

**SOLID WASTE MANAGEMENT PRACTICE AND ITS IMPACTS ON
DRAINAGE SYSTEM AND ENVIRONMENT IN ASELA TOWN**



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DRAINAGE SYSTEM AND ENVIRONMENT IN ASELA TOWN

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ADAMA, ETHIOPIA

DECLARATION

I declare that this thesis entitled “Solid Waste Management Practice and Its Impacts on Drainage System and Environment in Assela Town” is my own work and has not been submitted to any university for similar purpose. The references used in this thesis are duly recognized by proper citations.

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RECOMMENDATION

I, the major advisor/supervisor of this research, hereby certify that I have closely advised/supervised the student while developing this thesis and read the draft thesis entitled “Solid Waste Management Practice and Its Impacts on Drainage System and Environment in Assela Town ” prepared under my guidance by Endale Tilaye Sahile. Therefore, I recommend the submission of the thesis to the department for further review and evaluation.

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APPROVAL PAGE

I/we, the advisors of the thesis entitled “Solid Waste Management Practice and Its Impacts on Drainage System and Environment in Assela Town” and developed by Endale Tilaye Sahile, hereby certify that the recommendation and suggestions made by the board of examiners are appropriately incorporated into the final version of the thesis.

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LIST OF ACRONYMS AND ABBREVIATIONS

As l	above Sea Level
CSA	Central Statistical Agency
DST	drainage systems of town
EPE	Environmental Policy of Ethiopia
EPM	Environmental Protection and Management
FDREPCC Commission	Federal Democratic Republic of Ethiopia Population Census
FGD	Focus Group Discussion
FO	Field Observation
GIS	Geographic Information System
HH	House Hold
HHS	household survey
ICWA	Integrated city wide Approach
ISWM	Integrated Solid Waste Management
KII	Key Informants Interview
MSW	Municipal solid waste
NGOs	Non-Governmental Organization
SBPS	Sanitation, Beauty and Parking Sector
SBPDA	Sanitation, Beauty, Parking and Development Authority
SPSS	Statistical Package for Social Science
SWMP	Solid Waste Management Proclamation
SWM	Solid waste management

ABSTRACT

Improper solid waste management has become a major environmental problem in Assela town. In-adequate solid waste management in the town has resulted in the accumulation of waste on open lands, in drains and in the residential areas, causing a nuisance and foul-smelling pools, environmental pollution through leachate from piles and burning of waste, clogging of drains. This study was, conducted to assess the existing situation of SWM, public participation and its impact on drainage and environment in the town. Different sampling methods were employed to select the study units like stratified sampling, techniques and purposive sampling. Even though most of the collected data from the interviewed respondents were qualitative in nature, it was also supported by quantitative information collected through survey and secondary sources. The study was conducted on randomly selected 137 households that are estimated to represent all classes of income levels; low, middle and high. The alternative disposal methods within the category of illegal solid waste disposal practice (94%). From those respondents who use unauthorized means of disposal sites, majority of the respondents (4%) answered as they simply burn solid wastes inside their fence and on the roadside. However, about 51% of the respondents replied that they disposed their solid wastes in near riverside; similarly, about 2% of them were dumping their solid wastes on their back yard. In addition, from the selected samples, 38% and 5% were disposed their solid wastes on space and other alternatives respectively. Drainage system are blocked by solid and liquid wastes of various types leading to flash flooding this can affect surface water quality of the town and environment as well. Therefore, the best ways that used to tackle the above problems are: implementation of sustainable solid waste management practices through awareness creation and training, improvement of sanitation, beautification and parking sector institutional structure and budget allocation, implement of rules, regulation, and involvement of community in solid waste management practices with all stakeholders. Since solid waste needs proper management and disposal practices at a source, the generated solid wastes should be arrange and identified at the source for further use. The developed solid waste management and disposal strategies expect to provide guidelines for proper management and disposal practices of the generated solid wastes. Therefore, the town municipality together with the concerned bodies should implement the developed solid waste management and disposal strategies in order to bring significant change in solid waste management and disposal practice of the town.

Key words: Assela Town, Community participation, Disposal practices, Drainage system, Household, Solid Waste Management.

CHAPTER ONE

1. INTRODUCTION

1.1. Background of the study

Solid waste is any material, which comes from domestic, commercial and industrial sources arising from human activities that has no value to people who possess it and is discarded as useless (Kumar M, et al., 2020). In the early days, waste disposal did not pose difficulty as habitations were sparse and land was plentiful. However, from the time humans began to congregate in tribes, villages and communities the accumulation of waste become a problem (Katiyar, 2019).

Solid waste, which is a consequence of day-to-day activity of human kind, needs to be managed properly. Particularly, waste volumes have increased in urban area due to the rapid growing urban population, concentration of industries, consumption of residents and inadequate finance and facilities to manage waste collection and disposal (Tegeng, 2008). This state of affairs has led to the volume of solid waste generated to go beyond what the available facilities can accommodate.

Solid waste management (SWM) thus emerged as an essential, specialized sector for keeping cities or towns healthy and liable. Solid waste management refers to source separation, storage, collection, transportation and final disposal of waste in an environmentally sustainable manner (Feleke, 2005). In the light of this, municipal solid waste management is an important environmental health service and an integral part of basic urban services. This is because, the health implications of poor waste management can be very damaging to the people exposed to these unsanitary conditions. Diseases such as cholera, typhoid, dysentery and malaria are all related to the practice of poor waste management (Trankler J. Visvanathan C. Kuruparan P. Tubtimthai, 2005). This can result in the loss of human resources needed in the development of the country.

Urban waste management has been a challenge for municipalities and urban governments in Africa, largely due to poor infrastructure, limited institutional capacity of the municipalities and bureaucratic competence. Municipalities throughout Ethiopia are not free of these problems, as they have been facing major challenges with solid waste collection and landfill management. The management approaches, methods and techniques employed in waste management by municipal have been unsuccessful. Moreover, in comparison with other

public sectors it has been observed that sectors dealing with waste management have often received little attention from the governments (Kassa G. , 2009).

Solid waste management is one of the major problems faced by different cities all over the world. The problem is particularly due to urbanization, industrialization, poor urban planning and lack of adequate resources, which contribute to the enormous amount of solid waste generation (S.T. Odonkor et al., 2020). This problem has resulted in serious environmental, social and economic complications in the developing countries like Ethiopia.

Problems in solid waste management of most developing countries differ from those found in industrialized countries in terms of composition, density, political and economic framework, and amount of waste, access to waste collection, awareness and attitude. In developing countries, the per capita generation of the solid wastes in urban residential areas is much less compared with the developed countries; however the capacity of the developing countries to collect, process, dispose, or reuse the solid wastes in a cost effective manner is significantly limited compared with the developed countries (Anschütz, 1996). Wastes developing cities are heavier, wetter and more corrosive compared to the developed cities. It has many future challenges related to waste and solid waste management systems.

Solid waste can be generated from different industries, governmental and non-governmental sector is critical problem for the socioeconomic development of Ethiopia. Accordingly, provision of safe and sufficient solid waste management indispensable components in the sustainable development of the nation.

There is lots of solid waste is generated in Assela Town, municipality is mainly responsible for solid waste management of the town as there is no private organization involved in such tasks. There is no communal solid waste container deployed in different sites of the town, as a result solid waste produced from every household are collected on roadside. Improper solid waste management practice have a critical problem for surface water quality since the town drainage ditches serve as dumping site for solid waste.

Even though, the study done on this area by (Lema et al., 2019) states that there was no study done before, to systematically asses the magnitude of the problem and the factors for the improper waste management in Assela but their study will serves as base line for this study now.

1.2. Statement of the problem

The problems of poor sanitation levels across African countries, including Ethiopia are made worse by urbanization with insufficient solid waste management and disposal practices, particularly the widespread of illegal disposal practices of solid wastes in open spaces, riversides, dumping inside the road, and other uncontrolled dumpsites. (UEPA, 1993).

Improper solid waste management have a crucial problem that is particularly due to urbanization, industrialization, poor urban planning and lack of adequate resources. This problem has resulted in serious environmental, social and economic complications in the developing countries like Ethiopia. (Stephen T. Odonkor, Kwasi Frimpong, Napoleon Kurantin, 2020).

There are numerous hospitals, health centres, hotels, industries, and small businesses area in Assela town. As a result, the town produces a lot of solid wastes. Due to the lack of involvement from private organizations, the town municipality is primarily in charge of managing the town's solid waste. Because the town lacks a suitable dampening site or communal solid waste container, residential solid waste is collected on the roadside of the town. (Lema et al., 2019)

According to Assela municipality high amount of solid wastes have been generate from residential, commercial and institutional sectors in the town. More than 70% of solid waste produced in the town is not collected and transported into proper damping site by the municipality rather than it was discarded into streets, drains, ditches, canals and open spaces. (Assela Town Municipality, 2013).

Assela town solid waste management services are not keeping up with the growth, development, and expansion of the community. There are significant budgetary constraints, a lack of institutional capacity, and an informal organization that characterize the town's existing solid waste management system. Hazardous solid waste produced by businesses centers, healthcare facilities, and other institutions is also not disposed of separately. An integrated solid waste management system not observed to reduce the negative effects of inappropriate waste management on the environment and public health risk. Low level of public awareness of solid waste management system, behavioral modification and communicational intervention to reduce the amount of waste that needs to be transported to the final disposal location, by waste minimization strategies through reduce, reuse, recycle, and recover.

There could be serious risk to the environment and public health from improper solid waste management procedures. Pollution of the air, water, and soil can result from the open dumping and burning of solid waste. The degradation of surface water's physical, chemical, and biological quality as well as the loss of related ecosystem services were caused by the disposal of solid wastes into water bodies. There may be a health danger to the municipality because streams that receive solid waste are frequently used for swimming and washing.

The land surface is being used to dispose many solid wastes. At the disposal location, no pollution control measures being used at the time. Because of the decomposition of waste and the creation of leachate, which contains a wide variety of substances, physical, chemical, and biological processes may occur in the disposal site.

Therefor there is improper sanitation situation of different Infrastructures, the drainage ditches are miss functioning of their desired purpose, and this can affect surface water quality of the town. Flooding is a major problem in Assela town which mainly happens due to the town's topography and urbanization caused by the increase in impervious surfaces and accumulation of storm water from upstream to downstream together with poor storm water management. In many places, the existing drains are blocked by solid and liquid wastes of various types leading to flash flooding.

This study is essential for management of solid waste and utilization of proper sanitation of roadway infrastructures.

1.3. Objectives of the research

1.3.1. General objective

To assess the existing situation of solid waste management, public participation and its impact on drainage system and environment in Assela town.

1.3.2. Specific objectives

-  To evaluate MSW management practice particularly on collection, segregation, disposal and public participation on solid waste management.
-  To identify impacts of solid waste management system of the town on environment and Drainage system of the study Area.
-  To assess potential importance and challenges to enhance public participation in integrated solid waste management.

1.4. Research Questions

The general and specific objectives of the study would be achieved by way of seeking answers to the following questions.

- ✚ What are the main challenges of MSW management practice on collection, segregation, disposal and public participation?
- ✚ What is the potential impact of existing MSW management of the town in regarding of environment and Drainage system of the study Area?
- ✚ What are the main challenges and the potential importance to implement integrated public participation in solid waste management of the study area and how?

1.5. Significance of the study

This study would have a contribution on the current solid waste management practice and its influencing factor in different sectors. It have great importance for municipality, community, sanitation beautification and parking sectors and other stakeholders for awareness creation and integration in solid waste management practice.

To provide a clear understanding the ways in which the town's drainage systems (DST) are obstructed by the improper solid waste disposal due to economic and social aspects of its intended use and surface water pollution hence impairing the environment.

Furthermore, it helps us to build an action plan for further implementation in the research area and informs for decision makers about appropriate solid waste management and disposal methods strategy at some levels. It provides baseline information for private, public, and some governmental organizations.

1.6. Delimitations and limitations of the study

Lack of adequate secondary data regarding the town's solid waste management and disposal practices is the biggest problem we encounter when conducting these studies. Insufficient data on the solid waste generation rate in the town of Assela for an extended period is available to do a trend analysis. Financial issues, respondents' hesitation and a serious lack of local research for references and well-documented evidence in the town municipality, health organizations, and other relevant areas. We managed to finish this study, nonetheless, by overcoming or getting beyond these challenges.

CHAPTER TWO

2. LITERATURE REVIEW

2.1. Introduction

This part of the study seeks to present the literature review by introducing the key concepts and terminologies that are relevant to this study. Then a review of the related literature is presented on the situation of solid waste management, where the research will be conducted. The review of the literature on the impact of poor solid waste management on health was the first major step in identifying, synthesizing, and integrating relevant evidence.

The evidence was then used to create and analyse a framework that summarizes and shows interlinkages and possible pathways through which exposure to solid waste may be detrimental to health (Kassa Z. , 2010).

2.2. Fundamental Concepts of Solid Waste Management

According to its definition, municipal solid waste is any substance for which the primary producer or consumer does not need to provide payment upon abandonment within an urban region. This definition encompasses all urban solid wastes if it is commonly considered by society as being within the obligation of the municipality to collect and dispose of (Tegeng, 2008). Furthermore, several authors define municipal solid trash as any undesired or worthless material that is disposed of due to human or animal activity. The most often contents tossed out of homes are solids, semi-solids, or liquids in containers. Food scraps, paper, plastic, glass, metal, and other household goods, along with general garbage from homes, businesses, and institutions, as well as non-hazardous solid waste from industry, are the main types and sources of municipal solid waste (Program, 2010).

