

NANSANA MUNICIPALITY SOLID WASTE MANAGEMENT STRATEGY AND PLAN (2025-2030)



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PREFACE

MAYOR, NANSANA MUNICIPALITY

This Solid Waste Management Strategy provides a roadmap for addressing the solid waste challenges facing Nansana Municipality. The roadmap encompasses Policy and legal framework; Collection and transportation services; Waste Recovery and Circular Economy; Waste Disposal; Financial Sustainability; Inclusive Participation; and Data and Monitoring.

The Strategy Document builds upon the municipal solid waste audit report that was developed earlier. The waste audit report identified the key challenges and priority areas that Nansana Municipality should focus on in an effort to move towards a circular economy in waste management.

The Strategy Document is prepared by Nansana Municipality as a precursor to receive related funding from the World Bank supported GKMA project. It provides a basis for developing the waste management site in Menvu into a Solid Waste Material Recovery Facility (MRF), thereby contributing towards minimization of waste from causing public health and environment related pollution problems.

This strategy provides the basis for policy makers at the Municipality to put in place the requisite enabling environment, which begins with a customised and localised bye-law that will address challenges within the Municipality.

Permit me to thank our development partners, Kampala Capital City Authority and all the entities in the GKMA, Civil Society Organisations, Private Sector, and the residents of this Municipality for the support in preparing this Strategy document.

It is my sincere hope that Nansana Municipality will shine and continue to be the Municipality of Choice, when it comes to sustainable solid waste management. We lead while others follow! For God and My Country.



Hon. Regina Nakkazzi Bakiitte Musoke
Mayor, Nansana Municipality

FOREWORD

TOWN CLERK, NANSANA MUNICIPALITY

This Solid Waste Management Strategy has an Action Plan focusing on formulation of a strong and reliable solid waste management legal and policy regime, collection and transportation services, waste disposal, recovery and circular economy and inclusive participation of local communities. The Strategy further focuses on financial sustainability and data and reporting as key areas that the Municipality will focus on while addressing the urban waste challenge.

As you may already be aware, Nansana Municipality is one of the densely populated municipalities in the Greater Kampala Metropolitan Area. It's at the gateway from the North, East and West of Kampala City. The infrastructure in the municipality is moderately developed to manage disasters. Two major highways (to Arua and Hoima cities) transverse the municipality to facilitate access or coordination of disaster related activities. Majority (90%) of the community access road network is not tarmacked and poses serious challenges to disaster management coupled with many challenges such as disposal of solid wastes, roadside markets and snack vending. Besides being a threat to natural ecosystems and human health, poor municipal solid waste management (MSWM) continues to negatively affect many activities in the Municipality, including disruption of movements, deterioration of infrastructure, and risk to lives.

In order to commence the journey towards sustainable waste management, the Municipality has prepared this Solid Waste Management Strategy to addresses key issues affecting the Municipality, to provide a clear waste management roadmap.

I sincerely thank our development partners, Civil Society Organisations, the Private Sector, and the community members for the collaborative efforts. I look forward to more support to enable the implementation of this Solid Waste Management Strategy for Nansana Municipality.



Mr. Festo Tandeka

Town Clerk, Nansana Municipality

EXECUTIVE SUMMARY

The Waste Management Strategy for Nansana Municipality sets out the necessary strategic interventions for improving SWM in the Municipality at every step of MSWM service chain. The strategy responds to the need to strengthen the institutional framework, setting up transparently managed financial mechanisms and implementing the waste hierarchy and circular economy concepts for improved management of MSW. The Strategy is also aligned with the vision 2040 and the national development plans; as well as the climate action plan and the green growth strategy.

The development of the strategy was informed by the results of the Nansana Municipality Waste Audit, which determined over 508 tons/day of waste to be generated in Nansana Municipality alone. This quantity aligns with that determined in the situational assessment for solid waste collection undertaken in the GKMA in 2024. Accordingly, Nansana fell in Area 3, lumped up with Makindye-Sabagabo, Kira and non-municipal areas comprising town councils and sub-counties. These areas were characterized by low collection service coverage (<15%), limited public administrative capacity, low level of private sector activity, and a dependency on other municipalities' infrastructure for final disposal of collected waste. Up to 508 tons/day of municipal solid waste generated in Nansana Municipality, only a small proportion of about 15% is collected of which only 1% goes to recovery. The uncollected waste is left on land, drains or burned while the collected waste is disposed of in open dumpsites without any environmental pollution control with devastating impacts on the environment.

The vision of the strategy is *“A clean, garbage-free Municipality of Choice”* and the mission is *“To deliver inclusive and quality people-led solid waste management services and promote opportunities for social empowerment and economic development”*. The strategic objectives are, to; (i) build capacity of Nansana Municipality on MSWM, (ii) increase MSW collection to at least 60%; (iii) increase public participation, community awareness and knowledge for effective and efficient MSWM; and establish robust infrastructure for MSWM in Nansana Municipality.

To realistically improve the current MSWM situation in Nansana Municipality, the strategy has set practical short-medium term goals, to be achieved within 3-5 years of the launch of the strategy and long-term goals for 5-10 years. The short term goals are as follows:

- **Policy and regulatory foundations:** Within Year 1, Nansana will finalize and adopt a local bye-law aligned with national waste regulations, enforcing mandatory waste segregation, Extended Producer Responsibility (EPR), and penalties for non-compliance. Informal waste pickers will be integrated into formal systems through registration, training, and distribution of protective equipment, while regulatory impact assessments will guide Public-Private Partnership (PPP) frameworks.
- **Public awareness and community engagement:** A multilingual, multimedia education campaign will be launched to promote waste sorting, safe disposal, and circular economy practices. Local "Zero-Waste Ambassadors" and neighbourhood waste committees (with 30%

gender representation) will drive behavioural change, with pilots in schools, markets, and religious institutions.

- **Waste collection and transportation:** Standardized dual-compartment bins will be rolled out across all divisions, prioritizing high-density zones and public institutions. Private haulers will operate under zoned collection contracts tied to KPIs (90% coverage, biweekly pickups), while low-income areas will receive subsidized door-to-door collection via community-based organizations.
- **Infrastructure and technology investments:** A Material Recovery Facility (MRF) at Menvu will process recyclables, complemented by pilot decentralized composting sites and small-scale anaerobic digesters for organic waste. Real-time tracking systems and dashboards will monitor waste flows.
- **Financial mechanisms:** Nansana will adopt a hybrid user-fee model that balances cost recovery with affordability, promoting cost equity by linking waste charges to the volume and type of waste generated, rather than income level. Cash for work will be instituted whereby very poor community members can undertake activities in waste management, to be paid so that they can use a portion of their earnings to pay for solid waste collection.
- **Monitoring and governance:** A three-tier governance system (Steering Committee, Technical Operations Unit, Divisional Waste Teams) will oversee implementation. Baseline waste data will be published, with annual audits and community forums ensuring transparency.

The long term interventions, to consolidate gains, scale infrastructure, and institutionalize circular economy practices across Nansana, include.

- **Policy and legal consolidation:** The bye-law will be updated based on implementation data, with stricter EPR enforcement (*e.g.*, mandatory take-back schemes) and tax incentives for circular businesses.
- **Expanded public engagement:** Gender-responsive programs will scale, empowering women/youth in waste, while circular economy hubs for repair/reuse will expand to all divisions. "Pay-As-You-Throw" systems will be refined with equitable pricing.
- **Advanced waste processing:** The MRF at Menvu will be upgraded to AI-assisted sorting, integrating informal workers as formal staff. Large-scale composting/WTE facilities will be deployed where feasible, and mechanical-biological treatment (MBT) plants will process residual waste.
- **Material recovery from waste and waste management reform reforms:** Menvu will continue to be improved and operated as an MRF facility and transfer center, with ultimate disposal performed elsewhere in collaboration with the central government, GKMA and neighbouring municipalities. Bans on landfilling organics/recyclables will phase in, with remediation of illegal dumpsites.

- **Financial sustainability:** User fees will expand municipality-wide, supported by green bonds and a 5% emergency reserve fund. Performance-based funding will ensure operator accountability.

Waste management is a costly intervention. Small municipalities are unlikely to manage waste management in the context of considering it as a resource, from which materials can be recovered. To undertake sustainable waste management, the scale beyond municipalities working single handedly is necessary. This is referred to as the principle of subsidiarity.

Under this principle of subsidiarity, the share of responsibilities will warrant the urban authorities (for instance Nansana Municipality) to enforce the organisation of waste generation, storage at the generation area, and payment for waste collection to licensed waste collection companies. The urban authorities therefore, have to provide a conducive enabling environment for the private sector to operate under regulations set by the local authorities. The Central Government would then be responsible for the development of Material recovery facilities (MRFs) and other ultimate waste treatment and disposal facilities. This suggested change requires a policy shift, which, even if it may take time to realise, should be pursued.

The implementation of the strategy over the period of five years will require an estimated **UGX 10,265,728,000 (Uganda Shillings, Ten billion two hundred sixty-five million, seven hundred twenty-eight thousand shillings only)**. This is equivalent to **US\$ 2,774,521 (United States Dollars Two million seven hundred seventy four thousand five hundred twenty one only)**.

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LIST OF ACRONYMS

The following acronyms have been adopted for easy communication:

CDM	Clean Development Mechanism
EPR	Extended Producer Responsibility
GDP	Gross Domestic Product
GKMA	Greater Kampala and Metropolitan Areas
GoU	Government of the Republic of Uganda
IPC	Infection Prevention and Control
ISWM	Integrated Solid Waste Management
KPIs	Key Performance Indicators
LC	Local Council
LC1	Local Council One (Village Level Leadership council)
LC2	Local Council Two (Parish Level Leadership Council)
LCV	Lower Calorific Value
LG	Local Government
MoLHUD	Ministry of Lands, Housing and Urban Development
MSW	Municipal Solid Waste
MSWM	Municipal Solid Waste Management
MWE	Ministry of Water and Environment
NEC	National Enterprises Corporation
NEMA	National Environment Management Authority
NMC	Nansana Municipal Council
NUWWS	National Urban Solid Waste Management System
NWSC	National Water and Sewerage Corporation
PAYT	Pay as You Throw
PET	Polyethylene terephthalate
PPP	Public Private Partnership

RDF	Refuse Derived Fuel
RRR	Reduce, Reuse and Recycle
SDG	Sustainable Development Goal
SMS	Short Message Service
ToRs	Terms of Reference
TV	Television
UBOS	Uganda Bureau of Statistics
ULGA	Uganda Local Governments Association
UNBS	Uganda National Bureau of Standards

1 BASIS OF THE STRATEGY

1.1 Background

Managing solid waste effectively remains a significant challenge for the rapidly expanding Nansana Municipality. To protect public health, ensure safety, and promote environmental sustainability for its growing population, this detailed waste management framework has been developed. The plan aims to address the issues of waste production, collection, transportation, treatment, and disposal in a sustainable manner. It employs an integrated approach that considers social, economic, and environmental factors to provide lasting solutions.

Created through extensive engagement with key stakeholders—including government bodies, private sector entities, non-governmental organizations, community leaders, and residents—the plan underscores the vital role of community participation and education in fostering sustainable waste management practices. Over a five-year period, the strategy is designed to achieve several critical objectives.

1.2 Scope of the Report

This report outlines a Municipal Solid Waste Management Strategy for Nansana Municipality, focusing on sustainable and locally adaptable solutions. It examines the legal framework, including Uganda’s Constitution, the National Environment Act, Cap 181 (2019), and relevant policies like the Public Health Act, to ensure compliance and effective governance. The strategy is informed by a waste audit (aligned with SDG Indicator 11.6.1), analyzing current waste composition, generation trends, and future projections specific to Nansana. Structured around seven key components—policy/regulatory strengthening, waste collection/transport, circular economy promotion, treatment/disposal, inclusive stakeholder participation, financial sustainability, and monitoring systems—the report prioritizes actionable short-term (1–3 years) and long-term (3–5+ years) measures. Consultations with local stakeholders ensure community-centric approaches, addressing Nansana’s unique waste management challenges while aligning with national goals.

1.3 Anchorage in Existing Policies and Laws

1.3.1 *Constitution of the Republic of Uganda (As Amended)*

The legal and institutional framework constitutes the key drivers of the solid waste management strategy. The legal framework is derived from national Constitution of 1995. This provides emphasis on the importance of environmental protection and conservation through its National

Objectives and Directive Principles of State Policy. These principles guide the state in achieving social and economic objectives, which can include environmental management. This will be complemented with policy and legal instruments such as bye-law that have been generated by Nansana Municipality for this purpose.

1.3.2 National Environment Act, Cap 181 (2019)

The National Environment Act, Cap 181 (2019) provides a comprehensive framework for environmental management, constituting the National Environment Management Authority (NEMA) as the principal coordinating body for environmental activities. The Act addresses emerging environmental issues such as climate change, hazardous chemicals, biodiversity offsets, strategic environmental assessments, and petroleum activities. It also supports regulations like the National Environment (Waste Management) Regulations, 2020, which emphasize sustainable waste management practices. These regulations promote the waste hierarchy, segregation of hazardous and non-hazardous waste, licensing for waste handlers, and encourage local governments to establish compliant waste disposal sites. NEMA, under the Act, spearheads environmental policy development, guides government on sound environmental management, and ensures compliance with environmental laws and standards.

1.3.3 Public Health Act, Cap 310 (2023)

The Public Health Act, Cap 310 (2023) serves as the primary legal framework for solid waste management (SWM), mandating local authorities to ensure regular waste collection, prohibit open dumping, and enforce penalties for non-compliance. It explicitly requires households and businesses to adhere to proper waste storage and disposal practices, aiming to reduce public health risks such as disease outbreaks and environmental pollution. However, implementation faces significant challenges, including weak enforcement due to limited municipal resources, low public awareness of segregation and recycling rules, and regulatory overlaps with other laws like the Pollution Control Act.

1.3.4 Occupational Safety and Health Act, Cap 220 (2006)

Under Uganda's Occupational Safety and Health Act (2006), employers in the solid waste management (SWM) sector are legally obligated to protect workers from occupational hazards. This includes providing appropriate personal protective equipment (PPE) such as gloves, masks, boots, and high-visibility clothing, along with enforcing its consistent use. Employers must also conduct regular workplace hazard assessments, particularly focusing on risks like exposure to medical waste, toxic chemicals, and sharp objects. Additionally, they are required to implement training programs covering safe waste handling techniques, emergency response procedures, and injury prevention, with mandatory refresher courses at least annually.

1.3.5 National Solid Waste Management Strategy

Uganda's national solid waste management strategy is designed to address the challenges posed by rapid urbanization and population growth. The strategy is supported by a regulatory framework that includes the National Environmental Management Authority (NEMA) and specific regulations governing waste management activities. Key policy developments include the National Urban Solid Waste Management Policy, which aims to provide a national framework and facilitate collaboration with non-state actors. Strategic initiatives such as the Plastic Circularity Strategy promote a circular economy for plastics through reuse, recycling, and reduction. Despite challenges like inadequate infrastructure and limited public awareness, the strategy recommends adopting successful models from other countries and investing in infrastructure and public education.

1.3.6 National E-Waste Management Strategy

The National E-Waste Management Strategy is a structured approach to managing electronic waste within broader municipal waste systems. It focuses on establishing formal collection and recycling programs, enforcing regulations to prevent illegal dumping, and promoting safe disposal practices to protect public health and the environment. Key elements include Extended Producer Responsibility (EPR), which holds manufacturers accountable for end-of-life products, and public awareness campaigns to encourage proper e-waste disposal. The strategy also supports circular economy initiatives, such as refurbishment and reuse, while fostering partnerships between governments, private recyclers, and international organizations. By integrating e-waste management into municipal planning, the strategy aims to reduce environmental harm, create green jobs, and ensure sustainable handling of growing electronic waste volumes.

1.3.7 National Plastics Waste Management Strategy

Uganda's National Plastics Waste Management Strategy addresses severe plastic pollution, emphasizing circular economy solutions like local recycling initiatives (e.g. PET-to-tile conversion) and Extended Producer Responsibility (EPR), though enforcement remains inconsistent. Community-led projects, such as Tree Adoption Uganda's waste sorting and briquette production, demonstrate grassroots resilience by reducing flooding risks and empowering women through income-generating waste management. Organic waste, constituting over half of municipal waste, is often burned or dumped, prompting calls for composting and biogas solutions to align with Sustainable Development Goals (SDGs).

1.4 Waste Audit through SDG indicator 11.6.1 Baseline

1.4.1 Per capita waste generation

According to the waste characterisation and baseline report (Deliverable 1 of this assignment), the findings highlight disparities in per capita domestic waste generation across the divisions. The data was corrected from ten domestic settings over a period of seven days according to the standard for waste auditing. The sampled domestic settings were distributed across each of the divisions (Figure 1). Accounting for outliers and removing them, Nansana 0.405 kg/capita/day, Nabweru 0.493 kg/capita/day, Gombe 0.434 kg/capita/day, and Busukuma the lowest at 0.275 kg/capita/day, providing key insights for waste management planning and policy development. These variations likely stem from differences in domestic income levels, consumption patterns, and access to waste collection services, factors supported by previous literature (Wilson et al., 2015).

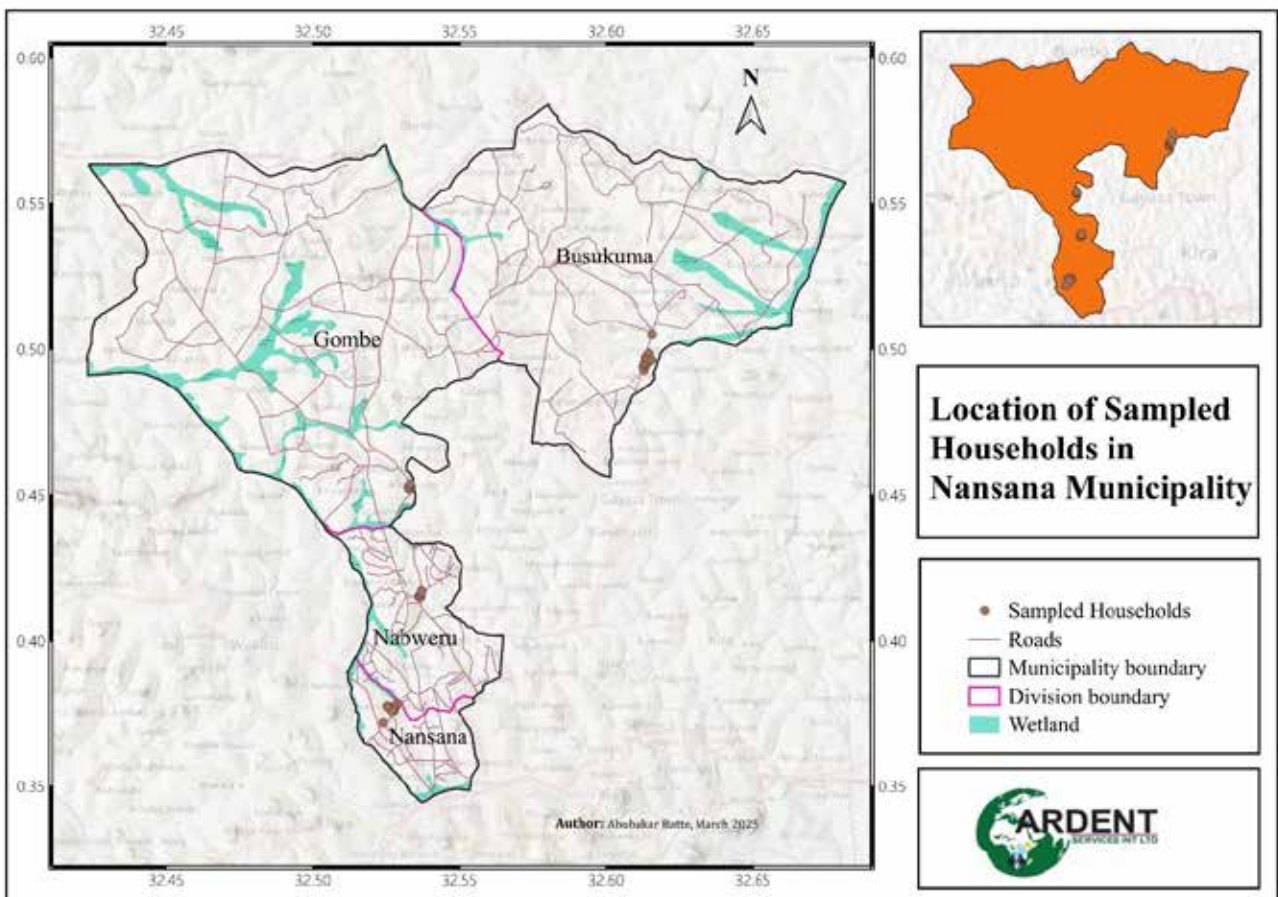


Figure 1: Locations sampled for characterisation of domestic waste

Table 1: Per capita domestic waste generation in Nansana Municipality

#	Division	Generation rate (kg/cap/day)	Total Population	Waste generated (kg/day)
1	Nansana	0.405	279,558	113,221
2	Nabweru	0.493	205,601	101,361
3	Gombe	0.434	148,281	64,354
4	Busukuma	0.275	73,000	20,075
TOTAL			706,439	299,011

Additionally, the data in Table 1 reveals a total daily domestic waste generation of 299,011 kg/day (299 tons/day) across the surveyed areas, further emphasizing the need for tailored waste management strategies based on local disparities. The total daily domestic waste generation exhibits the urgency for scalable waste management solutions.

