

**DATA COLLECTION SURVEY
ON
MUNICIPAL SOLID WASTE
MANAGEMENT
IN
AFRICAN CITIES

FINAL REPORT**

MARCH, 2022

JAPAN INTERNATIONAL COOPERATION AGENCY

YACHIYO ENGINEERING CO., LTD.
JAPAN ENVIRONMENTAL SANITATION CENTER

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List of Abbreviations

Common

Abbreviation	Description
ACCP	African Clean Cities Platform
AFD	Agence Francaise de Developpement
AfDB	African Development Bank
BOT	Build Operate and Transfer
EIA	Environmental Impact Assessment
FABA	Fly Ash and Bottom Ash
FIT	Feed in Tariff
FOB	Free on Board
GDP	Gross Domestic Product
GNI	Gross National Income
EPR	Extended Producer Responsibility
UNICEF	United Nations Children's Fund
GEF	Global Environment Facility
GNI	Gross National Income
EPR	Extended Producer Responsibility
GGGI	Global Green Growth Institute
IDB	Inter-American Development Bank
IsDB	Islamic Development Bank
IFC	International Finance Corporation
JICA	Japan International Cooperation Agency
LFG	Landfill Gas
OJT	On-the-Job Training
OPEC	Organization of the Petroleum Exporting Countries
PPP	Public Private Partnership
PQ	Prequalification
UN	United Nations
UNIDO	United Nations Industrial Development Organization
USD	United States Dollar
WaCT	Waste Wise Cities Tool
WB	World Bank
WtE	Waste to Energy

Cote d'Ivoire

Abbreviation	Description
ANAGED	Agence Nationale de Gestion des Déchets
ANASUR	Agence Nationale de la Salubrité Urbaine
ANDE	Agence Nationale de l'Environnement
CFA	Franc CFA
CGP	Hôpital Général de Port-bouët
CHU	Centre Hospitalier Universitaire
CIAPOL	Centre Ivoirien Antipollution
CIE	Ivorian Electricity Company
CMN	Centre Médical Nimatoullah
DAA	District Autonome d'Abidjan
FFPSU	Fonds de Financement es Programmes de Salubrité Urbaine

Abbreviation	Description
INHP	Institut National d'Hygiène Publique
MINASS	Ministère de l'Assainissement et la Salubrité:
MINEDD	Ministère de l'Environnement et la Développementurable
MSHP	Ministère de la Santé et l'Hygiène Publique
NEP	The National Environment Policy
NSDS	The National Sustainable Development Strategy
ONAD	Office National de l'Assainissement etu Drainage
PNGDS 2021-2025	Plan National de Gestion Des Dechets Sanitaires 2021-2025
SMEs	Small and Medium Enterprises
TEOM	Household Waste Removal Tax

Angola

Abbreviation	Description
HDP	High-density polyethylene
NWA	National Waste Management Agency
PVC	Polyvinyl Chloride

Ethiopia

Abbreviation	Description
AASWMA Plan 2013-2022	Addis Ababa City Administration Solid Waste Management Agency 2013 - 2022 Finote Prosperity Plan
CIFA	Community Initiatives Facilitation Assistance
CNEEC	China National Electric Engineering Co.
EEP	Ethiopian Electric Power
EPA	Environmental Protection Authority
EPE	Environmental Policy of Ethiopia
ESID Project	Ecologically Sustainable Industrial Development Project
ETB	Ethiopian Birr
GTP	Growth and Transformation Plan
GTP-2	2nd Growth and Transformation Plan
ISWM Plan	Integrated Solid Waste Management Plan 2018-2028
IWaSP	International Water Stewardship Programme
MoUDC	Ministry of Urban Development and Construction
NHSS	National Hygiene and Sanitation Strategy
PASDEP	Plan for Accelerated and Sustained Development to End Poverty
REA	Regional Environmental Agency
SEU	Sectoral Environmental Unit

Guinea

Abbreviation	Description
ANASP	National Agency for Sanitation and Public Health
PME	Petite et Moyenne Enterprise
UGPAC	Conakry Sanitation Project Management Unit

Uganda

Abbreviation	Description
KCCA	Kampala Capital City Authority
KLSC	Kiteezi Landfill Salvagers Community

Abbreviation	Description
KWM PPP Project	Kampala Waste Management PPP Project
KWMP	Kampala Waste Management Project
NDP	National Development Plan
UBOS	Uganda Bureau of Statistics
UGX	Uganda Syringe

Botswana

Abbreviation	Description
BITRI	Botswana Institute for Technology and Innovation
DWMPC	Department of Waste Management and Pollution Control
GCC	Gaborone City Council
GEF	Global Environment Facility
KwDC	Kweneng District Council
MENT	Ministry of Environment, Natural Resources Conservation and Tourism
MHW	Ministry of Health and Wellness
MLGRD	Ministry of Local Government and Rural Development

South Africa

Abbreviation	Description
CoJ	City of Johannesburg
CoT	City of Tshwane
CWE	Operation Phakisa: Chemicals and Waste Economy
DALRRD	Department of Agriculture, Land Reform and Rural Development
DBE	Department of Basic Education
DBSA	Development Bank of Southern Africa
DEFF	Department of Environment, Forestry and Fisheries
DHC	Department of Human Capital
DHSWAS	Department of Human Settlement, Water and Sanitation
DMRE	Department of Mineral Resources and Energy
dMRF	Dirty - Material Recovery Facility
DoH	Department of Health
DoT	Department of Transport
DSI	Department of Science and Innovation
DTIC	Department of Trade Industry and Competition
EAM	Department of Environmental and Agriculture Management Services
Eskom	Electricity Supply Commission
GDARD	Department of Agriculture and Rural Development, Gauteng Provincial Government
GIFA	Gauteng Infrastructure Financing Agency
IWMP(s)	Integrated Waste Management Plan(s)
IWMS	Integrated Waste Management Strategy
MBT	Mechanical Biological Treatment
MEC(s)	Member(s) of Executive Council
MFMA	Municipal Finance Management Act
NDP	National Development Plan
NEMWA	National Environmental Management: Waste Act
NWMS2020	National Environmental Management Strategy 2020
POPs	Persistent Organic Pollutants
REIPPPP	Renewable Energy Independent Power Producers Procurement Programme
SALGA	South African Local Government Association

Abbreviation	Description
SAPRO	South African Plastics Recycling Organization
SAWIC	South African Waste Information Centre
SAWIS	South African Waste Information system
SoWR	State of Waste Report
ZAR	South African Rand

Tanzania

Abbreviation	Description
CBO	Community Based Organization
NEMC	National Environment Management Council

Nigeria

Abbreviation	Description
AC	Area Council
AEPB	Abuja Environmental Protection Board
AMAC	Abuja Municipal Area Council
FCC	Federal Capital City
FCT	The Federal Capital Territory
FCTA	The Federal Capital Territory Administration
FMoE	Federal Ministry of Environment
NESREA	National Environmental Standards and Regulations Enforcement Agency
NGN	Nigerian Naira
STDD	Satellite Towns Division Department

Kenya

Abbreviation	Description
NCC	Nairobi City Country

Summary

1. Overview

1.1 Background and Objectives

The population in Africa has been growing at the fastest rate in the world, and is estimated to increase from 1.276 billion persons in 2018 to 2.5 billion by 2050¹. The amount of waste generated in Sub-Saharan Africa is estimated to increase by threefold from 174 million ton/year in 2016 to 516 million ton/year in 2050. In most African countries, the waste collection rate is low, at less than 55%, raising the possibility of illegal dumping of uncollected waste. In addition, sanitation and public health conditions are threatened by poor waste sorting, as well as inadequate intermediate treatment, recycling and final disposal operations.

The objectives and outputs of this Study are; (1) to identify the priorities and needs for assistance and assess the possibilities of intercity cooperation, (2) to assess the feasibility and requirements for introducing waste-to-energy facilities (hereinafter referred to as “WtE”), and (3) to recommend the review of the policies for assistance through African Clean City Platform (hereinafter referred to as “ACCP”) by surveying the current situation of municipal solid waste management (hereinafter referred to as “MSWM”)

1.2 Study Description and Methodology

This Study consists of the following four components: (1) Identification of cooperation needs in the waste sector by identifying conditions and issues of municipal solid waste (hereinafter referred to as “MSW”) management, extraction of lessons learned from existing projects, identification of priority issues and priority actions, consideration of possible city-to-city cooperation, and examination of cooperation policy framework through ACCP; (2) Survey on the status of waste management under the influence of COVID-19; (3) Feasibility study on the introduction of WtE; and (4) Development of a tool to understand the general situation of MSW management.

The survey method is a combination of literature review, remote survey using local consultants, and field survey.

1.3 Target Countries and Cities of the Survey to Confirm Local Information

Table 1 shows an overview of the countries and cities targeted by the survey to confirm local information. The JICA Study Team planned detailed field surveys for seven countries: the République de Côte d'Ivoire (Cote d'Ivoire), the Republic of Angola (Angola), the Federal Democratic Republic of Ethiopia (Ethiopia), the Republic of Uganda (Uganda), the Republic of Guinea (Guinea), the Republic of South Africa (South Africa), and the Republic of Botswana (Botswana). However, due to the spread of COVID-19, the JICA Study Team was only able to travel to three countries: Cote d'Ivoire, Angola, and Uganda. For Nigeria and Tanzania, field surveys were not considered from the start, but remote surveys were conducted.

¹ <https://www.jetro.go.jp/biz/areareports/special/2019/0702/38e6d7ed0510c745.html>

Table 1 Overview of Target Countries and Cities for Field and Domestic Surveys

	Targeted countries and cities	Population (Year)	GDP (USD) (Year) GDP per capita (USD)
Field Survey Country	Cote d'Ivoire	26,378,275 (2020)	44 Billion (2019)
	Abidjan	5,551,934 (2020)	1,691 (2019)
	Angola	32,097,671 (2021)	95 Billion (2019)
	Luanda	8,801,035 (2020)	3,145 (2019)
	Ethiopia	114,963,583 (2020)	91 Billion (2019)
	Addis Ababa	4,793,699 (2020)	953 (2019)
	Hawassa	429,170 (2020)	
	Guinea	12,907,395 (2021)	14 Billion (2019)
	Conakry	2,039,725 (2021)	950 (2019)
	Uganda	Approx. 41,600,000 (2020)	35 Billion (2019/20)
	Kampala	1,680,600 (2020)	910 (2019/20)
	Botswana	2,351,625 (2020)	18 Billion (2019)
	Gaborone	280,519 (2020)	7,660 (2019)
	Kweneng District	387,096 (2020)	
South Africa	59,308,960 (2020)	*1 335 Billion (2019)	
Johannesburg	5,926,668 (2021)	5,978 (2019)	
Tshwane	Approx. 3,700,000 (2021)		
Domestic Survey Country	Nigeria	206,139,587 (2020)	429 Billion (2020)
	Abuja	3,277,740 (2020)	2,083 (2020)
	Tanzania	Approx. 57,630,000 (2020)	63 Billion (2019)
	Dodoma	2,083,588 (2012)	1,080 (2019)

*1: 5,077,625 (million ZAR) was converted at the rate of 0.066USD/ZAR.

2. Current Status and Issues of Waste Management in Target Cities of the Field Surveys

The field surveys of the target cities have identified the implementation agency of solid waste management, current SWM status, and major issues in each city as described hereafter.

(1) Abidjan Autonomous District, Cote d'Ivoire

Implementation agency	Solid waste management in Abidjan is carried out by the National Waste Management Agency (ANAGED), a central government agency.
Key data of waste management	Generation amount: 4,441 ton/day, Collection amount (disposal amount): 4,000 ton/day, Collection rate: 90%, Recycled amount: 222 ton/day, Recycling rate: 5%
Collection and transportation	Collection and transportation of waste is outsourced by ANAGED to two private companies. There are three transfer stations in operation in the city, and two more are under construction.
Final disposal	The Kossihouen landfill is the only landfill in the city, and approximately 1/3 rd of the landfill area has already been used. This landfill is equipped with leachate collection pipes and treatment facility. There are plans to construct a new landfill with the assistance of the World Bank.
Priority issues	<ul style="list-style-type: none"> ● Establishment of fundamental laws and regulations for solid waste management and recycling is urgently needed. ● A solid waste management plan for Greater Abidjan needs to be formulated and implemented in order to build a sound material-cycle society in the future.

	<ul style="list-style-type: none"> ● In the six satellite communes around Abidjan Autonomous District, illegal dumping into rivers and ditches is widely observed, and the collection and transportation capacity needs to be strengthened.
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(2) Luanda Province, Angola

Implementation agency	Solid waste management in Luanda province is implemented by outsourced private companies under contracts with the Luanda provincial government through the provincial public corporation.
Key data of waste management	Generation amount: 9,133 ton/day, Collection amount (disposal amount): 6,167 ton/day, Collection rate: 70%, Recycled amount: 450 ton/day, Recycling rate: 5%
Collection and transportation	The provincial government corporation and private companies contracted by the provincial government are responsible for collection and transportation.
Final disposal	Mulenvos landfill, the only landfill in the province has a remaining lifespan of 16 years. This landfill is equipped with leachate collection and drainage pipes, leachate reservoirs and recirculation facilities, and weighbridges. Furthermore, considerations are under way to upgrade the landfill with intermediate treatment facilities using PPP scheme.
Priority issues	<ul style="list-style-type: none"> ● The central government has launched a policy toward a circular economy, and the solid waste management system in the Luanda Province is undergoing a major transformation. However, Luanda Province has not developed a plan to handle these changes. ● The practice of illegal dumping into rivers, etc. is widespread, and it is required to strengthen the management of waste collectors and their capacity of collection and transportation, to improve the efficiency of waste transportation, and to raise awareness of residents.

(3) Addis Ababa city, Ethiopia

Implementation agency	Solid waste management in Addis Ababa city is carried out by Addis Ababa Solid Waste Management Agency (AASWMA).
Key data of waste management	Generation amount: 3,344 ton/day, Collection amount: 2,508 ton/day, Collection rate: 75%, Amount of Waste to Energy: 649 ton/day, Recycling amount: 200 ton/day, Recycling rate including WtE: 25%, Disposal amount: 1,998 ton/day
Collection and transportation	Waste collection and transportation, and operation of transfer stations are outsourced to private companies.
Intermediate treatment	Rappi WtE facility was built in 2018 adjacent to the Koshe final disposal site by China's Electric Power Works Co. and Cambridge Industries Ltd. of the United Kingdom. The facility is operated by Ethiopia National Power Corporation.
Final disposal	Koshe final disposal site is the only final disposal site in the city. The disposal site is an open dumping site with some part of the site improved by Fukuoka Method, and

	has a remaining lifespan of two years. Although the Sandafa final disposal site was built with the support of Agence française de développement (AFD), it was forced to close in 2017 due to opposition from nearby residents.
Priority issues	<ul style="list-style-type: none"> ● An environmental standard for Fly Ash disposal needs to be developed. ● Koshe final disposal site has little remaining capacity, and development of new final disposal facilities is needed. ● The Rappi WtE Facility is only treating about half of its design capacity and needs to be improved.

(4) Hawassa city, Ethiopia

Implementation agency	Solid waste management in Hawassa city is carried out by the Hawassa city government.
Key data of waste management	Generation amount: 245 ton/day, Collection amount (disposal amount): 196 ton/day, Collection rate: 80%, Recycled amount: 15 ton/day, Recycling rate: 6%
Collection and transportation	Waste collection is conducted in two ways: direct collection by the city management and collection by private companies and the informal sector.
Final disposal	Hawassa final disposal site, the only final disposal site in the city is directly operated by the city. In addition to municipal waste the disposal site accepts industrial and construction waste as well, is an open dump site, and has a very small remaining disposal capacity. There is information that the World Bank will support the development of a new disposal site.
Priority issues	<ul style="list-style-type: none"> ● The collection rate is estimated to be approximately 80%. However, majority of the waste is collected and transported by donkey carts, which are an inefficient and unsanitary mode of waste collection. There is a need to introduce motorized waste collection and transport equipment. In conjunction with the introduction of motorized equipment, a collection and transportation plan needs to be modified. ● The final disposal site is an open dumping site, and its operation needs to be improved.

(5) Conakry city, Guinea

Implementation agency	Solid waste management in Conakry city is carried out by the Conakry city government.
Key data of waste management	Generation amount: 1,440 ton/day, Collection amount (disposal amount): 787 ton/day, Collection rate: 55%
Collection and transportation	Waste collection is outsourced to a private company.
Final disposal	Minière landfill, the only landfill in Conakry city has a remaining lifespan of three years. The landfill is not equipped with any environmental conservation facilities,

	such as leachate collection pipes and storage ponds. Although the site is operated by a private company, soil covering is not applied and fires also have occurred.
Priority issues	<ul style="list-style-type: none"> ● The waste collection ratio is low and much of the waste is illegally dumped. In particular, the collection rate of waste collection service fees by primary waste collectors is low and needs to be improved.

(6) Kampala city, Uganda

Implementation agency	Solid waste management in Kampala is carried out by the Kampala Capital City Authority (KCCA), through its Urban Division
Key data of waste management	Generation amount: 2,000 ton/day, Collection amount (disposal amount): 1,200 ton/day, Collection rate: 60%, Recycled amount: 200 ton/day, Recycling rate: 10%
Collection and transportation	Kampala city is divided into six zones, five of which have privatized collection and transportation. Three private collection companies provide collection services under individual contracts with households and offices. In the remaining zone, KCCA directly operates waste collection.
Final disposal	Kiteezi landfill is the only landfill in the city, and its remaining lifespan is very short. KCCA is planning to develop a new landfill site, Dbundu landfill site under a PPP scheme.
Priority issues	<ul style="list-style-type: none"> ● Since collection and transportation is privatized, there is inadequate waste collection in slum areas where the slum dwellers cannot afford to pay service fees to private companies.

(7) Gaborone city, Botswana

Implementation agency	Solid waste management in Gaborone city is carried out by the Gaborone city government.
Key data of waste management	Generation amount: 125 ton/day, Collection amount (disposal amount): 100 ton/day, Collection rate: 80%,
Collection and transportation	Collection and transportation service is conducted both directly by the city and outsourced to private companies.
Final disposal	Most of the waste in Gaborone city is disposed in Gamodubu Regional Landfill which is operated by Kweneng district council, while some waste is disposed in South East Sanitary Landfill operated by Southeast district council.
Priority issues	<ul style="list-style-type: none"> ● Since Gaborone city does not own a landfill and is dependent on disposal facilities in other cities, the city needs to have a regional solid waste management plan to facilitate cooperation with neighboring municipalities in SWM.

(8) Kweneng District, Botswana

Implementation agency	Solid waste management in Kweneng district is carried out by Kweneng district council and its three sub district councils.
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Key data of waste management	Generation amount: 231 ton/day, Collection amount (disposal amount): 139 ton/day, Collection rate: 60%
Collection and transportation	Basically, waste collection is directly conducted by the local government. However, due to a lack of collection vehicles, wastes in small villages in rural areas are collected by private individuals or private companies using donkey carts and small tractors.
Final disposal	Wastes in Kweneng district are disposed in Gamodubu landfill. The site is operated by Kweneng district council and receives waste collected in Gaborone City and Southeast district (including industrial and medical wastes). The landfill's remaining lifespan is approximately ten years.
Priority issues	<ul style="list-style-type: none"> ● The waste collection rate is low at approximately 60%, especially in suburban villages, where people are forced to dispose of their wastes at designated dumping sites, and it is necessary to improve these conditions. ● Gamodubu landfill has a 10-year remaining lifespan, however, fire accidents are frequent, and the landfill operation needs to be improved.

(9) Johannesburg city, South Africa

Implementation agency	Waste management in Johannesburg city is carried out by the City of Johannesburg (CoJ).
Key data of waste management	Generation amount: 1.4 million ton/year, Collection amount: 1.3 million ton/year, Collection rate: 94%, Disposal amount: 1.2 million ton/year, Recycled amount: 0.1 million ton/year, Recycling rate: 7%
Collection and transportation	CoJ outsources the collection, transportation, disposal and cleaning of municipal solid waste (MSW) in the city to a private company, Pikitup Johannesburg (Pikitup).
WtE	Currently, a project is underway to introduce alternative waste treatment technologies, including a WtE facility. Development Bank of Southern Africa (DBSA) is cooperating with CoJ on both financial and technical aspects.
Final disposal	There are six landfills in Johannesburg (two of which are closed) and three privately owned landfills in the North Region. All of these landfills are licensed facilities under the law. Three of the landfills have power generation facilities that use biogas generated from the landfills.
Priority issues	<ul style="list-style-type: none"> ● The final disposal site has little remaining capacity, necessitating a project to construct an intermediate treatment facility.

(10) Tshwane city, South Africa

Implementation agency	Waste management in Tshwane city is carried out by the City of Tshwane (CoT).
Key data of waste management	Generation amount: 1.9 million ton/year, Collection amount: 1.8 million ton/year, Collection rate: 94%, Disposal amount: 1.7 million ton/year, Recycled amount: 0.1 million ton/year, Recycling rate: 5%

Collection and transportation	In Tshwane city, collection and transportation is carried out by CoT through outsourcing to private contractors.
WtE	As in Johannesburg city, a project is underway to introduce alternative waste treatment technologies, including a WtE facility.
Final disposal	There are ten landfills in Tshwane city, of which six have already stopped receiving waste and only four are currently in operation. All four landfills are operated by CoT.
Priority issues	<ul style="list-style-type: none"> ● The final disposal site has little remaining capacity, necessitating a project to construct an intermediate treatment facility. ● Due to the very limited implementation of source separation, household waste is not being recycled, and these efforts need to be expanded.

The solid waste management level is set using the “country's development stage” as indicated in the “Waste Management Sector Position Paper (JICA June 2017, 4th Edition)” as an indicator.

<p>[Measures according to the country's development stage]</p> <p>Stage 1: “Improvement of public health” In countries where urbanization is progressing, the amount of waste generation increases with population concentration, leading to deterioration of public health. At this stage, there is an urgent need to improve public health through appropriate collection and disposal, with the first priority on improving the collection rate, in order to “not be overtaken by the waste amount”.</p> <p>Stage 2: “Reduction of environmental impact and pollution prevention” As industrialization progresses and secondary industries develop in particular, the risk of pollution becomes apparent. In this stage, the types of waste generated become more diverse, and the scope of impact expands due to the health hazards caused by environmental pollution, such as air and water pollution. In addition to urban waste management, which has been actively supported in the past, there is a need to reduce environmental impact and prevent pollution through appropriate treatment and management of hazardous waste.</p> <p>Stage 3: “Establishment of a sound material-cycle society through 3Rs” As economic development progresses and the awareness of civil society matures, people's awareness of the environment increases, and they move to a stage where they promote waste reduction and recycling, reduce environmental burdens including greenhouse gas emissions, and aim to build a sound material-cycle society.</p>

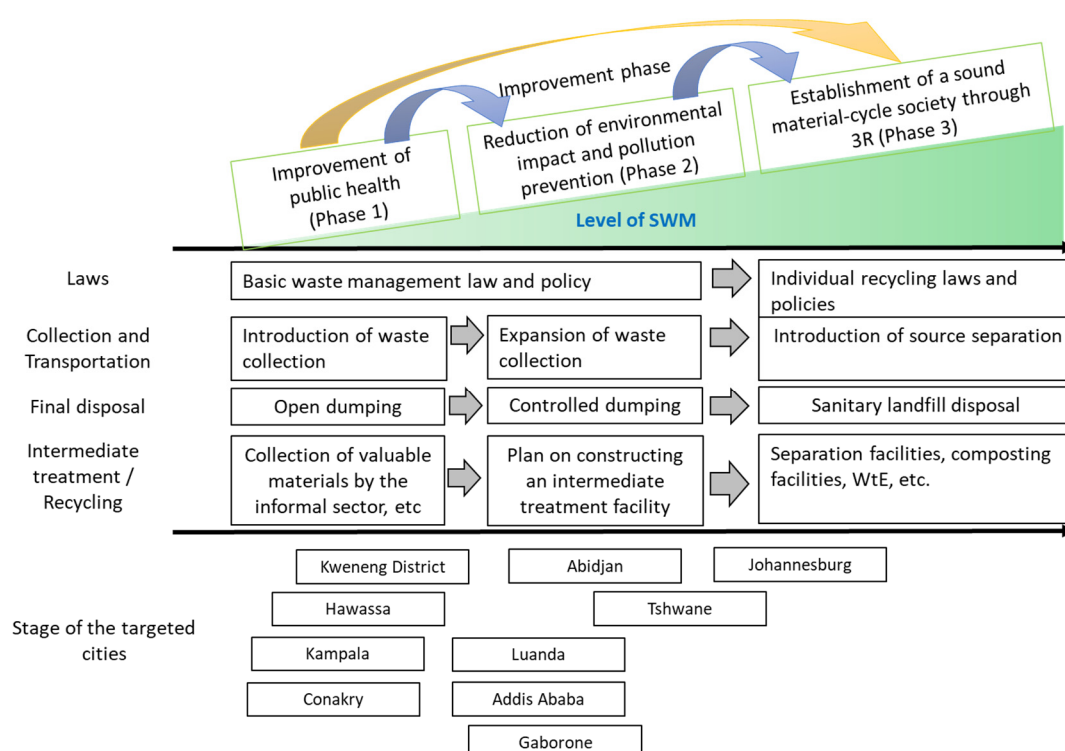
The stages of solid waste management are analyzed from a variety of perspectives, and it is difficult to classify them in a common and universal manner. However, for the purposes of this Study, the indicators shown in Table 2 are utilized to classify the countries, in order to compare multiple countries from a holistic perspective.

Table 2 Indicators of Solid Waste Management by Development Stage

Item	Stage	Indicator
Law	1	No laws and regulations for solid waste management, or they exist in parts of legislation in multiple environmental laws and regulations.
	2	Fundamental laws on solid waste management exist. Or, laws and regulations that systematically organize solid waste management exist, although they are not solely solid waste management laws and regulations.

Item	Stage	Indicator
	3	Individual laws related to recycling exist.
Collection and Transportation	1	Illegal dumping is frequently observed due to severe inadequate waste collection and transportation capacity.
	2	Most of the generated waste is collected, and the incidence of illegal dumping is limited.
	3	Generated waste is adequately collected, and separate collection of recyclable materials salvaged from the waste is being carried out.
Final Disposal	1	Open dumping site
	2	Disposal sites with leachate collection and drainage facilities, weighbridge and application of covering soil. (Controlled dumping site).
	3	Sanitary landfill sites with leachate treatment facilities (sanitary landfill site).
Intermediate Treatment	1	No plans for the development of intermediate treatment facilities exist, and collection of recyclable materials by the informal sector, private sector, etc. are carried out.
	2	In addition to the collection of recyclable materials by the informal sector and private sector, etc., the development of intermediate treatment facilities is being considered and planned.
	3	Intermediate treatment facilities such as sorting facilities, composting facilities, and WtE facilities are being developed and operated.

In order to compare and verify SWM conditions of multiple cities from various perspectives, the stages of solid waste management in the target cities are illustrated in the image shown in Figure 1. According to the findings of this study, only Johannesburg City has reached Phase 3: establishment of a sound material-cycle society through 3Rs, while Hawassa City, Conakry City, Kampala City, and Kweneng District are assessed as being in Phase 1: improvement of public health.



Source: prepared by JICA Study Team

Figure 1 Stages of waste management in the target cities

3. Draft Framework for Cooperation with ACCP Member Countries

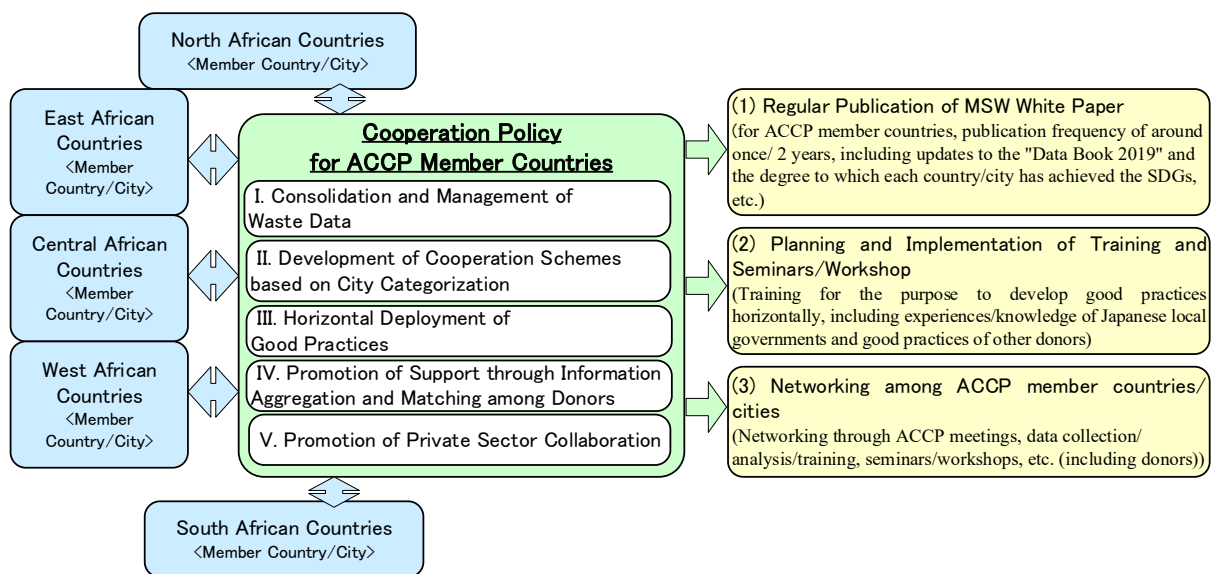
Based on the findings of this Study, the expected roles and contributions of ACCP are summarized as follows.

Expected Roles and Contributions of ACCP:

A medium to share information to all stakeholders involved in waste management in the African region, to share knowledge and mutual collaboration among countries in the region, and to promote support through information aggregation and matching among donors, with the aim of realizing clean cities and healthy lifestyles.

3.1 Draft Cooperation Policy Framework for ACCP Member Countries

Based on the findings of this survey, the following figure shows an image of the draft cooperation policy framework for ACCP member countries and cities, including the roles and contributions that ACCP is expected to perform.



Source: prepared by JICA Study Team

Figure 2 Image of Cooperation Policy Framework for ACCP Member Countries

(1) Consolidation and Management of Waste-related Data

Waste management data of ACCP member countries and cities shall be consolidated and centrally managed in ACCP. In this context, information on good practices, including the status of donor support in each country, future support plans, and the details of support projects, shall be also consolidated. Based on the data collected, statistical processing and analysis shall be conducted, “AFRICA SOLID WASTE MANAGEMENT DATA BOOK 2019, JICA” shall be updated, and “MSW White Paper” of ACCP member countries shall be published on a regular basis in order to provide information to donors and to share knowledge among countries, both regionally and on the continent level. In addition to presenting numerical values for the SDGs indicators, the White Paper shall also create and publish waste flows using the Waste Wise Cities Tool (WaCT)² for cities where a sufficient amount of information is available.

² WaCT was established by UN-Habitat to understand the conditions of solid waste management in developing countries.

ACCP's related work on this item is described below.

1) Assistance in obtaining waste-related data for each country/city

- Dissemination and implementation guidance for surveys on waste quantity and quality, and waste delivered to landfills
- Dissemination and application guidance for SDGs Indicators 11.6.1 and 2.5.1 and the WaCT methodology
- Dissemination and application guidance to member countries on the “Identification Tool for MSW Management Overview”.

2) Centralized consolidation, management, and analysis of waste-related data from each country

- Updating the “AFRICA SOLID WASTE MANAGEMENT DATA BOOK 2019”
 - Regular publication of ACCP MSW White Paper
 - Inventory of relevant laws, regulations, standards etc. of ACCP countries
 - Identification of good practices
- Contributing to issue-specific training and horizontal deployment of good practices, as described in item (3) below.

(2) Development of Cooperation Schemes based on City Categorization

In considering cooperation schemes based on ACCP, ACCP member cities shall be categorized by “population size” and “stage of waste management level,” and appropriate cooperation schemes shall be envisioned for each category and examined.

The concept of categorization is as follows.

1) Categorization by city size

- Large cities: Population over 2 million or waste generation over 1,000 ton/day
 - Medium and small cities: Population less than 2 million or waste generation less than 1,000 ton/day
- The “1,000 ton/day of waste generation” set as an indicator takes into consideration the expected treatment capacity (approximately 500 ton/day) of intermediate treatment facilities (incineration facilities, MBT, MRF, biogas etc.) that are expected to be developed mainly in large cities in the future, and their operation together with direct landfill disposal at final disposal sites, etc.

2) Categorization by level of waste management

- Stage 1: Improvement of public health
- Stage 2: Reduction of environmental impact and pollution prevention
- Stage 3: Establishment of a sound material-cycle society through 3Rs

The waste management level is set using the “country's development stage” as described in the indicators set forth in the “Waste Management Sector Position Paper (JICA June 2017, 4th Edition)”.

Table 3 shows the results of the city categorization, which was tested in the target cities of the field survey in this Study. In developing support in ACCP member countries/cities, lessons learned, good practices, etc. generated by cities have the potential to be horizontally transferred to other cities, especially those in the same city category.

Table 3 Categorization of the targeted cities

Stage	Large cities (population more than 2 million)	Medium and small cities (population less than 2 million)
Stage 1: Improvement of public health	Conakry	Hawassa, Kampala, Kweneng District
Stage 2: Reduction of environmental impact and pollution prevention	Abidjan, Luanda, Addis Ababa, Tshwane	Gaborone
Stage 3: Establishment of a sound material-cycle society through 3Rs	Johannesburg	

Source: prepared by JICA Study Team

(3) Horizontal Deployment of Good Practices

1) Sharing of Knowledge and Good Practices among ACCP Countries

Horizontal deployment of good practices shall be implemented through seminars, workshops, issue-specific training, and third-country training using ACCP as a platform. The third country training shall include “South-South cooperation” arrangements with Morocco, South Africa, and other host countries. The trainings shall be conducted in the countries/cities where the good practices were implemented, and the trainees shall be invited to those countries/cities. In addition, a new ACCP training center (tentative) with online training could be considered. UN-Habitat has experience in pilot projects for improving landfill sites in Ethiopia and other countries. By utilizing this experience and implementing pilot projects with respect to specific areas, such as the improvement of final disposal sites using the Fukuoka method, as ACCP on-the-ground capacity building, improvement of solid waste management can be expected. These can be summarized as follows.

- Seminars, workshops, training and dispatch of experts within Africa
- Development of an online training (ACCP Training Center) system
- Pilot projects in specific areas such as improvement of final disposal sites

The following are proposed project components that contribute to the horizontal deployment of good practices and examples of good practices obtained from this study.

<Proposed Project Components for Horizontal Deployment of Good Practices>

- Identify waste-related data and prepare flow diagrams (application of WaCT and SDGs indicators)
- Develop solid waste management master plans and action plans
- Improve collection and transportation; improve disposal sites; introduction of intermediate treatment; strengthen organizations and institutions; and raise public awareness and introduce 3Rs
- Create and implement a regional waste management framework
- Policies to promote private partnerships and private investment (FIT, etc.)
- Arrange and conduct third-country training within ACCP member countries

<Examples of Good Practices in the Target Countries/Cities of this Study>

- Introducing and operating a waste information management system (South Africa)
- Outsourcing of collection services to private sector, and managing and monitoring by the government (Abuja city/Nigeria)
- Outsourcing to private sector of collection and transportation; transportation from transfer stations; and final disposal (Abidjan/Cote d'Ivoire)
- Privatization of collection service (Kampala city/Uganda)
- Source Separation Initiatives (Botswana)
- Landfill work, operation and management of final disposal site (Luanda province/Angola)
- Upgrading to a final disposal site using Fukuoka method (Addis Ababa city/Ethiopia)
- Establishment of an association of waste pickers and support from government and other organizations (South Africa)
- Introducing and operating biogas power generation at the final disposal site (Johannesburg city/South Africa)
- Processing of e-waste (recycling center) (Kampala city/Uganda)

2) Sharing of Experience and Knowledge of Developed Countries

In the surveyed countries, interest in the introduction of intermediate treatment/recycling and circular economy was high, however, experience and knowledge in these areas were lacking. The input from Japan and other developed countries to ACCP member countries will be very helpful for them to smoothly introduce the intermediate treatment facilities and circular economy policies in their respective countries. In practical terms, training in developed countries and the preparation of tools for compiling the knowledge of developed countries are expected to be developed. The ACCP has already prepared the “Guidebook for Environmental Education on Solid Waste Management in Africa” and other documents/guidelines, and in addition to updating these documents, various guidelines (for example, the development/operation of WtE facilities and the contracting and management of private waste collection companies) could be developed. These can be summarized as follows.

- Training in developed countries
- Development of solid waste management related tools and guidelines

(4) Promotion of Support through Information Aggregation and Matching among Donors

Various donors are currently planning and implementing assistance programs in ACCP member countries. It is expected that ACCP can act as an intermediary between donors to facilitate the realization of efficient and effective assistance programs by consolidating and matching assistance information, keeping in mind the urban typologies, project components, and assistance schemes described above. In addition, UN-Habitat is at present extensively inviting relevant organizations and international organizations, including donors, to participate in the ACCP.

The main items of the ACCP's inter-donor coordination role are listed below.

- Encourage donor participation in ACCP

- Monitor the status of donor supports and future plans for support in the environment and waste sectors at ACCP
- Facilitate the formation of highly effective assistance by consolidating and providing information on assistance by donors and sometimes matching them.

(5) Promotion of Private Sector Collaboration

This Study has revealed the reality that many of the surveyed countries are using PPP and other schemes for private-sector collaboration, and this trend is expected to continue in the future. ACCP is in a position to promote private sector investment by disseminating information on international competitive bidding schemes planned in member countries, preparing environmental standards inventories, etc., and providing support for business matching, as described below. This would also contribute to the ACCP's goal of "Promotion of Investment". Furthermore, ACCP can provide private companies with information on investment opportunities in ACCP member countries by disseminating such information to the International Solid Waste Association and related academic societies in developed countries. These can be summarized as follows.

- Dissemination of bid notices on PPP projects planned in member countries
- Preparing inventories of related laws, regulations, standards, etc. (also described in (1) Consolidation and Management of Waste-related Data)
- Business matching at seminars, etc. (government - foreign companies, local private companies - foreign companies)
- Dissemination of information to the International Solid Waste Association (ISWA), etc.

3.2 Direction of Improvement in Waste Management by JICA

Based on the major issues of the target countries, the "Draft Cooperation Policy Framework for ACCP Member Countries (12.2 of Chapter 12)" and JICA's proposed cooperation policy (short and middle terms)³, which was examined in the target countries and cities of this study, the following table shows the direction of improvement in waste management by JICA.

Table 4 Summary of ACCP and Donor Support for Each Stage of Solid Waste Management

Item	Phase	Support by ACCP (Draft)	Support by Donors (including JICA)
Common Items		<ul style="list-style-type: none"> ● Identification of good practices and publication of "MSW White Paper" ● Consolidation and provision of information on supports among donors ● Dissemination of information through ISWA etc. 	
Waste management	Phase 1	<ul style="list-style-type: none"> ● Training at ACCP Training Center ● Inventory of relevant laws, regulations, standards etc. of ACCP countries 	<ul style="list-style-type: none"> ● Establish laws and ordinances related to ensuring public health ● Develop waste management plans and action plans ● Identify waste flows

³ The referenced table of contents numbers are 2.4.3 in Chapter 2, 3.4.3 in Chapter 3, 4.5.3 in Chapter 4, 5.4.2 in Chapter 5, 6.4.3 in Chapter 6, 7.6.3 in Chapter 7 and 8.8.2 in Chapter 8.

Item	Phase	Support by ACCP (Draft)	Support by Donors (including JICA)
		<ul style="list-style-type: none"> ● Dissemination of the “Identification Tools for MSW Management Overview”. 	
	Phase 2	<ul style="list-style-type: none"> ● Ditto 	<ul style="list-style-type: none"> ● Develop solid waste management plans and action plans ● Accumulate waste management data and incorporate into plans ● Identify waste flows and create future flows
	Phase 3	<ul style="list-style-type: none"> ● Training in developed countries including Japan 	<ul style="list-style-type: none"> ● Develop a strategic plan for 3Rs and sound material-cycle society ● Accumulate waste management data and incorporate into plans ● Apply WaCT and SDGs indicators
Collection and transportation	Phase 1	<ul style="list-style-type: none"> ● Dispatch of experts to Africa ● Training in Africa 	<ul style="list-style-type: none"> ● Eliminate waste from urban residential areas ● Improve collection rate and expand collection areas ● Improve collection equipment ● Organize the role assignment for primary and secondary collections ● Improve collection rate and introduce efficient collection and transportation
	Phase 2	<ul style="list-style-type: none"> ● Ditto 	<ul style="list-style-type: none"> ● Provide collection services to low-income communities
	Phase 3	<ul style="list-style-type: none"> ● Training in developed countries including Japan 	<ul style="list-style-type: none"> ● Introduce source separation at the storage and discharge stages ● Introduce collection of separated wastes
Intermediate and recycling	Phase 1	<ul style="list-style-type: none"> ● Training in developed countries including Japan 	<ul style="list-style-type: none"> ● Identify waste pickers and improve working conditions ● Identify and register recycling companies
	Phase 2	<ul style="list-style-type: none"> ● Ditto ● Publication of bid notices on PPP projects etc. and business matching 	<ul style="list-style-type: none"> ● Define the role of recycling companies in waste management projects ● Develop intermediate treatment facilities
	Phase 3	<ul style="list-style-type: none"> ● Ditto 	<ul style="list-style-type: none"> ● Develop intermediate treatment facilities and consider introducing WtE ● Treat and recycle E-waste ● Identify domestic venous industry and establish recycling chain
Final disposal	Phase 1	<ul style="list-style-type: none"> ● Dispatch of experts to Africa ● Training in Africa ● Development of guidebook for landfill improvement and operation ● Pilot project for landfill improvement with Fukuoka method 	<ul style="list-style-type: none"> ● Identify and eliminate illegal dumping sites ● Identify and improve open dumping sites
	Phase 2	<ul style="list-style-type: none"> ● Ditto ● Development of guidelines for safe closure and site use 	<ul style="list-style-type: none"> ● Arrange the final disposal sites according to the plan ● Construct final disposal sites (controlled disposal sites) ● Consider regional disposal sites (if needed)
	Phase 3	<ul style="list-style-type: none"> ● Training in developed countries including Japan 	<ul style="list-style-type: none"> ● Construct landfill sites (sanitary landfill sites)

Item	Phase	Support by ACCP (Draft)	Support by Donors (including JICA)
			<ul style="list-style-type: none"> ● Construct regional landfill sites (if needed) ● Take measures to extend the lifespan of the final disposal site and consider how to use the site after closure
Organization and institution	Phase 1	<ul style="list-style-type: none"> ● Training at ACCP Training Center 	<ul style="list-style-type: none"> ● Establish a department in charge of waste management, and allocate human resources ● Enhance waste management services by the government ● Introduce environmental management and monitoring
	Phase 2	<ul style="list-style-type: none"> ● Ditto ● Development of guidelines to be used for private sector outsourcing and management (collection and transportation) 	<ul style="list-style-type: none"> ● Develop sections of the waste management department and allocate human resources ● Consider and introduce private sector outsourcing ● Manage the private companies properly by the government ● Strengthen environmental management and monitoring
	Phase 3	<ul style="list-style-type: none"> ● Training in developed countries including Japan 	<ul style="list-style-type: none"> ● Define the role of waste management in building a sound material-cycle society. ● Collaborate with the PPP project and energy sectors, and promote these collaboration projects. ● Further strengthen environmental management and monitoring
Finance	Phase 1	<ul style="list-style-type: none"> ● Training at ACCP Training Center 	<ul style="list-style-type: none"> ● Secure budget (facility development and equipment procurement) ● Develop financial management system
	Phase 2	<ul style="list-style-type: none"> ● Ditto 	<ul style="list-style-type: none"> ● Secure budget (facility maintenance and equipment procurement) ● Improve and strengthen financial management systems ● Introduce a fee collection system
	Phase 3	<ul style="list-style-type: none"> ● Training in developed countries including Japan 	<ul style="list-style-type: none"> ● Secure budget (facility maintenance and equipment procurement) ● Improve tipping fee ● Introduce FIT
Society and community	Phase 1	<ul style="list-style-type: none"> ● Dispatch of experts to Africa ● Training in Africa ● Provision of guidelines for environmental education 	<ul style="list-style-type: none"> ● Raise residents' awareness on waste management ● Identify the informal sector
	Phase 2	<ul style="list-style-type: none"> ● Ditto 	<ul style="list-style-type: none"> ● Promote citizens' participation in waste management ● Conduct environmental education and awareness activities ● Increase rate of fee collection
	Phase 3	<ul style="list-style-type: none"> ● Training in developed countries including Japan ● Pilot project for raising public awareness to support source separation 	<ul style="list-style-type: none"> ● Promote citizen participation in 3Rs and a sound material-cycle society ● Conduct awareness raising activities involving diverse stakeholders ● Promote source separation and fee collection

Source: prepared by JICA Study Team

The capacity of C/P agencies, project scale, contents, etc. will be examined for each project, and the applicable JICA scheme will be determined. JICA's support schemes are as follows.

- Technical cooperation project for preparation of solid waste management plan and action plans; implementation of pilot projects; and capacity development (Dispatchment of individual expert, Training in Japan [including issue-specific training and collaboration with local governments], third country training [including south-south cooperation])
- Japanese ODA loan project for facility development and equipment procurement (relatively large project)
- Grant aid project for facility development and equipment procurement
- Program approach as a comprehensive support model combining tangible and intangible elements (combination of Grant Aid and Technical Cooperation),
- Volunteer Programs (including Japan Overseas Cooperation Volunteers [JOCVs], Senior Volunteers)
- Private sector partnership support projects (including overseas investment and financing projects for the private sector)
- Citizen participation project (Grassroots technical cooperation etc.)
- Others

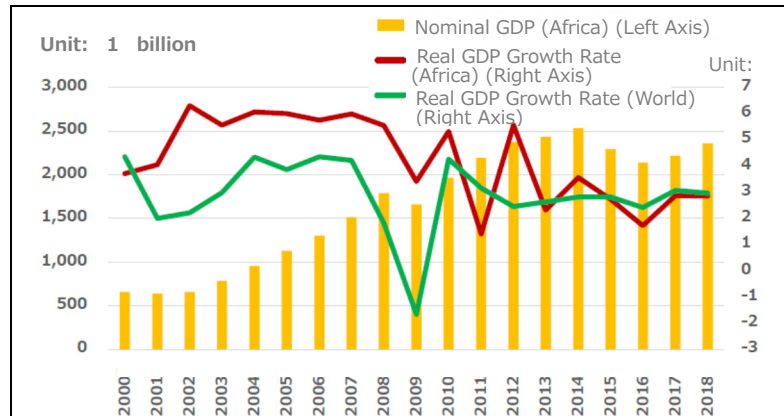
CHAPTER 1 Outline of this Survey

1.1 Background and Objectives of this Survey

1.1.1 Background

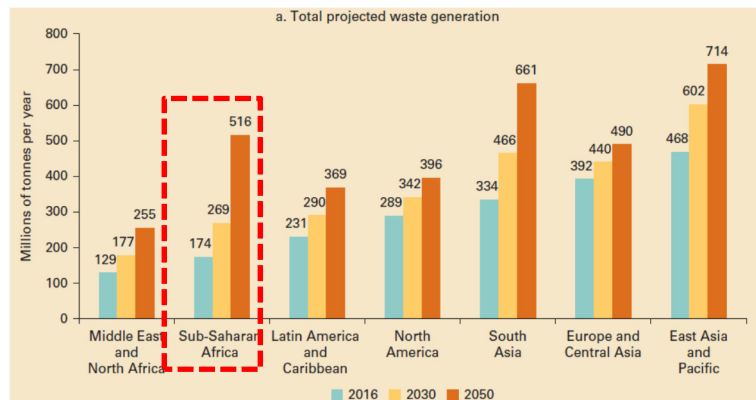
(1) Current Situation of Solid Waste Management in Africa

The urban population in Africa has been growing at an annual rate of 3.58%, the fastest in the world, and is estimated to grow from 0.55 billion in 2018 to 1.26 billion by 2050⁴. The African economy slowed down due to a fall in resource prices in 2014, but has been on a recovery trend since then as shown in Figure 1-1. Although the current economic growth rate is not high when compared to the population growth, the amount of waste generated in Sub-Saharan Africa is estimated to increase from 174 million ton/year in 2016 to 516 million ton/year in 2050, a threefold increase, as shown in Figure 1-2. In most African countries, the collection rate is low, at less than 55%, and there is a possibility of illegal dumping of uncollected waste. In addition, the sanitation and public health are threatened by poor sorting, intermediate treatment, recycling and final disposal.



Source: TICAD7, Africa Data Book, JETRO

Figure 1-1 Trends in GDP growth rate in Africa (2000-2017)



Source: What A Waste 2.0, the World Bank,

Figure 1-2 Estimation of waste generation amount

(2) Background for Establishment of ACCP

The Sustainable Development Goals (SDGs) adopted by the UN General Assembly in September 2015 set targets and indicators related to the waste management sector. In this context, the African Clean Cities Platform (ACCP) was established in April 2017 at the initiative of the Ministry of Environment of Japan, JICA, UNEP, UN-Habitat and the City of Yokohama, based on the declaration made at the 6th Tokyo International Conference on African Development (TICAD VI). Subsequently, at TICAD VII, the three

⁴ <https://www.jetro.go.jp/biz/areareports/special/2019/0702/38e6d7ed0510c745.html>

pillars of “Economy,” “Society,” and “Peace and Stability” and Japan's future initiatives were presented, and the ACCP will contribute to the second pillar, “Society,” which is “Sustainable Urban Development”.

On the other hand, JICA launched the JICA Clean Cities Initiative (JCCI) this year to promote the Global Agenda (GA), a comprehensive project management system introduced by JICA, in urban areas of developing countries and to contribute to the realization of “clean cities”. Currently, 90 cities in 42 countries are participating (as of January 2022), and the following activity goals have been set with the aim of “enabling African countries to realize clean and healthy cities”.

- Sharing of knowledge and networking
- Promotion of SDGs
- Promotion of investment

1.1.2 Objectives

The objectives and outputs of this Survey are (1) to identify the priorities and needs for assistance and assess the possibilities of intercity cooperation, (2) to assess the feasibility and requirements for introducing waste-to-energy facilities (hereinafter referred to as “WtE”), and (3) to recommend the review of the policies for assistance through African Clean City Platform (hereinafter referred to as “ACCP”) by surveying the current situation of municipal solid waste management.