Solid wastes also refer to all wastes generated by human and animal activities that are typically solid and are disposed of as undesirable or worthless. As per the definition, solid wastes comprise of both organic and inorganic solid waste materials that are generated by homes, commercial, institutional, and industrial operations that have lost their original value in the eyes of the users (Teshome, 2021).

2.3. Solid Waste and its Management

Municipal wastes are not well managed in developing countries due to the alarmingly increasing solid waste production, which is more than the capacity of the cities and municipalities. It was reported that, waste collection rates are often lower than 70% in low-income countries and more than 50% of the collected waste is often disposed of through uncontrolled land filling (Lema et al., 2019).

Over the past 50 years, the practice of waste management has emerged and currently it encompasses disposal, treatment, reduction, recycling, segregation and modification. Despite increasing industrialization and urbanization, dumping of solid waste, particularly in landfills, remains a major means of disposal and implied treatment. Major developments have occurred in landfill technology and in the legislative control of waste categories that can be subject to disposal by land filling. Direct dumping of the waste without proper examination and separation leaves a serious impact of environmental pollution causing a tremendous growth in health related problems (Cheru, 2006).

2.4. Categories of Solid Wastes

There are many different kinds of solid waste, depending on where it generates. Among the many different forms of solid wastes are paper, glass, plastic, cardboard, leather, wood, textiles, metals, yard wastes, ashes, and special wastes (like large items, consumer electronics, white goods, batteries, and oil tires), are among others (Belete, 2002). The three primary categories of solid wastes are hazardous, industrial, and municipal wastes (Cheru, 2006). Industrial wastes are wastes that are generated by industrial operations. The kind of an industrial base determines the actual makeup of industrial wastes in a nation. Industrial process wastes consist of a very diverse range of constituents.

Consequently, the composition of industrial waste is determined by the kind of industries engaged. Among the wastes that come under this category are tarry residues, demolition and building debris, metallic sludge, organic waste from food processing, packaging materials, plastics, papers, acids, and alkalis, ash from regular industry rubbish, and hazardous garbage. Any wastes or combinations of wastes that have the potential to cause a considerable increase in morbidity, mortality, or sickness because of their quantity, concentration, or physical, chemical, or pathogenic characteristics are classified as hazardous wastes.

Municipal solid wastes are materials that the primary generator or user abandons in an urban area without receiving remuneration). Municipal rubbish is another term used to describe

these items. The municipal solid waste in underdeveloped countries also contains significant amounts of industrial solid waste from small businesses. There are many different kinds of solid wastes in these sources. On the other hand, per the following, some of the typical solid wastes from these sources are urban solid waste products that are disposed of in urban areas and are usually considered to be under municipal responsibility (Belete, 2002).

This group, sometimes referred to as domestic waste or residential rubbish, includes wastes generated by daily household activities. Included in them are wastes from cooking, sweeping, cleaning, gardening, and burning fuel. Together with outdated equipment, furniture, and clothes, it also contains reading material and packaging. Waste from retail establishments, offices, hotels, restaurants, petrol stations, warehouses, and other establishment is falls under the category of commercial rubbish or refuse. Food wastes, office supplies, and packing materials are usually included in this group (Municipality, 2015). Solid waste is defined as any unwanted solid material that has been set aside as a result of animal and human activity. Solid wastes can be generally classified into three primary classes: hazardous, industrial, and municipal wastes.

It is possible to argue that there are two main categories for disposing of municipal solid waste. These are recyclable and biodegradable, as well as non-recyclable and non-degradable. Put another way, both organic waste that breaks down quickly and non-organic waste, such as bottles, glasses, and papers, can be found in municipal solid waste.

2.5 Sources of Solid Wastes

The sources of SW include industrial, municipal services, residential, commercial, institutional, construction, demolition, industrial, treatment plant sites, and agricultural solid wastes. Many types of industrial operations create SWs as they process, manufacture, or transport their raw materials. The majority of these wastes are dangerous in nature. In addition to being dangerous, the waste produced by these sources is inorganic and needs to be specially treated before being disposed of (Kume, 2004). The materials gathered throughout the SW period comprise a wide range of compounds from various sources.

In a same manner, a society's socioeconomic and technological standing determines where SWs originate. It is possible for a tiny Ethiopian rural population to have known forms of SW from known sources. While there could be a lot of suppliers in a large metropolis like Addis Ababa. When they empty wastebaskets, the majority of people can recognize SW. The number of households classified as SWs is far higher than is realized. Assela town's other

sources of solid waste include mostly municipal services, residential, commercial, institutional, and small industrial sources. Additionally, there are small-scale manufacturing operations in the town that generate substantial amounts of solid trash. The sources listed below are universal in all situations.

2.6. Issues in Solid Waste Management

The following major issues must be considered in discussing the management of solid wastes: (1) increasing waste quantities; (2) wastes not reported in the national MSW properly; (3) lack of clear definitions for solid waste management terms and functions; (4) lack of quality data, (5) need for clear roles and leadership in federal, state, and local government; (6) need for even and predictable enforcement regulations and standards, and (7) resolution of inter-country, interstate, and inter-country waste issues for MSW and its components (Alemayehu et al., 2021).

2.7. Methodology Analysis of solid waste

MSW management strategies developed without quality data on the risks and costs of all available options under consideration are not likely to optimize decision making and may, in some cases, result in unsound decisions. Because data are often costly and difficult to obtain, decision makers should plan for an active data collection stage before making critical strategy choices. Literature review and interviews provide a workable framework to develop a survey questionnaire. Self-administered questionnaire used to describe the aspects, practices and challenges of SWM. (Belete, 2002)

2.8. Theoretical Approach

According to ENPHO (2008), if solid waste (SW) is not effectively managed; it can result in serious adverse impacts on environment and public health. Therefore, solid waste management (SWM) is a critical component within urban sanitation and it is also one of the most important and resource intensive services provided by municipalities (Cheru, 2006). Solid waste management strategies that focus on source reduction, resource recover, and reuse have proven to be more cost effective over the long run or in the near future. They are less damaging to the environment because they prevent or minimize waste generation at the source (Municipality, 2015).

2.9. Integrated Solid Waste Management

An integrated solid waste management system involves the use of a range of different treatment methods, and key to the functioning of such a system is the collection and sorting

of the waste (Alemayehu et al., 2021). It is important to note that no one single treatment method can manage all the waste materials in an environmentally effective way (Zerbock, 2003). Data is relevant in evaluating sizes and locating collection facilities and route design for waste disposals. Thus, reliable database is necessary to identify appropriate policies that suit local conditions for efficient solid waste management in cities of developing countries (Abegaz, 2021).

2.10. Effects of Illegal Solid Waste Disposal Management

2.10.1. Effects of Illegal Solid Waste Disposal on Health

Human health, the environment, the town's ecological state, children's health, sanitation issues, and the amount of pollutants in the water, soil, and atmosphere can be affected by exposure to hazardous solid waste management practices (Ziraba et al. 2016). Numerous research projects have been undertaken globally to determine the relationship between hazardous solid waste and human health. Contamination of surface and ground water sources by solid wastes generated from residential, institutional, agricultural, and industrial sources can also pose a major health danger. Waste from hospitals and other medical facilities needs to be handled carefully since it poses serious health risks.

The neighbourhood may potentially be exposed to health risks from solid waste treatment and disposal facilities. Inadequately managed and constructed landfills draw a wide variety of insects and rodents that carry disease, while poorly run incinerator facilities generate air pollution Zerbock (2003),. There are health concerns associated with recycling as well, especially if appropriate action is not done or preventive measures are not taken to avoid an unwanted outcome. Workers that handle trash directly, such as waste collectors and waste workers are more susceptible to a variety of chronic and infectious diseases.

Hazardous organic materials present serious health dangers to the public, including the possibility that they could serve as breeding grounds for disease vectors, as previously indicated. They may also increase the spread of disease or pose other threats to public health. When medical waste or human or animal excrement enters the waste stream, solid waste handlers and waste pickers are particularly susceptible and can become disease vectors, catching and spreading illnesses. Landslides or fires can demolish homes and cause serious injuries or fatalities to residents in areas where slums or shantytowns are located next to open dumps or poorly planned or run landfills. The piling of debris along streets may provide physical risks, obstruct drains and cause localized flooding (Rahayu et al., 2018).

2.10.2. Consideration for Aesthetics

Uncontrolled solid waste dumping can be replaced with a safer option called land filling. The establishment of special locations (landfills) where garbage that cannot be recycled or composted can be managed becomes required because it is abundantly obvious that improper waste disposal can endanger both human life and the environment. The design of a typical landfill keeps methane emissions from igniting fires and shields ground water from contamination.

2.10.3. Surface and Ground Water Contamination

The leachate of landfills and dumps can contain pathogenic organisms and harmful compounds due to the presence of municipal solid waste streams. (Leachate, the liquid waste released from landfills and dumps, is made up of liquid wastes, organic waste that has rotted, rainwater that has seeped in, and soluble material extracts). Depending on the drainage system and the make-up of the surrounding soils, this discharge from an unlined landfill may contaminate surface or ground water. Expensive modern technologies are required for the treatment or removal of several harmful compounds that have been disposed of in the general solid waste stream.

Solid waste can damage local plants and animals and change aquatic environments when it is dumped into rivers or streams. Fish and other aquatic life forms cannot breathe because of the high nutritional content of organic wastes, which can reduce the amount of dissolved oxygen in water bodies. Solids have the ability to alter bottom habitat, stream flow, and sedimentation. These priceless natural resources and the services they offer could be severely harmed or destroyed by siting dumps or landfills in delicate ecosystems (Gelan, 2021).

2.11. Difficulties in Managing Solid Waste Disposal

The following are some of the difficulties associated with solid waste disposal management that impact the transportation, disposal, and collection of solid waste:

2.11.1. Economic Difficulties

The government of developing nations places little emphasis on municipal solid waste management, which results in the industry receiving very little funding. Local governments are particularly affected by this issue since they lack a strong financial foundation for providing public services, such as managing municipal solid waste. Additionally, the local tax collection system is underdeveloped. A lot of local governments in developing nations

have inadequate financial planning and administration in addition to insufficient funding (Rahayu et al., 2018). Lack of financial management and planning, particularly cost accounting depletes limited resources available for the sector even more quickly and causes solid waste management services to halt for some times, thereby losing faith of service customers (Kassa G. , 2009). Interview material indicated that the financial issue is really serious. The yearly budget is allocated to the sectors in an insufficient and fair manner. The municipality had a poor source of funding because it depended on income to run its operations. The lack of funding was thus one of the elements impacting MSWM in the municipality for the inefficient service delivery.

2.11.2. Insufficient Public Awareness and Perceptions

The municipal solid waste management system may be impacted by public understanding and attitudes around waste. Public awareness and participation are necessary for every stage of municipal solid waste management, including the storage of household waste, waste segregation, recycling, frequency of collection, willingness to pay for waste management services, and opposition to the location of waste treatment and disposal facilities (Kofi et al. , 2021). According to Zerbock (2003), one of the main reasons why solid waste management practices fail in developing countries is the lack of public awareness and school education regarding the significance of proper solid waste management for people's health and well-being. This also severely limits the use of community-based approaches in these countries.

Consequently, another obstacle to the town's municipal solid waste management program was the lack of public awareness and attitudes. Most homes were not aware of the repercussions of using subpar techniques for handling and disposing of solid waste. According to the survey's findings, the town's municipality does a very poor job of raising public knowledge of solid waste management.

2.11.3. Implementation of Rules and Regulations at Minimum Level

According to the report, it is challenging to give distinct mandates to various industries involved in waste management services due to a lack of sufficient regulation. The town's implementation program and set of rules and regulations were inadequate. However, a lot of work was done to raise community understanding of solid waste management, including the laws, ordinances, and related fines.

2.12. Solid Waste Management Practice in Ethiopia

In Ethiopia's cities, solid waste management (SWM) and appropriate location disposal techniques are growing in importance as environmental and public health concerns. In Ethiopia, like developing countries, increase of SW generation and unlawful solid waste disposal practices are caused by rapid urbanization, fast expansion of economic development and population booming. According to Kassa Z. (2010), "the average solid waste production rate is about 0.221 kg per person per day and it is also estimated that only 2% of the population received solid waste management, collection, and proper place disposal activity." This demonstrates the poor state of the SWM service's operations and the few attempts made to improve the circumstances.

The growing number of micro and small-scale businesses are starting to engage in primary solid waste collection, which involves gathering rubbish from households and transporting it to MSW containers and transfer sites. The private sector's involvement in this process is likewise fairly restricted. In summary, the actual state of solid waste management in Ethiopia suggests that the issue cannot be resolved solely through the efforts of local governments; instead, a significant amount of the private sector, in particular microenterprises and the community, must be involved (Tegegne, 2006).

As a result, the most severe sanitation issues are seen in many Ethiopian towns. Moreover, SW their attraction mounds of decaying vegetables and other organic SW about the street, riverbed and market area. Humans will interact with the created SW. People who are directly affected by the cycle at various points, as well as those who are at risk, are many and include the unsaved area's population, facility staff who spread infections, pre-schoolers, and nearby residents of waste disposal facilities.

According to Ripabilic (2008), Ethiopia has seen a quick increase in per capita income, rural-urban mobility, and urbanization. Though this growth is presumably accompanied by a rise in the demand for public services and infrastructure (Belete, 2002), this has not shown to be the case. Ethiopian towns that would like to offer basic municipal infrastructure and services such solid waste management but not have the institutional ability or the financial means to do so.

