



United Nations Industrial Development Organization (UNIDO)

Project: *“Promotion of BAT and BEP to reduce uPOPs releases from waste open burning in the participating African countries of SADC sub-region”*

---

# **SOLID WASTE MANAGEMENT PLAN**

## **Municipality of ANTSIRABE**

(Draft version)

## Disclaimer

The designations employed and the presentation of material in this project publication do not imply the expression of any opinion whatsoever on the part of the GEF Secretariat or the UNIDO concerning the legal status of any country, territory, city or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries.

The mention of firm names or commercial products does not imply endorsement by GEF and UNIDO. Material in this project publication may be freely quoted or reprinted, but acknowledgement is requested, together with a copy of the publication containing the quotation or reprint.

© United Nations Industrial Development Organization, 2020  
This document has been funded by the Global Environment Facility (GEF).

Prepared by Richard David LEE  
TU Wien  
Institute for Water Quality and Resource Management  
Karlsplatz 13/226  
1040 Vienna  
Austria  
<https://iwr.tuwien.ac.at/en/resources/home/>

## Table of contents

<i>1</i>	<i>INITIAL CONSIDERATIONS</i> .....	<i>6</i>
1.1	Pre-planning decisions .....	6
<i>2</i>	<i>BACKGROUND</i> .....	<i>8</i>
2.1	Waste problematic in the local context .....	8
2.2	Initial scope of the plan .....	9
<i>3</i>	<i>STATUS QUO ASSESSMENT</i> .....	<i>11</i>
3.1	Default data collection.....	11
3.1.1	Population and municipal data.....	11
3.1.2	Waste quantity and composition data .....	12
3.1.3	Waste policies and legislation .....	13
3.1.4	Institutions in place.....	16
3.1.5	Technologies in use .....	17
3.1.6	Costs and financing of the WMS.....	21
3.1.7	Stakeholder participation .....	29
3.2	Future projections.....	30
3.2.1	Projected municipal solid waste quantity .....	30
3.2.2	Projected municipal solid waste composition.....	31
3.3	Deficit analysis .....	32
3.3.1	Material flow analysis diagram of municipal waste management system .....	32

3.3.2	Waste management system deficiencies based on material flow analysis and other data collection.....	34
3.3.3	Emissions estimates based on waste composition and quantities.....	34
3.4	Status report.....	38
4	<i>PLANNING PHASE</i> .....	39
4.1	Setting objectives and targets.....	39
4.2	Stakeholder feedback on targets and objectives.....	42
4.3	Scenario creation.....	43
4.3.1	Description of scenarios.....	43
4.4	Action plan.....	44
4.4.1	Predicted MFA diagram based on WMS improvements.....	48
4.4.2	Expected reduction of uPOP and GHG emissions based on WMS improvements.....	49
5	<i>IMPLEMENTATION</i> .....	53
5.1	Implementation program.....	53
6	<i>MONITORING AND REVIEW</i> .....	60
6.1	Actions to be monitored.....	60
6.2	Performance indicators.....	62



### **General information about Municipality of Antsirabe**

Antsirabe Urban Municipality (Antsirabe I) is one of the five sub-prefectures that constitute the Vakinankaratra region. It has a surface of 180 Km<sup>2</sup>.

Antsirabe, the second largest city in Madagascar, has long been home to important industrial activities:

- The COTONA of the SOCOTA group remains the leading textile complex in the Indian Ocean with a branch in Mauritius which produces about 20 million metres of fabric per year, employing some 2000 people.
- SACIMEM of the CORALMA group manufactures cigarettes, smoking tobacco and chewing tobacco for the Malagasy market and for export. The development of SACIMEM on the local market is limited by purchasing power. This is why it focuses its efforts on the competitiveness of its products for export. SACIMEM supports more than 450 families.
- STAR produces beer, one of the best according to connoisseurs, as well as soft drinks such as Coca Cola, Fanta, Sprite and other products under American licence.

Overall, all the sub-prefectures of the DRDR are characterised by the predominance of food crops, with speculation in sugar cane and coffee remaining very limited.

At the level of the Urban Municipality of Antsirabe, about 29,600 farmers cultivate different speculations on 4,234 Ha of surface area for a total production of 18,000 T.

The Urban Municipality of Antsirabe is composed of six (6) arrondissements with a total population of 340,904 shared out in 60 Fokontany, 31 of which have a total population of 261,925 inhabitants spread over 4,961 households in the urbanized areas. The remaining population ie 78,979 inhabitants in 18937 households live in the surrounding areas.

In the urban municipality of Antsirabe, on average, 38% of households are served by a collection system organized either by the municipality itself through its technical service or individually at the household level.

In the waste management system, the Commune is currently working with the FAMAFa structure, which operates in 6 Fokontany through the implementation of a pre-collection system at the household level and sorting at the level of waste bins.



## 1 INTITIAL CONSIDERATIONS

### 1.1 Pre-planning decisions

Table 1: Decisions taken during the initial meeting with stakeholders about the planning process of the solid waste management plan

Results of initial pre-planning meeting with stakeholders on						
List of stakeholders to take an active role in the planning process (make note of which ones attended the meeting with an *)		Number and purpose of each working group	Stakeholders and their assigned working group	Timeline for the planning process	Meeting frequency of working groups	Other significant planning deadlines
<u>Waste managers:</u> - Mayor of the municipality* - Technical direction of municipality - Environmental direction from municipality - FAMAFa - FIMAS	<u>Waste generators:</u> - Households in Fokontany - Hotels, - Commercial activities - Market	WG1: Waste collection:  WG2: Waste recycling and recovery	WG1 : - Direction Technique, - Direction Environnement - FAMAFa, Technical - Service Project and Partnership - Technical consultant - NGO - Fokontany - Representative of private sector  WG2 : - Direction Technique,	(*)	(*)	Waste collection rate and all cost of waste management determined by WG1  Scheme of waste recycling and composting system defined by WG2



Results of initial pre-planning meeting with stakeholders on						
List of stakeholders to take an active role in the planning process (make note of which ones attended the meeting with an *)		Number and purpose of each working group	Stakeholders and their assigned working group	Timeline for the planning process	Meeting frequency of working groups	Other significant planning deadlines
			<ul style="list-style-type: none"> <li>- Direction Environnement</li> <li>- FAMAFa, Technical</li> <li>- Service Project and Partnership</li> <li>- Technical consultant</li> </ul>			

(\*) Note that this plan was prepared in several steps:

- 1- Preparation of the plan by a small group composed of the Technical Directorate, the Directorate of Environment and the Unit of Decentralized Cooperation and Partnership Development with the support of the Technical Consultant;
- 2- Presentation of the draft plan to the Mayor;
- 3- Organization of a workshop with the stakeholders;
- 4- Presentation of the draft Plan by the Mayor to the Communal Council for validation



## 2 BACKGROUND

### 2.1 Waste problematic in the local context

Table 2: List of reasons why waste is problematic in ANTSIRABE

Problems waste is causing in ANTSIRABE	
<u>Health-related:</u>	<ul style="list-style-type: none"> <li>• Increased sightings of rodents like mice and rats scavenging in uncollected waste piles</li> <li>• Not all waste that's generated is collected → leads to open dumping and burning</li> <li>• Informal waste pickers, working in unsanitary conditions without protective clothing, seen as risk</li> </ul>
<u>Environmental:</u>	<ul style="list-style-type: none"> <li>• No sanitary liner at the managed disposal site; leachate runs into the groundwater</li> <li>• No pre-treatment for wet organic waste going to landfill; methane emissions:</li> <li>• Low level of ownership of good sanitation practices</li> <li>• Clogging of storm water drainage channels</li> <li>• Clogging of wastewater networks</li> </ul>
<u>Aesthetic:</u>	<ul style="list-style-type: none"> <li>• Community collection bins are overflowing near major points of commercial activity in town; businesses are moving to other areas</li> </ul>
<u>Technical</u>	<ul style="list-style-type: none"> <li>• Low logistical capacity: vehicles and tractors often broken down</li> </ul>
<u>Legal</u>	<ul style="list-style-type: none"> <li>• Lack of a legal framework for waste management (Municipal Hygiene Code)</li> </ul>
<u>Financial</u>	<ul style="list-style-type: none"> <li>• Weakness of the financial resources of the municipality</li> <li>• Weak financial capacity of the associations</li> <li>• Lack of a policy for collecting fees/taxe</li> </ul>





