches. Today there are 11 recovery branches of which 6 are in South Africa and one each in Botswana, Lesotho, Namibia, Zimbabwe, and Swaziland, and an agency in Mozambique. Collect-A-Can's recovery rate is at an all-time high, and confirms them as a world leader in stall beverage can recovery. In 1999/ 2000, more than R22-million was paid to nearly 38 000 collectors, 80% of whom have no other source of income. Collect-A-Can's recovery rate of 63% puts South Africa in the world's top 5 (and makes Collect-A-Can the most successful operation of it's kind in the world). Vehicles

are sent out to Chatsworth and other areas on request to collect cans. KZN Collect-a-Can services Durban and surrounding areas. A 1.5m high bag takes about 1000 crushed cans and is worth R13.50 if brought to the station by the client. If the agent collects the cans the cost of the bag of waste is then R6.50. Household cans such as coffee, milo and milk cans contain a lot of tin, so these types of cans do not generate as much revenue as beverage cans. KZN Collect-A-Can is subsidised by ISCOR and therefore cans that contain a high level of tin do earn good revenue.

Private contractors collect cardboard and paper from shops in the Chatsworth Centre and take them to Buy Back Centres such as Waseems Waste Paper who is an agent for Mondi Recycling (Personal Communication, PRO-Chatsworth, 12 September 2003). Mondi provides paper and cardboard banks to the Aryan Benevolent Homes. One bank of paper and cardboard is collected by this organization per month. The proceeds of the paper/cardboard sales are utilized by the Arayan Benevolent Homes (Personal Communication, PRO-Aryan Benevolent Homes, 12 September 2003).

4.15 CONCLUSION

Some of the factors affecting the community and damaging the environment to some extent are the consequences of the poor solid waste management prevailing in the formal areas of Chatsworth. The lack of formal waste removal services is a serious problem in an urban area where waste is piling up along the roads and in open spaces and is clogging and polluting the drainage systems and streams. It is perceived to be a health hazard and to have a negative visual impact on the formal residential area.

Increased quantities of solid waste are dumped in the area by formal residents while illegal dumping of garden waste, building rubble and household wastes are a cause for extreme concern. Attaining health for all is dependent on knowledge of environmental aspects of diseases and how environmental management can improve. Good health and well being cannot be attained or maintained in deteriorating or hazardous surroundings. Lack of knowledge and attitudinal change is an important part of the solution to waste pollution related problems.

CHAPTER FIVE

DISCUSSION, RECOMMENDATIONS AND CONCLUSION

5.1 INTRODUCTION

According to UNESCO (1996) the quality of solid waste services in a particular area is influenced by both the specific conditions that prevail in the area and the socio-economic status of the community receiving the services. A comprehensive description of socio-economic factors has been provided by Mayet (1993) that relate to the state of infrastructural development in a residential area. These include: lifestyle and value systems, aspirations and attitudes, levels of education and a willingness to recycle or reduce waste output as well as the ability of people to pay for services based on income and willingness to pay (Sadler, 1997). USEPA (1992) has reported that personal and social relationships (perceptions) influence behaviour and may inspire or inhibit compliance with the set standards for service provision.

The current waste management service in the formal residential area of the Township of Chatsworth is inefficient. These communities are subjected to illegal and indiscriminate dumping, forming "sinks" for tons of waste scattered in open spaces. Residents are often forced to burn or dump their waste in open spaces because they have no other means of disposing it. Local authorities experience difficulties keeping pace with development and meeting the growing demand for basic infrastructure and public services. The waste problems in the said communities have severe health, environmental and economic implications. It has been shown that it is impossible to solve environmental problems in isolation to the socio-economic and political milieu. It is also clear that the victims of environmental problems in most cases are helpless and or poor. It is therefore imperative that the empirical findings and the theoretical ones be looked at in the light of bridging the gap between socio-economic elements and vulnerability of certain classes of people to environmental hazards.

This chapter reports a discussion on the main findings regarding the demographics, practices and views of households about solid waste management. An in-depth

interpretation of a descriptive household survey using personal interviews of individual households to determine resident's attitudes, current solid waste management practices and socio-economic and demographic profile is presented. A comprehensive interpretation of the semi-structured interviews with authorities is also presented. The analysis and interpretation of the collected data indicated important trends regarding the ways in which domestic solid waste was managed in the study area.

5.2 DISCUSSION

The discussion will, in most part, dwell on some of the pertinent questions and responses relating to the disposal of wastes. The prevalent situation will be evaluated against that presented as case studies in chapter two.

5.2.1 Demographic Characteristics of Households

This section reports the major findings on the demographics of the population in the study area as per questionnaire survey. The influence of the demographic profile on solid waste practice was investigated based on the respondent's socio-economic status in the study area. The age of respondents appears to be related to a number of waste management issues such as illegal waste disposal, recycling and awareness. The greatest concern for these issues was among residents who fell into the middle age groups. It appears that younger age groups (25-34 years) and older age groups (65-74 years) were more responsible for illegal dumping and had less awareness of recycling initiatives. On the basis of these findings, it was concluded that the younger persons in the study area had less regard for the environment and the same applied for the older persons. The lack of interest among the young and the older age groups was attributed to the fact that young people in most societies often have little sense of responsibility, as they assume that someone else will take care of problems such as environmental issues. The older people on the other hand, are generally inactive and tend to lose interest in community issues as put forward in other studies (National Progressive Primary Health Care Network [NPPHCN], 1999).

Byrne (1996) and DEAT (1997) indicated that past experiences of older people living in developing communities where local government failed to provide adequate waste

collection and street-cleansing services had forced people to accept the fact that they live in degraded environments. The resultant effect of such experiences is a negative interaction between people and the environment. This is exacerbated by poverty, unemployment and a lack of resources (Sapsford and Jupp, 1996). As discussed in Chapter two, the lack of community development is likely to result in the loss of esteem with the resultant feeling that an individual can play a limited or no role in changing the external environment (DEAT, 1997).

The positive attitude towards concerns for the state of the environment amongst the youngest age group (25-34 years) may be explained by their recent experiences and knowledge gained at training institutions. Poswa (2000) indicates that individuals of the younger age groups can be regarded as being of an experiential stage at which they like to see, and be part of changes in their environments. According to Robbins (1993) the desire for the changes may be triggered by self-esteem needs of an individual, which is directly related to expectations for success.

5.2.2 Gender Distribution of Households and its Effect on Solid Waste Management Practices

The majority of the respondents in the study were females (78%) who were the most knowledgeable persons about waste management in the household. The socio-economic status of the communities indicated that the most knowledgeable persons about waste management were women. This may be attributed to the influence of culture of the societies as argued by Schheinberg *et al.;* (1999) which promotes the passing of responsibilities by men to women in the households. Women in most societies are responsible for domestic work which includes many tasks such as cleaning the home, waste management, child care, shopping and well being of their husbands as indicated in Chapter two of this study.

The study has indicated that both sexes were of the common view that illegal dumping was a problem and showed concern towards a littered environment. The employment distribution of respondents of households shows housewives made up the biggest category. From this observation it appears that these women were expected by men of the households to be responsible for answering the questionnaire. Scheinberg *et al.;*

(1999) and the World Bank, (1999) reveal that this type of practice might have been perpetrated by the existing norms in the society which widely regard women, due to their lower economic and social status, as responsible parties for handling domestic responsibilities, in particular those associated with cleanliness.

The above gender analysis has brought to light the importance of gender attitudes in the planning of waste management systems in particular domestic solid waste services. The issue of gender has received little or no serious attention in waste management planning. Poswa (2000) revealed that in spite of the proportionally high numbers of women workers in most municipal cleansing services and community-based collection services, decision-makers, planners and waste managers have ignored the effect of gender in the rendering of waste management services. The effect of different perceptions of men and women in family settings needs to be understood in order to design effective and sustainable domestic waste management service programmes. The significance of such an understanding is that men and women, including boys and girls, are engaged in different waste related activities such as managing resources within the household/ family; formal municipal collection services; recycling or private enterprise for different reasons. Some participate partly because of cultural traditions and conventions, practical interest including earning income and maintaining a healthy living environment, and/ or to gain recognition as a worthy community member (Scheinberg et *al.;* 1999).

5.2.3 Education and it's Impacts on Solid Waste Management

The analysis of the education profile of the community is of paramount importance for two reasons. First, is that knowledge about educational levels of the community is vital in assisting the service providers in developing strategies or programmes to enhance environmental education taking into account the low overall education levels of some sectors of the population. Second, is that the level of education relates to attitudes towards solid waste service programmes. It is clear from this study that the overall education levels were average with 19% tertiary to 63% secondary in an area with low to middle socio-economic status. This is supported by the 2001 census report, which revealed that only 8.4% of South Africans had tertiary education and 17.9% of those aged 20 years or more had never attended school (Statistics South Africa, 2003).

Like most developing communities which are ravaged by poverty, many families in Chatsworth cannot afford the high costs of education, hence the high percentage of individuals with secondary education who did not pursue a tertiary education. The outcome of the overall higher percentage of respondents with a secondary to tertiary education can be interpreted as showing that the determinant for residing in an affluent society is not necessarily education, but that wealth could be the main reason. The development trends in the society have shown that individuals from the middle class acquire higher education in order to improve their well-being and to be better positioned in their jobs, with the ultimate aim of sustaining their livelihood (Robbins, 1993).

The study has found that the more educated residents had less regard for waste removal and dumped waste illegally. The result of this study does not concur with other studies with a similar topic. Poswa (2000) in his study on domestic waste management found that the less educated people did not regard cleanliness and waste related issues as a priority. Generally, people with higher educational levels should have a better understanding of the impacts of wastes on the environment. A study conducted by CSIR for Enviro Tech (1999), documented in the literature review, has revealed that the average South African person living in urban areas uses products, which cause up to 2 kg of waste every day. The study has also revealed that this waste is on the increase as more people attain higher standards of living.

Another positive finding of the study was that respondents of all educational categories were aware that illegal dumping was a problem in the township and that it can be stopped. This indicates that there is an urgent need for ongoing education together with attitudinal changes in domestic waste management in the township. It was deduced from the results that, whilst other factors may contribute to negative attitudes, education is a critical factor, which needs to be seriously considered in the planning of and in operating a solid waste programme. Education is significant for sustaining waste management programmes because people can only be convinced, if they understand, the message they receive about improving their environments.

5.2.4 The Impacts of Employment and Income on Solid Waste Management Practices

The study has found that a significant percentage of the respondents were housewives and unemployed (41%). The high unemployment rate could negatively impinge on a solid waste management system in terms of ability to pay for services such as garden removal and purchasing of additional bin bags. Unemployment is a good indicator to the local waste management authority to come up with appropriate community-based waste collection systems that could attract job opportunities for the local residents.

There is also a relationship between different factors such as income, education, unemployment, gender and the socio-economic status of the residential area. Such a relationship was attributed to the observation that the lower income households were the highest perpetrators of illegal dumping, concentrated in an area of low socio-economic status, a high rate of unemployment, high number of respondents being housewives and poor education records. The effect of income and education on a number of waste related issues including the perceptions of respondents towards illegal dumping, litter and its impacts were examined.

The results indicate that income and unemployment did affect poor waste practices in the township. The study has revealed that the lowest income category had contributed to a high percentage of illegal dumping whilst the highest income category had contributed to a low percentage of illegal dumping. Therefore, income influences how people regard clean streets, open spaces, littering and illegal dumping. This confirms what has been documented in the literature that higher socio-economic groups are more concerned about environmental issues, including solid waste management as put forward by Viljoen *et al.*, (1987). It must be noted that the majority of the households (58%) interviewed earned an income ranging between <R1200-R3000 and all contributed to illegal dumping. Households that earn an income of up to R3000 in urban areas cannot be regarded as being affluent more so with the high inflation rate experienced in the country. Based on the above findings the results do concur with the study conducted by Mbande (1998) that the poorer the community, the less emphasis and sensitivity towards solid waste management. Basic needs such as housing and employment are

human needs required for survival and also contribute to safety, social, esteem and self-actualisation. The findings of this study have been further supported by respondent's views on issues regarded as most problematic and needing urgent attention. Strongest concerns were for employment and then housing. Solid waste management is definitely not a priority for the poor and as such would be at the bottom of their list.