As to the report, Assela town is among the rapidly expanding towns in Ethiopia, distinguished by its rapid population growth, industrialization, economic progress, and urbanization. The town employs inadequate and unproductive solid waste management

techniques. Institutional difficulties, financial difficulties, accessibility issues, and community resistance are just a few of the obstacles causing this. As a result, the municipality is dealing with a variety of issues, including ecological, aesthetic, health, and environmental issues. As a result, I discovered that the research area's management plan included studying solid waste management, disposal, generation volume, and general methodology.

2.13. Solid Waste Management Policy-Related Concerns

An analysis of the legal framework governing waste management is necessary to have a complete knowledge of contemporary waste management methods and their consequences. Rather than having judges impose laws, legislators write them in Ethiopia according to the civil law system. The Constitution of Ethiopia is the primary source of environmental law, according to experts in the field. The bases for the Environmental Policy of Ethiopia are articles 92.1 and 92.2 of the Constitution of the Federal Democratic Republic of Ethiopia: "Article 92.1: "Government shall endeavour to ensure that all Ethiopians live in a clean and healthy environment"; Article 92.2: "Government and citizens shall have the duty to protect the environment" (Forum for Environment, 2010)". In three distinct articles, the Ethiopian Environmental Policy either directly or indirectly mentions solid waste management: "Article 3.7 addresses issues related to human settlement, urban environment, and environmental health; Article 3.8 addresses issues related to the control of hazardous materials and pollution from industrial waste; and Article 3.9 addresses atmospheric pollution and climate change."

Solid Waste Management Proclamation No. 513 is the main waste management policy at the federal level. The proclamation's primary objective, which was announced in February 2007, is to boost community involvement. According to the proclamation, "solid waste management action plans designed by, and implemented at, the lowest administrative units of urban administrations can ensure community participation (Proclamation No. 513, 2007)" are a necessary means of ensuring community participation in order to prevent the negative effects and to enhance the benefits resulting from solid wastes.

2.14. Pollution of Groundwater and Surface Water

Vulnerability of groundwater to pollution indicates combinations of geological and hydrological parameters give risks associated to groundwater pollution than other combinations (Kumar M, et al., 2020). Groundwater aquifers are hydraulically connected to the overlying land surface through interwoven pore fringes. The vulnerability of an aquifer to contamination depends on this. Groundwater that receives water and contamination from land

surface is considered more vulnerable than groundwater that receives water and contaminants more slowly and in lower quantities.

The quality of groundwater depends on the relative quantity of contaminants that reach the aquifer, travel time of contaminants, and the geological system contaminant-attenuation capacity. Any effort to control or prevent surface and groundwater pollution in any area requires, adequate proper understanding of such natural intrinsic characteristics of any targeted aquifer in terms of vulnerability to contamination and the background information of the activities in the area in question.

2.15. Effects of Municipal Solid Waste on the Environment

Uncontrolled solid waste dumping exposes urban residents, to potential risks from polluted water particularly those living adjacent to dumpsites, UN health food sources, air, land and vegetation pollution. Poor solid waste disposal and handling of wastes leads to environmental degradation, ecosystem destruction and high risks to public health. Environmental problems associated to solid waste range from health hazards, water pollution and soil, offensive odour and repulsive sight. The outcome of this all is degradation of our environmental quality (Trankler., 2003).

Most dumpsites are sited within the vicinity of living communities and wetlands. The dumpsites are often not technologically sited for adsorption of toxic substances. Therefore makes them responsive to discharge pollutants to nearby water bodies and to the air through leachates or dumpsite gases respectively (AID, 2004). Many water resources have been remarked as being hazardous to man as well as other living systems (Tegeng, 2008).

The highest numbers of the uncontrolled dumping sites are many years old with unmanaged waste disposal techniques. Such dumping sites have significant environmental impacts. Solid waste poses significant life threatening potential health of the terrestrial, aquatic and aerial environments (AASBPDA, 2004).

2.16. Effects of Pollutants on Health

Water naturally contains small amounts of dissolved substances such as zinc, calcium, magnesium and even impurities like silt, sand and microbial substances under normal circumstances. These quantities are considered safe for human use; however, when they exceed threshold limits, then the water is polluted (Feleke, 2005). Metal ions and their complex exhibit a wide range of toxicity to organisms ranging from sub-lethal to lethal

depending upon the time of exposure and the ambient temperature. For example, the heavy metals; Pb, Zn, Mn, Cd, As, Ni and Hg are highly toxic even in low concentrations (Zerbock, 2003). Cadmium and lead have significant hazardous to human health; long term exposure to lead may cause severe disruption of biosynthesis of haemoglobin and/or anaemia, damage of kidneys, high blood pressure, brain damage, miscarriages, disruption of nervous system and sperm damage in males. Mercury can be responsive to brain and kidney damage and interference with the nervous system and regeneration of haemoglobin (Trankler., 2003). When these pollutants are indiscriminately dumped in the landfills, the resulting leachate finds ways into the groundwater or is washed surface water and streams causing water pollution.

Zn reaches the water bodies through artificial pathways like by-products of steel production or coal-fired power stations, as well as burning of waste materials (AASBPDA, 2004). To a small extent, Zn is found through effluents from commercial industries, mining leaching, from fertilizers, and smelting activities.

Measured pH values in samples are mere indicators of acidity but not measure of potential activity levels of actual hydrogen ions (H^+). The pH measurements scale run from 0-14 with 7.0 considered neutral. PH below 7.0 is considered acidic while those above 7.0 considered bases. PH levels are indicators of the health implications of a water source as organisms thrive based on acidity a given range.

Pathogens and nutrients also contribute to water quality. Pathogens like coli forms are resultant of untreated sewage. Is a portion of the coli form bacteria group that originates from the intestinal tract of war m blooded animals and is an indicator of the bacteriological noxious contamination of domestic water supply. The presence of E.coli presence in portable water has been attributed to many diseases. On the other hand, Total coliforms may not necessarily be harmful to human though according to Environmental Protection Agency (EPA) they are indicators of pathogens that need regular investigation. Coliform levels symptoms under the category of gastroenteritis may not be serious for healthy people. However, they can lead to serious complications to people having weak immune systems (Bartone, 2000). Escherichia coli. Forms in drinking water is often reflected through biological indicator of the total coliforms. The Escherichia coliform is an indicator of the presence of pathogens in water. Their presence in drinking water is of concern because of the various diseases they may cause to human beings.

2.17. Water Quality Standards and Guidelines

Water Quality Standards and Guidelines are primarily aimed at protecting public health and aquatic life. The standards and guidelines are established case wise by each country to regulate the levels of contaminants permitted in their various water sources (AID, 2004). They consist of the water quality criteria to protect users, determine if they are being attained, water body's designated uses, and anti-degradation policies to protect high-quality water bodies. Water quality degradation has attracted the attention of many organizations such as WHO in efforts to promote a worldwide response to water quality deterioration.

The WHO Guidelines for Drinking-Water Quality (GDWQ) covers the Physical, chemical and microbiological aspects of water quality (WHO, 2004). The guidelines are regularly updated based on scientific research and consultations with various stakeholders and professionals which leads to the periodic release of revised documents (WHO, 2004). The third and fourth editions of the guidelines were published in 2004-2008 and 2011 respectively.

The WHO recommended GDWQ are not mandatory limits, although they are intended to form a basis for individual countries to formulate and regulate their national water quality standards and guidelines in the context of local or national environmental, social economic and cultural conditions. Proper implementation of the WHO guidelines will ensure the safety of drinking water supplies by elimination or reduction to a minimum acceptable concentration of constituents of water known to be hazardous to health (AID, 2004).

The GDWQ are generic and are aimed to protect worldwide public health. The most important stage of implementation of these standards is the conversion and adaptation of the underlying Philosophy, guidance and given numeric values to quality standards defined per country. Unlike in developed countries that have, attained higher standards in addressing water quality issues, the situation in Kenya remains uncertain. However, Kenya is making efforts to follow the global trends of reducing standard concentration levels through the KEBS and NEMA that have localized the international standards for the Kenyan case. This research used the KEBS and NEMA standards in the analysis of the Physio-chemical and biological analysis as given in the findings in chapter four.

2.18. Potential Health Effects of contaminated surface water flow and groundwater

Land filling is a common globally though, it's a controlled method of disposing solid wastes on land with the purposes of eliminating public health, environmental hazards and

minimizing nuisances without contaminating surface or subsurface water resources. Despite this, many dumping sites are inadequate of lining and precautions in the construction leading to seepage of leachate from the decomposition of the organic wastes (Bartone, 2000)

Many water borne diseases such as diarrhoea, typhoid, cholera, paratyphoid, hepatitis, enteric fever, dermatitis, blue baby syndrome can be caused by drinking water that has high nitrates. Benzene, a known component of gasoline, is a human carcinogen (Belete, 2002). The serious health effects of lead such as learning disabilities in children; kidney, nerve, liver problems; and pregnancy risks. The best way to reduce the health risks associated with poor drinking water quality is by preventing contaminants from reaching the ground water is (Feleke, 2005).

CHAPTER THREE

3. Materials and Methods

3.1. Study Area

Assela is a town located in central Ethiopia. It is located in the Arsi zone of the Oromia Region. In addition, it is the capital of Tiyo district. Tiyo district is bounded by districts Hitosa from north and northern east, Digalu Tijo from south and southern east and ziway dugda district from west and northern west.

Also, Assela is the seat of numerous Non-Governmental Organizations and faced based organizations. In addition, it is a medium level town in its stage and is surrounded by small towns and serves as market centre mainly for agriculture. (Lema et al., 2019).

The town is far about 175 kilometres from Finfinnee on Finfinnee-Adama-Bale Robe main road as well as 75 km south of Adama town. The geographical location of the town is 7°57'N latitude and 39°7'E longitude (it is taken as centre point location).

The current structure plan of Assela town in Area is expected to be about 5000 hectare. According to the 2007 census of Ethiopia (Aauthority, 2007) and the population projection of Assela by the Central Statistical Authority of Ethiopia, the city's population grew from 67,269 in 2007 to 115,214 in 2018.

Assela town falls within summer maximum rainfall region of the country, which is located in the foothill, and there are wider low-lying areas of the town that are highly affected by flood that commenced from the surrounding chain of mount Chilalo. The town needs different clean and well-structured drainage ditches for flood prevention and surface water or runoff management.

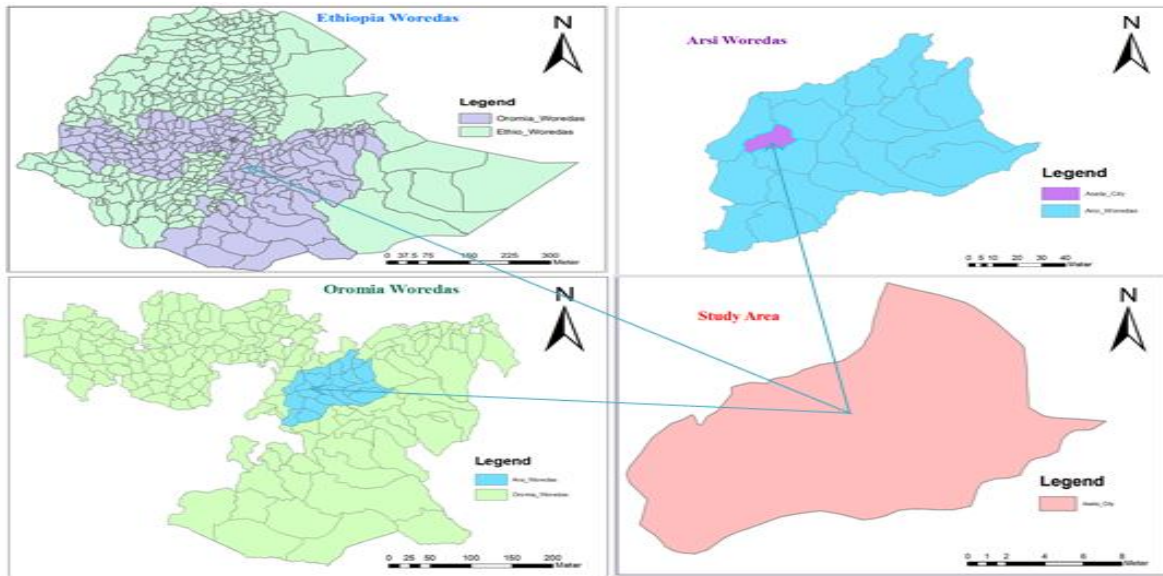


Figure 3.1. Arsi zone districts and Location of study area (Arsi zone bureau)

3.2. Research Design

Since it is appropriate for describing the current situation, recounting facts, and examining events in their natural setting, the research can use a descriptive survey research strategy to acquire the data appropriately (Ripablic, 2008). The current study used the descriptive survey method and a mixed research design strategy that blended qualitative and quantitative research design. It was suggested to use a highly organized quantitative research methodology that would yield data suitable for statistical analysis. A qualitative research design was used to examine and interpret the study's problem based on data acquired from both primary and secondary sources. To achieve the specified goals, both qualitative and quantitative methodologies were used.

3.3. Source of data

Information was gathered from primary and secondary data sources. Structured surveys, semi-structured interviews, focus group desiccation, and field observation were used to gather the primary data sources. Another crucial source of information for this investigation was secondary data. The secondary data for this study was acquired from relevant books, journals, manuals, published and unpublished articles, research papers, reports from municipalities and other written materials, as well as reports from the environmental protection agency. Additional secondary data could be collected from sectoral offices operating in the town by preparing formats, checklist and questionnaire to be administered by respective data sources. Further. Stakeholder consultation outputs could also categorized under secondary data for this study.

