

SOLID WASTE MANAGEMENT IN JAMAICA:
AN INVESTIGATION INTO WASTE REDUCTION STRATEGIES

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This report, “Solid Waste Management in Jamaica: An investigation into waste reduction strategies” is hereby approved in partial fulfillment of the requirements for the Degree of MASTER OF SCIENCE IN CIVIL ENGINEERING.

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Preface

The solid waste reduction study described in this report took place during the author's service as a Peace Corps Volunteer in the Parish of St. Ann, Jamaica from August 2005 to June 2007. The author worked as a Sanitation Engineer with the Northeast Regional Health Authority, a division of the Ministry of Health.

This report is submitted in order to complete the requirements of the author's master's degree in Civil Engineering from the Master's International Program in Civil and Environmental Engineering at Michigan Technological University. This report describes the study that was completed in order to identify appropriate solid waste management solutions for rural communities in the Parish of St. Ann.

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Abstract

Waste reduction is recognized by the United Nations as a logical starting point for sustainable solid waste management. The USEPA defines waste reduction as “a broad term encompassing all waste management methods – source reduction, recycling, and composting – that result in a reduction of waste going to a landfill or combustion facility.” Waste reduction strategies have received much attention in developed countries, leading to increased understanding of their application and thus their ultimate societal prevalence.

In developing countries, such as Jamaica, waste reduction strategies are less familiar but have the potential to resolve the current solid waste issues. The current household solid waste management practices, such as disposal by burning and indiscriminant dumping resulting from inadequate collection, can negatively impact public and environmental health. Additionally, past interventions have not resulted in sustained participation or improvements in solid waste management. Therefore, an investigation is warranted to determine the applicability of waste reduction strategies in Jamaica, based on the local need for long-lasting solutions and the support of waste reduction methods.

In order to identify which waste reductions strategies to promote, the existing solid waste management system in Jamaica is assessed based on a group of factors compiled from waste reduction research in other countries. Public participation is at the center of the investigation since success of waste reduction is reliant on the participation of the individual. The report discusses the factors and describes the research methods used to categorize each factor as either a barrier or an incentive to initiating waste reduction methods. Based on the distribution of barriers and incentives, a series of recommendations is made for improving solid waste management, including proposed methods of waste reduction.

The analysis of factors revealed that the greatest potential for initiating waste reduction strategies exists at the household level through community-based programs. The diversion of food waste from the waste stream is currently achieved through the practice of domestic animal feeding. Expansion of this practice is one of the

recommendations made and other recommendations include initiate yard waste composting, improve collection services, and initiate public education campaigns.

1 Introduction

Solid waste management is an important facet of sustainable development for any nation and prioritizing solid waste management is greatly supported by global initiatives. Agenda 21, the Rio Declaration on Environment and Development, explicitly affirmed that environmentally sound management of wastes was among the environmental issues of major concern in maintaining the quality of Earth's environment and especially in achieving environmentally sound and sustainable development in all countries (UNDESA, 2005).

Sustainable solid waste management was again affirmed by the United Nations Millennium Development Goals (MDGs), adopted by 189 countries and signed by 147 heads of state and governments during the UN Millennium Summit in September 2000 (UNDP, 2007). The MDGs are eight goals to be achieved by 2015 that address the world's main development challenges and recognize the interdependence between growth, poverty reduction and sustainable development. Though not as explicitly stated as in Agenda 21, sustainable solid waste management is indirectly advocated in the seventh goal which addresses environmental sustainability, and aims to integrate the principles of sustainable development into country policies and programs, and reverse the loss of environmental resources.

In the Caribbean region, solid waste management (SWM) is a significant aspect of the sustainable development agenda, and most of the region's SIDS countries have agreed to implement Agenda 21 (UNEP and CEHI, 2004). Jamaica is one of the Small Island Developing States (SIDS) within the Caribbean that has taken action to improve its

solid waste management system. In 1996, the Government of Jamaica started a project to improve solid waste management services across the island (MLG&E, 2006). In the 10 years since the start of the project, some progress has been made with the establishment of the *National Solid Waste Management Authority* and the *National Solid Waste Management Act*. This progress represents a framework for solid waste management in Jamaica; however, gaps and challenges still exist.

In the Parish of St. Ann, centrally located on the north coast of Jamaica, poor household solid waste management is a concern for public health authorities, since vector-borne diseases associated with solid waste, like *leptospirosis*, are a serious threat¹. Recently, a project was done by the Rodent Control Unit of the St. Ann's Bay Health Department to investigate the increase in rodent related complaints in this area of the parish. The high rodent infestation was observed to be primarily the result of poor solid waste management in the area, namely infrequent solid waste collection, indiscriminant dumping, and illegal solid waste dump sites (NERHA, 2006).

These problems exist to some degree in most communities in Jamaica, and consequences exist not only for human health but also for the fragile environment. The proliferation of litter in the towns and cities of Jamaica often result in clogged drainage systems which further leads to flooding. Ground water and surface water sources can be compromised, and soil and air pollution results from poor solid waste management practices². Compromised public and environmental health resulting from inadequate

¹ In 2005, the Northeast Regional Health Authority confirmed 8 cases of *leptospirosis* out of forty-six suspected cases in the Parish of St. Ann (NERHA, 2005).

² A study done in 1989 by the Pan-American Health Organization, showed that the existing SWM system in Jamaica at the time was inadequate, and among the problems identified in association with this were the "actual and potential contamination of surface and groundwater, as well as soil and air pollution." (Pinnock, 1998)

solid waste management can have considerable impacts on the future development of Jamaica. Further investigation is therefore necessary to identify sustainable solutions for the management of household solid waste in Jamaica.

Waste reduction is said to be a logical starting point for sustainable solid waste management, by reducing the amounts of waste that must be managed, by collection and disposal (UNEP, 1996). Chapter 21 of Agenda 21 emphasized that reducing wastes and maximizing environmentally sound waste reuse and recycling should be the first steps in waste management. This concept was introduced by Agenda 21 and illustrated by the *waste hierarchy*, which is a stepwise approach to waste management.

The general principle of the *waste hierarchy* consists of the following steps, in order of environmental priority: 1) minimizing waste, 2) maximizing environmentally sound waste reuse and recycling, 3) promoting environmentally-sound waste disposal and treatment, and 4) extending waste service coverage.

The United States Environmental Protection Agency (USEPA) defines waste reduction as “a broad term encompassing all waste management methods – source reduction, recycling, and composting – that result in reduction of waste going to a landfill or combustion facility” (USEPA, 1995). Waste reduction has also been identified by the UNEP’s *Directory of Environmentally Sound Technologies (ESTs) for the Integrated Management of Solid, Liquid, and Hazardous Waste for Small Island Developing States in the Caribbean Region*, to be suitable to the environmental, economic, climatic, cultural and social context of the Caribbean Region (UNEP and CEHI, 2004).

The components of waste reduction included in the USEPA definition have been the focus of past research in developed countries such as the United States, Canada, and

Great Britain, which are farther along in adopting these strategies. Specifically this research has focused on identifying the factors that influence public participation in order to meet the waste reduction goals set forth by the respective governments. Unfortunately, fewer studies have addressed waste reduction strategies within the context of developing countries. Chung and Lo (2004) observe that “there is a real need to measure and study waste management or other environmental behavior in developing societies in its own right so that unfamiliar relations and important factors that prevail will not be overlooked.”

1.1 Objectives

In Jamaica, where waste amounts are increasing as a result of increasing population and where human and environmental health problems exist due to the currently low collection efficiency and environmentally unsustainable methods of disposal, waste reduction is a solution that warrants investigation. Based on the significance of Agenda 21 and the recommendations implied by the *waste hierarchy* for sustainable solid waste management in developing countries, the present research will consider all aspects of waste reduction that are included in the USEPA definition, including source reduction, recycling, and composting.

Despite the differences between developing and developed countries, specifically in terms of solid waste management, the findings from previous research provide insight as well as a foundation for similar research in developing countries. Therefore, this study investigates the existing solid waste management system in Jamaica based on the factors

that have been shown to be influential in successful waste reduction initiatives in other countries.

A significant component to successful waste reduction programs is public participation, and recognizing and understanding the factors that influence participation is important in the effort to identify and promote sustainable solid waste management solutions (McKenzie-Mohr, 2000). Within the realm of household solid waste management, the individual is the primary waste generator and primary user of the waste management system, so in identifying waste management solutions, the ultimate goal should be to develop strategies that enable long-term commitment and participation.

In light of the fundamental importance of public participation in the overall success of initiating waste reduction, this component will be emphasized in the present study. Therefore, the overall goal of this research is to identify the waste reduction strategies that should be promoted to improve management of household solid waste, based on the extent of the existing barriers and incentives within the solid waste management system while considering public participation. The following specific objectives will be pursued in order to achieve the overall goal of the research:

1. Compile a list of factors that have been shown to influence waste reduction initiatives and behavior by a review of previous waste reduction research from developed and developing countries.
2. Develop research methods to gather information about the existing management system of household waste in Jamaica using the factors as a guide.
3. Determine whether each factor can be considered a barrier or an incentive to public participation of waste reduction strategies based on the synthesis of information.
4. Recommend the waste reduction strategy(ies) that should be promoted based on extent of barriers and incentives.

2 Review of Literature

The present study focuses on the three components of waste reduction – recycling, composting, and source reduction – with the aim of identifying the strategy(ies) that should be promoted for improved management of household solid waste in Jamaica. This section will review past waste reduction research conducted in developed and developing countries, so as to compile a group of factors that will be the basis of the assessment of the existing solid waste management system in Jamaica. The following discussion of past research addresses factors that influence waste reduction in terms of individual participation and behavior, and factors that influence overall feasibility of implementing these strategies.

A few studies have already investigated various waste reduction strategies in the context of developing countries. For example, Troschinetz (2005) investigated recycling of municipal solid waste in developing countries, and Pendley (2005) considered large-scale composting specifically in Jamaica. These studies are relevant to the present study, and will be highlighted in this section.

Troschinetz (2005) identified twelve factors influencing sustainable recycling in developing countries, while considering the three dimensions of sustainability – environment, society, and economy. The factors were derived from quantitative and qualitative examination of twenty-three case studies of developing countries. The factors were then subjectively designated as either a barrier against or an incentive toward recycling, based on interpretation of statements made in the individual country-specific case studies. The twelve factors identified are:

1. Government Policy
2. Government Finances
3. Waste Characterization
4. Waste Collection and Segregation
5. Household Education
6. Household Economics
7. Municipal Solid Waste Management (MSWM) Administration
8. MSWM Personnel Education
9. MSWM Plan
10. Local Recycled-Material Market
11. Technological and Human Resources
12. Land Availability

Jamaica was one of the twenty-three case studies included. The particular Jamaican source was a study that assessed the feasibility of a composting operation incorporating appropriate technology at the Riverton disposal site in Kingston, Jamaica (Pendley, 2005). Based on the interpretations made by Troschinetz (2005) of the study conducted by Pendley (2005), only two of the twelve factors were considered to be incentives to recycling in Jamaica, namely *Government Policy* and *Government Finances*. Whereas five factors were seen to be barriers to recycling, including *Waste Collection/Segregation*, *Household Education*, *MSWM Administration*, *Local Recycled-Material Market*, and *Technological & Human Resources*, the remaining five factors were not apparent in the literature source and thus were not included in the results for Jamaica (Troschinetz, 2005, pg. 37).

Pendley (2005) conducted a feasibility study and comprehensive action plan for a large scale municipal composting operation at the Riverton disposal site in Kingston, Jamaica. The rationale for this study came from the desire of the Government of Jamaica to integrate waste reduction strategies into the existing solid waste management (SWM)

system in order to divert compostable waste from the landfill. The operation was designed to process commercial organic waste, not household organics.

The use of appropriate technology for the composting operation was emphasized by Pendley (2005), which the author states is often overlooked in developing countries that import high-tech equipment and designs from aid agencies and developed countries. The author discusses the three main categories of composting technologies: windrow composting, aerated static piles, and in-vessel composting.

The study concluded that a windrow composting operation would be 'economically feasible,' and that the production of compost could be used as a cover material at the Riverton dumpsite, resulting in a significant cost savings (Pendley, 2005). Economic benefit was the primary goal of this composting operation, since the quantities of organic waste originating from the planned sources did not represent significant waste reduction. Significant to the present research, Pendley (2005) suggested that significant waste reduction could be accomplished through source reduction with increased backyard composting, since about 50% of household waste is organic material.

The two studies just examined provide a foundation for further investigation into the feasibility of waste reduction strategies in developing countries. Pendley (2005) concluded that large-scale composting was economically feasible, but suggested that backyard composting and source reduction would result in greater quantities of diverted waste. The research conducted by Troschinetz (2005) suggests that recycling may not be the best option for Jamaica at the present time based on the presence of few existing incentives. Given the limited utilization of information in determining the existing

incentives and barriers to recycling in Jamaica, this component of waste reduction will be examined in more detail in the present research.

2.1 Waste Reduction Behavior

Behavioral change is viewed as a necessary component for solid waste management reform in Jamaica (Figuroa, 1998) and central to achieving a sustainable future (McKenzie-Mohr, 2000). Figuroa also cites that a ‘cultural transformation’ must be recognized in order to implement the waste management policies and programs that research finds to be appropriate for the Jamaican context.

The practice of reducing waste requires individuals to acknowledge the impacts of the waste they generate and then make conscious decisions to generate less, whether it is through reusing materials, altering consumer behavior, or composting food and yard waste. This culture of waste reduction has not been established yet on a large-scale in Jamaica, evidenced by the proliferation of litter, especially plastic and Styrofoam, and the limited extent to which recycling, composting, and source reduction occurs. Affecting behavioral change for reducing waste will require an understanding of the factors that influence individual behavior in regards to waste management.

Much of the research to identify factors that influence waste reduction behavior has focused on increasing participation in a particular waste reduction program. Psychological and internal variables (i.e. personal attitudes, personality, and intentions), demographic variables (i.e. age, income, education, and occupation), and external and situational variables (i.e. access and convenience) are commonly studied to determine how each factor influences pro-environmental behaviors, like waste reduction. Like the

findings of the Troschinetz study, the factors identified in other studies are usually classified as either an incentive or barrier to actual waste reduction behavior. This section will discuss some key findings from waste reduction research, including studies of recycling, composting, and source reduction, in order to reveal the behavioral factors that have been found to be significant in encouraging public participation.

2.1.1 Environmental Concern Is it logical to assume that individuals with concern for the environment will practice pro-environmental behaviors, like recycling, composting, and source reduction? Research has shown that the environmental attitudes of the public have been increasing and expanding to include a variety of demographic groups in developed countries, other than just the urban, well-educated, and affluent groups (Mainieri et al., 1997). More specifically, in the United States, Canada, and Great Britain, recycling programs have also expanded, making recycling possible for more people and therefore lessening the effect of environmental concern (Schultz et al., 1995).

Derkson and Gartell (1993) compared communities in Edmonton Canada that had varying access to recycling programs and found that environmentally concerned individuals will recycle if provided the opportunity and, more importantly, even unconcerned individuals will participate when granted access to the program. Schultz and Oskamp (1996) investigated whether general environmental attitudes and concern are strong predictors of behavior when the amount of effort required for the behavior is high. The research showed that environmental concern predicted recycling behavior only when the amount of effort required for action was high. Instead, behaviors have proven to be more significantly influenced by specific attitudes about recycling, like knowledge of

waste reduction methods, access to programs, time, effort, and convenience (Oskamp et al., 1991; Vining and Ebreo, 1992; Schultz et al., 1995; Derkson and Gartell, 1993; Schultz and Oskamp, 1996). The past recycling research suggests that an individual's level of environmental concern may not guarantee their participation in a recycling program, but in fact other factors may relate more significantly to their actual behavior.

Source reduction is considered an innovative waste management behavior compared to recycling, which has become a social norm in developed countries. In a study about environmentally-responsible consumerism, Ebreo et al. (1999) found that general concern for the environment, in addition to social factors and more specific concerns about the effect of the product on human and animal life might be related to purchase decisions and other waste reduction behaviors. Ebreo et al. suggest environmental concern and attitudes towards the environment are still significant in relation to source reduction, specifically in relation to environmentally-responsible consumerism.

The difference between source reduction and recycling in terms of an individual's concern for the environment suggests that environmental concern is still a significant predictor of behavior in situations where the waste reduction strategy is not widespread. In Jamaica waste reduction activities are not a staple of the existing waste management system and are not salient among the public. Thus, in order to initiate waste reduction programs in Jamaica, a significant level of environmental concern may be required among the public, and this may need to be recognized by the solid waste management sector.

The expansion of environmental concern and proliferation of waste reduction programs are equated to a rise in *social capital* in the environmental field that has been accumulating since the 1970s in developed countries (Figueroa, 1998). The concept of social capital is introduced by Figueroa as a way in which a community can be an economic resource for the municipality by transferring solid waste management activities from the public sector to the household sector, for example, by employing waste reduction strategies to lower collection and disposal costs. Figueroa suggests that in order to see the economic benefit, a community must first accumulate a certain level of social capital with respect to environmental issues before a municipality can get the public to voluntarily take over aspects of solid waste management.

Figueroa (1998) illustrates that in Canada, savings have been realized in both the economic and environmental realms within the solid waste management sector by the utilization of backyard composting. In addition to the direct savings to the municipality, the involvement of households in disposing of their own garbage can potentially bring them to a greater sense of environmental responsibility as well as raise the individual's responsibility to deal with the pollution that they create. But this cultural transformation has yet to occur in Jamaica as the author states, where backyard composting is practiced on a limited basis and from a traditional gardening perspective rather than for environmental reasons.

By initially encouraging voluntary transformation of solid waste management practices, like backyard composting, the household will garner support for compliance with future solid waste regulations and reforms. Encouraging other more environmentally sustainable waste management practices, Figueroa (1998) states, 'could

begin to bring the environmental social capital to a critical threshold, at which point there would be sufficient popular consciousness, knowledge, organization and experience to support the reshaping of waste practices' (pg. 40). Therefore, despite the decreased significance of environmental concern related to waste reduction in developed countries, it is possible that in the case of developing countries like Jamaica, the existing level of environmental concern will need to be increased before households begin to participate in waste reduction programs.

2.1.2 Knowledge, Access, and Convenience Knowledge of waste reduction methods can either motivate individuals to participate, or inadequate knowledge can be a barrier to waste reduction behavior. In a study investigating motivating factors and barriers to recycling behavior in New Jersey, Simmons and Widmar (1990) answered the question: "what influences individuals to reduce their own production of garbage and to participate in recycling programs?" The study concluded that a lack of knowledge and a lack of personal salience and efficacy were barriers that interfered with the motivating effect of a person's sense of responsible action and conservation ethic. Therefore, without the information and perception of individual ability to reduce waste, the individual will not act on their internal sense of responsibility by participating in waste reduction programs.

In a review of the empirical psychological research regarding recycling behavior, Schultz et al. (1995) observed that recyclers in the past were characterized to have a high level of social responsibility, whereas presently internal responsibility must be accompanied with knowledge of how and what to recycle. A meta-analysis of recycling

research dating back to 1968 by Hornik et al. (1995) showed that there are four groups of variables that predict recycling behavior, where the strongest predictors are internal facilitators, such as having knowledge of how and what to recycle and awareness of the importance of recycling.

Increasing the knowledge of waste reduction for the targeted population has been seen as a necessary method of increasing public participation in waste reduction programs. This point is illustrated in the study conducted by DeYoung et al. (1993) which focused on strategies to motivate waste reduction behavior in Chelsea, Michigan in order to divert 30% of the waste stream from the landfill, through recycling, composting and source reduction. A survey was employed to examine the influence of information and prompting techniques on waste reduction behavior in four treatment groups. The treatment group that received a combination of environmental and economic reasons (information and prompts) to reduce waste showed the most significant increase in self-reported waste reduction behavior, in comparison to the treatment groups that received only environmental or economic reasons.

The perception of waste reduction programs as being inconvenient and inaccessible have been found to be barriers for public participation in waste reduction methods. Access to waste reduction programs facilitate a process which enables individuals to act upon their pro-environmental attitudes, changing a non-recycler into a recycler (Vining and Ebreo, 1992). “Accessibility to a structured, institutionalized program that is easy and simple to use, has been described as the most important determinant of recycling behavior,” by Derkson and Gartell (1993).

Waste reduction strategies require individuals to invest personal resources, like time, space, money, and effort. Hornik et al. (1995), discusses these barriers and categorizes them as ‘external facilitators,’ one group of four groups of variables that predict recycling behavior. The authors explain that reducing these barriers is one of the criteria for achieving long-term commitment and participation.

Figueroa (1998) states, “there is very little broad consciousness in Jamaica concerning the importance of solid waste reform,” which suggests that the public is not knowledgeable about the importance of waste reduction practices, not to mention the logistics of recycling, composting, and source reduction. In addition, there is very limited access to existing waste reduction opportunities and the few that exist are inconvenient to most living outside of the capital of Kingston. Therefore it will be necessary to create an environment that enables individuals to participate in waste reduction programs, by establishing the necessary infrastructure to provide greater access to programs and educational information on the logistics of these strategies.

2.1.3 Demographic Variables

Demographic variables have proven to be inconsistent predictors of recycling (Schultz et al., 1995) and other waste reduction behavior. Hornik et al. (1995) found that no single demographic variable considered in the study was found to be a strong predictor of recycling, while others found that a high income level (Oskamp et al., 1991) and older age positively related to recycling behavior (Scott, 1998). Ebreo and Vining (2001) examined reasons and justifications for peoples’ self-reported recycling and source reduction behaviors, and found that a number of demographic variables were related to the waste reduction behavior. Specifically,

employment status, occupation, gender and type of housing were related to recycling behavior, and the same variables as well as household size were related to source reduction.

Oskamp et al. (1991) conducted a survey in a suburban community with an existing curbside recycling program, and found that most of the demographic variables tested, specifically age, education as well as having a liberal political orientation did not distinguish between recyclers and non-recyclers. However, the study found that recyclers had significantly higher family incomes than non-recyclers and were more likely to own their own home, which proved to be the most significant factors in predicting recycling behavior.

2.1.4 Translation of Behavior

More attention has been paid to identifying factors that influence recycling than identifying factors that influence other waste reduction methods, like source reduction and composting. Antecedents of various waste behaviors, including recycling, reuse, and waste reduction was the focus of a study conducted by Barr et al. (2001) in Exeter, England. The findings revealed that recycling is a much more ‘definitive behavior’ than waste reduction and reuse, where respondents reported that they either always or never recycled, whereas waste reuse and reduction were practiced with less defined frequency. The author suggests that recycling predictors are logistical in nature (i.e. access, knowledge, and convenience) and norm based, whereas reuse and reduction predictors are values and concern-based, and individuals that practice reduction and reuse have internalized the waste problem.

Recycling and composting are technological strategies to waste management, whereas source reduction relies heavily on behavioral change. Recycling and source reduction are two different forms of conservation behavior (Ebreo et al., 1999), but research has shown that individuals view recycling as a source reduction strategy, not a separate waste reduction strategy (Ebreo and Vining, 2001). In comparisons of waste reduction methods, one behavior has been found to not be a sound predictor of another behavior, and that each behavior is influenced by different variables (Ebreo and Vining, 2001; Oskamp et al., 1991).

2.2 Sixteen Factors Based on the previous review of the literature, a group of sixteen waste reduction factors has been identified from past research in developed and developing countries, which will be the basis for evaluating the existing solid waste management system. The sixteen factors are:

1	Government Policy	9	MSWM Plan
2	Government Finances	10	Local Materials Market
3	Waste Characterization	11	Technological and Human Resources
4	Waste Collection and Segregation	12	Land Availability
5	Household Education	13	Environmental Concern
6	Household Economics	14	Knowledge
7	MSWM Administration	15	Access and Convenience
8	MSWM Personnel Education	16	Demographics

The following section provides an overview of the study area, as well as an overview of the national, regional, and local spheres of the existing solid waste management system. Information and data from the three realms will be gathered through quantitative and qualitative research methods in order to achieve the overall goal

of the present study. A detailed description of the methods used in the present study is provided in Chapter Three.

2.3 Background

2.3.1 Jamaica Jamaica is an island nation located in the Caribbean Sea (Figure 2.1), with an area of approximately 11,000 square kilometers, slightly smaller than the state of Connecticut (CIA Factbook, 2007). The climate is considered to be tropical, with hot and humid coasts and a temperate interior. Jamaica is mostly mountainous with 1,022 km of discontinuous coastal plain (CIA Factbook, 2007).



Figure 2.1: Map of Caribbean Sea (CIA Factbook, 2007). Jamaica is located in the center of the figure just south of Cuba.

2.3.1.1 Population In 2004, the population of Jamaica was approximately 2.65 million, with a gender distribution of 49.3% males and 50.7% females. The working group of the population, represented by ages 15 through 64 years old, constituted 61.9%.

Approximately one-third of the population is under 15 years old, and the elderly portion (65 years old and older) constitutes roughly 8% (PIOJ, 2005).

2.3.1.2 Economy The Jamaican economy is heavily dependent on the services industry, accounting for 71.9% of the total GDP in 2005 (PIOJ, 2005). The Jamaican economy derives most of its foreign exchange from remittances, tourism, and bauxite/alumina mining (CIA Factbook, 2007). The Gross National Income (GNI) per capita in Jamaica in 2005 was \$3,400 in current US dollars (Atlas Method), and the Gross National Product in 2004 equated to US\$8.9 billion (World Bank, 2007). Jamaica is ranked 99th of nations based on the reported per capita GNI, defining Jamaica as a ‘developing country’ because it is considered one of 58 ‘lower-middle income’ economies (GNI between \$876 and \$3,465) in the world (World Bank, 2007). *The Jamaica Survey of Living Conditions 2003*, which reports findings in relation to estimates of household consumption and poverty, showed that in 2003 the annual mean per capita consumption, at current prices was JA\$88,062³ (PIOJ and STATIN, 2005, pg. 1). The average national incidence of poverty in 2003 was at 19.1%, representing the population living below the poverty line of JA\$40,611 per annum (PIOJ and STATIN, 2005, pg. 7).

2.3.2 Parish of St. Ann The Parish of St. Ann is centrally located along the north coast of Jamaica. It has an overall area of 1,212.6 square kilometers, making it the largest of the fourteen parishes. St. Ann is bordered by the Caribbean Sea to the north,

³ According to the CIA Factbook, the exchange rate in 2003 was 57.741 Jamaican dollars per US dollar; 61.197 (2004), 62.51 (2005), 65.768 (2006).

the Parish of St. Mary to the east, Parish of Trelawny to the west, and the Parishes of Clarendon and St. Catherine to the south.

The 2001 Census showed the population of St. Ann to be approximately 166,700, making St. Ann the 6th most populated parish (Statistical Institute of Jamaica, 2001). A more recent estimate of Parish population based on birth and death rates since the 2001 Census, shows that the population in 2005 was approximately 174,399 (Statistical Institute of Jamaica, 2005).

Gender is relatively evenly distributed in the parish, where the male population is 50.4% (83,982) and the female population is 49.6% (82,780). The largest single age group within the population is the 5-9 year old age group, at 11.54%. The *working group* (15 – 64 years old) comprises almost 59% of the population. The portion of the population that is 65 years and older constitutes roughly 8% (Statistical Institute of Jamaica, 2001). The distribution of urban and rural populations is shown in Table 2.1, and it can be seen that the urban population has been increasing since the early 1980s.

Table 2.1: Urban and Rural Population of the Parish of St. Ann, 1982-2001 (Statistical Institute of Jamaica, 2001)

	2001	%	1991	%	1982	%
St. Ann	166800	100	149400	100	137700	100
Urban	44600	26.7	36600	24.5	26000	18.9
Rural	122200	73.3	112800	75.5	111700	81.1

The capital of St. Ann, St. Ann’s Bay has been the traditional administrative, institutional and service center of the Parish. However in recent times Ocho Rios has surpassed the capital in growth, developing into one of the island’s leading tourist destinations. Second only to Montego Bay, St. Ann generates a large income from

tourism (MLG&E, 2006). Economic livelihood in St. Ann is also derived from bauxite mining and agriculture.