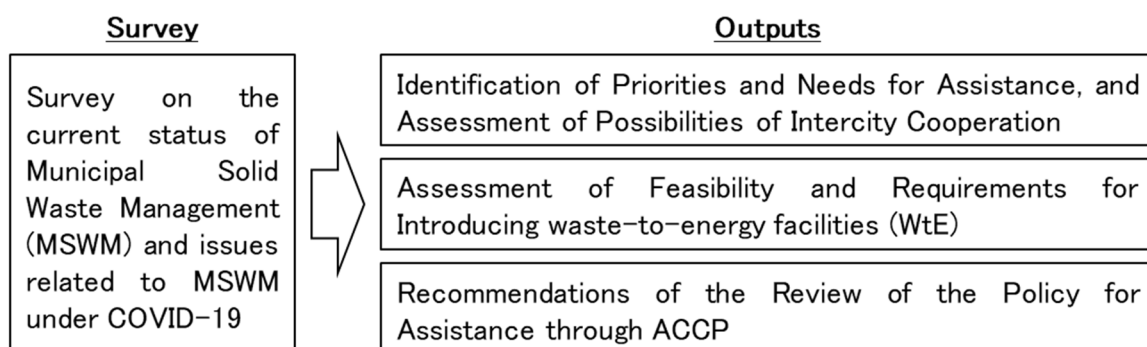


Figure 1-3 Flow and Objectives of the Survey

1.2 Target Countries and Cities

1.2.1 Field Survey Countries and Cities

The field survey targets seven countries designated by Japan International Cooperation Agency (hereinafter referred to as “JICA”), and basically one city has been selected from each target country. However, two cities have been selected from countries where efficient surveys and horizontal deployment were expected. The field survey countries and cities are shown in Table 1-1.

Table 1-1 Field Survey Countries and Cities

No.	Target Country	Target City	
1	Cote d'Ivoire	Abidjan* ¹	-
2	Angola	Luanda (Capital)	-
3	Ethiopia	Addis Ababa (Capital)	Hawassa
4	Uganda	Kampala (Capital)	-
5	Guinea	Conakry (Capital)	-
6	South Africa	Tshwane (Capital)	Johannesburg* ²
7	Botswana	Gaborone (Capital)	Kweneng District* ³

*1) The city is a former capital and its population and economic scale are larger than those of the current capital, and the impact of MSWM is estimated to be greater.

*2) The city has precedent cases of WtE.

*3) The city is neighboring to the capital and has the largest final disposal site in the country that accepts the waste generated in the capital.

1.2.2 Domestic Survey Countries and Cities

The two countries that were selected as the target domestic survey countries in consultation with JICA are shown in Table 1-2. For selecting the two countries, the following five fundamental conditions from the results of “Questionnaire for COVID-19 Impact” conducted by JICA through ACCP were considered.

- Infectious waste in city is on the increase (or not yet known).
- Resources to address COVID-19 are insufficient.
- There is a need to address COVID-19
- Target city should be the capital city
- JICA office is located in the selected city

Table 1-2 Domestic Survey Countries and Cities

No.	Target Country	Target City
1	Nigeria	Abuja
2	Tanzania	Dodoma

Nigeria and Tanzania were selected as the target countries for the survey to extract lessons learned from the existing JICA projects in both countries.

1.3 Relevant Organizations

The relevant organizations in the target countries and cities are listed in Table 1-3.

Table 1-3 Relevant Organizations of the Target Countries and Cities

Target Country	Target City	Relevant Organization (Central Government)	Relevant Organization (Local Government)
Cote d'Ivoire	Abidjan	<ul style="list-style-type: none"> • Agence Nationale de Gestion des Déchets (ANAGED) (National Waste Management Agency) • Ministère de l'Assainissement et de la Salubrité (Ministry of Sanitation) 	<ul style="list-style-type: none"> • District Autonome d'Abidjan
Angola	Luanda	<ul style="list-style-type: none"> • Ministry of Environment • National Waste Agency 	<ul style="list-style-type: none"> • Provincial Government of Luanda
Ethiopia	Addis Ababa	<ul style="list-style-type: none"> • Ministry of Urban Development and Housing (MoUDH) 	<ul style="list-style-type: none"> • Addis Ababa City Administration
	Hawassa		<ul style="list-style-type: none"> • Waste Management and Greenery Core Processing, Hawassa City Administration
Uganda	Kampala	<ul style="list-style-type: none"> • Ministry of Kampala • Ministry of Water and Environment 	<ul style="list-style-type: none"> • Kampala Capital City Authority (KCCA)
Guinea	Conakry	<ul style="list-style-type: none"> • Ministry of Hydraulics and Sanitation • National Sanitation Department National Agency for Sanitation and Public Health (ANASP) 	<ul style="list-style-type: none"> • Conakry Sanitation Project Management Unit (UGPAC)
Botswana	Gaborone	<ul style="list-style-type: none"> • Department of Waste Management and Pollution Control (DWMPC), Ministry of Environment, Wildlife and Tourism 	<ul style="list-style-type: none"> • Environmental Health Department, Gaborone City Council
	Kweneng District		<ul style="list-style-type: none"> • Public Health Department, Kweneng District Council
South Africa	Tshwane	<ul style="list-style-type: none"> • Branch: Chemicals and Waste Management, Department: Environment, Forestry and Fisheries 	<ul style="list-style-type: none"> • City of Tshwane Metropolitan Government
	Johannesburg		<ul style="list-style-type: none"> • City of Johannesburg, Government of Local Unity

1.4 Survey Implementation Structure

The members of the JICA Study Team for the Survey are shown in Table 1-4. In addition, local consultants with intimate understanding of MSWM in each country were engaged for supporting the survey in the target countries.

Table 1-4 Member of JICA Study Team

Position	Affiliation	Name of Expert
Team Leader / Solid Waste Management Plan	Yachiyo Engineering Co., Ltd.	Hisashi YAMAUCHI
Deputy Team Leader / Municipal Waste Management-1 (Waste Collection / Transportation)	Yachiyo Engineering Co., Ltd.	Takatoshi ARAI
Municipal Waste Management-2 (Intermediate Treatment / Final Disposal)	Japan Environmental Sanitation Center	Makoto YAMAMOTO
Municipal Waste Management-3 (Institutional System / Financial Analysis)	Yachiyo Engineering Co., Ltd.	Hiroki ISHIHARA
ICT / Private Sector Collaboration / External Funds Mobilization	Yachiyo Engineering Co., Ltd.	Masae YAMAMOTO
Municipal Waste Management Status Analysis / Checklist Development	Yachiyo Engineering Co., Ltd.	Chikako YAMANAKA

Table 1-5 shows the local consulting firms and local staff utilized in this Survey, for the field survey countries and the domestic survey countries.

Table 1-5 Local Consulting Firms and Local Staff

Target Country	Local Consulting Firm	Local Staff
Cote d'Ivoire	Bazaleel + Turnkey Contractors, Inc.	-
Angola	-	Rui Henriques Fragoso da Silva
Ethiopia	MS Consultancy	-
Uganda	J and W Agencies (A) Ltd	-
Guinea	-	Mr. Barry Amadou Lamarana
Botswana	-	Mr. Kgotso Kevin Onneile
South Africa	Executive Research Associates	-
Tanzania	J and W Agencies (A) Ltd	-
Nigeria	-	Ms. Abieyuwa Lgbinoghene, Ms. Kate Okhihie, Ms. Coletta Osumade

1.5 Survey Schedule

The period of the Survey was from January, 2021 through March, 2022. The survey schedule is shown in Table 1-6.

Table 1-6 Survey Schedule

Work Item	2020												2021		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
<1st Stage>: Domestic Work (January-February, 2021)															
[010] Collection and Analysis of Existing Data and Selection of Target Countries and Cities															
[020] Preparation of Inception Report															
<2nd Stage>: Domestic Work and Field Survey (February-December, 2021)															
[030] Surveys related to Conditions, Tasks and Cooperation Plans of Municipal Waste															
[040] Municipal Waste Management under COVID-19 Pandemic															
[050] Feasibility Study for Introduction of WtE															
[060] Report of the Survey Progress to JICA															
[070] Summary Report of Survey Results															
<3rd Stage>: Domestic Work (January-March,2022)															
[080] Discussion of Draft Final Report															
[090] Submission of Final Report															
[100] Presentations at Conference hosted by JICA or ACCP															
▲ Seminar/Conference															
■ Deliverables															

Legend : ■ Field Survey □ Domestic Work

▲ Seminar/Conference
 ■ Deliverables
 ▲ Inception Report
 ▲ Progress Report
 ▲ Draft Final Report
 ▲ Final Report

1.6 Field Survey Schedule

(1) Cote d'Ivoire

The 1st field survey (Cote d'Ivoire) was conducted by the members listed in Table 1-7. The schedule of the 1st survey is shown in Table 1-8.

Table 1-7 Members and Duration of 1st Field Survey

Member	Position	Duration of Survey
Hisashi YAMAUCHI	Team Leader / Solid Waste Management Plan	July 5 th , 2021 – July 13 th , 2021 (9 days)
Makoto YAMAMOTO	Municipal Waste Management-2 (Intermediate Treatment / Final Disposal)	July 12 th , 2021 – July 20 th , 2021 (9 days)
Hiroki ISHIHARA	Municipal Waste Management-3 (Institutional System / Financial Analysis)	July 5 th , 2021 – July 20 th , 2021 (16 days)
Masae YAMAMOTO	ICT / Private Sector Collaboration / External Funds Mobilization	July 5 th , 2021 – July 20 th , 2021 (16 days)

Table 1-8 Survey Schedule of 1st Field Survey

	Date			Interviews and Site Visits etc.
1	July 5 th	Mon	-	Haneda Airport (Tokyo) → Charles de Gaulle Airport (Paris)
2	July 6 th	Tue	-	Charles de Gaulle Airport (Paris) → Felix Houphouet Boigny International Airport (Abidjan)
3	July 7 th	Wed	AM PM	JICA Cote d'Ivoire Office MINASS
4	July 8 th	Thu	AM	ANAGED
5	July 9 th	Fri	AM PM PM	DAA Marubeni Corporation Abidjan Liaison Office World Bank
6	July 10 th	Sat	-	Site visit of Abidjan Autonomous District (waste collection, etc.)
7	July 11 th	Sun	-	Preparation of seminar materials
8	July 12 th	Mon	AM PM	ECOTI SA (Operator of waste collection/transportation and transfer station) COLIBA (Plastic Recycling Company)
9	July 13 th	Tue	AM PM PM PM	CLEAN EBURNIE (Operator of Kossihuen landfill site) MINEDD CFAO ECO EBURNIE (Operator of waste collection/transportation and transfer station) Conceptos Plásticos (Plastic Recycling Company)
10	July 14 th	Wed	AM PM PM	Green Countries (Production of compost / Plastic recycling) INHP AfDB (African Development Bank)
11	July 15 th	Thu	AM AM PM	GGGI (Global Green Growth Institute) INHP ONAD
12	July 16 th	Fri	AM PM	PCR Test Seminar
13	July 17 th	Sat	-	Site visits of Grand-Bassam (waste collection etc.)
14	July 18 th	Sun	-	Felix Houphouet Boigny International Airport (Abidjan) → Charles de Gaulle Airport (Paris)
15	July 19 th	Mon	-	Charles de Gaulle Airport (Paris) →
16	July 20 th	Tue	-	→ Narita Airport (Tokyo)

(2) Angola

The 2nd field survey (Angola) was conducted by the members listed in Table 1-9. The schedule of the 2nd survey is shown in Table 1-10.

Table 1-9 Members and Duration of 2nd Field Survey

Member	Position	Duration of Survey
Takatoshi ARAI	Deputy Team Leader / Municipal Waste Management-1 (Waste Collection / Transportation)	October 16 th , 2021 – October 30 th , 2021 (15 days)
Makoto YAMAMOTO	Municipal Waste Management-2 (Intermediate Treatment / Final Disposal)	October 16 th , 2021 – October 30 th , 2021 (15 days)

Table 1-10 Survey Schedule of 2nd Field Survey

1	Date			Interviews and Site Visits etc.
	Day	Month	Year	
1	October 16 th	Sat	-	Narita Airport (Tokyo) →
2	October 17 th	Sun	-	→ Dubai Airport (Dubai), Dubai Airport (Dubai) → Luanda Airport (Luanda)
3	October 18 th	Mon	AM PM	JICA Angola Office UTGSL
4	October 19 th	Tue	AM PM	Ministry of Economy and Planning Ministry of Finance
5	October 20 th	Wed	AM PM	Illegal dumping sites, waste collection/transportation and road sweeping activities Vista Recycling Plant
6	October 21 st	Thu	AM PM	Kilamba City Administration EU Consultants
7	October 22 nd	Fri	AM PM PM	Sequele Waste Water Treatment Facility Elisal Mulenvos Landfill Site
8	October 23 rd	Sat	-	Site visit for checking the waste collection situation
9	October 24 th	Sun	-	
10	October 25 th	Mon	-	Checking collected documents
11	October 26 th	Tue	AM PM	Site visits to transfer stations PCR Test
12	October 27 th	Wed	AM PM PM	Ministry of Economy and Planning Luanda Provincial Government National Waste Agency
13	October 28 th	Thu	AM PM	JICA Angola Office Luanda Airport (Luanda) →
14	October 29 th	Fri	-	→ Dubai Airport (Dubai)
15	October 30 th	Sat	-	Dubai Airport (Dubai) → Narita Airport (Tokyo)

(3) Uganda

The 3rd field survey (Uganda) was conducted by the members listed in Table 1-11. The schedule of the 3rd survey is shown in Table 1-12.

Table 1-11 Members and Duration of 3rd Field Survey

Member	Position	Duration of Survey
Takatoshi ARAI	Deputy Team Leader / Municipal Waste Management-1 (Waste Collection / Transportation)	January 10 th , 2022 – January 22 nd , 2022 (13 days)
Makoto YAMAMOTO	Municipal Waste Management-2 (Intermediate Treatment / Final Disposal)	January 10 th , 2022 – January 22 nd , 2022 (13 days)
Hiroki ISHIHARA	Municipal Waste Management-3 (Institutional System / Financial Analysis)	January 10 th , 2022 – January 22 nd , 2022 (13 days)

Table 1-12 Survey Schedule of 3rd Field Survey

		Date		Interviews and Site Visits etc.
1	January 10 th	Mon	-	Narita Airport (Tokyo) →
2	January 11 th	Tue	-	→ Doha Airport (Doha), Doha Airport (Doha) → Entebbe Airport (Kampala)
3	January 12 th	Wed	PM PM PM	Global Green Growth Institute (GGGI) AFD JICA Uganda Office
4	January 13 th	Thu	AM AM	Kawempe Division Nakawa Division / Nakawa Waste Recycling Company
5	January 14 th	Fri	AM PM	Kiteezi Landfill Site Kiteezi Recycling Company
6	January 15 th	Sat	-	Site visit to Katanga District, Checking collected documents
7	January 16 th	Sun	-	Checking collected documents
8	January 17 th	Mon	AM PM	Ministry of Kampala De Waste (Private Waste Collection Company)
9	January 18 th	Tue	AM AM AM PM	Ministry of ICT Ministry of Energy Ministry of Water and Environment Transfer Stations in Rubaga and Makindye
10	January 19 th	Wed	AM AM PM	NEMA PCR Test GIZ
11	January 20 th	Thu	PM	JICA Uganda Office
12	January 21 st	Fri	-	Entebbe Airport (Kampala) → Doha Airport (Doha)
13	January 22 nd	Sat	-	Doha Airport (Doha) → Narita Airport (Tokyo)

1.7 Summary of Findings

In this study, multiple target cities were studied and draft cooperative policies through ACCP were considered. In order to compare and verify the target cities from a holistic perspective, the waste management level was set using the “country's development stage“ as described in the “Waste Management Sector Position Paper (JICA June 2017, 4th Edition)” as an indicator.

[Measures according to the country's development stage]

[Stage 1: “Improvement of public health”]

In countries where urbanization is progressing, the amount of waste generation increases with population concentration, leading to deterioration of public health. At this stage, there is an urgent need to improve public health through appropriate collection and disposal, with the first priority on improving the collection rate, in order to “not be overtaken by the waste amount”.

[Stage 2: “Reduction of environmental impact and pollution prevention”]

As industrialization progresses and secondary industries develop in particular, the risk of pollution becomes apparent. In this stage, the types of waste generated become more diverse, and the scope of impact expands due to the health hazards caused by environmental pollution, such as air and water pollution. In addition to urban waste management, which has been actively supported in the past, there is a need to reduce environmental impact and prevent pollution through appropriate treatment and management of hazardous waste.

[Stage 3: “Establishment of a sound material-cycle society through 3Rs”]

As economic development progresses and the awareness of civil society matures, people's awareness of the environment increases, and they move to a stage where they promote waste reduction and recycling, reduce environmental burdens including greenhouse gas emissions, and aim to build a sound material-cycle society.

The stages of solid waste management are analyzed from a variety of perspectives, and it is difficult to classify them in a common and universal manner. However, for the purposes of this study, the indicators shown in Table 1-13 were utilized to classify the countries, in order to compare multiple countries from a holistic perspective.

Table 1-13 Indicators of Solid Waste Management by Stage of Development

Item	Stage	Indicator
Law	1	No laws and regulations for solid waste management, or they exist in parts of legislation in multiple environmental laws and regulations.
	2	Fundamental laws on solid waste management exist. Or, laws and regulations that systematically organize solid waste management exist, although they are not solely solid waste management laws and regulations.
	3	Individual laws related to recycling exist.
Collection and Transportation	1	Illegal dumping is frequently observed due to severe inadequate waste collection and transportation capacity.
	2	Most of the generated waste is collected, and the incidence of illegal dumping is limited.
	3	Generated waste is adequately collected, and separate collection of recyclable materials is being carried out.
Final Disposal	1	Open dumping site
	2	Disposal sites with leachate collection and drainage facilities, weighbridge and application of covering soil. (Controlled dumping site).
	3	Sanitary landfill sites with leachate treatment facilities (sanitary landfill site).
Intermediate Treatment	1	No plans for the development of intermediate treatment facilities exist, and collection of recyclable materials, salvaged from the waste by the informal sector, private sector, etc. are carried out.
	2	In addition to the collection of recyclable materials by the informal sector and private sector, etc., the development of intermediate treatment facilities is being considered and planned.
	3	Intermediate treatment facilities such as sorting facilities, composting facilities, and WtE facilities are being developed and operated.

CHAPTER 2 Solid Waste Management in the Republic of Cote d'Ivoire

In the Republic of Cote d'Ivoire (hereinafter referred to as Cote d'Ivoire), in addition to the remote survey utilizing the local consulting firm (Bazaleel + Turnkey Contractors, Inc.), interviews were conducted with relevant agencies. The results of the survey are described in this chapter.

2.1 Overview of Target Country and City

2.1.1 Population

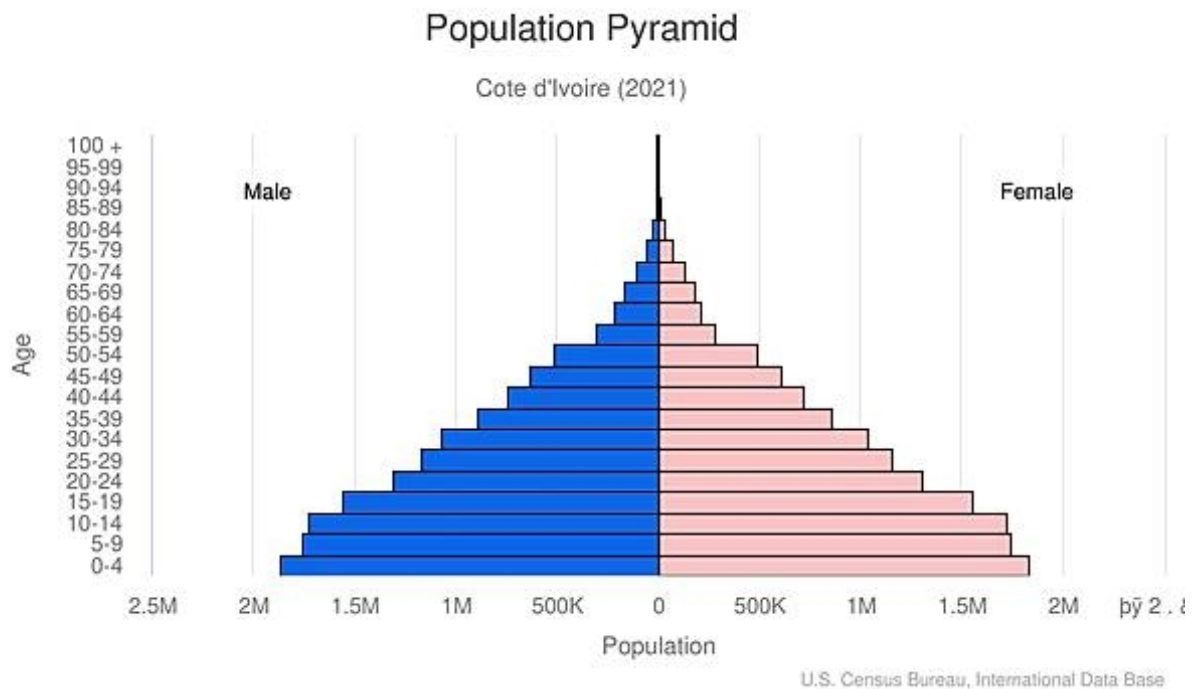
Table 2-1 shows the annual population for the period from 2014 to 2020 of the entire country of Cote d'Ivoire. The population annual growth rate for this period is around 2.55 - 2.58%. According to section 2.1.3 hereafter, with a land area of 318,003 km², the population density in 2020 was 83 person/km². Compared to the population density in Japan of 335 person/km² in 2020, the population density in Cote d'Ivoire is less dense.

Table 2-1 Population Trend in Cote d'Ivoire

Year	2014	2015	2016	2017	2018	2019	2020
Population (person)	22,647,672	23,226,148	23,822,726	24,437,475	25,069,226	25,716,554	26,378,275

Source: World Bank

Figure 2-1 shows the population pyramid of Cote d'Ivoire, which is “pyramidal” in shape, indicating that the population is in a state of high birth and death rates (a stage of expansive population).



Source: CIA, “the World Factbook”

Figure 2-1 Population Pyramid in Cote d'Ivoire

The Autonomous District of Abidjan (hereinafter referred to as “Abidjan”), the economic center of Cote d'Ivoire, is made up of 13 communes. In Cote d'Ivoire, a census was conducted in 2014 in major cities including Abidjan. Table 2-2 shows the projected population for the period 2014-2020, calculated based on the 2014 census.

Table 2-2 Population Growth Rate and Projected Population in Abidjan

Item / Year	2014	2015	2016	2017	2018	2019	2020
Population growth rate (%)	2.770	2.770	2.770	2.770	2.770	2.800	2.850
Projected population (person)	4,707,404	4,837,799	4,971,806	5,109,525	5,251,059	5,398,089	5,551,934

Source: prepared by JICA Study Team from data of the 2014 census and population growth rate⁵

As shown in Table 2-1 and Table 2-2, Abidjan has a population share of approximately 21% (2020) of the entire Cote d'Ivoire. In addition, the population growth rate of Abidjan is higher than that of Cote d'Ivoire as a whole, indicating that Abidjan is experiencing a population influx.

2.1.2 Economic Situation

The main economic indicators for Cote d'Ivoire are shown in Table 2-3.

Table 2-3 Main Economic Indicators for Cote d'Ivoire

Indicator	Year 2017	Year 2018	Year
GDP growth rate (real)	7.70 (%)	7.43 (%)	7.49 (%)
Total GDP (nominal)	38.1 (billion USD)	43.0 (billion USD)	44.4 (billion USD)
GDP per capita (nominal)	1,528 (USD)	1,681 (USD)	1,691 (USD)
Consumer price inflation (average for the period)	0.69 (%)	0.36 (%)	Negative 1.11 (%)
Exports (FOB prices)	12,614 (million USD)	11,804 (million USD)	11,615 (million USD)
Imports (FOB prices)	9,632 (million USD)	11,002 (million USD)	11,733 (million USD)
Current account balance (balance of payments basis)	Negative 1,049 (million USD)	Negative 2,077 (million USD)	N/A
Trade balance (balance of payments basis)	3,374 (million USD)	2,455 (million USD)	N/A

Source: JETRO, “Cote d'Ivoire Country Profile and Basic Statistics” (as of August 31, 2021)

The main industries in Cote d'Ivoire are agriculture (coffee, cocoa, etc.), oil and natural gas. Cote d'Ivoire's main exports are cocoa, petroleum products, and jewelry, and its main imports are petroleum products, machinery, and grain.

⁵ <https://www.macrotrends.net/cities/21602/Abidjan/population>

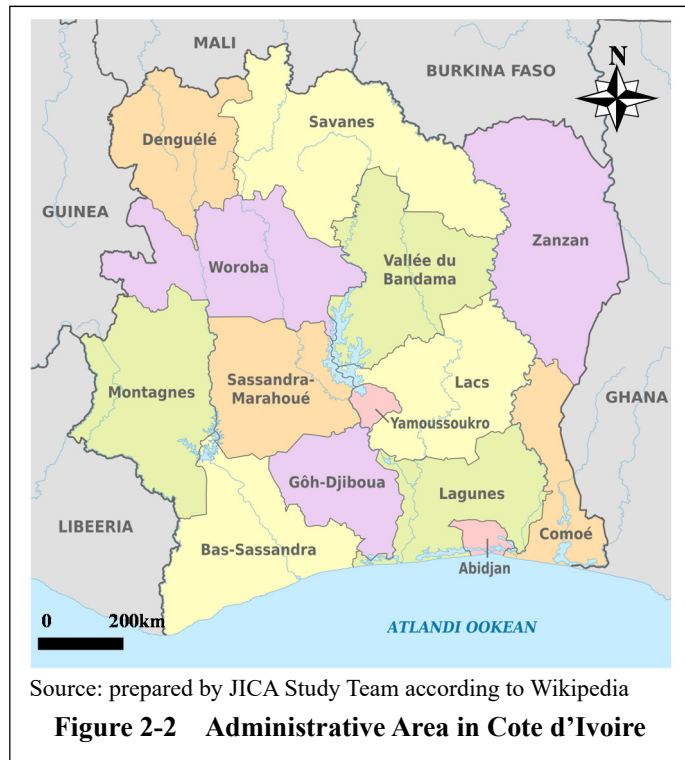
2.1.3 Topography

Cote d'Ivoire is located on the Gulf of Guinea in West Africa, with an area of 322,463 km² (of which 318,003 km² is land), and is bordered by five countries: Liberia, Guinea, Mali, Burkina Faso, and Ghana. As shown in Figure 2-2, Cote d'Ivoire is made up of 12 districts and 2 autonomous districts (Abidjan and Yamoussoukro), and 31 regions are established under the districts.

The southern part of Cote d'Ivoire is the lowest point in the country, at 0 m above sea level, and is often flooded during the rainy season. The topography of Cote d'Ivoire is mostly flat, but the northern part is higher than the southern part, gradually rising from the south (about 0 m) to the north (500 m).

Because of this topography, many rivers flow

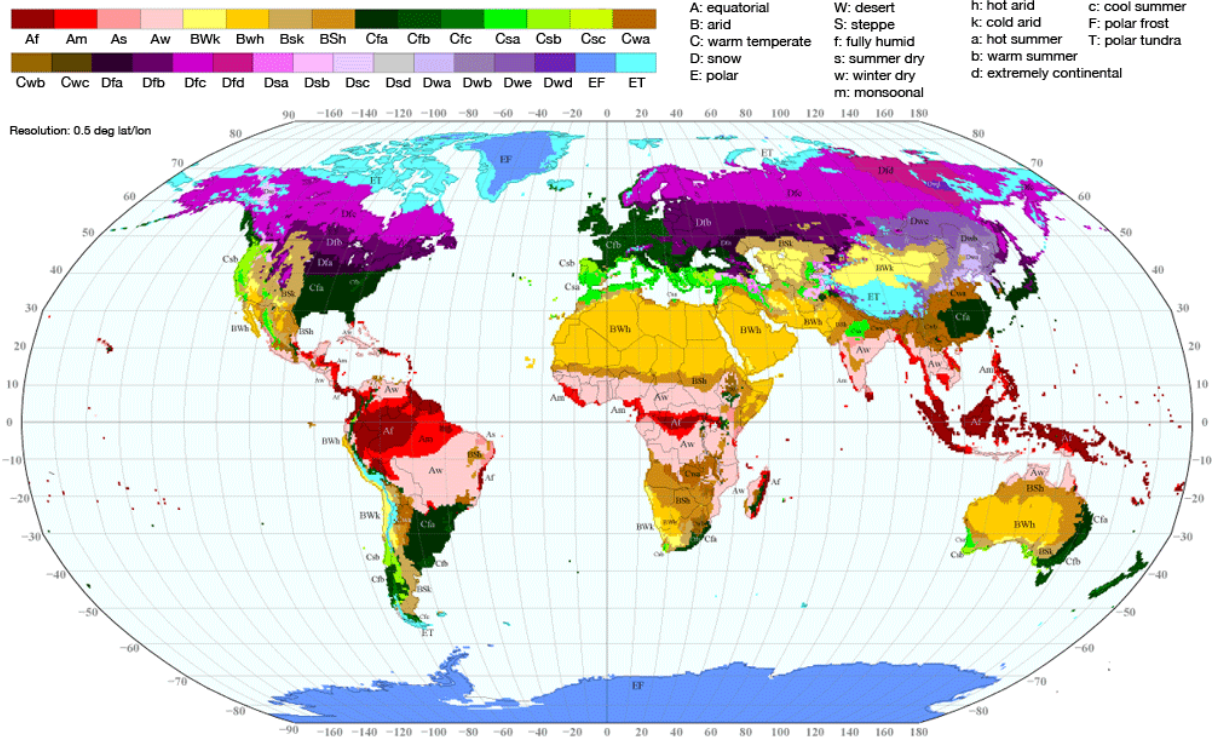
from the north into the Gulf of Guinea, and lagoons and tropical rainforests have developed along the coastline. The highest point in the country is Mount Nimba, which rises on the border of Guinea in the north-western part of Cote d'Ivoire, at 1,752 meters. The average altitude of the country is 250 meters.



2.1.4 Meteorological Conditions

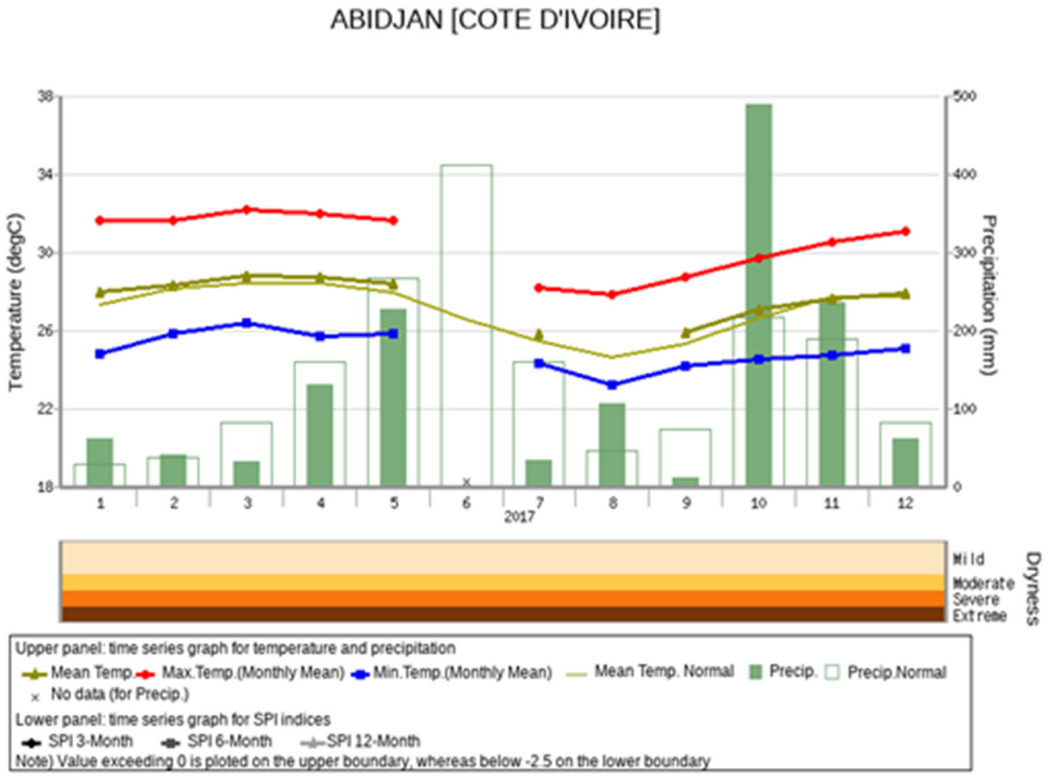
Cote d'Ivoire has three seasons (warm dry season: November to March, hot dry season: March to May, and hot rainy season: June to October). According to the Köppen climate classification (Figure 2-3), Cote d'Ivoire basically belongs to the savanna climate (Aw), while parts of the coastline are distributed in the tropical monsoon climate (Am). In the savanna climate (Aw), the wet and dry seasons can be clearly identified, and the vegetation is characterized by tropical grasslands with sparse growth of drought-resistant trees (called savanna). Abidjan belongs to the savannah climate (Aw), and the graph of rainfall and temperature for 2017 (Figure 2-4) shows that the temperature is high throughout the year, while precipitation is clearly low in some periods (December to March).

World Map of the Köppen-Geiger Climate Classification



Source: Weatherbase

Figure 2-3 Köppen Climate Classification



Source: Japan Meteorological Agency, "ClimatView - a tool for viewing monthly climate data"

Figure 2-4 Graph of Temperature and Precipitation in Abidjan (2017)

2.2 Laws, Regulations, Plans and Organizational Structures related to Solid Waste Management in the Country

2.2.1 Laws and Regulations related to Solid Waste Management

Currently, Cote d'Ivoire does not have any specific laws on solid waste management, however there are some laws and regulations describing some aspects of solid waste management. In the case of Abidjan and other cities, the Environmental Code is the basic law for solid waste management, and related agencies follow this Code's relevant laws and regulations. The relevant laws and regulations are shown in Table 2-4.

Table 2-4 Laws and Regulations relevant to Solid Waste and Environment in Cote d'Ivoire

Laws and regulations	Description of waste management and environment
Law No. 2016-886 of 8 November enacting the Constitution of the Republic of Cote d'Ivoire	Law No. 2016-886 of 8 November enacting the Constitution of the Republic of Côte d'Ivoire, Article 27 of which recognizes "that everyone throughout the national territory has the right to a healthy environment" and states that the transit, importation or illegal storage and dumping of toxic waste on the national territory constitute crimes that are not subject to any statute of limitations. Article 40 adds that "The protection of the environment and the promotion of the quality of life are a duty for the community and for each natural or legal person. The State is committed to protecting its maritime space, its waterways, its natural parks as well as its historic sites and monuments against any form of degradation. The State and public communities take the necessary measures to safeguard the fauna and flora. Where there may be a risk of harm that could seriously and irreversibly affect the environment, the State and public communities are required to assess the potential harm and to adopt the necessary preventive measures by applying the precautionary principle".
Law No. 88-651 of 7 July 1988	Law No. 88-651 of 7 July 1988 on the protection of public health and the environment against the effects of toxic and nuclear industrial waste and noxious substances, prohibits throughout the whole national territory all acts relating to the buying, selling, importing, transiting, transporting, depositing and storing of toxic and nuclear industrial waste and noxious substances.
Law No. 96-766 of 3 October 1996 (Environmental Code) and Decree No. 96-894 of 8 November 1996	Law No. 96-766 of 3 October 1996 establishes the general framework for the protection of fundamental elements of the environment, requiring the conduct of an environmental assessment for all major development projects (Art.39) and a structure for implementing the national ESA procedure. This procedure is defined by Decree 96-894 of 8 November 1996 which determines the rules and procedures applicable to studies on the environmental impact of development projects and which also defines the different project categories, the EIA content and the requirement to hold public consultations.
Decree No. 98-43 of 28 January, 1998	Decree No. 98-43 of 28 January 1998 relating to installations classified for the protection of the environment, Article 3 of which stipulates that "General facilities that may present dangers or disadvantages for environmental protection as described in Article 1 shall be submitted for prior environmental compliance authorization by the Minister responsible for Environment. Authorization shall not be granted if such dangers or disadvantages can be prevented through the implementation of specific measures to be specified by the Minister responsible for Environment".
Decree No. 2005-03 of 6 January 2005	Decree No. 2005-03 of 6 January 2005 on environmental auditing requires operators of classified facilities to carry out an environmental audit every three years.
Law No. 98-755 (Water Code) and Decree No. 2015-346 of 13 May 2015	This Water Code is the basic law for the management of rainfall, surface water, groundwater and marine areas in Cote d'Ivoire. Water resources are important in Cote d'Ivoire, and districts provide integrated water resources management for all water resources and related facilities and equipment. The priorities of districts in this code are: (1) to provide drinking water, (2) to conserve and manage water resources,

Laws and regulations	Description of waste management and environment
	and (3) to meet the water-related needs of the population. In addition, the following obligations related to water management of the district are indicated in this code: maintaining the quality of water resources, preventing wastes (especially prevention of waste inflow into waterways), conserving water resources, preventing waterborne diseases, and developing and maintaining facilities/equipment related to water resources.
Decree No. 2017-692 of 25 October 2017	This is the Decree for organizing Agence Nationale de Gestion des Déchets (ANAGED), which describes the structure, outline, and tasks of ANAGED.

Source: African Development Bank (May, 2019)

2.2.2 Policies and Plans related to Solid Waste Management

Cote d'Ivoire has two environment-focused plans and strategies: the National Environment Policy (hereinafter referred to as "NEP") and the National Sustainable Development Strategy (hereinafter referred to as "NSDS"). In addition, the National Development Plan 2016-2020 (hereinafter referred to as "NDP 2016-2020") includes a section on solid waste management. The plans related to solid waste management and environment are shown in Table 2-5.

Table 2-5 Plans related to Solid Waste Management and Environment in Cote d'Ivoire

Plan	Description of waste management
The National Environment Policy (NEP)	The National Environmental Policy (NEP) was adopted in 2011 and aims to create a benchmark for mainstreaming environmental issues into development policies and strategies. The Government's objective was to create a healthy and sustainable environment for all and to protect the country's natural resources. More specifically, it aimed to (i) make every effort to simultaneously resolve economic development and poverty reduction problems without further depleting or degrading natural resources; (ii) preserve or restore ecosystem capacities in order to provide essential goods and services for the maintenance of economic activities; and (iii) enhance the quality of receiving environments and the living environment.
The National Sustainable Development Strategy (NSDS)	The National Sustainable Development Strategy (NSDS) also adopted in December 2011, aims to identify measures and determine the means of mainstreaming sustainable development principles into national policies and programmes and reversing the current environmental resource depletion trend. It also aims to ensure equitable economic progress while preserving the resource base and the environment for future generations.
The National Development Plan 2016-2020 (NDP 2016-2020)	This is a development plan for the period 2016-2020. It states that development would be based on five axes: (i) strengthening the quality of systems and governance; (ii) accelerating the development of human resources and social welfare; (iii) accelerating the structural transformation of the economy through industrialization; (iv) improving national infrastructure and protecting the environment; and (v) strengthening regional integration and international cooperation. In (iv), "sustainable management of wastes including solid wastes" is mentioned as one of the outcomes, and it is stated that the government would focus on "preparation of a master plan on waste management", "development of industrial and hazardous waste management infrastructure using public-private partnerships (hereinafter referred to as 'PPP')", and "collection, separation and recycling of wastes". It also mentions the development of a legal framework for the environmental sector, including waste management.

Source: African Development Bank, "NDP 2016-2020" (May, 2019)

Concerning the master plan for solid waste management in Abidjan, a project for plan development is being implemented by support from the Islamic Development Bank (hereinafter referred to as "IsDB"). The details

are described in the section on “other donors” further in this chapter.

2.2.3 Organization Structure for Solid Waste Management

Currently, the Agence Nationale de Gestion des Déchets (hereinafter referred to as “ANAGED”) functions as the implementing agency for solid waste management in Cote d'Ivoire. On the other hand, in Abidjan, ANAGED has outsourced the solid waste management activities to three private companies, “ECOTI SA”, “ECO EBURNIE” and “CLEAN EBURNIE”.

An overview of the institutions involved in waste management and the environment in Cote d'Ivoire is described hereafter.

(1) Ministry of Sanitation (Ministère de l'Assainissement ete la Salubrité: MINASS)

Ministry of Sanitation (the Ministère de l'Assainissement ete la Salubrité¹, hereinafter referred to as “MINASS”) is the government agency in charge of municipal solid wastes (hereinafter referred to as “MSWs”) and is responsible for developing policies and plans for MSW management. MINASS has subordinate organizations, such as the National Agency for Waste Management (ANAGED) supervising solid waste management for the entire Cote d'Ivoire, the national sanitary drainage authority (the Office National de l'Assainissement et du Drainage, hereinafter referred to as “ONAD”), etc.

MINASS is made up of the following departments, which together with their main roles are shown below.

- Audit Department: to ensure compliance with the Ministry's internal regulations, etc.
- Human Resources Department: to manage the Ministry's human resources.
- Finance Department: to manage the Ministry's budget and conduct financial monitoring and evaluation of projects, and to be responsible for tax collection.
- Legal and Litigation Department: to draft regulations related to sanitation, to promote the dissemination of legal documents, and to supervise the implementation of regulations related to the management of hazardous waste and other materials.
- Strategy, Planning and Statistics Department: to coordinate and implement the activities of the Ministry within the framework of PND 2016-2020; and to prepare the necessary indicators related to sanitation
- External Relations and Public Relations Department: to prepare and implement plans and strategies for external relations and public relations on sanitation.
- Project Cooperation and Monitoring Department: To implement projects based on cooperation with other countries and international organizations on hygiene related issues including waste management.
- Organization and Quality Department: to disseminate and promote the quality policy in terms of hygiene and sanitation; and to design and implement strategies for continuous quality improvement at the organization level according to existing quality management practices.
- Information and Service Department: to develop and implement the Ministry's IT master plan; and to manage the Ministry's IT.
- National Monitoring Office in Urban Health Management and Damage: to manage the proper functioning of the Ministry's role in health monitoring.

- Hygiene Team: to supervise the implementation of hygiene regulations, to work closely with the police and communities to ensure compliance with hygiene regulations, and to handle complaints from residents.

(2) National Agency for Solid Waste Management (ANAGED)

ANAGED is an agency under MINASS responsible for MSW management in Cote d'Ivoire, and organized under “Decree No. 2017-692 of 25 October 2017”. ANAGED was formed by the merger of the National Urban Sanitation Organization (Agence Nationale de la Salubrité Urbaine, hereinafter referred to as “ANASUR”) and the Urban Sanitation Program Financing Fund (Fonds de Financement es Programmes de Salubrité Urbaine, hereinafter referred to as “FFPSU”). ANASUR itself was established in 2007.

ANAGED consists of the following four divisions

- Human Resources and Legal Department: responsible for the management of human resources, legal and financial affairs of ANAGED.
- Budget, Finance and Resources Department: responsible for budget applications, arranging necessary resources for waste management activities, and managing ANAGED's assets.
- Operations and Programs Department: responsible for handling the implementation of waste related planning and management; and planning of infrastructure related to solid waste management.
- Communication and External Relations Department: responsible for implementing ANAGED's external communication policy; and building partnerships among ANAGED and organizations involved in solid waste management, as well as national and international stakeholders.

The budget for waste management controlled by ANAGED (expenditures: Table 2-6, revenues: Table 2-7) is shown below. Waste management service costs such as waste disposal fees are not collected directly from service recipients. The waste disposal fee (Household Waste Removal Tax, hereinafter referred to as “TEOM”) is collected from contract parties (residents) of Cote d'Ivoire's electricity company (Ivorian Electricity Company, hereinafter referred to as “CIE”) together with their electricity bills. TEOM varies depending on the amount of electricity used, and in the case of Abidjan, it is 2.5 FCFA/kW. In addition to the collection of TEOM together with electricity bills, waste disposal fees are also collected by imposing taxes on “fixed assets,” “use of highways,” “import of used cars,” and “import and local production of plastic products such as plastic bags”.

Table 2-6 Expenditure of ANAGED Related to Waste Management

Year	2018	2019	2020
Expenditure in Abidjan	31,675,085,599 FCFA	31,675,085,599 FCFA	31,675,085,599 FCFA
Expenditure in Cote d'Ivoire	37,044,569,104 FCFA	37,044,569,104 FCFA	37,044,569,104 FCFA
Percentage of Abidjan	85.51%	85.51%	85.51%

Source: ANAGED

Table 2-7 Revenues of ANAGED Related to Waste Management

Year	2018	2019	2020
Revenue in Abidjan	53,072,809,244 FCFA	45,995,470,703 FCFA	49,175,563,479 FCFA
Revenue in Cote d'Ivoire	69,275,153,016 FCFA	62,988,781,548 FCFA	75,321,190,169 FCFA
Percentage of Abidjan	76.61%	73.02%	65.29%

Source: ANAGED

The following table shows an outline of the three private contractors, “ECOTI SA”, “ECO EBURNIE” and “CLEAN EBURNIE”, and the details of their contracted services.

Table 2-8 Outline of Three Private Companies involved in Solid Waste Management in Abidjan and their Contracted Services

Company name	Contracted services
ECOTI SA	<p>This is a Tunisian company with the majority of capital held by ECOTI SA Tunisia.</p> <p>The main activities of ECOTI SA are “secondary collection”, “management and operation of transfer stations”, “transportation from transfer stations”, “cleaning of roads” and “maintenance of related equipment” in five communes in Abidjan (Abobo, Anyama, Bingerville, Cocody and Plateau). No recycling activities are conducted by the company.</p> <p>ECOTI SA signed a seven-year contract with ANAGED on December 15, 2018 (with a possible extension of three years) for a contract value of 24,500 CFA/t (based on the waste amount delivered to the landfill). The contract is on a BOT basis, and related equipment and facilities will be transferred to ANAGED through purchase by ANAGED at the end of the contract.</p>
ECO EBURNIE	<p>This company is a branch of the Portuguese company “Mota-Engil”.</p> <p>The main activities of ECO EBURNIE are “secondary collection”, “management and operation of transfer stations”, “transportation from transfer stations”, “cleaning of roads” and “maintenance of related equipment” in eight communes in Abidjan (Adjame, Attecoube, Yopougon, Songon, Koumassi, Marcory, Port-Bouet and Treichville). No recycling activities are conducted.</p> <p>ECO EBURNIE signed a seven-year contract with ANAGED on December, 2018 (with a possible extension of two years). Their contract value is set on the basis of the waste amount delivered to the landfill. The contract is on a BOT basis, and related equipment and facilities will be transferred to ANAGED through purchase by ANAGED at the end of the contract.</p>
CLEAN EBURNIE	<p>This company is a branch of the Portuguese company “Mota-Engil”.</p> <p>The main activity of CLEAN EBURNIE is operation of Kossihouen landfill site where the waste collected in Abidjan by “ECOTI SA” and “ECO EBURNIE” is received. It also cleans the roads around the landfill site. No recycling activities are conducted.</p> <p>CLEAN EBURNIE signed a seven-year contract with ANAGED on November 2, 2018 (with a possible extension of two years). Their contract value is set on the basis of the waste amount delivered to the landfill site. The contract is on a BOT basis, and related equipment and facilities will be transferred to ANAGED through purchase by ANAGED at the end of the contract.</p>

Source: prepared by JICA Study Team

Other organizations related to solid waste management and the environment are the Ministry of Environment and Development (Ministère de l'Environnement et la Développementurable, hereinafter referred to as “MINEDD”), ONAD, the National Environment Agency (Agence Nationale de l'Environnement, hereinafter referred to as “ANDE”) and the Cote d'Ivoire National Pollution Control Center (Centre Ivoirien Antipollution, hereinafter referred to as “CIAPOL”). An outline of these organizations is shown below.

Table 2-9 Outline of Other Related Organizations

Organization	Outline
MINEDD	It is the agency in charge of E-wastes and industrial wastes. (Not responsible for MSWs.) It is the administrative ministry for ONAD and ANDE.
ONAD	It is an organization under MINASS, which is responsible for stormwater and drainage management. It is in charge of the project for development of waste management master plan being implemented with the support of IsDB.
ANDE	ANDE is an organization under MINEDD, established under Decree No. 97-393 of 9 July 1997. It is in charge of environmental assessment and monitoring of development projects.
CIAPOL	CIAPOL is an organization under MINEDD, established under Decree No. 91-662 of 9 October 1991. It is responsible for the prevention of pollution from companies/vessels and equipment that cause pollution of the sea; and for the administration and enforcement of laws/regulations and international conventions relating to environmental protection.

Source: prepared by JICA Study Team according to the interview results

2.3 Solid Waste Management Situation in Abidjan

2.3.1 Organizations for Solid Waste Management

Before 2007, the office of Abidjan (District Autonome d'Abidjan, hereinafter referred to as "DAA") was in charge of solid waste management in the district. Currently, DAA plays a role in environmental education and awareness raising activities for the formation of a Sound Material-Cycle Society in Abidjan, but in recent years, due to lack of budget, DAA has not been able to do so much.

DAA has been holding weekly meetings with ANAGED to share information. In the past, DAA also conducted activities to remove illegal dumping sites, but this has been discontinued due to lack of budget.

2.3.2 Ordinances and Policies related to Solid Waste Management

The Environmental Code is the basic law for solid waste management in Abidjan and other cities, and related agencies follow the Code and related laws and regulations. Abidjan does not have its own laws and regulations, but follows the laws and regulations at the national level.

2.3.3 Overview of Solid Waste Management

The results of population, waste (generation and disposal) amounts, collection rate, and unit generation amount in 13 communes of Abidjan are shown in the following table. The results of the interviews with private collectors showed that the collection rate was between 80% and 90%, and accordingly two cases were set. The disposal amount is the amount of waste transported to Kossihuen Landfill (actual measurement).

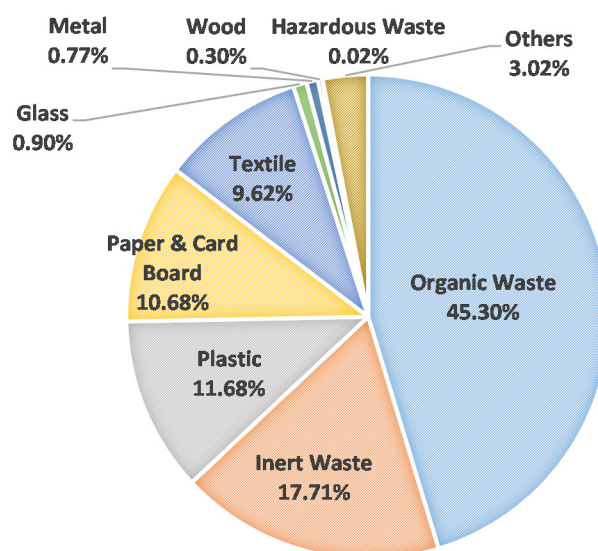
Table 2-10 Waste Generation and Disposal Amounts and Unit Generation Rate

	Year 2019		Year 2020	
Waste disposal amount	3,534 ton/day		4,221 ton/day	
Waste collection rate	80%	90%	80%	90%
Waste generation amount	4,418 ton/day	3,927 ton/day	5,276 ton/day	4,690 ton/day
Service population	5,398,089 people		5,551,934 people	
Unit generation rate	0.82 kg/person/day	0.73 kg/person/day	0.95 kg/person/day	0.84 kg/person/day

Source: prepared by JICA Study Team

According to ANAGED interviews, ACCP country data (2016), research paper⁶ (2018) and others, the unit generation rate in Abidjan is set as 0.8 kg/person/day, and the waste generation rate calculated from the waste amount delivered to the landfill is in the range of 0.736-0.828 kg/person/day. Accordingly, the unit generation amount for Abidjan is set at 0.8 kg/person/day.

