



Local Solid Waste Plan Greater Madaba Municipality

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Diagnostic Report for Madaba municipality

1. Executive summary

Madaba Municipality recognizes the significance of efficient Solid Waste Management (SWM) in meeting the community's needs. SWM is a multifaceted endeavor encompassing technical, environmental, economic, social, institutional, legal, and political factors. In 2019, Madaba initiated its Local Solid Waste Management Plan (LSWMP), setting the stage for a groundbreaking update in 2023, making it the first municipality in Jordan to revise an existing plan.

As per the Guidebook that was prepared for developing the solid waste management plans, Waste generation rate per capita in rural area in 2021, with yearly growth of 1.02% is 0.93 Kg/day.capita and waste generation rate per capita in urban area in 2021, with yearly growth of 2.04% is 1.14 Kg/day.capita. The municipality currently manages 13,759 containers and barrels, primarily composed of barrels at 84%. The overall capacity, including good and substandard containers, stands at 4,787,800 liters, with an equivalent capacity of 3,982,250 liters.

The municipality uses Madaba landfill, operated by Madaba JSC, which is approximately 9 km two way from the center of the municipality.

The annual fuel consumption for SWM vehicles within Madaba is 245,041 liters. The cost per ton of waste management services varies significantly between Greater Amman Municipality and Madaba Municipality, with Madaba's cost per ton lower at 35 JOD in 2019, attributed to its smaller population and waste generation. Geographic location, waste collection methods, and disposal facilities further contribute to these cost disparities.

It is recommended to continue curbside collection using 1100-liter galvanized iron containers without wheels or covers. In 2023, 226 waste workers are required for effective sweeping. Madaba Municipality's urban index is 88%, whereas when compared to GAM it is 98%. It is recommended to assign one worker to serve approximately 821 citizens, necessitating a total of 244 workers, accounting for an 8% absence rate.

Currently, one compactor handles recyclables, while another compactor deals with mixed waste. The plan envisions increasing the number of recyclable compactors to two by 2024 and expanding source separation by 2026.

Madaba's SWM is relatively advanced compared to similar municipalities, but challenges persist, particularly in efficient sorting due to limited public commitment and suboptimal container placement. Additionally, waste collection routes are primarily based on drivers' local knowledge, leading to increased costs and collection time.

Furthermore, it is advisable to consider using compactors with a capacity ranging from 8 m³ to 12 m³ for more efficient waste management.

In 2019, the municipality had 4,426 waste containers, with plans to expand by adding 80 (1100 liters) and 50 (200 liters) containers over five years. Regrettably, the expansion was not realized, but by 2023, the city possessed 13,759 containers. The increased number of containers imposes higher financial and human resource demands, affecting maintenance, fuel, wages, and vehicle upkeep, alongside environmental and aesthetic impacts.

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The vehicles currently operate at a capacity of 89.21 tons/day, as per the Guidebook, suggesting two to three trips daily to the landfill. Nevertheless, 11 of the municipality's compactors, surpassing their 11-year lifespan, operate at zero capacity. Their maintenance, fuel, and security costs are substantial, warranting their replacement, considering the municipality's fleet of 26 vehicles, of which 11 have exceeded their 11-year operational life.

By 2028, it is essential to replace all SWM vehicles within the greater municipality of Madaba.

Revenues are sourced from professional license renewals and fees collected by the electricity company. However, complexities arise when deducting the services provided by the electricity company, contributing to a 78% cost recovery ratio. The fee collection ratio currently stands at 43%, indicating challenges in collecting fees efficiently.

In 2023, the total container capacity required is estimated at 1,086,750 liters per day. Currently, the municipality has a container capacity of 3,982,250 liters per day, surpassing the population's immediate needs. However, to prevent excessive container capacity, a strategy is recommended to gradually replace one-third of the containers each year as the municipality approaches suggested container capacity.

The Madaba Municipality's SWM plan update is geared towards addressing current challenges, enhancing sustainability, and optimizing waste management in the community. Commitment to proactive measures and community engagement will be instrumental in achieving these objectives.

2. Initiating Mentoring Activities

To ensure the ongoing mentoring activities in six selected municipalities in Jordan, Lebanon and Tunisia, kick-off meeting with the involved consultants were conducted, and followed by another kick-off meeting including all of the involved consultants for each municipality.

During these meetings, the role of each partner was explained, as well as the interconnected activities that would require collaboration of more than one partners, in order to ensure that all partners are on the same page in terms of roles, responsibilities, required tasks and most importantly timelines.

The tightest deadline was regarding the work that will be done by the SMEs. Accordingly, all consultants are requested to submit two identified problems and the proposed solutions with a cost not-exceeding 5,000 euro for each solution before the end of April 2023. Therefore, progress will be checked next week to ensure the submittal of these documents in a timely manner.

The aim of this document is to provide tentative dates and times for meetings with the consultants as well as the municipalities throughout the course of the project. The meetings will go on until the end of June, as this the proposed end date for the ongoing tasks. In case there are any delays, new meetings will be proposed duly.

All the proposed dates and times and tentative, and can be changed throughout the project if needed, based on the availability of the attendees.

3. Meetings schedule

The current progress is for Madaba Municipality, accordingly, the following sections will only show the proposed dates for the meetings, as the municipality have started with the data collection processes and they are done in updating the LSWMP for Madaba with the consultant.

1. Madaba municipality (Responsible: Abdallah Awawdeh)

Date	Time	Targeted entity	Main agreements or outputs	Status
09/4/2023	11:00 CET	Consultant and municipality	Deliverables: revised methodology and identified problems for SMEs Next deadlines: diagnostic report Others:	
26/4/2023	11:00 CET	Consultant and municipality	Deliverables: Diagnostic report Next deadlines: Others:	Development of the diagnostic report
01/5/2023	11:00 CET	Consultant and municipality	Deliverables: Diagnostic report Next deadlines: Others:	Development of the diagnostic report
9/5/2023	11:00 CET	Consultant and municipality	Deliverables: Diagnostic report Next deadlines: Others:	Development of the diagnostic report

List of Abbreviations

MSWM	Municipal Solid Waste Management	M&E	Monitoring and Evaluation
MoLA	Ministry of Local Administration	O&M	Operations & Maintenance
MoENV	Ministry of Environment	FDS	Final Disposal Site
FDG	Focus Discussion Group	HDPE	High Density Polyethylene
GRM	Grievance Redress Mechanism	LDPE	Low Density Polyethylene
CBO	Civil Based Organization	PP	Polypropylene
NGO	Non-Governmental Organization	PS	Polystyrene
PPP	Public Private sector Partnership	PET	Polyethylene Terephthalate
SOP	Standard Operation Procedures	PVC	polyvinyl Chloride
CSO	Civil Society Organizations	PPE	Personal Protective Equipment
MoA	Ministry of Agriculture	GAM	Greater Amman Municipality
JOD	Jordanian Dinar		

4. Introduction

Effective SWM (Solid Waste Management) planning enables municipalities to identify, measure, and evaluate waste-related management needs and develop sound alternatives for meeting public service and community requirements. Developing an effective SWM system in any Jordanian municipality can be challenging as its complex and multidisciplinary nature. Developing an effective SWM system will have numerous technical, environmental, economic/financial, social, institutional, legal (regulatory), and political factors that are independently significant and often interact with each other.

In SWM, the planning process must address several integrated services, including street cleaning, garbage collection, transport, transfer, processing (recovery), and disposal. Effective planning requires thorough knowledge and investigation of the baseline (current) SWM, and related situations to then build and adopt strategies, and action plans to improve SWM services and meet future requirements and objectives that may be influenced by increasing populations (permanent and temporary). The Municipal Plan should guide a municipality in defining and implementing priority actions while specifying the time, resources, and activities necessary to accomplish them.

To help the Jordanian municipality develop their own local MSWM Plan, the Ministry of Local Administration has developed a “GUIDEBOOK FOR LOCAL SOLID WASTE MANAGEMENT PLANS FOR JORDANIAN MUNICIPALITIES”. This Guidebook is intended to assist Jordan’s municipalities in developing and implementing Local MSWM Plans (Municipal Plans). The Municipal Plans are necessary to develop, strengthen and reinforce optimal practices in local solid waste management (SWM). The Guidebook seeks to merge national and regional SWM targets with local-level technical and options analysis activities to guide municipalities in creating environmentally sound and cost-effective Municipal Plans that address each municipality’s unique SWM situations and needs.

In terms of municipal service provision, solid waste management (SWM) was identified as one of the top priorities to address in the country. Local institutions face challenges in their service provision efforts, both in terms of staff capacity and technology. SWM plans aim to include low-cost and effective solutions while engaging citizens in finding and adopting the solutions in the process.

As Madaba municipality developed its LSWMP in 2019, they are now seeking to update the plan for the upcoming 5 years. By this time, Madaba municipality will be the first municipality in Jordan to update their already existing plan, during the updated plan, a comparison between the figures, priorities & projects will be conducted and analyzed.

5. Legislative aspect of MSWM in Jordan

The MSW Management (MSWM) sector is one of the most complex sectors in Jordan due to the wide variety of Solid Waste (SW) types, which, in turn, involves many different competent entities depending on their relevant area of interest.

Regarding legislative aspects, the plan defines relevant laws and regulations governing waste management activities as well as legislative frameworks for the Ministries of Environment and Local Administration, which include strategies related to solid waste directly or indirectly, the most important of which are:

- Economic Modernization Vision 2022.
- Waste Sector Green Growth National Action Plan 2021-2025.
- The National Climate Change Adaptation Plan of Jordan 2021.
- The National Waste Management Plan (2022-2026).
- The Draft National Environmental Strategy (NES) 2020.
- The National Energy Strategy; and
- The National Strategy on Public-Private Partnerships (PPP).

2. Legislations, laws, regulations, and instructions about the Municipal Solid Waste Management

- Legislative framework of the Ministry of Local Administration:
 - Local Administration Law No. 22 of 2021: This law is concerned with defining the legal framework under which the local administration operates in Jordan, and defines the competencies, powers, and responsibilities of each entity in the local administration and works to develop them. That the administration be more effective and comprehensive.
 - Joint Services Councils Regulation No. 113 of 2016 and its amendment No. 66 of 2022: This regulation relates to defining the legal framework that governs the work of joint services councils in Jordan and stipulates the terms of reference, powers, and responsibilities for each council, and how it is formed, appointed its members, and funded.
 - The Regulation for Government procurement No. 8/2022 and its Amendment No.15/2022: This regulation relates to the organization of government procurement operations in Jordan and defines the procedures and conditions necessary to conduct government procurement in an effective and transparent manner.
 - Instructions for organizing government procurement procedures for the year 2019: These instructions define the framework for the legal procedures necessary for government procurement in Jordan and specify the conditions and procedures that must be followed to ensure the transparency and integrity of the procurement process.
 - Municipal Supplies and Works Instructions 2019: These instructions specify the business procedures and equipment necessary for the development of municipal services in Jordan

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and specify the standards and specifications that must be followed in the development of infrastructure.

- Nuisance prevention and waste Fees collection regulation within the municipalities' Borders No. 68/2016 and its amendment No. 59/2019:

This system aims to collect fees from citizens for waste collection and removal services within the municipal boundaries, which includes collecting waste from homes, streets, and public places, and transporting and clearing it according to approved procedures and standards.

These fees are collected through invoices issued by the municipality to citizens, and the value of these fees depends on the type, quantity, and frequency with which waste is collected.

This system aims to motivate citizens to reduce the amount of waste they produce, increase their environmental awareness, and improve the quality of health and environmental services within municipalities.

The collection of fees and the application of the system are organized in cooperation between the concerned authorities in the municipality and other government agencies, and work is being done to monitor and evaluate the collection system on a regular basis to ensure that the desired goals are achieved.

- Legislative framework of the Ministry of Environment:
 - The Environmental Protection Law No.6/2017:

The main legislative framework that defines the general principles of environmental protection in the Hashemite Kingdom of Jordan. This law aims to preserve the Jordanian environment and improve the quality of life in the Kingdom.

The law includes several topics related to preserving the environment, such as sustainable development, controlling pollution from factories, vehicles, homes, etc., protecting natural resources such as water, soil, wildlife, and marine life, preserving biodiversity and natural reserves, and providing the necessary measures to deal with natural disasters and pollution resulting from industrial accidents.

The law also includes defining the responsibilities and obligations of individuals and government and private agencies in protecting the environment and improving the quality of life, defining the necessary procedures to verify the compliance of these agencies with environmental laws and regulations, and determining appropriate penalties and fines for violators.

The Jordanian Environmental Protection Law No. 6 of 2017 is an important legal framework for preserving the Jordanian environment and promoting sustainable development in the Kingdom.

- Waste Management Framework Law No.16/2020.
- Non-hazardous SWM Regulation No. 44/2022.
- Instructions for applying the national mechanism to the principle of extended product responsibility to address the negative effects resulting from waste packaging materials (2022).
- The Regulation for Hazardous Waste Management & Handling No.68/2020; and it's Amendment Regulation No.58/2022

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- Instructions for Electrical and Electronic Waste Management 2021
- The Regulation for Environmental classification and licensing 69/2020, and its Amendment No.97/2020
- Environmental Information and Monitoring System of Waste Management Regulation No. 85/2020.
- Environmental Protection Fund Regulation No.18/2018, and its Amendment No.144/2019.
- Environmental Protection Management Regulation No. 37/2018.
- Environmental control and inspection Regulation No.65/2009
- Instructions for organizing the storage, transportation, treatment, and trade of organic fertilizer (2009).
- Instructions for Hazardous waste that are prohibited from entering the Kingdom (2016).
- Instructions for electronic tracking of vehicles transporting wastewater, waste mineral oils and hazardous waste (2017).
- Hazardous waste management and handling instructions (2019).
- Soil Protection Regulation No.25/2005.
- Protecting the Environment from Pollution Emergency Situations Regulation No.26/2005.
- Instructions for technical and environmental requirements for the establishment and operation of sanitary landfills in the Kingdom (2021).
- Instructions for the technical and environmental requirements for establishing and operating waste transfer stations in the Kingdom (2021).
- Instructions for preparing the MSWM plan at the regional and local levels (2019).
- Instructions for the safe closure and rehabilitation of environmentally unsafe waste dumps (2019).
- Air Protection Regulation No.28/2005.
- Natural Reserves & National Parks Regulation No.29/2005.

3. Other relevant laws

- Public Health Law No.47/2008 and its Amendment Law No.11/2017.
- Agricultural Law No.44/2002 and its Amendment Law No.2/2020.
- The Water Authority of Jordan (WAJ) Law No.18/1988 and its Amendment Law No.16/1998.
- The Cultural Heritage & Antiquities Law No.21/1988 and its Amendment Laws No.23/2004 and No.55/2008.
- The Regulation for Groundwater Monitoring No.85/2002.
- The Renewable Energy & Energy Efficiency Law No.13/2012 and its Amendment Law No.33/2014.
- The Public-Private Partnership Law No.17/2020 (PPP Law).
- Investment Environment Law No. (21) of 2022.

6. Committees and teams

In order to ensure the sustainability of the plan, the “GUIDEBOOK FOR LOCAL SWM PLANS FOR JORDANIAN MUNICIPALITIES” stipulates the formation of several groups labelled as committees and teams. Each group had its own roles and responsibilities; accordingly, the members of each group were selected to ensure that their abilities and knowledge match the purpose of their corresponding group. Group members include both men and women to ensure gender equality. The groups were formed after several discussions with the relevant municipal members and staff as well as members of the local community, as follows:

1. The stakeholders’ committee

The **Stakeholder Committee** is anticipated to be an entity that represents society in the planning process. It has a representative form and not an official form. The principal role of the Stakeholder Committee is participation in helping to create the vision and objectives of the Municipal Plan and provide enhanced legitimacy to the Municipal Plan outputs and results. The Stakeholder Committee may also have an important ongoing role in monitoring, evaluating, and updating the Municipal Plan as progress is made in accomplishing its results. The main characteristics of the stakeholders’ committee are as follows:

- Represent the Society in the planning process.
- Participate in the different Municipal Plan development activities.
- Support the Working Groups with opinions and information related to their activities.
- Help identify SWM priorities.
- Help identify and adopt a vision and objectives for the Municipal plan.
- Review the performance targets, proposed projects, and programs resulting from the implementation of the Municipal Plan.
- Review and approve the draft Municipal Plan once it has been developed; and
- Assistance in monitoring, evaluating, and updating the Municipal Plan based on accomplishments and impediments to progress.