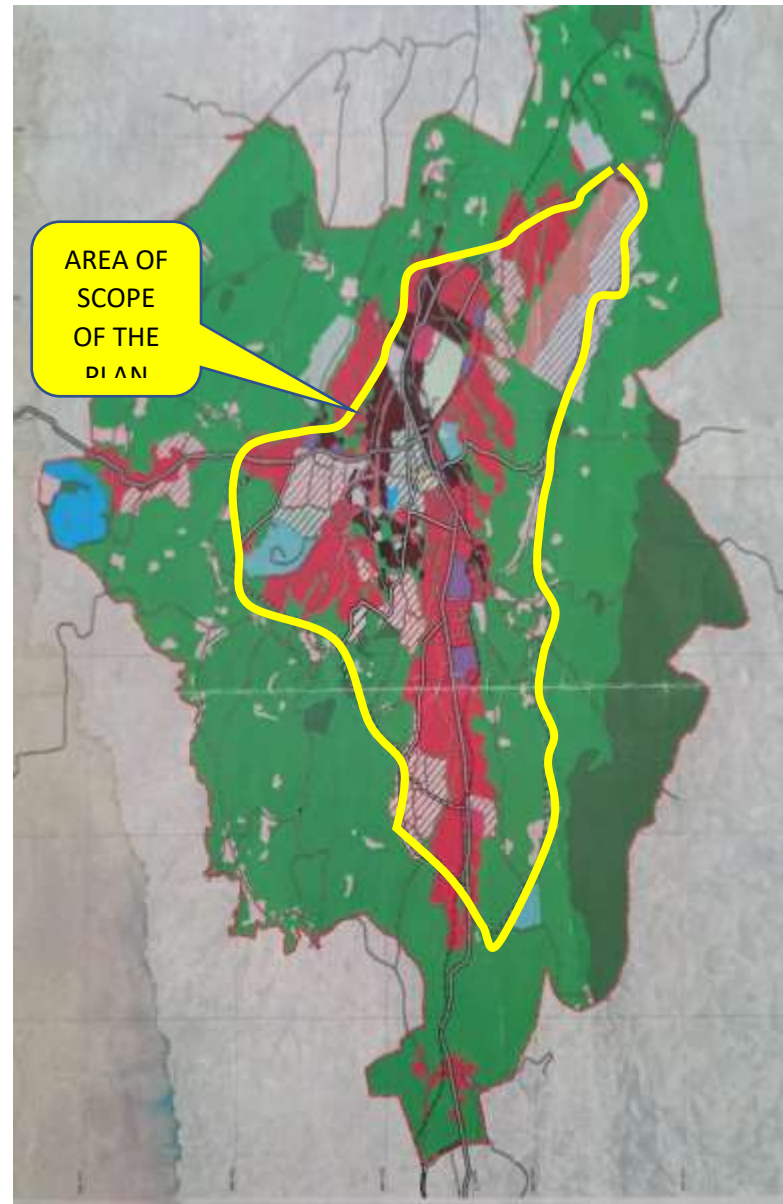
## 2.2 Initial scope of the plan

Table 3: Initial scope of the solid waste management plan

Solid Waste Management Plan Scope		
Geographic	Types of Waste	Timeline (e.g., overall 5-10 years; 1-2 action plans resp.)
<u>Included:</u> <ul style="list-style-type: none"><li>- all 31 urbanized fokontany</li></ul> <u>Excluded:</u> <ul style="list-style-type: none"><li>- 29 surrounding fokontany</li><li>- All industries facilities</li></ul>	<u>Included:</u> <ul style="list-style-type: none"><li>- Municipal solid waste (MSW)</li></ul> <u>Excluded:</u> <ul style="list-style-type: none"><li>- industrial waste</li><li>- agricultural waste</li><li>- Healthcare waste</li></ul>	5 years



Map of scope of the plan





### 3 STATUS QUO ASSESSMENT

#### 3.1 Default data collection

##### 3.1.1 Population and municipal data

Table 4: Required population and municipal data for the SWMP

[insert municipality name]'s Population and Municipal Data			
Population size (No. of people)	Size of WM area (km <sup>2</sup> ) or (No. of households)	Population density (ppl/km <sup>2</sup> ) or (ppl/household)	GNI/capita (USD/person)
261 925 people	49 610 households	2916,27 people/km <sup>2</sup>	521 USD/person



### 3.1.2 Waste quantity and composition data

Table 5: Required waste quantity and composition data for the SWMP

ANTSIRABE's Waste Quantity and Composition Data																								
Determined average waste generation rate per person	(kg/pers/day)	0,3 kg/day																						
Population	(no. of ppl)	261 925 people																						
Total waste generated per day (tonnes/day)	(tonnes/day)	78,6 tonnes/day>																						
Total waste generated per year (tonnes/year)	(tonnes/year)	28689 tonnes/year>																						
Determined average waste composition	(%)	<table border="1"> <thead> <tr> <th>Waste Material</th> <th>Average Percent in Waste</th> </tr> </thead> <tbody> <tr> <td>Organic</td> <td>60,9%</td> </tr> <tr> <td>Paper &amp; Cardboard</td> <td>6,4%</td> </tr> <tr> <td>Plastics</td> <td>7,3%</td> </tr> <tr> <td>Metals</td> <td>0,3%</td> </tr> <tr> <td>Glass, ceramic</td> <td>3,6%&gt;</td> </tr> <tr> <td><i>Rubber, Leather, and Synthetics</i></td> <td>0,2%</td> </tr> <tr> <td><i>Textiles</i></td> <td>2%</td> </tr> <tr> <td>&lt;Wood&gt;</td> <td>3,3%</td> </tr> <tr> <td>&lt;Inert Material&gt;</td> <td>0%</td> </tr> <tr> <td>&lt;Other&gt;</td> <td>7,5%</td> </tr> </tbody> </table>	Waste Material	Average Percent in Waste	Organic	60,9%	Paper & Cardboard	6,4%	Plastics	7,3%	Metals	0,3%	Glass, ceramic	3,6%>	<i>Rubber, Leather, and Synthetics</i>	0,2%	<i>Textiles</i>	2%	<Wood>	3,3%	<Inert Material>	0%	<Other>	7,5%
Waste Material	Average Percent in Waste																							
Organic	60,9%																							
Paper & Cardboard	6,4%																							
Plastics	7,3%																							
Metals	0,3%																							
Glass, ceramic	3,6%>																							
<i>Rubber, Leather, and Synthetics</i>	0,2%																							
<i>Textiles</i>	2%																							
<Wood>	3,3%																							
<Inert Material>	0%																							
<Other>	7,5%																							
Determined average waste density (kg/m <sup>3</sup> )	(kg/m <sup>3</sup> )	300 kg/m <sup>3</sup>																						



### 3.1.3 Waste policies and legislation

Table 6: Policies and legislation relevant to solid waste management; reproduced from (UNEP, 2009)

Area of Waste Management	Laws and Acts	Regulations and Standards	Economic Instruments	Enforcement
Overall (General)	<ul style="list-style-type: none"> <li>- Law No. 90-033 of 21 December 1990 on the Malagasy Environment Charter</li> <li>- Law n° 98-029 du 20 /01/99 relating to Water Code (applies to waters dependent on the public domain, surface water, groundwater)</li> <li>- Law N° 99-021 du 19/08/ 99 on Industrial pollution management policy (wastewater management, solid waste management)</li> <li>- Decree N ° 2004-167 modifying some provisions of decree n ° 99-954 of December 15, 1999 relating to the compatibility of investments with the environment (MECIE)</li> </ul>			
Source Reduction (Production & Consumption)	<ul style="list-style-type: none"> <li>- Decree N° 2017-010 prohibiting the production, import, marketing, stockpiling and use of plastic bags in the national territory</li> <li>- Decree N° 2015-930 on Classification and environmentally sound management of waste electrical and electronic equipment in Madagascar</li> </ul>			



Area of Waste Management	Laws and Acts	Regulations and Standards	Economic Instruments	Enforcement
Segregation of Waste (at source)				
Primary Storage & Collection		- City Bylaw N° 167/2020/CU/ABE regulating the hours of deposit of waste for each household in the bins.		
Transportation & Transfer Stations				
Treatment				
Landfills				
Incinerators				
Recycling				
Resource Recovery				



Area of Waste Management	Laws and Acts	Regulations and Standards	Economic Instruments	Enforcement
(Healthcare Waste)				



### 3.1.4 Institutions in place

Table 7: Institutions involved in solid waste management; reproduced from (UNEP, 2009)

Type of Service	Regulator	Service Provider			
		National Government	Local Government	Private Sector	Informal
Municipal Solid Waste Management					
1. Collection			Municipality FAMAFA		
2. Transportation			Municipality		
3. Treatment					
4. Disposal			Municipality	Companies (*)	
5. Recycling / Resource Recovery					A few parts of the recoverable waste ( uncollected by the municipality) are sold/donated by households to informal recyclers/reclaimers.
(Healthcare Waste Management)			Healthcare facilities		

(\*) Two companies bring their waste directly to the landfill site (general waste)





### 3.1.5 Technologies in use

Table 8: Technologies available for solid waste management; taken and modified from (UNEP, 2009)

Type of Service	Technology				
	Type	Quantity	Year of Purchase / Years in Operation	Condition (old, new, well maintained, overused, worn, out of operation)	Important Features
Municipal Solid Waste Management					
1. Collection/2. Transportation	Metal dump truck	2	2020	Well maintained	Ease of handling
	Metal dump truck	1	2022	New	
	Tractor	1	2010	old	
	Tractor	1	2010	Out of operation	
	Truck	1	2018	overused	
	Truck	2	2009	Out of operation	
3. Treatment					
4. Disposal					
5. Recycling / Resource Recovery					
(Healthcare Waste Management)					



### 3.1.5.1 Waste collection rate

Table 9: Waste collection rate as determined by quantity and load capacity of entire waste collection fleet

Waste Collection Register					
Collection vehicle type and its load capacity	Average waste density of waste type (e.g., MSW)	Calculated mass of waste delivered per truck load	Average number of trips to disposal site per vehicle per day	Number of active collection vehicles of this type per day	Total waste collected (tonnes/day)
(m <sup>3</sup> )	(kg/m <sup>3</sup> )	(kg/vehicle load)	(No.)	(No.)	(tonnes/day)
Metal dump truck 6 m <sup>3</sup>	300 kg/m <sup>3</sup>	1,800 kg/load = 1.8 tonnes/load>	4	3	<b>21,6 tonnes/day</b>
Truck 5 m <sup>3</sup>	300 kg/m <sup>3</sup>	1500 Kg/load = 1,5 Tonnes/load	4	1	<b>6 tonnes/day</b>
<b>Tractor 3 m<sup>3</sup></b>	<b>300 kg/m<sup>3</sup></b>	<b>900 Kg/load = 0,9 Tonnes/load</b>	<b>2</b>	<b>1</b>	<b>1,8 Tonnes/day</b>
<b>Total Waste Collected per Day</b>					<b>29,4 tonnes/day</b>



### 3.1.5.2 Percentage of the population serviced

Table 10: Percentage of the population served by waste collection services, according to surveys or other data

Waste Collection Coverage Rate	
Total number of households that participated in survey	35
No. households that participated from impoverished areas	21
No. households that participated from affluent areas	14
Collection rate for impoverished households	40%
Collection rate for affluent households	80%
No. people living in impoverished areas	157 155
No. people living in affluent areas	104 770
<b>Calculated waste collection coverage rate</b>	<b>37,4%</b>



### 3.1.5.3 Waste recycling, recovery, and organic waste valorization rate

Table 11: Waste valorization rate of Antsirabe

[insert year] Waste Recycling, Recovery, and Organic Waste Valorization Rate		
Recovery activity description	Quantity of waste	Percentage of total waste generated
	(tonnes per year)	(%)
Organic waste converted to compost or applied directly to soil as an organic fertilizer in agriculture	0	0
Combustible waste used as a fuel or for energy generation in an incineration plant (unrecyclable paper and plastics, rubber, wood, textiles, etc.)	0	0
Waste materials separated for recycling purposes (metals, plastics, paper)	0	0
Waste materials recovered for direct reuse or repurposing (e.g., plastic bottles)	0	0
	<b><i>Total Percent Waste Valorized</i></b>	<b><i>0</i></b>



### 3.1.6 Costs and financing of the WMS

#### 3.1.6.1 Total costs

##### Operating costs

##### *Labor costs*

Table 12: Register of total labor costs, based on all workers formally and informally employed by the WMS

