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Integrated Sustainable Waste Management Master Plan for the Union of Municipalities of Jurd El Kaitee



Prepared by

studioazue
informal urbanism and bioecology

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List of Acronyms

APW	Agriculture Plastic Waste
CDR	Council for Development and Reconstruction
C/N	Carbon/ Nitrogen balance
C&D	Construction and Demolition waste
C&I	Commercial and Institutional
DRS	Deposit Refund System
EDL	Electricité du Liban
EPC	Environment Permanent Committee
EPR	Extended Producer Responsibility
GCC	Green Collection Centre
HH	Household
HORECA	Hotels, Restaurants, Café
IMC	Mediterranean Certification Institute
IMF	Independent Municipal Fund
IR	Informal Recyclers
IRS	Informal Recycling Sector
LCA	Land Character Assessment
MBT	Mechanical Biological Treatment
MIS	Monitoring Information System
MoE	Ministry of Environment
MoIM	Ministry of Interior and Municipalities
MoSA	Ministry of Social Affairs
MP	Master plan
MRF	Material Recover Facility
OFMSW	Organic Fraction of Municipal Solid Waste
OMSAR	Office of the Minister for State and Administrative Reforms
PFD	Process Flow Diagram
PFM	Public Feedback Mechanism
RDF	Refuse Derived Fuel
RR	Register Recyclers
TWG and WG	Technical Working Group, Working Group
UNDP	United Nation Development Program
UoMJK	Union of Municipalities of Jurd El Kaitee
WMTU	Waste Management Technical Unit

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1 Executive Summary

The Master Plan for Integrated Sustainable Waste Management Jurd Al Kaitee is developed under the EU funded project "*EuropeAid*/155108/DD/ACT/LB Complementary support to the development of waste management schemes- ENI/2017/155108/9". The main elements of this plan will be briefed in the following section. It is worth mentioning that the plan is elaborated in accordance with the findings of the baseline for Union of Jurd Al Kaitee Municipalities (UOMJK).

The proposed plan follows the principle of the Integrated Sustainable Waste Management framework that says, "work with what already works; do not reinvent the wheel". Therefore, the main objectives of the plan are:

- To create an integrated and sustainable system in Jurd Al Kaitee, institutionally and financially capable to provide adequate and inclusive waste management services
- To reorganise and standardise collection to reduce costs, optimize efficiency and introduce separate collection of multiple waste streams
- To develop resource recovery through source separation and support the efforts towards a circular economy in the union
- To reduce the volume of waste and the environmental impacts through treatment before disposal
- To protect public health and the environment through safe disposal

In order to achieve these objectives, the following measures are proposed in the Plan:

Waste reduction and public health improvement

- Reduced waste burning, particularly of plastics
- Reduced littering
- Reduced use of plastic bags

Strengthening the Existing Collection System

To improve efficiency, collection services need to be reorganised and is proposed within this Master Plan. As such, a unified system of collection is developed and calls for standardization based on three Land Use/ Land Classification Assessment developed for the region:

1- Urban Dense Area, main villages urbanised areas
2- Field Crop in Large area and Forest, Grassland, including rural areas around the villages
3- Touristic and Protected areas, mainly Qammua.

In each of the three areas, different type of collection systems was modelled and applied for each of the waste streams identified.

Waste generated by activities in these areas have been classified into four waste streams.

1. Residual wastes: These are made up of mainly mixed household and commercial wastes.
2. Recycling and packaging wastes; These are made up of mainly materials or products that can be recycled.
3. Organic waste; Mainly food wastes from households and commercial activities such as restaurants and hotels

4. Special waste: These are other wastes that are non-household or commercial wastes that are not already classified as being hazardous and it includes Agricultural residues, Food-processing (including slaughterhouse/butchers waste), WEEE, Bulky, Tires, Exhausted oils and C&D.

Residual waste and mixed waste streams collection

In order to reduce the frequency of residual waste or mixed waste collection, the plan introduced a source separation collection scheme that focus on source separation of recyclables and organic stream which led to reducing the overall quantity of residuals.

Recycling packaging waste

The plan identifies cardboard and paper as the first materials to be collected separately from commercial and institutional body. Cardboard will be collected from HHs based on voluntary delivery of cardboard to cages/containers placed in front of shops and institutions.

Plastic containers and plastic bags will be source separated as well and collected from designated bins for HHs. The collection will be "door to door" or "building to building" (depending on the type of building) using collection using non-compactor trucks by the union of municipalities.

Organic material

Organic food waste is to be collected with a source separation collection system from HHs. The plan proposes a HHs "door to door" or "building to building" system using as appropriate containers or bags for collections only in Urban Dense Areas. Initially, the system will be implemented only for HHs showing interest to participate in the pilot phase. The collection will be extended to the commercial activities (HORECA). The collection of organic waste will be performed also for agricultural residues but seasonally. In rural areas the organic collection will not be performed. Following the Baseline (Annex 2), some of the OFMSW is already captured by the informal system (e.g., given to animals), and the Plan calls for support to the HHs with Home composting.

Special and other waste streams

The plan takes into consideration a system that is already managed by the IRS. Hence, there is a clear potential for 'win-win' co-operation between the formal and informal sectors. The Plan projects the registration of the IRs so that they can be involved in a "On Demand" collection system. Households IRs and MSW formal collection will be coordinated to increase the Special Waste Collection and to avoid overlapping between Formal and Informal collection.

- WEEE, Bulky and Exhausted Oils: Registered IRS only, will be able to officially collect in these materials in the UoMJK territory, through a permit. The support from the UoMJK and the TU will enable them to increase their turnover and they will be the only ones allowed to collect from citizens. Through the "on demand" system, recyclers will sell the collected materials as they are or pre-treated to Junk Shops that are located outside the UoMJK territory.
- Agricultural residues: Collection will be carried out on seasonal basis. The residues collected should be those that are currently being burned. An important aspect is to identify the seasonality or residues production and avoid any burning.
- Tires: waste will be the responsibility of the union of municipalities. Tires will be collected and stored and then transferred to a tires recycling factory in Chouf for processing.
- Construction and Demolition (C&D) waste: C&D from construction sites or home renovation will be stored in skipper on the site then will be collected and moved to landfill under the monitoring of the Technical Unit.
- Slaughter waste: The plan includes a special separate collection and disposal in landfills. In the future the plan suggests that the construction of facilities to treat and recycle these types of waste.

Improving the efficiency of the Street sweeping and litter collection services

In Jurd Al Kaitee, it has been estimated that street sweeping, and litter represents around 15% of Municipal Solid Waste due to inefficient collection system, IRs scattering waste from bins and from common people discarding litter in the street from their residencies or from vehicles.

The sweeping activities are organized into service areas depending on the status of the roads and urbanisation characteristics. Where roads are well maintained, mechanical street sweepers can be used. Cleaning activities should be also prioritized in areas that require better and more efficient cleaning such as commercial centres or after events.
Service is planned to be provided for the routine cleaning and sweeping of public paved areas and seasonally in touristic areas. The street sweeping service must be regulated by a contract, must be in coordination with the residual waste collection service.

Treatment

The plan recommends the organisation of waste treatment of the four specific waste streams (Residual, Organic, Recyclables, Special) and some additional sub streams identified.
Residual waste: Once collected from different areas, residual waste will be unloaded at the existing MBTs in Mishmish and Fnaideq. The planning team has divided the area into 3 clusters following the division in Sub unit: upper-stream, middle-stream and down-stream. All villages from Mid and upstream, except for Fnaideq, will send their mixed waste to mishmash facility. Treating collected Residual waste at the MBTs involves combination of manual and mechanical sorting to remove the recyclable materials that are not source separated. The rest of the received materials will be stabilized and transported for landfilling. The plan envisages a reduction of residual waste going to the landfill will be decreased to 37% in 2035.
Recyclables waste: source separated cardboards and papers that are collected from commercial bodies will be taken to an MRF in the downstream area for screening and baling and will be sold to the market. Source separated Plastic bags and containers will be transferred to Mishmish Plastic Recycling Line that the plan is proposing. The plastic bags will be pelletized and remanufactured into drain-pipes, while the containers will be baled and sold to plastic recycling companies.
Organic waste: the organic food waste collected as part of the segregation at source system and will be transported to a premium quality composting plant, together with agricultural residues to be transformed into one or more premium quality organic fertilisers in the downstream area.
Special waste:

- *Bulky items and WEEE*: the bulky waste will be transported to a green collection center planned, which has a section dedicated to repair if in good condition and redistribution or to dismantling and sorting of these types of waste.
- *Tires:* there is a factory in Chouf Lebanon, and another planned in the Bekaa valley for processing waste tires. Bulk deliveries of tires will be arranged with these factories.
- *C&D waste*: The waste coming from the two C&D waste categories identified will be disposed in Srar Landfill. In the future, at a regional level, you will have to think about a plant that recycles them.

Disposal

All open or uncontrolled dumpsites in Jurd Al Kaitee will be closed by 2030. The produced residuals will be transferred to Srar landfill. Srar landfill is already subject to a national plan that provides for all Akkar waste to be transferred to this site

Institutional System

Institutional Development and Governance

The plan identifies the new national law for waste management (Law 80/2018) as an example of progress in waste management legislation. Article 9 of law 80 on administrative decentralization allowed the development of a management system on the technical, managerial and financial aspects that legally allows the UOMJK to monitor, control and recover the costs of waste management. Following the ISWM methodology and Waste Aware Indicator 6L.2 the Plan calls for a specific department dealing only with MSW a so called Waste Management Technical Unit.

Waste Management Technical Unit

The Waste Management Technical Unit (WMTU) is a specialised unit within UoMJK administration that oversees the design and implementation of SWM policies and plan in the union area. The TU serves to guarantee the waste management service for all the municipalities of the UOM. The formalisation of the TU guarantees its official function and the sustainability of its work. It will then act as an official focal point for all SWM activities within the UoMJK area towards other stakeholders. The main responsibilities of the WMTU are:

- Planning
- Monitoring and protection of the environment and public health
- Data collection, registration, and analysis
- Cost recovery of waste management operations
- Information service for users

Inclusivity

The planning team suggests a serious upgrade of the inclusivity in the waste management system. This will combine a framework for progress in both users' and providers inclusivity. The MP calls for an accountable, transparent, effective and efficient contracting method for service providers, integration of the informal recyclers (IRs) and a Public Feedback Mechanism (PFM) where information, complaints and suggestions are processed and evaluated, or responded to. Such an upgrade is crucial to a successful SWM system.

Environmental Permanent Committee and Local Committees

The plan proposes that the WMTU be supported by the establishment of an Environmental Permanent SWM Committee (EPC) consisting of citizens and volunteer groups that have already been working in the participatory process for the SWM master plan.

Such committees would coordinate regularly with the WMTU and assist it in all stages of the implementation of SWM policies, also by contributing to setting up and mainstreaming public feedback mechanisms like townhall meetings and open consultative sessions.

Monitoring Plan

The new SWM system will be monitored by the Waste Management Technical Unit. The WMTU will monitor the SWM system with the support of the EPC. The plan calls for a MIS (Management Information System) supported by a shared, transparent database.

Public Awareness and Education

The awareness and communication strategy focuses on:

- community mobilization to raise awareness among local stakeholders and the population on waste-related pollution, littering and environmental sustainability
- and on waste management in order to reduce solid waste production at all community levels and increase recycling, source separation and accountability.
- Environmental and civic education
- Support for financial and social sustainability of the SWM system (aware about the importance of the cost recovery, about the PFM and how does it work, etc…)

Financial Sustainability

According with the Ministry of the Environment and OMSAR, the cost for landfill disposal will be paid by the central government, with funds coming from national taxes. The Plan therefore did not take into consideration the management of the disposal of residual waste. In general, total costs for disposal should take into account the following:

- Direct costs: means the management costs of the landfill site. Daily coverage of waste, data collection, weighing, inspections, leachate management.

- Indirect costs: costs which are not accounted in the daily operations but that affect the landfill facility before (construction, site selection) and after (end of life, requalification).

Following the latest estimations average costs for disposal which allows paying direct and indirect costs should range between 40 and 60 USD/ton.

The plan proposes the implementation of a cost recovery system based on the costs of the service that, other than the physical component of the system, includes the costs to maintain the WMTU, for awareness and communication, monitoring, the Mobile App and the PFM. In addition, the costs also include the initial cost for the source separation collection systems. According to the estimations (see annex 7), the cost per household is estimated at approximately 10,000 LL / month. The tariff will be calculated based on the electricity consumption for each user.

2 Introduction: The Swam Participatory Process in Jurd Al Kaitee

2.1 Union of Jurd Al Kaitee

The Union of Municipalities of Jurd Al Kaitee (UoMJK) is located in the eastern part of Akkar governorate. The area is characterized by a mountainous landscape. The governorate borders North-Northeast Syria, on Southeast the Governorate of Hermel, on South the Minieh Donnieh governorate and the Bared River and on West with the Mediterranean Sea. Despite being a rural area, Akkar is characterized by a high population density compared with other parts of Lebanon, this is particularly true along the coastal plain where the major urban agglomerates are located.

According to studies developed by MADA [1] MoSA [2] and UNDP [3] [4], Akkar is the most economically deprived region in Lebanon, with the highest overall poverty rates in the country. The main economic productive activities are connected to agriculture and a significant part of the local population is directly and indirectly involved in agricultural activities. In the mountainous region of Akkar governorate (see Figure 1), agriculture consists mainly of cultivation of olive trees and other types of fruit trees. The overwhelming majority of farms are small in size. Livestock production (sheep, goats, bees, poultry) makes a minor but significant contribution to the livelihood coping mechanism of HHs.

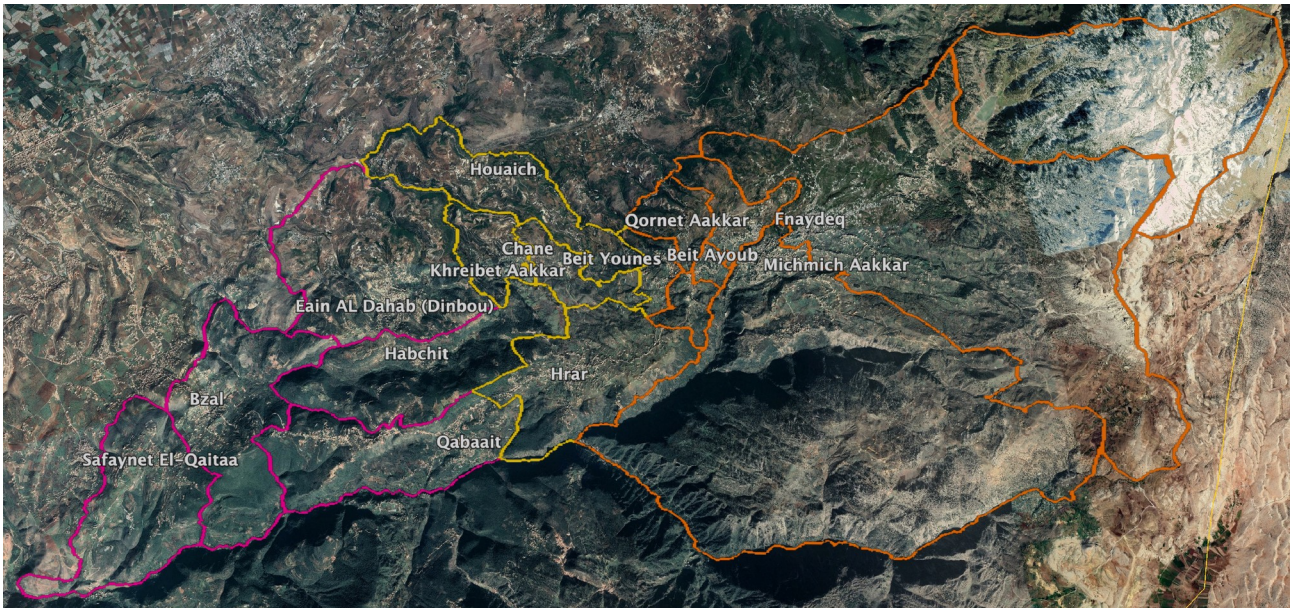


Figure 1 – Geographic map of the Union of Municipalities of Jurd El kaitee

2.2 Relationship to the OMSAR Akkar Planning

Jurd Al Kaitee Union of Municipalities include municipalities that belong to the bigger region of Akkar. The SWM Master Plan of Jurd El Kaitee has been developed following and in coordination with the Regional

Master Plan elaborated by OMSAR for the entire Akkar's Mohafaza under the EU funded project *"Technical support to upgrading the solid waste management capacities in Lebanon – ENPI/2017/389-095"*[1].
Similarly, to OMSAR's Plan for Akkar, the ISWM Plan for Jurd Al Kaitee is about the establishment and implementation of an integrated waste management system in the Region that is meant to reduce the environmental and public health impacts of waste management, enhance the resource recovery activities, increase the efficiency and the cost–effectiveness of the existing system, and strengthen both institutional development and cost recovery. Following a key recommendation contained in Akkar's Plan, in developing the UoMJK's Master Plan the social and institutional aspects have been considered to be fully as critical to the overall system development as the purely technical, environmental and economic considerations.

2.3 The PROMARE SwaM Project for Participatory ISWM Planning

The SWaM project is implemented in the framework of the PROMARE initiative, a European Commission funded initiative launched in 2016-2017. The Baseline and Planning phases rely on a participatory process that has involved stakeholders, especially users and local institutions, in designing and choosing the system that meets site-specific needs and preferences.

Stakeholders' Groups Participation

After the phase three of the Planning process, three Technical Working Groups (TWGs) have been established during the planning process, with each one comprised of five to 10 representatives from the UoMJK (see methodology in Annex 9 ppt). The TWGs have worked with the Planning team (Lead by Studioazue with the support of employees from the other partners) to elaborate ISWM [5] (see also Annex 2 – Baseline) targets for the Region and create the Planning scenarios which lead to the development of comprehensive integrated waste management Plan for the Union. Here below is provided a detailed list of the TWGs (See methodology in Baseline report in Annex 2).

Table 1 – Stakeholders contribution to the Master Plan

2.3.1 TWG description	**Objective**	**2.3.2 Planning Topics Covered**
Disposal Group	The main objectives of the group is to find solutions to stop illegal dumping and burning, to deliver residual waste to a safe disposal site and to close uncontrolled dumpsites. The group aim is to find options to increase the efficiency of residual waste transportation. 1.1.1.1	- Transfer the responsibility of waste management from the Municipality-level to the Union-level - Find controlled suitable disposal sites for all Municipalities of the UoMJK - Identify the residual waste stream quantities in 15 years Master Plan - Close all dumpsites - Evaluate economic and environmental feasibility and viability of option (1) to use a transfer station; option (2) to transport the residual directly to Srar. Determination the final cost of both scenarios.

[1]

		- Work on improving the contracts between the public and the private sectors 1.1.1.2
Service and value chain Group 1.1.1.3	The main objective of the group is to look into solutions and options for waste reduction, solid waste collection and source separation. The sources of waste considered are houses, businesses/ commercial bodies and private and public institutions. 1.1.1.4	- Discuss and understand waste types produced from different sources - Confirm the importance of sorting from the source - Select the system for each waste stream, how to collect, transport and treat 1.1.1.5
Governance Group 1.1.1.6	The main objective of this group is to look into possible scenarios to institutionalize waste management system in the Union of Jurd Al Kaitee Municipalities	- Sound Institution: Contracts, Informal Recyclers - Economic: Cost Recovery, Waste Fee - Social: Participation, Feedback Mechanism - Inclusivity: Awareness Campaigns (Sub-committee) - Workers' Health and Safety at Work - Monitoring of the waste management system

The participation process proved to be a necessary and effective manner in which to bundle resources, de-politicise the Plan and create institutional cohesion that was reflected in the Validation Workshop (VW) that resulted in broad-based validation and approval of the Plan.

3 Summary of the Baseline Analysis

This chapter summarises the baseline data collected during the planning process. For further details, see Annex 2 – Baseline.

3.1 General Geographic and Demographic information

3.1.1 Jurisdictional boundaries

The Jurd Al Kaitee Union of Municipalities extends over an area of 139,91 km^2. The Union was established in 2005 and comprises 15 villages: Beit Ayoub, Beit Younes, Bzal, Chane, Eain Al Dahab, Fnaidek, Habchit, Houaich, Hrar, Khreibet Akkar, Michmich, Qabaait, Qornet Akkar, Qraiyat and Sfaynet El Qaitaa.
In addition to these municipalities, the Union includes the Qammoua plain, which borders the Union's on the Northeast edge and it is administered by Fnaidek Municipality (see Figure 1 and Figure 2).

3.1.2 Geomorphologic characteristics

Jurd al Kaitee is a rural area characterised by the presence of villages with fragmented to moderately fragmented built up areas. The UoJK's landform is characterised by deep valleys and ravines, high uplands, and mountains. As for the land use, mixed forests and non-irrigated arable land are the most widespread land uses (see Annex 4 - LCA).

3.1.3 Climate

The Northern Akkar district is influenced by a temperate Mediterranean climate with two main seasons: snowy, cold Winters and warm Summers. separated by intermediate relatively short mid-seasons (Spring and Autumn).

3.2 Urbanization and population characteristics key data

Jurd Al Kaitee Union of Municipalities is a rural area characterized by a population density of 943 persons/km^2.

Table 2 - Data about population and area of Jurd Al Kaitee Union of Municipalities

Parameter	Best available triangulated data
UoMJK Summer Population (persons) Lebanese nationality	131.876 persons
UoMJK Winter Population (persons) Lebanese nationality	**95.315** persons
UoMJK Population growth rate	2,48%
Average size of Householder (HH) North Lebanon	6,1 persons/family
UoMJK Population (persons) Syrian refugees	6.411 persons
UoMJK Average size of Householder (HH) Syrian Refugees	4,9 persons/family
UoMJK Area of the Union (km^2)	139,91 km^2 (+1 km^2 Quammoua)
UoMJK Household Number (Lebanese)	21.610 HHs
UoMJK Household Number (Syrian)	1.308 HHs

Population density (persons/km^2)	943 persons/ km^2

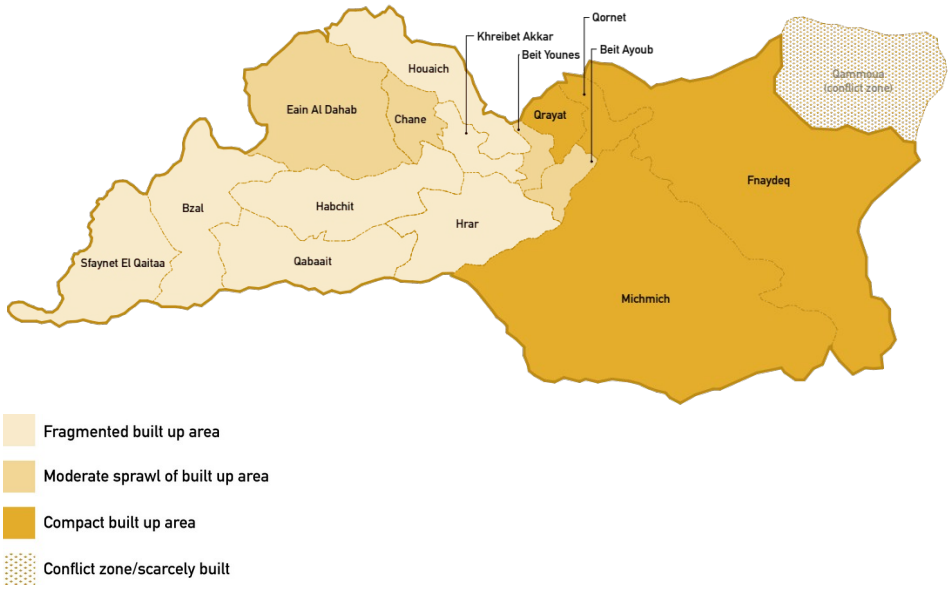


Figure 2 - Urbanization character: fragmented rural versus compact built up areas

3.3 Waste Quantities, Characterisation, and Generation

Table 3 and Error: Reference source not found to Error: Reference source not found show the results of the estimation of Solid Waste Quantity and Composition held in the framework of the project in winter 2018 in Jurd al Kaitee

Table 3 - Solid Waste quantities generates and collected

Waste generation		**WINTER**	**SUMMER**
Solid Waste generated per HH in HHs kg/HH/d[2]	4,1		
Solid Waste generated per HH in HHs t/month in UoMJK		1881	2445
Solid Waste generated in commercial activities		552	718
Solid Waste generated including HH and commercial t/month		2433	4866
Waste collection		**WINTER**	**SUMMER**
Solid Waste collected per HHs kg/HH/d	2,74		
Solid Waste collected per HH in HHs and commercial t/month		1267	1646
Solid Waste collected in UoMJK (winter and summer) t/y	16794		
No. HHs all UoMJK (excluding KA and H)[3]		15202	21619

3.3.1 Waste Composition at HH Level

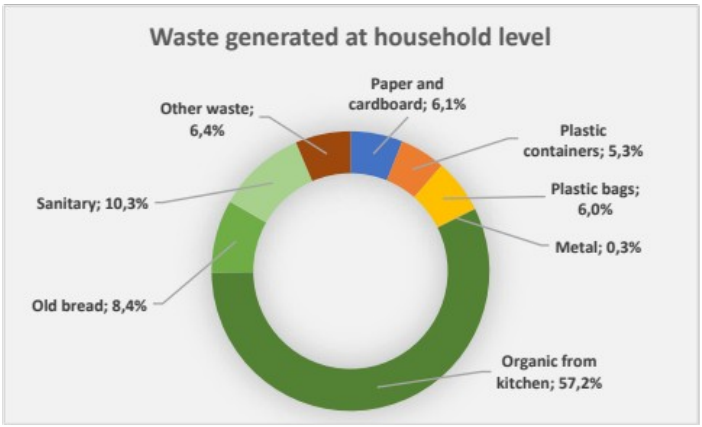


Figure 3 - Household Waste Fractions Generated in the UoMJK Percentages by weight

3.3.2 Waste Composition Commercial

Commercial waste collected accounts for the 21,4 % of the total waste. In Table 4 are shown the main types of waste from businesses. In Figure 4 are displayed the percentages of the total waste of each commercial waste

[2] *To simplify the estimantions, the analysis has been done considering the waste quantities per day stable and not affected by the seasonality*

[3] *Kerbet akkar and Habshit, two villages where waste are not collected and since the waste quantity analysis has been done for the collected waste the two villages are not included in the estimations of the waste collected per HH (see annex 2 – Baseline)*

categories. Figure 5 highlight the percentage of material in the total waste collected including HHs and commercial.

Table 4 - Commercial and Institutional Materials

Material	Description
Manufacturing Industrial Waste (kg/year), aluminium fiberglass, plastic, packaging	Waste from manufacturing, blacksmiths, auto repair or small workshops
Mechanic Waste from End of Life vehicles, automotive maintenance and repairs, such as batteries, waste oil, scrap metal; spent frying oil; lubricants	Waste from cars and trucks is generated at garages, workshops and repair centres and includes nonferrous and ferrous metal parts, lead acid accumulators and smaller batteries, and used crankcase oil. Metals and batteries have a very high rate of diversion from waste to recycling. In contrast, used crankcase oil and other automotive fluids are discharged to the ground or to wastewater and are a serious source of pollution. There is no information as to whether there is a market for used crankcase oil nor for spent frying oils.
Supermarket Cardboard (Old corrugated containers, OCC)	Supermarkets are the main source of cardboard, in region no evidence of any recycling system or an active market closer than Tripoli, however, is recycled in other area of Lebanon. A small part is diverted to Mimosa a company producing napkins
Supermarket Plastic and glass	Plastic bottles, glass and other packaging waste coming from wholesale and retail operations. Culturally, beverages and food are purchased for use at home and are not consumed on the retailer's premises
Livestock Manure (chicken/cows)	Cow and chicken manure mainly reused by the agricultural sector
Small construction wastes, LDPE foil, tape, packaging and paint cans and other waste	Waste from carpenters and DiY (do it yourself) repairs and renovations, small metal tools and parts, paint tin cans and plastic films.
Carpenter sawdust	Such a high percentage is sold that none is found in the waste stream
Butchers Cow Skin	Hides of animals sold to leather factories or other tanneries
Butchers Preparation of chicken and meat	Offal and bone are discharged to MSW, in particular from small shops, for which the official slaughterhouse is too far away or too expensive, or because it is culturally preferred to demonstrate to customers that the animal is killed in front of the shop
Vegetable shop Plastic crates	Reused and sold to the market once a year
Vegetable shop Organic	Vegetable parts, parts given to animal's part reach the residual waste stream
HORECA[4] Food and food preparation waste	Waste from Hotels, Restaurants and Cafes, high seasonal fluctuation (more than 100% increase, some open only in summer). A stream to be analysed more during summer including potential of ask from "*narguile*" consumption
HORECA mixed MSW	Mixed material including aluminium cans, plastic PET and ferrous cans – highly recyclable and the 3% of the generated in the UoMJK is being sorted at the Michmich transfer station.
Health care waste	Medical waste from clinics, some materials are recycled by a variety of different organisations
Packaging from health care waste	Not currently recycled with potential, currently end in residual waste collection
Commercial solid waste from offices	Paper and cardboard from offices; food waste from cafeterias and meetings; furniture, textiles, cleaning materials
Pruning and urban green space management	Urban pruning occurs once a year in the month of February of March, trees on the streets and small gardens. UNDP funded a project in Hrar to prune in year 2019. Waste is burned – it is currently not suitable for heating but might be suitable for chipping as much or as bulking agent in processes to produce compost or biogas (***or if dried, for home furnaces?)
Forest management	Cutting of trees to manage the forest, all municipalities have a small forest, it is not suitable for heating but might be suitable for chipping as mulch
Paper from Schools	High amount of paper, 48 schools in the union, recyclable paper is mixed with residual waste and lunch waste in the residual waste communal containers
PET bottles from Schools	Considerable amount of PET, at the moment no sign of recycling market in the Union, discharged to the residual waste. Some households reported burning in the winter for heat
Construction and demolition	Dumped by private companies in 6 sites, 4 of them specific only for C&D waste

[4] *Hotel, Restaurant, and Café waste.*

waste	
WEEE	Waste from Electronic and Electric Equipment waste. Bulky, E-waste washing machines, fridges, screens and Kitchen appliances are all taken by the semiformal recycling system, which pays the users. Very little quantities such as cables, or batteries or bulbs are going to the residual waste and are part of the other waste stream
Agricultural residues	Residues from plant production and herbaceous and arboreal crops. In the area there are agricultural activities among which the fruit trees plantations are dominant

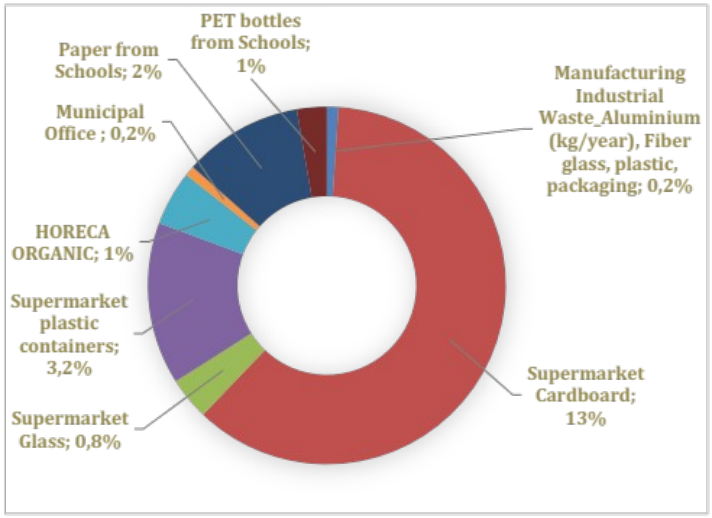


Figure 4 - Commercial Waste Fractions Generated in the UoMJK

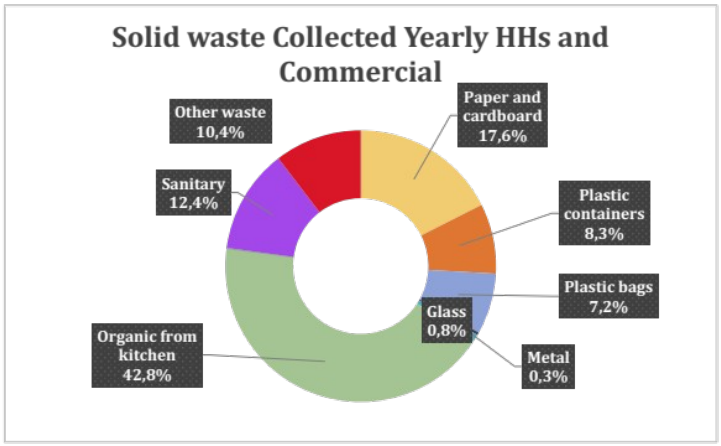


Figure 5 - Overall Fractions of collected waste from HHs and Commercials (rounded)

3.4 Physical Components

In Jurd Al Kaitee, despite the presence of two MBTs (Mechanical Biological Treatment), facilities in the area, only Michmich sorting facility is operational. At the time of the planning activity, it was found/reported to treat an average 3% of the total collected waste in Jurd Al Kaitee (see Annex 2 – Baseline report). The baseline study showed a large and imponderable difference between the quantity of waste disposed versus the quantities collected. About 50% of the waste generated does not end up in the waste bins for collection. As

the case of HHs, some of waste generated by Commercial's activities identified in Figure 4 does not end up in the bins but is being collected by the Informal Recycling Sector (IRS). More detailed information on waste quantity, composition and characterisation can be found in the Baseline document in Annex 2.