The *Jamaica Survey of Living Conditions, Parish Report 2002* stated that the annual mean per capita consumption expenditure in 2002 for St. Ann was JA\$48,508, which is 42.4% below the national consumption expenditure of JA\$82,248. The findings also showed that St. Ann had the lowest mean per capita consumption in Jamaica, and the highest incidence of poverty, at 37.0%, compared with the national poverty rate of 19.7% (PIOJ and STATIN, 2002).

2.4 Waste Management in Jamaica

2.4.1 History of the National Solid Waste Management Authority

Historically solid waste management was, by law, the responsibility of the Parish Councils and local authorities at the parish and local levels in the form of five Parks and Markets companies. These companies, responsible for collection and disposal, were wholly owned by the Government of Jamaica. The *National Solid Waste Management Policy*, created by the Ministry of Local Government in 2000, examined consolidating waste collection to a single agency.

The National Solid Waste Management Act 2001 was developed to improve on the historically fragmented solid waste legislation. Additionally, the *Act* established the *National Solid Waste Management Authority* (NSWMA), the principal solid waste management agency with responsibility for planning and research, human resources, and regulations. As it assumed the responsibilities of solid waste management, the NSWMA

subsumed the management of the Parks and Markets companies island-wide (The Daily Gleaner, 2006).

Currently there are four regional Parks and Markets companies which are divisions of the NSWMA (Table 2.2). Each regional office serves one *wasteshed*, which have been defined based on ‘the most effective and feasible collection and disposal network that can be implemented’ (NSWMA pamphlet, 2003). The Parks and Markets companies are responsible for solid waste management operations, such as street cleaning, collection and disposal site management within the parishes they operate.

Table 2.2: The four regional Parks and Markets Agencies currently within the National Solid Waste Management Authority and the Parishes in which they operate (NSWMA, 2000)

Regional Parks and Markets Agency	Parishes Served
Metropolitan Parks and Markets (MPM)	Kingston and St. Andrew, St. Catherine, St. Thomas
Southern Parks and Markets (SPM)	Manchester and St. Elizabeth, Westmoreland
Western Parks and Markets (WPM)	Hanover, St. James, Trelawny
Northeastern Parks and Markets	St. Ann, St. Mary, and Portland

2.4.2 Waste Generation and Composition

The most comprehensive data for solid waste generation and waste stream composition in Jamaica can be found in the *Comprehensive Solid Waste Management Study* conducted by Norconsult International in 1996 (Norconsult/GOJ, 1996). This document is used by the *National Solid Waste Management Authority* for its statistical information in preparing reports and is the guiding document when NSWMA is considering the projections and recommendations given in the report.

The Norconsult study findings are presented in Table 2.3. This table shows that waste generated at the household level comprised more than half (55%) of the total municipal solid waste generated in Jamaica, and the average daily per capita generation rate was approximately 0.39 kilograms. The daily per capita generation rate for household waste in the Parish of St. Ann was determined to be 0.38 kilograms, as indicated in Table 2.3 under the heading ‘parish with extensive tourist industry’. The waste quantities and characteristics provided in Table 2.3 were determined from field investigations and analyses at the existing dumps of Riverton, Retirement, and Lakes Pen. This data are not adjusted for generated waste that is either dumped or burned by individual households.

Table 2.3: Household and total solid waste generation rates for three zones of Jamaica: 1) Kingston and the parish of St. Andrew, 2) Parishes with extensive tourism industry, and 3) Other Parishes (Adapted from Table 2-4 in Norconsult/GOJ, 1996).

Waste Type	Kingston and St. Andrew		Parishes with Extensive Tourist Industry*		Other Parishes	
	kg/cap/year	kg/cap/day (& %)	kg/cap/year	kg/cap/day (& %)	kg/cap/year	kg/cap/day (& %)
Household	155	0.42 (55%)	140	0.38 (59%)	140	0.38 (63%)
Other wastes	125	0.33 (45%)	100	0.27 (41%)	80	.22 (27%)
Total MSW	280	0.75	240	0.65	220	0.6

* Applied for Westmoreland, St. James, and St. Ann

A more recent daily per capita waste generation rate of 1.0 kilograms or 2.2 pounds (0.365 tons/person/year) was determined by the NSWMA in 1999. This value is still used by NSWMA and was determined based on data gathered from the Riverton wasteshed. By using census data, the generation rate is extrapolated to determine the generation rates in other parishes (NSWMA, 2003). Using this methodology, based on the 1.0 kg/person/day generation rate and the population of St. Ann in 2005 of 174,339 (Statistical Institute of Jamaica, 2005), the total daily generation rate for the parish is

approximately 174,000 kilograms or approximately 190 tons. This figure represents approximately 7 per cent of the approximately 2,900 tons of solid waste generated in Jamaica every day⁴.

A waste characterization study of household waste was conducted by the Planning and Research Department of NSWMA in 2003. Waste stream composition data from both studies is presented in Table 2.4, and only slight variations exist between the respective waste stream components. The waste stream component ‘other’ has the largest discrepancy between data sets, since the Norconsult study included more waste types in this category compared to the NSWMA, such as diapers, rubber and leather, and fines.

Table 2.4: Comparison of household waste stream composition data (Adapted from Norconsult/GOJ, 1996 and NSWMA, 2003). Data in this table is compiled from the Norconsult Study conducted in 1996 (Table 2-22) and a waste characterization study conducted in 2003 by the Planning and Research Department of the National Solid Waste Management Authority. Both sets of data represent waste in the Kingston Metropolitan Area of Jamaica

Waste stream component	Norconsult Study (1996)	NSWMA (2003)
Food waste	30.7	53.7
Yard waste	10.3	
Paper/Cardboard	20.4	17.3
Plastic	10.5	11.8
Metal (all types)	4.7	4.3
Glass	3.4	4.3
Textile	4.0	2.9
Other	15.9	4.5

2.4.3 Storage, Collection, and Disposal Waste containerization is not regulated by NSWMA, but left up to the household, which has resulted in a myriad of waste storage containers. In a containerization study conducted in Jamaica, Gage (1998) found that in the low-income areas any convenient container was typically used,

⁴ In comparison, the daily per capita waste generation rate for United States in 2005 was 4.54 lbs or 2.06 kg and in that year, 245.7 million tons of municipal solid waste was generated (USEPA, 2006).

including small plastic bags, milk crates, five gallon pails, and cardboard boxes. On the other hand, in the middle and high-income communities, welded expanded metal receptacles located at the curbside were used to store bagged waste until collection occurred.

Gage proposed that container type determines how long the waste can be kept before collection, so for example the smaller the container, the shorter the period, since odors develop as the waste begins to decompose. If the waste is not stored in a proper container, disease vectors such as flies and rats are attracted. Improper storage can also cause the waste to be scattered by animals, which can have further consequences on the public health of the surrounding community. Solid waste problems are exacerbated when the collection cycle does not match the disposal cycle dictated by the storage container, leading to the use of unsustainable disposal methods such as illegal dumping and burning.

Plastic bags, if used alone and not collected frequently, are vulnerable to scavenging animals, like dogs and rats that break open the bags in search of food and thus scatter the waste. Containers, such as milk crates, five-gallon PVC pails, and cardboard boxes are small containers that also require frequent collection, and attract pests due to the odors of decomposition. The best containers are those that have a lid, are vermin proof and are able to contain all the waste generated between times of collection, but that can be safely handled by waste collectors (Gage, 1998).

Collection of household waste is supplied by NSWMA through the regional Parks and Markets (PMs) waste management companies. In the Parish of St. Ann, the Northeast Parks and Markets Waste Management Limited (NEPM) is the primary body

responsible for household solid waste management. NEPM is also charged with the Parishes of St. Mary and Portland.

In areas that do not receive collection services by NEPM, households utilize other disposal methods. The *2001 Population Census* data shown in Table 2.5 illustrates the various types of household solid waste disposal methods reportedly utilized by the 45,380 households in the parish of St. Ann (Statistical Institute of Jamaica, 2001). As Table 2.5 shows, the majority (58 %) of households in St. Ann reported burning, followed by regular public collection (31%). In comparison, the national disposal practices illustrate a more even distribution between public collection and burning, probably as a result of the high urban populations in Kingston and Montego Bay that have better access to collection services.

The data presented in Table 2.5 also reveals that unsustainable disposal methods are practiced more frequently by rural households than urban households. Curb-side collection by NEPM, represented by 'Regular Public Collection' was reported by a higher percentage of urban households (63.4%) than rural households, whereas a higher percentage of rural households reported burning (87.7%).

Table 2.5: Percent distribution of disposal methods by Jamaican households and urban and rural households in the Parish of St. Ann (Statistical Institute of Jamaica, 2001)

Disposal Method	% of Jamaica households	Total St. Ann Household	% of total St. Ann Households	Urban % of total St. Ann households	Rural % of total St. Ann households
Total	100.0	45380	100.00	28.49	71.51
Regular Public Collection	41.86	13929	30.69	63.44	36.56
Irregular Public Collection	5.89	654	1.44	47.71	52.29
Private Collection	0.46	316	0.70	12.66	87.34
Burn	43.03	26236	57.81	12.33	87.66
Bury	1.17	643	1.42	7.00	93.00
Dumping (all types)	6.01	2947	6.49	9.33	90.70
Dumping: Sea/River/Pond	1.00	222	0.49	9.46	90.99
Dumping: In own yard	2.74	1764	3.89	5.67	94.33
Dumping: At Municipal Site	1.36	506	1.12	20.36	79.64
Dumping: Other	0.91	455	1.00	11.21	88.79
Other	0.27	196	0.43	14.29	85.71
Not reported	1.32	458	1.01	34.06	66.16

Jamaica has no sanitary landfills, but rather six official dumpsites located regionally around the island. The disposal sites lack the technical components of sanitary landfills due to insufficient funding, as well as lack appropriate equipment for adequate regular treatment of the waste. The *National Solid Waste Management Policy* (NSWMA, 2000) cites a number of sanitary and environmental problems associated with them:

- Leaching of toxic and hazardous substances as sites are unlined
- Transmission of infections to sorters and livestock that rummage through the waste
- Uncontrolled burning as a result of spontaneous combustion from wastes
- Foul odors, vermin and flies resulting from uncovered waste

2.4.3 Public perception of solid waste in Jamaica

The public's perception of solid waste was last documented in *The Survey of Environmental Awareness and Attitudes in Jamaica 1998*, conducted by the National Resource Conservation Authority (NRCA), which assessed the attitudes of the Jamaican public towards environmental issues. A significant result of the study, relevant to the

current study, found that the issue of ‘garbage’ was a major concern for respondents (Espeut, 1999).

In an unprompted question, the respondents were asked to name the major issue they opined to be facing the Jamaican environment. ‘Garbage disposal’ was the single biggest concern (17.7%), up from 10.9% in a similar survey conducted in 1991. The top five environmental issues are presented in Table 2.6.

Table 2.6: Top five issues facing the Jamaican Environment, 1991, 1998 (Adapted from Table 3.8 of *The Survey of Environmental Awareness and Attitudes in Jamaica 1998*). The table represents the top five most commonly reported issues to be named ‘major’ by 82.3% of respondents that provided a response to the unprompted question.

Major Issue	1998 (%)	1991 (%)
Garbage disposal	17.7	10.9
Poverty	13.7	NA
Deforestation	11.8	6.9
Air pollution	5.6	6.8
Poor sanitation (sewage)	3.9	14

In addition to naming the one major issue facing the environment, as shown in Table 2.6, the respondents were also able to name as many as four other issues, and again garbage disposal was the most frequently reported subsidiary issue, at 18.3% (Table 2.7). A comprehensive list of unprompted responses was then formed, combining the principal and subsidiary concerns. Table 2.8 shows that the public’s concern about garbage had doubled from 1991 to 35.9% (Espeut, 1999).

Interestingly, when asked to identify among a list of ten issues which impacted most negatively on the Jamaican environment, the most common response was again ‘household garbage’ at 22.5%, receiving a greater response than the unprompted questions (Table 2.6). Espeut (1999) suggests the actual level of public concern about the

impact of solid waste on the environment lies somewhere in between the unprompted (17.5%) and the prompted (22.5%) responses.

Table 2.7: Other Issues facing the Jamaican Environment (Adapted from Table 3.9 of *The Survey of Environmental Awareness and Attitudes in Jamaica 1998*). The table represents the top five issues that were reported as secondary concerns by those respondents that provided a response to the unprompted question.

Subsidiary Issue	1998 (%)	1991 (%)
Garbage disposal	18.3	7.1
Poor management of towns and cities	14.2	NA
Deforestation	12.4	7.1
Air pollution	8.9	10.0
Water Pollution	8.9	NA

Table 2.8: Top five issues in the comprehensive list of issues facing the Jamaican Environment, 1991, 1998 (Adapted from Table 3.10 of *The Survey of Environmental Awareness and Attitudes in Jamaica 1998*). The table represents the top five issues in a comprehensive list of concerns about Jamaican environment obtained without prompting.

All Issues	1998 (%)	1991 (%)
Garbage disposal	35.9	18.1
Deforestation	24.2	14.0
Poverty	19.3	NA
Poor management of towns and cities	17.0	NA
Air pollution	14.5	16.8

Table 2.9: Ranked Importance of various National Issues, Jamaica (Adapted from Table 3.18 of *The Survey of Environmental Awareness and Attitudes in Jamaica 1998*)

National Issue	Percentage of respondents ranking issue 'Most Important'
Cost of Living	29.1
Unemployment	28.8
Crime	28.1
Garbage Disposal	4.9
Overpopulation	2.3
Deforestation	1.3
Sewage	1.3
Air Pollution	1.2

When compared to social issues, like unemployment, crime, and cost of living, garbage ranked considerably lower among the important issues reported by respondents,

as shown in Table 2.9. The data presented in Table 2.9 illustrates the reality of life, where environmental issues and the concern for the environment are easily forgotten or diminished in light of the other social issues facing the country. Regardless of the actual hierarchy of issues in Jamaica, solid waste is still negatively impacting human health and the environment in Jamaica, and the need for sustainable solutions is apparent.

2.4.5 Importance of Waste Reduction Data show that rural areas are underserved by regular public collection which is leading to the unfortunate use of unsustainable disposal methods, like open burning (Table 2.5). There is evidence that Jamaicans are significantly concerned about the environmental issue of solid waste (Table 2.8), which poses well for improving the solid waste management system in Jamaica. In light of the ever present need for solid waste disposal and the prevalence of unsustainable practices, the most need exists for sustainable solutions in the rural communities of Jamaica. Waste reduction strategies may benefit the rural communities of Jamaica the most, since these strategies reduce the amount of solid waste requiring collection, thereby reducing the households' need for collection or use of unsustainable disposal methods. Therefore, a rural community is the setting for the household survey questionnaire described in Chapter Three of this report.

2.5 Demographics of Study Area The study area is located in the Northwest constituency of the Parish of St. Ann, which was also targeted by the Rodent Control Programme in 2006 (NERHA, 2006). The study area is the site of the

Waste Reduction Study Questionnaire (WRSQ) survey which aims to assess the factors that relate to individual and household waste management.

The demographic characteristics discussed in this section and presented in Table 2.10 are based on the WRSQ survey data collected in February 2007. The WRSQ survey was administered to 79 individuals, and the data represents the demography of the survey respondents and additional household members. Further information about the methodology employed to select the sample and conduct the survey is discussed in Chapter Three.

The overall age distribution of the sample follows a similar trend of the national and parish distribution, as seen in Figure 2.2. The *under 15* portion of the population is the largest age group, constituting 29.3%. The *working group*, represented by the population between 15 through 64 years old, constitutes 59.8% of the household members of the 79 housing units surveyed. The gender distribution is 44.6% male and 55.4% female, which is a wider distribution than both the distribution of St. Ann and Jamaica as shown in Table 2.10.

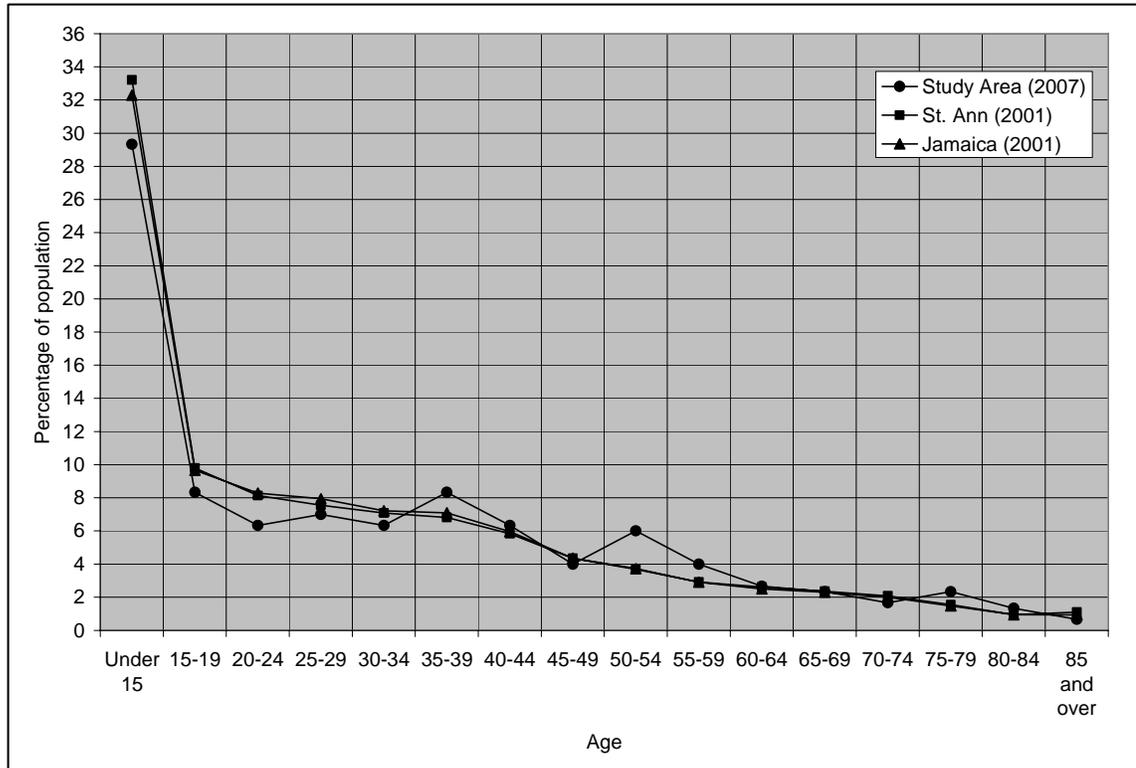


Figure 2.2: Age distribution by percentage of population for Jamaica (Statistical Institute of Jamaica, 2001), the parish of St. Ann (Statistical Institute of Jamaica, 2001), and the Study Area (WRSQ survey, 2007). The data represents the ages of 78 respondents and 298 additional household members. One respondent chose not to provide their age or the demographic information of the other household members.

Primary is the highest attained education level for almost 50% of the study area population that is 15 years and older⁵. In comparison, the Parish and national figures show that the majority of the population over 15 years old has attained a secondary education. Over half (53.3%) of the study area population reported having no income, where these individuals are either unemployed, a student, or not of working age (under 15 years old), 28.8%, 44.4%, and 21.9%, respectively.

⁵ The Statistical Institute of Jamaica provides parish and national data on highest attained education level based on age for individuals 15 years and older.

Overall, the demographic profile of the study area is educated, younger than 50 years old, either employed, in school, or not of working age, and of low economic status.

Table 2.10: Demographic characteristics of the respondents to the survey, the additional household members, and the general population of St. Ann and Jamaica (Statistical Institute of Jamaica, 2001)

	Survey respondents	Sample population	St. Ann	Jamaica
Total Population	79	300	166,593	2,607,632
<i>Gender</i>				
Male (%)	37.7	44.3	50.3	49.3
Female (%)	62.3	55.0	49.6	50.7
Non-response (%)	2.5	0.7	n/a	n/a
<i>Age</i>				
0-14 (%)	0	29.3	33.21	32.3
15-29 (%)	11.4	21.7	25.48	25.9
30-49 (%)	46.9	25.0	24.06	24.6
50-64 (%)	27.9	12.7	9.21	9.1
≥65 (%)	12.7	8.3	8.05	7.6
Don't know/Non-response (%)	1.3	2.9	n/a	n/a
<i>Education level of population 15 years and older</i>				
No school/Don't know (%)	0	3.8	2.4	2.9
Primary (%)	47.4	47.8	28.4	25.5
Secondary (%)	34.6	34.0	55.1	55.5
Tertiary and Other (%)	17.9	14.4	13.9	15.8
Total	78	209	111,078	1,754,384
<i>Employment Status</i>				
Employed (%)	38.0	32.3	66.9	68.0
Unemployed (%)	48.1	22.0	8.0	8.6
Student (%)	1.3	24.3	32.0	33.1
Retired (%)	11.4	8.7		
Not of working age (%)	0	11.7	n/a	n/a
Non-response (%)	1.3	1.0	n/a	n/a
Total	79	300	86,435	1,081,280
<i>Per capita income per week (JA\$)</i>				
No income (%)	38.0	53.3	n/a	n/a
≤\$1000 (%)	0	0.3	n/a	n/a
\$1000-\$3200 (%)	6.3	3.0	n/a	n/a
\$3200-\$4999 (%)	11.4	6.0	n/a	n/a
\$5000-\$6900 (%)	7.6	3.0	n/a	n/a
\$7000-\$8900 (%)	0.0	1.7	n/a	n/a
≥ \$9000 (%)	7.6	3.0	n/a	n/a
No response/Don't know (%)	29.1	29.7	n/a	n/a

3 Methods and Procedures

To achieve the research objectives, information from the national, regional, and community levels of society was gathered through qualitative and quantitative research methods. Qualitative information was gathered through in-depth interviews with national and regional institutions with varying roles within the solid waste management system. Quantitative data were gathered through a questionnaire survey conducted on the household and individual level within the chosen study area. Secondary data relevant to solid waste management in Jamaica were assembled from national statistics, reports, and studies.

3.1 In-depth Interviews The in-depth interviews targeted four stakeholders and decision-makers in the field of solid waste management at both the national and regional levels in Jamaica, as shown in Table 3.1. The information provided by the respondents is a source of qualitative information to describe the existing solid waste management system as well as assess the factors that may influence the public participation and the overall success of waste reduction strategies in Jamaica.

The stakeholders were chosen based on the respective role within the solid waste management system. The *National Solid Waste Management Authority* and the North-East Parks and Markets Waste Management Ltd (NEPM), are the national and regional bodies responsible for household solid waste management in Jamaica. The Jamaica Environment Trust (JET) is the major environmental non-governmental organization which also operates a small recycling depot, while Unified Recycle Ltd operates a regional recycling depot.

Table 3.1: List of respondents and date of in-depth interview, including respective agency and office location

Agency	Respondent's Name	Location	Level	Date of Interview
National Solid Waste Management Authority (NSWMA)	Hillary Smith, Planning and Research	Kingston, St. Andrew	National	Nov. 14, 2006
Northeast Parks and Markets Waste Management Ltd (NEPM)	Alvin Williams, Regional Manager	Ocho Rios, St. Ann	Regional	Feb. 8, 2007
Jamaica Environment Trust (JET)	Kerry-Ann Curtis, Program Coordinator	Kingston, St. Andrew	National	Nov. 30, 2006
Unified Recycle Limited	Adam Johnson	Ocho Rios, St. Ann	Local	Non-response

First contact with the chosen respondent was made through the Environmental Health Officer, from the Northeast Regional Health Authority in Ocho Rios, Jamaica. This initial invitation for an interview conveyed the purpose of the study and the goals of the interview, as well as the type of information that would be discussed. Follow-up contact was then made by the author of this report to schedule the interview. In cases where the primary contact was not the appropriate person for the interview, the primary contact referred to a more appropriate secondary contact for the interview.

The in-depth interview adhered to an interview guide specific to the respondent and the function of their institution in solid waste management. The interview guide questions are solely open-ended and are derived from the factors identified by Troschinetz (2005) and other previous studies discussed in Chapter Two of this report. The exact interview guides are included in Appendix 1. The interviews were conducted by the author of this report and occurred either over the phone or in person, and lasted between 15 and 30 minutes.

3.2 Questionnaire Survey

The Waste Reduction Study

Questionnaire (WRSQ) survey examined solid waste management and waste reduction at the household and individual level. The questionnaire measured each household's existing solid waste practices, as well as individual knowledge, concerns, attitudes, and willingness to participate, regarding solid waste in general and waste reduction strategies in particular. The content of the questionnaire was based on three of the twelve Troschinetz (2005) factors: *Waste Collection and Segregation*, *Household Economics*, and *Household Education* (2005), and three behavioral factors: *Environmental Concern*, *Knowledge*, and *Demographics*.

3.2.1 Sample Frame

The WRSQ survey sample frame included the housing units in the communities targeted by the 2006 Rodent Control Survey: Farm Town, Bethel Town, Woods Town, Jack's Lodge, Allan Hall, Islington, and Ginger Hall. However, in order to select a statistically significant sample from these communities it was necessary to identify the study area boundaries. Unfortunately, the available maps did not clearly indicate all the aforementioned communities, nor were the boundaries delineated. For that reason, the present study employed the recognized boundaries of Enumeration Districts (EDs), NW002, NW003, and NW050 in the northwest constituency of St. Ann. Enumeration Districts are political divisions delineated for voting purposes, and are also recognized and utilized by the Statistical Institute of Jamaica in conducting the national census.

Therefore the WRSQ survey sample frame was based on the following two criteria, 1) the housing unit is in one of the communities targeted by the Rodent Control

Survey in 2006, and 2) the housing unit is located within the boundaries of one of the three aforementioned EDs. In Figure 3.1, the Enumeration District boundaries are represented by dashed-lines and the solid-lined boxes represent the areas targeted by the Rodent Control Survey. The area highlighted in yellow in Figure 3.1 represents the study area according to the sample frame criteria. The housing units⁶ on the eastern side of Enumeration District NW050, shown in Figure 3.1, were excluded from the WRSQ survey sample frame, since that area was not included in the 2006 Rodent Control Survey.

The two abovementioned sample frame criteria were employed since other common methods of determining the sampling frame, like address lists, phone numbers, and electoral lists, were either incomplete or unavailable for the general population in the study area. Besides the unavailability of listed information, selecting the sample based on one of these categories of information could incorporate bias into the sample frame. For example utilizing phone numbers would have resulted in a sample frame that only included residents with telephones, while explicitly disregarding disregarded a low-income portion of the population that can not afford telephones.

⁶ A Housing Unit is a defined by the Statistical Institute of Jamaica to be a building or buildings used for living purposes at the time of the census.



Figure 3.1: Map of study area in northwest St. Ann Parish of Jamaica, aligned on a north/south axis. The boundaries of the Enumeration Districts (EDs) are represented by the dashed lines. The areas under consideration in the Rodent Control Survey are within the boundaries of the solid-lined boxes. The red and yellow lines on the map are roads, and portion of the ED boundaries run along the roads. Housing units are represented on the map by small red squares.

3.2.2 Sample Design: Sample Size

The sample size for each

Enumeration District was calculated based on the sample frame of each Enumeration District using an online sample size calculator. Table 3.2 shows there are a total of 372 housing units in the sample frame, and the majority of housing units are located in ED NW002. The results of the calculations are shown in Table 3.3 and represent the minimum number of housing units to be sampled in order to achieve a 95% confidence level of ± 10 . The total sample size of 140 housing units was compiled from the three sub-samples presented in Table 3.3. Refer to Appendix 7 for more information about the online sample size calculator used in this study.

Table 3.2: Number of housing units included in the sample frame for the WRSQ survey, February 2007. The sample frame was chosen based on the number of housing units located within the boundaries of the enumeration districts, NW002, NW003, and NW050.