Waste Management Stage	Job Title/ Description	Number of Workers	Employer/ Employed by	Primary Source of Payments	Annual Salary + Other Costs per Worker (Ariary)	Annual total
Waste Collection Waste transportation	Management	2	Municipality	Miscellaneous taxes	4 800 000	<b>9 600 000</b>
	Chief of service	2	Municipality	Miscellaneous taxes	7 200 000	<b>14 400 000</b>
	Surveillant	4	Municipality	Miscellaneous taxes	4 800 000	<b>19 200 000</b>
	Agent nettoyage des rues	25	Municipality	Miscellaneous taxes	3 600 000	<b>90 000 000</b>
	<i>Manutentionnaire</i>	<i>15</i>	Municipality	Miscellaneous taxes	<i>3 600 000</i>	<b><i>54 000 000</i></b>
	<i>Drivers</i>	<i>7</i>	Municipality	Miscellaneous taxes	<i>4 200 000</i>	<b><i>29 400 000</i></b>
Waste Treatment						
Recycling / Resource Recovery						
Waste Disposal	<i>Security</i>	<i>1</i>			<i>3 600 000</i>	<b><i>3 600 000</i></b>



Waste Management Stage	Job Title/ Description	Number of Workers	Employer/ Employed by	Primary Source of Payments	Annual Salary + Other Costs per Worker (Ariary)	Annual total
Informal Solid Waste Management***						
(Healthcare Waste Management Chain)						
<b>Total Labor Costs per Year</b>						<b>220 200 000</b>

\*\*\*Record but DO NOT include in the overall annual labor costs

*Energy costs*

Table 13: Register of total energy costs, based on all of the vehicles, equipment, and facilities in operation in the WMS

Type of Service	Fuel/Energy-consuming vehicle, equipment, or facility	Quantity	Fuel/Energy consumption rate	Hours per year in operation	Total fuel/energy consumed per year	Average fuel price of the last 12 months	Annual total
		(No.)	(liters/hr; kWh)	(hrs/yr)	(liters or kWh)	(Ariary/liter)	(Ariary)
Municipal Solid Waste Management							
1.Collection 2.Transportation	Metal dump truck 6 m <sup>3</sup>	3	12 liters/hr	1560 hours/year>	18720 liters of petrol/year>	4900 per liter petrol>	<b>91 728 000</b>
	Truck 5 m <sup>3</sup>	1	4 liters/hr	520 hours/year>	6240liters or petrol/year>	4900 per liter petrol>	<b>30 576 000</b>



Type of Service	Fuel/Energy-consuming vehicle, equipment, or facility	Quantity	Fuel/Energy consumption rate	Hours per year in operation	Total fuel/energy consumed per year	Average fuel price of the last 12 months	Annual total
		(No.)	(liters/hr; kWh)	(hrs/yr)	(liters or kWh)	(Ariary/liter)	(Ariary)
	Tractor 3 m <sup>3</sup>	1	1,6 liters/hr	499,2 hours/year	798,72liters or petrol/year>	4900 per liter petrol>	<b>3 913 728</b>
3. Treatment							
4. Disposal							
5. Recycling / Resource Recovery							
(Healthcare Waste Management)							
<b>Total Energy Costs per Year</b>							<b>156 793 728</b>



Maintenance costs

Table 14: Register of total maintenance costs, based on all of the technologies and equipment in use in the WMS

Type of Service	Type of technology, vehicle, or equipment	Quantity	Years in operation	Condition	Original cost / Price at time of purchase	Estimated maintenance cost percentage	Annual total
		(No.)	(No.)	(old, new, overused, out of operation)	(Ariary)	(~5-10%)	(Ariary/year)
Municipal Solid Waste Management							
1. Collection							
2. Transportat ion	Metal dump truck 6 m <sup>3</sup>	3	2	New	150 000 000	45 000 000	<b>45 000 000</b>
	Truck 5 m <sup>3</sup>	1	5	overused	150 000 000	15 000 000	<b>15 000 000</b>
	Tractor 3 m <sup>3</sup>	1	13	old	50 000 000	5 000 000	<b>5 000 000</b>
3. Treatment							
4. Disposal							
5. Recycling / Resource Recovery							
(Healthcare Waste Management)							
<b>Total Maintenance Costs per Year</b>							<b>65 000 000</b>





Financial Costs

*Depreciation*

Table 15: Register of total depreciation costs, based on all financial assets included in the WMS

Area of waste management	Type of financial asset	Quantity	Original price of asset	Typical economic life	Inflation rate	Annual total
		(No.)	(Ariary)	(No. years)	(%)	(Ariary/year)
Municipal Solid Waste Management						
1. Collection 2. Transportation	Metal dump truck 6 m <sup>3</sup>	3	450 000 000	7	0	<b>64 285 714</b>
	Truck 5 m <sup>3</sup>	1	150 000 000	7	0	<b>21 428 571</b>
	Tractor 3 m <sup>3</sup>	1	50 000 000	10	0	<b>5 000 000</b>
3. Treatment						
4. Disposal						
5. Recycling / Resource Recovery						
(Healthcare Waste Management)						
<b>Total Depreciation Costs per Year</b>						<b>90 714 285</b>



*Interest rates*

Table 16: Register of total financial costs associated with borrowing money for larger purchases in the WMS

Purpose of loan (for purchase of which asset/s)	Amount of money borrowed	Interest rate on loan	Duration of loan	Annual payment (A) due to lender (annual financial cost of the loan)
	("P" = principal in USD)	("r" in %)	("n" in years)	(USD/year)
<b>Total Financial Costs of Loans per Year</b>				

<b>TOTAL COSTS PER YEAR: 558 592 628 Ariary/year</b>
--



### 3.1.6.2 Total available funding

Table 17: Financing methods used to fund the solid waste management system; reproduced from (UNEP, 2009)

Type of Service	Organization	Financing Mode		
		Direct Revenue	Local or Natl. Govt. / Intl. Cooperation	Private Sector
Municipal Solid Waste Management				
1. Collection/ Transportation	Population of 21 Fokontany (ROM (Household waste tax))	30 391 300		
3. Treatment				
4. Disposal	Contribution to landfilling			18 000 000
5. Recycling / Resource Recovery				
(Healthcare Waste Management)				

<b>TOTAL AVAILABLE</b>	<b>48 391 300 Ariary/year</b>
------------------------	-------------------------------



**FUNDING PER YEAR:**

3.1.6.3 Total cost per tonne of waste managed

Table 18: Total cost per tonne of waste managed

Total costs for WM services	Ariary/year)	<b>558 592 628 Ariary/year</b>
Total waste collected annually (MSW/day) x (312days)	(tonnes/year)	<b>9 173 Tonnes/year&gt;</b>
Total cost per tonne MSW managed	(Ariary/tonne)	<b>60 895,30 Ariary/tonne MSW</b>

3.1.6.4 Financial summary

Table 19: Financial summary based on all salient economic factors involved in waste management in the municipality

Financial Summary for Antsirabe		
TOTAL AVAILABLE FUNDING	Ariary/year	<b>48 391 300 Ariary/year</b>
TOTAL COSTS PER YEAR	(Ariary/year)	<b>558 592 628 Ariary /year&gt;</b>
FINANCIAL BOTTOM LINE (Funds minus Costs)	(Ariary/year)	<b>-510 201 328 Ariary /year</b>
ECONOMICALLY SUSTAINABLE (YES or NO)	(YES or NO)	<b>NO</b>



COST RECOVERY PERCENTAGE (Funds divided by Costs)	(%)	<b>0.086 → 8.66%</b>
COST PER CAPITA	(Ariary/person)	<b>2577 Ariary/person</b>
COST PER TONNE OF WASTE MANAGED	(Ariary/tonne MSW)	<b>60 895,30 Ariary /tonne MSW</b>

### 3.1.7 Stakeholder participation

Table 20: Stakeholder participation in solid waste management; reproduced from (UNEP, 2009)

Type of Service	Major Stakeholders	Level of Stakeholder Participation	Measures to Improve Stakeholder Participation
Municipal Solid Waste Management	Municipality	<u>Extensive</u> : collection, transportation, landfilling;  Direct collection by the municipality (high charge) compared to the resources (financial, personal, material resources)	<ul style="list-style-type: none"> <li>- Delegation of service</li> <li>- Increase of resources</li> </ul>
	FAMAFA	Limited to pre-collection: low coverage rate - Routing to municipal bins - Materials and equipment (maintenance and renewal)	<ul style="list-style-type: none"> <li>- Increase of the coverage rate</li> <li>- Renewal of materials</li> <li>- Recoverable waste to RCC by FAMAFA</li> </ul>
	Fokontany	Limited to pre-collection: low coverage rate	<ul style="list-style-type: none"> <li>- Awareness and monitoring of waste management</li> <li>- Enforcement of internal regulations</li> </ul>



Type of Service	Major Stakeholders	Level of Stakeholder Participation	Measures to Improve Stakeholder Participation
	FIMAS	Limited: - Action limited to the Asabotsy Market - Insufficient staff in comparison to the number of merchants	- Increase in staff and material resources
(Healthcare Waste Management)			

### 3.2 Future projections

#### 3.2.1 Projected municipal solid waste quantity

Current Population: **261 925**  
 Population Growth Rate: **1,08%**  
 Duration of SWM plan: **5**  
 Current per Capita Waste Generation Rate: **0,3 Kg/pers/j**



Projected Population: **275 286**  
 Projected per Capita Waste Generation Rate: **0,3 Kg/pers/j**  
 Projected Total Waste Generation Rate: **82, 58 Tonnes/day**

**3.2.2 Projected municipal solid waste composition**

Current Gross National Income per Capita: **521 USD**  
 Current Income Category: **Low**  
 Municipal GNI per Capita Growth Rate: **1,08%**  
 Duration of SWM plan: **5**

Projected Gross National Income per Capita: **547,58 USD**  
 Projected Income Category (if different): **Low**  
 Projected Waste Composition (if new income)<sup>1</sup>:

As there is no change in category for the country after projection, the composition of the waste is considered the same

Waste Material	Average Percent in Waste
Organic	60,9%
Paper & Cardboard	6,4%
Plastics	7,3%
Metals	0,3%
Glass, ceramic	3,6%>
Rubber, Leather, and Synthetics	0,2%
Textiles	2%
Wood	3,3%
Inert Material	0%
Other	7,5%