5.3 HOUSEHOLD WASTE COMPOSITION, GENERATION RATES, METHODS OF STORAGE AND DISPOSAL

A high proportion of food and garden waste was generated in the study area. Food waste was made up essentially of vegetables, organics and putrescibles. These wastes consisted of perishable food such as vegetable and fruit peels, rotten fruit and vegetable, left over foods, chicken feathers, and seafood shells from crabs and prawns. It was also discovered that the waste from the study area had high proportions of garden waste arising from the mowing of lawns, garden cleaning and dog litter. These findings are in accordance with the normal waste composition range of organic waste in developing countries which ranges from (20-50%) of the waste stream as indicated by Poswa (2000) and Cointreau (1992) and cited by Mbande (1999: 157).

Paper, cardboard and plastic was ranked the same as food waste. This waste consisted mainly of newspapers, magazines, old school manuscript books and card boxes. The high paper content in the study area comprised of carton containers, polystyrene food and beverage containers, convenience food wrappers and boxes, plastic carry bags, multiple furniture and appliance packaging. Paper, plastic and cardboard together contributed (28%) of the waste stream. These wastes were not classified during the analysis; however the above findings fall within the range of plastic proportions in waste streams in other developing areas in South Africa. For example, a waste stream analysis conducted in Ntuzuma in Durban has reflected that plastic materials constituted (4-7%) in the waste stream in 1998 with relatively high proportions of (6-25%), (7-15%) in Umlazi and KwaMashu Townships, respectively. In Umtata plastic materials comprised (13-22%) of the total waste stream (Poswa, 2000; McKay, 2000).

The category, "other" which comprised of (scrap metal, tyres, batteries, glass bottles and tin containers) was rated the lowest of (1%). The low percentage of household consumables such as empty beverage bottles, beer bottles and jam tins could be attributed to the fact that people from the low social status areas do not throw away valuable household items but reuse them as containers until they are no longer fit for use. The low percentage of metal content (aluminium cans and other scrap metals) in the study area can be associated with scrap metal collectors that exchange scrap metals for cash.

It can be inferred from these results that the absence of alternative means of collecting and disposing of garden waste in the study area, combined with the prohibition of burning waste in urban areas might have compelled residents to use the available municipal kerbside waste collection methods. The high organic content in the domestic waste stream in Chatsworth is similar with the composition of waste generated in other developing residential areas in South Africa. In this regard, Poswa's study in Umtata (2000) and Reddy's study (1992) in the Durban area found that the domestic waste from Phoenix (low income area) consisted mainly of organic waste (food waste). Similarly, Mayet (1993) has also pointed out a high proportion of garden waste in some Pietermaritzburg high-income areas (WRC, 1995).

The results clearly indicate that residents engaged in several waste disposal activities. It appeared that very little source separation had taken place in the households. A large portion of the study population had put all waste materials like food, garden, sanitary, paper, plastic, scrap metal, tin and appliances in the refuse bags for collection by the municipality. Reddy (1992) indicated that in low income areas food waste consisted mainly of organic content as to that of middle and high income areas that comprised of packaging components. The findings of WRC (1995) concur with this study. The mixing of the different types of waste like garden, food, sanitary (disposable nappies, sanitary towels) can be a problem since organic waste has a high moisture content and decomposes very quickly, more especially with the extreme summer temperatures experienced in Durban. The above problems together with once weekly waste collection services exacerbate the breeding of worms, nasty smells and attract flies and

rats. Offensive smells resulting from shells of sea foods etc., is exacerbated by once weekly collection. Pests such as dogs and cats are attracted by such smells when refuse is taken out early and left on the kerb-side for collection. These animals tear up the plastic liners in the search for food thereby scattering the waste on the streets and pavements.

Studies conducted in various developing communities in South Africa have shown distinct waste disposal patterns between suburbs with different socio-economic statuses (WRC, 1995). It is well documented in the literature review that wealthier communities tend to be "throw-away-societies", whilst the poor ones have less to throw away and are more inclined to reuse and refurbish articles that a wealthier community would discard (Blight and Mbande, 1994). The modern disposable lifestyle or throwaway–age may be a significant contributor to increased waste generation rates. The waste generation rate for each family size was unique within the same residential area. This supports the argument that waste quantities can be expected to vary from one family to another (irrespective of the family size) according to different living standards, which are linked to the income levels of the households. The domestic per capita waste generation rate is also influenced by the number of residents per household (Pfeffer, 1992). To this end, studies conducted in the USA to assess domestic waste generation rates indicated a fall in per capita values from 1.25kg/ day for two residents to 0.4kg/ day for ten residents. The increase in waste is, therefore, not in proportion to the increase in the number of residents. The relationship according to Pfeffer (1992) and UNESCO (1996) showed that the rate of reduction was most rapid between two and five residents, after which the rate decreased and was virtually independent of the number of residents when the number exceeded ten. A similar trend was found in this study where no relationship was found between family size and the amount of waste generated by households. For instance (63%) of respondents with family size up to 3 members generated 2 bags of waste whilst (38%) with family size of 6-7 members generated 2 bags of waste.

Pfeffer (1992) associated the variations of waste quantity among individual households to an economy scale in the purchase of food and beverage items. A large family will probably purchase these items in large containers while newspapers and other print

items decrease significantly with increasing size of residents per unit. The cause for this trend is that only one newspaper/ magazine is needed per household. This is however, culture-dependent. It appears that the same pattern is applicable in the study area as shown by the data in Fig 4.6 where the number of members per family was high but the amount of waste showed an inverse proportion compared to smaller family size.

5.4 KNOWLEDGE, ATTITUDES AND PRACTICES OF HOUSEHOLDS TOWARDS ILLEGAL DUMPING OF SOLID WASTES

One of the major problems with waste management that the study area experienced was inadequate collection and disposal of waste. A more specific problem, which contributes to this overall difficulty, includes illegal dumping. There are a number of reasons for such dumping. The study has indicated that all (100%) householders across the study area viewed apathy/ uncaring attitudes as the main reason why people littered and engaged in illegal dumping. Off the above (100%) that viewed apathy/ uncaring attitudes as their main reasons, respondents had also provided other reasons for littering and illegal dumping. Hence (60%) of the 100 respondents stated that a lack of facilities, a once weekly collection of waste, apathy and uncaring attitudes as the main reasons. The majority of the respondents expressed a dislike for littering and illegal dumping and regarded it as a major problem in the area. They also pointed out that their neighbours, themselves, garden workers, factories/ industries and nearby flat dwellers were the main dumpers. Squatters were also responsible for the practice. While the results clearly demonstrated that the majority of respondents reported a dislike for a littered environment and that it was a major problem in the area, their actual behaviour was more difficult to assess.

Plate 5.1: Illegal dumping of garden waste in the township of Chatsworth

The problem with littering and illegal dumping is that people often report one thing and do the opposite. A survey conducted on littering in Umtata in 1995, found that the street vendors and transport operators were of the opinion that the practice of littering and illegal dumping was not acceptable yet they were among the main perpetrators (Poswa, 2000). Therefore, reported behaviour and attitudes towards littering should be verified by observing the actual behaviour and assessing the state of the environment in order to develop appropriate measures. In Australia, it has been shown that half of the people who had been observed littering within the previous five minutes reported not to have littered in the last 24 hours (Australian Beverage Industry Environment Council (BIEC), 2000). Based on previous studies, it could be inferred that the denial syndrome often complicates the act of littering and dumping. Lack of facilities such as insufficient black bin bags for household waste and blue bags for garden waste is a major reason for householders dumping their waste. Durban Solid Waste provides homeowners with 26 black bin bags for 13 weeks. Tenants renting are expected to purchase their own bags if the landlords do not supply them. The same applies to garden refuse bags which the municipalities expect householders to purchase. As a result of insufficient refuse bags and the cost associated with purchasing these bags, waste is dumped illegally.

Another major contributor to illegally dumped waste is due to the once weekly collection. Due to the high temperature combined with high relative humidity in KwaZulu-Natal and the dominantly wet nature of waste, causes solid wastes to decompose more rapidly. According to the Daily News (2 March, 2003:5) Minority Front Councillor Paris Singh said in a motion to council that "residents were finding it difficult to manage their refuse because of the unusual summer weather that resulted in an increased maggot breeding period". Resident's domestic refuse were being disposed off in open spaces and on adjoining private properties in some communities, posing severe health risks. Because of the extreme heat these refuse bags release unbearable odours". Collection and disposal of waste as a result become problematic, requiring more frequent collection, which is not possible due to limited, or no resources (WRC, 1995). The consequence thereof, is uncollected waste, which leads to blocked storm water drains, breeding grounds for worms, cockroaches, flies, rats and mosquitoes and nasty smells.

According to the Rising Sun Chatsworth (4 April 2003) residents have been complaining to authorities since January 2003 about their homes and yards being infested with rats, and nothing has been done about the problem. The infestation is as a result of the residents dumping their dirt behind the flats that they live in. Often these wastes are burnt which can give rise to air pollution. Burning can lead to the release into the air of both toxins (e.g. from certain plastics) and suspended particles (e.g. ash). This method of waste disposal is fairly common practice in South Africa. Hardoy *et al.*, (1992) shows that in Alexander and Soweto large proportions of waste is burnt. In Rini, the effects of burning of uncollected waste had negative effects on air quality, in the form of noxious fumes and flying ash. Poor solid waste services degrade the living environment to levels that put human health at risk. The promotion of environmental health and provision of basic infrastructure and services for a healthy and decent living can be attributed to the absence off or limited human, technological and financial resources to meet the operational and maintenance needs. Personal interviews with the Head of the Municapility's Cleaning and Solid Waste Department, Mr Raymond Rampersad has revealed that the local council will have to increase the rates of home owners if they want more resources such as plastic refuse bags and a twice weekly

collection etc. Mr Rampersad stated that every R10 million increase in his department's operations budget constitutes (1%) increase in municipal rates.

The study has revealed that problems such as high unemployment levels and an increase in payment for services will impact on residents negatively. Interviews with authorities of DSW indicate that authorities are doing their best with regard to implementing the law by prosecuting offenders of illegal dumping. Summons are issued to culprits and they are given 7 days to clear their mess based on proof that they are guilty. Implementing the law is a tedious process as proof must be available to prosecute offenders. As such, DSW is responsible for clearing up illegal waste that is dumped when there is no proof of dumping and the municipality has to take responsibility for the cost of the clearing process. These authorities also conduct education and awareness but it seems like it is not sufficient since residents still engage in the practice. Resident's concerns regarding littering and illegal dumping range from a high level of concern to apathy. Apathy may be attributable to lack of knowledge about the proper handling of waste and environmental awareness. Residents themselves stressed the need for education to be recognised as an important element in making people manage their environment efficiently. This shows that residents are interested in living in a clean environment. It can be deduced from the results that, whilst other factors may contribute to negative attitudes, education is a critical factor which needs to be seriously considered in the planning of and in management programmes because people can only be convinced if they understand the messages they receive about improving their environments.

5.5 KNOWLEDGE, ATTITUDES AND PRACTICES OF HOUSEHOLDS TOWARDS ENVIRONMENTAL WASTE PROGRAMS

The study has revealed that just a few people were aware of environmental waste programs in the area. Some of the programs were Adopt-A-Spot by Keep Durban Beautiful Association, Mondi and the Sathya Sai Movement with paper recycling and the Durban Municipality with Metro Beat (Environmental Programme) promotion. The poor involvement in such programs indicates the level of priority that exists amongst residents with regards to environmental issues in the areas. Knowledge of such

programs is integral if communities are to participate in them. Authorities should be responsible for advising and keeping the public informed *via* different communication strategies such as media, pamphlets, workshops etc., to get the public involved in environmental programs.