The members of the stakeholder committee are presented in the following table:

Table 1: Members of the stakeholders committee

Name	Position and Organization
Omar Al-Najada	President of the Handicapped Association
D. Nuha Al-Nahas	People with disabilities representative
Eng. Farah Daoud	Ministry of Local Administration representative
Eng. Jumana Al-Abaddi	Ministry of Local Administration representative
D. Mohammad Al-Shareef	German Jordanian University representative

Name	Position and Organization
Hashim Al-Masarweh	Shabab 42 Foundation – CBO representative
Oday Al-Thawabia	Nashama Al-Ataa - CBO representative
-	All Jordan Youth Commission - CBO representative
Mohammad Abu Qa'oud	Head of Local Development Unit- Focal Point

4. The Planning committee

The planning committee that comprised members of the Municipal Council and chaired by the mayor, had the following tasks:

- Coordinate and discuss all relevant issues and progress with the Planning Team.
- Assign a Planning Committee member to also participate as a member of the Planning Team.
- Update the Municipal Council on the progress and issues associated with the planning process and the activities of the Planning Team; and
- Participate in the planning process activities when needed.

The members of the planning committee are presented in the following table:

Table 2: Members of the planning committee

Name	Position
Aref Al-Rawajeeh	The mayor
Khalid Abu Joudeh	Municipal Council member
Ali Al-Shawabkeh	Municipal Council member
Mustafa Abu Hasheesh	Municipal Council member
Malak Al-Mour	Municipal Council member
Jalal Al-Masandah	Executive Manager
Mohammad Abu Qa'oud	Head of Local Development Unit- Focal Point

5. The Planning team and working groups.

The Planning Team would be comprised of at least seven individuals appointed by the mayor including a team leader/facilitator, a member of the Municipal Council Planning Committee, senior relevant municipal staff, and professionals/experts from the private sector with knowledge of effective SWM practices and the current SWM situations in the municipality and community representatives. (The community representatives were selected from community-based organizations, religious leaders, women, youth, and the business community.)

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And had the following tasks and responsibility:

- Support the design of an initial action plan for the planning process.
- Lead and manage the planning process based on the planning process action plan.
- Conduct stakeholders' analysis and engagements.
- Prepare and coordinate for all planning process activities including management of meetings and workshops and networking with CSOs.
- Prepare all necessary documents and interim/final reports as necessary for reporting on progress and seeking Planning Committee approvals of activity results.

The **Working Groups** will be technical groups with membership derived from the Municipal staff as well as other relevant professionals and experts. The main role of the individual Working Groups will be in the evaluation of the current situation and analysis of technical and institutional options.

- Participate in the assessment of the current SWM situations in the municipality.
- Participate in the analysis of SWM development and upgrade options.
- Participate in the different activities associated with developing the Municipal Plan.

Due to the municipality's limited administrative and technical staff, the same members were assigned to the planning team as well as the working groups, as follows:

Table 3: Members of the planning team and working groups.

Name	Position
Abdallah Al-Sulaimat	Head of Sorting Station
Abdallah Al-A'tilat	Head of Health and Environment Department
Abdallah Al-Rawajeeh	Municipal Garage Manager
Mohammad Al-Khateeb	Head of Financial Department
Mohammad A'qab	Head of Lighting Department
Taghreed Al-Fa'ouri	Councils Manager
Samer Abu Ali	Garage Manager Assistant
Mohammad Abu Qa'oud	Head of Local Development Unit- Focal Point

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Figure 1: Meetings with the working team

7. Introduction about the municipality

The Greater Madaba Municipality is in the Central Region, 35 km from the capital, Amman. The municipality is characterized by a competitive and comparative advantage, which is tourism and agricultural, and the distinguished geographical location due to its proximity to the airport, the Dead Sea, and the capital, Amman, with a moderate climate. The total area of the municipality is 450 km², and the area within the organization is 45 km². Its population is 177,184¹, according to the official statistics of the Department of Statistics for the year 2022. The municipality's population is distributed in 23 areas mentioned in Table 4 below, according to the estimates of the Department of Statistics for the year 2022.

6. Municipality's population

The total population of the municipality is around 177,184 with a population density of 394 capita/km.

As for the disaggregated distribution of the population by gender within the municipality and the areas and localities it serves, it is mentioned in the following table:

Table 4: Population Census for the Municipality and Current Localities

Locality	Males	Females	Total	No. of families
Ma'moneia	5,555	5,482	11,037	2,206
Fayha'a	1,393	1,285	2,678	530
Waha (Mrejmet El-Hamed)	194	116	310	78
Heialaleyeh (Falha)	2,354	2,280	4,634	903
Hwayyet El-Balouneh	353	329	682	127
Jubail	593	307	900	174
Khatabiyyeh	1,184	1,113	2,297	480
Madaba	66,534	58,202	124,736	25,150
Jrainah	2,948	2,555	5,503	1,257
Ghernatah	982	975	1,957	391
Ariesh	1,056	988	2,044	418

¹ <http://dosweb.dos.gov.jo/ar/population/>

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Locality	Males	Females	Total	No. of families
Wasiyyeh	981	785	1,766	349
Abu Rdaineh	83	37	120	36
Maeen	3,820	3,543	7,363	1,630
Manshiyyet Maeen	1,655	1,504	3,159	632
Hamamat Maeen	21	5	26	6
Zarqa' Maeen	107	68	175	56
Ain Eddieb	7	0	7	4
Faisaliah	3,922	3,485	7,407	1,545
Syaghah	6	0	6	2
Oyoon Moosa	6	0	6	2
Libbeh	149	133	282	57
Mkhait	67	22	89	15
Total	93,970	83,214	177,184	36,048

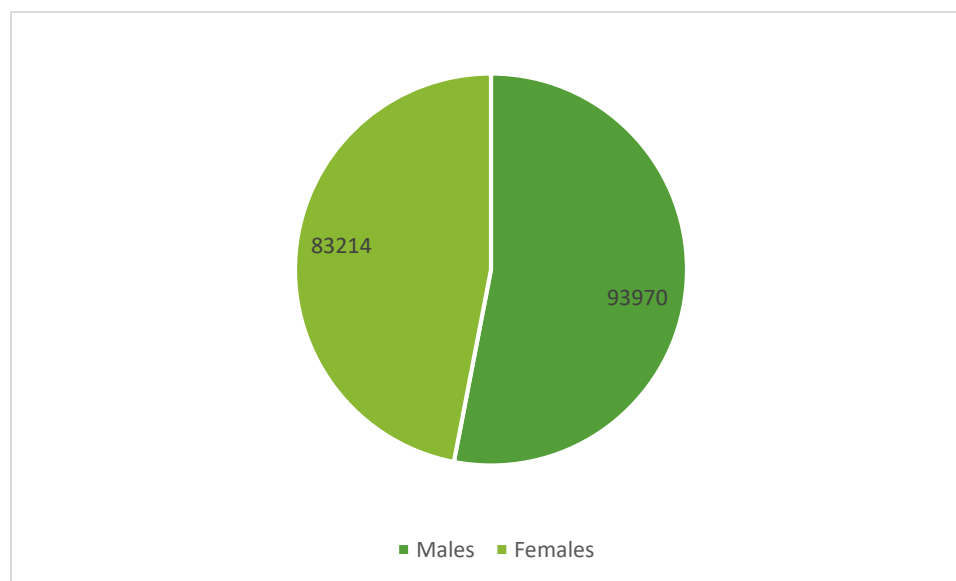


Figure 2: Population Disaggregated by gender.

Statistics available for the municipality, based on Department of Statistics (DoS) for the year 2022 indicate that 53 % of the municipality's total populations are men, and 47 % are women. At the national level, it was in the year 2020 approximately equal to 52.9% and 47.1%, respectively.

7. The residential and commercial clusters

According to the numbers within the report of the Department of Statistics for the year 2022, the number of families within the municipality is 36,048. The following is a summary of the main characteristics of the municipality:

Table 5: Types of licenses

Type of license	Number	Type of license	Number
Public schools	108	Banks/Exchange	18
Private schools	38	Clothes/Shoes	232
Colleges	2	Sweets/Bakery	182
Mosques	266	Crafts	155
Churches	12	Grocery	7
Hospitals	2	Electricals	192
Medical centers	19	Hotels	22
Beauty centers	406	Industries	6
Cafeteria	289	Restaurants	692
Others	734		

8. General information about SWM

The MSWM sector is a very diverse one, and it affects and is affected by many aspects, mainly administrative, technical, financial & social aspects, accordingly, all this aspect will be analyzed in depth to provide a thorough understanding of the current situation; however, to start this analyses, basic understanding of the MSW quantities and composition must be obtained.

8. Waste composition

Waste composition analysis defines as a preliminary analysis that provides an enhanced visualization of the waste streams. Waste composition is conducted to determine the suitable interventions in SWM operations. It is important to understand where and how efforts (financial and technical) should be invested to target higher quantities of more valuable waste streams.

Waste composition differs by lifestyle, financial income, and the presence of commercial, industrial, and agricultural activities. Waste composition was estimated by conducting a manual analysis of waste components based on selected representative samples from urban, rural, domestic, commercial, and industrial areas in 2019.

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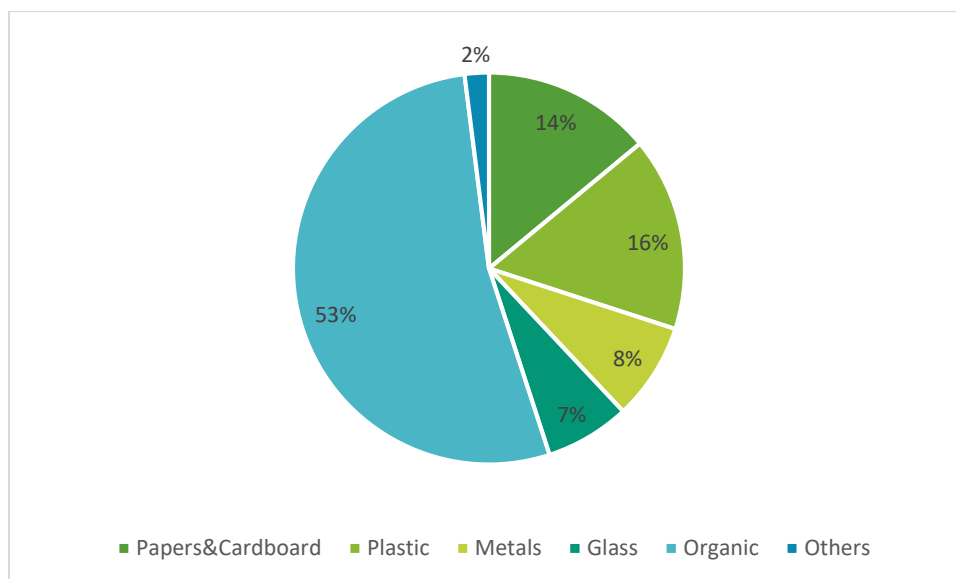


Figure 3: Waste composition- 2019

9. Waste generation projections

The amount of generated waste will be estimated according to the assumptions included in the National SWM Strategy and in Jordan and the Guide to Local SWM Plans. The assumptions were as follows:

Table 6: Jordan fundamental assumptions within the basic report of the national strategy for SWM

Fundamental assumptions	Value
Waste generation rate per capita in rural area in 2021, with yearly growth of 1.02%	0.93 Kg/day.capita
Waste generation rate per capita in urban area in 2021, with yearly growth of 2.04%	1.14 Kg/day.capita
Waste generation rate per capita in volume	4 L/day.capita
Safety factor for waste volumes (unexpected volumes)	1.5
Population growth rate all over Jordan	2.224%

Accordingly, these estimates were used to obtain projections of year-to-year waste generation based on the population growth up to 2028. The population growth rate, for all of Jordan, was estimated at 2.224%, according to DOS. Estimated populations and waste generation for the years leading up to 2028; based on the 2022 population of 177,184, are included in the table below.

Table 7: Population and generated waste projections for the following years

Year	2023	2024	2025	2026	2027	2028
Population of 177,184 in the base year of 2022	181,125	185,153	189,271	193,480	197,783	202,182
Waste generation rate of 1.14 from base year 2022 for urban area (kg/day/capita)	1.19	1.21	1.24	1.26	1.29	1.31
Waste generation rate of 0.94 from base year 2022 for rural area (kg/day/capita)	0.95	0.96	0.97	0.98	0.99	1.0
Total waste generated (ton/day)	205.351	215.0301	223.372	235.049	244.048	255.165
Total waste to be managed before compression (m ³ /day)	821.403	860.122	893.490	940.197	976.193	1020.658

The municipality currently landfills its waste at Madaba landfill, The municipality does not usually weigh, but by the request of the consultant, the municipality weighed the waste on Saturday and Tuesday for two times, and the result was 290 tons and 210 tons, respectively. This indicates the difference between the quantities of waste produced on official working days and holidays.

9. SWM in the Municipality

Following an understanding of the amount and composition of waste to be managed by the municipality, the diagnostic process will address existing municipal governance resources to identify leverage points or locations around which to build mechanisms to optimize MSWM.

The analysis will cover aspects mentioned earlier, which are:

- Institutional aspect.
- Technical aspect.
- Financial aspect.
- Social aspect.

10. Institutional aspect

This aspect of the plan depends on the availability of a department specialized in the MSWM process, which includes within its cadres qualified competencies to manage and implement this process. Therefore, the existing organizational structure concerned with MSWM operations will be explained below.

Organizational structure

The following figure shows the current organizational structure of the departments related to MSWM operations in the Municipality.

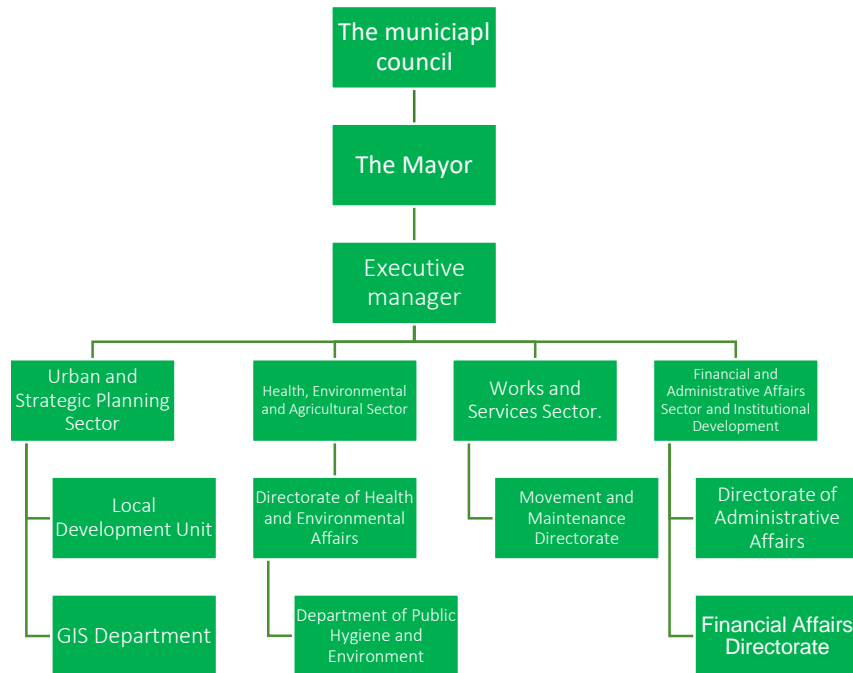


Figure 4: Organizational structure of departments & units governing MSWM process aspects.

Employees in SWM service:

It is normal for MSWM data to be distributed among the different departments since there wasn't a department specifically dedicated to providing services for municipal solid waste management. The scattering of data among departments limits its use and benefits for data-guided management of the SWM process.

Since collection and transportation are the most important aspects of SWM operations, it was necessary to assess the workers on the municipal staff. The results were as follows:

Table 9: Collection and transportation workers within the municipality staff

Description	Total Number
Permanent Workers assigned within the municipality	75
Part-Time workers assigned within the municipality	345
Workers assigned to street sweeping	152
Workers assigned to accompany MSWM collection vehicles	63 workers (20 permanent – 43 part-time)

Description	Total Number
Workers assigned to other tasks (office cleaning, janitorial, etc.):	188
Number of Supervisors	12
Number of Compactor Drivers	27
Number of open trucks drivers	12

The presence of **twelve** supervisors within the MSWM staff does not cover all areas within the municipality and thus reduces the efficiency of the work being done, and in relation to the number of workers, mechanisms and areas within the municipality, the number of supervisors must be increased on workers.