1.4.2 Domestic waste composition

A comprehensive analysis of domestic solid waste composition was conducted to determine the distribution of different waste categories. The assessment revealed that yard waste constituted the largest proportion at 50.2%, followed by food waste at 8.9%. Other notable components included wood and wood products (0.8%), textiles and wool (3.3%), mixed paper and pulp (0.6%), and plastics and rubber (10.9%). Minor fractions consisted of glass (0.5%), corrugated boxes (1.5%), and metals (0.1%). Additionally, a significant portion (23.2%) was classified under miscellaneous waste, while high-grade paper and newsprints were absent (0%). A detailed breakdown of these findings was presented in Deliverable 1 (Waste Characterisation and Baseline Report).

1.4.3 Mapping solid waste disposal facilities

Nansana Municipality has a designated a site in Menvu, Busukuma division for sustainable waste management, incorporating a materials recovery facility (MRF) plant (Figure 2). However, the facility is not yet operational. Waste is collected and transported over a long distance, to a new site belonging to KCCA in Buyala, Mpigi district. It has been reported that NEMA declared the site unsuitable for waste management. The physical plan for the development of the Menvu site has been carefully developed to take into account the concerns of NEMA, chiefly, the protection of the wetland (Annex 1). Consequently, the wetland has been demarcated and the proposed MRF is outside of the wetland boundaries. Moreover, the site in Menvu is not to be operated as a disposal facility, but as an MRF plant. The rejects will be transported and managed in a landfill to be located elsewhere, in a collaborative effort between Nansana Municipality, and the GKMA entities.

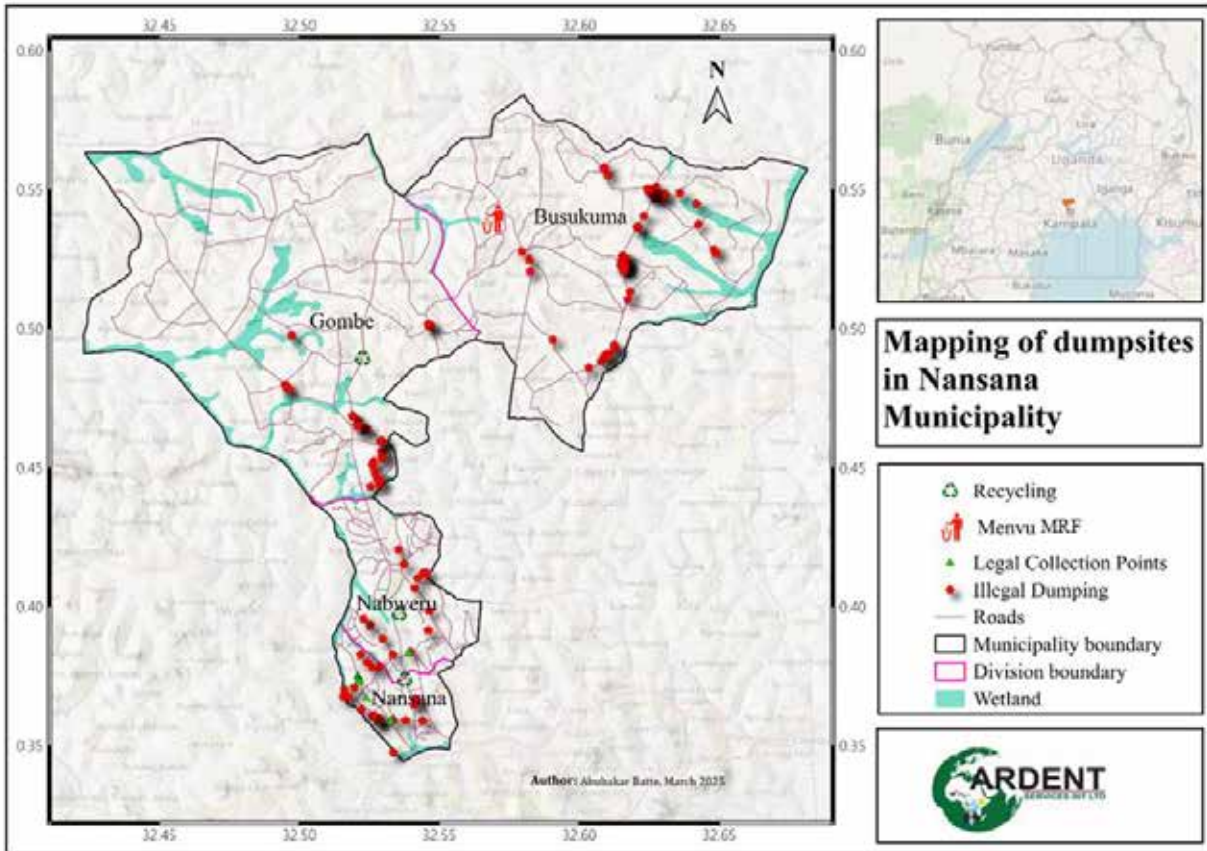


Figure 2: Location of dumpsites and recycling plants

The Municipality collects waste from temporary waste consolidation areas located primarily along roads near market centres awaiting collection and transportation to Buyala. Illegal dumping and unauthorized waste sites are persistent in all the divisions of Nansana Municipality, in the areas of Tenga, Ttula, among others. The existing waste consolidation areas where the municipality collects wastes (termed as legal collection points) and illegal waste deposition sites where the wastes are not collected in Nansana Municipality were identified and mapped on Figure 2. On a positive note, Nansana Municipality hosts three recycling plants, which help mitigate the burden of plastics and other wastes such as paper and certain types of packaging material such as Styrofoam. They include *Luzilog* enterprises and *Acacia Foundation Limited*. enterprises. *Dei Biopharma* is in the process of establishing fertiliser production unit, although it is not yet clear if the inputs will include any waste from Nansana Municipality. While the existing recycling plants do not offer a complete and permanent solution to the waste management problem, they contribute to reducing the overall volume of certain types of wastes generated in the area. It should be noted that the Nansana waste storage remains solely a responsibility of the generator as per NEMA regulations.

1.4.4 Quantification of waste generated

In Section 1.4.1, the per capita quantity of domestic waste generated in the four divisions of Nansana was estimated. This was used to compute the total quantity of household waste generated in Nansana Municipality. Accordingly, the total quantity of household waste generated in Nansana Municipality is of 299,011 kg/day (Table 1), which is equivalent to 299 tons/day. The non-household waste was computed using the household waste generated using relationships presented in Deliverable 1. Consequently, the non-household waste, computed at the rate of 0.7 times that of the household waste generates an additional 209307.614 kg/day (209.3 tons/day). When added, the total quantity of household and non-household waste generated in Nansana Municipality is computed to be 508,318 kg/day (508 tons/day). This figure does not differ from the 508 tons/day estimated for Nansana Municipality, according to the situational assessment conducted by GGGI and reported in January 2024.

1.4.5 Waste sorting and segregation

Currently, there exists no waste sorting and segregation at any meaningful scale in Nansana Municipality. Existing efforts are done by the informal sector, who collect plastics and other wastes of commercial value for sale to recyclers within our outside of Nansana Municipality. There are some private sector players involved in collection of plastics for recycling, such as *Luzilog* enterprises and Acacia Foundation Limited. Dei BioPharma is in the process of establishing a fertilizer production facility, although it is not clear if they will utilise any domestic waste in their process. Metal scraps are resourced from the waste stream. Existing resource recovery efforts are in place for plastics, and metal scraps have market elsewhere. However, organic waste recovery is dismal or non-existent. Majority of the players involved in waste collection for valorisation are informal. Although they provide a valuable service in recycling and waste picking, the informal sector is not regulated by the Municipality and their activities are unable to attract taxes to increase the Municipality's revenue base. Nansana Municipality has contracted waste collection service providers. Although they do not pay taxes, they are regulated by the municipal council. None of the private waste collection companies is involved in waste collection and segregation.

1.4.6 Waste composition and summary of material flows

A comprehensive assessment of household waste revealed distinct compositional trends, with organic waste—particularly yard waste (50.2%) and food waste (8.9%)—dominating the waste stream. Plastics and rubber accounted for a notable 10.9%, while other materials such as textiles (3.3%), glass (0.5%), metals (0.1%), and paper products (0.6%) were present in smaller quantities. A significant portion (21.5%) was classified as miscellaneous waste, indicating potential challenges in segregation and recovery. The average waste generation rate of 0.32 kg/capita/day translates to a total daily municipal output of 246,358 kg, emphasizing the need for localized and scalable waste management strategies.

Material flow analysis highlights the movement of waste from generation to disposal, revealing inefficiencies in current systems. The predominance of organic waste suggests high potential for composting and anaerobic digestion, diverting a substantial portion from landfills. Meanwhile, the presence of recyclables like plastics, paper, and metals—despite their low recovery rates—points to gaps in collection and sorting infrastructure. By mapping these flows, the municipality can identify key intervention points, such as expanding organic waste processing, improving recycling programs, and reducing non-recoverable waste through targeted public awareness campaigns. This data-driven approach ensures that waste management strategies align with actual generation patterns, optimizing resource recovery and minimizing environmental impact.

1.5 Consultations

Consultation meetings were held with the health inspection department at Nansana Municipality and with the political and technical staff in other divisions as well as with the waste collection companies. The consultations in non-domestic waste generating entities was undertaken in locations shown in Figure 3. Key findings from the consultations are presented in the next sections.

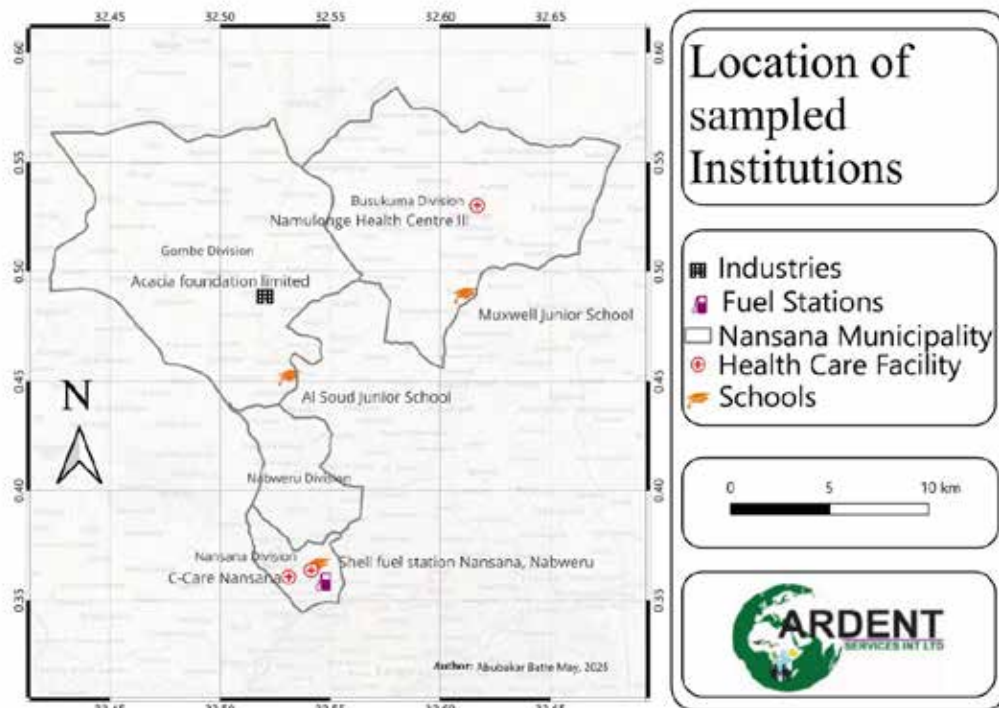


Figure 3: Location of the non-households/institutions

1.5.1 Consultations with the waste collection companies

Existing private companies have a low capacity to collect waste. Combined with the capacity of the municipality, an estimated 15 – 20% of the solid waste generated in Nansana Municipality is currently collected. During the survey, the team sought to know the opinions and concerns by the private waste collection operators and suggestions on what can be done to improve solid waste management within the areas of their operation. Table 2 presents the concerns and suggestions for improvement according to the solid waste collection companies.

Table 2: Summary of concerns and suggestions for improvement by solid waste collectors

Concerns	Suggestions for improvement
Limited or no willingness of households to pay for waste collection fees. The willingness to pay and so reliance is on commercial customers along the roads.	The municipality should come up with bylaws clearly spelling out the roles to be played by all the parties and penalties and enforces the implementation of the bylaws.
Lack of site for dumping the waste. The available site is too far and costly in terms of fuel although the charges are fixed and customers are unwilling to pay adjusted fees matching with the distance to the dumpsite.	Municipality should promote waste avoidance, source segregation, backyard composting (where possible) and use of locally produced composts. This will reduce waste available for collection and hence collection fees too.
Limited awareness. People are not sensitized about the need to pay for waste collection fees. The municipality and other local leaders have left the work of awareness campaign to the private service providers.	The municipality should take up the role of sensitizing the people through Local council leaders and don't leave it only to the private service providers as it is the case today.
There is a lot of influx of people in Nansana division. People come in and move out to other places and some of them go without paying for waste already picked.	Municipal council should give services providers contracts of long period to allow them secure loans from the bank to buy waste collection trucks; and absorbs such shocks of non-payers, Payment should be frequent, not longer than a week.
There are many defaulters to the extent that private collectors even use enforcement officers although it is illegal.	NMC enforcement team should ensure that each household has a receipt indicating that they have paid for waste collection to make it easy for Service providers who have limited powers to enforce people to pay.
Poor infrastructure that makes it hard for service providers to access some homes for waste collection.	The municipal council should improve infrastructure for easy access of service providers in all the areas that have waste.
The solid waste collection service providers have limited powers to compel people to pay for waste collection and they only depend on those who are willing to pay for waste who are very few.	The municipal council just give private waste collectors contracts and don't sensitize the people on TV stations like Kampala Capital City Authority does. NMC should step up and sensitized people through radio and TV stations.
There are providers who are not registered ranging from individuals, <i>Boda boda</i> riders	NMC should procure some containers in communities for them to dump their waste and wait

Concerns	Suggestions for improvement
and vehicles that collect waste from people's homes and dump everywhere on the road side.	for service providers to pick the waste when it is full. Unregistered collectors should be stopped.
Buyala is far for example where the truck would have two trips it can take one trip in a day and this leaves a gap of uncollected waste in the some communities.	NMC should work hard and secure its own dumping site to ease the work of service providers.
Buyala dumping sites has not been fully secured. Collectors face resistance from site management and claim that we are not supposed dump waste there.	As above, for Nansana Municipality to secure their own waste dumping site.
Since the collapse of Kiteezi landfill NEMA stopped giving out licenses to waste collection companies and the traffic officers are utilizing that opportunity to extort money from our vehicles.	NMC should work with KCCA and NEMA to ensure that all waste transporters are given waste transportation licenses.
Some households think that waste collection fees is part of the money paid as ground rent to the municipal council and don't want to pay for waste collection.	It should be made clear by ground rent collection team to explain to the people that they are paying for ground tax which doesn't include waste collection fees.
Most People are poor and have no money to pay for solid waste collection	NMC should identify places habited by the poor who cannot pay for waste collection and collect waste from those areas.
Some people think that we charge a lot of money for waste collection and some either end up defaulting or completely stop paying for the waste collection fees we charge.	Nansana Municipal Council should undertake extensive sensitisation an inform the residents about the solid waste collection fees.
There is a challenge of evening vendors who are protected by the municipal council who leave the dirty streets and no one to clean their areas of operation	NMC should also regulate evening vendors who always do business in the evening and leave their workplace so dirty.

1.5.2 Waste management in schools

The surveyed schools included Nabweru Community Nursery, Islamic Primary School in Nabweru Division, Muxewell Junior School in Busukuma Division and Al Soud Junior School in Gombe Division. These schools mainly produce organic waste from food, plastics from packaging, and paper and cardboard materials.

Sources and seasonal waste patterns: Organic waste levels are highest at the beginning of the school term, largely because of a surge in snack and food consumption. Most schools utilize a single bin for general waste, with the exception of food waste, which is separated. Designated staff members are responsible for collecting waste on-site and ensuring it is disposed of correctly at each school.

Waste disposal and recycling practices: Nabweru Community Nursery and Islamic Primary School manages its waste by utilizing a privately owned pit located away from the main school grounds, where waste is regularly deposited and burnt. In contrast, both Muxewell Junior School and Al Soud Junior School rely on smaller waste pits situated within their premises. At these schools, accumulated waste is typically burned every few days to maintain cleanliness. While these methods address immediate waste disposal needs, they highlight the ongoing challenges schools face in implementing more sustainable and environmentally friendly waste management practices. Waste collection at schools can take the form shown in [Figure 4](#).



Figure 4: Solid collection as done in the sampled schools

Key challenges in waste management: Managing waste effectively faces several hurdles, such as insufficient awareness and inadequate training among both staff and students. Waste collection is often unreliable, and there is a noticeable lack of bins and appropriate storage infrastructure. These shortcomings lead to ineffective waste separation and improper disposal methods.

Solutions and recommendations: Schools have made efforts to improve cleanliness by increasing the number of waste bins and deploying dedicated cleaning staff. However, to achieve a more

effective and sustainable waste management system, schools require additional financial resources, advanced waste disposal equipment, consistent training sessions for staff and students, and motivational programs that encourage recycling and environmentally responsible habits. These measures will not only enhance overall sanitation but also foster a culture of sustainability within the school community.

1.5.3 Waste management in healthcare facilities

The sampled healthcare facilities included BHL Community Health Centre in Nabweru, C-Care in Nansana, and Namulonge Health Centre III in Busukuma Division. Common solid waste includes organic matter like food scraps. Plastic and packaging materials are also frequent. Paper waste such as cardboard is another major type. Hazardous waste includes chemicals, and expired medication. Medical waste like sharps and infectious items were regularly produced mainly from the laboratories and maternity ward. Namulonge Health Centre III generated approximately 200 kg per week, and 160 kg for BHL Community Health Centre in a week and 117kg for C-Care Nansana. Hazardous waste mainly comes from laboratories, maternity wards, and injection rooms. Waste levels often increase seasonally; for example, more patients during the rainy season lead to more medical waste due to malaria cases. Facilities commonly use color-coded bins for waste separation and collection (Figure 5). A designated Infection Prevention and Control (IPC) staff member oversees this process. Before disposal, most facilities store waste in large containers such as bins or drums.



Figure 5: Waste practices at BHL Community HC (L); Namulonge HC III (R)

Waste disposal methods: Some facilities burn all their solid waste together with hazardous waste and infectious waste in well-constructed waste pits.

Waste transportation practices: The waste management procedures differ between facilities. Private waste collection services by “Right Projects” contractor which operate at BHL Community Health Centre and C-Care Nansana and Namulonge Health Centre III. There are designated staff members at each health facility who is in control of waste and coordinate with Right Projects.

Key challenges in waste management: The key challenges relating to waste management include the following:

- BHL Community Health Centre experienced challenges from neighbouring community caused by dumping which require continuous maintenance of drainage.
- Namulonge Health Centre III and BHL Community Health Centre expressed interest in having an incinerator to enable them handle high infectious material on-site.
- Namulonge Health Centre III and BHL Community Health Centre behaviour issues still challenge with low awareness levels for the in-patients and out-patients.
- The main problems at Namulonge Health Centre III consist of hazardous waste exposure together with poor collection services with no protective equipment, inadequate training and high disposal costs.

Solutions and recommendations: The suggestions to overcome the above challenges, include:

- The implementation of effective waste management needs additional financial support together with improved access to suitable equipment.
- The implementation of periodic training sessions will enhance both staff knowledge and workplace safety standards.
- Better enforcement of policies together with stronger policies would create uniform waste handling practices throughout all facilities.

Conclusions

- A comparative analysis of healthcare waste management in Nansana Municipality reveals high licensing coverage across all divisions, with compliance above 97%. However, a critical issue persists in the validity of operating licenses. Gombe and Busukuma have 97.9% and 97.3% of facilities with expired licenses, respectively, while Nansana and Nabweru are similarly affected. Waste handler coverage is highest in Nansana at 97.2%, followed by Gombe (92.7%), Busukuma (87.8%), and Nabweru.
- Ownership records are poorly maintained, especially in Nansana where 62.9% of facilities have unspecified ownership status. These trends reflect systemic weaknesses in enforcement, recordkeeping, and accountability across all divisions. While Right Projects is widely contracted for waste handling, segregation at source remains limited.

- The findings indicate urgent need for license renewal enforcement, strengthened monitoring, and community-level engagement to improve segregation and reduce public health risks.