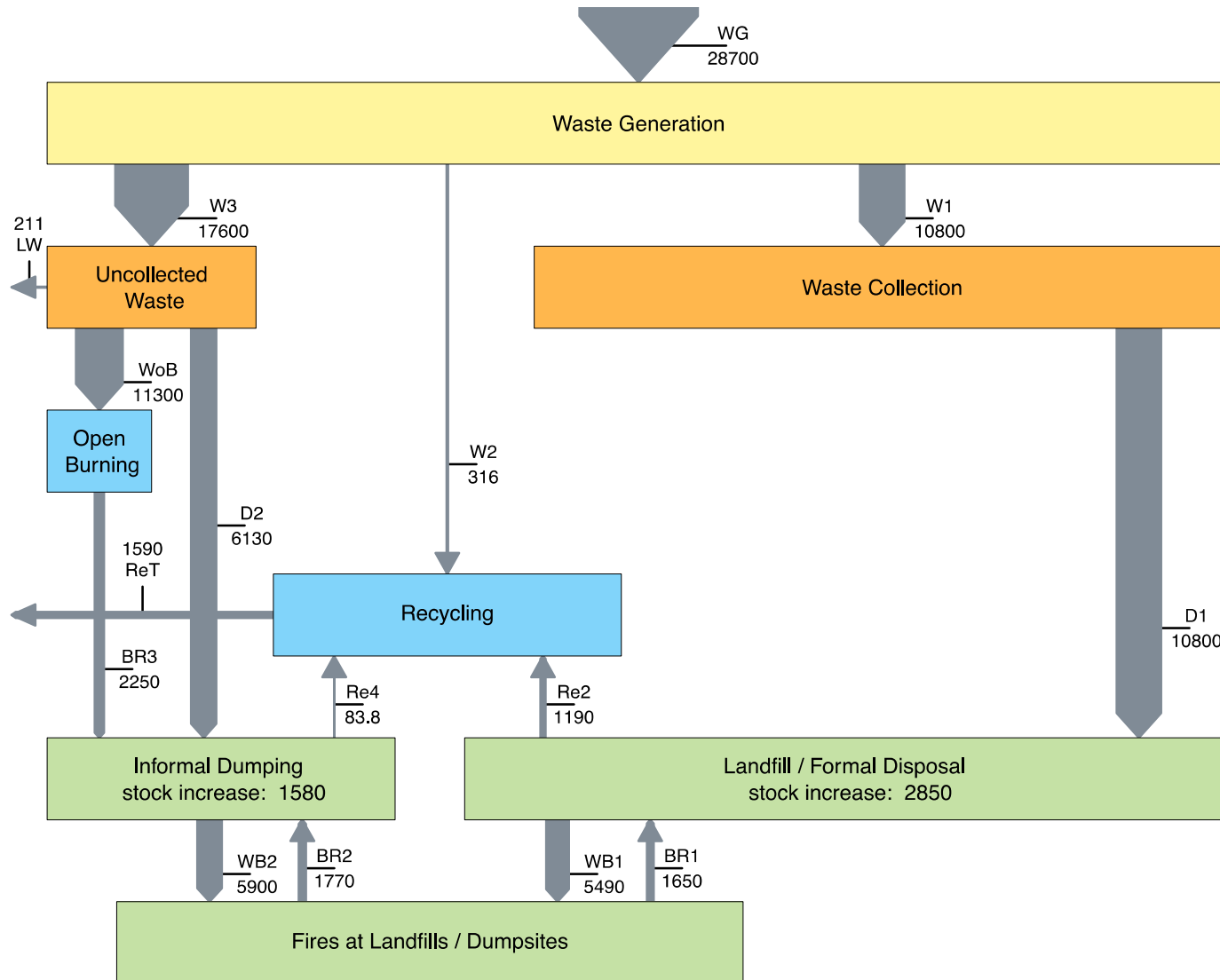
<sup>1</sup>Take values from Box 13 in the SWMP toolkit under Section 3.4.2 in the absence of more precise projection values.



### *3.3 Deficit analysis*

#### **3.3.1 Material flow analysis diagram of municipal waste management system**







### 3.3.2 Waste management system deficiencies based on material flow analysis and other data collection

- Data on uncollected waste were estimated but are not based on household studies or surveys:
  - % of waste sent by households to informal dumping;
  - % of waste sent to water;
  - % of waste burned
  - % of waste to recycling process
- The funds available for waste management are not well defined. Only waste fees and the contribution of private sector (2 companies) are allocated to waste management.
- % of fires at landfill and dumpsite are estimates but not based on study/survey

### 3.3.3 Emissions estimates based on waste composition and quantities

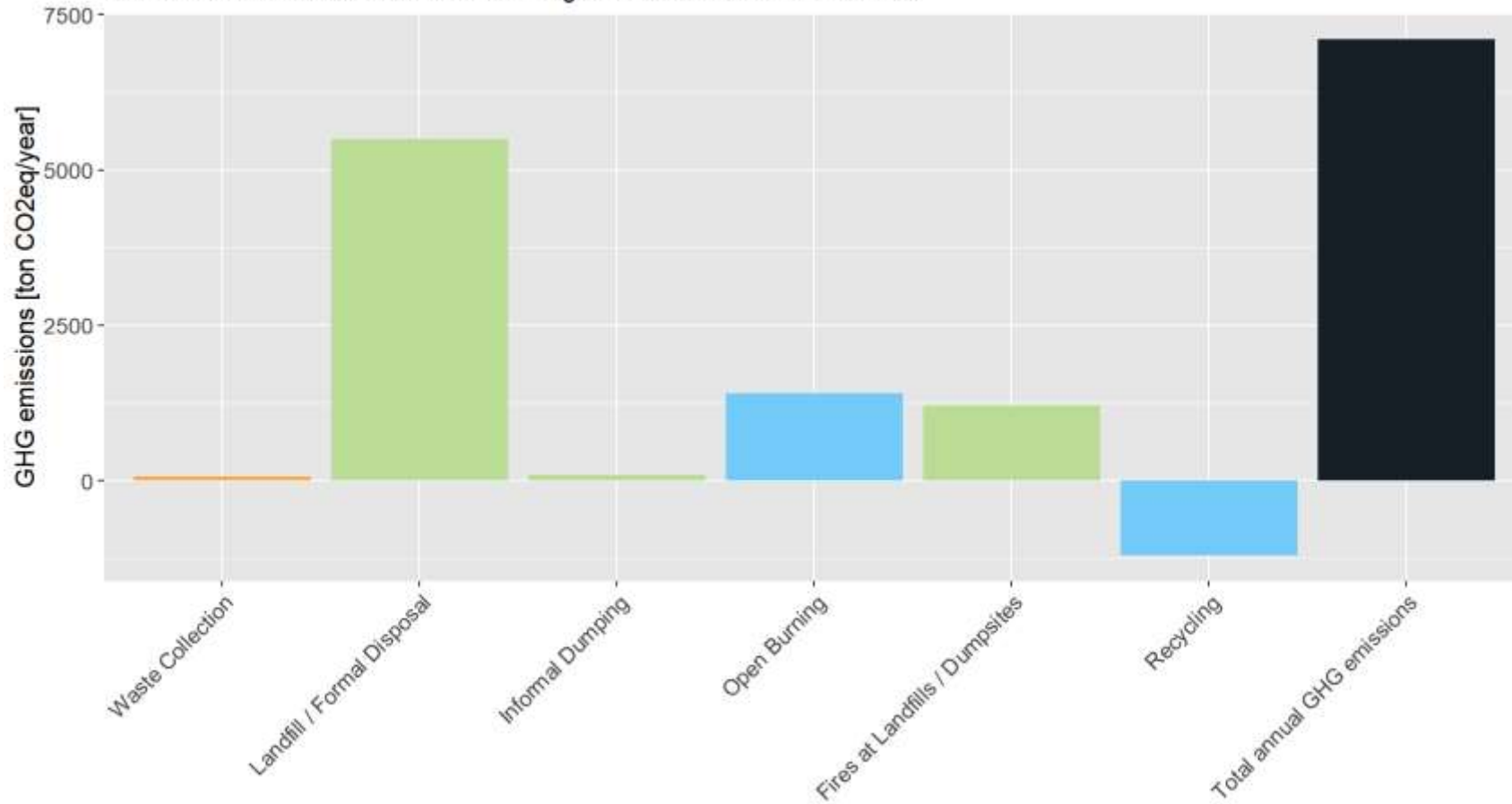
#### 3.3.3.1 Greenhouse gas emissions

PROCESS	EMISSION (Tonnes CO2 eq/Year)
Waste Collection	67
Landfill / Formal Disposal	5500
Informal Dumping	85
Open Burning	1400
Fires at Landfills / Dumpsites	1200
Recycling	- 1200
Composting	0
<b>TOTAL</b>	<b>7052</b>