In 2019 and 2020, CLEAN EBURNIE conducted a waste composition survey and stated that the waste composition in 2019 and 2020 was the same. Organic waste is approximately 45% of the total waste. However, it should be noted that these waste composition surveys were conducted for waste samples collected from incoming wastes to the Kossihouen landfill site and not on waste samples collected at the source.

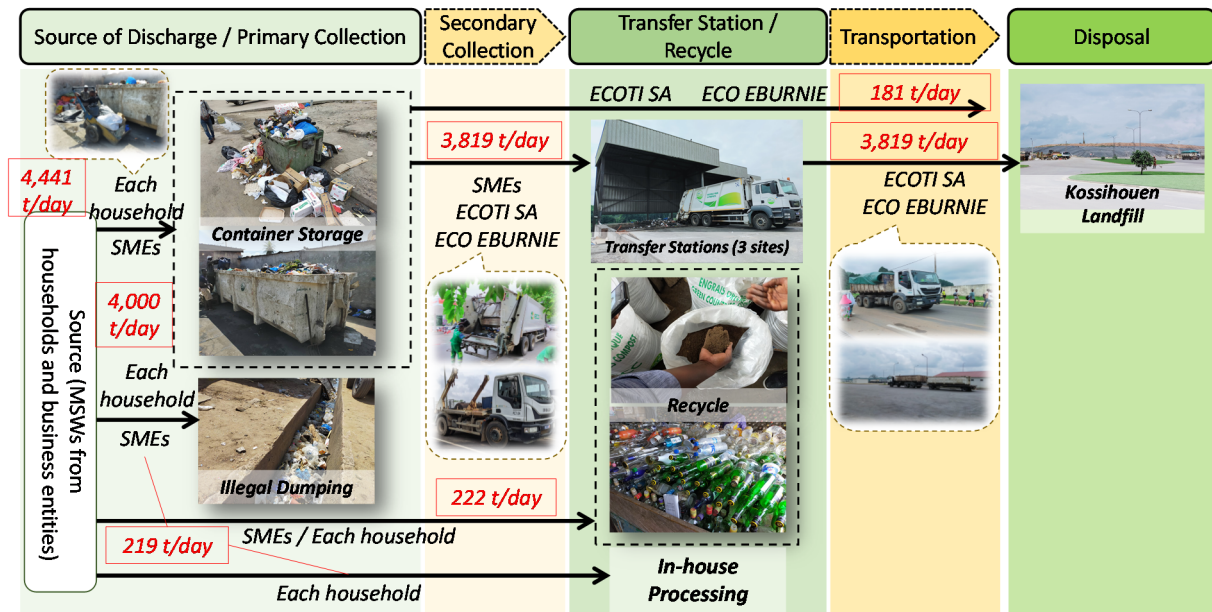


Source: CLEAN EBURNIE (2019 and 2020)

Figure 2-5 Composition of Incoming Wastes to Kossihouen Landfill Site

The waste flow of the solid waste management of Abidjan is shown in Figure 2-6.

⁶ <https://juniperpublishers.com/ijesnr/pdf/IJESNR.MS.ID.555886.pdf>



Source: prepared by JICA Study Team according to the site survey results and other data

Figure 2-6 Waste Flow in Abidjan

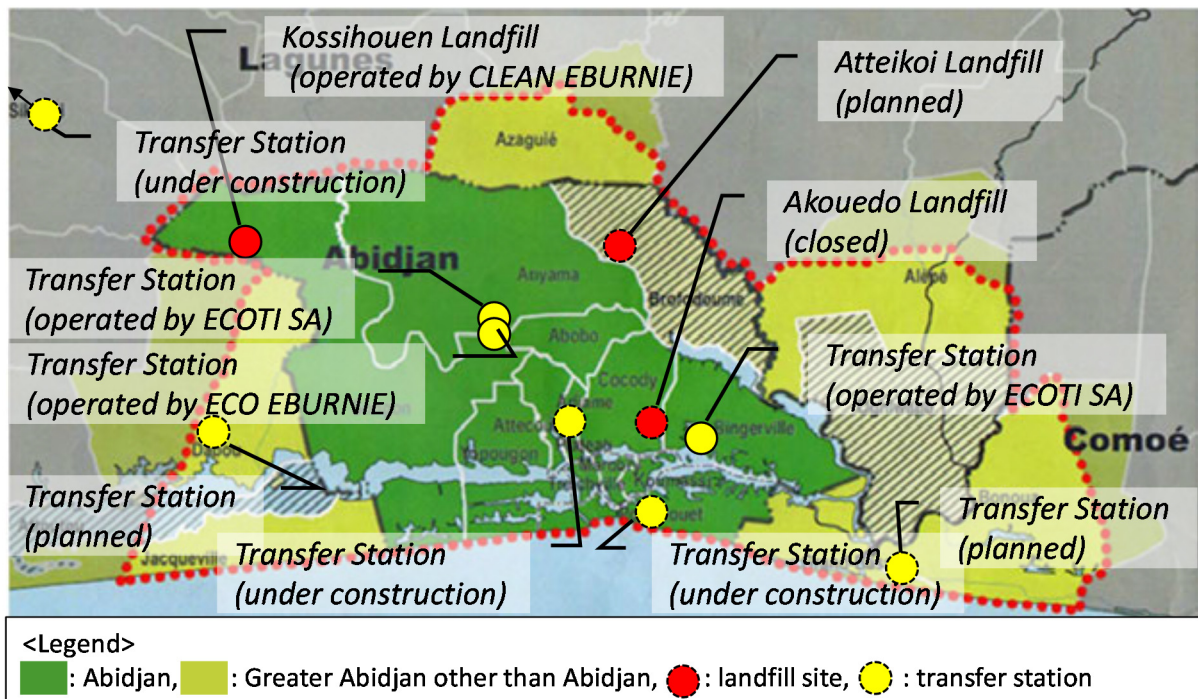
The calculation process for the above figure is shown below.

- Waste generation amount: 4,441 ton/day
*The “waste generation amount” is the product of the unit generation rate (0.8 kg/person/day) multiplied by the projected population in 2020 (5,551,934 people).
- Amount delivered to the landfill: 4,000 ton/day (questionnaire answer by ANAGED)
*In Abidjan, waste pickers do not extract recyclable materials, so this value is assumed to be equal to the “amount collected by ECOTI SA and ECO EBURNIE”.
- Amount delivered to transfer stations: 3,819 ton/day (questionnaire answer by ANAGED)
*This value is assumed to be equal to “amount delivered to the landfill via transfer stations” because recycling activities such as extraction of recyclable materials from the waste are not conducted at the transfer stations.
- Amount transported directly to the landfill: 181 ton/day
*The value is obtained by subtracting “(c) Amount delivered to the landfill via transfer station” from “(b) Amount delivered to the landfill”.
- Recycled amount: 222 ton/day
*The value obtained by multiplying the recycling ratio (5%⁷) by “(a) waste generation amount” is the “(e) Recycled amount”.
- Total amount of illegally dumped and in-house processed waste (un-managed waste): 219 ton/day
*The value obtained by subtracting the “(b) Amount delivered to the landfill” and “(e) Recycled amount” from “(a) Waste generation amount” is the “(f) total amount of illegal dumping and in-house processing”. From the interview with ANAGED, it seems that no in-house processing (including burning in the open fields) is conducted in Abidjan, and the proportion of illegal dumping is estimated to be high.

⁷ <https://www.livingcircular.veolia.com/en/city/Abidjan-afriwaste-optimizes-plastic-bottle-collection>

Based on the above calculations, the waste collection rate in Abidjan is estimated to be approximately 90% (= 4,000/4,441). (PROJECT APPRAISAL DOCUMENT of the World Bank reported a waste collection ratio of 85%.)

The locations of facilities related to waste management in Abidjan are shown in Figure 2-7.



Source: prepared by JICA Study Team according to SDUGA (JICA, 2015)

Figure 2-7 Facilities Related to Sold Waste Management in Abidjan

2.3.4 Current Status of Collection and Transportation

(1) Separation/Primary Collection

In Abidjan, there is no waste separation at the source. Basically, households discharge their wastes to containers or waste bins located alongside roads that are in good condition and have a certain width. Residents of households located far from the container or waste bins engage collectors (Small and Medium Enterprises, hereinafter referred to as “SMEs”) to carry the wastes from their households to containers or waste bins (i.e.; primary collection). SMEs collect waste from households using tractors (motorbikes with a cargo bed attached to the back) or hand carts.

It is reported that each household pays the fee directly to the SMEs. There are three types of SMEs: “SMEs that operate individually”, “SMEs that belong to organizations that manage SMEs”, and “SMEs that are managed by ECOTI SA or ECO EBURNIE”. Some SMEs extract recyclable materials from the collected wastes and sell them to recycling facilities or recycling companies that sell reused products (the recyclable materials are cleaned and sold).

		
Container set in a market (capacity: 20 m ³ (ECO EBURNIE))	Container along a road (capacity: 1.1 m ³)	Waste bins in the city
		
Waste discharging by SMEs	Collected recyclable materials	Shop selling reused materials

Source: photographs taken by JICA Study Team (July 10, 2021)

On the other hand, in Abidjan, there are many residents who do not discharge their wastes as mentioned above but just dump them in open spaces illegally. This is especially common in areas where many low-income people live, as collection services are not sufficient and people do not understand the importance of paying for waste disposal. In Abidjan, such illegally dumped wastes accumulate in gutters and waterways scattered by wind and rain, causing frequent flooding due to inadequate rainwater drainage. The central government and DAA consider solid waste management, especially improving the awareness of residents on waste management to be an important issue.

		
Small illegal dumping on the road side	Illegal dumping along the river bank	Wastes accumulated in a gutter

Source: photographs taken by JICA Study Team (July 9 and 10, 2021)

According to ANAGED, waste collection is being conducted in three communes of the six communes making up Greater Abidjan, outside of Abidjan. One of the three communes with waste collection is Grand-Bassam, where “Gi2E” is in charge of waste management. There is more waste scattered around the containers used by Gi2E than in Abidjan, and the awareness of residents regarding waste discharge may be lower than in Abidjan.



Source: photographs taken by JICA Study Team (July 17, 2021)

(2) Secondary collection

The wastes stored in containers and waste bins are collected using container carriers and compactors. The secondary collection in Abidjan (13 communes) is carried out by two private companies, “ECOTI SA” and “ECO EBURNIE”, under contract with ANAGED. The summary of the secondary collection service of both companies is shown in Table 2-11.

Table 2-11 Summary of Secondary Collection Service

	ECOTI SA	ECO EBURNIE
Target collection area	5 communes in Abidjan (Abobo, Anyama, Bingerville, Cocody and Plateau)	8 communes in Abidjan (Adjame, Attecoube, Yopougon, Songon, Koumassi, Marcory, Port-Bouet and Treichville)
Collection frequency	1 to 3 times/day (most of the collection is done at night due to the traffic situation in Abidjan.)	1 to 3 times/day (most of the collection is done at night due to the traffic situation in Abidjan.)
Collection method	Station collection	Station collection
Number of employees	Driver: 242 persons, worker: 486 persons	Driver: approximately 400 persons, worker: approximately 1,000 persons
Equipment for secondary collection	Compactor (18 m ³): 13 units Container carrier (3 m ³): 33 units Container carrier (6 m ³): 15 units (for waste boxes on long roads (collection by road sweepers)) Container carrier (7 m ³): 6 units (to be transported to the transfer station in Bingerville commune)	Compactor (5 m ³): 18 units Compactor (7 m ³): 42 units Compactor (24 m ³): 30 units Container carrier (5 m ³): 4 units (one of which is out of order)
Transportation destination	Collected waste is mainly transported to transfer stations in Anyama commune and Bingerville commune. Some of the collected waste is transported directly to the landfill in Kossihouen.	Collected waste is mainly transported to the transfer station in Anyama commune. Some of the collected waste is transported directly to the landfill in Kossihouen.

Source: prepared by JICA Study Team according to interviews with ECOTI SA and ECO EBURNIE

The collection vehicles and equipment used by “ECOTI SA” and “ECO EBURNIE” for secondary collection are currently owned by both companies. ANAGED will purchase all collection vehicles at the end of the BOT contracts with both companies.

In the case of container-based collection, the container filled with waste is basically exchanged with an empty container. However, on roads where containers cannot be placed for long periods of time due to road width issues, waste discarded on the roadside is loaded into empty containers on the spot by wheel loaders. This loading and unloading work at the collection point takes about one hour per large container, which makes collection inefficient. Furthermore, even under the influence of COVID-19, some workers do not take

infection control measures seriously, which results in an unsanitary working environment and a high risk of infection. In addition, the long hours of loading containers on roads with inadequate road widths result in large-scale traffic congestion.

		
Collection by a compactor (18 m ³) (ECOTI SA)	Collection by a compactor (24 m ³) (ECO EBURNIE)	Loading wastes into empty containers by wheel loader (ECO EBURNIE)
		
Container carrier for secondary collection (3 m ³) (ECOTI SA)	Container carrier for secondary collection (6 m ³) (ECOTI SA)	Container carrier for secondary collection (7 m ³) (ECOTI SA)
		
Compactor for secondary collection (5 m ³) (ECO EBURNIE)	Compactor for secondary collection (7 m ³) (ECO EBURNIE)	Compactor for secondary collection (24 m ³) (ECO EBURNIE)

Source: photographs taken by JICA Study Team (July 10 and 13, 2021)

Solid waste management is being carried out in the Grand-Bassam commune, which is one of the communes that make up Greater Abidjan outside Abidjan, by the private company “Gi2E”. Basically, Gi2E is collecting waste using containers (20 m³). In addition to Grand-Bassam, Gi2E is also involved in primary collection as SMEs in Abidjan.

(3) Transfer Stations and Transportation

ECOTI SA manages one transfer station in Anyama commune (waste receiving amount: approximately 1,600 ton/day) and one in Bingerville commune (waste receiving amount: approximately 100 ton/day). Currently, a new transfer station (estimated waste receiving amount: approximately 700 ton/day) is under construction at Adjame commune and is scheduled to be in operation by the end of 2021. The transfer station at Anyama

commune has a GPS tracking system for collection vehicles managed by ECOTI SA. This system also determines the location of the containers.

ECO EBURNIE manages one transfer station in Anyama commune (waste receiving amount: approximately 1,500 ton/day). Currently, a new transfer station (estimated waste receiving amount: approximately 1,000 ton/day) is under construction at Port-Bouet commune and is scheduled to be in operation by the end of 2021. The transfer station at Anyama commune has a GPS tracking system for collection vehicles managed by ECO EBURNIE.

A summary of facilities and operating conditions of the transfer stations operated by both ECOTI SA and ECO EBURNIE is shown below.

Table 2-12 Summary of Transfer Stations and Transportation by ECOTI SA and ECO EBURNIE

	ECOTI SA	ECO EBURNIE
Transfer station	<p><u>In operation</u></p> <ul style="list-style-type: none"> Anyama commune (waste receiving amount: approximately 1,600 ton/day) Bingerville commune (waste receiving amount: approximately 100 ton/day) <p><u>Under construction</u></p> <ul style="list-style-type: none"> Adjame commune (waste estimated receiving amount: approximately 700 ton/day) 	<p><u>In operation</u></p> <ul style="list-style-type: none"> Anyama commune (waste receiving amount: approximately 1,500 ton/day) <p><u>Under construction</u></p> <ul style="list-style-type: none"> Port-Bouet commune (estimated waste receiving amount: approximately 1,000 ton/day)
Operating hours	24 hours a day, 7 days a week	24 hours a day, 7 days a week
Facilities of the transfer stations in operation	Weighbridge, fences, gates, GPS vehicle tracking system, generators, health center for workers, office, etc.	Weighbridge, fences, gates, GPS vehicle tracking system, storage batteries for power outages, health center for workers, office, car wash area, storage yard, etc.
Waste loading method	Waste loading from collection trucks by dust chute (vertical opening facility for dropping waste)	Waste loading from collection trucks by dust chute (vertical opening facility for dropping waste)
Transportation vehicles	Trailers (70 m ³): 6 units Container carriers (30 m ³): 31 units	Semi-trailer (20 m ³ x 2 trailer): 60 units
Waste pickers	There are waste pickers. (The activity status in the transfer station in Bingerville commune has not been confirmed.)	There are no waste pickers.
Others	The station accepts wastes brought in from outside and sets a tipping fee for them.	The station accepts wastes brought in from outside and sets a tipping fee for them.

Source: prepared by JICA Study Team according to the results of interviews with ECOTI SA and ECO EBURNIE

		
Trailer for transshipment in the transfer station (70 m ³) (ECOTI SA)*	Container carrier for transshipment in the transfer station (30 m ³) (ECOTI SA)*	Weighbridge in the transfer station (ECOTI SA)*

		
Unloading facility for collection trucks in the transfer station (ECOTI SA)*	Unloading facility in the transfer station (ECOTI SA)*	GPS vehicle tracking system (ECOTI SA)*
		
Semi-trailer for transshipment in the transfer station (20 m ³ ×2) (ECO EBURNIE)**	Weighbridge in the transfer station (ECO EBURNIE)**	Storage yard for spare parts (ECO EBURNIE)**
		
Waste unloading facility in the transfer station (ECO EBURNIE)**	Waste unloading in the transfer station (ECO EBURNIE)**	GPS vehicle tracking system (ECO EBURNIE)**

Source: photographs taken by JICA Study Team (July 12* and 13**, 2021)

With World Bank support, new transfer stations will be built in the Grand-Bassam, Sikensi, and Dabou communes. It is expected that these stations will be in operation by the end of 2023. However, as of July 2021, they are still waiting for a final response from their counterpart, MINASS, regarding the land acquisition.

According to the waste collectors of Gi2E, which is responsible for waste management in Grand-Bassam, the containers are transported to a facility in Mondoukou, where the wastes are disposed of.

(4) Road Sweeping


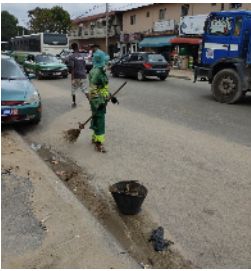

Road sweeping in Abidjan is included in the contract with ANAGED for “ECOTI SA” and “ECO EBURNIE”, and is performed by “ECOTI SA” and “ECO EBURNIE”. It was also confirmed that “CLEAN EBURNIE”, which operates the landfill, cleans the roads around the landfill site. Road cleaners wear the uniform of the company to which they belong and use sweeping brooms to clean roads throughout the city. Road sweepers also collect wastes from roadside waste bins. If any wastes are found on the roadside after sweeping, “ECOTI SA” and “ECO EBURNIE” are fined.

Table 2-13 Summary of Road Sweeping Services

	ECOTI SA	ECO EBURNIE
Target areas	5 communes in Abidjan (Abobo, Anyama, Bingerville, Cocody, and Plateau)	8 communes in Abidjan (Adjame, Attecoube, Yopougon, Songon, Koumassi, Marcory, Port-Bouet, and Treichville)
Number of cleaners	Approximately 1,600 persons	Approximately 700 persons
Cleaning vehicles	Road sweeping vehicle (6 m ³): 6 units Road sweeping vehicle (3 m ³): 3 units	Road sweeping vehicle (6 m ³): 11 units (5 of them out of order) Road sweeping vehicle (3 m ³): 3 units

Source: prepared by JICA Study Team according to the results of interviews with ECOTI SA and ECO EBURNIE

In Grand-Bassam commune, which is one of the communes that make up Greater Abidjan outside of Abidjan, solid waste management is carried out by “Gi2E”. Road sweepers of Gi2E wear the uniforms of Gi2E.

		
Road cleaners on the roadside (ECO EBURNIE)	Road cleaners on the roadside (ECO EBURNIE)	Road cleaners on the roadside (Gi2E)

Source: photographs taken by JICA Study Team (July 10 and 17, 2021)

2.3.5 Current Status of Intermediate Treatment / Recycling

In Abidjan, there is no intermediate treatment such as incineration, only recycling activities by private companies. However, both ECOTI SA and ECO EBURNIE are not engaged in recycling activities. JICA Study Team conducted interviews on the activities of the private recycling companies during the field survey. The results are summarized below.

(1) COLIBA (recycling plastics)

COLIBA is a plastic recycling company established in 2017 (currently with approximately 50 employees). This company makes PET flakes from collected PET bottles through the process of “sorting, crushing, cleaning, and packaging”. The company has two factories and has installed 65 containers in Greater Abidjan, and plans to actively install recycling bins at gas stations, schools, and supermarkets to collect PET bottles. The company has also introduced an application for smartphones, through which residents can request the collection of PET bottles (points are awarded for using the application). In addition to the production of PET flakes, the company also provides environmental education at schools and other institutions on recycling and other topics.

(2) Conceptos Plásticos (recycling plastics)

Conceptos Plásticos is a Colombian plastic recycling company (currently with approximately 42 workers) that was established in September 2018. This company is collaborating with UNICEF with the objectives of “building new schools with recycled products” and “developing plastic waste technologies”. The company manufactures plastic bricks and pillars from collected plastic wastes through the process of “crushing, melting, and molding”. The bricks are then used to build schools and other facilities (149 buildings have been constructed in the entire Cote d'Ivoire country between 2019 and 2021). The raw materials, plastic wastes, are purchased from individuals and women's groups (individuals belonging to a group who bring in plastic wastes are paid 200 CFA/kg (100 CFA/kg: individual, 100 CFA/kg: group)).



Source: photographs taken by JICA Study Team (July 13, 2021)

(3) Green Countries (composting and recycling plastics)

Green Countries is a company established in 2016 (currently with approximately 42 workers). The company accepts mixed wastes from individuals and plantation companies such as SIFCA, IVORYO, and COMAFRUIT. After sorting manually into organic wastes and plastic wastes, the organic wastes are used for composting and the plastic wastes are used for making paving stones. Green Countries has one facility in Bongo for composting and paving stone production, and three facilities for composting only in Azaguie, Aboisso, and Bonoua. They receive approximately 18,000 ton of organic wastes per year (2020) and produce approximately 10,000 tons of compost products. Compost products are sold for 3,000 CFA (10 kg) or 10,000 CFA (50 kg).



Source: photographs taken by JICA Study Team (July 14, 2021)

2.3.6 Current Status of Landfill Site

(1) Akouedo Landfill Site

Akouedo landfill site (53 ha) was used from 1965, and was closed in 2018 when the current Kossihouen landfill site started operation. Currently, it is reported that the companies, VEOLIA and PFO, are rehabilitating this landfill site.

(2) Kossihouen Landfill Site

Kossihouen landfill site is the only landfill site in operation as of July 2021, and is operated by “CLEAN EBURNIE” under a concession agreement with ANAGED. This landfill site only accepts wastes transported by “ECOTI SA” and “ECO EBURNIE”, which basically means that it only accepts wastes from Abidjan. The equipment and facilities used by CLEAN EBURNIE to operate the landfill are currently owned by the contractor (CLEAN EBURNIE) and will be purchased by ANAGED after the contract with ANAGED ends (BOT).

The following is a summary of the Kossihouen Landfill operated by CLEAN EBURNIE.

Table 2-14 Summary of Kossihouen Landfill Site

	CLEAN EBURNIE
Location	Located 42 km west of the center of Plateau commune (Located in Songon commune, 2 km from Kossihouen village)
Area	Approximately 150 ha
Disposal capacity	Approximately 8.5 million m ³ (of which approximately 3 million m ³ has been used)
Operation hours	24 hours a day, 7 days a week (3-shift rotation)
Disposal amount	Approximately 4,200 ton/day
Landfill type	Anaerobic sanitary landfill (landfill gas will be collected to generate biogas power)
Facility	Landfill, leachate treatment facility, weighbridge (5 lanes), radioactive waste detector, fence, gate, health center for workers, office, etc.
Landfill site	Soil covering (20 cm soil covering for 1.5 m waste layer), gas vent pipes, leachate collection pipes, leachate control pond, etc. Zone 1 and Zone 2 are covered by the concession agreement, and Zone 2 is currently in operation. New construction and operation of Zone 3 is currently under negotiation with ANAGED. New construction and operation of Zone 4 and later zones are also envisioned.
Leachate treatment facility	1,760 m ³ /day (= 220 m ³ /day × 8 facilities) Filtration using membrane filters separates the stabilized leachate into condensed leachate (40%) and water (60%). The water is discharged into the river after safety is confirmed at an inspection facility.
Landfill equipment	Dump truck: 1 unit Excavator: 2 units Bulldozer: 4 units Wheel loader: 2 units Motor grader: 1 unit Backhoe loader: 1 unit Landfill compactor: 2 units Lift vehicle: 1 unit
Waste pickers	There are no waste pickers at the landfill.

Source: prepared by JICA Study Team according to the results of interview with CLEAN EBURNIE

CLEAN EBURNIE is constructing a biogas power generation facility within the landfill using landfill gas generated from the landfill. As of mid-2021, the plant was expected to be in operation by the end of 2021, however the specific amount of landfill gas generated and the amount of electricity generated were currently under investigation. The electricity generated will be sold to CIE, but the purchase price based on the Feed in Tariff was still under discussion. There were no government subsidies for construction costs, and the facility was to be built entirely with CLEAN EBURNIE's investment.

		
<p style="text-align: center;">Installation sign board next to the entrance</p>	<p style="text-align: center;">Weighbridge (5 lanes)</p>	<p style="text-align: center;">Appearance of the landfill</p>

Source: photographs taken by JICA Study Team (July 13, 2021)

(3) Attakai Landfill Site

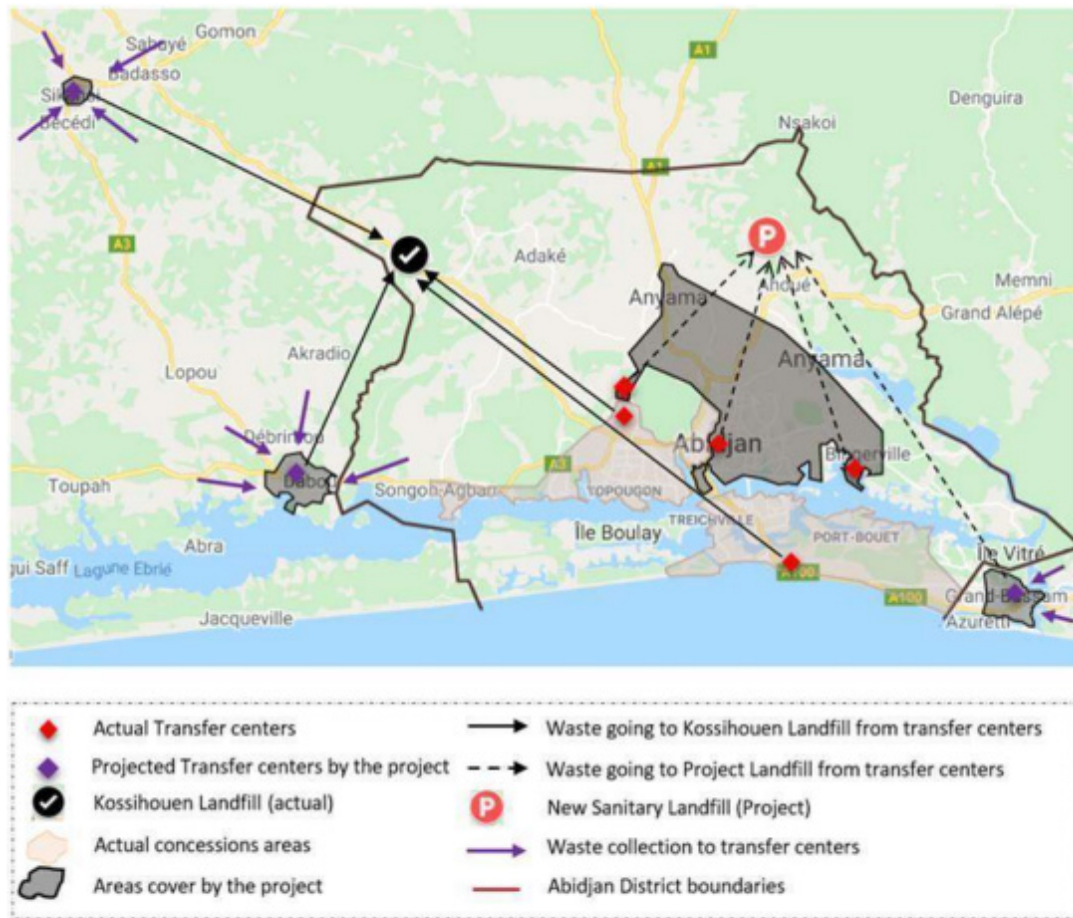
It is planned to construct a new landfill in Attakai commune, northeast of Abidjan, with the assistance of the World Bank. As of July 2021, World Bank is still waiting for a final response from their counterpart MINASS regarding land acquisition, although they expect to begin operation by the end of 2023.

2.3.7 Activities by Other Donors

Currently, the World Bank and IsDB are engaged in projects related to waste management.

(1) World Bank

As shown hereafter, the World Bank intends to implement a project, which mainly consists of constructing a new landfill site with recycling facilities in Attakai and transfer stations in Grand-Bassam, Dabou and Sikenshi (3 stations). As of July 2021, as mentioned above, land acquisition has not been completed and they are still waiting for a final decision from MINASS. The proposed construction sites are as follows



*Note: Location of new facilities is indicative and not final.
Map created using Google map*

Source: World Bank, excerpts from “PROJECT APPRAISAL DOCUMENT” (2020)

Figure 2-8 Location Map of Word Bank’s Solid Waste Management Project in Abidjan

The World Bank plans to implement the following projects related to solid waste management. In addition to the tangible aspects described above, the World Bank plans to provide support for the intangible aspects as well, including raising public awareness. On the other hand, specific support for implementation will be proposed by the implementation consultants, and the specific method of support has not yet been confirmed.

Table 2-15 Summary of New Solid Waste Management Project by World Bank in Abidjan

Component title	Activity contents
Component 2: Improvement of solid waste management infrastructure and services (US\$124 million)	
<p>Subcomponent 2.1: Strengthening solid waste management capacities in the Abidjan Autonomous District (US\$118 million)</p>	<ul style="list-style-type: none"> (i) Technical feasibility studies for the optimization of SWM in the Abidjan Autonomous District and contractual modalities for PPPs (ii) Technical feasibility, preparation of safeguard documents, detailed engineering design studies, and supervision services related to the proposed investments (iii) Technical feasibility study for the management of solid waste from health activities in the Abidjan Autonomous District and for the mode of contracting with the private sector (iv) Construction of a new solid waste treatment/valorization and disposal facility, including fixed equipment and associated roadworks in the Abidjan Autonomous District (v) Construction of three transfer centers and a recycling center, including civil works and fixed equipment to complete the existing system already included in the current concessions (vi) Elimination of uncontrolled deposits and dumpsites in the localities of Grand-Bassam, Sikensi and Dabou once the new solid waste treatment/recycling and disposal facility is constructed and operational
<p>Subcomponent 2.2: Strengthening sector governance, institutional capacity, and citizen engagement (US\$2.7 million)</p>	<ul style="list-style-type: none"> (a) Operationalization of the existing laws and regulations governing SWM, through ensuring <ul style="list-style-type: none"> (i) effective municipal and intercommunal planning for SWM (ii) the availability of financial resources for secondary cities waste collection (iii) an increase in local solid waste taxation to strengthen the sector's self-financing capacities and sustainability (b) Technical assistance seeking to <ul style="list-style-type: none"> (i) strengthen the institutional framework through a range of activities from legal support to capacity building (ii) promote a sustainable financing mechanism for the sector, including support for carrying out surveys and tax databases for solid waste fees/taxes (iii) reinforce the PPP framework, with the standardization of key bidding documents and contracts (iv) enhance solid waste service delivery by promoting private sector participation in SWM and optimizing the upstream value chain of waste collection and transportation in view of overall services improvement and their effective link with the newly established downstream infrastructure and tailoring capacity building activities to participating municipalities to support them in managing the newly established SWM system, including preventing marine and sanitary litter in the Abidjan Autonomous District
<p>Subcomponent 2.3: Improving solid waste management through citizen engagement, recycling, reuse, composting, and digital technology (US\$3.3 million)</p>	<ul style="list-style-type: none"> (a) An outreach program to sensitize and improve public behavior on solid waste and litter management, to reduce solid waste in the drainage network. The activity will adopt a participatory and inclusive approach with citizens, communities, and nongovernmental organizations (NGOs) (with a particular focus on women's' organizations), who will be engaged throughout the project for implementation and monitoring of results. (b) A strategy to develop and operationalize best practices in waste reduction, recycling, and circular economy including the identification of three to four value chains with high potential for local recycling and circular economy opportunities. (c) A gender-focused training program to develop the skills of small and medium enterprises (SMEs) on relevant recycling tools and techniques as well as on entrepreneurship skills focusing on the most profitable and relevant value chains. (d) Technological tools to be used by national agencies, municipalities, and citizens to allow better monitoring and control of SWM services. It will involve the use of technologies such as geolocation, web applications, and smartphones to collect operational information, measure and monitor performance of service providers, and plan and communicate service quality.

Source: World Bank, "Project Appraisal Document", (2019)

In addition to the above-mentioned support for MSW management, the World Bank is also considering a new

project for medical waste management in Abidjan.

(2) IsDB

A project is being carried out by IsDB to develop the master plan for solid waste management in Abidjan - the implementing consultants are TERRABO, SETEC Cote d'Ivoire and SETEC France. According to the Terms of Reference, the project consists of five missions from A to E (Mission A: basic information collection survey; Mission B: detailed survey and evaluation of the survey results; Mission C: proposal of a waste management system and development plan, Mission D: development of a master plan; and Mission E: detailed study of key projects in the master plan). As of July 2021, missions A and B have already been completed and mission C is being implemented. On the other hand, this master plan only covers MSWs under the jurisdiction of ANAGED, and the project area is Abidjan, not Greater Abidjan. The target year is 2030, and the Master Plan is expected to be finalized in June 2022.

ONAD, which supervises the IsDB project, is also a member of the project council for the above solid waste management project supported by the World Bank, and states that there is consistency between this master plan and the World Bank's project mentioned above.

2.3.8 Status of Initiatives related to Digital Transformation (DX)

ECOTI SA and ECO EBURNIE, which are responsible for waste collection in Abidjan, have installed tracking systems for their vehicles. The tracking system allows the user to check the current location of the vehicle as well as the past travel route, distance travelled, speed travelled, and gasoline consumption for each vehicle (with search function). The containers used for waste collection do not have GPS functions, but their locations are determined in advance so that the system can identify which vehicle has collected which container, etc.

2.3.9 Status of Monitoring on SDGs' waste-related Indicators

Table 2-16 shows the status of monitoring on SDGs' waste-related indicators (11.6.1, 12.3.1, 12.4.2, 12.5.1 and 14.1.1).

Table 2-16 Status of Monitoring on SDGs' waste-related Indicators (Abidjan)

SDGs Indicators		Current status
11.6.1	Proportion of urban solid waste regularly collected and with adequate final discharge out of total urban solid waste generated, by cities	Abidjan has successfully improved its waste management system by outsourcing waste management to the private sector (actually the waste collection rate has increased). Of the total MSW generated in Abidjan, the percentage of MSW collected and treated in controlled facilities is 90%. If collection in the informal sector is included, the percentage of treated MSW is 95%.
12.3.1	a) Food loss index, and b) Food waste index	There are currently no laws, policies, or initiatives in place to reduce organic wastes including food (food products) and others.
12.4.2	(a) Hazardous waste generated per capita; and (b) proportion of hazardous waste treated, by type of treatment	Cote d'Ivoire is still working on measures to combat chemical contamination by hazardous waste (monitoring and evaluation activities, etc.) in response to the problem of illegal dumping of hazardous wastes (chemicals) that occurred in 2006. In addition, since the problem arose,

SDGs Indicators		Current status
		the country has enforced Law No. 2016-886 of 8 November, which stipulates that “the brokering, importation, illegal storage, or dumping of hazardous waste is a crime not subject to the statute of limitations”. Law No. 88-651 of 7 July 1988 also provides for hazardous waste. In the international framework, the Cote d'Ivoire is a member of the Basel Convention.
12.5.1	National recycling rate, tons of material recycled	According to ANAGED, the current private sector contracted collection system is facing the problem of waste being dumped into ditches, etc. Consequently, ANAGED has instructed private contractors to focus on waste collection rather than 3R activities, including recycling. On the other hand, ANAGED is looking beyond the improvement of collection to 3R activities such as recycling, and has instructed private contractors to propose such activities. The amount of recycling in Abidjan is estimated at 222 ton/day, which is equivalent to 5% of the total generation amount of MSW.
14.1.1	(a) Index of coastal eutrophication; and (b) plastic debris density	Abidjan has outsourced most of its waste management, including waste collection, to private contractors since 2018. Abidjan is located on the Gulf of Guinea, and uncollected waste used to be washed out to sea by wind and rain, causing marine pollution problems, but the increased collection rate has reduced marine pollution. On the other hand, although the amount of pollution has been reduced, marine pollution caused by spilled wastes still remains an issue. However, there is no data related to plastic waste being discharged into the ocean. If 60% of the illegal dumping were to be dumped in rivers washed into the sea, this would result in 15.3 ton/day of marine plastic. Amount of marine plastic = 219 ton/day x 11.68% (composition of plastic) x 60% = 15.3 ton/day

Source: prepared by JICA Study Team

2.3.10 Medical Waste Management

A master plan on medical waste – Plan National de Gestion Des Dechets Sanitaires 2021-2025 (hereinafter referred to as “PNGDS 2021-2025”), has been developed. This master plan consists of five objectives: (i) strengthening the legal framework for medical waste; (ii) enhancing sustainable management of medical waste; (iii) strengthening the medical waste management system, including emergency response; (iv) developing a sustainable financial system for medical waste management and PPP; and (v) monitoring and evaluating PNGDS 2021-2025.

In Cote d’Ivoire, medical wastes from hospitals and wastes from the COVID-19 center are clearly separated. The Ministry of Health and Sanitation (Ministère de la Santé et l’Hygiène Publique, hereinafter referred to as “MSHP”) is in charge of medical wastes, while wastes from the COVID-19 center are handled by the National Institute of Public Health (Institut National d’Hygiène Publique, hereinafter referred to as “INHP”), which is under MSHP. Medical wastes are separated, stored, and processed at each hospital. Basically, each hospital manages its own disposal, but small hospitals and clinics without facilities outsource the disposal of their generated waste to outside companies.

Table 2-17 summarizes the medical waste management in the four hospitals where the questionnaire survey was conducted.

Table 2-17 Summary of Medical Waste Management in 4 Hospitals in Abidjan

	Centre Hospitalier Universitaire (CHU) d'Angré	Hôpital Général de Port-bouët (CGP)	Hôtel Médical des Impôts	Centre Médical Nimatoullah (CMN)
Private/Public	Public	Public	Private	Private
Number of doctors	157 persons	46 persons	30 persons	22 persons
Number of beds	203 beds	124 beds	40 beds	6 beds
Generation amount	500 kg/day	N/A	Approximately 25 kg/day	500 kg/day
Treatment method	Incineration (in-hospital)	Incineration (in-hospital)	Incineration (outsourced) Outsourced to Hôpital Militaire d'Abidjan (HMA)	Incineration (outsourced) Outsourced to HMA, Elston Cote d'Ivoire
Treatment amount	500 kg/day	N/A	23.6 – 26.4 kg/day	N/A

Source: prepared by JICA Study Team according to the questionnaire survey results

		
Storage of medical wastes (in CHU Angré Hospital)	Incinerator (in CHU Angré Hospital)	Incinerator (in CHU Angré Hospital)
		
Separation of medical wastes (in CMN Hospital)	Incinerator (in HMA Hospital)	Incinerator (in HMA Hospital)

Source: prepared by JICA Study Team according to the questionnaire survey results

COVID-19 centers are facilities for PCR testing and are located throughout the Cote d'Ivoire (10 centers in total in Abidjan). Waste discharged from the COVID-19 centers in Abidjan is transported to the incinerator for medical waste in the city by dedicated standard vehicles (3 vehicles in total, one of them is loaned free of charge for 3 months by a private company) for incineration treatment. In general, wastes from the COVID-19 center are transported to an incinerator in Abobo (processing capacity 1.2 ton/day) for incineration treatment. However, as of July 2021, the incinerator in Abobo is under repair, so the wastes are instead urgently treated in an incinerator in Yopougon (in the Pasteur Institute, treatment capacity 600 kg/day).

2.4 Issues and Cooperation Needs of Solid Waste Management in Cote d’Ivoire and Abidjan

2.4.1 Issues and Stages of Solid Waste Management

(1) Issues of Solid Waste Management

The issues of the whole country and Abidjan in solid waste management are considered as follows;

- Solid waste management in Cote d’Ivoire is based on “the Environmental Code”, but it has not been revised since it came into effect in 1996. In addition, no ordinance has been enacted at the municipal level, such as in Abidjan. It is necessary to formulate a basic law for waste management.
- In Abidjan, waste collection services have been improved by the introduction of outsourcing, but there are still many areas where waste collection is not provided, such as slums and other inaccessible areas. Improvement of collection in low-income communities is required, including improvement of management and monitoring of private companies by the government.
- Six communes around Abidjan, which belong to Greater Abidjan, are under the jurisdiction of ANAGED for waste management as well as Abidjan, but illegal dumping of waste is significant. Improvement of collection services in these areas is required.
- In Abidjan, ECOTI SA, ECO EBURNIE and CLEAN EBURNIE are required to develop and implement recycling plans, but these have not been implemented. Recycling is done by private recyclers and collection of recyclable materials is done by SMEs. They extract recyclable materials during the primary collection or buy them from each household. Furthermore, there is no separation at the source in Abidjan. As the promotion of recycling is one of the national goals, recycling activities are required at each stage of the waste flow.
- A solid waste management master plan for MSW in Abidjan is currently being developed by IsDB. On the other hand, there is no master plan for waste management in Greater Abidjan including the surrounding communes. It is also considered necessary to formulate action plans to realize the master plan.
- As for final disposal, no issues have been identified as a new disposal site is scheduled to be constructed by World Bank in addition to the Kossihouen landfill site that is currently in operation. However, a review of the collection system, including the transportation system using transfer stations, is required for the operation of the two disposal sites, located in the east and west of the country.
- In the future, the participation of residents will be indispensable for the introduction of appropriate solid waste management. DAA has been conducting programs for raising public awareness, but they are limited due to lack of budget. It is expected to improve sustainable solid waste management by involving various stakeholders.

(2) Solid Waste Management Stages and Priority Issues

The status for each stage of solid waste management in Abidjan is summarized in Table 2-18. Based on the description in Table 1-13, the stages of solid waste management in Abidjan are evaluated as being in transition

from Stage 2 (Reduction of environmental impact and pollution prevention) to Stage 3 (Establishment of a sound material-cycle society through 3Rs). However, with regard to laws and regulations, no laws and regulations specializing in solid waste have been enacted, and accordingly this Study has evaluated this item as Stage 1 (Improvement of public health), and it is a higher priority as an issue than other items.

Table 2-18 Stage of Solid Waste Management in Abidjan

Item	Stage	Situation
Legislations	1	There are no laws and regulations specific to solid waste management, and the Environmental Code, which covers the whole environment, is the fundamental law. However, the Environmental Code was enacted in 1996 and does not clearly define the regulations for solid waste. Moreover, it does not establish policies for a circular economy.
Collection and Transportation	2	In Abidjan, two private companies contracted with ANAGED are collecting and transporting the waste, and the collection rate is very high at 80-90%. On the other hand, illegal dumping in rivers and ditches is widely observed in the six satellite communes around Abidjan Autonomous District.
Final Disposal	3	The Kossihouen landfill is the only disposal site in the Abidjan Autonomous District currently operated by the private sector. This landfill is properly operated with leachate treatment facilities, radioactive waste detectors and weighbridges etc. (No waste pickers have been observed.) The World Bank is also planning to carry out a project which includes a new landfill construction in Atteikoi.
Intermediate Treatment and Recycling	2	A private contractor is preparing a biogas power generation facility utilizing landfill gas (LFG) on the site of the Kossihouen landfill. On the other hand, recycling is not widespread in Abidjan.

Explanation of Stage 1 : Improvement of public health, 2 : Reduction of environmental impact and prevention of pollution, 3 : Building a sound material-cycle society through the 3R activities

Source: prepared by JICA Study Team

Of the solid waste management issues listed in (1) above, those issues necessary to facilitate stepping up to the third stage (Building a sound material-cycle society through the 3R activities) are evaluated as high-priority issues.

<p><Priority Issues></p> <ul style="list-style-type: none"> ➤ Establishment of fundamental laws and regulations for solid waste management and recycling is urgently needed. ➤ A solid waste management plan for the Greater Abidjan needs to be formulated and implemented in order to build a sound material-cycle society in the future. ➤ In the six satellite communes around Abidjan Autonomous District, illegal dumping into rivers and ditches is widely observed, and the collection and transportation capacity needs to be strengthened.

2.4.2 Good Practices on Solid Waste Management

In the case of solid waste management in Cote d'Ivoire and Abidjan, a good practice that can be used as a reference for other countries is the outsourcing of waste collection and transportation, and landfill operation to the private sector. As for collection and transportation, the waste collection rate, which was low before outsourcing this activity to the private sector, has improved to 80-90%. And the landfill operation outsourced to the private sector has been successful in terms of leachate treatment, soil cover application, etc. On the

other hand, since the private contracting fee is based on the amount of waste delivered to the landfill, recycling at the collection stage is limited in order to secure disposal amount. Accordingly, Abidjan has an issue of low recycling rate.

2.4.3 Proposed Cooperation Policy

Table 2-19 shows the proposed cooperation policy in solid waste management for the whole country and Abidjan in Cote d'Ivoire. In the Table, cooperation related to the priority issues mentioned in 2.4.1 are in red letters, and this Study considers these to be of higher priority for assistance than the others. However, in providing these high-priority assistance, self-help efforts by Cote d'Ivoire's side are essential, for instance, ANAGED's active leadership in promoting recycling, which had been entrusted to private companies etc.

Table 2-19 Proposed Cooperation Policy (Cote d'Ivoire)

	Issue	Short-term assistance (red letters are those related to priority issues)	Middle-term assistance
Central Government (Ministry of Hygiene)	Development laws and regulations	[Technical Cooperation Project */Dispatch of Experts/Training in Japan] ➤ Assistance in formulating legislation as a basis for solid waste management ➤ Support for revision of Environmental Code ➤ Assistance in formulating laws and regulations on recycling	
Central government (ANAGED)	Improvement of waste collection in low-income communities	[Technical Cooperation Project *] ➤ Improvement of waste collection in slums and other low-income communities (including assistance to ANAGED on guidance methods to private contractors)	
	Improvement of waste collection in the 6 satellite communes	[Technical Cooperation Project] ➤ Improvement of waste collection in the 6 satellite communes (including assistance to ANAGED on guidance methods to private contractors)	
	Promotion of recycling	[Technical Cooperation Project] ➤ Support for the development of recycling promotion plans at each stage of the waste flow, including source separation ➤ Support for the introduction of incentives to the private sector to promote recycling activities	
	Development of a waste management master plan and action plans for Greater Abidjan	[Technical Cooperation Project **/]** ➤ Development of a solid waste management master plan and action plans targeting Greater Abidjan	[Japanese ODA Loan Project] ➤ Support for F/S implementation and construction of WtE facility
	Review of the collection system, including the transportation system using transfer stations after the operation of the new landfill by the World Bank.	[Technical Cooperation Project ***] ➤ Support for improvement of the collection system taking advantage of Kossihouen landfill and Atteikoi landfill	
Local government	Involvement of residents in the implementation of appropriate waste management	[Technical Cooperation Project *] ➤ Implementation of campaigns, etc., involving residents and students ➤ Implementation of public relations activities utilizing television and other media	

* If this component is implemented under the Technical Cooperation Project, it will be implemented as a package with other components.

** Coordination with ongoing assistance by the Islamic Development Bank is needed.

*** After consultation with the World Bank, the component will be implemented taking care not to overlap the project contents.

Source: prepared by JICA Study Team

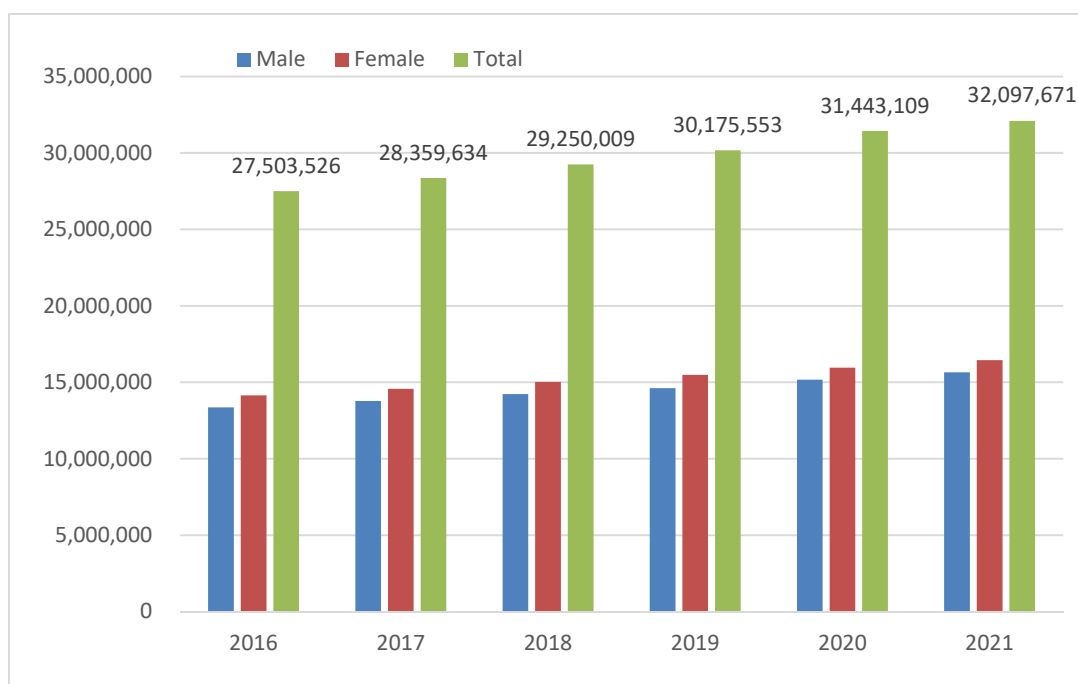
CHAPTER 3 Solid Waste Management in the Republic of Angola

In the Republic of Angola (hereinafter referred to as “Angola”), in addition to a remote survey conducted by a local consultant (Mr. Rui Henriques Fragoso da Silva), a field survey was implemented by the Japanese consultants. The results of the surveys are presented in this chapter.