11. Technical aspect

According to the MSWM structure in Jordan, the municipality collects the waste and transport it to the landfill managed by Madaba JSC (Joint Service Council). Therefore, the technical evaluation will assess all aspects of MSWM starting with waste storage in containers, then the waste collection fleet, and then the available waste treatment facilities.

12. Waste containers

Waste collection containers are the pillar of the MSWM process, so the process of maintaining and replacing them periodically is a prerequisite to ensure that they are not corroded and to be able to serve the main purpose for which they were found. All this helps municipality employees in the process of its management and accessibility. If all of the above is not done, this will result in negative aspects to this process, including, but not limited to, reducing the general efficiency of the waste collection process from containers and also reducing safety for municipal employees, and this also affects the general idea of the municipality's residents in case the containers are in poor condition. It will generate a general idea about the poor management of municipal solid waste.

Waste containers can be made from different materials and in different shapes. The most common type of container in Jordan is 1100 liters of steel container. There are also containers with different capacities such as 770 liters, 240 liters, and 120 liters as well as 5000 liters steel winch containers which are usually used in high-density commercial areas.

Containers are categorized into bad and good according to container age and depreciation rate. A factor of 1 is given for new containers less than two years old, a factor of 0.5 for containers between two and four years old, and a factor of 0.0 for containers over 4 years old as shown in the table below:

Table 10: Containers Depreciation factor

Container age	Depreciation factor	Category
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Less than 2 years	1	Good
From 2 years to 4	0.5	Bad
More than 4 years	0.0	Very Poor

The evaluation relied heavily on the technical assessment of the situation of the containers by the waste collection workers. This assessment can be clarified by looking at the results in the following table, which are detailed by regions:

Table 11: Containers' status, size, and location

	Condition	Containers 5000 L	Containers 1100 L	Containers 900 L	Barrels 200 L
Quantity	Good	0	927	4	3,212
	Bad	0	423	22	5,630
	Very Poor	21	780	0	2,740
Sub-total		21	2,130	26	11,582
Total		13,759			
Total Volume (L)	Good	0	1,019,700	3,600	642,400
	Bad	0	232,650	9,900	563,000
	Very Poor	105,000	858,000	0	548,000
Sub- total	Liter	105,000	2,110,350	13,500	1,753,400
Total		3,982,250			
Total Volume (m ³)	Good	0	1,019.7	3.6	642.4
	Bad	0	232.65	9.9	563
	Very Poor	105	858	0	548
Sub- total	m ³	105	2,110.35	13.5	1,753.4
Total		3,982.25			

The total number of containers and barrels is 13,759, as the number of barrels reached 11,582, so the percentage formed by barrels out of the total number of containers is 84%, with a total capacity including both good and bad waste containers is 4,787,800 liters identified by the guidebook as the actual capacity, while the equivalent capacity is 3,982,250 liters.

In 2019, the available number of waste containers was 4,426. An increase in their quantity was proposed, consisting of 80 containers with a capacity of 1100 liters and 50 containers with a

capacity of 200 liters, over the previous five years, with the aim of improving the waste management infrastructure. However, unfortunately, the municipality did not commit to implementing this proposed increase. By the year 2023, the total number of containers in the city had risen to 13,759.

It is noteworthy that this significant increase exceeded the previously proposed increment and surpassed the actual needs of the population. This situation resulted in an increase in the financial costs associated with the maintenance and operation of the excess containers. With the increased number of containers, it necessitates the allocation of more financial and human resources to maintain and operate them properly.

Furthermore, there are additional costs related to the waste collection vehicle fleet. Increasing the number of containers requires the presence of more vehicles and drivers. This leads to an increase in fuel costs, wages, and maintenance for the waste collection vehicles.

In addition to the financial costs, there are negative impacts on the environment and urban aesthetics. The increase in the number of containers can lead to congestion in streets and residential areas, affecting the overall appearance of the city and resulting in the distortion of natural landscapes.

MSWM collection and transfer

Waste collection and transportation is the primary process of municipal solid waste management. So, it is natural that this process is the most expensive process as well. This process includes costs for salaries, fuel, maintenance, and insurance, which are very high. So, we have to consider the most appropriate part through which we can manage to reduce the cost of this process.

Since salaries are an untouchable part, then we can reduce costs related to fuel and maintenance, by finding the optimal route for vehicles for collecting and transporting waste, which covers the largest distance within the shortest route and time period, which directly affects the process of maintaining the vehicles and thus reduces the costs of this process. Also, the periodic maintenance of vehicles ensures that the cost is reduced and that it is protected from failure in a large and continuous way, thus reducing the total value of this process.

Thus, vehicle depreciation is a critical factor in the valuation process in order to avoid vehicles with operating costs higher than the capital cost of the new vehicle. Moreover, high maintenance costs resulting from maintenance also mean long downtime leading to lower quality of service.

As a result, the following equation is used to calculate the indicative capacity in order to determine the efficiency of the vehicle according to the total amount of **waste collected per work shift per day**, which can be calculated using the following formula:

$$\begin{aligned} & \text{Waste Collection per Vehicular Shift} \\ & = \text{Vehicle volume (m}^3\text{)} * \text{\#oftrips per shift} * \text{Loading Density} \left(\frac{\text{ton}}{\text{m}^3} \right) \\ & * \text{Loading Rate} * \text{Operation Rate} * \text{Rate of Efficiency} \end{aligned}$$

Loading rate: Nominal capacity per trip per vehicle is 100%. Considering actual loading volume, 90% of loading rate is applied within the formula.

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Operating rate: Ideal total working days is 100% assuming no days-off, no standby and no repair days. A total working day availability of 86% (6 days per week) of operation rate is applied considering actual working days that the collection/transport service is provided.

Loading density: 0.625 ton/m³ for compactor trucks

= 0.3 ton/m³ for dump trucks (with no compaction).

Rate of Efficiency: Since a collection/transport vehicle will likely require more repair downtime thereby suspending its operation in a greater frequency as it gets older, the following rate of efficiency can be applied:

Table 12: Vehicle's Depreciation Template

Vehicle age in the target year	Actual rate
Less than 7 years	100%
From 7-11 years	50%
12 years and more	0%

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Using the above criteria, the data of solid waste collection vehicles were analyzed as follows:

Table 13: Information about MSW collection vehicles

Route #	Vehicle's plate number	Vehicle's capacity m ³	Type	Number of trips per day	Year manufacturing of	Loading rate	Actual rate	Operating rate	Loading density	Waste Collection per Vehicular Shift
1	5-8955	7	Compactor	2	1998	0.9	0	1	0.625	0.00
2	5-8917	11	Compactor	2	1998	0.9	0	1	0.625	0.00
3	5-16069	2	Compactor	3	2002	0.9	0	1	0.625	0.00
4	5-16609	2	Compactor	2	2009	0.9	0	1	0.625	0.00
5	5-10668	6	Compactor	1	2002	0.9	0	.1428	0.625	0.00
6	5-10669	6	Compactor	1	2002	0.9	0	1	0.625	0.00
7	5-21496	15	Compactor	standby	2007	0.9	0	0	0.625	0.00
8	5-29863	2	Compactor	standby	2008	0.9	0	0	0.625	0.00
9	5-19092	2	Compactor	standby	2009	0.9	0	0	0.625	0.00
10	5-19402	5	Compactor	1	2009	0.9	0	1	0.625	0.00
11	5-19410	5	Compactor	1	2009	0.9	0	1	0.625	0.00
12	5-23818	8	Compactor	3	2015	0.9	0.5	1	0.625	6.75
13	5-22608	6	Compactor	3	2014	0.9	0.5	1	0.625	5.06
14	5-24189	11	Compactor	2	2015	0.9	0.5	1	0.625	6.19
15	5-24196	11	Compactor	1	2015	0.9	0.5	1	0.625	3.09

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16	5-24195	11	Compactor	1	2015	0.9	0.5	1	0.625	3.09
17	5-24186	11	Compactor	1	2015	0.9	0.5	1	0.625	3.09
18	5-25062	18	Compactor	2	2017	0.9	1	1	0.625	20.25
19	5-25243	18	Compactor	1	2016	0.9	0.5	1	0.625	10.13
20	5-26054	9	Compactor	standby	2017	0.9	1	0	0.625	0.00
21	5-27064	3.5	Dump truck	3	2019	0.9	1	1	0.3	2.84
22	5-22753	3	Dump truck	3	2014	0.9	0.5	1	0.3	1.22
23	5-19375	3.5	Dump truck	3	2008	0.9	0	1	0.3	0.00
24	5-22756	3	Dump truck	3	2014	0.9	0.5	1	0.3	1.22
25	5-20280	3.5	Dump truck	3	2011	0.9	0	1	0.3	0.00
26	5-27067	3.5	Dump truck	3	2019	0.9	1	1	0.3	2.84
Overall Capacity (ton/day)										65.76

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The operational capacity of the vehicles according to the Guidebook approved by it is 89.21 tons/day, where the Guidebook states that one vehicle must complete two to three trips per day according to its size to the landfill. The municipality has 11 compactors with an operational life of more than 11 years, so the actual rate of their operation is zero, but they make trips and collect waste. But in view of this, the cost of maintaining, fueling, and securing these vehicles is very large and expensive, so it is recommended to replace them, since the total number of vehicles is 26 and there are 12 of them that have exceeded their operational life of 11 years. Therefore, the municipality must start replacing the vehicles, because this will lead to great pressure on them in terms of maintenance and fuel costs.

The municipality purchased 2 compactors of 2008 and 2017 with a capacity of (2 tons and 9 tons), but they were used as a reserve because the municipality did not use them.

The municipality uses Madaba landfill, which is approximately 9 km two way from the center of the municipality.

The annual fuel consumption for the SWM vehicles that operate within Madaba municipality is 245,041 Liter, the below table shows the total fuel consumption, average fuel consumption per km and the total CO₂ emissions.

Annual SW vehicles fuel consumption and CO ₂ emission				
# of vehicles	Annual working days	Average fuel consumption per km (L/km)	Total fuel consumption (L)	CO ₂ emissions (ton.CO ₂)
26	317	0.4	245,041	6,567.09

The waste collection vehicles generated annually a total of 6,567 tons of CO₂, and this number has a chance to be reduced through many options, such as enhancing the current collection tracks by optimizing new waste collection and transportation routes, replacing the old operating vehicles by new ones, and conducting the regular maintenance.

13. Current operating projects

Madaba Sorting Facility

Current Situation

The facility was operated at the end of 2018 through GIZ support. The area of the facility is around 10,763 square feet (1,000 m²) and has 4 hangars.

The design capacity of the facility is around 10-20 tons/day, The facility is currently processing 300-550kg of material per day. The main material the facility recovers are:

- Mixed paper/cardboard
- Metal (Aluminum and steel cans)
- Plastics (PET, LDPE/HDPE, PP and PE)

At the moment, the facility is operated by Madaba municipality. The municipality is in charge of recyclables collection, transportation of the material to the facility, sorting the material and selling the processed recyclables.

The following represents the flow chart for the facility:

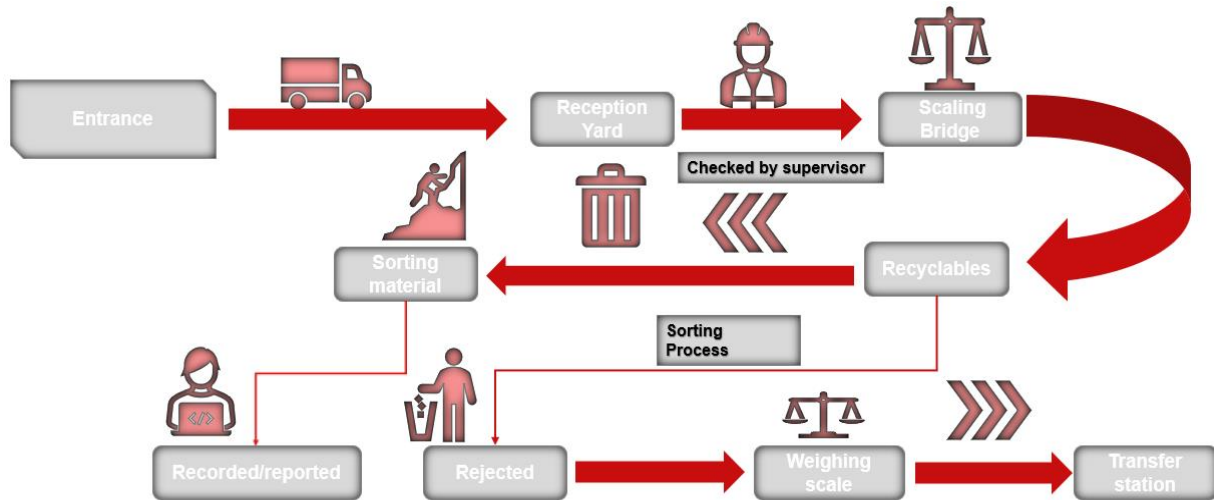


Figure 5 Madaba sorting facility workflow.

The work schedule of the facility is as follows.

- The facility operates 300 days a year.
- The facility operates from Monday - Saturday between 8:00 - 2:00 (6 hours/day).
- The facility closes on Fridays and National Holidays.
- The equipment operates for around 2 hours per day.

Facility components

The main components of the sorting station are:

- Entrance gate,
- Reception and weighing area,
- Administration building,
- Unloading area,
- Screening area,
- Temporary storage area,
- Processing area,
- Warehouse,

Facility equipment

The facility has the following equipment:

- Weighing Bridge,
- Sorting line (sorting belt and yard),

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- 2 cardboard baler press machines,
- Baling press for aluminum and PET,
- Plastic shredder (PE, PP),
- Paper shredder,
- Forklift,
- Mini

Loader



Figure 6 Baler machine



Figure 7 Baler machine



Figure 8 Plastic & paper shredder machines



Figure 9 Plastic & paper shredder machine



Figure 10 Bobcat / 2018



Figure 11 Sorting belt for mixed waste



Figure 12 Weighing Bridge with a capacity of 15ton.

Sorting at source project operating by UNDP

The project is aiming to reduce the recyclable material amounts from reaching the FDS, by targeting the commercial sector, residential sector and the schools. The primary collection process is done through a previously provided plastic bags or containers, or directly from the residents to the waste bank. The below figure shows the process map for the sorting scheme.