3.4.1 Existing Efforts to Recover Recyclables and to Reduce Waste Requiring Disposal

In Jurd al Kaitee as previously mentioned, a very low fraction of waste is separately collected, recovered, or formally treated. Mishmish MBT processes around 10 t/d and recovers around 3% of the total collected waste generated on the territory of the UoMJK (see Annex 2 – Baseline). The informal sector and repair, re-use, give-away, and recovery at HH level, contributes to 26% diversion of waste from dumpsites. In addition, a percentage of the generated waste (bread, around 8%; organic from HHs around 12%) is diverted to animals and other activity reuse, repair as part of the common practices observed in area during the baseline phase.

3.4.2 Special Wastes and Specific Issues.

Additional to the materials catalogued above, there are various special waste streams generated or disposed within the territory managed by the UoMJK and still part of the MSW. Some of them are informally managed by the IRS, others are dispersed in the area without a particular concern for the environment and can be randomly encountered in the most remote corners of the UoM.

The electronic waste and bulky items are mostly managed by the IRS. Being an informal value chain, the physical management often causes high environmental impacts, especially the cables as they are burned to recover the copper. The construction and demolition waste represent a problem as they are dumped without any controls in different spots of the region. The master plan will take care to the Construction and demolition because they should be included in the MSW. The definition of MSW varies widely between countries, household wastes are always included, as are some C&I and C&D wastes from smaller businesses and institutions [6].

Furthermore, a very important problem is related to slaughterhouse waste which are not currently treated and is difficult to control as there is no communal slaughterhouses and animals are killed and slaughtered directly inside the premises of the butchers, and that as well in that case should be considered as MSW.

3.5 Governance Component

In that paragraph are summarized the governance aspects of the SMW in the UoMJK, following the ISWM methodology three are three drivers for the governance [7]:

- Sound Institutions
- User and Provider Inclusivity
- Financial Sustainability

3.5.1 Sound Institutions

3.5.1.1 Lebanese Legal and Institutional Context

At the national level, the Country has enacted a number of national laws and framework for waste management. In 2018, a law and a policy framework were enacted and are currently shaping the overall national waste management framework namely:

- **Law 80/2018** for integrated waste management; it is the only legislative framework that is directly related to waste management.
- The **Integrated Waste Management Policy** that was enacted in January 2018 by a council of Minister Decision.
- In addition to these national frameworks, there are number of decrees and laws such as the **Law 444/2002** of environment which represent the general framework about Environment protection.

At the local level, the ongoing national orientation toward decentralization of the waste management sector gives the Unions a level of autonomy in waste in monitoring and implementing sound waste management. Table 5 the summary of the national legal framework related to SWM in Lebanon.

Table 5 – Summary of the legal framework (more detailed information in the Baseline, annex 2)

Ministry of Environment (MOE)	Preparation of environmental legislation, development of plans and issuing of licenses The solid waste issue falls within the scope of the Residential Environment department of the Ministry of Environment.
Ministry of Interior and Municipalities (MoIM)	Funding and implementation of waste project It is currently overseeing the waste issue, since waste management has been entrusted to municipalities and municipal unions through number of decrees and laws
Council for Development and Reconstruction (CDR)	Fund raising, program development, development of bids CDR contributes to the development and implementation of waste treatment projects in other cities including Akkar. The CDR is a member of the Central Technical Team that is responsible for reviewing and implementing any waste treatment project prepared by municipalities or municipal unions
OMSAR (Office of the Minister of State for Administrative Reform)	OMSAR launched a solid waste management program to improve solid waste services in rural areas. It deals with the implementation of projects for the construction and equipping of waste treatment facilities, in preparation for the operation and maintenance of these facilities at a later stage

3.5.2 Users and Providers Inclusivity: Service providers Informal Sectors:

About the service providers for Residual Waste, some municipalities have stipulated lump sum contracts that do not involve any correlation with the real generation of waste or its seasonal variations. The agreements between municipalities and the main service provider are short-term contracts (one year or six months) and they do not give the possibility of developing policies or incentives to discourage landfilling and do not offer the conditions for the service provider to invest and modernize the system. An important opportunity is the willingness to participate that the stakeholders have shown to date, dedicating themselves to the discovery of the waste management system and actively working together with the representatives of the other municipalities.

In Jurd Al Kaitee, the informal Recycling Sector is represented by the Waste Pickers and the Waste Buyers. The observed waste collectors in the area are from different nationalities, mainly Lebanese. Currently, there is no existing coordination between the municipalities and the IRs. Though, the Informal Sector in Jurd Al Kaitee, plays a crucial role in reducing the quantity of recyclables that end up in dumpsites and municipal bin's, there is no form of coordination between the municipalities and the IRs.

3.5.1 Financial Sustainability

In Jurd Al Kaitee, there is no proper cost accounting take place. With the allocated municipality budget for waste management the UoMJK, the municipalities end up with low quality of waste service. Cost recovery practices are inexistence in the union. In term of fund availability and access to capital, the municipalities have access to different donors due to the Syrian Crisis. Overall, the financial sustainability in waste management Jurd AL Kaitee scored Low/Medium.

The cost of waste treatment and disposal can range between the 28 USD/Ton and 70 USD/Ton excluding the environmental cost and the gate fee cost. After a questionnaire (see Annex 2 Baseline) it resulted that around 70% of the population is willing to pay more than 5000 LL per month for the Service for SWM.

3.6 Conclusions of the Baseline: SWOT

The SWOT analysis presented in Table 6 and Table 7 represents a summary of the conclusions on the baseline analysis, it must be considered that since it is a participatory process the SWOT analysis represents the conclusion of a process of gathering, analysing, sharing and validating information. SWOT therefore reflects the thinking and judgment of the stakeholders and result of the process to give and agree about the same information to respect the first principle of the participation: Equality of information.

3.6.1 Physical Component

Table 6 – Summary of the Physical component in SWM in the UoMJK

PHYSICAL COMPONENT	
Public health – waste collection	
Strengths	**Weaknesses**
Collection coverage 97%	Collection fragmented and not efficient, two villages are not covered Street sweeping collecting also MSW causing littering problems

	Special waste collected with domestic
Opportunities	**Threats**
Potential to optimise the system	Political division between municipalities Not sense of public health risks by burning plastic in the heating system
Environmental Protection – Treatment and Disposal	
Strengths	**Weaknesses**
There is an MBT facilities in Michmich	Only waste from Michmich and Qornet Akkar are treated in the plant, representing the 25% of the MSW collected in the UoMJK Lack of safe disposal sites, only 6 municipalities out of 15 deliver waste to a controlled dump, the rest are using their illegal and uncontrolled dumpsites. Around 19 dumping sites have been detected in the UoMJK area for domestic waste, 4 for C&D waste and 1 for other special waste
Opportunities	**Threats**
Experience in managing MBTs	Strong NIMBY syndrome
Resource recovery	
Strengths	**Weaknesses**
Strong recovery from the informal and semi formal sector Strong reuse of waste from Households	Low performance of Michmich MBT facilities around 10% of recyclable material, low value of the second raw material, no separation between domestic and special waste
Opportunities	**Threats**
Potential to increase the value of the material	Lack of willingness to recognize and improve the informal or semiformal sector

Governance Component

Table 7 – Governance SWOT analysis

SOFTWARE	
Institutional development – Sound institutions	
Strengths	**Weaknesses**
Local: Establishment of the Union of Municipalities of Jurd Al Kaitee National: National Waste law approved (n. 80/2018) National: Division between implementation (OMSAR/CDR) and monitoring (MoE)	Lack of Planning and reliable data, absence of dedicated department for SWM, lack of regulation and policies for domestic and special waste, lack of cooperation between municipalities Overlapping of responsibilities and competencies between Ministries (CDR, MoE, OMSAR, MoIMs, MoF)
Opportunities	**Threats**
Willingness of the municipalities to work together (from WG)	Lack of trust of the National government, corruption (WG)
User and provider inclusivity	

Strengths	**Weaknesses**
Equity of service provision Awareness done in past 5 years	No Awareness Plan in place or coherency /continuity with awareness campaigns implemented. Only to the 33% of the population of the area has been exposed to Awareness Campaigns/Initiatives in the past 5 years Communication from users to institutions or provider not structured and not processed Low level of recognition and acceptance of the Informal Recycling Sector in some municipalities are not allowed to operate. Contract with service provider based on lump sum estimations
Opportunities	**Threats**
Informal sector willingness to be recognised Presence of a complaint mechanism even if not structured (WG) Private sector ready to invest	Selfishness (WG) Presence if Informal Recycling Sector (WG)
Financial sustainability	
Strengths	**Weaknesses**
Budget for SWM (collection mainly) 100% partially covered	No costs recovery from HHs and commercial No costs accounting for end-of-life disposal sites, environment and health No clear costs accounting, budget mixed with other expenses
Opportunities	**Threats**
Service costs reduced using private service provider Access to capital for investment	Municipalities use IMF (Independent Municipal Funds) to pay for the WM costs Municipalities don't know how to implement local costs recovery measure; they rely on the modification of the National Law.

4 Principles, Objectives and Targets

4.1 Principles and priorities

The ISWM framework and the ERM-World Bank Strategic Planning Guide [8] are the guiding methodologies that have been used to elaborate the Plan. Both methodologies recommend the adoption of a Planning framework and to work with Principles. In accordance with those indications, the Master Plan for the UoMJK has adopted its main framework principal from the National Legal Framework (law on Solid Waste no. 80/2018) while another set of complementary principles, have been proposed and validated during the stakeholder workshop held on the 6th of April 2019 (see Annex 9 for the list of workshops) and are more linked to more regional specific aspects. The MP is not considering special Hazardous Waste but only hazardous waste inside the municipal solid waste. In any event in which hazardous waste will be present will be managed following Lebanese regulation in particular Decree 998/1, which regulates the registration procedure and obligations of hazardous waste generators at the MoE. Decree 999/1 which Sets the licensing, registration procedures and obligations of hazardous waste tansporter. Furthermore, the MP seeks for the respect of any safety and healthy norms and regulation including if necessary, the framework for the management of hazardous waste which include wastes resulting from healthcare practices (excluding infectious waste) from the Decree 5606/2019 and 59/1 which sets the licensing, registration procedures and obligations of hazardous waste storage facilities at the MoE (with expectations: radioactive waste, hazardous and infectious waste resulting from health institutions to where provisions apply).

Table 8 – Principles from the planning process and from the Waste Law 80/2018

Article 2: The principle of integrated household solid waste management	Application of the principle of integrated household solid waste management, which is founded on the following stages: source reduction, reuse, source and plant sorting, recycling, composting, energy recovery and final disposal of residual waste, should be applied.
Article 3: Principles of reduction, reuse and recycling	To the principles of source reduction, reuse and recycling should be given precedence over other stages of integrated solid waste management in Lebanon with an objective of reducing their adverse effects on the environment After applying the principles referred to in paragraph (1) of this Article and after composting, to recover energy resources found in solid waste as long as this process is possible and economically viable, and it does not cause any adverse effects on the environment. Solid wastes that cannot be reused, recovered or recycled should be disposed of in an environmentally sound manner and in accordance with the provisions of this Law; applicable national environmental

	standards, in particular those relating to air emissions or to the environment; and public health and safety requirements.
Article 4: The sustainability principle	Solid waste should be managed from its source of origin to final disposal sites, in an environmentally suitable manner that does not increase social and economic burdens and that prevents: a. Contamination of surface water and groundwater, air, soil, flora and fauna. b. Harm to public health Local administrations and/or the central authority may entrust the management of any phase of integrated waste management, in whole or in part, to the private sector, subject to the provisions of this Law.
Article 5: The proximity principle	Solid waste should be sorted, treated and then disposed of in licensed facilities as close as possible to their place of origin and away from residential areas to reduce transport distance, emission of pollutants and consumption of petroleum products in transport, subject to these sites being technically licensed and being economically viable.
Article 6: The precautionary principle	Appropriate measures should be taken to avoid any adverse effects that may be caused by certain stages of solid waste management, based on latest technological and scientific information, even before obtaining conclusive scientific evidence of the potential risks.
Article 7: The principle of prevention of uncontrolled dumping, landfilling and burning of solid waste	Forbid dumping, discharge, landfilling, burning or disposal of solid wastes in soil, pits, rock caves, surface waterways, groundwater, air, sewage networks and other infrastructure or sites not licensed for this purpose.
Article 8: Polluter pays principle	Polluters bear the costs of managing the solid waste they generate and the costs of the mitigation measures to be taken to resolve the problems ensuing from the waste or that may result from it, provided that these costs are commensurate with the quantity and quality of the waste.
All participants agree to work on a holistic and integrated Plan to solve the waste management in Jurd Al Kaitee	Continue to re-enforce participatory planning and the spaces for participation of citizens and users in long-term solutions for integrated sustainable waste management in Jurd Al Kaitee

4.2 Objectives

The proposed plan aims to integrate the existing components of the current system (see Annex 2 – Baseline report) and the future ones into an Integrated Sustainable Waste Management System. Table 9 below

presents the objectives of the plan and how they do relate to the findings of the baseline and to the principles validated.

Table 9 – Objectives of the Master Plan

From the Baseline	Objective
Low rate of burning	Reduce uncontrolled burning of waste used as “irregular fuel” to zero from HH and heaps
Re-use	Organise, support, and maximise re-use
Inefficient collection	Make collection more efficient, reliable, and effective
Waste spread on street	Eliminate disposal of waste in heaps and significantly reduce littering
Disposal of waste takes place in open dumps with no or little monitoring	Close, reclaim and return to the community (with functional requalification) all open dumps located within the region. Find solutions to dump all MSW generated inside the UoMJK in a Sanitary Landfill or a controlled dumpsite.
Inefficient infrastructure	Make the infrastructure more efficient, reliable, and cost-effective
Presence of Informal Sectors	Formalise, integrate, and legalise the informal sectors or eliminate them
Presence of public participation yet not systemized	Create institutional guarantees and systems to ensure participation of system users and the public in the solid waste and valorisation system
Unbalanced relationship with between the public and private sector	Find a balance between public and private participation in the solid waste and valorisation system, to protect users from health risks and to allow service providers to invest
Absence of planning and limited capacities	Strengthen capacities and institutional commitment for Planning, ensuring compliance with plans, and regular updates
No cost recovery systems	Work with the Government and Ministries of Finance and Environment to introduce fair, legal, and transparent cost recovery systems
The environmental cost is never counted	Create transparent mechanisms for monetising the environmental impacts of solid waste and recycling activities and use these mechanisms to implement systems to ensure that the polluters pay.
Absence of Data	Introduce regular data registration and monitoring at all points of disposal or valorisation
User inclusivity	Continue to re-enforce participatory planning and the spaces for participation of citizens and users in long-term solutions for integrated sustainable waste management in Jurd Al Kaitee

4.3 Targets

Within the participatory process, considering the objectives and the context, the planning team and the involved actors have selected a horizon of 15 years for the realization of the set objectives. During this time the plan must be reviewed and reviewed according to a monitoring plan (see chapter 9.6). At the end of the period considered, the institutions will have to create a further Master Plan for SWM. In Table 10 and Table 11 the proposed targets.

Table 10 - Targets related to the physical component

PHYSICAL COMPONENTS TARGETS RESOURCE RECOVERY Targets	BASELINE	NECESSITY
Reduce plastic bags use: 40% by 2035	Plastic bags account for the 7 % of the total waste collected	Awareness and incentives for reusable bags
Reduce littering by 50%, increasing street sweeping and awareness, by 2035	Street sweeping only in three municipalities out of 13.	Vehicle and manpower Awareness Containers on the main streets
Reduce waste burning by 50% at HH level in 2035	The 5 % of waste are burnt at HH level in the villages of Kherbet Akkar and Habshit. Poor families burn plastic in the heater in winter. Cable are burnt to recover copper	Start waste collection in Habshit and Kherbet Akkar, Awareness and education Tools for WEEE treatment
Recyclables: To capture 35% of the total initial waste collected recyclables in the waste stream by 2035 through proper source separation programs and some additional recovery by the existing facility. Clean Plastic bags and Plastic containers: 40% Cardboard and Paper: 60%	Today, the recovery rate is 3.25% of the waste which is very low and can significantly be improved.	Capture value. Reduce the volume of the waste. Change behaviour of citizens. Integrate informal recyclers; Reduce the treatment capacity. Reduce the residual stream
Organic fraction: To capture 40% of the organic fraction by 2035 through source separation programs	Today there is no organic fraction source separation. Only in the MBT of Mishmish organic is separated but compost cannot be sold due to the presence of heavy metals and impurities.	Mitigate the impacts of organic; fraction (leachate, biogas) Create soil improver. Change behaviour of citizens. Reduce the treatment capacity. Reduce the residual stream
Special waste: reduction of 50% of **cable** burning by 2025, increase of WEEE treatment by 50 % by 2005. 100% safe disposal of **slaughterhouse or butcher waste** by 2030.	No treatment, no safe disposal, special waste mostly mixed with HH and commercial waste	Create value chain for valuable material from commercial and industrial activities, separate hazardous from municipal waste
TREATMENT AND DISPOSAL	**BASELINE**	**NECESSITY**

Targets		
Safe disposal: all residual waste diverted to a safe disposal by 2025. At least 66% of the residual waste disposed in a Sanitary cell or controlled dump by 2021.	Today waste disposal ratio is about 33% in open dumps creating serious health and environmental risks. 40 % is going to Srar, controlled dump, 13% is burned, 10 % is dumped in open dump after the sorting in Mishmish MBT plant	Protect public health. Create a safe alternative in case waste treatment and recycling do not deliver.
Residual stream: Reduce the residual stream to less than 60% of the waste generated by 2035	Today waste disposal ratio is about 96%.	Increase the life of the landfill. Increase the diverted waste. Increase the captured value
Reduction of waste landfilled prior treatment: Treatment before landfilling should be more than 60% in 2025	Fnaidek MBT and Mishmish should take all waste of the UoMJK. However, they operation must be improved and closely monitored to limit environmental impacts.	Reduce biogas. Reduce leachate. Reduce pollution potential. Increase resource recovery

Table 11 – Targets related to the governance

GOVERNANCE TARGETS SOUND INSTITUTION	BASELINE	NECESSITY
Technical unit: fully empowered with management of the Waste Management budget by 2020	Waste managed by single municipalities without capacity to manage and monitor	Create a team, with waste management experience and provide capacity building, planning of regular capacity update or the team. Give resources for monitoring
Database: database created to be fully under control of the WMTU by 2020	Lack of reliable data	Create a database for the all UoMJK with a monitoring plan and regular updates
Contract with private sector: establish a template for contract that allows source separation, disincentive the final disposal by 2020	Lump sum contracts, short contracts and not clear responsibilities	Contract that define responsibilities, allow monitoring, waste measured by tonnes, clear terms and obligations
FINANCIAL SUSTAINABILITY	**BASELINE**	**NECESSITY**
Costs reflect environmental degradation: cost for disposal consider environmental degradation and end of life by 2020	No clear cost per tonne at Srar controlled dump. No end of life obligations, no costs for degradation	Discussion with service provider, request support from National agencies and ministries, such as OMSAR and MoE and MoIM to identify and enforce minimum costs for disposal
Costs recovery system: create a by law that allow the WMTU to recover costs for WM directly from the	No costs recovery rely on IFM	Request to prepare the by law from an expert. Prepare feasibility study to identify the right tariff

users by 2020		that include the WMTU needs and the monitoring.
USER INCLUSIVITY	**BASELINE**	**NECESSITY**
Permanent committee: establish a permanent committee at the UoMJK to allow influencing decisions by 2020	No participation	Continuing the participatory process of the plan, establishing a permanent committee where members are representative of the stakeholders that were participating to the Master Plan participatory process
Awareness: develop an awareness Action Plan by 2020 following the awareness and communication strategy in the present Master Plan	Very little and random awareness, without activities on the ground	Aware citizens and user and inform them about new collection system, waste tariff and increase transparency. Built the sense of being in the UoM
Environmental Education: add to the official curriculum the Civic and Environmental education in schools by 2035	No official courses on environmental and civic education	Official Civic and Environmental education will structure the behavioural changes. Civic and Environmental education need to be together since SWM need also civic education as a way to respect rules to live inside the society.
Feedback mechanism: create a PFM by 2020	No structured feedback, not accessible to all users	PFM that is accepted, accessible to all users, processed by the WMTU.
PROVIDER INCLUSIVITY	**BASELINE**	**NECESSITY**
Establish a system to register the IRS, establish a register with list of registered entities that are allowed to collect in the UoMJK by 2021. Coordinate with the National Government and the Chamber of Commerce to establish a formalisation process and an Environmental Companies National Register and formalise RR working in the area of Jurd AL Kaitee by 2035	IRS is present and active, very high competition most of them comes from outside the region. IRS not recognised in some municipalities is forbidden.	Formalisation to regulate working conditions. Integration and coordination with the formal system and with users to collect more reduce disposal

5 Waste Reduction and Prevention

Following the Waste Hierarchy and the article no. 3 of the Waste Law no. 80/2018, the first actions the Master Plan projects are Waste reduction and prevention. Based on the Baseline information the Master plan calls for one main actions for Waste reduction and two for health risks reduction (prevention). The planning team designed the strategy to reduce the use of plastic bags, to reduce littering and waste burning.

5.1 Reduction of Plastic Bags

The Mater Plan calls for 30% reduction in plastic bags usage in Jurd Al Kaitee in 2035,
through actions that provide incentives to residents to reduce the plastic bag usage, and proposals for alternative solutions such as distribution of textile bags and other reusable bags. The role of the awareness and communication is going to be crucial for a successful implementation of the Master Plan.



Figure 6 - 30 % reduction of plastic bags usage by 2035

5.2 Strategy for littering reduction

Litter, in non-participatory processes referred to as “Behavioral Waste” but more accurately representing an indicator of failure of the system to serve the users, counts for 9% of the total quantity of waste generated in Jurd Al Kaitee. The impact on this waste stream could be reduced by 50% by 2035 through awareness and monitoring campaigns that focus on improved service levels and stimulation of new norms and values, in the first instance for the residents in the first phase and later for visitors, tourists, and employees from outside

the region. On the physical system level, litter bins will be installed in specific areas to achieve the set target and regularly monitored and emptied.



Figure 7 - Reduced littering by the Public by 50% bey 2035

5.3 Strategy for reduction of burning associated with recovery

As the main source of burning in Jurd Al Kaitee is the informal recyclers that burn electronics materials, in particular electric cables to collect copper. The plan projects a reduction of such behaviour by 50 % through adaptation of increased of WEEE treatment mechanism and introduction of cables separators (Stripper) machines by 2035. The stripper will be available at the Green Collection Centre or will be supplied to Registers Recyclers (RRs).

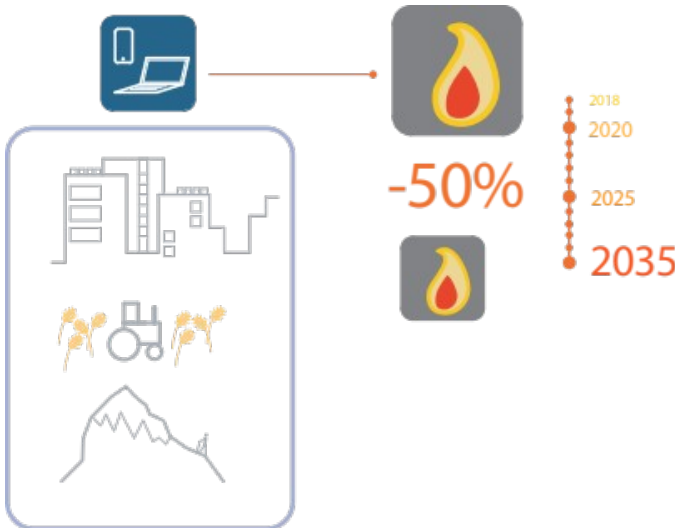


Figure 8 - 50% reduction in burning cable and WEEE by 2035

5.4 Household burning

Burning of waste in households in the winter is a deeply-rooted traditional behaviour in the more rural areas Jurd Al Kaitee. The plan envisions to reduce indoor burning of plastic for heating by 50%.by 2035. This will be achieved through awareness campaigns on the negative health effects of indoor burning on health and through incentivizing people to participate in the planned plastic recycling program instead of burning.

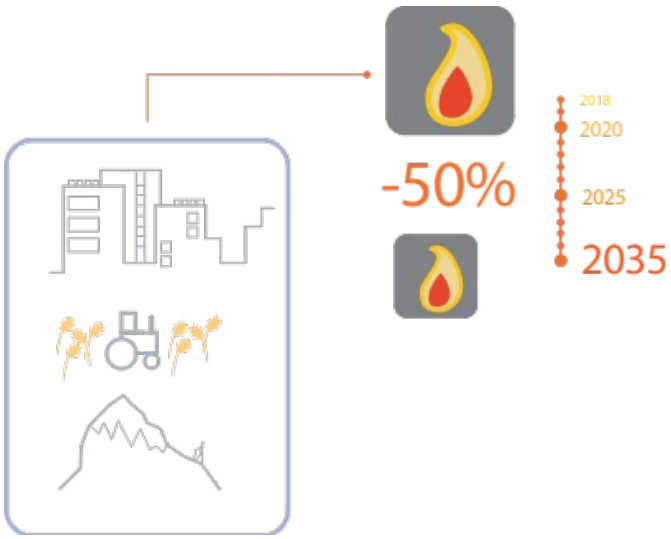


Figure 9 - 50 % reduction of Waste Burning by 2035

6 Waste Collection

The identification of land use and values, thanks to the LCA tool instrumentation and the definition of the main waste flows to be managed through strategic planning have made it possible to project a collection system that calls for increased and targeted Waste Segregation at Source. The System was suggested, studied and designed through the participatory process at the level of TWG by transparently informed and representative actors in a neutral environment where the planning team only played a role of technical advisory supporting the management of topics. The system has been designed with the objective of minimizing the amount of residual waste going to landfills, according with the principles of law 80/2018.

6.1 Waste streams

The re-organisation of waste collection is the cornerstone of this Master Plan. This is because the current collection system is characterized by low efficiency, lack of economy of scale and low environment and health protection. Stakeholders frequently discussed and ultimately concluded that that only a better organized and optimized waste collection system can achieve the desired levels of and hold unit costs at a moderate level, while developing and rolling out a number of forms of resource recovery activities. One of the first steps, after the baseline analysis, was to identify the specific waste streams that should be collected and managed separately, and when possible, directed to some form of recovery or valorisation. This exercise helps the planning process and encourages decision makers and stakeholders to recognise them and set up targets, objectives and a suitable monitoring system. The current plan identifies four waste streams, as show in Table 12.

Table 12 - Waste streams identified and validated by the stakeholders

Waste stream	Sub streams	Description
*Residual waste**	Organic waste Recyclables waste dry Non-recyclables waste (dry) Special waste	Organic and non-organic waste remaining after source separation of recyclables, including organic streams from households and businesses.
*Organic waste**	Food waste from HHs Food waste from restaurants Green waste from gardens	Putrescible waste material from households, commercial and touristic activities collected through source separation
*Recyclables**	Packaging waste Recyclables from HHs Recyclables from commercial activities	It includes all recyclables waste (packaging, other recyclables waste streams), coming from households, commercial and touristic activities.