3.1 Overview of Target Country and City

3.1.1 Population

The population of Angola is growing at a rate of several percent per year, as shown in Figure 3-1. The country’s population in 2021 was 32,097,671. Angola is composed of 18 provinces, and Luanda Province, where the capital is located, is the target area of this study. The population of Luanda Province in 2020 was 8,801,035, according to the estimates of the National Institute of Statistics.



Source: National Institute of Statistics of Angola

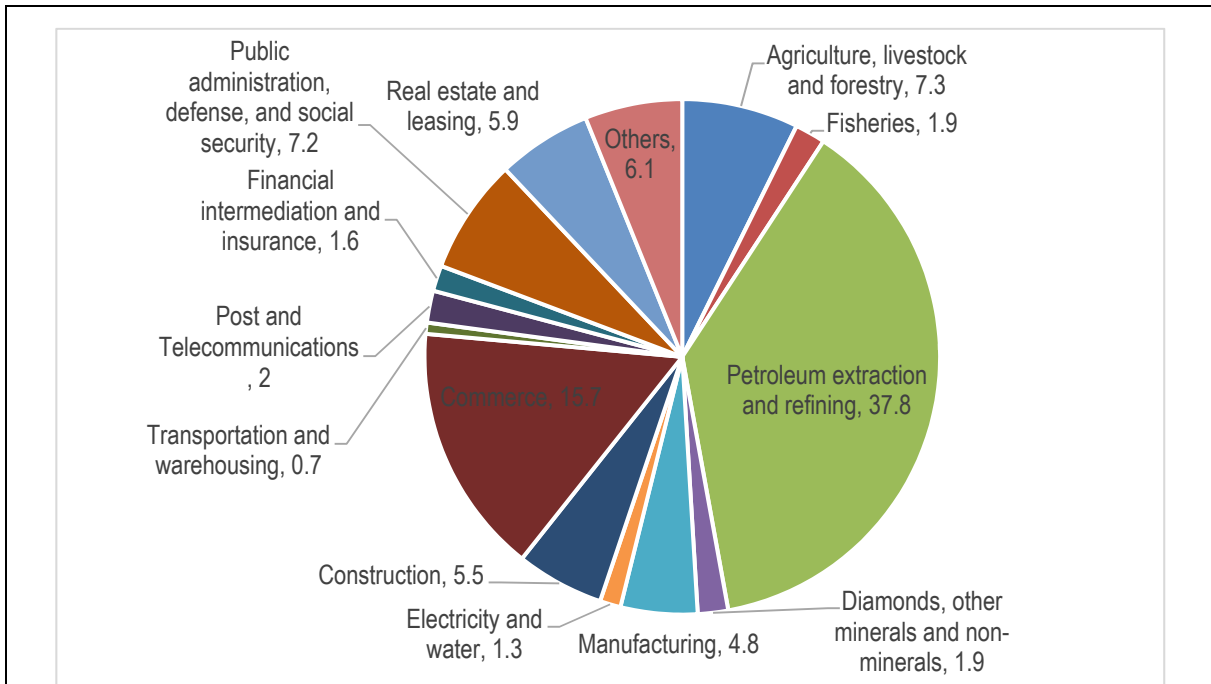
Figure 3-1 Population Trends in Angola

3.1.2 Economic Situation

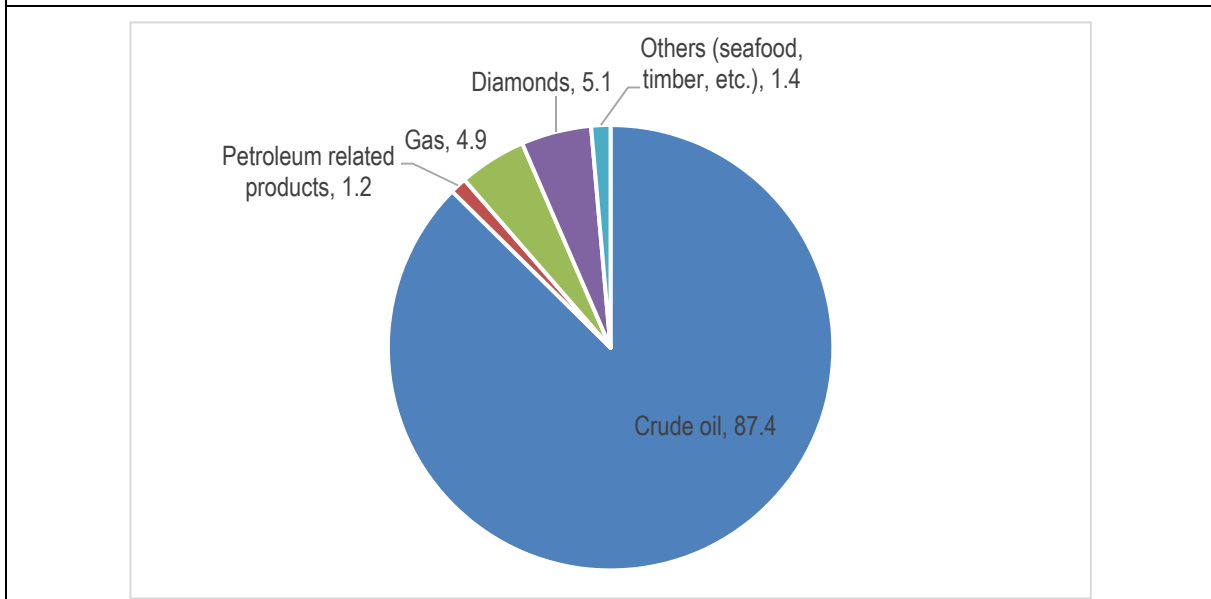
Angola is the largest oil producer in sub-Saharan Africa, along with Nigeria. In 2007, Angola joined the Organization of the Petroleum Exporting Countries (OPEC), and in 2009 it held the presidency of OPEC. The Angolan government, however, has been affected by the decline in oil prices in recent years, and under its National Development Plan, the country has set the urgent task of diversifying its industries by promoting agriculture and manufacturing in order to break away from an oil-dependent economy⁸. As Figure 3-2 shows,

⁸ The website of Ministry of Foreign Affairs of Japan

oil extraction and refining accounts for about 40% of Angola’s 2020 GDP, and crude oil accounts for about 90% of the country's exports.



GDP structure of Angola in 2020 (%)



Total exports: 209,037.4 million USD

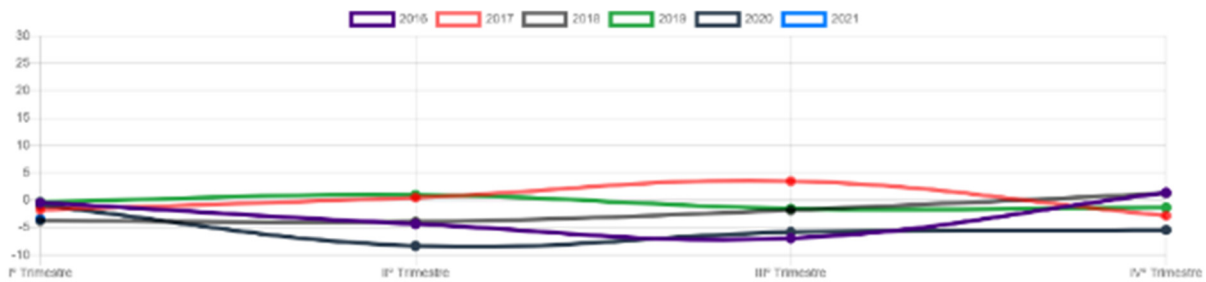
Breakdown by export commodity in 2020 (%)

Source: Embassy of Japan in Angola, “Monthly report of Angola in July 2021”

Figure 3-2 GDP Structure and Breakdown by Export Commodity

The GDP growth rate is shown in Figure 3-3. Economic growth has been sluggish in recent years due to the effects of COVID-19. The GDP growth rate for the first quarter of 2021 was -3.4%. The unemployment rate

for the second quarter of 2021 was 31.6%⁹.

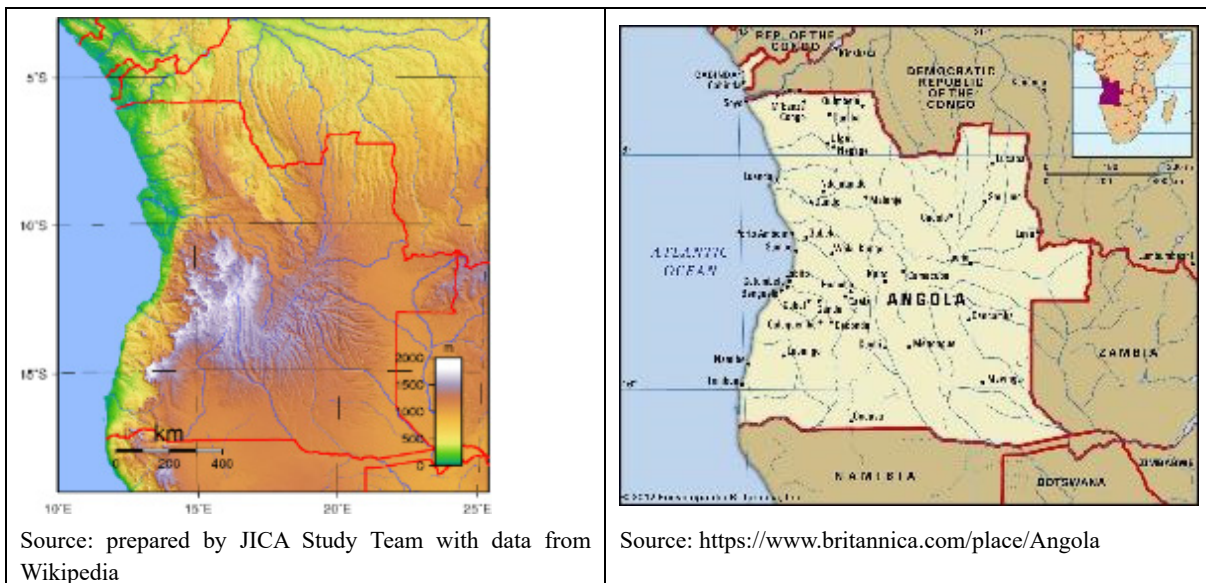


Source: National Institute of Statistics of Angola

Figure 3-3 Changes in GDP Growth Rate

3.1.3 Topography

The total land area of Angola is 1,247,000 km², which is about 3.3 times the size of Japan¹⁰. Except for the province of Cabinda, Angola is bordered by Namibia to the south, Zambia to the east, and the Democratic Republic of Congo to the north. Although the country is large, most of its interior, except for the narrow coastal plains, is a vast plateau-like highland. Angola is composed of 18 provinces, with cities under the provinces, and the nation’s capital is Luanda City.



Source: prepared by JICA Study Team with data from Wikipedia

Source: <https://www.britannica.com/place/Angola>

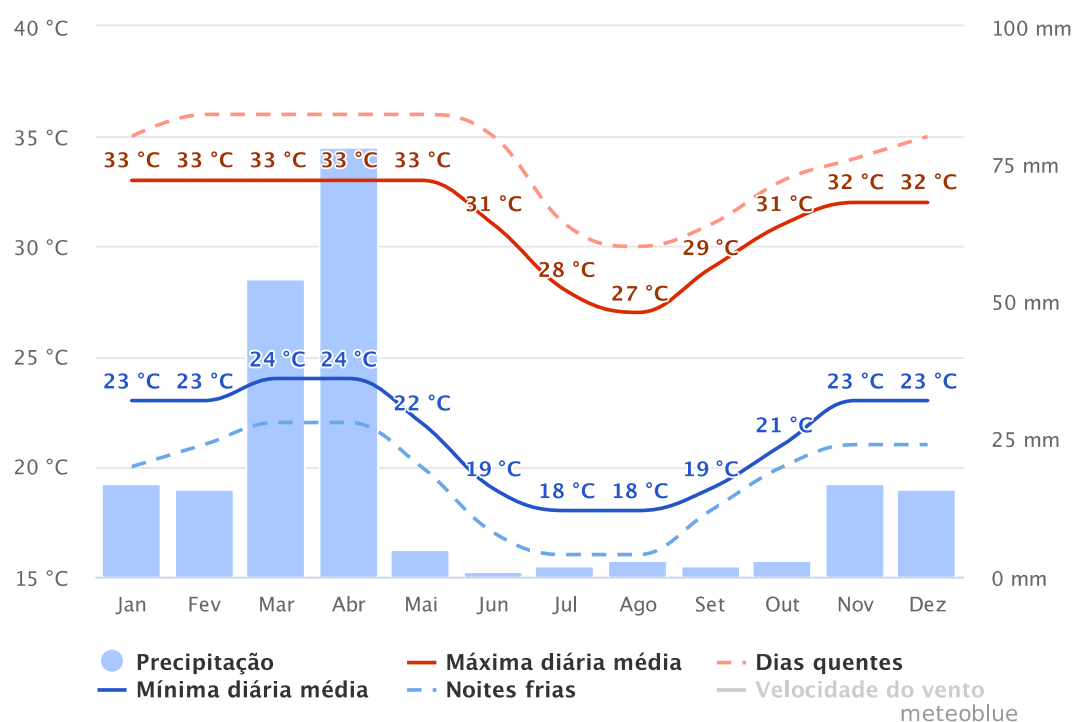
Figure 3-4 Topography and Map of Angola

3.1.4 Meteorological Conditions

Precipitation is very low along the Angola’s Atlantic Ocean coast due to the influence of the cold currents flowing through the Atlantic Ocean. The capital city, Luanda, and many other port cities receive little precipitation throughout the year, with only a small amount of rainfall during the rainy season.

⁹ National Institute of Statistics of Angola <https://ine.gov.ao/>

¹⁰ The website of Ministry of Foreign Affairs of Japan



Source: www.meteoblue.com

Figure 3-5 Temperature and Precipitation in Angola

3.2 Laws, Regulations, Plans and Organizational Structures related to Solid Waste Management in the Country

3.2.1 Laws and Regulations related to Solid Waste Management

The laws and regulations related to solid waste management in Angola have been established as follows.

- Environment Management Law No. 5 of June 19, 1998
- Presidential Decree No. 51 of June 23, 2004: Environmental Impact Assessment (EIA)
- Presidential Decree No. 59 of July 13, 2007: Environmental Licensing System
- Presidential Decree No. 1 of January 13, 2010: Environment Examination System
- Presidential Decree No. 190 of August 24, 2012
- Presidential Decree No. 117 of April 22, 2020: Environmental Licensing Rule

The Presidential Decree No. 190 (August 24, 2012) regulates the following matters: Article 7 - Waste Management Plan, Article 9 - Responsibilities of Waste Managers, Articles 12 and 13 - Management of Non-Hazardous Wastes, Article 14 - Collection and Transportation of Non-Hazardous Wastes and Cleaning, Article 15 - Treatment, Recycling and Disposal, Article 16 - Hazardous Waste Management, Article 17 - Hazardous waste management plan, and Article 18 - Storage and marking of hazardous wastes.

Presidential Decree No. 117 of April 22, 2020 is a new regulation on environmental impact assessment and environmental licensing system. This regulation, abbreviated as the Environmental Licensing Regulation,

replaces Presidential Decree No. 51 of July 23, 2004 and Presidential Decree No. 59 of July 13, 2007. The Environmental Licensing Regulation defines, among other things, the procedures to be followed for the purpose of authorizing an activity and the rights and obligations of the licensed operator.

(1) Definition and Classification of Wastes

Wastes are classified into hazardous and non-hazardous wastes. Hazardous wastes are defined by Presidential Decree No. 190 (August 24, 2012). Non-hazardous wastes are classified as follows.

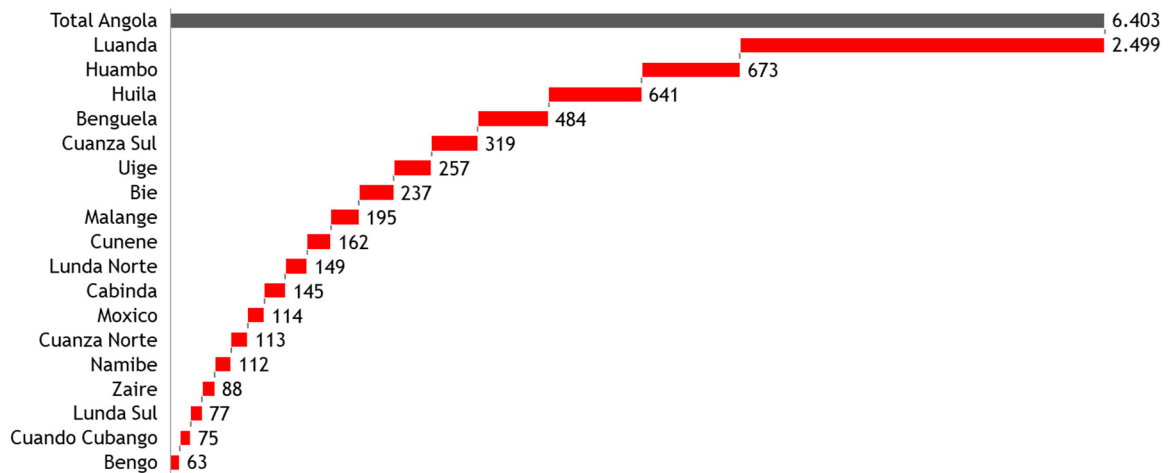
1. Solid domestic wastes or similar, those from dwellings or similar;
2. Solid commercial wastes, those from commercial establishments, offices, restaurants and the like, whose daily volume does not exceed 1,100 liters, which are deposited in containers in conditions similar to the waste referred to in the previous paragraph;
3. Bulky household waste, that is discharged from households, and the removal of which is not possible by normal means given the volume, shape, dimensions or the deposition of which in existing containers is considered unsuitable by the commune or municipality;
4. Sectoral wastes, those generated in any agricultural, industrial, commercial or service provision, the daily volume of which exceeds 1,100 liters and which cannot be deposited or treated as solid urban waste;
5. Special wastes, wastes with specific characteristics, namely, packaging, waste electrical and electronic equipment, end-of-life vehicles, construction and demolition waste, batteries, tires, mineral oils and others, which must be subject to specific collection and treatment methods;
6. Garden residues, those resulting from the conservation of private gardens such as shavings, branches, trunks or leaves;
7. Solid residues resulting from the public cleaning of gardens, parks, roads, water drains, cemeteries and other public spaces;
8. Solid industrial waste, resulting from ancillary activities and equivalent to urban solid waste: those with characteristics similar to the waste referred to in points a) and b), namely those coming from cafeterias, canteens, offices and uncontaminated packaging;
9. Hospital solid waste, uncontaminated, comparable to domestic waste;
10. Residues from the defecation of animals on the streets.

3.2.2 Policies and Plans related to Solid Waste Management

(1) Strategic Plan for the Management of Urban Waste

In Angola, the Strategic Plan for the Management of Municipal Waste was formulated in 2012 as a comprehensive plan for solid waste management. About 10 years have passed since the plan was prepared, however, no new plan has been developed. As shown in Figure 3-6, the plan estimates the waste generation in 2020 to be 6,403 ton/day nationwide, of which 2,499 ton/day is estimated in Luanda Province.

Total waste (million tons per year)



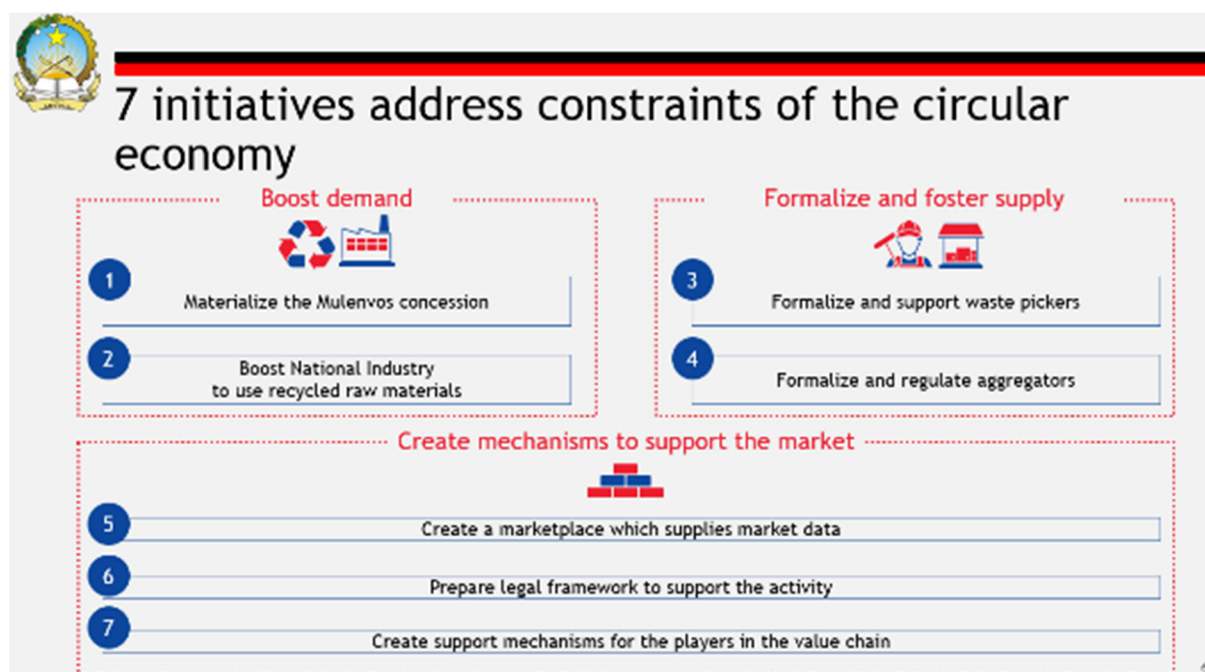
Source: PESGRU, “Solid Urban Waste Valorization Market - Formalization and Promotion Strategy, Luanda, March 2021, Strategic Plan for the Management of Urban Waste (2012)

Figure 3-6 Estimated Amount of Waste Generation in Strategic Plan for the Management of Urban Waste

(2) Strategy to Develop and Promote an Urban Waste Valorization Market

The Ministry of Economy and Planning (hereinafter referred to as “MEP”) has been promoting the Solid Urban Waste Valorization Market - Formalization and Promotion Strategy since 2021, with the aim of realizing a circular economy. This strategy sets out seven initiatives to realize a circular economy, as shown in Figure 3-7, sub-grouped under the three strategies of “Boost demand”, “Formalize and foster supply” and “Create mechanisms to support the market”. In the strategy of “Boost demand”, the following initiatives are planned: (1) to realize a recycling facility (to be built under a PPP scheme) at the Mulenvos landfill site in Luanda Province (to be described later in this chapter), and (2) to foster industries that will use the recovered recyclable materials as raw materials. In the strategy of “Create mechanisms to support the market”, the planned initiatives are: (3) to formalize and support waste pickers, and (4) to formalize and regulate collection stations for recyclable materials. Finally, the initiatives under the strategy of “Create mechanisms to support the market” are: (5) to create a marketplace which supplies market data, (6) to prepare legal framework to support the activity of this strategy, and (7) to create support mechanisms for the players (organizations and individuals) in the value chain¹¹.

¹¹ A value chain is a concept describing the full chain of a business's activities in the creation of a value. The strategy considers the value chain as a series of activities related with recycling, collection of valuables, classification/treatment, manufacturing, shipping and selling.



Source: Excerpt from PPT explaining the Solid Urban Waste Valorization Market - Formalization and Promotion Strategy

Figure 3-7 Initiatives for Solid Urban Waste Valorization Market - Formalization and Promotion Strategy

3.2.3 Organization Structure for Solid Waste Management

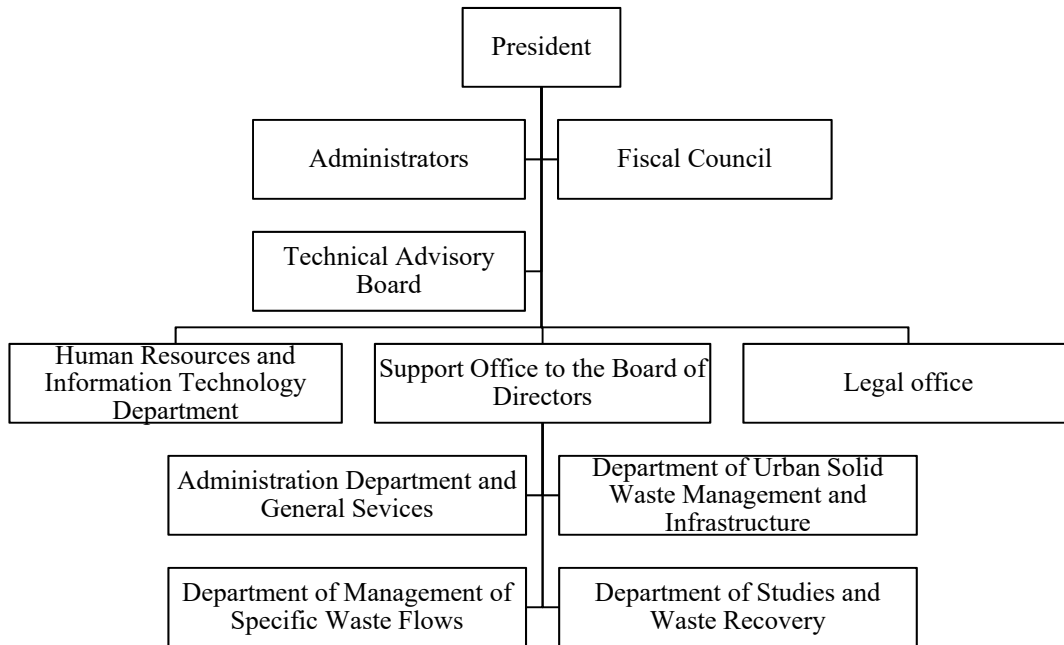
(1) Ministry of Environment

The Ministry of Environment was established by the new government following the 2008 elections by reorganizing the previous Ministry of Urban Affairs and Environment. The Ministry of Environment formulates policies and laws related to solid waste management, and licenses and certifies private waste contractors and others through the National Waste Agency. The Ministry of Environment is responsible for the management of both hazardous and non-hazardous wastes and has the following specific responsibilities.

1. Issue and disclose the mandatory rules on the procedures to be followed in the scope of the management of hazardous and non-hazardous waste;
2. Proceed with the environmental licensing of facilities or sites for the storage and / or disposal of waste;
3. Accredite, in coordination with the supervisory bodies, after hearing the interested bodies, the waste transporters, as well as the vehicles used in their transportation;
4. Register the public or private entities that deal with waste;
5. Adopt, in coordination with the supervisory sectors, the necessary measures to suspend the storage, disposal or transport of waste, carried out illegally and / or under conditions that constitute a danger to public health or the environment;
6. Guarantee public participation in the licensing process, as well as access to relevant information on waste management;
7. Monitor compliance with the provisions of this Regulation.

(2) National Waste Agency

The National Waste Agency, a subordinate agency of the Ministry of Environment, promotes waste management policies based on the priorities of generation control, reuse, recycling, recovery and disposal (waste management hierarchy). The National Waste Agency's responsibilities include monitoring of waste management; providing comments on planning; receiving and evaluating complaints; and licensing of business and subsequent inspections.



Source: prepared by JICA Study Team

Figure 3-8 Organization Chart of National Waste Agency

(3) Local Government

The local government is the implementing agency for waste management and has the following responsibilities in addition to the day-to-day collection, treatment and disposal of waste.

- To add specific regulations to those established by the Ministry of Environment.
- To establish fees for the collection, treatment and disposal of wastes.
- To be a part of the permission system for the collection, treatment, and disposal of all types of waste.

3.2.4 Finance for Solid Waste Management

(1) Budget for Solid Waste Management

The 2021 budget of the waste management and environmental protection sector of Angola is shown in Table 3-1.

**Table 3-1 Budget of Angola for Solid Waste Management and Environmental Protection Sector
(National Budget of 2021)**

Institution	Description	Budget
Ministry of environment	Annual budget for basic sanitation;	163,603,947.00
	Annual budget for the development of environmental policies;	48,434,171.00
	Annual budget of the national waste agency.	14,852,000.00
Provincial government of Luanda	Annual budget for basic sanitation in Luanda;	36,088,298,655.00
	Annual budget for basic sanitation in municipal administrations;	1,219,654,783.26
	ELISAL EP's annual budget;	35,885,662,022.00
	UTGLS's annual budget;	Not available
Luanda administrative commission	Annual budget for basic sanitation in the municipality of Luanda;	308,967,432.12
	Annual budget for UTECOM	Not available
Military house	Annual budget for BEL	Not available

Source: Ministry of Finance

(2) Fee System for Solid Waste Management

In Angola, the local government collects the waste disposal fees from the residents.

3.2.5 Environmental Education and Awareness Raising Activities

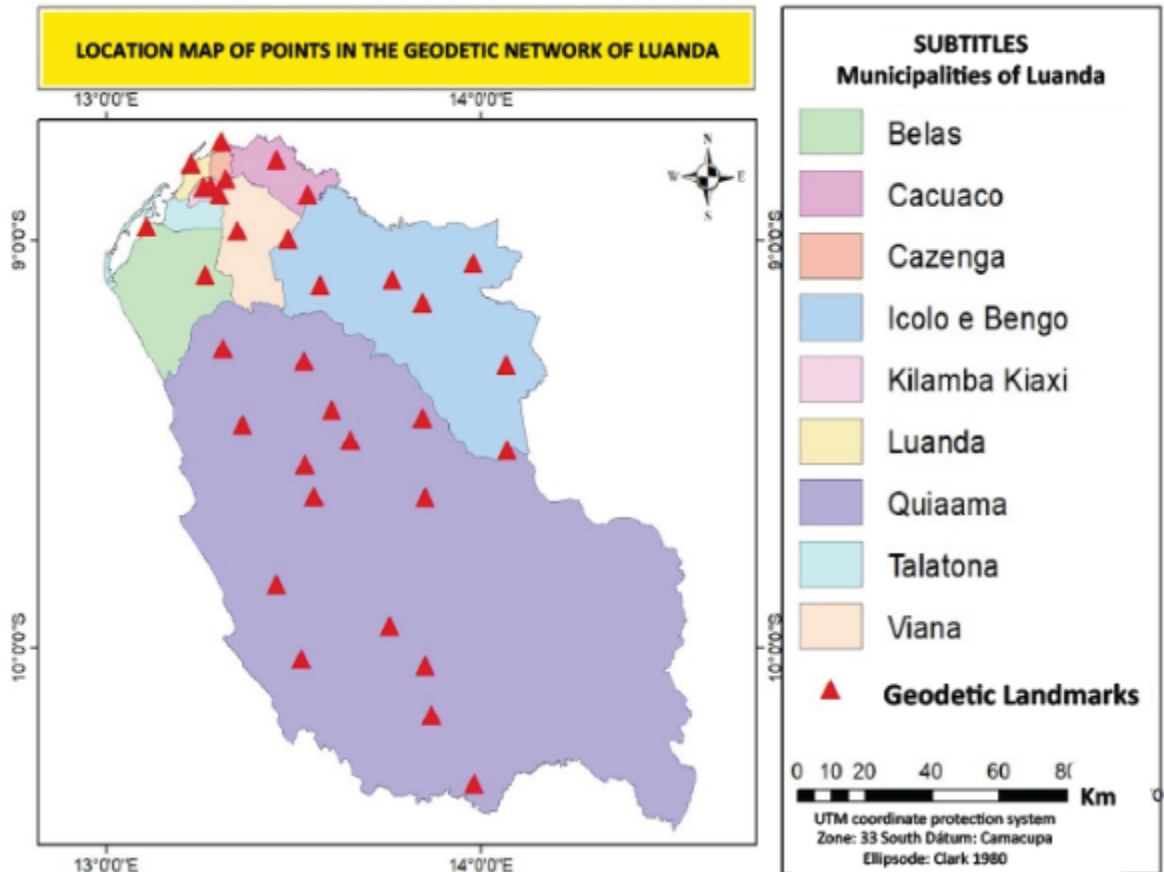
The Ministry of the Environment has been organizing the “Angola Environmental Fair” as an educational and PR project with the aim of achieving a Circular Economy. The objectives of this fair are as follows;

- To strengthen the Circular Economy by encouraging the private sector to invest in environmental/cleaner technologies and by encouraging better management of production and consumption.
- To disseminate good environmental development projects and activities.
- To present solutions, technologies, equipment, products and services related to environmental technologies.
- To attract investors by making them aware of the potential of Angola
- To promote partnerships between national and international companies
- To contribute to the development of the country

3.3 Solid Waste Management Situation in Luanda Province

3.3.1 Organizations for Solid Waste Management

The Luanda Province has expanded its area in 2011 and 2016, and now consists of 9 municipalities as shown in Figure 3-9.

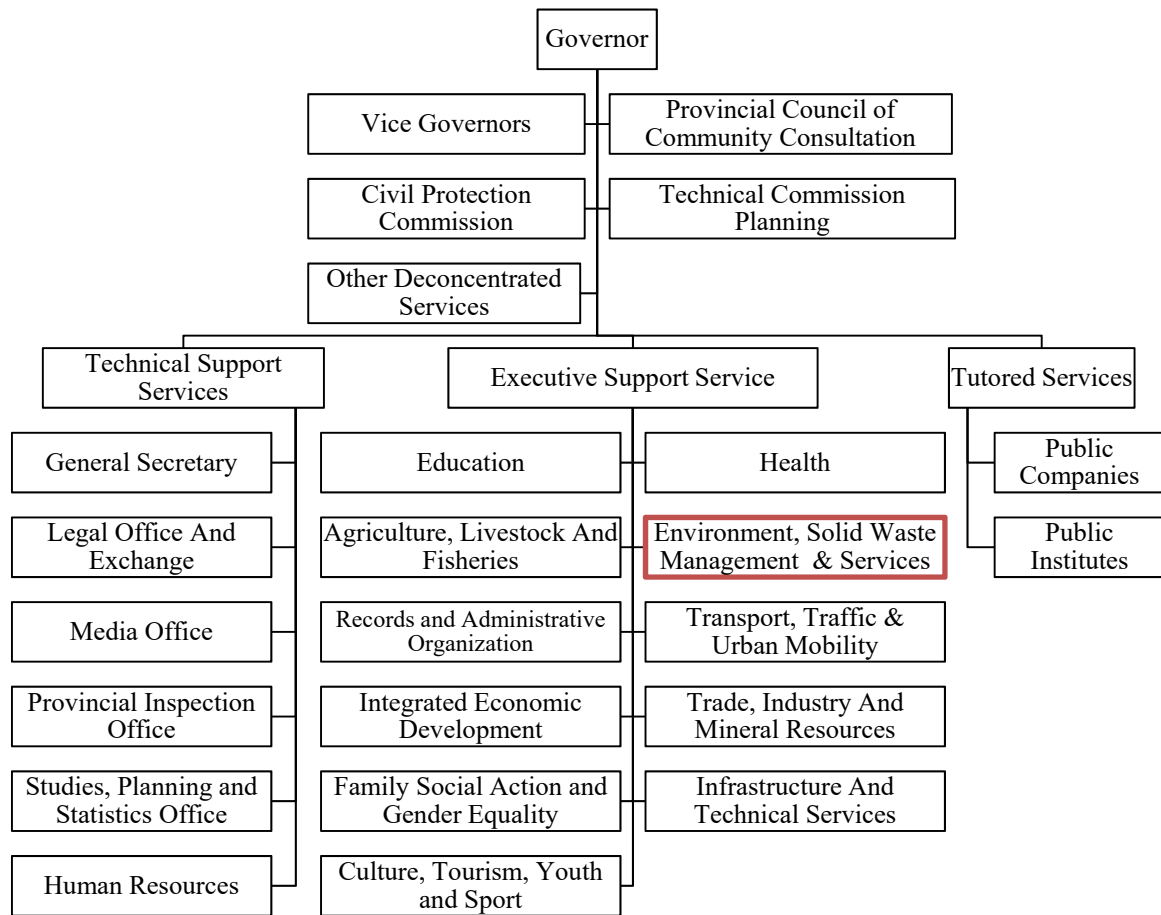


Source: Luanda provincial government

Figure 3-9 Component Municipalities of Luanda Province

(1) Provincial Government and ELISAL

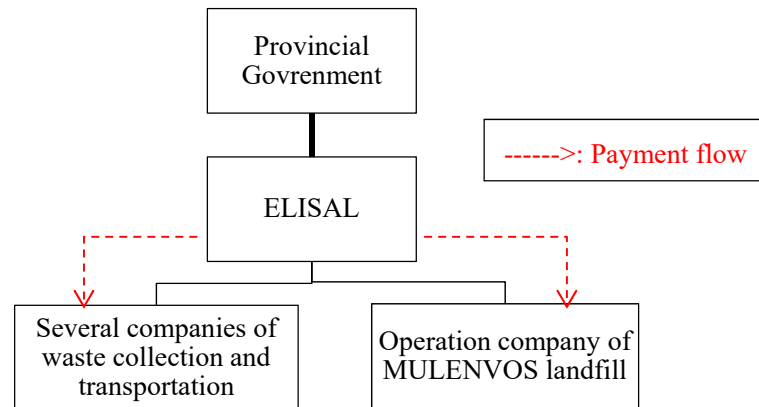
Waste management in the Luanda Province has been carried out under the control of the provincial government and mainly by the provincial corporation (ELISAL). The municipality is responsible for some of the street cleaning operations and has no other duties related to waste management. The organizational chart of the provincial government is shown in Figure 3-10, where the Department of “Environment, Solid Waste Management & Services” is in charge of waste management. ELISAL consists of the Department of General Affairs, the Department of Planning and Engineering, the Department of Operations, and the Department of Sanitation, with approximately 2,000 employees.



Source: prepared by JICA Study Team

Figure 3-10 Relevant Organizational Chart of Luanda Provincial Government

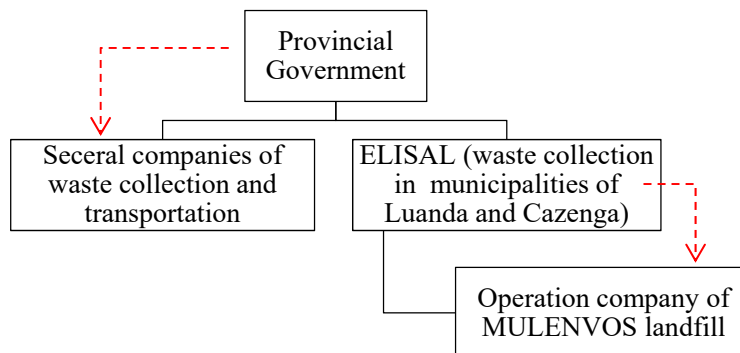
Solid waste management in Luanda Province is implemented by the provincial government through the management of ELISAL, but the system has undergone significant changes in recent years. Until 2015, as shown in Figure 3-11, the provincial government contracted with private waste collectors to carry out waste collection in the province. The provincial government also allowed ELISAL, a provincial government corporation, to manage these private waste collectors. Additionally, ELISAL has a budget for the operation of the Mulenvos landfill, which will be described later, and has contracted with a private operator to operate the landfill.



Source: prepared by JICA Study Team

Figure 3-11 Solid Waste Management System in Luanda Province (until 2015)

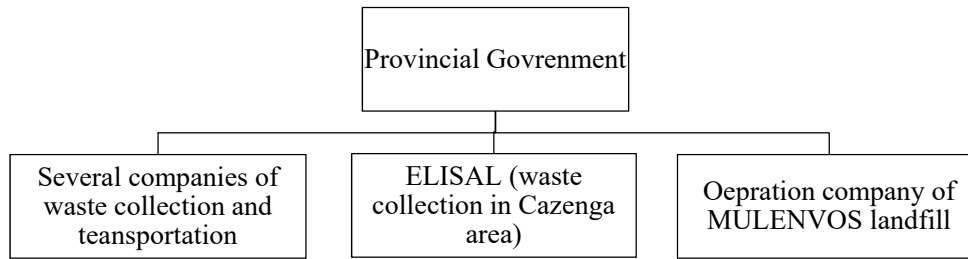
From 2016, the scope of ELISAL's work was reduced and limited to the operation of the Mulenvos landfill and the collection of waste in the municipalities of Cazenga and Luanda, as shown in Figure 3-12. ELISAL has about 2,000 staff and workers.



Source: prepared by JICA Study Team

Figure 3-12 Solid Waste Management System in Luanda Province (from 2016 to 2020)

Furthermore, the central government (MEP) and the provincial government are currently in the process of changing the responsibility for operating the Mulenvos landfill from ELISAL to a new system under a PPP scheme. ELISAL's scope of work will be limited to waste collection in Cazenga municipality. The tender for the improvement of the Mulenvos landfill operation was announced in March 2021, and 36 domestic and foreign companies made submissions. Elisal, under the supervision of the provincial government had implemented solid waste management until 2015, and from 2021 solid waste management in Luanda Province has been implemented directly by the provincial government. Currently, the waste management system in Luanda Province is in a major transition period.

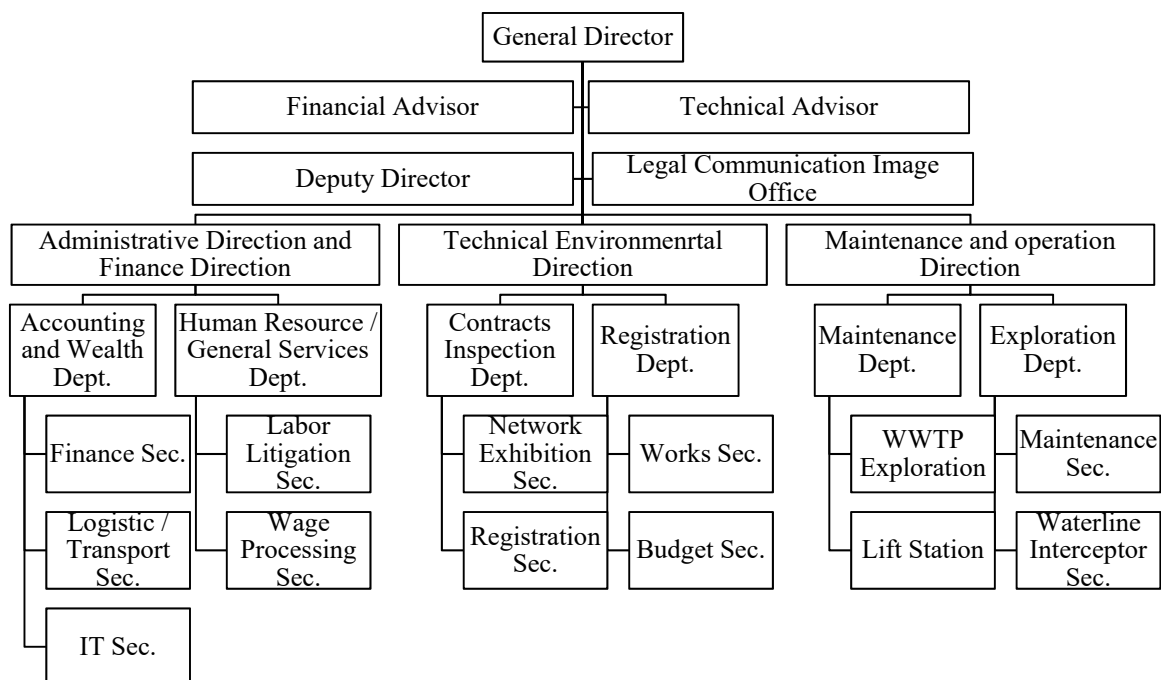


Source: prepared by JICA Study Team

Figure 3-13 Solid Waste Management System in Luanda Province (from 2021)

(2) UTGSL

UTGSL, like ELISAL, is a public corporation belonging to the provincial government and is mainly in charge of sewage and drainage. As far as solid waste management is concerned, UTGSL is in charge of the management of rivers and drainage channels, and especially before the rainy season starts, it commissions contractors to dredge the wastes accumulated in the drainage channels.



Source: prepared by JICA Study Team

Figure 3-14 Organization Chart of UTGSL

(3) BEL

BEL is a military-affiliated public enterprise with about 1,300 employees, engaged in cleaning roads in the province.

3.3.2 Solid Waste Management Finance

(1) Current Status of Solid Waste Management Fee System

Presidential Decree No. 107 (May 2016) authorizes the collection of solid waste management fees in Luanda Province. The monthly fee per household is set at 2,500 Kz (1 Kz=0.235310 JPY¹²) in Article 6 of the same Presidential Decree, and the areas covered by the waste management fee and the fee amount are shown in Table 3-2. Residents pay the fee to the provincial government along with the electricity bill.

Table 3-2 Coverage Areas of Solid Waste Management Fee and Amount of Fee

Province	Municipality	District	Amount tax
Luanda	Luanda	Alvalade, Mártires do Kifangondo, Bairro Militar, Cassenda, 1º de Maio, Bairro da Policia, Maianga, Samba, Bairro Azul, Praia do Bispo, Ilha do Cabo, Mutamba, Chicala, Coqueiros, Maculusso, Kinaxixi, Miramar, Cruzeiro, Comandante Valódia, Bairro Operário, São Paulo, Vila Alice, Nelito Suares, Bairro Popular, Terra Nova	2.500.00 Kz
	Belas	Benfica, Centralidade do Kilamba	
	Talatona	Patriota, Futungo, Morro Bento, Urbanização Nova Vida	
	Viana	Vila Pacifica	
	Cacuaco	Centralidade do Sequele	

Source: prepared by JICA Study Team

On the other hand, the following classifications and regulations have been made for monthly fees to be paid by businesses enterprises in Article 6 of the same Presidential Decree.

- Micro businesses 12,500 Kz
- Small-scale businesses and public institutions 18,000 Kz
- Medium-scale businesses 40,250 Kz
- Tenants of commercial facilities, etc. 3,500.00 Kz
- Large-scale businesses 1,640,000 Kz.

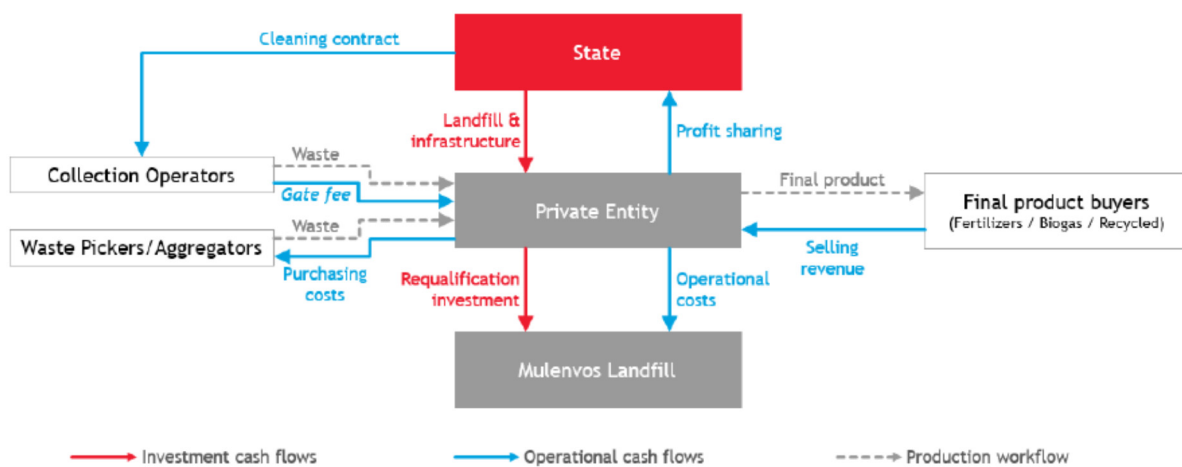
3.3.3 Ordinances and Policies related to Solid Waste Management

As mentioned earlier, MEP and the Luanda provincial government are promoting a policy to improve the Mulenvos landfill and operate the landfill site as a final disposal and recycling center under a PPP scheme. The main objectives of this policy are to; (1) achieve world class solid waste management standards, (2) ensure a sustainable solid waste management system over the long term, (3) guarantee early improvements, and (4) reduce the provincial government budgets and future operating costs. This project for the landfill site will be implemented as a BOT scheme. The tender has already been publicly announced and 36 companies have submitted tenders. As of October 2021, an evaluation committee, composed of MEP, Ministry of Finance (hereinafter referred to as “MF”), and others, are evaluating the proposals submitted. The evaluation is in the final stage and the contract negotiations with the contractor were to start in November 2021. If agreement is reached in the contract negotiations, the selected contractor and the provincial government will sign the contract. MEP will supervise this PPP project in coordination with relevant agencies. In this PPP

¹² JICA’s rate in March 2022.

project, in addition to the landfill site operation, the contractor will be responsible for the installation and operation of sorting facilities; collection of recyclable materials; conversion of organic waste to fertilizer; and construction, operation, and sale of electricity from biogas power generation facilities. The details of the specific facilities will depend on the proposals submitted by the applicants.

Currently, the PPP scheme is being considered as shown in Figure 3-15. The provincial government contracts with a collection and transport company to collect waste in each municipality. The collection and transport company will transport the waste to the Mulenvos landfill site, and pay a disposal (tipping) fee to the operator. The operator will also purchase recyclable materials from the waste pickers at the Mulenvos landfill and sell them to recycling companies. These costs will be used to operate the landfill and a portion of the profits will be returned to the provincial government.



Source: Ministry of Economy and Planning, “Feasibility Study-Preliminary version - Mulenvos Landfill Public-Private Partnership Launch” (December 2020)

Figure 3-15 PPP Scheme under Consideration

3.3.4 Overview of Solid Waste Management

In Luanda Province, approximately 9,100 ton/day of waste is generated, of which approximately 6,200 ton/day is collected, resulting in a collection rate of approximately 70%. The waste unit generation rate for the entire province of Luanda is estimated to be 1.0 kg/person/day. All the collected waste is transported to Mulenvos landfill site for final disposal.