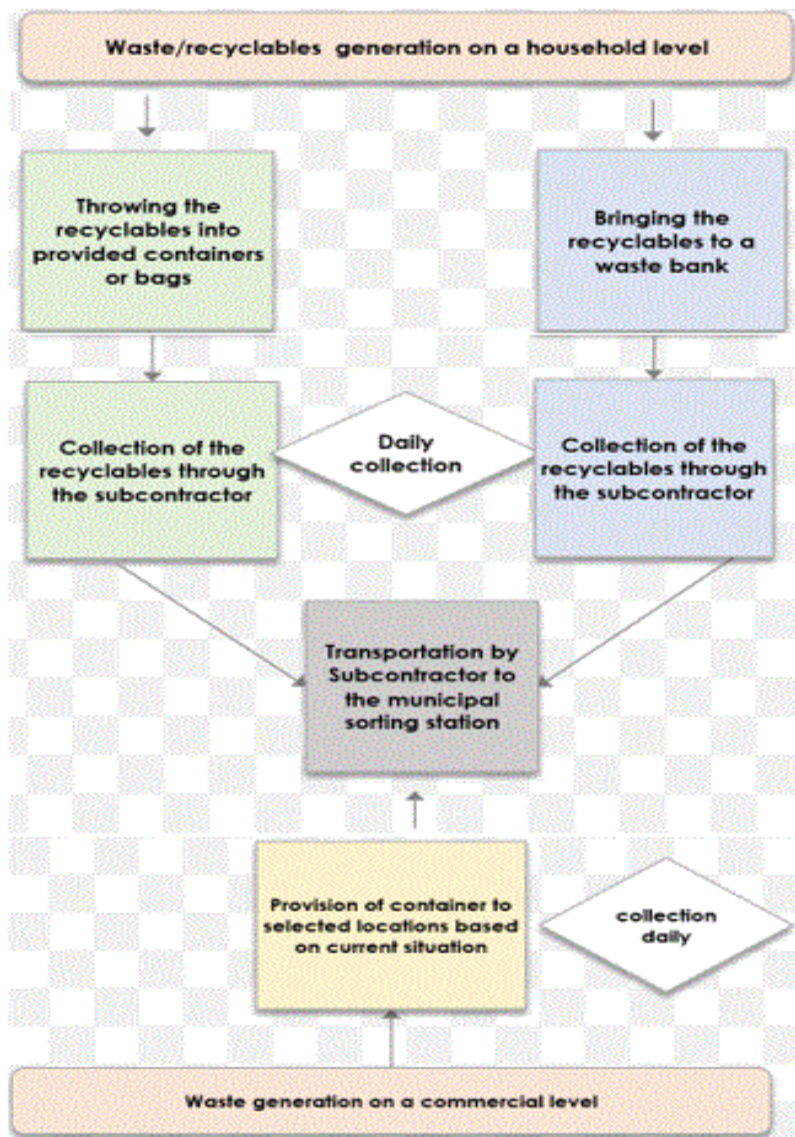


Figure 13 Process map for sorting scheme

The sorting scheme has different integral parts, as shown below:

- Containers/bags – both will be distributed to the targeted areas based on the generated amount of recyclables
 - o Single family houses will receive bags,
 - o Apartment buildings (multi-family houses) will receive containers that are to be placed on the private property of the building/inside to avoid the containers or the recyclables to be stolen
 - o Commercial facilities will receive containers if they do not have containers or specific collection point
- Collection
 - o Schedule: the collection will take place daily in the first phase of the collection, to show availability and raise awareness on the opportunity to recycle waste, as well

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as to achieve the targeted amount of collected recyclables; for the second phase of collection, an assessment will be conducted for the collection and possibly adjust the schedule for collection

- Execution of collection will be done by the subcontractor, a door-to-door mechanism while accommodating peoples' preferences in the timeframe as much as possible

An additional opportunity that is to be further explored is the possibility to establish a waste bank in the Haya Cultural Park, in the proximity of the targeted neighborhoods. Through the waste bank, additional recyclables can be obtained from either interested people of close by areas or waste pickers, who are collecting material without a vehicle, as the scrap yards to which the waste pickers could also sell are further away, in the Southeastern outskirts of Madaba.

Targeted area

The project after deep study selected the areas that have the potential to be part of the project, therefore, the list of areas was as follows:

1. Al Shafa Neighborhood (534 households)
2. Nasser Neighborhood, (461 households)
3. 15 malls, hypermarkets, restaurants, and Cafes,
4. 13 hotels,
5. 1 university,
6. 15 private and governmental schools,
7. 8 industrial factories,

The total number of generators is around **1047 waste generators**, through adding malls, hypermarkets and industrial factories, the project is ensuring a higher collection rate of recyclables.

The population dynamics on the neighborhood level can be estimated through the average amount of persons per household (DoS), which is 4.8 person, accordingly, the Shafa neighborhood has around 2,563 inhabitants and the Nasser neighborhood has around 2,213 inhabitants.

14. Financial aspect

The financial aspect within the analysis of the MSWM plan is concerned with the existence of cost centers within the municipal financial system. There is no solid waste cost center within the municipality's financial framework. Therefore, the evaluation was directed towards collecting all the financial data related to the MSWM process, including revenues.

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Expenses and collected fees as shown in the table below:

Table 14: Financial status of the MSWM at the municipality

Financial situation	Item	Amount (JOD/year)	Total
Stipulated Revenues	Households	1,935,756	2,057,508
	Commercial	121,752	
Costs	Cost of Collection – Salaries of Workers:		2,627,923.888
	The Salaries of sweeping and gathering workers		
	Sweeping and gathering workers overtime		
	Cost of Collection – Salaries of Drivers:		
	1. Driver’s salaries		
	2. Drivers’ overtime		
	3. The Salaries of management staff related to SWM		
	4. Management staff related to SWM overtime		
	Cost of Collection – O&M Costs:		
	1. Fuel		

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Financial situation	Item	Amount (JOD/year)	Total
	2. Vehicles maintenance and oil	218,000	
	3. Vehicles' insurance	33,000	
	4. Vehicles' wash cost	5,000	
	5. Street cleaning equipment and uniforms	22,545.5	
	6. Purchasing containers and maintenance	58,962	
	7. Trash bags	4,890.5	
	Disposal Cost	2,000	
Fees Collected	Households	700,000	875,556
	Commercial	171,606	
	Tickets on commercial sector	3,950	
Cost Recovery Ratio = Total billing (revenues)/total cost			78%
Fee collection ratio = Total actual fee collection/total billing (revenues)			43%

Revenues include amounts paid directly to the municipality through the renewal of annual professional licenses, as well as fees collected by the municipality from the electricity company, as the electricity company collects waste fees from the residential sector as part of the home's electricity bill. After deducting the cost of services provided by the electricity company to the municipality, such as street lighting and municipal electricity consumption. In comparison to the previous plan, the cost recovery now increased by almost 7%, which it caused because of the sorting activities that conducted during the previous years.

The cost per ton of waste management services in Greater Amman Municipality and Madaba Municipality differ significantly. In GAM, the cost per ton is 47.5 JOD in 2019, whereas in Madaba Municipality, it is 35² JOD. This substantial difference can be

² To calculate the cost per ton, divide the total cost of waste management by the total waste generated in tons per year.

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attributed to various factors. Firstly, GAM handles a larger population and generates a higher amount of waste, resulting in higher operational costs. Additionally, Amman, likely requires more advanced waste management infrastructure and services, leading to increased expenses. On the other hand, Madaba, a smaller municipality with a lower population, may have comparatively lower waste management costs. Furthermore, geographical location, waste collection methods, and disposal facilities can also influence the cost disparities between the two municipalities.

10. Evaluating Current SWM Situation

A set of questions is included for each aspect to assess the current situation based on the data collected, the analysis process, challenges, and potential interventions. These questions are intended to prompt a more in-depth examination of the current situation based on a preliminary examination of the answers to these questions.

The questions are categorized into the above four categories as follows:

15. Institutional aspect

This aspect examines the department/division responsible for the MSWM process as well as the technical competence of the staff among other criteria, as follows:

Table 15: Institutional evaluation template

Question	Answer	Comments
Is there a specific Department/Division for MSWM within the municipality?	No	It's listed over the organizational structure, but the municipality don't have the qualified personal
Is there enough staff for SWM services or sub-services?	No	The municipality has lack of the available staff to operate the sorting facility
Is there a sub-service managed by the private sector?	No	
Are there plans for SWM prepared in the municipality?	Yes	The LSWMP was prepared in 2019
Is there an ongoing capacity-building program for the municipality's SWM staff? If so, please specify.	No	

Establishing an Occupational Health and Safety Department is a must in order to ensure the health of the workers as well as to ensure that all municipal employees (not just the SWM staff) have the required health and safety equipment.

16. Technical aspect

This aspect re-analyses the collected data related to the technical aspect of SWM, including street cleaning, primary and secondary collection, separation at source, transportation, treatment, and private sector involvement as follows:

Table 16: Technical evaluation template

Question	Answer	Comments
What is the coverage ratio for street sweeping service?	60%	Due to the lack of staff, the vastness of the area, and the significant distances between different areas.
Does the municipality use manual, mechanical or both for street sweeping?	Manual	
Does the municipality distribute small Containers in the streets?	Yes	There are around 250 small containers, distributed through the MoENV
What is the coverage ratio for the collection service?	100%	
What is the available container capacity per capita per day in liters?	22 L/person for all containers 9.2 L/person for good containers	Standard capacity is 6 litter/person
What is the vehicle's capacity in tons compared to the generated quantity of waste per day?	32.02 %	43.44 %-This is calculated based on the standard number of trips as per the guideline. 32.02 % - This is calculated based on the current number of trips
Does the municipality practice any source separation?	Yes	Within some residential and commercial areas
Does the municipality practice any recycling activities?	Yes	There is a sorting at source activities within some districts and commercial sector, those materials delivered to the sorting station that managed by the municipality.
Are informal recyclers/waste pickers active within the collection system including both informal recyclers and collection crews)?	Yes	
What is the distance from the municipality centre to the landfill?	4.5 one way	
Is there a transfer station utilized in waste transport?	No	The distance from the municipality centre to the landfill is too close

Does the municipality dump waste into an unsanitary dumpsite?	Yes	
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MSWM is currently considered simple, but it is more advanced than some municipalities of its own category. Sorted waste, especially cardboard and plastic, is collected from containers designated for sorting in some areas, but the process is not carried out efficiently, due to the lack of commitment of the population, and the failure to place containers designated for waste. households next to the sorting containers, which leads to the use of sorting containers as containers for collecting mixed waste. The waste is also collected by following the paths based on the drivers' knowledge of the areas instead of having scientifically developed paths, which ensures optimal routes in terms of collection time and distance, which can significantly reduce operating costs.

It should be noted that the available capacity of containers is large compared to the population, and the negative impact that this situation can have on collection costs with very low operational efficiency is that these containers will certainly have a very low fill rate. Simply put, higher capacity containers mean more unloading trips for the vehicles in collection vehicles, and this requires more operation of the hydraulic piston pump, more fuel, and longer uptime, thus higher cost and lower operating efficiency. Furthermore, even if the number of trips recommended in the guidebook is fulfilled, the compactors' capacity, when compared to the amount of waste generated, is insufficient to handle the amounts of waste generated at the present time.

17. Financial Aspect

The assessment addresses the missing information in the financial system as well as providing an underemphasizing of the importance of the cost recovery ratio and cost centers. The following table deals with the main topics in the financial system:

Table 17: Financial evaluation template

Question	Answer	Comments
Does the municipality have a cost centre for the SWM services and sub-services?	No	
Does the municipality have a sub-cost centre for each sub-service including street sweeping, collection, transportation, and disposal?	No	
Does the municipality utilize a full cost accounting system in calculating costs?	No	The current accounting system is basic, and it's the same system used in the Jordanians municipalities
What is the Cost Recovery Ratio?	78%	
What is the Fee Collection Ratio?	43%	

The lack of an inclusive financial system is a source of concern in this aspect, as it is in the Institutional aspect. Because the current system is so simple, there is no allocated service budget. As a result, the municipality was unaware of the cost recovery and fee collection rates because the revenues and expenditures of MSWM services were distributed across several cost centers, such as the fuel cost of municipal waste collection fleet is calculated for all vehicles in aggregation and not just for MSWM vehicles.

18. Social aspect

An evaluation of the municipality's effective participation of the local community; this step is critical to ensuring the suitability and sustainability of the SWM process.

Table 18: Social evaluation template

Question	Answer	Comments
Is there an existing public awareness and educational program within the municipality?	No	
Are there any current and ongoing activities for a public awareness and educational program?	No	
Is there a systematic complaint and GRM system in use in the municipality?	Yes	Through the municipality's website, and there are some paper complaints received and documented from the municipality
How are complaints followed up in the municipality?	-	The assigned person for each complaint is based on the complaint's classification
How is the number of complaints calculated?	-	The number of complaints is calculated only for the documented ones.

The municipality must create a system for following up and documenting complaints in the municipality, and clarifying the procedures followed in handling each complaint within the complaints received by the municipality, in order to ensure the quality of services provided to citizens, which will improve the public image of the services provided by the municipality.

11. SWOT analysis

To summarize the municipality's situation, an analysis of Strengths, Weaknesses, Opportunities, and Threats (SWOT) was performed to assess the current situation and identify potential improvements that would improve the quality of MSWM services. The following was the analysis of strengths, weaknesses, opportunities, and threats:

Table 19: SWOT analysis

Strengths	Weaknesses
<ul style="list-style-type: none"> ✓ Great cooperation from the municipal departments and the mayor. ✓ Enough containers ✓ Presence of a sorting station. ✓ The existence of sorting at source activities within the municipality. ✓ Existence of a SWM plan. ✓ The short distance between the municipality and the landfill. ✓ The existence of a new tariff for waste collection based on the generated amounts from the commercial sector. ✓ The close distance from the capital, where this location gives bigger opportunities for the municipality. 	<ul style="list-style-type: none"> ✗ The compactors wear out and their capacity is low, which leads to a high maintenance cost. ✗ The lack of sufficient documentation of information and data related to the MSWM process. ✗ Lack of public health and safety plans for employees. ✗ There are no detailed and documented plans for occupational safety, as they do not include identification and classification of accidents that must be reported and systematic methods of reporting and dealing with them. ✗ Lack of knowledge of national and regional plans and strategies. Failure to implement some laws due to lack of knowledge of them.

	<ul style="list-style-type: none"> ☒ There is no separation of waste from the source at all the municipality neighbourhoods, it's only applicable in some small portion of the municipality ☒ There is no dedicated and detailed budget for solid waste management. ☒ There is no periodic follow-up of the standards for measuring the performance of employees. ☒ There are no indicators and criteria to measure the performance of the SWM system. ☒ Costly maintenance of vehicles. ☒ The available vehicular capacity is insufficient. ☒ The number of workers is sufficient, but not all of them are working as waste collection or sweeping workers.
Opportunities	Threats
<ul style="list-style-type: none"> ✓ Existence of previous experiences and activities for recycling in the municipality ✓ Creating a coalition and cooperation with neighboring municipalities through cooperation with international agencies ✓ Updating the MSWM plan. ✓ The large number of tourists. 	<ul style="list-style-type: none"> ☒ The previous generated SWM plan wasn't followed up and implemented in fully by the municipality. ☒ The expansion of the geographic area of the municipality and its nature. ☒ Waste generated from the local community and dumped on the side of the road. ☒ Climate and weather conditions "area specificity". ☒ The large number of tourists.

The large number of tourists can be considered as an opportunity as an economic boost increased tourism can bring significant economic benefits to a region, generating revenue and job opportunities. This increased economic activity can be utilized to invest in robust waste management infrastructure and services, as the number of tourists to the municipality of Madaba in 2019 was estimated at about 700,000 tourists, with an average of two days of sleep. On the other hand, the number of tourists is a threat by increased waste generation, a rush in tourism can result in a significant increase in waste generation, exceeding the capacity of existing waste management systems. Insufficient waste infrastructure may lead to inadequate collection, improper disposal, or illegal dumping, causing environmental pollution and health risks.

12. Previous plan projects

The previously developed plan was having a list of proposed projects, that should be implemented by the municipality, either through its own annual budget, or by seeking funds from any international or local donors. In this section, the previously proposed projects will be revised and assessed.

19. Upgrade the sorting actions

During this project, the municipality was aiming to upgrade the GIZ sorting station and the receiving amounts over there. In the first stage they took a good step before COVID-19 pandemic was presence. After that, the

GIZ fund was stopped, and the municipality seek another fund from the UNDP to implement a project that raise the quantities of recyclable materials. The project is undergoing now. However, the workers at the sorting station are still need some training. In addition, the local community still needs a continuous awareness campaign.

20. Design a full accounting system

No action was taken from the municipality toward this project. While the previous plan was emphasized on this project, due to the weaknesses were found in the financial system, that still occurred right now during developing the current diagnostic report. This project will be replicated in the updated plan, since it will be one of the tools that will help the municipality in monitoring the whole processes that related to the SW.

21. Buy new containers

The previous plan shown that the municipality only needs to buy 80 containers with the size of 1,100 liter, and 50 containers with the size of 120 liter. Unfortunately, without replacing that much of containers. The municipality decided to buy more than 900 containers with the size of 1,100 liter, and more than 3,000 barrels. That leads to increase the work load, fuel cost, maintenance cost and resulted as a decreasing in the cost recovery ratio. Those numbers will be taken into consideration in the next phase of updating the plan.

22. Buy new compactors

The proposed number of compactors were 8, 3 with the size of 12 m³, while the remaining 5 with the size of 6 m³, but the municipality purchased 2 compactors of 2008 and 2017 with a capacity of (2 tons and 9 tons), but they were used as a standby vehicle because the municipality did not use them.

23. Collection routes optimization

This project was suggested to be implemented during 2020, but until now the municipality don't take any action toward implementing this project. The current operating tracks are still depending on the driver's knowledge. This project will be a priority in the upcoming phase for the municipality to reduce the cost of fuel and maintenance.

24. Buy a mechanical sweeper

The proposal of adding a mechanical sweeper to the SW operating fleet was aiming the reduction of work load, and number of sweeping workers in the municipality. But the municipality didn't implement this project and replaced it by hiring more workers.