3.4. Sample Size and Sampling Technique

Stratified sample approaches were used for the current investigation. The strata for the eight kebele in the town were taken. Random sampling was used to choose the sampled kebele from each stratum. Based on the corresponding relative percentages of each stratum, the number of samples within each kebele was calculated. Residential and non-residential respondents were divided into two groups in the current study, with residential respondents making up 90% and non-residential respondents 10% of the total number of dwelling units, respectively (Tegegne, 2006). A sample technique was used to determine the sample size (n) of participating households [25].

$$n = \frac{Nz^2PQ}{d^2(N-1)Z^2pQ} \dots\dots\dots 3.1$$

Where; P=Housing unit variable (Residential houses which is 90% of N

Q=Non-residential houses which is 10% of N

N=Total number of households (23634)

Z=Standardized normal variable & 95% confidence interval equal to 1.96

d=Allowable error (0.05)

As a result, n=137 was determined to be the bare minimum reliable sample size for housing units. There were 137 responders in the entire sample. After that, a methodological sampling procedure was used to determine how many samples were taken from each kebele based on the relative percentage of samples within each kebele.

Table 3. 1. Distribution of selected sample respondents

No	Kebele	Respondents			Percent		
		Male	Female	Total	Male	Female	Total
1	H/Gudina	1749	1949	3698	47.3	52.7	100.0
2	Buusataa	1114	1133	2247	49.6	50.4	100.0
3	Hanku	1429	1440	2869	49.8	50.2	100.0
4	Walkessaa	1848	1852	3700	49.9	50.1	100.0
5	Chilalo	1195	1197	2392	50.0	50.0	100.0
6	Halila	1246	1259	2505	49.7	50.3	100.0
7	Kombolcha	1311	1312	2623	50.0	50.0	100.0
8	Burkitu	1780	1820	3600	49.4	50.6	100.0
	Total	11672	11962	23634	49.4	50.6	100.0

3.5. Solid waste characterization

Composition is the term used to describe the individual components that make up the solid waste stream and their relative distribution and is usually described by in weight-percentages for the different parts that make up a certain waste. The knowledge about the characteristics of waste like its composition of different physical components is essential for the development or improvement of composting activities as well as the introduction of a proper solid waste management (Hussein I, Abdel-Shafy, Mona S.M. Mansour, 2018). To assess the composition of the solid wastes each sample segregated and weighed with sensitive balance. The study samples of solid waste classified as: (1) Organic waste: food wastes, leaves, branches, paper; (2) Plastics: bottles, plastic bags, wrappings; (3) Metal: bottle tops, wires; (4) Bones: animal bones and (5) Textiles: clothes, cloths and others. The particle composting process, which is a natural process of size reduction. Smaller particles usually have more surfaces per unit of weight, which means they facilitate more microbial activity on their surfaces, which leads to rapid decomposition. However, if all particles are small, they stick closely together and allow few open spaces for air to circulate. This is especially problematic when the material being composted has high moisture content. The optimum particle size has enough surface area for rapid microbial activity, but also enough void space to allow air to circulate for microbial respiration. For composting, the optimum range of particle sizes of municipal solid wastes is usually between 20-50 mm. A good knowledge of the solid wastes characterization before disposal is important for the management of MSW. During the management of solid wastes, some problems could be arisen due to their possible heterogeneous structure. The physical features of solid wastes are important for selecting the method of collection, transportation, recoverable matter and energy transformation as well as selecting and designing of the proper disposal methods (Martin, 2004).

3.5.1. Loss on ignition

Determining the loss on ignition is a non-biological, gravimetric method, which allows to accurately measure the content of organic substances in materials i.e., composts, wastes or soils. The analysis of the organic matter content is essential for waste characterizations.

3.6. Data collection and Analysing Approaches

3.6.1. Transect walk survey

To ascertain the quantity and placement of transect lines, an initial walk-through survey would be carried out. As a result, the selected transect lines of Assela town would be clustered and assessment can be held. The assessment variables in observation include drinking water quality and associated risks, surface water quality and water quality related problems of solid waste on open drainage ditch.

3.6.2. Environmental

The Integrated Town-Wide Approach (ICWA) was the methodology used for the environmental baseline assessment of the study area. The ICWA is a tool that aids in identifying the current gap in the town's system for delivering solid waste collection services. Consequently, a thorough evaluation of the current state of the solid waste services delivery system would be carried out.

3.6.3. Scope of socioeconomic study

Based on both geographical and thematic factors, the study's scope would be examined. In terms of geography, the research would encompass the whole town or a selected kebele. All of the selected kebele is included in the household survey. When it comes to the thematic, the study would look at the town's housing unit, economic activity, accessibility to sanitation facilities, major socioeconomic issues facing the town, the socioeconomic dynamics of the waste produced by various institutions, the willingness and ability of the public to pay for the service, identification of stakeholders, and an analysis of the socioeconomic inputs that go into the design of waste disposal facilities and sanitation schemes.

3.6.4. Participatory Approach

Since Community engagement is the most beneficial development technique for effectiveness and sustainability of development the study. We can try our best to pay attention for the way during the study time.

3.6.5. Integration Approach

There are two perspectives on integration. Integration with diverse experts involved in the Integrated City-Wide Inclusive solid waste disposal management is one aspect. The other part of integration is performing the collecting system in holistic approach or inclusive in content. A number of concerns, including health, population growth, land usage, water supply, gender

issues, and the development of infrastructure such as roads and drainage systems, are directly related to the waste disposal system. Thus, the involvement of multiple sectors in the investigation is required. Stakeholder and different community participation would be necessary for this.

3.7. Methods of Data collection and Analysis

The study used both quantitative and qualitative data collection methods would be employed to explore solid waste practices in Assela town. All those methods, which used for data collection and analysis during the course of socioeconomic study. In other words, study methods are the tools employed to collect and analyse data for the socioeconomic study. Both of major data source primary data and secondary data are used during data collection.

3.7.1. Data Collection Instruments

In order to get the required data for the investigation, some fundamental instruments were used. Such as questionnaires, interviews walk survey or field observations, and focus group discussions (FGD), as primary while reading books, publications, and consulting already completed research were used as secondary data sources.

Questionnaire

A key instrument for gathering data from the carefully chosen respondents was the structured questionnaire. For this study both closed-ended and open-ended items were included in the questionnaires used to collect both qualitative and quantitative data. In English, the first queries were about prepared and translates into Oromic and Amharic. This helped the responders comprehend the question and provided support.

Interviews

The purpose of interview was collects to gather supplementary information, to stabilize the questionnaires response. Interview was conducts face to face supported by semi- structured questionnaires.

Public Consultation

Public consultation helped to collect qualitative data from the local people. This involved making public gathering from all groups of people living in the study area. This involved discussing the general objective and processes of the integrated town-wide Solid waste Plan.

Stakeholders Engagement and Analysis

Stakeholders of the proposed study would be identified and consulted. Their engagement would be analysed based on their interest, power or influence and importance.

Focus Group Discussion

Group interviews and discussion was held with different selected members. This involved making discussion with some selected groups of the community on selected points related to issues binding them together as a group in the proposed Integrated Town-Wide Solid waste disposal system. In other words, special groups of people like kebele Administrator, representatives of solid waste collector from house hold would be asked about solid waste collection to discuss their special issues in relation with the proposed study. Different number of FGD members are participated at different time from SBPs staff, municipality sector staff, community and other sectors.

Key Informants Interview (KII)

In order to be more certain and enriched by all the required data, conducting key informant interview is plausible technique of primary data collection. It used to collect valuable data from persons from the community who are knowledgeable about some specific issues. Such key informants is Kebele administrators, representatives of persons who are collecting solid waste from households, representatives of related sectoral offices like Water Supply and Sewerage Enterprise, health offices, labour and social affairs office, Women, Youth and Children Office etc.

Observation

During the study Observation involved transect walk with knowledgeable community members in some of the parts of the town to explore settlement pattern, slum areas, accessibility, land use pattern, situation of solid and liquid waste disposal system. It also involved looking existing communal toilets, public bath and other sites serving as waste disposal site currently and selecting potential sites, which would serve for waste disposal system. A checklist was used for systematic observation and to validate the information received from the other sources.

Household (HH) Survey

Household survey is a part of primary data collection, which would involve preparing structured questionnaires for interviewing of surveyed households in the study. By determining number of Households in the town and out of them, the sample size is a percent of them. The sample size was determined based on statistical formulas.

Ethical considerations

Local officials and leaders of the community would be briefed about the study's purpose before entering the study area to gather data. Every family was guaranteed the confidentiality of the information they supplied, and participants in the study had to be willing and volunteers. Verbal consent was requested from each responder.

3.7.2. Data analysis

Descriptive and simple statistical analysis were among the basic exploratory strategies used to analyse the data. The sample households' socioeconomic profile, including factors like dependency ratios, education levels, income patterns, and household demographics, may be evaluated using the descriptive statistics. The Statistical Package for Social Science (SPSS) were used for analysis after the raw data is loaded into Excel. The explanations are then improved by the appropriate summary tables, graphs, figures, and summarized data that are created. Analysing the answers on solid waste types, primary sources of solid waste formation, effects on the surrounding environment, and diseases and issues brought on by the solid waste will also involve the application of simple descriptive statistics. Quantitative information on social and economic traits, solid waste production, and other

CHAPTER FOUR

4. Result and Discussions

4.1 Socio-Economic and Demographic Characteristics of Respondents

Practices for managing and disposing of solid waste vary greatly and are correlated with respondents' varied backgrounds. In this study, I attempted to create diverse sample households and other solid waste-generating sectors in the town of Assela with a variety of socioeconomic and demographic features of the respondents. I made an effort to create multiple randomly chosen sample respondents with varying socioeconomic and demographic traits. The respondents were chosen using stratified selection and purposive sampling procedures in order to gather the relevant data on the "Practices and Challenges of Solid Waste Management" issue.

Table 4.1. Socio economic and demographic characteristics of respondents

Variables	Option	No. of respondents (frequency)	Percentage (%)
Sex	Male	62	45.3
	Female	75	54.7
	Total	137	100
Family size	1 to 4 Family	38	27.7
	5 to 8 Family	93	67.9
	9 to 12 Family	6	4.4
	Total	137	100
Age	Up to 25 years	3	2.2
	26 to 38 Years	12	8.8
	39 to 50 Years	86	62.8
	51 to 62 years	29	21.2
	Above 62 years	7	5.1
	Total	137	100
Educational Level	No education	10	7.3
	1 to 8 grade	74	54.0
	9 to 12 grade	46	33.6
	Above certificate	7	5.1
	Total	137	100
Average monthly income	Below 1000 birr	45	32.8
	1000 to 3000 birr	88	64.2
	Above 3000 birr	4	2.9
	total	137	100

Source: Survey data, 2023

Basic information regarding income, age, sex, family size, and educational background is included in the description of the socioeconomic and demographic characteristics of the target group. The above table clearly demonstrates the features of the responses for the chosen respondent. As shown in Table 4.1, Sex percentage of male and female respondent's accounts 45.3 % and 54.7% respectively, Age percentage of the respondents was 2.2%, 8.8 %, 62.8 %, 21.2 % and 5.1 % for Age 15-25, 26-38, 39-50, 51-62, and above 62 respectively. The income level of participated respondents' also illustrated in table 4.1. Selected respondents were categorized into three groups based on their monthly average respondent's income. Thus, dominant (64.2 %) number of sample respondents' average income is grouped in the first category who earns (1000-3000 birr) birr per month. 32.8 % number of sample respondents' average income is grouped in the second category who earns less than 1000 birr per month. In addition, the least number of respondents (2.9 %) was grouped in to the third category that earns greater than 3000 birr. Regarding the background of respondents with respect to family size percentage 27.7 %, 67.9 and 4.4 % for 1-4 family, 5-8 family, and 9-12 family respectively.

Educational level greater numbers of respondents (54%) have educational level of (1-8th) grades complete and next to this (33.6%) have educational level of 9-12 grades complete. No formal education or illiterate 7.3% and Certificate and above (5.1%) has relatively great share. The sample respondents' educational backgrounds had a beneficial impact on the ability to obtain concise and varied perceptions. The socioeconomic and demographic makeup of a community has an impact on how waste is managed and disposed of, and in the case of a given location, these factors have a direct impact on the Assela town's effective waste management and disposal methods.

4.2. Solid waste Generation in Assela town and Disposal site

Table 4.2. Amount of solid waste generated from HH per day

No	Amount of solid waste generated from HH per day	Respondent			Present (%)
		Male	Female	Total	
1	< 0.5kg	5	3	8	5.8
2	0.5-1kg	8	18	26	19
3	1-1.5kg	38	43	81	59.1
4	1.5-2kg	9	7	16	11.7
5	>2kg	2	4	6	4.4
	Total	62	75	137	100

From the total surveyed HHs, 5.8 percent respond that they are generating less than 1 Kg of solid waste, 19 percent respond that they are generating solid wastes from 0.5-1Kgs and 59.1% respond that 1-1.5 Kg and 11.7 % respond that above 1.5-2 Kg and 4.4% respond above 2kg sold waste materials per day.

4.2.1. Observation /Transect walk survey/ solid waste disposal site of Assela town

The town has one solid waste disposal site in kombolcha Kebele. However, the solid waste managements of Assela city is very poor and imposing environmental and social problems. Both solid and liquid waste dumping sites are situated close to each other. The impact on nearby residents is very high and it caused closure of one preparatory school situated near the waste dumping site. Access road to liquid waste disposal site is inaccessible in rainy days. Solid waste tends to block access road to the liquid waste disposal site. Moreover, institutions and households released their liquid wastes to street (ditch) rather than managing at their compound. Liquid wastes are discharged in to ditches and fields from hotels, prison, university, residence, etc. These activities cause the pollution of buffer areas and rivers; create bad smell and cause of communicable diseases. Eventually, they are deteriorating the environment and polluting the water and soil resources.