Table 3-3 Waste Generation and Collection in Luanda Province

Municipality	Population 2021	Unit Generation Rate (kg/Capita/day)	Waste Generation (ton/day)	Waste collection (ton/day)
Quiçama	33,644	0.8	27	6,167
Belas	366,189	1.2	439	
Cacuaco	1,118,608	1.0	1,119	
Icolo e Bengo	117,310	0.8	94	
Luanda	1,742,180	1.2	2,091	
Viana	2,015,715	1.0	2,016	
Cazenga	1,429,102	1.0	1,429	
Kilamba Kiaxi	1,034,110	1.0	1,034	
Talatona	884,177	1.0	884	
Total	8,741,035	1.0	9,133	6,167

Source: estimation based on information from NWA and Elisal

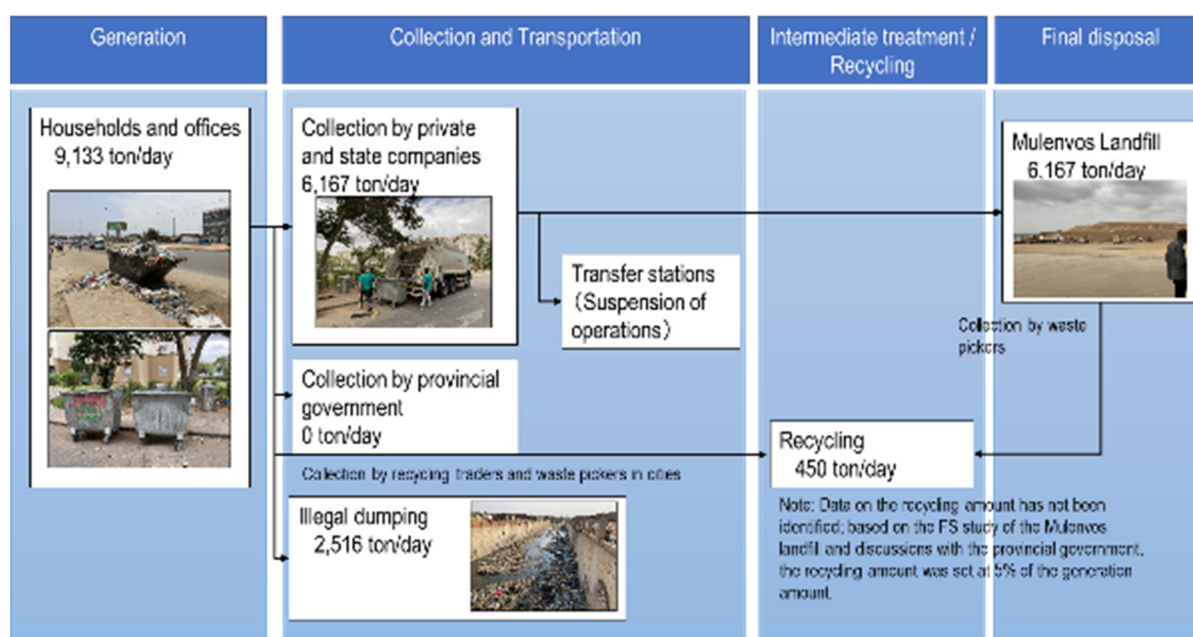
As there are currently no confirmed results of waste composition surveys conducted by public institutions, the result of waste composition survey provided by a private company is shown in Table 3-4.

Table 3-4 Waste Composition

RECYCABLE NAME	QUANTITY %
Organics	60%
Iron	6%
Textiles	3%
Plastics	3%
Paper	19%
Glass	3%
Others	6%

Source: prepared by a private company

The waste flow in Luanda Province is estimated as shown in Figure 3-16.



Source: prepared by JICA Study Team

Figure 3-16 Waste Flow in Luanda Province

3.3.5 Current Status of Collection and Transportation

(1) Confusion in the Collection and Transportation System and Current Status

The Luanda provincial government had initially signed a seven-year contract with a private collection company, which was contrary to the Public Contract Law which stipulated a maximum contract period of four years, and therefore the signed contract was in violation of the law. Consequently, in 2021, the Luanda provincial government was forced to terminate the contract with the private collection company, and waste collection stopped from the beginning of that year.



Source: prepared by JICA Study Team

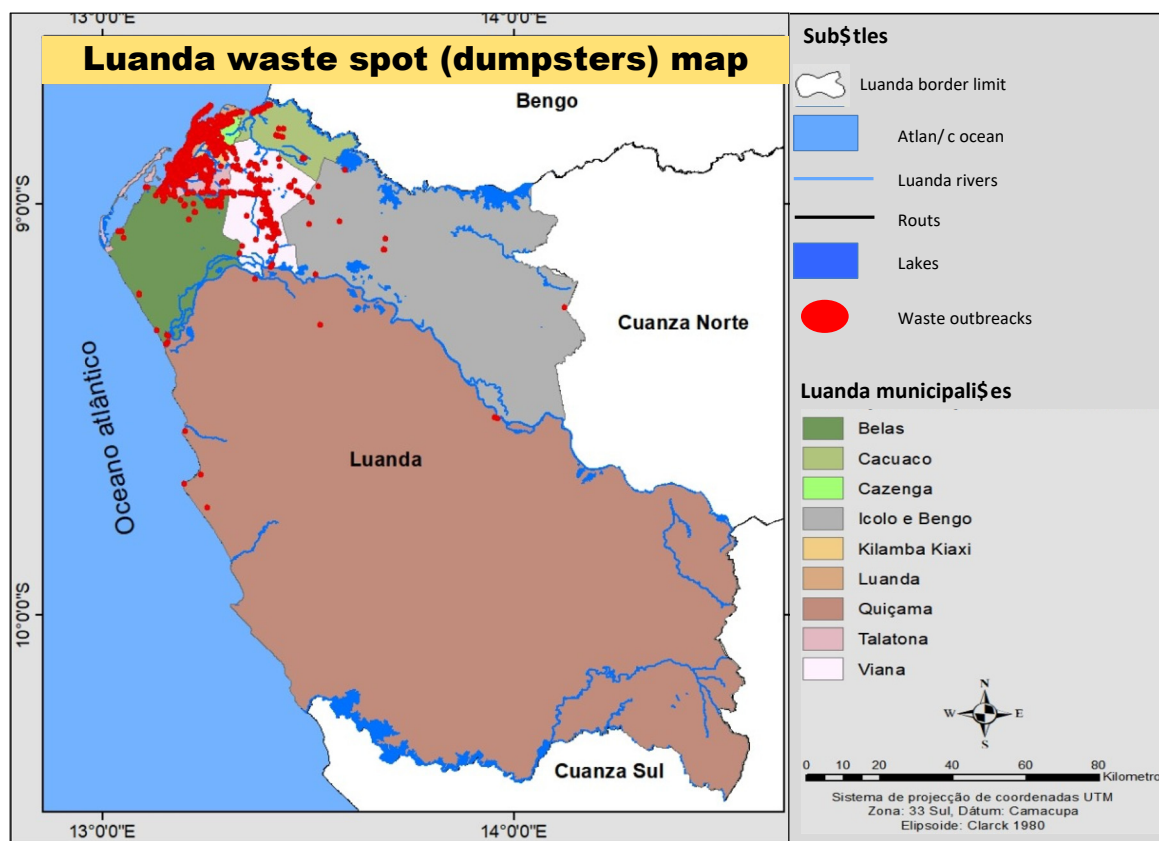
As a contingency measure, the Luanda provincial government has taken steps to encourage large commercial areas and manufacturers to contract directly with private collection companies. In addition, the Luanda provincial government signed contracts with nine private collection companies, listed in Table 3-5 for a period of nine months from March to December, 2021 to resume waste collection.

Table 3-5 Private Collection Companies in Operation from March to December 2021

Municipality	Private Collection Company
Belas	Jump Business Lda
Cacuaco	Multilimpeza Lda
Cazenga	Elisal E.P
Icolo e Bengo	Er-Sol Lda
Luanda	Elisal E.P
Quilamba Quiaxi	Chay Lda
Quissama	Sambiente Lda
Talatona	Consorsium Dassala/Envirobac Lda
Viana	Sambiente Lda

Source: prepared by JICA Study Team

As part of the road maintenance operations, the Luanda provincial government has outsourced the monitoring of illegal dumping to a private company. Figure 3-14 shows the locations of illegal dumping during the period when waste collection was stagnant, at the beginning of 2021. Illegal dumping of waste was occurring throughout the province.



Source: Luanda provincial government

Figure 3-17 Location Map of Illegal Dumping in Luanda Province

(2) Present Situation of Collection and Transportation

In Luanda Province, as mentioned earlier, approximately 9,100 ton/day of waste is generated, of which about 6,200 ton/day is collected, which is a collection rate of about 70%. In the province, waste is collected regularly,

and although there are some cases where waste overflows from containers and is scattered on the streets before the collection day, the urban areas appear to be relatively clean. On the other hand, there is a considerable amount of waste dumped in rivers, drainage channels, and coastal areas. Before the rainy season, the public corporation (UTGSL), the Ministry of Construction and its contractors dredge the waste from the drainage channels to prevent flooding due to waste clogging.



Source: prepared by JICA Study Team

(3) Transfer Station

The Luanda provincial government constructed 22 transfer stations as shown in Table 3-6, which are operated by waste collection companies (including ELISAL) contracted to collect waste in the region. However, many of the stations have stopped operating due to the confusion surrounding waste collection contract period in early 2021 and opposition from residents. Besides, the provincial government has not been able to ascertain the status of the suspended operations.

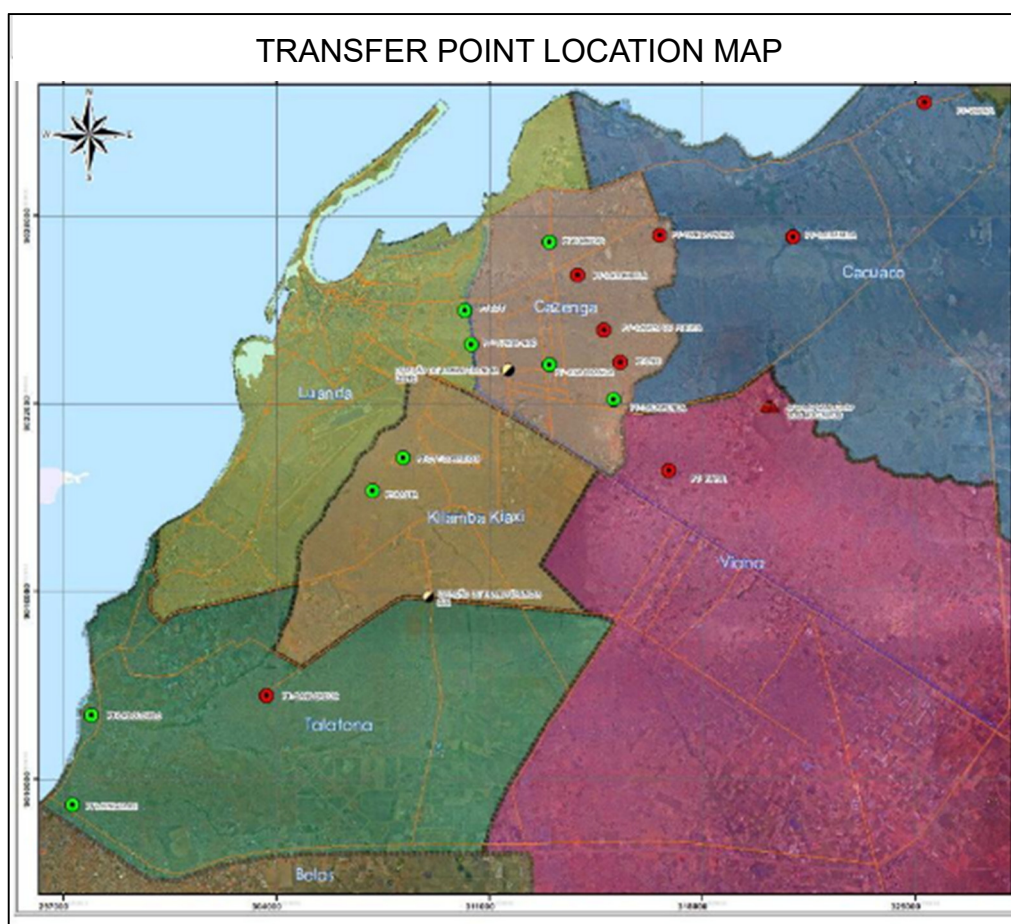


Source: prepared by JICA Study Team

Table 3-6 List of Transfer Stations in Luanda Province

MUNICIPALITY	DISTRICT	NAME	AREA
Cazenga	Cazenga	Asa Branca	1,600 m ²
	Cazenga	Kwanzas	2,000 m ²
	Cazenga	Kalawenda	2,000 m ²
	Hoji Ya Henda	Catumbela	1,200 m ²
	Kima Kieza	C.N.E	2,500 m ²
	Kima Kieza	Campo da Poeira	3,000 m ²
	11 de Novembro	Panga	2,000 m ²
	Talatona	Talatona	Cabolombo
Talatona	Talatona	Chinguar	1,600 m ²
	Camama	Dangereux	2,000 m ²
	Luanda	Rangel	Tunga Ngó
Rangel		CTT Rangel	1,600 m ²
Kilamba Kiaxi	Kilamba Kiaxi	CTT Correios	1,400 m ²
		Rasta	2,000 m ²
Cacuaco	Cacuaco Centro	Cerâmica	1,800 m ²
	Cacuaco Centro	Vidrul	1,800 m ²
Viana	Zango	Zango	1,600 m ²
	Baia	Km30	1,600 m ²
	Estalagem	Fapa	2,000 m ²
Quiçama	Cabo Ledo	Quiçsama	1,600 m ²
Belas	Ramiros	Ramiros	1,600 m ²
Icolo e Bengo	Mazozo	Icolo e Bengo	1,800 m ²

Source: Luanda provincial government



Source: Luanda provincial government

Figure 3-18 Location Map of Transfer Stations (excluding Quicam, Belas and Icolo e Bengo)

3.3.6 Current Status of Intermediate Treatment / Recycling

There are two incineration facilities for medical waste at the Mulenvos landfill site. The recycling-related facilities are intermediate treatment facilities for municipality solid waste, and there is no incineration facility.

(1) Recycling Companies in the Luanda Special Economic Zone

The Luanda Special Economic Zone (hereinafter referred to as “SEZ”), located in Viana municipality in Luanda Province, is the largest SEZ in Angola, with an area of 4,717.91 hectares. Luanda SEZ was established in 2009 by the Luanda provincial government, with the aim of fostering the Angolan manufacturing industry, attracting domestic and foreign private investments, creating jobs and diversifying the economy.

In Luanda SEZ, environmental protection efforts are being made to reduce the generation amounts of by-products (wastes, wastewater, gas emissions, noise, etc.) during the manufacturing process. In this context, efforts are also being made to reduce, recycle, and reuse solid wastes. As shown in Table 3-7, there are many recycling companies that use the wastes and recyclable materials generated in the manufacturing processes of industries operating in Luanda SEZ, etc. as raw materials.

Private Investment and Export Promotion Agency of Angola (hereinafter referred to as “AIPEX”) under the Ministry of Economy and Planning, which manages private investment and overseas exports, and Luanda SEZ have shown willingness to develop recycling facilities in the SEZ.

Table 3-7 Recycling Companies Using Recycled Resources from Luanda SEZ

Name of company	Type of business	Recycled resources as raw materials
Riusol	Plastic Utensils	HDP / PP / Color
GMST	Clinic / Recycling factory	Unknown
Angoplaste	Plastic Utensils	PET / Polypropylene
BD. Soluprafia	Raffia Bags	Polypropylene of 2 references
Reepplastico	Plastic Utensils	Polypropylene
Embalvidro	Glass bottle production	Sand, Limestone, Caustic Soda, Coal, Iron Oxide for Color Shade
Power Angola LDA	Plastic Utensils	PVC
Pacote Certo	Paper Boxes	No response
Mayaya Mafuta	Plastic Bag Production	No response
Induplastic	Plastic Material	No data
Zeepac	Plastic Material	Polypropylene and Cpp

Source: prepared by JICA Study Team

(2) Recycling Activities by Private Companies

There are many recycling-related companies in Luanda Province, as shown in Table 3-8. Among them, Ada steel company is a steel manufacturer and produces 500,000 tons of steel per year. Ada purchases a large amount of recovered iron products from waste and manufactures steel products. Fabrimetal company also manufactures steel products using recovered iron products. Fabrimetal was established in 2006 and currently produces 12,000 tons per year with 600 employees.

Table 3-8 Recycling-related Companies in Luanda Province (excluding the Luanda SEZ)

Name of Company	Outline of business, target valuables, etc.
3z sucata de angola	Separation and grouping of metals for sale
<u>Ada steel</u>	<u>Steel rods for construction</u>
Ambi reciclo	Waste management for recycling
Angorecicla	Production of recyclable plastic containers
Best angola metal	Recycling business
Carjoba	Car workshop (maintenance oil, batteries, plastics, chairs, buckets and bathtubs)
Celina prospera	Iron and plastic
Cooperativa barra de sabão zango	Manufactures of soap with used cooking oil
Crescen trl	Not available
Delta steel mill	Marketing of steel bars
Embalang	Recycling and processing of all recyclables
Enviroservice/netservice	Recycling of electronic waste
Eureciclo	Environmental classification
Fabrica de metal do zango	Steel production
<u>Fabrimetal</u>	<u>Production, sale of steel bars</u>
Fullblish	Manufactures of plastics and packaging
Grafernando	Cardboard and plastic
Greenmind	Maintenance oils, batteries and plastics
Guara	Reuse and recycling of organic cardboard waste, maintenance oils, filters and metals
Karam industria	Aluminum cans and ingots for export
Kcp-kalungo plastico comercial	Not available
Khoshima mining	Not available
Kicando	Not available
Kushi angola lda	Not available
Kvacundo	Not available
Latifo comercio e industria	Not available
Leka poleka	Micro waste management and waste separation by composition
Lox reciclagem e educação ambiental	Waste separation
Linguemba	Not available
Mca vias construções	Not available
Miguel ribeiro	Not available
Montecar service	Tire recycling
Nampak	Cans
National paper	Not available
Netservice angola	Separation of waste by composition
Neuerth	Lead and aluminum
Nova ambiente	Viana garbage operator (general waste collection)
Orabil	Not available
Patricia gomes	Not available
Plaslata	Collection, treatment and recycling of waste
Plastic wave co	Pieces and art
Primeplast lda	Plastics
Prolurb	Collection, and recycling of maintenance oils, batteries and cans
Qgmi queiroz galvão	Waste collection
Rescol	Not available
Resurb	Not available
Sambiente	Management of hazardous, domestic, hospital and industrial waste
Smartnet technology e solutions	Depositing machines for trapped beverages
Striver	Not available
Sucata angola	Metal escarpments
Tonangol	Waste toner scrap
Trinew	Segregated waste collection
Universidade metodista de angola	Education (frying oils)
Vassoforça	Recycling plastic bottles to make brooms
Vidrul	Glass industry
<u>Vista waste</u>	<u>Plastic, glass, papers and waste collection</u>
Zona especial economica	Separation of waste by composition

Source: NWA

VISTA company is currently separating, collecting, and selling recyclable materials from commercial wastes (equivalent to ordinary business wastes in Japan), but these activities have only just begun in Luanda Province. This company was engaged in the waste collection business on consignment from the provincial government until early 2021. However, the contract was terminated during the confusion in early 2021 and the company did not participate in the subsequent tenders for waste collection services. VISTA is currently not undertaking any collection services from the provincial government. VISTA currently contracts directly with markets and businesses for the collection and transportation of commercial waste, as well as the separation, collection, and sale of recyclable materials from the collected wastes. The amount of recyclable materials handled by VISTA is shown in Table 3-9. For example, the import price of plastic raw materials is USD700/ton, but VISTA sells plastic at USD120/ton, which is in high demand. VISTA has three special vehicles for public awareness raising activities.

Table 3-9 Amount of Recyclable Materials Handled by VISTA

Recyclable Materials	Amount of Shipment
Glass	14 ton/day
Plastics	100 ton/month
Aluminum	15 ton/month
Woods (chips)	40 ton/month

Source: results of the interview with VISTA



VISTA's recycling Facilities (separation and collection)

Source: prepared by JICA Study Team

(3) Recycling by Informal Sector

In addition to the private companies mentioned above, recyclable materials are also collected and sold by the informal sector both in the city and at the landfill site.



Source: prepared by JICA Study Team

3.3.7 Current Status of Landfill Site

(1) Operational Status of Mulenvos Landfill Site

Mulenvos landfill site is the only final disposal site in Luanda Province. The Mulenvos landfill site is located in the southeast direction of Luanda City, in Viana municipality (refer to Figure 3-19). Table 3-10 provides an overview of the Mulenvos landfill site. Mulenvos landfill site was developed by the provincial government in December 2007 and has a total area of 270 ha. Presently an area of 40 ha is in use, and there is an expansion area of 120 ha. The remaining lifetime is 16 years (until 2037). Despite the vastness of the province of Luanda, the Mulenvos landfill site is the only final disposal site serving the whole province. Luanda Province has an area of 18,835km²¹³, which is about nine times the size of Tokyo (2,193.96 km²)¹⁴. Even if Kissama municipality, which occupies more than half of Luanda Province (mostly a national park) is excluded, Luanda Province still has an area larger than Tokyo. However, there is only one final disposal site in the province. In addition, the access road to Mulenvos landfill is vulnerable, making it difficult for large vehicles such as large trailers to pass through. During the rainy season, it is also difficult for municipal solid waste collection vehicles to pass. A transfer station has been established, but is not currently in operation. Even when it is in operation, it does not improve the efficiency of transportation because the access road condition is poor for the large trailers of the transfer stations. In order to improve these problems, the provincial government planned to construct two new final disposal sites, but the implementation of this plan has been abandoned.

¹³ <https://ja.wikipedia.org/wiki/%E3%83%AB%E3%82%A2%E3%83%B3%E3%83%80%E5%B7%9E>

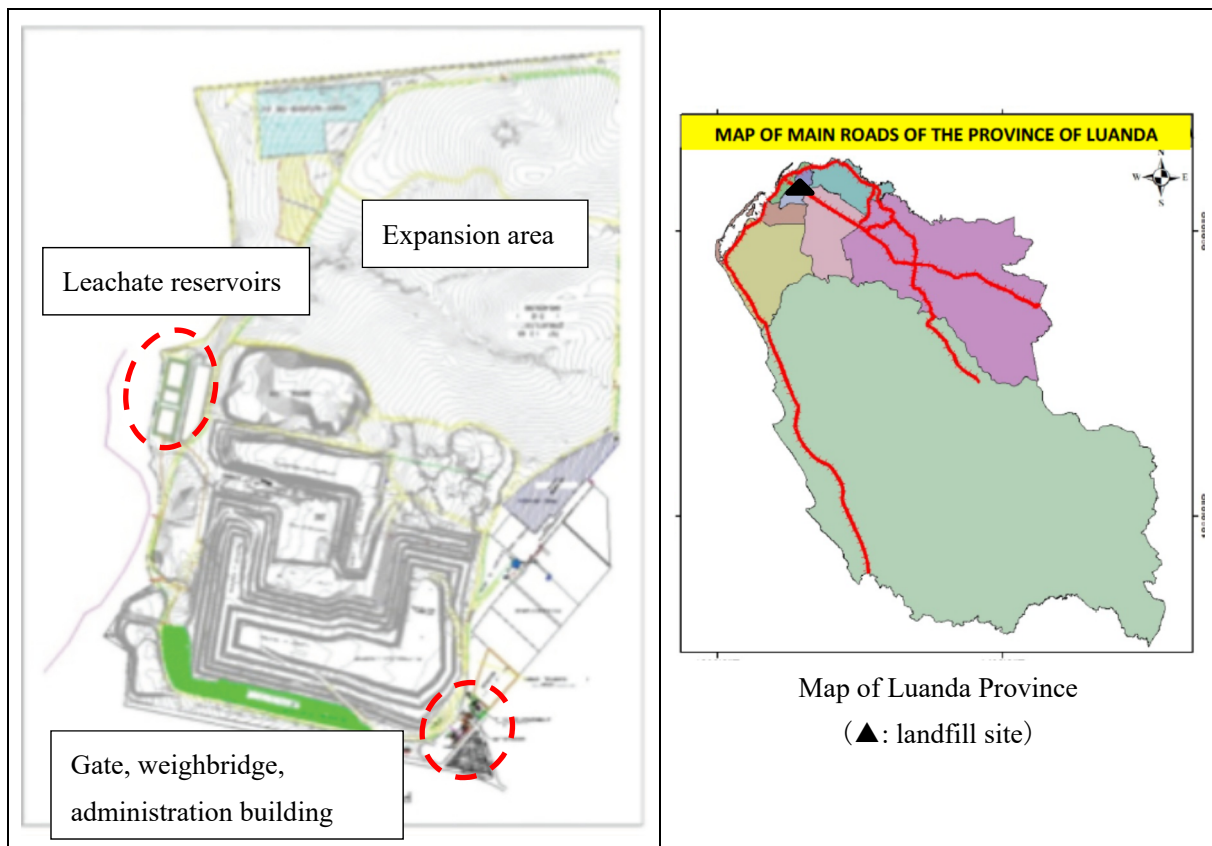
¹⁴ Website of the Tokyo Metropolitan Government
<https://www.metro.tokyo.lg.jp/tosei/tokyoto/profile/gaiyo/kushichoson.html>

Table 3-10 Outline of Mulenvos Landfill Site

Item	Outline	
Overall	Start of operation: December 2007 Site area: 270 ha (40 ha in service, expansion area 120 ha) Remaining lifetime: 16 years (until 2037) *1	
Main facility	Disposal area Leachate collection and drainage systems (sheets and pipes) Leachate reservoirs and recirculation equipment Weighbridge	
Main operating heavy equipment	Soil covering and leveling work Bulldozers: 8 units Track loader: 1 unit Landfill loader: 2 units Excavator: 6 units Dump truck: 14 units	Other works Tanker trucks for leachate recirculation: 2 units Pumps for leachate recirculation: 2 units Water supply vehicles: 2 units Fuel tanker trucks: 2 units

*1: Feasibility Study-Preliminary version- Mulenvos Landfill Public-Private Partnership Launch, December 2020, Ministry of Economy and Planning

Source: Prepared by JICA Study Team



Source: prepared by JICA Study Team

Figure 3-19 Plan Drawing and Location Map of Mulenvos Landfill Site



Source: prepared by JICA Study Team

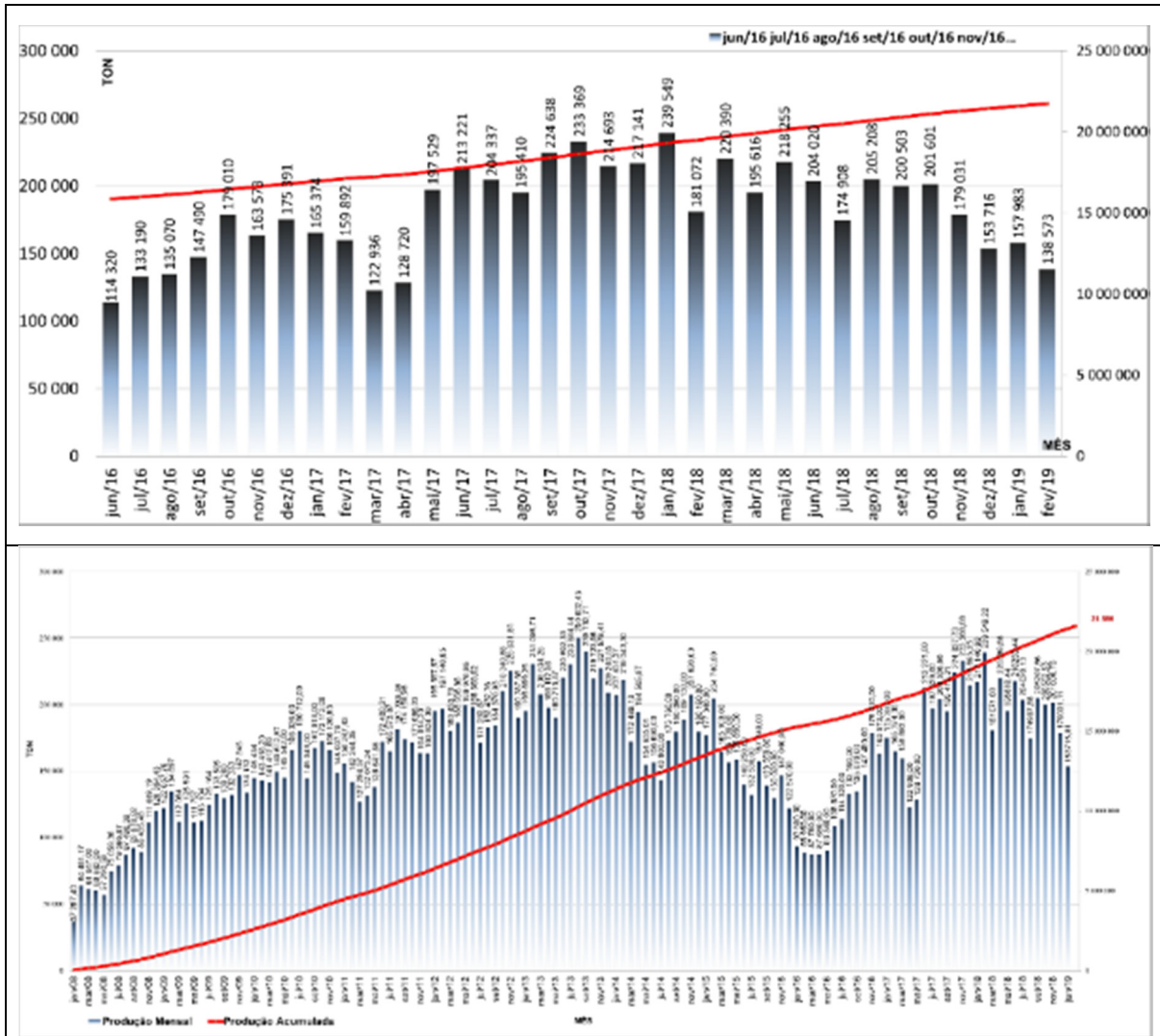
The Mulenvos landfill site is operated by the provincial government corporation, ELISAL. The disposed waste at the landfill is properly covered with soil, and there are no odors and flies. The landfill site is planned to have 8 vertical levels with each level 7 m high (7 m x 8 levels = 56 m). The landfill site has been operated on a stable slope with small perimeter level berms every 7 m heights. The landfill site is enclosed by fences and walls, but some of the fences are damaged, and waste pickers are coming and going freely. There are many (several hundred) waste pickers in the landfill site. They set fire to the wastes to collect recyclable materials, so proper management of waste pickers is an issue. Except for the issue of the waste pickers, the site is being managed appropriately and can be evaluated as a landfill site with relatively high level of management among developing countries. Waste pickers are living in some parts of the site, however there are no houses in the landfill site. Accordingly, the expansion area has been secured, which was an initial concern.



	
<p>Landfill area (operated with constructing small berms every 7 meters)</p>	<p>Many waste pickers</p>
	
<p>Impermeable liner sheet at the bottom of the landfill (photograph taken during construction)</p>	<p>Disposal area for unloading and landfilling wastes</p>
	
<p>Leachate reservoir</p>	<p>Incinerator for medical wastes (there are 2 units)</p>

Source: JICA Study Team

Figure 3-20 shows the trend of the amount of incoming waste to the landfill. From 2014 to 2016, the waste amount decreased, but it has been increasing again since 2017. Based on the waste amount for one year from March 2018 to February 2019, the average daily amount of incoming waste is calculated to be 6,167 ton/day.



Source: Mulenvos landfill site

Figure 3-20 Trend in the Amount of Incoming Waste at the Landfill

(2) Closed Landfill Site

The figure below shows the closed status of the former landfill site used from the 1970s to the 1990s. The final soil cover had been applied and no bad odor has reportedly been generated since more than 10 years. This closed landfill site is located on the main road and a shopping mall is being built nearby.



Closed landfill site (Gulf 2 dumping site)

Source: JICA Study Team

3.3.8 Activities by Other Donors

At this time, there is no confirmed support from other donors for the solid waste management sector. However, EU is planning to provide 50 million Euros of support to the waste sector in Luanda Province, and is dispatching consultants to investigate what kind of support could be provided. EU is focusing on “Circular Economy”, “Utilization of Informal Sector” and “Recycling by Private Sector”. The EU study has just started with the first field mission in October 2021, and the report is scheduled to be submitted around February 2022. At present, the specific contents of the support have not been finalized and are in a blank slate.

3.3.9 Status of Initiatives related to DX

No initiatives related to DX in the field of waste management were identified in this Study.

3.3.10 Status of Monitoring on SDGs’ waste-related Indicators

Table 3-11 shows the status of monitoring on SDGs’ waste-related indicators (11.6.1, 12.3.1, 12.4.2, 12.5.1 and 14.1.1).

Table 3-11 Status of Monitoring on SDGs’ waste-related Targets (Luanda Province)

SDGs Indicators		Present Situation
11.6.1	Proportion of urban solid waste regularly collected and with adequate final discharge out of total urban solid waste generated, by cities	Of the total municipal solid waste generated in Luanda Province, the percentage of municipal solid waste collected and disposed in controlled landfill is 68%. If collection in the informal sector is included, the percentage of collected municipal solid waste is 75%.
12.3.1	a) Food loss index, and b) Food waste index	There are no laws, policies, or initiatives currently in place to reduce organic waste from food (food products) and other sources.
12.4.2	(a) Hazardous waste generated per capita; and (b) proportion of hazardous waste treated, by type of treatment	Angola is a member of the Basel Convention. There is no data on the amount of hazardous waste generated or collected. In addition, although there is a licensing system for waste treatment companies, there is no system for monitoring the treatment performance. Therefore, (a) the amount of hazardous waste generated per capita and (b) the percentage of hazardous waste treated are not available.
12.5.1	National recycling rate, tons of material recycled	The amount of recycling in Luanda Province is estimated at 450 ton/day, which is equivalent to 5% of the total generation amount of municipal solid waste.
14.1.1	(a) Index of coastal eutrophication; and (b) plastic debris density	Data related to plastic waste being discharged into the ocean does not exist. The impression is that most of the illegal dumping in Luanda Province is in drainage channels, rivers and the ocean. If 60% of the illegal dumping occurred in drainage channels and was washed into the sea, this would result in 45 ton/day of marine plastic. Amount of marine plastic = 2,516 ton/day x 3% (composition of plastic) x 60% = 45 ton/day

Source: prepared by JICA Study Team

3.4 Issues and Cooperation Needs of Solid Waste Management in Angola and Luanda Province

3.4.1 Issues and Stages of Solid Waste Management

(1) Issues of Solid Waste Management

The issues of the central government of Angola in solid waste management are considered as follows;

- Waste collectors and others are not complying with laws and regulations and are conducting inappropriate waste management. NWA's main tasks are to supervise the implementation of waste management and to review and approve licenses, but there are no tools in place to manage these tasks.
- There is no system in place to collect and manage information on waste management data (waste volume, facilities, etc.) from each municipality and licensed contractors. In 2020, the development of these systems was considered, but they have not yet been realized.
- There is a lack of training programs and capacity building opportunities at the level of provincial and municipal administrators.
- According to the laws and regulations, NWA is supposed to set up and supervise branch offices in each province, but due to lack of personnel and financial resources, branch offices have not been set up.

The issues of solid waste management in Luanda Province can be considered as follows;

- Waste collection is not sufficiently carried out due to low capacity of waste collectors. In addition, there is a lack of control by the provincial government, resulting in a large amount of uncollected waste.
- Due to the lack of public environmental awareness, uncollected waste is illegally dumped into rivers and other areas. In particular, during the rainy season, drainage channels are blocked with waste, which may cause rainwater to overflow onto the city streets, so drainage channels are dredged before the rainy season.
- Despite the vast area of Luanda Province, Mulenvos Landfill is the only final disposal site, leading to inefficient transportation of waste. Furthermore, the access road to Mulenvos landfill is in a bad condition and unsuitable for heavy vehicles.
- Luanda Province is undergoing major changes in its waste management system, including a change in the role of ELISAL. In addition, while the central government has announced a strategy toward a Circular Economy, a new strategy for Luanda Province has not been formulated.

(2) Solid Waste Management Stages and Priority Issues

The status and stages of solid waste management in Luanda Province are summarized in Table 3-12. In this Study, based on the description provided in Table 1-13, the stages of solid waste management in Luanda Province are generally evaluated as Stage 2 (reduction of environmental impact and pollution prevention).

Table 3-12 Stages of Solid Waste Management in Luanda Province

Field	Stage	Status
Legislations	1~2	Although there is no independent law on solid waste management, Presidential Decree No. 190 regulates solid waste management. In Luanda Province, no policies have been developed to reform the solid waste management system or to address the circular economy.
Collection and Transportation	1	Private companies and public corporations contracted by the provincial government are responsible for collection and transportation, but the collection rate is 70%, and illegal dumping into rivers and drainage channels is widespread. There is only one landfill site, which makes collection inefficient.
Final Disposal	2~3	Mulenvos landfill is the only landfill with a remaining lifespan of 16 years. The landfill is equipped with leachate collection pipes, leachate reservoirs, leachate recirculation facilities, a weighbridge, etc.
Intermediate Treatment and Recycle	2	There is no intermediate treatment facility owned by the provincial government, but an intermediate treatment facility is planned under a PPP project that is currently being evaluated for bids. Recycling by the informal sector and private contractors is advanced.

Explanation of Stages - 1 : Improvement of public health, 2 : Reduction of environmental impact and prevention of pollution, 3 : Building a sound material-cycle society through the 3R activities

Source: prepared by JICA Study Team

Of the waste management issues listed in section (1) above, the following issues are rated as particularly high priority.

<p><Priority issues></p> <ul style="list-style-type: none"> ➤ The central government has launched a policy toward a circular economy, and the solid waste management system in the Luanda Province is undergoing a major transformation. However, Luanda Province has not developed a plan to handle these changes. ➤ The practice of illegal dumping into rivers, etc. is widespread, and it is required to strengthen the management of waste collectors and their capacity for collection and transportation, to improve the efficiency of waste transportation, and to raise awareness of residents.
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The contents of cooperation related to the priority issues described in 3.4.1 are shown in red letters in Table 3-13, and these are considered to require higher priority support than other issues. However, together with provision of high-priority support, the following self-help efforts by Angola are considered to be indispensable.

The efficiency of waste transport is declining due to the shutdown of transfer stations. It is necessary to analyze the problems of the suspended operations of transfer stations and make efforts to restart their operation.

3.4.2 Good Practices on Solid Waste Management

A good practice in waste management in Angola and Luanda Province is the operation of Mulenvos landfill, which can be used as a reference for other countries. Waste disposed at Mulenvos landfill is properly covered with soil, and there is no bad odor, and no flies. The landfill has a stable slope with level perimeter berms every 7 meters in height. Although there are some issues to be addressed, such as the management of the waste pickers, the landfill operation and covering work are being carried out in an exemplary manner.

3.4.3 Proposed Cooperation Policy

The proposed policy of cooperation in waste management for the central government of Angola and Luanda provincial government is shown in Table 3-13.

Table 3-13 Proposed Cooperation Policy (Angola)

Issue		Short-term assistance (red letters are those related to priority issues)	Middle-term assistance
Central government	Strengthening management of private contractors	[Technical Cooperation Project] ➤ Development and operation of a monitoring system for licensed SWM services companies.	
	Development of waste management data system	➤ Development and operation of a waste management data collection system for municipalities	
	Development of training and capacity building system	[Technical Cooperation Project] ➤ Development and implementation of training systems and training materials [Training in Japan and in third countries] ➤ Capacity development through training participation	Implementation of support for equipment, etc. related to the establishment of branch offices when the necessary human resources are secured
	Establishment of branch offices of NWA		
Luanda provincial government	Strengthening management of waste collectors and capacity for collection and transportation	[Technical Cooperation Project] ➤ Development and application of tools for the management of waste collectors ➤ Procurement of containers and installation at illegal dumping sites such as riverbeds ➤ Reduction of illegal dumping and open burning by raising public awareness	
	Strengthening of awareness-raising among residents and measures against illegal dumping of wastes in rivers	[Grant Aid Project] ➤ Strengthening direct collection (collection by ELISAL) and consigned collection (equipment rental) by providing waste collection equipment	
	Strengthening of the final disposal system	[Technical Cooperation Project] ➤ Development of a master plan for waste management and consideration of plans for new landfill sites and plans related to the introduction of circular economy	[Japanese ODA Loan Project] Construction of a new landfill site
	Formulation of strategies for a circular economy	➤ Implementation of pilot projects for plans related to circular economy	[Japanese ODA Loan Project] Construction of an intermediate treatment facility

Source: prepared by JICA Study Team

CHAPTER 4 Solid Waste Management in the Federal Democratic Republic of Ethiopia

In the Federal Democratic Republic of Ethiopia (hereinafter referred to as Ethiopia), in addition to the remote survey utilizing the local consulting firm (Bazaleel + Turnkey Contractors, Inc.), interviews were conducted with relevant agencies. The results of the survey are shown as follows.

4.1 Overview of Target Country and Cities

4.1.1 Population

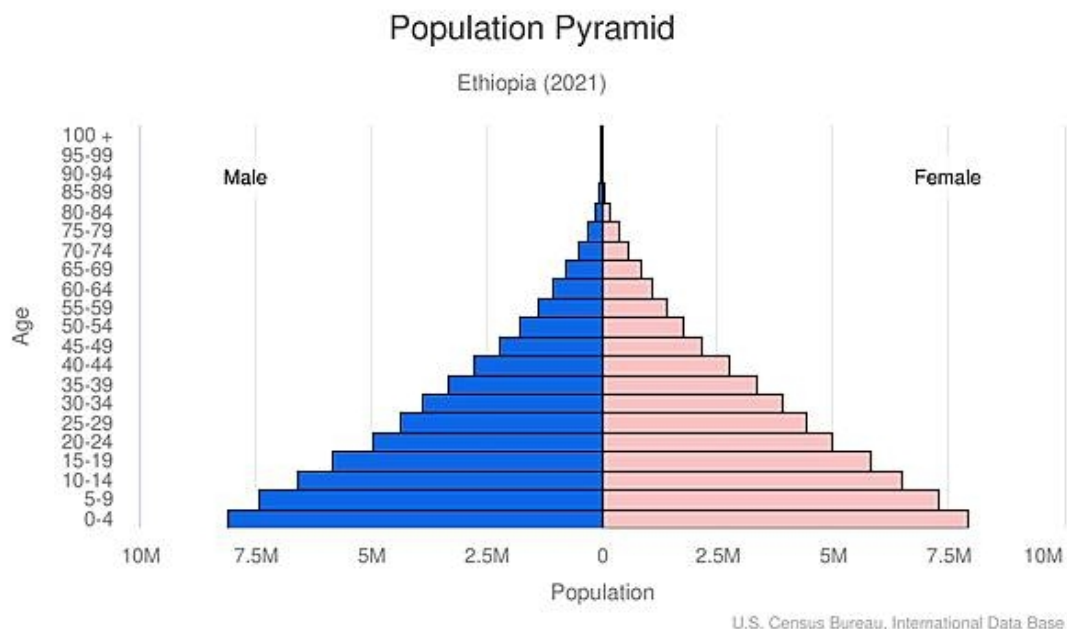
Table 4-1 shows the population of Ethiopia for 2014–2020. As shown in Table 4-1, Ethiopia's overall rate of population growth ranged from 2.57% to 2.79% during the survey target years. Based on Ethiopia's land area of 1,104,300 km², this translates to a population density of 104 people per km² (2020). In comparison to Japan's population density (335 people/km² in 2020), this is a relatively low population density.

Table 4-1 Population Trends in Ethiopia

Year	2014	2015	2016	2017	2018	2019	2020
Population	98,094,264	100,835,453	103,603,461	106,399,926	109,224,410	112,078,727	114,963,583

Source: World Bank

Figure 4-1 shows Ethiopia's population pyramid (2021). As indicated by the pyramid shape of Ethiopia's population pyramid, the country has a high fertility and mortality rate (population explosion stage).



Source: CIA The World Factbook

Figure 4-1 Ethiopia's Population Pyramid

Although a nationwide census was conducted in Ethiopia in 2007, including the cities of Addis Ababa and Hawassa, none has been conducted since that time. As a result, the inability to know Ethiopia's precise

population is an issue. Table 4-2 shows the population projections for Addis Ababa.

Table 4-2 Population Growth Rate and Projected Population of Addis Ababa

Year	2014	2015	2016	2017	2018	2019	2020
Population growth rate (%)	4.36	4.36	4.37	4.36	4.36	4.37	4.39
Projected population	3,708,942	3,870,785	4,039,927	4,215,965	4,399,674	4,591,983	4,793,699

Source: Website¹⁵

UN-Habitat carried out a survey in Hawassa in 2019, and based on local interviews the population was estimated to be 387,087 in 2017. Table 4-3 shows the projected population based on the 2017 population at a 3.5% population growth rate, referenced from the ACCP data book. However, due to the heavy population inflow into Hawassa as a result of industrial park development, the actual population growth rate is likely to be higher than 3.5%. (According to the interview survey, the population of Hawassa is expected to be around 500,000 by 2021).

Table 4-3 Population Growth Rate and Projected Population of Hawassa

Year	2014	2015	2016	2017	2018	2019	2020
Population growth rate (%)	N/A	N/A	N/A	3.5	3.5	3.5	3.5
Projected population	N/A	N/A	N/A	387,087	400,635	414,657	429,170

Source: Survey team calculation based on 2017 population (from the UN-Habitat report) and rate of population growth¹⁶

From Table 4-1, Table 4-2 and Table 4-3, we can see that Addis Ababa holds roughly 4.2% of Ethiopia's total population, while Hawassa holds roughly 0.4% (2020). The fact that Addis Ababa and Hawassa are growing at a faster rate than Ethiopia as a whole indicates that population inflows into the region are also expected to continue.

4.1.2 Economic Situation

Table 4-4 summarizes Ethiopia's key economic indicators.

Table 4-4 Ethiopia's Key Economic Indicators

Item	2017	2018	2019
GDP growth (real)	10.15 (%)	7.71 (%)	7.44 (%)
Total GDP (nominal)	75.7 (billions of dollars)	80.3 (billions of dollars)	91.2 (billions of dollars)
GDP per capita (nominal)	817 (dollars)	853 (dollars)	953 (dollars)
Consumer price inflation rate (average for the period)	N/A	N/A	N/A
Exports (FOB price)	4,078 (millions of dollars)	3,879 (millions of dollars)	4,408 (millions of dollars)
Imports (FOB price)	17,638 (millions of dollars)	16,997 (millions of dollars)	16,650 (millions of dollars)
Current account balance (based on balance of international payments)	△ 5,929 (millions of dollars)	△ 4,611 (millions of dollars)	N/A

Source: JETRO, "Country Profile and Basic Statistics for Côte d'Ivoire" (as of September 1, 2021)

¹⁵ <https://worldpopulationreview.com/world-cities/addis-ababa-population>

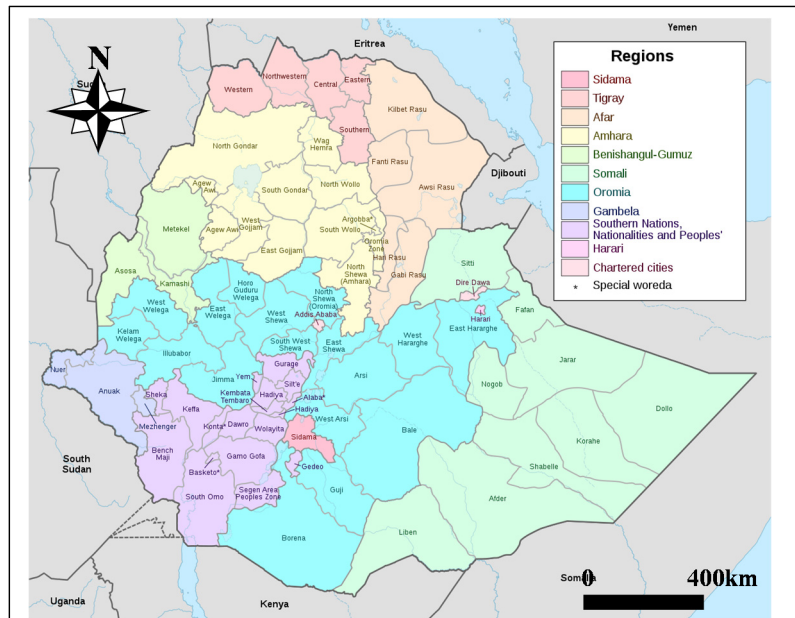
¹⁶ <https://www.macrotrends.net/cities/21602/abidjan/population>

Ethiopia's primary industry is agriculture (grains, beans, coffee, oilseeds, cotton, sugarcane, potatoes, flowers, etc.) Ethiopia's primary exports are coffee, oilseeds, and cut flowers, and its primary imports are machinery, automobiles, and electrical appliances

4.1.3 Topography

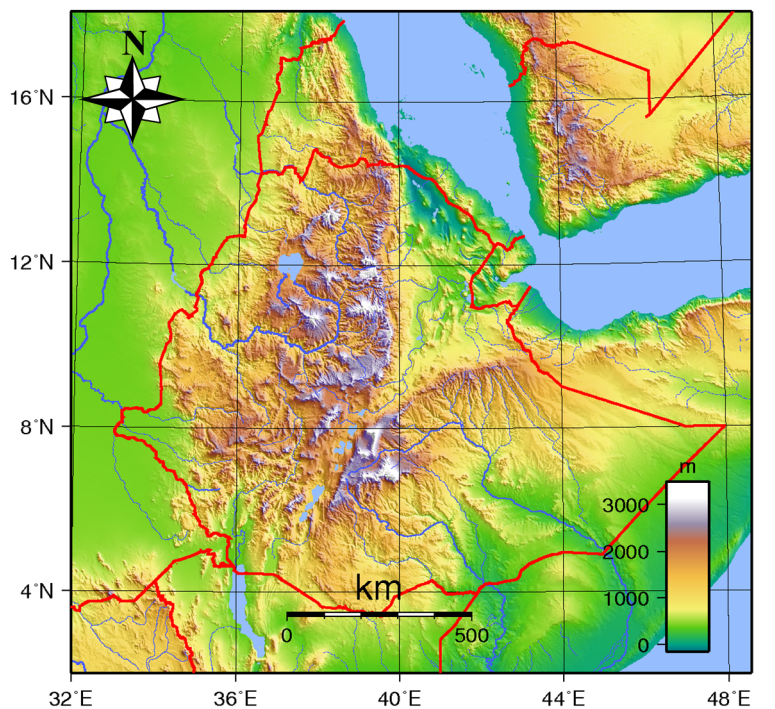
Ethiopia is a landlocked East African country with a total land area of 1,104,300 km², and is bordered by six countries: Somalia, Kenya, South Sudan, Sudan, Eritrea, and Djibouti. As shown in Figure 4-2 Ethiopia is administratively divided into 12 regions and 2 chartered cities (Addis Ababa and Dire Dawa), with 31 states in the regions.

As illustrated in Figure 4-3, Ethiopia is divided into the Ethiopian Plateau in the west, the Eastern Highlands in the east, and the Great Rift Valley lowlands in between the two plateaus. The Ethiopian Plateau is a high plateau that is over 2,000 m in elevation, beginning with the 4533 m Mount Ras Dashan and gradually decreasing in elevation as it approaches the west (Sudan side). The Eastern Highlands is similar, beginning at 4307 m (Mount Batu) and gradually descending to the southeast (Somali side) until it reaches the desert. The Great Rift Valley lowlands span the country from northeast to southwest. Ethiopia is also characterized by numerous deep valleys and sheer cliffs, which complicates transportation development and causes infrastructure development to lag as it does today.