Enumeration District	Sample Frame: # of Housing Units ¹
NW002	250
NW003 (smallest geographical area)	92
NW050 (largest geographical area)	30 ⁷
Total	372

1: Statistical Institute of Jamaica, 2004

Table 3.3: Final sample sizes for WRSQ survey based on the sample frame in each Enumeration District. The values represent the minimum number of housing units that must be sampled to achieve a 95% confidence level of ± 10 in each Enumeration District.

Enumeration District (ED)	# of housing units in sample frame	Final sample size for each ED sub-sample
NW002	250	70
NW003	92	47
NW050	30	23
Minimum total sample size		140

Source: www.surveysystem.com/sscalc.htm, Accessed January 31, 2007

⁷ The Statistical Institute of Jamaica indicates that NW050 has 85 housing units; however the housing units located on the eastern side of the ED were not included in the Rodent Control Survey in 2006 and are therefore excluded from the WRSQ survey sample. The number of housing units within the boundaries of NW050 and included in the Rodent Control Survey was observed to be approximately 30.

3.2.3 Sample design: Sample Selection

Survey respondents were

selected in-situ using a random sampling technique called *equal probability systematic sampling*, which involves the direct selection of subjects from the sampling frame (Garson, 2006). Specifically, the selection of housing units from the sample frame was based on the following two criteria: 1) the housing unit was selected in accordance with the specific sample interval of the Enumeration District and 2) the respondent was a resident of the housing unit and between the ages of 18 and 74 years old. The sampling interval varied for each Enumeration District sub-sample and was the approximate result of dividing the ED sample frame by the sub-sample size, as shown in Table 3.4

Table 3.4: Sampling interval for each Enumeration District based on the minimum number of housing units to be sampled.

Enumeration District No. (sample frame)	Sub-sample size (housing units)	Sampling interval
NW002 (250)	70	<i>Every third housing unit</i>
NW003 (92)	47	<i>Every other housing unit</i>
NW050 (30)	23	<i>Every other housing unit</i>
<i>Minimum Sample</i>		<i>140</i>

3.2.4 Survey Procedure: Pilot

The WRSQ survey was first field-

tested prior to the full-scale implementation to ensure that the questionnaire would function as it was intended. The components of the questionnaire tested and observed included questionnaire design (length, language, question order, and responses), data collection, and data processing.

The field test was conducted on Thursday February 15, 2007. The field test attempted to reflect the conditions that would exist during the full-scale implementation, so the pilot was performed in the study area and at the same time of day that the full-scale survey would be conducted.

The field test entailed administering the questionnaire to the sample population while observing the strengths and weaknesses of the questionnaire design. A pilot survey evaluation form was completed with each administered questionnaire, noting particular questions that needed to be revised for wording, response choice, or question order.

The pilot showed that respondents had difficulty differentiating their concerns between *very concerned* and *a little concerned* for questions 9 through 18 (see Appendix 2 for WRSQ survey). Therefore, the response choices for these questions were reduced to *concerned*, *not concerned* and *no opinion* in order to lessen the respondents' confusion as well as the ambiguity of the results. Similarly, the original Likert attitude scale was decreased to a 3-point scale, *agree*, *disagree*, and *no opinion* from 5 responses, *strongly agree* to *strongly disagree*. Likewise, responses for questions 2 and 5 were also reduced to alleviate respondent confusion as shown in Table 3.5.

Table 3.5: Revision of response choices for Questions 2 and 5 in Section One based on observations made during the pilot WRSQ survey, February 2007

Original choices	Revised choices
Question 2	Question 2
I have no concerns about the environment	I am not concerned
I have few concerns about the environment	I am concerned
I have some concerns about the environment	I have no opinion
I am quite concerned about the environment	
I am extremely concerned about the environment	
Question 5	Question 5
I have no effect	I have no effect
I have very little effect	I have some effect
I have some effect	I have a lot of effect
I have a large effect	I have no opinion
I have an extremely large effect	

3.2.5 Survey Procedure: Interviewer

The survey implementation

required the creation of two teams of interviewers to assist the author of this report in administering the questionnaire. Both teams were formed from Health Department personnel and included a core team of seven senior-level health personnel and a secondary team of three community peer educators.

A training session was arranged for both teams to review the questionnaire and plan for the survey implementation. Each interviewer was given a folder of materials, including an outline of the survey design methodology, sampling procedures and instructions, and guidelines for administering the questionnaire. During the core team training session, each interviewer practiced administering the questionnaire to understand the purpose and the procedure for each question, but this was not done with the secondary team.

The training sessions were meant to reduce individual impact of the interviewer on the respondent; however variations among the interviewers are to be expected. Differences among the interviewers may include use of personal language, use of various probing techniques, extensive explanation of the questions, and incorrect sample procedure, to name a few.

The social status of the interviewer may also impact the respondent, because the respondents may feel an intrinsic pressure to respond in a way that does not reflect the truth, and may answer the way they think the interviewer wants them to answer. According to Bertrand and Mullainathan (2001), the interactive nature of the survey procedure plays a large role in shaping the responses to subjective questioning where the respondents want to avoid looking bad in front of the interviewer. The survey team in

this case consisted of personnel from the Health Department with the authority to routinely inspect households and communities for public health risks, and this may be intimidating to the respondent.

3.2.6 Survey Procedure: Implementation

The full-scale survey was administered on the days of Tuesday February 20th, Wednesday February 21st, and Wednesday February 28th, 2007, between the hours of 9am and 5pm. The dates and times were chosen based on the experience and advice of a Public Health Inspector who has worked in the area. Of the 140 housing units required to achieve the 95% confidence level of 10, a total of 79 respondents participated in the survey, resulting in an overall response rate of 56.4%. Table 3.6 shows the participation rate for the individual Enumeration Districts within the study area.

Table 3.6: Response rates for WRSQ survey for each Enumeration District given the respective sample size and sampling interval. The final sample size represents the minimum number of housing units that needed to be sampled to achieve the 95% confidence level of 10, for each Enumeration District.

Enumeration District	Final Sample size (#)	Questionnaires Completed (#)	Response Rate (%)
NW002	70	51	72.9
NW003	47	16	34.0
NW050	23	12	52.2
Total	140	79	56.4

Sampling mortality due to non-response is considered to be “a serious form of bias in survey research and every effort should be made to secure a high percentage of returns” (Suchman, no date provided). The overall non-response rate of 44.6% is attributed to the fact that housing units were unoccupied at the time of the survey and is not the result of unwilling respondents. Based on the possibility that some residents

would not be at home during the time of the survey, a procedure was developed to minimize the sampling mortality.

The procedure entailed selecting a housing unit located next to the non-responsive housing unit on the same side of the street, and then resuming the original sampling interval. Figure 3.2 illustrates the procedures for sampling and for non-response; where housing units are represented by either a number or a letter box. In this example, the survey begins at housing unit #1, and the next housing unit to be sampled is #4. In NW002, the survey interval is every third housing unit, so the housing units to be selected represented by shaded boxes in the diagram, including #1, #4, and #7. To demonstrate the non-response procedure, assume that no one is home in #4 or they decline to participate in the survey, so then #5 is to be selected for the survey. Once #5 is surveyed, the original survey interval is resumed and the next housing unit selected is #7.

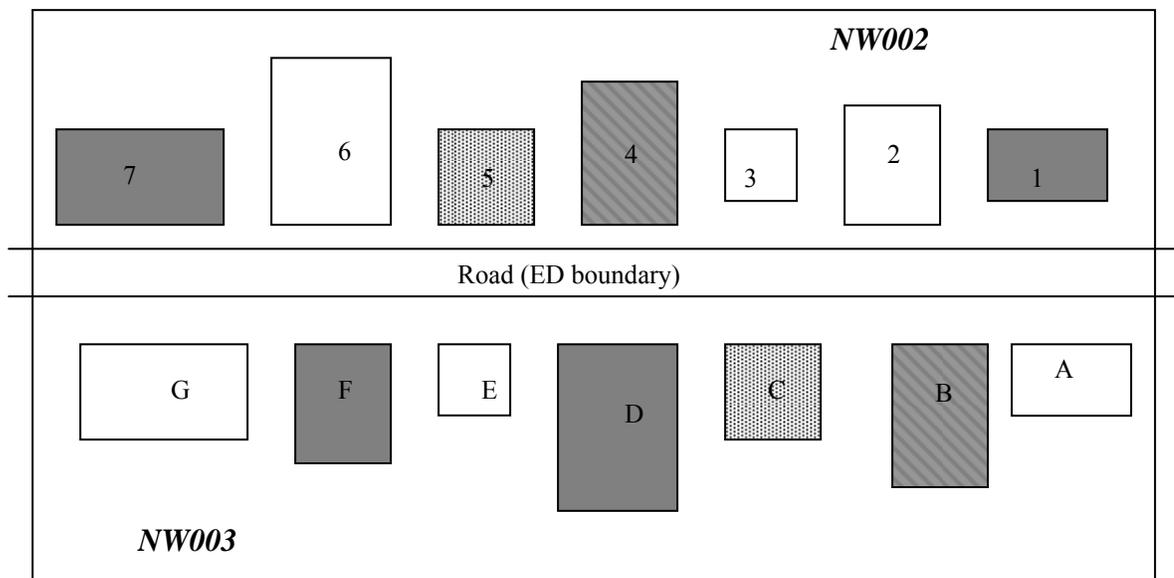


Figure 3.2: Example of survey sampling and non-response procedure for WRSQ survey, February 2007. If no one was home in #4, the next housing unit #5 would be selected. Upon completion of the survey at #5, the original sampling interval would resume, and housing unit #7 would be selected for the survey. This procedure is also used in the other Enumeration Districts and procedure for ED NW003 is demonstrated in the diagram.

Each interviewer was assigned a section of the study area in which to conduct the survey, and a starting point was determined randomly by picking a numbered piece of paper, representing either the first, second, or third housing unit in the assigned section. The interviewer proceeded through the assigned section surveying every third or every second housing unit depending on the Enumeration District in which they were conducting the survey. Figure 3.3 illustrates the actual survey routes, where the arrows indicate the direction of travel of each of the 10 interviewers represented by individual numbers. A list of interviewers' names is included in Appendix 5 of this report.

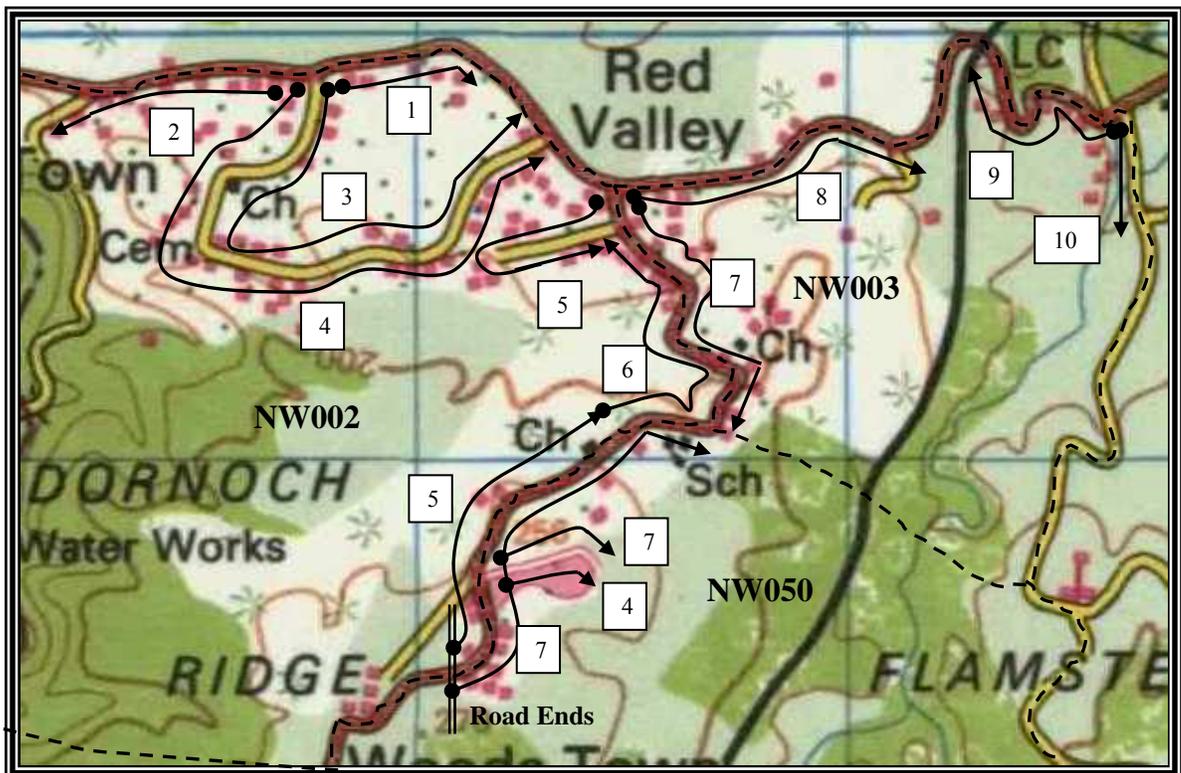


Figure 3.3: Close up of WRSQ survey study area illustrating the sampling routes taken by the individual interviewers, represented by the solid lines. The ED boundaries are represented by the dashed lines. Streets and roads are represented by the yellow and red lines, respectively.

The sampling routes of the interviewers followed the major streets and roads in the area, but failed to include housing units not visible along the sampling routes. There are housing units that are located in areas that were difficult to access by the interviewer, due to terrain or vegetative cover. Safety of the survey team is a major consideration, so accessing these areas is not possible, but it is recognized here that excluding these housing units reduces the response rate.

3.2.7 Questionnaire Design

Question wording is a major consideration when developing questionnaires. This is especially true for surveys conducted in developing countries for two reasons, 1) local language and verbiage, and 2) literacy of respondents. The questions must use the language with which respondents are familiar with without sacrificing the meaning of the question, as well as bear in mind the literacy level of the respondents. Accordingly, the WRSQ survey was reviewed by six local health personnel to verify that each question used locally appropriate terminology and to ensure that the respondents would be able to comprehend the concepts addressed in the questionnaire.

The questionnaire has a total of forty-three questions grouped into seven sections of similar concepts: 1) Natural Environment, 2) Household Solid Waste Management, 3) Concerns about solid waste management, 4) Willingness to participate, 5) Solid Waste Management Attitude Scale, 6) Environmental Health, and 7) Demography. The questionnaire takes approximately 30 minutes to complete, but each question is useful in achieving the objectives of this study and more importantly each question is helpful to the

Health Department in their efforts to improve solid waste management in Parish of St. Ann.

3.2.7.1 Introduction The introduction of the WRSQ survey served to introduce the interviewer and convey to the respondent the purpose of the survey, the importance of the respondent's participation, and how the responses would be used. Participation of the respondent was voluntary so the respondent was asked if they are willing to participate in the survey. Additionally, the survey was confidential so the respondent was told that their identity will not be connected to the responses they provide.

3.2.7.2 Section One - Natural Environment The *Survey on Environmental Awareness and Attitudes in Jamaica 1997* was the last relevant examination of Jamaicans attitudes toward environmental issues (Espeut, 1999). The *Survey* revealed the issue of solid waste as a significant concern for individuals at that time. For this reason, this section of the WRSQ survey measured the respondents' current level of understanding and concern about the natural environment for comparison purposes with the *Survey* (Espeut, 1999). The questions originate from the *Survey on Environmental Awareness and Attitudes in Jamaica 1997* since the questions proved to be adequate in assessing individual awareness about environmental issues.

Concern for general environmental issues has not been found to be a significant predictor of waste reduction behavior when also considering other factors like access, knowledge, and effort (Schultz et al., 1995; Derkson and Gartell, 1993; Schultz and Oskamp, 1996). Therefore, this section of the WRSQ survey investigated the public's view of the impact household garbage has on the natural environment compared to other

issues, as well as the impact that the respondents believe they have on the natural environment. The responses to the questions in this section assess the factor of *Environmental Concern*.

3.2.7.3 Section Two - Household Solid Waste Management The questions in this section measured the current household solid waste management practices, namely storage and disposal. This section relates specifically to *Household Education*, a factor identified by Troschinetz (2005) to influence recycling, comprised of having knowledge of solid waste management and an understanding of the linkages between human behavior, waste handling, and health/sanitation/environment (pg. 43).

Currently there is no standard storage container mandated by the Government of Jamaica, and the list of storage choices in the WRSQ survey reflects the myriad of storage containers that are commonly used. Choices for disposal are derived from the Statistical Institute of Jamaica census data, and also include recycling, reuse, and composting, in order to identify any current waste reduction practices of the respondents. Disposal in this case, referred to practices by the household to remove stored waste from the household, which may include public collection, burying, dumping, and/or burning. Burning can be viewed as a form of waste processing, but in Jamaica it is considered a disposal method because the resultant ashes receive no further treatment.

In this section, the respondent was also asked for ways of reducing the amount of solid waste that the household must dispose of by the methods they employ, based on their reported disposal practices. The responses to this question denoted the respondents' awareness of other disposal methods, like recycling or source reduction.

3.2.7.4 Section Three - Concerns about solid waste management

This section assessed the respondents' concern about public and environmental health risks associated with commonly practiced solid waste management methods in Jamaica, like burning and illegal dumping. These questions indirectly measured knowledge and awareness of risks associated with improper solid waste management and originated from the factor *Household Education* (Troschinetz, 2005).

The responses to these questions were scored to reflect the respondent's level of concern, where a high score represents a high level of concern, and a low score represents a low level of concern. A response of *no opinion* was interpreted as unfamiliarity of the respondent with the possible health risks associated with improper solid waste management.

The section concluded with an open-end question that asked the respondent for suggestions for improving the solid waste management situation in their community. The responses could be helpful in identifying solutions the residents think will work to improve the solid waste management situation in their community. This question also provided an opportunity for the respondent to participate in the early stages of the intervention process.

3.2.7.5 Section Four - Willingness to participate

The success of any solid waste management program requires the participation of the public. Schultz et al. (1995) observed individual participation is the one commonality between recycling programs, even though the procedural or organizational structures may vary and change. For that reason Section Four of the survey assessed the individual's willingness to participate in potential waste reduction programs.

First, the awareness of the respondents about composting and recycling was questioned to assess their knowledge of familiar waste reduction practices. These two concepts are more widely acknowledged in Jamaica than the concept of source reduction, so the latter concept is not included in this initial assessment, as to reduce confusion by the respondent. Source reduction was addressed more directly when willingness of the respondents to purchase fewer disposable items was examined.

The waste reduction programs mentioned in this section are just a few examples of possible waste management and waste reduction programs, and each requires various levels of resource inputs. The questions address programs requiring many technological and financial resources, like curbside recycling, a bottle-refund system, and small-scale composting, as well as low-cost, low-tech programs such as educational campaigns. Since some services require the residents to pay for a service, like curbside recycling, willingness to pay was also assessed in this group of questions.

A common sight in the Jamaican solid waste management system is the *skip*, which is a large concrete or metal container that serves as a central location for households to dispose of their garbage. The solid waste in the skip is then collected by the public solid waste management agency. Since skips are so common, this concept was included as a possible solution to the solid waste management issues in the study area.

3.2.7.6 Section Five - Solid Waste Management Attitude Scale

The attitude scale measured the respondent's attitudes concerning waste management in Jamaica in order to determine whether the current attitudes toward waste management are barriers or incentives to waste reduction strategies.

The scale was constructed by first generating a list of twenty-four potential statements that imitate waste management attitudes that have been heard or observed in Jamaica by the author of this report. Each statement was then rated by a judge from a team of health personnel on a 5-point scale in terms of how much each statement indicated a favorable or positive attitude towards solid waste management in Jamaica. When using this method, it is important to instruct the judges that the items are not rated according their own opinion of the statement.

The median value and the interquartile range were then computed for each statement based on the individual judge's scores. The median is the value above and below which 50 per cent of the ratings fall, and the interquartile range is the difference between the first and third quartile. In this case, the mean value represented the degree that each statement represents a positive attitude. A mean score of 5 represented a strongly positive attitude towards solid waste management in Jamaica, and a mean score of one represented a strongly negative attitude. The interquartile range represented the variability of the responses among the judges, where an interquartile range of 4 represented a high level of variability of the judge's rating, and zero represented a low level of variability.

It is recommended that statements at equal intervals across the range of medians (1 to 5) and those that have the smallest interquartile range should be selected for the final list of statements (www.socialresearchmethods.net/kb/scalthur.php). These recommendations were used as the first step in selecting the statements for the SWM attitude scale. Each statement was also considered for its relevance to the local situation, whether the statement was redundant to other sections, and finally for its ability to clearly

assess an individual's attitude toward solid waste. The original list of twenty-four statements is provided in Appendix 4.

The final list of twelve statements addressed issues related to solid waste management, like public education, health, possible solutions to the problem, the roles of the individual and government, and the importance of a garbage-free community compared to other personal issues. The responses to these statements were scored as to quantify the individual's attitude toward solid waste management, where a high score represents a positive attitude, and a low score represents a negative attitude. A response of *no opinion* was interpreted as unfamiliarity of the respondent with the concepts posed in the statement. The final list of twelve statements can be viewed in Appendix 2.

3.2.7.7 Section Six - Environmental Health

Environmental health can be

defined as the interrelationship between people and their environment that promotes human health and well-being and fosters a safe and healthful environment

(mapp.naccho.org/MAPP_Glossary.asp). Solid waste is just one of many issues that affect environmental health and this section served to comprehensively assess the current environmental health situation in the study area for possible risks to the households. Questions pertaining to housing material, number of rooms, and housing tenure, are environmental health indicators employed by the Health Department to evaluate living standards of residents within the Parish.

3.2.7.8 Section Seven - Demography

Demographic characteristics were

discussed in Chapter Two of this report to be factors influencing participation in waste reduction programs, so this section aimed to determine which demographic

characteristics are related to waste management behavior in Jamaica. A demographic profile of the households and the community is also useful to the Health Department in their effort to develop appropriate interventions. The demography statistics gathered in the WRSQ survey were also compared with regional and national census data.

The final question of the survey asked which household member is responsible for taking care of the household garbage. This question was deemed important in understanding any existing role distinction in regards to household solid waste management.

In other surveys by the Health Department, the demography questions are typically placed at the beginning. Demography of the respondents is important to any survey, but in this case it was not the focus, therefore this section was placed at the end of the questionnaire. Placing the demography questions at the end also conveyed to the respondent that the main purpose of the survey was not to gather sensitive information about age, education level, and income range, and thus the respondent is less suspicious and more willing to participate.

3.2.7.9 Limitations within Questionnaire

The WRSQ survey relied on self-reported data, which assumed that the respondent gave truthful and accurate responses of their solid waste practices, concerns, and attitudes. However if the survey was conducted in a professional manner, this phenomenon will occur less often (http://www.sysurvey.com/tips/introduction_to_survey.htm, accessed February 26, 2007). With the aim of increasing the questionnaire's credibility for the respondent, the WRSQ survey was prefaced with an introduction explaining the purpose of the questionnaire and how the responses would be used by the Health Department.

A significant portion of the questionnaire involves subjective questioning where the questions ask for the respondent's opinion and attitude. Bertrand and Mullainathan (2001) proposed that the most pernicious problem with subjective questioning is the possibility that attitudes may not 'exist' in a coherent form. This form of bias was observed during the pilot survey where respondents had difficulty differentiating between varying levels of attitude and concern. Based on the pilot survey observations, the questionnaire was revised in order to reduce the respondents' confusion of the subjective question responses.

In addition, part of the problem suggests that respondents believe that they should have an opinion just because the interviewer is asking the question (Bertrand and Mullainathan, 2001). Overall, the questionnaires had low rates of *no response* to the subjective questions. However, Section Seven – Demography experienced higher rates of *no response*; specifically the final question pertaining to the household member responsible for household solid waste management experienced a 43% non-response rate. The sensitivity of this particular question may be the result of its placement in the questionnaire, when a more appropriate location could be in Section Two – Household Solid Waste Management.

The WRSQ survey data also shows a relatively high no response rate for the reported income range of the household members, at 29.7%. It is quite reasonable to assume that the respondent did not know the income range of the other members of the household, which easily explains the high non-response rate for this question. It is unfortunate that income information is unknown for a third of the household members included in the survey since income has been shown to have a positive correlation with

waste reduction behavior (Oskamp et al, 1991). So assessing this factor of waste reduction behavior in the context of Jamaican society will yield uncertain results due to the incomplete data.

4 Analysis and Discussion

The information gathered from the in-depth interviews and the results from the WRSQ survey were synthesized along with the secondary data in order to analyze each of the sixteen factors previously discussed in Chapter Two. The WRSQ survey data were organized and analyzed using SPSS, a statistical analysis and data management software system (SPSS Inc., 2002). The in-depth interview responses were categorized according to the factor that the interview question addressed.

This chapter begins with a detailed analysis of each factor, followed by a brief summary of the analysis in written and tabular form. Not all the data and information gathered through the research methods are presented here. This chapter only presents the qualitative information and quantitative data that is pertinent in describing the existing solid waste management system and determining whether each factor is an incentive or barrier to public participation and the overall success of waste reduction strategies.

4.1 Factor One – Government Policy The influence of Government Policy on recycling in developing countries refers to the presence of regulations, enforcement of laws, and use of incentive schemes.

The National Solid Waste Management Act of 2001, the governing legislation for solid waste management in Jamaica, mandates that the *National Solid Waste Management Authority* “take the necessary steps for the effective management of solid waste and ensure that the waste is collected, stored, transported, recycled, reused, or disposed of in an environmentally sound manner” (Part II, Section 4, Paragraph 1). However, there has been little progress in implementing this mandate. Furthermore, the solid waste legislation presented in the *Act*, makes no mention of targets and goals for

waste reduction, which are aspects of solid waste policies that should be included (UNEP, 2005a).

Additional legislation beside the *National Solid Waste Management Act*, related to waste reduction was proposed by the Solid Waste Management Project. The SWMP was a collaborative effort between the Government of Jamaica and the Inter-America Development Bank which aimed to improve solid waste management island-wide, and the *National Solid Waste Management Act* and the NSWMA were significant outcomes of the Project. The SWMP specified that the following waste reduction regulations would be developed subsequent to the promulgation of the Act:

- I. Product packaging
- II. Importation of goods and packaging
- III. Containerization and littering
- IV. Resource recovery

Of these four regulations, only littering is currently regulated, by the Cleanliness Regulation (formerly the Litter Act). To date, programs to implement the waste reduction legislation have not been put into place, because waste reduction is not a current political priority since the current focus for NSWMA resources is collection and disposal (Smith, 2006). The lack of waste reduction legislation and policies, plans, and programs as well as the lack of enforcement of legislation are characteristics of solid waste management in the Caribbean region, and are viewed as factors that are currently limiting waste reduction activity (UNEP and CEHI, 2004).

A representative from a national NGO, the Jamaica Environment Trust (JET), suggests that the government must make waste reduction a priority by establishing laws

requiring public participation (Curtis, 2006). She stated that Jamaicans are ‘incentive driven,’ which has been demonstrated in the past by schools that participated in a recycling program conducted by *Recycle for Life* (RFL). *RFL* was a plastics reclamation company consisting of bottling companies operating in Jamaica that collected PETE (polyethylene terephthalate) from participating schools in exchange for points which could be used towards purchasing school resources.

Incentives by government or other bodies to get people involved in waste reduction strategies like *RFL* “is the most significant factor influencing the success of waste reduction,” as indicated by the NSWMA representative (Smith, 2006). However, external incentives have been shown to be useful in initiating participation but less important in maintaining behavior in the long run or when the incentives cannot be sustained (Ebreo and Vining, 2001). This has also been the case in Jamaica.

The representative from JET recognized that program participation increased and a culture of waste separation developed in the students as a result of the external incentives provided for by *RFL*. *RFL* represented a bridge between the waste reduction strategies documented in the *Policy* (NSWMA, 2000) and a specific program to involve individuals and businesses in the effort to reduce waste. Implementing specific programs at the regional, community and institutional levels is viewed as an important aspect of effective legislation and policies by the UNEP, in its *Integrated Waste Management Scoreboard* (2005a). Unfortunately, when *Recycle for Life* dissolved in 2004 as the Government of Jamaica threatened to impose additional taxes on imported plastics, the bottling companies could no longer fund *RFL* and the incentive-based

recycling program. Not surprisingly, as the external incentives ceased, so did the motivation to participate in the program by the school.