5.6 KNOWLEDGE, ATTITUDES AND PRACTICES OF HOUSEHOLDERS TOWARDS RECYCLING

Majority of residents in the study area disposed off almost every type of waste material including recyclables like plastics, glass, tin, newspapers and scrap metals for collection. Very little source separation took place at home. However, between 2%-29% of respondents reported that they were recycling paper, plastic, tin and scrap metals. It could be deduced from these results that there was very little voluntary recycling in the study area. The consequence thereof is probably an increased amount of waste generated with the resultant increased littering and illegal dumping. This may explain why Durban Solid Waste finds it difficult to cope with the demand for waste collection when considering the continually increasing urban population (Poswa, 1998). One solution to this problem could be to make residents aware of the benefits of recycling goods such as glass, plastic, paper and metal items which will have the added benefit of alleviating the much stretched resources of the eThekwini Municipality.

Respondents were also asked to state the different types of recycling programs available, which they participated in. Scrap metal and tin recycling was the most popular type. Residents viewed scavengers or reclaimers as important elements in reducing waste quantities. Mondi domes are used for paper collection and placed in schools and central points. Very few residents were aware of and participated in cardboard collection and school recycling programme. The majority of the respondents were positive about the establishing of a recycling programme throughout the study area with almost all the residents (94%) in favour of this. The door-to-door recycling program was the most favoured by the respondents. It appears that gender and socio-economic status of the community had an influence on the choice of the collection program. The preference for the door-to-door collection systems may be linked to the amount of time residents were prepared to spend on waste issues as reflected by the

female respondents. Further, it is possible that those who chose a door-to-door collection system found this method convenient and were familiar with it.

The drop-off recycling program was the second preferred method. It is possible that the drop-off centre was not chosen due to a lack of knowledge about how it would function in the particular community. Freeman (1999) shows that paper, cans, plastic, and glass recycling companies have had mixed success with collection depots in South Africa, where the public could bring their recyclables for collection and drop them off at a specific point. It is difficult to control what goes into these containers. These containers are usually owned by charities for fund raising purposes by companies like Mondi as in the case of Chatsworth, and the trend now is to house them on school grounds, while offering the school a percentage of the profits gained from the contents thereof. In this way the charity is benefitting from the security of the containers and the input from the school, and the schools benefit from the cash.

Separation at sources whereby special bags to pre-sort waste for collection did not seem to be popular amongst residents. The cost of purchasing separate bags, time constraints and laziness or negative attitudes could be attributed to this option. The results of the analysis indicated that only (35%) of the respondents were of the perception that recycling was a success. This concurs with a study by Freeman (1999) where it was found that in South Africa there is general public resistance and apathy to the concept of recycling, plus few incentives offered to get involved in what can be a time consuming process but in countries like Germany the concept of recycling was widely practised.

Although only (35%) of the respondents were of the perception that recycling was a success respondents were optimistic about the benefits of recycling programs and indicated that the programs should be expanded in the area because it would reduce waste quantities, reduce illegal dumping and will create employment opportunities for formal and informal collectors. Studies conducted by Mears (1998) show that recycling is practised for many reasons, including financial gain, energy conservation, litter abatement, reducing the waste stream, the potential of the waste stream to pollute and the conservation of raw materials. This study has shown that the public, schools and

other organisations collect different materials and sell them to collection agents. It has also shown that informal recycling takes place when residents take out domestic waste for collection. This practice also takes place on many municipal sites through scavenging as indicated in the literature review and studies conducted by Adedipe (2002) and Freeman (1999). Adedipe (2002) indicated that the entrepreneurship of recycling and waste reclamation should be encouraged, developed and promoted by local authorities. Interviews with waste reclaimers reveal that a growing number of poor unemployed people earn an income in this way.

5.6.1 Purchasing of recyclable shopping bags

The survey has revealed that (58%) of the residents are willing to purchase recyclable shopping bags. Those that were willing to purchase recyclable bags had given multiple reasons why they would purchase the bags. Ninety percent of those willing to purchase the recyclable bags stated that if they purchased recyclable bags there would be a decrease in the quantity of inferior quality shopping bags that adds to the waste stream, the bags are enviro-friendly and bio-degradable, the bags will be of better quality and longer lasting and can be reused. All respondents who were willing to purchase these bags stated that these bags would be environmentally friendly. This indicates that householders are interested in reducing the waste stream by purchasing these bags. They are also aware of the negative impacts of plastic bags to the environment and would like to avoid this.

There were a significant amount of respondents that were not keen on purchasing recyclable shopping bags as well and they gave reasons why they would not purchase these special plastic bags for shopping. Main reasons for not purchasing these bags were that it would be too costly and it would be an additional cost to their shopping budget. Respondents felt that if they forgot to carry a shopping bag with them then they would be compelled to purchase another. Some respondents were of the view that this would add to the economic problems already experienced by the unemployed and poor. This concurs with a study conducted by Blight and Mbande (1994) that solid waste management issues are not considered a priority in low-income areas. For the unemployed and poor, needs such as food is regarded as priority since it is a basic need.

It is not expected that those struggling to have basic needs would be sensitive to waste management or would have fundamental concerns for purchasing special shopping bags to reduce the waste stream. The co-operation of residents that are unemployed and poor would be less committed because of the low level of sensitivity.

According to the Natal Mercury (8 July, 2003) in Waste-Not-Want-Not-News (2003:3), a new survey has revealed that most Durban residents hate taking along a plastic bag to do their shopping as it makes their shopping experience "less enjoyable". In addition, Durban residents were more prone to buy new shopping bags each time they went shopping. The above finding concurs with the findings of the study in Chatsworth. Cape Town based research surveys recently conducted a survey in which it asked 2000 consumers countrywide their views on the law that required consumers to pay for their plastic bags at shops if they did not carry their own. The overall findings of this study found that almost (60%) of the respondents claimed their shopping experience had become less enjoyable because of the new ruling. The results showed that people from higher income brackets seemed less deterred by the new plastic bag legislation than people from the lower income group. The study found that people from lower classes were less likely to buy new bags each time they went shopping. The above result concurs with the findings of this study that poor people will prioritise their shopping needs to purchase most essential needs than to buy new bags each time they went shopping. New legislation seems to have a significant impact on metropolitan residents, with only (38%) claiming the new ruling had not affected them personally. More than (60%) of the respondents believed the new legislation was a scam so retailers could increase their profit margins, with most not believing that the savings in the cost of bags would result in cheaper food prices for consumers. The thinking behind the new plastic bag legislation is to promote recycling by making it commercially viable. It is also hoped that it would succeed in changing people's behaviour and in raising public awareness of the importance of waste management (Natal Mercury, 29 June 2003).

5.6.2 Garden refuse bags

Blue plastic refuse bags have to be purchased by residents for garden refuse disposal from DSW or the local supermarket etc. The study has indicated that not all residents were willing to purchase plastic bags due to financial constraints experienced by the poor in the township of Chatsworth and as a result garden waste was dumped illegally or burnt. Authorities do not collect garden refuse put into black bin bags and taken out for collection. Garden refuse must be placed in the correct bags and taken out for collection on the day of general waste collection. The local authorities do not collect garden wastes placed on verges of streets on any other day. The study has indicated that the majority of the residents are not aware that garden wastes must be placed in special colour bags. As a result of this, garden wastes are often burnt or dumped illegally on roadsides or open spaces. Waste authorities need to inform the public about the existence of garden refuse bags. Wide media coverage with regards to where these bags can be purchased will ensure that garden wastes are handled properly.

5.6.3 Recycling through reclaimers/ scavengers

The recycling network in the study area consists of scavengers who separate reusable materials at the collection sites. In this study it is waste put out by residents for collection by authorities. The literature review also demonstrates that waste picking by scavengers takes place at the landfill sites. Some of the problems experienced by respondents were that scavengers and animals scattered the waste in search of valuable products and created a bigger mess. The study has revealed that more than half of the respondents were of the opinion that waste scavengers were not a problem since they helped to reduce the waste stream. Interviews with waste reclaimers revealed that a growing number of poor unemployed people earned a subsistence income from the sale of collected waste. Studies conducted by Freeman (1999), Lombard (1999), Mears (1998), Adedipe (2002) and the literature review has indicated that recycling *via* reclaimers of waste creates many employment opportunities for the unemployed. The high rate of unemployment in the country means that scavenging has to be seen as a real option for promoting recycling and creating employment. Experience in many countries has shown it to be beneficial for waste collection services to include existing collectors, rather than to launch new programs for resource recovery (Furedy, 1990a). Accordingly

Ohnesorgen (1993) Freeman (1999), Adedipe (2002) indicate that scavenging is a resource, because they recycle solid waste, and cities have to learn to work with them and train them, and not work against them since there are much economic benefits arising from recycling activities.

5.6.4 Chatsworth refuse transfer station

The refuse transfer station in Chatsworth is opened to the public seven days a week. This facility is intended for the public, so that they can dispose off excess waste that is not picked up by the municipality. The majority of respondents of the area are not aware of the transfer station and the purpose of it. The study has revealed that those who were aware of the station had found it beneficial as the facility was free to the public, accessible over the weekends for the working class and accepted the most common type of wastes such as garden, scrap metal and household wastes. Problems such as the station not being centrally located and transport not available to transfer the wastes from home to station can be associated to poor economic conditions experienced in the area. Poor people that have no access to a motor vehicle cannot take their waste to this station and if the station is not centrally located it creates a bigger problem. If authorities have to pick up wastes from resident's homes there is a charge for this service. In order for the Chatsworth refuse transfer station to be of maximum benefit to its targeted residents, the economic situation of the area must be considered. Interviews with authorities from the refuse transfer stations have revealed that Community Development Workers are appointed in formal and informal communities to educate and inform communities on waste education and awareness. The results indicate that even though authorities are playing a role in making communities aware of environmental issues with regard to waste, it is not enough and a concerted effort is needed. Awareness of the station is vital in order for residents to make maximum use of it. Information and awareness regarding environmental issues and services available to the masses should be ongoing and done on a regular and larger scale in order to conscientise the intended communities to be active participants to help manage solid waste problems efficiently.

5.7 COMMUNITY PARTICIPATION

The ultimate solution to solid waste management in the township of Chatsworth is to devolve responsibility to members of the community. Throughout the study there was very little community participation and awareness of community approaches or community based schemes. Community participation has been undermined in the study area by:

- Time constraints to attend meetings and environmental workshops;
- Lack of awareness of workshops; and
- Lack of awareness of environmental committees in the area.

Better results are attained when communities are highly motivated and have adequate levels of education, awareness and appropriate skills with regard to waste and environmental issues (WRC, 1995). Communities should be required to take responsibility for their own environments. Through community self-help, waste management costs are reduced and community self-interest is increased. The advantage of this strategy is its emphasis on community involvement in the reuse of waste materials. DEAT (1996) has suggested the following steps to encourage community involvement:

- Promotion of environmental education, information and capacity building in communities;
- Promotion and provision of support for community-based initiatives to seek solutions to waste management, sanitation, and access to resources; and
- Creation of community forums responsible for developing integrated environmental, developmental and spatial plans.

Poswa (2000) indicates that the Masakhane campaign is a good example of a community empowerment strategy, which was launched in various communities in South Africa in 1995. The primary objective of the Masakhane strategy was to facilitate development through mobilisation of the public, private sector and community resources. It encouraged partnerships and civil responsibilities. According to the Palmer Development Group (1999), the fundamental principles of Masakhane include the following:

- Involvement: the participation of each sector generates an overall feeling of pride, ownership and endurance;

- Responsibility: when every member of the sector does his/her duty a law-abiding society is created;
- Coperation: focus on a common objective helps to narrow the areas of difference between sectors;
- Inclusiveness: this enlists participation of different sectors;
- Initiative: each sector is encouraged to take the initiative to deal with and develop its own interests;
- Empowerment: information, skills and knowledge give each sector the power to participate fully in the projects; and
- Compromise: each sector must be prepared to subordinate some of its interest to the long-term objectives of growth and development.

Poswa (2000) shows that these principles are generic and can be applied by many municipalities in developing communities. Community participation has brought about a change in waste management handling and a spirit of cooperation, trust and tolerance between the municipality (service provider) and the households (service recipients).

The findings of this study indicate that communication of the goal of environmental committees, projects, workshops etc., have not built awareness among the public for participation. Community projects would have been successful if there was continuous monitoring and incentives for participation. Local authorities must continue supporting communities, be committed and integrate the projects into their day-to-day activities in order for communities to participate actively.