Source: Adapted from Wikipedia

Figure 4-2 Administrative Districts of Ethiopia

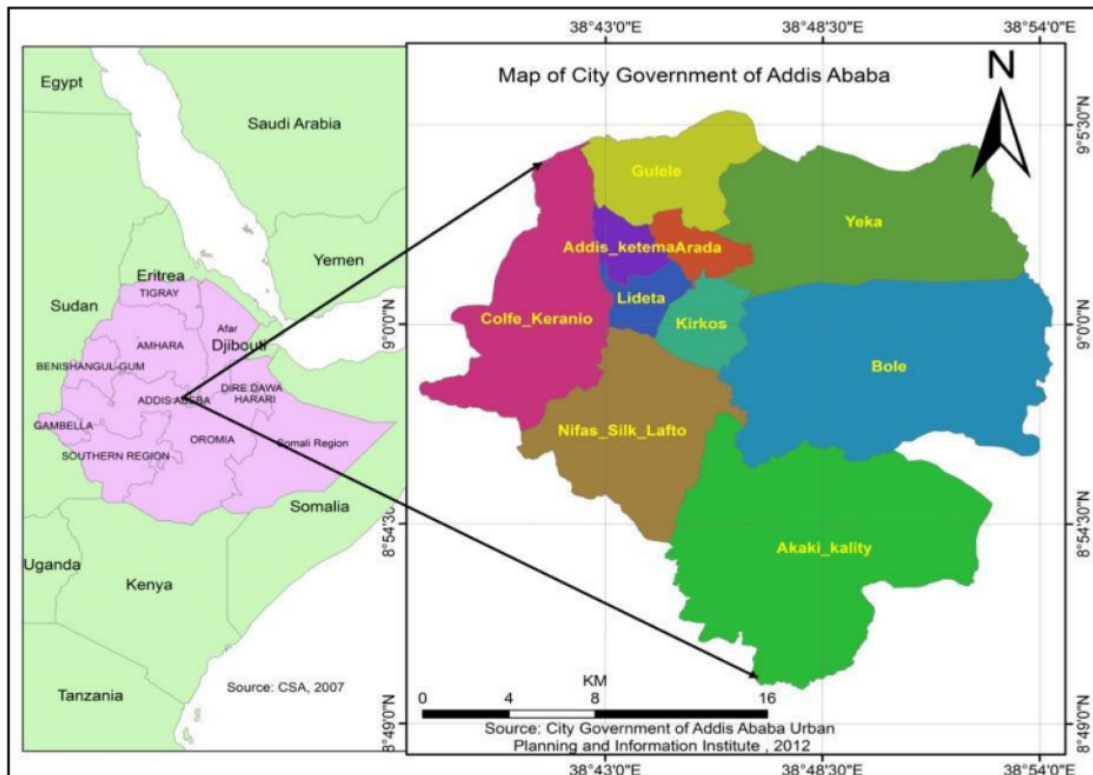


Source: Adapted from Wikipedia

Figure 4-3 Topographic map of Ethiopia

Addis Ababa (540 km²) is Ethiopia's capital, consisting of 10 sub-cities (see Figure 4-4) and 99 districts. Addis Ababa is located roughly 2,400 m above sea level and benefits from a year-round stable climate due to its high plateau location.

Hawassa, on the other hand, is located on the eastern shore of Lake Hawassa in Africa's Great Rift Valley (roughly 1,700 m above sea level)



Source: Paper (Eshetu Gelan, 2021)

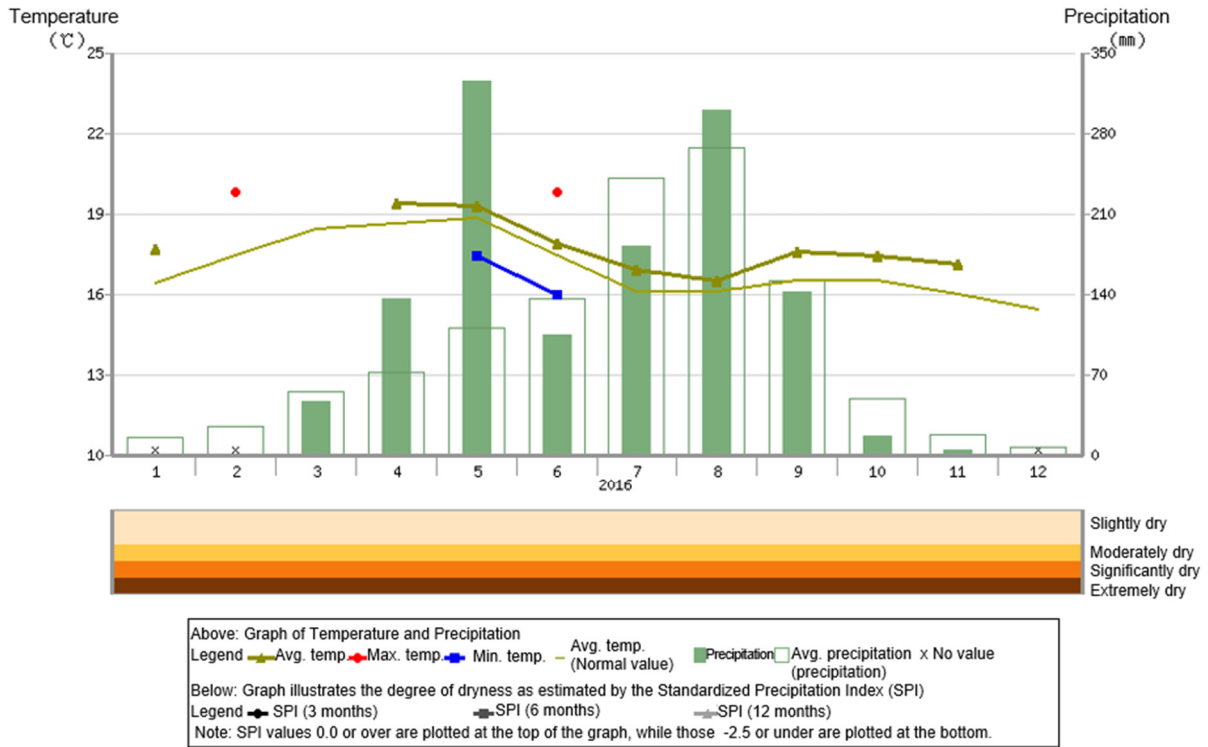
Figure 4-4 Administrative Divisions of Addis Ababa

4.1.4 Meteorological Conditions

Ethiopia has three seasons: the wet season (February to May), the rainy season (June to September), and the dry season (October to January). Temperatures vary widely across the country due to the country's vast geographical area and varied altitude, but can exceed 50 °C in the hottest areas. Ethiopia can be divided into climatic zones due to its varied topography.

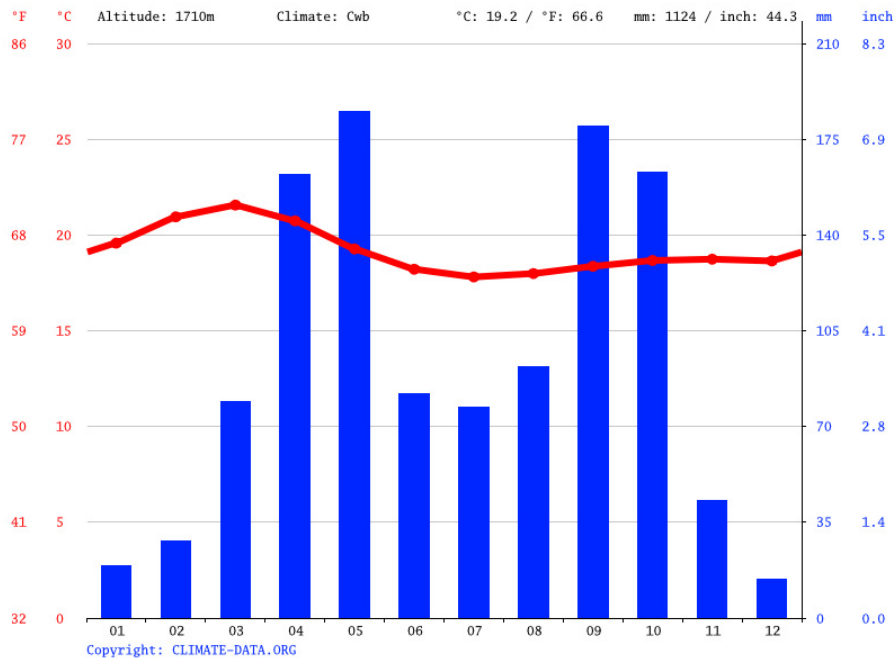
Addis Ababa is classified as having a temperate oceanic climate (Cfb) in the Köppen climate classification (Figure 2-3). As previously stated, the city is located at an elevation of roughly 2,400 m above sea level, and the climate is relatively comfortable throughout the year, with maximum temperatures of 20–25 °C and a minimum temperature of around 15 °C. Addis Ababa experiences heavy rainfall in August and a dry climate from December to February (annual precipitation: around 1,200 mm). Figure 4-5 shows the rainfall and temperature map for Addis Ababa (2016). In contrast, Hawassa, has a dry winter subtropical highland climate (Cwb), which is hot and humid during the rainy season (around May), but dry during the dry season (around December). Hawassa's rainfall and temperature map is shown in Figure 4-6.

Addis Ababa, Ethiopia



Source: Japan Meteorological Agency, "World Weather Data Tool"

Figure 4-5 Rainfall and Temperature Map for Addis Ababa (2016)



Source: Climate-data.org

Figure 4-6 Rainfall and Temperature Map for Hawassa

4.2 Laws, Regulations, Plans and Organizational Structures related to Solid Waste Management in the Country

4.2.1 Laws and Regulations related to Environment and Solid Waste Management

Table 4-5 shows laws and regulations related to solid waste management and environment in Ethiopia. "Solid Waste Management Proclamation No. 513/2007" is the specific waste-related legislation.

Table 4-5 Solid Waste Management and Environment Related Legislation in Ethiopia

Legislation	Year of Enactment	Summary
Federal Democratic Republic of Ethiopia Constitution, 1994	1994	<p>The 1994 Constitution makes no specific mention of waste management. On the other hand, "Article 44: Environmental Rights" provides the following information on the people's environmental rights:</p> <ul style="list-style-type: none"> • All persons have the right to a clean and healthy environment. • All persons who have been displaced or whose livelihoods have been adversely affected as a result of State programmes have the right to commensurate monetary or alternative means of compensation, including relocation with adequate State assistance. <p>Additionally, "Article 92: Environmental Objectives" identifies the following as environmental areas:</p> <ul style="list-style-type: none"> • Government shall endeavor to ensure that all Ethiopians live in a clean and healthy environment. • The design and implementation of programmes and projects of development shall not damage or destroy the environment. • People have the right to full consultation and to the expression of views in the planning and implementation of environmental policies and projects that affect them directly. • Government and citizens shall have the duty to protect the environment.
Environmental Protection Organs Establishment Proclamation	2002	<p>The Proclamation is divided into four parts</p> <ul style="list-style-type: none"> • Part 1: This part contains the Proclamation title and text definitions. • Part 2 (Establishment of an Environmental Protection Agency (EPA)): This part specifies the EPA's role in developing policies, strategies, laws, and standards, as well as its specific powers and responsibilities. • Part 3 (Establishment of Sectoral Environmental Units (SEU) and Regional Environmental Agencies (REA)): This part states that the EPA is responsible for coordinating and monitoring legislation and environmental protection. With regard to REAs, it states that they are responsible for coordinating the formulation, implementation, review, and revision of regional conservation strategies; environmental monitoring, protection and regulation; they shall ensure the implementation of federal environmental standards or, as may be appropriate, issue and implement their own no less stringent standards; and they shall prepare reports on the respective state of the environment and sustainable development of their respective states and submit them to the Authority. • Part 4 (Miscellaneous Provisions): This part states that the Proclamation shall enter into force on October 31, 2002.
Environmental Impact Assessment Proclamation No. 299/2002	2002	<p>This Proclamation consists of the following seven parts.</p> <ul style="list-style-type: none"> • Part 1: This part contains the Proclamation title and text definitions. • Part 2: Part 2 is divided into four sections: (1) General Provisions, (2) Considerations to Determine Impact (3) Projects Requiring Environmental Impact Assessment, and (4) Trans-regional Impact Assessment. "(1) General Provisions" contains general provisions, such as the requirement that no project requiring an environmental impact assessment be initiated without

Legislation	Year of Enactment	Summary
		<p>prior approval from the Environmental Protection Agency (EPA) or other relevant agency. "(2) Considerations to Determine Impact" states that the impact assessment must take into account the project's size, location, nature, cumulative effects, etc. "(3) Projects Requiring Environmental Impact Assessment" states that every project that falls fall within the categories specified in the applicable laws and regulations are subject to an environmental impact assessment (projects not likely to have negative impacts are not required to conduct an environmental impact assessment). "(4) Trans-regional Impact Assessment" states that projects that may have trans-regional impacts must carry out an environmental impact assessment and that regional environmental organizations must also submit an environmental impact assessment report to the environmental protection authority (Environmental Protection Agency).</p> <ul style="list-style-type: none"> • Part 3: Part 3 is divided into four sections: (1) Duties of a Proponent, (2) Environmental Impact Study Report, (3) Review of Environmental Impact Study Report, and (4) Validity of Approved Environmental Impact Study Report. "(1) Duties of a Proponent" states that the proponent must conduct an environmental impact assessment of any project with adverse environmental impacts and submit a report to the environmental protection authority (Environmental Protection Agency) and other relevant agency (proponents must bear the cost of the environmental impact assessment). "(2) Environmental Impact Assessment Report" specifies the minimum information that must be included in the report. "(3) Review of Environmental Impact Study Report" states that the environmental protection authority (Environmental Protection Agency) or relevant agency must respond within 15 days of submission with an approval or disapproval decision, taking into account factors such as public comments, and expert opinions. "(4) Validity of Approved Environmental Impact Study Report" states that approval of the report will be revoked if the project is not implemented within the timeframe specified when the approval was granted, that documents necessary to maintain the approval must be submitted, and the environmental protection authority (Environmental Protection Agency) or relevant agency must respond within 30 days whether the report validity will be extended or not. • Part 4: Part 4 is divided into four sections: (1) Occurrence of New Circumstance, (2) Implementation Monitoring, (3) Environmental Impact Assessment of Public Instrument, and (4) Jurisdiction. "(1) Occurrence of New Circumstance" states that if unforeseeable circumstances arise after the environmental impact assessment report is submitted, the environmental protection authority (Environmental Protection Agency) or relevant agency may order the report to be revised. "(2) Implementation Monitoring" states that the environmental protection authority (Environmental Protection Agency) or relevant agency is required to monitor whether the proponent of an approved project is implementing the required tasks (if not being implemented, they will be directed to make necessary changes). • Part 5: Part 5 is divided into three sections: (1) Public Participation, (2) Incentive, and (3) Grievance Procedures. "(1) Public Participation" states that the environmental protection authority (Environmental Protection Agency) or relevant agency must make environmental impact assessment reports accessible to the public and solicit comments on it as part of their evaluation. "(3) Grievance Procedures" states that any person with a complaint or dissatisfaction regarding an approved project may submit a grievance notice to the head of the environmental protection authority (Environmental Protection Agency) or relevant agency, which must respond within 30 days. • Part 6 (Offences and Penalties): This part specifies the maximum fines applicable to various types of violators, such as those who carry out projects

Legislation	Year of Enactment	Summary
		<p>without obtaining the required permit or approval.</p> <ul style="list-style-type: none"> Part 7 (Miscellaneous Provisions): This part states that the Proclamation shall enter into force on December 3, 2002.
Environmental Pollution Control Proclamation No. 300/2002	2002	<p>This Proclamation consists of the following six parts.</p> <ul style="list-style-type: none"> Part 1: This part contains the Proclamation title and text definitions. Part 2 (Control of Pollution): Part 2 is divided into three sections: (1) Control of Pollution, (2) Management of Hazardous Waste, Chemical and Radioactive Substances, and (3) Management of Municipal Waste. "(1) Control of Pollution" states that the environmental protection authority (Environmental Protection Agency) or relevant agency are responsible for prosecuting violators of environmental pollution-related laws and regulations. "(2) Management of Hazardous Waste, Chemical and Radioactive Substances" states that hazardous waste management (disposal, storage, transport, treatment, and disposal) requires permits and approvals from the environmental protection authority or relevant agency. "(3) Management of Municipal Waste" states the municipalities (urban administrations) are responsible for waste management (collection, transport, recycling, treatment or safe disposal). Part 3 (Environmental Standards) states that the environmental protection authority is responsible for developing practical environmental standards based on scientific evidence (including water quality, air quality, soil quality, noise, waste, and odors). Part 4 (Environmental Inspectors): Part 4 describes the rights, responsibilities, and other responsibilities of the environmental inspectors appointed by the environmental protection authority. Part 5 (Offenses and Penalties): this section describes the fines and penalties for violating this Proclamation or related laws. Part 6 (Miscellaneous Provisions): This part states that the Proclamation shall enter into force on December 3, 2002.
Criminal Code Proclamation No.414/2004	2004	<p>The following are references to waste management or the environment in the Criminal Code.</p> <ul style="list-style-type: none"> Article 519 (Environmental Pollution): States, "Whoever, in breach of the relevant law, discharges pollutants into the environment, is punishable with fine not exceeding ten thousand ETB, or imprisonment not exceeding five years" (if the discharge of pollutants results in harm to human health or the environment, the penalty is up to ten years in prison). Article 520 (Mismanagement of Hazardous Wastes and other Materials) states that anyone who fails to control or unlawfully transports hazardous wastes, etc. faces a fine of up to 5,000 ETB or up to a three-year prison sentence.
Solid Waste Management Proclamation No. 513/2007	2007	<p>This Proclamation consists of the following five parts.</p> <ul style="list-style-type: none"> Part 1: This part contains the Proclamation title and text definitions. Additionally, it states that its objective is to enhance capacities to prevent adverse impacts. Part 2 (Solid Waste Management): Part 2 is divided into three sections: (1) General Obligations of Urban Administrations, (2) Solid Waste Management Planning, and (3) Inter-regional Movement of Solid Waste. "(1) General Obligations of Urban Administrations" states that "municipalities (urban administrations) shall create enabling conditions to promote investment on the provision of solid waste management services" and "any person shall obtain a permit prior to his engagement in the collection, transportation use or disposal of solid waste." "(2) Solid Waste Management Planning" states that each municipality is required to develop and implement a waste management plan involving the Lowest Administrative Level. "(3) Inter-regional Movement of Solid Waste" includes a stipulation that regional states "shall keep the shipment of solid waste to other regions for final disposal at the minimum possible."

Legislation	Year of Enactment	Summary
		<ul style="list-style-type: none"> Part 3: this section discusses how glass bottles, cans, plastic bags, used tires, food waste, household waste, and construction waste are to be managed and handled. Part 4: Part 4 is divided into the following sections: (1) Transportation of Solid Waste, (2) Construction of Solid Waste Disposal Sites, and (3) Auditing Existing Solid Waste Disposal Sites. "(1) Transportation of Solid Waste" states that equipment for transporting waste materials must be registered, and that annual registration renewal and audits etc. are required. "(2) Construction of Solid Waste Disposal Sites" states that the construction of a new landfill site or the renovation of an existing landfill site must adhere to applicable environmental impact assessment laws and regulations. "(3) Auditing Existing Solid Waste Disposal Sites Establishment" states that municipalities are to conduct environmental audits of existing landfill sites, and that the owner must make modifications if problems are found. Part 5 (Miscellaneous Provisions): Part 5 includes sections on such as "Civil Liability," "Penalties," etc. "Civil Liability" states that the owner of a landfill site is liable for any environmental damage or health hazards that occur during or after its operation. "Penalties" states that municipalities may impose fines on relevant organizations manufacturers, importers, etc.) for noncompliance with regulations. It also states that the Proclamation shall enter into force on February 12, 2007.
Prevention of Industrial Pollution council of Ministers Regulation No. 159/2008	2008	The Regulation states that liquid waste discharged from factories must comply with applicable environmental regulations. It also states that licensing must be obtained before discharging any liquid waste. Factories must also monitor the type of waste they discharge and maintain records for submission to the EPA on a regular basis.
Food, Medicine and Health Care Administration and Control Proclamation No. 661/2009	2009	In section "30. Waste Handling and Disposal" of "Part 6 Hygiene, Environmental Health and Control of Communicable Diseases," is states the following: "No person shall collect or dispose of solid, liquid or other wastes in a manner contaminating the environment and harmful to health"; "Any wastes generated from health or research institutions shall be handled with special care and their disposal procedures shall meet the standards set by the executive organ"; and "It is prohibited to discharge untreated waste generated from septic tanks, seepage pits, and industries into the environment, water bodies or water convergences."

Source: Survey team, Federal Democratic Republic of Ethiopia Constitution, 1994, Environmental Protection Organs Establishment Proclamation, Environmental Impact Assessment Proclamation No. 299/2002, Environmental Pollution Control Proclamation No. 300/2002, Criminal Code Proclamation No. 414/2004, Solid Waste Management Proclamation No. 513/2007, Prevention of Industrial Pollution council of Ministers Regulation No. 159/2008, Research Report on Africa's Waste Management Sector Project (2010), Information Collection and Verification Survey for Municipal Solid Waste Management in Africa (2020)

4.2.2 Policies and Plans related to Solid Waste Management

Table 4-6 summarizes Ethiopia's solid waste management and environmental policies and plans. No waste-specific policies or plans have been put in place.

Table 4-6 Solid Waste Management and Environmental Policies and Plans in Ethiopia

Policy/Plan	Year of Enactment	Summary
Environmental Policy of Ethiopia (EPE)	1997	The policy deals with Ethiopia's environment in a broad sense, and was developed to protect Ethiopians' health and quality of life while also promoting social and economic development. The policy aims to accomplish these goals by adhering to

Policy/Plan	Year of Enactment	Summary
		<p>the concept of sustainable development, which emphasizes the prudent management and utilization of natural resources and the environment. The policy also considers the rights of citizens, organizations, and government bodies, and their obligations to protect the environment to achieve the above-mentioned objectives stated in the Federal Democratic Republic of Ethiopia's Constitution (1994).</p> <p>The policy is broad in scope in terms of the environment, as demonstrated by the policies in Chapter 3 on the ten key sectors (agriculture, forests, biodiversity, water, energy, mining, human settlements, industry, climate change, and cultural heritage). Although there is no sector dedicated to waste, waste is mentioned in "3.7 Human Settlements, Urban Environment and Environmental Health" and "3.8 Control of Hazardous Materials and Pollution from Industrial Waste." "3.7 Human Settlements, Urban Environment and Environmental Health" includes a section on improving sanitation," which includes establishing storage areas for human waste and household waste, recognizing the importance of waste management from collection to safe disposal, and as much as possible, recycling solid waste from households and commercial facilities as energy or fertilizer. "3.8 Control of Hazardous Materials and Pollution from Industrial Waste" states that a national policy and guidelines for hazardous waste management should be developed, which includes establishing standards when locating waste disposal sites near wells, dams, and other bodies of water; establishing management guidelines and legally mandating waste disposal and public and industrial hygiene; and developing a national policy and guidelines for medical, agricultural, and other waste management.</p> <p>In addition, Chapter 4 discusses policies concerning ten cross-sectoral issues (population growth, community participation, land tenure, land use, social and gender, environmental economics, environmental information systems, research, impact assessment, and education and awareness). Although waste-related issues are not specifically mentioned, related topics include "4.2. Community Participation and the Environment," "4.9. Environmental Impact Assessment (EIA)," and "4.10 Environmental Education and Awareness."</p>
Guidelines on Industrial Waste Handling and Landfill Planning and Management	2003	<p>This is one of the several guidelines developed with the support of UNIDO.</p> <p>Part I establishes standards for the management and disposal of industrial waste by companies, etc., beginning with the identification of the type and quantity of waste to be managed. Wastewater treatment is also discussed.</p> <p>Part II discusses waste disposal site planning, including site selection, disposal site types, and technical standards.</p>
Guidelines on Integrated Pollution Prevention and Control	2003	<p>This is one of the several guidelines developed with the support of UNIDO.</p> <p>These guidelines outline the establishment of a comprehensive strategy to prevent pollution. It asserts that waste management must shift from a coping strategy centered on final disposal to a concept centered on waste reduction and reuse.</p>
Guidelines Ambient Environmental Standards for Ethiopia	2004	<p>These guidelines were developed based on the aforementioned "Environmental Pollution Control Proclamation No. 300/2002" through support from the United Nations Industrial Development Program (UNIDO). (This is one of eight guidelines developed by UNIDO's Ecologically Sustainable Industrial Development (ESID) Project). The guidelines discuss environmental standards for air, water, soil, groundwater, and noise, including descriptions of the risks associated with each substance and analytical (monitoring) methods that are commonly used.</p>
Urban Development Policy	2005	<p>This policy aims to interconnect Ethiopian cities to increase their international competitiveness and enable them to serve as regional centers of democracy and development through efficient service delivery, habitation suitability, and compliance with development plans. Article 1.1.1 D of "Section 1: Urban Development Issues and the Need for Urban Development Policies" summarizes the policy's major components.</p> <ul style="list-style-type: none"> • Municipal solid and liquid waste management issues arising from informal slum settlements should be addressed by organized systems that are already in place

Policy/Plan	Year of Enactment	Summary
		<ul style="list-style-type: none"> • Disease prevention mechanisms must be established through the Urban Health Extension Program • Residents must be mobilized to manage solid and liquid waste in cities, public-private partnerships must be established, and waste must be recycled to avoid pollution problems
National Hygiene and Sanitation Strategy (NHSS)	2005	NHSS is a healthcare strategy created in 2005 by the Ministry of Health. This Strategy was created to supplement the Ministry of Health's "Health Policy" and Ministry of Water Resources' "Ethiopian Water Sector Strategy." Though it does include solid waste as part of public health, NHSS is not a waste-specific strategy; rather, it is primarily concerned with the management of liquid waste (manure). Section "1.3.7 Solid Waste Disposal" states the considerable amount of urban solid waste is faeces-contaminated sludge is obstructing safe disposal and must be managed properly.
Plan for Accelerated and Sustained Development to End Poverty (PASDEP)	2005	PASDEP is a five-year medium-term plan developed by the Ministry of Finance and Economic Development (MoFED) and covers from June 2005 to October 2009. Although there is no specific reference to waste, several references to waste are scattered throughout. "7.15.3 Envisioned Environmental Outcomes and Targets during the Period of PASDEP" states that "65 urban municipalities shall develop sound Municipal Solid Waste Management Plans that mainstream gender equity and has begun implementation." It also states that its goal is to reduce the negative environmental impacts of urban waste.
Growth and Transformation Plan (GTP) for 2010/11-2014/15	2010	GTP is a five-year medium-term plan for economic development and poverty reduction that builds on the PASDEP. GTP places a premium on agriculture and rural development, industry, infrastructure, social and human development, good governance, and democratization during the period it covers. The GTP establishes the following targets: <ul style="list-style-type: none"> • Achieve the Millennium Development Goals (MDGs) by 2014/15 by maintaining an annual average real GDP growth rate of 11%. • Ensure the quality of education and health services, and achieve the MDGs in the social sector. • Achieve sustainable nation-building by transforming the country into a stable, democratic, and progressive state. • Maintain a stable macroeconomy to ensure long-term growth. There is no specific reference to waste.
National Hygiene and Sanitation Strategic Action Plan for Rural, Peri-urban and Informal Settlements in Ethiopia	2011	This Action Plan is intended to serve as a guide for implementing the NHSS, covering from 2011 to 2015.
Solid Waste Management Manual: With Respect to Urban Plans, Sanitary Landfill Sites and Solid Waste Management Planning	2012	This manual was created to serve as a planning and implementation guide for administrative or private professionals working in the field of urban planning, especially urban environment. It also aims to increase the level of awareness among various waste management stakeholders (waste management organizations, residents, etc.). This manual provides sanitation practitioners, regional planners, and other relevant agencies involved in urban environmental protection with the services they need to conduct individual waste management studies. The Manual consists of the following seven chapters. <ul style="list-style-type: none"> • Chapter 1 (Introduction) • Chapter 2 (Policy and Legislative Framework for Solid Waste Management) summarizes Ethiopia's waste management laws and regulations as of 2012. • Chapter 3 (Basic Aspects of Solid Waste Management System) summarizes waste management statistics (waste generation rate, density, etc.) and provides an overview of each stage (primary storage, secondary storage, treatment, and disposal).

Policy/Plan	Year of Enactment	Summary
		<ul style="list-style-type: none"> • Chapter 4 (Phases in Assessment of Solid Wastes in Urban Plans) describes methods used to assess waste in urban plans. • Chapter 5 (Sanitary Landfill Site Selection Criteria, Methods and Closure) describes the methods used in each stage of final landfill site selection, from site selection to site closure. • Chapter 6 (Integrated Solid Waste Management Planning) describes the process for developing an integrated waste management plan. • Chapter 7 (Recommendations)
Urban Solid Waste Handling and Disposal Strategy, 2014	2014	<p>The Urban Development Policy was developed in 2014 as a means of implementing the aforementioned Urban Development Policy. Under this strategy, each city is required to develop a comprehensive waste management plan suited to their specific circumstances every five years. The following are the primary strategies.</p> <ul style="list-style-type: none"> • Increase urban capacity to treat and dispose of solid waste in a timely and dependable manner. • By establishing consensus, the general public, private sector, and government agencies can carry out their own joint missions for solid waste treatment and disposal. • Implement solid waste handling and disposal operations by encouraging SMEs to create jobs. • Improve the handling of gases released from solid waste landfills to achieve climate-resilient green economic development. • The city's role has been defined with the following goals: • Goal 1: Establish an efficient organizational structure and comprehensive legal framework for the sector in the city and region. • Goal 2: Strengthen the city's oversight, evaluation, and feedback systems by establishing an integrated solid waste management and leadership system. • Goal 3: Strengthen the sector's human resource development as well as its capacity for sustainable, constructive implementation. The sector is expected to create jobs for citizens. • Goal 4: Ensure that waste container locations, transfer points, and landfill boundaries are properly demarcated in city plans as appropriate, and that proper services are provided. • Goal 5: Establish systems for reducing waste from their output sources, waste sorting, and reuse. Establish systems for treating and disposing of hazardous waste. • Goal 6: Increase the area covered by solid waste collection and transport by increasing the use of modern technology in solid waste treatment, disposal systems, and service provision. • Goal 7: Raise public and stakeholder awareness of and participation in the sector to enable positive contributions from them. • Goal 8: Integrate systems for the registration, exchange, and utilization of solid waste at the federal government and local levels. • Goal 9: Ensure that revenues and funding for solid waste are sufficient and sustainable. • Goal 10: Increase adequate solid waste disposal to reduce greenhouse gas emissions by 1 million tons by 2024/25.
National Integrated Urban Sanitation and Hygiene Strategy, 2015	2015	<p>The strategy was developed with the support of UNICEF based on "Development of a national urban sanitation and hygiene strategy in Ethiopia." One of the strategy's goals is to "mitigate the negative impacts of poor urban sanitation on health, environment, society, education and the economy by implementing full sanitation systems for liquid and solid waste." The strategy includes the following objectives: "to reduce, recycle or reuse 50% of all solid waste generated in medium and large towns and cities by 2025 (interim target of 20% by 2020)"; "to dispose of 100% of the remaining solid waste in controlled tipping and sanitary landfill sites by 2030 (interim target of 50% by 2020)"; "to ensure safe disposal of 100% health care waste</p>

Policy/Plan	Year of Enactment	Summary
		from all health care facilities by 2025 (interim target of 95% by 2020)"; and, "to enforce safe treatment, reuse or disposal of industrial liquid and solid wastes to ensure ecosystem, agricultural and human protection from all industries by 2035 (interim target of 30% of all industries by 2020). Section "6.2 Service delivery for Solid Wastes, Faecal Sludge, Liquid Wastes and Industrial Wastes" describes the management and implementation methods that should be used at each stage (primary collection, secondary collection, etc.).
2nd Growth and Transformation Plan (GTP2) for 2016-2020	2016	Continuing after the above-mentioned GTP, GTP-2 is intended to serve as a medium-term development plan for the period 2016–2020. By increasing productivity in sectors such as agriculture and industry, the GTP-2 aims to achieve rapid, sustainable, and broad-based growth. GTP-2 sets the following objectives: <ul style="list-style-type: none"> • Achieve an annual average real GDP growth rate of 11% within a stable macroeconomic environment. • Develop the domestic engineering and fabrication capacity and improve productivity, quality, and competitiveness of the domestic productive sectors to speed up structural transformation. • Further solidify the ongoing public mobilization and organised participation. • Deepen the hegemony of developmental political economy by strengthening a stable democratic developmental state. Although there is no section dedicated to waste, "4.5. Urban Development and Housing" states that the waste collection and disposal coverage will be increased to 90%. Additionally, "5.6. Expanding Energy Infrastructure and Ensuring its Quality" states that at least 50% of energy should be generated from waste.
Ten Years Development Plan A Pathway to Prosperity 2021-2030	2021	This development plan is the continuation of GTP-2 discussed above and spans from 2021 to 2030. It is divided into 12 chapters, with "Chapter 5: Economic Sectors Development Plan" focusing on waste management (liquid and solid) and "Chapter 11: Environment and Climate Change" on environmental issues. "Chapter 5: Economic Sectors Development Plan" states "to raise the coverage of liquid waste removal from 1% to 50% and dry waste removal from 30% to 80% in towns with a population of over 20 thousand" by 2030. "Chapter 11: Environment and Climate Change" states that by 2030, the country's capacity to control greenhouse gases will be raised from 92.7 million metric tons (MT) (CO ₂ basis) to 162.3 million MT (CO ₂ basis). It also proposes increasing the country's forest coverage from 15.5% to 30% by 2030.

Source: Survey team, National Hygiene and Sanitation Strategy, National Hygiene and Sanitation Strategic Action Plan for Rural, Peri-urban and Informal Settlements in Ethiopia, Growth and Transformation Plan (GTP) for 2010/11–2014/15, Solid Waste Management Manual: with Respect to Urban Plans, Sanitary Landfill Sites and Solid Waste Management Planning, National Integrated Urban Sanitation and Hygiene Strategy, 2015, 2nd Growth and Transformation Plan (GTP-2) for 2016–2020, Ten Years Development Plan a Pathway to Prosperity 2021–2030, Research Report on Africa's Waste Management Sector Project (2010), Information Collection and Verification Survey for Municipal Solid Waste Management in Africa (2020)

4.2.3 Organizations Structure for Solid Waste Management

Previously, solid waste management in Ethiopia was handled by the Urban Climate Resilient Bureau within the Ministry of Urban Development, Housing and Construction (MoUDHC). The Resilient Solid Waste Management Directorate and the Climate Resilient Urban Green Development and Beautification Directorate were responsible for waste management in Ethiopia. However, following a recent reorganization, Ethiopia's Ministry of Urban Development and Construction (MoUDC) is now the lead agency responsible for waste management. The department in charge is the Solid Waste Support and Follow-up Directorate within the Urban Climate Resilience and Environmental Bureau.

4.3 Solid Waste Management in Addis Ababa

4.3.1 Organizations and Finance related to Solid Waste Management Organization

In the past, Addis Ababa's solid waste management was handled by a variety of departments, including the Addis Ababa Cleanness Administration Agency and the Addis Ababa Solid Waste Recycling and Disposal Project Office. Proclamation No. 58/2018 prompted the reorganization of these organizations. Currently, the Addis Ababa Solid Waste Management Agency is responsible for solid waste management in the city. The Addis Ababa Solid Waste Management Agency is responsible mainly for the following tasks as specified in Proclamation No. 58/2018:

- Waste management shall be managed both directly and indirectly.
- Conduct waste management education and awareness activities at various levels.
- Set up and implement a rapid and efficient waste retention, collection, transport, and disposal system that takes into account the population's health risks and environmental pollution.
- Implement waste management in accordance with plans and ordinances established by the city.
- Conduct municipal waste management surveys and share the findings with organizations engaged in municipal waste management.
- Introduce systems that will reduce waste generation.
- Manage waste service fees as approved by the city. Service fees may be collected directly or through outsourcing.

The Addis Ababa Solid Waste Management Agency maintains offices in each sub-city and woreda (Sub-city Solid Waste Management Office and Woreda Solid Waste Management Office), and both offices are responsible for supervising private contractors handling waste transport etc. (private contractors are contracted by Addis Ababa Solid Waste Management Agency headquarters).

The following table summarizes revenue and expenditures for waste management in Addis Ababa from 2016 to 2020.

Table 4-7 Revenue and Expenditures for Solid Waste Management in Addis Ababa

Year	2016	2017	2018	2019	2020
Income	305,197,184 ETB	560,771,334 ETB	527,407,406 ETB	670,979,090 ETB	752,134,631 ETB
Expenditures	182,127,372 ETB	340,887,960 ETB	459,379,800 ETB	661,284,944 ETB	752,136,631 ETB

Source: Prepared by the survey team based on interviews with the Addis Ababa Solid Waste Management Agency

In Addis Ababa, waste collection service fees are collected together with water fees, and are calculated as a percentage of water fees. (Residential: 20%; Commercial: 42.5%)

4.3.2 Ordinances and Policies related to Solid Waste Management

Table 4-8 summarizes Addis Ababa ordinances and policies related to solid waste management and the environment.

Table 4-8 Ordinances and Policies in Addis Ababa

Ordinance/Policy	Year of Enactment	Summary
Addis Ababa Solid Waste Management Policy	2002	<p>The policy's objectives are to promote recycling and waste reduction, to provide education on waste and the environment, to engage all stakeholders, and to ensure that waste is collected on a regular basis and properly disposed of by citizens. The following are the major sections.</p> <ul style="list-style-type: none"> • Matters related to emission sources, waste classification, treatment, and disposal • Matters related to collection, transport, disposal, re-use, and recycling of waste • Matters related to data management, follow-up and evaluation, research studies, and environmental assessments • Matters related to the role of government and the private sector, NGOs, community participation, and research institutions, etc. • Financial matters • Matters related to environmental education • Organizational matters • Legal and regulatory matters
Solid Waste Handling and Disposal Regulation No. 13/2004	2004	<p>This is a municipal waste management regulation that went into effect following the adoption of the Addis Ababa Municipal Charter. The following are the major sections. This Regulation consists of the following nine parts.</p> <ul style="list-style-type: none"> • Part 1: This part contains the Regulation title and text definitions. • Part 2: Management and collection of solid waste • Part 3: Management and disposal of solid waste from selected facilities • Part 4: Waste transfer stations and landfill sites • Part 5: Provisions regarding the supply of private sanitation services • Part 6: Sanitation services for liquid waste • Part 7: Authority and roles of relevant organizations • Part 8: Special provisions • Part 9: Penalties, additional provisions, etc.
The Addis Ababa City Government Executive and Municipal Service Organs Re-establishment Proclamation No. 35/2012	2012	<p>This is a Proclamation on establishing an organization in Addis Ababa. Among the organizations mentioned in the proclamations are the Addis Ababa Solid Waste Recycling and Disposal Project Office which was previously in charge of waste management in the city, and the Addis Ababa Cleanness Administration Agency. This Proclamation has been revised by Proclamation No. 58/2018 from 2018.</p>
Prevention and Control of Code Violation No. 54/2012	2012	<p>This Code establishes the procedures for preventing and enforcing Code violations, as well as the organizational structure and operating procedures for the municipal government's Code Enforcement Service Office. Although the Code does not address waste specifically, it does state that it controls illegal activities that include waste generated by households, businesses, industries, offices, street sweeping, construction, agriculture, and quarries, as well as general waste generated by society and animal activities.</p>
A Proclamation for the Re-amendment of the Addis Ababa City Government Executive and Municipal Service Organs Re-establishment Proclamation No. 58/2018	2018	<p>This Proclamation follows the revision of the above-mentioned Proclamation No. 35/2012. Pursuant to this Proclamation, the Recycling and Disposal Project Office etc. that had previously managed municipal waste have been decommissioned and integrated into the Addis Ababa Solid Waste Management Agency. This proclamation outlines the powers and responsibilities of the Addis Ababa Solid Waste Management Agency, including the ones mentioned above.</p>

Ordinance/Policy	Year of Enactment	Summary
Addis Ababa City Government Revised Integrated Solid Waste Management Regulation No. 100/2018	2018	As a revision of Regulation No. 13/2004, this Regulation consists of the following parts: (1) General Provisions, (2) Two Handling, Separation, Transportation, Reusing, Recycling and Disposal of Solid Wastes, (3) Solid Waste Disposal, (4) Utilization and Management of Dustbins Cans for Small Solid Wastes, (5) Waste Management of Cleaning Service Providing Associations/Organizations, (6) Management and Disposal of Solid Wastes Generated from Various Places, (7) Management and Disposal of Hazardous Waste, (8) Deciding Cleaning of Various Places and a Permanent Sanitary Day, (9) Using Safety Protection and Creating Awareness, (10) Obligations for Organizations Engaged in Solid Waste Cleaning Service, (11) Power and Duties of the Agency and Other Organs, (12) Incentives and Service Charges, (13) Administrative Penalty and Measure, and (14) Miscellaneous Provisions.

Source: Survey team, a Proclamation for the Re-amendment of the Addis Ababa City Government Executive and Municipal Service Organs Re-establishment Proclamation No. 58/2018, Addis Ababa City Government Revised Integrated Solid Waste Management Regulation No. 100/2018, Research Report on Africa's Waste Management Sector Project (2010), Information Collection and Verification Survey for Municipal Solid Waste Management in Africa (2020)

The "Addis Ababa City Administration Solid Waste Management Agency 2013 - 2022 Finote Prosperity Plan (AASWMA Plan 2013–2022)" was developed in 2013 as a waste management plan for Addis Ababa. This plan lists 14 objectives, each with its specific indicators. As an example, Table 4-9 shows the indicators for one of the objectives, "Increase the service population for waste collection and transport."

Table 4-9 Collection Volume Specified in the AASWMA Plan 2013–2022

Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Annual collection volume (tons)	770,285	796,213	822,000	848,309	830,486	856,135	881,479	912,065	945,485	980,745

Source: Addis Ababa City Administration Solid Waste Management Agency 2013 - 2022 Finote Prosperity Plan

4.3.3 Overview of Solid Waste Management

Table 4-10 shows the per capita waste generation, projected population, and waste generation in Addis Ababa. In 2020, Addis Ababa commissioned a consultant (Global Environmental Solution, Inc.) to survey per capita waste generation, including waste composition. The survey found that the average waste generation per household is 0.48 kg/capita/day, although this varies by household income and sub-city. (High income: 0.55 kg/capita/day, middle income: 0.47 kg/capita/day, low income: 0.42 kg/capita/day, Addis Ketema district: 0.72 kg/capita/day (highest district), Arada district: 0.32 kg/capita/day (lowest district)). Additionally, the waste collection rate was approximately 75% in 2018 (see ACCP Data Book).

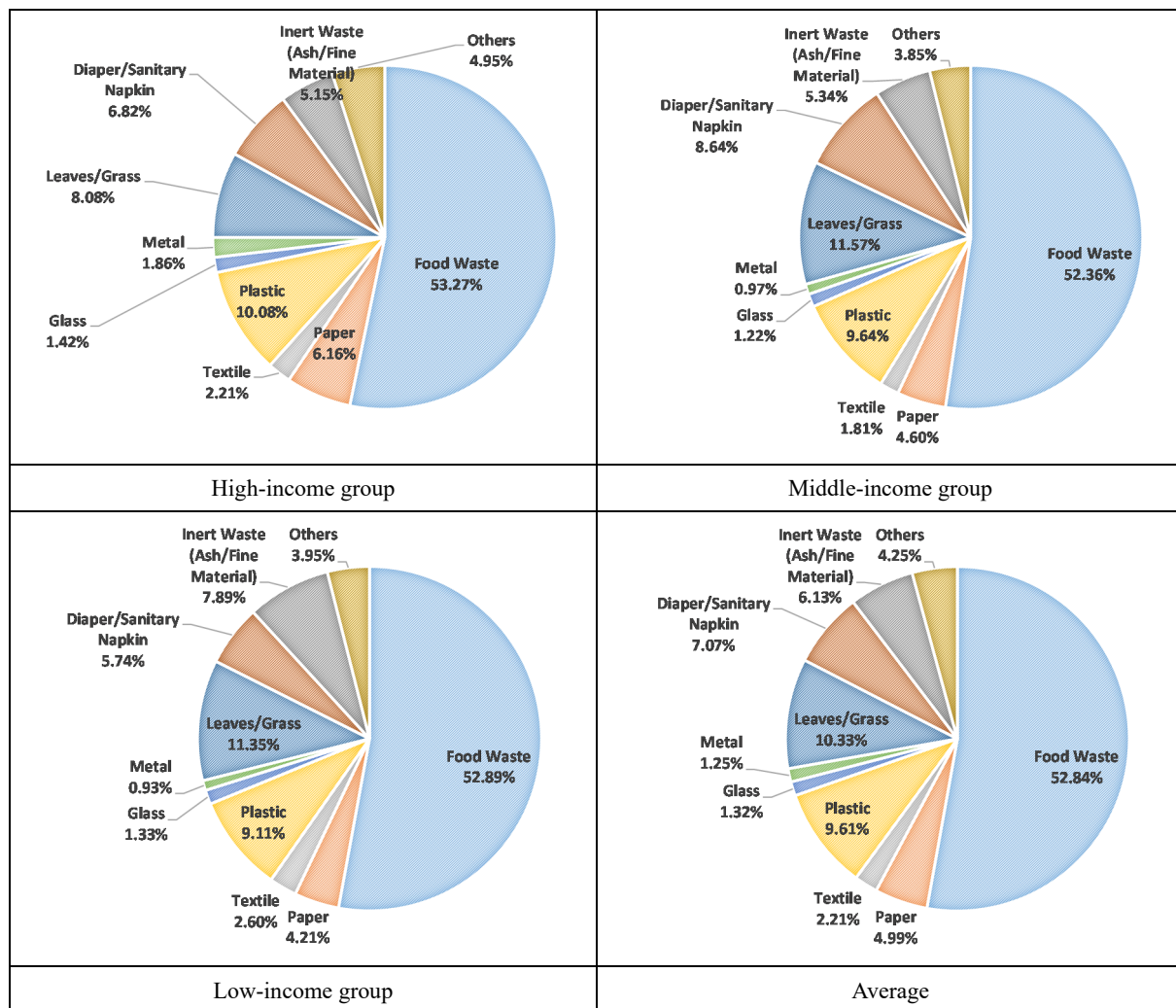
Table 4-10 Residential per Capita Solid Waste Generation Rate and Waste Volume in Addis Ababa

	2019	2020
Residential per capita solid waste generation rate	0.48 kg/capita/day	0.48 kg/capita/day
Projected Population of Addis Ababa (from Table 4-2)	4,591,983	4,793,699
Residential waste generated	2,204 tons/day	2,301 tons/day

Source: Municipal Solid Waste Generation Rate and Characterization Study of Addis Ababa City (November, 2020)

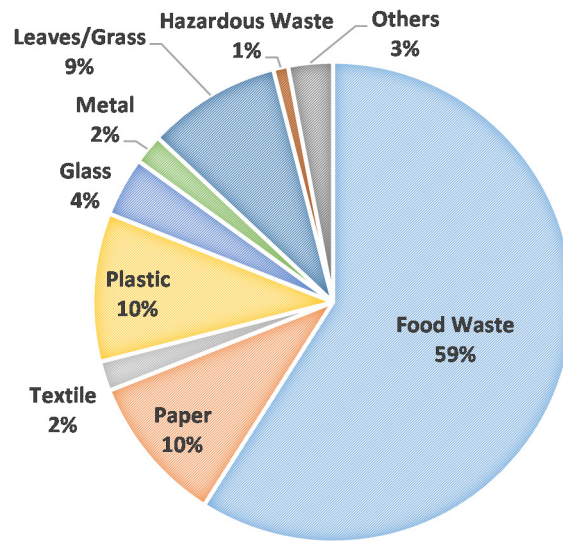
According to the calculations in Figure 4-10, the amount of general waste generated each day including household and business waste is estimated at 3,441 tons. Based on this, the amount of business waste generated each day can be estimated at 1,140 tons (=3,441 tons/day - 2,301 tons/day). These results indicate that the ratio of household to commercial waste in Addis Ababa is roughly 2:1.

The aforementioned consultant-led survey commissioned by the city in 2020 also included a survey of waste composition at the source (i.e., household and business waste). Figure 4-7 shows the composition of household waste, while Figure 4-8 shows the composition of commercial waste. According to the survey, household and commercial waste contain respectively 74.3% and 76.2% moisture content, indicating that both types of waste contain a significant amount of moisture.



Source: Municipal Solid Waste Generation Rate and Characterization Study of Addis Ababa City (November, 2020)

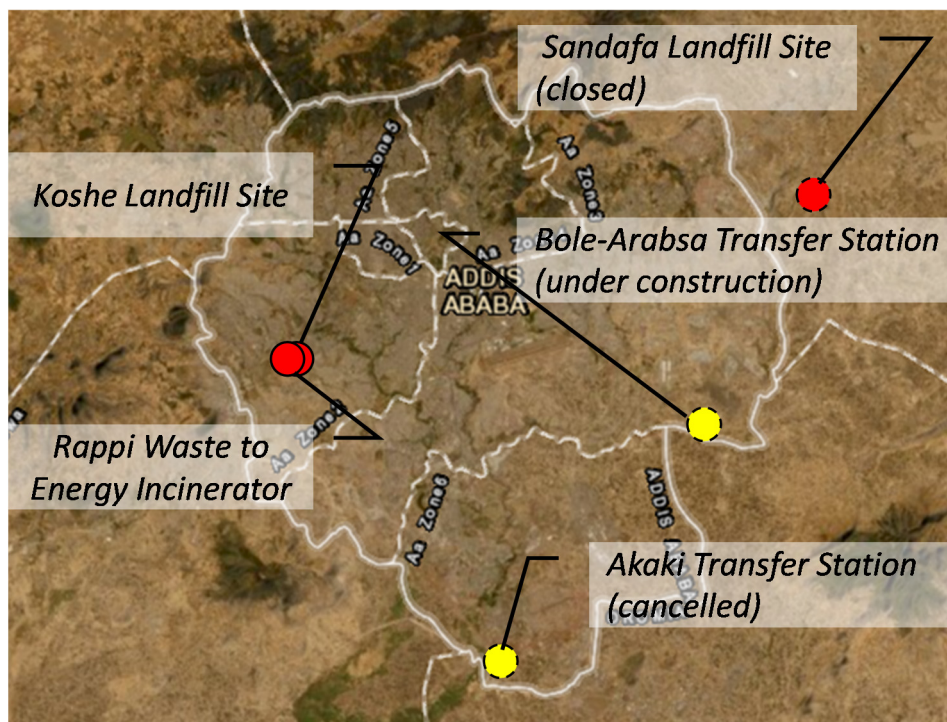
Figure 4-7 Composition of Household Waste (2020)



Source: Municipal Solid Waste Generation Rate and Characterization Study of Addis Ababa City (November, 2020)

Figure 4-8 Composition of Commercial Waste (2020)

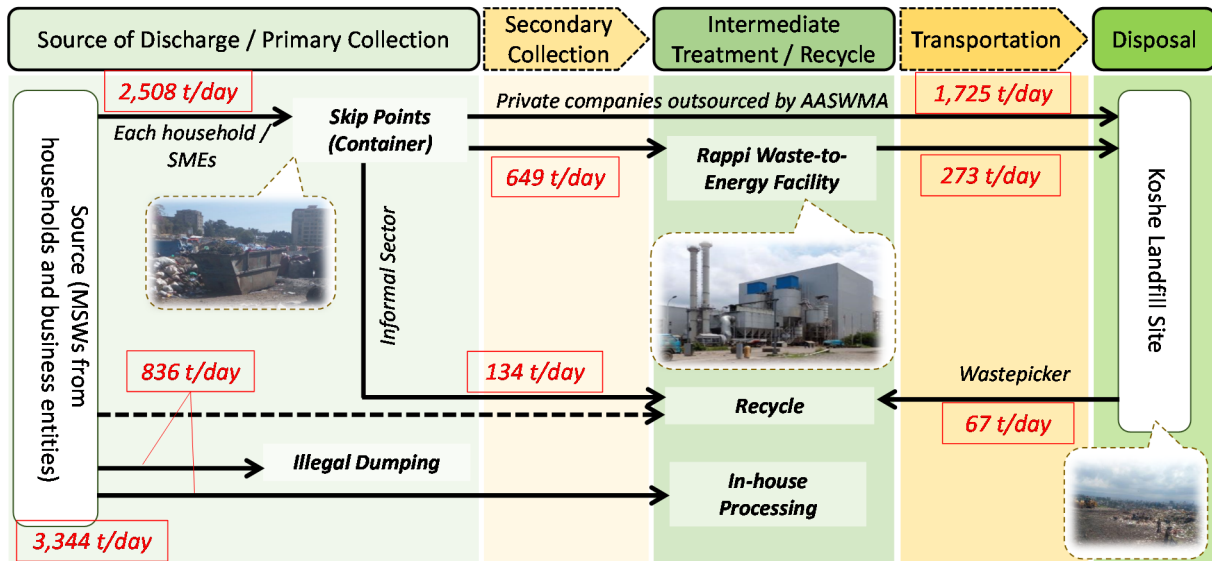
Figure 4-9 shows a map of the current locations of waste-related facilities in Addis Ababa.