4.2 Factor Two – Government Finances

Cost of operations, the budget allocated to MSWM by local and national governments, as well as the stability and reliability of funds comprise the Government Finances factor influencing recycling in the third world.

The *National Solid Waste Management Policy* states that funding for solid waste management comes from the central government through the national budget, grants and property taxes (NSWMA, 2000). According to the NSWMA representative, JA\$1.65 billion (US\$25 million) is allocated yearly to solid waste management from the National Budget (Smith, 2006). Additional funds are allocated from the central government's Budget Deficit Financing (BDF) since the funding provided by property taxes is unreliable and insufficient⁸. Therefore, at the start of the budget year, a percentage of the BDF is allocated to the Ministry of Local Government, which is then distributed to the various sectors including the parish councils, fire departments, and solid waste management.

Among the case studies analyzed by Troschinetz (2005), government finances were seen as one of the biggest barriers to recycling, mainly due to the lack of funding put toward solid waste management by the government. Financing is also viewed as a major constraint in Jamaica in implementing sound solid waste management policy and programs, as stated in Chapter 20 to 22 in the 2002 Jamaica Country Profile⁹ (United Nations, 2002). At the local level, it is common that funds from central government

⁸ The *National Solid Waste Management Policy* states that in 2000 payment compliance for property taxes was only 50% (page 8).

⁹ The 2002 Country Profile Series provides information on the implementation of Agenda 21 on a country-by-country and chapter-by-chapter basis.

allocated to the Regional Parks and Markets companies are inadequate for waste management operations. In an interview with the Regional Manager of Northeast Parks and Markets Waste Management, Ltd, the northeast regional division of NSWMA, it was stated that allocated funds are commonly half of the amount requested in the submitted budget (Williams, 2007).

The three main components of the yearly NEPM budget are administrative, operations, and maintenance. Of the three, the largest component is operations (collection and transport of waste, and maintenance of disposal site), consisting of almost 60% of the total budget as shown in Table 4.1. The remaining 40% is distributed between administrative and maintenance.

Table 4.1: Percent of budget allocated to the three main components of the yearly budget submitted to Central Government by NEPM Waste Management Ltd (Williams, 2007).

Budgetary component	Percentage of budget
Administration	23%
Maintenance	18%
Operations	59%

Cost recovery mechanisms are currently limited to the funds provided by property taxes and the central government as described above. The *Economic and Social Survey of 2003* indicated that some progress is being made in developing these cost recovery mechanisms, which stated that regulations have been drafted to implement tipping fees (PIOJ, 2005, pg. 18.4). However, private solid waste collection companies are still currently permitted to dump at the disposal sites without paying a tipping fee, representing a loss of revenue to the NSWMA. In fact, in the interview with the Regional Operations Manager of NEPM Waste Management Ltd, it was revealed that those regulations have yet to be finalized and thus tipping fees have not been implemented.

Fees for licensing solid waste companies, waste processing, and recycling facilities are additional sources of potential revenue from NSWMA operations which are specified by the *National Solid Waste Management Policy*, but which have not been implemented. Again, progress is slow to implement necessary measures for sustainable solid waste management in Jamaica. However, some progress is being made with the recovery of cost through the ‘polluter pays’ principle.

With the aim of ultimately reducing the generation of solid waste, the *Policy* specifies the “polluter pays” principle as becoming the guiding principle under which the *National Solid Waste Management Authority* operates. The “polluter pays” principle suggests that the waste generator is always aware of the reality that a cost is associated with collection, transportation, and disposal of solid waste. The *Policy* also states that the NSWMA will include incentives, penalties and public education to accompany the initiative, with the aim of reducing the incidence of illegal dumping (NSWMA, 2000).

The extent to which the “polluter pays” principal is currently operating is unknown, but a recent news article highlighted the increasing number of legal cases being prosecuted against polluters, specifically owners of lots on which illegal dumps are being located (Daily Gleaner, June 6, 2006).

4.3 Factor Three – Waste Characterization

Accurate and reliable data pertaining to generation and recovery rates, and composition of waste stream comprise the Waste Characterization factor influencing recycling in the third world.

“A thorough understanding of the characteristics of the solid waste is requisite in making rational decisions in solid waste management, but it remains a prevalent practice to pay little heed to conducting a comprehensive and accurate survey of quantity and

composition” (UNEP, 2005b, pg. 32). In Jamaica, waste characterization studies are currently conducted by the Planning and Research Department of the *National Solid Waste Management Authority*, located in Kingston. Statistical information on waste quantity and composition can also be found in the *Comprehensive Solid Waste Management Study* conducted by Norconsult International in 1996, which also serves as a reference for the NSWMA.

The studies conducted by NSWMA are generally limited to the waste generated within the Riverton wasteshed. One of the four wastesheds in Jamaica, the Riverton wasteshed is served by the Riverton Disposal site and four of Jamaica’s five largest urban centers lie in this wasteshed (Pendley, 2005). The most recent NSWMA waste characterization study was conducted in 2003, which focused on waste composition of household waste within the Riverton wasteshed. Waste statistics for other parts of the country were determined by extrapolating the data gathered within the Riverton wasteshed using known population data.

In 1999, the NSWMA determined the daily per capita generation rate for Jamaica to be 1.0 kilogram/person/day. This figure is still the accepted generation rate used in literature. Based on the available population census data, in 2005, the waste generation rate and waste collection rate for the entire northeast region, including the Parishes of St. Ann, St. Mary, and Portland was estimated to be 136,687 tonnes/year (150,629 tons/year) and 95,680 tonnes/year (105,439 tons/year), respectively (NSWMA Planning and Research Department). In Chapter Two, it was determined that the Parish of St. Ann generated 192 tons/day or approximately 70,000 tons annually, which is about 47% of the annual generated waste in the NE wasteshed.

The NSWMA generation rate is said to be representative of the urban generation rate and the per capita generation rate for rural areas was assumed to be similar. Waste generation rates and composition are unique from country to country and even between communities within a country, since they are affected by factors such as degree of industrialization, extent and nature of socioeconomic development and the climate (UNEP, 2005b). The available waste data for Jamaica could be underestimating the current quantities of household waste being generated and could be unreliable in the composition of waste, since waste generation was last studied in 1999 and composition was last studied in 2003. Furthermore, waste generation rates and waste stream composition data should accurately reflect the variations in waste character that may exist in communities of varying socio-demographic profiles.

The UNEP (2005b) suggests that rigorous, scientifically performed studies of waste quantities are necessary to properly design, operate, and monitor solid waste management systems. This is also true in designing, operating, and monitoring waste reduction systems. Measuring the waste stream will identify waste components with the greatest diversion potential and the quantity of material that will supply the materials-market. Additionally, accurate and up-to-date waste characterization information will benefit the effort by the government to reduce waste by incorporating the study findings into educational campaigns and policy initiatives.

4.4 Factor Four – Waste Collection and Segregation The presence and efficiency of formal or informal collection and separation by scavengers, the municipality, or private contractors comprises the Waste Collection and Segregation factor.

The agency with principle responsibility for collection of household waste in the Parish of St. Ann is Northeast Parks and Markets (NEPM) Waste Management Ltd. NEPM is one of four regional divisions of the *National Solid Waste Management Authority*, providing waste management services to the Parishes of St. Ann, St. Mary and Portland.

NEPM provides door-to-door collection for residents within the collection areas, achieving an estimated collection efficiency of 70% of the entire regional population¹⁰ (Williams, 2007). A fleet of seven compactor and open-body tipper trucks currently operates in the parish of St. Ann, collecting the household waste and disposing of it at one of two dumpsites located within the parish. The Regional Operations Manager cited lack of collection equipment as the major limitation to achieving 100% collection efficiency (Williams, 2007).

Collection service varies for each community, where some communities only receive collection once per month due to the difficulty in accessing the community, compared to weekly collection in the urban areas of Ocho Rios and St. Ann's Bay. Of course the most extreme cases involve no collection services, in which case NEPM states it will work with the community to develop a system of waste management appropriate for the particular community (Williams, 2007). For communities that receive once per month collection, NEPM only collects non-biodegradable materials and encourages the communities to compost organic materials.

¹⁰ The regional population of St. Ann, St. Mary, and Portland is reported as 358,270 (Statistical Institute of Jamaica, 2001).

Collection services in Jamaica are often influenced by ‘the nature of the community,’ where the street layout and terrain can make collection both difficult and expensive. Within the study area, the WRSQ survey found that almost 95% of survey respondents are concerned about the collection services provided by NEPM, specifically citing infrequent and unreliable collection.

Currently, only parts of the study area are serviced by NEPM, and by observation it is easy to see that the deplorable road conditions are preventing the compactor trucks from accessing the entire study area. The results of the WRSQ survey confirm the lack of collection services in particular areas, where in Enumeration District NW050, only one of the eight respondents reported using the collection truck to dispose of their garbage, specifically metals and glass. When respondents were asked to provide suggestions for improving solid waste management in the area, 72% mentioned improving collection through expanded service coverage and increased collection frequency. Despite the reported desire for increased collection by the respondents, research conducted in Jamaica has shown that the public has very little trust in the local government to improve the solid waste management system based on the local government’s track record in providing a satisfactory service (Pap, 2001). Although new technologies have been implemented in communities around the country, in the form of communal dumpsters and increased curbside collection, old behaviors, like burning, are still being practiced since the collection service becomes insufficient.

The situation in the study area is not unique for Jamaica where ‘the collection system is generally inadequate’ (Gage, 1998). Gage states that the collection agencies receive much of the blame for the solid waste problems, but suggests that the customer is

also at fault for the issues facing the collection system, in the type of container employed. Containerization is not regulated by the NSWMA, and households often choose the container most convenient to them. The *Comprehensive Solid Waste Management Study* conducted by Norconsult International in 1996 (Norconsult/GOJ, 1996) cited that the waste storage systems were not compatible or appropriate to the collection systems and were adversely affecting the speed and efficiency of collection as well as threatening the health of the community and that of the garbage collectors (pg. 2-26).

In the eleven years since the Norconsult report, little has changed in regards to containerization, as the WRSQ survey revealed. Of the myriad of containers reported by respondents, plastic bags are most commonly used (48.1%), which in this case are small grocery bags reused as trash bags. Containers, both covered and not covered, are used by 27.8% of the respondents, where these containers are plastic or metal, ranging from a simple milk crate to metal drums. Finally, storing solid waste in a pile in the yard is also common, probably since yard space is abundant in the rural areas. Table 4.2 presents the percentage distribution of storage methods for the WRSQ survey.

Table 4.2: Distribution of storage containers reportedly utilized by the 79 WRSQ survey respondents, February 2007

Type of Storage	Percent
Closed container	17.7
Open container	10.1
Plastic bags	48.1
Pile in the yard	16.5
Other	1.3
More than 1 storage method	3.8
Total	97.5
No response	2.5
Total	100.0

In terms of disposal, the results from the WRSQ survey, presented in Table 4.3 show that residents are utilizing several types of disposal methods for the differing solid waste types. Food waste is reportedly reused as animal feed, for either dogs or pigs, by 40.5% of the respondents. Not surprisingly, burning is the most commonly reported disposal method in the study area for yard trimmings, paper and cardboard, and plastic. As was shown in Chapter Two, burning is also the most common disposal method employed for all types of household waste in the Parish of St. Ann and Jamaica, 57.8% and 43.3%, respectively.

Within the study area, burning is probably employed for these materials because combustion is effective in ‘getting rid’ of this waste, in comparison to the unavailable collection. Conversely, burning is not commonly used for disposing of metals and glass as presented in Table 4.3, since they are noncombustible materials. It should be noted that ‘burning’ is usually done in a pile within close proximity to the home, and not in an incinerator. So the waste slowly reduces to ash in a low temperature, slow burning fire relative to that within an incinerator. The resultant ash receives no further treatment or disposal. Air contaminants of household solid waste may include particulate matter and toxic chemicals such as benzene and dioxins.

Table 4.3: Most common disposal methods for each type of solid waste, reported in the WRSQ survey, February 2007

Type of Waste	Most common disposal method	Percentage
Food waste	Reuse	40.5
Yard trimmings	Burn	74.7
Paper/cardboard	Burn	78.5
Plastic	Burn	68.4
Metals	Garbage truck	35.4
Glass	Garbage truck	35.4

As discussed in Chapter Two, the type of container dictates the length of time that the waste can be stored, and use of improper storage containers can attract disease-vectors, such as rats. In order to reduce this public health threat, the collection cycle of the Parks and Markets companies should match the disposal cycle of the households in the respective jurisdictions. In the study area, the garbage collection is infrequent at best and at worst, unavailable, so it is not surprising then that the WRSQ survey respondents reported using other disposal methods. The prolific use of unsustainable disposal methods, especially burning, is the negative result of both the current collection capacity and the use of insufficient storage containers by the residents. Therefore, both of these issues will need to be addressed concurrently to improve household solid waste management, specifically in regards to reducing the public health threat posed by vector-borne diseases.

In contrast, the WRSQ survey results suggest that a culture of waste segregation exists in the study area, evident by the use of different disposal methods for biodegradable and non-biodegradable waste. The presence of this behavior will benefit a future recycling program or other waste reduction strategy that requires waste segregation at the home, which is also known as source separation. Source separation is important when considering the quality of the final recycled or composted product, where separately collected solid waste types from the household provides a clean and reliable feedstock (Wilson et al., 2001). In the event that waste reduction programs become widespread in Jamaica, waste segregation at the source is an aspect of solid waste management that could be transferred from the municipality to the household as Figeroua

(1998) suggests, especially since Jamaica, like other developing countries, lacks the financial resources to develop a facility for separation.

In addition to the evidence of existing segregation behavior, the survey results indicate that 96% of survey respondents are willing to separate the waste types if a recycling program was established in their community. Despite the fact that 82.2% of respondents agree that ‘regular garbage collection is the only solution to the garbage problem,’ the WRSQ survey results indicate a desire for access to other disposal options in their communities, like recycling.

4.5 Factor Five – Household Education Having knowledge of MSWM and an understanding of the linkages between human behavior, waste handling, and health/sanitation/environment compromise Household Education.

Within the scope of household solid waste management, this factor is probably the most significant because it addresses the realm of the individual consumer and waste generator. The importance of the individual as a part of the household and greater community within the solid waste management system can not be underestimated or unheeded, since public participation is crucial for the success of waste reduction (McKenzie-Mohr, 2000). Schultz et al. (1995) observed that one commonality among recycling programs is the reliance upon public participation even though the procedural and organizational structures of each vary and change. Public participation, resulting from public awareness raised through education, is viewed by international organizations as being necessary for successful waste management programs (UNEP, 2004 and USEPA, 1995).

The Directory of ESTs for the Integrated Management of Solid, Liquid, and Hazardous Waste for SIDS in the Caribbean Region (UNEP and CEHI, 2004) postulates

that lack of education of the general public is a factor contributing to the limited waste reduction activity in the region. *The Directory* (UNEP and CEHI, 2004) states that public education is one of the most critical actions necessary in Small Island Developing States, to help find solutions to solid waste problems. It recommends that the public should be informed of the environmental, health and economic impacts of current solid waste generation and disposal habits (UNEP and CEHI, 2004).

The Jamaica Environment Trust, whose focus is environmental advocacy and education, has observed through their educational campaigns that most Jamaicans are aware of proper disposal methods but are unable to act on this knowledge because of the existing barriers, such as lack of access to waste collection and recycling programs. In response to these barriers, households practice disposal methods that are unsustainable like burning and illegal dumping despite the health risks. JET recommends that in order to achieve behavioral change in relation to solid waste practices, “Jamaicans need to understand why they must change their behavior and how the behavioral change will benefit them” (Curtis, 2006).

Discrepancy between awareness and concern of a health risk and reported behavior is seen in the results of the WRSQ survey. Burning was found to be the most common disposal method used for a variety of waste types, however, on average, 86.4% of the respondents that reported burning their garbage also reported being concerned about the health risks related to it (Table 4.4). The inconsistency between the health concern and the practice of burning garbage is probably related to the fact that burning is an easy and simple answer to inadequate garbage collection, suggesting that convenience of disposal offsets the perceived health risks to the individual.

Table 4.4: Percentage of concerned respondents that also reported ‘burning’ as a disposal method for the various waste types in the WRSQ survey, February 2007.

Type of waste	No. report burning	Percentage concerned (%)
Food waste	10	70
Yard trimmings	59	84.7
Paper/cardboard	62	82.3
Plastic	54	81.5
Metals	8	100
Glass	6	100

Illegal dumping is the most common disposal method in the developing world (Medina, 2002) and is the third most common disposal method used in Jamaica (Table 2.5). But illegal dumping within the study area is relatively low, where only 4.0% of the 79 respondents reported dumping one of the six waste types on the road or in a gully. Dumping household solid waste into a river or gully was most common in Enumeration District NW050. Respondents cited dumping ‘in a gully located on private property’ in response to the lack of garbage collection services in the community due to the road conditions.

Overall concern for issues addressed in the WRSQ survey was high among respondents (Figure 4.1) suggesting that respondents recognize and are aware of the issues related to poor solid waste management. Of the 79 respondents, 77 expressed concern for the garbage situation in Jamaica as a nation, and 76 expressed concern for vector-borne diseases, like leptospirosis and malaria, associated with improper storage and disposal methods. Both vector-borne diseases have received much attention in the news recently¹¹ thereby exposing the prevalent solid waste issues in Jamaica. Media

¹¹ Jamaica experienced an outbreak of 326 reported cases of malaria beginning in December 2006. Drains blocked by garbage can result in stagnant bodies of water, encouraging the breeding of malaria carrying mosquitoes. Furthermore, accumulated garbage encourages the growth of the rat population. In 2005, 4 individuals from the parish of Clarendon contracted leptospirosis and died. The sustained rains at the time affected the rats’ habitat leading to a rise in rodent infestation in residential communities.

exposure of these issues potentially expands the awareness of the viewing population through the information conveyed in the story.

In some cases, WRSQ survey respondents expressed no concern for issues that did not affect them directly. For example, in NW050 a respondent expressed having no concern about flooding due to blocked drains because the area is not prone to flooding and no drains are located in that area. Of least concern for the respondents was the reduction of natural resources that are used to manufacture the consumer products. It was also the issue that garnered the highest ‘no opinion’ response rate, at nearly 14%, suggesting a clearly distinct unfamiliarity compared to other issues.

Based on the WRSQ survey results, it appears that issues that either have a direct impact on the respondent or have received attention in the news are of more concern to the respondents. Therefore, perhaps an effective method of raising awareness of issues, especially those that are unfamiliar to individuals, will be through the media where the messages should focus on the potential negative impacts that solid waste issues have on everyone even if not directly.

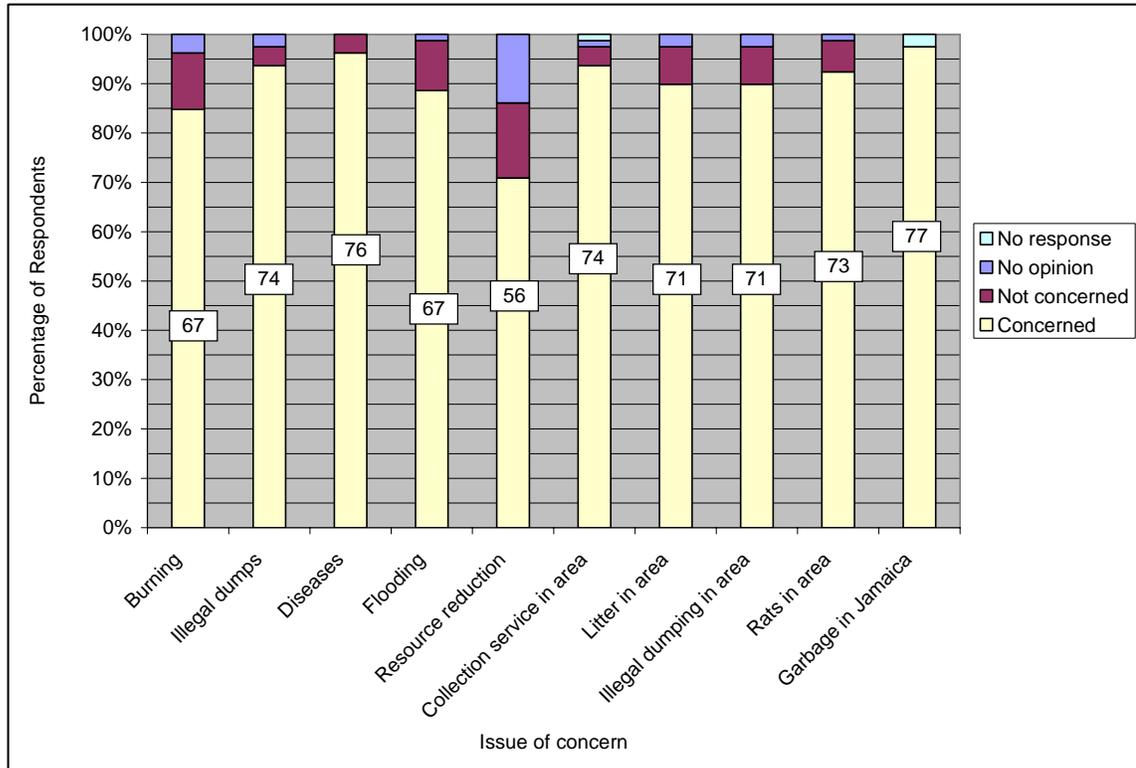


Figure 4.1: Level of concern for issues addressed in Section 3 of the WRSQ survey, February 2007. The chart presents the overall results of the 79 respondents in the three enumeration districts of the study area. The numbered boxes on each bar indicate the frequency of respondents expressing concern about an issue.

Public education is included in the *National Solid Waste Management Act of 2001* as a function of the *National Solid Waste Management Authority*, stating that ‘the *Authority* shall promote public awareness of the importance of efficient solid waste management and foster understanding of its importance to the conservation, protection and proper use of the environment’ (Part 2, Section 2, paragraph 4). In addition, the *Policy* indicates the *Authority* will partner with the private sector to sponsor messages about the correct practices of reducing the amount of waste generated, reusing articles and items where possible, and recycling and storing waste.

Based on the interviews with NSWMA and NEPM Waste Management Ltd, the primary waste reduction initiatives are public education campaigns (Smith, 2006;

Williams, 2007). Education about composting is the main waste reduction strategy this is currently emphasized by NEPM, where each community within the service area is visited twice a year for educational purposes. Source reduction is also a component of the public education conducted by NEPM, but according to the Regional Operations Manager, the behavioral change has not come about yet, shown by the continued proliferation of plastic and Styrofoam litter (Williams, 2007).

The Regional Operations Manager of NEPM opined that public education and public awareness are steps in implementing successful waste reduction strategies in Jamaica, and suggests starting in the schools. The same sentiment was voiced in the study area, where educating children about the environment was supported by 97.5% of the respondents, and proper solid waste management was supported by 76.9% of the respondents. Furthermore, over 90% of respondents agreed that public education about proper garbage management is one way to fix the problem.

In a study of recycling roles within the household, Meneses and Palacio (2005) recommended that educational programs include components to build ecological conscience or environmental knowledge, ecological involvement, and ecological self-realization among citizens. In the context of Jamaica, past research has shown a need for environmental education. Espeut (1999) found that 61.1% of respondents indicated that they had enough information about actions to protect the environment, but based on previous answers in the survey, the author concluded that Jamaicans are in need of environmental information to a much greater extent than this. Espeut recommended that the first task of environmental education be to convince the public that they need environmental information.

The need for further environmental education is also evident in the study area. The respondents were asked to define the term ‘natural environment’, and the responses were coded according to whether they provided a definition accorded with the definition used in the WRSQ survey:

The environment may be defined as the whole world around us: the air, water and land, forests, wetlands and the sea, and all the animals and plants living about us.

Of the seventy-four individuals that provided a response, only 21.6% provided a ‘correct’ definition of the natural environment, which indicates an understanding about the natural environment (Table 4.4). To be considered ‘correct’, the definition needed to include at least one aspect of the definition given above. The definition given above was taken from the definition given in *The Survey on Environmental Awareness and Attitudes 1998*, where roughly 50% of the respondents had an ‘adequate understanding of the concept of the environment’ (Espeut, 1999). Incorrect definitions indicate a lack of understanding by the respondent of the term ‘natural environment’. Incorrect responses often referred to the respondent’s immediate surroundings (i.e. “the surrounding community” or “the surrounding area”) or referred actions to keep it clean,

Table 4.4: Percentage of WRSQ survey respondents that understand the natural environment by providing a correct definition accorded by the following: *The environment may be defined as the whole world around us: the air, water and land, forests, wetlands and the sea, and all the animals and plants living about us.* Non-response rate for this question is 6.3%

Coded response	Percent
Understand	21.6
Don’t understand	35.1
Don’t Know	43.2

Of all the demographic variables considered in the WRSQ survey, education level appears to predict a correct understanding, based on a Pearson chi-square test indicating a statistically significant relationship (at $p < 0.05$). As shown in Table 4.5, as education level increases the percentage of correct definitions given by respondents also improves. Individuals that had attended and graduated from at least a secondary educational institution were more likely to understand the term 'natural environment' than respondents with only a primary education. The findings from the WRSQ survey confirm in part the findings of *The Survey on Environmental Awareness and Attitudes 1998*, which found that younger (< 55 years old) and more educated individuals were more likely to understand the term 'natural environment' (Espeut, 1999). Overall, the WRSQ survey data in Table 4.5 suggests that the demographics of the respondent, besides education level, are not a significant predictor of the respondent's level of understanding of the term 'natural environment'.

Even though the survey results shown in Table 4.5 indicate that demographic variables are not related to environmental concern, the results do imply that environmental educational campaigns will need to target all individuals, regardless of demographic profile. Environmental campaigns conducted in schools will be most useful in primary institutions, since it was found that an individual with a higher education was more likely to understand the term 'natural environment'.

Table 4.5: Understanding the term ‘natural environment’ by Gender, Age, Education Level, Employment Status, and Income Level of WRSQ survey respondent, February 2007. The Pearson Chi-square value represents the statistical significance of each demographic variable, where $p < 0.05$ represents a statistically significant relationship between the demographic variables and the respondents’ understanding of the natural environment.

Demographic Variable		Understand	Don't Understand*	Count	Total
Gender ($p = 0.621$)	Male	26.9 (7)	73.1 (19)	26	100
	Female	19.6 (9)	80.5 (27)	46	100
	Total	22.2 (16)	77.8 (46)	72	100
Age ($p = 0.582$)	15-24	60 (3)	40 (2)	5	100
	25-34	20 (2)	80 (8)	10	100
	35-44	18.2 (4)	81.8 (18)	22	100
	45-54	21.1 (4)	78.9 (15)	19	100
	55-64	30 (3)	70 (7)	10	100
	65-74	0 (0)	100 (3)	3	100
	75-84	0 (0)	100 (3)	3	100
	85 plus	0 (0)	100 (3)	1	100
Total	21.9 (16)	78.1 (57)	73	100	
Education Level ($p = 0.033$)	Primary/All-age	6.1 (2)	93.9 (31)	33	100
	Secondary	26.9 (7)	73.1 (19)	26	100
	Tertiary	55.6 (5)	44.4 (4)	9	100
	Other	40 (2)	60 (3)	5	100
	Total	21.9 (16)	78.1 (57)	73	100
Employment Status ($p = 0.483$)	Employed	24.1 (7)	75.9 (22)	29	100
	Unemployed	18.9 (7)	81.1 (30)	37	100
	Student	100 (1)	0 (0)	1	100
	Retired	16.7 (1)	83.3 (5)	6	100
	Total	21.9 (16)	78.1 (57)	73	100
Income Range ($p = 0.137$)	No income	13.8 (4)	86.2 (25)	29	100
	\$1000-\$3200	20 (1)	80 (4)	5	100
	\$3200-\$4999	22.2 (2)	77.8 (7)	9	100
	\$5000-\$6900	20 (1)	80 (4)	5	100
	\$9000 or more	66.7 (4)	33.3 (2)	6	100
	NR/DK	20 (4)	80 (16)	20	100
	Total	21.6 (16)	78.4 (58)	74	100

* Includes coded responses – ‘don’t know’ and ‘incorrect’

Espeut (1999) concluded that knowledge about the environment is, by itself, not the determining factor for environmental activity, but actions are governed by individual

norms and values. This conclusion is also corroborated in research from developed countries. Composting was determined not to be an intentional act, meaning that resources and knowledge are necessary to practice composting (Taylor and Todd, 1997). Barr et al (2001) found that recycling is fundamentally 'norm based' where participation by others will influence other individuals to participate, whereas source reduction is a values and concerns-based behavior, where internalizing the waste problem will enhance source reduction participation. Barr et al. also suggest that policies, practical action, and educational campaigns should approach each strategy based on the unique attributes of each waste reduction practice, taking into account the respective behavior predictors.

