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7TH INTERNATIONAL CONFERENCE ON SUSTAINABLE SOLID WASTE MANAGEMENT




Establishment of Strategic Management Plan and Awareness & Change Management Plans for the Solid Waste Management The Case Study of Al Fayhaa cities in North Lebanon

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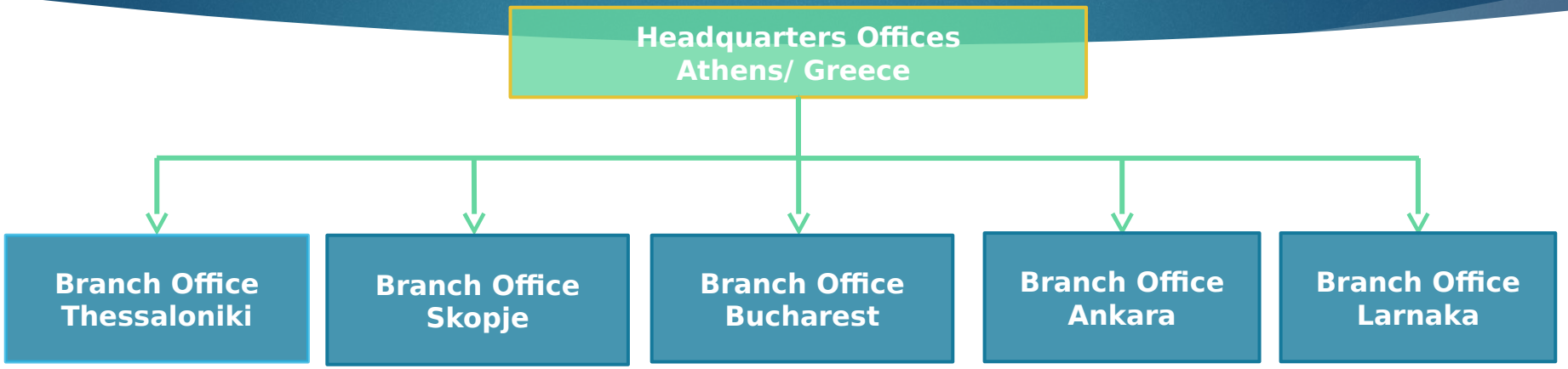

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  - ✓ KfW Development Bank
  - ✓ Local authorities/Ministries
  - ✓ Waste Management Organizations-Public Utility Companies
  - ✓ Private sector

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- Founded in Beirut in 1956
- Active in the fields of architecture, planning, infrastructure, transportation, water resources and environmental engineering

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- ✓ Kuwait Fund for Arab Economic Development
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- ✓ Islamic Development Bank
- ✓ European Investment Bank
- ✓ KfW Development Bank
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Project background information

Project Title:	**Provision of Services for The Preparation of Strategic Management Plan and Awareness & Change Management Plans for the Solid Waste Management in Al Fayhaa Cities in North Lebanon.**
Contracting Authority:	Lebanese host Community Support Project (LHSP/ UNDP).
Contractor:	Consortium **(1)** Dar Al Handasah Nazih Taleb & Partners, **(2)** ENVIROPLAN S.A.
Project area (location):	Urban Community Al Fayhaa (UCF) composed of the cities of Tripoli, El-Mina, El Baddawi and Al Qalamoun.
Beneficiaries:	The institutions and organizations benefiting from this Project and considered as beneficiaries are: • Urban Community Al Fayhaa (UCF); • Population of Al Fayhaa cities.
Project Duration:	6 calendar months. (31/05/2018-30/11/2018)
Project Purpose:	The main purpose of the ISWMF Project is to build the capacity in this transitional phase to the local authorities represented by UCF and in the same time to divert the maximum volume of waste possible from the landfill/ dumpsite taking into consideration the social, environmental, and economic limitations of all stakeholders involved.
Project Objective:	In response to the current situation, the Project being implemented includes various components that help support the Urban Community Al Fayhaa (UCF) in carrying out service provision to citizens.
Project Results:	Documents delivered: • Strategic Management Plans including: - Municipal Solid Waste (MSW) & Commercial Waste Collection Plan and Feasibility Study; - Treatment & Disposal Plan for each type of collected MSW and Feasibility Study and - Sweeping and Street Cleaning Plan and Feasibility Study. • Awareness & Change Management Plans (Program).

Municipal Solid Waste & Commercial Waste Collection Plan

Study area

The Urban Community Al Fayhaa (UCF): Cities of Tripoli, El Mina, El Baddawi and Al Qalamoun.

Estimated population:

-Approx. 400,000 Lebanese Residents

-More than 63,000 refugees

Waste Generation:

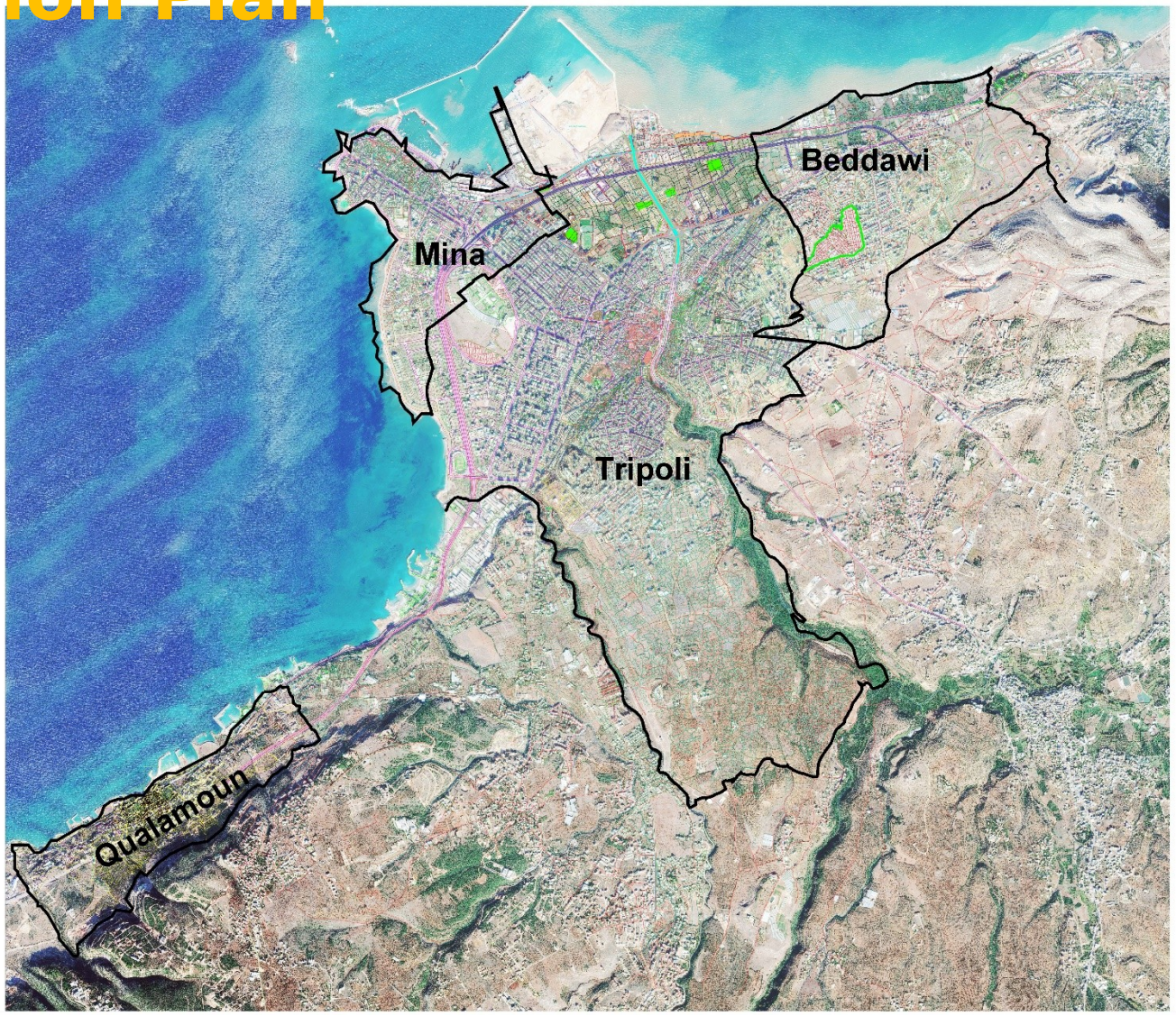
-Approx. 480 t/day

General Characteristics of current waste management:

-Improper handling of MSW

-All types of waste are being mixed

-All the quantities of MSW are disposed in Tripoli dumpsite after partial treatment in an MBT plant.



Municipal Solid Waste & Commercial Waste Collection Plan

Transfer and Collection plan for MSW is the building block for proper collection and transfer of all generated municipal solid waste in Al Fayhaa cities. Includes the following sections:

- Project area, Socio-economic aspects, Population Data
- Policy, Legal and Institutional Framework
- Current MSW & Commercial Waste Collection and Transfer and its Deficiencies
- Composition of Waste in Al Fayhaa (Methodology, Obtained results, Comparison)
- Municipal Solid Waste Forecast
- Option Analysis for the Waste Collection and Transfer System-Recommended Waste Collection System in Al Fayhaa Cities
- Calculations of Bins & Trucks for all separately collected waste fractions
- Collection schedule
- Determination of Collection points per zone
- Financial Analysis (CAPEX, OPEX, LUC, Sensitivity Analysis)
- Action Plan for MSW & Commercial Waste Collection
- Monitoring & Supervision Plan for Audit of Collection & Transfer Operations

Policy Framework

Policy Summary on Integrated Solid Waste Management prepared by the Ministry of Environment of Lebanon and approved by the Council of Ministries on 11.01.2018.

Proposed principle: the adoption of integrated solid waste management hierarchy in a way towards circular economy in order to achieve the following objectives:

- Years 2019-2024: min 25% material recovery, min 35% energy recovery and max 40% sanitary landfilling;
- Years 2025-2035: min 35% material recovery, min 50% energy recovery and max 15% sanitary landfilling.

Local authorities are proposed to be responsible for 3R principles (reduce, reuse and recycling), sorting at source, secondary sorting, collection and transfer.

The central authorities shall be responsible for treatment, energy recovery and sanitary landfilling.

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Establishment of Strategic Management Plan for Solid Waste Management

- Avoidance of Waste Generation
- Maximization of waste exploitation
- Reducing the waste disposal on the landfills
- Minimization of Environmental Impact
- Protection of public health
- Improving the economy (Circular Economy)
- Better quality of life

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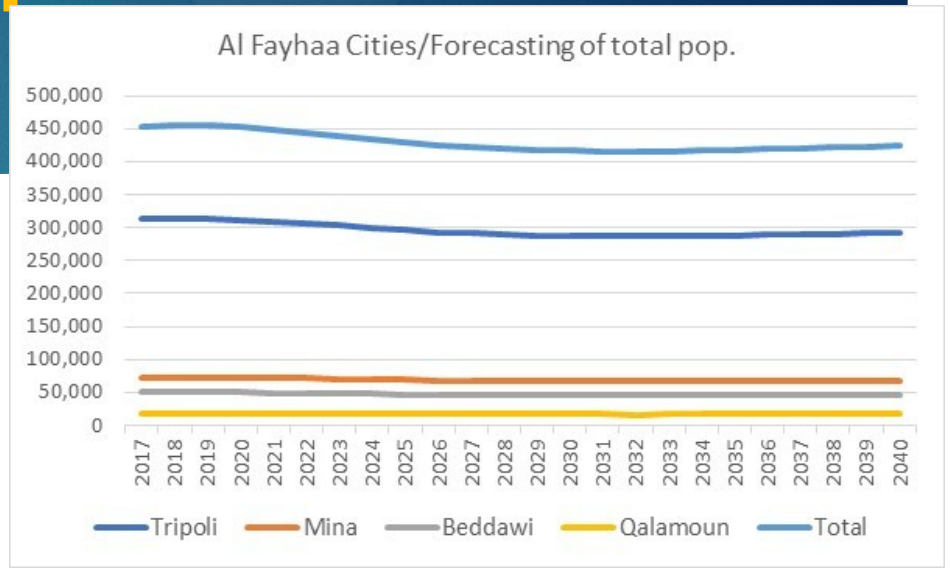
Municipal Solid Waste & Commercial Waste Collection Plan

Forecasting of total population

Total population (permanent and refugees) in Al Fayhaa (total 4 cities) for the period 2018-2040.