### SWM ANTSIRABE - Annual Greenhouse Gas emissions

GHG emissions have been determined using emission factors from the IPCC





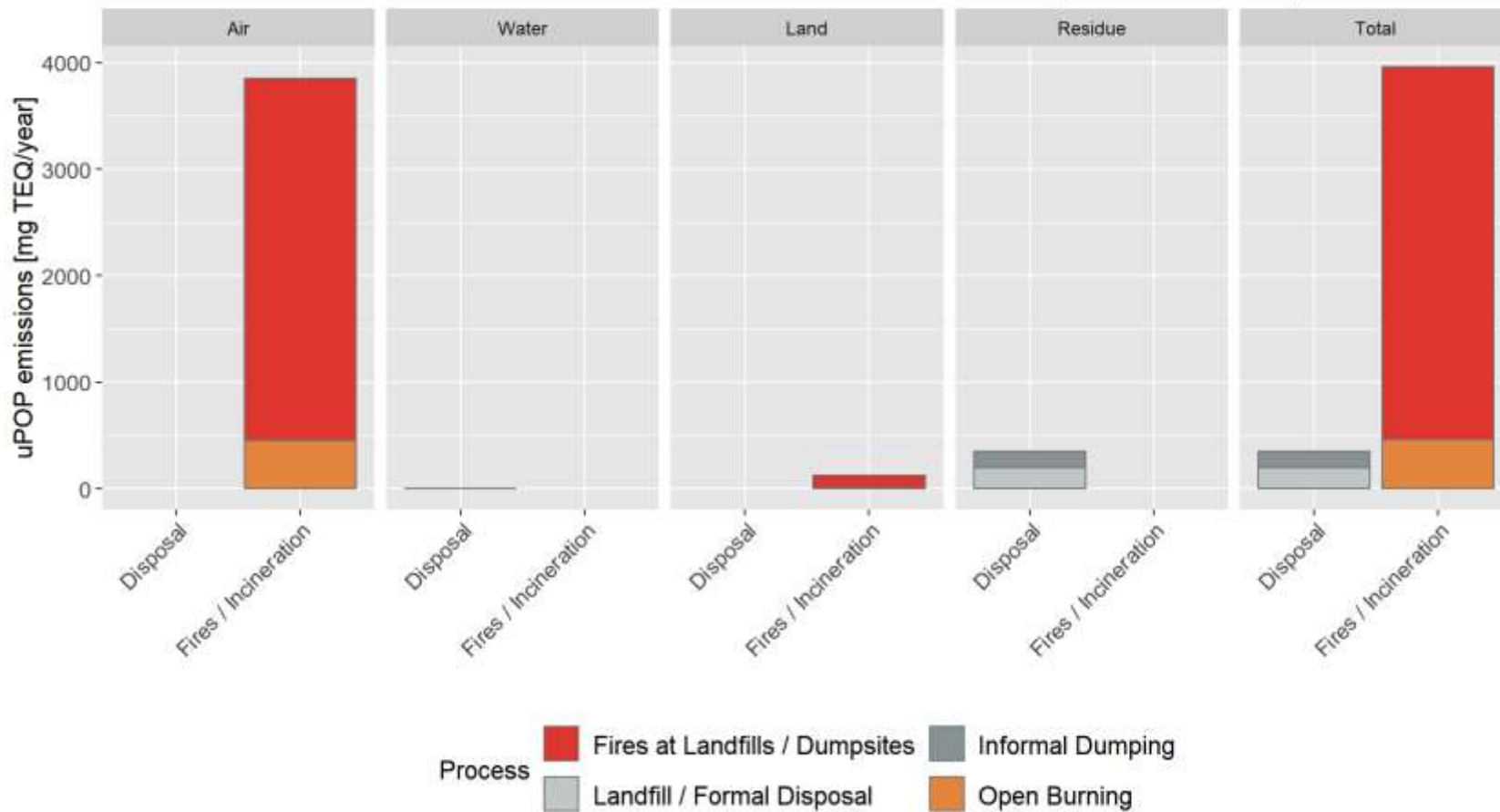
### 3.3.3.2 Unintentional persistent organic pollutants (uPOPs) emissions

PROCESS	EMISSION ( $\mu\text{g}$ TEQ/year )
Landfill / Formal Disposal	200
Informal Dumping	150
Open Burning	460
Fires at Landfills / Dumpsites	3500
Composting	-
<b>TOTAL</b>	<b>4310</b>



### SWM ANTSIRABE - Annual unintentional Persistent Organic Pollutant emissions

uPOP emissions have been determined in accordance with the Toolkit for POP Emissions (Stockholm Convention)





### 3.4 Status report

Table 21: Benchmark indicators in ANTSIRABE; reproduced from (Wilson, et al., 2012)

Overall Status Report of Antsirabe					
	Analytical criteria	No.	Indicator	Unit	Value or Description
Drivers for solid waste management	Public Health	1	Percentage collection coverage	(%)	37,4
	Environmental control	2A	Percentage controlled treatment or disposal	(%)	0
	Environmental control	2B	Quantity of uPOPs emitted from open burning	(µg TEQ/year)	460
	Environmental control	2C	Quantity of greenhouse gas emissions from WMS	(tonnes CO <sub>2</sub> -eq/year)	7100
	Resource management	3	Percentage materials recycled or recovered (valorized)	(%)	0
Governance strategies	User inclusivity	4A	Degree of user-inclusivity (HIGH – MEDIUM/HIGH – MEDIUM – LOW)	Qualitative	Low
	Provider inclusivity	4B	Degree of provider-inclusivity (HIGH – MEDIUM/HIGH – MEDIUM – LOW)	Qualitative	Low
	Financial sustainability	5A	Population using and paying for collection as percentage of total population	(%)	23,37%
	Financial sustainability	5B	Overall cost recovery percentage	(%)	8,66



## 4 PLANNING PHASE

### 4.1 Setting objectives and targets

Table 22: Complete list of objectives and targets with their descriptions for the SWMP

Objective	Target and its quantifiable value to be reached (if applicable)	Target Inputs (necessary resources)	Target Outputs (expected results)	Responsible Party and/or Stakeholder	Milestones and applicable Deadlines	Priority (High, Medium, or Low)
Increase of cost recovery percentage to sustainable the waste management	Increase the cost recovery percentage to 70%	<ul style="list-style-type: none"> <li>• Dedicated collection agents to collect fees</li> <li>• Communication and awareness materials</li> </ul>	<ul style="list-style-type: none"> <li>• Collected fees increased</li> <li>• Population informed and aware of the need to pay the fee</li> </ul>	Municipality : - Financial direction - Communication Service	1 <sup>st</sup> semester	High
	Find other financial resources for waste management	<ul style="list-style-type: none"> <li>• Connection</li> <li>• Means of transport</li> </ul>	<ul style="list-style-type: none"> <li>• Partnership contract established</li> </ul>	Municipality : - Decentralized Cooperation and Partnership Development Unit - Direction of Environment - Technical Direction - Association - NGO - Private sector	1 <sup>st</sup> et 2 <sup>nd</sup> year of the Plan	High
		<ul style="list-style-type: none"> <li>• Garbage bins</li> <li>• Rolling equipment:</li> </ul>	<ul style="list-style-type: none"> <li>• Number of Fokontany served increases</li> </ul>	Municipality : - Technical Direction	5 <sup>th</sup> year	



Objective	Target and its quantifiable value to be reached (if applicable)	Target Inputs (necessary resources)	Target Outputs (expected results)	Responsible Party and/or Stakeholder	Milestones and applicable Deadlines	Priority (High, Medium, or Low)
Increase of waste collection rate	Increase the collection to 60%	<ul style="list-style-type: none"> <li>- Maintenance of existing equipment</li> <li>- Acquisition of new equipment</li> <li>• Staffing</li> <li>• Financial resources</li> </ul>	<ul style="list-style-type: none"> <li>• Well-maintained equipment</li> <li>• Number of operational/available materials increases</li> <li>• Fund available for waste collection increases</li> </ul>	- Direction of Environment		
	Find a Private and Public partnership for the collection of waste	<ul style="list-style-type: none"> <li>• Connection</li> <li>• Means of transport</li> </ul>	<ul style="list-style-type: none"> <li>• Partnership contract established</li> <li>• Collection system with partners in place and operational</li> </ul>	Municipality : - Decentralized Cooperation and Partnership Development Unit	3 <sup>rd</sup> year	High
Improve municipality regulation concerning waste management	Municipal code of hygiene	<ul style="list-style-type: none"> <li>• Municipal Hygiene Commission</li> </ul>	<ul style="list-style-type: none"> <li>• Municipal Code of hygiene developed and implemented</li> </ul>	Municipality : - Legal department - Environment Department	2 <sup>nd</sup> year	Medium
Put in place recycling and recovery	Composting: 20% of collected waste composted	<ul style="list-style-type: none"> <li>• Materials: infrastructure, machinery</li> <li>• Human resources:</li> </ul>	<ul style="list-style-type: none"> <li>• Composting site built and operational</li> </ul>	Municipality : Technical direction Farmers' Association Waste pickers	2 <sup>nd</sup> semester of the 1st year	High





Objective	Target and its quantifiable value to be reached (if applicable)	Target Inputs (necessary resources)	Target Outputs (expected results)	Responsible Party and/or Stakeholder	Milestones and applicable Deadlines	Priority (High, Medium, or Low)
process in the waste management		<ul style="list-style-type: none"> <li>-Municipal employees</li> <li>• Financial resources</li> <li>• Communication</li> </ul>				
	Material recovery facility	<ul style="list-style-type: none"> <li>• Material equipment for FAMAFA: Charettes, wheelbarrows</li> <li>• Sorting bins for households</li> <li>• Materials: infrastructure, machines</li> <li>• Human resources:               <ul style="list-style-type: none"> <li>- Municipal employees</li> <li>- FAMAFA</li> </ul> </li> <li>• Financial resources</li> <li>• Communication</li> </ul>	<ul style="list-style-type: none"> <li>• RCC built and operational</li> </ul>	Municipality : <ul style="list-style-type: none"> <li>- Technical Direction</li> <li>- Fokontany</li> <li>- FAMAFA</li> </ul>	2 <sup>nd</sup> semester of the 1 <sup>st</sup> year	



#### 4.2 Stakeholder feedback on targets and objectives

Table 23: Results of stakeholder consultation target feasibility questionnaire

Target Number with Brief Description	Stakeholders Associated with the Target	Average/Most Relevant Response to Question 1	Average/Most Relevant Response to Question 2	Average/Most Relevant Response to Question 3	Average/Most Relevant Response to Question 4

As mentioned in the pre-planning phase, consultation with waste management stakeholders will take place after the preparation phase by a restricted team. The stakeholder feedback table will be completed at this stage.



### 4.3 Scenario creation

#### 4.3.1 Description of scenarios

For the next five (5) years, the municipality of Antsirabe in partnership with MEDD /ONUDI within the framework of the project "*Promotion of BAT and BEP to reduce uPOPs releases from waste open burning in the participating African countries of SADC sub-region*" has already defined a scenario for the improvement of the waste management. This scenario includes:

- 1- Installation of a composting site at the Ambohidava dump site
- 2- Establishment of a sorting center (RCC) for waste recovery

In addition, the following points of improvement are proposed to support these two projects

- 3- Increase of the current collection rate
- 4- Increasing the rate of tax collection
- 5- Elaboration of the Municipal Hygiene Code



#### 4.4 Action plan

Table 24: Action plan for reaching determined targets of the overall SWMP

Action Plan for Period: 2023 - 2028						
Waste Type	Objective	Target Number with Brief Description	Responsible Party and/or Stakeholder	Actions to be Taken		
				Short-term	Mid-term	Long-term
				(2023)	(2024-2026)	(2027-2028)
Municipal Solid Waste	1. Increase of cost recovery percentage to sustainable the waste management	1.1 Increase the cost recovery percentage to 70% <i>The current recovery rate is 23%</i>	Municipality :  - Financial Direction - Communication Service	1.1.1 Redeployment of agents of the commune 1.1.2 Awareness campaign of the population in fokontany 1.1.3 Implementation of a system of proximity collection 1.1.4 Collection	1.1.4 Recovery  1.1.5 Monitoring Evaluation	1.1.4 Recovery
		1.2. Find other financial resources for waste management <i>(The fees on household waste will not be sufficient, it is necessary to find other sustainable funding)</i>	Municipality : - Decentralized Cooperation and Partnership Development Unit - Direction of Environment - Technical Direction - Association - NGO - Private sector	1.2.1. Contact and negotiation with public and private partners  1.2.2. Presentation of the Waste Management Plan  1.2.3. Organization of site visits	1.2.4. Establishment of a partnership agreement	