Public education is acknowledged by international agencies and research in developed countries to have a significant affect on the participation of individuals in waste reduction programs. In Jamaica, public education is also recognized by the NSWMA and legislating documents to be a necessary component of solid waste management. More importantly, education about issues related to solid waste management is actually reaching the public through the media and community education programs.

The current level of knowledge about solid waste management and concern about issues related to solid waste management, as illustrated in the WRSQ survey, provides a starting point but is not enough for long lasting public participation. Public education campaigns should be directed at all demographic profiles and should focus on raising awareness about the environment and links between public health, while accounting for the unique norms that direct the each waste reduction behavior.

4.6 Factor Six - Household Economics

Individuals' income influencing waste handling behavior (reuse, recycling, and illegal dumping), presence of waste collection and/or disposal fees, and willingness to pay by residents comprise the Household Economics factor.

In developed countries, such as the United States, unit pricing schemes are employed as an incentive to encourage households to participate in waste reduction practices. Unit-pricing schemes motivate households to reduce consumption of solid waste disposal services since they charge customers according to the amount of solid waste generated. In the Parish of St. Ann, residents pay a small sum for solid waste management services through property taxes. But in 2000, the current level of compliance of payment was estimated to be only 50% (NSWMA, 2000). According to the *Jamaica Survey of Living Conditions Parish Report 2002*, the mean monthly property tax payment in the Parish of St. Ann was JA\$62¹², or 0.3% of the total household consumption (PIOJ and STATIN, 2002).

Table 4.6 shows the income distribution within the study area, and just over half (53.3%) of the study area population has no income, where 28.8%, 44.4%, and 21.9% are *unemployed, student, or not of working age* (under 15 years old), respectively.

Table 4.6: Income range distribution by percentage for 79 WRSQ survey respondents, 300 household members in study area, February 2007

Income Range (JA\$)	Respondent (%)	Study Area (%)
No income	38.0	53.3
≤\$1000	0	0.3
\$1000-3200	6.3	3.0
\$3200-\$4999	11.4	6.0
\$5000-\$6900	7.6	3.0
\$7000-\$8900	0.0	1.7
≥ \$9000	7.6	3.0
No response/Don't know	29.1	29.7

¹² According to the CIA Factbook, the exchange rate in 2002 was 48.416 Jamaican dollars per US dollar; 57.741 (2003), 61.197 (2004), 62.51 (2005), 65.768 (2006).

Bivariate analysis was conducted in order to identify a statistically significant relationship between income range and storage method. A Pearson chi-square test revealed that the relationship is not statistically significant (at $p < 0.05$), where income appears to have no affect on the type of storage method used by respondents. Table 4.7 illustrates the distribution of reported storage method versus the respondent's reported income. Interestingly, the respondents with the highest income level use plastic bags more than any other income level group.

The findings here contradict those of Gage (1998) that individuals and communities of higher-income employ storage containers of larger capacity and increased durability (i.e. 45-gallon drums, large plastic containers, or steel mesh containers), whereas residents of lower-income areas employed convenient containers (i.e. milk crates and plastic buckets). In the WRSQ survey, almost one-third (28.6%) of the respondents that reported a storage method did not provide an income range, which may explain the statistically insignificant relationship between income and storage method.

Table 4.7: Reported storage method versus the reported income range of the WRSQ survey respondent, February 2007. The highlighted entries show the storage method type most frequently used by a given income range. Bivariate analysis revealed a Pearson chi-square value of 0.339.

HH storage method of SW (%)	Respondent's income range					
	No income	\$1000-\$3200	\$3200-\$4999	\$5000-\$6900	\$9000 or more	No response/ Don't know
Closed Container (18.2%)	30.0	25.0	22.2	0.0	16.7	4.5
Open Container (10.4%)	3.3	25.0	33.3	0.0	0.0	13.6
Plastic Bags (49.4%)	40.0	50.0	33.3	50.0	66.7	63.6
Pile in the yard (16.9%)	20.0	0.0	11.1	50.0	0.0	13.6
Other (1.3%)	3.3	0.0	0.0	0.0	0.0	0.0
More than 1 storage method (3.9%)	3.3	0.0	0.0	0.0	16.7	4.5
Total (100%)	100.0	100.0	100.0	100.0	100.0	100.0

Past research in developed countries, as discussed in Chapter Two of this report, has also shown a link between income level and environmentally-responsible disposal behavior. Specifically, recycling behavior is practiced more by individuals with a higher income level (Oskamp et al, 1991). A similar relationship was not present when income level was compared to the disposal methods employed by the WRSQ survey respondents. In fact, respondent income appears to have no affect on the type of disposal method employed for the various waste types. Table 4.8 presents the bivariate analysis of the variables, illustrating the most frequently reported disposal method employed for each income level and waste type.

Table 4.8: Most frequently reported disposal method for each waste type versus the reported income range of the WRSQ survey respondent, February 2007. The values represent the percentage of respondents within the income range reportedly using the specified disposal method for the waste type.

Waste Type	Respondent's income range						Pearson chi-square value
	No income	\$1000-\$3200	\$3200-\$4999	\$5000-\$6900	\$9000 or more	No response/ Don't know	
Food Waste	Reuse (48.3%)	Reuse (60.0%)	Reuse (44.4%)	Burn (50.0%)	Reuse (33.3%)	Reuse (33.3%)	0.282
Yard Trimmings	Burn (80.0%)	Burn (80.0%)	Burn (66.7%)	Burn (83.3%)	Burn (66.7%)	Burn (69.6%)	0.694
Paper/ Cardboard	Burn (83.3%)	Burn (100.0%)	Burn (77.8%)	Burn (83.3%)	Burn (60.0%)	Burn (78.3%)	0.914
Plastic	Burn (82.8%)	Burn (80.0%)	Burn (66.7%)	Burn (50.0%)	Garbage Truck (60.0%)	Burn (65.2%)	0.115
Glass	Garbage Truck (36.7%)	Garbage Truck (40.0%)	Garbage Truck (44.4%)	Other (33.3%)	Garbage Truck (60.0%)	Garbage Truck (36.4%)	0.768
Metal	Garbage Truck (42.9%)	Garbage Truck (60.0%)	Dump in Yard (22.2%) Garbage Truck (22.2%)	Garbage Truck (33.3%)	Garbage Truck (60.0%)	Garbage Truck (40.0%)	0.616

On the other hand, by inspection of the data in Table 4.8, the reported disposal methods appear to be used for a particular waste type, regardless of income level. Burning, for example is predominant to other disposal methods for yard waste regardless of income level, whereas glass and metals are disposed of by a garbage truck for all income levels. Again, burning is considered a method of garbage disposal in Jamaica, not just a method of waste processing to reduce volume for other disposal.

Despite the apparent statistically insignificant relationship between income level and reported storage and disposal methods, the findings do have implications for solid waste management interventions in the study area. The findings suggest that interventions to improve household solid waste management practices will need to target all income levels within the area, not just lower-income individuals as past research has suggested. In addition, intervention planning will have to take into consideration all waste types and all disposal methods, since disposal method appears to depend on the type of waste.

Figure 4.2 illustrates that roughly 50% of survey respondents expressed a willingness to pay for recyclable materials collection. However, respondents were the most unsure about paying for this service, compared to other programs addressed in the WRSQ survey. Based on a Pearson chi-square test, income level does not appear to affect willingness to pay for curb-side recycling services, as shown in Table 4.9. In other words, even individuals with no reported income reported willingness to pay, and individuals with a higher income level reported unwillingness to pay.

Table 4.9: Reported willingness to pay for curb-side recycling compared to income level reported by WRSQ survey respondents, February 2007. Bivariate analysis revealed a Pearson chi-square value of 0.286.

Reported Willingness (%)	Respondent's income range						Total
	No income	\$1000-\$3200	\$3200-\$4999	\$5000-\$6900	\$9000 or more	No response/Don't know	
Don't Know	30.0	0.0	55.6	16.7	33.3	26.1	29.1
No	13.3	0.0	11.1	16.7	33.3	30.4	19.0
Yes	56.7	100.0	33.3	66.7	33.3	43.5	51.9

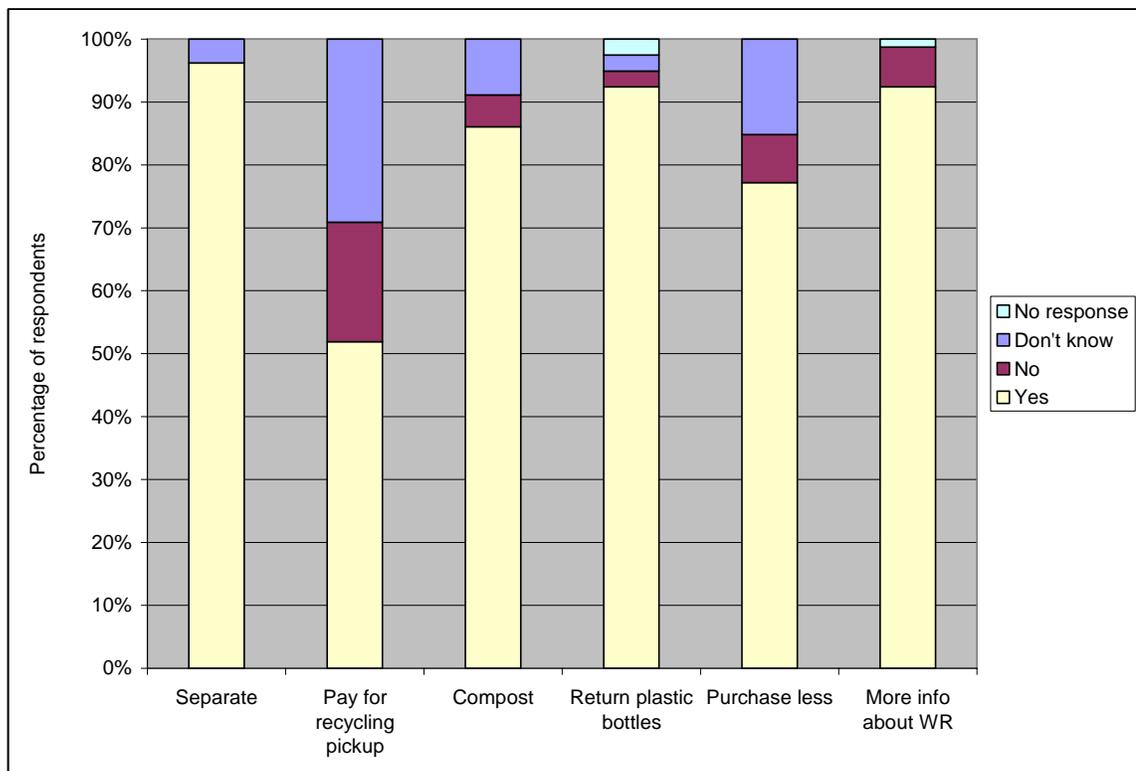


Figure 4.2: Distribution of willingness to participate in various programs reported by WRSQ survey respondents, February 2007. Willingness to participate in the following: separating materials into separate bags for curbside recycling; pay for pickup of recycling materials; compost food and yard waste; return plastic bottles to the store for a bottle refund; purchase less disposable items; and more information about how and what types of solid waste to compost, reuse, and recycle.

Perhaps due to the economic constraints of the respondents, where 30.0% of respondents reported having no income, the willingness to pay for recycling pickup is not as great as the willingness demonstrated for other programs that are not associated with an explicit cost to the respondent, like waste separation. For some residents, affordability of the service will dictate whether they are willing to pay, which may explain the uncertainty of individuals (29% 'do not know') and the statistically insignificant relationship between income level and willingness to pay (Table 4.9). Furthermore, the current state of the garbage collection service being unreliable or unavailable is perhaps causing uncertainty or reluctance among the respondents to participate due to a low confidence level in the existing collection services.

4.7 Factor Seven – MSWM Administration Presence and effectiveness of private and/or public management of waste through collection, recovery, and disposal comprises the MSWM Administration factor.

The *National Solid Waste Management Authority* is the statutory body with responsibility for management of solid waste nationwide as mandated by the *National Solid Waste Management Act*. The Authority is responsible specifically for:

- Overall management of solid waste
- Establishing sector standards and performance criteria
- Public and community education
- Licensing solid waste companies, collection vehicles, and disposal site operators
- Contracting solid waste collectors for municipal garbage collection
- Planning and defining collection zones in collaboration with the Parish Councils, the Kingston and St. Andrew Corporation and the Town Planning Authority
- Establishing the tipping fee structure and rates
- Operating solid waste disposal sites in the short term and preparing them for divestment to the private sector subsequently

The *National Solid Waste Management Policy* states that the focus of the *Authority* is to provide management while the private sector will be encouraged to carry out the operations that include collection, transportation, and disposal (NSWMA, 2000). Despite this prescribed separation of responsibilities between private and public entities, the NSWMA is still very much financially and operationally focused on collection and disposal of municipal waste through the four regional Parks and Markets companies (Table 4.10).

Table 4.10: The four regional Parks and Markets agencies currently within the National Solid Waste Management Authority and the Parishes in which they operate (NSWMA, 2000)

Company	Parishes Served
Metropolitan Parks and Markets	Kingston and St. Andrew, St. Catherine, and St. Thomas
Southern Parks and Markets	Manchester, St. Elizabeth, and Westmoreland
Western Parks and Markets	Hanover, St. James, and Trelawny
Northeastern Parks and Markets	St. Ann, St. Mary, and Portland

According to the NSWMA representative interviewed by this report's author, the long-term goal of NSWMA is to privatize the operational aspects of the sector, like street sweeping, collection and disposal (Smith, 2006). Once the private entities take over the operational components, the necessary funds will be available to the NSWMA for investigating and implementing waste reduction strategies. The privatization of solid waste operations will also result in the NSWMA being a solely regulatory and enforcement agency. The planned shift from publicly to privately administered solid waste management is corroborated by Troschinetz (2005), stating that privately

administered solid waste management has been very successful in many of the case studies and is therefore viewed to be an incentive to recycling.

In addition to collaborating with private contractors, the *Policy* (2000) points to eight other Jamaican agencies that play a principal role in solid waste management:

- Ministry of Health – sanitation and public health
- Ministry of Environment and Policy – environmental policy
- The Natural Resources Conservation Authority – environmental management
- The National Water Commission – management of sewage sludge
- The Shipping Association of Jamaica – ship generated waste
- The Port Authority of Jamaica – ship generated waste
- Bureau of Standards – eco-packing
- Ministry of Finance and Planning

The *National Solid Waste Management Policy* (NSWMA, 2000) is just one of many policies, guidelines, and pieces of legislation that address different aspects of sanitation in Jamaica. The roles and responsibilities of each of the above agencies in terms of solid waste management are not detailed in the *Policy* (2000), resulting in gaps and overlaps.

In a more recent publication (NSWMA, 2003), responsibilities between agencies appear to be much more defined. For example, discussions with the National Environment and Planning Agency (NEPA) have begun to address the need for collaboration in order to prevent unnecessary overlap in the execution of the respective mandates. The areas of collaboration include: enforcement, NEPA's Permit and License system, NSWMA Licensing system, and site visits in respect to complaints or associated with applications. The *Authority* will also work with the NEPA and the local authorities

to ensure optimal collection zones and appropriate siting for disposal facilities and transfer stations.

4.8 Factor Eight – MSWM Personnel Education Presence of trained laborers and skilled professionals in MSWM positions comprises the MSWM Personnel Education factor.

The *National Solid Waste Management Authority* is governed by a Board of Directors appointed by the Minister of Local Government and Environment, and the head of the Board is the Executive Chairman. The day-to-day operations of the *Authority* are managed by the Executive Director, in addition to the personnel in departments such as Accounts, Transport, Parks, Planning and Research, Resource Development, and National landfill, to name a few.

At the Regional level, the day-to-day operations are managed by the Regional Operation Manager (ROM). According to the Regional Operations Manager at NEPM, a variety of positions are available within the various departments, including administrative, secretarial, accounting, supervisory, and operational (i.e. street sweepers, drivers, sidemen, and landfill attendants). The ROM stated that the most important positions within the company are the operational positions as they are most visible to the public (Williams, 2007).

The *National Solid Waste Management Act* (2001) specifies that the *Authority* in addition to its primary functions of solid waste management may ‘conduct seminars and provide appropriate training programs and consulting services and gather and disseminate information relating to solid waste management.’ This suggests that the *Authority* will conduct both seminars for personnel within NSWMA and the Regional Parks and Markets, as well as public education for issues related to solid waste management. When

asked about training and education within NEPM currently underway for laborers and professionals, the ROM indicated that skills' training is the focus for NSWMA in 2007. All positions will receive unique training to further educate the personnel about their respective role within NSWMA (Williams, 2007).

In addition to skills training, waste reduction education and training sessions should be provided for personnel within NSWMA and the regional Parks and Markets. Solid waste management personnel with an understanding of the importance of waste reduction and its role within a solid waste management system will enable the strategies to be even more successful. As the Regional Manager stated, the operational personnel, those individuals sweeping the waste in the streets and collecting the waste from homes and institutions are in direct contact with the public, which provides an opportunity to reinforce the public educational campaigns that are attempting to build awareness within the public of the solid waste problem.

4.9 Factor Nine – MSWM Plan The presence and effectiveness of a comprehensive, integrative, long-term MSWM strategy comprises the MSWM Plan factor.

Troschinetz (2005) observed that a solid waste management plan was highly encouraged by every case study to positively influence recycling and other forms of sustainable solid waste management. A national plan should first provide a total overview or baseline of the waste situation in the country, such as waste quantities, treatment capacity, financial aspects, and environmental impacts. The plan should also prescribe targets and strategies based upon the analysis of the baseline data. The waste plan should not only address long-term strategies and targets but should also be complemented by: 1) local waste management plans, taking into consider local conditions

and waste trends and 2) a legal framework to assist in effective implementation and enforcement. The combination of a waste policy and legal framework provide the foundation for the waste plan (UNEP, 2004).

The *National Solid Waste Management Act* is the governing legislation for solid waste management in Jamaica and states, ‘the *Authority* has the power to establish procedures and develop, implement, and monitor a national plan and other plans and programs related to solid waste management.’ Thus far, the *National Solid Waste Management Act* and *Policy* are the two documents that resemble a solid waste management plan for Jamaica, addressing aspects of solid waste management such as responsibilities and functions of the NSWMA, regulatory framework of the Act, strategies for cost recovery, strategies for waste processing and waste minimization, and strategies for public education and enforcement. Unfortunately, neither document discusses objectives to implement the strategies, nor states short- and long-term targets and goals for cost recovery or waste reduction, as recommended by international development agencies like the UNEP (2004).

4.10 Factor Ten – Local Recycled-Materials Market The existence and profitability of market systems relying on recycle-material throughput, involvement of small business, middlemen, and large industries and exporters.

Composting and recycling programs require a supply of raw materials or feedstock and demand for the final product. The supply and demand sides comprise the waste recovery market. Yet lack of markets for these materials is viewed as a challenge to new and existing composting (Zurbrugg, 2002) and recycling programs (June, 1997). Zurbrugg (2002) stated that many large and small scale composting operations have

failed, despite the known ecological benefits, because inadequate attention was given to marketing and developing a high quality product.

The decision to introduce composting in low-income countries must be ‘market-oriented and based on careful economic and financial analysis,’ as recommended by Schubeler (1996). The cost analysis should not only account for production, marketing, and transportation, but also the economic benefits to the environment and the solid waste management system. In *Composting and Its Applicability in Developing Countries*, Hoornweg et al. (1999) observe that compost rarely generates a profit on its own, but can provide economic satisfaction when benefits to the environment are accounted for and the cost savings associated with avoiding waste disposal is included. In order to capitalize on the benefits of composting, the issue of compost marketing is not so much finding a use for the finished compost but rather finding cost-effective applications (Hoornweg et al., 1999).

In a feasibility study for a composting operation at the Riverton disposal site in Kingston, Pendley (2005) investigated the raw material inputs and a cost-effective application necessary for a viable operation. Pendley concluded that a composting operation would be economically feasible, and that utilizing the final compost as landfill cover would result in direct and indirect economic benefits. The direct economic benefit was the avoided cost of hauling cover material to the dumpsite, and indirect economic benefits included avoided space occupied at the dumpsite, reduction in methane emissions, avoided marketing costs, and avoided quality control costs. Due to the chosen technological inputs of the proposed operation, the large-scale composting operation at

Riverton would not utilize household organic waste but rather food, yard, and animal waste from markets and commercial entities.

In terms of smaller-scale backyard composting operations, it is recommended that they should be promoted when a significant number of homes have gardens or yards (UNEP, 1996), since other farmers and households can utilize the final product as a natural fertilizer. Unfortunately, the WRSQ survey revealed a potential issue that could arise in the demand side of a community-based operation. In the study area only 20.2% of respondents reported growing specifically fruits or vegetables for household consumption, and 53.2% of the respondents reported not growing any type of food for household consumption. These findings suggest that the demand for the final product would not be adequate to sustain a local composting operation in the study area.

The growth of recycling programs in developed countries, like the United States, has revealed limitations to this waste reduction strategy. Ebreo et al. (1999) stated that ‘once recycling becomes popularized among the public and the behavior is widespread, the level of recyclable materials diverted from the waste stream reaches a plateau.’ The authors cited two impediments to recycling being a primary solution to solid waste management issues: 1) non-recyclable materials awaiting the start of a new market, and 2) market saturation of existing markets.

In the Caribbean Region, the isolation of islands from potential recyclable-materials markets is one of the factors contributing to the lack of waste reduction activity (UNEP and CEHI, 2004). In addition, quantities of waste are often not large enough to support local recycling networks, as stated in *The Directory of ESTs for the Integrated Management of Solid, Liquid, and Hazardous Waste for SIDS in the Caribbean Region*

(UNEP and CEHI, 2004). The relatively small quantity of waste available for recycling compared to larger countries is also recognized by the *Jamaica's National Solid Waste Management Policy*, stating that Jamaica will not be able to support many large recycling enterprises as a minimum quantity of waste is required for the operations to be viable (NSWMA, 2000).

According to the Jamaica Environment Trust, the recycling market in Jamaica is 'small but growing,' where currently five industrial entities export materials for recycling (Curtis, 2006). These few companies collect waste paper, PETE bottles and scrap metal, which are then shredded and crushed to reduce the volume for shipping (NSWMA, 2000). Caribbean Paper Recycling Company in Kingston, for example, processes waste paper for export which is first sorted by grade, then cleaned and compacted into bales, and finally shipped to foreign paper mills that convert the material into new paper products. As of 2003, the plant intended to export approximately 20,000 tonnes (22,046 tons) of baled paper each year (Jamaica-Gleaner.com, 2003).

The Jamaica Environment Trust established a recycling depot in 2002 in Kingston. Items currently collected include PETE bottles, HDPE bottles, newspaper, cardboard, and glass, which are then sold to industry partners for export. Unfortunately, due to the current operation structure and limitations of the depot, if individuals want to take advantage of the recycling operation at the depot, they must bring the materials to the depot on their own time and expense.

The current state of the recycling and composting market in Jamaica is limited, but the examples of programs discussed above suggest that it is growing. The NSWMA

representative states that organizations need to capitalize on a larger scale the existing components of the waste stream (Smith, 2006).

4.11 Factor Eleven – Technological and Human Resources

Availability and effective use of technology and/or human workforce and the safety considerations of each comprise the Technological and Human Resources factor.

In many developing countries, adequate funds are not available to implement technology that is reliable and appropriate (Troschinetz, 2005). Implementation of a sustainable integrated solid waste management plan that incorporates waste reduction needs trained staff, appropriate equipment and facilities, and a sustaining budget (Claggert et al., 1998). The current solid waste management system in Jamaica utilizes a combination of tipper and compactor trucks for collection of household waste. In the northeast region, NEPM utilizes a fleet of 15 trucks, seven of which operate in the Parish of St. Ann. These types of trucks, which are designed for wide streets, are incompatible with much of the terrain and roadways, and are an example of the inappropriate transfer of technology from developed countries.

The funds allocated from central government to the regional Parks and Markets are inadequate for maintenance of equipment and operations, as stated by the Regional Operations Manager at NEPM (Williams, 2007). Currently it is estimated that NEPM is receiving only half of the funds it requests from central government (Williams, 2007). When asked what the funds would be used for if the full amount was allocated, the Regional Operations Manager cited operations, including transportation, collection, and disposal.

The Planning and Research Department at the NSWMA collects data and monitors indicators related to waste generation, collection, service coverage, and location

of illegal dumpsites. Computer databases, GIS, and statistical programs are a part of the technological resources used by NSWMA to manage solid waste in Jamaica.

The effectiveness of waste reduction programs, specifically composting and recycling will be enhanced through appropriate equipment design (Schubeler, 1996). Given the complexity of recycling and composting programs, the technological resource inputs will vary to meet local conditions and requirements. Providing a detailed plan for a recycling and composting operation in the study area is beyond the scope of this study. Nevertheless, it can be stated that prior to implementing either a small- or large-scale operation, sufficient planning should be done, considering the source of material and expected generation rates, and a thorough investigation of cost-effective use of the final product. Design of the composting or recycling operation must consider the technological and human resource requirements of material collection, transport, and processing, while taking into account possible impacts to public and environmental health.

Even though the composting of organics is a natural process, public health issues can result from design and operation inadequacies. Large composting operations present a potential hazard to environmental and public health and safety, through possible hazardous substances in the compost leachate and runoff (UNEP, 2005a). Composting food waste, even in small quantities (i.e. backyard composting), if not done properly can attract rodents, insects, and scavenging animals. So careful consideration is necessary before backyard composting is considered an appropriate solution, since in the past poor solid waste management practices within the study area caused rodent infestations.

4.12 Factor Twelve - Land Availability

Land attributes such as terrain, ownership, and development that dictate the MSWM options comprise the Land Availability factor.

As was discussed in *Factor Four – Waste Segregation and Collection*, collection services are significantly hindered in the Parish of St. Ann because of the hilly terrain, community layout, and road conditions. In response to the minimal collection of waste in some areas, residents are utilizing other methods of disposal, as shown by the WRSQ survey.

The challenges faced by the NSWMA on a national level and the NEPM on a local level to meet the basic collection needs of the residents also represent barriers to initiating waste reduction strategies, such as centralized recycling and composting. These programs will not succeed without the sustained collection of material from households. Collection is a necessary part of waste reduction programs that extend beyond the scale of the residents' backyards and community. Public participation is another issue to consider in relation to this factor, since limited collection will affect the potential for widespread participation.

4.13 Factor Thirteen - Environmental Concern

Past research in developed countries has revealed that environmental concern is no longer significant in predicting participation in recycling programs (Schultz et al., 1995) but is still useful in motivating source reduction behavior (Ebreo et al., 1999). In the context of Jamaica, Figueroa (1998) suggests that once a community accumulates a certain level of social capital with respect to environmental issues, they can perform some solid waste

management activities, like composting, which will have direct economic and indirect environmental benefits.