25. Hiring SW workers

There was no shortage in the number of workers assigned for sweeping and collection in the municipality in the previous plan. However, the municipality hired more than 120 new workers as a SW worker but more than 180 workers are assigned for other staff not related to the SW.

26. Awareness campaign

The municipality conducted awareness campaigns during the previous years, that targeted the households, commercial sector and the schools. Those campaigns were either part of previously operating projects, like the GIZ and UNDP projects, or through the municipality itself.

13. Build the Framework of the Plan

27. Identifying Priorities

Based on the information obtained from the diagnostic phase of the municipal plan development process, the current SWM problems were given priority in terms of importance in implementing an effective SWM system in the municipality. This ranking should be consistent with the intended results of the National Strategy.

To facilitate the municipality's prioritization process, the issues associated with existing SWM services should be individually categorized and presented and a priority ranking developed for each issue. A simple ranking methodology is proposed by which the ranking of priority projects will be based on the decision of the Planning Committee working in conjunction with the municipality's Planning Team and Working Groups through voting. It is likely that some of the priority initiatives will be equally ranked since they may be accomplished in parallel.

Table 8 Priorities' identification

Main topic	Sub-topic	Order	The short- and medium-term goal at the end of 2027	Notes
Institutional aspect	Continuity of providing services within the municipality's responsibility, including street cleaning, waste collection, and treatment. Working in shifts, purchasing machinery and equipment	1	2023-2028	The municipality will receive two compactors within the upcoming three months
	Establish a department (directorate) for solid waste management	2	2024	The department existed on the organizational structure of the municipality, without any qualified employee
	Establishing new municipal solid waste management facilities, including transfer stations and waste treatment facilities, and improving service infrastructure for the process of collecting, transporting, and treating solid waste.	3	2024	The municipality currently has its own sorting facility, but it looks to operate a factory that produces a cardboard cup, the factory existed but without the required operational equipment.
	Establishing an effective management information system and introducing modern and advanced software systems in the field of information management related to the management of municipal solid waste.	4	2024	Once the SWM department has the qualified employee, the MIS should be established.

	Involve the private sector in one or more solid waste management service operations.	5	2025	The private sector now operating the metal containers factory, but the municipality is looking to involve the private sector in managing the whole SW processes.
Regulatory framework	Update or develop special local instructions to set effective systems for separating waste according to its sources and recovering costs.	1	2024	
Technical aspect	Improving service coverage to include 100% street sweeping.	1	2027	The municipality is looking to add a mechanical sweeper to its fleet, and add the number of roads with an edge.
	Develop strategies and programs for awareness and education of stakeholders to reuse and recycle solid waste materials (at least paper, metal, plastic, and glass as defined in the national strategy).	2	2024	Once the SWM department has an awareness officer, the strategy will be developed. Meanwhile, the strategy could be developed between the head of cleaning department and the head of LDU.
	Establish a separate system for collecting recyclables (at least paper, metal, plastic and/or glass as defined in the national strategy).	3	2024	The municipality now separate the cardboard and nylon within the commercial sector and one neighborhood, now they will increase the number of participated neighborhoods.
	Building local solid waste treatment facilities to increase waste diversion and resource recovery individually or with other municipalities and with a clear plan in terms of ownership and operation, as well as financial and institutional arrangements with the municipalities participating in such facilities.	-	2026	There is an existing sorting facility in the municipality. However, the municipality looking to has a composting facility after study if its feasible or not.
	Building local transport station(s) as needed to increase the efficiency of	-	-	There is no need for that, since the landfill distance

	the collection system individually or with other municipalities and with a clear plan regarding ownership and operation, as well as financial and Institutional arrangements with the municipalities involved in such facilities.			less than 5 km from the center of the municipality.
	Improving service coverage to include 100% street sweeping.	6	2028	Reaching 100% for street sweeping if the municipality buy a mechanical sweeper, assign the workers in their roles and all streets are paved.
	Reducing organic waste that is disposed of in local or regional landfills.	7	2024-2028	5%, but if the composting facility looks feasible, then this percent might reach 15% in 2028.
	Packaging waste recovery (including reusable materials and materials/energy recovery).	7	2024-2028	10%
	Packaging waste recycling.	7	2024-2028	5%
	Identify all random landfills and close/develop these sites as necessary.	-	-	N/A
Financial aspect	Establishment of a solid waste management cost center with subsidiary cost centers for sub-services, linked to the main finance.	1	2024	
	Create a comprehensive costing system for municipal waste management tasks based on sound international standards.	3	2024	
	Update the payer's database (based on electricity bills) and re-evaluate options to reach all waste producers through the billing process.	2	2024	
	Create a new cost recovery system, or change the tariff based on	-	-	Already established.

	a comprehensive accounting system.			
	Establish an efficient and effective fee collection system.	5	2025	
Social aspect	Establishing an electronic complaints system and grievance compensation mechanism that are effective, quick to respond and improve performance.	1	2024	
	Develop and implement a plan for comprehensive and sustainable awareness-raising behavior change programs targeting the community, including men, women, youth, and people with special needs, with the help of civil society organizations and competent official bodies (this can be done in coordination with the joint service councils, as part of the regional awareness and education initiative).	2	2025	
	Develop a local action plan to integrate (formalize) the informal sector (i.e., waste collectors), (this can be done in coordination with joint service councils, as part of a regional initiative.) (More information on integrating the informal sector can be found at Possible options and recommendations towards establishing a viable integrated system for municipal solid waste in Jordan - Second draft report.)	3	2025	

14. Analyzing options

It is important to evaluate all possible options in all the different aspects to ensure that the objectives set are achieved. The number of options varies greatly between different aspects, so the most appropriate options were selected based on the current situation of the municipality as well as short-term goals. Accordingly, the options for each side are detailed as follows:

28. Institutional aspect:

Organizational structure

It is important for the municipality to have a separate department responsible for solid waste management services and facilities regardless of whether the services and facilities are provided by municipal employees or private contractors. This section of the municipality must be supported by enough qualified employees. This department must also be prepared to improve existing services and develop new facilities and services necessary to implement and operate an effective solid waste management system. Thus, the following organizational structure is proposed:

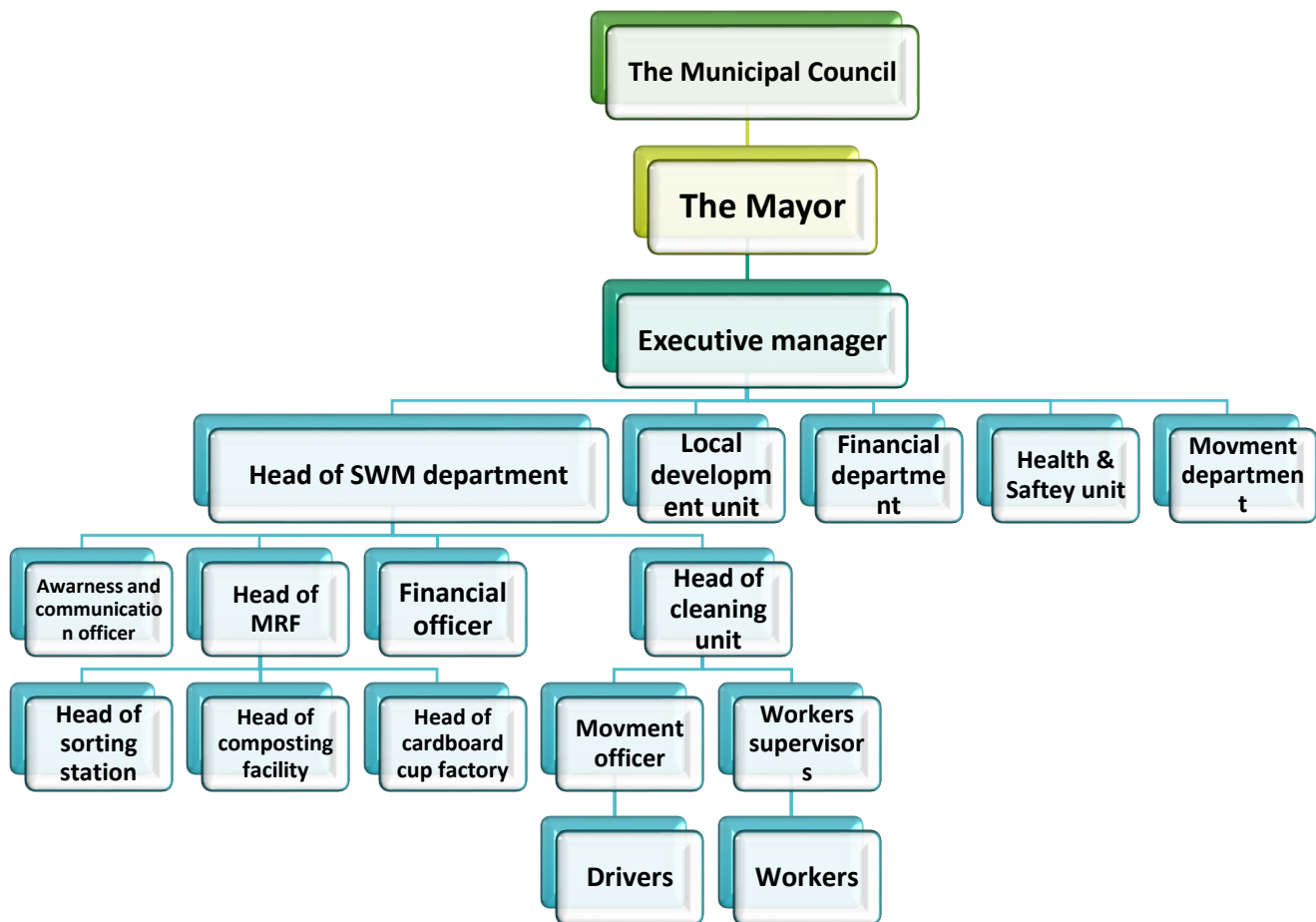


Figure 14 The proposed organizational structure

The proposed organizational structure ensures that there is a dedicated municipal solid waste management department, and horizontal communication channels with all other relevant departments, primarily the department of movement. It also assumes the establishment of a special department for health and safety. All proposed departments should be under the direct supervision of the Executive Director, as this will ensure

that all departments are at the same level facilitating communication and cooperation between all relevant departments.

Capacity Building

Based on the different interviews conducted throughout the plan development period, several aspects of capacity building for the municipal staff were identified based on his position. Those aspects include administrative, financial, technical, and operational aspects, which also clarify the best approach to training and follow-up.

Municipal staff (current and future) should be aware of the various aspects of MSWM, and the main aspects that require capacity building sessions are listed below from most urgent to least:

Table 9 Capacity building topics required for different categories of municipality employees

Target Group	Areas covered in brief	Topics	Approach to training and following-up
Supervisors, heads of departments, and institutional staff	General orientation on preparing and implementing a solid waste management plan, including technical and technological aspects.	<ul style="list-style-type: none"> • Knowledge in handling and managing various types of solid waste. • Knowledge of occupational health and safety matters for H&S staff and all municipality employees (not just MSW). • Implementation of the solid waste management plan. • Various technical options. 	<ul style="list-style-type: none"> • Theoretical Training • Periodic follow-up from senior management, in addition to annual follow-up by the Ministry of Local Administration (MoLA)
	Technical and Operational	<ul style="list-style-type: none"> • Developing solid waste collection routes. • Distribution of containers and workers according to the needs of the regions. • Maintenance of tools, equipment (including preventive), and management systems. 	<ul style="list-style-type: none"> • Theoretical and practical training • Periodic follow-up by the training provider and the municipality administration
	Financial Management	<ul style="list-style-type: none"> • Develop a budget for solid waste management, 	<ul style="list-style-type: none"> • Theoretical and practical training

		<p>including cost centres and indirect costs.</p> <ul style="list-style-type: none"> • Cost recovery for solid waste management services. • Fees collection rate. • Clarify the importance of the solid waste management sector. 	<ul style="list-style-type: none"> • Periodic follow-up by the training provider, the municipality administration, and the Ministry of Local Administration (MoLA)
	Legislative aspect	<ul style="list-style-type: none"> • Introducing the laws and instructions of municipal solid waste management. • Introduce occupational health and safety standards, practices and procedures. 	<ul style="list-style-type: none"> • Theoretical Training • Periodic follow-up from senior management, in addition to annual follow-up by the Ministry of Local Administration (MoLA)
	Monitoring & Evaluation	<ul style="list-style-type: none"> • Providing a primer on monitoring and evaluation. • Record keeping and documentation. • Activate monitoring tools. 	<ul style="list-style-type: none"> • Theoretical Training • Periodic follow-up from senior management, in addition to annual follow-up by the Ministry of Local Administration (MoLA)
	Community involvement	<ul style="list-style-type: none"> • Communicating with the community through focus groups and workshops and giving their opinion. • Developing behavioural change programs 	<ul style="list-style-type: none"> • Theoretical and practical training • Periodic follow-up by the training provider and the municipality administration
Sanitary workers and drivers	Standards and Procedures	<p>Operational aspects:</p> <ul style="list-style-type: none"> • Introducing solid waste management standards and work procedures. 	<ul style="list-style-type: none"> • Theoretical and practical training • Periodic follow-up by the training provider and the municipality administration

		<ul style="list-style-type: none"> • Introducing occupational health standards. • Introducing their role in the solid waste management system. 	
	Strengthening technical capacities for better implementation of solid waste management components (i.e., training for drivers, maintenance workers, workers in treatment facilities, etc.)	<ul style="list-style-type: none"> • Knowledge in handling and managing various types of municipal solid waste. • Initial collection and transfer. • Sorting and recovering materials. • Fleet and equipment maintenance (including preventive) and management. • Occupational health and safety training, including: <ul style="list-style-type: none"> - Handling of dangerous/toxic materials. -Band aid. -Health risks and precautions. 	<ul style="list-style-type: none"> • Theoretical and practical training • Periodic follow-up by the training provider, the municipality administration, and the Ministry of Local Administration (MoLA)

Furthermore, it is important to know that according to Article 15b of the Local Administration Law No. 22/2021, municipalities can form partnerships with other municipalities and partner with the private sector to manage municipal solid waste.

29. Technical aspect

The technical options available to achieve an effective solid waste management system in any municipality vary, and many of them emanate from more than one available sub-option for the options that the municipality must make in developing its municipal plan. The following table provides a basic assessment of street sweeper service options with general advantages and disadvantages:

Table 10 Street cleaning options

Street sweeper service options

Option	Advantages	Disadvantages
Option 1: Manual Street sweeper	<ul style="list-style-type: none"> • Applicable to paved and unpaved streets. • Applicable on streets where parking is allowed. • Applicability to narrow streets and alleys with limited vehicle access. • Low capital cost of street cleaning equipment. • No fuel cost. • Low maintenance cost. • Create many jobs. 	<ul style="list-style-type: none"> • Low street cleaning efficiency. • Increasing the physical effort of street cleaning workers. • Increased employee salary cost.
Option 2: Mechanical Street sweeper	<ul style="list-style-type: none"> • High efficiency in street cleaning. • Low physical effort of the hired employees. • Lower salary cost due to lower number of hired employees. 	<ul style="list-style-type: none"> • Not applicable to unpaved surfaces and streets without sidewalks. • Not applicable to streets where parking is permitted (unless parking can be prohibited at times designated for street cleaning). • Not applicable to narrow streets and alleys although small mechanical road sweepers can be used in such locations if there is sufficient parking space to place smaller street sweeping equipment. • High capital cost of street cleaning equipment. • High fuel cost. • High cost of vehicle maintenance.
<p>The result: manual street sweeping / and a mechanical sweeping in the main roads of the municipality</p>		

Waste collection options can be detailed into different categories, with a basic evaluation of collection service options with general advantages and disadvantages. The following table presents waste collection options according to the types of materials collected:

Table 11 waste collection options according to types of material collected

Option 1: Mixed waste collection

Where waste is collected (not separated at source) and transported as mixed materials.

Sub option	Advantages	Disadvantages
Not applicable	<ul style="list-style-type: none"> • Lower capital and operational costs. • The type of system likely to be used in the municipality. 	<ul style="list-style-type: none"> • Not in concurrence with the proposed targets of the National Strategy as a desired and priority approach. • No support for recycling and recovery processes.