Recommendations

- **Enforce License Renewals:** Municipal authorities must implement quarterly inspections and reminders to ensure facilities renew expired licenses promptly across all divisions.
- **Strengthen Recordkeeping:** Improve facility data by mandating clear ownership declarations during licensing and including it in digital health facility registries.
- **Promote Source Segregation:** Launch awareness campaigns and provide color-coded bins to ensure households and healthcare facilities segregate waste before collection.
- **Enhance Waste Handler Coverage:** Ensure all divisions meet at least 95% coverage by formal waste handlers like Right Projects, prioritizing Busukuma and Nabweru.
- **Digitize Monitoring Systems:** Develop a municipal-level dashboard to track licensing, validity, and waste handler engagement in real time for faster enforcement.
- **Incentivize Compliance:** Offer reduced renewal fees or recognition to facilities maintaining valid licenses and proper waste segregation to encourage best practices.

1.5.4 Solid waste recycling facilities

The factory selected for this study was Acacia Foundation Limited, a company specializing in plastic recycling and manufacturing. Situated in Kungu, within the Matugga area of Gombe division, this facility plays a significant role in the Nansana's efforts to manage plastic waste and promote sustainable production practices.

Types of solid waste generated: The main types of solid waste generated at the factory include organic waste from food and plastic materials from packaging and production processes.

Solid waste generation overview: The factory produces roughly 10 kilograms of organic waste each day alongside a substantially larger quantity of recycled plastic, estimated to be 40,000 kg per day (40 tons/day), as a result of its manufacturing processes. The plastic waste primarily consists of rejected soft plastics, such as polythene bags, which are deemed unsuitable for recycling. Additionally, during the rainy season, the quantity of rejected plastics increases due to the influx of PET bottles that are often contaminated with mud and other debris, further complicating the waste management process.

Sources and seasonal waste patterns: During the rainy season, plastic waste increases significantly, with nearly two tons of rejected bottles discarded daily due to contamination by mud.

Waste disposal and recycling practices: The factory uses separate bins to collect different types of waste (Figure 6), promoting effective sorting and improving disposal and recycling practices on-site. Each department is responsible for managing its own waste, with all staff expected to actively participate in proper waste handling and segregation.



Figure 6: Plastic waste recycling at Acacia foundation company, Matugga

Waste transportation practices: Waste is stored in a designated storage area before disposal. Asante company, is responsible for the final disposal of their solid waste.

Treatment and disposal: Recycling is a key part of the treatment and disposal process and serves as the firm's main objective.

Policy compliance and training: The firm adheres to government policies and guidelines of the Uganda Government on waste management. They are also regulated on their products by the Uganda National Bureau of Standards (UNBS). Waste management training is conducted annually every May to ensure staff are updated on best practices and regulations.

Key challenges in waste management: A key challenge in waste management faced by the firm is the high cost of disposal, which can strain resources and impact efficiency. Another challenge is the inconsistency of waste handling partners, which can affect the reliability and effectiveness of waste management efforts. The waste handling partners who deliver raw materials (plastics) to the factory lack the necessary equipment or facilities, to deliver the waste as desired by the factory. In the end, some of the delivered plastics are rejected and become waste.

Solutions and recommendations: A partnership with Hima Cement, which accepts some waste for free, is one strategy implemented to improve waste management and reduce disposal costs. In order to improve waste management, implementing regular training programs would ensure staff

are knowledgeable. Additionally, offering recycling incentives would encourage more sustainable practices and increase participation.

1.6 Key take-aways from consultative meetings

The key take-aways from the consultative meetings are summarised in the next sections.

1.6.1 *Challenges in solid waste management*

Stakeholders expressed that solid waste management is one of the most pressing challenges in the division. The situation has become even more severe due to the influx of waste imported from other areas, which is indiscriminately dumped in public spaces, including streets, wetlands, and open fields. This not only worsens the sanitation situation but also increases health risks for the residents. In addition, stakeholders emphasized the urgent need for a proper dumpsite to manage the waste more effectively, as there is currently no designated, well-managed facility for waste disposal.

Private waste management service providers in the region are also facing significant challenges. They lack the necessary machinery, especially trucks, to handle waste removal efficiently. As a result, waste collection and transportation are often delayed, leaving waste to accumulate in various parts of the division. Furthermore, it was noted that there is a worrying trend where waste is sometimes relocated from one division to another, creating more waste in areas that are already overwhelmed.

The general consensus among the stakeholders is that the state of solid waste management is very poor. Of the total volume of waste generated daily, only about 15 - 20% of the waste is collected and properly managed. This leaves the majority of waste to accumulate and pose serious environmental and health risks. Some of the key issues contributing to the problem include:

- **Littering:** Polyethylene terephthalate (PET) bottles and plastic bags are carelessly discarded across the town.
- **Dumping from vehicles:** People often dispose of waste directly from their cars onto the streets or in open spaces.
- **Exploitation of vulnerable individuals:** Some individuals give their waste to people with mental disabilities, who then dump it haphazardly in undesignated areas.
- **Open burning:** There is a significant amount of waste being burned openly, releasing harmful fumes into the air.
- **Roadside dumping:** Waste is frequently dumped along the roadsides and other easily accessible areas, further polluting the environment.

Suggestions for improvement

To tackle the solid waste issue, stakeholders have proposed the following measures:

- **Sensitization:** Sensitization: To improve waste management in Nansana Municipality, a multi-faceted sensitization campaign using posters, community plays, school programs, community meetings, radio, social media, and practical demonstrations is vital. These strategies raise awareness, engage different audiences, and encourage positive behaviour change. Importantly, such campaigns can be further designed and tailored to fit the local context and cultural specifics within Information, Education, and Communication (IEC) materials for maximum effectiveness and relevance.
- **Reliable service providers:** Engaging more reliable and well-equipped waste management companies.
- **Enforcement of fines:** Introduction of fines and penalties for illegal dumping and poor waste disposal practices.
- **Signage and warnings:** Installation of warning signs and signposts in key areas to discourage illegal dumping.

1.6.2 Issues and proposed ways to respond to challenges in waste management

While some divisions *e.g.* Nabweru and Nansana are heavily urbanised, the level of urbanisation in Gombe is not as high as the other two mentioned above; and that of Busukuma is low. Consequently, Nansana is a diverse Municipality, includes heavily urban areas and rural towns. In urban areas, waste is collected, while in towns, waste is burned openly. There is also a problem of waste being dumped in Nansana from other surrounding areas, which further burdens the local waste management system.

In some parts of Nansana Municipality, community-led initiatives like "*Bulungi Bwansi*" (community cleaning) are held once a month to encourage collective efforts in waste management. This initiative, most prevalent in Busukuma Division helps mitigate some of the challenges, but it is still not enough to address the problem comprehensively.

On average, 50-70% of the waste generated is managed at the household level, with the remaining 30-50% is handled by municipal authorities or their licenced companies. Stakeholders estimate that on average, only about 15-30% of the waste is collected, suggesting that a large portion of the waste is left uncollected and improperly disposed of.

Most stakeholders in Nansana Municipality believe that the waste management situation is "bad to fair," with a small percentage indicating that it is "good." Despite the positive aspects of

community involvement, the overall waste management system is still far from ideal.

Some of the prevalent poor solid waste management practices in Nansana Municipality include the following:

- **Open dumping:** Solid waste is regularly dumped in public spaces, including roadsides and gardens.
- **Shifting responsibility:** There is a tendency for mothers to shift the responsibility of waste disposal to fathers, who also fail to handle, thereby resulting in no one responsible for waste management at the household level.
- **Dumping of waste on roadsides and in the gardens:** Waste is often dumped along roadsides or discarded in private gardens and undeveloped pieces of land (where they exist), causing pollution and odor.
- **Littering while eating:** Many people eat while walking, carelessly discarding their waste along the way.
- **Burning of waste:** Open burning of solid waste, particularly from markets, is common, contributing to air pollution.
- **Market vendors:** Vendors in markets tend to dispose of waste directly into storm water drainage systems, exacerbating flooding and environmental degradation.
- **Lack of waste containers:** A few waste containers are in place in the urbanized areas, and this forces people to dispose of waste inappropriately.

Stakeholders recommended the following actions to improve waste management in Nansana Municipality:

- **Sensitization:** Awareness campaigns to educate people on waste segregation, reduction, and proper disposal.
- **By-laws:** Implementation of stronger by-laws and regulations to enforce proper waste management.
- **Solid waste management committees:** Establishment of committees that can help oversee waste collection and ensure compliance with waste management policies.
- **Behavioural change:** Promoting better discipline, such as discouraging the practice of eating while walking, to reduce littering.
- **Waste containers:** Provision of more public waste bins in key areas, including markets and along main roads, to encourage responsible waste disposal.

- **Proper equipment for service providers:** Ensuring that waste management service providers are equipped with the necessary machinery, such as trucks, to carry out their tasks effectively.
- **Municipal support:** Nansana municipality should invest in collection trucks for each division to enhance the waste collection process.

Other concerns raised in respect of the land proposed for waste management in Busukuma;

In addition to above, stakeholders raised several other concerns regarding the proposed solid waste management facility location at Menvu. These included:

- **Recycling plant:** The community expressed opposition to a dumpsite being located in Menvu. Instead, they suggested the establishment of a recycling plant to reduce waste and promote sustainable waste management practices.
- **Water quality:** There is a strong demand for improvements in both the quality and quantity of water supplied in the nearby villages.
- **Upgrading the health center:** The stakeholders stressed the importance of upgrading the Kasozi Health Center III to improve access to medical treatment. However, upon further inquiry with the health inspectors at NMC, it was revealed that Kasozi Health Center III cannot be upgraded to health center IV due to the government policy of having one utmost one health center IV per constituency.
- **Infrastructure improvements:** There is a need for better road infrastructure to support waste collection and other municipal services.
- **Protection of neighbours:** The community is concerned about how neighbouring areas may be protected from the environmental and health impacts of waste management practices, particularly in relation to the proposed recycling plant. Consequently, the development of the recycling plant should involve stakeholders engagements, so that their fears are allayed.

1.7 SWOT Analysis

The effective management of waste in Nansana Municipality is crucial for achieving sustainable development, public health, and environmental protection within the Municipality. An analysis was performed uncovering the relevant strengths, weaknesses, opportunities and threats (SWOT) for waste management within Nansana Municipality. Strengths refer to internal strong points, abilities or enablers, which Nansana currently has. Weaknesses refer to internal shortcomings, inabilities, weak points or areas which are presently detrimental to Nansana's efforts in waste management. Opportunities refer to external prospects or areas that are beyond the control of

Nansana Municipality, but can be exploited for waste management. Threats refer to external obstacles, bottlenecks or challenges beyond the control of Nansana Municipality, but which affect or can affect situations or circumstances.

The strengths relevant to waste management in Nansana Municipality include:

- i. **Available competent staff:** Nansana has competent and motivated staff that deal with waste management, although few, but more can be recruited.
- ii. **Available infrastructure:** The municipality has trucks (although few and not customised), and these offer a good starting point for improvements.
- iii. **Possession of land:** Nansana municipality acquired and earmarked land for waste management.
- iv. **Job creation and economic benefits:** Waste management creates jobs for people who collect, sort, and process waste. This helps stimulate local economies and puts money in people's pockets.
- v. **Environmental protection:** Proper waste management helps keep the Municipality's air, water, and land clean. It reduces pollution, protects animals and their habitats, and conserves natural resources for future generations.
- vi. **Public health benefits:** When waste is not disposed of properly, it can spread diseases and make people sick. Effective waste management reduces this risk and keeps communities healthy.
- vii. **Technological advancements:** New technologies and innovations support efficiently and cost-effective waste management. These includes recycling via waste to nutrients/soil conditioners *e.g.* composting, and waste-to-energy plants; as well as biowaste conversion by the larvae of the black soldier fly or vermi-composting (composting with worms).
- viii. **Increased awareness:** More and more people are becoming aware of the importance of proper waste management. This can potentially lead to changes in behaviour, such as recycling, reducing waste, and participating in community clean-ups.

The weaknesses in relating to waste management in Nansana Municipality include:

- i. **Weak institutional frameworks:** High level mandates on waste management link to the National Environment Management Authority, Ministry of Local Government, Ministry of Lands, Housing and Urban Development, etc. This leads to institutional overlaps, duplication and conflicts.

- ii. **Inadequate infrastructure:** In Nansana, the facilities and equipment needed to manage waste properly are insufficient. This makes it difficult to dispose of waste in an environmentally friendly way.
- iii. **Lack of promotion of waste management hierarchy:** Nansana municipality should promote the waste management hierarchy, which promotes, in order of priority, waste minimisation, prevention, re-use, recycling, recovery (energy, nutrients or biochar/coal), and disposal. Waste resource recovery not only protects the environment, but can enable the municipality to save or gain money for waste management, which can be utilised in other pressing sectors.
- iv. **Lack of waste segregation:** Waste is mixed and there are no efforts to practice waste source segregation. This makes it difficult to realise any meaningful waste resource recovery. The Municipality should embark on piloting source separation of waste and scaling it up.
- v. **Lack of funding:** Waste management programs and services need money to operate effectively. However, this sector is underfunded.
- vi. **Public apathy:** Some people don't care about proper waste disposal or don't think it's their responsibility. This can lead to littering, dumping, and other harmful behaviours.
- vii. **Limited access to waste management services:** In some low-income areas with inadequate access as well as rural areas, the collection services do not reach.
- viii. **Corruption and mismanagement:** No particular examples, but difficult to rule out in many sectors. This can lead to waste not being disposed of properly, and funds being misused.

The opportunities relevant for waste management in Nansana Municipality include:

- i. **Circular economy growth:** Waste management can play a key role in the circular economy, where materials are reused and recycled instead of thrown away. This can create new economic opportunities and reduce waste.
- ii. **Renewable energy generation:** Waste can be converted into energy, like fuel briquettes for cooking or incinerated to produce electricity, potentially contributing to reliance on fossil fuels and mitigating climate change via replacement of briquettes for fuel wood and charcoal instead of cutting trees for charcoal.
- iii. **Technological innovations:** New technologies and innovations can improve waste management, making it more efficient, cost-effective, and environmentally friendly.

- iv. **Local, regional and international cooperation:** Working together with others to share best practices, address local, regional and global waste management challenges, and develop new solutions.
- v. **Public-private partnerships:** Collaborations between Nansana Municipality and private companies can improve waste management services, increase funding, and promote sustainability.

Threats to the waste management in Nansana Municipality include:

- i. **Climate change:** Climate change is making waste management more challenging, with increased waste generation, more frequent natural disasters, and changing weather patterns.
- ii. **Lack of comprehensive Legal and Policy Framework:** There is no policy that provide strategies for all types of waste management in Uganda and the legal provisions on waste management are limited.
- iii. **Population growth:** As the global population grows, so does the amount of waste generated. This puts a strain on waste management systems and infrastructure.
- iv. **Limited natural resources:** Waste management competes with other sectors for limited natural resources like water, energy, and land.
- v. **Economic downturns:** Economic recessions can reduce funding for waste management programs and services, making it harder to manage waste effectively.
- vi. **Public resistance:** Communities may resist waste management facilities or policies, and this was revealed by the community members in the areas surrounding the proposed Menvu MRF site. This can be resolved by community engagements and provision of correct information.

In summary, a SWOT analysis revealed strengths in existing infrastructure and community engagement, weaknesses in inadequate funding and public awareness, opportunities in emerging technologies and growing public demand for sustainable practices, and threats from climate change and economic downturns. To address the challenges, it is essential to enhance strengths, exploit opportunities, address weaknesses, and mitigate threats. By developing comprehensive waste management plans, engaging communities, and promoting sustainable practices, Nansana Municipality can reduce waste, promote recycling, and protect the environment for future generations.

2 STRATEGY AND STRATEGY COMPONENTS

2.1 Introduction to the Strategy and Strategy Components

Solid waste management (SWM) is a critical component of urban sustainability, addressing the challenges posed by increasing waste generation due to population growth, urbanization, and industrial expansion. Effective SWM strategies aim to mitigate environmental pollution, safeguard public health, and promote resource conservation through systematic approaches to waste collection, treatment, and disposal. Modern SWM strategies are guided by frameworks such as the waste hierarchy which is reduce, reuse, and recycle which are circular economy principles.

These strategies incorporate diverse components designed to address technical, social, financial, and environmental dimensions of waste management. Key components include a policy and regulatory framework that establishes guidelines and legal structures to ensure compliance and accountability in waste management practices. Additionally, collection and transport services are crucial for efficiently gathering and moving waste from generation points to treatment or disposal facilities. Recovery and promotion of circular economy also play a vital role by encouraging recycling, reuse, and resource recovery to minimize waste volumes and environmental impact.

Other essential components include treatment and ultimate disposal *e.g.* composting, energy recovery, or sanitary landfilling, which ensure environmentally sound waste management. Inclusive participation involves engaging stakeholders *e.g.* government bodies, private entities, informal sectors, and communities in decision-making processes to foster cooperation and shared responsibility. Furthermore, financial sustainability is critical for developing cost-effective models that ensure adequate funding for SWM without overburdening citizens. Lastly, monitoring and data management are pivotal in utilizing data-driven approaches for tracking performance, identifying gaps, and improving efficiency. By integrating these components into a cohesive strategy, SWM systems can be sustainable and aligned with global environmental goals.

2.2 Component 1: Policy and regulatory framework

National Level

Uganda currently lacks an officially approved national policy on Solid Waste Management (SWM). Although the National Urban Solid Waste Management (NUSWM) Policy was drafted in 2017 to cover the period 2015-2030, it has not yet been formally adopted. This proposed policy outlines several strategic approaches, including waste prevention and minimization, promotion of

reuse/recycling/recovery practices, exploration of energy recovery options, and fostering public-private partnerships in waste management. Before final approval can occur, authorities are conducting additional stakeholder consultations and completing a regulatory impact assessment to ensure comprehensive implementation.

Development Plan Integration

The Fourth National Development Plan (NDP IV) for 2025/26-2029/30 incorporates specific waste management objectives that align with broader sustainability goals. Key interventions include reducing waste generation through prevention and recycling initiatives, improving waste collection efficiency, establishing environmentally-friendly sorting and recycling facilities, and enhancing waste management infrastructure to create economic value. These measures aim to transform waste into a resource while generating revenue opportunities, reflecting a growing emphasis on circular economy principles within Uganda's development framework.

Green Growth Strategy

Complementing these efforts, the Uganda Green Growth Development Strategy (2017/18-2030/31) prioritizes efficient waste management systems as part of its sustainable urban development agenda. The strategy targets improved solid waste management in four divisions of Nansana Municipality. It emphasizes climate-smart solutions, leveraging mechanisms like the Clean Development Mechanism (CDM) to support low-emission initiatives.

Principle of Subsidiarity

The Principle of Subsidiarity, is premised on the fact that the delegation of authority best lies in a given organization and for a given decision. The principle of subsidiarity holds that decision-making authority is best placed: (a) where responsibility for outcomes will occur; and (b) in the closest appropriate proximity to where the actions will be taken that will produce the outcomes. Authority ought to be matched with responsibility, because one tends to use authority more judiciously if one knows that they will be held accountable for the results. Moreover, once so matched, both authority and responsibility ought to be situated as closely as possible to operations, so that decisions might be well-informed by the context of real situations. The share of responsibilities following the principle of subsidiarity will warrant the urban authorities (for instance Nansana Municipality) to enforce the organisation of waste generation, storage at the generation area, and payment for waste collection to licensed waste collection companies. The urban authorities therefore, have to provide a conducive enabling environment for the private sector to operate under regulations set by the local authorities. The Central Government would then be responsible for the development of Material recovery facilities (MRFs) and other ultimate waste treatment and disposal facilities.

2.3 Component 2: Collection and transport services

Current Waste Management Practices in Nansana Municipality

Nansana currently lacks a formal waste storage strategy, with residents using various methods such as plastic bags, dustbins, and placement on the ground despite the Public Health Act recommending standardized dustbins. Waste collection and transportation services in all the divisions is managed by a mix of licensed and unlicensed private informal waste collectors, while all divisions still remain underserved due to limited infrastructure capacities by the service providers. Menvu waste management facility is to be developed to serve as the primary site for both waste haulers, but only to be operated as MRF and transfer center. Ultimate waste disposal is to be hosted at another site elsewhere, in collaboration with Government, GKMA and neighbouring entities in line with the subsidiarity principle. Field surveys indicate widespread improper disposal practices, including burning, burial, and illegal dumping. To address this, the strategy prioritizes source segregation, strengthens community sensitization, and expands access to formal collection services especially in informal settlements. Enforcement of anti-dumping bylaws and partnerships with community-based organizations will reduce unsanitary disposal.

It should be noted that waste storage remains a full responsibility of the generator. Nansana Municipality has to play the key role of enforcement of the guidelines. There is need to make more consultations with NEMA about the possibility of licensing Menvu as a waste management site. According consultations with NEMA, more information is needed in regard to developing Menvu MRF as a sustainable waste management facility. Among the concerns of NEMA, is the protection of the wetland, allowing for the activities permitted in wetlands. The physical development plan for Menvu (Annex 1) clearly spells out this. Consequently, more consultations with the developed Menvu area action land-use plan should be pursued, for approval and consequently development.