Source: Prepared by the survey team based on data from the Addis Ababa Solid Waste Management Agency

Figure 4-9 Solid Waste Management Facilities in Addis Ababa

Figure 4-10 shows the flow of waste in Addis Ababa.



Source: Prepared by survey team

Figure 4-10 Flow of Waste in Addis Ababa

The process used to calculate the figure above is shown below.

- Amount transported directly from skip point to landfill site: 2,374 (surveyed transport volume) tons/day
*Average value from results of the August 2021 transport volume survey in "amount transported directly from skip points to landfill site."
- Amount transported from skip point to the Waste-to-Energy facility: 649 tons/day (surveyed transport volume)
*Average value from results of the August 2021 transport volume survey in "amount transported directly from skip location to the Waste-to-Energy facility."
- Amount transported from the Waste-to-Energy facility to landfill site: 273 tons/day (AASWMA)
* According to AASWMA interviews, 238 tons of bottom ash and 35 tons of fly ash are transported to the landfill site each day (totaling 273 tons of ash incinerated per day).
- Amount of waste generated: 3,344 tons/day; Amount of waste from source and skip point that is recycled: 134 tons/day; Amount recycled at landfill site: 67 tons/day
* Based on a waste collection rate of 75% (see 4.3.4 (1)), and Addis Ababa as a whole has a recycling rate of 6% (6% breaks down into 4% from skip points and 2% from landfill site) (see 4.3.5 (2)). Assuming that recycling at the source is insignificant compared to recycling at the skip point, the "Amount of waste generated" and "Amount recycled" are each calculated as shown above.
- Amount recycled from landfill site: 142 tons/day
* Amount recycled from the landfill site is set to 6.3% of the waste (excluding incinerated ash) transported to the landfill site.
- Total amount of illegal dumped and self-disposed waste (un-managed waste): 861 tons/day
* "Total amount of illegal dumped and self-disposed waste" is defined as the sum of the "Amount of waste generated" minus the "Amount transported to landfill site" and "Amount recycled." Based on information from the interview survey, there is little self-disposed waste in Addis Ababa (including open burning), and illegal dumping accounts for a large proportion of the total.

4.3.4 Current State of Collection and Transportation

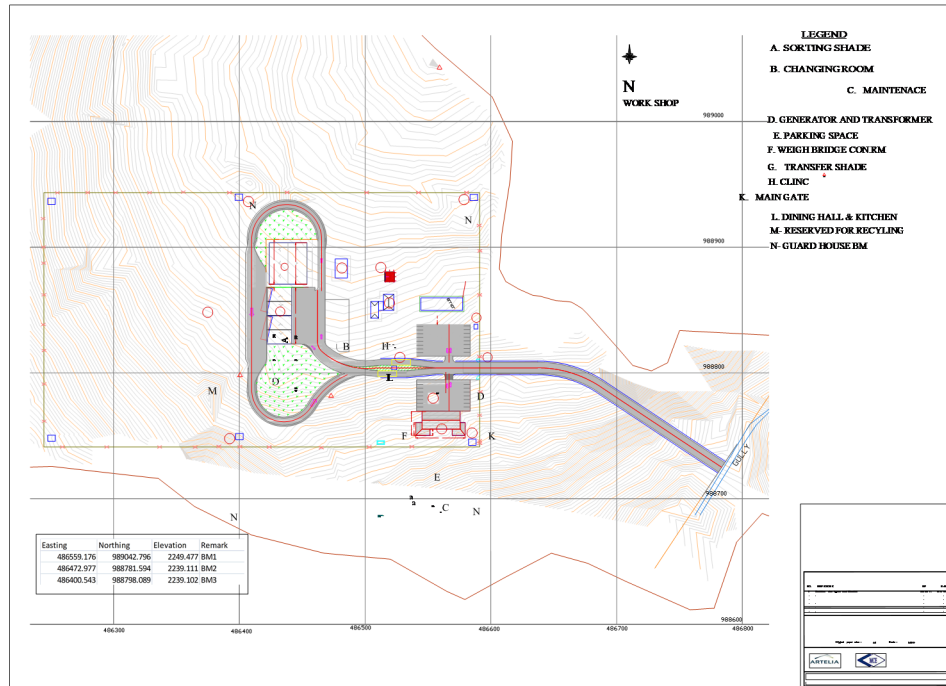
(1) Primary Collection and Storage

Primary collection (households and small-scale contractors) in Addis Ababa is primarily conducted door-to-door (around 2–3 times per week) by collectors employed by SMEs or the informal sector. According to the city, there are approximately 80 SMEs and 8,000 collectors employed by the SMEs and informal sector combined. However, the city is not aware of the exact number of people, etc. Addis Ababa is divided into roughly 550 districts (each district consists of about 800 to 1,000 households), and SMEs are assigned to each district. Each district's assigned SMEs collect garbage from around 600 to 1,050 households every day. Collectors primarily use pushcarts (wheelbarrows) to collect garbage, which is then transported to "skip points" where containers (8 m³) are placed (some garbage is illegally dumped on the side of the road). The collection rate is roughly 75%. The Addis Ababa Solid Waste Management Agency manages skip points in the ten sub-cities and woredas of Addis Ababa. According to reports, the city has hundreds of skip points, which are contributors to foul odors and rodent infestation. As a result, the city has implemented a policy to reduce the number of skip points by building large transfer stations. Currently, the informal sector and SMEs are separating mixed waste at several skip points. In addition, waste of a certain size from commercial facilities is collected and transported to the Koshe Landfill Site by private contractors, of which there are roughly 53 that are larger in scale than SMEs.



Source: Photos courtesy of local staff

Initially, the city had planned to build two large transfer stations in the city, one in Bole-Arabsa and the other in Akaki, but the plan to build the relay point in Akaki was abandoned due to resident opposition. The Bole-Arabsa relay facility is currently being built. Judging from Figure 4-11, the facility will include a sorting yard, maintenance area, and transloading area, as well as a cafeteria and clinic.



Source: Obtained via interviews

Figure 4-11 Design Drawing of Bole-Arabsa Transfer Station

(2) Secondary Collection and Relay Transport

Secondary collection and relay transportation are primarily contracted out to a private contractor by the Addis Ababa Solid Waste Management Agency (Addis Ababa Solid Waste Management Agency's Sub-City and Woreda offices supervise private contractors). Waste collected at skip points are transported to the Waste-to-Energy facility in Koshe (Rappi) or to the existing landfill site. Each piece of equipment is assigned a specific task, such as transporting waste to the incineration plant or landfill site. The former is for transporting high-calorie waste that has been partially sorted at skip points, whereas the latter is for transporting miscellaneous waste. Daily operations include the operation of 80 m³ compactors (19 units), 40 m³ compactors (25 units), and skip loaders for 8 m³ containers (85 units). Although the Addis Ababa Solid Waste Management Agency owns this equipment, it is leased to several private contractors since operations are conducted under private contract (previously, Addis Ababa Solid Waste Management Agency directly handled relay transport). According to the city, garbage collected in the skip loader is collected within 24 hours. Because Addis Ababa Solid Waste Management Agency's equipment has been in use for over a decade, it often breaks down despite routine maintenance and management.

	
<p style="text-align: center;">Photo of secondary collection and relay transport</p>	<p style="text-align: center;">Photo of secondary collection and relay transport</p>

Source: Photos courtesy of local staff

(3) Illegal Dumping

Illegal dumping of waste into open spaces, ditches, and rivers has become a problem in Addis Ababa as a result of factors that include insufficient waste collection systems, and a lack of resident awareness. Also, residents frequently dump illegally in areas difficult to access. This type of illegal dumping is causing serious health issues.

	
<p style="text-align: center;">Illegal dumping in rivers</p>	<p style="text-align: center;">Illegal dumping under bridges</p>

Source: Photos courtesy of local staff

(4) Road Sweeping

The city employs street sweepers to collect litter along roads and gutters. Trash is collected and stored in nearby garbage cans or containers using hand carts.

4.3.5 Current State of Intermediate Treatment / Recycling

In Addis Ababa, intermediate treatment includes treatment at the Waste-to-Energy facility as well as recycling by private contractors. Some households are reported to be self-sufficient in terms of waste disposal, but their number is insignificant.

(1) Waste-to-Energy Facility

The Rappi Waste-to-Energy Facility was constructed to coexist with the Koshe Landfill Site. Construction began in 2014 and was completed in 2018. It was built as a joint venture between China's China National Electric Engineering Co. (CNEEC) and the United Kingdom's Cambridge Industries Ltd. (Denmark's Ramboll served as consultants). Table 4-11 shows that specifications at the time the facility was planned were to generate 50 MW of electricity from 1,400 tons of waste per day (for which the city was responsible for providing). However, as shown in Figure 4-12, 1,400 tons of waste per day are not provided, and only 300 to 950 tons of waste are delivered per day. As a result, only about 25 MW is generated in reality versus the planned 50 MW. This is because the waste composition in Addis Ababa is different from the original projection, and high-calorie waste suitable for incineration has not been transported to the facility¹⁷.

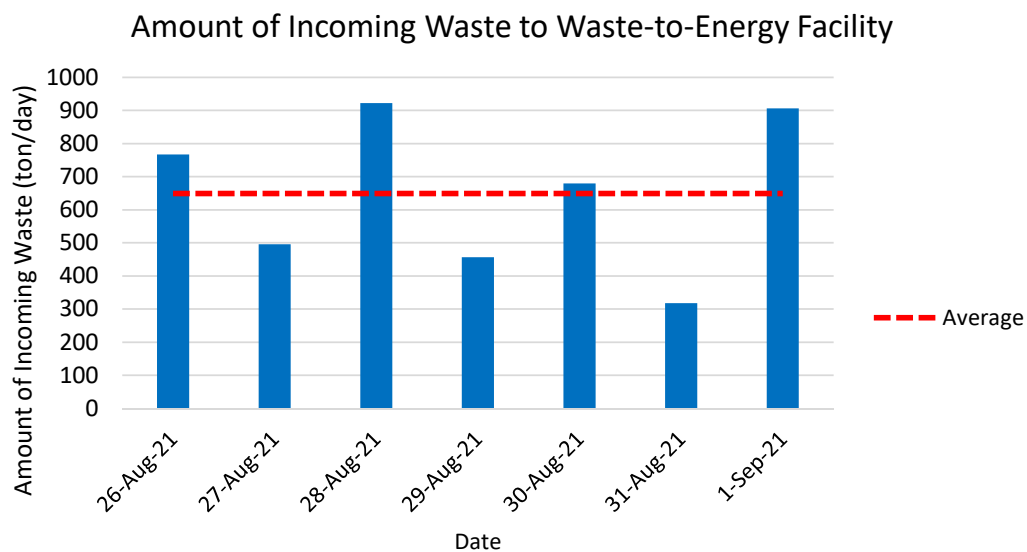
Furthermore, the city is responsible for the disposal of fly ash and bottom ash from the facility, but this is not being properly carried out. While the bottom ash is used to cover the soil at the landfill site, the fly ash is simply being dumped in a pit dug at the landfill site. There are no laws or regulations in Ethiopia governing the disposal of incinerator ash. Also, as shown in Table 4-6, the government has established Guidelines for Ethiopian Ambient Environmental Standards. The emission limits are also set as shown in Table 4-12, but it is unclear whether the standards are actually monitored or followed.

Table 4-11 Rappi Waste-to-Energy Facility

	Summary
Location	Western Addis Ababa (constructed to coexist with the Koshe Landfill Site)
Operating entity	Ethiopian Electric Power (EEP)
Operating Hours	24 hours a day, 6 days a week
Processing volume	2,500 tons/day
Generation capacity	50 MW (actual power generation is around 25 MW)
Initial cost	125 million USD
Operating cost	800 million ETB/year
Tipping Fee	0.02 cent/kg
Feed in Tariff (FIT)	FIT is not imposed since EEP operates all aspects of energy generation and distribution.
City responsibilities	Provide 1,400 tons of waste per day, and dispose of fly ash and bottom ash (FABA)

Source: Prepared by survey team based on questionnaire survey

¹⁷ Why Repie waste to Energy Project failed, Fraol Alemu (2019)



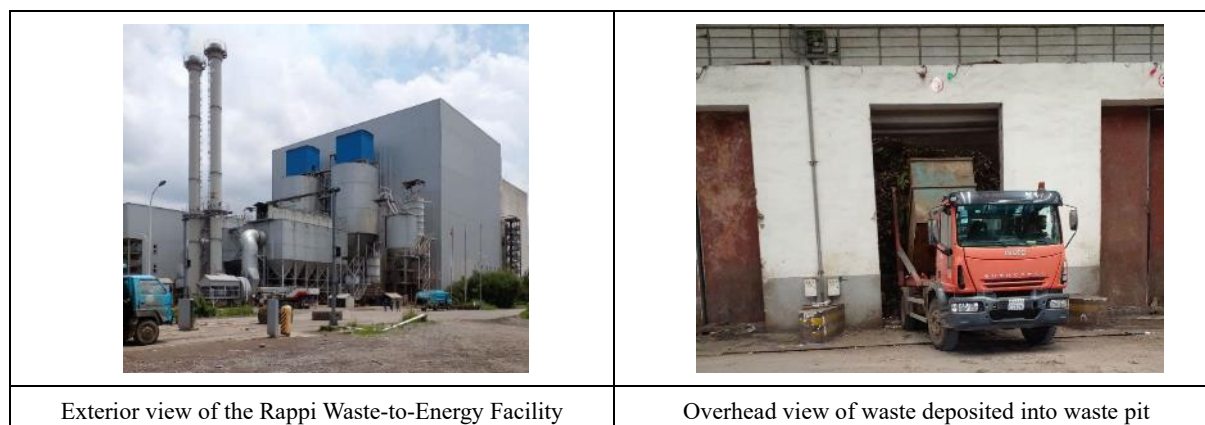
Source: Prepared by survey team based on survey by local staff

Figure 4-12 Results of Survey of Waste Transport Volume to Rappi Waste-to-Energy Facility





Table 4-12 Environmental Standards for Emission Gas in Ethiopia

Regulated substances		Baseline	Average time
Sulfate Dioxide (SO ₂)		500 µg/m ³	10 min
		125 µg/m ³	24 hrs
		50 µg/m ³	1 year
Nitrogen Dioxide (NO ₂)		200 µg/m ³	1 hr
		40 µg/m ³	1 year
Carbon Monoxide (CO)		100,000µg/m ³	15 min
		60,000µg/m ³	30 min
		30,000µg/m ³	1 hr
		10,000µg/m ³	8 hrs
Ozone (O ₃)		120 µg/m ³	8 hrs
Suspended Particulate Matter (SPM)	PM ₁₀	50 µg/m ³	1 year
		150 µg/m ³	24 hrs
	PM _{2.5}	15 µg/m ³	1 year
		65 µg/m ³	24 hrs
Lead (Pb)		0.5 µg/m ³	1 year

Source: Guidelines Ambient Environmental Standards for Ethiopia, 2004



Source: Photos courtesy of local staff

	
<p style="text-align: center;">Exterior view of the Rappi Waste-to-Energy Facility</p>	<p style="text-align: center;">Weighbridge for monitoring disposal/processing volume</p>
	
<p style="text-align: center;">Overhead view of waste pit</p>	<p style="text-align: center;">View of the control room</p>

Source: <https://www.africawte.com/about.html>

(2) Recycling by Private Contractors

In Addis Ababa, recycling is carried out by private contractors. Private contractors primarily collect and recycle plastic and paper waste, etc. from waste collectors. The recycling rate in Addis Ababa is estimated to be around 5% of total waste generated (2014). In an interview with the Addis Ababa Solid Waste Management Agency, the recycling rate was reported to be 6%. The following is a summary of the interviews and surveys conducted with private recycling contractors.¹⁸

1) Huyang Plastic Recycling company

The company was founded in 2012 as a private plastic recycling company. It accepts roughly 20 tons of waste/day and converts it into plastic flakes through a sorting, washing, and crushing process. The plastic flakes it produces are exported to the United States. According to the person in charge, sorting the mixed waste received is problematic because it has not been sorted out the source.

2) Penda Paper

Penda Paper recycles paper waste through a network of 7,000 collectors (established in 2015) Collected waste

¹⁸ U.S. Environmental Protection Agency (February 25, 2015)

is transported to a sorting facility in Akaki Kality owned by the contractor, where it is sorted by type, such as cardboard. The separated paper waste is recycled into pulp, which is used to produce paper. The pulp they generate is generally used in local paper mills.

In 2018, the company started a system to collect additional paper waste from households and small businesses by utilizing roughly 40 bicycles equipped with attached carts. These collection bicycles, called "Worke," travel throughout the city collecting waste. (The company purchases paper waste at 2 ETB/kg).

		
Recycling materials	Storage of products for export	Products for export

Source: Photos courtesy of local staff

Due to a lack of equipment, technology, and experience, only a few companies, including the affirmation Penda Paper and Suzo Industry, are able to recycle paper waste in Ethiopia.

3) Compost Small Enterprise

Each sub-city has SMEs etc. engaged in compost production, and in 2020, the entire city of Addis Ababa produced 1,015 tons of compost per year.

In 2020, an SME with 7 employees established in the Bole sub-city produced 1,500 kg/year of compost, which was used for fertilizing roadside trees.

	
Compost being produced	Produced compost

Source: Photos courtesy of local staff

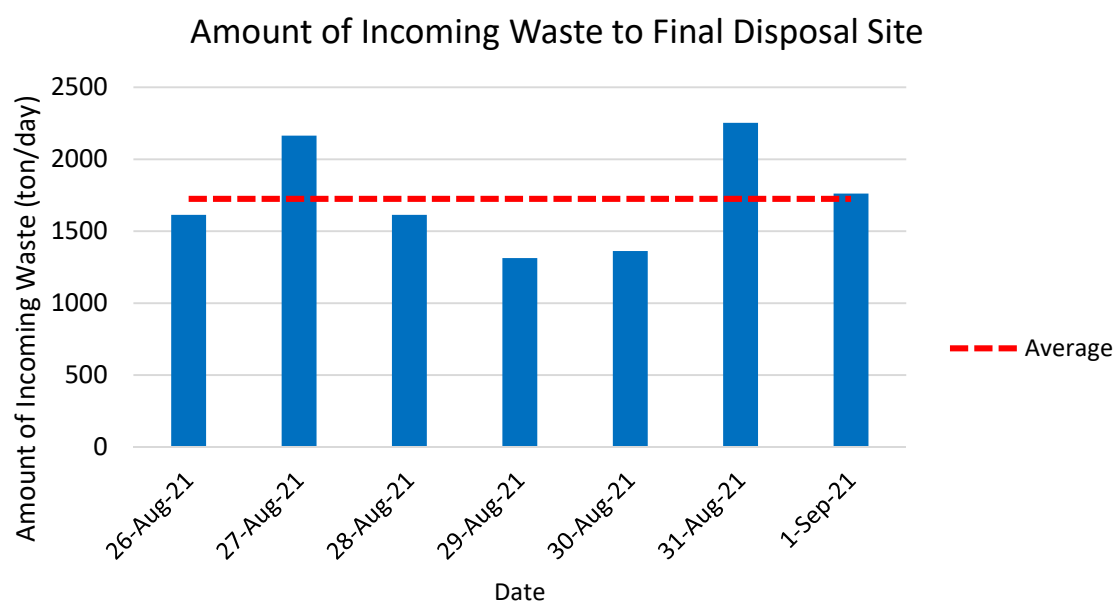
4.3.6 Current State of Landfill Site

The Koshe landfill site is the only landfill in operation as of July 2021 (25 ha) and has been used since 1968 as an open dumping landfill (no weighbridges, fences, leachate treatment facilities, etc.) with no covering. As the Koshe landfill site is almost full, the Sandafa landfill site, built with the support of the Agence Française de Développement (AFD), has been in use since December 2016. However, problems with leaks from leachate reservoirs and odors during the rainy season led to opposition by nearby residents, and in June 2017 the Sandafa landfill site was forced to close. Therefore, it was decided to reuse the Koshe landfill site, which had been taken out of service for the operation of the Sandafa landfill site. At the Koshe landfill site, a 50-meter-high refuse pile collapsed in March 2017, killing 200 people, including waste pickers and nearby residents. The waste pickers blame the collapse on the start of construction of the adjacent Rappi Waste-to-Energy facility. However, since there was no other facility to accept waste other than the Koshe landfill site, this landfill site is still in use today. A portion of the 37 ha Koshe landfill is used as the site of the Rappi Waste-to-Energy facility. Of the remaining landfill site, 19 ha has already been closed by AFD under an appropriate closure project, and the remaining 7 ha are currently being used for the landfill site. The appropriate closure project also included the installation of gas vent pipes and other equipment. For the 7 ha currently in use, the Japanese government, in collaboration with UN-Habitat, supported the introduction of the Fukuoka method (semi-aerobic landfill structure) as an Emergency Support Project for Urban Waste Management in Ethiopia (about 2.4 million USD) from April 2018 to prevent further collapse accidents. The project included not only the construction of construction delivery roads, slope forming with a stable slope, gas venting pipes, installation of a snake basin at the bottom, and a simple leachate treatment facility, but also support for intangible elements such as on-site training for waste pickers and site personnel. Currently, a greening project is also underway at the Koshe landfill site in preparation for a future eco-park concept. (30,000 seeds have already been planted.) Originally, there were two leachate treatment facilities, but currently only one is in use, and the leachate after treatment (aeration) is discharged into a nearby stream. Although the surface water regulation values are specified in the Guidelines Ambient Environmental Standards for Ethiopia, there is no laboratory or other facility for testing constituents at the landfill site. Leachate after treatment must be tested to confirm that it is harmless before being discharged, but in reality, this has not been carried out, according to the report. It has also been reported that compost production is taking place at the Koshe landfill and that some waste pickers are employed. An overview of the current Koshe landfill is shown in Table 4-13. Figure 4-13 shows the results of the one-week survey of volume brought in conducted for this study. The average volume brought in was approximately 1,725 tons/day.

Table 4-13 Koshe (Rappi) Landfill Site Overview







	Overview
Location	Western part of Addis Ababa city (in Kolfe Keranio Sub-City)
Area	Of the total 37 ha, a portion is used for the Rappi Waste-to-Energy Facility, and 19 ha has already been closed by AFD's Koshe landfill appropriate closure project. 7 ha is used as a landfill.
Remaining life	2 years
Operating hours	24 hours a day, 7 days a week
Processing capacity	Approximately 2,500 tons/day (average of the amount brought in: approximately 1,725 tons/day)
Incinerated ash discharge	Main ash: 86,886 tons/year (238 tons/day) (2020) Fly ash: 12,729 tons/year (35 tons/day) (2020)
Number of workers	109
Type	Semi-aerobic landfill (Fukuoka Method)
Facilities	Landfill, leachate reservoir, simple leachate treatment facility (aeration treatment), weighbridge (shared with the waste incineration and power generation facility located next to the site)
Landfill	Soil cover (main ash from waste incineration and power generation facilities is used as soil cover), leachate collection and drainage pipes
Landfill equipment	Dump trucks: 2 (operating 7 days a week) Excavator: 1 unit (operating 7 days a week) Bulldozers: 2 units (operating 7 days a week) Landfill compactors: 4 units (operating 7 days a week)
Tipping Fee	0.02 cent/kg
Waste picker	More than 1,500 waste pickers are active.

Source: Prepared by survey team based on questionnaire survey and essay (Eshetu Gelan, 2021)



Source: Prepared by the survey team based on research by local employees

Figure 4-13 Results on Incoming Waste Survey at Koshe (Rappi) Landfill Site

	
<p>View of Koshe landfill site</p>	<p>Waste pickers in action at the Koshe landfill site</p>
	
<p>Leachate storage area</p>	<p>Signage at Koshe landfill site</p>
	
<p>Koshe landfill site utilization plan (eco park)</p>	<p>Sandafa landfill site</p>

Source: Photo by local employees

4.3.7 Activities by Other Donors

The activities of other donors in the city of Addis Ababa are as follows.

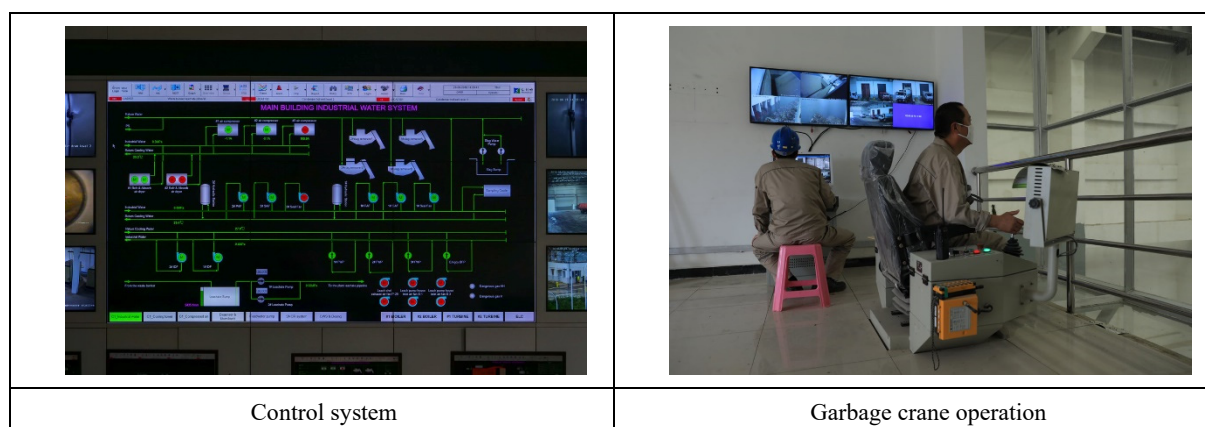
- The AFD (Agence Française de Développement), in collaboration with the city of Addis Ababa, has been implementing the project “Rehabilitating the Addis Ababa Landfill to Improve the Urban Environment (5,400,000 EURO, free of charge)” since June 25, 2010. The project includes the appropriate closure of the Koshe landfill, technical review and development of a 20-year waste management plan, and detailed design and construction supervision of a new disposal facility and relay facilities (two facilities). As for the appropriate closure of the Koshe landfill, 19 ha have already been closed.
- UN-Habitat, in cooperation with the Government of Japan, supported the introduction of the Fukuoka method (semi-aerobic landfill structure) at the Koshe landfill in 2018 to 2019 as part of the Emergency

Support Project for Urban Waste Management in Ethiopia (project budget: USD 2.3 million). The project included not only the construction of construction delivery roads, slope forming with a stable slope, gas venting pipes, installation of a snake basin at the bottom, and a simple leachate treatment facility, but also support for intangible elements such as on-site training for waste pickers and site personnel.

- UN-Habitat has set up emergency hand-washing stations, provided soap and encouraged hand-washing to prevent the spread of the coronavirus at the Koshe landfill.

4.3.8 Status of Initiatives related to DX

In the city of Addis Ababa, one of the initiatives related to DX is the disposal of waste through waste incineration power generation. The case of DX at the Reppi waste incineration and power generation facility is an advanced example among African countries, not only for the waste incineration system, but also for the overall facility system that controls such a system and the operation of the waste crane.



Source: <https://www.africawte.com/about.html>

4.3.9 Status of Monitoring on SDGs' waste-related Indicators

The status of monitoring on waste-related indicators (11.6.1, 12.3.1, 12.4.2, 12.5.1 and 14.1.1) of the SDG targets is shown in the following table.

Table 4-14 Status of Monitoring on SDGs' waste-related Indicators (Addis Ababa)

SDGs Indicators		Current State
11.6.1	Proportion of urban solid waste regularly collected and with adequate final discharge out of total urban solid waste generated, by cities	Of the total municipal solid waste generated in the city of Addis Ababa, the percentage of municipal solid waste collected and processed in controlled facilities is 75%.
12.3.1	a) Food loss index, and b) Food waste index	There are currently no laws, policies, or initiatives in place to reduce food and other organic waste.
12.4.2	(a) Hazardous waste generated per capita; and (b) proportion of hazardous waste treated, by type of treatment	Ethiopia is a signatory to the Basel Convention. No data on the amount of hazardous waste generated or collected has been identified.
12.5.1	National recycling rate, tons of material recycled	The city of Addis Ababa is estimated to recycle 348 tons/day, which is equivalent to 10% of its general waste generation.

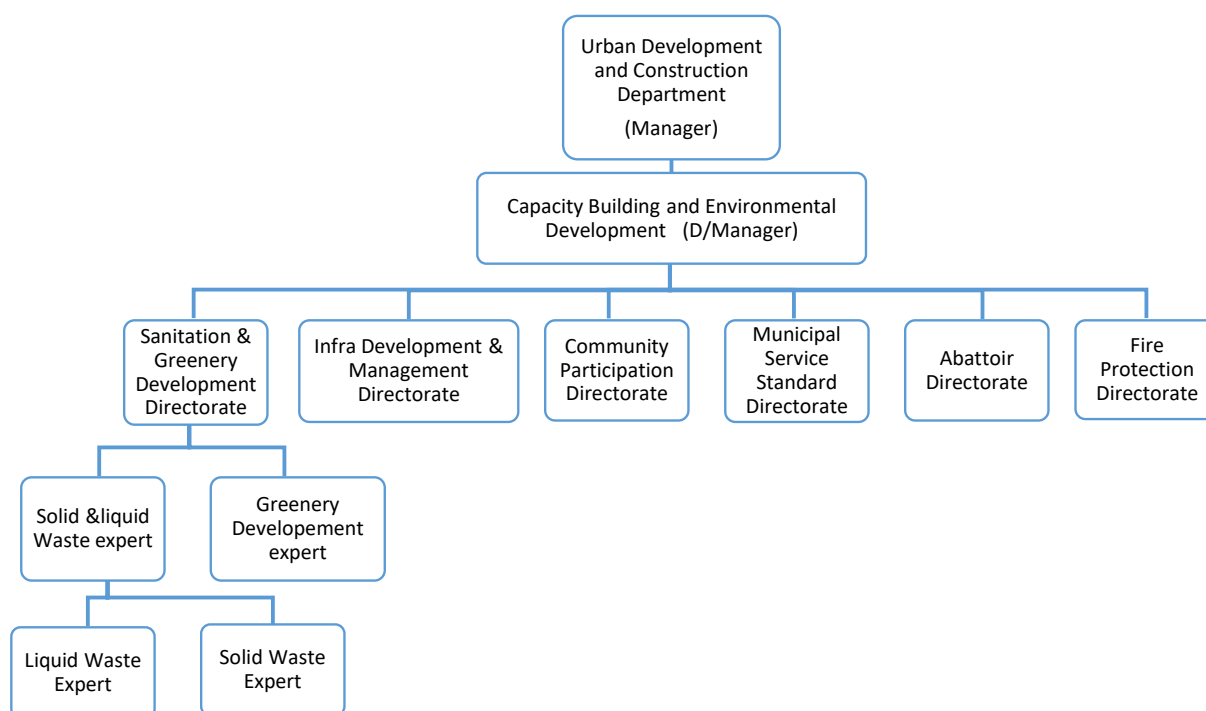
SDGs Indicators		Current State
14.1.1	(a) Index of coastal eutrophication; and (b) plastic debris density	Ethiopia is not an oceanfront country, and therefore is not a country that has an impact on marine pollution. There are also reports ¹⁹ that the import, manufacture, sale, and use of plastic bags, which are a major source of marine pollution, is banned.

Source: Prepared by the survey team

4.4 Solid Waste Management Situation in Hawassa

4.4.1 Organization and Finance for Solid Waste mManagement

Solid waste management in Hawassa is handled by the Urban Development and Construction Department of Hawassa City. Below is an organizational chart of the city of Hawassa's Urban Development and Construction Department.



Source: Prepared by survey team based on questionnaire survey

Figure 4-14 Organizational chart of the city of Hawassa's Urban Development and Construction Department

The following table shows revenues and expenditures related to solid waste management in the city of Hawassa. According to the city, the city's revenue sources for waste management are the central government and other donors (UK AID, UNDP, GIZ, CIFA²⁰ (Community Initiatives Facilitation Assistance) Ethiopia, GEF and World Bank).

¹⁹ <https://www.jetro.go.jp/biz/areareports/special/2019/0101/820e6f02ed651777.html>

²⁰ CIFA is an NGO originally from Kenya, and CIFA Ethiopia, which is responsible for Ethiopia, was established in 2005.

Table 4-15 Revenues and expenditures for waste management in Hawassa

Year	2017	2018	2019	2020
Revenues	71,000,000 ETB	48,000,000 ETB	41,000,000 ETB	38,844,053 ETB
Expenditures	N/A	N/A	N/A	41,920,892 ETB

Source: Prepared by survey team based on questionnaire survey

4.4.2 Ordinances and Policies related to Solid Waste Management

The city of Hawassa does not have any regulations such as solid waste management or environmental ordinances, and is subject to the laws and regulations set by the government. The Integrated Solid Waste Management Plan 2018-2028 (ISWM Plan) was established in 2017 as the city of Hawassa's plan in waste management. An overview of the ISWM Plan is shown in Table 4-16. The ISWM Plan was formulated in 2017. The ISWM Plan consists of five goals and the strategies associated with each. Specific goals are to increase the composting of organic waste and the recycling rate of plastic waste to about 90% by 2028.

Table 4-16 Summary of Integrated Solid Waste Management Plan 2018-2028

Goals/strategies	Overview
Goal I	Waste reduction
Strategy 1	Promotion of 6Rs (Rethink, Reduce, Reuse, Recycle, Re-gift, Repair)
Strategy 2	Develop, execute and enforce local regulations to minimize waste generation
Goal II	Improving collection & transportation
Strategy 1	Hawassa city administration to widen collection coverage
Strategy 2	Formalization of informal collection system
Strategy 3	Improving transportation infrastructure for secondary collection
Strategy 4	Develop and enforce legislations on hazardous waste collection
Goal III	Maximizing plastic recycling and composting
Strategy 1	Promotion of source separation
Strategy 2	Estimate organic and plastic waste to be recovered
Strategy 3	Investigate market research for demand and supply of recyclables and compost
Strategy 4	Identify technical recycling and composting options
Strategy 5	Stakeholder engagement management/workshop to explore PPP options
Strategy 6	Feasibility study and design of facilities
Strategy 7	Construction and operation
Goal IV	Improvement of the existing dumpsite and address further disposal requirements
Strategy 1	Improving operation management at the current disposal site
Strategy 2	Identify a new landfill site owned by Hawassa city administration
Goal V	Sustainable Financing of solid waste management
Strategy 1	Increased budget allocation for solid waste management by the local government
Strategy 2	Increased revenue from waste collection services
Strategy 3	Identify donors to fund waste management projects

Source: Solid Waste Management in Hawassa Assessment Report (UN-Habitat, 28 February 2019)

4.4.3 Overview of Solid Waste Management

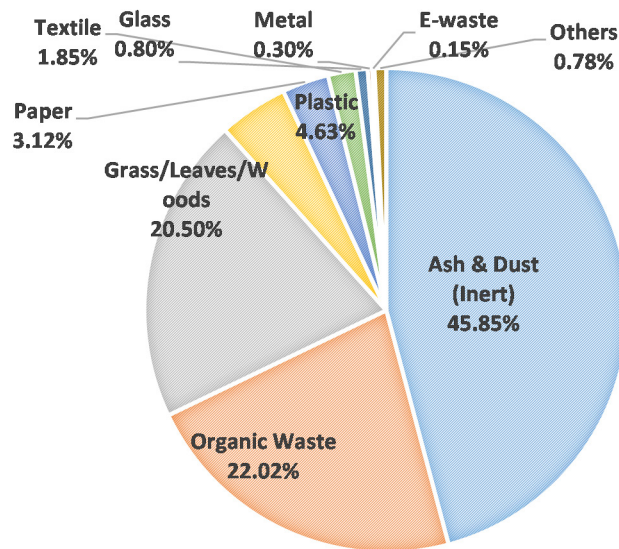
Table 4-17 shows the per unit generation, projected population, and waste generation in the city of Hawassa for 2019 and 2020. In addition, the waste collection rate is expected to be around 80% as of 2019 (see the ACCP Data Book).

Table 4-17 Per unit generation and waste volume for the city of Hawassa

	2019	2020
Per unit generation	0.43 kg/person/day	0.57 kg/person/day
City of Hawassa projected population (from Table 4-3)	414,657 people	429,170 people
Amount of waste generated	178 t/day	245 t/day

Source: Prepared by the survey team based on interviews with the city of Hawassa

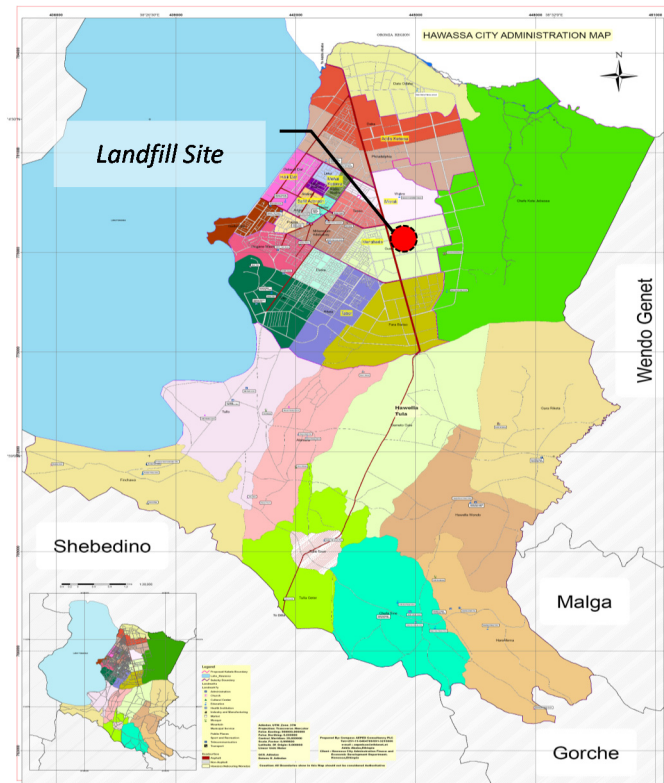
A waste composition survey at the source was conducted by US AID in 2015. The results of the waste composition survey are shown in Figure 4-15.



Source: Prepared by the survey team based on the Solid Waste Management in Hawassa Assessment Report (UN-Habitat, 2019)

Figure 4-15 Waste composition at source (2015)

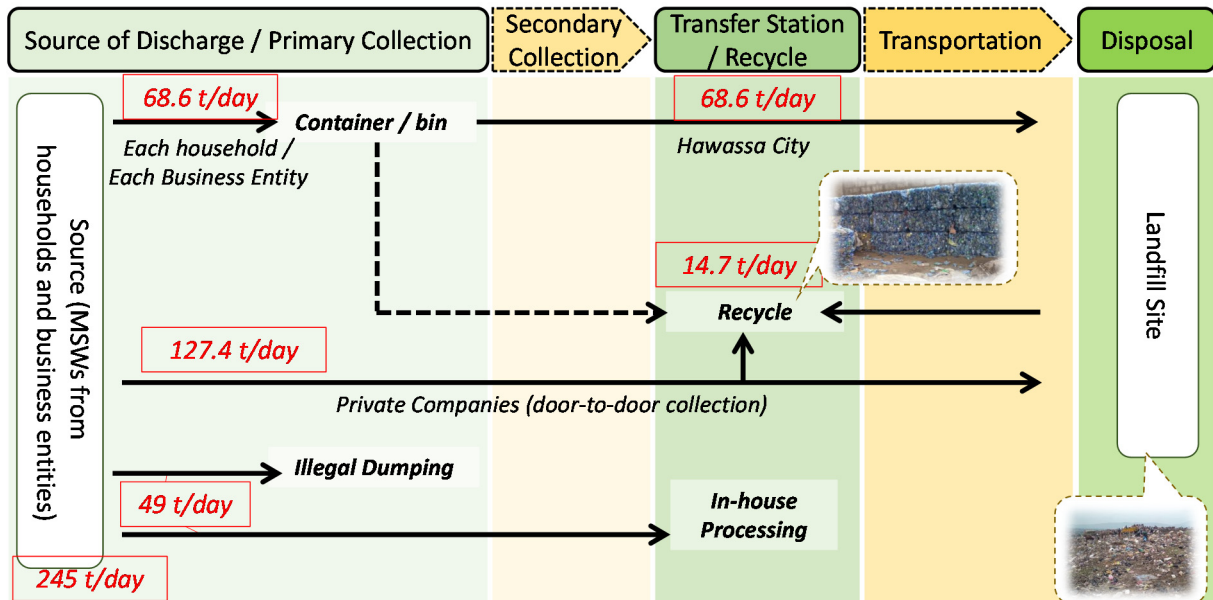
A map of the current location of waste-related facilities in Hawassa is shown in Figure 4-16.



Source: Prepared by the survey team based on materials provided by the city of Hawassa

Figure 4-16 Waste-related facilities in Hawassa

The waste flow of the city of Hawassa is shown in Figure 4-17.



Source: Prepared by survey team based on questionnaire survey

Figure 4-17 Waste flow chart for the city of Hawassa

The calculation process for the above figure is shown below.

- Amount generated: 245 tons/day
*The amount generate" is the value obtained by multiplying the generation intensity (0.57 kg/person/day) by the population projection for 2020 (429,170).
- Amount collected: 196 tons/day
*If we assume the collection rate of Hawassa (80% (see ACCP data book)) and the amount generated, the amount of garbage collected is calculated as above. Because the collection rate by the city directly and by private companies is 35% and 65%, respectively (see 4.4.4 (1)), the respective waste collection volume is calculated to be 68.6 tons/day and 127.4 tons/day.
- Amount recycled: 14.7 tons/day
*With no information on the recycling rate for the entire city of Hawassa, we assume a recycling rate of 6% of the volume generated, similar to that in Addis Ababa. Because the amount generated is 245 tons/day, the amount recycled in Hawassa is calculated to be 14.7 tons/day.
- Total amount of illegal dumping and self-disposal (un-managed waste): 49 tons/day
*The value obtained by subtracting the amount collected and the amount recycled from the amount of waste generated is defined as the total amount of illegal dumping and in-house disposal.

4.4.4 Current Status of Collection and Transportation

(1) Separation, Collection, and Transportation

In the city of Hawassa, although sorting at the source (two types) is performed, according to the city, the sorting rate is only about 30%, and in reality very little is sorted. Waste collection in Hawassa is conducted in two ways: collection by the city's direct management and collection by private contractors and the informal sector. An overview of each of the collection services is shown in Table 4-18 and Table 4-19. As shown in Table 4-18, the city's direct management collects by container, while private contractors²¹ and the informal sector collect door-to-door. The private and informal sector account for the majority (about 65%) of the total waste collection in the city of Hawassa. Each contractor and each informal sector has a contract with residents on a monthly basis and collects collection fees (collection by private contractors: 20-200 ETB/month (for houses), 20 ETB/month (for apartments), 5-10 ETB/bag (if not on monthly contract); collection by the informal sector: 20 - 200 ETB/month, 10-50 ETB/bag (if not a monthly contract)). Note that the city sets the above rates. Residents put their garbage in cloth bags used for storing coffee beans and take them to a private collector. The collection and transportation equipment is shown in Table 4-19, and collection and transportation are mainly carried out by donkey carts. During collection and transportation, there is also the problem of leachate leaking from collection and transportation equipment and contaminating the city. In the case of city-operated container collection, each household is responsible for taking garbage up to the container placed at the skip point, and no garbage collection fee is collected from residents. The containers located at the skip points are mainly 8 m³ in capacity.

Waste collected by the city, private contractors, and the informal sector is delivered directly to the landfill

²¹ Major private companies include Hawassa Wubet, Shalom Solid Waste, Befisa, Abakoda, Lewut Besira, Faya Fole, and many others.

without passing through a relay facility. Some collected refuse is hauled to recycling companies.

Table 4-18 Summary of collection services in the city of Hawassa

	Directly managed by the city of Hawassa	Private contractors and informal sector
Collection area	All of city of Hawassa	All of city of Hawassa ²²
Collection frequency	6-7 days a week, 3-8 times/day	6-7 days a week, 2-6 times/day
Collection method	Container collection	Door-to-door collection
Haulage location	Landfill	Landfill

Source: Prepared by survey team based on questionnaire survey with the city of Hawassa

Table 4-19 Summary of collection entities in the city of Hawassa

Collecting entity	Percentage of collection to total collection	Number of pieces of equipment					Work Number of personnel
		Skip loader (8 m ³)	Tractor (4m ³)	Light truck	Bajaj (2m ³)	Donkey cart (2m ³)	
City of Hawassa	35%	2 units (1 broken down)	4 units ²³	5 units	2 units	2 units	1,330 people
Informal sector	20%					Approximately 600 cars	
Hawassa Wubet Private Association	20%			4 units	8 units	8 units	62 people
Shalom Private Association	5%			1 units	1 units	20 units	20 people
Befisa Private Association	2%				1 units	10 units	20 people
Abakoda Private Association	3%				10 units		
Lewut Besira Private Association	3%				1 units	10 units	26 people
Faya Fole	2%				1 units		15
Beteseb Brivate Association		Not Functional					

Source: Prepared by survey team based on questionnaire survey with the city of Hawassa

(2) Road Sweeping

Road sweeping is directly managed by the city of Hawassa. There are approximately 1,200 street sweepers (mostly women) on staff as of 2019, who clean the roads and ditches every two days. The cleaned trash is collected in approximately 350 trash cans installed by the city. The collected waste is delivered directly to the landfill by a tractor (4 m³) as shown in Table 4-19.

²²Collection areas for private contractors are as follows Hawassa Wubet Private Association (Area: Whole city), Shalom Private Association (Area: Addis Ketema Sub-city and Bahil Aderash Sub-city), Befisa Private Association (Area: Tabor Sub-city), Abakoda Private Association (Area: Menehara Sub-city), Lewut Besira Private Association (Area: Tabor Sub-city), Faya Fole (Area: Hayik Dar Sub-city) and Beteseb Brivate Association (Not functional)

²³ Mainly used for road cleaning

(3) **Transfer Stations**

Although there are no transfer stations at this time, but there are plans to build transfer stations at Hiteta Kebele (Tabor), Philadelphia Kebele (Addis Ketema), and Leku Kebele (Mehal Ketema), and the procurement of contractors has already been completed. An outline of the plan is shown below. According to the city of Hawassa, the reason for the delay in construction of the transfer station is that there is a rule that the relay facility and the landfill must be at least 5 km apart, and the landfill site is located in an area near the center of the city, so the rule cannot be followed.

Table 4-20 Overview of Planned Transfer Stations

	Hiteta Kebele	Philadelphia Kebele	Leku Kebele
Planned waste delivery volume	160 t/day	96 t/day	96 t/day
Planned operating hours	6 days a week, 8 hours a day	6 days a week, 8 hours a day	6 days a week, 8 hours a day
Initial investment	3.1 million ETB	1.9 million ETB	1.9 million ETB
Land expropriation	Unearned revenue	Unearned revenue	Unearned revenue
Environmental assessment	Not implemented	Not implemented	Not implemented
Assumed year of operation	Undetermined	Undetermined	Undetermined

Source: Prepared by survey team based on questionnaire survey

4.4.5 Current status of Intermediate Treatment / Recycling

There is no incineration or other intermediate treatment in Hawassa, only recycling activities by private companies and the informal sector. There are four private recycling companies in Hawassa, consisting of three plastic recyclers, and one recycler that composts organic waste. Four recycling companies recycle a total of 6,600 kg/day. Assuming that the daily waste generation in Hawassa is 245 tons/day (Table 4-17), the recycling rate by private recyclers in Hawassa is about 2.7%. According to the city of Hawassa, recycling companies are unable to promote recycling due to a lack of compressors and other recycling equipment. On the other hand, if recycling activities by the informal sector are also taken into account, the actual recycling rate may be higher. According to a SIWI report²⁴, the amount of plastic recycled in Hawassa is 3.01 tons/day, which represents 21% of the total amount of plastic generated. Some recyclables are sold to a company in the city of Addis Ababa, about 300 km from the city, resulting in high transportation costs and not encouraging recycling in Hawassa. The actual recycling volume in Hawassa City is estimated to be 31.0 tons/day (see Figure 4-17). (The recycling rate is approximately 12.7%.) An overview of the private recyclers that were interviewed is shown below.

(1) Hawassa Webet Plastic Recycling Association

Hawassa Webet Plastic Recycling Association was founded in 2010 and initially had five employees. The company is a plastic recycling organization that accepts plastic waste collected from existing landfills and

²⁴ Source-to-Lake Analysis of Plastic Waste Management in Lake Hawassa Basin, January 2020

from the collection private and informal sector, compresses it, and transports and sells it to COBA Impact S.A. in Addis Ababa City. Currently, the company (62 employees) has light trucks (2), Bajaj (8), and donkey carts (8).

As of 2017, the company was accepting 30,000-32,000 kg/month of waste, with monthly transportation charges ranging from 20,000-28,000 ETB/month. Currently, it accepts approximately 3,000 kg/day of waste. The plastic compressor was provided free of charge by a private Italian company.



Source: Photos by local employees

(2) Cool Plastic Recycling Association

Cool Plastic Recycling Association is an organization founded in 2017. The company collects and recycles high-density plastic and melts the collected plastic to produce polyethylene bags (plastic bags). The company recycles 800 kg/day.