Total population (permanent and refugees)	2017	2021	2025	2029	2033	2036	2040
Tripoli	313,368	309,808	296,025	288,429	287,083	288,918	292,671
El Mina	72,665	71,841	68,647	66,887	66,576	67,003	67,875
El Baddawi	49,958	49,391	47,195	45,986	45,772	46,066	46,666
Al Qalamoun	18,167	17,963	17,166	16,727	16,651	16,759	16,978
Total	**454,158**	**449,003**	**429,033**	**418,029**	**416,082**	**418,746**	**424,190**

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Municipal Solid Waste & Commercial Waste Collection Plan

Forecasting of waste generation for Al Fayhaa cities

Generated Waste 4 cities (t)	2017	2021	2025	2029	2033	2036	2040
Tripoli	114,688	121,056	123,496	128,467	136,518	141,962	143,806
Mina	25,080	26,473	27,007	28,095	29,856	31,047	31,451
Beddawi	19,758	20,855	21,276	22,133	23,521	24,460	24,778
Qalamoun	6,169	6,513	6,645	6,913	7,347	7,641	7,740
Total	**165,695**	**174,897**	**178,424**	**185,608**	**197,242**	**205,110**	**207,775**
WGR for 4 cities (t/ca/year)	**0.365**	**0.390**	**0.416**	**0.444**	**0.474**	**0.490**	**0.490**

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Municipal Solid Waste & Commercial Waste Collection Plan

Qualitative waste analysis, Methodology

- Sampling and analysis of morphological composition of waste in Al Fayhaa cities has been carried out with waste samples of approximately 500 kg in weight to the landfill site.
Samples has been taken from two types of urban zones in each city in Al Fayhaa:
urban zone I - collective housing and commercial areas (settlements with blocks of residential buildings) in the city centers;
urban zone II - Individual houses in suburbs (settlements with houses that own yard /garden)
Waste bins (volume of 50 l) in which the waste is being classified in categories (21 waste fractions).

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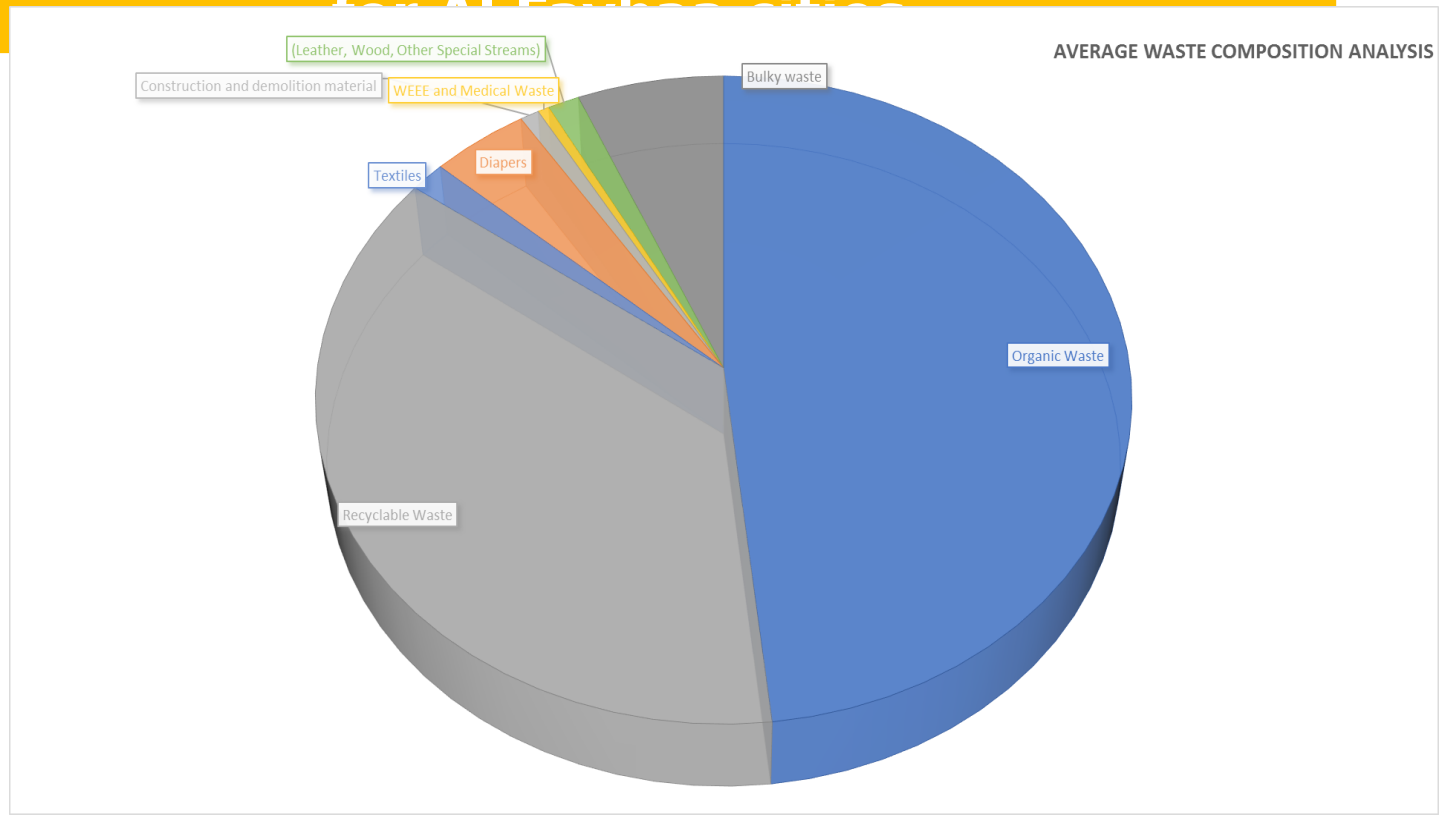
Municipal Solid Waste & Commercial Waste Collection Plan

Qualitative Waste Analysis-Average results for Al Fayhaa cities



TYPE	Weighted Average Waste composition including Bulky waste %
Garden waste	1.56%
Other biodegradable waste	46.72%
Paper	3.92%
Cardboard	4.16%
Tetrapak	0.59%
Glass	2.86%
Ferrous metal packaging and other	0.78%
Aluminium (non-ferrous) metal packaging and other	0.68%
Plastic packaging waste	1.77%
PE film	18.78%
PET bottles	2.59%
Other plastic / Hard plastic	0.72%
Textile	1.53%
Diapers	4.25%
Construction and demolition material	0.83%
WEEE	0.14%
Medical Waste	0.35%
Leather	0.42%
Wood	0.38%
Other special waste streams (Elastic - tyres etc.)	0.58%
Bulky waste	6.38%

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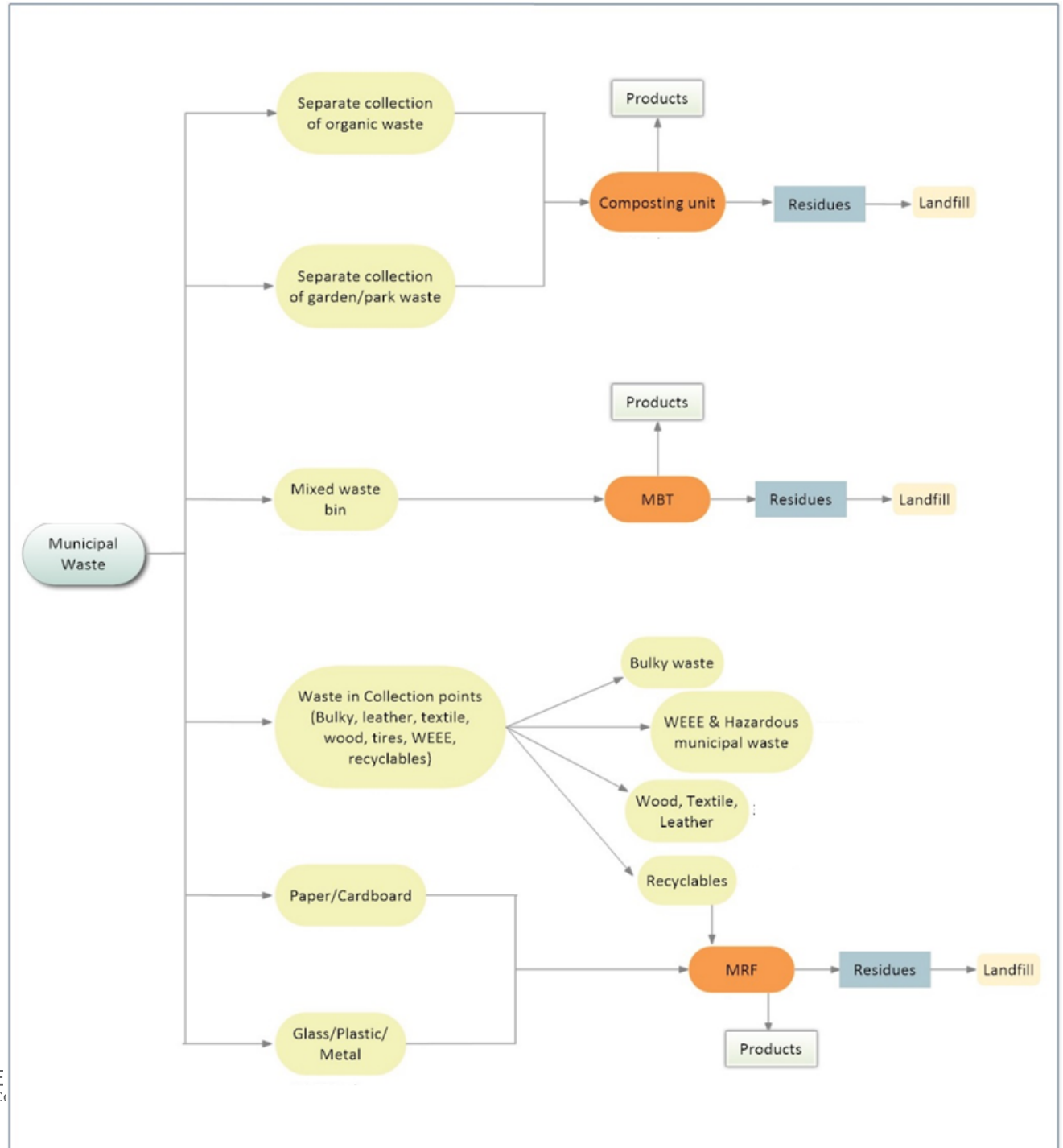
Municipal Solid Waste & Commercial Waste Collection Plan

Option Analysis for Waste collection and Transfer system

- The new waste collection system in Al Fayhaa : **Green Points**, **Four-bin system**
- ***Four (4) bins collection system.*** Separate collection of:
  - organic waste
  - paper and cardboard
  - glass, plastic, and metal in a common bin
  - residual municipal waste
- ***Green Points (GPs):***
  - Small quantities of recyclables,
  - Wood, Leather and Textile,
  - Waste electrical and electronic equipment (WEEE) and other special waste streams, and
  - Bulky waste
- ***Mainly on demand collection (it will be also the ability for collection through GPs):***

Waste fractions (categories) / Period	Garden/ Green	Recyclables in Green Points	Hazardous and WEEE in Green Points	Bulky waste	Textile, Wood & Leather in Green points	Recyclable collection bin	Organic waste bin
2018-2020	0%	0%	0%	0%	0%	0%	0%
2021-2024	50%	10%	10%	60%	10%	30%	10%
2025-2040	60%	10%	10%	100%	15%	30%	10%

Waste Collection System Flow Diagram



Municipal Solid Waste & Commercial Waste Collection Plan

Green Points (GPs)

- The green points are designed to work as complementary facilities of other measures for collection and recycling.

- The main benefit from GPs is the diversion and recovery of special waste streams (household hazardous waste, Waste of Electronic and Electric Equipment, batteries, bulky items, Green Wastes etc.), which otherwise would be disposed in ordinary landfill sites.