Proposed Waste Management Strategies

In order to address these challenges, Nansana will implement a structured waste minimization approach (Annex II) prioritizing prevention, reuse, recycling, and recovery. Public awareness campaigns will educate residents on proper storage and sorting practices. Collection services will be optimized through a zoned system, where private operators are contracted to meet strict performance benchmarks, including 90% coverage and twice-weekly pickups. A hybrid fleet using retrofitted tipping trucks and compactor trucks belonging to the Municipality and the Private waste collection companies will optimize waste collection in Nansana. Sustainability will be central, with waste generators mandated to segregate and reduce waste at source. Subsidized door-to-door services in low-income areas will be implemented through community organizations, funded by a cross-subsidy model targeting commercial entities.

Enforcement mechanisms will be strengthened through stricter licensing for waste haulers, penalties for illegal dumping, and a "polluter-pays" fee system to sustain service improvements. To reduce reliance on the Buyala dumpsite for KCCA, the municipality will pilot material recovery facility (MRF) at Menvu for sorting recyclables and promote decentralized composting of organic waste. Progress will be tracked through key metrics such as collection coverage rates, landfill diversion, and resident satisfaction, with annual service reviews ensuring contractor accountability. The expected outcomes include at least 60% reduction in illegal dumping within three years, a 50% increase in waste segregation at source, and full coverage of regulated collection services across all divisions by 2027. This comprehensive strategy balances practicality, enforcement, and sustainability to transform Nansana's waste management system.

2.4 Component 3: Recovery and promotion of circular economy

A robust municipal solid waste management strategy must prioritize equitable participation and systemic resilience to succeed. While Material Recovery Facilities (MRFs) with advanced sorting technologies like AI-driven systems are essential, their effectiveness hinges on reducing contamination at the source. This requires more than color-coded bins; standardized, universally accessible waste separation systems must be paired with multilingual education campaigns and localized incentives, such as tax rebates for high-compliance neighborhoods. Public-private partnerships (PPPs) should go beyond vague collaborations by securing long-term off take agreements with manufacturers—for instance, mandating minimum recycled content in packaging—and stabilizing markets through subsidies. Organic waste management demands a hybrid approach: centralized anaerobic digestion facilities can convert food scraps into biogas for municipal energy grids, but only if odor-control technologies and community engagement address public concerns. Decentralized composting, meanwhile, must be scaled equitably, with mandatory participation in multi-unit housing and neighborhood micro-facilities in dense urban areas. Extended Producer Responsibility (EPR) laws should impose tiered fees on producers based on product recyclability, with revenue directed toward collection infrastructure, while grants help small businesses transition to compostable materials.

Transitioning to a circular economy requires more than aspirational industrial symbiosis networks. Municipality should create tangible incentives, such as tax breaks for industries using waste-derived materials (e.g., construction sectors incorporating 30% recycled plastics) and penalties for non-recyclable product design. Circular hubs for repair and refurbishment must prioritize accessibility through sliding-scale pricing and partnerships with marginalized communities to ensure inclusivity. Public-private funding for start-ups should focus on scalable, commercially viable technologies, such as chemical recycling plants co-located with industrial clusters,

supported by anchor tenants to guarantee demand. Education and enforcement strategies must address equity gaps: Pay-As-You-Throw (PAYT) systems, or cash payments for work in activities of solid waste management, to enable poor households pay for their solid waste collection. Moreover, poor households can support the Municipality by tracking polluters and presenting evidence against which they can obtain some credits, to pay for their solid waste collection. Dumpsite bans on recyclables and organics should be introduced cautiously in a phased manner, coupled with free collection services for source-separated recyclables and partnerships with informal waste pickers to prevent illegal dumping. Finally, progress metrics should expand beyond dumpsite diversion rates to include social outcomes like green job creation and per capita waste reduction. Sustainable funding models such as eco-taxes on single-use plastics, revenue from recycled material sales, and social impact bonds will ensure long-term viability. By embedding equity, adaptability, and collaboration, this strategy reframes waste as a valuable resource. Through recycling, reuse, and upcycling initiatives, it supports green jobs, encourages circular economies, and strengthens climate resilience—especially in vulnerable communities while reducing environmental burdens and unlocking inclusive economic potential.

2.5 Component 4: Treatment and ultimate disposal

Waste Minimization and Recycling Strategies

Nansana will adopt a circular economy approach to waste management, focusing on prevention, reduction, reuse, and recycling (Annex II) through a combination of policy, infrastructure, and community engagement. The municipality will support small-scale recycling enterprises by partnering with local entrepreneurs and cooperatives, providing start up grants, and facilitating market linkages for products such as compost, animal feed, and recovered plastics. To ensure effective waste separation at the source, a mandatory sorting system will be implemented for all households and all institutions, backed by clear guidelines, distributed collection bins, and enforcement through byelaws. Informal waste pickers, who play a crucial role in the recycling chain, will be integrated into formal collection systems to improve efficiency and livelihoods. Public awareness campaigns, developed in collaboration with community leaders, will combine education with tangible incentives—such as reduced waste fees for compliant households—while penalties will deter improper disposal. Instead of relocating fresh food markets, which may simply displace waste, the strategy will introduce segregated waste collection and establish composting site to minimize organic waste. Additionally, alternative fuel initiatives, such as producing briquettes from market and agricultural waste, will be promoted to reduce deforestation. Private sector involvement will be encouraged through tax incentives for businesses that adopt low-waste packaging, while investments in (MRFs) will enhance recycling efficiency and create jobs.

Sustainable Disposal and Processing Solutions

For waste that cannot be reduced or recycled, Nansana Municipality will implement sustainable disposal methods that prioritize environmental protection and resource recovery. Organic waste will be managed through decentralized community composting and small-scale anaerobic digestion, producing biogas for local energy needs while minimizing transport costs. Only after proving demand and logistical feasibility will large-scale composting facilities be considered. For residual waste, mechanical sorting will recover remaining recyclables before disposal, while feasibility studies will assess appropriate thermal treatment options such as pyrolysis or gasification only if waste composition and energy demand justify their use. Owners of land on which solid waste is dumped in Nansana will be identified and issued nuisance notices, coupled with sensitisation of residents to stop illegal waste disposal. If refuse-derived fuel (RDF) production is pursued, long-term agreements with industries will be secured to ensure stable demand and prevent wasted investments. Continuous monitoring through waste audits and key performance indicators (*e.g.*, diversion rates) will allow for adaptive management, ensuring the system remains efficient and responsive to changing waste streams. By combining these approaches, Nansana aims to minimize landfill reliance, reduce pollution, and establish itself as a leader in sustainable urban waste management.

2.6 Component 5: Inclusive Participation

Inclusive participation is vital for equitable and sustainable solid waste management, requiring meaningful engagement of all stakeholders; governments, communities, informal workers, NGOs, and the private sector. The strategy emphasizes co-creation rather than mere consultation, ensuring marginalized groups, including women and youth, have decision-making power. Key actions include formalizing informal waste pickers through legal recognition, fair wages, and safety protections, while addressing potential resistance from formal waste companies through incentives like tax breaks.

To ensure gender and social equity, the strategy mandates 30% representation for marginalized groups in waste committees and provides targeted training and microloans for women-led waste enterprises. Structured participation mechanisms; such as stakeholder mapping, community ambassadors, and transparent grievance systems to strengthen accountability. Behavioral change campaigns, led by local "zero-waste ambassadors," encourage source segregation and public ownership of waste systems.

Performance tracking is embedded through Key Performance Indicators (KPIs), such as the percentage of informal workers integrated into formal systems and improvements in household

segregation rates. Dedicated funding (*e.g.*, 5% of municipal waste budgets) ensures long-term sustainability. The expected outcomes include higher trust in waste services, reduced landfill reliance, and inclusive green jobs to create a resilient system shaped by the community itself.

2.7 Component 6: Financial Sustainability

To ensure a financially viable and equitable solid waste management system, Nansana will adopt a hybrid user-fee model that balances cost recovery with affordability. The strategy promotes cost equity by linking waste charges to the volume and type of waste generated, rather than income level. This ensures that all users contribute fairly to service sustainability. Targeted municipal assistance may still support the most vulnerable without distorting the overall cost-recovery model. Costs should be modelled according to Annex V. Besides, cash for work will be instituted whereby very poor community members can undertake activities in waste management, to be paid so that they can use a portion of their earnings to pay for solid waste collection. Enforcement mechanisms, including penalties for non-payment and incentives for compliance, will ensure high collection rates. This system will be rolled out in phases, beginning with a six-month pilot in high-compliance zones before expanding to the entire municipality, accompanied by continuous public awareness campaigns.

To prevent funding shortfalls and encourage operational efficiency, private operators will receive municipal subsidies only if service costs exceed pre-defined benchmarks due to external factors like fuel price surges. Any surplus revenue will be allocated transparently: at least 60% for service expansion (*e.g.*, new waste bins or recycling facilities), 30% for community education programs, and 10% to an emergency reserve fund. Additional revenue streams, such as a 2% environmental levy on non-recyclable packaging (paid by producers) and public-private partnerships (PPPs) for waste-to-energy or recycling projects, will further diversify funding sources and reduce reliance on municipal budgets.

Financial safeguards, including biannual independent audits, a 5% contingency reserve within the annual waste management budget, and strict performance-based contracts for service providers, will ensure accountability and long-term sustainability. This approach not only secures stable financing but also promotes equity, efficiency, and environmental responsibility across all income levels.

2.8 Component 7: Monitoring and Data Management

To ensure accountable and effective strategy implementation, a three-tier governance framework will be established, combining strategic oversight, technical execution, and community-driven action. A nine-member Steering Committee will be established, chaired by the Mayor and

comprising three council executives, two independent waste experts, two private sector representatives, and two community leaders. Meeting quarterly, the committee will monitor key performance indicators (KPIs) such as diversion rates and cost efficiency—and guide resource allocation and strategic direction. The middle tier will feature a Technical Operations Unit, led by a dedicated Waste Manager and staffed by multidisciplinary specialists in logistics, environmental health, and data analytics. Leveraging the existing local government staffing structure, the Municipal Environment and Public Health Departments will oversee daily implementation, compliance enforcement, and dashboard monitoring. At the divisional level, waste management teams led by designated health assistants or environment officers and supported by trained community liaisons will develop localized action plans, engage residents monthly, and report performance via a central digital system. Crucially, the structure embeds accountability mechanisms; the Steering Committee must publish annual performance reports, the Technical Unit is bound by 72-hour response SLAs for public complaints, and Divisional Teams are required to allocate 5% of their budgets to community education initiatives. Cross-tier feedback loops, mandatory gender representation (minimum 30% in leadership roles), and integration of informal waste pickers into neighbourhood councils will ensure inclusivity and adaptability.

3 NANSANA WASTE MANAGEMENT STRATEGY

3.1 Introduction

The situation analysis indicated a grisly situation of municipal solid waste management in Nansana Municipality. The rapidly changing urbanisation alongside the socio-economic factors have rapidly transformed Nansana into a sprawling Municipality over the recent years. For this reason, a solid waste management strategy and action plan were prepared to contribute to the desired transformation of MSWM in Nansana municipality. The plan targets the waste management stream components which include generation; on-site handling and temporary storage; collection; transportation; processing; recycling and disposal in addition to the management by the institutions and communities.

The approach to solid waste management strategy and plan is underpinned by the concept of waste hierarchy. The waste management hierarchy is a widely accepted set of principles for managing waste efficiently and sustainably, which is evolving into a related and newer circular economy concept (Figure 7 and Figure 8). Waste management hierarchy presents an order of preference in waste management that presents the waste prevention as the most preferred, followed by the 3Rs (reduction, recycle, recovery) with waste disposal as the least preferred.

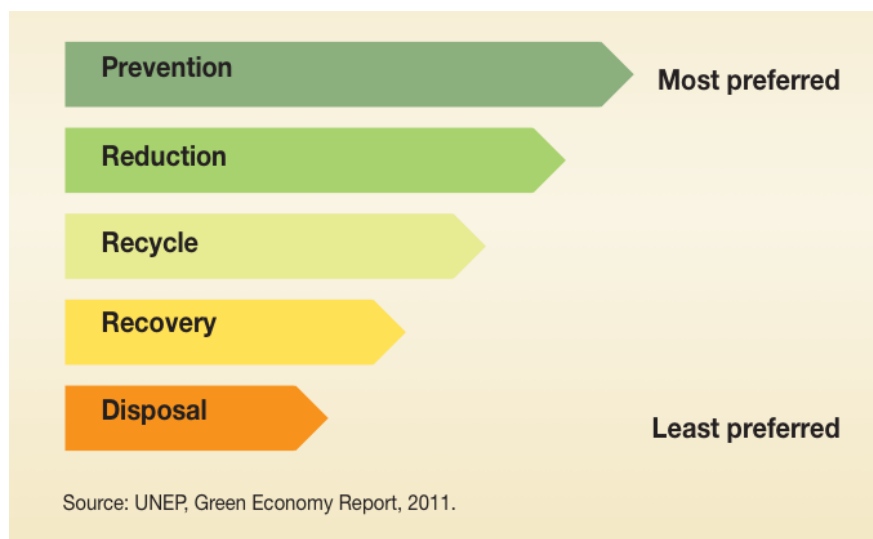


Figure 7: The concepts of waste management hierarchy and circular economy

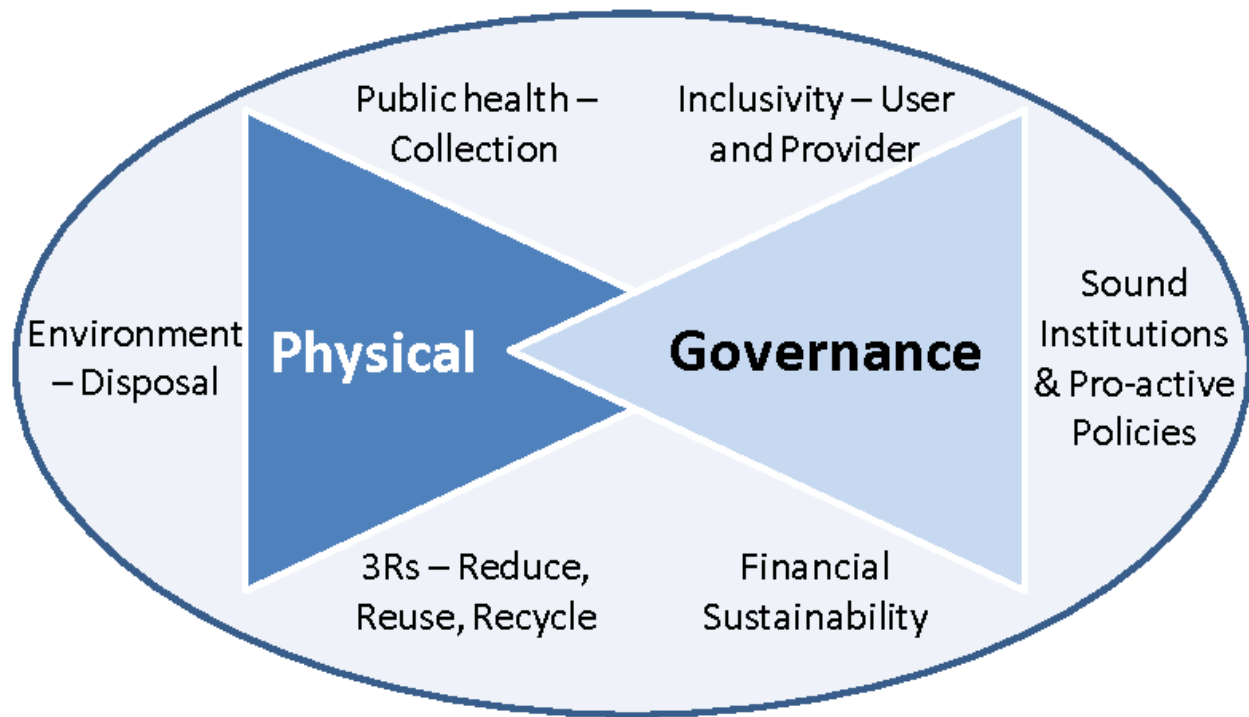


Figure 8: SWM analytical framework

The first triangle comprises the three key physical elements of the Integrated Solid Waste Management (ISWM) system, which are–

- i) **Public health**, which entails maintaining healthy conditions in the Municipality through a good and efficient solid waste management and collection services.
- ii) **Environment**, which entails protection of environment throughout the waste management chain, especially during treatment and disposal.
- iii) **Resource management**, which may be described as ‘closing the loop’ since it entails returning both materials and nutrients to beneficial use, through preventing waste and striving for high rates of organics recovery, reuse and recycling.

The second triangle comprises of the governance features of the ISWM system, which supports sustenance of the first triangle. The governance features entail a system that–

- i) Are inclusive, providing transparent spaces for stakeholders to contribute as users, providers and enablers.
- ii) Financial sustainability, which implies cost-effective and affordable waste management system (Annex V).

- iii) Resting on a base of sound institutions and pro-active policies which implies working policies and relevant institutions.

The aim of the solid waste management plan, is to provide a reliable, sustainable municipal waste collection service to every waste generator in the municipality, promote recycling, ensure that waste is transported and disposed in an environmentally safe and socially responsible manner, and is done in conjunction with the community based waste management systems that apply waste minimization activities (reduction, recycling, composting and reuse) following Annex II.

3.2 Objectives of the Strategy, Vision and Mission Statements

A summary of the vision, overall goal and objectives are summarized in Figure 9.



Figure 9: Vision, mission and goals for Nansana SWM improvement

3.3 Strategic Goals and Objectives

The overall goal of this solid waste management strategy is to develop, implement, and maintain a solid waste management system that is inclusive, innovative, controlled and community based, which minimizes the negative impacts of solid wastes and promotes sustainable growth for excellence. This will be developed through three broad strategic objectives:

- 1) To develop appropriate capacity of the population through awareness creation and sensitisation for efficient implementation of SWM and enable compliance with SWM programmes,
- 2) To finalise the SWM byelaw and build capacity of the SWM institutions for effective and efficient solid waste management,
- 3) To develop a robust solid waste management system with appropriate infrastructure for collection, transport, and disposal, while promoting waste minimization, recycling, and resource recovery. This dual approach will protect public health and the environment while unlocking economic opportunities from reusable and recyclable materials. From each goal and the broad strategic objectives specific objectives were derived which are shown in Table 3.

Table 3: Goals and Objectives for MSWM

Strategic Objectives	Goal 1 Build appropriate capacity at Nansana Municipal Council to address all the above	Goal 2 Have in place a robust SWM infrastructure that achieves at least 60% waste collection Nansana Municipality	Goal 3 Increases public participation, awareness and knowledge to achieve effective implementation of SWM
Objective 1	Build internal capacity within Nansana Municipal council in terms of adequacy and competency	Appropriate and adequate staff for effective operation of the SWM infrastructure	Achieve effective SWM through community cooperation and compliance that ensures public health
Objective 2	Improve internal infrastructure for effective and efficient SWM	Put in place appropriate collection containers, vehicles, improved road network and upgraded waste management facility	Achieve compliance with solid waste management byelaw to mitigate environment pollution
Objective 3	Make MSWM operations accountable, efficient and cost-effective	Achieve optimal performance of collection, transport and disposal system to protect health and the environment	Achieve community based waste management implementing 3Rs and minimize the quantity of waste collected, transported and dumped
Objective 4	Develop partnership with all stakeholders	Partner with private service providers in the SWM system	Achieve compliance with national waste management regulations (recycling, reuse and recovery)

To achieve the above vision, these Goals and Objectives are addressed with actions in seven thematic areas: (1) Policy and legislation, (2) Information, Education and Communications (IEC), (3) Infrastructure (4) waste reduction – 3Rs, (5) Capacity building, (6) Awareness, (7) Partnerships.

3.4 Time Frame

This strategy covers the 5-year period 2025/6-2030/31. It aligns with the Municipal Development Plan by contributing to key objectives on environmental sustainability, urban resilience, and improved service delivery. It will be monitored annually by the Municipal Council and MLHUD, with a mid-term review in financial year 2027/28 to ensure responsiveness to evolving conditions.

3.5 Scenario Analysis and Management Options

3.5.1 Scenario Analysis

The situational analysis underpinned the development of the scenarios. This was considered better than hypothetical scenarios that are not backed by any data. This was guided by the fact that future waste generation trends will depend on population growth as well as the level of prosperity (economic status of the waste generators). The scenarios were evaluated to choose the most appropriate sets of actions, based on cost effectiveness (Annex V), environmental conservation and public health concern. Four scenarios (Table 4) are considered;

- (i) Scenario 1 – reflecting the current situation – ‘do nothing’ option;
- (ii) Scenario 2 – presents the minimum conditions to comply with Uganda Public health regulations;
- (iii) Scenario 3 – presents an intermediate option between scenarios 2 and 3.
- (iv) Scenario 4 – represents the ideal most advanced management system.

Waste sorting and composting have been suggested to be introduced within the context of waste management hierarchy minimization component as waste diversion tactics reducing waste loads for final disposal. The ultimate targets were to involve the community at 25%, 50% and 75% initially at selected wards that will be replicated by other wards. Additional notes are provided hereafter.