Option 2: Separate collection

Where waste is collected and transported separately according to its type, with the aim of reusing, recycling, reducing for better, and/or treating organic waste.

Sub-option	Advantages	Disadvantages
Single material collection	<ul style="list-style-type: none"> • It is commensurate with the proposed objectives of the national strategy as a desirable option in the short and medium-term. • Easy to achieve based on the collections used in the municipality and the sources of materials classified by source. • The possibility of exploiting it to obtain the best means to achieve the collection of materials separately. • Sorting activities by source can be expanded, geographically and technically at later stages based on pilot projects linked to separate collection. • High quality and low pollution of reclaimed materials. • The high market value of the collected separate recyclables. • High Recycling/Recovery Rates. 	<ul style="list-style-type: none"> • It is not in line with the proposed performance objectives of the national strategy as a preferred long-term option. • Higher capital and operating costs depending on the number of materials collected. • It deals with only one material. • May reduce the efficiency of regular programs for the collection of roadsides (sidewalks).

<p>Recyclable mixed materials collection</p>	<ul style="list-style-type: none"> • In-line with the proposed performance targets of the National Strategy as a viable option in the short- and mid-term. • Efficient as the first step before engaging sorting-at-source initiatives. • Lower total and operational costs of the collection process. • Opportunity to recover a significant amount of operating costs by selling recyclable classified materials. 	<ul style="list-style-type: none"> • It does not correspond to the proposed performance targets of the National Strategy as a preferred long-term option. • Requires processing of mixed materials through a “clean” Materials Recovery Facility (MRF) to separate recyclable materials for marketing purposes. • Medium recycling/recovery rates. • Low quality of the reclaimed materials compared to the separate group due to pollution resulting from mixing with other wastes of different mixed materials. • The medium price of reclaimed materials due to lower quality than separately collected material.
<p>Separate collection of individual materials including organic waste or recyclable waste components</p>	<ul style="list-style-type: none"> • In line with the proposed performance targets of the National Strategy as a unique option in the short-, mid-and long-term. • High recycling/recovery rates for collected recyclables. • High purity of collected recyclables. • High value of recyclable materials. • Does not require a “clean” MRF to sort the collected recyclables. • Opportunity to recover a significant amount of operational costs due to the sale of high-quality recyclable materials. 	<ul style="list-style-type: none"> • High total and operational cost • Requires cooperation and effort on the waste generators.

Result: The municipality now has one compactor to collect the cardboard and other recyclables, while the other compactors collect the mixed waste materials. In 2024, the municipality is aiming to increase the recyclable compactor to two compactors, while in 2026 the municipality should increase the coverage area that separate the recyclables at source.

The following table presents waste collection options according to the level of effort required on the part of the waste generators.

Table 12 Waste collection options according to the level of effort required by the generator in waste collection.

Option 1: Communal collection		
Communal collection requires residential and commercial waste generators to transport their MSW to a municipal collection point.		
Sub-option	Advantages	Disadvantages
Central communal storage sites	<ul style="list-style-type: none"> • Effective in small and dense villages with low populations. • Minimal total and operational cost of collection compared to other alternatives. • Minimal traffic load on the street network due to the lower number of stopping points for collection by vehicles serving common collection points compared to collection door to door. • Experience may already exist in utilizing this form of collection sites it is the common approach in many municipalities. 	<ul style="list-style-type: none"> • Waste generators must carry their waste materials to communal containers. • Potential negative effect on street cleaning efforts and costs as well as on aesthetic conditions at communal collection sites. • Difficult to accomplish waste reduction incentives through some cost recovery programs and approaches since user fees or tariffs are not based on the actual amount of waste collected at each resident. • Possible spoilage and loss of recyclables from communal containers. • Possibility to steal the distributed containers.
Material sorting containers or sidewalk containers	<ul style="list-style-type: none"> • Applicable in almost all cases in urban and rural areas. • No negative impact on street-cleaning costs. • Less effort from waste producers as waste needs to be carried short distances when compared to shared containers. 	<ul style="list-style-type: none"> • May not be applicable in densely populated areas due to an inability to service these containers by conventional waste collection trucks. • Higher total and operational costs for collecting these containers when compared to the common collection points system (shared containers). • Difficulty to combine with the cost recovery programs since fees or tariffs are not based on the actual amount of waste generated. • Increasing traffic in the municipality's street network. • Possibility to collect items from barrels/containers. • Potential theft of bins/containers. • Conflict with parking spaces along the roads due to the use of barrels/ containers.

<p>Improved urban collecting sites.</p>	<ul style="list-style-type: none"> • Minimal total and operational cost of waste collection. • Applicable in all urban and rural service areas. • Can comply with the principle that the producer of waste pays because the waste from the waste producer can be measured physically. • The possibility of placing different containers for other types of waste (special waste, household hazardous, recyclable materials, etc.). • High reuse rates associated with collected materials at improved urban collection sites. • Minimal traffic burden on the municipality's street network. 	<ul style="list-style-type: none"> • High level of effort from waste generators since waste must be transported large distances to improved urban collection sites.
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Option 2: Block Collection

The waste generator delivers residential or commercial waste to the collection vehicle at the specified collection time.

Sub-option	Advantages	Disadvantages
	<ul style="list-style-type: none"> • Can be used in all urban and rural areas. • Minimum total and operational cost of waste collection. • No aesthetic effect in the residential areas due to the absence of barrels/containers along the roads and the absence of scavenging who could cause garbage production. • It improves the availability of parking spaces along the roads due to the lack of containers. 	<ul style="list-style-type: none"> • It cannot be applied in dense areas due to the unavailability of vehicles to collect containers. • Cannot be applied in densely populated areas. • Servicing can be hard as waste generators need a specific time to meet the collection truck at the time of collection. • Collection times may conflict with the working hours of the waste generators. • Potential negative effect on street conditions and cleaning costs. • Medium operational cost for collection.

	<ul style="list-style-type: none"> • Can be combined with other collection methods to provide collection services in remote rural areas with low populations. 	<ul style="list-style-type: none"> • Difficulty to combine with the polluter-pays-principle. • Increasing the traffic burden of the municipal road network at designated collection sites.
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Option 3: Curbside Collection

The waste generator places containers full of waste on the curbside and retrieves their containers as soon as it is emptied.

Sub-option	Advantages	Disadvantages
-	<ul style="list-style-type: none"> • Applicable in all urban and rural areas • No aesthetic effect in an urban area because the containers are only noticed when deployed on the day(s) of collection. • Improves the availability of street parking spaces due to the absence of bins or containers except on collection days. • Much less effort on the part of waste generators when compared to the common container collection system. 	<ul style="list-style-type: none"> • May not be applicable in densely populated areas due to the inability to service containers by conventional waste collection trucks. • Requires a specific waste collection schedule. • Potential negative effect on street cleaning costs. • Medium total and high operational cost for collection (The value of collection cost will need to be evaluated to consider the supply of waste generators with containers designated for waste and the number of stops for the collection employees). • Cost recovery programs are difficult to combine based on the actual amount of waste generated by waste generators. • Heavy traffic burden on the municipality's road network due to the collection process. • Possible spread of waste materials due to animals or wind effects. • Possible presence of waste scavengers from barrels/or containers which contribute to waste dispersal. • Possible to steal barrels and containers.

Option 4: Door-to-door Collection

The waste collector approaches the house to collect the wastes; the waste generator is not primarily involved in the collection process.

Sub-option	Advantages	Disadvantages
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-	<ul style="list-style-type: none"> • It can be combined with the polluter pays principle due to the proximity of waste collectors to potential sources of pollution sources. • No aesthetic impact in urban areas due to the absence of waste bins/containers on the streets and the absence of waste scavengers that can cause the spread of waste. • Low level of effort by waste generators (waste must be transported over very short distances). • Very effective option for pre-segregation of organic waste. • It improves the availability of parking spaces in the streets due to the absence of bins or containers. 	<ul style="list-style-type: none"> • Not applicable in all urban areas (the need for a backyard or garden area for waste storage and accessibility). • Medium total cost for collection vehicles. • High operational cost of collection service due to work requirements • High traffic impact on municipal roads due to frequent collection stops by collection vehicles. • Possible theft of bins/containers from backyard or garden waste storage locations. • Needs low frequency of collection to be financially sustainable. • Not applicable in hot climates if the waste is stored between collection periods.
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Option 5: Automated vacuum collection

The waste collection process is carried out automatically and the waste generator's effort is reduced. The municipal solid waste is transported at high speeds through underground pneumatic tubes to a collection station, where it is compressed and held in containers. When the container is full, it is transported to a processing facility or landfill.

Sub-option	Advantages	Disadvantages
-	<ul style="list-style-type: none"> • Applicable in all urban areas. • Avoidance of instances of failure of the MSW collection system due to vehicle unavailability. • Automation is 100% unaffected by weather conditions, strikes of collection staff, etc. • Positive impact on street-cleaning costs. 	<ul style="list-style-type: none"> • Not applicable in rural areas. • It cannot be applied in urban areas that have already been built (requires dedicated infrastructure). • Extremely high total cost for the collection. • Medium operational cost for collection. • Need to be monitored by experts. • Need for qualified staff to operate the vacuum system.

	<ul style="list-style-type: none"> • No aesthetic impact on municipal roads due to the absence of bins/containers along the roads, waste collection trucks moving along roadways, and the absence of waste scavengers. • No traffic burden on the municipality's roads network. • Very low effort level by waste generators as waste is transported over very short distances • Avoid cases of odour caused by organic waste as immediate removal is available without storing waste at the waste generation site or along roads. • Improves the availability of street parking spaces due to the absence of bins or containers. • Significantly reduces or eliminates odours, insects, and public health effects due to the elimination of waste storage. 	
<p>Result: Keep using the curbside collection.</p>		

The municipality shall relate the design of collection vehicle loading systems to the type of containers to be used in the collective container collection system. Logically, the loading mechanism of the containers should be compatible with the type of containers used. This will become an important element for selecting the type of containers and in the specification of the loading mechanism. Another important consideration is the standardization of collection containers and designs of vehicle loading systems as vehicles are capable of service at several locations within the municipality's collection service area.

Design criteria for effective collection service components include container types, capacity, and whether they are with or without covers. All these criteria necessitate the evaluation of technical aspects that will influence the selection of the collection system. Each component must be carefully understood and evaluated in terms of its physical and operational characteristics in determining the means chosen for combination.

The following table provides a basic assessment of collection container options with common advantages and disadvantages.

Table 13 Types of waste containers

Containers Material Type

Sub Option	Advantages	Disadvantages
Galvanized Steel	<ul style="list-style-type: none"> Higher resistance to corrosion and longer life. Long-lasting colour. 	<ul style="list-style-type: none"> High cost compared to other materials. It may be badly damaged by fires. May not be locally made.
Black steel	<ul style="list-style-type: none"> Lower price than galvanized type. Locally made. 	<ul style="list-style-type: none"> Short life expectancy due to high corrosion rates. It loses its colour easily upon normal use.
Plastic	<ul style="list-style-type: none"> Increased aesthetic appearance compared to metal containers. Lighter in weight than metal containers. Easy to transport during assembly due to lightweight. 	<ul style="list-style-type: none"> Higher cost. Completely destroyed when exposed to fires. May not be locally made.

Container wheel structures

Sub Option	Advantages	Disadvantages
With wheels	<ul style="list-style-type: none"> Can be moved for unloading even when located between parked cars. Reduced level of effort by collection workers. Less time is required for unloading at each collection stop. 	<ul style="list-style-type: none"> Higher total and maintenance costs. Not suitable for unpaved areas.
Without wheels	<ul style="list-style-type: none"> Lower capital and maintenance cost than wheeled units 	<ul style="list-style-type: none"> Requires a higher level of effort by collection workers. Requires more time to unload. It is difficult to move on paved areas and may be impossible to move on unpaved surfaces.

Cover

Sub Option	Advantages	Disadvantages
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With cover	<ul style="list-style-type: none"> • Reduces unpleasant odours, insects/flies, and animals' access to container contents, • Reduces the effect of rain on waste moisture content which helps reduce the generation of leachate in waste disposal sites. 	<ul style="list-style-type: none"> • Higher total and maintenance costs than containers without cover. • Need higher public awareness and commitment from people while putting waste into containers to properly open and close. • Covers are often the first thing to be damaged in shared containers. • It needs a special mechanism to open the cover when emptying.
Without cover	<ul style="list-style-type: none"> • Low total and maintenance cost than wheeled containers. 	<ul style="list-style-type: none"> • Increased impact of odours, insects/flies and animal access. • Increased waste moisture due to rainfall.

Size of Containers

Sub Option	Advantages	Disadvantages
120/240/360 liter	<ul style="list-style-type: none"> • Compatible with door to door and curb side collection systems. • May reduce the collection service frequency per week when compared to servicing of conventional 1,100 L communal containers. • Increased level of direct ownership of containers by individual waste generators. • Usually, containers are equipped with covers with the associated advantages. • Considered as the ideal application for separating and collecting waste from different sources. 	<ul style="list-style-type: none"> • Suitable only for individual houses or small commercial waste generation sites. • Increase in the number of stops and, as a result, an overall increase in collection time and cost.

1100 liter	<ul style="list-style-type: none"> • Suitable for most municipalities and collection areas. • Common size used in existing municipal waste collection systems. • The specified frequency of container unloading operations according to the characteristics (population, etc.) of all containers in the service area. • Number of containers at collective collection sites can be increased based on the experience gained in waste accumulated at each site 	<ul style="list-style-type: none"> • Not compatible with source separation and collection systems. • Depending on the nature of the serviced area and the availability of container distribution sites, the distance between containers may be excessive. • Subject to relocation by unauthorized people. • Odours and insects spread if not adequately frequently served.
4000 liters	<ul style="list-style-type: none"> • Low collection time and cost based on the amount of waste collected. • Less space utilization when compared to spreading of 4 - 1,100-liter containers. • Can be unloaded in the conventional compactor and requires large collection vehicles (13 m³ and more). 	<ul style="list-style-type: none"> • Suitable only for mixed-use areas (residential and commercial) or commercial and industrial areas. • It is difficult to move and therefore the situation requires the arrival of the vehicle to unload the containers.
8 m ³	<ul style="list-style-type: none"> • Reduced collection time and cost based on the unit cost of stored and collected waste. 	<ul style="list-style-type: none"> • Suitable only for commercial and industrial areas. • Need a truck with a special lifting mechanism.
Underground containers 1.5-2 m ³	<ul style="list-style-type: none"> • Reduced environmental impact (litter, odour, insects, and animal access). • Insignificant aesthetic impact. 	<ul style="list-style-type: none"> • Very high infrastructure cost. • High total and operating costs compared to other types of containers. • Need a special truck with a crane mechanism to collect waste.
Result: Containers with a capacity of 1100 liters/ galvanized iron/ without wheels/ without covers		

The following table presents a basic assessment of options for collection service vehicles with general advantages and disadvantages.

Table 14 Collection Vehicles options

Vehicle loading mechanism

Compactors with loading mechanisms depend on the type of containers used, and combined containers must comply with the capacity and design of the loading vehicles for the collection vehicles.

Sub-option	Advantages	Disadvantages
Non-compacted manual/automatic loading - small size	<ul style="list-style-type: none"> • Low total and maintenance costs. • Small vehicles with great manoeuvrability are usually used in traffic and narrow roads. • Less operational risks for collection workers. 	<ul style="list-style-type: none"> • Suitable only for narrow roads and city centres where the door-to-door collection method is used when containers with a storage capacity of up to 240 liters are available. • May need a transfer station due to the high cost of transport for small amounts of collected waste. • Medium to high relative unit operating costs due to the low payload.
Non-Compacted Automatic loading medium to big size (tipper crane trucks)	<ul style="list-style-type: none"> • Only one worker is needed due to the automatic loading system. • Relatively low maintenance cost. 	<ul style="list-style-type: none"> • Suitable only for systems using 1,100-liter containers. • May need a transfer station depending on the transportation distance to waste treatment or disposal facilities. • Medium to high relative unit operating costs due to the low load capacity.
Compactor vehicles	<ul style="list-style-type: none"> • Relatively low operational costs because the payload is higher than uncompacted vehicles. • Suitable for standard containers and manual loading. • It is considered within the traditional standards of municipal waste collection systems in many countries. 	<ul style="list-style-type: none"> • Relatively high maintenance cost due to mechanized components. • High operation risk for collection workers due to compaction mechanisms and travel between collection stops.