City	Number of GPs
Tripoli	5
El Mina	2
El Baddawi	1
Al Qalamoun	1
Total	**9**

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Municipal Solid Waste & Commercial Waste Collection Plan

Separate collected waste fractions – Calculation for bins

➢ Calculations were made for the following types of bins:

- Mixed waste bin of 1.1 m^3
- Paper/cardboard bin of 0.66 m^3
- Glass-plastic-metal bin of 1.1m^3
- Organic waste bin of 0.12 m^3

➢The average densities which have been used:

- Density for mixed waste 180 kg/m^3
- Density for paper/cardboard 112 kg/m^3
- Density for glass 270 kg/m^3
- Density for plastic 40 kg/m^3
- Density for metal 50 kg/m^3
- Density for biowaste 500 kg/m^3

Phase 1 (2021-2024)	Tripoli (all Zones)	El Mina (all Zones)	El Beddawi (all Zones)	Al Qalamoun (all Zones)	Al Fayhaa (Total 4 cities)
Mixed waste (Bins 1.1 m^3)	1,433	346	336	81	**2,196**
Paper/ Cardboard (Bins 0.66 m^3)	231	73	56	27	**387**
Glass-Plastic-Metal (Bins 1.1 m^3)	631	185	144	60	**1,020**

Phase 2 (2025-2040)	Tripoli (all Zones)	El Mina (all Zones)	El Beddawi (all Zones)	Al Qalamoun (all Zones)	Al Fayhaa (Total 4 cities)
Mixed waste (Bins 1.1 m^3)	90	23	30	6	**149**
Paper/Cardboard (Bins 0.66 m^3)	24	8	6	2	**40**
Glass-Plastic-Metal (Bins 1.1 m^3)	66	19	15	6	**106**
Biowaste (Bins 0.12 m^3)	31	7	6	2	**46**

Municipal Solid Waste & Commercial Waste Collection Plan

Separate collected waste fractions – Calculation for trucks

- Calculations were made for the following types of trucks:
  - Trucks of 14 m^3 for mixed waste,
  - Trucks of 14 m^3 for recyclable waste (Paper/cardboard and Glass-plastic-metal waste)
  - Trucks of 14 m^3 for organic waste bin,
  - Trucks of 6 m^3 for garden/park waste
  - Specialized trucks for slaughterhouse waste
  - Trucks with hook lift for bulky waste
- The average densities which have been used:
  - Density for mixed waste 0.45 t/m^3
  - Density for recyclables 0.30 t/m^3
  - Density for organic waste 0.8 t/m^3
  - Density for garden waste 0.22 t/m^3
- Truck utilization:
  - 85% for mixed waste, recyclable waste and garden/park waste

Phase 1 (2021-2024)	No. of trucks in Al Fayhaa (Total 4 cities)
Mixed waste (truck 14 m^3)	21
Paper/Cardboard (truck 14 m^3)	3
Glass-Plastic-Metal (truck 14 m^3)	7
Biowaste (truck 14 m^3)	2
Garden-Park (truck 6m^3)	-
Total	**33**

Phase 2 (2025-2040)	No. of trucks in Al Fayhaa (Total 4 cities)
Mixed waste (truck 14 m^3)	9
Paper/Cardboard (truck 14 m^3)	1
Glass-Plastic-Metal (truck 14 m^3)	1
Biowaste (truck 14 m^3)	-
Garden-Park (truck 6 m^3)	7
Total	**18**

Municipal Solid Waste & Commercial Waste Collection Plan

Collection points into Zones

➢Each collection zone is divided into Collection points and will have:

- 3 bins for mixed waste,
- 1 bin for glass-plastic-metal,
- 1 bin of biowaste for every 3 collection points and
- 1 bin of paper/cardboard for every 3 collection points

Zones	Collection Points Phase 1
Al Miten (Zone 1)	31
Azzmi (Zone 2)	49
Tabbaneh (Zone 3)	60
Zahrieh (Zone 4)	44
Al Tal (Zone 5)	39
Qoubbeh (Zone 6)	86
Al Maarad (Zone 7)	40
Bab El Ramel (Zone 8)	58
Abou Samra (Zone 9)	71
Total Tripoli	478
Al Jamarek (Zone 10)	27
Port Tripoli (Zone 11)	2
Al Bawaba (Zone 12)	30
Al Masaken (Zone 13)	28
Al Ziraa (Zone 14)	27
Total Mina	114
Al Baddawi (Zone 15)	112
Baddawi Camp	

Zones	Additional Collection Points Phase 2
Al Miten (Zone 1)	2
Azzmi (Zone 2)	3
Tabbaneh (Zone 3)	4
Zahrieh (Zone 4)	3
Al Tal (Zone 5)	2
Qoubbeh (Zone 6)	6
Al Maarad (Zone 7)	3
Bab El Ramel (Zone 8)	4
Abou Samra (Zone 9)	5
Total Tripoli	32
Al Jamarek (Zone 10)	2
Port Tripoli (Zone 11)	0
Al Bawaba (Zone 12)	2
Al Masaken (Zone 13)	2
Al Ziraa (Zone 14)	2
Total Mina	8
Al Baddawi (Zone 15)	10

Treatment & Disposal Plan

Integrated Waste Management System (IWMS)

The internationally approved ways of waste management include:

- Waste Prevention
- Re-use and Preparation for Re-use
- Recycling/Material Recovery
- Treatment of the Organic Wastes (Aerobic Composting/Anaerobic Digestion)
- Mechanical Biological Treatment (MBT)
- Thermal treatment – Waste to Energy
  - -Mass burn (Incineration)
  - -Advanced Thermal Treatment technologies (Gasification, Pyrolysis)
- Landfilling of residues

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Treatment & Disposal Plan

Separate Collection of Waste Streams

- Mixed Municipal Solid Waste
- Paper/ Cardboard Waste
- Glass/ Plastic/ Metal Waste
- Organic Waste

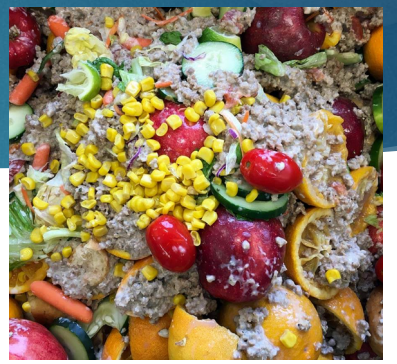
Awareness Raising

Treatment & Disposal Plan

Separate Collection of Waste Streams

The separately collected fractions in the proposed Waste Management System will be the following:

1) Garden/park waste (Green Points and on demand collection);
2) Recyclables in Green Points;
3) Household hazardous waste, WEEE, Wood, Textile, Leather and Bulky Waste in Green Points;
4) Organic waste in Organic Waste bin;
5) Plastic, Metals, Glass in Recyclable collection bin;
6) Paper/Cardboard in separate bin;
7) Waste that should be collected in Mixed Waste bin.



Achievement of the following objectives according to "Policy Summary on Integrated Solid Waste Management", prepared by Ministry of Environment of Lebanon:

- Years 2019-2024: 25% material recovery, 35% energy recovery and 40% sanitary landfilling
- Years 2025-2035: 35% material recovery, 50% energy recovery and 15% sanitary landfilling

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Treatment & Disposal Plan

Waste Treatment Options

- Materials recovery facilities (MRF) and recycling - sort and separate materials to produce products that meet defined specifications and so can be marketed.
- Treatment of organic waste - treated by either of two biological processes – aerobic and anaerobic.
- Mechanical Biological Treatment (MBT) - a combination of mechanical sorting and biological treatment of MSW, which may be configured to produce a variety of outputs.
- Thermal treatment options / Waste to Energy

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Treatment & Disposal Plan

Treatment Options

Examined Scenarios	Description
Scenario 1	Mechanical separation (Fe, Al), biodrying (SRF) and WtE plant for exploitation of produced RDF/SRF
Scenario 1A	Mechanical separation (Fe, Al) and biodrying (SRF) and exploitation of produced RDF/SRF in cement industry
Scenario 2	Mechanical separation (Recyclables, RDF), aerobic composting for production of CLO and WtE plant for exploitation of produced RDF
Scenario 2A	Mechanical separation (Recyclables, RDF), aerobic composting for production of CLO and exploitation of produced RDF in cement industry
Scenario 3	Mechanical separation (Recyclables, RDF), anaerobic digestion followed by aerobic composting of digestate (CLO) and WtE plant for exploitation of produced RDF
Scenario 3A	Mechanical separation (Recyclables, RDF), anaerobic digestion followed by aerobic composting of digestate (CLO) and

Treatment & Disposal Plan

Evaluation of Alternative Scenarios by using the Method of Multicriteria Analysis

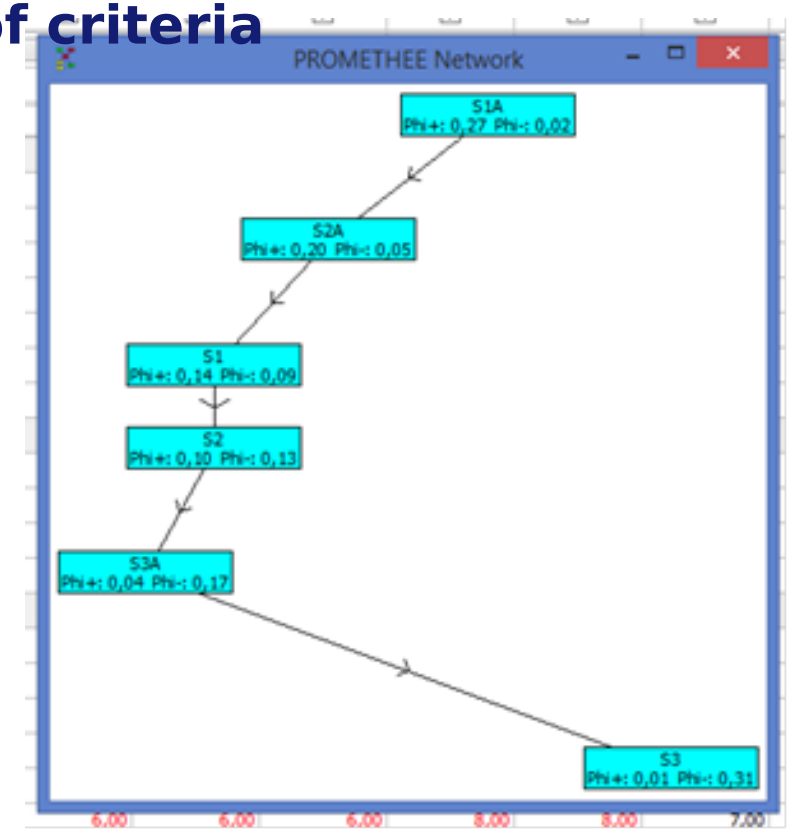
Multi-criteria analysis involves three main phases (a) the setting of criteria (financial, technical, environmental, and social-Institutional), (b) the weighting of criteria according to their significance and (c) the ranking of the

	Groups of criteria and description	
Financial Criteria		
F1	Investment Cost	Assess the cost of facilities construction etc.
F2	Operation Cost	Assess the operation cost and maintenance cost of facilities
Technical Criteria		
T1	Flexibility regarding waste quantity	Assess the possibility of adapting the process towards the changes and future variations of waste quantity
T2	Flexibility regarding waste quality	Assess the possibility of adapting the process towards the changes and future variations of waste quality
T3	Simplicity	Assess the simplicity of each technology
T4	Energy Exploitation	Assess the energy efficiency of each scenario
T5	Recovery of materials	Assess the recovery of materials for each scenario
Environmental Criteria		
E1	Air Pollution	The possible emission of air pollutants and the overall burden of the atmosphere from the application of each technology
E2	Pollution of soil, groundwater and surface water	Assess the impacts on soil, surface and groundwater from the construction and operation of the facilities of the various technologies
E3	Land area required for the facilities	Assess the various scenarios, depending on the area requirements for the sitting of facilities, calculating the required main area of landfills, which collect the more negative characteristics because of their direct contact with natural environment and in particular the ground.
E4	Mitigation measures in the environment	Assess the measures that should be implemented to address the impact likely to have arisen from the above criteria.
Social-Institutional		
S1	Degree of fulfilment of targets	Assess the compatibility of each scenario with the requirements and objectives of National legislation concerning the Solid Waste Management and in particular with the fulfilment of targets for recycling, recovery of materials as well as sanitary landfilling.
S2	Possibility of	Assess the employment opportunities of personnel, especially concerning of the

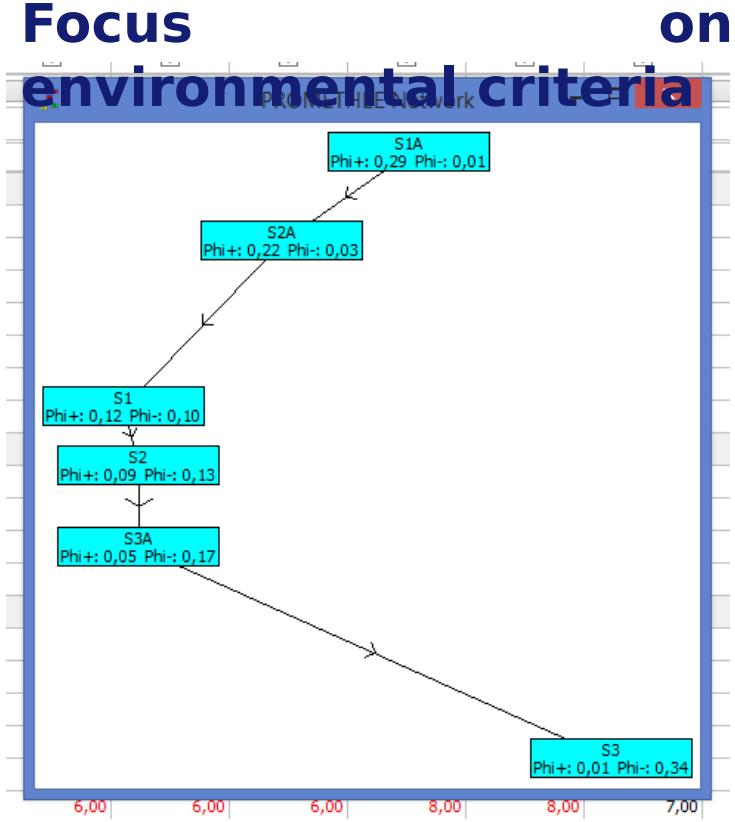
Treatment & Disposal Plan

Evaluation of Alternative Scenarios by using the Method of Multicriteria Analysis