Hazardous wastes: Hazardous waste from healthcare facilities and fuel stations was assessed. It should be contained to avoid harm and its treatment and disposal should be undertaken by companies licensed to handle hazardous wastes. Healthcare waste from hospitals, clinics, and pharmacies must be segregated at source and treated through incineration, autoclaving, or other approved methods based on waste type.

Electronic wastes: Although not assessed in these study-wastes should be separated from the waste stream, stored and sent to the national electronic waste management centre at National Enterprise Corporation (NEC).

Waste collection vehicles: Waste collection requires new vehicles and the type and numbers will depend on the complexity of the routes, accessibility and waste quality and waste quantities. See appendices 2 and 3 to guide selection of waste collection vehicles. It is prudent that the assessment of vehicles and advanced equipment be done by the Ministry of Works and Transport who will recommend their suitability. Guidance on waste collection vehicles is presented in Annex III and on waste management equipment in Annex IV.

Waste processing/treatment: Waste processing, composting, sorting and compaction were considered. Transfer station and handling of recovered wastes is recommended in Scenario 4.

Waste management facility: The site in Menvu is recommended for development, including recovery and recycling of waste; in addition to fencing, weighbridge and separate collection of bulky and hazardous wastes in some scenarios. The suggested developments are presented in the physical plan in Annex 3.

Table 4: Waste Management Scenario Sets for Nansana Municipality

Scenario 1(do nothing)	Scenario 2	Scenario 3	Scenario 4
Domestic collection			
- Waste bags/sacks - Direct emptying from containers - Mixed wastes collected 1-2 times a week - Only one municipal truck in use plus some of the private sector trucks.	- In addition to scenario 1 introduce waste sorting at home in ¼ of the wards - Partner with waste pickers to take the recyclables - Collect wastes 2 times a week using 2 municipal trucks + private sector trucks.	- In addition to scenario 1 introduce waste sorting at home in ½ of the wards - Partner with waste pickers to take the recyclables - Collect wastes 3 times a week using 3 municipal trucks and private sector trucks	- In addition to scenario 1 introduce waste sorting at home in ¾ of the wards - Partner with waste pickers to take the recyclables - Collect wastes 5 times a week using 4 municipal trucks and private sector trucks
Small businesses collection			
Waste containers privately taken to collection points Daily collection	As in scenario 1	- Bins for dry wastes and collect 2 times a week - Partner with waste pickers to take the recyclables	- Bins for dry wastes and wet wastes - Waste collection 3 time a week - Partner with waste pickers to take the recyclables
Public markets			
Wastes dumped on open ground and collected infrequently (once a week – Every Wednesday)	Upgrade collection points and collect 1 time a week	Upgrade collection points; Waste collection from designated areas to be done 2 times a week	- Upgrade collection points - Provide containers for dry recyclables - Collect 3 times a week
Institutional wastes			

Scenario 1(do nothing)	Scenario 2	Scenario 3	Scenario 4
Not organized at present	As in scenario 1	• Sorting at source • Schools composting • Selling of recyclables	• As in scenario 3 in addition to school vermicomposting • School vegetable gardens to consume the composts
Collection of hazardous wastes			
Not organized at present	• Set up bring centres for batteries, bulbs, chemicals containers • Hospitals and healthcare wastes: incinerate at hospital.	As in scenario 2	• As in scenario 2 in addition to containers in commercial areas and service stations. • Take solid hazardous waste to Nakasongola for incineration • Take toilet (liquid) waste/sludge hazardous to Lubigi combined wastewater and faecal sludge treatment plant operated by NWSC
Transport			
One truck for the Municipality used at the moment	Additional vehicles would be required for adequate coverage; At least two 20-ton trucks, including a compactor truck.	Three 20-ton trucks with the addition of 2 Auto-rickshaws for each division for poor access areas and routing analysis	As in scenario 2 with the addition of - Two more 20-ton trucks - 5 rickshaws for each division for poor access areas and do routing analysis
Processing			
Not organized at present	• Family backyard composting in ¼ of the wards • School composting	• Family backyard composting in ½ of the wards • School composting	• Family backyard composting in ¾ of the wards • School composting and vermicomposting • Municipal windrow composting • Dumpsite sorting transfer station • Municipal windrow composting
Waste Disposal			
• 2-5% of generated waste collected • Un-weighed mixed waste dumped • All collected wastes except those taken by waste pickers.	• Increase waste diversion to composting at home, schools and MC level • Upgrade Menvu into an appropriate waste management facility	• In addition to scenario 2, develop Menvu into an appropriate solid waste management facility, engineered with leachate treatment.	• In addition to scenario 3 introduce materials recovery and bulk waste diversion; build a transfer station for sorting waste and install weighbridge at the entrance of the MRF. • A large spreader/compactor tractor at the waste management facility.

- Institution and regulation issues of structural improvements, training/capacity building, byelaws, IEC are considered cross-cutting and are applied in all the scenarios analysis.
- The plan and strategy is based on population growth by 5% and GDP growth by 1.9-2% by the year 2028. By 2028 it is planned for available resources to be adequate for handling solid waste generation of 600 tons/day.

Trucks requirements: One additional new truck to be purchased per year (Assuming 20 tons each (loaded to 80% capacity), and the rest 4 in year 1 (to reach the required 5) belonging to the private sector; to reach a minimum of 80% collection, with each vehicle delivering 2 trips to the waste disposal site. It is also necessary to consider one vehicle on standby or due for repair.

For the implementation of measures to address the solid waste management, these were done using pairwise ranking that was further analysed as shown in Table 5.

Table 5: Analysis of waste management measures

Initial ranking based on pairwise method	Final ranking
i) New trucks and equipment	i) Collection: trucks; equipment, street litterbins, 3Rs
ii) 3Rs and develop own waste facility in Menvu	ii) Develop own MRF and final disposal at Menvu
iii) Improve Public-Private Partnership on MSWM (PPP)	iii) Fund solid waste as resource plan and sensitization and awareness
iv) Scale-up IECs (community and staff)	iv) Initiate Public-Private Partnership on MSWM
v) Collection points upgrade.	v) Gazette and upgrade of collection points
vi) Staffing, enforcement, byelaw	vi) Byelaw, scale-up enforcement and municipal court
vii) Fund waste as resource plan	vii) Institutional capacity building

3.5.2 Presentation of the favoured scenario

Recommendation of the preferred scenario was based on its likely cost, potential funding and its likely effects as presented in Table 6. Conclusions on selection are from the total scores based on the assessment criteria displayed above (Table 6). The highest score is for scenario 3 and therefore it will be developed into action plans for implementation. Scenario 3 presents the moderate level of investment where the cost is higher than that of scenario 2 but lower than that of scenario 4.

Table 6: Chart for scenario selection

Criteria	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Total cost	4	2	2	1
Capacity to collect more waste than at present	1	2	3	3
Capacity to collect at least 60% of waste by 2028	0	1	2	2
Capacity to minimize waste	0	2	2	2
Capacity to reduce environmental impacts	1	2	3	3
The potential for social inclusion	1	1	4	1
The level of public support	0	3	4	2
The need for public cooperation	0	3	3	2
Is institutional capacity able to cope with scenario?	4	2	1	1
Total	11	18	24	17

The cost is offset by its high contribution in waste minimization through recycling and reuse and also the contribution to the protection of public health and environment conservation.

4 NANSANA WASTE MANAGEMENT ACTION PLAN

4.1 Introduction

Taking into consideration the aspirations of Nansana Municipal Council, the inhabitant community and stakeholders and drawing information from the waste characterisation and baseline study, and meetings, an overall vision was proposed as presented in Figure 9 and shown again below.

“A clean, garbage-free Municipality of Choice”

And the mission

To deliver inclusive and quality people-led solid waste management services and promote opportunities for social empowerment and economic development

With the following strategic objectives

- i) Build capacity of Nansana Municipality on MSWM,*
- ii) Increase MSW collection to at least 60%,*
- iii) Increase public participation, community awareness and knowledge for effective and efficient MSWM,*
- iv) Establish robust infrastructure for MSWM in Nansana Municipality.*

The seven thematic areas outlined in this Section guided the selection of project options. The intervention projects will be a five-year plan and the activities. The intervention summaries are provided hereafter and the costed interventions and activities (Table 8). The total implementation cost over the five-year period has been estimated at **UGX 10,265,728,000 (Uganda Shillings, Ten billion two hundred sixty-five million, seven hundred twenty-eight thousand shillings only)**. This is equivalent to **US\$ 2,774,521 (United States Dollars Two million seven hundred seventy-four thousand five hundred twenty-one only)**.

Thematic areas: (1) Policy and legislation; (2) Information, Education and Communications (IEC); (3) Infrastructure; (4) Waste management hierarchy; (5) Capacity Building; (6) Awareness; and (7) Partnerships.

4.2 Indicative Costs and Scheduling

Below are preliminary cost estimates of various solid waste management plans. These preliminary costs are only indicative. A more elaborate costing could be done before implementing each intervention activity. Indicative costs of proposed solutions are displayed in Table 7 and Table 8.

The funding roadmap for the development of the Menvu Waste Management Site into a Material Recovery Facility (MRF) and Transfer Station spans from February 2025 to June 2030, with a total budget of UGX 1,815,657,000 (USD 490,718). The roadmap is structured in three phases. The short-term phase (2025–2026) focuses on establishing foundational infrastructure and policy frameworks, including environmental and social impact assessments, construction of pilot MRF facilities, procurement of collection vehicles, and policy enforcement such as licensing informal waste pickers. Funding for this phase is expected mainly from a World Bank/GKMA grant (60%), supplemented by contributions from Nansana Municipal Council (20%) and private sector partnerships (20%). The medium-term phase (2027–2028) aims to scale recycling and community engagement through MRF upgrades incorporating advanced sorting technologies, support for community recycling groups, and multilingual awareness campaigns with school composting clubs. Funding sources diversify to include green bonds (40%), extended producer responsibility (EPR) fees (30%), and user fees (30%). The long-term phase (2029–2030) targets financial sustainability and advanced waste processing, including a waste-to-energy pilot, landfill collaborations, and implementation of digital real-time waste monitoring systems. Climate finance (CDM) is expected to cover half of the costs, alongside public-private partnerships (PPPs) with recyclers and municipal reserve funds. Governance includes a Mayor-led steering committee with regular reviews and transparency measures. Risks such as licensing delays and low fee compliance are addressed with proactive consultations and social incentive programs.

In addition to the identified funding sources, the project could explore other potential funders to diversify and strengthen financial support. These may include bilateral development agencies such as USAID or the German GIZ, international environmental funds like the Global Environment Facility (GEF), and climate investment funds such as the Adaptation Fund. Foundations and NGOs focused on environmental sustainability, for example the Rockefeller Foundation and the Bill & Melinda Gates Foundation, could also be interested in supporting solid waste management projects. Moreover, partnerships with private sector companies through corporate social responsibility (CSR) programs could provide supplementary funding or in-kind support. Crowdfunding and local community financing mechanisms may further engage residents and create shared ownership of waste management initiatives. Strategic engagement with a varied mix of funders will enhance the resilience and scalability of the Menvu Waste Management project.

Table 7: Nansana Municipal Council Solid Waste Management Intervention Projects

Project Name	Municipal Solid Waste Management Infrastructure Development
Location	Nansana Municipality, Wakiso District
Number of Beneficiaries	706,439
Estimated cost	UGX 10,265,728,000 (Equivalent to US\$ 2,774,521)
Time Frame	2025/6-2030/31
Possible Source of Funds	Government of Uganda, GKMA, World Bank, Private Sector
Community Contribution	Waste minimisation activities and labour

The annual costs are estimated at UGX 1,637,918,000 in Year 1; UGX 3,053,867,000 in Year 2; UGX 1,506,280 in Year 3; UGX 1,970,048,000 in Year 4 and UGX 2,097,615,000 in Year 5.

Table 8: Indicative costs and scheduling

Recommended intervention	Activities	Responsibility	Cost / yr (UGX)'000	Total Cost (UGX)'000	Indicative timeline and Budgets				
					Yr1	Yr2	Yr3	Yr4	Yr5
Generation, Collection, Transportation									
1. Generation and primary collection				1,489,185					
1.1 Community mobilization, awareness and training	1.1.1 Awareness promotion and training	Public Health Department	-	109,500	54,750	36,500	18,250		
1.2 Community based waste management systems ¹	1.2.1 Support formation of community recycling and reuse economy		-	43,800	29,200	14,600			
	1.2.2 Organisational support to social inclusion efforts; e.g. waste pickers, women groups		19,345	58,035	19,345	19,345	19,345		
	1.2.3 Support to schools composting		36,500	182,500	36,500	36,500	36,500	36,500	36,500
	1.2.4 Schools waste minimization club	MC/Schools	36,500	182,500	36,500	36,500	36,500	36,500	36,500
1.3 Micro-financing	1.3.1 Micro-financing community groups (8 groups; 2 per division)	Finance Department	36,500	584,000	292,000	292,000			
1.4 Improvement of market waste collection	1.4.1 Secured market collection point	Engineering department	99,645	99,645	99,645				
	1.4.2 Operation of the collection site	Public Health Department	6,205	31,825	31,825	31,825	31,825	31,825	31,825
1.5 Commercial waste sorting	1.5.1 Bins for dry recyclable wastes = 700	Waste generators		10,220	10,220				
1.6 Collection vehicles ²	1.6.1 Auto-rickshaws ³ (Four)	Engineering department	14,965	59,860	59,860				
	1.6.2 Tractor and trailer (Scissor type) ⁴ = 1								
	1.6.3 Trucks ⁵ = 5								
2. Secondary Collection and Transport				5,765,511					
	2.1.1 Compactor truck = 1	Engineering Department	219,000	219,000	219,000				
	2.1.2 Twenty (20) ton-trucks = 4		365,000	1,460,000		365,000	365,000	365,000	365,000

¹See appendix 1 on waste reduction strategies.

²See information on waste collection vehicles in Annex III

³See section 2.1.1 this Table

⁴See 2.2.3 in this Table

⁵ See 2.1.2 in this Table

Recommended intervention	Activities	Responsibility	Cost / yr (UGX)'000	Total Cost (UGX)'000	Indicative timeline and Budgets				
					Yr1	Yr2	Yr3	Yr4	Yr5
2.1. Improvement of collection and Transportation	2.2.3 Scissor type Tractor and trailer = 1		164,250	164,250	164,250				
	2.1.2 Auto-rickshaws = 4 (400kg capacity) ⁶		-----	-----	-----				
	2.1.3 Street Bins = 100			10,585	5,293		5,293		
	2.1.5 Plan waste collection points and produce waste collection route chart. Map of optimised routing	Physical Planning		18,250	18,250				
	2.1.6 Procure waste collection tools and equipment	Public Health Department		73,000	73,000				
	2.1.7 Procure waste workers PPE			18,950	18,950				
	2.1.8 Upgrade collection routes within the urban area =25 km	Engineering department		3,102,500		73000	547,500	912,500	912,500
2.2. Improvement of waste transport efficiency route planning	2.2.1. Support for systematic infrastructure and route planning using modelling software			29,200	18,250	7,300	3,650		
	2.2.2. Route Chart management/supervision		Public Health Department	24,455	122,275	24,455	24,455	24,455	24,455
2.3. Fleets management	2.3.1 Preventive maintenance	Engineering Department	10,950	54,750	10,950	10,950	10,950	10,950	10,950
	2.3.2 Repairs		76,650	383,250	18,250	36,500	73,000	109,500	146,000
	2.3.3 Spare parts			766,500	36,500	73,000	146,000	219,000	292,000
Disposal									
3. Development of the waste management facility at Menvu				1,815,657					
3.1 Do ESIA for the Menvu site	3.1.1 Procure a consultant	MC/Engineering Department	80,191	80,191		80,191			
3.2 Development of the Menvu SWM site	3.2.1 Procure a contractor			165,966		165,966			
3.3 Menvu site protection and management	3.3.1 Initial management costs			584,000	73,000	73,000	109,500	146,000	182,500
3.4 Menvu equipment	3.4.1 Various equipment for MRF			985,500		985,500			
Institution, Legislation, Finance									
4. Capacity Building				386,535					
4.1. Strengthening governance, planning, financial and technical	4.1.1 Training of MC management staff	Nansana Municipal council, offices of Town Clerk,		112,420	56,210	56,210			
	4.1.2 Training technical staff on solid waste data collection and documentation including projections, modelling, RS-GIS, etc.			63,570	31,755	31,755			

⁶See section 1.6.1 in the Table

Recommended intervention	Activities	Responsibility	Cost / yr (UGX)'000	Total Cost (UGX)'000	Indicative timeline and Budgets				
					Yr1	Yr2	Yr3	Yr4	Yr5
capacity of the Municipal Council	4.1.3 Training finance staff on better financial planning resources allocation, cost recovery, optimisation and mobilisation	Social services and Environment		20,075	20,075				
4.2. Enhancing capacity of the public to participate in solid waste management	4.2.1 Training of waste pickers and handicraft makers			89,525	17,885	17,885	17,885	17,885	17,885
	4.2.2. Training of local artisans and craftsmen			54,750		54,750			
	4.2.3. Public mobilisation and awareness activities			46,335	16,000	10,280	10,075	5,000	5,000
5. Legislation				109,500					
2.1. Prepare MSWM Byelaws	5.1.1 Finalise the solid waste Management byelaw	MC (on-going)		109,500	109,500				
6. Information, Education and Communication (IEC)				182,500					
6.1. Prepare IEC document	6.1.1 Preparation of IEC document for NMC	Municipal Council		182,500	36,500	36,500	36,500	36,500	36,500
7. Comprehensive Data Collection and Documentation				516,840					
7.1. Data collection and documentation	7.1. 1 Data collection and compilation for one year. Projections, modelling.	Environment, Public Health, Engineering Departments		459,170		459,170			
7.2. Equipment	7.2.1 Procurement of computers and a server for solid waste database	Office of Town Clerk		57,670		25,185	19,345	13,140	
7.3. Costing	7.3.1 Do a comprehensive solid waste collection cost calculations ⁷	Engineering Department	0	0	0	0	0	0	0
Total (UGX)				10,265,728	1,637,918	3,053,867	1,506,280	1,970,048	2,097,615

⁷See sample calculation in Appendix V

4.3 Recommendations

Given the disparities, a one-size-fits-all approach would be ineffective and interventions may incorporate several aspects like;

- a) Targeted Collection Services: High-generation areas (Nansana, Nabweru and parts of Gombe) may need more frequent waste pickups, while low-generation zones (Busukuma) could benefit from community-based waste reduction programs.
- b) Public Awareness Campaigns: Promoting waste segregation and recycling in high-consumption areas could reduce landfill dependency.
- c) Infrastructure Investment: Expanding composting or waste-to-energy facilities could help manage a large proportion of the 508 tons/day efficiently, particularly in urbanizing divisions.
- d) Waste source-segregation: Each household should have at least two bags to enable source-segregation of waste and its collection and transport to facilitate resource-recovery.
- e) Keep off scavenging animals: Keep the waste in sealed containers or in areas not accessible by scavenging animals such as dogs, to avoid scattering the waste and dog bites.
- f) Increased outreach, sensitization and awareness creation: The Municipal council should facilitate health inspection workers to step up the sensitization, and awareness raising on solid waste management and general sanitation and hygiene in communities in the municipal council.
- g) The municipal council authorities should provide communal containers within communities for the household to use as storage point of collection of waste by municipal and private waste collectors.
- h) Capacity building: The municipal council should build the capacity of technical staff, in waste recycling, planning, logistics and fleet management. The municipality should also build the capacity of community members on waste segregation and their responsibility to segregate, temporary storage, recycling and payment for waste collection services.
- i) Improved infrastructure: The Municipality should invest in infrastructure for waste management, including primary and secondary collection vehicles, and waste bins to facilitate waste segregation in public places and market areas. Besides, the Municipality should improve roads accessed by waste collection trucks so that vehicle tears and repair costs don't escalate.
- j) Price setting and regulation: The municipal council should waste collection fees commensurate with people's affordability levels, and include in it the MOUs with private waste collectors.
- k) Services for the underprivileged: The Municipality should establish modalities for the very poor, *e.g.* cash for work, in order for them to earn some money to pay for their waste collected.
- l) GIS application in truck routing: Optimised waste collection routes should be prepared by Municipality and shared with the waste collectors in order to minimise expenses on fuel.
- m) IEC materials: The Municipality should prepare and disseminate IEC materials for information dissemination to community members about the do's and don'ts in waste management.
- n) Enact the by-laws: The Municipality should finalise the enactment of the by-laws to help local leaders in management of solid waste materials.

- o) Collaboration: NMC should collaborate with private sector, NEMA, KCCA and neighbouring municipalities to establish conducive frameworks for waste collection and transportation.
- p) Subsidiarity principle: Beyond waste collection and transport, the central government should develop sites for waste management, catering for recycling and safe disposal. In siting waste management and recycling/disposal facilities, a distance of 25 km (one way) is suggested.
- q) Involve Non-Governmental Organizations (NGOs) and Community based Organisations (CBOs): NGOs and CBOs are effective in sensitizing and creating awareness of the masses. One such an NGO specialised in community composting is *GiveLove* Uganda, which works in Kifumbira, Mulago III in Kampala.