Roto-Press vehicles	<ul style="list-style-type: none"> • Relatively low operating costs due to payload being larger than non-compaction vehicles. • Suitable for container and manual loading. 	<ul style="list-style-type: none"> • Relatively high maintenance cost due to mechanized components. • High operating risks for collection workers due to compaction mechanisms and movement between collection stops. • Not suitable for 4000-liter containers.
Compactor/roto-press vehicle size		
Sub-option	Advantages	Disadvantages
6-8 m ³	<ul style="list-style-type: none"> • High manoeuvrability in high traffic and narrow roads. 	<ul style="list-style-type: none"> • Relatively low payload compared to larger vehicles. • Need a transfer station even if the landfill is less than 25 km away due to the low payload. • Relatively high operating cost due to the low load capacity. • Suitable for 120, 240, 360, and 1,100-liter containers only.
12 m ³	<ul style="list-style-type: none"> • Medium manoeuvrability in high traffic and narrow roads. • Suitable for all container sizes including 4000 liters (except for roto-press type vehicles). • Can be cost-effective to move directly to landfill sites within 25 km. 	<ul style="list-style-type: none"> • Limited ability to manoeuvre in traffic and narrow roads.
18-21 m ³	<ul style="list-style-type: none"> • Suitable for all sizes of containers including those with a volume of 4000 liters (except for roto-press type vehicles). • Can be cost-effective to travel directly to landfill sites within 25 km. • Relatively low operational costs due to high load capacity. 	<ul style="list-style-type: none"> • Limited ability to manoeuvre in high traffic and narrow roads.
Result: 8 m³ – 12 m³ compactors.		

30. Financial aspect

The municipality should develop an effective financial management system for specific cost centers associated with individual SWM services and facilities based on a full cost accounting methodology. Optimally, the financial management system should be based on conventional computer software models that provide an effective and efficient means for monitoring all financial aspects of municipal solid waste management.

A user fee/tariff system (supporting legislation and an effective billing and collection process) should be implemented based on the polluter pays principle which is a stipulated component of the National Strategy. To the degree possible, the cost recovery system should seek to improve the cost recovery in the short term with the aim of achieving a full cost recovery in the longer term and a user fee/tariff collection system with a 100 % fee collection rate.

31. Social aspect

The municipality should develop an effective and ongoing participatory awareness and educational program as well as an effective complaint and GRM system. The municipality should partner with CBOs and local NGOs when implementing participatory awareness since they are considered as trusted entities for the community.

The program should include the following aspects at a minimum:

- Various dialogue sessions with the local community to find out the existing problems between the municipality and the local community.
- Knowledge of active and influential people and individuals in society
- Ensure the involvement of various groups of the local community.
- Continuous dialogue with the local community before starting the implementation of projects, especially those that need to involve the local community effectively.
- Involving the local community since the beginning of the plan, to ensure their support for the various projects and extinguishing part of the ownership of the members of the local community to ensure their support for the projects to ensure their success.
- Developing a detailed action plan to develop programs to involve the community and raise awareness in various environmental aspects.

15. Completing Implementation Requirements Analysis

The above activities resulted in the clear identification of challenges to be resolved and the ranking according to priority considerations by the municipality's Committees and Working Groups. Based on that, defining a specific analysis of improvements for quantifying the projects and initiatives required to create an effective SWM system in the municipality was conducted.

32. MSW Management and Collection

The following set of tables presents the basic content of the required implementation requirements analysis along with its preliminary design criteria. This will serve as a basis for future recalculation of the municipality's needs in street sweeping, containers' capacity, and vehicular capacity. According to the municipality's current situation, the municipality's needs were calculated in the various fields.

The following table presents the method for calculating the needed resources for street sweeping and its results:

Table 15 The method for calculating the materials needed for street sweeping

Problem/Issue	Implementation Requirements Analysis	Design Criteria
Street Cleaning Coverage	<p>To achieve 100% coverage, the municipality must:</p> <ul style="list-style-type: none"> • Determine the total length of roads to be cleaned. • Determine the roads that may need more than 1 shift each day. • Determine the size, number, and locations of containers for collecting materials resulting from street cleaning. 	<ul style="list-style-type: none"> • The area/length of the road specified for each worker should be estimated according to the type of service being provided whether it is street cleaning or initial assembly only or both in parts of the areas under the responsibility of the municipality, to estimate the total number of workers according to service coverage and frequency of service. • The average road area/length specified for each vehicle should be estimated on the basis of the expected productivity and working conditions of each type of vehicle if mechanical road sweepers are used, and as a result, the number and capabilities of mechanical road sweepers can be determined. • The municipality must specify the quantity and types of tools needed for the practical and personal safety purposes of the expected number of road cleaners (manual method). • The presence of bins to place the waste resulting from the sweeping process is required, depending on each area covered, and the number, size, and location of the containers are determined based on the nature of each area. <p>NOTE: Standard work standards for road sweepers (manual method) to be used in the required analysis include:</p> <ul style="list-style-type: none"> - 250-300 meters per worker in large population density areas (more than 50000 people) - 400 - 600 meters per worker for medium-density population areas (from 10,000 - 50,000 people) - 750 - 900 meters per worker in sparsely populated areas (less than 10,000 people).

		<p>In the absence of any of the road lengths and population density, it is possible to use another mechanism to determine the number of workers required, which is as follows:</p> <ul style="list-style-type: none"> • First, consider that the reference is the Greater Amman Municipality, as it provides the highest level of service in the field of solid waste management in Jordan. According to recent studies in the GAM, each worker serves approximately 950 citizens. However, there are two important differences that must be considered: <ol style="list-style-type: none"> 1) Workers in the Amman Municipality work 8 hours, while in other municipalities 6 hours in one shift. 2) The difference in the level of the urban index, which in Amman is estimated at 90%, while it differs from that in other municipalities, each according to its classification. • Accordingly, an analogous relationship has been developed between the Jordanian municipalities and the Amman Municipality as follows: <ol style="list-style-type: none"> 1) The ratio of working hours between the municipalities and the Amman Municipality is $6/8 = 0.75$. 2) The percentage of urbanization coefficient (X) compared to the Amman Municipality: $X/0.9=Y$. Therefore, the ratio between any municipality and the Amman Municipality is $(Y+0.75)/2=Z$. • Accordingly, the number of citizens served from each worker in a single shift becomes $950 * Z$. • As for mechanical road sweepers, the rules followed depend on the size and speed of the mechanism and the usual traffic intensity.
<p>Result:</p> <ul style="list-style-type: none"> • The number of workers required for 2023: 226 workers (Sweeping waste). 		

- The urban index of Madaba municipality is 88%.
- Percentage of urban index compared to GAM: $0.88 / 0.9 = 0.98$
- The percentage of offering by workers in the municipality compared to what it offers in the GAM is $(0.75 + 0.98) / 2 = 0.86$
- Accordingly, one worker should serve: $950 * 0.86 = 821$ citizen.
- The number of workers needed is: $185153/821 = 226$ workers.
- Since the rate of absence of work or access to annual leave or Bedouin or sick leave is about 8% of the total.
- Accordingly, the total number of workers required is 244 workers.

Based on the same method, the number of workers needed for the next five years is:

Year	2024	2025	2026	2027	2028
Number of workers needed	249	255	260	266	272
Shortage of workers	97	103	108	114	120
Number of required supervisors	17	17	17	18	18

It is worth noting that the shortage in 2024 assumes that no employees would be hired in 2023, if any employees are hired, the number of new workers should be subtracted from the total needed to find out the shortage, as well as the matter for all subsequent years.

The following table presents the method for calculating the needed containers' capacity based on target 100% Coverage and its results:

Table 16 The method for calculating required containers' capacity based on 100% target coverage

Problem/Issue	Implementation Requirements Analysis	Design Criteria
Containers	<p>To achieve 100% collection service coverage, the municipality must:</p> <ul style="list-style-type: none"> • Determine the required number and type of containers and how to distribute them. • Determine how to maintain distributed containers. 	<ul style="list-style-type: none"> • Determining the number of containers in poor condition, considering that the standard life expectancy of waste collection containers is about 4 years. • Average determination of the volume of waste production considering the growth rate and annual increase in waste production for each neighbourhood or collection area (it is recommended to use an average production of about 4 liters per person per day and a safety factor of about 1.5 liters). • Calculate the type and number of containers on an annual basis for all locations within the municipality. <p><u>Container Distribution Standards:</u></p>

		<ul style="list-style-type: none"> Based on each collection area (district or collection area), the approximate distance between waste producers and the location of the deployed container should be determined, which should not exceed 200 meters. Distribution of containers should be according to improved collection methods. Which must consider the population distribution and density in each area as well as the number of houses. Must know the characteristics of each area (commercial, agricultural, or residential) to determine the type and number of containers required. The filling percentage shall not be less than 70% and not more than 90%. Municipal employees should follow up on the suitability of containers and change them according to their feedback The municipality should ensure that the containers are easily accessible to children, the elderly, and people with disabilities.
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Result:

- The total container capacity required is in 2023. 1,086,750 l/day.
- The current container capacity of 3,982,250 liters/day (considering the efficiency rate of 50% for inferior containers) is more than enough for the areas in the municipality according to the current population.
- However, due to the low population density in most areas of the municipality, the required number of containers was estimated by considering the distance between homes in remote areas by estimating the required containers for each residential square of 40,000 square meters, using satellite images. Accordingly, the required number of containers for the entire municipality was estimated at 2250 containers. But, in this case, the municipality should also consider using smaller containers so that the total container capacity is not too high.

- Once the municipality reaches the suggested container capacity, it is recommended that the municipality replace one third of the containers each year, to ensure sufficient container capacity is available each year.

Based on the above, the capacity of the needed container for the next five years is:

Year	2024	2025	2026	2027	2028
Required capacity for containers (based on population)	1,110,918	1,135,626	1,160,880	1,186,698	1,213,092
Number of needed containers (based on population)	1,010	1,033	1,056	1,079	1,103

(assuming all bins are 1100 liters)					
Number of needed containers (based on population) (assuming all bins are 240 liters)	4,629	4,732	4,837	4,945	5,055
Number of needed containers (based on population) (assuming all bins are 120 liters)	9,258	9,464	9,674	9,890	10,110

The municipality does not require any additional containers for the next five years, as the current supply is deemed sufficient to meet the ongoing needs of the community. Periodic maintenance of the containers should be carried out in the event of any malfunction.

The following table presents the method for calculating the needed resources for waste collection and its results:

Table 17 The method for calculating the needed resources for waste collection and its results

Problem/Issue	Implementation Requirements Analysis	Design Criteria
Collection vehicles	<p>To achieve 100% collection service coverage, the municipality should:</p> <ul style="list-style-type: none"> Determine the required number and type of collection vehicles. 	<ul style="list-style-type: none"> Determine the generation rate of waste in tons considering the growth rate and the anticipated increase in waste generated each year. Divide the municipality into collections zones (if they do not already exist) based on the nature of each zone. The collection zones should be based on the type of activities in each zone (residential only, commercial only or mix), type of containers deployed or to be deployed (120, 240 L plastic, 700 l, 1100 L, or 500 L), and the width of streets and expected traffic for vehicular access. This will enable the municipality to decide the type, size, and capacity of the required collection vehicles in addition to the type of containers loading mechanism attached to the collection vehicles if any. Design an optimum routing system for the collection process based on sound international standards and procedures including up-to-date technologies like (GIS) and (GPS) for the containers and the collection vehicles.

		<ul style="list-style-type: none"> • Use the population generation and capacity calculations to determine the required capacity of collection vehicles. • Decide the type of collection vehicle in terms of capacity and type (compaction or non-compaction trucks) based on the nature of each collection zone. • Calculate the type and number of collection vehicles required on a yearly basis including the vehicles required for both effective regular service and back up for the time that vehicles are down for repair or preventative maintenance.
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The current deficit in vehicular capacity in 2023 is approximately 139.59 tons/day.

In the same way, the deficit in vehicular capacity for the next five years is:

Year	2024	2025	2026	2027	2028
The deficit in vehicular capacity (ton/day)	133.07	172.80	191.97	226.03	242.21

The existing vehicles within the municipality's staff constitute a burden on the municipality in terms of maintenance costs and fuel, but they are unable to cover the quantities of waste generated in the municipality.

*By 2028, the municipality must replace all its SWM vehicles.

The following should be noted:

Replacing vehicles assume that old vehicles (more than 11 years old) must be disposed of. However, a more accurate analysis is required to further evaluate the quality of the compound's details.

33. MSW Treatment

The municipality is currently disposing of all waste in Madaba landfill. As there are currently some sorting and recycling activities in the municipality, the municipality is encouraged to increase the coverage and amounts of treated waste in the coming years.

Since the municipality has a desire to start building a composting facility, it is important for the municipality to identify the target areas to start sorting activities for the organic materials. The residents of the municipality are distributed in 23 localities, and it is characterized by the presence of a special commercial market for each of those areas. From these markets, any expected activity of waste sorting and recycling can be started on a societal basis, as it is the most appropriate approach in this type of area.

In addition to participatory awareness campaigns with the local community, the municipality must conduct a few studies necessary to find out the most appropriate mechanism for the target waste types and the required quantities of sorted materials. These studies are:

- Preparing a feasibility study that includes an analysis of supply and demand in the market.
- Conduct a capacity assessment of community-based organizations and local NGOs to determine their willingness and capacity to initiate composting projects with the municipality.

All this information should be clear to the municipality before starting any composting initiatives. Once all of the above criteria are in place, the municipality must also prepare an operating manual and standard

operating procedures. It is recommended for municipal employees who will be responsible to visit composting stations and similar initiatives to learn from their experience.

16. Performance Targets and Key Performance Indicators (KPIs)

To ensure clear and obvious implementation, a set of annual targets were developed, along with measurable KPIs, so that the municipality can measure its own improvement.

Performance targets were identified based on meetings with the municipal staff, all targets are in line with the National Strategy. The municipality should aim for these annual targets as a minimum with an aim of even exceeding them. In any event, a baseline value for each target should be established and a yearly level of accomplishment related to the performance targets should be measured as a KPI at the end of each year.

34. Targets

The proposed targets for Madaba municipality target the improvements in the street cleaning, waste separation at source, and reduction of organic waste ending up at landfills. Although the awareness-raising and community engagement aspects are essential for any MSWM project, you can't measure the level of community engagement with simple numbers, and its impact will be sensed by the municipal staff and will be the base stone for all future MSWM projects.

The following table presents the set of basic performance targets that the municipality aims to achieve on an annual basis, as follows:

Table 18 Annual MSWM targets

Subject of Target	2024	2025	2026	2027	2028
Coverage of MSW street sweeping - currently 60%	65%	75%	85%	90%	100%
Set-up of separate collection systems for recyclables (at least paper, metal, plastic, and glass)	2%	4%	6%	8%	10%
Reduction of bio-waste ending-up to landfills without composting facility	1%	2%	3%	4%	5%
Reduction of bio-waste ending-up to landfills with composting facility	4%	6%	9%	12%	15%
Recovery of packaging waste (including reuse, materials recovery, and energy recovery)	1%	2%	3%	4%	5%

35. Performance indicators identification

Progress in achieving all performance objectives as defined in the solid waste management plan should be measured regularly to develop an accurate understanding of how the municipality is performing in achieving the purpose of its municipal plan. The following table shows some performance indicators for the objectives defined in the municipal plan.