A series of environmental issues currently affecting Jamaica’s natural environment were presented to the WRSQ survey respondents in order to measure the current level of concern of the respondents about the natural environment. Each respondent was asked to choose the one issue that they believed has the most negative impact on the environment. Additionally, they were able to name any other issue from the same list opined to be negatively affecting the natural environment. The results from the WRSQ survey are shown in Table 4.11, where the list of environmental issues was adapted from Table 3.15 in *The Survey of Environmental Awareness and Attitudes in Jamaica 1998* (Espeut, 1999).

Table 4.11: Environmental issues currently affecting Jamaica’s natural environment either considered to be a major issue or a secondary issue by the 79 WRSQ survey respondents, February 2007

Environmental Issue	Reported as <i>Major</i> (% of respondents)	Reported as <i>Other</i> (% of respondents)	Not Reported (% of respondents)
Household Garbage	32.9	34.2	32.9
Mining	25.3	34.2	40.5
Sewage Pollution	15.2	8.9	75.9
The individual	15.2	7.6	77.2
Cutting down trees	8.9	15.2	75.9
Dangerous solid waste	5.1	12.7	82.3
Automobile Exhaust	1.3	17.7	81.0
Pesticides and herbicides	1.3	10.1	88.6
Factories	1.3	6.3	92.4
Fishing	0	3.8	96.2

Household garbage was the issue most commonly reported to be negatively affecting Jamaica's natural environment by the WRSQ survey respondents. The results in Table 4.11 corroborate with *The Survey of Environmental Awareness and Attitudes in Jamaica 1998*, which found that *household garbage* ranked first in a list of issues negatively affecting Jamaica's natural environment (Espeut, 1999).

The mining industry is considered to be the second major issue affecting the natural environment, as shown in Table 4.11. The high level of concern about mining is plausibly due to a major bauxite mining operation located northeast of the study area. The impact of mining on the respondents' quality of life, like the noise and dust associated with mining, on top of the impacts to the environment, is probably a significant reason why the respondents consider it to be an issue. *The Survey of Environmental Awareness and Attitudes in Jamaica 1998* showed that mining was not a major environmental issue since only 6.0% of respondents reported it as a major issue. Mining, specifically bauxite mining, is a significant contributor to the national economy, but it has been receiving some negative press lately due to its impact on the local ecology. The high exposure in the recent media and the proximity to a mining operation probably contributes to the elevated concern in the study area at the present time.

Despite the low level of understanding about the environment among the WRSQ survey respondents, almost three quarters of the respondents (72.2%) reported concern for current state of the natural environment (Table 4.12). The level of concern in the study area is slightly higher than what was reported in *The Survey of Environmental Awareness and Attitudes in Jamaica 1998*, where 66.2% expressed at least some concern about the environment (Espeut, 1999).

Table 4.12: Level of concern about Jamaica’s natural environment reported by WRSQ survey respondents, February 2007

Response	Percent
No opinion	10.1
Not concerned	17.7
Concerned	72.2
Total	100.0

The Survey on Environmental Awareness and Attitudes 1998 found that concern for the environment was related to age and education level. Espeut (1999) suggested that concern was strongest among the younger respondents as well as in individuals with higher levels of education, where they gain more information about the environment and so become more aware and are more concerned, or perhaps know what is expected of them and answer in such a way as to appear concerned.

A bivariate analysis was conducted on the WRSQ survey results to identify whether certain demographic variables related to the reported concern of the respondents. Pearson chi-square tests were conducted for each demographic variable, and the results shown in Table 4.13 suggest that no single demographic variable relates to reported level of concern about the environment by the respondent ($p < 0.05$). Overall, the analysis reveals that individuals, regardless of demographic characteristics, demonstrate concern for the current state of the environment.

Table 4.13: Concern for the environment by Gender, Age, Education Level, Employment Status, and Income Level of WRSQ survey respondent, February 2007. No single demographic variable is statistically significant in relation to the respondent's concern for the environment.

Demographic Variable		Concerned	Not Concerned	No Opinion	Count	Total
Gender (p = 0.599)	Male	82.8 (24)	10.3 (3)	6.9 (2)	29	100
	Female	68.8 (33)	18.8 (9)	12.5(6)	48	100
	Total	74.0 (57)	15.6 (12)	10.4(8)	77	100
Age (p = 0.398)	15-24	83.3 (5)	16.7 (1)	0 (0)	6	100
	25-34	60.0 (6)	30.0 (3)	10.0 (1)	10	100
	35-44	69.6 (16)	13.0 (3)	17.4 (4)	23	100
	45-54	84.2 (16)	10.5 (2)	5.3 (1)	19	100
	55-64	70.0 (7)	30.0 (3)	0 (0)	10	100
	65-74	66.7 (4)	16.7 (1)	16.7 (1)	6	100
	75-84	66.7 (2)	0 (0)	33.3 (1)	3	100
	85 plus	100 (1)	0 (0)	0 (0)	1	100
Total	73.1 (57)	16.7 (13)	10.3 (8)	78	100	
Education Level (p = 0.820)	Primary/All-age	70.3 (26)	18.9 (7)	10.8 (4)	37	100
	Secondary	74.1 (20)	11.1 (3)	14.8 (4)	27	100
	Tertiary	77.8 (7)	22.2 (2)	0 (0)	9	100
	Other	80.0 (4)	20.0 (1)	0 (0)	5	100
	Total	73.1 (57)	16.7 (13)	10.3 (8)	78	100
Employment Status (p = 0.883)	Employed	80.0 (24)	13.3 (4)	6.7 (2)	30	100
	Unemployed	65.8 (25)	21.1 (8)	13.2 (5)	38	100
	Student	100 (1)	0 (0)	0 (0)	1	100
	Retired	77.8 (7)	11.1 (1)	11.1 (1)	9	100
	Total	73.1 (57)	16.7 (13)	10.3 (8)	78	100
Income Range (p = 0.813)	No income	63.3 (19)	23.3 (7)	13.3 (4)	30	100
	\$1000-\$3200	100 (5)	0 (0)	0 (0)	5	100
	\$3200-\$4999	77.8 (7)	11.1 (1)	11.1 (1)	9	100
	\$5000-\$6900	83.3 (5)	16.7 (1)	0 (0)	6	100
	\$9000 or more	66.7 (4)	33.3 (2)	0 (0)	6	100
	NR/DK	73.9 (17)	13.0 (3)	13.0 (3)	23	100
	Total	72.2 (57)	17.7 (14)	10.1 (8)	79	100

The findings from the WRSQ survey and the previous survey by Espeut (1999) might suggest that the concern for the environment has persisted over time and has expanded throughout the population despite individual demographic profile. The relative importance of this issue represented by the significant concern among the public shown

in both surveys should signify the need for decision-makers in the solid waste sector to pay more attention to solid waste and environmental issues. The existing level of concern for the environment can also be used as a point of leverage to expand the public consciousness of the solid waste problem and the importance of environmentally-sound practices, like waste reduction. As there are many resource constraints within the existing solid waste management system that may inhibit large-scale waste reduction and widespread participation, individual communities can establish waste reduction strategies based on their newly formed environmental values and concerns, and consequently reduce their dependence on public solid waste services.

4.14 Factor Fourteen – Knowledge

Research has shown that in order for individuals to act on an internal sense of responsibility to generate less waste or practice sustainable disposal methods, barriers relating to knowledge, access, and convenience must be minimized. These same barriers can also be incentives for waste reduction behavior, where knowing how and what to do, understanding the importance of waste reduction, and having access to effective and convenient programs have been shown to increase participation of waste reduction programs (Schultz et al., 1995; Hornik et al., 1995; Derkson and Gartell, 1993).

The Solid Waste Management Attitude scale in the WRSQ survey measured the attitude of the respondents concerning solid waste management in Jamaica. Of the twelve statements, five addressed the roles and responsibilities of the respondent and the government, and the results are presented in Table 4.14. According to the WRSQ survey results, respondents appear to be aware that individuals play an important role within the

solid waste management system, as well as their own responsibility to do their part, like picking up garbage in their community. It appears that the respondents are also aware of the connection between their purchase decisions and the amount of waste that is subsequently generated. Conversely, the results also suggest that respondents rely heavily on the provision of solid waste collection services, since almost 83% agreed that garbage collection is the only solution to the garbage problem. Not surprising is the blame that is placed on the government, where 81% agreed that the government is not doing enough, especially since the respondents communicate significant dissatisfaction with the current level of publicly administered solid waste management in the study area.

Table 4.14: Results of selected statements from the Solid Waste Attitude Scale in the WRQ survey, February 2007

Statement relating to solid waste management	Agree (%)	Disagree (%)	No Opinion (%)
I play an important role in the management of garbage in my community.	74.7	13.9	11.4
Picking up garbage in my community is my responsibility as a Jamaican citizen.	72.2	19.0	8.9
The government is not doing enough to fix the garbage problem.	81.0	8.9	10.1
Regular garbage collection is the only solution to the garbage problem.	82.3	16.5	1.3
The purchase decisions that I make can increase or decrease the amount of garbage my household must dispose.	74.7	11.4	13.9

The results in Table 4.14 suggest that Jamaicans explicitly acknowledge their role and responsibilities within the solid waste management system, but have little faith in the

government to fix the problem. What is more, waste reduction is not a political priority and is therefore not currently by the solid waste sector, thereby minimizing the opportunity for individuals to act upon their internal sense of responsibility.

The significance of individual knowledge in motivating waste reduction behavior is illustrated in the results of the WRSQ survey. In order to assess a basic level of knowledge of these methods, each respondent was asked whether they had ever heard of composting and recycling (Table 4.15). Interestingly, over half of the respondents had never heard of composting, but once the respondents were told more about composting, 86% reported willingness to participate in a composting program. These findings signify the positive impact that knowledge has on potential individual participation.

Table 4.15: Knowledge assessment of basic waste reduction methods based on reported responses from WRQ survey, February 2007

Response	Composting (%)	Recycling (%)
Don't know	1.3	1.3
No	57.0	13.9
Yes	41.8	84.8

4.15 Factor Fifteen - Access and Convenience

The recycling

and composting programs that do exist are accessible to the population within a limited geographical area; such is the case for the recycling depot at the Jamaica Environment Trust in Kingston. The current state of collection services significantly limits access to potential waste reduction programs for communities and individuals, where at least in the northeast region, 30% of the population is not provided public collection services. As Derkson and Gartell (1993) stated, 'accessibility to a structured, institutionalized program that is easy and simple to use is the most important determinant to recycling'; thus great

improvements in collection services will be necessary before any large-scale recycling or composting operations can take place.

In the short term, efforts to promote waste reduction can begin by providing information to individuals about reducing waste, such as conveying the importance of waste reduction and what can be done easily within the household. Enhancing knowledge of an issue and encouraging the development of attitudes that are supportive of an activity, without also providing the infrastructure for individuals to carry out what they have learned and assuming that a behavior will change, is an assumption often made when attempting to promote sustainable behavior (McKenzie-Mohr, 2000). The author cites many studies that show that enhancing knowledge and creating supportive attitudes often has little or no impact on behavior, and suggests that barriers must first be recognized and strategically minimized. Therefore, community-based waste reduction programs should be established in conjunction with informational campaigns to overcome the limited access to large-scale programs, and enable individuals to use the information and act upon their internal responsibility.

4.16 Factor Sixteen - Demographics

Research in developed

countries has attempted to identify the demographic variables that influence individuals to participate in waste reduction practices, but the findings have been inconsistent, as discussed in Chapter Two of this report. In the present research, demographic variables of the respondent were compared to willingness to participate, environmental knowledge, and environmental concern.

Overall, demography of the WRSQ survey respondents had little effect on these variables. Bivariate analyses found only one significant relationship as was discussed earlier, where respondents with higher education were more likely to understand the term ‘natural environment’. Limitations in the analyses exist because of inadequate data collected about income level of respondents and other members of the household. Furthermore, a direct comparison can not be made between the findings from developed countries and the present research, since waste reduction is not widely practiced in the study area nor has it been researched in Jamaica to the extent of developed countries.

Further research should be conducted on the existing waste reduction programs in Jamaica to determine whether demographics affect participation. Additionally, as these practices are incorporated into the solid waste management system and waste reduction behavior becomes more prevalent in society, research should be conducted to identify the changes that occur in the relationship between demography and behavior.

Since the respondent may not be the person within the household responsible for solid waste management, like storage and disposal, it was therefore necessary to identify the gender of the person responsible, which was the last question of the WRSQ survey. A distinction between men and women in regards to responsibility could suggest that household solid waste management is assigned according gender. Of the 45 respondents that provided a response to this final question, Table 4.16 shows that the responsibility of managing solid waste within the household is evenly distributed between men and women, and in some households, both genders share the responsibility.

Table 4.16: Gender distribution of responsibility of solid waste management within the household based on the WRSQ survey, February 2007

Gender of individual responsible for SWM in household	Frequency of Response	Percentage
Male	17	21.5
Female	16	20.3
Both Genders	12	15.2
No response	34	43.0

Bivariate analysis was conducted to uncover any possible links between gender and household solid waste management practices, like storage and disposal. Analysis of the relationship between gender of the household member responsible and storage method is shown in Table 4-17 and based on the Pearson chi-square test, the relationship between these variables is not statistically significant (at $p < 0.05$). As reported earlier, the use of plastic bags is the most common storage method (reported by the respondent), and is similarly shown in Table 4.17 to also be the most common storage method used for both genders.

Table 4.17: Reported storage method employed (by WRSQ survey respondent) by gender of person in household responsible for household solid waste management. Results are presented for the 44 of the 79 WRSQ survey respondents. Discrepancy in gender distribution in column labeled 'Total' and Table 4.16 is explained by non-response rate of Section Seven - Demographics.

Gender (p = 0.149)	Closed Container	Open Container	Plastic bags	Pile in the yard	Other	More than 1 storage method	Total
Male	50.0 (4)	60.0 (3)	37.5 (9)	0 (0)	0 (0)	0 (0)	36.4 (16)
Female	50.0 (4)	0 (0)	33.3 (8)	50.0 (2)	0 (0)	100 (2)	36.4 (16)
Both Genders	0 (0)	40.0 (2)	29.3 (7)	50.0 (2)	100 (0)	0 (0)	27.3 (12)
Total	100 (8)	100 (5)	100 (24)	100 (4)	100 (1)	100 (2)	100 (44)

Disposal method was also considered for a relationship between the gender of the individual responsible for household solid waste management, and the results of the

bivariate analysis are shown in Table 4.18. Overall, gender does not appear to affect the type of disposal method used for each waste type, based on the Pearson chi-square tests (at $p < 0.05$). The results in Table 4.18 show that for the most common disposal method reported by the respondent, the distribution of reported disposal method between genders is relatively even for food waste, yard trimmings, and paper/cardboard waste. The skewed gender distribution for metal and glass waste is due to the use of burning by more women than men for these waste types.

Table 4.18: Results of bivariate analysis between gender of individual responsible for household solid waste management and disposal methods based on responses from WRSQ survey respondents, February 2007. The data in the last three columns represents the percentage distribution of men and women using the most common disposal method for the respective waste type.

Waste Type	Pearson Chi-square test Value	Most common disposal method	% Distribution of Men	% Distribution of Women	% Distribution of Both Genders
Food Waste	0.739	Reuse	47.1	35.3	17.6
Yard trimmings	0.787	Burn	37.5	37.5	25.0
Paper/Cardboard	0.54	Burn	32.3	41.9	25.8
Plastic	0.216	Burn	36.0	48.0	16.0
Metals	0.155	Garbage Truck	72.7	18.2	9.1
Glass	0.362	Garbage Truck	58.3	16.7	25.0

The results in Tables 4.17 and 4.18 suggest that solid waste management within the household is not assigned according to gender, and storage and disposal methods are not dictated by the gender of the person responsible. Therefore, in order to change the current unsustainable practices of storage and disposal, like storage in plastic bags and burning, the campaigns to change the behavior need to target both men and women in the community.

4.17 Summary of Analysis

This study gathered information about the existing solid waste management system in Jamaica based on factors identified in past research to be significant for waste reduction, in order to evaluate its potential in Jamaica. Table 4.19 presents each factor considered in the present study and identifies whether it is an incentive or a barrier to initiating waste reduction strategies in Jamaica. This section also provides a summary of the analysis.

Table 4.19: Evaluation of waste reduction in Jamaica based on the analysis of the solid waste management system in regards to the 12 Troschinetz (2005) factors and behavioral factors identified from past research in developed countries

<i>No.</i>	<i>Factor</i>	<i>Assessment</i>
1	Government Policy	Barrier
2	Government Finances	Barrier
3	Waste Characterization	Barrier
4	Waste Collection and Segregation	Barrier (collection)/ Incentive (segregation)
5	Household Education	Incentive
6	Household Economics	Barrier
7	MSWM Administration	Barrier
8	MSWM Personnel Education	Not applicable
9	MSWM Plan	Barrier
10	Local Materials Market	Incentive
11	Technological and Human Resources	Barrier
12	Land Availability	Barrier
13	Environmental Concern (behavioral)	Incentive
14	Knowledge of waste reduction	Incentive
15	Access and Convenience	Barrier
16	Demographics	Not applicable

A common theme is revealed in the analyses of the factors, *Government Policy*, *Government Finances*, *MSWM Administration*, and *MSWM Plan*, which resulted in the designation of them as barriers. The analyses' pertaining to these factors reveals an

inability by authorities to act upon policies related to these factors that are documented in the *National Solid Waste Management Act* and *Jamaica Solid Waste Management Policy*. Specifically, it is the fact that these policies have not been implemented by the NSWMA that makes *Government Policy* a barrier and the financial and operational constraints that have restricted implementation that make *Government Finances* and *MSWM Administration* barriers. In addition, past incentive programs aimed at reducing waste and providing incentives for public participation have been affected by government actions. In an interview with the NSWMA, it was stated that waste reduction is just not a priority at this time. The NSWMA expects that when operations are privatized, more attention will be given to investigating waste reduction, but this is just another example of deficient action on the part of the government.

Understanding the waste stream, the amount and composition of generated waste, is necessary for identifying and planning appropriate waste management systems, including waste reduction programs. In Jamaica, waste data is available, but it is out-of-date and represents the waste generated by only a small portion of the population, therefore the factor *Waste Characterization* represents a barrier.

The factor *Waste Collection* is a barrier since the current collection system is leading to unsustainable disposal practices. Specifically in the study area these disposal practices are a result of household waste storage practices and the incompatibility of collection equipment with road conditions and street layout within the study area. *Waste Collection* was paired with *Waste Segregation* to create one factor by Troschinetz (2005), but this study has found that unlike *Waste Collection*, *Waste Segregation* is an incentive. The WRSQ survey results found that source separation was being readily practiced in

households in the study area and this behavior has the potential to benefit waste reduction programs that require source-separated waste.

Household Education is another factor within the household realm that is considered to be an incentive in this study. The analysis indicates that the public has at least some understanding of the links between solid waste management practices and public and environmental health. Conversely, the level of understanding of the environment was low in the study area, but was found to be related to the respondents' education level. Even though the findings revealed that actual practices may not align with the knowledge or concern, they do represent a base for expanding awareness and knowledge of solid waste issues and solutions.

Income level of the respondent was shown not be related to reported storage or disposal methods or their willingness to pay for recycling collection services. Affordability is cited as a consideration for willingness to participate in certain programs due to the economic constraints within low-income households. These issues encompass the *Household Economic* factor, and in conjunction with the currently unreliable payment of services through property taxes, the factor is considered to be a barrier.

The *National Solid Waste Management Authority* employs a variety of positions from Executive Director to street sweeper, and the most important positions are thought to be those most visible to the public. This study was unable to determine the whether the relevance of the *MSWM Personnel* factor to waste reduction based on the available information.

The existence and profitability of a materials market for composting and recycling are crucial components to the success of waste reduction. The existing materials-market

in Jamaica is small, including only a few companies that export materials to other countries for recycling. Despite the lack of on-island recycling infrastructure limiting individual participation in existing waste reduction programs, the *Local Materials Market* factor is considered to be an incentive since it has the potential to expand once other barriers are minimized.

Within the factor, *Human and Technological Resources*, the most significant limitation is the incompatible collection equipment currently servicing households. The final Troschinetz (2005) factor, *Land Availability* is the factor closely related to the *Waste Collection* and *Human and Technological Resources* factors. Like those factors it is also a barrier since it is the location of communities and the road conditions that makes collection by the compactor trucks impossible in some areas.

Other factors relating to waste reduction behavior and program participation were also assessed in this study. Concern for the natural environment was found to be considerable in the study area, and household garbage was opined to be the most noted issue negatively affecting the natural environment. Bivariate analysis showed that no single demographic characteristic was found to be significant in predicting the respondent's environmental concern in the present study. The conclusion that environmental concern exists throughout society regardless of demography indicates that *Environmental Concern* is an incentive to initiating waste reduction.

The public also appears to contain knowledge of their role and responsibilities within the solid waste management system concluding that the factor *Knowledge* is an incentive. Whereas *Access* and *Convenience* are barriers because of the limited accessibility to convenient waste reduction programs for individuals who wish to act on

their knowledge. *Demographic* characteristics were assessed as they relate to other factors, namely *Household Education*, *Household Economics*, and *Environmental Concern* and overall the demographic characteristics of the respondent were found to be unrelated to these other factors. Waste management behavior, specifically in regards to storage and disposal methods, was also found not to be dependent on the gender of the individual responsible for solid waste management within the household. These findings imply that campaigns to change waste management behavior will need to target all individuals, regardless of demography.

5 Conclusions

The overall goal of this research was to identify the waste reduction strategies that should be promoted for improved management of household solid waste based on the extent of the existing barriers and incentives. The study considered three waste reduction strategies, namely recycling, composting, and source reduction. The four objectives of this research were to:

1. Compile a list of factors that have been shown to influence public participation and the overall success of waste reduction strategies by a review of previous waste reduction research from developed and developing countries
2. Develop research methods to gather information about the existing management system of household waste in Jamaica
3. Determine whether each factor can be considered a barrier or an incentive to public participation and the overall success of waste reduction strategies based on the synthesis of information
4. Recommend the waste reduction strategy(ies) that should be promoted based on extent of barriers and incentives that exist for each waste reduction strategy

The most significant conclusion of this study is the apparent distinction between the designation of the factors as either an incentive or a barrier, specifically in regards to the location of factor within the solid waste management system. Factors designated as incentives appear to exist primarily at the household and community levels, specifically *Waste Segregation, Household Education, Environmental Concern, and Knowledge*; whereas the barriers exist primarily at the national or regional levels, namely *Government Policy, Government Finances, Waste Characterization, Waste Collection, MSWM Administration, MSWM Plan, and Access and Convenience*. In other words, the factors that are dependent on the individual and their respective behavior, concern, and

knowledge about solid waste management appear to be more supportive of initiating waste reduction strategies at the present time than the factors associated with service providers and government-based aspects of solid waste management.

Therefore, the most potential for initiating waste reduction strategies at the present time appears to be within the household, specifically by community-based waste reduction initiatives that improve local solid waste management. Literature has also shown that the transfer of solid waste management activities to the household and community is one step in the process of improving solid waste management in general. Regardless, in order for waste reduction to become a salient nation-wide waste management strategy that has significant positive impacts on the current solid waste issues in Jamaica, the barriers that currently exist need to be persistently minimized.

This study by no means provides a synthesis of all the available information on the public solid waste management system in Jamaica and proscribing detailed plans for appropriate waste reduction projects is beyond the scope of this study. Further research should be done to address specific issues within the sector, and requirements for appropriate waste reduction technologies; and further work should be conducted to develop targets and objectives for long-term waste reduction strategies.

The value of the present research exists in its utility to the Jamaican authorities involved in solid waste management. The findings can be used to facilitate more effective and appropriate solid waste management programs like waste reduction initiatives, by capitalizing on the incentives while strategically reducing the barriers or taking action to transform them into incentives.

6 Recommendations

In response to the conclusions presented, the following recommendations are provided for improving the management of household waste for the residents of the study area. The recommendations are specific to each stakeholder that should be involved in the strategic planning of the specific interventions. The recommendations are based on the synthesis of information gathered in the WRSQ survey findings, in-depth interviews, available literature, as well as on the author's two-year experience living in Jamaica. Similar studies should be conducted in other communities in Jamaica in order to develop unique solutions based on the prevailing solid waste practices and social conditions unique to each community.

RESIDENTS:

6.1 Recommendation 1: Animal feeding program to manage food waste – The most common method reported for the disposal of food waste is animal feeding, where 42.1% of respondents reported feeding food waste to domestic animals, such as pigs and dogs. The existing level of resident participation in this strategy of reusing food waste is invariably reducing the amount of organic solid waste being disposed of by other less sustainable manners, like burning, which is a common disposal practice for other waste types. The *International Source Book on Environmentally Sound Technologies (ESTs) for Municipal Solid Waste Management (MSWM)* observes that if individuals need the kitchen waste for animals they are unlikely to cooperate with centralized composting systems and concludes that disruption or replacement of animal feeding system with composting does not usually represent sound waste management practice (UNEP, 1996). In fact, a few respondents reported unwillingness to participate in a composting program because of the need for animal feed.

Backyard composting is a recognized method of managing food waste destined for a dumpsite (Figeroua, 1998), but in this case, promoting an animal feeding program is a preferred method of managing food waste. Composting is not recommended for the following reasons:

- Backyard composting should be promoted when a significant number of homes have gardens or yards (UNEP, 1996), but the current level of sustenance farming suggests an inadequate demand for the final product.
- Composting food waste, if not done properly can attract disease-carrying vectors. In the recent past, poor solid waste management practices within the study area have caused increase infestations of rodents, and inadequate composting operations will exasperate the problems.
- The organic waste stream in the study area is assumed to contain food items, like meats, daily products, and oil, which should not be composted as they attract pests, and can not be composted due to the high protein levels. Whereas, the waste stream can achieve greater diversion rates through the animal feeding program since these items can be fed to domestic animals.

6.2 Recommendation 2: Composting program to manage yard waste – Yard waste is primarily managed through combustion by the residents in the study area, where almost three quarters of the respondents reported this disposal practice for yard waste. Even though burning yard waste is inevitably reducing the quantity of waste being collected and disposed of in the official dumpsites, burning is an unsustainable solid waste management practice in terms of public health, since it can cause breathing problems for individuals with asthma or allergies. Furthermore, the respondents reported a high level of concern (84.4% of respondents) about burning solid waste supporting this recommendation as an appropriate strategy to improve solid waste management practices within the study area.

A few possible approaches to manage yard waste within the study area include, 1) voluntary backyard composting, provided the household has enough yard space and is knowledgeable on the composting process; and 2) a community-wide composting program in which material is processed in a central location within the community. The

specific program design requires much consideration of the supply of yard waste and demand for the final product, as well as the capacity of the community to effectively implement and efficiently sustain the process.

PUBLIC WASTE MANAGEMENT AUTHORITY (NEPM AND NSWMA):

6.3 Recommendation 3: Encourage residents to use appropriate storage

containers – Past studies conducted in Jamaica have recognized that use of improper storage containers cause difficulties for the collection providers and can create significant public health problems in regards to attracting disease vectors. In the study area, the proliferation of disease vectors in recent years, specifically rats, has been found to be the result of improper solid waste management practices. The WRSQ survey results reveal that improper storage containers are still used in the study, and in light of the past public health issues, residents should be encouraged and supported in using vector-proof containers in order to see improvement in vector control and overall public health.

6.4 Recommendation 4: Improve collection coverage and frequency in study

area – The current collection service is reaching only a fraction of the study area population, and in response to the current collection situation, unsustainable disposal methods are utilized to dispose of non-biodegradable materials, like metal, glass, and plastic. The prolific use of unsustainable disposal methods, especially burning, is the negative result of both the current collection capacity, the use of insufficient storage containers by the residents, and the mismatched disposal cycle of the residents and the collection cycle of the NEPM. The inadequate services are of great concern to the residents and 72% conveyed the need for improved service, and recommended a collection frequency of 2 times per month.