*Special waste**	Agricultural residues Food-processing (including slaughterhouse/butchers waste) WEEE Bulky Tires Exhausted oils C&D	Non HH waste except for WEEE, old furniture, all the hazardous household waste materials (e.g. cleaning and C&D waste) that disrupt waste treatment processes. Special waste includes also organic and non-organic waste produced by industrial or food-processing activities or specific (except for that as already classified as hazardous in the UN waste classification, H1 to H14) and waste from slaughterhouses. It includes also tires, C&D waste from construction sites, exhausted oils from cars and restaurants or HHs and commercial waste that fall into the special waste categories.

** Colours respect the Circular No. 7/1/2017. Amending Circular No. 8/1 dated 16/11/2015*

6.2 Land use

Through the support of LCA Level 3 (scale 1:5000) the territory of UoJKM has been classified in areas characterised by site specific land cover profiles and other parameters, such as socio-economic aspects, type of urbanisation, touristic potential, geology, soil type, land cover and use in different years, dominant landscape, cultivated areas, urban morphology and many others. For more details, please see Figure 10 (full LCA study is available in Annex 4). Based on the study three the Planning team identified three main type of areas. A variety of differentiated collection systems have been proposed for each below area. The criteria adopted are mainly related to urban and socio-economic aspects but also tourist potential areas. The areas considered for the scope of the planning process are the following:

1. *Dense Urbanisation Areas:* mainly residential/commercial with apartments, presence of banks and institutional buildings, narrow roads, mews, crowded during the day empty at night.
2. *Field Crop in Large areas:* Agricultural Agro-industrial and rural areas small villages under 5,000 inhabitants, commercial, but mainly agricultural
3. *Forest, Grassland, Touristic and Protected areas*: Qammoua National Reserve, (even if the Reserve it is not yet officially registered at National Government). Cypressuss forests and Grassland medium density, Bare rocks areas and Hill Lakes or rivers.

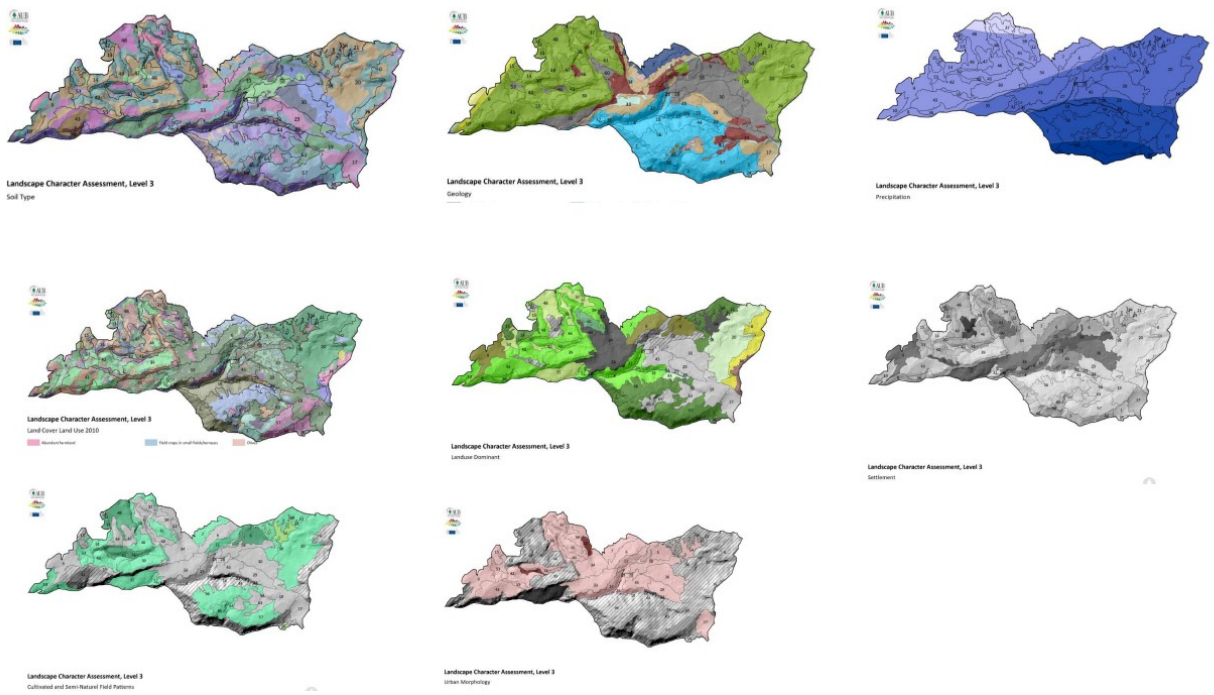
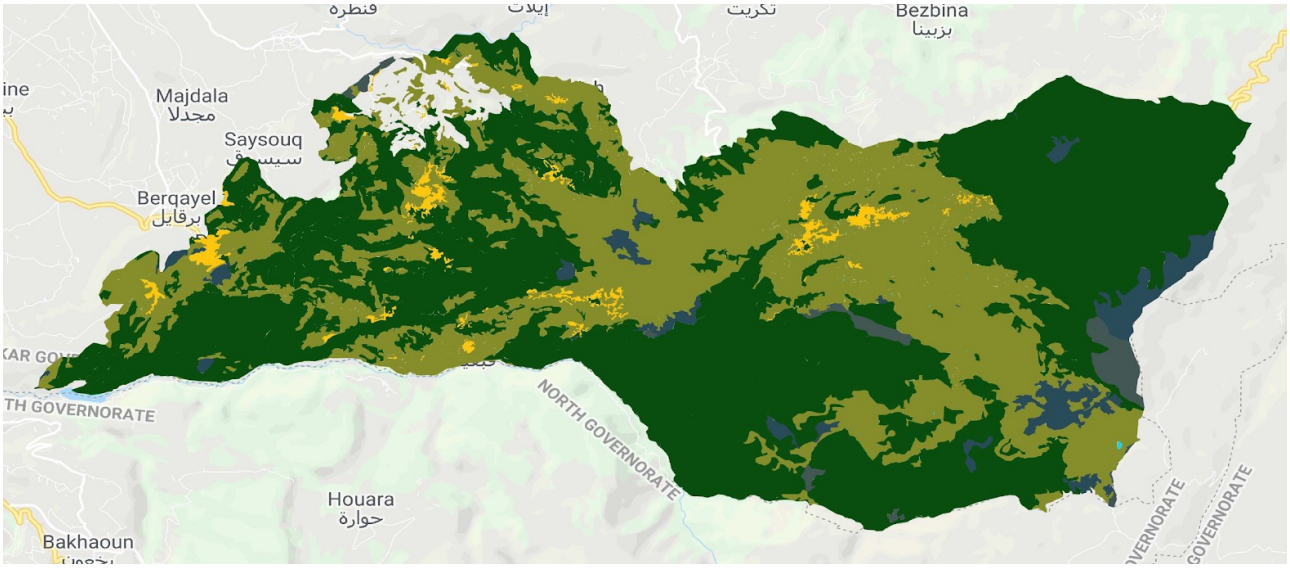


Figure 10 – Some of the parameters used for the LCA

The map in Figure 11, summarises and presents the information elaborated by the LCA at level 3 (scale 1: 5000) where the different uses of land are displayed. A different waste collection and transportation system has been studied per each waste stream identified in paragraph 6.1.



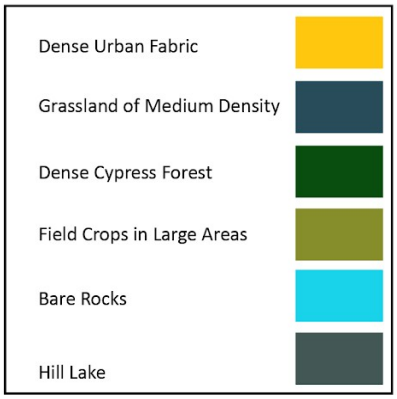


Figure 11 - Land use map from LCA

6.3 Waste Flow

The expected waste flow model based on the targets introduced above is presented in the diagram in Figure 12, which shows the quantities of waste in various streams between 2019 and 2035. The planning team accounts for a yearly increase of 2.48% (see Annex 2 – Baseline) in the overall quantity of waste which is proportional with the population growth. Based on this, the flow of waste in Jurd Al Kaitee will witness a reduction in the overall quantity of Residual waste requiring final disposal, if the set targets are met. It should be noted that the graph shows the expected change in 2025, when the plan projects that both the Up Stream and the Mid-stream municipalities bring their residual waste to Mishmish facility. The graph shows that the quantities to be sent to the landfill decrease due to the fact that at the MBT plant the organic material is stabilized and is expected to lose about 40% by weight.

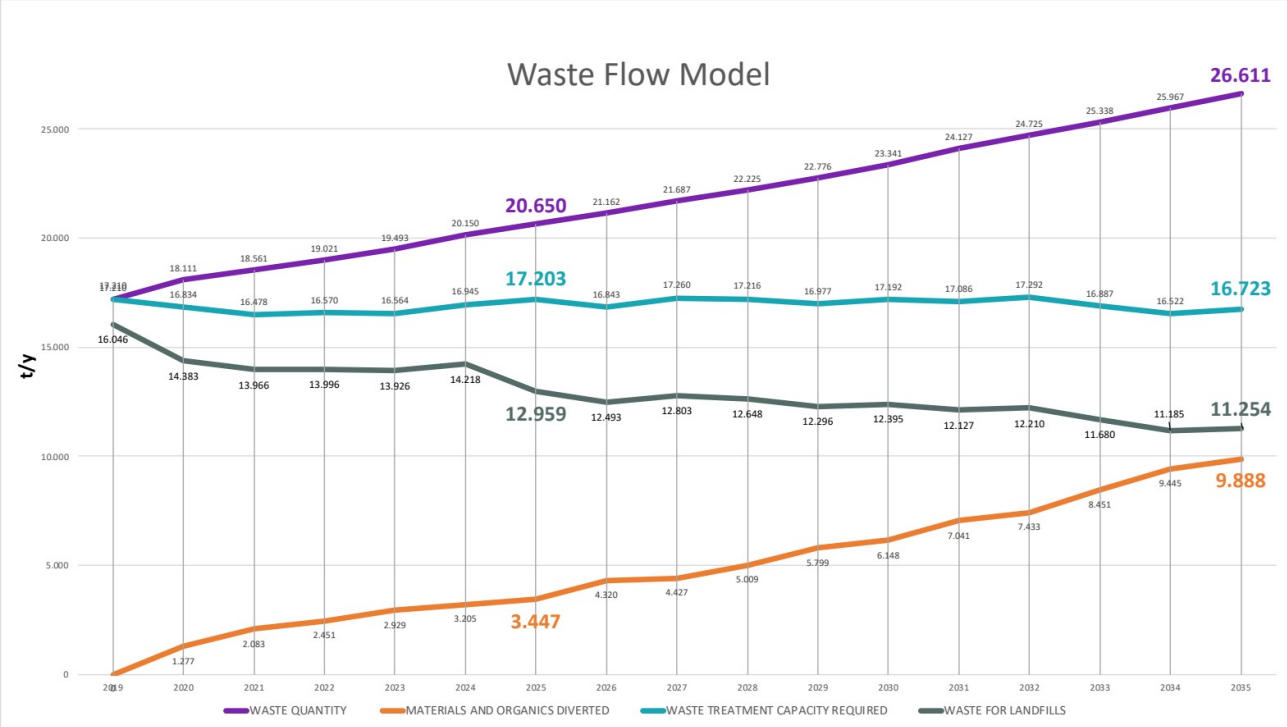


Figure 12 - Waste Project by stream model for Jurd Al Kaitee based on the target set

The Waste Management Projection by streams shows also the following:

- Recovered materials (including organics) reaches 9 888 tons by 2035 and represent the 37% of the total waste collected
- Residual waste stream Before MBTs is decreasing reaching 16 723 tons by 2035 representing the 63% of the total waste. This are the quantities that need to be treated in the MBTs.
- Sorting and Stabilisation process in MBTs after 2025, will reduce the Residual Waste stream to be landfilled to 42% which are equivalent to 11 254 tonnes per year in 2035. In Figure 13 the gradual changes between the material diverted to waste reduction and recycling and the waste to landfill.

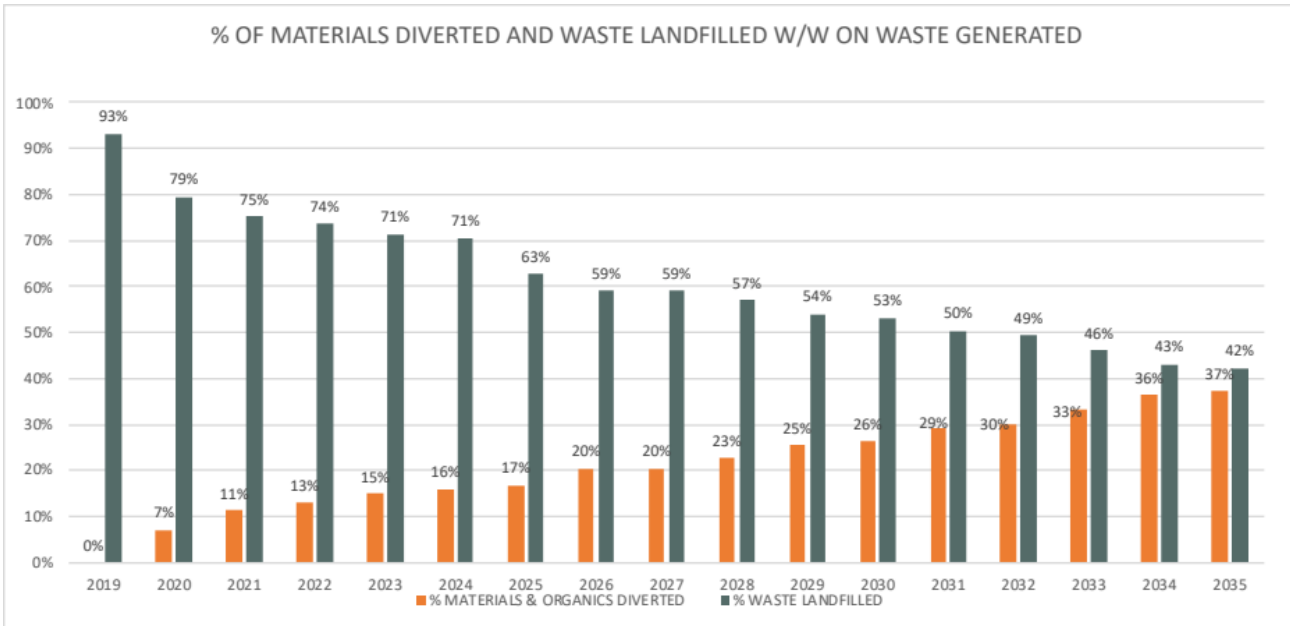


Figure 13- Materials diverted (including organics) and residual stream

In 2025 when the plan projects the full implementation of the final new SWM system and in 2035, the waste materials are as shown below. Detailed spreadsheets are available in Annex 7.

Table 13 - Materials in the waste stream in 2035

Fractions	**T/y in 2025**	**T/y 2035**
Total waste to be collected	20 650	26 611
Organics source separated	1 326	4 556
Paper and Cardboard	1 090	2 810
Plastic bags and containers source separated	811	1 671
Plastic bags reduced	151	583
Street sweeping	715	1 141
Waste to treat in MBTs	17 203	16 723
Waste to landfill	12 959	11 254

6.4 Recyclables

Following the art. 3 of the waste Law no. 80. “Principles of reduction, reuse and recycling”, the decree 5605/2019 and the waste hierarchy, the planning team join with the selected stakeholders (TWGs), modelled options to increase the quantities of materials sent to the value chains and reduce the amount of residual waste. The Plan projects recycling collection in the same areas of the residual waste collection and calls for the following material to be collected separately from the source:

- Cardboard
- Plastic bottle
- Plastic bags

- Organic waste

The plan calls for distribute and supply for containers of different colour per each material source separated. The colour code should respect the Circular No. 7/1 of the Lebanese Ministry of Environment[5].

6.5 Cardboard and Paper collection

Cardboard and paper should be the first material to be collected separately from shops and households. Separate source collection scheme can be implemented by the UoMJK in close cooperation with the local institutions and other stakeholders (other private companies, municipalities). Cardboard is going to be collected from commercial/institutional activities such as:

- shopping malls
- hospitals
- offices, banks, and other activities of tertiary sector
- institutions (municipalities, UoM, etc…)

Cardboard will also be collected from HHs using the commercial activities has a collection point. Each family will voluntarily deliver cardboard to a near-by shop or institutional building registered. Thus, cardboard generated by households and shops will be collected from the container at the shops. HHs and shops can also bring voluntarily their cardboard and paper to the Green Collection Centre (GCC). A specific container/cages will be distributed to businesses and institutional offices. The planning team suggests setting up a mechanism of incentives (tax reduction, free advertisement) for shops/institutions that collect more cardboard.
The planning team as planned for a different cardboard and paper collection system based on the dominant land use characteristics of each area.
The plan considers to collect the 60% of the cardboard separated by 2035 from commercial services as targets. The voluntary component of the families is not included in achieving the targets, since it rely only on "behavioural changes". However the team has deemed it necessary to provide the opportunity for those who want to dispose of the cardboard separately. The voluntary component will be supported by the awareness campaigns in coordination with the commercial services and with the GCC, and represent an opportunity for the communication and awareness to involve the HHs

Dense Urban Fabric areas
The collection of cardboard and paper in this areas will be performed shop to shop by the UoMJK. In densely populated areas shops are closer and it is economically feasible to collect "shop to shop". In the next figures, the process flow diagrams of the collection in the dense Urban Fabric areas.
Shops generating cardboard and paper will be provided with containers suitable for their quantities. The team suggest to use cages with wheels to facilitate the collection. The plan calls for a contribution of around 20% for the purchase of the containers to each commercial activity to increase the ownership. The final contribution will be discussed and validated with businesses representatives and with the support of the TWGs, during the Action Plan phase.

[5] *Circular No. 7/1 Amending Circular No. 8/1 dated 16/11/2015 on Guidelines Concerning the Integrated Management of Domestic Solid Waste to the Attention of Municipalities, Unions of Municipalities, Caimacams and Governors*



Figure 14 – Example of cages for cardboard collection

Waste Collection of cardboard should be delivered using compactor trucks, initially the standard waste compactor trucks can be used, however the Plan suggests buying compactor truck specifically made to collect cardboard and paper.

Inside the dense urban areas, the collection of the cardboard is organized in two different ways. Depending on whether the urban population is higher or lower than 5000 inhabitants. Below 5000 inhabitants (considered by a small village) a primary collection will be carried out, from the shops to a transfer point using small motor vehicles (motorized pushcarts) from which the material will be collected with compactors trucks and taken to the facilities for the pre-treatment. This system reduces the costs for collection in small towns. The same type of collection is also applied in the

Field Crop in large area, Rural areas, Forest, Grassland, Touristic and Protected areas

In those type of areas, the collection will be seasonally operated, mainly during the summer season where tourists move to the forests for BBQs or leisure. Similarly, to the urban centres with less than 5000 inhabitants, a primary collection will be carried out, from the shops to a transfer point using small motor vehicles (motorized pushcarts) from which the material will be collected with compactors trucks and taken to the facilities for the pre-treatment. In Figure 15 the summary PFD of the cardboard waste system.

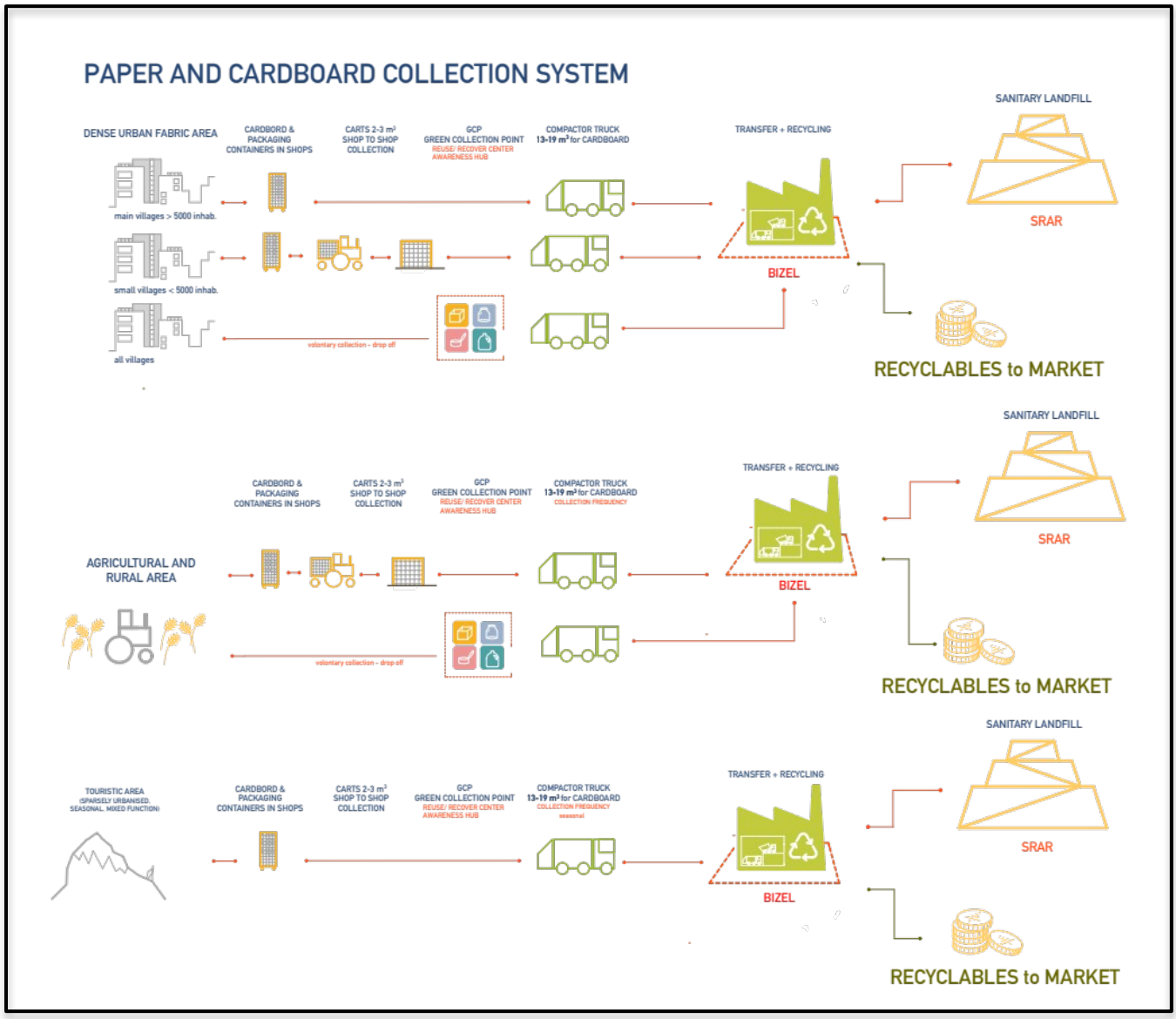


Figure 15 – Scheme of cardboard collection in the UoMJK

6.6 Plastic Bags and Plastic Containers' Collection

The planning team modelled a system for source separation and collection of plastic containers (PET bottles and HDPE and LDPE containers) and plastic bags (PE and PP). The system models the feasibility and impacts of a door-to-door or building to building collection through the provision of designated containers to each user willing to participate. Families will be required to keep the plastic bags clean after shopping and keep them separated in special containers inside their home. The plastic containers will be kept clean and separated by each HH disposed in a specific container. In houses with only one family the container will be distributed to the family. In building with more than one family the container will serve the all building and will be placed

inside the building and by agreement brought out by a member of one of the families (who agrees to be responsible), to a place that facilitates the collection with the waste collection truck.
The collection will take place on specific days, and where possible at predictable times. The planning team proposes the use of an audible signal device (such as with a specific music, similar system is used in the JK by the truck selling ice cream) easily recognizable by users.
Users must leave the container in an accessible area so that the operators can easily empty them. The plan projects the use of standard 120 - or 240-litre rolling carts as containers, so that they can be emptied automatically. Non--compacting vehicles are proposed for that specific collection or small compactors. In both options the vehicle should be equipped with an automatic system to lift and empty containers capable of operating with standard plastic containers (120, 240, 360 L).



Figure 16 – Standard 60, 120 and 240-litre. containers for plastic collection

The system calls for a contribution for the purchase of the containers by the families or by the building owners of around 10% of the value of the container, in order to increase ownership and guarantee the status of the containers over the long term. The same system will be applied to shops and restaurants. The contribution will be decided and validated during the action plan phase by a representative of the stakeholders and the TWGs.
In the event that users do not move out the bin at the set times, the collection truck will not stop and will not collect the recyclables. The containers should only be moved out if and when they are full, or when there is some other reason such as the responsible family will be away for the coming period.



Figure 17 – Example of truck for dry waste source separation collection.

The Master plan modelled the plastic source separation system using non compactor trucks or maximum mini-costipator (see Figure 17, on the right a tipper truck and on the left a mini-costipator), since it was resulting more efficient (see annex 7 spreadsheets)

If users deem it necessary, the plastic containers and bags can also be brought to the Green Collection Centre (GCC). The collection system will be the same, both in densely populated urbanised areas and in rural areas. In Touristic areas, the collection system provides the same system but the frequency is adjusted to take the effects of seasonality into account (see Figure 18).

The collected material will be transported to the Mishmish facility where the plan projects the construction of a dedicated recycling station (more details in chapter 7 Waste treatment). In Figure 18 shows the PFD of the plastic bags and containers collection system.

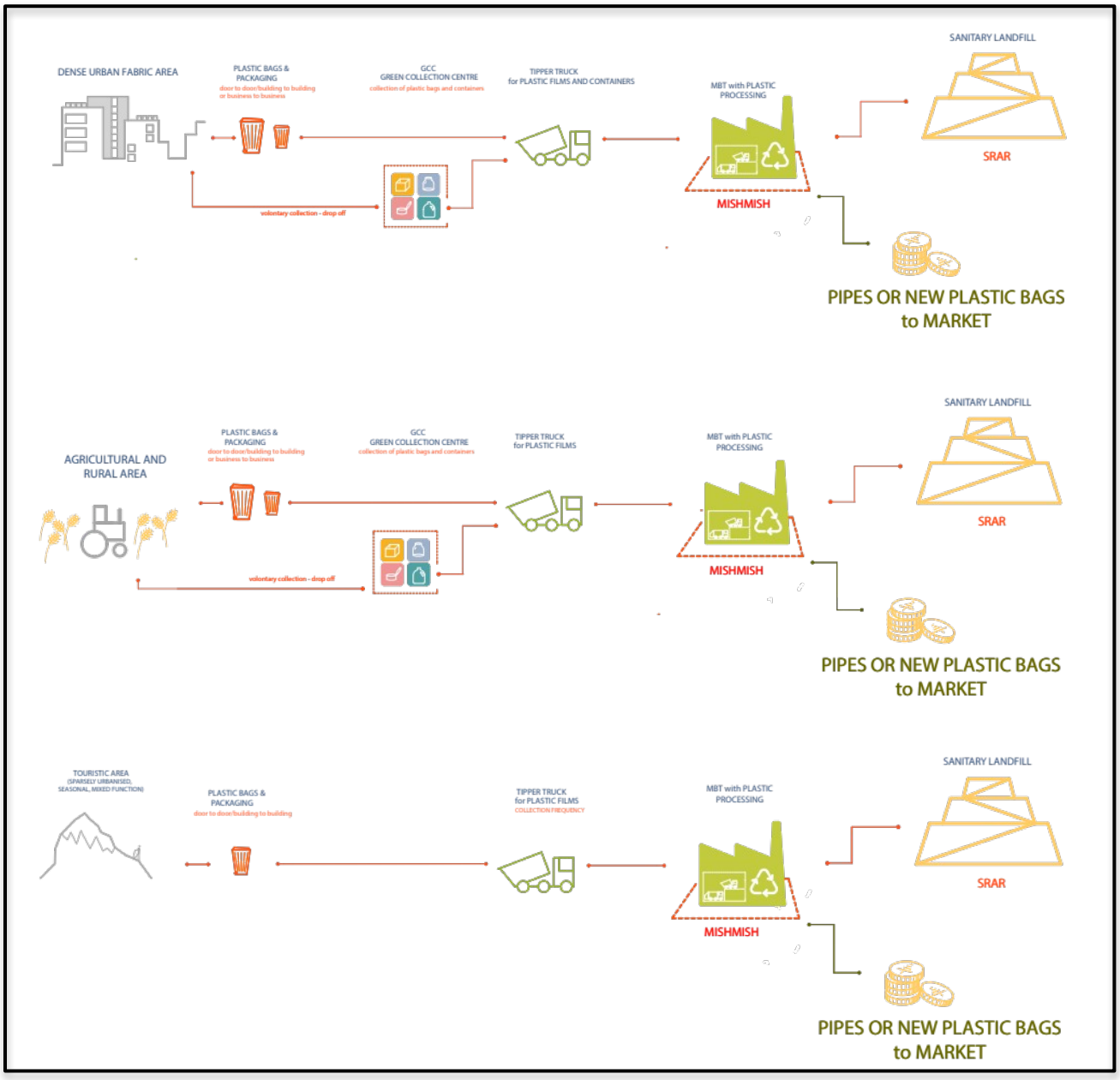


Figure 18 – PFD for plastic collection in the UoMJK

6.7 Organic Waste Collection

The Master Plan requires the source separation of the Organic Fraction of Municipal Solid Waste (OFMSW) from restaurants, hotels and households in Dense Urban Areas. The plan requests to implement a proper HHs "door to door, "building to building", "business to business" system using suitable standards and movable bins or 120 or 240 L rolling carts or similar containers equipped with lids . A separate organics collection system is proposed for the vegetable markets, hospitals (canteens and teashops), HORECA and households. A customized collection schedule will be implemented, using a mini-van or a small truck to collect the organic

fraction which, due to the high specific density of the material, does not need to be collected in compactor trucks.

For the efficient implementation of the system the active participation of residents, businesses and authorities is required. To increase accountability and sense of responsibility for the implementation of the program, suitable awareness tools should be applied. As such, the bins will be distributed with the necessary instructions and awareness material. Moreover, after a deep discussion during the TWGs, the planning team decided to request to the HHs, buildings and businesses to contribute 10% of the price of the container.

The organic material will be co-processed with agricultural residues to produce a premium quality organic compost-based fertilizer. In the rural areas mainly and for those not comfortable with separate collection of organics, a specific program to support home composting will be prepared, with supply of factory-made home composters in combination with workshops on how to select, place, use, build and operate them. Regular workshops are projected to enhance animal feeding (bread, vegetables, see chapter two). Graduating participants can receive a contribution to purchase materials to build their own home composter for their household or to share with other households in the same building. In case of home compost will be within the quality standards, the composting facility will buy the compost produced by the users.