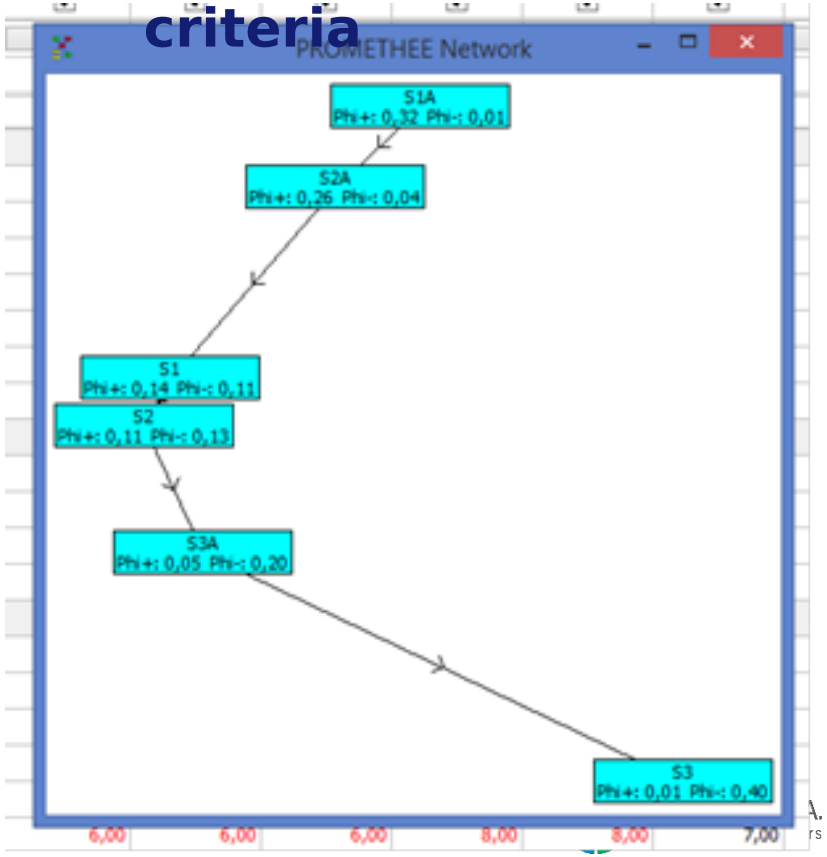
of criteria



Focus on environmental criteria



ocus on financial criteria



Investment Cost

The estimation of investment cost of each development scenario is one of the main evaluation criteria, which is affected by several parameters:

- the capacity of the unit
- the type and complexity of the technology
- the degree of automation of production processes
- the required infrastructure

Unit costs have been used in order to estimate the Investment cost of the treatment facilities.

Investment Cost

	Investment Cost	Investment Cost	Cost of Intangible components	Grand Total
	Phase A	Phase B		
	($)	($)	($)	($)
Scenario 1	124,291,719	1,210,949	1,506,700	127,009,368
Scenario 1A	27,642,767	1,210,949	1,506,700	30,360,415
Scenario 2	90,338,744	757,198	1,506,700	92,602,643
Scenario 2A	31,526,218	757,198	1,506,700	33,790,117
Scenario 3	106,226,108	1,664,705	1,506,700	109,397,513

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Operation & Maintenance Cost

The operating cost of each scenario is estimated for each waste management component: i.e. collection cost, mechanical sorting plant, biological plant, landfill, infrastructure works, etc. The assumption for calculation of operating cost:

Maintenance cost:

- 4% for mechanical sorting & biological treatment
- 4% for thermal treatment
- 2% for landfills and 1% for infrastructure

Labour cost: The labour cost has been calculated based on typical salaries for different staff categories, including in the various insurances, taxes, employers' contribution, etc.

Administrative costs: Administrative costs are calculated as a percentage of labor costs, i.e. to 20% of labor costs.

Energy – Fuel: The consumption values per t of incoming waste are presented

Monitoring: For the necessary environmental monitoring (noise, dust, odors, etc.) at work / perimeter of the site has been estimated for each scenario.

Aftercare/Insurance: The aftercare/insurance cost has been calculated as a given percentage of the investment cost, i.e. 0.70% of investment cost

Transportation cost for RDF: The respective transportation cost for RDF/SRF at a suitable cement industry has been calculated in each scenario.

Operational & Maintenance Cost

Scenario	O&M for the operation of Waste Management facilities ($/year)
Scenario 1	9,103,875
Scenario 1A	5,071,639
Scenario 2	8,462,409
Scenario 2A	5,607,425
Scenario 3	9,452,908
Scenario 3A	6,597,924

Revenues

Revenues from the operation of WMC include:
i) Sale of recyclables derived from Sorting plant,
(ii) Sale of recyclables derived from Mechanical treatment of mixed waste bin

1. Revenues from sales of recyclables derived from Sorting p

Al	601 €/t	697 $/y
Fe	343 €/t	398 $/y
Plastics	137 €/t	159 $/y
Paper/Cardboard	29 €/t	33 $/y
Glass	29 €/t	33 $/y

2. Revenues from sales of recyclables derived from Mechanic Treatment of Mixed waste bin

Al	601 €/t	697 $/y
Fe	343 €/t	398 $/y
Plastics	69 €/t	80 $/y
Paper/Cardboard	14 €/t	17 $/y
Glass	29 €/t	33 $/y

Scenario	Revenues ($/year)
Scenario 1	5,216,414
Scenario 1A	3,294,476
Scenario 2	5,738,088
Scenario 2A	4,067,770
Scenario 3	5,826,818
Scenario 3A	3,871,423

3. Concerning the produced electricity (for Sc 1, 2 & 3), it will cover the energy needs of the plant. The surplus electricity will be distributed to the grid without revenues.

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Economic Analysis

The economic analysis has been elaborated according the guidelines of New Guide to cost – benefit analysis of investment project by European Commission, December 2014. The following table summarizes the economic costs and benefits and the result of profitability calculations, ENPV.

Scenario	Present Value of Economic Benefits ($)	Present Value of Economic Costs (Investment) ($)	Present Value of Economic Costs (O&M) ($)	Net Economic Benefits ($)
Scenario 1	247,818,289	140,671,338	56,386,164	50,760,788
Scenario 1A	220,832,427	37,057,149	23,432,380	160,342,898
Scenario 2	249,354,911	105,440,469	62,215,455	81,698,988
Scenario 2A	225,680,422	42,495,205	38,728,178	144,457,039
Scenario 3	225,014,864	125,381,032	59,202,710	70,431,122
Scenario 3A	227,688,078	62,632,455	36,014,660	129,040,963

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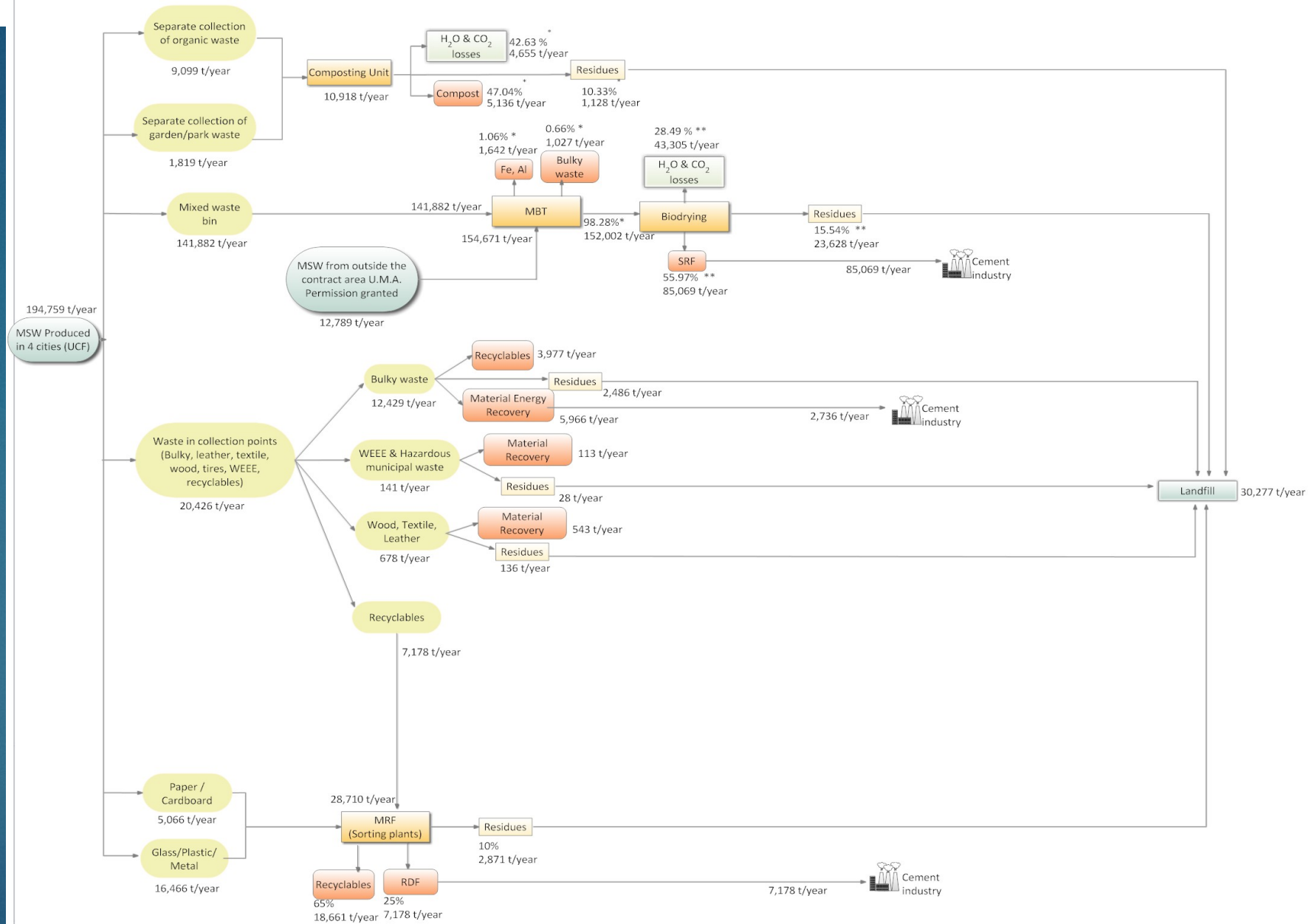
Flow diagram of recommended Scenario 1A



Sweeping & Street Cleaning Plan

Sweeping & Street Cleaning Plan and Feasibility Study aims to set the clear grounds for proper sweeping and street cleaning of avenues, streets, pedestrian roads, squares and parks in Al Fayhaa cities.
It includes the following aspects:

- Each type of roads + pedestrian walkways should be divided into either mechanical or manual sweeping plans;
- Al Fayhaa should be divided into sweeping zones as per geographical distribution + red zones
  (souks, restaurants, corniche, etc.);
- Each zone should have its own sweeping daily, weekly, and monthly plan;
- A sweeping schedule & proposed route for mechanical sweepers for each zone;
- Specifications, capacity & count of each type of sweeping vehicles;
- Specifications & Count of tools required for manual sweeping for each zone;
- Suggested locations of street sweeping personnel toolboxes in each zone.

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Sweeping & Street Cleaning Plan

Gaps and needs of upgraded sweeping and cleaning system

Demarcation of zones

Identification of the zones in UCF areas, in which there would be an increased need for cleaning services management.