In light of the concern of residents and the expressed need for increased services, NEPM should work with the community to establish a collection schedule that meets the needs of the community, by matching the disposal cycle of the residents, and accommodates the current capacity constraints of NEPM. Non-biodegradable materials should be the focus of the door-to-door collection service and NEPM should encourage

waste segregation between biodegradable and non-biodegradable and educate the community on the requirements for waste segregation.

In order to prevent the resumption of old waste management practices, like burning and dumping, the established collection schedule should be maintained by NEPM. Communication between the residents and NEPM will assist in maintaining the schedule and monitoring the collection efficiency, thus preventing the return of undesirable waste management behavior.

6.5 Recommendation 5: Develop public education campaigns to encourage public participation of sustainable waste management behavior – Individuals are the fundamental waste generators and users of the solid waste management system, so ensuring their participation is crucial in developing appropriate solid waste management programs. Literature supports the role of public education in successful solid waste management programs, in order to raise public awareness and encourage behavioral change and thereby to gain public participation.

The development of effective public education campaigns is a step in realizing the cultural transformation that is necessary for solid waste management reform in Jamaica. At this point, the most potential for reform is within the household and the individual, and the progress made through public education in raising awareness and encouraging behavioral change can assist future action by the government, as the public will be more supportive of future policies and programs.

Waste management service providers, like NEPM and the NSWMA should collaborate with NGOs that focus on environmental advocacy and education, so as to create an educational campaign that not only raises awareness of the environment but also provides the informational tools for incorporating sustainable practices into household waste management. The ultimate goal of the educational campaign should be to encourage as much public participation as possible in sustainable waste management practices.

Recommended components of the public education campaigns are as follows:

- Incorporate environmental education into school curriculum to raise awareness and develop pro-environmental attitudes and values in the large youth

populations. Support the development of environmental attitudes and values with school-based programs that put to use and illustrate the important link between the environment and sustainable solid waste management practices.

- Initiate educational campaigns for the general public to raise awareness of the natural environment in order increase the current level of understanding and develop intrinsic attitudes and values of environmental conservation and stewardship among the general public. The messages should also emphasize the reasons why environmental stewardship is important for the maintenance of public health and the protection of environmental health.
- Initiate educational campaigns for the general public to convey the links between public health and unsustainable solid waste management practices, common in households. The message should be supported with information about simple and easy to use household waste management methods to encourage participation.

6.6 Recommendation 6: Support and guide the initiation of waste reduction

programs – Important for changing the current waste management behaviors in Jamaica, the strategic reduction of barriers must accompany the effort to capitalize on the incentives. Specifically, encouraging the development of attitudes and values through public education must be accompanied by the implementation of programs that enable the individual to fully participate in waste reduction.

Given the current barriers that inhibit the initiation of wide-spread waste reduction programs, like centralized composting and recycling, the household and community should be the targeted arenas for encouraging waste reduction behavior. Source reduction is one strategy that should be promoted as it can be utilized within the household without the need of extensive resource inputs. The source reduction campaign should emphasize easy and simple practices that reduce the amount of waste generated, like reusing plastic and glass containers, and purchasing fewer products in disposable packaging. Environmental education will have a direct impact on the individual's motive to practice source reduction since environmental concern is viewed as significant prerequisite.

Composting is a strategy that could also be promoted, but should be approached with more heed. Careful consideration of each community should precede the implementation of a composting operation, since it is not an approach that is appropriate in all situations, as shown in the study area (Recommendation 1). Even if composting is found to be appropriate for the situation, the community should be well aware of the resource inputs, especially the need their continued participation, required for a safe and effective composting operation.

Recycling, by its definition, is not a strategy that should be promoted within the study area since the existing barriers will prevent sustained public participation. On the other hand, recycling can be promoted by informing the residents about recycling, so that they will be educated when the time comes for their active participation. In the meantime, non-biodegradable materials should be collected on a regular basis within the study area to initiate improved solid waste management practices.

6.7 Recommendation 7: Ensure community involvement in the planning, implementation and monitoring stages – Many stakeholders are involved in the solid waste management sector, and include but are not limited to: waste management service providers, public health inspectors, political officials at the national and regional levels, environmental agencies and NGOs, and the public. The present study is an important step in identifying solutions to the solid waste management issues within a community, but further consultation with the community is needed to develop an appropriate intervention, as the success will hinge on their participation. Encouraging and supporting community involvement in the program design will assist in creating community ownership of the solution and benefit the long-term sustainability of the program. The following steps in community involvement are recommended as follows:

1. Share findings and recommendations with residents of study area and conduct consultation for opinions and feedback
2. Form a steering committee for planning process (Community members and stakeholders)

The involvement of the other stakeholders mentioned above is also important for effective planning and implementation of programs. Each individual stakeholder has a unique role to play within the solid waste management system, and therefore each stakeholder should be able to provide expertise and insight into developing the program. Assistance in program planning for improved solid waste management can be found in numerous guides published by international agencies, and a brief list is provided in Appendix 6.

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Appendix 1. In-depth Interview Guides with Responses for three interviews with key stakeholders in the solid waste management sector of Jamaica

1. National Solid Waste Management Authority Ms. Hilary Smith, Planning and Research Department Interview conducted on November 14, 2006

MSWM Plan:

1. Does the Government of Jamaica have integrated, comprehensive plan for environmentally-friendly solid waste management? (Reference material)
A NSWMA Policy exists with an objective for an integrated plan and goals are outlined in the policy, but no targets. She also referenced the NSWMA Act. The policy speaks to waste reduction with an outline and the way forward is discussed.
2. How is waste reduction (recycling, composting, and source reduction) integrated in the Plan?
 - a. What are the targets and goals regarding waste reduction?
 - b. What are the objectives for achieving waste reduction in Jamaica?

Government Policy:

3. The GOJ/IDB Solid Waste Management Program listed the objectives, one being ‘implement waste minimization and diversion program budget’. What is the status of implementation of this objective?
 - a. What is the ‘programme budget’?
This part of the GOJ/IDB Program has not been implemented yet. NSWMA does assist commercial entities with providing guidelines and the entities utilize some of NSWMA resources, like entering the Riverton dump to gather waste.
 - b. Does it include aspects like education, technical assistance, planning, reporting, and incentives?
4. The NSWMA Act 2001 indicates that the following regulations will be developed, following the announcement of the NSWMA Act, so what is the development status of these regulations?
 - a. Product packaging
 - b. Importation of goods and packaging
 - c. Containerization and littering
 - d. Resource recovery
Regulation a, b, and d have not materialized as of yet. Containerization and littering has progressed with the Public Cleanliness Regulation (Litter Act), along with public education and enforcing of public cleanliness through the regulation.

Government Finances: (Reference material)

5. What are the current funding sources for operating the public solid waste management services?
The current funding sources include the Property Tax and Budget Deficit Financing. Most Jamaicans that own property pay a property tax, which is insufficient to fund the NSWMA operation, so BDF is used. At the start of the budget year, a % of the BDF is

allocated to Local Government, which is then distributed to Parish Council, Fire, and SWM.

6. What percentage of the public is currently paying the service fee?
7. How much money is allocated to solid waste management sector per year from the total national budget?

J\$ 1.65 Billion is allocated from the National Budget

8. What financial incentives and/or financial programmes are in place for waste reduction practices?

There are incentives for private sector which undertake recycling and recovery schemes

MSWM Administration:

9. How do the public and private agents collaborate on the varying components of solid waste management, i.e. collecting, disposing, financing, and regulating?

NSWMA is mandated by government through the NSWMA Act for collection, disposal and regulating. Of the municipal waste, NSWMA collects mainly the residential, while the private collectors collect commercial waste. There is an indirect partnering since collection is divided to NSWMA and private collectors, but they all bring the waste to the same disposal sites, which is considered a direct collaboration. There are no private disposal sites utilized by private collectors. Each entity finances its own operation, but NSWMA is the sole regulator of the entire sector.

10. Is there a movement for public services to become solely privately administered?

The aim is to privatize the operational aspects, like sweeping, collection and disposal. The Act speaks to NSWMA being mainly a regulation and enforcement body. The purpose for this shift is so that NSWMA can begin to facilitate and finance more waste reduction operations, because now most of the funds go to operating.

11. What priority is given to developing waste reduction programs, in comparison to developing the collection services and disposal facilities?

Currently the focus is on collection and disposal since that requires a high percentage of resources, so waste reduction has not been realized or a priority. See question 10.

Technological and Human Resources:

12. What are the primary technological resources (equipment, MIS) used to manage the nations solid waste?

Compactor and tipper trucks, a weigh scale (GOJ/IDB program) that is not operational just now, computer databases, GIS, Statistical programs (analyze data from weigh scale to determine generation of waste in other parishes)

13. Where do the funds originate for operating/maintenance costs and capital investment of new equipment?

The funds originate from the 1.65 billion pool. Each region submits a detailed budget to the NSWMA which then goes to the MLG for financing.

14. What technological and human resources are currently being used for waste reduction practices (recycling, composting, source reduction)?

The composting program proposed by Pendley didn't proceed to the large scale. Ms. Smith indicated that commercial entities are the primary user of waste reduction technology.

General Questions:

15. In terms of waste reduction, what is the most significant factor that influences the success in Jamaica?

Incentives by government or other body that get people involved is what will encourage or stem waste reduction success in Jamaica. The divisions of the waste stream exist (plastics, paper, and metals) for recycling programs; they just need to be capitalized on the larger scale. Caribbean Paper Recycling Company recycles paper that originates from Riverton; the scavengers bring the paper for money.

16. What are the current waste reduction initiatives underway by NSWMA?

The extent of waste reduction initiatives currently underway by NSWMA includes collaborations with other agencies and the private sector, and public education campaigns.

Clarification on November 23rd: phone

When asked about the extent to which NSWMA uses the Norconsult Report, Ms. Smith indicated that the study is used for its statistical information in preparing reports. The study is the guiding document when considering the projections and recommendations given in the study. The recommendations in the study have not necessarily been realized, the reason may be for lack of financial resources or a planned decision was made to not follow the recommendations. The Ministry of Local Government and Environment indicates on their website that the Norconsult study 'failed to provide a clear strategy to serve as a basis for an investment programme,' referring to the GOJ intent to improve solid waste management across the island.

2. Northeast Parks and Markets Waste Management Limited

Mr. Alvin Williams, Regional Operations Manager

Interview conducted on November 21, 2006

Finances:

1. What are the main components of the NEPM yearly budget?

a. e.g. administrative, operational, maintenance, public outreach, personnel training

b. Percentage of total budget of each component

The three main components of the yearly NEPM budge are administrative, operations, and maintenance. The largest component of the budget is operations (collection, transport, and maintenance of disposal site and waste) consisting of almost 60% of the total budget, and the remaining 40% is distributed between administrative and maintenance, as shown in the table below.

<i>Budgetary component</i>	<i>Percentage of budget</i>
<i>Administration</i>	<i>23%</i>
<i>Maintenance</i>	<i>18%</i>
<i>Operations</i>	<i>59%</i>

2. Are the funds allocated to NEPM enough to cover the yearly budget for NEPM? *Mr. Williams indicated that the funds allocated to NEPM are not enough and only half of what the submitted budget requests from central government. When asked what the funds would be used for if an increase was granted, Mr. Williams stated that the funds would be utilized for operations, including transportation, collection, and storage at the disposal site.*

Administration of services:

3. Can you please provide the data for the following:
- NEPM service coverage
 - NEPM collection efficiency

The current collection efficiency is 70% of the entire regional population, and according to Mr. Williams the efficiency is not 100% due to the lack of resources, trucks, and equipment. For communities that receive once per month collection, NEPM is only collecting non-biodegradable materials and encouraging the communities to compost. This can be considered a source reduction initiative, since the amount of waste being collected and disposed of in the dumpsite is decreased.

4. Can you please describe the collection process utilized by NEPM?

NEPM provides door-to-door collection for the residents within the collection areas. The fleet of compactor and open-body tipper trucks collects the household waste and delivers it to the dumpsite when the truck is full. NEPM has a total of 15 trucks for the region and seven of those, work in St. Ann.

5. How does NEPM and private waste contractors collaborate to ensure waste services are provided to the public?

NEPM collects household waste while the private collectors provide service to the commercial entities. NEPM monitors the operations of the private collectors and in some cases meet with them to discuss the issues that arise. For example, the sciffs provided by the private collectors sometimes overflow and when the collector arrives to empty the sciff, they fail to sweep the surrounding garbage. These conditions are not sanitary.

The private collectors dump the collected waste at the dumpsites managed by NEPM but at the present time NEPM is not collecting a tipping fee from the private contractor. According to NEPM, the plans for implementing a tipping fee are in the works, but the exact date for implementation is uncertain.

6. Is there a presence of scavengers in the Parish of St. Ann?

- How significant is their presence?
- Are they helping or hindering NEPM efforts in the Parish?

Scavengers are a daily presence at the disposal site, where they collect copper, glass bottles, and cardboard to sell for income. NEPM estimates about 20 persons are scavenging at the site. They are not considered a nuisance to the official operations taking place because so far there has not been any incidence of theft or vandalism. Overall they cooperate with NEPM, because according to NEPM they depend on the dumpsite for materials for income and don't want to jeopardize the relationship with NEPM.

MSWM Personnel:

7. What types of jobs are available at NEPM?

a. Are persons required to have any special skills?

A variety of jobs are available at NEPM, including administrative, secretarial, accounting, supervisors, operational (sweepers, drivers, sidemen, and landfill attendants). Each position has its respective skills requirements that depend on the responsibilities of the position. Mr. Williams stated that the most important positions within the company are the operation positions since these are the aspects of the total operation at NEPM that are most visible to the public.

8. Is there training/education available within NEPM for laborers and skilled professionals?

The focus of 2007 for NSWMA is skills training, so all positions will receive training unique to the position.

Technological and Human Resources:

9. How is the health and safety of the workers ensured?

Workers are provided with safety gear and for those in direct contact with the waste, receive vaccinations from the local health center.

10. Does NEPM have the resource (human, financial, technical) capacity to maintain the equipment that is used?

NEPM employs a full-time mechanic that maintains the equipment. Mr. Williams states that the financial resources are inadequate to maintain the equipment.

11. Does NEPM utilize information systems for monitoring and control indicators like waste generation, collection, service coverage, locations of illegal dumpsites, etc?

NEPM does not utilize information systems for monitoring indicators in house. The Planning and Research Department at NSWMA collects and monitors the information and communicates with NEPM about the data relevant to the region.

General Questions:

12. What are the current waste reduction initiatives underway by NEPM; these may include recycling, composting, and source reduction initiatives?

Composting is the main reduction technique that is encouraged by NEPM. According to Mr. Williams, NEPM visits each community within the service area twice a year for educational purposes. Mr. Williams mentioned that NEPM has also educated the communities about source reduction, based on consumer decisions, but the behavioral change has not come about yet.

Mr. Williams referred to the year-long school competition facilitated by NSWMA, in which between 25 and 30 schools from St. Ann participate in. The schools are visited on a regular basis for assessment of various factors, including school yard appearance and cleanliness and extent of environmental clubs, contributing to a final score that determines the overall winner.

13. In terms of waste reduction, what is the most significant factor that influences the success in Jamaica?

The opinion of Mr. Williams is that education and awareness of the public is the key to waste reduction taking hold in Jamaica. He recommends starting with the children in school.

3. Jamaica Environment Trust
Kerry-Ann Curtis, Program Coordinator
Interview conducted on November 30, 2006

Current initiatives:

1. What waste reduction activities, such as public education and awareness campaigns, or implementation of technological solutions, are currently in place in Jamaica?

Ms. Curtis was unaware of any other initiatives other than a possible competition sponsored by NSWMA, called the clean schools competition. She was uncertain whether this program had been initiated yet.

2. What are the current waste reduction initiatives underway by JET specifically; these may include recycling, composting, and source reduction initiatives?

JET sponsors the "Schools Environment Program", and they partner with NGOs and Schools around the island. 210 schools and 10 NGOs are participating, for example Portland Environmental Protection Agency, Malvern Science Research Center, and the St. Thomas Environmental Protection Agency. Twice a year, teacher training workshops are held to sensitize teachers to the environmental problems in Jamaica, and in 2004 a solid waste management workshop took place.

The Earth House is a small-scale depot for materials to be recycled. JET has industry partners that chip, bail and export the materials to other countries.

3. What institutional/industrial entities are making strides towards waste reduction in Jamaica, specifically in regard to recycling, composting, and source reduction?

There are 5 industrial entities that participate in recycling (chipping, bailing, and shipping): Sweetcraft, Plastic Recyclers of Jamaica, Caribbean Paper Recyclers, Garbage Disposal Sanitation Systems, and Protect the Environment Trust. Sweetcraft also uses post-consumer recycled materials for its products.

Local Recycle-Material Market:

4. Does a market exist in Jamaica for recycled materials?

Ms. Curtis stated that the recycled-materials market is "small, but growing." JET receives many inquiries for assistance by persons interested in purchasing equipment for recycling purposes. Another example of the growth is seen at Sweetcraft, where Ms. Curtis says has increased its exports of materials for recycling.

5. What is the current process of the recycling sector in Jamaica?

The current process requires materials to be exported for use in other countries.

Household Education:

6. What is your opinion of the public's level of awareness concerning solid waste management in their homes and communities?

Based on the experiences of JET in working with communities, Ms. Curtis believes that most Jamaicans are aware of proper disposal, but the physical application is virtually impossible. This can be due to the restrictions provided by the severe landscape and the layout of the communities, thus preventing collection, and encouraging other disposal methods.

When asked specifically about waste reduction, Ms. Curtis stated that, “there is no level of consciousness regarding waste reduction,” and “there is no culture of packing lunch in container.” Meaning that people do not recognize how their actions and choices create waste.

General Questions:

7. What factors influenced initial success and what factors influenced the ultimate disbanding of Recycle for Life?

Ms. Curtis gives credit to the incentives used to prompt the participants (mainly schools) into separating their plastic bottles from the regular waste, for the initial success of RFL. RFL provided points for a given weight of bottles that were collected, and these points could be used towards purchasing school resources. The collection trucks provided collection services for the bottles, so the level of effort for the school was very low, which may be another reason for success. Over time, a culture of source separation was established.

Recycle for Life was funded by bottling companies, and in 2003 when the GOJ threatened to impose an additional tax on bottling imports, RFL dissolved because the companies could no longer afford to support RFL. With the reduction of funding, RFL could no longer provide collection services and incentives, leading to the demotivation of the participants. In the end the source separation culture dissolve along with Recycle for Life.

8. In terms of waste reduction currently and/or in the future, what is the most significant factor that influences the success in Jamaica?

Ms. Curtis discussed three factors which are significant in the success of waste reduction. First, she recommends that government must make waste reduction a priority, by establishing laws which require public participation. In addition to that, public education will be necessary in order to raise awareness on why sustainable solid waste management is important. Finally, the appropriate infrastructure will be needed to enable the public to put the education into practice.

9. What initiatives are feasible in your opinion regarding recycling, composting, and source reduction, such as economic incentives, taxes, guidelines and regulations?

Ms. Curtis, suggests that a good starting point would be to reestablish Recycle for Life. She made an interesting observation that “Jamaicans are incentive driven.” Jamaicans want to know how a change in behavior will benefit them and they need to understand why they must change their behavior. The incentives used could be economic, or linking sustainable SWM to health and the environment are possible was to prompt behavior change.

JET has submitted a proposal to EFJ for a test pilot study associated with curbside recycling. There are two communities in Kingston that have expressed a desire for this service, and they will be the setting for the study. The aim is to assess the feasibility of curbside recycling, and no study like this has been done yet.

We also briefly discussed that there is no current network of recycling operations in Jamaica, even though some do exist, they do not know about each other.

Appendix 2. Waste Reduction Study Questionnaire Survey employed in the study area in February 2007

Date of the interview: -----/-----/----- (Day/Month/Year)

Questionnaire No.: _____

Name of Community: _____

Enumeration District No.: NW _____

Interviewer: _____

Total time of interview: hours: _____ minutes: _____

Number of times household visited: _____

Respondent Selection: We need to speak with member of the household between the ages of 18 and 74 years.

Introduction

- “Hello. My name is _____ and I’m part of the health team from the North East Regional Health Authority conducting a questionnaire survey as a continuation of the Rodent Control Survey conducted in this area last year. This questionnaire survey **focuses on garbage and other public health issues.**
- The purpose of this survey is to gather more **information** from residents like you about your current practices, concerns, and opinions. The survey will take about **30 minutes.**
- Will you participate in the questionnaire survey? You are not required to give your name, so you will not be connected to the answers provided.
- The answers you provide to the following questions will be able to direct the Health Department in its effort to serve you, so please answer as **accurately as possible.** Thank you very much for your time.
- Let’s begin...”

Section One - The Natural Environment

1. What do you understand by the term “natural environment”?

(Interviewer: If the respondent takes a long time to respond, assume that the person does not understand the term “environment” and write “doesn’t know” on the lines below, and then read the definition provide below, to enable them to answer the following 4 questions.)

*Definition: The **environment may be defined as** the whole world around us: the air, water, and land, forests, wetlands, and the sea, and all animals and plants about us.*

2. Knowing what the natural environment is, are you *concerned or not concerned* about the current state of the natural environment?

1	I am not concerned
2	I am concerned
0	I have no opinion

3. What do you personally say is the **major issue** currently affecting Jamaica’s natural environment? (one answer)

1	Automobile exhaust	6	Household garbage
2	Sewage pollution from pits and toilets	7	Cutting down trees
3	Fishing	8	Mining (Bauxite)
4	The individual person	9	Dangerous solid waste like chemicals, waste from factories, and medical waste
5	Factories	10	Pesticides and herbicides used in farming

4. What **other issues** concern you about Jamaica’s natural environment? (Choose as many as you like from the list above)
-

5. How much effect do you think **you** have on the natural environment, do you have: *no affect, some affect, a lot of affect, or no opinion?*

1	I have no effect
2	I have some effect
3	I have a lot of effect
0	I have no opinion

Section Two - Household Solid Waste Management

6. Please describe how your household **stores** the garbage from your house.
(Interviewer: Do not provide the choices, but select the choice below that best fits the respondent's description)

1	Closed Container, please describe:
2	Open Container, please describe:
3	Plastic bags
4	Pile in the yard
5	Other, <i>specify</i> :
6	Don't Know

7. Please describe how your household **gets rid** of the following types of garbage from your house.
(Interviewer: Select the choice below that best fits the respondent's description. Include any additional comments made by the respondent in the space provide)

Types of Garbage	Burn 1	Bury 2	Dump				Garbage Truck 7	Recycle 8	Reuse 9	Compost 10	Other (Specify) 11
			River/ Gully 3	In yard 4	On road 5	NEPM Dumpsite 6					
Food waste											
Yard trimmings											
Paper/cardboard											
Plastic											
Metals											
Glass											

Comments regarding Question 7: _____

8. Can you think of any ways of reducing the amount of garbage that your household must burn, bury, dump, or leave for the garbage truck?

Section Three - Concerns about solid waste management

To the following 5 questions, please tell me whether you are: Concerned, Not Concerned, or you have No Opinion.	Concerned	Not concerned	No Opinion
	2	1	0
9. How concerned are you about health risks related to burning garbage?			
10. How concerned are you about illegal dumps polluting rivers, streams, and wells?			
11. How concerned are you about diseases that are related to improper storage and disposal methods, like leptospirosis and malaria?			
12. How concerned are you about flooding due to garbage blocking drains and gullies?			
13. How concerned are you about the reduction of natural resources that are used to make the products we buy and use (such as, oil for plastic bottles and trees for paper)?			
To the following 5 questions, please tell me whether you are: Concerned, Not Concerned, or you have No Opinion.	Concerned	Not concerned	No Opinion
	2	1	0
14. How concerned are you about the service provided by the garbage truck in this area?			
15. How concerned are you about litter in this area?			
16. How concerned are you about illegal dumping in this area?			
17. How concerned are you about the presence of rats in this area?			
18. How concerned are you about garbage in Jamaica as a nation?			

19. Do you have any suggestions for improving the managing of garbage in this area: _____

Section Four - Willingness to participate

To the following 11 questions, please answer with either: yes, no, or don't know.	Yes	No	Don't Know
	2	1	0
20. Have you ever heard about composting ?			
21. Have you ever heard about recycling ?			
22. If a recycling program was set up, that collected materials like plastic, paper, metals, etc, would you be willing to separate these into separate bags for collection purposes?			
23. Would you be willing to pay for pickup of these recycling materials from your home?			
24. Would you be willing to participate in a program to compost food and yard waste?			
25. If you were paid for every plastic bottle that you returned to the grocery store, would you participate in a program to return the plastic bottles?			
26. Would you be willing to purchase less throwaway products (such as, plastic bottles) to help reduce the amount of garbage you get rid of, if an alternative product of the same cost was provided?			
27. Would you like more information about how and what types of garbage you can compost, reuse, and recycle in order to reduce the amount of garbage that you need to get rid of?			
28. If a skiff was located in your community, would you be willing to carry your garbage to it?			
29. Would you be willing to participate in building the skiff for your community?			
30. Would you be willing to participate in the maintenance of this skiff?			

Refer to the following definitions if the respondents are unfamiliar with the terms in questions 20 and 21.

Recycling involves the collection of materials and products that humans are done using, then processing these materials and making them into new products, for example, collecting plastic bottles to make other bottles or other things.

Composting is a natural process of breaking down organic garbage (like vegetable peelings) into a soil like material which can be used for farming and gardening.

Reuse is the practice of using an item more than once, for example, using a glass jar to store supplies, or using scandal bags as trash bags.

Section Five – Solid Waste Management Attitude Scale

31. For the following statements, please tell me whether you agree , disagree , or you have no opinion .	No.	Agree	Disagree	No Opinion
I play an important role in the management of garbage in my community.	1			
Environmental education should be taught in schools.	2			
The purchase decisions that I make can increase or decrease the amount of garbage my household must get rid of (dispose of).	3			
I don't care that burning garbage can be bad for my health and the health of others.	4			
People throw garbage on the streets and in the drains and gullies because they have no other means of getting rid of (disposing of) their garbage.	5			
The government is not doing enough to fix the garbage problem.	6			
Correct garbage management should not be taught in schools.	7			
Other personal issues (like crime, unemployment, and cost of living) are more important to me than a garbage-free community.	8			
Regular collection of garbage is the only solution to the garbage problem.	9			
Picking up garbage around my community is my responsibility as a Jamaican citizen.	10			
Public education about proper garbage management is one way to fix the garbage crisis.	11			
It is very important that the Government of Jamaica put recycling laws and programs in place.	12			

Section Six - Environmental Health

32. What kind of **toilet facilities** does your household use?

1	Water closet linked to sewer main
2	<i>Water closet not linked:</i>
21	Absorption pit
22	Septic Tank
23	Other
3	<i>Pit Latrine:</i>
31	Conventional
32	VIP
33	VIDP
4	None
5	Other, <i>specify:</i>
6	Don't Know

33. Are the toilet facilities located on your premises?

Yes 1	No 2
-------	------

34. Are the toilet facilities used only by your household, or do you share the facilities with other households?

Exclusive use 1	Shared 2
-----------------	----------

Please specify the number of other households using the facility _____

35. What is the main source of **drinking water** for your household?

1	Water piped directly into house or yard (public supply)	5	Well
2	Water piped directly into house or yard (private tank)	6	River, lake, spring, pond
3	Public standpipe	7	Rainwater (tank, drums)
4	Wayside tank	8	Other, <i>specify:</i>

36. If the main source is 'public standpipe' or 'wayside tank', approximately how far from this dwelling is the source? _____

37. Are **disease vectors** or breeding sites present or observed (like, rodents and mosquitoes)?

Yes 1	No 2
-------	------

38. Which of the following best describes the **main material** of your house?

1	Concrete
2	Wood
3	Zinc
4	Concrete and wood
5	Concrete and zinc
6	Wood and zinc
7	Other, <i>specify</i> :

39. How many rooms are in this house (including bedrooms)? _____

40. What type of **tenure** do you have on your home?

1	Owned
2	Leased
3	Rented
4	Rent free
5	Squatted
6	Other

41. Does your household grow any food for household consumption?

1	Vegetables
2	Fruit
3	Animals
4	Other
5	No

Section Seven - Demography

42. Please provide the following information for the occupants in the household.

Household member No.	Age at last birthday	Gender 1 Male 2 Female	Education level (last school graduated) 1 Primary/All age 2 Secondary 3 Tertiary 4 Other 5 No school 6 Don't Know	Employment 1 Employed 2 Unemployed 3 Student 4 Retired 5 Not of working age 6 Don't Know	Income Range per week 1 No Income 2 Less than \$1000 3 \$1000 to \$3200 4 \$3200 to \$4999 5 \$5000 to \$6999 6 \$7000 to \$8999 7 \$9000 or more 8 No response/DK
Respondent					
Household Head (if different than respondent)					
1 st					
2 nd					
3 rd					
4 th					
5 th					
6 th					
7 th					
8 th					

43. Which **person is responsible for taking care of the garbage** from your house? (Please indicate on the above table)

“That concludes the survey and thank you so much for your time. Would you be willing to provide your phone number in case we need to follow-up for clarification?”