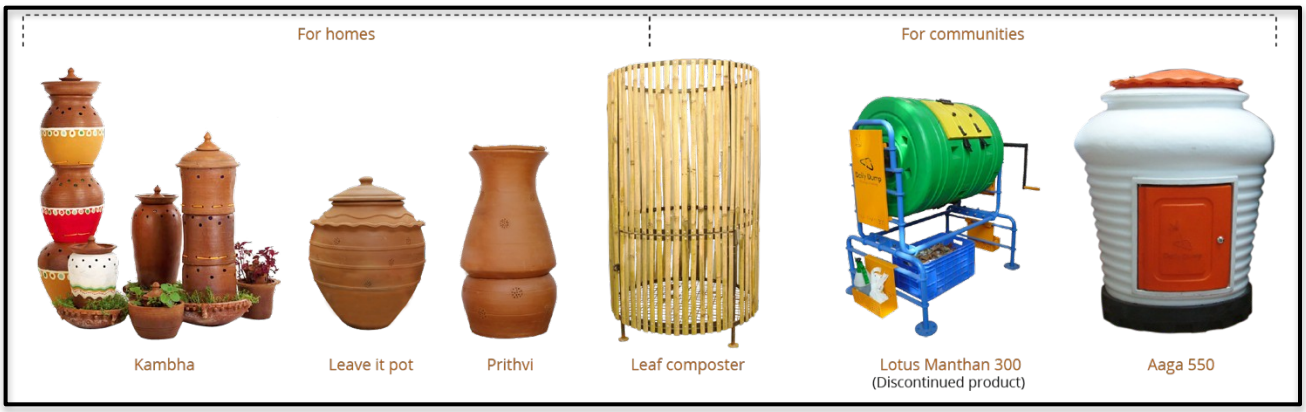


Figure 19 – Example of types of home composting equipment, for single HH and for a community

Field Crop in Large area: rural area and agricultural waste

In the rural areas, the Plan proposes an "on-demand" and seasonal collection of agricultural residues, that will be collected through specific agreements with individual farmers or groups or cooperatives. The management board of the composting facility (present MBTs or a new Facility) will be responsible, with the support and approval of the WMTU, for the preparation of a calendar in which, residues collection will be planned according to the requests of farmers and co-ordinated with their production cycle. The residues collected will be transported to the composting plant.

The collection of organic waste in rural areas will not be carried out within the horizon of the plan. According to the information gathered in the baseline, in rural areas the families raise small poultry and the plan to encourage the use of organic waste as food to feed farm animals. Therefore, there is no provision for separate collection at family level. For the remaining organic waste, the plan provides support for home composting.

Due to the complexity of the system the team suggest not to foreseen organic waste collection for Touristic area in the present Master Plan. The WMTU should monitor the touristic activities and add the Organic Waste

Collection in touristic areas in the future. In Figure 20 is displayed the summary of the OFMSW collection system at UoMJK level.

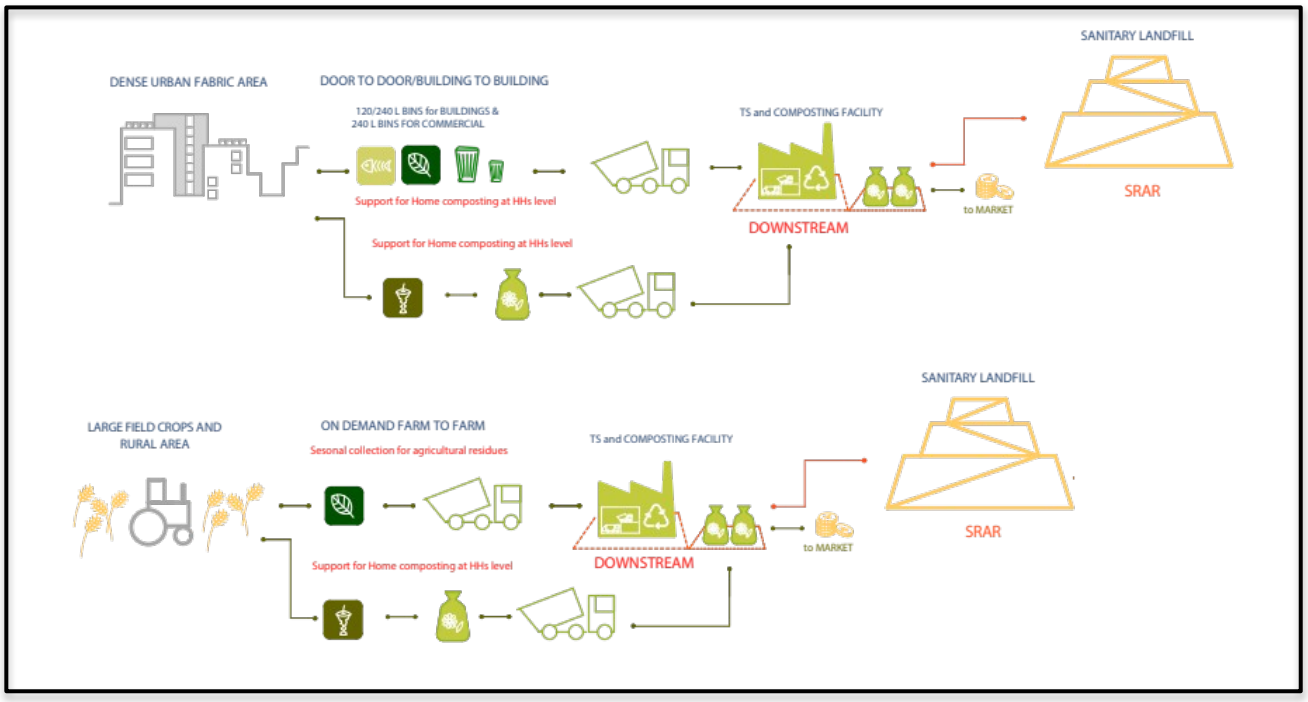


Figure 20 – Scheme for OFMSW collection in the UoMJK

6.8 Special Waste

With reference to the collection and management of special waste, the plan takes into consideration the formalising and institutionalising of the system that is already managed by the IRS (see Annex 3 - IRS study). From the research conducted during the baseline phase, there is a clear potential for 'win-win' co-operation between the formal and informal sectors. As such, in addition to addressing some of the social aspects of waste management, support will be provided to the informal sector. In addition, there will be a higher potential to increase their recycling rate and income, which could eventually result in a further reduction of the overall costs of waste management for the formal sector[6].

6.8.1 WEEE, Bulky Waste, Spent Oil

The special waste that will be the responsibility of the IRS (Informal Recycling Sector) are:

- Spent Crankcase Oil (oil from Mechanics and Cars Workshops that are already informally collected).

- Bulky waste (furniture, wood, scrap metal from houses self-renovation)

- WEEE (small electric and electronic equipment, washing machines, fridges etc…)

The plan proposes actions to extend and increase the collection of the indicated special waste by giving support to IRS. The SWM system will support them to increase their skills through providing training and workshops, supplying tools and offering support in marketing. In exchange to-be-formalised collectors will

6 *Building recycling rates through the informal sector, D. Wilson et al.. 2008*

need to agree to register at the UoMJK offices and in the WMTU database and will have to respect the environmental regulations for the treatment of the special waste fractions collected.

6.8.2 Main aspects of the special waste collection

The coordination with the UoMJK to organise the collection of special waste will be done by the WMTU. The IRS will be registered monitored by the WMTU. Registered IRS only, will be able to benefit from the support and will be the only entities officially entitled to collect the special waste mentioned above in the UoMJK territory. The WMTU will issue a permit and they will be entered into a register. UoMJK though the WMTU will provide support with refresher courses, tools incentives to renew their vehicles, zonal exclusivity in concessions to collect from household or commercials, etc.... Detailed measures should be studied during the implementation phase. The support from the UoMJK will enable the informal collectors to legalise their access and therefore their turnover and they will be the only ones allowed to collect from citizens and commercials. Through the "on demand" system. Recyclers will sell the collected materials as they are or pre-treated to Junk Shops that are located outside the UoMJK territory. At the regional level, a multifunctional plant is being built for the treatment of special waste.

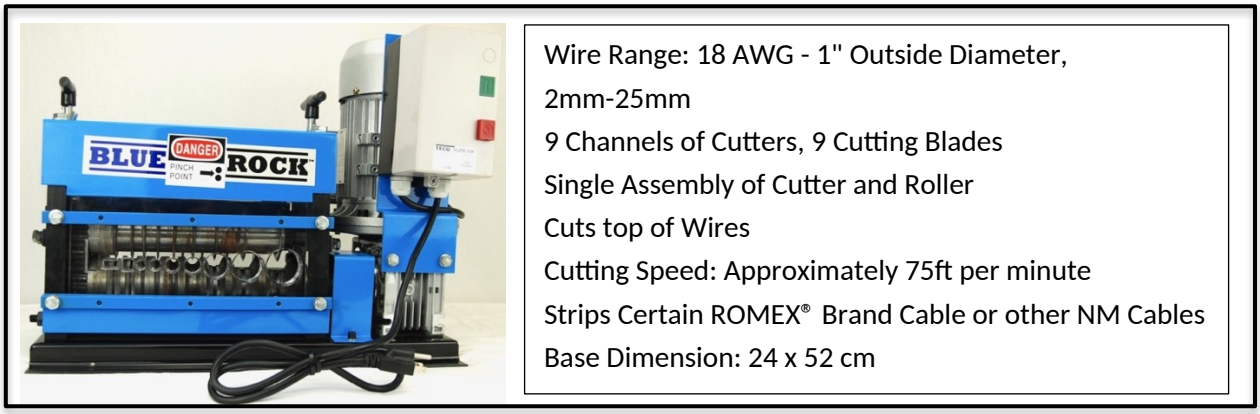


Figure 21 – Stripper machine to separate copper from rubber in electric cables

6.9 On demand collection system

The system provides that the WMTU directly or through an information campaign or through a button inside the mobile application, the citizen has access to the telephone numbers of the IRS registered at the UoMJK archive, so that they can call them and agree on a day and time to collect a bulky or electronic waste at home. It should be noted that the system is already informally active in the territory. In Figure 22 the PFD of the special waste collection system. Based on the analysis of the IRS (see Annex 3 – IRS study), the recyclers have their own small truck and they run their collection system. The Master Plan do not want to interfere in a system that is already working ad that had already relations and connections. The Plan calls for a progressive formalisation of the IRS and to improve the cooperation between Users, formal SWM and Institutions.

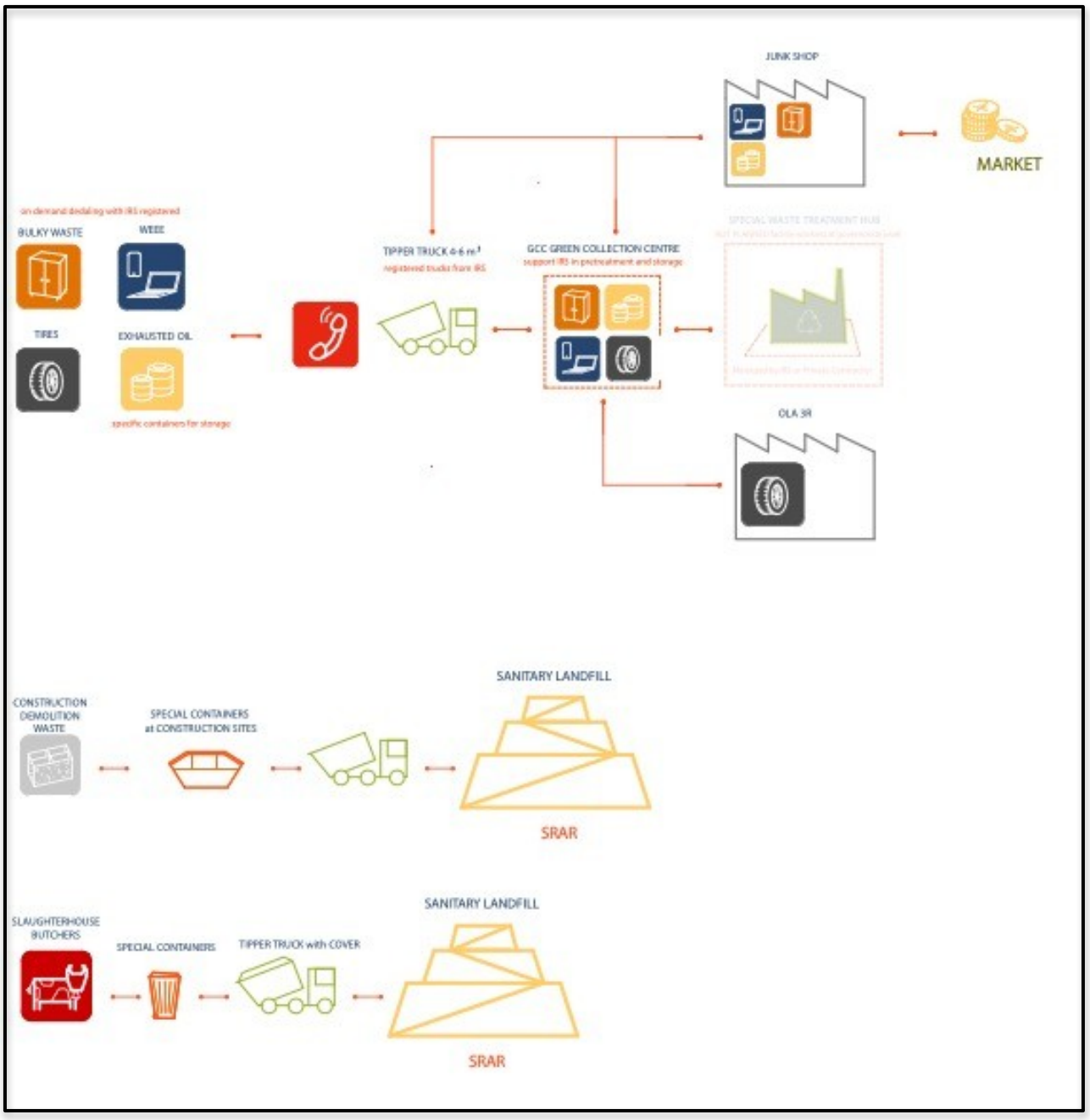


Figure 22 – PFD of special waste collection system in UoMJK

6.10 Green Collection Centre (GCC) and the IRS

The Plan calls for a service to be activated at the GCC for registered IRS so that they can separate certain materials without impacting on the environment. A more in-depth study by experts in the various sectors of

special waste will be able to better define which tools the GCC shall be equipped with. As an example, it is easy to separate plastic rubber from copper in electric cables using a simple machine called Stripper (see Figure 21). This tool thus allows to reduce the burning of the cables and to increase the value of the metals.

Green Collection Centre will be established for the secondary collection and storage of recyclables. These points can be considered as micro-recycling centres where the formalized IRS can temporarily drop the recyclable materials collected from one area. The GCCs are planned to be used also by individuals or HHs who can drop off their recyclable materials. The planning team project to establish a pilot GCC located in strategic and easily accessible area, ideally the location should be in the Mid or Down-stream. The GCC will be used as a tools to diffuse awareness and communication campaign. In some example of Green Collection or Recycling Centres, they can be just a container or a more structured facility with a storage area, treatment and with are dedicated to repair, reuse and upscale, an area for volunteering recyclables drop off and an area to host visitors and a vocational training room.

The GCC should be considered a pilot activity, an indicative target between 1% and 3% of the total SWM is set up. The percentage assumed do not include potential second-hand material that can be collected with the activity not related to MSW such as training courses, collection of second-hand objects or like collection of items from the service of emptying basements or storerooms. The 1% has been set up as the minimum target to keep the GCC sustainable. In case of lower % the UoM should pay for the loss and include the costs in the cost recovery system. An indicative cost-benefit analysis has been drafted in annex 7 -Spreadsheets, however a proper business plan should be done once the GCC will funded.



Figure 23 – Examples of Green Collection Centres

6.10.1 Construction and Demolition waste

The Plan for the next 15 years, does not include a treatment of construction waste, but its disposal in landfills. The UoMJK through the WMTU will have to monitor the construction sites and ensure that they have a container, like Skip or similar, in order to store construction waste. The WMTU will then have to guarantee

that these containers are taken to the landfill avoiding that they are unloaded illegally. In the future, at a regional level, the planning team suggests a national plan to implement Construction and Demolition waste recycling systems with the introduction of an EPR (Extended Producers Responsibility).

6.10.2 Slaughterhouse and Butchers waste

Slaughter waste is considered hazardous and the Plan includes a special collection and disposal in landfills. In the future, the plan suggests the construction of a slaughterhouse facility which incorporate a system to treat and recycle these types of waste. In addition to that slaughterhouse activities should be regulated in the National Government, to force butchers to slaughter their animals in an official slaughterhouse and not in their own shops.

6.10.3 Tires

Collect to the GCC or storage in Transfer Station and send to OLA 3R[7] facility in Chouf area, once the quantities can fill a big truck. The national government should regulate it in the future (see draft strategy for SWM) with and EPR system.

6.11 Residual Waste Collection

Progressively, during the non-organic and organic source separation system and the special waste collection implementation, the frequency for the collection of the residual waste will be reduced. It's well recognized that reducing the frequency of mixed waste collection is the first step to stimulates a waste source separation scheme. Following the assumption and targets presented before, the implementation of the Plan will reduce the quantities of residual waste from almost 1976 tons/year in 2020 to around 8941 tons/year in 2035.
Reducing the Residual waste collection will allow to:

- have more space and time for collection of recyclables waste
- reduce the initial extra costs for collection of sources separated recyclables waste streams

The Master Plan calls to keep the "communal collection system"[8] in the residual waste collection system and increase the efficiency and the efficacy (public health protection) with the following main measures:

- reduction of residual waste collection frequency
- bins and trucks standardization
- bins with lid

In the following paragraphs the residual waste collection system per areas characterised by a different dominant land-use:

[7] *OLA 3R **Ola 3R** in Joune (Chouf) is a "Scrap tires recycling" project based on a new environmental friendly process which will help to get rid of waste tires and acquire fines final products through its simple process and its total fiber and steel extraction without any emission or minor odours with a minimum*

[8] *Communal collection: use of large communal storage containers, usually placed in the street. More details in SPG for MSWM, Word Bank. 2006. Step 4B.*

Dense Urban Fabric areas

The collection of residual waste in areas characterised by a dense urban fabric will continue with a communal collection. The municipalities will have to adapt by standardizing the bins and making the standard collection so that the same vehicle can collect in different areas. In areas with very narrow streets it is recommended the use of 120 L, 240 L or 360 L bins. In peripheral areas with high density the Plan recommend larger containers such as 1100 L.
All bins should have a resistant lid easy to be lifted.

Field Crop in Large areas

The collection of residual waste in the rural areas remains similar to the present, even in these areas the municipalities will have to distribute standard containers, with lids and consider the progressive reduction of the residual waste. Due to the waste flow the plan calls for not increase the "communal collection" containers, just to maintain and replace them after the amortisation period.

Forest, Grassland, Touristic and Protected areas

The collection in these areas will be activated during the touristic season only. Containers should have the same features suggested for the rest of the areas, lids and standardisation. Special attention should be given to areas dedicated to BBQ in forests, Parks or Protected Areas. The Plan calls for supplying special containers next to the BBQ or leisure areas. The operators of the protected areas will collect from the containers from the BBQ or leisure areas and bring them to the entrance where big standard containers with covers will be located. These containers should be placed in areas accessible to compactor trucks.

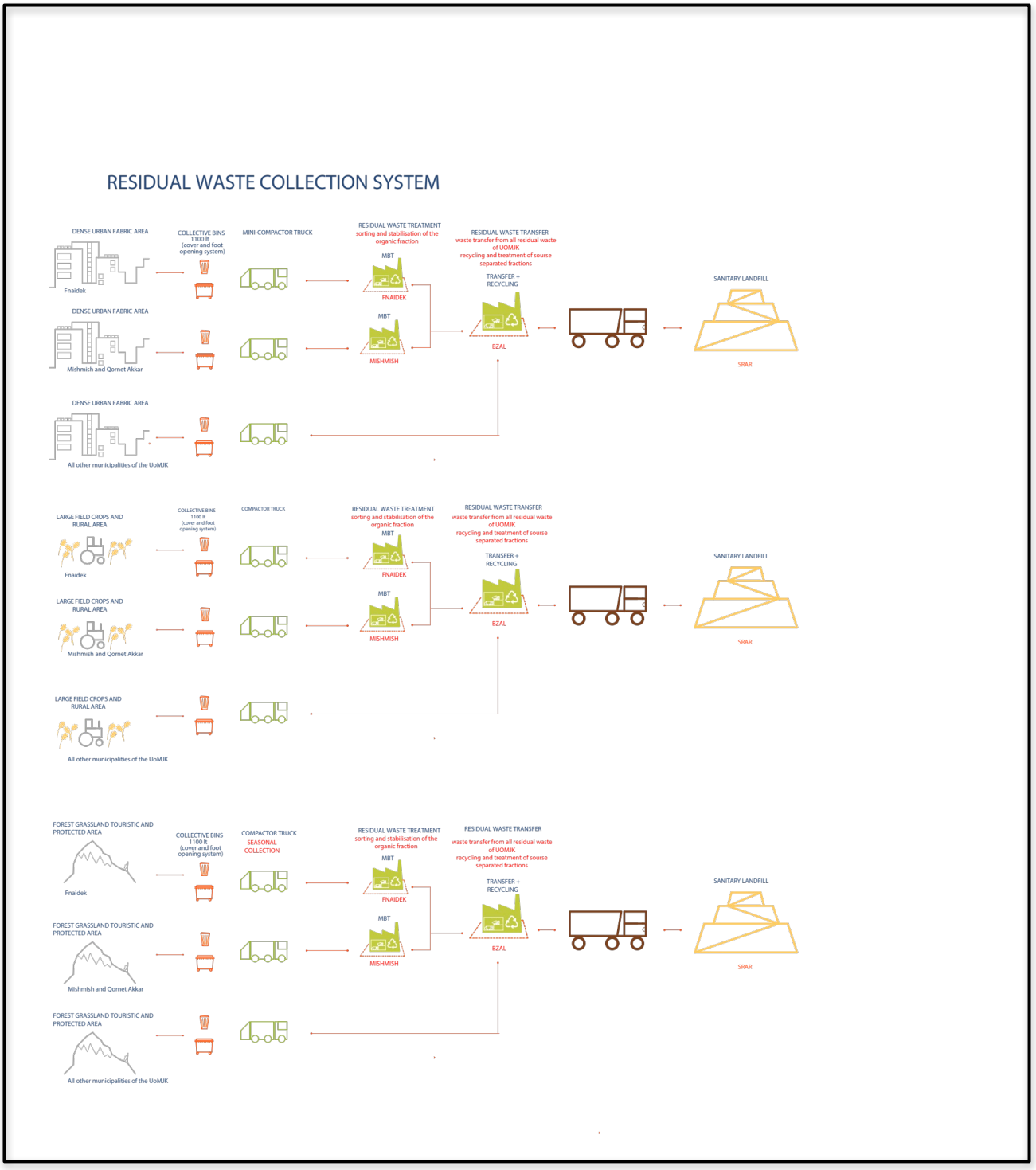


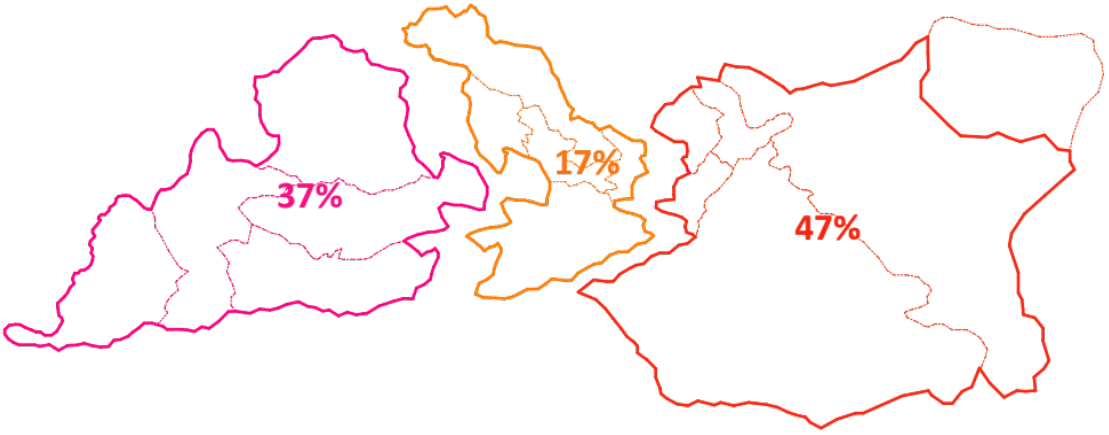
Figure 24 – Residual waste scheme for the UoMJK

6.12 Union of Municipalities Clusters division and waste Transfer

The current way of organizing waste collection in each municipality is inefficient and it does not allow the development of scale economies and cost optimization. It is necessary to overcome the fragmentation of municipalities and promote a regionalized approach to waste collection. The UoMJK will take the

responsibility of the waste management through the WMTU. The proposal of shifting the waste management from a municipal to a regional level has been validated during the stakeholders meeting and the Baseline validation workshop. Based on this, the Plan proposes to organize waste collection in clusters of municipalities following the division in Sub-units: Upper Stream Municipalities, Middle Stream Municipalities and Down Stream Municipalities.

The indicative clusters division is presented in Figure 25 where are displayed the percentages of waste generated per sub-unit.



Sub-unit	DOWN-STREAM	MID-STREAM	UP-STREAM
Municipalities	Bzal	Beit Younes	Beit Ayoub
	Eain El Dahab	Chane	Fnaidek
	Habchit	Houaich	Michmich
	Qabaait	Hrar	Qornet Akkar
	Safaynet El Qaytaa	Khreibet Akkar	Qraiyat

Figure 25 – Sub-Units division following geographical parameters

The UoMJK will start immediately (inception phase foreseen in 2020), to take the SWM responsibility from the single municipalities as a first step for the implementation of the Master Plan. The Plan recommends the UoMJK to proceed subcontracting a service provider, to collect the residual waste. The WMTU should prepare a long-term contract (e.g. 10 years). The contract will be prepared, issued and monitored by the Waste Management Technical Unit. The Planning team agreed with the stakeholders about the clauses and conditions that should be in the contract (see Chapter 9.3 Provider Inclusivity). After the first 10 years the UoMJK shall take the decision to leave the private service provider and take over the residual waste collection or to continue with the private service provider.

6.12.1 Residual waste transportation

The Master Plan projects an inception period in which the Municipalities of Jurd El Kaitee commit to deliver the responsibilities of the SWM service to the UoMJK. The inception period can have variable duration. An Action Plan will be prepared to identify the duration and the steps for the first 2/3 years of the Master Plan implementation. At the end of the inception period the MBT plants (Mishmish and Fnaidek) should be able to receive the residual waste from the Mid and Upper stream and part of the municipalities of the Lower stream.

Mishmish MBT is closer to the Upper Stream and Middle Stream municipalities and the plan call for an increase of its capacity.

An agreement between the municipalities and Mishmish MBT should be prepared as soon as the Mishmish MBT capacity will be increased. Fnaidek MBT will be receiving waste only from Fnaidek municipality

Mishmish MBT will be receiving part of the residual waste produced in the Lower Stream. Due to logistic and economic reasons not all the municipalities of the Lower stream will deliver waste to Mishmish. The municipalities of the Lower stream that will not deliver residual waste to the MBT will the ones closer to the Transfer Station site.

The Transfer station will be located in the Lower Stream area, but the final identification of the site will be part of the Action plan. All waste produced by UoMJK, treated and non-treated will be transported to the Transfer Station and from there will be delivered, with larger trucks directly to the Srar landfill. The Master Plan models that by 2025 the Transfer Station is operational and as well the Mishmish MBT capacity is increased to accommodate all residual waste of the Up and Mid Streams. The station is planned to receive the following waste:

- Residual waste, stabilised and reduced in weigh after the MBT treatment from Fnaidek MBT (processing waste form Fnaidek municipality)

- Residual waste, stabilised and reduced in weigh after the MBT treatment from Mishmish MBT (processing waste from Up and Mid-Stream municipalities).

- Residual waste as they are from the Lower Stream municipalities.

The residual waste of the Lower Stream represents the 37 % of waste of the JK (see Annex 2 – Baseline report). The plan calls for increase the Mishmish MBT to accommodate waste from the village of Ain El Daab even if is in the Lower Stream. Ain El Daab is bordering the Mid-Stream cluster and is the biggest municipality and represent the 19% (see Annex 2 – Baseline report) of waste produced in the JK. Including Ain El Daab in Mishmish MBT the amount to waste not treated to be in TS will be reduced to the 18%. In Figure 26 the PFD of the 2020 and 2025 Residual waste Transportation.