Action Plan for Period: 2023 - 2028						
Waste Type	Objective	Target Number with Brief Description	Responsible Party and/or Stakeholder	Actions to be Taken		
				Short-term	Mid-term	Long-term
				(2023)	(2024-2026)	(2027-2028)
	2.Increase of waste collection rate	2.1.Increase the collection to 60%  <i>(the collection rate of 37.4% should be improved)</i>	Municipality :  - Technical Direction - Direction of Environment	2.1.1 Periodic maintenance and commissioning of existing equipment 2.1.5. Improvement of the collection program (pre-collection...) 2.1.6. Raising the awareness of the population 2.1.7 Strengthening the governance system of the municipality	2.1.1 Periodic maintenance of materials and equipment 2.1.2. Acquisition of new materials 2.1.3. Installation of garbage bins in the fokontany where they are lacking 2.1.5. Improvement of the collection program (pre-collection...)	2.1.1 Periodic maintenance of materials and equipment  2.1.5. Improvement of the collection program (pre-collection)
		2.2.Find a Private and Public partnership for the collection of waste <i>(the resources available to the municipality should be strengthened to achieve the collection objectives)</i>	Municipality : - Decentralized Cooperation and Partnership Development Unit	2.2.1. Contact and mobilization of public and private partners  1.2.2. Presentation of the Waste Management Plan	2.2.3. Establishment of a partnership agreement  2.2.4. Collection of waste by partners	2.2.4. Collection of waste by partners



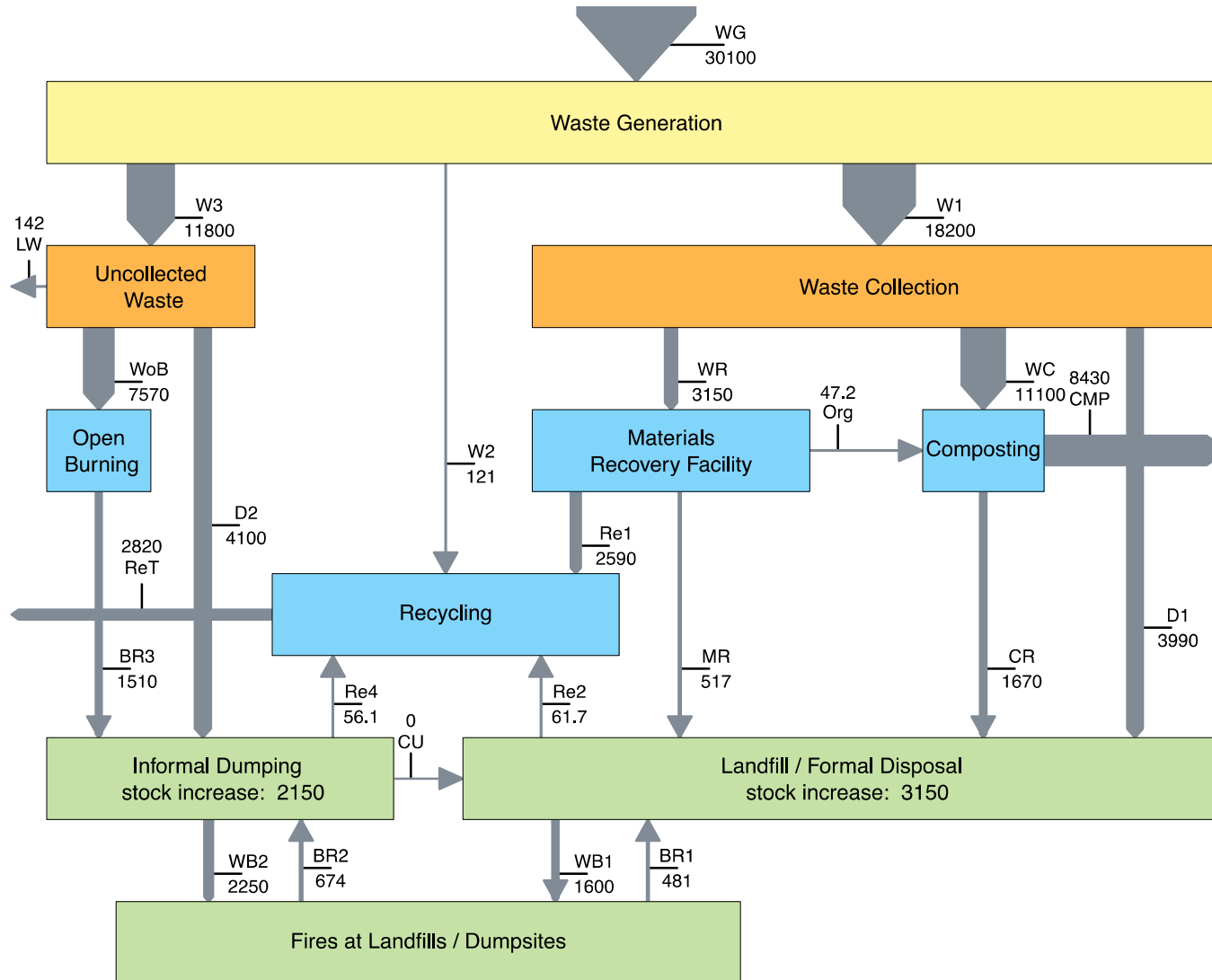
Action Plan for Period: 2023 - 2028						
Waste Type	Objective	Target Number with Brief Description	Responsible Party and/or Stakeholder	Actions to be Taken		
				Short-term	Mid-term	Long-term
				(2023)	(2024-2026)	(2027-2028)
	3. Improve municipality regulation concerning waste management	3.1. Municipal Code of hygiene  (The implementation of the Code will improve waste management through the respect by the population of the rules of hygiene)	Municipality :  - Legal department - Direction of Environment	3.1.1. Preparation and issuance of the by-law establishing the Municipal Hygiene Commission  3.1.2. Elaboration and validation of the Municipal Hygiene Code	3.1.2. Awareness and dissemination of the Municipal Hygiene Code  3.1.3. Enforcement of the Municipal Hygiene Code	
	4. Put in place recycling and recovery process in the waste management	4.1. 20% of collected waste is composted (To recover the compostable materials that are currently disposed of in landfills the installation of a composting site is planned)	<ul style="list-style-type: none"> <li>Municipality : Technical direction</li> <li>Farmers' Association</li> <li>Garbage pickers</li> <li>Company</li> </ul>	4.1.1. Construction of the facility 4.1.2. Setting up the waste system 4.1.3. Acquisition of materials and equipment 4.1.4. Recruitment of agents 4.1.5 Training of agents 4.1.6. Start-up of the site 4.1.7 Sensitization of the community (farmers, users	4.1.8 Compost production and sale  4.1.9. Setting up an agricultural demonstration	4.1.8 Compost Production and Sales



Action Plan for Period: 2023 - 2028						
Waste Type	Objective	Target Number with Brief Description	Responsible Party and/or Stakeholder	Actions to be Taken		
				Short-term	Mid-term	Long-term
				(2023)	(2024-2026)	(2027-2028)
		<p>4.2 RCC</p> <p><i>(To recover recoverable materials and reduce emissions, the installation of a CCR is planned)</i></p>	<ul style="list-style-type: none"> <li>• Municipality: Technical direction</li> <li>• FAMAFA</li> <li>• Garbage pickers</li> <li>• Company</li> </ul>	<p>4.2.1. Construction of the facility</p> <p>4.2.2. Setting up the waste system at the pre-collection level (bin, sorting...)</p> <p>4.2.3. Acquisition of materials and equipment</p> <p>4.2.4. Recruitment of agents (FAMAFA)</p> <p>4.2.5 Training of agents</p> <p>4.2.6 Identification and setting up of pilot sites</p> <p>4.2.7. Start-up of the site</p> <p>4.2.8. Community awareness (generators, buyers/sellers)</p> <p>4.2.9 Contact and contracting with recyclers</p>	<p>4.2.10 Operationalization of the RCC</p> <p>4.2.11. Awareness campaign</p> <p>4.2.12. Extension of pilot sites</p>	<p>4.2.10 Operationalizing the RCC</p>



### 4.4.1 Predicted MFA diagram based on WMS improvements







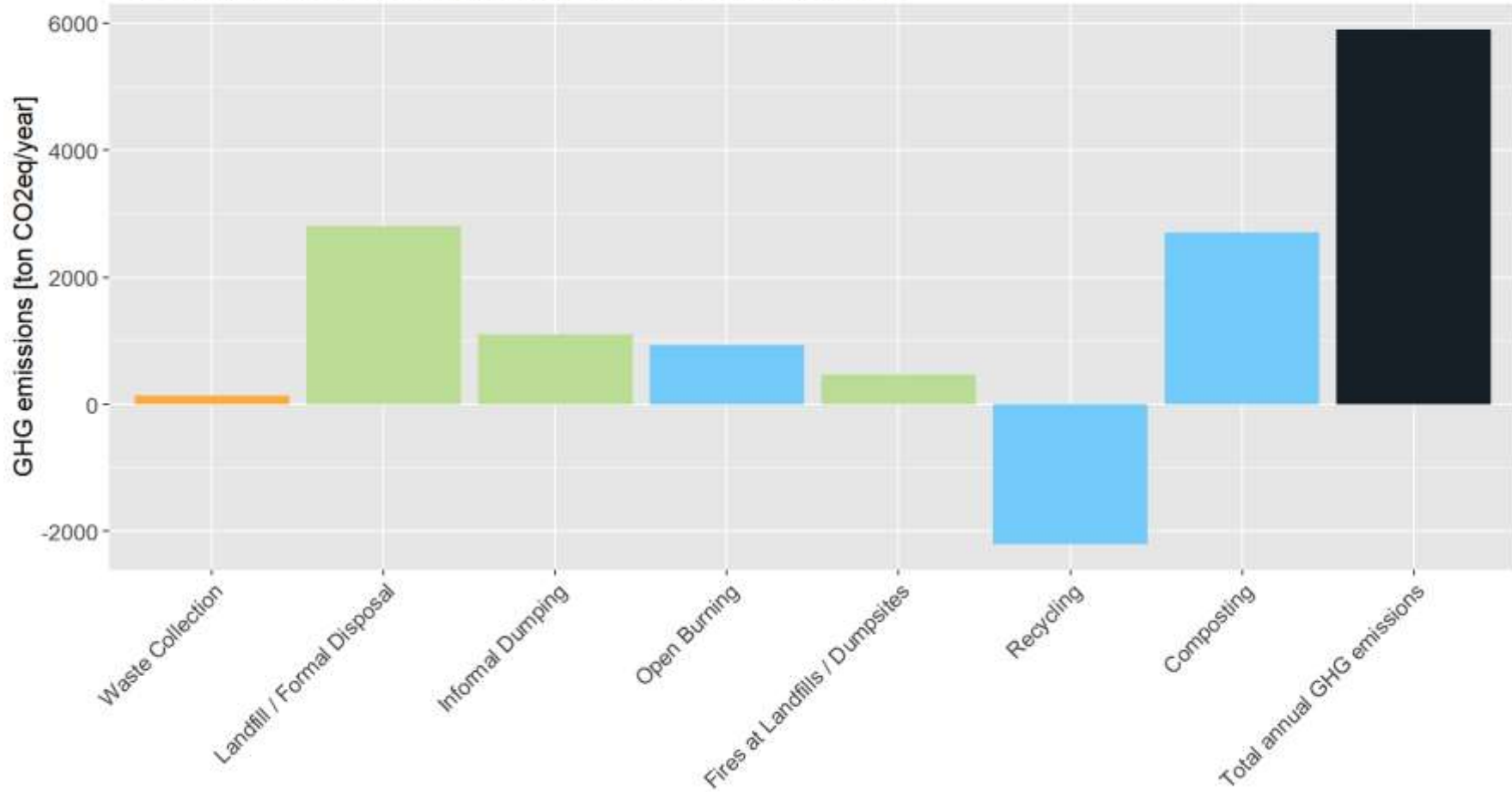
**4.4.2 Expected reduction of uPOP and GHG emissions based on WMS improvements**