Capacity building of local management in Nansana municipality has already been recommended and should be arranged as a matter of urgency. The prioritized actions and urgency needs in the proposed plan is outlined below in Figure 10.



Figure 10: Prioritised actions and urgent needs

Community based solid waste management model is proposed where the community is considered as a core actor in MSWM. Community based waste management system can benefit from the **Parish Development Model funding** that could target using waste as a resource, thus creating business for the community that will increase household income. Within the community, various ways or activities can be designed to transform attitudes and behaviour to favourable ways for improved solid waste management.

Local forums can be used to involve all stakeholders. The forums can accommodate government institutions, NGOs, CBOs, politicians, activists, teachers, students and people from all walks of life to participate. Participants will share and highlight their solid waste management problems with a focus on primary collection and will devise solutions. Facilities at schools or Community Centres could be used as sites for awareness creation.

Advocacy: In the forums, advocacy by prominent individuals or groups to introduce appropriate models in different areas or targeting particular stakeholders can take place

LC1 meetings: The meetings with the households of the targeted problem areas should be organized to motivate and train the community about solid waste disposal system and sensitize them about harmful effects caused by poor handling of the waste that include littering.

Auto-Rickshaw Services: Collection of solid waste from households in poor access areas to transport to Truck Points should start after the LC1 meetings. Allocate 2 auto-rickshaws per division. Other means like handcarts and tricycles may also be considered.

Waste Segregation: The sorting of wastes to segregate organic and non-organic materials will take place to prepare materials for composting and also for recycling. Segregated wastes should be put in separate-coloured bins. In order to promote accountability and efficiency, all households and businesses must segregate waste at source separating recyclables, compostables, and residuals. Only sorted waste will be collected. Waste pickers and community-based recyclers will support secondary sorting and recovery, focusing on enhancing the value chain for recyclables and compost production.

Composting: Segregated food/green waste in a particular quantity will be treated in the specific sheds in a built container for composting. Compost making process will take time of 8 weeks by natural process and can take 15 days with effective microorganism (EM) Technology. In Nansana schools are appropriate for implementing composting as a starting point before venturing to households.

Micro-financing: Local artisans/ craftsmen, waste pickers or community groups should be financially supported on micro-loans with favourable repayment schemes. They should be trained to make waste bins for households, small businesses, hotels and restaurants and larger containers. Mechanics and motor electricians should be trained (skilled) and supported to repair the municipality waste fleets.

The community mobilisation, sorting, composting and recycling scheme phased activities is summarised in Figure 11.

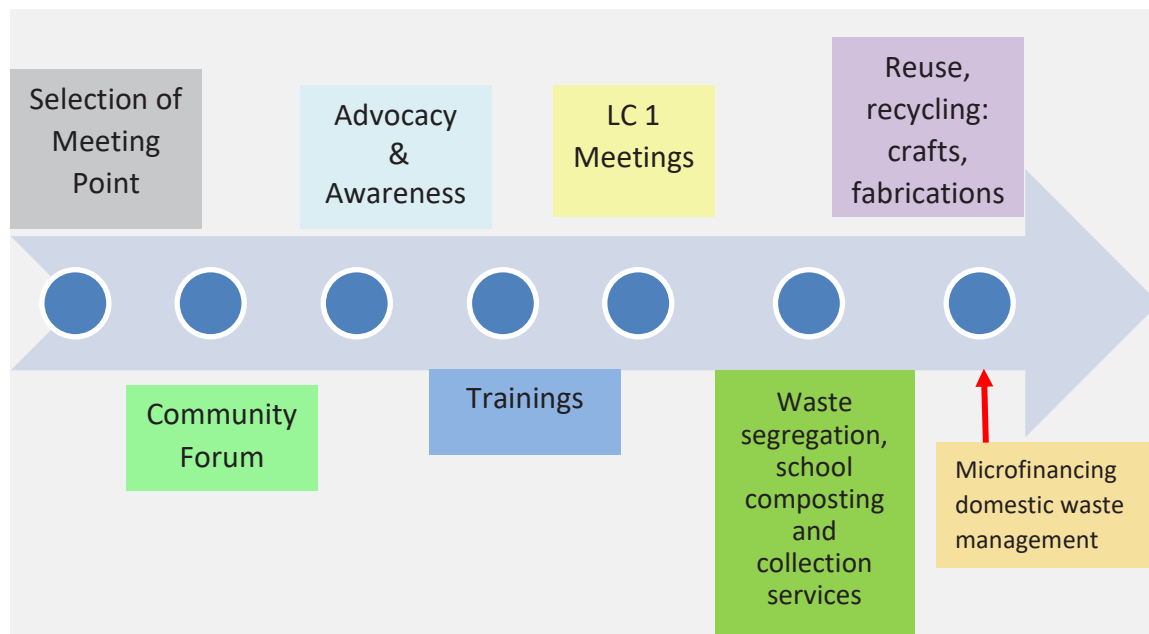


Figure 11: Community Mobilisation Timeline

You can incorporate waste workers of all levels at an appropriate stage in the flowchart above, especially stages 2 to 5. Sweepers and garbage pickers orientation and training component is very important. The training should include topics on grading and separation of domestic waste, economic benefits, social benefits, health hazards mitigation and the importance of working as a group.

Waste Collection: Auto-Rickshaws have been recommended as collection vehicles that will receive wastes directly from households or emptied by paid workers. The auto rickshaws can reach a capacity of 400 kg and can handle wastes from hard to reach areas and convey to the truck points or take them directly to the disposal sites.

The waste route must be mapped clearly displaying the primary (for trucks) and secondary (for auto rickshaws) routes. This will form the basis for the waste collection route chart.

Final Disposal; Nansana municipality does not have an organized final disposal site. Thus, the land that was acquired at Menvu should be developed into a waste management facility for use as a matter of urgency.

Physical Planning: A new physical plan should be prepared that is inclusive of solid waste management infrastructure. The spatial plan should consider land use suitability where land use demarcations indicating solid waste collection sites, waste transportation routes, waste management facility and the major waste generation areas are mapped.

Social inclusion: Considering the waste pickers and community groups as partners in waste management should be considered. For example, formalisation of the activities of waste pickers will enable the municipality to control their activities.

Partnership: Partnership with the private sector should be explored at the different stages of the waste stream with the objective of improving cost effectiveness that will improve the waste management in general.

5 MONITORING AND EVALUATION FRAMEWORK

5.1 Overview

This Monitoring and Evaluation (M&E) Framework will be part of the entire solid waste management plan for Nansana Municipal Council and will specifically focus on the proposed interventions. The M&E framework is open to modifications as deemed necessary or needed to suit particular circumstances as interventions are being implemented and as additional information may become available for the key stakeholders at all levels of implementation.

Monitoring and evaluation of the implementation is particularly important in view of the fact that the implementation will be done with focus on community-based management and in an inclusive manner involving all key sectors, agencies, other stakeholders and also the financing modalities. M&E will be important in checking whether the objectives of the plan are being realised, they are materialising, and whether the management approach is on course as well as the anticipated benefits. Furthermore, it will allow for lessons to be learned during the implementation of interventions that will provide information for the future.

5.2 Objectives of the Monitoring and Evaluation

The strategic objective of monitoring and evaluation is to inform the MHLUD and NMC regularly and systematically track progress of implementation of the solid waste management plan. This will enable the NMC, Local Governments and other stakeholders to know whether and understand how the planned activities have been undertaken and the general use of resources and attainment of results including the processes. The major M&E functions shall be conducted by the NMC Secretariat and MHLUD offices.

5.3 Monitoring and Evaluation Reporting Requirements

The solid waste strategic plan forms part of the input to the overall Municipal Development Plan and progress reporting. Therefore, it will be periodically reported within the Municipal Joint Budget Performance Reviews which is based on quarterly basis involving political leaders at all levels, Municipal headquarters and Division technical staff as well as key stakeholders including participating development partners.

The monitoring and evaluation teams shall follow the detailed M&E implementation requirements. These will include:

- Progress and activities reports, produced by implementing departments of the NMC;
- Quarterly and annual reports compiled by the leading departments;
- Emergency reports that will be produced depending on where the request has been placed;
- Specific reports produced by the NMC and MHLUD as may be requested for by the District, Donor, Government and other agencies.

The reports will address mainly the extent of implementation of the interventions, successes and challenges encountered. Routine monitoring and supervision shall be a function of NMC teams. The main evaluation shall be conducted at mid-term and end of the investment plan by the MLHUD.

5.4 Mid and End of Term Evaluation

The mid and end term evaluation review of the municipal solid waste management plan will be conducted through a highly participatory approach involving all stakeholders in the entire process.

5.5 Stakeholders Monitoring and Evaluation

The stakeholders at various levels must be involved through their representatives and structures. The Divisions, Wards, Cells with intervention projects must be adequately represented during the process. In all these various levels, NMC will coordinate and will consolidate all the information and make available to the stakeholder forum. However, at the Municipal Council level, the relevant departments will ensure that it is also reported to the District Council.

To avoid duplication of monitoring and reporting and to maximize synergies, the present reporting system in the Municipal Council should operate, but the reporting system may be reviewed as well.

5.6 Communication and Feedback Strategy

It is recognised that the attainment of an inclusive approach to management planning is also hedged on the behaviour change and communication. It is, therefore, important that the feedback mechanisms and communication is put in place. This will reinforce the following:

- **Participation:** The importance of participation of all stakeholders in the implementation of this plan, its ownership and sustainability.
- **Information dissemination:** support and enhancement of information dissemination in order to effectively promote the implementation of the solid waste management plan and maximisation of inter and cross-sectoral/governmental communication and coordination.
- **Mobilisation:** mobilisation of all stakeholders at all levels.
- **Behavioural change:** there are many aspects of solid waste handling and associated protection of health and the environment that require attitude change. Communication provides how to reach out to everyone.
- **Targeting:** the communication will enable to reach out to different groups with different objectives for each group including potential beneficiaries of different categories.

Project Management Framework (PMF): This is a tool to organize results of the monitoring and evaluation processes. The PMF is to link what you will monitor with how you will do it. This is applied

from the start of a project, may be updated annually, as required and is used for baseline collection and later for comparison with actual progress. Example of PMF format is shown in Table 9.

Table 9: Project monitoring matrix

Level	Results	Performance Indicators	Data source	Collection methods	Frequency	Responsible	Data use	Baseline	Target
Impact									
Short-term 1.0									
Medium-term 1.1									
Output 1.1.1									
Repeat for all results									

5.7 Risk Assessment

Only a preliminary level risk assessment plan framework is possible at this stage. It is notably inspired by the threats identified during the stakeholders' workshops at various levels and during the field situation assessment. This implementation risk assessment can be further examined during the annual work planning stages and at quarterly work planning for the NMC, where some of the detailed issues are cleared and pointed out and recommended way forward are better known. Table 10 provides an overview of the preliminary possible risk assessment.

Table 10: Risk Assessment Format

Inputs/ Level	Activity	Risk factor / constraint	Possible impact	Potential mitigation measures
Interventions planning and implementation	Definition of all intervention, prioritisation of actions and implementation modalities.	• Unpredictability of funding all components of the strategy • Tendencies of delays and poor governance • Inadequate coordination between departments/sectors and Divisions • Low-level of buy- in/ up-take by individual departments/ sectors and Divisions or Wards.	• Delays in overall progress or in some areas of the interventions • Discourages private sector participation • None or incomplete agreement on appropriateness of intervention, inputs/ benefits for each department/sector, community.	• Good governance measures are put in place or operationalized. • Avoid bureaucratic delays
		• Beneficiaries are not adequately informed of choices	• Resistance to intervention implementation and resultant major delays • Poor cost-effectiveness of interventions/ design.	• Importance of fully involving respective communities especially their local leadership at an early stage of an intervention.

Inputs/ Level	Activity	Risk factor / constraint	Possible impact	Potential mitigation measures
				Consolidate all existing data; start with improvement of monitoring systems as priority.
		Impacts of hazardous wastes emerging	Hazardous wastes mixed with other wastes makes them unusable.	Allowance for hazardous wastes in the final design and inclusion of mitigation measures
Implementation and operation	Inclusion of all operational needs of each department	Finalisation and implementation does not fully cater for all the relevant departments and beneficiaries expectations	The worth of the interventions are not realised and benefits are not optimised.	Need for inclusion for all stakeholders at relevant points of the Plan, in an activity and in whatever aspect deemed beneficial.
	Implementation	Resistance from different stakeholders	Delays for implementation.	Transparency, accountability and appropriate communication
	The operation of the solid waste Management plan	Domination by one or more department(s) or level of Municipal Council	Leads to marginalisation of other departments/ sector(s) or other level of local governance	Open system of management

5.8 Monitoring Instrument

Here below is a proposed form for monitoring the progress of interventions using performance indicators (Table 11).

Table 11: Proposed format for monitoring progress

Interventions	Components	Performance Indicator	Comments
Generation, Collection, Transportation			
1. Generation and Primary Collection	1.1.1 Awareness promotion and training	Number of groups and individuals trained	
	1.2.1 Support formation of community recycling and reuse economy	- Number of groups, households or individuals' active: - Waste picking and sales; Crafts making; Artisans activities using wastes; Tradesmen involved in wastes	
	1.2.2 Support to partnership with waste pickers	Number of groups working in partnership with waste pickers	

Interventions	Components	Performance Indicator	Comments
	1.2.3 Support to schools composting	Number of schools that have received funds for composting and implemented composting	
	1.2.4 Schools waste minimization club	Number of schools with waste management clubs	
	1.3.1 Support of community groups: recyclers; artisans and craftsmen (8 groups; 2 per division)	The number of community based groups supported	
	1.4.1 Secured market collection point	Market waste collection point constructed	
	1.4.2 Operation of the collection site	Number of waste collection sites rehabilitated and well established	
	1.5.1 Bins for dry recyclable wastes = 700	Number of bins for dry recyclable wastes bought and distributed	
	1.6.1 Auto-rickshaws	Number of auto-rickshaws bought	
	1.6.2 Tractor and trailer (Scissor type) = 1	One scissor lift Tractor and trailer bought	
	1.6.3 Trucks = 2	Number of non-compactor waste truck bought	
Collection and transport			
2. Secondary Collection and Transport	2.1.1 One compactor truck = 1	One compactor truck bought	
	Five Twenty (20) ton Non-trucks	See 1.6.3 above	
	Scissor type Tractor and trailer = 1	See 1.6.2 above	
	2.1.2 Auto-rickshaws = 4 (400 kg capacity) ⁸	See 1.6.1 above	
	2.1.3 Street Bins = 100	100 waste bins in place	
	2.1.4 Plan waste collection points and produce waste collection route chart. Map of optimised routing	Collection site maps and collection routes produced	
	2.1.5 Procure waste collection tools and equipment	Number of tool types bought for waste collection workers	
	2.1.6 Procure waste workers PPE	Number and types of PPE bought for waste collection workers	
	2.1.7 Upgrade collection routes within the urban area	Waste collection routes upgraded	
	2.2.1 Support for systematic infrastructure and route planning using modelling software	One modelling software bought Three Computers bought One server bought	
	2.2.2 Route Chart management/supervision	System for supervision of waste transportation vehicle movement is in place	
	2.3.1 Preventive maintenance	Schedule for preventive maintenance	
	2.3.2 Repairs	Records of repairs	
	2.3.3 Spare parts	Quantity and types of spares bought	
	2.4.1 Support the establishment of Bring sites set up	Number of bring sites established	
Disposal			
3. Development of Waste Management Facility at Menvu	3.1.1 Procure a consultant	Consultant procured and consultancy done	
	3.2.1 Procure a contractor	Contractor procured and civil works done	
	3.3.1 Initial management costs	Money secured	
	3.4.1 Waste spreader/ compacter	Waste spreader/compacter in place	
Institution, Legislation, Finance			

⁸See section 1.6.1 in the Table

Interventions	Components	Performance Indicator	Comments
4. Capacity Building	4.1.1 Training of MC management staff	Number of management staff trained	
	4.1.2 Training technical staff on solid waste data collection and documentation including projections, modelling, RS-GIS, etc.	Number and designation of technical staff trained	
	4.1.3 Training finance staff on better financial planning resources allocation, cost recovery, optimisation and mobilisation	Number of the finance staff trained	
	4.2.1 Training of waste pickers and handicraft makers	Number of waste pickers trained	
	4.2.2 Training of local artisans and craftsmen	Number of local artisan and craftsmen trained per Division	
	4.2.3 Public mobilisation and awareness activities	Number of events launched and completed	
5. Legislation	5.1.1 Finalisation of the solid waste Management byelaw	New solid waste management byelaw in place	
6. Information Education Communication	6.1.1 Preparation of IEC document for Nansana municipal council	IEC procedure and guidelines in place	
7. Comprehensive Solid Waste Management Data Collection and Documentation	7.1 Data collection and compilation for one year. Projections, modelling.	• Most recent solid waste management data collected and documented and • the associated modelling completed	
	7.2 Procurement of computers and a server for solid waste database	Number of computer and server bought	
	7.3 Do a comprehensive solid waste data collection cost ⁹	Document on comprehensive costing of solid waste collection in place	

⁹See sample calculation in Appendix V

6 PRIORITISING THE ACTION PAN

6.1 Priority implementation actions (Short-Medium i.e. 3-5 years)

These actions lay the foundation for a sustainable solid waste management system in Nansana, focusing on immediate impact, institutional setup, and behavioural change.

- **Policy and regulatory foundations:** Within Year 1, Nansana will finalize and adopt a local bye-law aligned with national waste regulations, enforcing mandatory waste segregation, Extended Producer Responsibility (EPR), and penalties for non-compliance. Informal waste pickers will be integrated into formal systems through registration, training, and distribution of protective equipment, while regulatory impact assessments will guide Public-Private Partnership (PPP) frameworks.
- **Public awareness and community engagement:** A multilingual, multimedia education campaign will be launched to promote waste sorting, safe disposal, and circular economy practices. Local "Zero-Waste Ambassadors" and neighbourhood waste committees (with 30% gender representation) will drive behavioural change, with pilots in schools, markets, and religious institutions.
- **Waste collection and transportation:** Standardized dual-compartment bins will be rolled out across all divisions, prioritizing high-density zones and public institutions. Private haulers will operate under zoned collection contracts tied to KPIs (90% coverage, biweekly pickups), while low-income areas will receive subsidized door-to-door collection via community-based organizations.
- **Infrastructure and technology investments:** A Material Recovery Facility (MRF) at Menvu will process recyclables, complemented by pilot decentralized composting sites and small-scale anaerobic digesters for organic waste. Real-time tracking systems and dashboards will monitor waste flows.
- **Financial mechanisms:** A hybrid user-fee model will be piloted in select wards—commercial users pay full costs, while vulnerable groups receive subsidies. A 2% environmental levy on non-recyclable packaging will fund infrastructure, alongside PPP investments in composting/recycling start-ups.
- **Monitoring and governance:** A three-tier governance system (Steering Committee, Technical Operations Unit, Divisional Waste Teams) will oversee implementation. Baseline waste data will be published, with annual audits and community forums ensuring transparency.

6.2 Implementation actions (Medium to Long-term i.e. 5+ years)

These actions consolidate gains, scale infrastructure, and institutionalize circular economy practices across Nansana.

- **Policy and legal consolidation:** The bye-law will be updated based on implementation data, with stricter EPR enforcement (*e.g.*, mandatory take-back schemes) and tax incentives for circular businesses.

- **Expanded public engagement:** Gender-responsive programs will scale, empowering women/youth in waste, while circular economy hubs for repair/reuse will expand to all divisions. "Pay-As-You-Throw" systems will be refined with equitable pricing.
- **Advanced waste processing:** Upgrade the Menvu MRF into AI-assisted sorting, integrating informal workers as formal staff. Large-scale composting/WTE facilities will be deployed where feasible, and mechanical-biological treatment (MBT) plants will process residual waste.
- **Reforms on waste management facility and landfilling:** Continue to operate the Menvu waste management facility with improved circular economic interventions such as leachate treatment and methane capture. Bans on landfilling organics/recyclables will phase in, with remediation of existing illegal dumpsites.
- **Financial sustainability:** User fees will expand municipality-wide, supported by green bonds and a 5% emergency reserve fund. Performance-based funding will ensure operator accountability.

GLOSSARY OF TERMS

GLOSSARY OF TERMS

Advocacy: Persuading others to support an issue of concern to an individual, group or community.

Agricultural solid wastes: Waste such as food residues, animal dung, crop residues, grass and leaves. Such wastes are mostly non-hazardous and biodegradable in nature. However, containers for used or obsolete pesticides, herbicides and rodenticides are hazardous.

Best practice: The planning and/or operational practice that is the most technically and politically feasible, cost-effective, sustainable, environmentally beneficial and socially sensitive, to a particular locality.

Budget: Annual estimate of revenue and expenditure of an organization (e.g., municipality/enterprise)

Bye-laws: rules made by the lower local councils including municipality, town, Division, and sub county councils within their power to enforce the law in their area of jurisdiction. These are guided by the Local Government Act sections 3, 39 and 45.

Capacity building: Improving and building the technical and managerial skills and resources within an organization.

Collection frequency: The number of municipal solid waste (MSW) collections made from a specific location within a given time period.