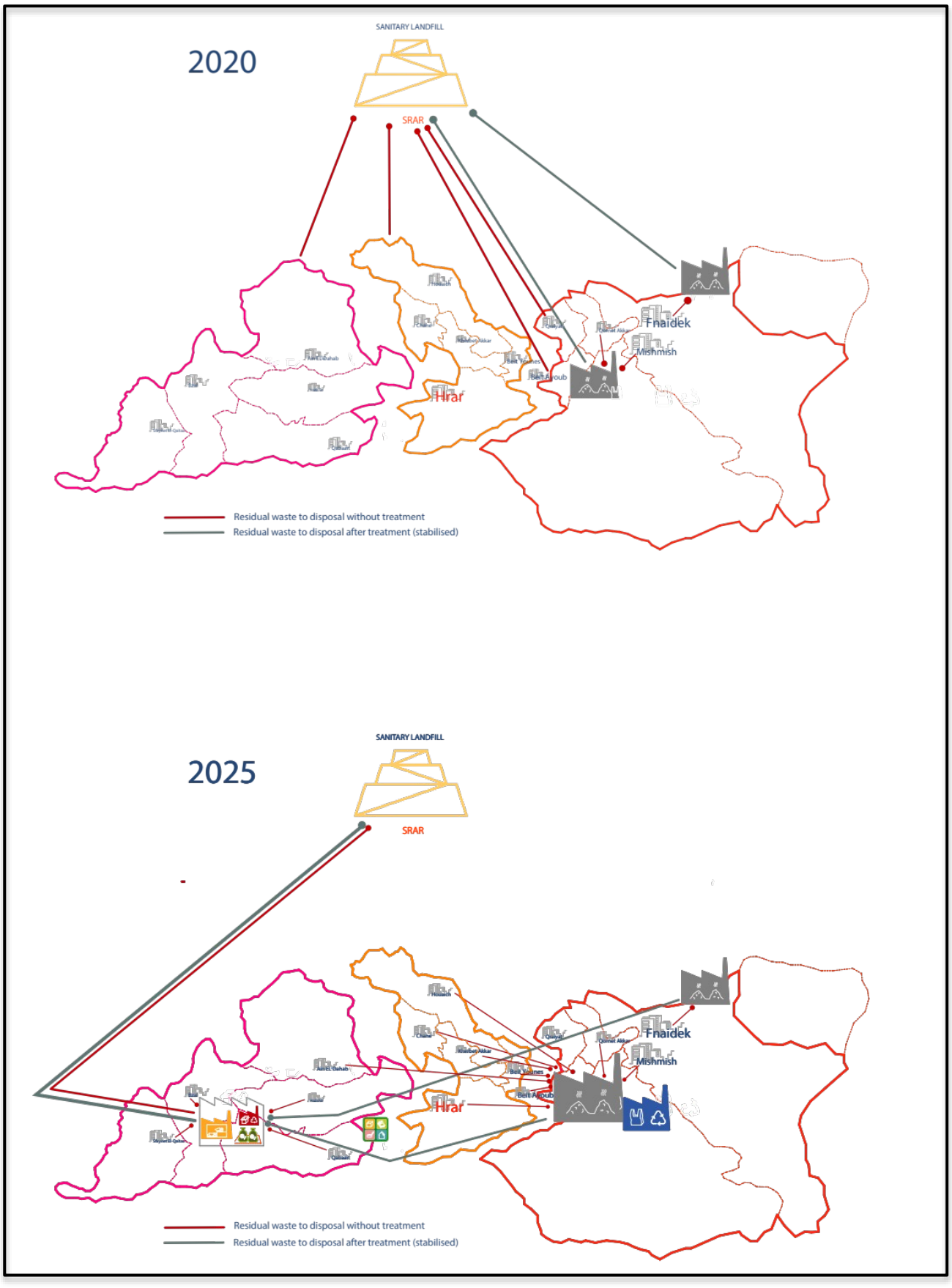

2020
SANITARY LANDFILL
SRAR
Fnaidek
Mishmish
Hrar
Residual waste to disposal without treatment
Residual waste to disposal after treatment (stabilised)
2025
SANITARY LANDFILL
SRAR
Fnaidek
Mishmish
Hrar
Residual waste to disposal without treatment
Residual waste to disposal after treatment (stabilised)

Figure 26 – Residual waste collection in 2018 and in 2025

The planning team suggest that the collection will be implemented by a single Service Provider for the all UoMJK. Based on the data of the zoning map, the average daily waste production in every cluster for 2018 is presented in

The figures take into consideration that the Plan provides for the reduction of littering with the introduction of street sweeping in the municipalities that currently do not carry out this service, the introduction of small containers on the street and the awareness. The reduction of 50% in littered waste foreseen by the Plan will therefore have as a consequence the increase of the amount of residual waste. Furthermore, if we consider the increase in population, the actual reduction in residual waste becomes 39% of the total waste in 2035., the projection in 2035 it is also displayed. The reduction in residual waste to be collected is minimal if compared to the quantities collected in 2018 (from the baseline).

The figures take into consideration that the Plan provides for the reduction of littering with the introduction of street sweeping in the municipalities that currently do not carry out this service, the introduction of small containers on the street and the awareness. The reduction of 50% in littered waste foreseen by the Plan will therefore have as a consequence the increase of the amount of residual waste. Furthermore, if we consider the increase in population, the actual reduction in residual waste becomes 39% of the total waste in 2035.

Table 14 – Residual waste quantities to be collected per cluster in 2018 and in 2035, after the implementation of the master plan

	Name	**Max Residual waste to be collected in 2018 t/y**	**Max Residual waste to be collected in 2035 t/y**	**Percentage from total waste**
Cluster 1	Upstream municipalities	7825	7607	47%
Cluster 2	Middle stream municipalities	2790	2712	17%
Cluster 3	Down stream municipalities	6179	6007	37%

6.13 Transfer Stations or direct hauling

The TWGs dedicated to Solid Waste Transport and Disposal and the WMTU have developed the two following options for residual waste transportation:

1- ***Direct hauling:*** each municipality, after a minimum treatment or stabilization, brings its residual waste to Srar landfill. The option was evaluated with a view to centralized collection managed by the UoM in order to improve efficiency each truck should be full before going to Srar.

2- ***Transfer Station:*** the collection system brings the waste to the MBTs plants (except Lower Stream without Ain El Daab), while rejects from sorting and the stabilized organic material are taken to a transfer

station. From here the waste is directly transferred to a larger vehicle (around 40 m^3) and transported to Srar.

According with the analysis the use of a transfer station procures savings of 11% compared to the cost of direct transport to Srar. It should be borne in mind that the Plan provides that the cost of transport to the landfill, which in both options represents an important cost with respect to the entire system, has an economic incentive function to achieve the objectives of the separate collection. In fact, if the source separation objectives will be achieved in 2035 (i.e. reduction of 41 % of waste to be landfilled), the Transfer Station will allow the UoMJK to save around the 43% of the costs to transport waste to Srar. The saving without Transfer Station will be around the 36% if source separation targets are achieved in 2035. See Table 15 with the cost foreseen with and without the Transfer Station. It should consider that the costs to operate the TS are included without costs for the investment.

Table 15 – Difference in costs for transportation with or without TS

USD/y	**2024***	**2035****	**Saving compared to the present system**
Cost without TS and source separation	284 884	225 482	-58%
Costs with TS and source separation	252 928	200 189	-62%

** MBTs only receiving residual waste from Fnaidek, Mishmish and Qornet Akkar*

*** MBT treating residual waste from Up and Mid-stream and Ain El Daab.*

Table 15 shows the progressive decrease in the costs for residual waste transportation to Srar with a without the Transfer Station (TS) as the municipalities of the Up and Mid-Stream will take their waste to Mishmish MBT. The table considers that Fnaidek MBT will be ready and will be treating the residual waste of the entire Municipality by 2020. In 2025 the Mid-Stream municipalities will start to take all waste to Mishmish for stabilisation.

6.14 Street Sweeping (separating/integrating sweeping and collection)

This fraction of MSW, which is collected from the streets, includes:

- Waste generated by natural causes, such as dust, leaves, branches, insects, wind and waterborne materials, animal and human faeces, and the like.
- Waste generated by vehicle sand traffic such as rubber from tires, and car parts.
- Litter (behavioural waste), or, waste that is deliberately thrown on the street or on the surface water, such as cigarette buds, flexible packaging from chips or sweets, non-permitted waste discharged in rivers and/or parks or household waste loose or in bags. Such litter can be dumped when the collection system is inconvenient, unavailable, or unreliable.

It is suggested to collect the street sweeping stream separately from the municipal waste collection system. This will significantly help to achieve a better waste treatment at the MBT facilities and increase the recovery rates. In addition, after applying door to door collection and reducing the frequency of the residual collection, more time can be dedicated to street sweeping.

The sweeping activities are organized into service areas depending on the status of the roads and the urban fabric. Where roads are well maintained, mechanical street sweepers can be used. Cleaning activities should be also prioritized in areas that require better and more efficient cleaning such as commercial areas or after events.

Service is planned to be provided for the routine cleaning and sweeping of public paved areas that, include roads and bridges, streets and sideways, public squares, tunnels, and ways in public parks and seasonally in touristic areas.

The Plan provides for a reduction in street waste of around 50%. The goal will be achieved through a mix of activities.

The Plan envisages to increase the area in which the service is carried out also including the municipalities that currently do not carry it out. According to the information contained in the baseline, only the municipalities of Fnaidek and Mishmish perform a street sweeping service. The Plan foresees that by 2025 also that all Municipalities of Jurd Al kaitee Union will carry out this service at least in areas categorised as Dense Urban Fabric.

The street sweeping service must be regulated by a contract and it should be signed in coordination with the residual waste collection service. The Plan suggests two options:

- **Street sweeping is contracted to the same Service Provider** that collects residual waste through a separate contract. In this way the Service Provider has the possibility to manage the two services creating economies of scale. This option presents the added value of having a single interlocutor and must not carry out the coordination of the two services. The refusals from street sweeping are considered residual waste and will be transported by the same collection system.

- **Street sweeping is managed by UoMJK**. In this case, it is necessary to prepare a contractual agreement that involves a strict distribution of responsibilities, especially with respect to the management of waste that is found scattered close to bins and about the transport of street sweeping waste that will go directly to landfill. In the event that for practical reasons they will be transported to the MBT facilities they must remain separate and transported as they are due to the landfill.

6.14.1 Residual waste increase due to sweeping

Considering an expansion of street sweeping also to municipalities that do not do so, the plan provides for an increase in residual waste. Increase that was added to the total amount of waste to be treated at the plants. The quantities include the littering reduction modelled in the Master Plan (see waste flow in annex 7).

Table 16 – Street Sweeping increase

	2020	**2025**	**2035**
Target for littering reduction	30%	40%	50%
Residual waste to be collected with the street sweeping t/y	474	715	1 141

7 Waste Treatment

The plan aims at building a waste management system that is based on the 'Circular Economy' approach whereby the flow of resources is managed in a way that minimizes waste production, maximizes the recovery of recyclables in order to alleviate the environmental burden of the existing dumpsites in Srar and reduce the quantity of residual waste. The project addresses the whole lifecycle of the waste and once implemented is expected to divert 9 888 tonnes per year (see waste flow in paragraph 6.3 or in Annex 7) of the current waste stream from open dumping and/or landfilling through source separation, recycling and composting. In order to achieve this, the following waste treatment methodology will be implemented: Composting, Cardboard and Paper Recovery, Plastic Containers and Bags Recycling and Green Collection Centre

7.1 Organic Waste

Organic waste to be collected accounts for around 43% of the total waste quantity in Jurd Al Kaitee. The main streams of this material are HH waste and agricultural waste. Following is the total quantity of waste from both streams:

Table 17 Quantity of Organic Waste

Year	**2020**	**2025**	**2030**	**2032**	**2035**
TOTAL MSW	18 111	20 650	23341	24725	26 611
Organics	7816	8835	9986	10578	11385
Target	5%	10%	20%	30%	40%
Quantities Diverted	***391***	***883***	***1,997***	***3,173***	***4,554***

7.1.1 Compost Facility

For that purpose, the consultants propose to consider Source Separated Municipal Solid Waste Composting. The Plan aims to treat 40% of the generated waste by 2035.
Source separated organics will go to a new composting plant in Jurd Al Kaitee for high quality organic fertilizer compost-based production. A new composting plant is planned and should preferably be located in the downstream. This is to facilitate the transport of compost to agricultural areas, towards the Minieh and Donnieh regions. The location of the plant and its final design must be carried out by specialized design company. The design must have the following constraints:

- the architectural design should respect landscape, the LCA should also guide the design.
- the design should include a visitor area clean and separate from the process. The visitor area should be used for awareness and communication purposes to increase the knowledge of the composting process and the accountability of the Organic Fraction Source Separation system.
- the design should be modular to accommodate the increase of material foreseen in the Master Plan

- the facility should be designed to accommodate space for different post-treatment of compost, such as production of pellets, enrichment, EM (Effective Micro-organism) treatment.
- the facility should be designed with a storage for agricultural residues dimensioned based on the need of green waste (to give structure) and based on the fact that agricultural waste are produced only in specific seasons.

The shift towards source separation organic matter composting has been predicted by the TWG for the benefit of composting on the main commercial activity in the region which is agriculture. The TWG sees organic waste as a profitable practice for both the farmer and the union. The Lebanese Law which through a Compost Ordinance[9] regulate the compost quality and its sources, allows use of compost in agriculture only if produced out of organic waste from Source separation systems.

Technology

The Planning team does not provide a technological solution for the production of compost, it will be decided and selected at the time of design phase. The targets of the Master Plan call for a 10 % of organic matter collected from HHs and restaurants after two year of implementation of the Organic waste source separation. The amount corresponds to around 794 tonnes/year (see waste flow). In order to balance the C/N ratio the planning team recommend adding around 30% of green agricultural residues. In that case around 238 tonnes/year of agricultural waste should be collected and stored. In Table 18 the estimation of compost produced, considering the loss of moisture from the process. The estimation shows a yearly production of around 666 tonnes.

Table 18 – Estimation of compost produced with the collection of 10% of Organic waste from source segregation.

Material	Raw material t/y	Compost produced considering t/y*	Total compost produced t/y
OFMSW	794	476	666
Agricultural residues or residues from urban and forest management	238	190	

**considering 40% loss of water (moisture) from the OFMWS process and 20% loss from the other residues*

Household Composting

This option requires a high level of ownership at residents' level. In addition to that, semi-skilled personnel need to be involved for constant monitoring of compost. If applied properly, composting can significantly reduce collection and transportation fees. Or it will help to scale up the composting value chain by increasing the quantity of compost produced.

The composting Plant in collaboration with the WMTU will also be responsible for the management of the product originating from home composting. In fact, the plan provides for users to be able to produce their own compost and sell it at a lower price than the market price for the centralized composting facility.

Final Products

[9] *Compost Ordinance for Lebanon can be downloaded from MOE of Lebanon website :in English and Arabic language: http://www.moe.gov.lb*

The final product of composting is organic fertilizer that can be marketed and sold in the market as fertilizers. The final product should follow market analyses and provide for further treatments such as refining, pelletizing and packaging. In Lebanon the market for compost needs to be increased. The planning team recommend producing a marketing study and develop a marketing strategy join with the awareness and communication strategy. The final product can have different shape and features, the design phase should include a study to select two or three type of fertilisers to be produced from the composting process. Based on study conducted for all Lebanon in 2012[10], compost can be sold in different shape, but farmers prefer pellets. The planning team suggest considering a period of transition for compost production, at least two cycle of compost should be tested before starting the marketing. After that period the team suggest certifying the fertilised with one of the two main certification bodies active in Lebanon, Libancert and IMC (Certification Mediterranean Institute).

7.2 Cardboard and Paper

Cardboard and Paper from Commercials accounts for 13% of the total waste quantity in Jurd Al Kaitee (see paragraph 3.3.2 or Annex 2 – Baseline report). The main streams of this material are Retail's shop and supermarkets. Following is the total quantity of waste from both streams, Table 19 summarise the projection of collection from 2020 till 2035.

Table 19 - Quantities of cardboard in the waste stream by 2035

Year	**2020**	**2025**	**2030**	**2035**
Paper and Cardboard t/y	3188	3634	4108	4683
Paper and Cardboard Recycling -Source Collection targets (%)[11]	15%	30%	45%	60%
Quantity Diverted Tons/Year	*478*	*1090*	*1849*	*2810*

7.2.1 Treatment

A Material Recovery Facility will be established in the downstream area of Jurd Al Kaitee for cardboard and paper pre-treatment. The facility will be established in the same compound of the composting plant and the Residual Waste Transfer Station. The selection of the capacity accounts for the 60% target by 2035, the daily input will be decided following the collection frequency in the action plan and inception phase. The facility should be designed by professionals and should respect the following:

- the architectural design should respect landscape, the LCA should also guide the design.
- the facility should be designed with a storage area dimensioned to allow two to three months storage

[10] *Marketing Study for organic fertiliser in Lebanon and MENA area, Studioazue, 2012.* http://www.studioazue.eu/marketing-study-for-organic-fertilizer-lebanon-2012/

[11] *Percentages related the total amount of cardboard and paper and not to the total waste*

- the design should include a visitor area, clean and separated from the working area. The visitor area should be used by the awareness and communication strategy to increase the knowledge of the Paper and Cardboard process and increase the accountability of the Paper and Cardboard source separation system.
- the design should be modular to accommodate the increase of material foreseen in the Master Plan
- the facility should have an area where the cardboard is watered to reach the optimal moisture.

In Lebanon the market for recycled paper and cardboard is increasing and the material is locally processed. Depending on the client it needs to be transported compressed and bailed, in Figure 27 a vertical bailer, available in the market also horizontal bailers are available.



Figure 27 – Vertical baler installed in a MRF facility processing paper and cardboard

7.3 Plastic Recycling

Plastic Containers account for 8% and plastic Bags accounts for 7% for a total of 17% (see chapter 3 or Annex 2 – Baseline report) of the total waste quantity in Jurd Al Kaitee. The main streams of this material are households and commercial activities. This stream consists mainly of different kind of plastic including PET, HDPE, PE, PP and LDPE.

Table 20 - Quantities of plastic containers and plastic bags entering the recycling value chain

Year	**2020**	**2025**	**2030**	**2035**
Target %	10%*	25%*	30%*	40%*
Quantity of Plastic Bags Diverted Tons/Year	132	377	511	777
Quantity of Plastic Containers Diverted Tons/Year	152	434	588	894

** quantities refer to the percentage of the 17% of plastic in the Solid Waste*

The plastic bags and the plastic containers will be collected together and separated at the facility of Mishmish. The Master Plan projects the construction of a facility to treat plastic bags, separated at the source and produce pipes or granulate row plastic to be sold in the market. Plastic containers will be sold in the market as second raw material.

7.3.1 Treatment: Mishmish plastic bags

During the planning process Al Sheikh Group, a private company working in recycling plastic containers and bags, prepared a pre-feasibility study for a facility recycling plastic in Mishmish (in Annex 8 is available the pre-feasibility study). The study was technically reviewed by the Technical Planning Team. The facility mentioned in the study will use clean plastic bags to produce plastic pipes to use in construction. The minimum quantities to have the economical sustainability that should be processed in that facility are around 180 tonnes/y, which correspond to 60% of the capacity of the facility proposed by the Al Sheikh company.
Following is the main characteristic of the recycling line:
Plastic film recycling plant is used to:

1) Shred, wash, dewater and dry
2) produce granules from PP, PE, HDPE Film or woven bags,

1. High automation level, try best to reduce your cost on labour (especially for three shifts) and ensure high processing capacity: 200-250 kg/hr.
2. Friendly control system (PLC integrated & separated control on each machine) and Touch screen panel, easy for operation, monitor and emergency stop.
3. All parts contacting with plastic material and water are made of high-quality 304 stainless steel ensure no second pollution to flakes.
4. Ideal impurity removal effect

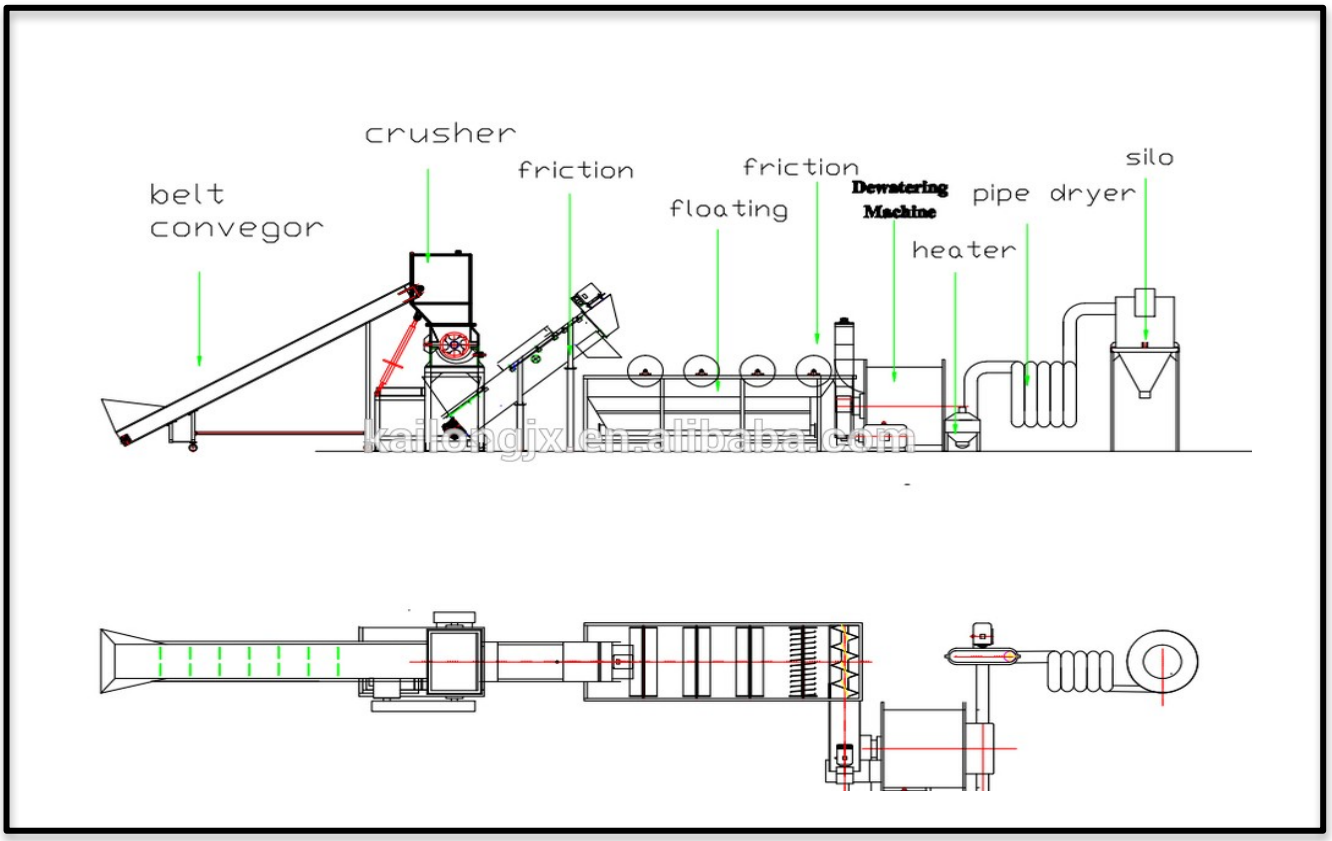


Figure 28 Designed Plastic Bags Recycling Lines for Mishmish Facility ©Al Sheikh Group

Final Product

Mishmash plastic recycling line will be producing shredded plastic a second material that can be sold to plastic recycling facilities. Adding, the plastic recycling will produce PP and PE plastic granules; another potential product from the recycling product is plastic pipes that can be manufactured for infrastructure work.

Based on the feasibility study, in Annex 8, the time for the construction of the plastic manufacturing facility is around 7 months, and it is recommended to start the plastic bag collection system three month before starting the operation of the facility to store enough quantities for the start-up period. The Master Plan calls for the starting of the plastic collection 5/6 months before the end of the facility construction. Based on the targets (see waste flow annex 7), the second year of implementation of the plastic bags source separation the quantities will be abound 203 t/y which will be sufficient to sustain the facility. The location of the facility was agreed and shared with the stakeholders and will be located next to the Mishmish in the same land. Further feasibility study and EIA need to be produced to evaluate mitigation measures to reduce the environmental impact as much as possible. The location is suitable in term of reducing the transportation costs of the second raw material. The facility needs to be located considering the MBT upgrade space required.

7.4 Green Collection Centre

Through the establishment of a pilot Green Collection Centre, the Planning Team aims to engage students, other users, service providers and institutions in the waste management in Jurd Al Kaitee and to create and keep a new waste behaviour that leads to a waste aware generation.

Through this project, residents will have the chance to explore the 4 Rs in an innovative way. It will focus on piloting/ introducing the culture of REDUCE REUSE REPAIR RECYCLE.

In the region, the GCC can creates a space for residents of different ages, groups or businesses to learn and implement sound waste behaviour and practices.

This project is aligned with the Integrated Sustainable Waste Management Plan that aims to introduce best waste management practices and reduce waste generation and landfilling.

In its educative form, the centre will showcase case studies and success stories on REDUCE REUSE REPAIR RECYCLE from around the world. This will take place through regular talks and discussion with influential individuals on various waste management topic such as circular economy, integrated sustainable waste management, waste management feedback mechanism, value chains, materials' life cycles etc.

With this format, the Green Collection Centre will encourage residents to bring second-hand objects, unwanted objects and different type of waste generated in their every day to the centre to repair them or to turn them into new useful products or something more beautiful based on innovative design. This will take place through number of workshops and training with architects, artists, innovators and vocational trainers (e.g, carpenters, electricians) on Repair and Upcycling.

The planning team suggest to use the GCC to keep the community participation, ownership, interaction and awareness, by linking it with the awareness and communication strategy and campaigns, and by doing some other initiative such as, yearly exhibition, school competitions, workshops, vocational trainings, talks and discussion and meeting with TWGs, or Public Debates on SWM or other topics.

Services suggested at the GCC

Treatment:

The Green Collection Centre is a drop off centre for recyclables and from households. In addition to that the green centre is a drop off for special waste that can be reused by other residents such as WEE and Electronic and bulky waste. The Centre is a collection point for old cloth that can be re-arranged and redistributed to people in need. This process is supervised and managed by a receptionist and project assistant. With the aim to increase the economical sustainability and ownership of the community, the Planning Team with the TWGs suggest running the following activities:

- Workshop for reuse and upscale
- Second hand collection system, emptying old apartments or garages.
- Second hand Shop, the GCC can sell the products of the upscale, and the repaired and restored items collected from the service of emptying old apartments or garages.
- Repairing service, service where a citizen can go and ask to repair their items not functional.
- Educational centre, for vocational training to train youth or other interested citizens. The Planning team suggests making connections with some institute for education in the area on the country, such as the

ISSA/CNAM (Institut Supérieur des Sciences Appliquées et Economiques), they have a branch in Tripoli[12]. They work more on IT and business administration which can be useful in the management or the GCC. There are many other Universities or Schools that might be interested in participating to the vocation training at the national level.

7.5 Mishmish and Fnaideq MBTs

According the forecast made, the need is for a waste treatment facility that will serve the whole residual stream for the area, which is 16,723 tons/year by 2035. Currently, the region has two MBT facilities with total capacity of around 7300 tons/year in Mishmish and Fnaideq (see Annex 2 - Baseline report).

These MBTs will remain the core facilities for residual waste treatment in the region. However, the Plan is envisioning some further improvements according to the following scenario where by 2030, Mishmish should receive the residual waste from the Upstream and Midstream villages excluding Fnaideq (the municipality will use its MBT). With the increase in the total number of municipalities that send their waste to Mishmish, the capacity of Mishmish facility will be gradually increase.

7.6 RDF Future Option

In Lebanon, more and more, the government seems to be moving towards the production of RDF from Residual Waste, to be used as a fuel in Cement plants. At the time of the preparation of the plan it is not clear if this mechanism will be implemented and when it will be operational and, in any case, it is too early to understand if it is worth to activate an RDF production in Jurd El Kaitee. In any case, the Masterplan provides general indications regarding the savings that would be made in the quantities and volumes of Residual waste to be sent to landfills. Only for estimation purposes, the Master Plan project the implementation of an RDF facility in 2030. In the disposal chapter, in Table 21 are showed the residual waste to landfill in tonnes per year and m3/y, with and without RDF production.

[12] http://www.cnam-liban.fr/presentation/les-centres/

8 Waste Disposal

8.1 Landfill Volume Required

The volume to be taken to the Srar landfill will be gradually reduced with the implementation of the Plan. The Plan envisages that the MBT plants of Mishmish and Fnaidek are brought up to speed and reach a capacity that receives all the waste from the Mid and Up stream. The Table 21 shows the estimated annual quantities to be sent to the landfill. The quantities of residual waste in table 21 include the reductions in weight by the stabilization process in the facilities. In 2025 it is expected that Mishmish MBT will be able to treat all the waste from the Up-Stream (except for Fnaidek) and Mid-stream, including some Down-stream municipalities, and consequently there is a greater reduction in residuals waste from that year. Table 21 include also the difference in quantities in case the RDF production will be activated in 2030. The activation of the RDF will reduce the total amount of residual waste of around 27%. Yearly the reduction will be of around the 79%.

Table 21 – Residual Waste to be sent to Srar Controlled Dump in weight and volume

	2020	2025	2030	2035	Total space required at Srar m^3
Quantities of residual waste t/y BAU* (MBTs)	14 383	12 959	12 601	11 254	
Quantities of residual waste m^3 BAU (MBTs)	28 767	25 919	25 202	22 507	409 106
Quantities of residual waste t/y RDF	-	-	2 547	2 363	
Quantities of residual waste m^3 RDF	-	-	5 093	4 727	297 142

** BAU Business as Usual*

8.2 Srar Dumpsite management

The master plan does not propose solutions on the management of the final disposal site, the Srar Controlled dumpsite is already under the National Plan, the site will provide final residual waste disposal for the entire Akkar region. OMSAR is currently working with EU funds to build a Sanitary Cell inside the dumpsite and an MBT facility. The cost for the disposal (Gate fee) is now paid by the National Government and the project is that they will continue to pay for it using national funds coming from indirect taxation. The Masterplan end at the gates of the Srar landfill. Regarding the final disposal two main considerations need to be highlighted:

- All jurd El Kaitee municipalities and villages agreed on sending residual waste to Srar controlled dump and pay for it
- The considerable distance from the Jurd El Kaitee area and Srar dumpsite should be used by the WMTU and the UoMJK who will be the owner and implementation body of the Master Plan, as an indirect incentive to increase the waste reduction, recycling and source segregation.

8.2.1 Option for disposal

Although it is established, through meetings with the owner of Srar controlled dump (Amana Al Arabia, the company that owns the landfill) and other relevant stakeholders and through the TWGs, that Srar controlled is available to receive all residual waste from the UoMJK, even before the sanitary cell is completed, the plan proposes an option in case JK's residual waste could not be sent to Srar.

The plan foresees that through the TWGs with the technical support of the WMTU, a participatory process will be started to evaluate where to dispose the residual waste in case Srar is not accessible. This process could also be useful in an emergency.

The option concerns the transport of residual waste from the Transfer Station to an alternative option to Srar. The options will be examined in TWGs, the project team proposes principles that must be respected while selecting the disposal options:

- The Fnaidek dumpsite must be closed in any case and the area must be reclaimed and returned to citizens with a specific function.
- The residual waste must in any case be directed to the TS and the return to the individual municipal dump sites is not allowed.
- The alternatives will be sought outside the territory by conveying the waste to landfills already present in the near-by regions and it will not be possible to think of alternative solutions that are not provided in the national plans.