Figure 4.1. Solid waste disposal site in Kombolcha kebele

Assela town has one specified site for disposing solid waste. The existing site is poorly managed and it is located adjacent to a river (Kombolcha River) and residential area. Both liquid and solid waste from the abattoir is being washed into the Kombolcha River and creating pollution of the river and releasing bad smell too. The existing situation of the transportation system is depending on a number of working vacuum trucks, which are limited in number and is not in a good condition, operated by both the private and the public (government) sectors.

The final disposal for municipal solid waste in Assela city is an open dumping site. The site is located near to human habitation and to preparatory school. As a result, the school has been closed now due to the undesirable impact of the dumping site for the school community. There has been high emission of smoke because of combustion of solid waste. In addition, to solid waste, the dumping site also used as fecal sludge disposal site.

Table 4.3. Solid waste Characterization in Assela town

No	When and who can characterize solid waste	Respondent			Present (%)
		Male	Female	Total	
1	During collection by HH	5	3	8	5.8
2	By municipal	4	6	10	7.3
3	By SBP workers	2	1	3	2.2
4	No characterization	51	65	116	84.7
	Total	62	75	137	100

Survey data 2023

From the total survey household about 5.8% the respondent says Solid waste characterization done by the household during collection of waste and about 7.3% of the respondent done by municipality. The other 2.2 solid waste generated separated during collection time by the SBP workers and about 84.7% of the respondent answer is the solid waste cannot be characterized at the time of collection and disposing. This survey data indicate that almost all solid waste cannot separate and disposed properly depending on its physical and chemical or biological characteristics for the environmental protection of Assela town.



Figure 4.2. Uncharacterized waste at municipal disposal site

4.3. Solid Waste Management and disposal practices in Assela

This section was design to analyse and briefly describe how SWM and disposal practiced in Assela town, particularly SWs that was generates from respondents. As per the survey result of the study and the research's' personal observation, due to inadequate SWM and disposal practices in Assela town. In the town SW were disposed in everywhere like nearby river, Roadside, drainage and other open spaces of the town. Even the respondents stated that the municipality by itself they cannot control and collects illegal SW disposal practices and they do not manage and punished which are dumps in the surrounding of the community's living area. Such actions or failures of municipality really contribute a lot to environmental pollution and human health problems

The selected sample respondents were also asks whether they had SWM, collection material (temporary storage) at home. All the respondents replied as they had temporary solid waste storage at house hold level and they have one or two public SW collection bins in the town. In the study area the respondents was used as an alternative for SW disposal services which was generated from houses, Hotels or restaurants and Cafes used different places like open spaces, road side, near river side and on the drainage.

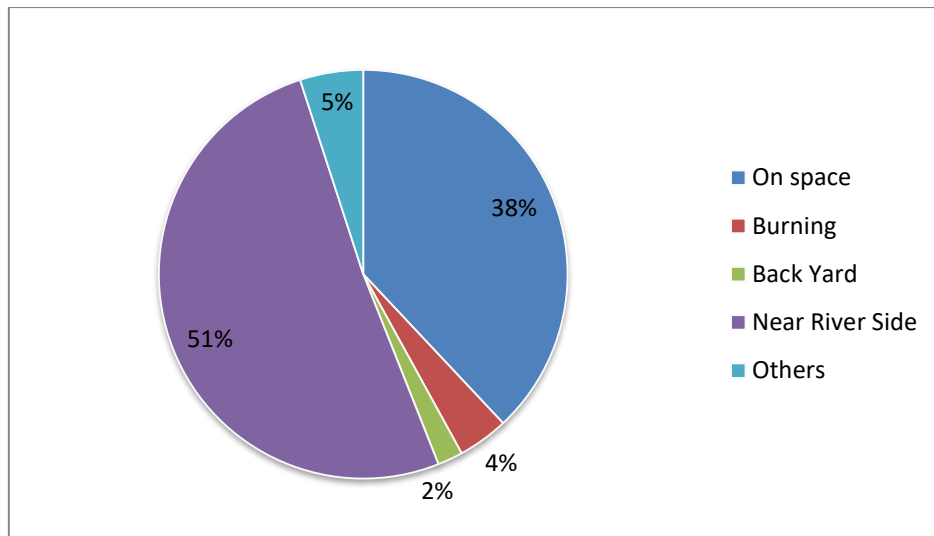


Figure 4.3. Solid waste disposal site used by the community in the town

Many of the respondents claimed to have employed illegal methods of SW disposal techniques in Assela town, as seen in figure 4.3 above. This suggests that, as the above figure illustrates, alternate disposal techniques fall under the same category as illegal SW dumping practices. Out of those who said they dispose of their waste illegally, 4% said they just burn it inside their fence, 38% said they dispose of it in an open area, and 2% said they dump it in their backyard. Furthermore, of the samples that were chosen, 51% and 5%, respectively, disposed of their solid waste in a nearby river and used other options.

Thus, the question of whether or not the town had a common SW collection container was posed to the respondents from the selected sample. Every respondent claimed that there are no solid waste collection bins in the town at any site. Additionally, we are also verify that there is no sufficient SW collecting container seen in the town for the group of HHs through personal observation during our transect walk survey and the lack of budgetary assistance produces illegal solid waste disposal activities.

The illegal solid waste disposal practices that are occurring in various parts of the town are largely caused by the lack of a solid waste collection container, the lack of a private sector solid waste collection association, and the low participation of governmental and non-governmental organizations in solid waste management and disposal services in the town.

This indicates that the survey's findings are corroborated by the research field observation, which shows the town's illicit solid waste disposal practices.



Figure 4.4. Illegal solid waste disposal site observed in the town

4.3.1. Storage and Disposal Trends of Solid Waste in Assela Town

Adequate handling of solid waste on the site of production is essential for efficient disposal and management procedures (Bartone, 2000). The town of Assela has not yet implemented a method for classifying solid waste in containers at the source of residence SW.

Table 4.4. Kinds of solid waste handling management and on-site storage in Assela town

No	Solid waste Handling	Respondent			Percent (%)
		Male	Female	Total	
1	Plastic bag	14	9	23	16.8
2	Local basket	48	66	114	83.2
	Total	62	75	137	100

Source: Survey result, 2023

The data presented in Table 4.4 above indicates that the respondents do not utilize closed containers to dispose of the solid waste they generate at home. This is because neither open nor closed containers are available in their community. Plastic bags were utilized by Assela Town respondents for solid trash collection and management. Twenty-three respondents (16.8%) said they had to use plastic bags to store the solid waste they generated. Solid waste was disposed of in a neighbourhood basket by the remaining 114 responders (83.2%). There are no public solid trash containers located by the local municipality. The illegal solid waste dumping methods in Assela town are only made worse by one communal solid waste pickup

bin. In an effort to lessen the issue, the solid waste collection equipment needed was not adequately funded by the Assela town municipality, sanitation, beautification, and parking sectors. Otherwise, the proliferation of illicit solid waste disposal methods poses a serious threat to the environment, ecology, aesthetic values, and public health.

Based on the results of field observations, the state of unlawful solid waste disposal activities in Assela town was as shown in the image below. This chart shows how widespread illegal solid waste dumping activities were in the town. This suggests that the town is not following the law and that solid trash collection procedures are not being carried out properly. Figure 4.5 illustrates the continued low level of public involvement, awareness, and participation in SWM and disposal procedures by the town SBPS and the municipality.



Figure 4.5. Partial view of solid waste disposal practices, 2023

4.3.2. Trends of Collection and Transportation of Solid Waste in Assela Town

The collection and transportation practices of solid waste in Assela town were implements in different ways. Table 4.5 below displays the trends in solid waste collection and transportation practices based on information gathered from survey results. Data collected indicates that, out of 137 respondents, 6 respondents, or 4.4%, were used for solid waste collection and transportation activities carried out by family members or labour, and 9 respondents 6.5% of the respondents used a donkey cart or car to collect and transport their solid waste, 2.9% of respondents used a solid waste collection and burning method on their

compounds, and the remaining 118 respondents, or 86.2%, did not collect and transport their solid waste to designated landfills or appropriate locations. SWs were disposed of and dumped everywhere.

Table 4.5. Methods used in Assela town for collection and transportation of solid waste

No	Ways of solid waste transportation and disposal practice in HH	Respondents			Present
		Male	Female	Total	
1	Labor (Family Member)	3	3	6	4.4
2	By Donkey and cart	6	3	9	6.5
3	Burning in the compound	2	2	4	2.9
4	Does not transported and disposed	51	67	118	86.2
	Total	62	75	137	100

Sources: Survey data, 2023

From the above information in Assela town, most of the responders don't apply the right disposal and solid waste management techniques. The respondents are listed with various justifications for these reasons. These include the lack of a solid waste collection and transportation vehicle or car, as well as an inadequate time and plan for accountable sectors to raise community awareness and curb improper solid waste disposal practices. All things considered, the data above demonstrates that solid waste transportation and collection methods in the town of Assela are extremely low and poorly implemented, and as figure 4.6 below illustrates, residences dispose of solid garbage everywhere.



Figure 4.6. A portion of the illegal solid waste disposal site in 2023.

4.3.3. Trends of Incinerating Solid Waste in Assela Town

The trends of solid waste incineration methods in Assela town were implemented in an inefficient manner, based on data gathered from survey results. The town's 137 households provided data on their solid waste management practices. Of these, 8 respondents (5.8%) burned their waste in their compound, 17 respondents (12.4%) burned it outside of their compounds, and 112 respondents (81.8%) said they did not incinerate the generated solid waste (SWs) that was illegally dumped in gorges, streams, and open spaces. The incineration practices in Assela Town are displayed in table 4.6, which also provides information on the frequency of burning and the number of households that participate, according to the respondent's level.

Table 4.6. Solid waste incineration techniques in Assela town

No	Incineration places	Respondent			Present (%)
		Male	Female	Total	
1	Incineration in the compound	3	5	8	5.8
2	Incineration road side	7	10	17	12.4
3	Not incinerated	52	60	112	81.8
	Total	62	75	137	100

Sources: Survey data, 2023

Figure 4.7 below illustrates the incineration practices of solid waste in Assela town based on observation data collected for this study.



Figure 4.7. Solid waste incineration practice, 2023

4.3.4. Environmental and health effects of improper solid waste disposal practice in Assela town

Table 4.7. Unsafe solid waste collection, segregation and disposal

No	Unsafe solid waste collection ,segregation and disposal	Respondent			Present (%)
		Male	Female	Total	
1	Very serious	58	66	124	90.5
2	Somewhat serious	3	7	10	7.3
3	Not serious	1	2	3	2.2
	Total	62	75	137	100

Survey data 2023

The data on above table indicate that about 90.5% of household respond that unsafe solid waste collection, segregation and disposal practice is very serious and 7.3% and 2.2% of they says somewhat serious and not serious. The majority of the respondent says it is unsafe he collection and disposing systems are them the greater health effect.

Table 4.8. Environmental problem of improper solid waste disposal

No	Improper solid waste collection and disposal practice is an environmental sanitation problem for Assela town	Respondent			Present (%)
		Male	Female	Total	
1	Yes	62	74	136	99.3
2	No	0	1	1	0.7
	Total	62	75	137	100

Survey data 2023

From table above 99.3% of HHs respond that improper solid waste collection and disposal practice is environmental problem for Assela town. Only 0.7% of the respondent says no, we can conclude there is serious environmental sanitation problem from improper solid waste collection and disposal practice in Assela town.

Table 4.9. Disease caused by solid waste

No	Disease affecting your family due to improper swm	Respondent			Present (%)
		Male	Female	Total	
1	diarrhea	15	30	45	32.8
2	Respiratory disease	33	27	60	43.8
3	Other	14	18	32	23.4
	Total	62	75	137	100

Survey data from HH

The table 4.9, above depicts that out of 137 respondents was selected for this study, 45 households (32.8 %) household family affected by diarrhoea disease whereas the rest i.e. 60 households (43.8 %) household family is affected by respiratory disease and 32 household family by other disease Cause by improper solid waste. This indicate improper solid waste is a series Cause for the community health.

4.3.5. Solid waste Disposal in Drainage system of the town

The FGD participants claimed that flooding is a problem in Assela town. The municipality has constructed drains, but more new drainage lines are required to safely remove the storm water generated from different sources. The existing drains should be monitored and maintained regularly. They say that some drainage lines are being blocked by solid wastes due to the lack of follow up and control.

Solid waste is dumped in the drainage lines. Some residents drain solid waste and wastewater into storm water drainage lines. When damaged, some drainage lines are open without maintenance because the municipality is not regularly monitoring the damaged drains. the majority of the drains suffer from siltation and poor workmanship. Poor management of the drains is the other major problem identified during field observation. Grey water from some households and commercial activities are connected into drainage lines.

Table 4.10. Drainage Ditches are SW disposal site by HH

No	Drainage Ditches are taken as preferable SW disposal site by HH	Respondent			Present (%)
		Male	Female	Total	
1	Yes	60	71	131	95.6
2	No	2	4	6	4.4
	Total	62	75	137	100

HH survey data

From the table 4.10 above 95.6% of the community (HH) choice the drainage ditch for disposal of their solid waste whereas 4.4 of the respondent says the drainage ditch are not the first choice for solid waste disposal. This implies that drainage ditches are serve as solid waste disposal in the town and miss functioning of their desired purpose.