5.8 SOLID WASTE MANAGEMENT POLICY

Knowledge of the solid waste management policy is very new to most respondents. Most of respondents did not know that a policy on waste existed. Neither did respondents know that they have power to make comments and participate with regards to policy on waste issues. Only councillors and authorities were knowledgeable with regards to policy on waste. This indicates the need for major awareness and information driven programs to educate the public with regard to their rights on environmental

issues for them to be active participants of their communities and to be responsible for their local environments.

5.9 DISCUSSION WITH WASTE AUTHORITIES

Interviews with authorities revealed that DSW has a legal responsibility to enable all sectors of the community to make informed, responsible decisions regarding how they and others manage the waste that they produce. eThekwini Municipality has, for many years, been proactive in this regard as evidenced by the establishment of KDBA 23 years ago and the Waste Minimisation division 10 years ago.

The interviews indicated that in fulfilling this responsibility the local authority has a number of tools that it can use–ranging from formal education programmes in schools to door-to-door education. Another tool is the formation of local "Keep it Beautiful Associations" the purpose of these Associations being to coordinate the efforts of volunteers to clean and beautify their community. The interviews show that if there is commitment to the principles of participative education then involvement of volunteers is essential, and that everybody should accept responsibility for the cleanliness of their area. Interviews conducted with Mari Van Der Merwe who is the Education Co-ordinator (KDBA) and Acting Business Manager (DSW) revealed that Chatsworth is one of the first areas that achieved success through the establishing of community co-ordinating committees in 1984. This indicates that there was much enthusiasm and initiative initially and the community did show interest in their environment by engaging in different community programs to keep Chatsworth beautiful. However, the Keep Havenside Beautiful Association and other environmental action groups in Chatsworth were only sustained for a few years because it did not receive the full support of the community. KDBA continues to play an active role on the following Enviro Forums: Phoenix Enviro Forum; Chatsworth Enviro Forum, Newlands East; Enviro Forum and Inter Departmental Committees for Umlazi, Kwa Mashu, Inanda and Ntuzuma. These committees have made major in-roads through co-ordinated inter departmental action in addressing area specific problems, but depends on community commitment, participation and support for environmental programs to continue and be successful. Total commitment from all role players, that is, residents as well as

authorities must be available to ensure that programs like the Keep Havenside Clean don't get shelved like before. Enviro Forums, therefore, are an excellent way of ensuring that effective and on going communication of factual information about good waste management to people, in particular about how to reduce the amount of waste that they produce. This requires a concerted awareness and education program, both at formal and non-formal levels, and preferably involving the media. Education of the lay public will increase the capacity of communities to enter partnerships with the local authority in the planning and monitoring functions relating to the selection and control of appropriate waste management systems to suit their own local needs.

Discussions with authorities from KDBA have also revealed that Adopt–A-Spot/ Adopt-A-Verge Programme is a major development and is successful which is now being implemented throughout the Unicity. There are currently 247 active Adopted Spots in residential, commercial and industrial areas as well as numerous Adopted verges (Annual Report of The Association of Clean Communities Trust, 2003). Some of the positive results of this programme are:

- A number of public areas are cleaner and more attractive, hence eliminating litter and illegal dumping and makes the area much safer;
- Individuals involved in the program have developed a sense of pride in their respective neighbourhoods and places of work and recreation; and
- Some participants have used cleared areas to create vegetable gardens and in so doing provide sustenance for themselves and their families and even the opportunity to generate some income.

KDBA authorities also conduct surveys called the Photometric Index. This was conducted twice this year. This survey gives you a profile of the litter situation in Durban over the last twenty years. Litter has been surveyed 41 times since December 1983. Of significance is that the survey readings indicated that litter has been reduced by more than 71% during the past twenty years. The survey indicates that the current reading is consistent with those taken over the past few years and that most litter still tends to be made up of small items such as till slips, drink caps and cigarette stubs (Annual Report of the Association of Clean Communities Trust, 2004).

5.9.1 Educational Institution Programme

The KZN Department of Education and Culture has continued to support the implementation of the activities of the KDBA Educational Institutions Programme (EIP) on waste management in all of their learning centres. In recognising the contributions made by the Education Committee of KDBA, it must be highlighted that the committee is made up of individual teachers voluntarily and randomly representing different phases of the General Education and Training (GET) Academic band. The KZN Environmental Education Curriculum Forum (EECF) continues to be the networking body for all Environmental Learning Service Providers or Stakeholders. A total of not less than eight hundred schools participated in the EIP of which the ten schools interviewed in Chatsworth were also part off. These schools engaged in various activities such as workshops, presentations, school visits, projects, presentations, environmental clubs, competitions, pre-primary school activities, clean-up campaigns, and site visits. School involvement with environmental programs has shown many benefits such as financial gains from recycling, environmental awareness, and integrated approaches to caring for the environment etc. The implementation of environmental policy in the education curriculum will increase environmental awareness of the younger generation and in so doing will help to pass the message to elders in promoting a clean environment. Schools are seen as the most effective target area for this education to be initiated.

5.9.2 Discussion with Waste Minimisation Officer

The interviews revealed that informal collectors in various areas of the city are monitored and educated regularly on proper waste management in order to decrease litter and illegal dumping. Education of informal collectors will help to resolve problems such as scattering of household waste put out for collection. Reclaimers scavenging on landfill sites are exposed to risks of injuries and their health as shown in the literature review and by studies conducted by Adedipe (2002) and Freeman (1999). As such, the waste reclaimer-driven recycling scheme at the Bisasar Road Landfill in Springfield was formalised, with long serving buyers of recyclables enjoying exclusive buying rights from the site, and the waste reclaimers being allowed at stipulated times to recover recyclables from the provided transfer station.

Results of the interviews with schools and respondents show that problems were experienced with recycling banks placed at strategic corners. Problems such as damage of the banks due to vandalism, theft of paper waste, glass strewn all around the banks etc. Members of the public are not informed who to contact when banks are full or when igloos are damaged since contact numbers are not posted on the banks. As such, Mondi has employed agents to keep an eye on banks. This means that banks are maintained and moved according to what is most convenient. Information regarding recycling banks need to be more user friendly so that the public can communicate with the said authorities. Interviews with authorities from Waste Paper companies show that there is a future for paper and cardboard recycling in KwaZulu-Natal. Sappi recycling has a partnership with Babs Waste Paper and Waseems in Chatsworth who collect paper and cardboard through informal collection operations along the street corners as well as through buy back centres which are available in many parts of eThekweni Municipality. With buy back centres such as Babs Waste Paper and Waseems etc., Sappi had a deal with local authorities regarding making the land available which is usually on a rental basis. Further, through their agents they support the operators of these buy back centres with a full kit, which includes the container, scale, sinage, and the start-up cash float. In this regard they contribute towards promoting a clean environment whilst creating economic opportunities for the local people.

5.10 PERCEPTION OF RESIDENTS TOWARDS THE SOLID WASTE MANAGEMENT SYSTEM

Respondents generally agreed that solid waste management is a problem in Chatsworth. Respondents gave multiple responses on the negative impacts of improperly managed wastes on human/ animal health and the natural environment. The most common reasons given were that it is a health hazard, as improperly managed wastes attracted pests e.g. flies, rats, cockroaches and ants, these pests could spread germs and diseases, results in unpleasant smells that cause nausea and headaches, and is a risk to humans/ animals and motor vehicles from broken glass, open cans and sharp objects. Improperly managed wastes also impacted negatively on the natural environment. The analysis of the study indicates that a significant amount of more than half (51%) of the study population viewed improperly managed wastes as the contributor to land and air

pollution, decreased land values, was unpleasant to the eye and created breeding grounds for pests.

Respondents were asked to state issues they regarded as most problematic and needed urgent attention in their area. All respondents were asked to state under the categories "no concern", "little concern" and "strong concern" for each of the issues. Eighty-four percent of the respondents showed a very strong concern for employment as the first issue that was regarded as most problematic and needing urgent attention, housing was the second showing strong concern whilst waste management was the third issue of strong concern that was regarded as problematic and needed urgent attention. Waste being regarded as the third issue of strong concern is significant and indicates that it is not as serious as employment and housing but must be viewed as an important issue needing urgent attention as compared to electricity, telephones, road/ transport and shops/ centres.

Respondents were also asked to express their personal opinions about the municipal collection services by rating it. The purpose of this assessment was to determine how they felt about the current domestic solid waste collection services. Fifty two percent of the respondents rated the refuse collection system as good, (2%) very good, the rest rated it between poor and adequate but poorly managed. On the basis of these results it was evident that the current municipal solid waste service programme still enjoyed the support of most residents. However, the analysis of the overall responses of the sample revealed that a large number of respondents (75%) viewed illegal dumping as a problem in the area. Yet, only (31%) of all respondents acknowledged that they were responsible for illegally dumping, (46%) stated that they did not dump waste illegally whilst (23%) did not respond. The no response could be attributed to the fear of admitting to the guilt of dumping wastes illegally.

Most respondents (77%) were of the opinion that it was the responsibility of the municipality to stop illegal dumping. Respondents had forwarded multiple reasons for littering and illegal dumping in the area. A significant amount (60%) of the respondents stated that the main reasons for littering and illegal dumping was because of a lack of

facilities, once weekly service (led to decomposition of organic waste), apathy and uncaring attitudes and a lack of education. The household survey indicated that residents of Chatsworth are dissatisfied with the current methods of waste disposal and they display a fairly high level of awareness of problems associated with the current waste removal system. Whilst not as important as employment and housing, most residents did indicate that they place a high priority on receiving an efficient collection system.

The survey results indicated that householders provided multiple responses on suggestions and solutions to curb the problem of illegal dumping and littering to improve the solid waste management situation in the Township of Chatsworth. More than half (51%) of the respondents suggested that promotion of education in the form of (awareness programs, extensive media coverage, environmental campaigns and clean-ups), provision of more bin bags for household and garden waste collection, waste collection days should be increased to twice weekly, municipality to clean up open and public spaces, community and authority to work together, enforcement of strict laws and fines and placement of skips/ recycling domes at strategic points should be implemented to solve the waste management problem in the area. The above-mentioned suggestions indicate that respondents are not satisfied with the waste system in the area.

5.11 LEVEL OF SERVICE

All formal households are provided with a once weekly kerb-side-collection service by the local municipality. The house owners are issued with a supply of twenty-six black bin plastic bags every thirteen weeks. The bags are filled and placed on the kerbside for collection in front of the houses by the occupants on their scheduled removal days. Commercial and industrial sites receive the same level of service. Waste is collected in refuse compactors, which is compressed and then taken to the Chatsworth transfer station. It is then filled on to a horse and trailer and transported to the Springfield landfill site. The Parks and Recreation Department of Chatsworth assists DSW to collect waste that was not picked on routine collection days put out by residents. If authorities do not pick up these wastes then the waste is usually dumped illegally on open or vacant land. The primary role of the Parks and Recreation Department is to

maintain verges, streets, monitor open and undeveloped council property and tree planting. The department's role is to provide a safe and clean environment for residents in the neighbourhood. Private contractors such as Waste Tech are employed to assist with maintenance of verges, bushes and grass in public spaces. Officers from DSW implement the legal system by catching culprits through investigations and imposing fines to offenders of illegal dumping. They also promote environmental awareness by talking to culprits of illegal dumping and conducting media and marketing efforts to combat illegal dumping. NGOs as well as the private sector such as KDBA, WESSA (Wildlife Association of South Africa) Collect-A-Can, Waste-Tech Enviroserve etc work together with DSW to ensure a clean, safe and beautiful environment. Despite all the above efforts of the local municipality to provide an efficient waste system to residents of Chatsworth, major waste problems are still experienced and have been illustrated by way of the vast amount of illegal dumping in the area.