Special criteria for the zoning of areas:

- Highways
- Main roads
- Major roads
- Minor roads
- Urban road network
- Local network
- Pedestrian network
- Planned roads
- Stairs
- Open places
- Roundabouts
- Commercial activity

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Sweeping & Street Cleaning Plan

Recommended level of cleaning services

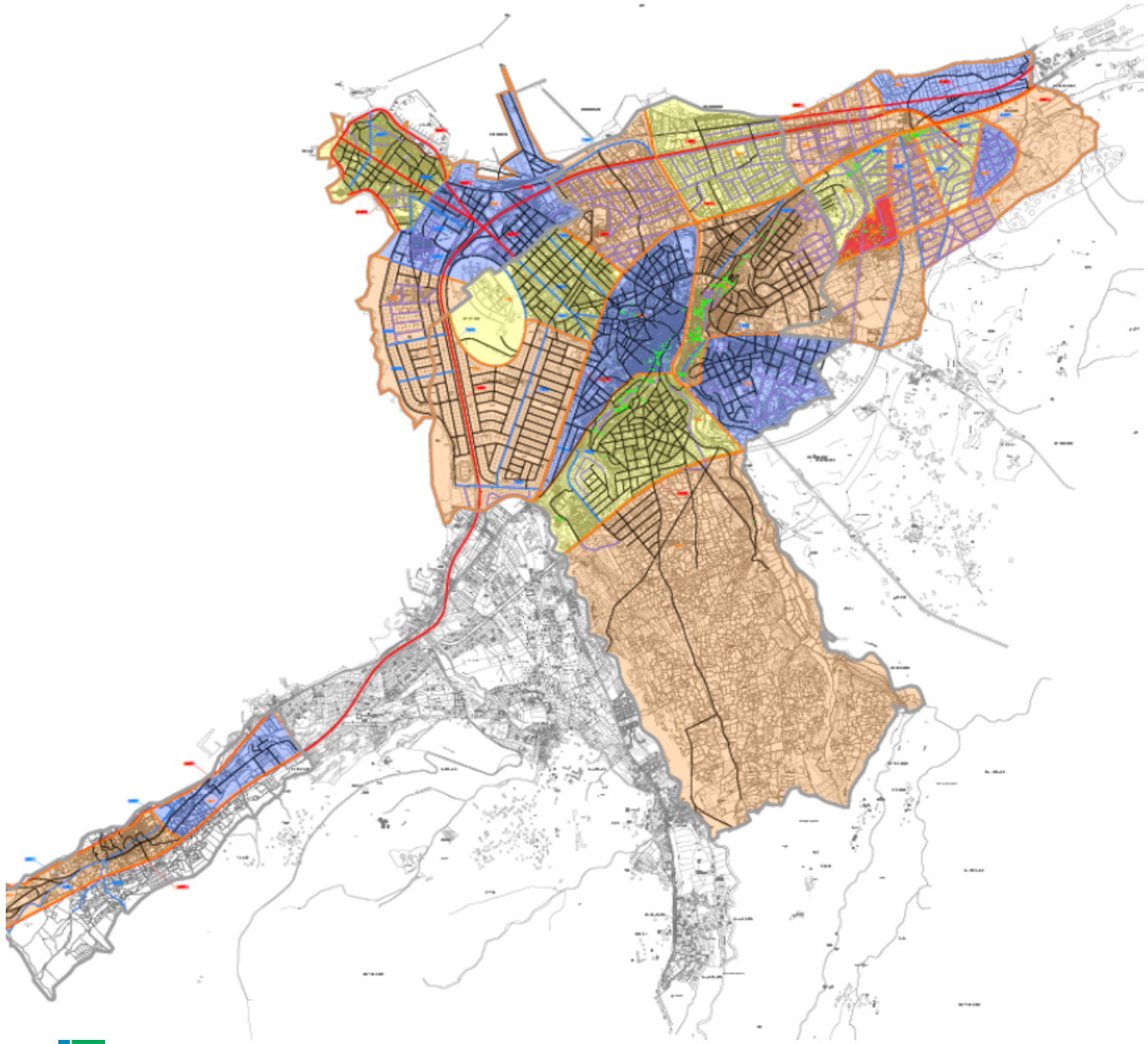
- **3 categories (zones) based on the level of needed cleaning services**

Cleaning Zone	Areas included	Total street network covered
A	• Highways, • Main roads, • Bridge, • Cities entrances	37 km
B	• Secondary network (major roads), • Major commercial roads	28 km
C	• Urban areas road network (minor roads), • Local network, • Pedestrian network, • Planned roads, • Stairs, • Open areas	Urban street network covered: 315 km Total open spaces area: 925.800 m^2 (92,58 ha), Stairs: 5,265 km

Note: *The Palestinian Gatherings and Official UNRWA Camps in the area of Al Fayhha is excluded from sweeping & cleaning plan.*

Sweeping & Street Cleaning Plan

Route Maps-Al Fayhaa Cities



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Sweeping & Street Cleaning Plan

Mina

Main Roads Category A

Riad El Solh - Rachid Karami, MMR1: 2200m (Mechanical Cleaning)

Tripoli - Batroun Highway, MMR2: 1900m (Mechanical Cleaning)

Main Road 3, MMR3: 500m (Mechanical Cleaning)

El Istiklal Road, MMR4: 2000m (Mechanical Cleaning)

Jamal Abdul Nasser Road, MMR5: 800m (Mechanical Cleaning)

Secondary Roads, Category B

El Mountazah Road, MSR1: 800m (Mechanical Cleaning)

Iben Khaldoun Road, MSR2: 700m (Mechanical Cleaning)

Palestine Road, MSR3: 1000m (Mechanical Cleaning)

Secondary Road 4, MSR4: 500m (Mechanical Cleaning)

Secondary Road 5, MSR5: 600m (Mechanical Cleaning)

Secondary Road 6, MSR6: 600m (Mechanical Cleaning)

Individual Urban Areas, Category C

Mina Area 1, MA1:

Urban Roads: 11350m
(9100m Mechanical Cleaning, 2250m Manual Cleaning)
Urban & Pedestrian Network: 3200m
(1600m Mechanical Cleaning, 1600m Manual Cleaning)

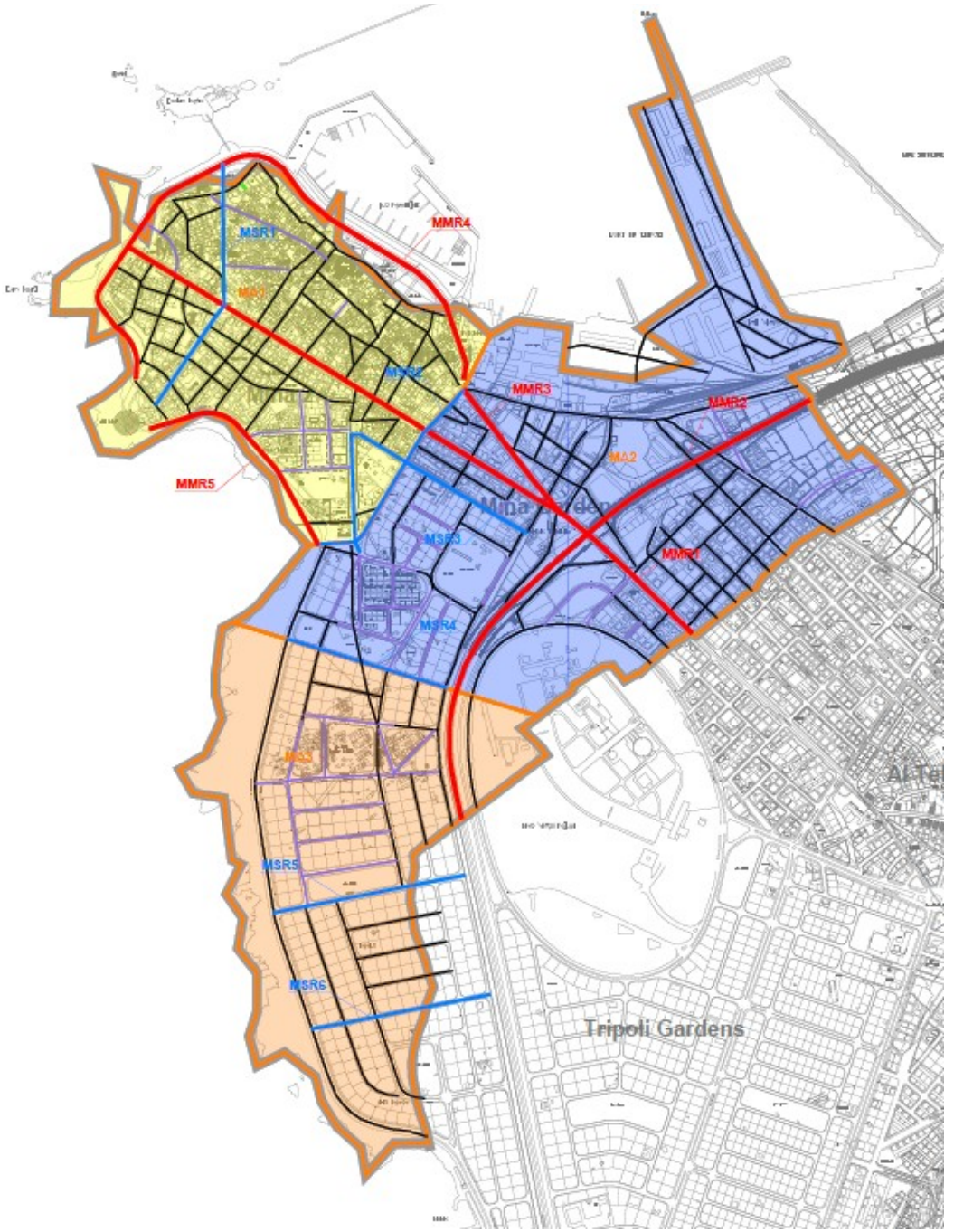
Mina Area 2, MA2:

Urban Roads: 18450m
(14750m Mechanical Cleaning, 3700m Manual Cleaning)
Urban & Pedestrian Network: 5100m
(2550m Mechanical Cleaning, 2550m Manual Cleaning)

Mina Area 3, MA3:

Urban Roads: 9500m
(7600m Mechanical Cleaning, 1900m Manual Cleaning)
Urban & Pedestrian Network: 2400m
(1200m Mechanical Cleaning, 1200m Manual Cleaning)

Main Roads
Secondary Roads
Existing Urban Roads
Planned/New Urban Roads
Individual Urban Areas Boundaries
Stairs



Sweeping & Street Cleaning Plan

Tripoli

Main Roads, Category A

Tripoli Main Road 1, TMR1: 4600m (Mechanical Cleaning)

Tripoli Main Road 2 TMR2: 3000m (Mechanical Cleaning)

Tripoli Main Road 3, TMR3: 2400m (Mechanical Cleaning)

Tripoli Main Road 4, TMR4: 800m (Mechanical Cleaning)

Tripoli Main Road 5, TMR5: 2000m (Mechanical Cleaning)

Tripoli Main Road 6, TMR6: 2000m (Mechanical Cleaning)

Secondary Roads, Category B

Secondary Road 1, TSR1: 1200m (Mechanical Cleaning)
Secondary Road 2, TSR2: 900m (Mechanical Cleaning)
Secondary Road 3, TSR3: 1300m (Mechanical Cleaning)
Secondary Road 4, TSR4: 700m (Mechanical Cleaning)
Secondary Road 5, TSR5: 2000m (Mechanical Cleaning)
Secondary Road 6, TSR6: 1700m (Mechanical Cleaning)
Secondary Road 7, TSR7: 900m (Mechanical Cleaning)
Secondary Road 8, TSR8: 1100m (Mechanical Cleaning)
Secondary Road 9, TSR9: 1300m (Mechanical Cleaning)
Secondary Road 10, TSR10: 1100m (Mechanical Cleaning)

Individual Urban Areas, Category C

Tripoli Area 1, TA1:
Urban Roads: 13500m
(10800m Mechanical Cleaning, 2700m Manual Cleaning)
Urban & Pedestrian Network: 3100m
(1550m Mechanical Cleaning, 1550m Manual Cleaning)

Tripoli Area 2, TA2:
Urban Roads: 11850m
(9500m Mechanical Cleaning, 2350m Manual Cleaning)
Urban & Pedestrian Network: 2700m
(1350m Mechanical Cleaning, 1350m Manual Cleaning)

Tripoli Area 3, TA3:
Urban Roads: 13100m
(10500m Mechanical Cleaning, 2600m Manual Cleaning)
Urban & Pedestrian Network: 3000m
(1500m Mechanical Cleaning, 1500m Manual Cleaning)

Tripoli Area 4, TA4:
Urban Roads: 22450m
(18000m Mechanical Cleaning, 4450m Manual Cleaning)
Urban & Pedestrian Network: 5400m
(2700m Mechanical Cleaning, 2700m Manual Cleaning)