4.4. The reasons behind for Assela Town's inadequate solid waste management and disposal techniques

Solid wastes are a by-product of human activity, according to Tegegne (2006). It is nearly common to encounter some kind of SWs produced by human activity of all kinds. It suggests that the creation of SW is inevitable and that getting rid of it is essential. Hence, it is impossible to provide clean and healthy living conditions in cities and hamlet without reliable and regular solid waste management and suitable disposal techniques.

The rapid growth of the population, lack of equipment for managing and controlling solid waste, and fast urbanization are all contributing factors to the rise in solid waste and illegal disposal practices. These factors also create difficulties for the management of solid waste in the town of Assela. Additionally, the town of Assela is currently experiencing frighteningly high rates of urbanization and population growth, which are combined with a sharp rise in the unlawful solid waste disposal practices. Consequently, the research sector needs to create and implement cost-effective solid waste management and disposal procedures.

4.4.1. Insufficient Management and Disposal of Solid Waste

According to (Zerbock, 2003), it alludes to the town's inadequate SWM and disposal methods. Only a small portion of the population in the developing countries is being served by SWM and disposal methods. According to the interview and focus group discussion result the causes for poor SWM and disposal services in the town was - Financial considerations, do not designate adequate budget for SWM and disposal service on the town. Because of this, the local SBPS is unable to adequately and successfully serve the community. Also, they are not providing enough transportation, dumping equipment, or SW collection (vehicles and trash bins). It is "obvious that the main financial source of municipality is tax, which is inadequate to deliver effective SWM, collection and disposal practices service along with other responsibility of the municipality or town administration," according to those employed by the municipality. The SBPS activities are generally not carried out correctly and satisfactorily in this situation.

According to Trukkler J. Visvanathan C. Kuruparan P. Tubtimthai (2005), this is especially true for local governments, which are the true beneficiaries of SWM and disposal practice issues. Reactions to the necessity for SWM have not been helpful. The number of unlawful SW disposal activities in the town is rising because to a lack of financial resources. Strong dedication from the town's politicians, leaders, and other stakeholders is required to lessen or eliminate this issue from the community. Enough funds were allotted to the town's SBPS by the municipality and administration.

4.4.2. Inefficient Operations in Solid Waste Management and Disposal Trends

The availability, sustainability, and appropriate disposal procedures of solid waste management (SWM) and disposal practices in the municipality were impacted by operational inefficiencies. The reasons behind the operational inefficiencies of municipal solid waste management (SWM) and disposal practices can include inadequate management ability within the institution, ineffective institutional structure, ineffective organizational procedures, and the use of inappropriate technologies (Belete, 2002). Focus group discussions and staff interviews in Assela town municipality indicate that inadequate institutional structure and unsuitable technology use contribute to operational inefficiencies in SWM and disposal practices. Financial and operational issues arise from operational inefficiencies as well as inadequate involvement from stakeholders and accountable bodies. Poor institutional coordination, outdated technology, and a lack of commitment are the main causes of insufficient SWM and appropriate disposal methods in Assela town. The town municipality then uses the right resources to integrate information about illegal solid waste management (SWM) from other sectors, lessen its effects, and alter its organizational structure and human resource technical skills. Engage the private sector in the town's SW collection, transportation, and disposal activities. Ultimately, a major factor in the failure of SWM and disposal procedures in the town of Assela is operational inefficiency. An appropriate number of people should be chosen to oversee the SWM and disposal activities. These issues can be resolved or minimized by providing training to institution staff or involving the private sector in SWM and disposal procedures. Sufficient funding should be allocated for the skilled labour force, changing the organizational structure, and allocating technically skilled human resources.

4.4.3. Selection of Improper Solid Waste Disposal Site

Developing nations, the management of municipal solid waste typically involves almost uncontrolled on-land disposal. Such inadequate SW disposal location make un-economical use of the existing free area; enable free access to solid waste pickers, animals and flies (Cheru, 2006).

The town SBP focus group discussion revealed that improper SW disposal practices and site selection are the root causes of ecological degradation, illegal contact between illegal SWs and surface, ground, and soil waters, air pollution from burning SWs, and disease transmission through various vectors such as birds, insects, and rodents. According to the data gathered from survey results, the distances of the landfill site and the infrastructure of SWs transportation, collection and correct place disposal methods are not available according to WHO guidelines (WHO, 2004).



Figure 4.8. Hanqu River serve as solid waste dumping site

In the town they are not full fill the SW collection transportation and disposal equipment are not support SWM and disposal practices in the town. In addition, in the town, there are no solid waste bins and transporting household SWs provide by the municipality at any place in the town. The table 4.11, below depicts that out of 137 respondents was selected for this study, only 8 households (5.8 %) have access for house-to-house collection and disposal service whereas the rest i.e. 129 households (94.2 %) do not have direct access. According to this, the disposal landfill accessibility and infrastructural activity as indicated in table 4.5 below.

Table 4.11. Access of solid waste transportation services in Assela town

No	Access for transport	Respondent			Percent (%)
		Male	Female	total	
1	Have	2	6	8	5.8
2	Have not	60	69	129	94.2
	Total	62	75	137	100

Source: Survey data, 2023

Because of this, the municipality's chosen landfill disposal activity did not use an efficient technique for collecting and transferring solid household garbage. Furthermore, in the town, there are no formal or informal sectors involved in solid waste management and disposal activities. This indicates that in order to solve the issues with solid waste management and disposal procedures in the town of Assela, improvements must be made to the collection, transportation, and disposal service.



Figure 4.9. In accessibility of dumping site in rain session

4.4.4. Absence of Infrastructure for Solid Waste Management

In the operations of solid waste management and disposal procedures, equipment for collecting and disposing of solid waste is important, regardless of how mechanized it is. Hence, the researcher evaluated the town's circumstances, paying particular attention to collecting containers, transport vehicles, and solid waste management and disposal methods, in order to determine the impact of these facilities on those activities. In order to support solid waste management and appropriate disposal methods, the town of Assela lacks sufficient and readily available materials, as shown by the results of focus groups and interviews. The reasons for this include the deficiency of transport trucks and solid waste collection bins.

4.4.5. Lack of waste bins or containers for storing solid waste

The type and distribution of solid waste collection containers should be the primary concern of the responsible body in the area when it comes to proper solid waste management and disposal practices, taking into account human health, aesthetic value, and the suitability of the waste for the intended beneficiaries. Conversely, the town's environmental pollution, public health issues, and poor aesthetics were made worse by the lack of solid waste collection containers. One of the major obstacles preventing the town from using appropriate solid waste management and disposal procedures, according to the focus group talks (SBPS), is the lack of containers. Furthermore, the respondents state that they are not used as temporary collection and storage sites for solid waste in the town. Due to these reasons, society has now disposed of people in an unapproved location by searching for a last resort. This is the factors for environmental, ecological, aesthetic state and human health problems in the community.

Solid garbage is produced, according to the Assela town municipality, from a variety of sources, including homes, businesses, institutions, hotels, and enterprises. The quantity of these produced solid wastes varied depending on the source.

4.5. Participation of the Community and Institutions in SWM and Disposal Trends

4.5.1. Institutional configuration of the Assela town

Sensible, workable, enforceable, and culturally aware laws supported solid waste management. Municipal SWM has an institutional component that addresses organizational procedures, the ability of accountable institutions, and the institutional structure and arrangements for SWM. Although they are manually mentioned and documented in documents, the current institutional setup for the SWM and appropriate disposal procedures in Assela town are not functioning in real life. They essentially do not coordinate or integrate with other industries.

Because the community, local kebele leaders, the health sector, non-governmental organizations, the private sector, and other responsible stakeholders were not included or did not participate in SWM and disposal practices, the institutional arrangement of SWM and disposal practices in Assela town was generally poor.

4.5.2. The involvement of the private sector in solid waste disposal practices

Numerous enterprise kinds, from small, unofficial businesses to major corporate institutions, are included in the private sector. As potential service suppliers, private firm was primarily interested in generating a return on their investment by selling SW collection, transfer,

treatment, recycling and disposal services. They may supply money, labour, organizational and managerial ability, technical competence, and other resources when they work in different kinds of partnerships with the public sector. As per Municipality (2015), a private sector was established to operate on transportation and SW collection activities. The association comprises 30 male members and 10 female members. Nevertheless, the association is not operational at this time.

The management and disposal of solid waste are currently carried out in Assela town without the involvement of the formal or informal private sector. Even so, the legal system and the regulations governing the management and disposal of solid waste have not been adequately enforced by the municipality. Due to a lack of attention to solid waste management, collection, and appropriate disposal procedures by the town's competent agencies, the SBPS and municipality. The SWs from the town are being reduced by them without using any alternative procedures. It is not their intention to form any private associations involved in the transportation and collection of SW.

Based on the results of a survey given to 137 participants, the private sector's involvement in solid waste collection and transportation was found to be important in reducing the unlawful disposal of solid trash, according to the respondents. The majority of respondents (131, or 95.6%) to this question answered "yes," while just six, or 4.4%, answered "no," citing ignorance of the role played by the private sector in SW collection and transportation.

Table 4.12. Participation of the private sector

No	Does the private sector participation in Solid waste collection and transportation are important	Respondent			Percent (%)
		male	Female	Total	
1	yes	60	71	131	95.6
2	No	2	4	6	4.4
	Total	62	75	137	100

Source: Survey data, 2023

Based on the data presented above, it can be seen that the town of Assela does not have any private sector involvement in solid waste collection and transportation, despite community awareness of the importance of such engagement. The information above suggests that neither the town municipality nor SBPS develop or engage in small-scale, private sector initiatives related to the collection and transportation of solid trash inside the town. However, there are instances when a small number of café and restaurant owners use animal pull carts to transport their waste to the appropriate disposal location in compliance with solid waste management regulations.

4.5.3. The role of institutions in illegal solid waste disposal practices

Depending on what they do and how they use controls, many institutions have distinct contributions to make to the creation, management, collection, and behaviour of solid waste. There are numerous institutions located in the town of Assela, it seems. Different kinds and quantities of solid waste are produced by these institutions' operations. Hospitals, schools, lodging facilities, and small-scale textile businesses are the categories into which the institutions are divided. There are differences in the quantity and kind of solid waste produced by this institution. It is necessary to follow appropriate management and disposal procedures for all types and quantities of solid waste. Examining the institutional frameworks allowed us to observe the solid waste management and disposal methods of the various institutions. Institutions differ from one another in terms of how solid waste is generated and effectively managed.

The biggest problems for solid waste management and suitable place disposal practices at institutional level include increased solid waste creation owing to their population number, the amount of production, poor implementation rule and regulation, lack of technology and the like (Lemesa Hirpe and Chunho Yeom, 2021). The institutional leaders' dedication and accountability are essential for effective and efficient solid waste management and disposal procedures, as they are the ones who must be willing to carry out the operations. Cities in underdeveloped nations face significant challenges with regard to their collection, treatment, and disposal of waste. Though some likely still do, a lot of solid wastes have also dealt with this issue in the past (Kume, 2004). Assela Town SBPS institutions handle the solid waste generated by their institutions, whereas some do not manage, collect, and transport the solid garbage generated by their institutions. Education and health sectors of Assela town SBPS respondents state that their institutions' solid wastes are appropriately managed, based on data gathered from field observations, focus group discussions, and FGD. Furthermore, the

product solid wastes are eliminated throughout the school grounds in a biodegradable manner. In order to manage and dispose solid wastes effectively, school regulations are required. Make the teaching and learning process inviting first, according to the school's principle. Comparable to that, the fundamental tenets of health services include respecting the environment and the individual as well as utilizing resources in any manner and always keeping the environment and materials clean before use. But both sectors' disposal practices are subpar. Because it effect air pollution on the other way, the rest Hotels, Restraints and small industries are not adequately manages solid trash in correct area and dumps on selected landfill. This is making the town's illicit solid waste disposal activities worse.

4.5.4. Participation of the Community in the Management and Disposal of Solid Waste

Participants in solid waste management activities can be characterized as people or organizations that have a legitimate interest in reaching the objective of reducing the methods by which solid waste is disposed of. Making the general public aware of the issues caused by improper solid waste management is one method to reduce the amount of solid waste produced.

The institutional framework for solid waste management and disposal procedures in the town of Assela does not involve or involve the community. Because of these reasons, the community is not involved in the disposal and management of solid waste. As a result, the issues in Assela town are supporting unlawful methods of disposing of solid waste.

The municipality and SBPS are not assisting the community in minimizing and reducing illegal solid waste dumping practices, based on data collected from FGD (kebele leaders) of Assela town. The participant identifies the primary responsible parties for this activity and the strategies being used to curtail the unlawful disposal of solid waste. The consequences of improper disposal methods for solid waste are becoming more pronounced on a daily and occasional basis in these causes. Only a small number of the town's hotel, restaurant, and cafeteria operators properly manage and dispose of their solid waste.

This suggests that there is a lack of community involvement in solid waste management, collection, and disposal procedures in the municipality. Based on the information gathered from interviews and focus group discussions, there is little community involvement in solid waste management and appropriate disposal procedures. Due to a lack of dedication and cooperation, as well as other factors, the effects of improperly disposed of solid waste are not given enough attention.

4.6. Challenges of Solid Waste Management & Disposal practices

The existing solid waste management of Assela city was found to be unsafe. Solid waste disposal procedures in Assela Town are not under control or adequately handled, according to the findings of the field observation and interviews. From the discussion that came before, it is evident that the town's procedures for managing and disposing of solid waste are badly run, and the services are obviously insufficient. Rarely, individuals such as owners of homes, hotels, cafeterias, and restaurants would correctly collect and carry a small percentage of the solid trash in Assela town to the final disposal location.