PROCESS	EMISSION (Tonnes CO2 eq/Year)
Waste Collection	130
Landfill / Formal Disposal	2800
Informal Dumping	1100
Open Burning	930
Fires at Landfills / Dumpsites	470
Recycling	-2200
Composting	2700
<b>TOTAL</b>	<b>5900</b>



### SWM Antsirabe - Annual Greenhouse Gas emissions

GHG emissions have been determined using emission factors from the IPCC





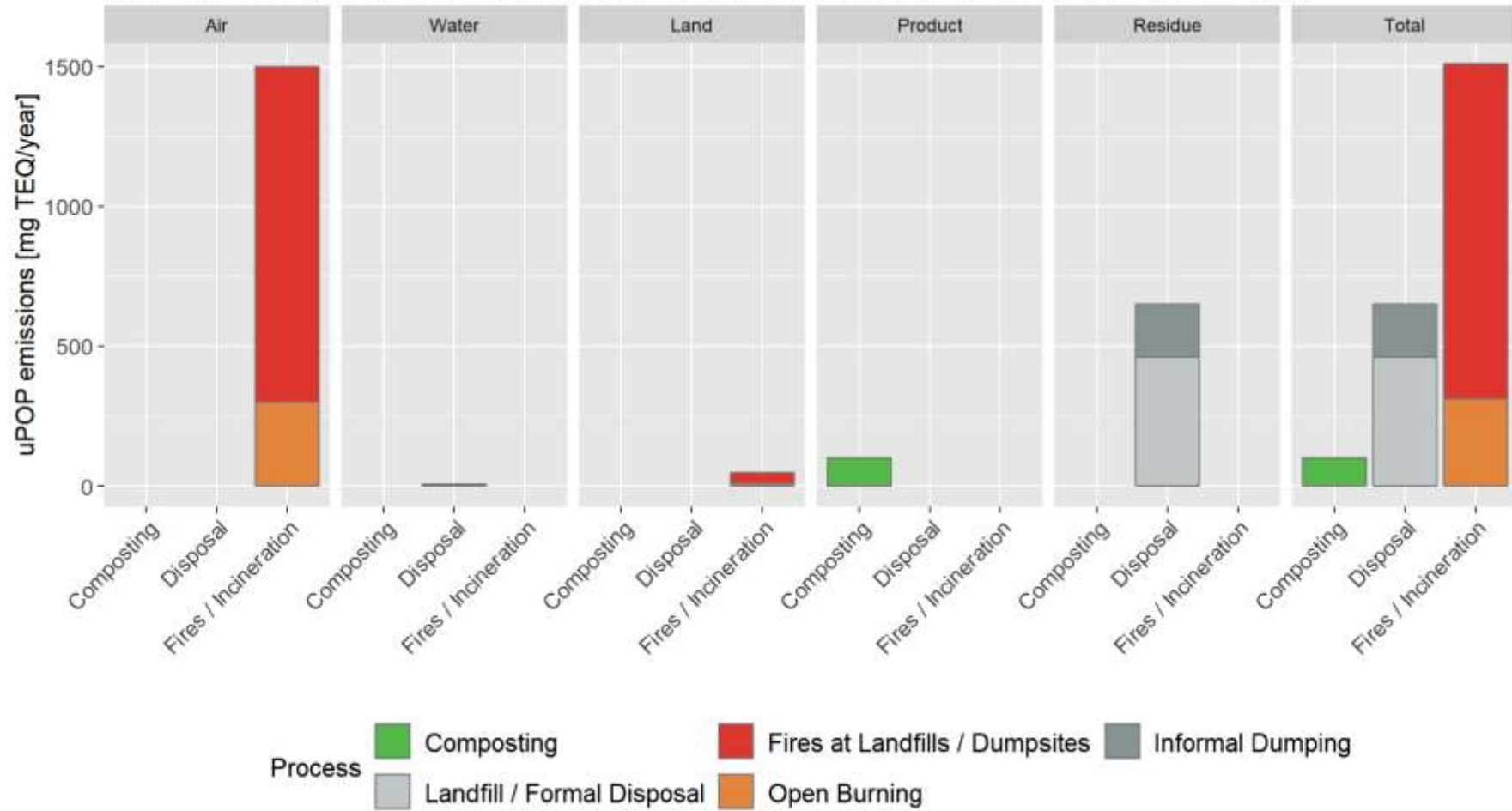
Summary of UPOPs emissions

PROCESS	EMISSION ( $\mu\text{g}$ TEQ/year )
Landfill / Formal Disposal	460
Informal Dumping	190
Open Burning	310
Fires at Landfills / Dumpsites	1200
Composting	100
TOTAL	2260



### SWM Antsirabe - Annual unintentional Persistent Organic Pollutant emissions

uPOP emissions have been determined in accordance with the Toolkit for POP Emissions (Stockholm Convention)





## 5 IMPLEMENTATION

### 5.1 Implementation program

Table 25: Planned implementation program to ensure effective execution of the plan's actions to be taken

Implementation Program						
Waste Type	Actions to be taken	Costs of actions (Ariary)	Economic Instruments to cover costs of each action	Relevant Policy and Legal Instruments	Relevant Partnerships and Environmental Agreements to be forged	Relevant Stakeholder Participation and Public Awareness efforts
Municipal Solid Waste	<b>1. Increase of cost recovery percentage to sustainable the waste management</b>					
	<b>1.1 Increase the cost recovery percentage to 70%</b>					
	1.1.1 Redeployment of municipal staff			Municipal note		
	1.1.2 Awareness campaign for the population in fokontany	10 000 000	<ul style="list-style-type: none"> <li>- Own resources (PR) of municipality: Taxes</li> <li>- Grants (State, Donors, Private sectors,...)</li> <li>- Donations</li> <li>- Contributions from persons and companies</li> </ul>		<ul style="list-style-type: none"> <li>- MEDD/ MEAH</li> <li>- Private sector</li> <li>- OGO</li> <li>- Medias</li> <li>- ...</li> </ul>	



Implementation Program						
Waste Type	Actions to be taken	Costs of actions (Ariary)	Economic Instruments to cover costs of each action	Relevant Policy and Legal Instruments	Relevant Partnerships and Environmental Agreements to be forged	Relevant Stakeholder Participation and Public Awareness efforts
	1.1.3 Setting up a neighborhood recovery system	5 000 000	RP- CUA	Deliberation of the City Council		
	1.1.4 Recovery		RP- CUA (payment of agents' salaries and purchase of consumables)		- Regional Budget Office - Treasury	
	1.1.5 Monitoring/Evaluation	30 000 000	- Own resources (PR) fo municipality: Taxes - Grants (State, Donors, Private sectors,...)		- MEDD/ MEAH - Private sector - Donors - OGO	
<b>1.2. Find other financial resources for waste management</b>						
	1.2.1. Contact and negotiation with public and private partners	2 000 000	RP- CUA		- Public partners - National and international partners	
	1.2.2. Presentation of the Waste Management Plan	5 000 000	RP-CUA		- Public partners - National and international partners	
	1.2.3. Organization of site visits					



Implementation Program						
Waste Type	Actions to be taken	Costs of actions (Ariary)	Economic Instruments to cover costs of each action	Relevant Policy and Legal Instruments	Relevant Partnerships and Environmental Agreements to be forged	Relevant Stakeholder Participation and Public Awareness efforts
	1.2.4. Establishment of a partnership agreement			Deliberation of the City Council	- Public partners - National and international partners	
<b>2. Increase of waste collection rate</b>						
<b>2.1. Increase the collection to 60%</b>						
	2.1.1 Periodic maintenance and commissioning of existing equipment	65 000 000	RP-CUA			
	2.1.2. Improvement of the collection program (pre-collection...)		- RP-CUA - FAMAFA - Fokontany			
	2.1.3. Raising the awareness of the population	10 000 000			- MEDD/ MEAH - Private sector - NGO - Medias - ...	OUI
	2.1.4. Strengthening the governance system of the municipality	30 000 000	- Own resources (PR) fo municipality: Taxes - Grants (State, Donors, Private sectors,...)		- Ministries - (MEDD, MEAH, MEF,...) - Private sector - Donors - Consulting firm	