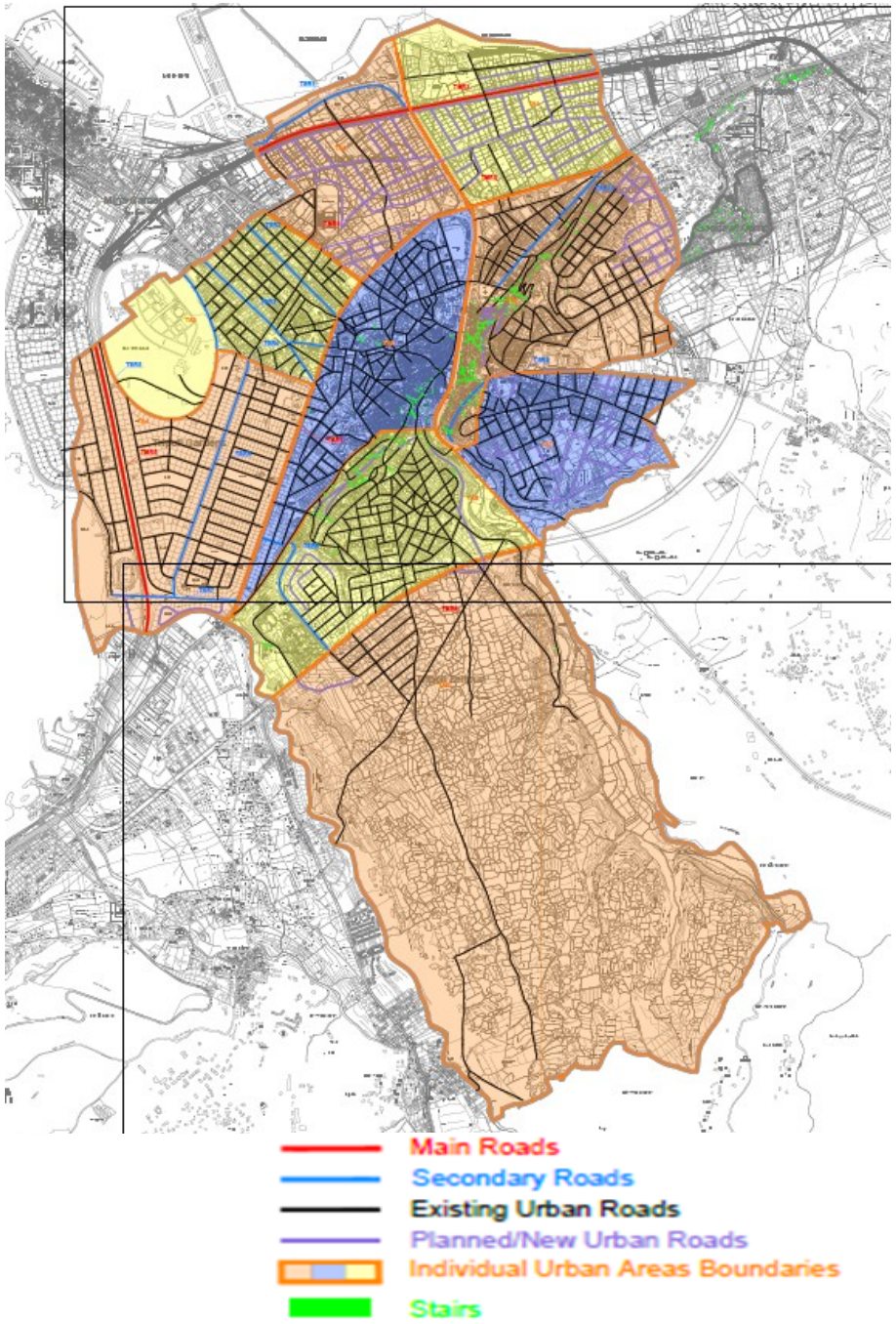
Tripoli Area 5, TA5:
Urban Roads: 25800m
(20650m Mechanical Cleaning, 5150m Manual Cleaning)
Urban & Pedestrian Network: 6800m
(3400m Mechanical Cleaning, 3400m Manual Cleaning)

Tripoli Area 6, TA6:
Urban Roads: 21800m
(17450m Mechanical Cleaning, 4350m Manual Cleaning)
Urban & Pedestrian Network: 5700m
(2850m Mechanical Cleaning, 2850m Manual Cleaning)

Tripoli Area 7, TA7:
Urban Roads: 17000m
(13600m Mechanical Cleaning, 3400m Manual Cleaning)
Urban & Pedestrian Network: 4100m
(2050m Mechanical Cleaning, 2050m Manual Cleaning)

Tripoli Area 8, TA8:
Urban Roads: 26300m
(21000m Mechanical Cleaning, 5300m Manual Cleaning)
Urban & Pedestrian Network: 6600m
(3300m Mechanical Cleaning, 3300m Manual Cleaning)

Tripoli Area 9, TA9:
Urban Roads: 14900m
(11900m Mechanical Cleaning, 3000m Manual Cleaning)
Urban & Pedestrian Network: 3200m
(1600m Mechanical Cleaning, 1600m Manual Cleaning)



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Sweeping & Street Cleaning Plan

Qualamoun

Main Roads, Category A

Coastal Highway, QMR1: 3640m (Mechanical Cleaning)

Seaside Road, QMR2: 3600m (Mechanical Cleaning)

Secondary Roads, Category B

Secondary Road 1, QSR1: 2450m (Mechanical Cleaning)

Secondary Road 2, QSR2: 660m (Mechanical Cleaning)

Secondary Road 3, QSR3: 665m (Mechanical Cleaning)

Individual Urban Areas, Category C

Qualamoun Area 1, QA1:

Urban Roads: 3400m
(2720m Mechanical Cleaning, 680m Manual Cleaning)

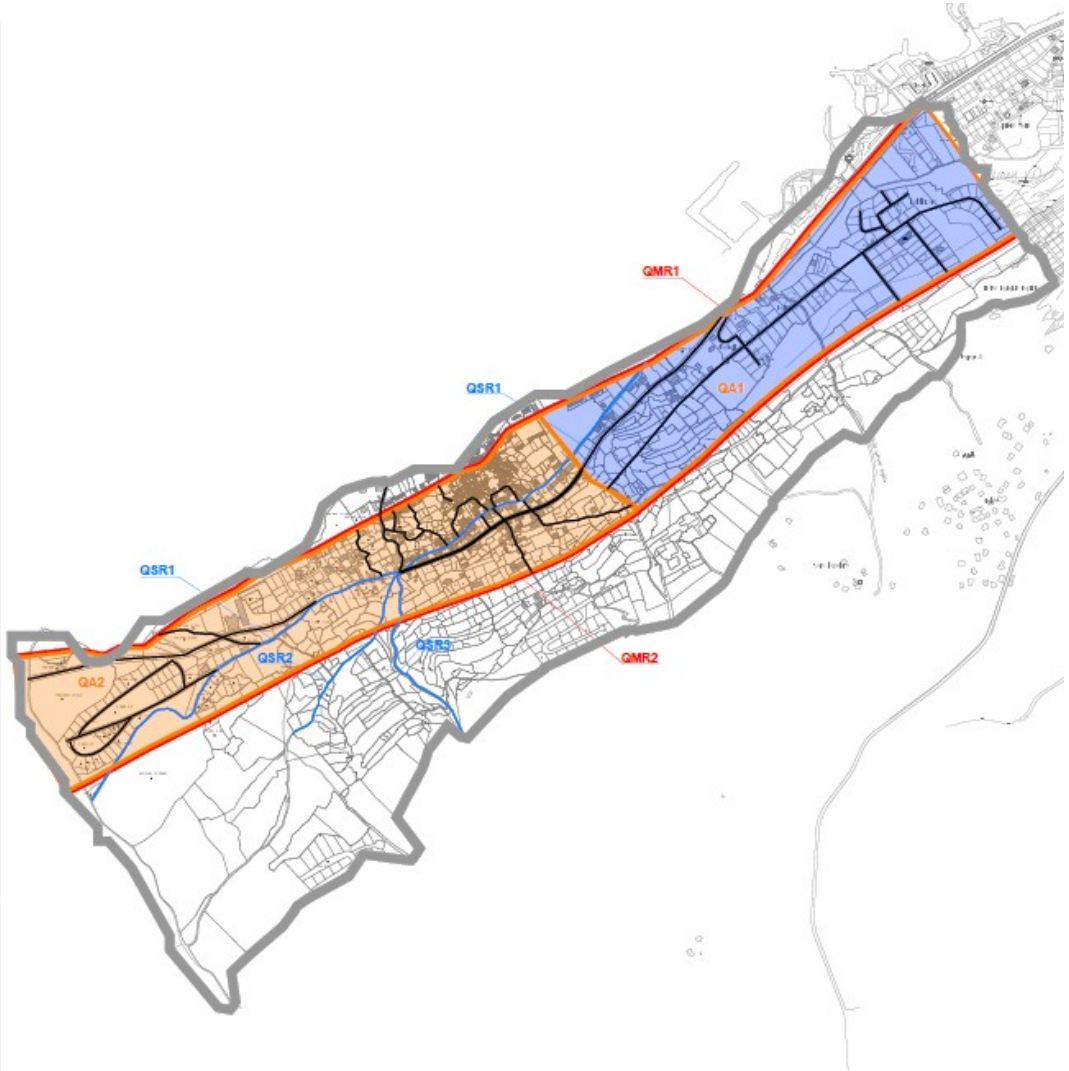
Urban & Pedestrian Network: 750m
(375m Mechanical Cleaning, 375m Manual Cleaning)

Qualamoun Area 2, QA2:

Urban Roads: 4800m
(3840m Mechanical Cleaning, 960m Manual Cleaning)

Urban & Pedestrian Network: 500m
(250m Mechanical Cleaning, 250m Manual Cleaning)

Main Roads
Secondary Roads
Existing Urban Roads
Individual Urban Areas Boundaries
Stairs



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Sweeping & Street Cleaning Plan

Beddawi

Main Roads, Category A

Main Road 1, BMR1: 2740m

Tripoli-Batroun Highway, BMR2: 2000m (Mechanical Cleaning)

Tripoli-Minieh Highway, BMR3: 2650m (Mechanical Cleaning)

Secondary Roads, Category B

Secondary Road 1, BSR1: 2200m (Mechanical Cleaning)

Secondary Road 2, BSR2: 880m (Mechanical Cleaning)

Secondary Road 3, BSR3: 1370m (Mechanical Cleaning)

Secondary Road 4, BSR4: 1400m (Mechanical Cleaning)

Secondary Road 5, BSR5: 2200m (Mechanical Cleaning)

Individual Urban Areas, Category C

Beddawi Area 1, BA1:
Urban Roads: 5300m
(4200m Mechanical Cleaning, 1100m Manual Cleaning)
Urban & Pedestrian Network: 1100m
(550m Mechanical Cleaning, 550m Manual Cleaning)

Beddawi Area 2, BA2:
Urban Roads: 4000m
(3200m Mechanical Cleaning, 800m Manual Cleaning)
Urban & Pedestrian Network: 900m
(450m Mechanical Cleaning, 450m Manual Cleaning)

Beddawi Area 3, BA3:
Urban Roads: 7000m
(5600m Mechanical Cleaning, 1400m Manual Cleaning)
Urban & Pedestrian Network: 2100m
(1050m Mechanical Cleaning, 1050m Manual Cleaning)

Beddawi Area 4, BA4: *Beddawi Camp is excluded from the sweeping plan by UCF.
Urban Roads: 1200m
(960m Mechanical Cleaning, 240m Manual Cleaning)
Urban & Pedestrian Network: 400m
(200m Mechanical Cleaning, 200m Manual Cleaning)