As per the Assela town municipality, SBPS, hardly approximately thirty percent of the duly collected and disposed of solid trash in the town was appropriately managed. Nonetheless, the majority of municipal SWs—roughly 70%—are disposed of throughout the town (Municipality, 2015). The town's inadequate solid waste management and disposal procedures were made worse by the lack of SW bins or containers. The town of Assela experiences low rule and regulation implementation, lack of institutional coordination, lack of funding, and absence of private sector participation in solid waste management and disposal activities. These reasons contribute to the town's facilitation of unlawful solid waste disposal practices.

4.6.1. The community's understanding of solid waste management and disposal procedures

Collection, transportation, and disposal of waste, as well as generation, monitoring, and regulation of SWs, are all included in the set of characteristics known as solid waste management. Improving the methods that minimize unlawful SW disposal activities from the town requires raising community awareness about solid waste management, collection, and proper location disposal procedures. To prevent putting further strain on the collection program, community attitudes toward improper disposal of SWs need to be adjusted. To put it another way, the data should reassure the public that the illegal solid waste management disposal techniques have a detrimental influence on the community (UEPA, 1993).

The majority of respondents, the survey's results indicate, were unaware of the detrimental effects that unlawful SW dumping techniques have on the neighbourhood. Eighty six percent (86) of the 117 respondents did not know how illegal solid waste disposal activities affect society's aesthetics, ecology, and human welfare. Twenty respondents, or 14% of the total, stated that improper disposal of solid waste has an impact on people, the environment, and the state of affairs.

Table 4.13. The adverse consequences of illegal solid waste disposal methods

No	Do you know the impacts of illegal SW disposal practice in the community	Respondent			Percent (%)
		Male	Female	Total	
1	Yes	8	12	20	14
2	No	54	63	117	86
	Total	62	75	137	100

Sources: Survey data, 2023

One factor that affects the effectiveness of solid waste management is awareness. More specifically, the outcome of this variable may be construed as the level of respondents' awareness increases; the probability of effective solid waste management at household level and individual level would be essential. This study's findings were found to be consistent with those of (Anschütz, 1996). This opinion is further supported by the following: Public health and environmental conditions can be negatively impacted by insufficient SW collection and disposal activities, and the importance of proper disposal can be raised by awareness-raising campaigns and educational initiatives. Such efforts should also inform individuals of their obligations as SW generators and of their rights as citizens to solid waste management services (Cheru, 2006).

4.6.2. Challenges with Budget Allocation for Solid Waste Management

The budget allotted for solid waste related sector, which are the town sanitation, beautification and parking sector, has a considerable impact on the service delivery performance of the sector. As a result, one of the biggest obstacles to efficient solid waste management is the available budget or funding source.

In response, he said, "That is why the sector did not provide containers, at least in some parts of the town, permanently solve vehicle related problem, and other necessary facilities." There were no additional revenue streams available to the municipality to assist the enhancement of solid waste disposal and management (full-fil collection equipment). The solid waste management, collection, and disposal techniques in Assela town were not expressly paid for by even the chosen respondents. since they don't work in the SW collection sectors' formal or informal private sectors. The SW collecting, transportation, and administration activities are currently supported by no other NGOs or government organizations in the town. So, the essential information obtained from municipality employees through interviews and focus

group discussions (FGD) was analysed as follows in order to understand the reality of Assela town.

Based on the statements made by the head of sanitation, the town revenue and taxes collected from the public are the only sources of funding for solid waste management and disposal practices. The inadequate and unequal distribution of the annual budget allocation, beautification, and parking sector are also blamed. Only a fraction of the municipality's budget, which is derived from internal revenue, is allocated to purposes relating to solid waste management, with the other funds going toward other fundamental town development, according to the SBPS.

The funding allotted for solid waste management and disposal procedures is also insufficient, according to the key informant interviews, to maintain the service effectively. As a result, the industry was unable to confirm effective SWM in the town by purchasing and providing the required infrastructure. This finding coincides what has been founds by (Abegaz, 2021). So, the lack of funding was one of the issues impacting SWM and disposal practices in the municipality for the inefficient provision of services.

4.6.3. Rules and Regulation Implementation at Low Level

There is many polices and legislative element that are one-way or another way connected to SWM and suitable disposal procedures, an attempt have been undertaken to focus on the (Environmental Policy of Ethiopia EPE No. 513/2007). The environmental policy's item No. 3, "human settlements, urban environment, and environmental health," lists the policy concerns pertaining to solid wastes. Ethiopia's environmental policy mandates that human settlement, the urban environment, and environmental health be preserved and protected from various harms. Living creatures depend heavily on human settlement, the urban environment, and environmental health.

By providing the means for solid waste management and disposal procedures, recognizing the significance of changing behaviour through public awareness campaigns and education, the laws aim to "improve environmental sanitation and quality." Solid waste collection, management, and disposal methods are given importance in the policies that address environmental sanitation issues. The government and communities work together in a sound partnership to design the policies. The implementation of the rules and regulations, which aim to improve the environment's quality, health, and aesthetic condition while reducing illegal solid waste disposal practices and raising public awareness of the issue, has been agreed upon by the town municipality and SBPS staff members. It is practically not possible

to implement the environmental policy or the rules and regulations in the town of Assela. The town municipality and SBPS are not implemented the environmental policies.

Put another way, if families are aware that there are laws and regulations pertaining to solid waste management and that the municipality enforces them, then the rate of illegal site disposal activities in the town will at least decrease. Consequently, questions were posed to a subset of respondents in order to find out if the households knew that the town had laws and regulations pertaining to solid waste management and proper place disposal practices, as well as how strictly they were enforced.

Table 4.14. Solid Wastes Rule and Regulation Awareness Community

No	Do you know the existence of law and regulation about solid waste management	Respondent			Percent (%)
		male	Female	total	
1	Yes	4	8	12	8.8
2	No	58	67	125	91.2
	Total	62	75	137	100

Sources: Survey data, 2023

In accordance with the information in Table 4.14, about 91.2% of the participants acknowledged not being aware of laws and regulations pertaining to solid waste disposal and management. Of the respondents who were chosen, the remaining 8.8% said they were aware of rules and regulations pertaining to solid waste management and disposal procedures. It is evident from the data collected for the aforementioned survey that the environmental policy, rules, and regulations are not followed or enforced in the town of Assela. The proper treatment, collection, and management of synthetic waste (SW) that regenerated from many sources was not well-known or understood by the community.

The survey results table 4.15 below indicate that there is little application of the rules and regulations regarding inappropriate behaviour by both individuals and institutions. Only five respondents (3.6%) out of the 137 in the sample said that regulations are strictly enforced and that breaking the law is seriously penalized by the municipality. The majority of the 132 respondents in the sample (96.4%), however, stated that there are no SWM-related regulations that may be enforced in the municipality. It suggests that they were not aware of any penalty-related actions that the town and SBPS, who are illegally disposed of in the town, were taking.

Table 4.15. Application of strict laws and rules for misbehaving people or organizations

No	Implementation law & rules of miss behaving individuals or institutions	Respondent			Percent (%)
		Male	Female	Total	
1	Yes	3	2	5	3.6
2	No	59	73	132	96.4
	Total	62	75	137	100

Sources survey data, 2023

Eventually, this makes it clear that one of the main causes or constraints for the execution of solid waste management and disposal practices in Assela town is the lack of awareness creation regarding the existence of solid waste management laws and regulations and their enforceability, which is either non-existent or very low in the town. They said that the biggest obstacles to the town's efforts to manage, collect, and dispose of solid waste were a lack of knowledge and enforcement of the law already in place. The town's implementation program and set of rules and regulations were inadequate. On the other side, great efforts were made to raise community awareness of solid waste management, appropriate locations for collection and disposal, as well as the related laws and fines.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1. Conclusion

Solid wastes are produced by human activities in a variety of ways. These solid wastes are then collected at a chosen landfill or dumpsite after being handled correctly at the source. The public health is generally affected by the spread of diseases like cholera, malaria, diarrhoea, and the like because they do not consider the impact or hazards to human life, ecology, and the aesthetic condition of the environment. Wherever human activity such as institutional, economic, home, and private ones are permeated, undesirable or worthless items are produced. These unwanted materials have an impact on metropolitan areas.

Practices for managing and disposing of solid waste are complicated because they take into account several scientific, economic, practical, and social variables. Similar issues include: a lack of community involvement, a lack of funding, institutional weakness or lack of coordination, a lack of private sector participation in solid waste management, a lack of SW collection and transportation equipment or materials, an inappropriate choice of landfill location, a lack of transportation track or vehicle, and a lack of community solid waste bins. The third issue is a social one related to reluctance, awareness issues, poor application of laws and regulations, and a lack of pledges to provide effective and satisfactory SBPS service in the community of Assela.

The existing solid waste management of Assela town was found to be unsafe. This poor solid waste management practices could pose major environmental and public health risks. The open dumping and burning of solid waste are potential cause for soil, water and air pollution. Dumping of solid wastes in to water bodies was responsible for the deterioration of physical, chemical and biological water quality of surface water and loss of the associated ecosystem services. Streams that received solid waste are widely used for washing and bathing purpose that is a potential health risks to the inhabitants of Assela town. Assela town has a liquid waste dumping site adjacent to the existing solid disposal site. Septic tanks are emptied by vacuumed tracks and dumped at the said dumping site during the dry season. During rainy season due to lack of all-weather road, vacuum trucks are not giving the service. The location itself is not appropriate because it is near to and in between the resident area and government institutes, which can affected due to the Emission of smoke from the dumping site, offensive odor and unhygienic situation.

Houses constructed at riversides are directly discharging their wastewater into nearby rivers and streams and polluting the receiving water bodies and soil. During the site assessment, septic tanks of condominium, Hotels and other residential houses were overflowing into nearby drainage ditches that can be filled with solid waste and eventually discharged into rivers and streams flowing through the town, affecting aesthetic view of the city, and polluting the environment. The existing drainage service coverage in Assela town generally can be considered inadequate both in quality as well as in coverage. The type of drainage facilities in the town are along the main asphalt road have uncovered rectangular open ditch with both side of the road. Others are gravel, cobble stone and earthed surfaced roads have rectangular trench channel, earthed channel, and natural water way. During field observation and walk through the majority of the drains were blocked by solid wastes of various types and found in poor condition. The management of the drains is poor and drains are mismanaged.

Absence of public participation in integrated solid waste management activities, general lack of private sector involvement in SWM and disposal practices, absence of coordination between responsible sectors to reduce solid waste in the town, absence of community SW bins, and absence of solid waste collection and transported vehicles. In addition, this causes the town's use of unlawful methods for disposing of solid trash to rise which have potential risk. The majority of solid waste that is produced is dumped in roads, streets, open areas, drainages, and waterways, which has an impact on human health and the spread of diseases like malaria, diarrhoea, and cholera as well as animal health and has negative social, economic, and environmental effects. It also has an impact on biodiversity and the ecology of wetlands. Additionally, there are problems with how the town applies the law.

Generally in order to ensure proper management and disposal practice activity of SW in the town, the Assela town government, municipality, SBPS, local community leaders, investors, individuals, and the zonal administration pay particular attention. The severity of the situation and its effects on human life, water quality, the appearance of the town, and environmental contamination will have serious repercussions. Therefore, the town municipality should implement the developed SWM and disposal strategies along with the relevant bodies in order to significantly alter the town's solid waste management and disposal practices.

5.2. Recommendation

As already said or mentioned, the Assela town municipality, SBPS, and other stakeholders have weak or poor solid waste management and disposal procedures, which are solid waste collection, disposal or dumping, and transportation methods and implementation strategies.

These recommendations are made in order to progress or improve this:-

- ✓ The municipality of Assela town commits to equipping "SBPS and the health and environmental protection section" with the necessary personnel and resources in both a quantitative and qualitative manner.
- ✓ The existing solid waste disposal site of the town is encroached with settlement and needs to be relocated. However, for the immediate solution construction of access road to the existing dumpsite could be considered.
- ✓ Municipality cooperation with different governmental and non-Governmental office in the town and Build capacity of micro and small enterprises who are working on solid waste collection, transportation and disposal systems permanently.
- ✓ Giving awareness to the community Disposals of solid or liquid wastes inside the drains and set a schedule for maintenance time to maintain damaged drains, and clearing wastes dumped inside the drains.
- ✓ The Assela Town Municipality and SBPS take to allot enough budget, full fill SWBs and select ideal areas for SW collection containers and transportation tracks.
- ✓ According to guidelines, the municipality of Assela Town chooses and constructs landfills in suitable locations for a SW disposal site.
- ✓ The Assela town SBPS are placing an adequate number of community trashcans at distances that are reasonable for homeowners or residents. Business districts, markets, commercial areas, institutions, and areas close to other public services should also receive proper consideration.
- ✓ The town SBPS creates an effective and clever strategy plan for unlawful SW disposal activities, including the application of rules and regulations that are required based on environmental laws for misbehaving individuals, groups, and organizations.
- ✓ In addition to participating in private stakeholder SWM & disposal activities, Assela Town Municipality and SBPS also welcome individual investors and community members.

Since practically all HHs, individuals, and institutions are unwilling to collect, dump on proper locations, and transport SWs that are created from their homes, community participation, involvement, and awareness must be done. Assela town has to prepare a

suitable landfill or waste disposal site because it is a rapidly expanding and overpopulated town. Therefore, an integrated SWM and disposal practice structure that associations a range of SW treatment alternatives such source reduction, composting, recycling, and SW to energy transformation is advised based on the production rate and illegal SW disposal practices in the town of Assela. Generally speaking, if the town administration, municipality, and SBPS improve, they will focus more on municipal SWM practices and offer equitable attention to all areas of the town; The local administration's vision of "Beautiful, Clean, and Green Assela" won't be too far away.