5.12 IMPORTANT LESSONS LEARNT

i) Resident's attitudes

An assessment of resident's attitudes to the domestic solid waste programme revealed that most residents reported that the current solid waste programme was good but poorly managed and need to be improved. This emphasised the need for examining perceptions of recipients of the service on an ongoing basis. This should be done knowing that the unique nature of the environments and conditions in different areas of operations result in problems that require local solutions. Hence, responsible managers should always conduct local audits of their service systems in order to identify shortcomings and develop appropriate interventions.

ii) Community awareness

The study also indicated that the concern of residents to waste management issues ranges from a high level of concern to one of apathy. The existence of apathy may be attributable to a history of poor service levels and lack of environmental awareness and will need to be addressed through education. It is thus likely that education be recognised as an important part of any service provider's responsibilities.

iii) Need for user-friendly programmes

There is a need to design user friendly and consumer orientated solid waste service programmes. User friendly relates to convenience of the service programme to the users. The basic service needs and choice of designs are important. Additionally, the involvement of affected communities is vital for setting priorities. Some communities for example, may prioritise the amount of time it takes the municipality to answer a query, while others might prioritise the cleanliness of an area.

iv) Public participation

Public involvement ensures a dialogue or a two-way communication that involves both getting information out to the public and retrieving information about issues and concerns from the public. Attempts should, therefore, be made to ensure the involvement of all stakeholders in the early stages of the planning process in order to encourage public input and acceptance of the solid waste management plans.

v) Waste generation and composition is related to lifestyles patterns

The study also revealed the unique pattern of waste generation and composition rate that existed in the area compared to other developed areas. The waste stream showed that there are no typical solid waste characteristics for low and high-income areas. Waste differs from one community to the other. It is argued that this variation primarily depends on socio-economic status. It was noted that lifestyle choices determined the community's disposal patterns as varying lifestyles were found to have a direct influence on waste disposal. Godbey *et al.*, (1998) explains that the increasing domestic waste generations associated with the increase of working women as this result in dual income households. Consequently, the limited time family members spend at home prompts them to purchase convenience goods which, in turn creates more waste per capita than the more heavily packed goods. This can be explained as a consequence of inevitable social change. The unpredictable nature of waste generation and composition rates poses major problems in solid waste planning. This can largely be attributed to their direct association with the changing lifestyle of householders. The major factors influencing waste generation and composition rates include overall population growth, income, size of household, geographic factors, and seasonal variations and lifestyles

factors such as the use of convenience products. Information on current waste generation and composition rates can be used to calculate future waste generation estimates and assist planners in devising effective policy strategies to target certain waste materials for source reduction efforts.

vi) Good management

There is a direct link between good management and the provision of an effective service. Good management involves ongoing consultation and communication between the service provider and the community and effective supervision and monitoring on the ground. Not only will it be necessary to ensure the universal provision of adequate services, but also that this is in accordance with situation specific factors such as the local economy, culture, physical aspects and community needs. Hence, an integral part of managing waste services will need to be interaction and communication with communities to ensure that the services provided are appropriate to community needs. A key component of this interaction will also be education of the community.

5.13 WASTE MANAGEMENT CHALLENGES

The political, social, environmental, economic and technical situation in South Africa creates a unique and dynamic milieu for waste management systems. New approaches are required to handle rapid urbanisation, recycling and residential waste through regionalisation, legislation and control. A waste management system for South Africa should be related to the country's financial position, resources, the socio-economic level of its people and its potential for industrial growth. The vulnerability of the local environment, the quantity and types of wastes generated as well as the attitude of people all increase the complexity of the problem. The challenge for waste management in South Africa is to manage the situation with all its constraints and opportunities in such a way that the environment is not threatened unnecessarily. Innovative solutions to cope with the demand for collection of domestic waste while addressing community needs are required. It is believed that the ultimate solution to solid waste management in developing areas is to devolve responsibility for waste collection to members of the community.

In Pietermaritzburg, South Africa, a city of some half a million people, an award winning Habitable Environments Partnership has been successful over the past five years initiated by an affiliate of the Urban Sector Network (USN) (A national group of urban development NGOs). The programme now renders services and support to several thousand low-income households and addresses aspects of:

- Service maintenance;
- Environmental management; and
- Local economic development.

The USN and other key partners including the national government's Department of Provincial and Local Government (DPLG) have recognised the value of this programme. The programme is now being promoted as an innovative and important model that can respond to a variety of challenges that we in South Africa face. The programme involves building a partnership between communities, an NGO and local government. Local community based organisations (CBOs) employ people from the community and enter into an agreement with the municipality to provide services. They are then paid for these services. The NGO's role has been to set up the programme, provide facilitation and support to both the CBOs and the municipality.

The USN and DPLG as partners believe they have a strategy that can tackle this kind of situation through the development of municipal-community partnerships. A local level partnership is established to gear-in additional capacity to face these challenges, whilst also addressing developmental concerns and poverty in these areas. Such partnerships have the effect of empowering the community to address their need to ensure that their living environment is made more habitable and maintained that way. It enables them to develop the necessary capacity and institutional arrangements to take control of their situation.

The services provided by local residents typically include:

- Cleaning of roads;
- Clearing of storm water channels and drains;
- Cutting of grass verges;
- Cleaning and maintaining public sites, such as community and sports facilities;
- Door to door refuse removal;

- Construction of retaining walls using recycled car tyres;
- Planting of grass and trees on public land and maintaining these;
- Providing door to door household education on stasbilising soil and banks to reduce runoff and erosion; and
- Managing community facilities.

In 1999 this programme was recognised nationally for its contribution towards the development of a model approach to good governance at a neighbourhood level. In 2001 it was a finalist in the local green Trust Awards and it has been adjudged a finalist in the World Bank Development Marketplace awards in the top 10% out of 2400 entries from 122 countries. Steps to expand the programme outside Pietermaritzburg is on the way with the intention of building a national municipal-community partnership' programme based on this experience.

i) Changing mindset

The issue of changing mindset is the most difficult task facing solid waste service delivery. The South African government has introduced an integrated waste management approach as a shift from end-of-pipe solution to pollution prevention (DEAT, 2000). This requires a change of approach from the traditional management style where costly law enforcement measures were used to citizen-orientated management approaches that promote consumer participation and prioritisation of service delivery. The key stakeholders to deal would include municipal/government authorities (including politicians), consumers and the media.

Solid waste delivery service can be improved by reorientation of municipal/ government authorities from reliance on costly remedial measures to proactive approaches that involve proper planning. The attitude of rating solid waste management services as a relatively low priority in relation to other municipal services needs to change. Responsible municipal and government authorities need to be convinced that solid waste management is an essential service, which is as important as water and sewerage services. The image of an urban environment is not judged by the structural appearance but by its cleanliness (litter free environment). Solid waste management is dynamic due to its link to technology. To operate efficiently, it requires resources such as transport

and skilled human power, which must be trained. The low priority given to this service is manifested by the ever-low budgets, unskilled managers/ supervisors and a lack of autonomous status to operate freely. The commonly held belief that solid waste collectors need no training on the basis that the qualification of being a collector is willingness to work under unsanitary conditions needs to change.

The training of workers is very important, as this would help them to handle their customers in an appropriate manner, for instance dealing with resident's complaints etc. Workers are an important part of any service programme. The high cost incurred by most municipal solid waste authorities is directly linked to the lack of forward planning to optimise solid waste services. According to UNESCO (1996) considerable savings and improvement in the level of service could be gained by optimising the operation of solid waste collection systems. Poswa (2000) indicates that political support is equally important for deciding on priorities. Municipal solid waste authorities need to change their decision-making styles to one that is more citizen orientated. Poswa (2000) shows that this calls for the reduction of the amount of bureaucratic delays where officials have enormous powers and make unquestionable decisions, which often compromise the quality of services. An approach where there is interaction between service providers, workers and service recipients is essential. The greatest challenge is the restructuring of local service delivery to provide equitable services in a fair and balanced manner based on democratic principles to a formerly decided society with development patterns that differ from one area to another.

Consumer mindset characterised by uncaring attitude and apathy for the environment and a general lack of support for service providers, must also be dealt with in order to provide acceptable services. The municipalities need to build good relationships with local citizens they serve. A consultative process is required with the active participation of the community to discuss service related issues. Local municipalities need to work together with consumers by responding to complaints etc. Residents need to be educated about simple waste management practices such as disposal options like flattening cardboard boxes to reduce space in refuse bins and collection trucks, source reduction, source separation, waste minimisation, recycling, composting of kitchen wastes etc.

Consumers need to be enlightened and given incentives to boost their interest and co-operation.

The media is also an important stakeholder in changing resident's mindsets. A committed media is needed to inform the public about good and bad waste management practices. Poswa (2000) states that bad publicity for environmental offences has worked well in other developing countries. A good media support whereby hard copies of advertisements through news-papers, posters, flyers community radio stations, television etc., is crucial to report on environmental degrading practices. Information dissemination is impeded by the lack of media involvement in solid waste issues.

ii) Stakeholders

The new political dispensation and the need for transparency has introduced complications of a bewildering magnitude to the negotiating arena involved in the management of the environment because it has brought the general public into the process. The general public is largely ignorant of the issues and the processes involved in the waste management dilemma and therefore do not have the capacity to participate in the planning and decision-making process without some form of initial capacity building. Waste collection systems established without consulting the stakeholders about their needs have resulted in a lack of community interest and the development of a culture of low payments to non-payments for services. This has contributed to the marked environmental degradation seen in the formal township of Chatsworth. The litter abatement measures that have been implemented thus far have largely been unsuccessful because they have failed to ensure that the general public takes ownership of its waste and litter. Solid waste management authorities have to develop mechanisms to ensure citizen participation in policy initiation, decision-making and implementation. The aim of this mechanism is to develop an appropriate integrated planning arrangement. Through this process, the public on the one hand becomes educated about the economic and logistical realities of managing municipal solid waste. Solid waste planners on the other hand gain a better understanding of public concerns. Attempts should therefore be made to ensure the involvement of all stakeholders in the early

stages of the planning process in order to encourage public input and acceptance of the solid waste management plans.

Citizen participation in service delivery is one of the goals of Local Agenda 21 and originated from the Rio summit on Environment and Development in 1992. This summit mandated local authorities to develop sustainable development plans for their cities. As such local authorities are required to acquire the information needed for formulating the best strategies through consultation and consensus building, and to learn from citizens and local, civic, community, business and industrial organisations. This requires a holistic investigation of alternative solutions that rest on sound planning, and principles of management for sustainable development. Partnership with civil society is important in the light of the limited resources, which include funds and management capacity to deliver services at the pace of the ever increasing and changing consumer demands. This highlights the fact that most municipalities in developing areas, including Chatsworth, do not have the capacity to deliver all the required municipal services.

iii) Legislative Framework

The present uncoordinated approach with diverse and sometimes conflicting laws governing waste management and pollution control is ineffective in protecting the natural environment. The fundamental problem is related to a lack of adequate enforcement. The present system is incapable of harnessing the potential contribution of communities and Non Governmental Organisations and hence is incapable of integrating efforts into the formal regulatory system. The Department of Water Affairs and Forestry's (DWA&F, 1998) Minimum Requirements, the Integrated Environmental Management Procedure, Scheduled trade permit conditions and environmental management systems, which all impinge on the planning process is very difficult to comprehend.

v) Community Involvement

There is a lack of public awareness with regard to waste disposal and landfill site development. Community involvement in waste management issues is vitally important

e.g. participation in setting own community standards. This process must be governed by rules that set standards of acceptable behaviour and time frames for a process that must be binding on all the stakeholders and participants.

5.14 RECOMMENDATIONS

Seventy thousand households do not have any refusal collection according to the Head of Municipality's Cleaning and Solid Waste Department (Daily News, 2 March 2003). According to the 2001 Census survey, 50,8% of householders in KwaZulu-Natal did not have any refuse removal system (Department of Statistics South Africa, 2004a). This is a serious situation and the extension of services to currently under serviced areas need to be undertaken urgently. To meet the needs of a world population that is expected to grow by an additional 3,7 billion in the next 25 years (Mears, 1998), the introduction of rapid and timely changes in production and consumption patterns are essential. The era has passed when natural (physical) capital was considered as infinite relative to the scale of human use. The protection of the environment is essential if poverty is to be reduced. With regard to waste management, the challenge is to use the constraints and opportunities in a way that poses no threat to the environment. Natural capital must be addressed at all levels of government in developing countries, mainly through education and training.