8.3 Dump closure

The Master Plan calls for the progressive closure of all the illegal and uncontrolled dumps in the area of Jurd El Kaitee by 2030, the first step is to ensure sufficient funds for their reclamation and functional requalification. The UoMKJ with the WMTU and the committee of stakeholders should be the leader and sole responsible for the process and funds.

The aim of the process has two main components and goals:

- Should ensure that the site is not any more dangerous for the public health and for the environment.
- Should ensure that the site is given back to the community with some functional requalification to be public and usable by all the population.

The second aspect in particular need a strong involvement of the key stakeholders, in Table 22 the main steps and time suggested by the planning team to implement the reclaiming and functional requalification of one uncontrolled dump.

Table 22 – Tentative workplan for dumps reclamation and requalification

Steps/months	3	6	9	12	15	18	21	24
Fund raising	■							
Geological and Hydrogeological studies, EIAs, design		■						
Procurement for reclamation			■					
Reclamation works			■	■				
Community involvement process		■	■	■	■	■	■	■
Design for requalification					■			
Requalification						■		
Support requalification							■	■

8.3.1 LCA use in site selection, dump closure and functional requalification

The aim of LCA is to assess the capacity of landscapes to accommodate change (in our case, waste facilities, new and different land use of reclaimed dumpsites), by looking at their character (technical and socio-economic) and visual sensitivity to a proposed change, as well as the value of the landscape. Considering that the main outcome of the LCA is a set of guidelines on how to approach different landscape character areas and types, the proposed change imagined when considering landscape sensitivity is any human intervention, whether through sprawl, quarrying, waste generation, cultivation, and natural processes of change that may be accelerated by human intervention such as erosion, desertification, water and soil pollution.

Landscape capacity matrix

If a landscape has high quality, high visual sensitivity, and high landscape sensitivity, then its landscape capacity is low or no ne, meaning that if a proposed change were to occur, this landscape would not be able to accommodate it without a significant effect on the character of the landscape. A Landscape with high landscape capacity means that it has high potential to accommodate change without significant impact on its character.

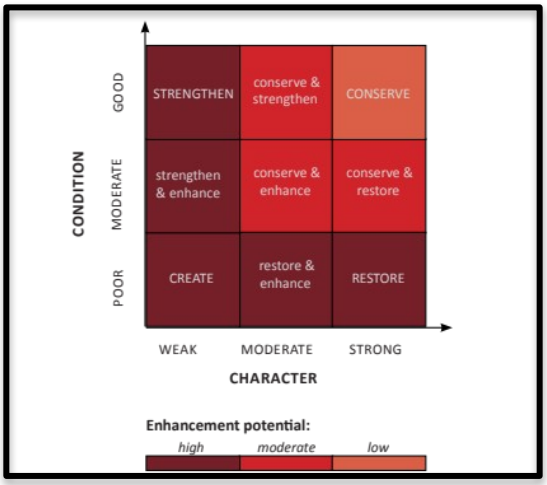


Figure 29 – Example of Landscape Sensitivity Strategic Matrix

Landscape Character Sensitivity was assessed to check if there were characteristic / particular elements, or distinguished traits of an area, such as Juniperous and Oak Forests, and areas with traditional houses. LCS is classified as low if the landscape will be minimally affected by human intervention, or if there is already human intervention and the landscape value remains high. Moreover, a relationship exists between landscape character sensitivity and visual sensitive, since a highly visually sensitive landscape often has a high landscape character sensitivity. In Figure 30 – Landscape evaluation of the area of the UoMJK.

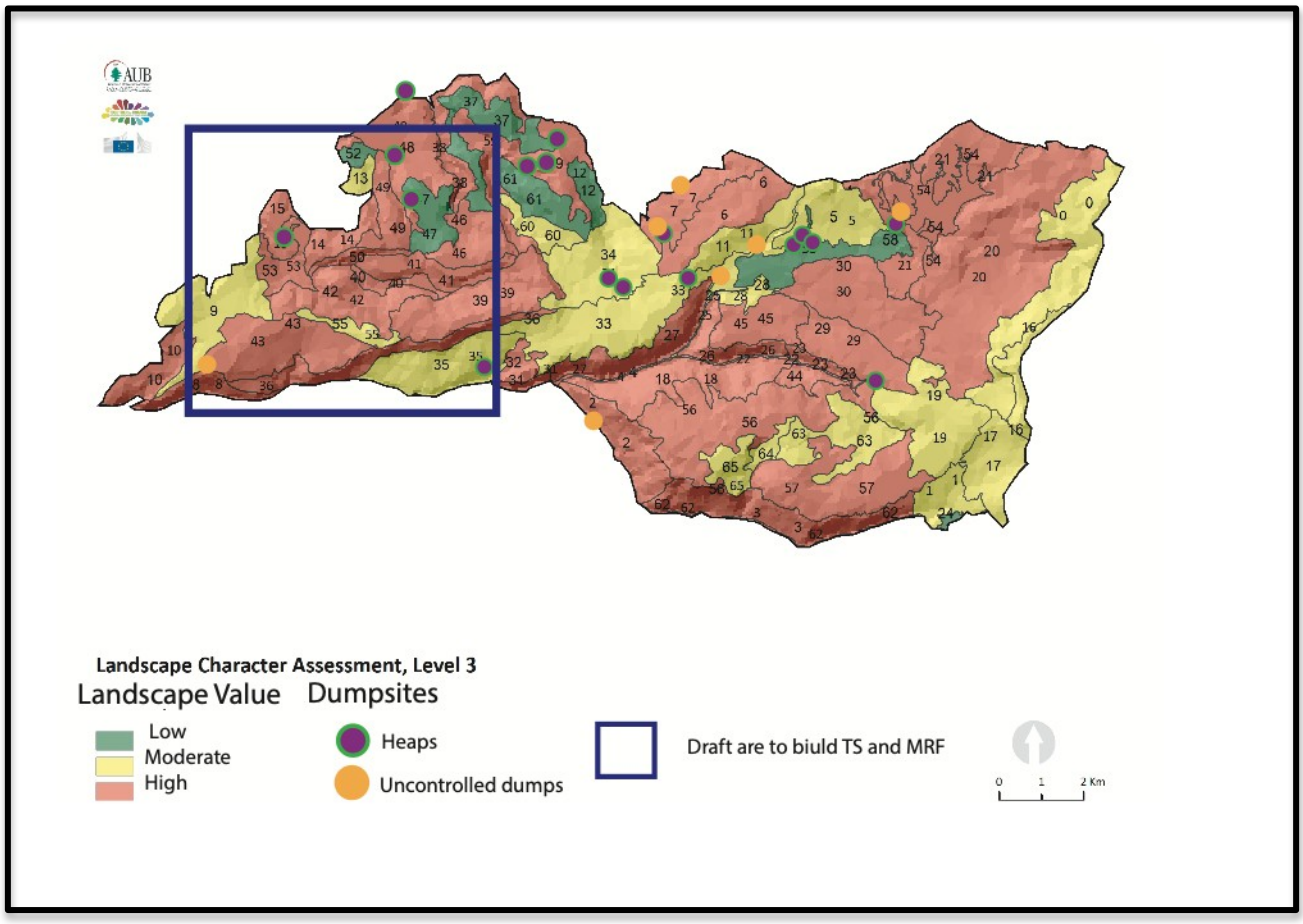


Figure 30 – Landscape evaluation of the area of the UoMJK with dumpsites

LCS (Land Character Sensitivity) characters have been interpolated with the location of uncontrolled dumpsites. On the map it is easy to see how most of the uncontrolled landfills are in very sensitive areas including the Fnaidek landfill (area 54). The blue box on the map identifies the macro area in which a participative process has to be activated with the aim of selecting the land on which to build the Transfer Station and the MRF. As you can see, there are areas more towards the Municipalities of Chane and Ein El Daab which have a lower environmental and landscape sensitivity. Annex 12.4 provides the complete LCA level 3. The Plan recommends making use of the LCA in the Participatory process for the selection of the land to build the infrastructures and for the selection of the type of functional re-extension of the uncontrolled landfills to be closed. The process should be done after a Stakeholders analysis however the Planning team suggest involving the UoMJK, the WMTU and the TWGs, plus additional representatives of the preselected municipalities (see figure 29).

9 Sound Institution

9.1 National Level Requirements

The Lebanese Government has made some progress in waste management legislation. In October 2018 it approved the first law that regulates and frames waste management. The Government is currently working on a national strategy. Gaps need to be filled in terms of guidelines for local authorities, establishment of a National Agency, control and monitoring tool such as the EPR system.
In any case, article 9 of law 80 provides the following:
Administrative decentralization should be adopted in the application of integrated solid waste management by local administrations taking on the stages of integrated solid waste management in whole or in part in accordance with environmental and economic viability.
The Master plan has developed a management system of both the technical and the managerial and financial aspects that legally allows the UoMJK to monitor, control and recover the costs of waste management. Following the new regulation, not yet approved, the Lebanese government, has to pay the costs of managing the landfills.

9.2 Regional Level Requirements

The institutional capacity in waste management requires a regional and local structure able to guarantee the service. An efficient local structure reduces the impact by following the national directives adapting them to the local context. The ISWM and the Waste Aware indicators, foresees measures that increase the institutional capacity, the Planning, the monitoring of the service and the collection, the generation and management of reliable data and the cooperation with other neighbouring areas/UoMs and with the region.

9.3 UoJK municipalities SW management framework

Based on the TWGs discussion, the role of the UoMJK in the waste management will be changing during the planning period. The main objective agreed is that the UoMJK will take over the collection of Residual Waste, the Sweeping and the source separation system. The UoMJK will keep as a private only the management of the IRS and the Green collection. However initially the MP suggest to sign a contract to deliver the service for Residual waste and street Sweeping to a private service provider, through a selection procedure where the company that serve already 4 municipalities out of 13 Amana El Arabia can participate.
The UoMJK will start gradually with the source separation collection, managed by the WMTU. The UoMJK should get the support from the other municipalities in particular Mishmish since they have already a facility working with recyclables. The UoMJK alternatively can give the collection of the recyclables to a different service provider at least in the first two years and organise the source separation collection after that period.

The main goal for the UoMJK directly managing the source separation are the following:

- The UoMJK is more committed and close to the population and achieve better results
- With a "pay as you though" contract with a service provider for Residual Waste, the UoMJK have more interest in collecting recyclables and pay less to the service provider. In Table 23 a tentative scheme for the responsibility in SWM.

Activity	2020	2025	2035
Residual Waste collection	Private	Private	UoMJK
Recyclables collection	UoMJK/Private	UoMJK	UoMJK
Special waste collected by IRS	Private registered	Private formalized	Private formalised
Other Special waste	UoMJK	UoMJK	UoMJK
Green collection point	Private	Private/UoMJK	Private/UoMJK

Table 23 – Tentative framework for SWM in the UoMJK MP

9.3.1 Roles and Responsibility of WMTU

The Plan envisages the creation of a Waste Management Technical Unit (WMTU) that is dependent on the UoMJK and guarantee that waste management service is efficient and effective for all the municipalities of the UoM. The main roles of the WMTU are:

- Planning
- Monitoring and respect of the environment and public health
- Data collection
- Costs are covered
- Inform the population on the services and manage the Public Feedback Mechanism

Planning

The WMTU should prepare and revise the Master Plan based on Milestones and Monitoring Plans, revise and change targets according to the monitoring plan, prepare Action Plan every 3/5 years, involve the Committee (more details in chapter 10 User Inclusivity) in the preparation and validation of the Master Plan and the Action Plan, according with the National regulation and policies.

Monitoring

WMTU will have to carry out the Monitoring Plan. Bylaw must ensure that there is a distinction between who monitors and who offers the service. The Plan project that the UoM manage the waste collection, the transportation and disposal service, through a contract with a Private Company. The separate collection from the source is directly managed by UoM using their vehicles, employees and funds.

In both management systems, the WMTU will be responsible for monitoring, through the support of the community and the users with the Environmental Committee and the Public Feedback Mechanism.

Data collection

WMTU will be responsible for implementing a MIS (Monitoring Information System) and will be responsible for collecting and updating data and information based on the Monitoring Plan schedule. The MIS will be included in the Mobile Application and accessible to all citizens and users. The database must also be accessible to the Ministry of the Environment through which it will be able to carry out cross-monitoring.

Costs recovered

Ensure the Recovery of Costs, and the equity of the tariff in respect of the "polluter pays" principle of the law. Search for funds, write proposal for investment or improve the service and its efficiency. Collect the tariff from citizens. Search for possibility for investment to improve, modernise the system, bins, trucks, facilities or the Green Collection Centre. Finally, funds should be also used to fund refreshing courses upgrades for the employees of the WMTU.

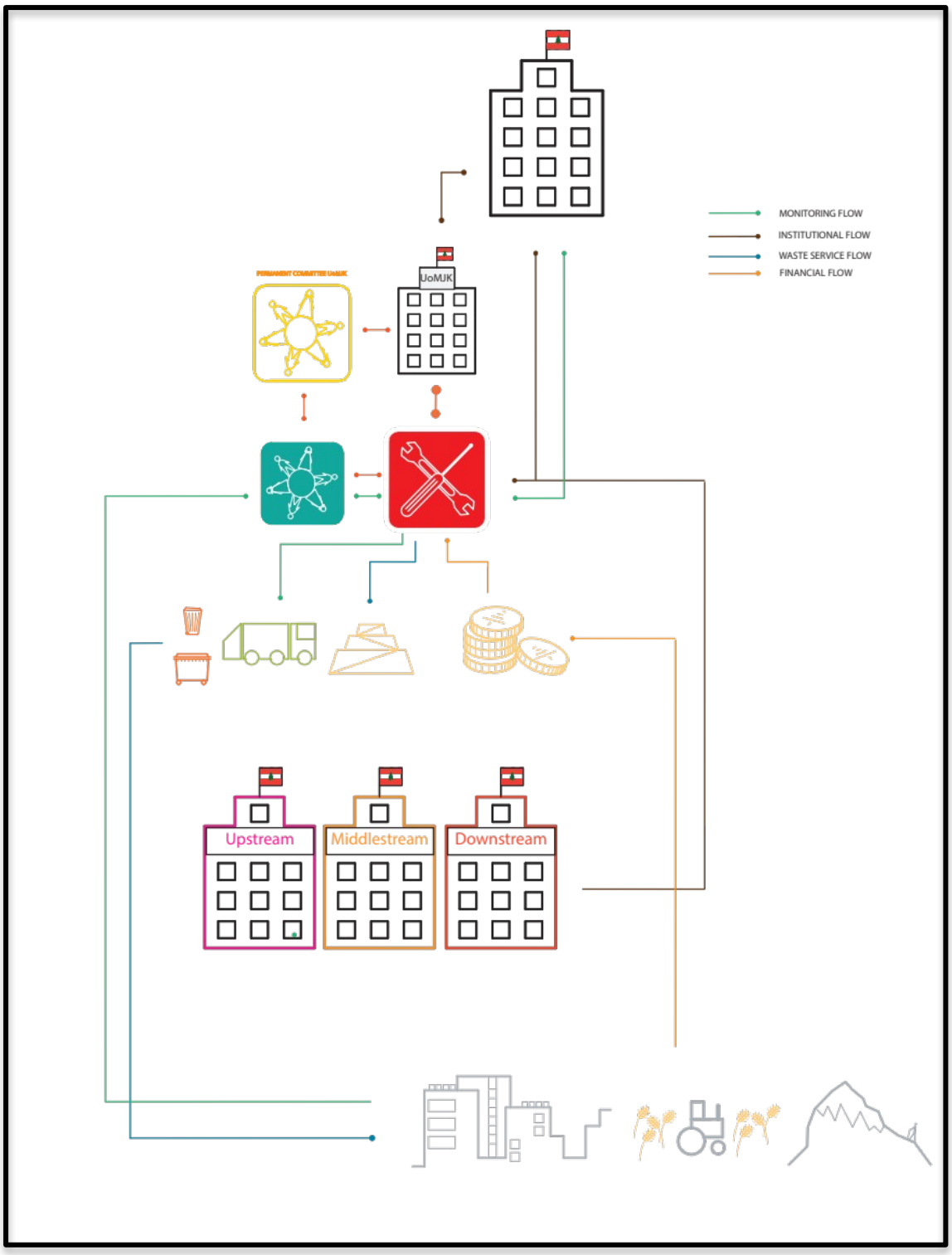


Figure 31 – Detailed organizational, chart of the WMTU

9.3.2 Bylaw and procedure to establish WMTU

The Waste Management Technical Unit is a specialised unit within UoMJK administration that oversees the design and implementation of SWM policies within the union area. To function effectively, the WMTU requires to be formalised by a decision taken by the union's policy-making authority, the union council, before being ratified by the Union chairperson, who heads the executive authority. The necessity of creating specialised administrative units within local authorities is stipulated in the Lebanese Municipal Act (Decree-Law No. 118, issued on 30 June 1977 and its amendments), as per Table 24 below:

Table 24 – Relevant articles for WMTU establishment

Article reference	Provision
49, §19	The municipal council shall be responsible for […] organising the systems related to the municipality's staff and workers and determining the scale of wages and salaries.
62, §4	The following decisions shall be subject to the authentication of the Minister of Interior [and Municipalities]: […] Creating municipal units, organising them, determining their organisational structure and competence as well as the scale of salaries and wages.
77	1- The head of the executive authority shall preside over the municipal units and ensure their smooth work and the coordination between them in his capacity as the head of the municipal staff following the order of succession. 2- The head of the executive authority shall be entitled to delegate some of his powers to […] the heads of the municipal units, except for the right to issue texts of public character.
83	The municipality shall be entitled to establish as it needs of administrative, financial and **technical units** […]. Common units […] may also be created for two or more municipalities and common civil servants may also be appointed between them. 1- The common units […] shall be created upon a decision issued by the Minister of Interior [and Municipalities]. 2- The Minister of Interior [and Municipalities] shall set up unified statutes for the common civil servants while preserving the right for the municipalities with common units to establish its own statutes, provided that these statutes shall be approved by the Minister of Interior [and Municipalities]. 3- The remuneration of the said civil servants are divided by virtue of a decision made by the Minister of Interior [and Municipalities] between the concerned municipalities, on the basis of percentage rates. 4- The decisions of the Minister of Interior [and Municipalities] in this respect shall be issued upon the suggestion of the Governor [Mohafez] and the opinion of the concerned municipalities.
121	The head of the executive authority shall be assisted, in the management of the union affairs, by a group of staff presided over by a manager and comprises an engineering and health unit, an administrative and financial unit and the police unit. The council of the union shall be responsible of establishing systems and frameworks for union civil servants in place. The president of the union council shall appoint the civil servants according to the systems and the frameworks in force.

129	The council of the municipal union shall adopt the same regulations and procedures set forth in the present law for the execution of the work in the municipal councils.

Formalisation of the WMTU

The formalisation of the WMTU guarantees its official function and the sustainability of its work. It will then act as an official focal point for all SWM activities within the UoMJK area towards other stakeholders, namely: the municipalities that are members of the Union, the private contractors that are undertaking SWM responsibilities, the local communities, the governorate of Akkar, civil society organisations and international organisations. The WMTU may be staffed by hiring competent workers on the basis of permanent contracts or temporary contracts (remunerated on a per-day or per-month basis) depending on the resources available to the union.

Adopting bylaws for the WMTU will allow to set forth the WMTU's core mission, its internal administrative organisation, a detailed scope of work and its different roles and responsibilities in managing the solid waste system in the UoMJK area. Most importantly, it will formalise (1) its functional relationship with a SWM committee that includes citizens and volunteer groups and (2) the introduction of a waste tariff for cost-recovery purposes within the union area. This will ensure the sustainability of the ISWM plan after the master plan is adopted and implemented.

9.4 Functional relationship between the WMTU and the local community to ensure inclusivity

The WMTU would be supported by the Environmental Permanent SWM Committee (EPC) consisting of citizens and volunteer groups already working in the participatory process for the SWM master plan. According to Article 53 of the Municipal Act, the council of the union or the municipality may establish as many committees to study the issues falling within its scope. The committees' membership consists of elected council members and/or appointed members from outside the council (i.e., citizens and experts).
Such local committees would coordinate regularly with the WMTU and assist it in all stages of the implementation of SWM policies, also by contributing to setting up and mainstreaming public feedback mechanisms like townhall meetings and open consultative sessions.

Implementation of a waste tariff by the WMTU to ensure sustainability

Legally speaking, UoMs do not have tax collection power (only municipalities do) and local authorities in Lebanon may not impose taxes that are not stipulated in the existing legislation. However, it is possible to ensure the sustainability of SWM in local governance by introducing "cost recovery tariffs". The cost-recovery tariff for waste management, in this case, is not a tax. The proposed tariff should recover part of the costs incurred from waste collection, treatment (primary/secondary sorting or recycling), management (setting up a database, monitoring the SWM process by WMTU staff and service providers), awareness activities/campaign, operating and maintaining waste management facilities etc.

The main reasons for looking into the feasibility of a waste recovery tariff are as follows:

1- The money transfers that local authorities receive from the Independent Municipal Fund (IMF) and the revenues available to them will not be enough to cover the implementation of an ISWM system at the local and regional levels. IMF grants will likely not be transferred fully and on time. After 1.5 years of delay, the government transferred only half of the due funds in April 2019. The situation in unlikely to change given the central government's austerity policy.
2- The tariff should also serve as an incentive to reduce waste generation, respecting the polluter pay principle (art 9 of the SWM Law no. 80/2018).

In Lebanon, some local authorities already collect similar tariffs from residents to recover part of the costs incurred to provide certain services, such as the informal generation and distribution of electricity to households and businesses (setting a standard rate to sustain diesel generators or solar panels for the area) and managing slaughterhouses (by adding a complementary fee on the existing slaughter tax). These tariffs are legally referred to in Arabic as *ja'âlat tahsîl* (جعالة تحصيل).

Therefore, it is possible to finance the WMTU through an additional percentage of the budget of the member municipalities, considering that they benefit from a specific project of common interest (like an SWM project). This percentage is determined by a decision taken by the council of the union in the light of the project fees. The decision is then subject to the approval of the Minister of Interior and Municipalities (Art. 133, §2 of the Municipal Act).
Alternatively, the cost-recovery tariff could be stipulated in the bylaws of the WMTU along with a detailed feasibility study that justifies the adopted rates in view of the area's socio-economic situation. The justification should develop why this tariff serves the public interest. Including the tariff in the bylaws is an important guarantee which can be later consolidated or legalised upon the adoption of MoE's proposed decree on cost-recovery fees.
The suggested waste tariff should not be a flat rate, which would contradict the "polluter pays"[13] principle. It will be fair and flexible, taking into consideration the socio-economic status of the households, the size and type of the commercial bodies and institutions (plants, universities, schools, factories, businesses). The way and frequency the tariff would be collected will be decided by the WMTU and EPC and added to the bylaw. It can be monthly or quarterly.
To ensure residents' buy-in, a mass awareness campaign on the introduction of the waste recovery tariff should be conducted.
As for tariff's collection method, this requires further consultations with the union council given the low and ineffective collection rate at the level of municipalities and the union. The tariff may be collected by the member municipalities or the union.

Resources and procedure for adoption
Prior to adopting the bylaws, the union council should take a decision to develop them. Following this, a legal expert who has extensive experience in drafting municipal bylaws should be hired. Once the draft is ready, it should be forwarded to the competent authorities, namely:

[13] *See art. 8 of Lebanese Law 80/2018*

1- The main stakeholders that should informally approve of the introduction of the waste tariff are OMSAR and MoE. The MoE should be consulted for information-sharing purposes and to win the Minister's support.
2- The main stakeholders that should **formally** approve the WMTU's bylaws are MoIM and the Council of State (Lebanon's Administrative Court).

9.5 Data Management and Registration of Transactions

The WMTU will perform a reliable, continuous and systematic data and information collection that will feed and update the MIS (Management Information System). The management of these data is regulated by the monitoring system which will be shared and approved with the central government to be able to compare the performances of other regions.
The Master plan provides a draft of the aspects that should be included in the Monitoring Information System (see Annex 6) which must necessarily be updated and completed following the system in force. The MIS obviously changes if it is necessary to carry out the monitoring of services contracted out to private or if the public service does it or if a management has been started through PPP or PSP.
The costs for data collection, sharing and validation must be accounted in the cost recovery system. Data collection and analysis will be conducted by the WMTU that will have the responsibility to verify if the plan and the activities connected to it, are giving the expected results.
MIS have the following advantages:

- MIS reports allow for evaluation of the performance of employees, machinery, and even money (investment). This allows the WMTU staff to make decisions about the future and to monitor the master plan status.
- Helps in cost control by pointing out turnovers, idle times, wastage of resources etc.
- Compares budgets and plans to actual performances and figures. So MIS can pinpoint variances and help the WMTU management in taking appropriate actions to correct the situation.
- MIS also identifies the strengths of the SWM system, allowing the management to take the opportunity to exploit it more
- Takes away the uncertainty and risks involved with managerial decision making
- Allows for data to flow smoothly along all the various levels of the organization with minimal effort, and allows for more effective communication as well, allows also sharing with ministries such as MOE, OMSAR and CDR or with the Environmental National Agency in the future
- And finally, as far as accounting is concerned, MIS is the source for information regarding the WMTU and WM financial health and current financial situation.

In Figure 32 a proposed structure of a MIS to be applied to the WMTU, managing all aspects of the SWM system proposed in the Master Plan.



Figure 32 – Potential MIS structure for the WMTU

9.6 Intermunicipal cooperation

While the collection of residuals, organic and recyclables waste is linked to a local context, the treatments and the final disposal are linked to the regional level. Furthermore, the Masterplan provides for the improvement and formalization or registration of specific collections already existing (e.g., IRS see Annex 3) which, for sustainability reasons rely on a wider service area (e.g., collection of tires, or WEEE).

For these reasons it is important that the UoMJK and WMTU activate a collaboration with the Akkar region and with the bodies responsible for the management of North Lebanon and with the national level.

At the regional level the collaboration should be activated also with the neighbouring UoMs and the others local authorities active in Akkar region. The Plan suggests to constantly coordinate with the regional Master plan produced by OMSAR.

Furthermore, in order to guarantee a greater commercial network, the plan recommend making agreements and collaborations with the Governorate level (e.g. Saida governorate where tires should be transported).

Since the preparation of the Masterplan for the UoMJK was prepared before other Masterplans implemented in the Akkar region and given that the OMSAR Masterplan is still under construction, the Plan envisages that the UoMJK and WMTU are the promoters of these inter-regional collaborations, going to visit the other UoMs and forming a platform or a committees where all the Akkar institutional bodies meet to discuss about Solid Waste Management aspects.

9.7 Monitoring plan

Monitoring the SWM system will be one of the main objectives of the WMTU (see paragraph 9.2).

Monitoring the performance of the SWM system of the UoMJK has a number of goals and tasks:

- to observe closely the quality of the SWM service provided in order to maintain or improve service quality and in order to follow the instructions of the Master Plan
- to encourage the efficient use of available resources;
- to relate the outputs of a service to inputs (and ultimately their cost);
- to improve service quality overall and relative to cost;
- to generate accountability of service providers;
- to put downward pressure on cost of service provision;
- to provide information on which management can make policy and management decisions about the service;
- to compare the service, provide between two or more sub-municipalities or municipalities in a regional association;
- to compare the quality of service provision in the UoMJK with a previous month or year; and
- to monitor and evaluate the quality of services provided by private service contractors.

The monitoring plan will be going into details according with the Action Plan and updated on the basis of the priorities selected for the project financed by the EU up to 2021. Every year the WMTU have to update the Waste Aware indicators that will function as macro indicators to evaluate the SWM system and to determine if the Masterplan has made improvements in the service. Waste Aware indicators, the manual and the excel file with the baseline situation are in Annex 5. In Annex 6 the planning team has attached a suggested schedule for the monitoring plan.

10 Inclusivity

10.1 Awareness and Communication Strategy

The awareness and communication strategy focus on:

- community mobilization to raise awareness among local stakeholders and the population on waste-related pollution, littering and environmental sustainability
- and on waste management in order to reduce solid waste production at all community levels and increase recycling, source separation and accountability.
- Environmental and civic education
- Support for financial and social sustainability of the SWM system (aware about the importance of the cost recovery, about the PFM and how does it works, etc…)

The awareness and communication strategy focus not only on individuals and households, but also on a different target groups in order to better reach out the broader Jurd El-Kaitee community.
Based on the Baseline of Waste Aware Indicators (WAI) the guidelines for the awareness strategy directly refer to the following indicators (see Annex 5):

- 3Q on “Quality of resource management - Reduce, Repair, Reuse, Recycle” indicator to assess the ‘quality’ of 3Rs provision; Topic 3R.3, or on the “Focus on the top levels of the waste hierarchy […] in lower waste generating cities”, in order to promote reduction and reuse of waste through good practices, together with the institutional support at municipal level; the strategy for waste reduction in the waste hierarchy in general follows the principles of the new waste law (nr. 80/2018).
- 4U on “User inclusivity” represent, within the project, the degree to which all users, or potential users, of the solid waste services are involved in and influence how those services are Planned and provide feedbacks
- 4U.3, or on the “Level of public involvement”, with evidence of actual public involvement at appropriate stages of the solid waste management decision-making, Planning and implementation process. Within this awareness strategy, the relevant stakeholders actually participate in public involvement through appropriate and balanced representation (community leaders, religious leaders, municipal police, local association, schools, women, youth, population at large)
- 4U.4 “Public Feedback mechanism”, accessible, well known and processed feedback mechanism
- 4U.5, or “Public education & awareness”, through implementation of comprehensive, culturally appropriate public education and awareness raising programs dedicated to schools and local stakeholders (community leaders, religious leaders, local police, local associations, schools, women, youth, citizens)

10.1.1 Methodology

The awareness and communication strategy envisage using the Environmental Permanent Committee and in particular the section of the governance sub-committee that dealt with awareness and education during the Planning process. The EPC sub-group on governance and communication, which involves several actors who have already worked on preparing the communication strategy in the present Master Plan, will be responsible for implementing the action plans and coordinating and activating the campaigns following the development of the master plan and the strategic objectives. The sub-committee section will also have the task of mobilizing the groups to raise awareness and identify the target groups for each of the objectives of the strategy.

10.1.2 Objectives

The general objective of the awareness and communication strategy focuses on building a public common consciousness about Integrated Sustainable Waste Management and related environment and health impacts. Each of the objectives has been proposed developed and validated within the TWGs.
The specific objectives are presented in Table 25.