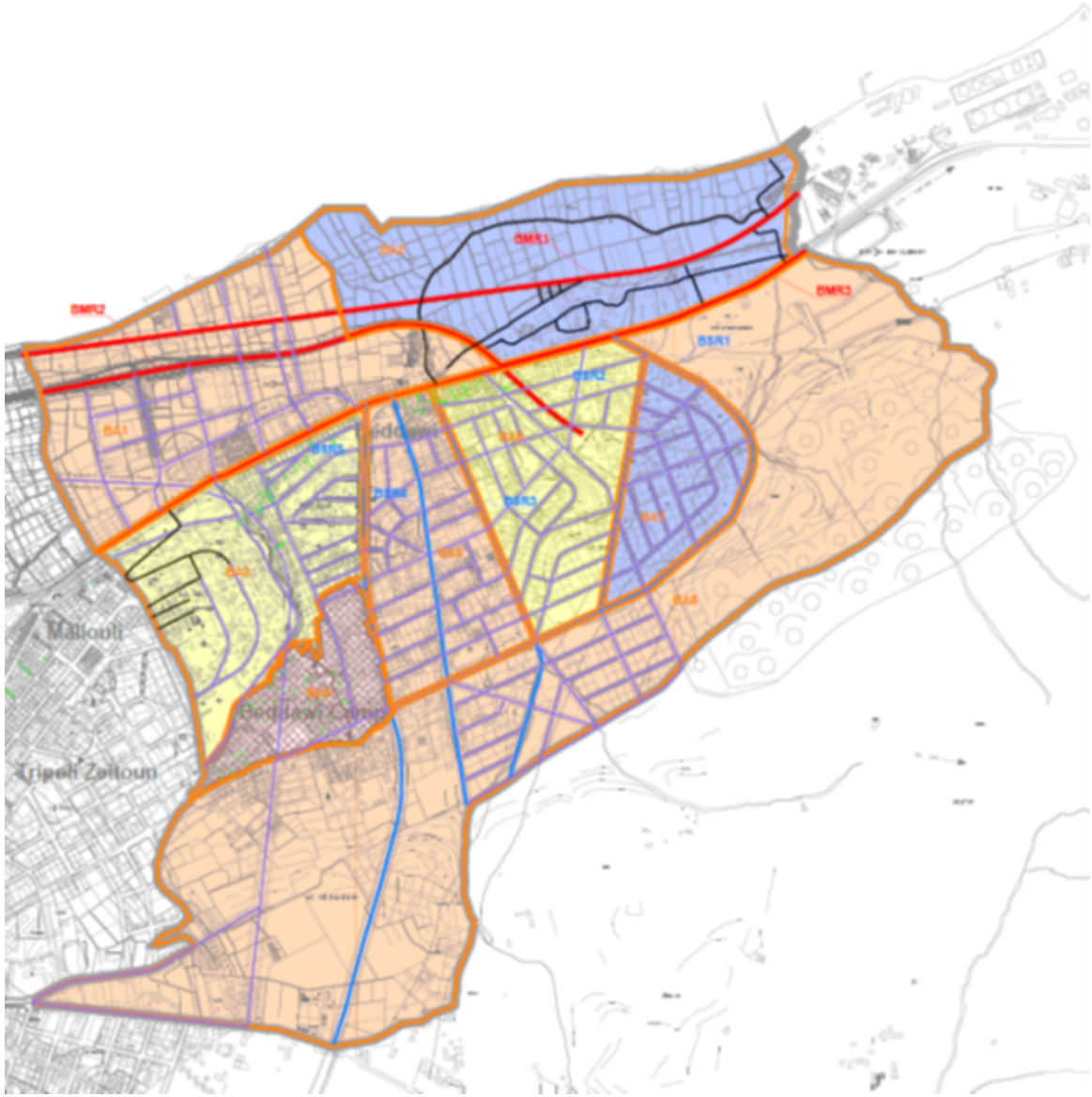
Beddawi Area 5, BA5:
Urban Roads: 4600m
(3700m Mechanical Cleaning, 900m Manual Cleaning)
Urban & Pedestrian Network: 900m
(450m Mechanical Cleaning, 450m Manual Cleaning)

Beddawi Area 6, BA6:
Urban Roads: 6700m
(5400m Mechanical Cleaning, 1300m Manual Cleaning)
Urban & Pedestrian Network: 1900m
(950m Mechanical Cleaning, 950m Manual Cleaning)

Beddawi Area 7, BA7:
Urban Roads: 3700m
(3000m Mechanical Cleaning, 700m Manual Cleaning)
Urban & Pedestrian Network: 800m
(400m Mechanical Cleaning, 400m Manual Cleaning)

Beddawi Area 8, BA4:
Urban Roads: 7300m
(5800m Mechanical Cleaning, 1500m Manual Cleaning)
Urban & Pedestrian Network: 2200m
(1100m Mechanical Cleaning, 1100m Manual Cleaning)

Main Roads
Secondary Roads
Existing Urban Roads
Planned/New Urban Roads
Individual Urban Areas Boundaries
Stairs



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Sweeping & Street Cleaning Plan

Sweeping Plan Zones

Zone A: It is proposed to be cleaned **once a day** (morning or afternoon)

Zone B: It is recommended to be cleaned **every third day** (e.g. Monday – Thursday – Sunday or Tuesday – Friday - Monday or Wednesday – Saturday - Tuesday etc)

Zone C: Zone C is proposed to be cleaned **every fourth day**

Plan schedule				
Zones	**Day**	**Days/Week**	**Days/Month**	**Days/Year**
A zone	1	6	26	312
B zone	-	2-3	10	120
C Zone	-	1-2	7-8	91

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Scenarios for the cleaning system

1. The extreme case of the whole burden covered with pedestrian street cleaners (with or without a pedestrian-controlled sweeper) and

2. The opposite extreme scenario, that all of the street cleaning is carried out using large compact or chassis sweepers

Sweeping Scenarios	CAPEX ($) (excl. VAT)	OPEX ($/year)
1. Full manual sweeping	**658,900**	**3,857,870**
2. Full mechanical sweeping	**4,240,200**	**734,513**
3. Optimized	**2,892,084**	**2,060,583**

Scenarios	FNPV ($)
1. Full manual sweeping	**17,468,011**
2. Full mechanical sweeping	**7,282,282**
3. Optimized	**11,772,542**

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Awareness & Change Management Program

1. A short video which highlights all existing sorting at source initiatives in Al Fayhaa + interviews with the launchers of those initiatives.

2. Eight (8) Public Awareness & education short videos on how to reduce, reuse, and sort different types of waste:
   - At home
   - In the office
   - In school
   - In the street
   - In a restaurant
   - In the vegetable market
   - In a Greenpoint
   - Bulky waste

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Awareness & Change Management Program

Prepared Videos

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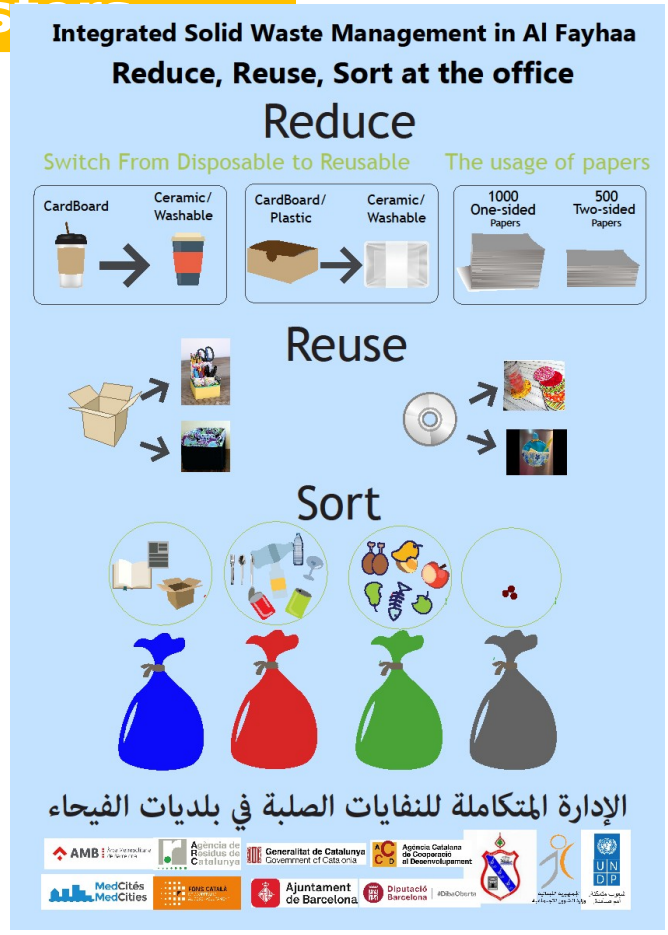
Awareness & Change Management Program

Prepared Posters



Awareness & Change Management Program

Prepared Posters

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Awareness & Change Management Program

Prepared Handbook

Sorting at Source and Waste Recycling

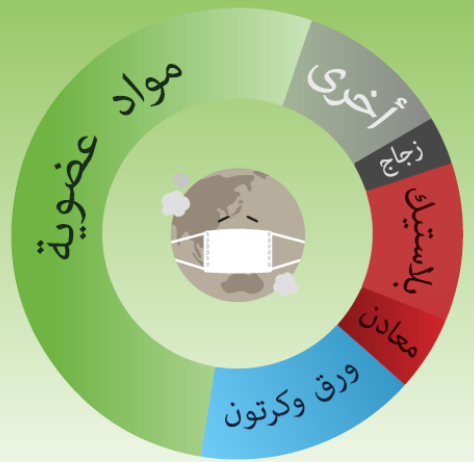
Let's Reduce, Reuse & Recycle Handbook

يهدف هذا الدّليل إلى تشجيع سكّان مدن الفيحاء على البدء باعتماد التسلسل الهرمي للنفايات كأحد أفضل الممارسات الدولية لإدارة النفايات، وعلى إطلاعهم على طرق إدارة النفايات، والتعرف بشكل خاص على الفرز من المصدر باعتباره ممارسةً تلائم مجتمعهم.

كما أنّه يهدف إلى التشجيع على السلوك البيئي المناسب، وإلى تبني المواطنين للعادات الملائمة في مجال إدارة النفايات

ولتحقيق التقدّم السريع وإجراء التغييرات المستدامة، ينبغي على السكّان المشاركة بفعالية. ومن خلال هذا الدليل، نأمل أن نوضح بشكل أفضل أهمية الحد من النّفايات، وإعادة استخدامها، والفرز من المصدر، وإعادة تدوير النفايات قدر الإمكان

تنقسم أنواع النفايات* في لبنان نسبياً كما يلي:



من خلال إعادة استخدام النفايات وفرزها لإعادة التدوير، سوف تبقى نسبة منخفضة جداً من نفاياتنا في المكبات

تتضمن مبادئ الحد من النفايات، وإعادة الاستخدام، وإعادة التدوير، سياساتٍ أساسية للإدارة المستدامة للمواد، من أجل إقتصاد مبنيّ على حياة سليمة ومستدامة

*Waste Characterization Study; JV Dar Taleb - Enviroplan, Al Fayhaa ISWMF, UNDP, 2018

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Awareness & Change Management Program – Several Workshops

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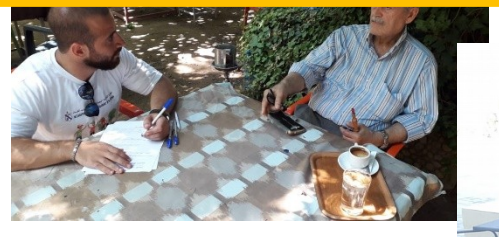
Awareness & Change Management Program

Performed Street Surveys



الإدارة المتكاملة للنفايات الصلبة في بلديات الفيحاء

استطلاع

رأيك مهم جدا في عملية التخطيط

كن مشاركًا في التغيير

الجزء الأول: فهم المجتمع لموضوع ادارة النفايات

الرقم	السؤال	نعم	كلا	لا اعرف
1	هل انت راض عن الطرق الحالية لجمع النفايات والتخلص منها؟			
2	هل تعرف كيف تخفف من انتاج النفايات؟			
3	هل تعرف بعض ايجابيات فرز النفايات من مصدرها؟			
4	هل تقوم بإعادة استخدام او تصليح اي من المنتجات التالية: قناني بلاستيكية، اجهزة كهربائية، الخ...			
5	هل لديك معلومات عن التسبيخ في المنزل؟			
6	هل سوف تساهم في تخفيف الإنتاج واعادة الإستخدام والفرز من المصدر؟			
7	هل تدعم تطبيق مخطط محسّن لإدارة النفايات في بلديتك شرط ان يتطابق مع المعايير الدولية؟			

الجزء الثاني: تقبل المجتمع لمشروع إدارة النفايات واستعداده لدفع ثمن الإدارة

الرقم	السؤال	نعم	كلا	لا اعرف
1	هل تعرف ماذا هو مبلغ المال الذي تدفعه مقابل التخلص من نفاياتك؟			
2	هل قد تقبل بمعمل لمعالجة النفايات قريبًا من بيتك؟			
3	ما هو معدل دخلك الشهري المنزلي؟			ل.ل
4	كم شخص يعيش في منزلك؟			ش

الجزء الثالث: معلومات عامة

الجنس: ☐ ذكر ☐ انثى

العمل: ☐ نعم ☐ كلا ☐ متقاعد(ة)

العمر: ☐ 12-17 ☐ 18-24 ☐ 25-34 ☐ 35-55 ☐ 55+

التعلم: ☐ إبتدائي ☐ مدرسة ☐ جامعة ☐ تعليم عالي ☐ تقني

مكان العيش: ☐ وسط المدينة ☐ ضواحي ☐ قرية

شكرًا لمساعدتك!