The findings of the study will be valuable for policy formulation, for a new pragmatic approach to environmental problems will have, to be embarked upon. For any environmental policy to be meaningful it has to address the socio-economic need of the people. To help change the perception and attitudes, solid waste management should be seen by the poor as addressing their needs. It has to be seen within the context of just not a service delivery mechanism but should be part and parcel of holistic development. This will ensure that the social-economic issues such as job creation and skills development that will lead to the delivery of basic needs are addressed. Once an appropriate system is in place, co-operation and sensitivity towards solid waste management has to be encouraged through awareness campaigns and enforced where necessary. This could be achieved by making the community co-responsible for waste management. Community participation in the development process is the hallmark of a

successful sustainable programme. It is important that we alter our approach to pursue a complete, holistic concept of sustainable development that includes not only the natural resources at the front end, but also the disposal of waste at the backend. Sustainable development must form the cornerstone of our approach to waste disposal in the future.

i) Education

The training and education of people has been consistently overlooked and is one of the more important elements in a country's waste management system. In addition to the obvious formal channels of education via the schools, the community at large must be educated to become informed on what constitutes good and bad waste management. Once the community understands the difference it will be able to become constructively involved in assisting with the discovery and implementation of appropriate solutions to the waste management crisis. Effective communication of waste management-related information for the person on the street requires a concerted waste awareness campaign. Relevant information on waste management must be made available to interested and affected parties. In this regard there is need to develop and maintain data bases on general and hazardous waste and the associated disposal operations. There is need for the introduction of effective litter abatement measures through public awareness campaigns, education programmes and appropriate sanctions for environmental misdemeanours. Sanctions that would affect all sectors of the community equally should be selected and these could include community service e.g. street sweeping and public place cleaning for littering and illegal dumping offences. Community education on waste and littering through organisation such as the Institute of Waste Management (IWM), Keep South Africa Beautiful (KSAB), Keep Durban Beautiful Association (KDBA) and sister organisations which run Tidy Town Programmes. Education of the public and close co-operation with industry and all tiers of government are also of immediate concern.

Progress at the individual level is critical. Enlightened consumers choose those products that are produced by organisations that exercise a "Duty of Care" towards the environment. The Duty of Care is a collective responsibility. As such, where the capacity to understand the situation is lacking this must be remedied at all levels of

society through formal and informal education. An intensive educational programme needs to be developed to enlighten consumers about the payment for services. The culture of non-payment is deeply noted in some members of the community that it will take time to change their way of thinking. Consumers need to be informed why they have to pay and why certain methods are preferred to others. An increase in the waste collection days, extra refuse bags of household and garden wastes, more regular street and public place cleanups, removal of free garden wastes will lead to increase in municipal rates. Residents need to be educated about alternative and cheaper methods of taking care of their environment. This is a long process that the solid waste management authorities have to be engaged in to improve the quality of services.

ii) Legislative framework

At present there is no effective co-ordinating body regulating pollution control in South Africa. Many other Government Departments apart from DEAT have major responsibilities in the field of pollution control. There are bodies such as the South African Bureau of Standards (SABS), which play an important role in pollution control. Effective integration of the regulatory framework for pollution control will help to secure a healthy environment for South Africans, one of the basic human rights identified in the Constitution. Waste is the root cause of pollution. It is therefore necessary to control waste in order to control pollution. Effective Waste Management requires a holistic approach that deals with waste from its generation to its final disposal with the aim of arriving at the best practicable environmentally acceptable option. Waste and pollution affect everybody and every person has to bear some responsibility for it. An effective strategy to deal with the problem must involve all people and all institutions in society. All levels of Government, the Private Sector, NGOs, CBOs, trade unions, business, urban researchers, public health managers, environmental crusaders and the public at large must play a role since the poor and inefficient management of wastes is clearly a critical area of concern. The fundamental problem is related to a lack of adequate enforcement. The driving force for change in the waste industry in South Africa must be regulation within appropriately integrated legislation based on an environmentally caring policy supported by a definite strategy to control all the elements of the waste management system. A well-planned and adequately staffed

regulatory authority structure is required to ensure that, on the basis of good local control, the country's waste stream can be managed.

iii) Governance and waste management

The extent to which Waste Management is effective and sustainable depends on the system of governance, ranging from national, through regional to local tiers of government. It also depends on other factors, which impact governance, particularly urbanization and socio-economic features of political history.

iv) National and Local Governance

A lack of institutional responsibility and capability has been identified. The current situation of various national government departments having involvement in waste management needs to be examined, with a view to the establishment of either a national waste management department/ board, or the allocation of all waste management responsibilities to one existing department. The capacity to address waste management will depend on the local governance scenario. Within local authorities continued attention needs to be given to improve domestic solid waste services, particularly to unserviced communities. The emphasis needs to be placed on universal access to an adequate level of service, selection of appropriate levels of service, efficiency, communication with users and proper financial procedures. Complementing this structure would be provincial level waste management directorates in each of the provinces. Although the focus of this project has been on domestic waste, such departments would need to have jurisdiction over all forms of waste. The purpose of these structures would be to co-ordinate and monitor the handling of waste by third tier agencies. It is after the issue of overall governance is fairly settled that the matter of waste management governance can be reasonably addressed with appropriate mechanisms of tackling the associated problems.

v) Community participation and capacity building

Solid waste management is an integrated system that encompasses both community involvement and waste management processes. The success of any system depends on the adequate inclusion of these factors. Planning emphasis, which is the ultimate

responsibility of the local authority, should incorporate both community involvement and planning which should involve the waste management process. Each aspect of the waste management process has to be correct for a successful waste management system. There should be a holistic approach to solid waste management, which should include all waste generators in the vicinity. It is important for the project to be seen to be addressing all stakeholders'needs. They should define these needs through a stakeholder forum. It is also important that the level of communication with the people at grassroots level is in place and that they are supportive. It is critical to have a community structure responsible for implementing the project so that the community can be co-responsible for project decision and to keep community structures informed. It becomes easier even if there are problems at a local level to have people directly informed through involvement.

Awareness campaigns are important to raise the level of awareness of the public and to change the attitudes of people towards effective cleanliness. It requires a combination of monitoring, awareness campaign and discipline to contribute to a well-managed area. Training should be designed and evaluated to be appropriate to local needs. Training and awareness should not only be about household waste management, but should also encompass responsibility beyond waste management such as public places. Solid waste training should concentrate on changing attitudes and making the community responsible for managing its wastes efficiently. A comprehensive awareness campaign against litter encompassing schools, business, Department of Education and Health should be started in the study area. This should be coordinated by the eThekwini Municipality and related campaigns. Communities can participate around issues of development. For example in many townships in KwaZulu-Natal, all planners for the townships are based in Durban, which means these people have a theoretical understanding of the problems in the particular area and is imperative that no decision be taken without full participation of the community. People can participate effectively through the formation of environmental groups etc. The organisations will serve the purpose of development and empowerment as the individuals realise their full potential. Community participation will have to go hand in hand with capacity building, which entails educating people about environmental issues and their relationship to develop.

vi) Integrated Waste Management

The broad goal of the waste management sector must be to upgrade the standards of living of its general public. This goal is aligned with the standards that have been set by the Integrated Pollution Control (IPC) programme which has been initiated by the Department of Environmental Affairs and Tourism. IPC aims to co-ordinate all the legislation governing waste management in South Africa. This programme should be supported. Good waste management systems need to be implemented at all levels in the communities as well as in the business sector (commerce and industry) of the eThekwini Municipality. Through the correct application of the hierarchy of waste management, waste minimisation at source should be promoted wherever practical in order to reduce the volume of waste to be disposed. This may include composting of garden refuse and other resource recovery options or recycling. The mission of a holistic policy on integrated pollution control is effective in making the present system more efficient, and which is sustainable, affordable and implementable.

5.14.1 Waste Management Techniques

i) Waste minimisation

Waste minimisation is the way to go in terms of bringing about environmental sustainability in KwaZulu-Natal. Sustainability of the environment is the key aspect in this regard because once there is a sustainable waste minimisation programme in place the waste disposal costs are either reduced or eliminated, and this can create a fiscal muscle that can be utilised to sponsor other development projects in the society. In addition to this it will contribute to the sustainability of the environment. More money is likely to be saved through an extensive waste minimisation programme, especially considering the relatively higher costs associated with transporting waste, and running a landfill site.

ii) Resource recovery and recycling

Although in the past there has been some success with resource recovery and recycling in South Africa, these activities need to be encouraged further. Attention should be given to the lack of incentives for resource recovery and the lack of markets for recycled goods. Recycling of waste is the way to go in order to achieve a sustainable

environment in KwaZulu-Natal because a lot of recyclable waste in the waste stream can be diverted, and that is likely to reduce waste that goes to the landfill sites. There is also an opportunity for providing job creation opportunities through the recycling buy–in centres especially with the unemployment rate being so high in the province. Diverting waste away from the traditional route of waste disposal will save local government authorities money, thus making funds for other development projects.

iii) Creation of markets

Markets should be created for reclaimed materials and for products made from secondary materials. The recycling industry has developed spontaneously despite the fact that there is no legislation enforcing or addressing recycling in South African Cities. Attempts to establish large waste-separation and recycling ventures have failed mainly because the market value of the products recovered could not cover the costs involved (Mears, 1998). SMEs have been more successful in this field. Local authorities must assist SMEs in establishing recycling ventures. Legislation is needed to empower private enterprise and to give structure to the management of recycling.

iv) Composting

Backyard composting projects should be established in order to divert organic wastes from households and communities and create compost. Composting presents a proven reliable method for refuse of high organic matter content. Another economic aspect of refuse especially from developing countries is the predominantly organic nature and the possibility of transforming waste for use as waste on farms i.e. used as a valuable soil conditioner. Waste can also be used in trench gardening or pit beds to produce vegetables for consumption and sale. Such initiatives will reduce the volume of waste that goes to the landfill sites, thus saving the local authorities and private companies a lot of money on waste disposal costs.

v) Need for balanced waste management techniques

There should be a balanced manner in which waste is managed in KwaZulu-Natal. For example, various waste management techniques such as education composting, landfill, recycling, reuse and waste minimisation should be considered, and measures must be

put in place to ensure that all these techniques are optimised in order to achieve this objective, the communities in which these projects are implemented should be consulted extensively. Source reduction and the separation of waste material at source, which is the household level or facility must be encouraged. In addition to this economic opportunities for the communities should be created in order to boost local economies.

It is estimated that on the Bisasar Road Landfill Site in Springfield, Durban, waste pickers represent in the region of 200 families who earn a total of R300 a month per family (Freeman, 1999).

In Dar-es-Salaam (Adedipe, 2002) reported that some minimal level of informal sorting and scavenging takes place. This reduces the volume of wastes and "scatters" it so that it is easily biodegradable in the soil. It has been estimated that about 600 scavengers are active in Dar-es-Salaam, though the number could be more. There is no organised forum for these recyclers, nor do they have any relationship with the Dar-es-salaam City Council. The recyclable materials are used directly or sold to users.