Respondent's Phone Number: _____

Address of Dwelling: _____

Appendix 3. Complete table of results, distributed by Enumeration District, from the WRSQ survey, February 2007

Question No.	Question	Response	Total	NW002	NW003	NW050
1	What do you understand by the term 'natural environment'?	Correct Definition	16	10	4	2
		Incorrect Definition	26	14	8	4
		Don't know	32	24	3	5
		NR	5	3	1	1
		Total	79	48	15	11
2	Knowing what the natural environment is, what is your level of concern for the current state of natural environment?	I am not concerned	14	6	6	2
		I am concerned	57	42	7	8
		I have no opinion	8	3	3	2
		Total	79	51	16	12
3 and 4	Environmental issues currently affecting Jamaica's natural environment					
	Automobile Exhaust	Major issue	1	0	1	0
		Other issue	14	8	5	1
		Not chosen	64	43	10	11
		NR	0	0	0	0
		Total	79	51	16	12
	Sewage pollution from pits and toilets	Major issue	12	7	5	0
		Other issue	7	5	1	1
		Not chosen	60	39	10	11
		NR	0	0	0	0
		Total	79	51	16	12
	Fishing	Major issue	0	0	0	0
		Other issue	3	1	2	0
		Not chosen	76	50	14	12
		NR	0	0	0	0
		Total	79	51	16	12

Question No.	Question	Response	Total	NW002	NW003	NW050
3 and 4 cont'd	The individual person	Major issue	12	10	1	1
		Other issue	6	4	1	1
		Not chosen	61	37	14	10
		NR	0	0	0	0
		Total	79	51	16	12
	Factories	Major issue	1	0	1	0
		Other issue	5	1	2	2
		Not chosen	73	50	13	10
		NR	0	0	0	0
		Total	79	51	16	12
	Household garbage	Major issue	26	16	1	9
		Other issue	27	16	9	2
		Not chosen	26	19	6	1
		NR	0	0	0	0
		Total	79	51	16	12
	Cutting down trees	Major issue	7	5	1	1
		Other issue	12	10	1	1
		Not chosen	60	36	14	10
		NR	0	0	0	0
		Total	79	51	16	12
Mining (bauxite)	Major issue	20	14	5	1	
	Other issue	27	22	2	3	
	Not chosen	32	15	9	8	
	NR	0	0	0	0	
	Total	79	51	16	12	

Question No.	Question	Response	Total	NW002	NW003	NW050
3 and 4 cont'd	Dangerous solid waste (chemical, industrial, and medical waste)	Major issue	4	2	2	0
		Other issue	10	8	0	2
		Not chosen	65	41	14	10
		NR	0	0	0	0
		Total	79	51	16	12
	Pesticides and herbicides used in farming	Major issue	1	1	0	0
		Other issue	8	7	0	1
		Not chosen	70	43	16	11
		NR	0	0	0	0
		Total	79	51	16	12
5	How much effect do you think you have on the natural environment?	I have no affect	8	6	0	2
		I have some affect	46	32	11	3
		I have a lot of affect	14	8	3	3
		I have no opinion	10	5	2	3
		NR	1	0	0	1
		Total	79	51	16	12
6	Please describe how your household stores the garbage from your house.	Closed Container	14	7	4	3
		Open Container	8	7	1	0
		Plastic Bags	38	27	8	3
		Pile in the yard	13	8	1	4
		Other	1	0	1	0
		More than one method	3	2	1	0
		Don't know	0	0	0	0
		NR	2	0	0	2
		Total	79	51	16	10

Question No.	Question	Response	Total	NW002	NW003	NW050
7	Please describe how your household gets ride of the following types of garbage in your household. FOOD WASTE	Burn	10	6	4	0
		Bury	1	1	0	0
		Dump in River/Gully	0	0	0	0
		Dump in Yard	12	11	1	0
		Dump on road	0	0	0	0
		Dump at NEPM site	3	1	1	1
		Garbage Truck	6	3	3	0
		Recycle	0	0	0	0
		Reuse	32	17	6	9
		Compost	9	6	1	2
		More than one method	1	1	0	0
		Other	2	2	0	0
		NR	3	3	0	0
		Total	79	48	16	12
	Please describe how your household gets ride of the following types of garbage in your household. YARD TRIMMINGS	Burn	59	38	13	8
		Bury	0	0	0	0
		Dump in River/Gully	1	0	0	1
		Dump in Yard	6	4	2	0
		Dump on road	1	1	0	0
		Dump at NEPM site	3	1	1	1
		Garbage Truck	2	2	0	0
		Recycle	0	0	0	0
		Reuse	0	0	0	0
		Compost	6	4	0	2
		More than one method	1	1	0	0
		Other	0	0	0	0
NR	0	0	0	0		
Total	79	51	16	12		

Question No.	Question	Response	Total	NW002	NW003	NW050
7 cont'd	Please describe how your household gets ride of the following types of garbage in your household. PAPER/CARDBOARD	Burn	62	41	13	8
		Bury	0	0	0	0
		Dump in River/Gully	1	0	0	1
		Dump in Yard	1	1	0	0
		Dump on road	0	0	0	0
		Dump at NEPM site	3	1	1	1
		Garbage Truck	4	4	0	0
		Recycle	0	0	0	0
		Reuse	1	1	0	0
		Compost	1	0	0	1
		More than one method	3	2	0	0
		Other	1	1	1	0
		NR	2	0	1	1
		Total	79	51	15	11
	Please describe how your household gets ride of the following types of garbage in your household. PLASTIC	Burn	54	36	9	9
		Bury	1	1	0	0
		Dump in River/Gully	1	0	0	1
		Dump in Yard	4	3	1	0
		Dump on road	0	0	0	0
		Dump at NEPM site	3	1	1	1
		Garbage Truck	10	8	2	0
		Recycle	0	0	0	0
		Reuse	0	0	0	0
		Compost	0	0	0	0
		More than one method	3	1	2	0
Other	1	0	0	1		
NR	2	1	1	0		
Total	79	50	15	12		

Question No.	Question	Response	Total	NW002	NW003	NW050
7 cont'd	Please describe how your household gets ride of the following types of garbage in your household. METALS	Burn	8	4	2	2
		Bury	4	3	0	1
		Dump in River/Gully	7	3	0	4
		Dump in Yard	12	9	3	0
		Dump on road	0	0	0	0
		Dump at NEPM site	5	1	3	1
		Garbage Truck	28	22	5	1
		Recycle	0	0	0	0
		Reuse	2	2	0	0
		Compost	0	0	0	0
		More than one method	2	2	1	0
		Other	5	1	0	3
		NR	6	4	2	0
		Total	79	47	14	12
	Please describe how your household gets ride of the following types of garbage in your household. GLASS	Burn	6	3	3	0
		Bury	5	4	0	1
		Dump in River/Gully	7	3	0	4
		Dump in Yard	13	9	4	0
		Dump on road	1	1	0	0
		Dump at NEPM site	4	1	2	1
		Garbage Truck	28	24	3	1
		Recycle	2	2	0	0
		Reuse	2	2	0	0
		Compost	0	0	0	0
		More than one method	3	1	1	1
Other	6	1	1	4		
NR	2	0	2	0		
Total	79	51	14	12		

Question No.	Question	Response	Total	NW002	NW003	NW050
8	Can you think of any ways of reducing the amount of garbage that your household must burn, bury, dump, or leave for the garbage truck?	Offered suggestion	51	31	11	9
		Don't know	28	20	5	3
		NR	0	0	0	0
		Total	79	51	16	12
9	How concerned are you about health risks related to burning garbage?	Concerned	67	43	14	10
		Not concerned	9	8	1	0
		No opinion	3	0	1	2
		NR	0	0	0	0
		Total	79	51	16	12
10	How concerned are you about illegal dumping polluting rivers, streams, and wells?	Concerned	74	48	14	12
		Not concerned	3	3	0	0
		No opinion	2	0	2	0
		NR	0	0	0	0
		Total	79	51	16	12
11	How concerned are you are diseases that are related to improper storage and disposal methods?	Concerned	76	48	16	12
		Not concerned	3	3	0	0
		No opinion	0	0	0	0
		NR	0	0	0	0
		Total	79	51	16	12
12	How concerned are you about flooding due to garbage blocking drains and gullies?	Concerned	70	45	15	10
		Not concerned	8	5	1	2
		No opinion	1	1	0	0
		NR	0	0	0	0
		Total	79	51	16	12

Question No.	Question	Response	Total	NW002	NW003	NW050
13	How concerned are you about the reduction of natural resources that are used to make the products we buy and use?	Concerned	56	39	10	7
		Not concerned	12	8	3	1
		No opinion	11	4	3	4
		NR	0	0	0	0
		Total	79	51	16	12
14	How concerned are you about the service provided by the garbage truck in this area?	Concerned	74	49	14	11
		Not concerned	3	1	2	0
		No opinion	1	0	0	1
		NR	1	1	0	0
		Total	79	51	16	12
15	How concerned are you about litter in this area?	Concerned	71	46	15	10
		Not concerned	6	4	1	1
		No opinion	2	1	0	1
		NR	0	0	0	0
		Total	79	51	16	12
16	How concerned are you about illegal dumping in this area?	Concerned	71	45	16	10
		Not concerned	6	5	0	1
		No opinion	2	1	0	1
		NR	0	0	0	0
		Total	79	51	16	12
17	How concerned are you about the presence of rats in this area?	Concerned	73	49	14	10
		Not concerned	5	2	2	1
		No opinion	1	0	0	1
		NR	0	0	0	0
		Total	79	51	16	12

Question No.	Question	Response	Total	NW002	NW003	NW050
18	How concerned are you about garbage in Jamaica as a nation?	Concerned	77	49	16	12
		Not concerned	0	0	0	0
		No opinion	0	0	0	0
		NR	2	2	0	0
		Total	79	51	16	12
19	Do you have any suggestions for improving the managing of garbage in this area?	Gave Suggestions	69	44	14	11
		No Suggestion	10	7	2	1
		NR	0	0	0	0
		Total	79	51	16	12
20	Have you ever heard about composting	Yes	33	22	6	5
		No	45	28	10	7
		Don't know	1	1	0	0
		NR	0	0	0	0
		Total	79	51	16	12
21	Have you ever heard about recycling?	Yes	67	44	14	9
		No	11	7	2	2
		Don't know	1	0	0	0
		NR	0	0	0	0
		Total	79	51	16	12
22	If a recycling program was set up, would you be willing to separate materials into separate bags for collection purposes?	Yes	76	48	16	12
		No	0	0	0	0
		Don't know	3	3	0	0
		NR	0	0	0	0
		Total	79	51	16	12

Question No.	Question	Response	Total	NW002	NW003	NW050
23	Would you be willing to pay for pickup of these materials from your home?	Yes	41	27	11	3
		No	15	8	5	2
		Don't know	23	16	0	7
		NR	0	0	0	0
		Total	79	51	16	12
24	Would you be willing to participate in a program to compost food and yard waste?	Yes	68	45	15	8
		No	4	3	0	1
		Don't know	7	3	1	3
		NR	0	0	0	0
		Total	79	51	16	12
25	If you were paid for every plastic bottle that you returned to the grocery store, would you participate in a program to return the bottles?	Yes	73	46	16	11
		No	2	1	0	1
		Don't know	2	2	0	0
		NR	2	2	0	0
		Total	79	51	16	12
26	Would you be willing to purchase less throwaway products to help reduce the amount of garbage you get rid of, if an alternative product of the same cost was provided?	Yes	61	42	12	7
		No	6	1	1	4
		Don't know	12	8	3	1
		NR	0	0	0	0
		Total	79	51	16	12
27	Would you like more information about how and what types of garbage you can compost, reuse, and recycle in order to reduce the amount of garbage that you need to get rid of?	Yes	73	48	13	12
		No	5	2	3	0
		Don't know	0	0	0	0
		NR	1	1	0	0
		Total	79	51	16	12

Question No.	Question	Response	Total	NW002	NW003	NW050
28	If a skiff was located in your community, would you be willing to carry your garbage to it?	Yes	75	48	16	12
		No	1	1	0	0
		Don't know	3	2	0	1
		NR	0	0	0	0
		Total	79	51	16	12
29	Would you be willing to participate in building the skiff for your community?	Yes	69	44	13	12
		No	6	5	1	0
		Don't know	4	2	2	0
		NR	0	0	0	0
		Total	79	51	16	12
30	Would you be willing to participate in the maintenance of this skiff?	Yes	73	145	16	12
		No	4	4	0	0
		Don't know	2	2	0	0
		NR	0	0	0	0
		Total	79	51	16	12
31	For the following statements...					
	I play an important role in the management of garbage in my community.	Agree	59	35	15	9
		Disagree	11	9	1	1
		No opinion	9	7	0	2
		NR	0	0	0	0
		Total	79	51	16	12
	Environmental education should be taught in schools.	Agree	77	49	16	12
		Disagree	1	1	0	0
		No opinion	1	1	0	0
		NR	0	0	0	0
Total		79	51	16	12	

Question No.	Question	Response	Total	NW002	NW003	NW050
31 cont'd	The purchase decisions that I make can increase or decrease the amount of garbage my household must get rid of.	Agree	59	41	13	5
		Disagree	9	4	3	2
		No opinion	11	6	0	5
		NR	0	0	0	0
		Total	79	51	16	12
	Regular garbage collection is the only solution to the garbage collection.	Agree	65	7	3	3
		Disagree	13	43	13	9
		No opinion	1	1	0	0
		NR	0	0	0	0
		Total	79	51	16	12
	Picking up garbage around my community is my responsibility as a Jamaican citizen.	Agree	57	35	12	10
		Disagree	15	11	3	1
		No opinion	7	5	1	1
		NR	0	0	0	0
		Total	79	51	16	12
	Public education about proper garbage management is one way to fix the garbage crisis	Agree	72	48	14	10
		Disagree	5	1	2	2
		No opinion	2	2	0	0
		NR	0	0	0	0
		Total	79	51	16	12
It is very important that the Government of Jamaica put recycling laws and program in place.	Agree	75	50	15	10	
	Disagree	1	0	0	1	
	No opinion	3	1	1	1	
	NR	0	0	0	0	
	Total	79	51	16	12	

Question No.	Question	Response	Total	NW002	NW003	NW050
32	What kind of toilet facilities does your household have?	Water closet linked to sewer main	0	0	0	0
		Water closet linked to Absorption pit	61	39	11	11
		Water closet linked to Septic tank	1	0	1	0
		Water closet linked to other	0	0	0	0
		Conventional pit latrine	11	7	3	1
		VIP latrine	0	0	0	0
		VIDP latrine	0	0	0	0
		None	0	0	0	0
		Other	0	0	0	0
		More than one type	6	5	1	0
		Don't know	0	0	0	0
		NR	0	0	0	0
		Total	79	51	16	12
33	Are the toilet facilities on your premises?	Yes	78	50	16	12
		No	1	1	0	0
		NR	0	0	0	0
		Total	79	51	16	12
34	Are the toilet facilities used on by your household or do you share with other households?	Exclusive use	76	50	14	12
		Shared	3	1	2	0
		NR	0	0	0	0
		Total	79	51	16	12

Question No.	Question	Response	Total	NW002	NW003	NW050
35	What is the main source of drinking water for your household?	Public supply: Water piped directly into house or yard	73	48	13	12
		Private tank: Water piped directly into house or yard	6	3	3	0
		Public standpipe	0	0	0	0
		Wayside tank	0	0	0	0
		Well	0	0	0	0
		River, lake, spring, pond	0	0	0	0
		Rainwater (tank, drums)	0	0	0	0
		Other	0	0	0	0
		NR	0	0	0	0
	Total	79	51	16	12	
36	If the main source is 'public standpipe' or 'wayside tank', approximately how far from this dwelling is the source?	Total	0	0	0	0
37	Are disease vectors or breeding sites present or observed (like mosquitoes and rats)?	Yes	54	35	13	6
		No	24	15	3	6
		NR	1	1	0	0
		Total	79	79	16	12
38	Which of the following best describes the main materials of your house?	Concrete	26	15	10	1
		Wood	0	0	0	0
		Zinc	0	0	0	0
		Concrete and wood	8	6	1	1
		Concrete and zinc	40	28	4	8
		Wood and zinc	4	2	0	2
		Other	1	0	1	0
		NR	0	0	0	0
	Total	79	51	16	12	

Question No.	Question	Response	Total	NW002	NW003	NW050
39	How many rooms are in this house (including bedrooms)?	One	2	0	0	2
		Two	10	7	1	2
		Three	14	8	2	4
		Four	17	11	5	1
		Five	12	10	2	0
		Six	6	4	1	1
		Seven	4	0	2	2
		Eight	4	3	1	0
		Nine	1	0	1	0
		Ten	2	2	0	0
		Eleven	1	1	0	0
		NR	6	5	1	0
		Total	79	51	16	12
40	What type of tenure do you have on your home?	Owned	58	35	12	11
		Leased	0	0	0	0
		Rented	10	6	4	0
		Rent free	5	5	0	0
		Squatted	0	0	0	0
		Other	6	5	0	1
		NR	0	0	0	0
		Total	79	51	16	12

Question No.	Question	Response	Total	NW002	NW003	NW050
41	Does your household grow any food for household consumption?	Vegetables	8	5	3	0
		Fruit	2	1	1	0
		Animals	5	3	2	0
		No	42	31	5	6
		All (vegetables, fruit, and animals)	9	7	0	2
		Vegetables and Fruit	6	2	2	2
		Vegetables and Animals	2	2	0	0
		Fruit and Animals	5	0	3	2
		NR	0	0	0	0
		Total	79	51	16	12
42	Respondent's Age	15-19	1	1	0	0
		20-24	5	3	0	2
		25-29	3	2	1	0
		30-34	7	6	1	0
		35-39	11	8	1	2
		40-44	12	10	1	1
		45-49	7	4	1	2
		50-54	12	8	2	2
		55-59	7	2	4	1
		60-64	3	1	1	1
		65-69	4	2	1	1
		70-74	2	1	1	0
		75-79	1	0	1	0
		80-84	2	2	0	0
		85 and over	1	1	0	0
NR	1	0	1	0		
Total	79	51	16	12		

Question No.	Question	Response	Total	NW002	NW003	NW050
42 cont'd	Respondent's Gender	Male	29	19	5	5
		Female	48	31	10	7
		NR	2	1	1	0
		Total	79	51	16	12
	Respondent's Education Level	Primary/All-age	37	25	8	4
		Secondary	27	18	4	5
		Tertiary	9	4	3	2
		Other	5	4	0	1
		No school	0	0	0	0
		Don't know	0	0	0	0
		NR	1	0	1	0
		Total	79	51	16	12
	Respondent's Employment Status	Employed	30	22	4	4
		Unemployed	38	22	9	7
		Student	1	0	0	1
		Retired	9	7	2	0
		Not of working age	0	0	0	0
		Don't know	0	0	0	0
		NR	1	0	1	0
Total	79	51	16	12		

Question No.	Question	Response	Total	NW002	NW003	NW050
42 cont'd	Respondent's Income Range per week	No income	30	15	9	6
		Less than JA\$1000	0	0	0	0
		JA\$1000 - \$3200	5	3	1	1
		JA\$3200 - \$4999	9	8	0	1
		JA\$5000 - \$6999	6	2	2	2
		JA\$7000 - \$8999	0	0	0	0
		JA\$9000 or more	6	5	1	0
		Don't know	22	18	2	2
		NR	1	0	1	0
		Total	79	51	16	12
43	Which person is responsible for taking care of the garbage from your house?	Male	17	7	7	3
		Female	16	8	5	3
		Both genders	12	8	3	1
		NR	34	28	1	5
		Total	79	51	16	12

Appendix 4. Original list of statements for the Solid Waste Management Attitude Scale, WRSQ survey

1	Providing door-to-door collection is the responsibility of the government.
2	I am satisfied with service provided by NSWMA (NEPM).
3	My community has a garbage problem.
4	Burning garbage is not bad for my health.
5	Garbage blocks drains which can cause flooding.
6	Leptospirosis is a disease carried by rats.
7	Piles of garbage provide shelter and food for rats, flies, and mosquitoes.
8	Regular collection of garbage is the only solution of the garbage problem.
9	Picking up litter around my community is my responsibility.
10	There is enough information available on how to compost.
11	The Government of Jamaica has a good plan for managing garbage.
12	Public education is needed about proper solid waste management.
13	Illegal dumping will not result in a fine or time in prison.
14	Garbage management should not be taught in schools.
15	Other personal issues (like crime, employment, cost of living) are more important to me than a clean community.
16	The government is not doing enough to fix the garbage problem.
17	Environmental education should be taught in schools.
18	There are enough garbage receptacles in major towns, like St. Ann's Bay and Ocho Rios.
19	The political representative in for my community is concerned about the garbage problem.
20	I play an important role in the management of garbage in my community.
21	There is enough information available about the health impacts of inadequate storage and disposal methods.
22	It is very important that the Government of Jamaica put recycling laws and programs in place.
23	The purchase decisions that I make can increase or reduce the amount of garbage my household must get rid of.
24	People throw garbage on the streets and in drains and gullies because they have no other means of getting rid of their garbage.

Appendix 5. List of WRSQ survey interviewer names, including representative agency and agency location

Name	Agency	Location
Jennifer Post	Peace Corps Volunteer, Northeast Regional Health Authority	Ocho Rios, St. Ann, Jamaica
Nicole Wynter	Northeast Regional Health Authority	Ocho Rios, St. Ann, Jamaica
Frank Beecher	Northeast Regional Health Authority	Ocho Rios, St. Ann, Jamaica
Bridgette Traille	Northeast Regional Health Authority	Ocho Rios, St. Ann, Jamaica
Leroy Scott	St. Ann's Bay Health Department	St. Ann's Bay, St. Ann, Jamaica
Mark Miller	St. Ann's Bay Health Department	St. Ann's Bay, St. Ann, Jamaica
Trevor Lotian	St. Ann's Bay Health Department	St. Ann's Bay, St. Ann, Jamaica
Sherika Lewis	St. Ann's Bay Health Department	St. Ann's Bay, St. Ann, Jamaica
Newton McDonald	St. Ann's Bay Health Department	St. Ann's Bay, St. Ann, Jamaica
Tanesha Richards	St. Ann's Bay Health Department	St. Ann's Bay, St. Ann, Jamaica
Phileisha Miller	St. Ann's Bay Health Department	St. Ann's Bay, St. Ann, Jamaica
Kerry-Ann McCloud	St. Ann's Bay Health Department	St. Ann's Bay, St. Ann, Jamaica

Appendix 6. Brief list of solid waste management planning guides, including author and link to electronic version (if available)

Title (year of publication)	Author	Website
<i>Waste Management Planning - An environmental sound approach for sustainable urban waste management: An Introductory Guide for Decisions-Makers (2004)</i>	Division of Technology, Industry, and Economics, United Nations Environmental Program (UNEP)	http://www.sandec.ch/SolidWaste/Documents/10-Miscellaneous/Waste%20Management%20Planning-UNEP.pdf
<i>Solid Waste Management (2005)</i>	Division of Technology, Industry, and Economics, United Nations Environmental Program (UNEP)	http://www.unep.or.jp/ietc/Publications/spc/Solid_Waste_Management/index.asp
<i>Integrated Waste Management Scoreboard – A tool to measure performance in municipal solid waste management (2005)</i>	Division of Technology, Industry, and Economics, United Nations Environmental Program (UNEP)	http://www.unep.or.jp/ietc/Publications/spc/IWM_scoreboard-binder.pdf
<i>Strategic Planning Guide for Municipal Solid Waste Management (2001)</i>	Wilson, D.C., Whiteman, A.D., and Tormin, A.C; published by World Bank	www.worldbank.org/urban/solid_wm/erm/start_up.pdf
<i>International Source Book on Environmentally Sound Technologies (ESTs) for Municipal Solid Waste Management (MSWM) (1996)</i>	Division of Technology, Industry, and Economics, United Nations Environmental Program (UNEP)	http://www.unep.or.jp/ietc/ESTdir/Pub/MSW/index.asp
<i>A Directory of Environmentally Sound Technologies for the Integrated Management of Solid, Liquid and Hazardous Waste for Small Island Developing States in the Caribbean Region (2004)</i>	Division of Environmental Policy Implementation, United Nations Environment Program and the Caribbean Environmental Health Institute	http://www.cehi.org.lc/ESTDIRECTORY.pdf
<i>Composting and Its Applicability in Developing Countries (1999)</i>	Hoornweg, D., Thomas, L., and Otten, L., published by the Urban Development Division, World Bank	

Appendix 7. Description of online sample size calculator

The sample size for the WRSQ survey was calculated using an online sample size calculator as described in Section 3.2.2 of this report. The calculator is available at www.surveysystem.com/sscalc.htm, as a public service of Creative Research Systems, providing software for market researchers, political pollsters, human resource professionals, social scientists and others who use questionnaires.

This particular online resource was utilized to determine the number of respondents required to attain survey results that will reflect the larger Parish and national populations. And as the website states, “you can use it [the sample size calculator] to determine how many people you need to interview in order to get results that reflect the target population as precisely as needed.”

In order to calculate the sample size, the website requires the researcher to input values for two variables: the confidence level and confidence interval. The website defines the variables as follows:

Confidence interval: the plus-or-minus figure usually reported in newspaper or television opinion poll results. For example, if the confidence interval of 4 is used, and 47% of the sample picks an answer, then you can be ‘sure’ that if you had asked the question of the entire relevant population between 43% (47-4) and 51% (47+4) would have picked that answer.

Confidence level: indicates how sure you can be. It is expressed as a percentage and represents how often the true percentage of the population who would pick an answer lies within the confidence interval.

For the present research, a confidence level of 95% and a confidence interval of ± 10 were chosen for use in the sample size calculator. The confidence level was chosen based on the statement made in the website that, “most researchers use the 95% confidence level.” Given the limited personnel and financial resources available for implementing the survey, the confidence interval of ± 10 was chosen based on the respective sample size, so as to minimize the sample size and maximize the confidence interval. Sample size calculations were conducted for three confidence intervals in order

to identify the most appropriate value for the WRSQ survey. The results from the calculations are shown in Table A7.1.

Table A7.1: Calculated sample sizes for each Enumeration District for three different confidence intervals. Each calculation utilized a 95% confidence level.

Enumeration District (sample frame)	Confidence Interval		
	±5	±10	±20
NW002 (250)	152	70	22
NW003 (92)	74	47	19
NW050 (30)	28	23	14

As presented at the Creative Research Systems' website, the formulas used in the Sample Size Calculator:

Sample Size

$$SS = \frac{Z^2 * (p) * (1-p)}{C^2}$$

Where:

Z = Z value (e.g., 1.96 for 95% confidence level)

p = Percentage picking a choice, expressed as a decimal (0.5 used when calculating sample size)

C = Confidence interval, expressed as a decimal (e.g., 0.1 = ±10)

Correction for Finite Population

$$\text{New SS} = \frac{SS}{1 + \frac{SS-1}{Pop}}$$

Where:

Pop = Population (Note: for the calculations in Table A7.1, the population equals the sample frame for each Enumeration District)