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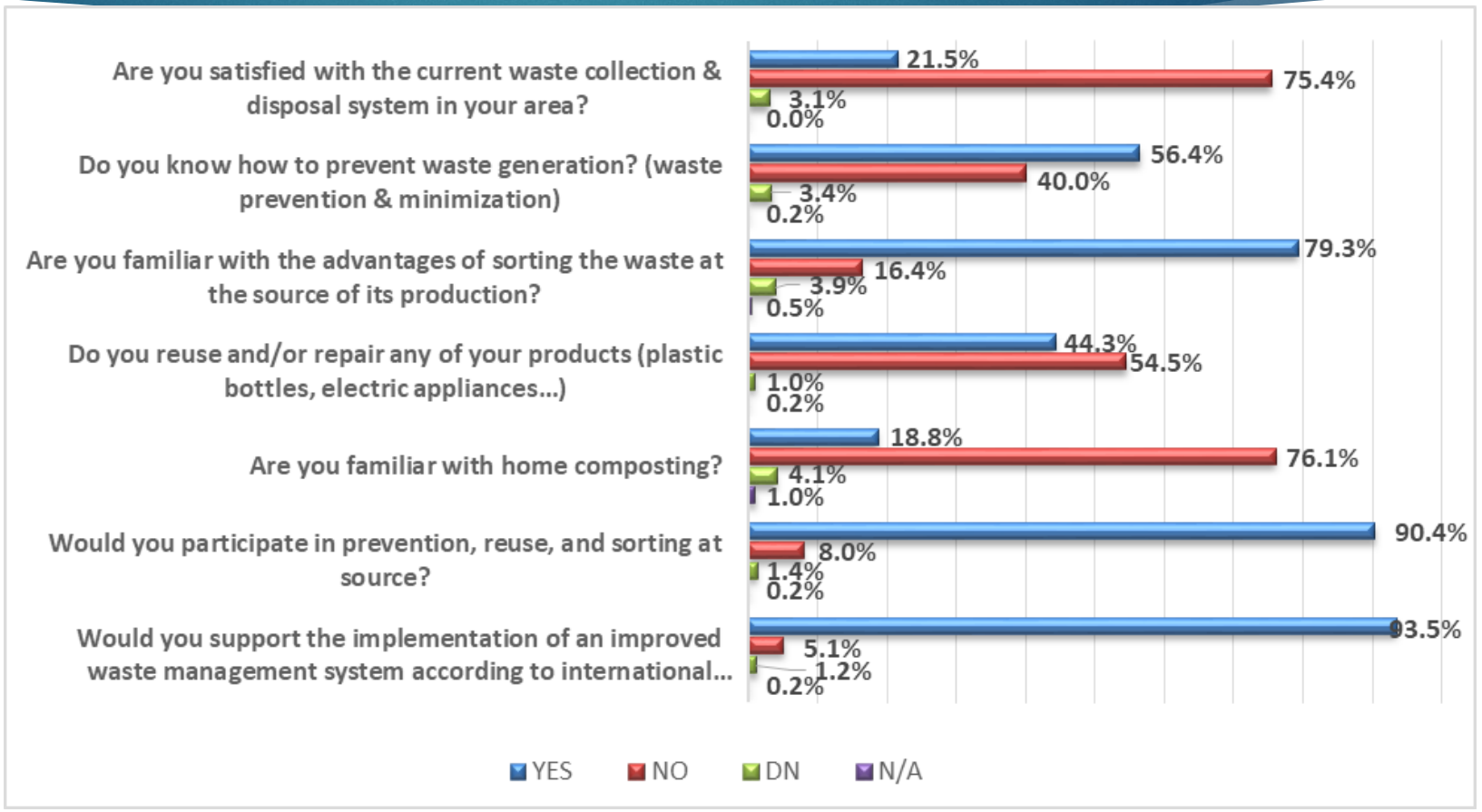
Street Surveys
Community Perception on Waste Management



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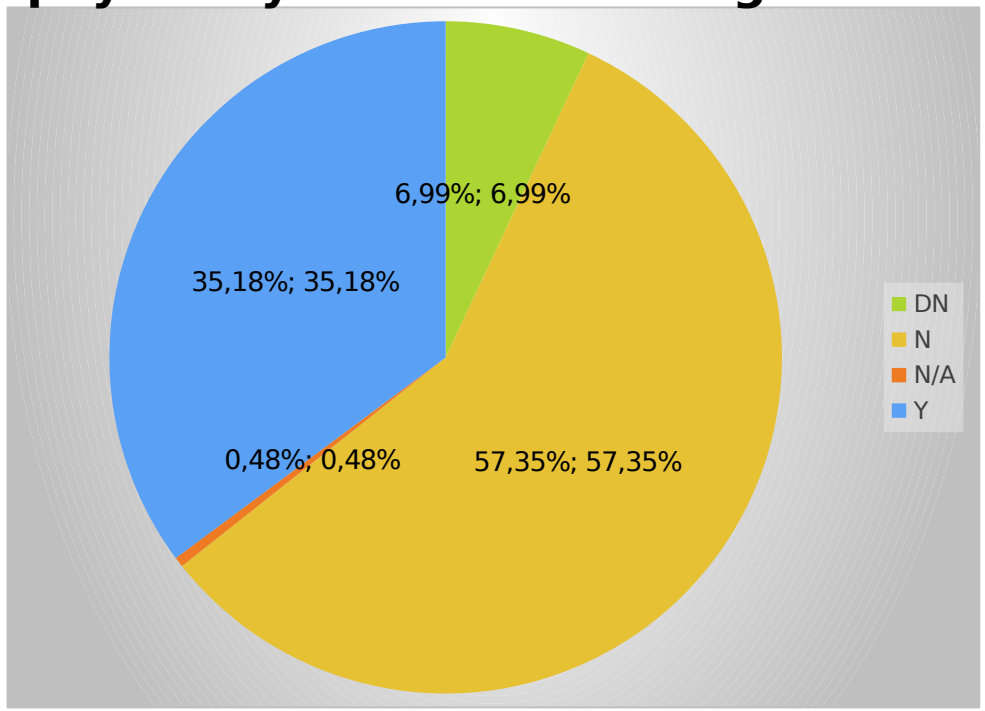
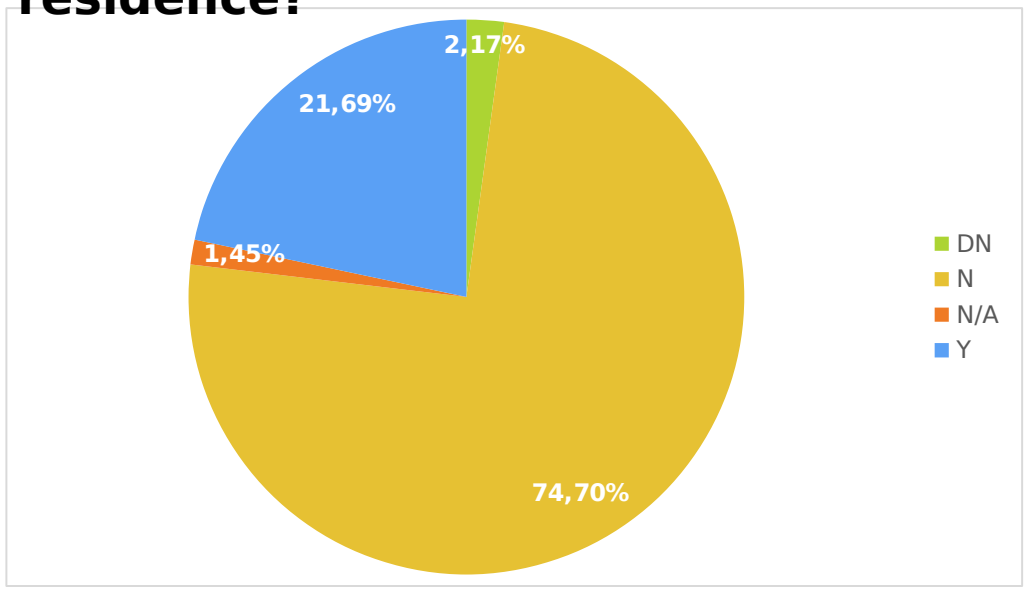
Street Surveys
Community Acceptance & Willingness to pay for Waste Management

Do you know how much money you pay today for Waste Management?



Would you accept a waste treatment plant near your residence?



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Street Surveys General Information

GENDER:	67 %	Male	32 %	Female	1%	N/A				
EMPLOYED:	41 %	Yes	24 %	No	35 %	Retired				
AGE GROUP:	1%	12-17	8%	18-24	13 %	25-34				
LEVEL OF EDUCATION:	3%	Elementary	50 %	High School	34 %	University		Higher Education	13 %	Technical
RESIDENCE:	80 %	City Centre	14 %	Suburbs	6 %	Village				

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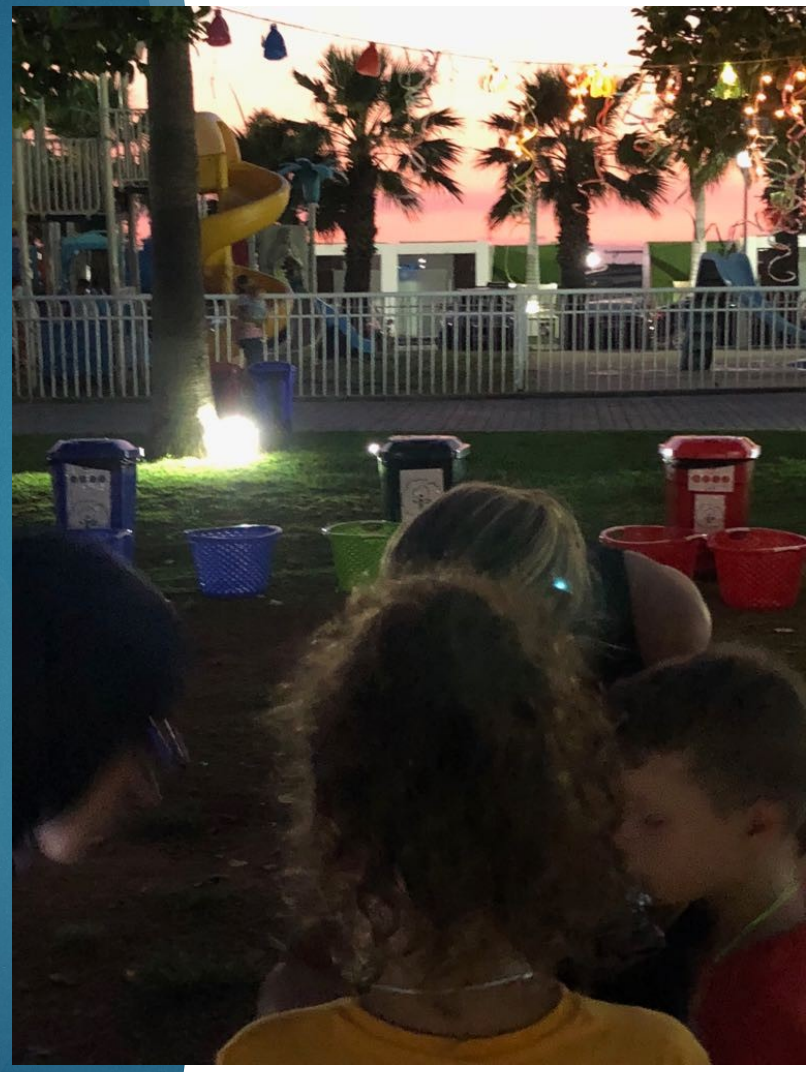
قمرالدين التقى مجلس ادارة المستشفى الاسلامي واستمع الى خطة معالجة النفايات من وفد "دار الهندسة نزيه طالب"

استقبل رئيس بلدية طرابلس المهندس احمد قمرالدين في مكتبه في القصر البلدي، وفدا من "دار الهندسة نزيه طالب وشركاه"، ضم المهندسون زياد نشابة، انطوني عون وجو جاد رفقا.

ناقش المجتمعون "بنود خطة معالجة النفايات من المصدر ضمن النطاق الاداري لاتحاد بلديات الفيحاء، طرابلس، الميناء، القلمون والبداوي".

ولفت الوفد بعد اللقاء، "ان دار الهندسة تجري الدراسة المطلوبة بناء لعقد موقع مع برنامج الامم المتحدة للتطوير الانمائي، ولقد

Role of the Civil Society Organizations



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Thank you for your attention!!

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