Implementation Program						
Waste Type	Actions to be taken	Costs of actions (Ariary)	Economic Instruments to cover costs of each action	Relevant Policy and Legal Instruments	Relevant Partnerships and Environmental Agreements to be forged	Relevant Stakeholder Participation and Public Awareness efforts
	2.1.5. Acquisition of new materials	300 000 000	- Own resources (PR) fo municipality: Taxes - Grants (State, Donors, Private sectors,...)	Deliberation of the City Council	- Government - Donors - Private sector	
	2.1.6. Installation of waste bins in the fokontany where they are lacking	50 000 000			- Government - Donors - Private sector - Fokontany	
<b>2.2. Find a Private and Public partnership for the collection of waste</b>						
<b>2.3.</b>						
	2.2.1. Contact and mobilization of public and private partners	2 000 000	RP-CUA		- Public partners - National and international partners	
	2.2.2 Presentation of the Waste Management Plan	5 000 000	RP-CUA	Deliberation of the City Council	- Public partners - National and international partners	
	2.2.3. Establishment of a partnership agreement					
	2.2.4. Collection of waste by partners					OUI
<b>3. Improve municipality regulation concerning waste management</b>						
<b>3.1. Code municipal d'hygiène</b>						
	3.1.1. Preparation and issuance of the by-law establishing the			- Deliberation of the City Council		OUI





Implementation Program						
Waste Type	Actions to be taken	Costs of actions (Ariary)	Economic Instruments to cover costs of each action	Relevant Policy and Legal Instruments	Relevant Partnerships and Environmental Agreements to be forged	Relevant Stakeholder Participation and Public Awareness efforts
	Municipal Hygiene Commission			Arrêté Municipale		
	3.1.2. Elaboration and validation of the Municipal Hygiene Code	25 000 000	- RP-CUA - Financial and technical partners	Deliberation of the City Council	Hygiene municipal Commission : municipality, Region, Parliamentarians, STD, Fokontany, private sector, NGO, Civil society, University,...	
	3.1.3. Awareness and dissemination of the Municipal Hygiene Code	10 000 000				
	3.1.4. Enforcement of the Municipal Hygiene Code				Hygiene Municipal Commission	
<b>4. Put in place recycling and recovery process in the waste management</b>						
<b>4.1. 20% des déchets collectés sont compostés</b>						
	4.1.1. Construction of the facility	150 000 000	- RP-CUA - Financial and technical partners		National/International companies	
	4.1.2. Setting up the waste system	5 000 000				
	4.1.3. Acquisition of materials and equipment	300 000 000				- Government - Donors - Private sector
	4.1.4. Recruitment of agents	7 000 000				
	4.1.5 Training of agents		- RP-CUA			- Ministries - Municipality



Implementation Program						
Waste Type	Actions to be taken	Costs of actions (Ariary)	Economic Instruments to cover costs of each action	Relevant Policy and Legal Instruments	Relevant Partnerships and Environmental Agreements to be forged	Relevant Stakeholder Participation and Public Awareness efforts
			- Financial and technical partners		- Consultants/ Trainers	
	4.1.6. Sensitization of the community (farmers, users)	10 000 000	RP-CUA		- NGO - Medias - ...	
	4.1.7. Start-up of the site	30 000 000	RP-CUA		Private sector	
	4.1.8 Compost production and sale					
	4.1.9. Setting up an agricultural demonstration					
<b>4.2 RCC</b>						
	4.2.1. Construction of the facility	150 000 000	- RP-CUA - Financial and technical partners		National/International companies	
	4.2.2. Setting up the waste system at the pre-collection level (bin, sorting...)	5 000 000	RP-CUA			
	4.2.3. Acquisition of materials and equipment	300 000 000	- RP-CUA - Financial and technical partners		- Government - Donors - Private sector	
	4.2.4. Recruitment of agents (FAMAFA)	7 000 000	FAMAFA			
	4.2.5 Training of agents				- Ministries - Municipality	



Implementation Program						
Waste Type	Actions to be taken	Costs of actions (Ariary)	Economic Instruments to cover costs of each action	Relevant Policy and Legal Instruments	Relevant Partnerships and Environmental Agreements to be forged	Relevant Stakeholder Participation and Public Awareness efforts
					- Consultants/ Trainers	
	4.2.6. Identification and setting up of pilot sites	30 000 000	RP-CUA			
	4.2.7. Start-up of the site					
	4.2.8. Community awareness (generators, buyers/sellers)	10 000 000		- ONG - Medias - ...		
	4.2.9 Contact and contracting with recyclers	2 000 000				
	4.2.10 Operationalization of the RCC	30 000 000	RP-CUA			
	4.2.11. Awareness campaign	10 000 000		NGO		
	4.2.12. Extension of pilot sites	50 000 000	- RP-CUA - Financial and technical partners		Donors	



## 6 MONITORING AND REVIEW

### 6.1 Actions to be monitored

Table 26: Actions to be continually monitored as part of the new waste management system

Area of waste management	Actions to be monitored	Responsible party or stakeholder
General	Mobilizing municipal resources	<ul style="list-style-type: none"> <li>• Financial Affairs Department</li> <li>• Financial partners</li> <li>• Treasurer FAMAFa</li> </ul>
	Search of partners/funders	
	Definition of annual financing needs	
	ROM recovery	
	Collection of revenues generated by the provision of collection services	
	Acquisition of materials and equipment	
	Carrying out regular analyses and summaries of the budget consumed in relation to the planned budget	
	Reinforcement/ recruitment of agents for waste management	Human Resources Department/ FAMAFa
	Construction of facilities	Technical Department
	Implementation of a communication and awareness plan	Hygiene Municipality Commission
	Conducting a citizen satisfaction survey	
	Regular analysis and synthesis of the results obtained in relation to the objectives set	
	Effective enforcement of the Municipal Hygiene Code	
Collection and Transportation	Management of waste management infrastructure (waste bins)	<ul style="list-style-type: none"> <li>• Environmental Department</li> <li>• Technical Department</li> </ul>
	Management of rolling stock and equipment	
	Organization of the collection system	
	Evaluation of the financial impact of the cost of collection/transportation on the municipality's budget	
	Evaluation of fuel quantities and costs	



Area of waste management	Actions to be monitored	Responsible party or stakeholder
Recycling and Recovery	Formalization of the activities of informal waste pickers at the sources of waste generation	<ul style="list-style-type: none"> <li>• Environmental Department</li> <li>• Technical Department</li> <li>• FAMAFA</li> </ul>
	Collection of revenues generated by informal and formal recycling activities respectively	
	Evaluation of the quantity of each material recycled in a formal or informal way	
Treatment	Waste characterization	<ul style="list-style-type: none"> <li>• Environmental Department</li> <li>• Technical Department</li> <li>• FAMAFA</li> </ul>
	Monitoring of the increase in the amount of waste treated compared to the waste collected (%)	
	Monitoring of the quantities of "outputs" of the treatment processes: - compost produced - separated and sorted recyclables	
	Collection of revenue from compost sold and/or recycled materials	
	Evaluation of the costs and expenses of operating the RCC	
Disposal	Monitoring of open burning rate reduction at landfill sites	<ul style="list-style-type: none"> <li>• Environmental Department</li> <li>• Technical Department</li> </ul>
	Reduction of emissions from untreated organic waste going to landfill, as well as from open burning	
	Reducing the amount of waste going to landfills	



## 6.2 Performance indicators

Frequency at which a performance report will be published and a review of the system will occur: 2 years in (1-5) years

Table 27: Performance indicators for assessing performance outputs of the new WMS based on implementation of the SWMP

Area of waste management	Performance Indicator (PI) <sup>1</sup>	Targets linked to PI	Necessary data collection <sup>2</sup>	Responsible party for data collection
General	Individual waste production.	0,3kg/day	- Waste characterization (type, quantity..)	Environmental Department
	Municipal Resource Recovery Rate	70%	- Number of collection agents - % of population aware of the use of the tax dedicated to household waste	Financial Department
	Recovery rate of household waste fees	70%		
	Number of complaints received by the Municipality	0	- Number of complaints received by the municipality about the collection of waste in the bins - Number of complaints received about unsanitary conditions in neighbourhoods	Monitoring and Control Department Road Agent
Collection and Transportation	Waste collection rate	60%	- Number of agents dedicated to the collection - Equipment and materials and equipment dedicated to collection - Number of partnerships established with local actors - Number of garbage bins in the fokontany where they are lacking	Environmental Department / Technical Department

<sup>1</sup>Performance indicators have the purpose of quantifying the performance outputs of the overall system. As such, the performance indicators selected to assess the plan will be closely linked to the targets determined to meet plan objectives.

<sup>2</sup>Should be closely related to the actions to be monitored.



Area of waste management	Performance Indicator (PI) <sup>1</sup>	Targets linked to PI	Necessary data collection <sup>2</sup>	Responsible party for data collection
	Increased revenue from the provision of collection services	70%	<ul style="list-style-type: none"> <li>- Number of fokontany where the waste management system: pre-collection, composting site, sorting center is in place</li> <li>- % of population adhering to the system (survey)</li> </ul>	FAMAFA
	User and citizen satisfaction rate	90%	% Satisfied users (survey)	Environmental Department/ Department of health and social affairs/ FAMAFA
	Overall reduction of insalubrity	80%	<ul style="list-style-type: none"> <li>- Mapping of unhealthy areas in the municipality</li> </ul>	
Recycling and Recovery	Increase in annual production of recycled waste	70%	<ul style="list-style-type: none"> <li>- Amount of recoverable waste processed at the RCC level</li> </ul>	Municipality/ Responsible of RCC/ FAMAFA
	Increased revenue from recycled products	60%	<ul style="list-style-type: none"> <li>- Quantities of recyclable waste sold</li> </ul>	
	Annual reduction in the volume of waste going to landfill	-30%	<ul style="list-style-type: none"> <li>- Annual quantity of waste sent to landfill</li> </ul>	
	Annual reduction in the amount of untreated waste disposed of	-50%		
Treatment	Quantity of waste treated compared to waste collected	20%	<ul style="list-style-type: none"> <li>- Annual production of the composting site</li> </ul>	Municipality/ responsible of composting site / FAMAFA
	Processing efficiency	90%	<ul style="list-style-type: none"> <li>- % of compost vs residue</li> </ul>	
	Quantity of composts sold compared to produced	60 %	<ul style="list-style-type: none"> <li>- Quality of compost produced</li> <li>- % of farmers using compost (survey))</li> </ul>	
	Increased revenue from composts sold	60%	<ul style="list-style-type: none"> <li>- Revenue from the sale of compost</li> </ul>	



Area of waste management	Performance Indicator (PI) <sup>1</sup>	Targets linked to PI	Necessary data collection <sup>2</sup>	Responsible party for data collection
	Annual reduction in open burning and open waste disposal levels	-20%	<ul style="list-style-type: none"><li>- Annual amount of waste burned in the open</li><li>- uPOPs emissions</li></ul>	