Table 19 Sample indicators for the targets

Subject of Target	Performance Indicator	Unit
Coverage of MSW street-cleaning service	<ul style="list-style-type: none"> Length of roads cleaned/total road length in the municipality, or Total municipal population/work norms of street sweeper (about 1 worker for 1000 inhabitants). 	%

Coverage of MSW collection service	<ul style="list-style-type: none"> Actual population served/total population of the municipality, or Area served by the collection system/total area of the municipality, or Quantity of waste collected/quantity of waste generated. 	%
Implementation of a separate collection system for recyclables	<ul style="list-style-type: none"> Is there a separate collection system for recyclables in operation? Implementation of experimental or integrated systems for sorting. 	YES/NO Experimental/Integrated
Implementation of reuse and recycling of MSW materials	<ul style="list-style-type: none"> Is there a system or program for the reuse and recycling of MSW materials? Implementation of experimental or integrated systems for sorting. 	YES/NO
Closure and remediation (if necessary) of uncontrolled or unlicensed disposal sites	<ul style="list-style-type: none"> Number of uncontrolled or unlicensed dumpsites actually closed/total number of uncontrolled or unlicensed dumpsites within the municipality 	%
Diversion of organic waste from local or regional permitted landfills	<ul style="list-style-type: none"> Quantity of organic waste reduced or composted/total organic waste generated based on recorded quantities of organic waste produced at large generators such as grocery/vegetable markets, central stores, and food markets in combination with estimations of organic waste generation ratios from the National Strategy and cross-referenced with the waste composition analysis component of accomplishing the Municipal Plan. 	%
Recovery of packaging waste for reuse and materials/energy recovery	<ul style="list-style-type: none"> Quantity of recovered packaging waste/quantity of packaging waste generated. 	%
Recycling of packaging waste	<ul style="list-style-type: none"> Quantity of recycled packaging waste/quantity of packaging waste generated based on baseline surveys, municipal waste tonnage, and waste composition analysis. 	%

17. Proposed Projects, Actions and Measures

The projects are the primary outcome of the planning process and the targeted accomplishments of the municipal plan. The projects to be completed because of the municipal plan will determine how the municipality will achieve its solid waste management objectives. As a result, the municipality's plan clearly identifies and provides the basis for the projects that the municipality will seek to implement to achieve an effective solid waste management system. The specific project includes the implementation of operational activities such as containers, road planning and improvement, or elements such as public awareness and education programs or cost recovery.

36. Projects' identification and description

The first step in this stage in evaluating suitable projects for each goal, cost estimates are made according to the current market situation in terms of salary, cost of materials, construction, etc. The projects were selected based on the municipality's diagnosis phase of the existing solid waste management system and analysis of options and performance goals that were identified as the goals of the municipality's plan. The following table shows the proposed projects, procedures and measures for the goals and objectives previously identified, as follows:

Table 20 Projects' identification and description

Goal	Target	Project Description	Cost Estimate
Improve data collection and implement an effective data management system	Building a database of solid waste management information in the municipality	<ul style="list-style-type: none"> Develop an Information Management System 	5,000 JOD
Improve street cleaning (Service coverage and quality should be improved (including key performance indicators that are to be determined))	Raising the level of service	<ul style="list-style-type: none"> Hire more staff. Purchase equipment and tools for workers, the needed equipment for the workers is available in annex (2). Purchase compactors. Buy two mechanical street sweeper. 	300,000 JOD
Encourage and promote waste component reduction, recycling, and reuse	Raise awareness and reduce the amount of waste received by landfills	<ul style="list-style-type: none"> Buy containers for separate collection system. Design and implementation of an experimental or complete sorting collection system. 	200,000 JOD
Enhance or implement participatory awareness and educational programs	Raising awareness	<ul style="list-style-type: none"> Design comprehensive, long-term, and effective participatory public awareness programs. 	10,000 JOD

		<ul style="list-style-type: none"> Implementation of the program. 	
Improve citizen engagement in all relevant aspects of the municipality's SWM system	Raising the level of service	<ul style="list-style-type: none"> Design and implement an effective complaint and GRM system 	10,000 JOD
Create an effective SWM Financial System	Building a database for the financial side of solid waste management	<ul style="list-style-type: none"> Design and implement a financial system based on full cost accounting and independent cost centres for SWM functions and facilities Design a new user fee/tariff system based on the polluter pays principle to achieve a 100 % cost recovery rate (including consideration and mechanism for minimizing the potential impact on socio-economically vulnerable households.) Design and implement an effective fee collection system. 	20,000 JOD
Ecological Park	<ul style="list-style-type: none"> Create a sustainable and environmentally friendly space. Raising awareness. 	<ul style="list-style-type: none"> Design and implement the park. Buy parks supplies such as containers for separate collection system, games, benches. Awareness campaigns. 	70,000 JOD

37. Action Plan

After project selection, the action plan will identify the exact projects for each year along with the estimated cost and potential funding source. The business plan will focus more on the next year 2024, where future projects can change (either slightly or significantly) depending on the progress of projects in previous years. The action plan is presented in the following table:

Table 21 Action plan matrix

Project	Implementation Period- Cost Estimate in JD					Source of Fund			
	2024	2025	2026	2027	2028	Municipality	International donors	Private	Local Donation
Design and implement a	20,000					x			

financial accounting program to calculate the costs and revenues of waste									
Compactors ³	320,000	240,000	240,000	240,000	240,000	x			
Designing waste collection routes and places for placing containers ⁴	30,000					x			
Mechanical sweeper ⁵	30,000			30,000		x			
Hiring employees ⁶	369,526	389,461	409,838	430,669	451,963	x			
Tools ⁷	11,638	12,302	12,981	13,676	14,385	x			
Participatory community awareness campaigns	10,000	10,000	10,000	10,000	10,000	x			
Capacity building programs	25,000	25,000	25,000	25,000	25,000	x			
Ecological Park	70,000								
Sub Total	886,164	676,763	697,819	749,345	741,348				
Total	3,751,439								

To summarize the total budget and potential funding sources, the following table has been drawn up:

Table 22 Suggested allocation of expenditure for each funding source

Donor	2024	2025	2026	2027	2028	Sub Total
Municipality	886,164	676,763	697,819	749,345	741,348	3,751,439
Donors	0	0	0	0	0	0
Local Donation	0	0	0	0	0	0
Total						3,751,439

38. Annual action plan with possible internal and external funds

After the budget is allocated from the municipality, the remaining gap must be filled from external sources. These external sources may include the Jordanian government, donors, and donations from the private sector and the local community. The municipality must develop a plan to secure the necessary resources from the aforementioned entities. This plan should include the projects to be funded at a cost estimate, who

³ 8m³ Compactor cost 80,000 JOD

⁴ Currently, the GIS department is actively involved in the development of routes for waste collection vehicles. The anticipated timeline for the completion of this project is by the year 2023.

⁵ Mechanical sweeper 30,000 JOD.

⁶ Monthly salaries of the proposed employees within the plan for the year: MSWM head of Division: 700 JOD, H&S Head of Division: 550 JOD Awareness Officer: 450 JOD and Sanitary Workers (300 JOD per worker).

⁷ Tools costs 120 JOD/worker.

can apply for funding, some marketing for projects that may be in partnership with the private sector and for local/external donation mainly for projects that can be classified under social contribution. These projects may include public awareness/education campaigns and the establishment of an effective complaints handling system. Such projects can be financed by telecom companies, environmental institutions, banks, local radio stations and other media companies.

The following table provides a financial analysis for 2024, which can be used as a model for the coming years:

Table 23 Financial analysis for 2024

Project	Estimated Cost	2024 Plan				Funding source		Preparation Arrangements: Feasibility Study, Terms of Reference, Bidding Documents
		1 st Quarter	2 nd Quarter	3 rd Quarter	4 th Quarter	Municipality - Determining the budget line	Others- Select it	
Design and implement a financial accounting program to calculate the costs and revenues of waste	20,000			20,000		Municipality		Bidding document
optimization of the existing waste collection routes and container's placement	30,000	30,000				Municipality		
Participatory awareness campaigns	10,000	2,500	2,500	2,500	2,500	Municipality		
Compactors	320,000	80,000	80,000	80,000	80,000	Municipality		
Capacity building programs for both SWM and H&S department	25,000	7,000	6,000	6,000	6,000	Municipality		

18. Recommendations

1. Establishing a municipal solid waste management department with a qualitative and balanced representation.
2. Conduct participatory awareness sessions and interactive sessions with the community on a regular basis.
3. The need to re-evaluate containers and methods of distribution and collection of containers.
4. Elimination of collection vehicles with long service life, to reduce high maintenance costs.
5. Assessing the readiness of local organizations to establish composting activities in cooperation with the municipality, as this option would be the best possible option for waste sorting, given the large amount of waste generated per day.
6. Preparing all necessary feasibility and market studies, signing agreements with suppliers and/or end users, and obtaining the necessary approvals from the relevant authorities before starting any composting projects.
7. Develop a system of citizen participation and an effective complaints system.
8. Develop a comprehensive financial system to facilitate the process of knowing expenses and revenues.
9. Providing employees wishing to participate in the management of the solid waste sector with specialized intensive technical training in the solid waste management sector.
10. Involve employees in updating/following up on the solid waste management plan after they have obtained capacity-building programs.
11. It is essential to involve active and reliable CBOs or local NGOs in any future activity or initiative related to solid waste management as they can facilitate communication through their database and networks. As well as gaining the trust and acceptance of society regarding the participation of women and youth.

19. Operating, Monitoring and Maintaining Results

The appointed committees and groups will work with the rest of the municipality's staff to ensure that expected results are achieved, as well as to assess annual progress. The main role of the committees is during the development of the plan, and the detailed role of each group is detailed during each task and step in the solid waste management guide.

The Annual Progress Report will be discussed with the community and committees, showing progress, tasks accomplished, and justification for delays (if any). One of the critical steps in monitoring and evaluating the tasks performed is updating and adjusting the work plan by prioritizing different activities and/or substituting other activities according to the actual needs of the community and municipality.

To facilitate this process and ensure a similar approach is pursued, the following evaluation models have been provided.

39. Evaluating of progress based on the annual evaluation of the municipal plan's achievements

It is important to assess the progress made as a result of the annual work plans on an annual basis. This assessment should include all projects that were to be completed in whole or in part each year and whether the desired progress has been made.

The following table is intended to serve as a template for the annual assessment of progress or delays related to projects addressed in the annual work plans:

Table 24 Progress assessment template for 2024 action plan

Delayed Projects	Reasons for delay	Recommendations
Projects implemented before the planned schedule	Reasons	Recommendations

The following table is intended to serve as a model for the annual evaluation of the overall progress in achieving the performance objectives of the municipal plan:

Table 25 Action plan evaluating template

Target value	Present Value	% Of achievement	Reasons	Recommendations

40. Informing the community of progress in achieving the plan

After preparing the annual assessment of the progress of the action plan and informing the Municipal Council, a progress report must be submitted to the Stakeholder Committee as community representatives for review and comment.

20. Modification and Update

The staff of the municipality, primarily the members of the working group, prepares an annual progress report showing the tasks accomplished and any delays (if any) in the work of their departments, and the Executive Director and the Planning Committee evaluate the performance of each department in terms of the percentage of completion of their tasks. After the annual evaluation, there will be a need to adjust and update the plan, at least to reflect annual changes and check progress against the KPIs.

41. Update the annual action plan based on progress in achieving the goals

Based on the interim evaluation process related to the annual action plan, the current annual action plans should be reviewed and updated to reflect the results of the progress assessment process. Actual progress made each year will be a factor in the development of subsequent annual action plans for continued progress.

42. Securing approval of the updated work plan from the Municipal Council

The Municipal Council shall review and approve annual action plans updates in order to take them into account in the annual budget allocation for solid waste management purposes

21. Annexes

43. Annex 1: Job description cards

Head of the MSWM division

Both men and women are encouraged to apply to the announced positions.

Job description card			
Position	Head of the MSWM Unit		
Line supervisor	Head of enviromental division		
Job Location (organizational structure)			
Sector	General services	Division	Enviroment
Main objective	Implementing cleaning operations in the regions and following them up, implementing waste collection operations and directing the necessary work programs for those concerned		
Main activities			
<ol style="list-style-type: none"> 1) Planning, coordinating, and supervising the implementation of all activities related to the division in a manner that ensures effective and efficient progress of work. 2) Ensuring the implementation of the division's policies and procedures and communicating with the division's employees by holding periodic meetings aimed at discussing and reviewing the division's workflow and the policies and procedures followed. 3) Defining the main tasks and priorities of work, assigning and distributing them among the employees of the division, in addition to following up their performance levels and determining their training needs. 4) Managing and coordinating the activities of the division and its relations with other divisions and divisions in a manner that guarantees access to a large amount of effectiveness in the work. 5) Follow up on the cleaning activities in the municipality's areas. 6) Manage supportive environmental cleaning campaigns and emergency plans. 7) Ensuring the implementation of waste collection operations in the municipality's areas. 8) Follow up on maintenance operations of equipment and vehicles for collecting and transporting waste and containers and participating in preparing maintenance plans. 9) Follow up on securing the municipality's areas with the required number of containers and supervise the distribution and maintenance process. 10) Ensuring compliance with public safety rules and instructions. 11) Carrying out other tasks as directed by the line supervisor. 			
Academic qualifications	Bachelor's degree in Environmental Engineering, Civil Engineering, Industrial Engineering, Agricultural Engineering, or equivalent.		
Practical experience	<ul style="list-style-type: none"> • Four years or more of work experience in a similar career field • At least two years of working as a leader 		
Qualifications	General qualifications	Technical qualifications	
	<ul style="list-style-type: none"> • Planning, organizing, and coordinating • Managing and achieving results • Excellent communication skills 	<ul style="list-style-type: none"> • Knowledge of how to deal with solid waste • Computer literacy 	

	<ul style="list-style-type: none">• Time management and work priorities• Awareness of occupational and health safety	<ul style="list-style-type: none">• Knowledge of the basics of costcalcualtion• Technical reporting preparation and writing capabilities
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Outreach and Communication Officer

Both men and women are encouraged to apply to the announced positions.

Job description card			
Position	Outreach and Communication Officer		
Line supervisor	Head of the MSWM division		
Job Location (organizational structure)			
Sector	General services	Division	MSWM
Main objective	Preparing environmental outreach and communication programs through various media to transfer the individual to the state of environmental awareness and achieving a concept for sustainable development.		
Main activities			
<ol style="list-style-type: none"> 1) Organizing various environmental activities, competitions and campaigns. 2) Preparing films, advertisements and publications related to environmental protection, and following up the division's website. 3) Directing all groups of society, deepening their awareness of environmental problems and proposing mechanisms to motivate societies to contribute to finding appropriate environmental solutions. 4) Supervising the preparation of reports and achievements and submitting them to the division head. 5) Work to form community committees and activate their role by taking sound decisions to reach the integration of roles between the provider and the recipient of the service. 6) Ensure the implementation of the division's policies and procedures and communicate with the division head and employees by holding periodic meetings aimed at discussing and reviewing the division's workflow and the policies and procedures followed. 7) Carrying out other tasks as directed by the line supervisor. 			
Academic qualifications	Diploma degree in Social Science, Communication/Social Media, Environmental Engineering, Civil Engineering, Industrial Engineering, Agricultural Engineering, or equivalent.		
Practical experience	Two years or more of work experience in a similar career field		
Qualifications	General qualifications		Technical qualifications
	<ul style="list-style-type: none"> • Planning, organizing, and coordinating • Managing and achieving results • Excellent communication skills 		<ul style="list-style-type: none"> • Knowledge of outreach and community engagement and participatory approaches. • Good computer knowledge.

Head of the H&S division

Both men and women are encouraged to apply to the announced positions.

Job description card			
Position	Head of the H&S division		
Line supervisor	Executive manager		
Job Location (organizational structure)			
Sector	General services	Division	H&S
Main objective	Ensuring the compliance of all workers with the occupational H&S procedures.		
Main activities			
<ol style="list-style-type: none"> 1) Ensuring the availability of the required H&S equipment for all staff. 2) Preparing H&S plans and precautions for the various operations carried out by the municipal staff. 3) Ensuring the staff's commitment to the H&S plan. 4) Conducting frequent inspections for the different divisions at the municipality. 5) Conducting first aid training courses for staff and occasionally targeted community groups. 6) Inspecting the procured H&S equipment to ensure its suitability. 7) Conducting periodic reports. 8) Carrying out other tasks as directed by the line supervisor. 			
Academic qualifications	Diploma degree in Industrial Engineering or equivalent.		
Practical experience	Two years or more of work experience in a similar career field		
Qualifications	General qualifications		Technical qualifications
	<ul style="list-style-type: none"> • Planning, organizing, and coordinating. • Planning, organizing, and coordinating • Excellent communication skills 		<ul style="list-style-type: none"> • Knowledge of H&S standards, and first aid operations • Good computer knowledge.

44. Annex 2: Lifespan of the cleaning equipment

Type of equipment	Periodic needs
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Smooth broom	Once every month
Rough broom	Once every 3 months
Green/green turquoise overall	Once every 3 months
Gloves	Once every 3 months, for collection workers
Light orange boots	Once every 6 months
High rubber boots	Once every two years to be used in rainy seasons
Orange cap	Once per year. To be used during the summer
Raincoat	Once every 2 years
Garbage bags	As needed