Table 25 – Objective of the awareness and communication strategy with key messages

Objective	**Key message**	**Target from the Masterplan**
Reduce Littering	Belonging to Environment	50% in 2035
Support for plastic bags and uncontrolled burning reduction and reuse	More Health Less waste less costs	30% in 2035
Support to source segregation and support to Registered Recyclers (RRs) or Informal Recyclers (IRs)	Financial benefits Work opportunity Cooperation	60% cardboard 3% collection at GCC 40% plastic bags and containers in 2035 40% organic in 2035
Support to the costs recovery system on SWM	Better service Fee not tax	80% of the population pays in 2035
Increase Civic and Environmental education	Better future	All schools run an official programme for Civic and Environmental education in the curricula by 2035
Public Feedback Mechanism (PFM)	Control the system	A PFM with a recording system is operational and monitored by the WMTU before 2025

10.1.3 Targets

Some targets were selected with the Sub – TWG on communication and are the one related to the Education objective and to the PFM.

10.1.4 Targets groups

The planning team agreed with the TWGs to include the following target groups in all activities.

- local authorities and community leaders
- commercial activities
- civil society of UoMJK
- students and teachers

Additional groups will be involved based on the different objectives and will be further discusses during the first three years Action plan.
In general the awareness and communication plan calls for the inclusion as much as possible of the gender equality and youth involvement.

10.2 User Inclusivity

For about 10 months, the participatory planning process has seen the participation of key actors identified by the different municipalities and through an analysis of the actors. The main objective of the participation is to give the possibility to the key stakeholders to **influence decisions**. The team developed activities and adapted different tools to involve the stakeholders, the team recommends keeping the level of participation reached during the process, by keeping a high level of ***transparency*** in the implementation and operation of the new SWM system and respecting the following principles:

1. ***Diversity:*** Diversity is often seen as problematic. On the contrary, the diversity of opinions it is a resource, positive and necessary [9]. It is divergent ideas that generate innovation [10]. Many people "naturally" do not like conflict and prefer to avoid talking about politics or controversial issues with those who think differently. However, conflicts do not seem to occur significantly in participatory processes which aim is to divert conflict towards common solutions.
2. ***Equality:*** If the political equality of citizens is inherent in the very notion of democracy, in participatory processes, it is mandatory that all stakeholders reach the same level of basic information and notions that guide the process.
3. ***Neutrality:*** A participatory process that aims to serve a community as a whole, rather than a particular group or "faction", must be credible, fair and neutral. It is not enough that the process is impartial; it must also be perceived as such by the affected community.

At the moment the Master Plan was validated, the 28 of August 2019 (see Annex 9 for more details).

10.2.1 Environment Permanent Committee

The Masterplan calls for the TGWs to continue working as an official body inside a major committee linked to the UoM, which has the function of controlling the waste management system by providing support to the WMTU and which is able to **influence the decisions** also during the operation of the new WM system. The TWGs will constitute an Environmental Permanent Committee (EPC) which is going to be part of the decision-making process within the UoMJK institutional structure. In order to guarantee the fairness of the information, the committee must be able to participate in the councils of the UoM. The plan provides that

two representatives of the EPC must be able to participate to Municipal and Union councils. The two representatives after should report to the EPC. The EPC will coordinate directly with MOE and its committee as per Decree 108/2019.

The EPC will be differentiated into three sub-committees according to the division already active in the TGWs.

Sub committee Residual waste and Final Disposal

Sub committee Value Chain

Sub committee Governance and Communication

Within a capacity building program at UoMJK, the Swedish NGO SKL is activating a standing committee to influence decisions on all aspects of governance at UoMJK. The Plan provides for the Permanent Environmental Committee to become an integral part of this wider committee during the establishment phase.

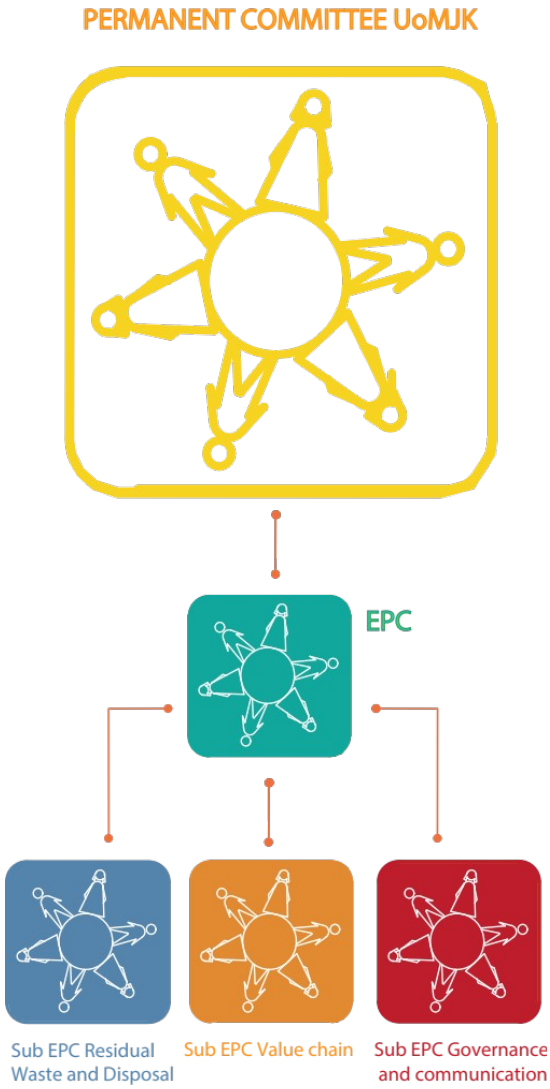


Figure 33 – Structure of the committees

10.2.2 Public Feedback Mechanism

The Plan calls for the setting up of a feedback mechanism. The baseline shows that in the UoMJK there is already a system, but it is not structured. The problems are not solved because the complaints do not reach responsible and decision makers. The Plan involves the creation of a Mobile Application in which there is a button where users can express their complaints, report a problem and provide suggestions. The mechanism in the Application will be directly managed by WMTU staff who will have the task of solving problems. The Mobile Application should be designed in a way that allows users to insert a message, photos and the location of the problem. The WMTU should be able to show to the users when the problem has been solved and all the information should be automatically saved in a database to record the history of the major problems, of how they have been solved.

10.3 Provider Inclusivity - Private Sector Participation – CONTRACTING

During the participatory process, the TWGs discussed guidance and regulation for service contracts.

The Planning team recommend the involvement of experts on procurement and contracting for the stipulation of the contractual agreement. In particular at national level the Plan envisages that the UoMJK and the WMTU could rely on the support from the Ministry of the Environment and OMSAR experts. In Table 25 are summarised the guidance and regulation discussed which will also be applied to the agreement with IRS or the RRs.

Table 26 – List of critical issues to be taken into consideration in the contract agreement

No.	Clause	Description
1	**Final costs for landfilling should consider end of life closure and functional requalification**	Request to the National Government to consider end of life and requalification costs
2	**Final costs for landfilling should be by tonne**	The Lump sum contract used at present makes impossible to collect data and to monitor waste reduction and recycling. Final disposal is now at the responsibility of the National government who pays for it.
3	**Street Sweeping vs Primary collection**	The contract must identify a clear division of responsibilities between street sweeping and collection. There are cases in which waste are thrown next to the bins or cases where the waste is scattered around the bins. The contract must give this responsibility to the collection system and not to sweeping.
4	**Use of Standardised bins**	The private contractor should have the guarantee that the public will use only standardised bins

5	**Frequency of collection**	The service provider should price the service also based on frequency
6	**Flexibility in collection frequency**	The contract should have a clause were the contracting authority can request the reduction of the frequency of collection. This is important when the source separation will be at a more advanced stage to reduce the cost of the SWM system.
7	**Schedule for special conditions**	In the contract the service provider should supply for a special schedule for specific conditions (collection in summer, in touristic areas, Ramadan, etc…)
8	**Workers previously working for the Municipalities**	The service provider undertakes to employ as much as possible the staff previously employed by the municipalities.
9	**Use of OSCHE (Operational Safety and Health Equipment**	Safety and Health equipment should be decided with the parties and respected by the service provider
10	**Clear definition of the terms of payment**	The use of IMF for SWM will be gradually reduced thanks to the cost recovery system. Payment should be foreseen to be done during the year to keep the need for costs recovery
11	**High bond**	Service provider should allow monitoring, visits, anytime from WMTU staff and MOE
12	**Responsibility of the contracting authority (Public) of the citizens behaviours**	Clearly identify where the behaviour of the citizens increase the costs of the service provider and how it is allowed to ask fees to the contracting authority (UoMJK)
13	**Contract duration**	The contract should have a duration that allows the private individual to invest (means depreciation time). At the same time, it should allow institutions to change service providers if they are not satisfied with the service.
14	**Annual Work Plan**	The service provider should send annual and six monthly Work Plan for collection and disposal

Responsibilities, who should work on that:

- **Service provider should be responsible**
- **Public and contracting authorities: conditions that the public should guarantee to allow work of the private company**
- **National government responsibility to solve that issue**

10.4 Working with Informal Recyclers

Informal recyclers are considered a key stakeholder to establish an inclusive waste management value and service chain in Jurd Al Kaitee. They play a crucial role in collecting metal, WEEE and bulks hence decreasing the quantity of residual waste that the municipalities have to deal with. From a governance perspective, the Plan recommend the selection of a number of informal recyclers and IWBs to collect waste in designated areas. Such decision requires few administrative steps that leads to the integration or at least the registration of the sector toward the fulfilment of the value chain targets.

10.4.1 Integration of the Informal Sector

Metals and WEEE collected accounts for only 0.5% of the total quantity of waste in Jurd Al Kaitee which is considered very low. The data and the IRS study (see Annex 3) shoes that the informal collection system is active and collect most of these materials. The Plan calls to include IRs in the process eliminate the need to invest in metal and WEEE recycling infrastructure specially that the sector is already functional. A direct relation will be created between the IRs and the UoMJK through the Waste Management Technical Unit (WMTU). The plan envisions that the existing IRs in the region commit to operate collection of metal, WEEE and increase the value chain through operations permits issued by the WMTU. The permit allows IRs with legal and registered vehicles to collect designated materials from the region following a set schedule. The WMTU should provide incentives or support to the registration of IRs and issue a temporary permit which will expire if after an agreed period the IRs will fail to register the vehicle, and therefore will not be allowed to collect materials in the UoMJK. A contact list of selected/official IRs will be shared with the residents and businesses of the SWM system. In case they need to throw a special waste (WEEE, metals, bulky waste, furniture) they have two options.

1- call one of the numbers in the list and wait for the RR (Registered Recycler) to come and withdraw the item.
2- Deliver the item to the GCC

The “on demand” collection system when the users will get use, will lead to fuel savings as the RRs do not need to run idle but they can organize a ride by following the addresses in which users have requested the withdrawal of special waste. The system also, accommodates the request of the local authorities and TWGs for monitoring the work of the IWBs and IRs, as well as the interest of the collectors to have a protected legal status.

10.4.2 Actions for the Union of Municipalities of Jurd Al Kaitee for integration

During the consultation, and after the findings of the IRS study (Annex 12.3), it became clear that the TWGs and the mayors would prefer that the informal collectors – specifically IWBs and street pickers – be registered and have clear rights and obligations. The informal collectors interviewed were positive about such a requirement, because it would increase their status, give them some protection and allow them to collect more quantities with more efficiency (On Demand).

The planning team in coordination with the TGWs is setting up three steps for registration:

1- ***Registration of the vehicles for transporting goods***: the registration of vehicles as "transport vehicles" is a separate registration from vehicle licensing and is basic legalisation of the vehicle and the activity.
2- ***Registration as a recycling service provider at the UoMJK:*** WMTU will have the responsibility of selecting and registering the Informal Recycler and his vehicles to be allowed to collect in a specific area of the UoMJK. Only recyclers who have registered vehicles will have access to the special waste "on demand" collection system. RRs will be in the contact list to be delivered to the users and will be supported with awareness and communication campaigns.
3- ***Formalisation and registration at the Chamber of Commerce and MOE.*** The third steps represent the official formalisation. The process foresees the involvement of the Chamber of Commerce of Tripoli, the Ministry of Commerce and Industry and the MoE, to advocate for the development of a special category in the Chamber of Commerce where all the entities operating in the waste management sector are registered. To enter the category, the company or entity will have to meet certain requirements, provide certain data, such as vehicle registration, and insurance for workers. Formalised Recyclers will be subject to monitoring both by the Chamber of Commerce itself and by the WMTU to which they refer. The role of the MOE will be to approve registration and support to the UoMs to monitor the FR (Formalised Recyclers)

The Master Plan give instruction to the WMTU on how to reach step one and step two (steps above), while step three need a strong coordination with the National Government. The Registration Process should be implemented and managed by the WMTU of the UoMJK

1. Binding and controlling informal operators through legal mechanisms of permitting, which imply mutual obligations. The RR should register the vehicle, show quantities collected to feed the databse and the WMTU should develop the "on demand" collection system, through the sharing of the contact list, and the awareness and communication campaign.
2. Structural integration mechanism: specifying, planning for, and in time requiring compliance with municipal and Union recycling targets and circular economy measures.

In order to guarantee the registration process, Table 26 shows which incentives, rights and obligations must be ensured by the WMTU to the RRS.

Table 27 – Incentives and obligations of the TU and Registered Recyclers

RRs	**UoMJK - WMTU**
Vehicle basic registration	Information/Communication system to connect IRs with waste producers and users
Respect labour and environment regulation	Supply training and refreshing courses for IRs to increase the value of materials and to reduce health and environment risks
Participate to coordination meeting, training and refreshing courses	Supply economic incentives for vehicle registration
Register their transactions and allow monitoring from the WMTU (only)	Monitor registered IRs, ensure that non-registered IRs are not collecting in the JK area.
Register their activity at the WMTU register	Establish an official register and update it and share it with the users

11 Financial Sustainability

11.1 Pricing disposal

According to the Ministry of the Environment and OMSAR, the cost for landfill disposal will be paid by the central government, with funds coming from national taxes. The plan therefore did not take into consideration the management of the disposal of residual waste. In general, total costs for disposal should take into account the following:

- Direct costs: means the management costs of the landfill site. Daily coverage of waste, data collection, weighing, inspections, leachate management.

- Indirect costs: costs which are not accounted in the daily operations but that affect the landfill facility before (construction, site selection) and after (end of life, requalification).

- ***Environmental costs:*** the category includes all those costs to avoid and minimize the environmental impact. It includes the costs for the construction of the landfill, the waterproofing layers, the drainage system for rainwater, leachate recovery and treatment and biogas collection system. These costs also include the costs for landscape management of the landfill and the cost to ensure the control over type and origin of waste reception and handling.
- ***Health costs:*** these costs include all measures aimed at minimizing contamination with resources directly or indirectly connected with the anthropic life of the region. In some cases, they are similar to environmental costs, such as the collection and treatment of leachate that must not contaminate sources whose use is domestic, or waters used in agriculture.
- ***Socio-economic costs*** related to the social and economic impact that the landfill causes in the immediate vicinity. The devaluation of the surrounding land should be considered as well as the costs to reduce the unpleasant odours.
- ***Costs for environmental and functional recovery:*** when the landfill has ended its life, after 20-30-40 years of activity, the land should be covered and monitored to guarantee that waste becomes inert. In addition, a cost for the reclamation and functional requalification of the land must be considered to give it back to the community. Within the cost for this operation, a cost and flexible time must be considered to decide with the community within a participatory process, the new function of the land.

Following the latest estimations average costs for disposal which allows paying direct and indirect costs should range between 40 and 60 USD/ton.

11.2 Activity-based budgeting and costing

Following the baseline data collection, it was shown that municipalities calculate their expenses for Solid Waste Management based on resources, which makes it difficult to estimate the costs for the SW activities. The master plan, in order to allow the WMTU to carry out the correct monitoring and establish the correct

tariff to cover the costs of the service, has prepared a budget based on activities. Each component of the service is analysed, and the costs assessed as a single service, see the spreadsheets in Annex 7. The Planning team recommend the WMTU to keep and update the spreadsheets to monitor the SWM service efficiency and effectiveness.

11.3 Full cost recovery

The plan proposes the implementation of a cost recovery system based on the costs of the service that, other than the physical component of the system, includes the costs to maintain the WMTU, for awareness and communication, monitoring, the Mobile App and the PFM. In addition, the costs also include the initial cost for the source separation collection systems. According to the estimations (see annex 7), the cost per household is estimated at approximately 6 to 8 US$/month. The plan plans to differentiate these costs so that they are as balanced as much as possible, respecting both consumption and the economic condition of each HH. The plan also aims to respect the fact that many houses are inhabited only at certain times of the year.
Therefore, the project team plans to measure the tariff by applying a percentage on electricity consumption. Data about electricity consumption can be obtained with a special request to the companies contracted by the EDL to collect the electricity bill[14] or directly from the HHs. The action plan and the feasibility study to be carried out with the bylaw will allow the WMTU to collect the tariff. The tariff will be calculated assigning a percentage of the average electricity bill, resulting in, on average, a total income corresponding in around 6 to 8 US$/month.
The plan foresees that for the first 5 years the percentage of payers will be increasing progressively starting from around 40%, which will not be sufficient to pay the entire service and therefore the UoMJK will have to fill the gap using the IMF. The Lebanese Government is setting up a regulation for the cost recovery, and the Master Plan will follow the law, however the cost recovery system in the UoMJK should start before and be flexible to change based on the National Government directions.
The Plan calls to reach 80% of the payers by 2035.
The tariff will be applied both to HHs and to commercial activities as well as to the agro-industry. It should however be considered that the cost of the final disposal of residual waste will not be included in the tariff as it is paid by the central government. Figure 34 illustrates the division of the tariff according to the different users.

[14] *In Akkar region the company is called BUS (Butec Utility Services)*

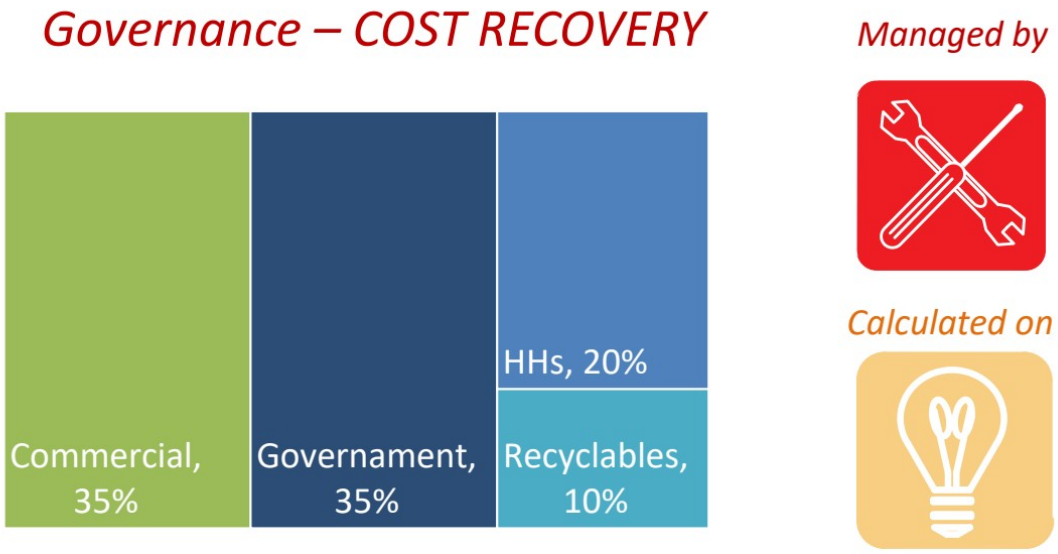


Figure 34 – Cost recovery system for different users

Concerning the commercial activities, the tariff will always be set up according to the electricity consumption but using a higher percentage (it must represent about 35% of the total cost) compared to the household rate as the shops produce a more waste. Finally, the tariff provides that 10% of the cost is recovered through separate collection and value chain. This objective can only be achieved by activating all the activities foreseen in the Master Plan and in 2035 with all the targets achieved.

Until 2035 the "pay as you through" system where users pay based on their real production of waste will not be applied, the Master Plan suggest giving incentives to commercial of HHs that are recycling and respecting the collection system. Or to give discount or money to the HHs that bring waste to the GCC. The assumption of the payments is estimated considering 100% users paying the fee. In the financial analysis percentages are different due to different estimation in the efficiency of the users paying the fee.

11.4 Extended Producer Responsibility

EPR schemes aim to make producers responsible for the environmental impacts of their products throughout the product's value chain, from design to the waste phase. EPR policy seeks to shift the burden of managing certain wastes from municipalities and taxpayers to producers, in line with the "producer pays principle" of the Lebanese Law no. 80. The EPR to be activated need a National Framework, which regulate also the role and responsibilities of the UoMs and Local Authorities. Once the National government will have prepared the framework the Plan should be ready to establish an EPR system. The Master Plan calls for the EPR on the following products:

- **Batteries**
- **Cooking, Frying and Mineral Oils**
- **EEE, Electrical, and Electronic Equipment**
- **Furnitures**

- Packaging

- Tires

- Vehicles

- C & D waste

- APW

In addition to the above listed material that need an EPR system, the plan suggests to include APW (Agriculture Plastic Waste) which are plastic films, irrigation pipes, mulching films, plastic bags from fertilisers or pesticides. In this case the EPR should be regulated by a private or public body which will coordinate activities between users (farmers), distributors and collectors and APW recyclers and producers. Some of the APW such as plastic bags from pesticides need to be separated and they should follow a different collection system because are considered hazardous waste.

The EPR systems if activated and enforced in the UoMJK will contribute to the cost recovery system. The collection of the aforementioned materials will in fact be partly or totally paid by the EPR system, thus relieving the user of part of the costs of waste management. In Figure 35Figure 35 the summary of the EPR as should be applied by the Lebanese Government.

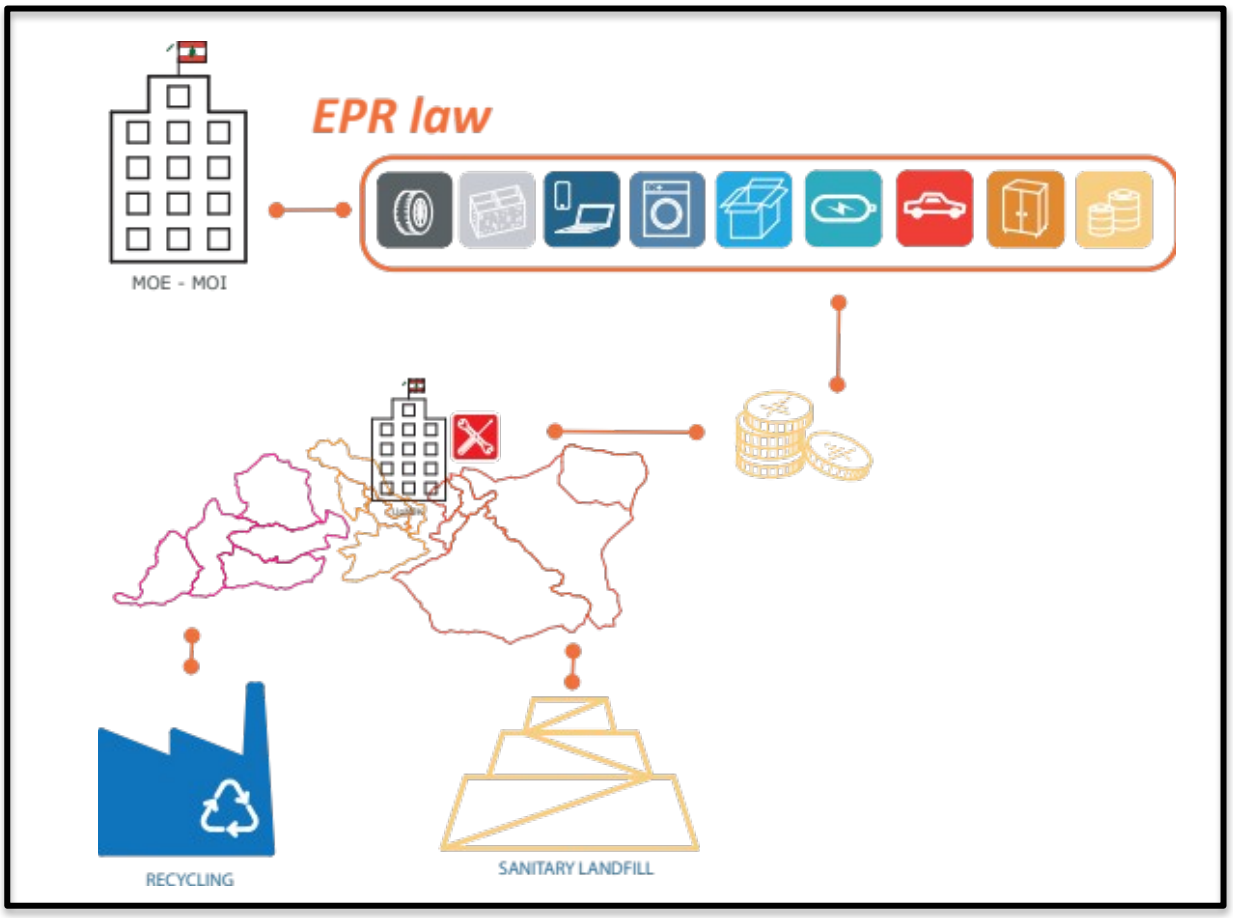


Figure 35 – EPR scheme, distribution of responsibilities between National and Regional institutions

Deposit refund systems

Alternatively, to EPR and for materials to be decided and discussed with the WMTU and the TWGs of the Environmental Committee during the Action Plan, a Deposit-Refund Systems (DRS) can be also applied. The DRS seek to ensure that valuable materials (e.g., glass containers or Aluminium cans) are not disposed of, but rather recovered and recycled or treated appropriately. In addition, an oft-cited aim of deposits for one-way beverage containers is to avoid littering and promote the use of recyclable packaging materials. Deposit Refund Systems do not create revenues for the state, but neither do they involve major administrative efforts other than sporadic controls. In general, they have been very effective in increasing the collection and recycling rates of the product in question, securing higher rates than other producer led collection systems, for example, for packaging materials. The social effects of such schemes are generally not negative, as they do not involve noticeable additional costs for consumers and, in some cases, they can support income opportunities for informal workers collecting discarded products to recover the deposit.

Deposit Refund Systems can be introduced voluntarily by producers or as an obligation by national authorities. Producers are obliged to charge a deposit to retail companies, which are then obliged to pass the

deposit on to the consumer. Retailers pay the refund to consumers when they bring back the product or the packaging waste, and they reclaim the refund from the producers (or another coordinating body). The Master Plan for advocate the National Government to design a system, which will be applied as a pilot in the UoMJK.

11.5 Fundraising

The master plan envisages that UoMJK and in particular WMTU look for external, national and international funds. The possibility of having access to external funds, allows the WMTU to carry out experiments and pilot projects to improve the service and modernize it as the Plan is implemented. Having the possibility to carry out pilot projects makes it possible to improve the response to users' needs and have greater efficiency in interventions.

11.6 Financial Analysis

A preliminary financial analysis was conducted through an excel spreadsheet (available in Annex 7) where different parameters (which is possible to select through a scroll down option cell) are inserted allowing UOMJK to evaluate different options of the SWM system and therefore have an idea of the relative costs.
The spreadsheets have been prepared in coordination with OMSAR consultants to be in line with their SWAM program. A summary of the results is shown in Table 28. The analysis was conducted at the year 2021 considering the targets to be achieved so that it is possible to compare the results. The system allows to estimate the costs in the following years up to 2035. The costs are inclusive of:

- WMTU
- Awareness (added in other costs)
- New facilities
- Upgrade of existing MBTs

The analysis considers that the UoMJK do not pays for the gate fee, since until now it is covered by the Lebanese National Government.
The table represents the total costs of the SWM service including the reduction for disposal of residual waste due to source separation. The analysis shows that with the source separation, including the income and the costs for depreciation the total costs for waste management can be considerably reduced in particular thanks to the plastic collection and the organic. More details are available in the spreadsheet in annex 7. It is relevant to highlight that the costs to establish the source separation increase the total costs for the SWM system, but with the possibility to sell recyclables and in particular by selling a product (plastic pipes) and not second raw material, the total costs for the service can be reduced. The organic collection it is the most demanding in term of costs, however the analysis considers a high-quality production of compost that can be sold at 200 USD/tonne (see spreadsheets). The composting final product it is crucial in the benefit of the OFMSW source separation, if the compost will not be sold or sold at less than 100 USD/tonne the source separation will be efficient and will increase the total costs of the SWM system.

Table 28 – Summary of SWM total costs adding source separation

US$/y in 2021	*Status quo*	Residual waste no recycling plus sweeping	Residual+Sweeping+ Cardboard and Paper	Residual + Sweeping+Cardboard and Paper + Plastics	Residual+Sweeping+ Cardboard and Paper+ Plastic+Organic
Investment	-	2 246 388	2 684 201	3 933 002	4 916 512
Depreciation	-	253 890	312 868	597 469	759 304
Salaries	-	510 610	448 060	472 370	507 470
Maintenance		187 892	201 742	281 435	342 325
Consumption		98 726	114 353	352 204	387 498
TS fee		185 610	166 010	144 572	96 907
Other costs		38 472	66 411	96 039	125 083
Overhead		19 003	18 681	26 136	26 966
Contingencies	-	96 914	95 273	133 291	147 727
Total without depreciation	726 867*	1 137 227	1 110 530	1 506 046	1 635 975
Income	-	-	138 151	679 604	817 754
Grand total		1 319 948	1 285 247	1 285 760	1 004 185
Cost per tonne	44	93	60	79	55

11.7 Scenario with UoMs pays the gate fee and financial costs projection

The costs for waste management have been compared using two scenarios, see Table 29.

Scenario 1: it includes all the activities and measures suggested in the present master plan, activated and giving the expected results. That means, all the source separation systems, cardboard, plastic and organic, and all the activities related to the waste hierarchy compliance, such as waste reduction, awareness for littering and the Green Collection Centre.

Scenario 2: called improved *status quo*, it considers that only the residual waste collection is active but improved in efficacy and efficiency, so that all waste is collected and disposed in at least a controlled dump. The analysis considers as well, the costs as if the UoMJK will be responsible of the final disposal.

The results of the two scenarios are summarised in

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The biggest investment is the collection and treatment of the OFMSW, however if the compost quality has been respected and the market will start to increase the demand, it contribute to reduce the costs for the entire SWM service.. More details and more potential scenarios are available in Annex 7 of the present document in a workable spreadsheet. The investment it is estimated as if there is not a SWM system at all, so

that it might include items or equipment that is already existing in the area and therefore should be excluded from the total investment required.