In Ibadan (Adedipe, 2002) recycling activities have been going on in informal sector mostly at the dumpsites. Waste recycling is an aspect that has not been paid the required attention; yet, ideally, a significant proportion of waste of different types should be salvaged, particularly at the household level. But since wastes are not sorted out at source, a large proportion of them are lost since they are so contaminated by the time they reach the dumps that they are difficult to retrieve by scavengers. The integration into the formal waste management process of informal agents such as scavengers needs to be addressed. If the authorities stop this activity, an alternate source of income generation will have to be found by the pickers. It is therefore, advocated that to promote recycling and informal waste collection by scavengers, there is a need to:

- Encourage the separation of waste material at source, that is household or facility level;
- Procedures to allow informal collection of waste for recycling needs to be investigated. Cooperation between households, local authorities and the increasing number of scavengers/ reclaimers are important in this regard;

- Streamline the operations of the scavengers through proper registration, training, upgrading of techniques commonly used by them, and putting in place the requisite health protection mechanisms; and
- Linking them with end users.

vi) Cost/ payment of waste services

The cost of waste services should be charged according to the income levels and the class status of the area. Cross subsidisation of waste should be considered whereby every house-holder residing in the more affluent areas such as Umhlanga and Durban North pay an extra amount of R10 in their monthly rates. This increased amount of R10 included in the rates payment could subsidise the cost of garden bags, provision of more domestic waste bags etc., for householders in low-income areas. For example, every 10 000 households in Umhlanga could subsidise 100 000 households in a township like Chatsworth. Currently householders are expected to purchase bags for collection of garden waste. The municipality provides a limited number of black refuse bags to householders and excess wastes are therefore dumped illegally. Cost of waste services is a determining factor in service delivery. Cross subsidisation of minimal increase in rates payments by the affluent householders of eThekwini Municipality for poor residents in the Ethekwini Municipality could be considered as a way of improving service delivery. Cross subsidisation for waste services in the form of minimal increases to the affluent resident's rates will assist in providing a better waste service to the entire eThekwini Municipality and thereby make the entire municipality look clean and safe.

vii) Further research

Residents, as consumers, play an important role in informing the municipality of their priorities, interests and problem areas while community-based organisations (CBOs) and non-govermental organisations (NGOs) represent different civic society interests in general. The latter groups are important for conducting research initiatives with relevant bodies. The business sector could assist with funding as well as educating their employees on relevant solid waste issues. Information dissemination can be done through the media and other existing communication means. Solid waste workers as the engines of the service delivery can provide vital information on operation issues and

their labour relations interest will be secured by the presence of labour union representatives. Through research new knowledge and status quo reports will be produced. It is further recommended that research be done on recycling by informal collectors such as scavengers. The issues that need to be addressed would include the amount of economic activity taking place, its effect on the overall economy as well as the percentage of people using the study area to obtain direct food and implication on health. Local research should be encouraged and be part of the process. Joint initiatives involving civics, workers, training institutions and schools can assist in this process.

5.15 CONCLUSION

Capacity to respond to the service backlogs caused by the apartheid era and challenges of a rapidly urbanising country is lacking in many of South Africa's municipalities. Local government is under enormous pressure to respond to the maintenance and environmental needs of formal, informal and newly completed low-income housing projects in townships of developing areas. Many formal low-income residential areas do not have access to an efficient waste management service. The absence of access to an efficient service constitutes an anesthetic and serious health risk. Newly constructed infrastructure in developed areas is rapidly deteriorating, with drains being blocked, erosion eating into the roads and refuse strewn all over our residential areas. Here too public threats have developed and there is, for obvious reasons, a lack of pride in the local environment. For townships in developing parts of South Africa, waste management being a major aesthetic problem is not new. As a result the unsightly waste heaps, increasingly transforming into landmarks, constitutes public health hazards are becoming obvious, given the frequent occurrences of environment-sanitation related diseases. The solution to the problem is rather complex and is borne by an interplay of the prominent factors of rapid urbanisation and population growth, lack of political will, unco-operative governance, inadequate financial allocation, unstable administrative framework, un-enforced legal system, and unskilled human resources, among others.

The pathway to a clean and healthy environment lies in the management of waste in a manner consistent with its reduction complemented with sorting, reuse, recycling and repair activities and ventures. Although the latter strategies have been in operation for

sometime, they have been characterized by "waste scavengers" in two vicious and linked cycles: that of poverty on the one hand, and that of vulnerability to health hazards, on the other.

It has been demonstrated in no uncertain terms that solutions to local problems can indeed be found by examining local conditions. This reaffirms the principle of think global but act local. Co-operative effort is needed to convince the service recipients that their active participation in the service planning through to implementation will bring long-lasting benefits. Consumer participation in decisions on services is essential in order to build a mutual trust between the service providers and the service recipients. The designers of solid waste management programmes need to produce profiles of their respective communities in order to gain knowledge of the local conditions and develop appropriate interventions that would meet the needs of service community. In doing so, there is the need for programmes of waste-to-wealth for poverty minimisation, through well organised composting and recycling ventures, with obvious and latent dividends to the environment; and ultimately, for sustainable development. There is an unquestionable benefit in sharing in the lessons of experiences, of those communities particularly those that have excelled. South Africa would require awareness campaigns, citizen involvement and empowerment to make such benefits sustainably gainful.

It is believed that this study provides vital information on the current solid waste practices of households of the Township of Chatsworth and patterns of domestic waste generation and composition and disposal. The findings will greatly assist solid waste planners to seek practical solutions to the current situation and the recommendations should facilitate forward planning. Finally, it is strongly recommended that the eThekwini Municipality and other similar service providers seriously consider the option of funding students to conduct research on the solid waste status, waste generation, composition rates and disposal methods for all areas within their jurisdiction. This cost-effective method could provide both an adequate training of personnel and improve a database on solid waste practice for sound planning.

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PERSONAL COMMUNICATIONS

Mr John Parkin, Deputy Head: Plant and Disposal (DSW) (4 November 2004).

Personal communication with resident (13 July 2004).

Personal communication with Mr Sandy Pillay, Resident (7 July 2004).

Personal communication with resident (18 Dec, 2003).

Mrs Charmaine Rajbansi, MPP Member: Environment Steering Committee (4 November 2003).

Mr Paris Singh, Councillor (5 November 2003).

Mari Van Der Merwe, Education Cordinator (KDBA) and Acting Business Manager Manager (DSW) (10 February 2003).

Lezi Ngqulunga, Education Officer (KDBA) (15 July 2004).

Mr Roy Sukdhev, Education Officer (KDBA) (10 July 2003).

Ms Sara Freeman, Waste Minimisation Officer (KDBA) (08 June 2002).

Mr Trevan Govender, Area Cleansing Officer-Chatsworth (03 June 2004).

Mr M. Naidoo, Chatsworth Transfer Station Operator (03 June 2004).

Mr Suresh Singh, Manager of Parks and Recreation Department, Chatsworth (18 November 2003).

Mr Pluky Govender, Area Cleansing Officer and Peace Officer (DSW) (15 September 2004).

Mr Don Erwin, Environmental Co-rdinator (DSW) (15 September 2004).

Mr Raymond Rampersadh, Director and Head of Municipality's Cleansing Solid Waste Department (DSW) (15 September 2004).

Mr Vincent Zwane, Branch Manager of Collect-a-Can (15 August 2004).

Public Relations Officer- Aryan Benevolant Homes-Chatsworth (12 September 2003).

Public Relations Officer – Chatsworth Centre (12 September 2004).

APPENDIX A

SOLID WASTE MANAGEMENT SURVEY

CONFIDENTIAL

1. SOCIO-DEMOGRAPHIC CHARACTERISTICS

Family Members	Relation to Household 1	Age 2.	Sex 3.	Marital Status 4.	Monthly Income 5.	Employ Status 6.	Education 7.	Place of Employ 8
Person 1	Head							
Person 2								
Person 3								
Person 4								
Person 5								
Person 6								

CODES

1. Relation to head
1. head
2. spouse of head
3 married child
4. spouse to married child
5. unmarried child
6. grandchild
7. father
8. mother
9. mother in law
10. father in-law
11. sister in-law
12. brother in-law
13. Other relatives

2. Age
1. 5-14
2. 15-24
3. 25-34
4. 35-44
5. 45-54
6. 55-64
7. 65-74
8. 75+

3. Sex
1. Male
2. Female

4. Marital Status
1. Currently married
2. Single (never married)
3. Widowed
4. Divorced
5. Separated
6. Abandoned
7. Single parent

5. Income
1. < 300
2. 300-499
3. 500-699
4. 700-899
5. 900-1099
6. 1100-1299
7. 1300-1499
8. 1500-1699
9. 1700-1899
10. 1900-2099
11. Other (state)

6. Employment Status
1. Professional
2. Technical
3. Managerial
4. Clerical
5. Sales
6. Craftsman
7. Labourer
8. Retired or Pensioner
9. Housewife
10. Unemployed
11. Self-employed
12. Other (Specify)

7. Highest Level of Education
1. No formal Education
2. Nursery School
3. Pre-school
4. Primary
5. Secondary
6. Tertiary

2. DWELLING CHARACTERISTICS

2.1 What type of home are you living in?

Ownership	1	Flat/duplex	4
Rental apartment (ect)	2	Informal	5
Out building/ tenant	3	Other	6

2.2 Housing / Property Density

During the week	At weekends	CODES
1	1	Number of people on the stand/property
2	2	Number of people in Respondent's family
3	3	Number of buildings on the property
4	4	Number of families on the property

2.3 Respondents duration of Stay on the property or in the area

a) How long have you lived here?_____
b) Where did you live before?_____
c) Reason for moving to present location_____

3. ISSUES IN GENERAL

Indicate below the issues you regard as the most problematic and needing urgent attention Please rate each issue on the following 5-point scale.

ISSUE	No concern 1	Little concern 2	Some concern 3	Strong concern 4	Critical 5
1. Electric supply	1	2	3	4	5
2. Telephones	1	2	3	4	5
3. Housing	1	2	3	4	5
4. Waste removal/Street Cleaning	1	2	3	4	5
5. Improvements of roads	1	2	3	4	5
6. Development of a Shopping Center	1	2	3	4	5
7. Creation of jobs	1	2	3	4	5

4. DOMESTIC SOLID WASTE

4.1 What kind of solid waste do you dispose? (MR)

Food waste	1
Garden waste	2
Sanitary waste (disposable nappies)	3
Paper, cardboard, plastic	4
Building material	5
Other (specify)	6

4.2 How do you store waste at your home?

Refuse plastic bags	1
Refuse bins	2
In a pit in the yard	3
Other (specify)	4

4.3 How do you dispose of the following waste? (Tick appropriate block)

Waste	Dump	Burn	Bury in trench	Flush in toilet	Refuse bag/ bin	Animal feed	Contractor Removal	Other (specify)
Food								
Garden								
Sanitary								
Paper								
Building								
Broken Applian.								
Unwanted Furnt								

4.4 How do you dispose of your scrap metal including scrap cars, tyres and batteries?

4.5 When last did you have a sewer blockage? _____

5. ILLIGAL DUMPING, LITTER AND ITS IMPACTS

5.1 Do you regard illegal dumping as a problem your area?

Yes	No

5.2 If yes, give reasons why you consider it a problem

5.3 What is the distance to the nearest illegal dumping site to your home?

5.4 Do you dispose of waste illegally? Yes/ No

5.5 If "Yes" in Q5.4, what type of waste do you dispose off?

5.6 If " Yes" in Q5.4, give reasons for disposing waste illegally.

5.7 If "Yes" in Q5.4, how do you transport waste to these dumps?

5.8 What do you think are the health impacts of illegal dumping?

5.9 What do you think are the environmental impacts of illegal dumping?

5.10 Which of the following are present in your area? Please give a description of you choice.

	Description
Odours	
Unaesthetic environment	
Insects and pest	
Harzadous	
Stream pollution	
Air pollution	
Drain damage	

5.11 Who do you think is responsible for illegal dumping? (More than one answer is acceptable)

My garden worker		Nearby flat dwellers	
My neighbours/ residents		Myself	
Municipal street cleaners		Squatters	
Project contract workers		Factories and industries	
A building contractor in the area		Other (specify)	

5.12 In your opinion why do you think people litter?

5.13 Do you think illegal dumping can be stopped?

Yes	How?
No	Why?

5.14 Do you believe that residents could play a role in stopping illegal waste disposal in your area?

Yes	How?
No	

5.15 Which of the following statements in your opinion are true or false with regard to littering and illegal dumping of waste?