Collection timing: The time period when MSW is collected from a location or pick-up point.

Collection vehicle: Vehicle used to transport MSW collected from premises and streets to transfer stations and waste disposal or composting sites.

Collection: The process of picking up wastes from residences, businesses, or a collection point, loading them into a vehicle, and transporting them to a processing site, transfer station or landfill.

Combustion: Refers to controlled burning of municipal solid waste, in which heat chemically alters organic compounds, converting into stable inorganics such as carbon dioxide and water.

Commercial wastes: Wastes those generated from business establishments, food and drink service establishments, shops, or open market places. These vary a great deal but may include packaging paper, cardboard, electronics, timber, wire, metals, plastic bags, tin cans, garbage and other wastes that are generally of non-hazardous nature.

Communication campaign: A strategically planned series of related, carefully targeted activities delivered through multiple channels to a large audience and designed to achieve a specific cognitive or behavioural goal in a predefined period of time.

Communication objective: A target that specifies the intended audience, the type of change expected when and where the communication activity is to take place and what criteria will be used to measure its success.

Communication strategy: A combination of methods, messages and approaches by which planners seek to achieve a communication objective.

Communication: The use of language as well as nonverbal signs to convey meaning between parties.

Community: A group of people living in the same geographic area with some degree of common interests and an easy means of communication.

Community-based organization: A specialized organization usually formed with a specific set of objectives which is not affiliated with governments but with specific populations.

Compost: The relatively stable humus material that is produced from a composting process of putrescible fraction of MSW in which bacteria in soil mixed with it break down the mixture into organic fertilizer.

Composting: The controlled biological decomposition of putrescible fraction of MSW in the presence of air to form a humus-like material. Controlled methods of composting include mechanical mixing and aerating, ventilating the materials by dropping them through a vertical series of aerated chambers, or placing the compost in piles out in the open air and mixing it or turning it periodically (windrow composting); or simply, the controlled degradation of putrescible fraction of MSW following some form of pre-processing to remove non-compostable MSW.

Disposal: The burial or incineration of solid waste.

Hazardous substance: Any chemical, waste, gas, medicine, drug, plant, animal or micro-organism which poses a great risk or danger to human health or the environment.

Hazardous waste: Any waste which has been determined by NEMA to be a hazardous waste or it is also any waste determined to be Corrosive, carcinogenic, flammable, persistent, toxic, explosive, radioactive and reactive to other waste. Hazardous solid waste must be handled and disposed of in accordance with the provisions of the National Environment Act.

Healthcare waste: Waste that is produced from healthcare facilities such as clinics, health centres and hospitals. This category of waste is composed of both hazardous (infectious) and non-hazardous wastes (also referred to as general waste). The management of healthcare waste requires special attention.

Household waste or domestic waste: Waste generated from households. It is mostly characterized as non-hazardous wastes. It may include rubbish, such as packaging materials, kitchen wastes, ash, etc.

Industrial waste: Waste produced from small, medium or large-scale industries. The type of waste produced may vary depending on the raw material used and the product of the industrial process. These wastes may be hazardous or non-hazardous, depending on the process. The solid waste produced could contain chemicals, wood, metal, ceramic or other components.

Institutional solid waste: Waste produced from public or government institutions, offices, schools, universities, religious institutions, sporting fields, etc. It can be very mixed in its components.

Media advocacy: The strategic use of mass media for advancing a social or public policy initiative.

Media strategy: A carefully tailored plan for using the media to accomplish a specific goal.

Municipal solid waste (MSW): Includes non-hazardous waste generated in households, commercial and business establishments, institutions, and non-hazardous industrial process wastes, agricultural wastes and sewage sludge. In practice, specific definitions vary across jurisdictions.

Municipal solid waste composition: MSW is as a heterogeneous mixture of different types of discarded materials. The composition of MSW depends on the conditions of the city or municipality in question. In general, MSW is composed of the following fractions: paper, rubber, plastic, fabric, leather, vegetable/ biodegradable, wood, glass, metal, etc.

Municipal solid waste management (MSWM): Supervised municipal solid waste management from their source of generation through collection or street sweeping, recovery and/or treatment/ processes to disposal.

Open burning of municipal solid waste: Is the practice of burning household trash (like plastic, paper, food scraps) directly outdoors in an open area, without any controlled combustion system, or flue gas cleaning system, thereby releasing smoke and harmful pollutants directly into the air. The resulting black carbon, due to incomplete combustion, together with furans, dioxins and other components make the smoke is highly polluting; often used in areas lacking proper waste management infrastructure.

Outreach: Contacting individuals in a target population through person-to-person channels.

Peer education: Dissemination of information and discussion about specific topics by members of a person's own age group, occupation, or social group.

Reclamation: Restoration of materials found in the MSW stream to a beneficial use which may be for purposes other than the original use (use in recycling).

Recovery: Chemical/biological processes such as biogas (methane) generation carried out at the landfill to recover gas (energy/heat). Municipal wastewater sludge generated at the municipal wastewater treatment facility is usually added to enhance process of gas generation. Putrescible fraction of the MSW is also used to produce compost and/or methane by fermentation (anaerobic digestion). 2. The process by which MSW otherwise destined for disposal are collected, re-processed or re-manufactured, and reused.

Recyclables: MSW fractions that still have useful physical and/or chemical properties after serving their original purpose and that can therefore, be reused or re-manufactured into additional products.

Recycle/reuse: Recovering and re-processing useable MSW that might otherwise end disposed in landfills (i.e. recycling of aluminium cans, paper, and bottles, etc).

Recycling: The process of transforming materials into secondary resources for manufacturing new products.

Redemption centres: Waste trading enterprises that buy recyclable materials and sells to brokers. Sometimes also called "buy-back centres".

Refuse: Another term for municipal solid waste.

Reuse: Using a product for the same or a different purpose.

Sorting: Physical/mechanical processes by which secondary materials (paper, metals, glass, and plastics/synthetics) are separated into different components of MSW. The process could be accomplished manually, by simple and/or sophisticated mechanical equipment.

Source reduction: Any procedure to reduce wastes at the point of generation, in contrast to sorting out recyclable components after they have been mixed together for collection.

Source separation: Keeping different categories of recyclables and organics separate at source, i.e. at the point of generation, to facilitate reuse, recycling, and composting.

Waste Management Hierarchy: The waste management hierarchy is a symbol for the strategic options available for dealing with MSW and their desirability. An adapted version of the hierarchy presents the more 'desirable' waste management practices at the top of the hierarchy (avoid, minimise and/or recover material) and the least 'desirable' practices at the bottom (treatment and/or disposal in

landfill), with dumping "floating" around the bottom, not even recognised by the MSWM concepts as an option in industrialised countries of the West.

Waste minimisation: Measures or techniques that reduce the amount of wastes generated during industrial production processes; the term is also applied to recycling and other efforts to reduce the amount of waste going into the waste management system (also waste reduction).

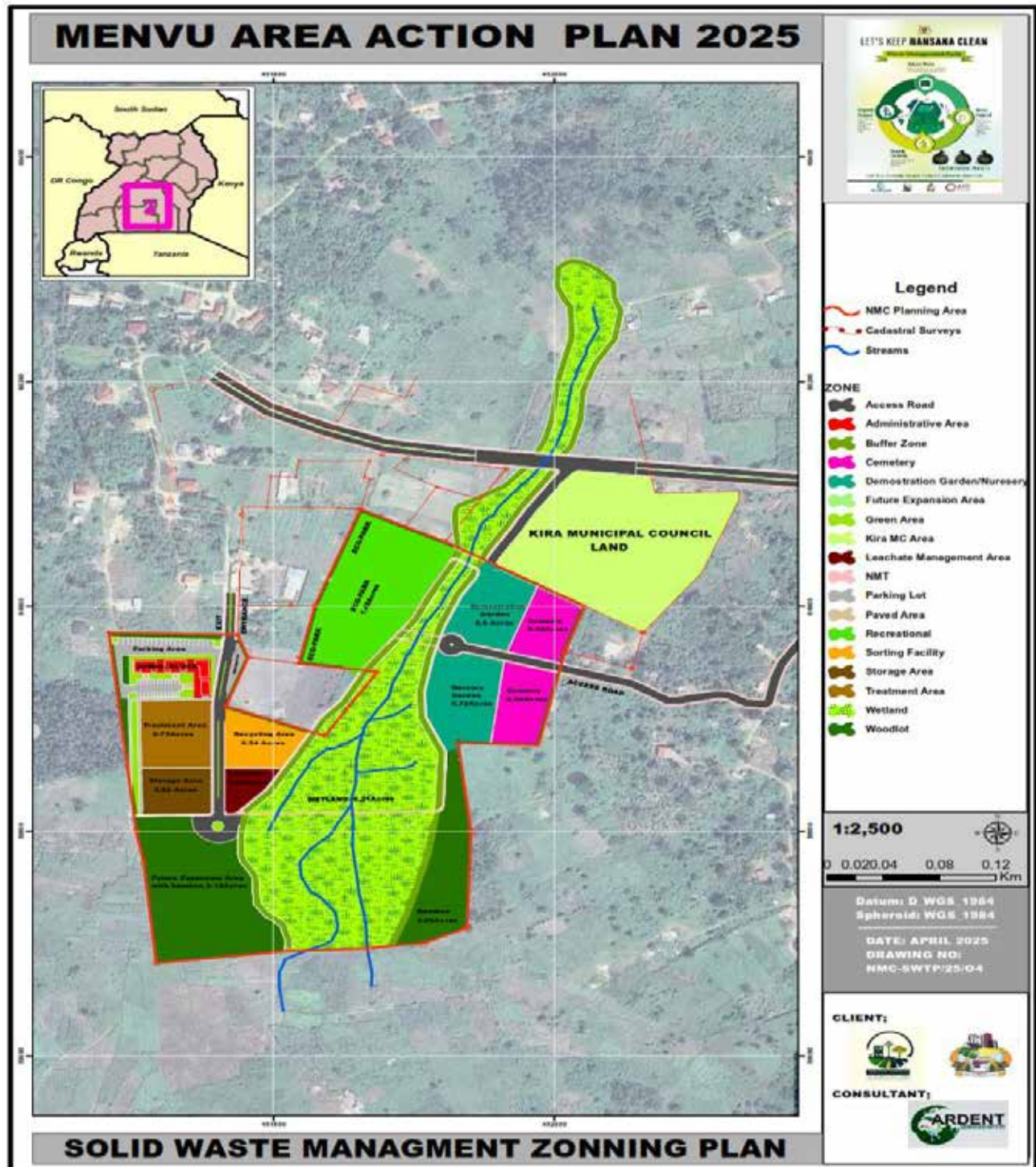
Waste recovery, materials recovery, or waste diversion: Obtaining materials/organics (by source separation or sorting out from mixed wastes) that can be reused or recycled.

Waste reduction: All means of reducing the amounts of waste that must be collected and disposed of by solid waste authorities. It ranges from legislation and agreements at the national level for packaging and product redesign to local programs to prevent recyclables and compostable organics from entering final waste streams.

Waste: Unwanted materials left over from any human activity; or refuse from places of human or animal habitation. Waste may be generically defined as heterogeneous mixture of material which is discarded as superfluous and has no further use or value to its owner.

ANNEXES

Annex 1: Physical Development Plan for Menvu Waste Management Site



Annex 2: Waste Minimisation Suggested Behaviour

Reduce

When you reduce the amount of waste you throw away, you save landfill space, save raw materials and natural resources such as energy and water, and save money. We can easily reduce the amount of waste we produce using some simple steps.

- Always take your own shopping bags and say 'no' to plastic bags at the supermarket
- Choose products with minimal packaging, and avoid individually wrapped products
- Buy products in reusable, refillable or recyclable packaging
- Avoid packaging fruit and vegetables in plastic bags
- Avoid disposable items such as paper serviettes, towels and tissues
- Buy long-lasting kitchen utensils, household products and clothing
- Mend broken appliances and furniture where possible
- Reduce packaging by buying in bulk
- Before you buy something, think "Do I really need it?"

Reuse

Reusing is another way of decreasing the amount of waste you throw away, which in turn decreases the volume of waste destined for landfill. In reusing a product, try and identify a long term use for the product. There are many ways to reuse things we consider unwanted or no longer useful

You can:- Take old books, magazines and toys to hospitals, doctor's rooms, gyms, dental surgeries, schools or preschools

- Hold a Garage Sale – your 'trash' may be another person's treasure!
- Instead of buying brand new power tools, borrow or hire the ones you might only use now and then
- Take good used clothing and household items to opportunity shops, school or church fairs
- Reuse containers such as glass jars for storage
- Take your own basket or calico bags when shopping
- Use the internet to locate someone that may be able to make use of your unwanted goods

Composting



In-vessel



Windrow

Source: USAID.2018. Sector Environmental Guidelines Solid Waste

Key Strategic Elements of Waste Reduction Programs

The table below describes some of the key elements which can be considered when developing strategic plans for waste reduction.

KEY ELEMENT	DESCRIPTION
Decoupling Economic Activity and Waste Generation	Historical trends in most industrial economies suggest that resource use and the resulting waste generation are linked to economic activity. However, it is possible to decouple economic growth from resource use through resource efficiency by “doing more with less”. Decoupling implies using less resources and generating less waste per unit of economic activity. Effective decoupling can only be achieved by understanding the drivers for waste generation (e.g., lifestyle, household size, waste management costs, population, consumption). Several measures can be employed to enhance decoupling such as economic instruments (e.g., taxes, fees, extended-producer reliability schemes), cooperation (e.g., voluntary and government agreements), and information-based instruments (e.g., ecolabels). ³⁷
Residential Organics Management	Implementation of home composting (e.g., food and yard waste) and waste reduction programs can significantly reduce the overall tonnage of waste generated within a community. Home composting programs can be facilitated by providing equipment to residents (e.g., food scrap containers, composting bins). In areas where economic activity is more prevalent and agricultural and livestock programs have been further developed, composting programs can be implemented at a much larger scale.
Materials Reuse Programs	Materials reuse programs, intended to continue the utility and lifespan of lightly used goods, such as electronics, construction materials, clothing, can reduce the generation of waste. These programs provide availability of products that may no longer be of use to one group but can have ample utility for others. For example, there are markets where used household furnishings, appliances, unused but serviceable construction materials are available free, or at a significantly reduced price. There are also electronics and computer recycling programs where serviceable, yet unwanted or refurbished equipment is donated to developing countries for education programs.
The Circular Economy	The concept of a Circular Economy is defined as “a regenerative system in which resource input and waste, emission, and energy leakage are minimized by slowing, closing, and narrowing energy and material loops; this can be achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, recycling, and upcycling”. ³⁸ Its application is based on business models that can achieve both financial benefits and resource efficiencies at various stages of the production cycle.

³⁷ Bain et. al. October 2012

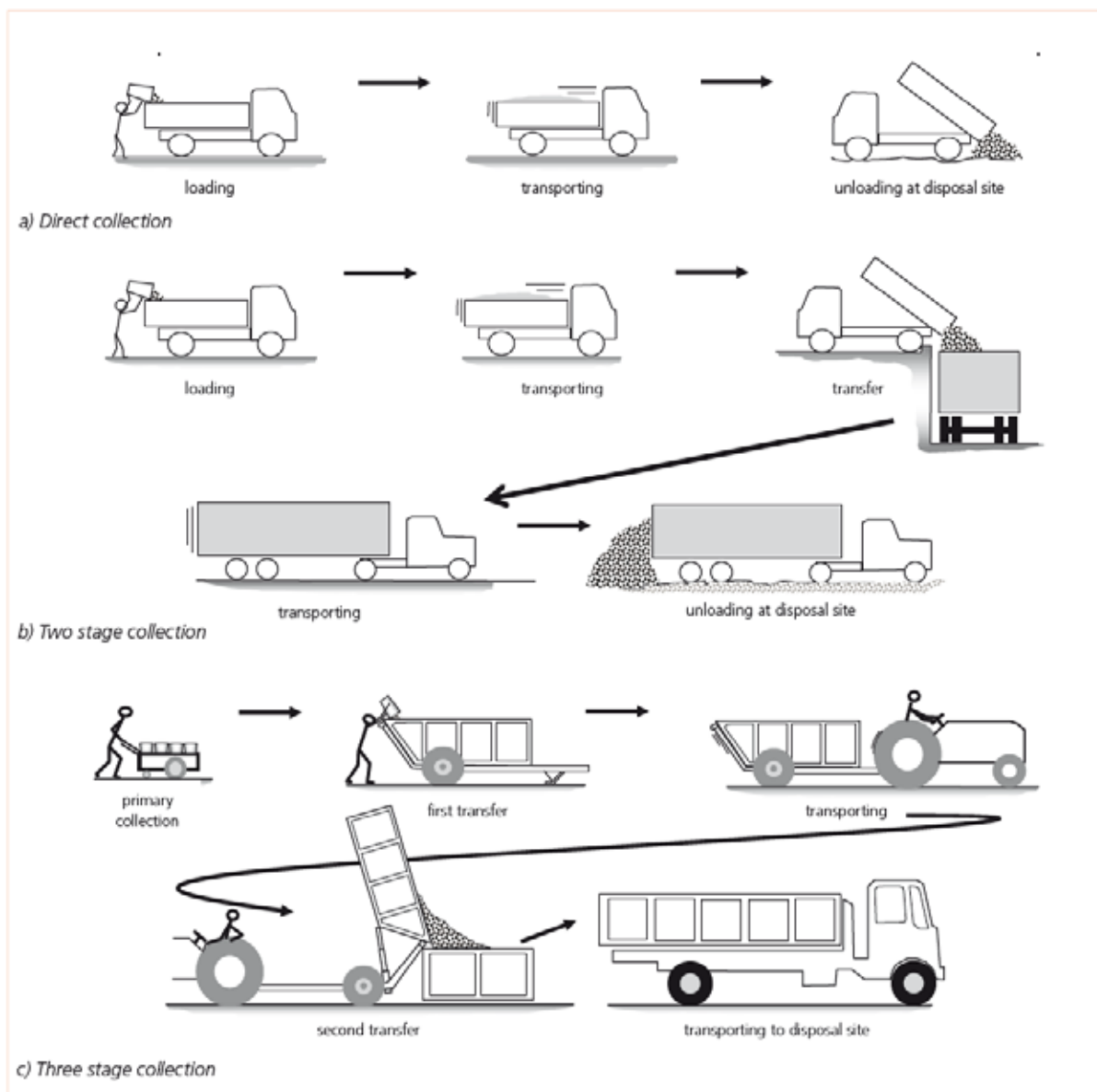
³⁸ Geissdoerfer, Martin; Savaget, Paulo; Bocken, Nancy M. P.; Hultink, Erik Jan (2017-02-01). "The Circular Economy – A new sustainability paradigm?". *Journal of Cleaner Production*. 143: 757–768

Source: USAID 2018. Sector Environmental Guidelines Solid Waste

Annex 3: Waste Collection Systems and Collection Vehicles

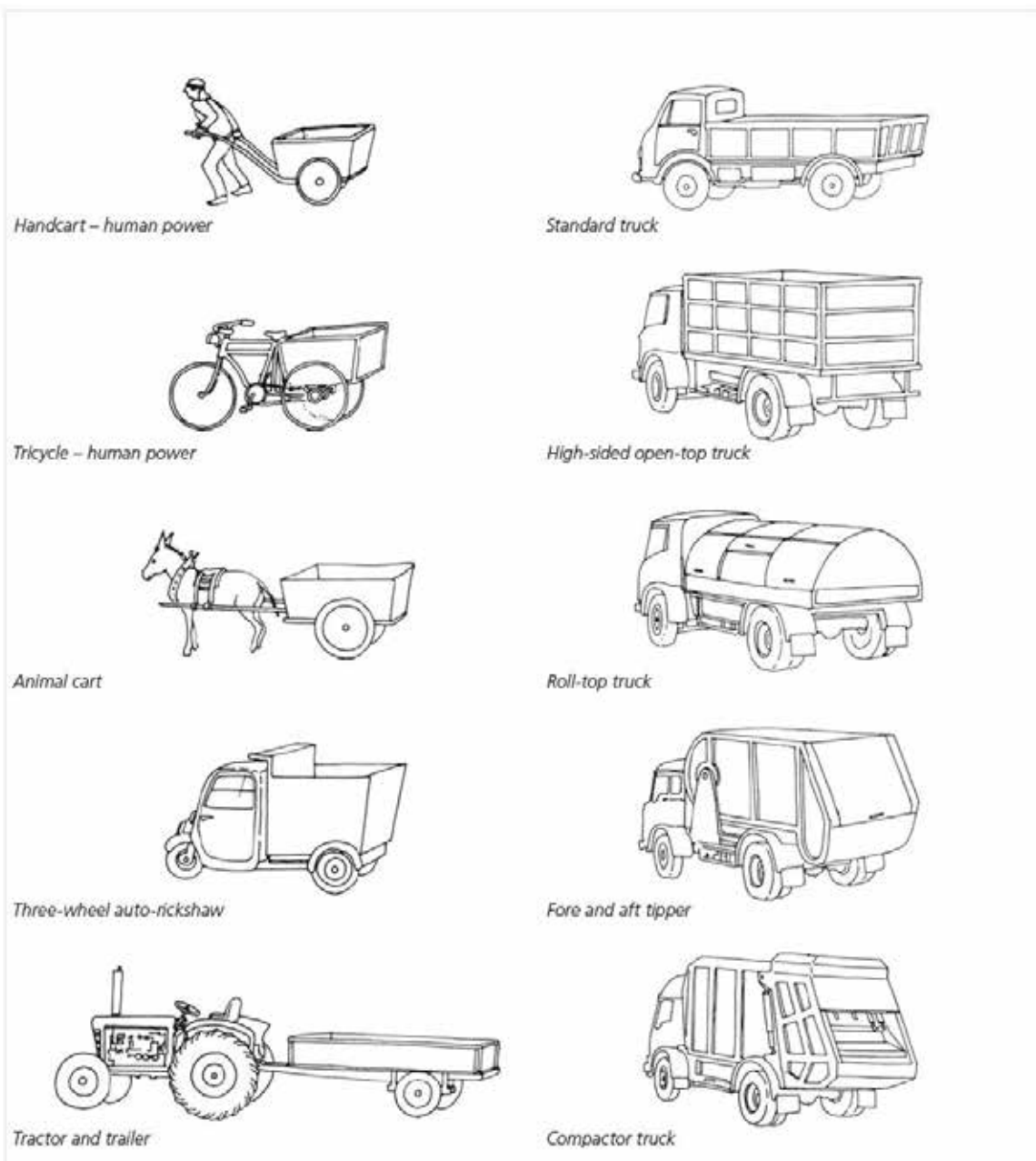
All information hereafter is from UN-HABITAT, 2010. Collection of Municipal Solid wastes in Developing Countries. HS/139/10E. ISBN: (Volume) 978-92-132254-5

Examples of waste collection systems



Source UN-HABITAT, 2010. Collection of Municipal Solid wastes in Developing Countries. HS/139/10E. ISBN: (Volume) 978-92-132254-5

Examples of waste collection vehicles or means ranging from manpower, animals, tractors, and trucks of different sizes and power



Vehicle loading height should not exceed the height of the loader's shoulders (1.5m)

Source UN-HABITAT, 2010. Collection of Municipal Solid wastes in Developing Countries. HS/139/10E. ISBN: (Volume) 978-92-132254-5

Small waste Collection Vehicles



Primary collection in Hanoi, Vietnam. Residents are bringing their wastes.