The main findings of the results are the following:

- The source separation will be reducing the total costs for the service, but it will increase the investment
- The biggest investment is the collection and treatment of the OFMSW, however if the compost quality has been respected and the market will start to increase the demand, it contribute to reduce the costs for the entire SWM service.
- If only the Residual waste collection will be kept by the UoMJK the costs will increase with the estimated increase of the population, while applying the Master Plan indications the SWM system will decrease the costs.
- Due economy of scale, the SWM system will reduce the costs reaching in 2035 a cost of 462 000 USD, which a reduction of the total costs of more than 50 %.

Table 29 – Costs for scenarios including final disposal up to 2035

years		2019	2021	2023	2025	2030	2035
Residual waste to be collected op 1		$ 8.564	$ 9.691	$ 10.177	$ 10.781	$ 12.186	$ 13.894
Residual waste to be collected op 2		$ 16.794	$ 18.561	$ 19.493	$ 20.650	$ 23.341	$ 26.611
Estimation rate for reduction due to MBT (sorting and stabilisation)	50%						
costs per tonne USD*	50						
costs for option 1 source separation and reduciton		$ 1.058.841	$ 1.004.185	$ 940.346	$ 868.522	$ 685.046	$462.199
costs for treatment & disposal including depreciation option 1		$ 214.101	$ 242.267	$ 254.432	$ 269.534	$ 304.658	$ 347.340
Total		**$ 1.272.942**	**$ 1.246.452**	**$ 1.194.779**	**$ 1.138.056**	**$ 989.705**	**$ 809.539**
costs per tonne							
costs for option 2 residual waste collection		$ 1.311.818	$ 1.319.948	$ 1.378.504	$ 1.386.565	$ 1.395.856	$ 1.456.551
costs for treatment & disposal including depreciation option 2		$ 419.850	$ 464.025	$ 487.325	$ 516.250	$ 583.525	$ 665.275
Total		**$ 1.731.668**	**$ 1.783.973**	**$ 1.865.829**	**$ 1.902.815**	**$ 1.979.381**	**$ 2.121.826**

11.8 Criteria for cost recovery

The cost recovery system has been calculated considering that the main costs will be paid by a service fee which include households and commercial. In Table 30 is presented the summary of the estimations done to assess the funding that will come from the cost recovery system and the funds that still need to be requested to the MOIM with the IMF tool.

The table shows the comparison of the options with different source separation systems compared with the percentages of users paying the fee.

In annex 7 are available all the working tables generating the below table, the WMTU should use the spreadsheet in Annex 7 to estimate different options and start implementing the one that suit more with the context and the economic and political condition of the Union. The modelling has been done using the average fee of:

- 8 US$ per household per month
- 70 US$ per commercial, agricultural and industrial activities per month (the estimation was done only for registered commercial activities)

The spreadsheet consider other different combination of the fee and it should be considered that the fee is an average.

The analysis has been done for the year 2021, but the results in percentages and the level in which the UoMJK will start covering the entire SWM system will be valid for the entire period of the planning horizon.

The estimation shows that the UoMJK will not need to request money anymore from IMF, to cover SWM, when they will reach around 60% of source separation of carboard and paper and when they will be able to collect the 40% of fee from households and 80% from businesses. It is evident that implementing the source separation of other material (plastic and organic) will lead to a reduction of the waste fee or will lead to increase the investments and the efficiency of the service.

Table 30 – cost recovery flow assuming different percentage of users paying

Average fee USD/month						
HHS	8					
Comm	70					
Direct costs recovery efficidency HHs		10%	20%	40%	60%	80%
Direct costs recovery efficidency commercial		40%	50%	80%	80%	80%
res+sw	HHS	$ 168.465	$ 336.931	$ 673.862	$ 1.010.793	$ 1.347.723
	Commercial	$ 313.152	$ 391.440	$ 626.304	$ 626.304	$ 626.304
	IMF	$ 838.331	$ 591.578	$ 19.783	$ -317.148	$ -654.079
res+ CP	HHS	$ 168.465	$ 336.931	$ 673.862	$ 1.010.793	$ 1.347.723
	Commercial	$ 313.152	$ 391.440	$ 626.304	$ 626.304	$ 626.304
	IMF	$ 803.630	$ 556.876	$ -14.918	$ -351.849	$ -688.780
res+CP+PL	HHS	$ 168.465	$ 336.931	$ 673.862	$ 1.010.793	$ 1.347.723
	Commercial	$ 313.152	$ 391.440	$ 626.304	$ 626.304	$ 626.304
	IMF	$ 804.143	$ 557.389	$ -14.406	$ -351.336	$ -688.267
	HHS	$ 168.465	$ 336.931	$ 673.862	$ 1.010.793	$ 1.347.723
	Commercial	$ 313.152	$ 391.440	$ 626.304	$ 626.304	$ 626.304
	IMF	$ 522.567	$ 275.814	$ -295.981	$ -632.912	$ -969.843

12 Mobile Application

The Master Plan calls for the implementation of a Mobile Application that brings together different functions. The option was selected during the TWG. The stakeholders jointly considered appropriate to create a dedicated application. Initially and especially for communication and awareness raising, the Plan also includes the use of a social network like Facebook. The implementation of the mobile application is planned in different phases following the implementation of the waste source separation systems, the Green Collection Centre and the other special waste collections.
The planned functions will support all aspects of the new waste management system including the awareness and communication and the PFM. The proposed functions are the following:

- ***Waste Where:*** this function provides a search space that gives information to the users about the composition of a specific waste and where it should be dumped or how it is collected, treated or disposed.

- ***Financial status:*** in this area users have access to the system costs, to the revenues from the value chain system. Registered user will have the possibility to have access to their SWM bill and tariff.

- Collection "on demand": this section gives information to the user on where to throw special waste such as WEEE, bulky, old furniture or used oils. The page will show the telephone numbers or contacts of all the Registered Recyclers, to allows the users to call them and set up an appointment to collect special waste from their homes.

- ***Waste and environment***: in this section users have the possibility to monitor the state of art of the Solid Waste Management system. The user can get information about the Solid Waste Treatment facilities, their location, the visiting hours and the contacts of the facility responsible or the customers service. Registered users, through this section, have access to the waste database managed by WMTU.

- ***Awareness and communication:*** here will be listed all events, workshop or committee meeting and the awareness campaign activities in which users are invited to participate, will be possible to download the brochure related to the awareness campaigns that UOMJK has created or is carrying out.

- ***PFM (Public Feedback Mechanism)***: in this section the public feedback mechanism will be developed, here complaints will appear, users will have access to photo of the problems and how the WMTU have solved them. The WMTU will have the obligation to answer the question or to solve the problem. The problems will remain posted in the function wall with a sign that will show if they have been solved or not yet and how. The system will be managed by the WMTU.
In Figure 36 the main functions are summarised.

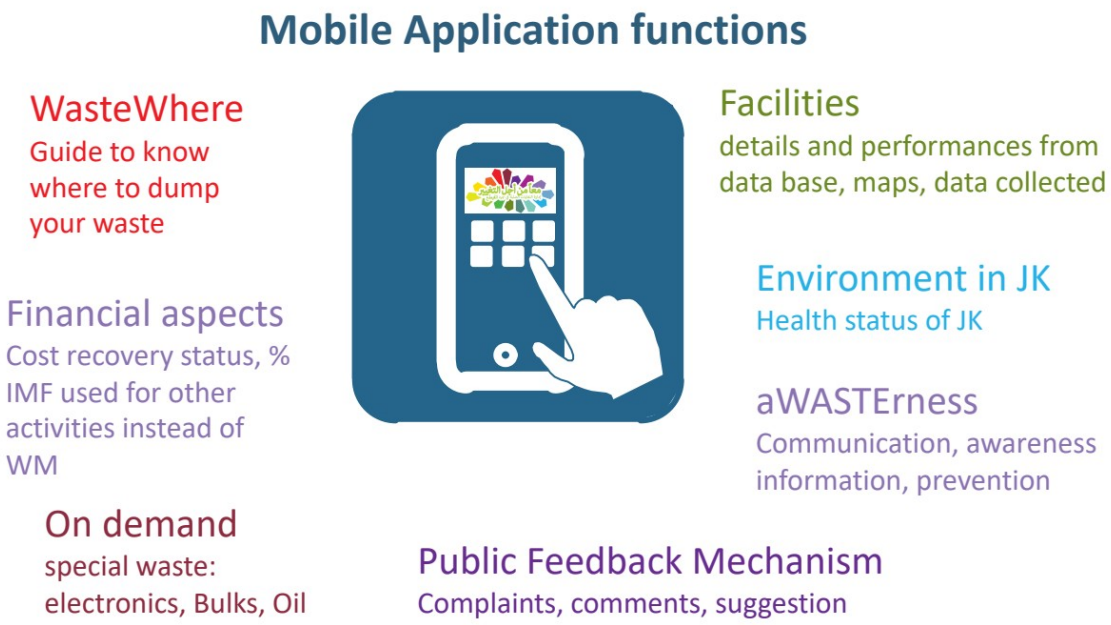


Figure 36 – Main functions of the mobile application

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14 Annexes

14.1 Annex 1 - Definitions

Term	Other terms or abbreviations used, or other things this term can refer to	Working definition
Avoided cost of disposal	Diversion credit	The amount that would have been paid per kilo for disposing of materials in a controlled or sanitary landfill and paying the official tipping fee.
Beneficiation	Processing, pre-processing, upgrading	Preparation of recovered materials for transport, marketing and recycling.
Biogas	Methane	Typically refers to a gas produced by the biological breakdown or digestion of organic matter in the absence of oxygen. Biogas originates from biogenic material and is a type of biofuel.
Bio-solid	Human excreta, wastewater treatment facility solids, animal wastes, agricultural wastes	Plant and animal wastes that have value as a soil amendment with fertilizer value that can be used as an input to agriculture, horticulture and silviculture.[1]
Broker	Stockist, dealer, trader, exporter	A trader in one or more types or grades of recyclables who trades without ever being the physical owner of the materials, usually having no storage place.
Capital cost	Investment cost, capital, purchase cost	The amount that it costs to purchase new equipment, facilities, space, buildings, etc.
Capture rate	Separation rate	A percentage relationship between the amount of recoverable materials that are directed to processes of recycling or composting and the total amount collected.
CBO	Community-based organization, grassroots organization	A private group organized to provide a waste collection, recycling, composting, community clean-up, environmental management, or solid waste function or service in a community, often fully or partially staffed by volunteers.
Certified emission reduction (CER)	Carbon credit, issued carbon credit	Climate credits (or carbon credits) issued by the Clean Development Mechanism (CDM) Executive Board for emission reductions achieved by CDM projects and verified by a third party or designated operational entity (DOE) under the rules of the Kyoto Protocol.
Clean Development Mechanism (CDM)	Kyoto project financing	An international institutional mechanism that allows industrialized countries that have targets under the Kyoto Protocol to invest in emission reductions in non-Kyoto countries and count those reductions towards their own legal commitments. A CDM project is issued with certified emission reductions, which may then be traded.
Commercial waste	Business waste, shop waste, small-quantity generator waste	Waste that comes from shops, services and other generators that are neither residential nor industrial. Sometimes includes institutional or public-sector waste.
Commingled materials	Mixed, multi-material, co-collected material, combined	Specific mixing of recoverable materials for the purposes of efficient collection. The combination is designed for streams, single-stream collection post-collection separating or sorting. Commingled materials do not include mixed waste.
Communal container	Container, skip, dumpster, box	A vessel to contain waste, usually larger than 1m^3 and used for more than one household.

Community	Barrio, Barangay, district, neighbourhood, ward	A physical or social subdivision of or within a city, it may be as small as a group of neighbours or as large as a formal sub-municipal division that may or may not have its own governance functions.
Composition	Characterization, make-up of waste, physical or chemical nature	Quantitative description of the materials that are found within a particular waste stream in the form of a list of materials and their absolute quantities per day or per year, or as a percentage of total materials.
Composting	Organic waste management, aerobic decomposition	The decomposition of materials from living organisms under controlled conditions and in the presence of oxygen.
Construction and demolition waste	Debris, C&D, rubble, contractor waste	Waste from the process of construction, demolition or repair of houses, commercial buildings, roads, bridges, etc. Generally divided into commercial construction waste from construction companies and do-it-yourself (DIY) waste from homeowners making their own repairs.
Controlled waste disposal	Controlled dumpsite, upgraded dumpsite	An engineered method of disposing of solid wastes on land, in which, at a minimum, there is perimeter fencing, site gate control and the waste is covered every day. Some form of reporting is usual, often in the form of a weighbridge (scale house), and some form of tipping fee is usually charged. A controlled waste disposal site differs from a sanitary landfill in that it is not sealed from below and does not have a leachate collection system.
Co-operative	Co-op, buyers' association, sellers' association, MSE, CBO	An enterprise organized as a co-operative with multiple owners who participate in activities. In some Latin American countries, co-operatives have a special tax status and so are a favoured form for establishing a business.
Coverage	Percentage service availability	The percentage of the total (household and commercial) waste-generating points (households or businesses) that have regular waste collection or removal.
Disposal – illegal	Dumping, wild dumping, littering	Disposal of waste at a site different from one officially designated by the municipal authorities, especially where it is specifically prohibited. May also refer to disposal at the wrong time or in the wrong quantities, even if all other aspects are correct.
Disposal – legal		Disposal of waste at a site designated by the municipal authorities.
Diversion	Recovery, avoided disposal	The process or result of keeping materials out of a disposal facility.
Dumpsite	Dump, open dump, uncontrolled waste disposal site	A designated or undesignated site where any kinds of wastes are deposited on land, or burned or buried without supervision and without precautions regarding human health or the environment.
Dump-picker	Scavenger, waste-picker	Woman, man, child or family who extracts recyclable materials from disposal sites.
Effectiveness	Reach, performance	The extent to which the solid waste or recycling system meets its goals and does what it claims to do; the cleanliness of the city.
Efficiency	Collection efficiency	One or more measures of the performance of the collection system, usually expressed as households/vehicles per day, or tonnes per litre of fuel used, or distance travelled per litre of fuel.
Ferrous metals	Iron, steel, magnetic metals	Metals which contain iron, and which react to a magnet and are subject to rusting.
Formal sector	Official, government, municipal	Encompasses all activities whose income is reported to the government and that are included within a country's gross national product; such activities are normally taxed and follow requisite rules and regulations with regards to monitoring and reporting.
Formal waste sector	Solid waste system, solid waste authorities, government, materials recovery facility	Solid waste management activities planned, sponsored, financed, carried out or regulated and/or recognized by the formal local authorities or their agents, usually through contracts, licenses or concessions.
Full-cost accounting (FCA)	Total cost analysis, true cost accounting	A systematic approach for identifying, summing and reporting the actual costs of solid waste management. It takes into account past and future outlays, overhead (oversight and support services) costs, and operating costs. FCA attempts to

		quantify environmental and social external costs.
Generator	Waste producer, household, business, user	The source of the waste (i.e. the first point at which it is discarded as a useful object and is redefined by its owner as waste).
Hazardous wastes	Toxic wastes	A material that poses substantial or potential threats to public health or the environment and generally exhibits one or more of these characteristics: • ignitable (i.e. flammable); • oxidant; • corrosive; • radioactive; • explosive; • toxic; • carcinogenic; • disease vector.
High-income countries	OECD countries, developed countries, the North	North Countries with a gross national income per capita of US$11,905 or higher or which are located in Europe, America or Oceania.
Household container	Set-out container, garbage can, waste can, waste bin, dustbin, bin	The vessel or basket used by a household or commercial generator to store and set out the waste materials, commonly made of metal, plastic, rubber or wood.
Household waste	Municipal solid waste, domestic waste, MSW, non-dangerous waste	Discarded materials from households that are generated in the normal process of living and dying.
Incineration	Burning, combustion	Controlled process by which solid, liquid or gaseous combustible wastes are burned and changed into gases.
Informal sector	Waste-pickers, rag-pickers, scavengers, junk shops, street vendors, bicycle taxis, etc.	Individuals or businesses whose economic activities are not accounted in a country's gross national product (GNP);such activities are not taxed; exchange of goods or services is on a cash basis; and the activities are not monitored by the government and often the activities operate in violation of, or in competition with, formal authorities.
Informal waste sector	Waste-pickers, scavengers, junk shops	Individuals or enterprises who are involved in waste activities but are not sponsored, financed, recognized or allowed by the formal solid waste authorities, or who operate in violation of, or in competition with, formal authorities.
Integrated sustainable waste management (ISWM)		ISWM is a systems approach to waste management that recognizes three important dimensions of waste management: (1) stakeholders; (2) waste system elements; and (3) sustainability aspects.
Itinerant waste buyer (IWB), itinerant waste collector (IWC)	IWC, IWB, house-to-house collector	Woman, man, child, family or enterprise who purchases or barters source-separated waste materials from households, shops or institutions, usually focusing on one specific material or type of materials. In the case of an IWC, there is no payment for the goods.
Joint implementation	Kyoto project financing	The CDM allows industrialized countries that have targets under the Kyoto Protocol to make emission reductions with Annex 1 Kyoto countries and count those reductions towards their own legal commitments. A JI project is issued with emission reduction units, which may then be traded.
Junk shop	Dealer, MSE recycler, trader	A business that buys, packs and trades recyclable materials, usually with limited or no upgrading.
Landfill	Engineered landfill, engineered waste disposal facility, controlled disposal facility	'An engineered method of disposing of solid wastes on land, in which, at a minimum, there is perimeter fencing, gate control and the waste is covered every day. Some form of reporting is usual, often in the form of a weighbridge (scale house), and some form of tipping fee is usually charged. A landfill differs from a sanitary landfill in that it is not necessarily sealed from below and does not necessarily have a leachate collection system.'

Materials recovery facility (MRF)	Intermediate processing centre, (IPC), intermediate processing facility (IPF), recycling processing centre	An industrial facility of moderate scale that is designed for post-collection sorting, processing and packing of recyclable and compostable materials. It is usually of moderate technical complexity with a combination of automated and hand sorting. The inputs are usually commingled or mixed recyclables and not mixed waste. The outputs are industrial grade materials, usually crushed or baled and separated by type, colour, etc.
Micro- and small enterprise (MSE)	Micro-enterprise, junk shop, small recycler	The smallest businesses, smaller than SMEs, usually having less than ten workers
Middle-income countries	Medium-income countries, emerging economies	Countries with a gross national income per capita from US$976 to $11,905.
Municipal solid waste (MSW)	Household waste, domestic waste	Wastes generated by households, and wastes of a similar nature generated by commercial and industrial premises, by institutions such as schools, hospitals care homes and prisons, and from public spaces, such as streets, bus stops, parks and gardens.
Municipality	Local government, local authority, mayor's house, city hall, city council, mayoralty, city, town, village	A unit of local government with its own level of governance, responsibility and representation, combining elected and appointed officials.
Operating and maintenance (O&M) cost	Operating and maintenance cost, operating cost	Costs associated with ongoing operations, such as energy, supplies, labour, rents, etc.
Organisation for Economic Co-operation and Development (OECD)		The OECD is an international organization of 30 countries that accept the principles of representative democracy and free-market economy. Most OECD members are high-income economies with a high Human Development Index and are regarded as developed countries.
Opportunity cost		The imputed or estimated loss associated with making a choice for option a and not choosing option b.
Organic waste	Bio-waste, green waste, wet waste, organics, food waste, putrescible, compostable	The decomposable fraction of domestic and commercial wastes, including kitchen and garden wastes and, sometimes, animal products.
Organized reuse	Repair, reuse, product recycling	A commercial or livelihood activity focused on extraction, repair and sale of specific items in the waste stream. An example is the recovery of up to 20 different types of glass bottles in the Philippines.
Pre-processing	Sorting, screening, sieving, compaction, densification, size reduction, washing, drying	Preparing recoverable materials from the waste stream to be used for subsequent processing without adding significant value to them.
Primary collection	Pre-collection, house-to-house collection	Organized collection of domestic waste from households, taken to a small transfer station or transferred to a truck or container.
Processing	Beneficiation, upgrading	Manual or mechanical operations to preserve or reintroduce value-added into materials. Usually involves densification, size reduction, sorting, and packaging or transport.
Recovery rate	Rate of recycling, percentage recycled, diversion rate	A percentage relationship between the amount of recoverable materials that reach recycling, composting or energy recovery and the total amount generated.
Recyclables	Recoverable, materials to be valorised	Materials contained in municipal solid waste which have an intrinsic value to the industrial value chain as represented by a price.
Recycler	Scavenger, waste-picker, MRF, junk shop	Entrepreneur involved in recycling.
Recycling	Valorisation, materials recovery	Extraction, processing and transformation of waste materials and their transfer to the industrial value chain, where they are used for new manufacturing. In some definitions, recycling is only considered to have occurred when materials have

		been sold.
Recycling or composting market	End-user industry, buyer, dealer, broker	Business, individual, organization or enterprise who is prepared to accept and pay for materials recovered from the waste stream on a regular or structural basis, even when there is no payment made.
Residual waste	Rest-waste, rest-fraction, residue, rejects	The discarded materials remaining in the waste stream or on the sorting line because they are not recyclable or compostable since they are perceived to have little or no monetary value.
Resource recovery	Energy recovery, materials recovery	Process of extracting economically usable materials or energy from wastes. May involve recycling. In English-speaking countries, the term is usually restricted to recovery of energy.
Reuse	Second-hand use	Use of waste materials or discarded products in the same form without significant transformation; may include a system developed to repair/refurbish items.
Sample	Sub-set	A representative part of a whole that allows conclusions to be made about the whole by investigating only a small part.
Sanitary landfill	Landfill, state-of-the-art landfill	An engineered method of disposing solid wastes on land in a manner that protects human health and the environment. The waste is compacted and covered every day. The landfill is sealed from below and leachate and gas are collected, and there is a gate control and a weighbridge.
Sanitation	Wastewater management, urban environment, urban cleansing	In the 'French sense', used to refer to urban environmental activities, including wastewater and solid waste management.
Secondary collection	Transfer, small transfer station	The movement of wastes collected from households from their first dumping point to processing, larger-scale transfer or final disposal.
Separate collection	Segregated collection, collection of recyclables, organics	Collection of specific types of materials at a designated time, in a different container or vehicle, or in another way in collection, selective collection order to maintain the separation potential and maximize the recovery.
Shadow price	Proxy price, hedonic price, contingent valuation	A reasonable estimate for the value of something based on extrapolating the price for something similar.
Single stream	Unsorted material, commingled, blue bag	System in which some combination of all recyclable materials (e.g. paper fibres and containers) are mixed together in a collection truck, instead of being sorted into separate commodities (newspaper, cardboard, plastic, glass, etc.) by the user and handled separately throughout the collection process. In a single stream, both the collection and processing systems must be designed to handle this fully commingled mixture of recyclables.
Small and medium-sized enterprise (SME)	Small- and medium-sized business, small business	Businesses usually having between 11 and 50 employees or workers.
Solid waste	Garbage, trash, waste, rubbish	Materials that are discarded or rejected when their owner considers them to be spent, useless, worthless or in excess.
Sorting	Classification, high-grading, selection	Separating mixed materials into single-material components, mechanically or manually, either at the source or after the collection process. In some cases, classifying a mixed single-material stream into specific grades or types of that material.
Source	Generator, origin, waste service user	The point at which a material is defined as waste and discarded, usually either a house or a business.
Source separation	Separation at source, segregation at source	Actions taken to keep and store certain materials separately from commingled (mixed) waste at the point of generation.
Stakeholder	Interested party, constituent, concerned citizen, affected party	Individual or institution (public and private) interested and involved in related processes and activities associated with a modernization process, plan, project

		goal or desired change.
Street cleaner	Street sweeper	Formal or semi-formal worker assigned by the city authority to remove litter from streets that cannot be attributed to any specific waste generator.
Street-picker	Street scavenger, waste-picker	Woman, man, child or family who removes recyclable materials from communal containers, streets and public places.
Tipping fee	Gate fee, disposal fee	The amount that is charged for disposing of waste at a facility, usually per tonne, per cubic metre or per vehicle.
Transfer	Transit, collection point, depot	The movement of wastes from their first point of discharge to final disposal; it usually includes some very basic processing: compaction, pre-sorting or size reduction.
Transfer station	Transit point	A place where waste from collection vehicles is aggregated and organized before being transported to disposal sites or treatment facilities.
Treatment	Decontamination, processing, incineration, anaerobic digestion, biogas production, pyrolysis, composting	Labour-based or mechanical methods to reduce the risk of exposure or to reduce the impacts upon the environment of toxic or hazardous materials associated with the waste stream; in some cases, can concurrently capture and increase the economic value of specific waste stream components' value-added.
Valorisation	Recycling, recovery, conserving economic value	The entire process of extracting, storing, collecting, or processing materials from the waste stream in order to extract and divert value and direct the material to a value-added stream.
Waste dealer	Junk shop owner, scrap trader, consolidator	Individual or business purchasing quantified (weighed or measured) materials for recycling or composting, storing them, upgrading or processing them, and then reselling them into the recycling value chain. A dealer usually has their own premises and some form of dedicated storage place.
Waste generator	Households, institutions, commercial establishments, industries	The agent or point via which a purchased, collected or grown product is discarded.
Waste-picker	Scavenger, rag-picker	Person or family who salvages recyclable materials from streets, public places or disposal sites.
Waste prevention	Waste avoidance, waste minimization, pre-cycling	Strategies or activities undertaken by individuals, businesses or institutions to reduce the volume and toxicity of material discarded.

14.2 Annex 2 - Baseline report

In a separate file

14.3 Annex 3 - IRS study

In a separate file

14.4 Annex 4 - LCA level 3

In a separate file

14.5 Annex 5 Waste Aware at the baseline

In two separate files, one pdf and one excel.

14.6 Annex 6 – Table showing a tentative schedule for the Monitoring Plan

No.	**Overall Service Provision**		*Recommended Frequency of Data Collection*
	Tonnage collected - weighed or estimated vehicle loads		Daily/weekly
		Residual waste	
		Organic waste	
		Plastic	
		Cardboard	
		Special	
	Population or number of households in area of UoMJK waste collection responsibility		Yearly
	Population or number of households actually collected from		Yearly
	Frequency of collection services by type, domestic, commercial, clinical etc.		Yearly
		Residual waste	
		Organic waste	
		Plastic	
		Cardboard	
		Special	
	Number of vehicles in municipality fleet by type, size, age, make, registration number		Monthly
	Name of person responsible for solid waste collection service		Yearly
	Management structure and numbers of persons involved in collection service designated: collection: administration; maintenance		Yearly
	Number of complaints received from public; nature of complaint and action taken	Using the Mobile Application system	Weekly
		Number of complaints solved	
RRs			
	Number of RR registered		Yearly
	Quantities collected per material (bulk, WEEE etc..		weekly
Operational Information			
	Number of collection vehicles operating and total vehicle hours worked		Weekly
	Number of persons operating collection service designated: collection administration; maintenance		Weekly

	Vehicle operational records by weekly driver worksheet:		Weekly
		identification of vehicle and driver	
		vehicle hours working	
		vehicle mileage covered	
		vehicle fuel used	
		number of vehicle trips to disposal sites	
		number of operating personnel in vehicle crew	
	Vehicle operating costs by maintenance log for each vehicle		Weekly
		identification of vehicle	
		fuel and oil	
		tires	
		routine servicing	
		maintenance and repairs, recording description, cost and time to complete: engine and transmission and brakes, hydraulic systems chassis and suspension, body work and glass, other	
	Financial Information		
	Residual waste collection		
	Vehicle operating costs by vehicle and by fleet		Monthly
	Labour costs; payroll plus overheads, consumables etc		
	All other solid waste collection departmental costs		
	Total costs presented as full cost of the collection operation		
		per ton of waste collected	
		per person/household served	
		per number of persons employed in solid waste collection	
	Plastic waste collection		
	Vehicle operating costs by vehicle and by fleet		Monthly
	Labour costs; payroll plus overheads, consumables etc		
	All other solid waste collection departmental costs		
	Total costs presented as full cost of the collection operation		

		per ton of waste collected	
		per person/household served	
		per number of persons employed in solid waste collection	
	Production of items to be sold (pipes, bags)		
	Organic waste collection		
	Vehicle operating costs by vehicle and by fleet		Monthly
	Labour costs; payroll plus overheads, consumables etc		
	All other solid waste collection departmental costs		
	Total costs presented as full cost of the collection operation		
		per ton of waste collected	
		per person/household served	
		per number of persons employed in solid waste collection	
	Seasonal schedule to collect agricultural waste		Twice/year
	Cardboard waste collection		
	Vehicle operating costs by vehicle and by fleet		Monthly
	Labour costs; payroll plus overheads, consumables etc		
	All other solid waste collection departmental costs		
	Total costs presented as full cost of the collection operation		
		per ton of waste collected	
		per person/household served	
		per number of persons employed in solid waste collection	
	Street Sweeping		
	Vehicle operating costs by vehicle and by fleet		Monthly
	Labour costs; payroll plus overheads, consumables etc		
	All other solid waste collection departmental costs		
	Total costs presented as full cost of the collection operation		
		per ton of waste collected	
		per person/household served	
		per number of persons employed in solid waste collection	
	Special waste collection		
	Vehicle operating costs by vehicle and by fleet		Monthly
	Labour costs; payroll plus overheads,		

	consumables etc		
	All other solid waste collection departmental costs		
	Total costs presented as full cost of the collection operation		
		per ton of waste collected	
		per person/household served	
		per number of persons employed in solid waste collection	
Income	Revenues collected from the tariff		Twice/Year
	Income from IMF		Yearly
	Revenues collected from commercial and industrial waste producers		Twice /year
		as a total sum	
		as a revenue per ton collected	

14.7 Annex 7 – Spreadsheets and waste flow

In a separate excel file as a working document, should be utilised by the WMTU to estimate costs and need to be updated during MP implementation.

14.8 Annex 8 – Feasibility study of the Plastic manufacturing facility in Mishmish

In a separate file

14.9 Annex 9 – Participatory methodology PDF (baseline methodology) and PPT workplan),

The annex include the list of participatory workshops held during the planning process. Working document to be utilised by the WMTU and updated during MP implementation

14.10 Annex 10 – Summary of the master plan – Factsheets – presentation for validation

In a separate file ppt.

14.11 Annex 11 – Circular 7/1

about national principles for waste source separation, in a separate file

14.12 Annex 12 – Results from MP validation workshop and UoMJK approval

The annex contains as well the approval from the Union of Jurd El Kaitee Municipality council