A. Littering	T	F	B. Illegal Dumping	T	F
Residents are the main cause			I'm paying my rates therefore I'm not responsible		
Littering by neigbours is unacceptable			If we don't dump the Municipality workers will not have work		
			It is the responsibility of residents to catch illegal		
			dumpers & report them to the Municipality		
			Industries from the area are responsible for illegal dumping		
			It is the Municipality's duty to stop illegal dumpers		
			Residence from nearby dump their wastes here		

6. RECYCLING AND WASTE REDUCTION

6.1 Is there any environmental awareness programs in your area?

Yes	1	Who runs program? Describe the program:
No	2	

6.2 Do you have solid waste Recycling Projects in the area?

Yes	1	Explain type of project:
No	2	

6.3 If "yes" above, Do you think that the Recycling Projects are working? (elaborate)

6.4 Do you think Recycling Projects should be expanded in your area?

Yes	1	Give reasons:
No	2	Give reasons:

6.5 How do you dispose off the following waste materials?

	Disposal options					
Waste	Send to recyclers	Reuse	Dispose/refuse bags collection	Throw in open spaces	Burn	Other (Specify)
Plastic containers & packets						
Glass						

Tin						
Newspaper & Cardboard						

6.6 Do you think that people should buy recyclable plastic bags for reuse?

Yes	Give reason:
No	Give reason:

6.7 Would you be willing to separate you household waste and participate in household waste recycling programs?

Yes	1
No	2

6.8 If yes above, which system would you prefer?

A drop off recycling program	1
A door to door collection program	2
To be supplied with special bags to pre-sort waste materials for collection	3
Other (specify)	4

7. COMMUNITY PARTICIPATION

Are there any committees in the area dealing with environmental problems?	1. Yes 2. No
If "Yes" above, what type of committees are there?	Specify:
Has the community mobilized to deal with solid waste issues in the area?	1. Yes 2. No
If yes did they form an environmental committee in the area?	1. Yes 2. No
Are you or any person in the family a member of any environmental committee?	1. Yes (specify committee) 2. No (Reason for not participation)
Are there any organizations dealing with solid waste problems in the area?	1. Yes (Name of the organization) 2. No
What are the tasks of these organizations?	Specify :
Does the community work with these organizations?	1. Yes (How?) 2. No
If the community has any solid waste related problems, whom do you seek assistance from?	
Have they been successful in solving problems?	1. Yes (How?) 2. No (Why?)
Was the community involved in workshops to formulate the present waste policies?	1. Yes 2. No (Why?)

8. LEVEL OF WASTE MANAGEMENT SERVICES

8.1 What is the frequency of waste removal in you area?

Daily	1	Once a month	4
Once a week	2	No response	5
Twice a week	3		

8.2 How much waste do you generate per week in bag/ kg (approx.)

One bag	1		0.5 kg	1	
Two bags	2		6-10kg	2	
Three bags	3		11-15kg	3	
Other	4		>15kg	4	

8.3 Do you know about the green bags used for collecting garden refuse?

Yes	1	Where heard?
No	2	

8.4 Does your area have scavengers during waste removal days?

Yes	1	Are they a problem? (explain)
No	2	

8.5 How do you rate the refuse collection service in your area?

Poor	1	Very good	4
Adequate but poorly managed	2	Not sure	5
Good	3		

8.6 Do you have street cleaning services in your area?

Yes	1	Who provides service?
No	2	

8.7 Are you aware of any refuse transfer station in your area? Yes / No

8.8 Is the transfer station adequate for solid wastes that are generated in the area?

Yes	1	Give reasons:
No	2	Give reasons:

8.9 Are you satisfied with the accessibility of the transfer station?

Yes	1	Give reasons :
No	2	Give reasons:

9. PRESENT ENVIRONMENTAL POLICY ON SOLID WASTE MANAGEMENT (SWM)

9.1 Knowledge of SWMP

Do you know about the present Solid Waste Management Policy (SWMP)	1. Yes (explain) 2. No
Where did you hear about SWMP?	1. Media 2. Community meetings 3. Friends/ relatives 4. Environmental organizations in the area 5. Other (Specify)
Do you know how the present SWMP works?	1. Yes (explain) 2. No
Do you think the SWM systems has improved or become worse?	1. Yes (explain how? 2. No
Do you think the environment has improved with the present SWMP in place?	1. Improved 2. Remain the same 3. Not sure 4. Don't know
What suggestion can you make to improve the present SWMP?	Explain:

9.2 What is your opinion on waste management in your area? _____

_____

9.3 What suggestions can you make to improve the solid waste management services in your area?

_____

APPENDIX B
SOLID WASTE MANAGEMENT
SEMI STRUCTURED INTERVIEW AUTHORITIES

1. COMMUNITY PARTICIPATION

Are there any committees in the area dealing with environmental problems?	1. Yes 2. No
If "Yes" above, what type of committees are there?	Specify:
Has the community mobilized to deal with solid waste issues in the area?	1. Yes 2. No
If yes did they form an environmental committee in the area?	1. Yes 2. No
Are you a member of any environmental committee?	1. Yes (specify committee) 2. No (Reason for not participation)
Are there any organizations dealing with solid waste problems in the area?	1. Yes (Name of the organization) 2. No
What are the tasks of these organizations?	Specify:
Does the community work with these organizations?	1. Yes (How?) 2. No
If the community has any solid waste related problems, whom do you seek assistance from?	
Have they been successful in solving problems?	1. Yes (How?) 2. No (Why?)
Was the community involved in workshops to formulate the present waste policies?	1. Yes 2. No (Why?)

2. RECYCLING AND WASTE REDUCTION

2.1 Is there any environmental awareness programs in your area?

Yes	1	Who runs program? Describe the program:
No	2	

2.2 Do you have solid waste Recycling Projects in the area?

Yes	1	Explain type of project:
No	2	

2.3 If "yes" above, Do you think that the Recycling Projects are working? (elaborate)

_____

_____

_____

2.4 Do you think Recycling Projects should be expanded in your area?

Yes	1	Give reasons:
No	2	Give reasons:

3. PRESENT ENVIRONMENTAL POLICY ON SOLID WASTE MANAGEMENT (SWM)

3.1 Knowledge of SWMP

Do you know about the present Solid Waste Management Policy (SWMP)	1. Yes (explain) 2. No
Where did you hear about SWMP?	1. Media 2. Community meetings 3. Friends/ relatives 4. Environmental organizations in the area 5. Other (Specify)
Do you know how the present SWMP works?	1. Yes (explain) 2. No
Do you think the SWM systems has improved or become worse?	1. Yes (explain how? 2. No
Do you think the environment has improved with the present SWMP in place?	1. Improved 2. Remain the same 3. Not sure 4. Don't know
What suggestion can you make to improve the present SWMP?	Explain:

4. Has the problem of waste management come up on the agenda in any of your meetings about the Chatsworth environment? YES/NO

4.1 If YES. Elaborate

_____

_____

5. What are you doing to help with the waste problems such as illegal dumping, insufficient solid waste bags, provision of free garden refuse bags, etc. in your area?

_____

_____

_____

_____

_____

6. What is been done or have been done by you, about maintenance of the environment with issues such as trimming of verges on streets, side walks, path ways, regular street sweeping, cleaning of bushes in open spaces and vacant land, better lighting systems in no dumping zones, and signage boards for no dumping areas?

_____

_____

_____

_____

_____

_____

7. What is your opinion on waste management in your area? _____

_____

_____

8. What suggestions can you make to improve the solid waste management services in your area?

_____

_____

Appendix C

SOLID WASTE MANAGEMENT
SEMI STRUCTURED INTERVIEW WITH WASTE COLLECTORS

1. How old are you?_____
2. Where do you live?_____
3. Male _____ Female _____
4. Race: Indian_____ African_____ Coloured _____ White_____
5. How many members are there in your family that you support with the money from the sales of waste collected?_____
6. Do you use the money from sale of waste collected to support your self only?_____
7. If no state who else the money from sales of waste collection supports?_____
8. Which areas do you collect waste from?_____
9. Do you reclaim waste from residential areas _____ businesses_____ other? _____
10. How long have you been collecting waste for sales?_____
11. What time of the day is it most beneficial for collection of waste.?_____
12. How many kg's of plastic_____ paper _____ and cardboard _____ do you collect on average per day?
13. Are there any other waste types that you collect from the waste stream to sell for cash?_____
14. State the type of waste in 13. e. g. glass, tin, old used furniture or other? _____
15. Do you collect waste: daily_____ once weekly _____ twice weekly _____ weekends _____ public holidays _____ rainy weather _____ other?_____
16. What method do you use to transport your collected item to the point for sale?

_____

17 Name the service provider/s that buys your collected items?_____

18. Approximately how much do you earn from your sales of collected items per day?

_____

THE KEEP DURBAN BEAUTIFUL ASSOCIATION
188 Argyle Road
PO Box 1535
Durban 4000
Tel:(031) 303 1665
Fax:(031) 303 3969

The Principal

WASTE MANAGEMENT EDUCATION PROGRAMME FOR EDUCATIONAL INSTITUTIONS

A big thank you to those schools who responded to the circular that was sent out in **2004** informing you of the selection of activities contained in our Waste Management Education Programme For Educational Institutions. The Keep Durban Beautiful Association aims to be up-to-date with its education resource material and has taken the responsibility to reach out to schools and communities to help them achieve and maintain a clean, healthy and beautiful environment.

It is unfortunate that as a result of the introduction of the National Curriculum Statement by the Department of Education and Culture, all workshops planned for the year had to be suspended pending the finalisation of the restructuring process. The materials used by the Association have however not been adversely affected by the changes. We renew the invitation to schools participate in our Programme, which has the full approval of the KZN Department of Education and Culture.

Please note that a new addition to our Learner Support Material resource pack is now available and is entitled " **Waste Management Learner Support Material For School Environmental Policy".**

Kindly indicate in which areas of the Programme your school will be interested by completing the form below and send it to us as soon as possible:

1. Awareness materials in the form of posters, lapel badges, decals, etc promoting correct waste management.

2. A Pre-primary School Kit which includes work sheets, classroom/ playground activities, items to make from waste and a story book.

2\

Education Division of DSW
17 Electron Road, Springfield, 4000
Tel:(031) 302 4836/4911 Fax:(031) 2631119

THE KEEP DURBAN BEAUTIFUL ASSOCIATION
198 Argyle Road
PO Box 1535
Durban 4000
Tel:(031) 303 1665
Fax:(031) 303 3969

WASTE MANAGEMENT EDUCATION PROGRAMME REPLY SLIP

Name of School _____

Physical Address _____

_____

Postal Address _____

_____

Tel. Number _____ Fax Number _____

Email _____

Contact Person _____

Please indicate with a tick which resources you require further information on:

- ☐ Awareness material
- ☐ Pre-primary school kit
- ☐ Support material
- ☐ The Primary School Manual
- ☐ The Doorstep Environment Programme
- ☐ Let's Reduce and Recycle manual
- ☐ Training for Educators
- ☐ Info on Clean Community systems
- ☐ Guidelines
- ☐ Access to the Adopt-A-Spot Programme
- ☐ Competitions and awards programmes
- ☐ Use of a resource Centre
- ☐ Educational Tours

Please return form to:

Ms Lezi Ngqulunga
PO Box 1535
DURBAN
4000

For further information contact Lezi Ngqulunga on: telephone number 031-3031665; fax 031-3033969; or email ntombing@dmws.durban.gov.za

APPENDIX E

KEEP DURBAN BEAUTIFUL ASSOCIATION

DOORSTEP ENVIRONMENT PROGRAMME

APPLICATION FOR MEMBERSHIP

SURNAME: _____

CHRISTIAN NAME: _____

DATE OF BIRTH: _____

STD/ CLASS: _____ YEAR: _____

SCHOOL: _____

ADDRESS: _____

_____

_____ CODE_____

LEVEL APPLIED FOR: _____

_____ _____

Pupil's signature Parent's signature

_____

Date

FOR OFFICE USE

Registration No: _____

Registration Fee Paid: _____

Certificates Issued:

Level	Bronze	Silver	Gold
One			
Two			
Three			
Four			

APPENDIX F

KEEP DURBAN BEAUTIFUL ASSOCIATION
DOORSTEP ENVIRONMENT PROGRAMME
MEMBERSHIP RECORD CARD

NAME: ..... DATE OF BIRTH: .....

SCHOOL: .....

LEVEL ONE		LEVEL TWO		LEVEL THREE		LEVEL FOUR	
Test	Date	Test	Date	Test	Date	Test	Date
1		1		1		1	
2		2		2		2	
3		3		3		3	
4		4		4		4	
5		5		5		5	
6		6		6		6	
7		7		7		7	
8		8		8		8	
9		9		9		9	
10		10		10		10	
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