Photo 7.2 Tricycles in Kunming, China – Load behind driver

Tractors, trailers and non-compactors

Agricultural Tractors and Trailers

Figure 7.9 Swan neck trailer drawbar greatly improves manoeuvrability



a) This design allows greater capacity and easier loading, and swan neck drawbar allows greater manoeuvrability



b) Body is wider at the top



c) There must be sufficient clearance between the drawbar and the tractor wheels to allow for uneven ground

Photos 7.9 Low loading height trailer with swan neck drawbar

Non-compacting collection



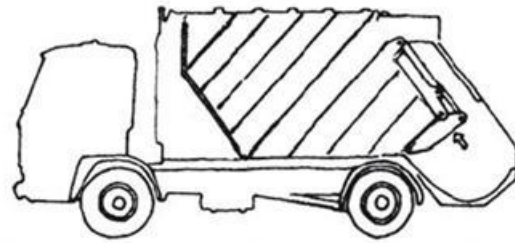
Figure 7.11 High-sided open top vehicle



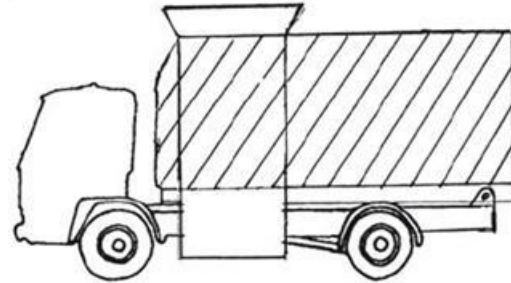
Photo 7.10 High-sided vehicle with side doors to assist loading



Figure 7.17 Crane system reaches out to pick up containers



a) The shaded area indicates storage volume in a rear-loading compactor



b) For the same chassis, the volume of a non-compaction body is significantly more.

Figure 7.21 Comparison of volumes of waste in compactor trucks and non-compaction trucks

Compactors



a) The low loading height and large hopper are big advantages



b) The waste is pushed out hydraulically by the compression (or ejector) plate

Photos 7.17 Rear-loading compacting plate compactor truck
Photo (a) Dennis Eagle

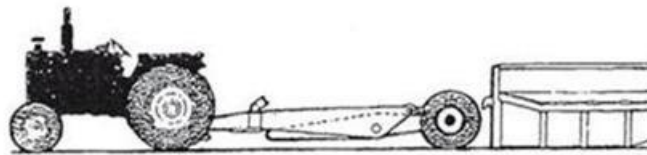


Photo 7.19 Compactor truck with binlift

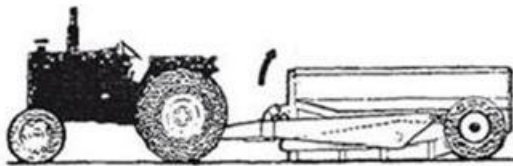


Photo 7.20 When the compaction mechanism cannot be repaired it can be taken off

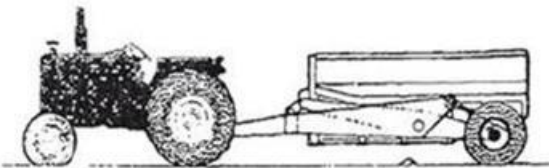
Tractors and Trailers



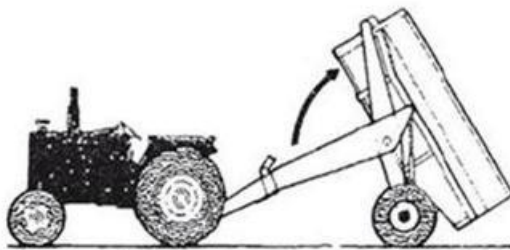
a) approaching container



b) picking up container



c) transporting container



d) emptying container

This scissor-lift system is manufactured in several countries including South Africa and Kenya. Load capacity 6 tons. Requires 50–60 hp tractor. Can be operated from tractor's

Figure 7.29 Scissor-lift container system

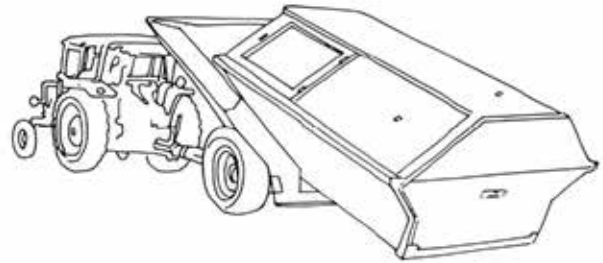


Figure 7.31 A very simple winch-on system can be used as a container lift or a conventional trailer

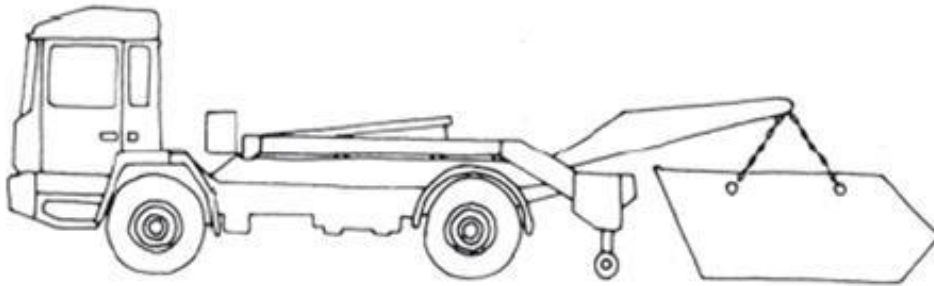


This trailer picks up 3 m³ community containers and empties them into large 8 m³ transfer containers. It is also capable of picking up, transporting and emptying the larger containers, when used with a 60 hp tractor. It is a low-cost and practical system for smaller towns

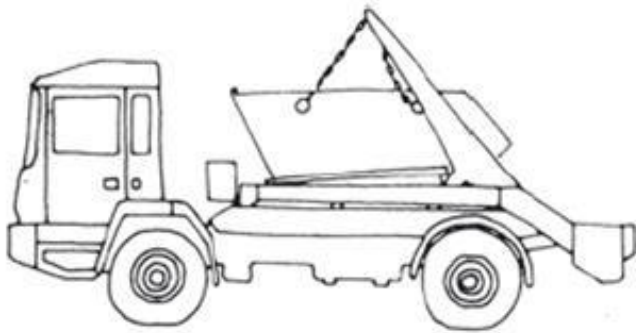
Photo 7.26 and Figure 7.32 High-tipping scissor lift trailer

Skip Lifter Trucks

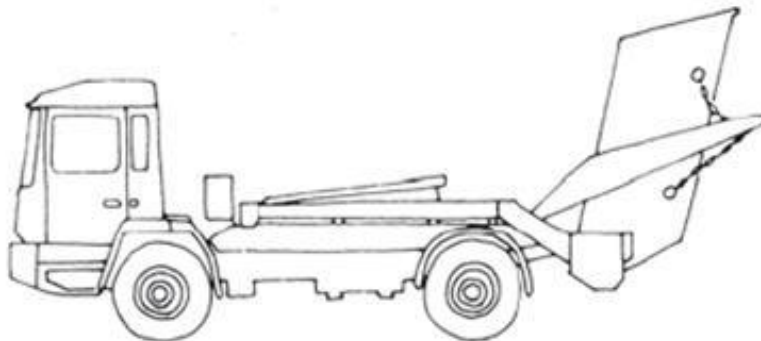
Skip Lift



a) picking up the container



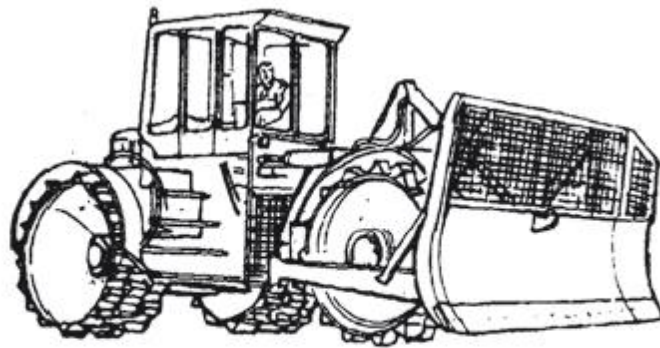
b) transporting the container



c) tipping the container

The size of the container is limited by the width between the lifting arms and the height under the crossbar at the top of the lifting arms.

Spreader and Compacter



Landfill compactor



Figure A5.2 The agricultural buckrake for spreading wastes



Photo A5.1 The agricultural buckrake for spreading wastes

Annex 4: Data on Solid Waste Management Equipment

Comparisons of capacities of capacities on compactor and non-compactor trucks

Item	a) Compactor truck	b) Non-compactor
Waste density at household (kg/m ³)	350	350
Waste density in truck (from Figure 7.3, kg/m ³)	730	480
Volume occupied by waste (Figure 7.21, m ³)	9.9	17.8
Payload (kg)	730 x 9.9 = 7,200	480 x 17.8 = 8,500
Weight of truck unloaded (tare, kg)	9,500	7,000
Total weight of loaded vehicle (kg)	16,700	15,500

Comparison of capacity two solid waste trucks as a function of waste density

Item (weights in kg)	Waste density (kg/m ³)	Vehicle type		Extra capacity of non-compactor	Notes
		Compactor	Non-compactor		
Permissible GVW		13,000	13,000		
Body Weight		3,500	1,500		
Chassis & cab weight		4,500	4,500		
Maximum waste load		5,000	7,000		= GVW – weight of chassis and body
Maximum payload (kg) at various densities	100	5,000	2,000	-60%	For non-compaction truck, the load is limited by volume
	250	5,000	5,000	0%	
	400	5,000	7,000	+40%	Both limited by weight

Summary of comparative characteristics of typical non-containerised solid waste collection vehicles

Vehicle type	See Section number	Gross vehicle weight (tons)	Body volume (m ³)	Operating range	Loading speed	Labour requirement	Capital cost per m ³ waste	Fuel & maintenance cost per m ³ waste	Economic life of vehicle	Suitability for narrow streets	Suitability for local manufacture of body
Small vehicles											
handcart	7.3.1	-	0.4	short	fast	high	low	low	short	good	yes
pedal tricycle	7.3.1	-	0.5	mid	fast	high	low	low	short	good	yes
animal cart	7.3.2	-	2.0	mid	fast	mid	low	low	mid	good	yes
autorickshaw	7.3.4	2	3	mid	fast	mid	low	low	mid	good	yes
Tractor & trailer	7.4	11	6	mid	mid	mid	mid	low	long	mid	yes
Non-compacting											
high side open body	7.6.1	10	10	long	slow	high	high	mid	mid	poor	yes
side loading roll-top	7.6.2	6	6	long	mid	mid	high	mid	mid	mid	yes
front loading "Tipack"	7.6.3	8	10	long	slow	mid	high	mid	mid	mid	yes
fore-and-aft	7.6.4	8	10	long	fast	low	mid	mid	mid	mid	yes
side-loading binlift	7.6.5	8	10	long	mid	low	mid	mid	mid	mid	yes
crane tipper	7.6.6	14	12	long	fast	low	mid	low	long	poor	part
Semi compaction											
side loading, barrier	7.7.1	9	10	long	slow	mid	mid	mid	mid	mid	yes
fore & aft with plate	7.7.2	9	10	long	fast	low	mid	mid	mid	mid	yes
Compaction											
rear loading hydraulic	7.8.2	14	10	long	fast	low	high	high	short	poor	no
screw compactor	7.8.3	14	10	long	fast	low	high	high	short	poor	no
rotating drum	7.8.4	14	10	long	fast	low	high	high	short	poor	no
paddle	7.8.5	7	6	long	fast	low	high	mid	short	mid	no

Notes: "Suitability for narrow streets" includes manoeuvrability and operation in unplanned areas, "mid" means medium

Truck depreciation

Depreciation periods for various types of asset have been set as follows:

- Compactor trucks. 5 years *
- Micro trucks 7 years
- Container transport trucks 7 years
- Wheeled bins 4 years
- Transfer containers 5 years **
- Transfer station 20 years ***

* The life of the compaction truck has been reduced from that of an ordinary truck because of the abrasive and acidic nature of the wastes. This is in line with experience in many countries.

** If the containers are manufactured from CorTen steel their depreciation period could be increased to 10 years.

*** There will be a small maintenance cost and reduced life expectancy on the hoists in the transfer station.

Annex 5: Calculation of Costs of Solid Waste Collection

Example of calculation the cost of waste collection system

A3.8.1 General data

Notes:

The unit of currency is the Mundi, and it is shown as ₦

The numbers in the first column are the line numbers of the spreadsheet programme

Items marked "d" are data that are provided. Other figures are calculated.

Items marked "s" are calculated results that are used in summing the costs.

10	d	Population served	750,000	
11	d	Household size	4.9	people per household
12	d	Waste generation rate	0.3	kg/cap/day
13	d	Bin emptying frequency	2	times a week
14		Longest interval between collections	4	days, after weekend
15	d	Working days	6	days per week
16		Working days per year	312	days per year
17	d	Working hours per shift	8	hours
18	d	Waste density in open trucks	400	kg/m ³ or 0.4 kg/litre
19	d	Employment cost for drivers	9,450	₦ per year
20	d	Employment cost for labourers	6,885	₦ per year
21	d	Fuel price	2.57	₦ per litre
22	d	Distance in urban area (compactors)	5	km
23	d	Speed in urban area (large trucks)	15	km/h
24	d	Speed in urban area (small trucks)	20	km/h
25	d	Speed in urban area at night	28	km/h
26	d	Distance outside urban area	24	km
27	d	Daytime speed outside city	35	km/h
28	d	Night-time speed outside city	55	km/h
29	d	Estimated maintenance cost as %	7.5	% capital cost/year
30		Depreciation periods		
31	d	Compactor trucks	5	years
32	d	Micro-trucks	7	years
33	d	Container transport trucks	7	years
34	d	Wheeled bins	4	years
35	d	Transfer containers	5	years
36	d	Transfer station	20	years
37				
38		Calculations		
39		Number of households served	153,061	[750,000/4.9]
40		Total weight generated in one day	225,000	kg/day [750,000 x 0.3]
41		or	225	tons/day
42		Weight generated by one household		
43		after longest interval (4 days)	5.88	kg [4 x 4.9 x 0.3]

A3.8.2 Comparing the systems

48			A. Compactor trucks		B. Small transfer station	
49		Wheeled bins	quantity	units	quantity	units
50	d	Households sharing a bin	4			
51		Weight of waste in bin when collected	23.52	kg		
52		Maximum volume of waste in bin	58.8	litres		
53		therefore 80 litre bins are big enough				
54		Number of bins required	38,265			
55	d	Cost of one bin	216	₺		
56		Total cost of bins	8,265,306	₺		
57						
58		Average weight collected per week	1,575,000	kg	1,575,000	kg
59		Weight collected per working day	262,500	kg	262,500	kg
60		or	262.5	tons	262.5	tons
61						
62		Trip time – Compactor and micro-truck				
63	d	Time for loading in one trip	90	minutes	d	28 minutes
64		Travel time in urban area (2 ways)	40	minutes	d	12 minutes
65		Travel time outside urban area (2 ways)	82	minutes		
66	d	Time unloading on landfill	10	minutes	d	4 minutes
67		Therefore total time for one trip	222	minutes		44 minutes
68	d	Time utilisation allowance	95	%	d	75 %
69		Number of trips per shift	2			8
70	d	Maximum load truck can carry	6	tons	d	2 m³
71					or	800 kg
72		Therefore number of trucks	22			41
73	d	Standby allowance for trucks	25	%	d	20 %
74		Number of trucks needed	28			50
75	d	Cost of one truck	209,250	₺	d	81,000 ₺
76		Total purchase cost of trucks	5,859,000	₺		4,050,000 ₺
77	s	Maintenance cost of trucks	439,425		s	303,750 ₺/year
78						
79		Trip time – Container transport truck				
80		Time for loading in one trip			d	8 minutes
81		Travel time in urban area (2 ways)				21 minutes
82		Travel time outside urban area (2 ways)				52 minutes
83		Time unloading (on landfill or at STS)			d	10 minutes
84		Therefore total time for one trip				92 minutes
85		Time utilisation allowance			d	95 %
86		Number of trips per shift				5
87		Maximum load truck can carry			d	14 tons
88		Therefore number of trucks in daily use				4
89		Standby allowance for trucks				20 %
90		Total number of trucks needed			d	5
91		Cost of one truck			d	243,000 ₺
92		Total purchase cost of trucks				1,215,000 ₺
93		Maintenance cost of trucks			s	91,125 ₺/year
95		Small transfer station and containers				
96		Number of transfer stations			d	4
97		Cost of one transfer station			d	432,000 ₺
98		Cost of one container			d	13,500 ₺
99		Number of containers in one STS			d	7
100		Storage provided by containers				392 tons
101		Total cost of containers				378,000 ₺

		A. Compactor trucks		B. Small transfer station	
103	Wage costs				
104	Number of drivers	22		45	
105	d Number of loaders on each collection truck	4		d 1	
106	Number of assistants on each transport truck			d 1	
107	Number of loaders	88		45	
108	Attendants at each transfer station (paid as labourers)			d 2	
109	Total transfer station attendants			8	
110	s Wage costs	813,780	ℳ/yr	s 790,155	ℳ/yr
111					
112	Energy				
113	d Daily consumption of one collection truck	100	litres/day	d 20	litres/day
114	d Daily consumption of one container truck			d 100	litres/day
115	s Cost of fuel for all trucks	1,764,048	ℳ/yr	978,245	ℳ/yr
116	Electricity consumption at one transfer station			d 27,000	ℳ/yr
117	Annual energy costs			s 1,086,245	ℳ/yr
118					
119	Depreciation				
120	Transfer station depreciation			s 86,400	ℳ/yr
121	s Compactor trucks	1,171,800	ℳ/yr		
122	s Wheeled bins	2,066,327	ℳ/yr		
123	Micro-trucks			s 578,571	ℳ/yr
124	Container transporters			s 173,571	ℳ/yr
125	STS containers			s 75,600	ℳ/yr
126					
127	Summary of annual costs				
128	Depreciation of bins and containers	2,066,327	ℳ/yr	75,600	ℳ/yr
129	Depreciation of vehicles	1,171,800	ℳ/yr	752,143	ℳ/yr
130	Depreciation of transfer stations			86,400	ℳ/yr
131	Maintenance of vehicles	439,425	ℳ/yr	394,875	ℳ/yr
132	Wage costs	813,780	ℳ/yr	790,155	ℳ/yr
133	Fuel costs	1,764,048	ℳ/yr	1,086,245	ℳ/yr
134	Total costs	6,255,380	ℳ/yr	3,185,418	ℳ/yr
135					
	Total waste generated per year	82,125	tons/year	82,125	tons/year
138	Unit cost of waste collection	76	ℳ/ton	39	ℳ/ton