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Appendix- I

I. Transect walk record sheet/observation/

In Table below the final “score” for each of the categories will be the average of the general conditions found in the community.

- *As we walk around, place ticks against the descriptions that best describe examples of what we see. At the end of the transect walk, deciding what the average of all the ticks should be for each of the categories and mark this clearly with a score of 1 to 4.*
- *When a particularly high-risk situation remark is taken. In each case, ask local people how frequently this situation occurs.*

City (town): _____

Location: _____

Gps coordinate at the start: _____

Date: _____

Income level (tick the appropriate response):

high-income ____

Medium-income__

Low-income__

Weather condition on the day_____

Write the appropriate answer under the score from the choice given below for How often does this risk occur?

Daily=1,

Weekly=2,

Monthly=3,

Annually=4

(By asking the community for information)

<i>Categories</i>	<i>observed risks</i>	<i>score</i>	<i>Locations where high risk is seen</i>	<i>Remark</i>
	<i>Piles of solid waste are accumulating in many sites, close to where people live and work, and at times</i>			

<i>Evidence of solid wastes</i>	<i>are obstructing drainage ditches or channels.</i>			
	<i>Piles of solid waste are accumulating in three or more sites, close to where people live and work, but are not obstructing drainage or channels.</i>			
	<i>Piles of solid waste are accumulating in one or two sites, but away from where people live and work.</i>			
	<i>Waste bins or enclosures are provided for solid waste collection, but the number of bins is inadequate, and overflow is evident.</i>			
	<i>An adequate number of waste bins or enclosures are provided, with no overflow evident.</i>			
<i>Drainage (storm Water and greywater). Describe the condition of the drainage structure</i>				
	<i>Drainage channels in a poor condition directing storm water and/or greywater away from homes and water points</i>			
	<i>Limited drainage infrastructure. Standing storm water and/or greywater is visible on the ground, close to homes or water points</i>			
	<i>Limited drainage infrastructure, with signs of storm water and/or greywater having overflowed recently close to homes or water points</i>			
	<i>Limited drainage infrastructure, but with no signs of having overflowed close to homes or water points</i>			
	<i>Drainage channels, well maintained and adequate to take flows.</i>			
<i>Note: Greywater is domestic wastewater that does not include toilet wastes and does not contain visible fecal materials.</i>				
<i>Sewerage (Black</i>	<i>Broken sewer pipes close to homes or water points, with signs of having overflowed recently</i>			
	<i>Limited sewer infrastructure with visible standing</i>			

water)Describe where you see, or identify black water entering into the drainage ditch	Blackwater close to homes or water points			
	Broken sewer pipes close to homes or water points, but with no signs of having overflowed			
	Piped sewers with signs of some leakage or blockages.			
	Adequate and well-maintained piped sewers, with no signs of leakage or blockages.			
Note: Blackwater is domestic wastewater that includes toilet wastes and contains visible fecal materials.				
Roads, Routes wide enough for humans or vehicles (cars, 3- wheelers, donkey carts, etc.) to transport solid waste	Gravel or paved roads, wide enough for small carts or 3-wheeler, but not for car access			
	Gravel or paved roads, wide enough to allow two cars to pass			
	Well maintained gravel or paved road, wide enough for two cars to pass			
	Very narrow paths that can be used by pedestrians only (too narrow for motorbikes) to pass			
	Unsurfaced roads wide enough for cars to pass			

Appendix- II

II. Household survey Questionnaire

A, about interviewer

Name of interviewer_____

Date of interview::_____	Time:_____	
Address of HH:_____	Code of HH:_____	
Sub-City:_____	Woreda_____ Kebele_____ House No_____	Other information:_____

B, General HH Information

Name of Household:_____		Sex		Age:_____
		Male:_____	Female:_____	
Education Level	Early childhood:___	primary school:___	secondary school:___	Postsecondary:___
	Short-cycle tertiary education:___	Bachelor's or equivalent:___	Master's or Equivalent:___	Doctoral or Equivalent:___
Marital status :	Single: ___	Married_____	Window :___	Divorced :___
Income level:	High_____	Low_____	Medium_____	No Income_____

Total number of people in the household: _____ Total number of male: _____ total number of female: _____

No	Name	Sex	Age	Education	work	Average Income
1						
2						
3						
4						

5						
6						
7						
8						
9						
10						

1. What would you say is the most important sanitation problem in your town (kebele)?

(circle the answer)

A, Air pollution

B, Unsafe drinking water

C, Insufficient water supply

D, Inadequate sewerage

E, Inadequate solid waste collection

F, Inadequate liquid waste collection

G, Unsafe solid waste disposal

H, Unsafe liquid waste disposal

I, unsafe disposal of hazardous waste

J, other specify; _____

2. How do you describe inadequate solid waste collection or unsafe solid waste disposal? (circle the answer from the list below)

2.1. Inadequate solid waste collection is.

A, Very serious

B, Somewhat serious

C, Not serious

D, Not a problem

2.2. Unsafe solid waste disposal

A, Very serious

B, Somewhat serious

C, Not serious

D, Not a problem

2.3. Were any members of your family sick in the past 6 months?

A, YES

B, NO

If yes how many of them get sick

(a) Adults _____

(b) Children _____

3. What type of disease affected them? (Circle the answer from the following)

A, Malaria

B, Dysentery,

C, Diarrhea

D, Typhoid

E, Schistosomiasis

F, Hookworm

G, Respiratory disease

H, other specify _____

4. Do you associate the above diseases with improper solid waste disposal? (Circle the answer)

A, yes

B, no

C, other specify _____

5. Does your household have container for storing household solid waste?

A, have metal or plastic container inside house or compound

B, metal or plastic container outside

C, we do not have container.

D, Other specify _____

6. If the answer for Q5 is No, how do store or collect your solid waste?

A, Dumping at septic tank

B, at public center

C, Dumping drainage area or roadside

D, Riverbank

E, Open space

F, other specify _____

7. Who is giving you solid waste emptying service? (Circle the answer)

A, The municipality

B, Private businessperson

C, small and micro-enterprise cooperative

D, other specify_____

8. *What to kind of solid waste management system you are using?*

A, Community container collection

B, Door to door collection system

C, Block collection system

D, other specify_____

9. *How you dispose your solid wastes? (circle from lists below)*

A, Dispose to open pits?

B, Open burning?

C, Bury in the ground?

D, Dump at open disposal sites?

E, Dispose at sanitary landfill?

10. *Presence of responsible bodies for management of disposal site?*

A, appropriate

B, not appropriate

11. *Appropriateness of disposal sites in terms of location and properly management*

A, appropriate

B, not appropriate

12. *How often is solid waste collected from your home or from container at public centers emptied? (Circle from the following lists)*

A, Three times a week

B, Twice a week

C, Once a week

D, Less frequently

E, Other specify_____

13. *Where is your solid waste container taken to be emptied? (answer from the following lists)*

A, Emptied into larger container at same building

B, Emptied into communal container in the neighborhood

C, Emptied onto an open field of waste in the yard

D, Taken to final disposal site directly

E, taken to transfer station

F, Other specify_____

14. What is your satisfaction of solid waste collection and disposal service-by-service providers?
- A, Very satisfied
 - B, Satisfied
 - C, Less Satisfied
 - D, not satisfied
 - E, Neutral
15. If less or not satisfied what bothers you most about your primary solid waste collection service?
- A, Infrequent collection
 - B, Inadequate container
 - C, Location of container is far
 - D, Unsanitary conditions at container
 - E, others (specify) _____
16. If your solid waste container is placed outside your home, or taken to a communal container, how often is the container emptied?
- A, Three times /week
 - B, Twice /week
 - C, Once / week
 - D, less frequently
 - E, others (specify) _____
17. If your container is taken to an open pile of waste in your neighborhood, how often is that pile removed?
- A, Three times /week
 - B, Twice /week
 - C, Once / week
 - D, less frequently
 - E, others (specify) _____
18. What quantity of solid waste produced per month? (circle from the following lists)
- A, Less than 30 kg
 - B, 30 kg to 40 kg
 - C, 40 kg to 50 kg
 - D, More than 50 kg
 - E, other specify _____

19. *Where did you dump your solid wastes?*

- A, More proportion of solid waste dumped to landfill*
- B, More proportion of solid waste dumped to open sites and along river*
- C, More proportion of solid waste dumped along river*
- D, Less proportion of solid waste dumped to landfill*
- E, Less proportion of solid waste dumped to open sites along river*
- F, Less proportion of solid waste dumped along river*

20. *Why do you think more proportion of solid waste dumped to open sites and along river?*

- A, Negligence*
- B, Poor awareness about negative impacts of unsafe disposal of waste*
- C, Inappropriateness of formal dumping site (landfill)*
- D, Other specify_____*

21. *What problems have you experienced due to improper collection and disposal of solid?*

(You may choose more than one)

- A, Noise*
- B, Odors*
- C, Unsanitary conditions*
- D, Aesthetic problems*
- E, Flies*
- F, Other specify_____*

22. *Is sufficient information made available to you about your waste management system (for example, information about collection times, payment of cleansing, risks associated with improper waste handling?)*

- A, YES*
- B, NO*

23. *If no, what type of information do you want to have?*

- A, Solid waste collection schedule or toilet or septic tank emptying schedule*
- B, proper handling of different kinds of wastes*
- C, Training or awareness creation*
- D, Other specify_____*

24. *How much money do you pay for solid waste service per month? If there is*

- A, Less than 10 Birr*
- B, 10-20 Birr*
- C, 20-30 Birr*
- D, greater than 30 Birr*
- E, paid nothing*

25. *If payments for waste management service in your city is not increased, the municipality or utility will not be able to improve waste management system. Are you willing to pay for improving waste management service?*

- A, Yes*
- B, No*

26. *If the answer for Question 25 is yes, how much money you are willing to pay for solid waste service per month in Birr?*

- A, less than 50*
- B, 50-100*
- C, 100-150*
- D, 150-200*
- E, 200-250*
- F, Above 250*
- G, whatever the utility charges apply*
- H, Cannot afford*

Appendix- III

III. Interview questionnaire

A, Interview For sanitation, beatification, and parking

- Check List for Environmental Impact Assessment

City/town/.....Zone.....Region.....

.....

No	Query	Yes	No	Unknown	Remark
1.	Is there recycling and reuse of solid waste in the town?				
2.	Is there properly designed solid waste disposal landfill system in the town?				
3.	What proportion of solid waste collected and disposed properly?				
4.	What is the total volume of solid waste generated per day in the town?				
5.	Is there solid waste segregation, recycling and reusing practice in the town?				
6.	Is there any form of liquid waste collection and disposal method in the town?				
7.	Are the existing solid and liquid waste disposal systems adversely affected the environment.				
8.	Are there any measures taken to improve the environmental impacts of solid and liquid waste collection and disposal?				
9.	Are there adequate institutional capacity in the city to manage the solid and liquid waste collection and disposal activities?				
10.	Composition of solid waste type (organic, plastic, wood, paper, metal, etc.);				

B, Checklist for industries/ business entity and type of solid generated and disposal mechanism.

No	Name of the industry / business entity/	Location	Type and amount of solid waste generated daily/annually	Method of collection, transportation, and disposal of industrial solid waste
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

1. How do you dispose dry /solid waste for your industry?

2. Do you think the existing dry/solid waste disposal site is appropriate? 1. Yes 2. No

3. If no, specify the reason? _____

4. Where is your recommendation site? _____

5. Why you recommend the site? _____

ADDRESS

Name of Business Entity _____

Its function _____

Ownership: 1. Private 2. Government 3. Others

Town _____

Woreda /Kebele _____

Number of Employees existed currently _____

C, Check List for Waste Management Infrastructure

1. Please list method of dry /solid waste disposal of the city administration

A, Using truck

B, House to house

C, others (specify) _____

2. Who is customer of dry /solid waste disposal systems of the town?
A, Individual household
B, Industries/factories
C, Other specify_____
3. How much is the tariff for using the dry/solid waste disposal service of the city?
A, for individual household Birr _____
B, for industries Birr _____
C, for other institutions Birr _____
4. Is there abattoir service in the town? 1. Yes 2. No
5. If no, specify the reason _____
6. Is there processing system for re-using solid and/ or liquid waste in the city? 1. Yes 2. No
7. If yes, specify re-using product _____
8. Do you think waste management service of the city is efficient? 1. Yes 2. No
9. If no, what do you propose for the solution?

Thank you for your information

Name of responsible person: _____

Date: _____

Signature /stamp: _____

Appendix- IV

IV. Focus group desiccation Questioner (municipal mangers, Bureau members and selected group)

1. *How you see solid waste management practice in Assela town?*
2. *Who is the responsible in solid waste disposal management practice in Assela town?
And how?*
3. *Where are dispose SW which are generated from Governmental and Non-Governmental organization like Hospitals, hotel, café or restaurants?*
4. *If there is no disposal site, where are dispose or dump solid wastes, which are generated from your houses? Discuss it_____*
5. *Is their public awareness in solid waste management practice in Assela?*
6. *Who have a responsibility in creating awareness, does the municipality is the only responsible?*
7. *What are the main causes for Poor SWM and disposal Practices in Assela town?*
8. *Does using inappropriate technologies and Poor institutional structure affect SWM?*
9. *Is it illegal SWM and disposal practices affect human beings & environment?*
10. *Is there enough budgets allocation and equipment supply for solid waste management and transportation activity in Assela town?*
11. *What are the challenges for solid waste management practice in the town?*
12. *Assela town municipality and sanitation sector are enforce miss behaving individual or institutions.*
13. *What is the rule, regulation, its implementation, and monitoring that have been propose by your bureau for efficient practice of SWM in Assela town?*