Source: Photos by local employees

(3) Shalom Plastic Bottle

Shalom Plastic Bottle was founded in 2012 and initially had six employees who collected waste. In 2017, the company entered the market as a recycler and currently has 1 light truck, 1 Bajaj, and 20 donkey carts (48 employees). The company uses a plastic compactor provided by a private recycling organization to transport

and sell compacted plastic waste to EKT Trading PLC in Addis Ababa City. Currently, the company accepts 1,500 kg/day of waste.



Source: Photos by local employees

(4) Green REE Business Corporation

Green REE Business Corporation was founded in 2013 and spends about four months producing compost from organic waste collected from existing landfills by waste pickers and the informal sector. As of 2017, it produces 1.3 tons of compost annually, which it sells to 64 greening organizations at 400 ETB/100 kg.



Source: Photos by local employees

4.4.6 Current Status of Landfill Site

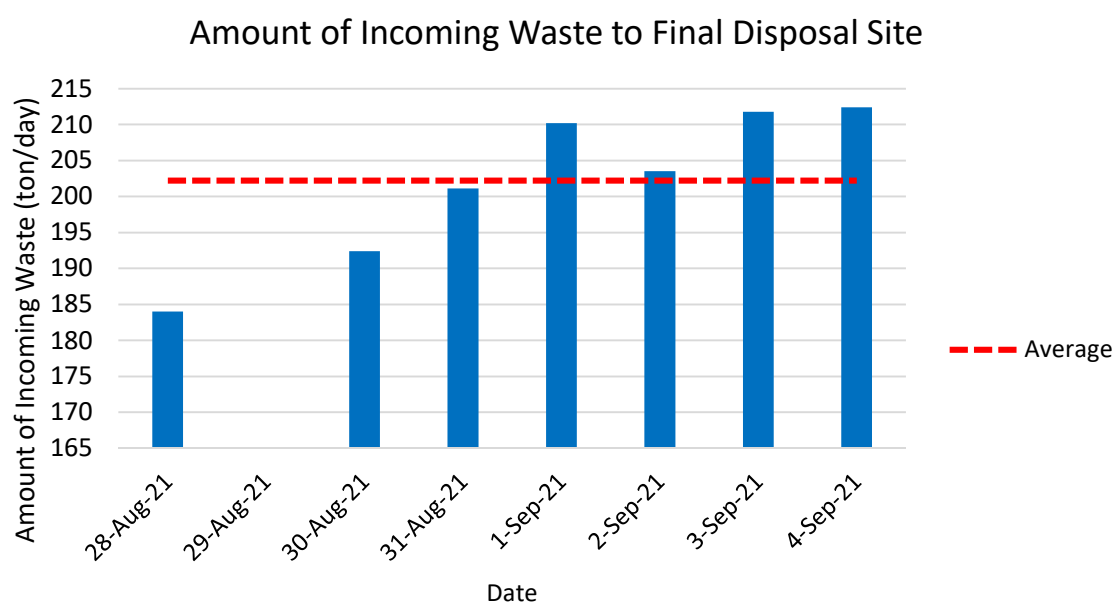
It is the only landfill site in operation as of July 2021 and is directly operated by the city of Hawassa. This landfill site accepts not only municipal waste, but also several types of waste, including industrial, construction, and agricultural waste. Table 4-21 shows an overview of the city of Hawassa's landfill site operated by the city of Hawassa. The landfill site itself has open dumping and not equipped for appropriate disposal. In addition, the landfill site began operation in 2010 and was originally intended to operate for about

15 years, but due to the rapid population growth into Hawassa, the disposal capacity has already been exceeded. The results of the one-week survey of the volume brought in (conducted by interview at the final disposal site) conducted in this study are also shown in Figure 4-18. The average volume brought in was approximately 202 tons/day. (Landfill volume brought in is 184-212 tons/day.)

Table 4-21 Overview of Landfill Site in Hawassa

	Overview
Location	Located in Guwe Kebele near the center of the city of Hawassa (see Figure 4-16)
Area	The site area is 6 ha, of which 3 ha is for the landfill.
Disposal capacity	Approximately 21 million m ³ (capacity already exceeded)
Operating hours	8 hours a day, 7 days a week
Throughput	Approximately 196.7 tons/day (average of the amount brought in: approximately 202 tons/day)
Number of workers	39 people
Type	Open dumping
Facilities	Landfill, office
Landfill	Soil cover (soil cover in place but not complete), leachate collection and drainage pipes
Landfill equipment	Dump trucks: 4 (operating 7 days a week) Bulldozer: 1 (operated 7 days a week)
Initial costs	Approximately 9,000,000 ETB
Operating costs	Approximately 4,320,000 ETB/year
Waste picker	More than 2,000 waste pickers are active.

Source: Prepared by survey team based on questionnaire survey



Source: Prepared by the survey team based on research by local employees

Figure 4-18 Results on Incoming Waste Survey at the Landfill in Hawassa



Source: Photos by local employees

As described above, due to the imminent need for an existing landfill site, the city is also considering a new landfill site. Table 4-22 shows an overview of the landfill site currently under consideration by the city. Although some concrete plans are in place, overall, many items are still in the planning stage and few specifications have been decided. There are also reports that the F/S is currently underway.

Table 4-22 Overview of Landfill being planned in Hawassa

	Overview
Area	4 ha (2 ha: public land, 2 ha: industrial park land)
Disposal capacity	Under consideration
Operating hours	8 hours a day, 7 days a week
Throughput	Under consideration
Type	Managed landfill
Facilities	Landfill, leachate treatment facility, weighbridge, offices, etc. (Considering introducing a sorting machine, composting facilities, etc.)
Landfill	Soil cover, venting pipes, leachate collection and drainage pipes
Assumed landfill equipment	Dump trucks: 2 (operating 6 days a week) Excavator: 1 unit (operating 6 days a week) Bulldozer: 1 (operated 6 days a week) Tractor: 2 (operating 6 days a week) Loader: 1 unit (operating 6 days a week)
Assumed initial costs	Approximately 30,000,000 ETB
Assumed year of operation	Undetermined

Source: Prepared by survey team based on questionnaire survey

4.4.7 Activities by Other Donors

The activities of other donors in the city of Hawassa are as follows.

- CIFA and GIZ have installed garbage cans in Hawassa as part of GIZ's International Water Stewardship Programme (IWaSP) project in Hawassa to promote collection and sorting.
- UK Aid Direct and CIFA provided plastic compressors and constructed the facility.

4.4.8 Status of Initiatives related to DX

No initiatives related to DX in the area of waste management were identified.

4.4.9 Status of Monitoring on SDGs' waste-related Indicators

The status of monitoring on waste-related indicators (11.6.1, 12.3.1, 12.4.2, 12.5.1 and 14.1.1) of the SDG targets is summarized in the following table.

Table 4-23 Status of Monitoring on SDGs' waste-related Indicators (Hawassa)

SDGs Indicators		Current state
11.6.1	Proportion of urban solid waste regularly collected and with adequate final discharge out of total urban solid waste generated, by cities	Of the total municipal solid waste generated in the city of Hawassa, the percentage of municipal solid waste collected is 80%.
12.3.1	a) Food loss index, and b) Food waste index	There are currently no laws, policies, or initiatives in place to reduce food and other organic waste.
12.4.2	(a) Hazardous waste generated per capita; and (b) proportion of hazardous waste treated, by type of treatment	Ethiopia is a signatory to the Basel Convention. No data on the amount of hazardous waste generated or collected has been identified.
12.5.1	National recycling rate, tons of material recycled	The city of Hawassa is estimated to recycle 31.0 tons/day, which is equivalent to 12.7% of its general waste generation.
14.1.1	(a) Index of coastal eutrophication; and (b) plastic debris density	Ethiopia is not an oceanfront country, and therefore is not a country that has an impact on marine pollution. On the other hand, the city of Hawassa is not an oceanfront city, but is located on the eastern shore of Lake Hawassa, where garbage is being discharged into the lake. Data exists for the city of Hawassa related to plastic waste that is spilled into Lake Hawassa, which is approximately 18% ²⁵ of the plastic generated. Therefore, the amount of plastic emitted into Lake Hawassa can be calculated to be 20.4 tons/day Amount of ocean plastic = 245 tons/day x 4.63% (composition of plastic) x 18% = 20.4 tons/day

Source: Prepared by the survey team

4.5 Issues and Cooperation Needs of Solid Waste Management in Ethiopia, Addis Ababa and Hawassa

4.5.1 Issues and Stages of Solid Waste Management

(1) Issues of Solid Waste Management

The following is a list of solid waste management issues in Ethiopia and the cities of Addis Ababa and Hawassa.

- In Ethiopia, the census has not been conducted since 2007, and official data such as the urban population do not exist. In order to understand waste information, it is necessary to understand the population.
- Although in Addis Ababa, a waste incineration and power generation facility is in operation, the city's responsibility to bring in waste (1,400 tons/day) is not being met, and only 300 to 950 tons/day is actually being brought in. As a result, only about half of the power generation capacity is being generated. Possible reasons for the low volume are that many valuable calories are extracted from skip points, most municipal waste contains high moisture content, and much of the waste discharged

²⁵ Source-to-Lake Analysis of Plastic Waste Management in Lake Hawassa Basin, January 2020

is not suitable for incineration, or that incineration is discouraged because there are no legal regulations regarding incinerated ash disposal. The city is also responsible for the disposal of fly ash and main ash from the facility, but proper disposal is not being done. In Ethiopia, there are no laws, regulations, or systems regarding the disposal of incinerator ash. Interviews also indicated that the facility's engineers were not very competent. Therefore, we believe that the entire waste management system (source separation - collection - transportation - treatment - disposal (including disposal of incinerated ash)) needs to be improved and appropriate laws and regulations need to be developed for the appropriate operation of existing waste incineration power generation facilities.

- The only landfill in use in the city of Addis Ababa is the Koshe landfill, which has already far exceeded its planned capacity, and there have been fatalities due to the collapse of the landfill surface. New landfills are required to be established as soon as possible.
- In the city of Addis Ababa, the Sandafa landfill and the construction of a new relay facility have been forced to be canceled due to opposition from residents. For the future construction of waste-related facilities, appropriate prior action, such as public briefings for local residents, will be required.
- In the city of Addis Ababa, it is estimated that approximately 25% of the volume generated is illegally dumped, which means that illegal dumping must be reduced.
- In the city of Hawassa, waste is primarily collected by the informal sector and SMEs and transported directly to the landfill. The collection rate is about 80%. On the other hand, as for collection and transportation equipment, donkey carts are mainly used, which are inadequate and inefficient in terms of collection equipment used, and there is need for improvement.
- The existing landfill in the city of Hawassa has open dumping and needs to be improved by using heavy equipment for compaction and soil covering, and by installing gas vent pipes. In addition, existing landfills have already exceeded their disposal capacity, so new landfills are required. There are reports that the World Bank will provide support for the development of a new landfill, but the city needs to clarify the future schedule and operational plan.

(2) Stages and Priority Issues of Solid Waste Management

The status for each stage of solid waste management in Addis Ababa and Hawassa are summarized in Table 4-24. Based on the image in Table 1-13, the stage of solid waste management in Addis Ababa are evaluated as Stage 2 (Reduction of environmental impact and prevention of pollution). However, with regard to final disposal, the evaluation is between Stage 1 and Stage 2, since Koshe landfill site has little capacity, and the issue has a higher priority as a challenge than in other areas. On the other hand, for solid waste management in Hawassa, a wide range of significant issues have been identified overall, and it is evaluated as Stage 1 (improvement of public health).

Table 4-24 Stage of Solid Waste Management in Addis Ababa and Hawassa

	Field	Stage	Status
Addis Ababa	Legislations	2	Ethiopia has a waste management law, Solid Waste Management Proclamation No. 513/2007, however no specific legislation related to recycling. Addis Ababa has a waste management bylaw, which was also revised in 2018.
	Collection and Transportation	2	In Addis Ababa, primary collection to intermediate transportation is basically conducted by SMEs or private companies contracted by AASWMA. The collection rate for primary collection is around 75%, however, illegal dumping has been observed in many parts of the city including inaccessible areas.
	Final Disposal	1~2	Sandafa Landfill Site, which was developed with the support of AFD, has been closed due to opposition from local residents, and Koshe Landfill Site, which has been in use for more than 50 years and has experienced some collapses, is still in use. With the support of UN-Habitat and the Government of Japan, the Fukuoka method has been introduced at the part of Koshe Landfill, and a simple leachate treatment pond has been installed.
	Intermediate Treatment and Recycle	2	A waste-to-energy incineration facility is operating on the same premises as Koshe Landfill Site. At the time of planning, the plant was to accept 1,400 tons/day of waste and generate 50 MW of electricity, however, the power has not been generated as planned. In addition, proper disposal of incineration ash (bottom ash and fly ash) has not been carried out. In Addis Ababa, recycling is being conducted by private companies, the informal sector, and others.
Hawassa	Legislations	2	Ethiopia has a waste management law, Solid Waste Management Proclamation No. 513/2007, however no specific legislation related to recycling. Hawassa has not enacted any ordinances for waste management, and follows the laws and regulations stipulated by the government.
	Collection and Transportation	1~2	Waste collection and transportation in Hawassa is conducted with container collection by Hawassa city and door-to-door collection by private companies, and the waste collection rate is estimated to be about 80%. Donkey carts are the main equipment for waste collection and transportation (collection by private contractors).
	Final Disposal	1	The landfill site in Hawassa accepts a wide variety of waste, including municipal, industrial, construction, and agricultural waste. The landfill is an open dumping site, and no proper disposal is carried out, including covering soil, and no treatment of leachate is provided.
	Intermediate Treatment and Recycle	1~2	Recycling is conducted by private companies and the informal sectors in Hawassa. Some recyclables are transported and sold to a recycling company in Addis Ababa, about 300 km away.

Explanation of Stage 1 : Improvement of public health, 2 : Reduction of environmental impact and prevention of pollution, 3 : Building a sound material-cycle society through the 3R activities

Source: prepared by JICA Study Team

Of the solid waste management issues listed in (1) above, the following issues are evaluated as particularly high priority among these. The waste-to-energy incineration facility in Addis Ababa (Rappi Waste-to-Energy Facility) is an advanced practice that can be a reference for other countries, however, it has been listed as a priority issue due to the problems it is facing in its operation.

<Priority Issues in Addis Ababa>

- An environmental standard for Fly Ash disposal needs to be developed.
- Koshe final disposal site has little remaining capacity, and development of new final disposal facilities will be needed.
- The Rappi WtE Facility is only treating about half of its planned capacity and needs to be improved.

<Priority Issues in Hawassa>

- The collection ratio is estimated to be approximately 80%. However, the collection and transportation equipment is mainly donkey carts, which are inefficient and unsanitary, requiring replacement of the equipment. In conjunction with the replacement of the equipment, a collection and transportation plan needs to be modified.
- The final disposal site is open dumping, and its operation needs to be improved.

4.5.2 Good Practices on Solid Waste Management

A good example of waste management in Ethiopia that can serve as a best practice for other countries is the improvement of the Koshe landfill to the Fukuoka method, which was implemented with the support of UN-Habitat and other organizations. The improvement to the Fukuoka method has improved the overall appearance of the landfill, reduced odors and flies, and reduced the odor of leachate, and the improvement project is highly appreciated by residents living adjacent to the landfill. On the other hand, it is necessary to improve not only the tangible aspects, but also the staff capacity for the operation of the improved landfill and other aspects of the landfill.

4.5.3 Proposed Cooperation Policy

The draft cooperation policy for waste management for Ethiopia and the target cities is shown in Table 4-25. Cooperation related to the priority issues mentioned in 4.5.1 is shown in red, and these are considered to be higher priority assistance than others. However, in providing these high priority assistance, self-help efforts by Ethiopian side, as indicated below, are considered essential.

- Addis Ababa: There are no standards for the disposal of incineration ash, and awareness toward the environmental impact is very low. Efforts should be made to improve environmental awareness. In addition, the government and municipalities need to take the lead in considering candidate sites for new landfill sites.
- Hawassa: The final disposal site is an unmanaged open dumping site, and the city needs to actively monitor the current situation, including the amount of material transported in, and manage wastepickers.

Table 4-25 Proposed Cooperation Policy (Ethiopia/ Addis Ababa, Hawassa)

	Issue	Short-term support (red letters are those related to priority issues)	Medium-term support
Central government	Difficult situation at the Koshe landfill in Addis Ababa City	[Technical cooperation project] ➤ Assistance in developing a master plan, including planning for a new landfill	[Yen loan project] ➤ Development of a new landfill ➤ Development of relay facilities ➤ Support for the appropriate closure of the Koshe landfill site
Addis Ababa City	Appropriate treatment of incinerator ash (bottom ash and fly ash)	[Technical cooperation project/dispatch of experts/training in Japan] ➤ Support for development of laws and regulations related to incinerator ash disposal	
	Stable operation of Rappi waste incineration and power generation facility	[Technical cooperation project/dispatch of experts/training in Japan] ➤ Support for capacity building of engineers at the Rappi waste incineration and power generation facility	
	Strengthening collection and transportation and eliminating illegal dumping	[Technical cooperation project] ➤ Review of the city's collection and transportation plan ➤ Development of relay facilities ➤ Establishment and implementation of a management system for SMEs and garbage collectors ➤ Conducting campaigns and other activities involving residents and students ➤ Conducting PR activities using TV and other media	
City of Hawassa	Support for development of laws and regulations	[Technical cooperation project] ➤ Assistance in developing waste management ordinances	
	Collection improvements	[Grant aid] ➤ Provision of waste collection equipment (especially if a landfill is built by the World Bank on the outskirts of the city, which will be difficult to handle with the current donkey carts). [Technical cooperation project] ➤ Review of the city's collection and transportation plan	
	Promotion of recycling	[Technical cooperation project**] ➤ Promotion of recycling to reduce waste	
	Existing landfill improvement	[Grant aid*] ➤ Provision of heavy equipment (bulldozers, excavators, etc.) [Yen loan project**] ➤ Existing landfill improvement	
	New landfill operation	The development of a new landfill is a matter of urgency, and there have already been reports that the World Bank will provide assistance. If the World Bank does not support the maintenance, there is a possibility of support through a yen loan.	

*In the case of implementation in a technical cooperation project, the project will be packaged with other components.

**Can be implemented if the World Bank does not build a new landfill.

***This will be done in consultation with the World Bank, taking care to avoid overlap in project content.

Source: prepared by JICA Study Team

CHAPTER 5 Solid Waste Management in the Republic of Guinea

In the Republic of Guinea (hereinafter referred to as “Guinea”), a remote survey was conducted utilizing a local consultant, Mr. Barry Amodou Lamarana. The results of the survey are presented below.

5.1 Overview of Target Country and City

5.1.1 Population

The populations of Guinea and Conakry City are shown in Table 5-1. The most recent census was conducted in 2014, and the population figures from 2015 are official estimates. As of 2021, populations of the whole country and Conakry City are 12,907,395 and 2,039,725, respectively.

Table 5-1 Population of the Guinea and Conakry City

Year	Guinea	Conakry City
2010	9,706,499	1,533,895
2011	9,966,006	1,574,905
2012	10,229,396	1,616,527
2013	10,496,641	1,658,760
2014	10,599,848	1,675,069
2015	10,917,711	1,725,300
2016	11,233,038	1,775,130
2017	11,555,062	1,826,019
2018	11,883,517	1,877,924
2019	12,218,357	1,930,838
2020	12,559,623	1,984,767
2021	12,907,395	2,039,725

Source: Annuaire statistique 2020

5.1.2 Economic Situation

The main economic indicators for Guinea are shown in Table 5-2.

Table 5-2 Main Economic Indicators for Guinea

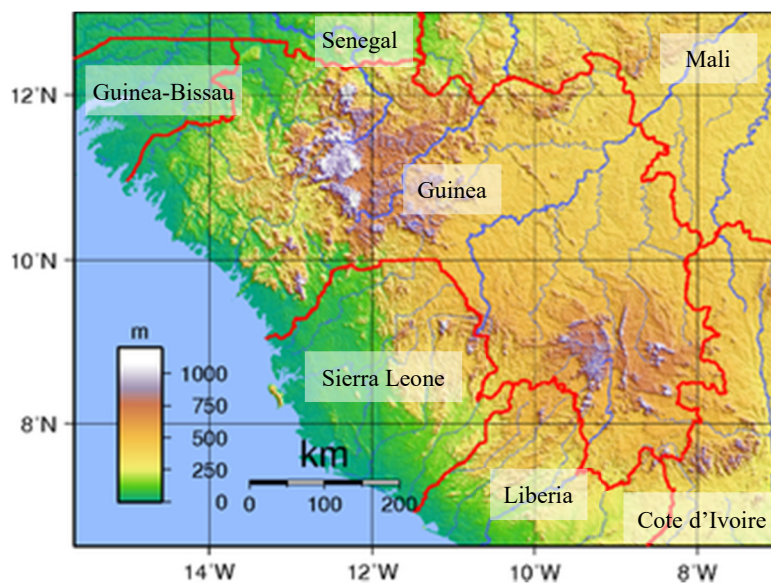
Indicator	Contents
Major industries* ¹	Agriculture: rice, cassava Mining: bauxite, alumina, gold, diamonds
GDP (2019) * ²	13.51 billion USD
GNI per capita (2019) * ²	950 USD
Economic growth rate (2019) * ²	5.6%
Price inflation (2019) * ²	7.5%
Exports (2019) * ²	3.76 billion USD
Imports (2019) * ²	5.61 billion USD

Source: *¹ Ministry of Foreign Affairs of Japan, *² World Bank

5.1.3 Topography

Guinea is located in West Africa, bordered by Senegal to the north, Guinea-Bissau to the northwest, Mali to

the northeast, Sierra Leone and Liberia to the south, Côte d'Ivoire to the southeast, and the Atlantic Ocean to the west. The total land area is 245,857 km². The country is geographically divided into four regions: Maritime Guinea, Middle Guinea, Upper Guinea, and Forested Guinea. Maritime Guinea, which includes the capital city of Conakry, is covered with mangrove forests, while the inland areas are plains with forests and savannas spreading alternately. Middle Guinea is almost coincident with the Fouta Djallon Mountains, where rainfall is low and grasslands are spread out. This mountainous region is the source of many rivers, including the Niger, Senegal, and Gambia. Upper Guinea, located to the north of the mountain's region, has the lowest rainfall in the country and is covered with savannas. The southern part of the country, Forested Guinea, is hot and humid, with tropical rainforests spreading around Mount Nimba, the highest mountain in the country.



Source: Geography of Guinea, Wikipedia (as of September 10, 2021)

Figure 5-1 Topographic Map of Guinea

5.1.4 Meteorological Conditions

Conakry City is classified as tropical monsoon climate according to the Köppen climate classification. It has a dry season (December to April) and a rainy season (May to November). The average temperature in Conakry City is shown in Table 5-3 and Figure 5-2, and its average rainfall is shown in Table 5-4 and Figure 5-3.

Table 5-3 Average Temperature in Conakry City (normal year)

Month	Temperature (°C)		Month	Temperature (°C)	
	High	Low		High	Low
JAN	30.9	23.3	JUL	27.6	24.3
FEB	31.0	22.8	AUG	27.0	23.8
MAR	30.8	23.7	SEP	27.9	24.1
APR	30.6	24.3	OCT	29.5	24.9
MAY	30.2	25.4	NOV	30.3	25.1
JUN	28.9	25.4	DEC	31.1	24.0
			Ave.	29.7	24.3

Source: Weather Atlas

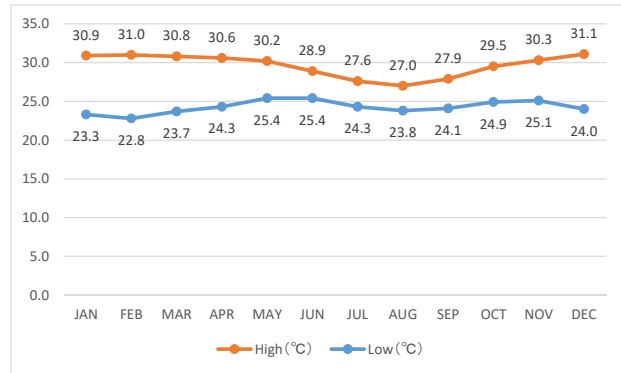


Figure 5-2 Average Temperature in Conakry City (normal year)

Table 5-4 Average Rainfall in Conakry City (normal year)

Month	Precipitation (mm)	Month	Precipitation (mm)
JAN	2	JUL	372
FEB	1	AUG	478
MAR	5	SEP	181
APR	18	OCT	107
MAY	48	NOV	56
JUN	134	DEC	8
		Ave.	117.5

Source: Weather Atlas

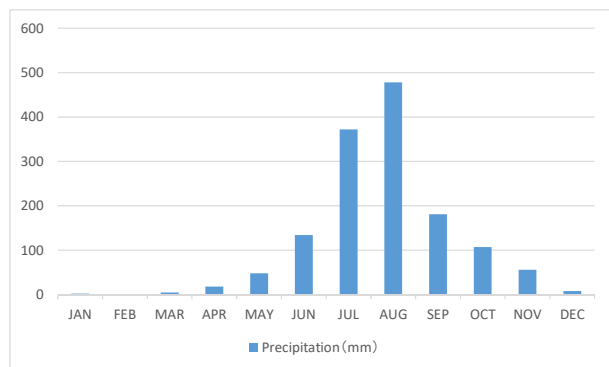


Figure 5-3 Average Rainfall in Conakry City (normal year)

5.2 Laws, Regulations, Plans and Organizational Structures related to Solid Waste Management in the Country

5.2.1 Laws and Regulations related to Solid Waste Management

There is no basic law specific to solid waste management in Guinea, but there are relevant laws such as the “Environmental Code” formulated in 2019 and “Joint Decree on the Attribution of the Municipalities in the Management of Household and Similar Waste” prepared in 2020. A summary of these laws is given in Table 5-5.

Table 5-5 Laws and Regulations related to Solid Waste Management in Guinea

Laws and regulations	Contents
Environmental Code (2019)	This law is the legal framework that governs all activities related to environmental protection and it covers solid waste management. It sets the basic rules for environmental protection and the criteria to ensure an environment that fits into the objectives of sustainable development at all levels. It also sets the rules to fight against various pollution sources and nuisances. In order to eliminate and reduce harmful effects on the public and the environment, it states that all waste must be collected, treated and disposed of. It defines the cleaning, pre-collection, collection, transport, landfill, treatment, recovery and disposal of household waste.
Joint decree on the Attribution of the Municipalities in the Management of Household and Similar Waste (2020)	This document stipulates that the municipalities are responsible for solid waste management in accordance with solid and similar waste management strategies approved by the relevant authorities. Therefore, the municipalities have responsibility for reorganization of collection areas, recruitment of collection SMEs and the administrative management of contracts, collection, transportation, and storage at the level of the collection areas, of transit and sorting, sorting and recovery of solid waste, control and cleanliness including valorization, and production of statistics.

Source: prepared by JICA Study Team

5.2.2 Policies and Plans related to Solid Waste Management

Guinea has policies for solid waste management, such as the “National Solid Waste Management Strategy”. In Conakry City, a master plan is currently being prepared. The major policies are shown in Table 5-6.

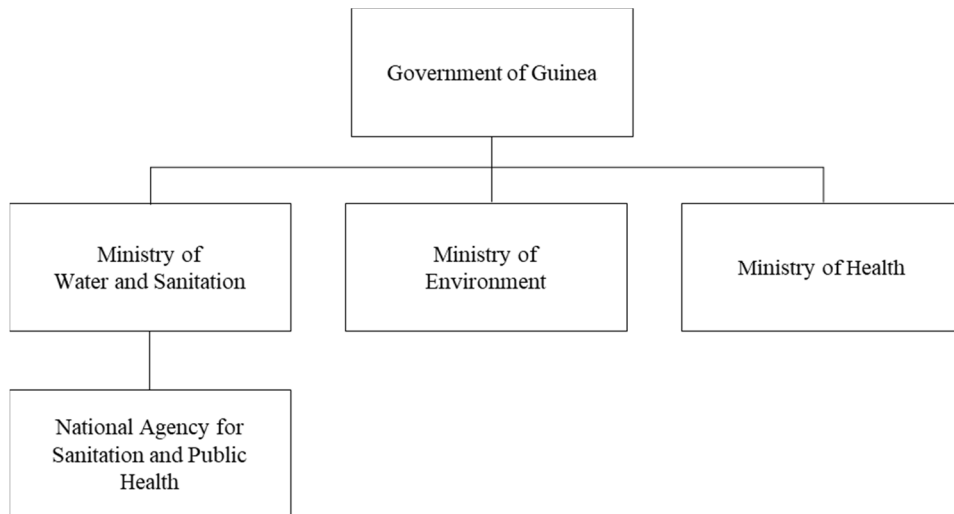
Table 5-6 Policies related to Solid Waste Management in Guinea

Policies	Contents
National Solid Waste Management Strategy 2018-2028	This is a strategy for solid waste management, including municipal solid waste, for which local governments are supposed to be responsible for its disposal. The strategy functions as a guideline for solid waste management. It also addresses the organizational structure of the waste management sector, the selection of appropriate technologies, the maintenance of sanitation in public spaces, and the management of specially managed wastes.
National Sanitation Policy (2011)	This policy is for contribution to sustainable development and improvement of the quality and the living environment of the population and guarantee of their health and protection of the environment. There are four specific objectives; (1) Promote appropriate sanitation through the National Policy and the concentrated and coherent implementation of action plans at the country level, (2) Encourage the citizens to acquire a reflex for cleanliness, practices, attitudes and behaviors in matters of sanitation, (3) Seek and mobilize the necessary and sustainable resources for financing the sanitation sector and (4) Ensure the strengthening of national and local sanitation capacities. The policy cites the promotion of recycling, the development of facilities to treat hazardous waste, and the introduction of incineration facilities in urban areas. In rural areas, the policy mentions the development of appropriate final disposal facilities and the dissemination of waste management technology.
National Environmental Policy (2011)	The policy is concerned with the management of natural resources and environmental protection, and refers to solid waste management in urban areas, particularly in Conakry City. It also mentions about generation, collection, transport and final disposal of waste in Conakry City.

Source: prepared by JICA Study Team

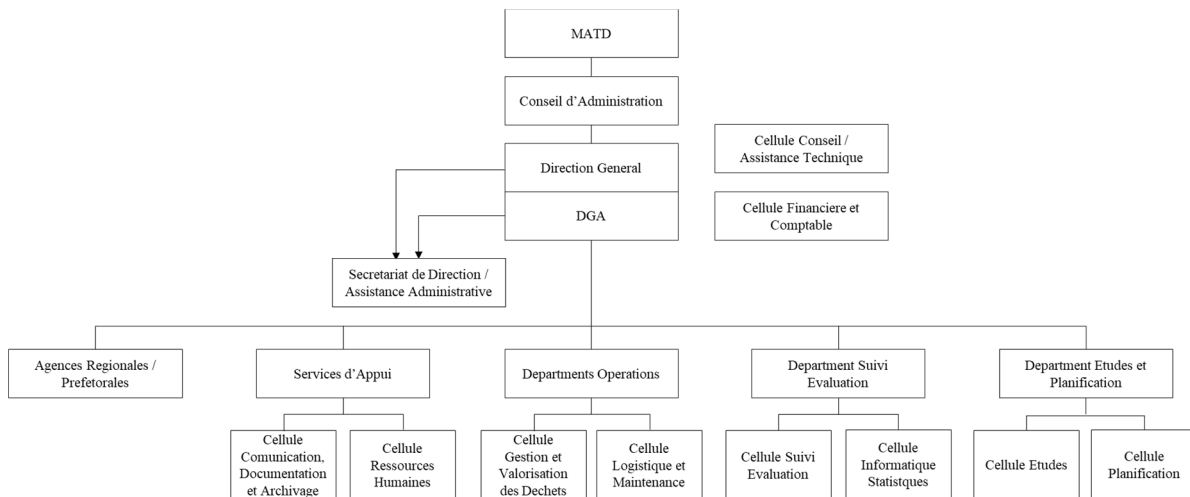
5.2.3 Organization Structures for Solid Waste Management

Solid waste management in Guinea is managed by the Ministry of Water and Sanitation and its sub-organization, the National Agency for Sanitation and Public Health (hereinafter referred to as “ANASP”). The organizational structure for solid waste management in Guinea is shown in Figure 5-4, the organizational chart of ANASP is shown in Figure 5-5, and the roles of each organization are shown in Table 5-7.



Source: prepared by JICA Study Team according to interviews with ANASP

Figure 5-4 Organization Structure for Solid Waste Management in Guinea



Source: ANASP

Figure 5-5 Organization Chart of ANASP

Table 5-7 Roles of Organizations involved in Solid Waste Management in Guinea

Organization	Role
Ministry of Water and Sanitation	Ministry of Water and Sanitation is the government agency responsible for the management of municipal solid waste. It is in charge of formulating laws, policies, regulations, and guidelines.
ANASP	ANASP is a subordinate organization of the Ministry of Water and Sanitation, and together with the Ministry of Water and Sanitation, is responsible for the management of municipal solid waste. ANASP is in charge of supervising the private companies engaged in each activity of waste management (collection and transportation, intermediate treatment, and final disposal) and formulating master plans.
Ministry of Environment	Ministry of Environment is the government agency responsible for the management of industrial and hazardous waste.
Ministry of Health	Ministry of Health is the government agency responsible for the management of medical waste.

Source: prepared by JICA Study Team

5.2.4 Information Collection and Disclosure System related to Solid Waste Management

The National Institute of Statistics publishes an annual environmental report, which includes data related to solid waste management. Part of the data includes trends of the shares (%) of the population receiving waste collection services from private companies, which are shown in Table 5-8. Private waste collectors are more prevalent in the more populated urban areas, especially in the Conakry Region where the capital city is located, at 41%. As described later, in Conakry City, collection by communes is actually carried out in all areas.

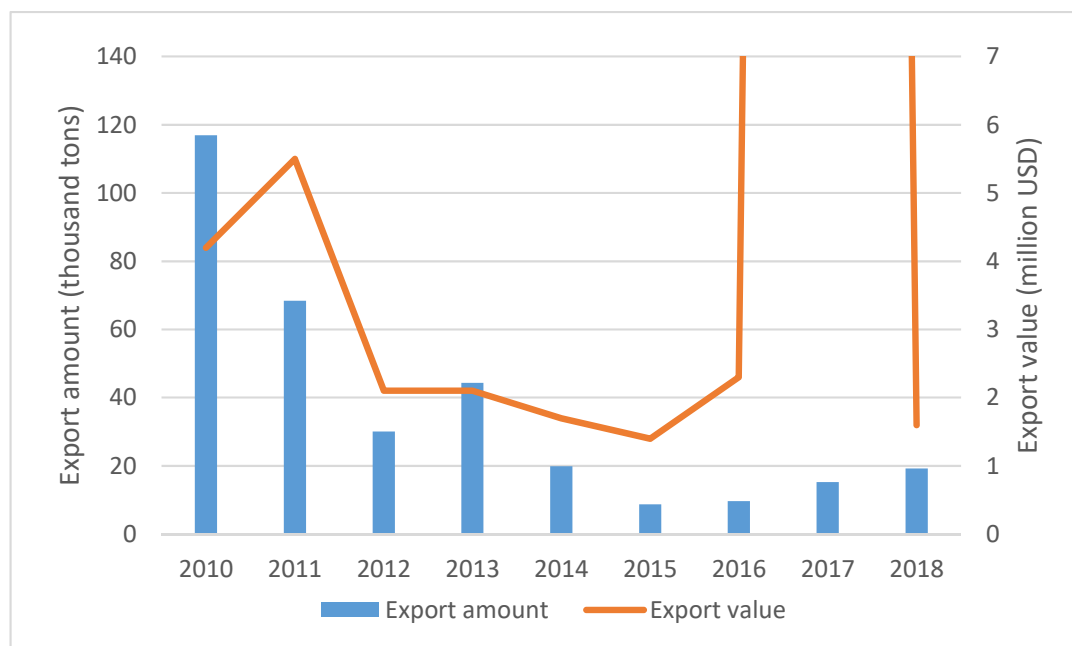
Table 5-8 Share of Population Receiving Waste Collection Service by Private Companies

Item / Year	2003	2007	2012	2018 / 2019
National average	10.5	6.5	4.9	9.7
Urban areas (including Conakry Region)	9.4	22.2	13.3	23.7
Conakry Region	55.4	38.8	21.6	41.0
Suburbs	0.8	0.3	1.2	2.1

Unit: %

Source: Annuaire des statistiques de l'environnement 2020

Figure 5-6 shows the export amount and value of recovered scrap metal (ferrous metals). Although some of the data are of questionable accuracy, such as the export value in 2017 (103,000,000 USD), in recent years, approximately 10,000 to 20,000 tons/year of scrap metal is exported, with an export value of 1,000,000 USD to 2,000,000 USD.



Source: Annuaire des statistiques de l'environnement 2020

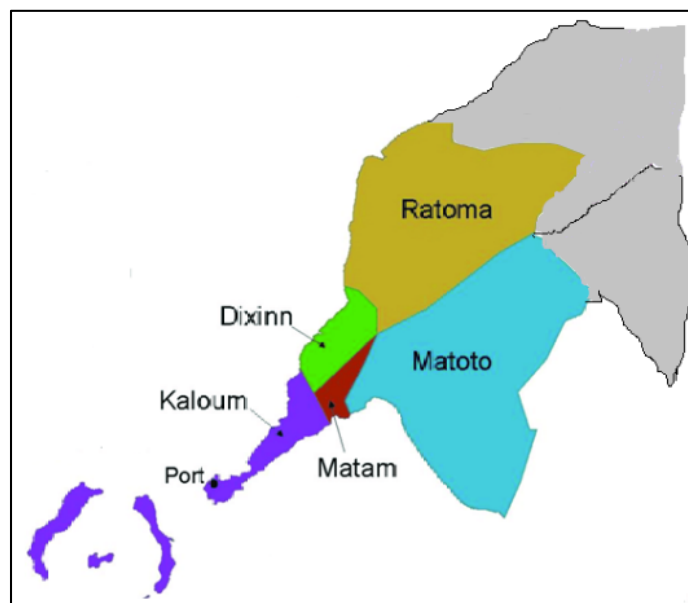
Figure 5-6 Trends in Amount and Value of Scrap Metal Exports

5.3 Solid Waste Management Situation in Conakry

5.3.1 Organizations and Finance for Solid Waste Management

(1) Organization

Solid waste management in Conakry City is managed by the Conakry Sanitation Project Management Unit (hereinafter referred to as “UGPAC”), which belongs to ANASP. UGPAC is responsible for establishing strategies and regulations for waste management in Conakry City, as well as for managing the communes (administrative units) that are components of Conakry City. Conakry City consists of five communes, namely Kaloum commune, Matoto commune, Ratoma commune, Dixin commune and Matam commune, that are in charge of solid waste management (especially secondary collection) in their respective areas. On the other hand, although Conakry City exists as an administrative organization, it does not play a substantial role in the field of solid waste management. As mentioned above, UGPAC and the communes are in charge of solid waste management in Conakry City.



Source: prepared by JICA Study Team

Figure 5-7 Location of Conakry City and Component Communes

(2) Finance

The financial resources for solid waste management in Conakry City are budget allocations from the central government. The Ministry of Budget and the Ministry of Finance are responsible for the overall fiscal management of the country. The budget allocation for each local government including Conakry City is implemented by these two ministries. The budget for solid waste management in Conakry City is 57.3 billion GNF. Of this amount, 19% comes from the central government (subsidies).

5.3.2 Ordinances and Policies related to Solid Waste Management

(1) Grand Conakry Vision 2040

The Government of Guinea, with the support of the EU, formulated the Grand Conakry Vision 2040 (hereinafter referred to as “Vision”) in 2016 as a growth strategy for Greater Conakry. The Vision assumes that by 2040, the population of the metropolitan area will double to 6 million from the 2016 population. Projects related to the Vision include the development of the Kouriah Industrial Park, housing development, expansion of the Conakry Port, and energy recovery from general waste. The Vision also states that the challenge is to preserve the city's environmental framework.

(2) Conakry City Urban Area Waste Management Master Plan

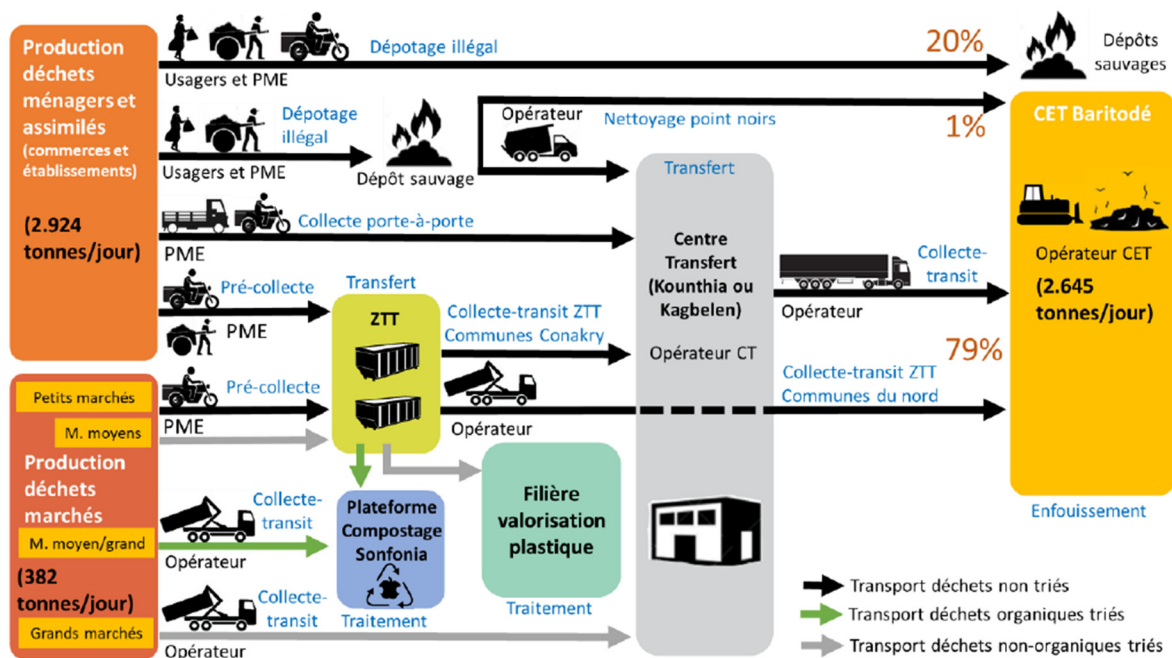
In Conakry City, the SANITA project is currently being implemented jointly by Enabel (a Belgian aid agency) and ANASP. As a part of this project, a master plan for solid waste management in the Conakry City metropolitan area is being developed.

The target area of this plan is the Conakry City metropolitan area (Conakry City, Coyah, Dubreka and Maneah). Six basic principles are being considered: “(1) solid waste management channels in the Conakry

City metropolitan area by 2040, (2) project management among local governments, (3) delegation of public services, (4) collection of separated wastes and its evaluation, (5) waste reduction, and (6) the principle of polluter pays”.

The plan also includes the following strategic objectives: “(i) strengthening the legal system and framework for efficient service delivery, (ii) introducing appropriate technologies to improve the quality of services for primary collection, secondary collection, transportation, treatment, and final disposal of waste, and (iii) improving the capacity of stakeholders for efficient and sustainable waste management”.

The plan assumes the waste treatment flow shown in Figure 5-8 in 2040. The entire Conakry metropolitan area will generate 3,306 tons of waste per day, of which 80% (2,645 tons per day) will be processed and disposed of at the Baritodé Technical Center, which is scheduled to be built in the future, and illegal dumping will be reduced to 20%.



Source: Handouts for the workshop related to the master plan for waste management in the Conakry City metropolitan area

Figure 5-8 Solid Waste Treatment Flow in Conakry City Metropolitan Area in 2040

5.3.3 Overview of Solid Waste Management

(1) Unit Amount and Generation Amount

In 2017, a waste quality and quantity survey was conducted for 75 households in Conakry City, led by the Ministry of Territorial Administration and Decentralization, with technical and financial support from EU and the Cabinet. The results of the waste quantity survey and estimates of the generation amount of household waste are shown in Table 5-9. The generation amount of waste is only from households, and does not include municipal solid wastes from business establishments (stores, offices, restaurants, schools, markets, etc.).

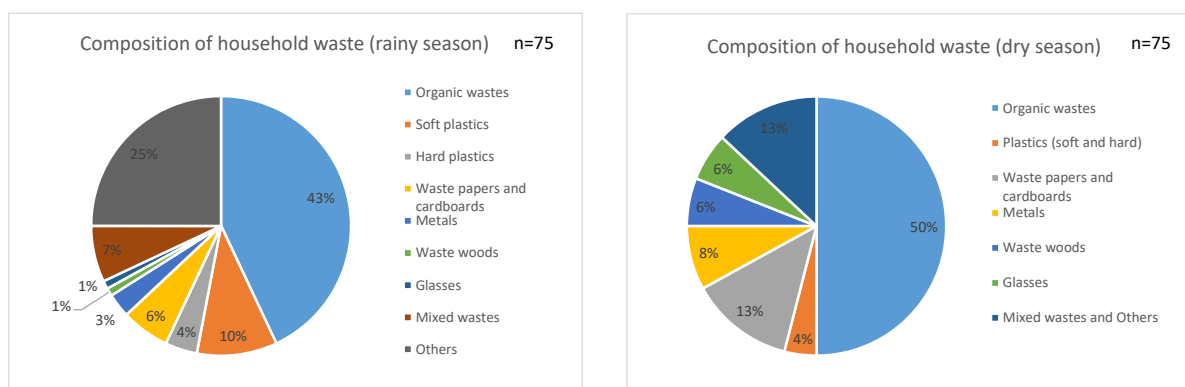
Table 5-9 Unit Amount and Generation Amount of Household Waste (2017)

Item	Value
Unit amount of waste generation (high-income)	0.49 kg/day/person
Unit amount of waste generation (mid-income)	0.35 kg/day/person
Unit amount of waste generation (low-income)	0.32 kg/day/person
Unit amount of waste generation (Conakry City)	0.40 kg/day/person
Generation amount of household waste (Conakry City) *	794 ton/day

* The population was calculated as 1,984,767 (Table 5-1).

Source: ENABEL, “Note de Synthese – Information et onnees disponibles sur la Gestion de Dechets Solides dans le Grand Conakry” (2020)

Figure 5-9 shows the composition of household waste obtained from the waste quality and quantity survey mentioned above. In both the rainy and dry seasons, organic waste accounts for approximately 40% to 50% of the total.



Source: ENABEL, “Note de Synthese – Infomations et onnees disponibles sur la Gestion de Dechets Solides dans le Grand Conakry” (2020)

Figure 5-9 Composition of Household Waste in Conakry (rainy and dry seasons)

In addition to the 2017 survey mentioned above, Conakry City conducted the waste quality and quantity survey in 2020 under the SANITA project. The survey covered households, business establishments (hotels, retail stores, schools, etc.) and markets. As a result of the survey, the unit amount of waste was calculated, and the generation amount of waste was estimated as shown in Table 5-10. The total generation amount of waste was estimated to be 1,440 ton/day, including 1,336 ton/day of waste from households, 38 ton/day of waste from business establishments, and 66 ton/day of waste from markets. Dividing this generation amount of waste by the population in 2020 (1,984,767 people), the unit of waste generation in Conakry City is 0.72 kg/person/day.

Table 5-10 Estimated Amount of Waste Generation in Conakry (2020 survey: Enabel)

Unit: ton/day

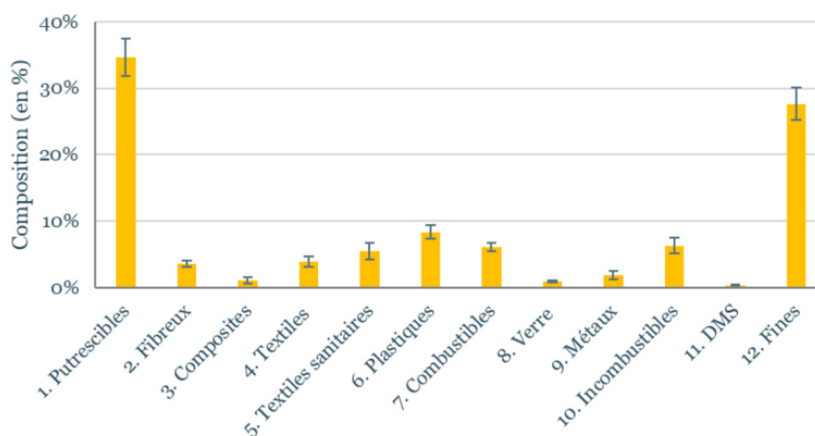
Commune	Households	Business establishments			Markets	Total
		Hotels /restaurants	Retailers/services /government agencies	Schools		
Ratoma	545.00	9.94	2.52	0.89	30.12	588.47
Matam	114.00	1.85	0.93	0.17	7.25	124.20

Unit: ton/day

Commune	Households	Business establishments			Markets	Total
		Hotels /restaurants	Retailers/services /government agencies	Schools		
Matoto	523.00	5.53	1.98	0.62	25.89	557.02
Kaloum	45.00	4.78	1.16	0.11	1.84	52.89
Dixinn	109.00	4.24	2.89	0.23	0.98	117.34
Total	1,336.00	26.34	9.48	2.02	66.08	1,439.92

Source: prepared by JICA Study Team with data from Etude de caractérisation des déchets solides municipaux dans l'aire urbaine de Grand Conakry

As a result of this study, the composition of the waste (total of household, business enterprise and market waste) in the Conakry metropolitan area is 35% organic waste and 28% fine particles (unclassifiable), as shown in Figure 5-10.



1. Organic wastes, 2. Fibres, 3. Composites, 4. Fabrics, 5. Diapers and sanitary materials, 6. Plastics, 7. Other combustibles, 8. Glass, 9. Metals, 10. Other incombustibles, 11. Hazardous wastes, 12. Fine particles (unclassifiable)
--

Figure 5-10 Waste Composition in Conakry Metropolitan Area (2020 survey: Enabel)

(2) Waste Flow

Figure 5-11 shows the waste flow in Conakry City. The amount of waste generation is 1,400 ton/day, while the amount of waste collection (secondary collection) is 787 ton/day, resulting in a collection rate of 56%.



Source: prepared by JICA Study Team

Figure 5-11 Waste Flow in Conakry City

5.3.4 Current Status of Collection and Transportation

(1) Primary Collection

In Conakry City, there is no separation at the source. Wastes from households are disposed of in bags. The wastes are collected from households by a number of micro collection agencies (hereinafter referred to as “PMEs”) contracted by the municipality for primary collection (door-to-door collection), which is done twice a week. The fees for waste collection are paid directly by the residents who use the service to the PME. The average fees and fee collection rates are shown in Table 5-11. With fee collection rates ranging from 50% to 70%, it is highly likely that the PME are not able to cover their required costs.

Table 5-11 Fees for Primary Collection in Conakry City (GNF/month)

Unit: GNF

Item	Ratoma	Matam	Matoto	Kaloum	Dixinn	Total
Fee collection rate	64.5%	51.0%	69.2%	63.4%	66.2%	63.5%
Average fee for waste collection from households	26,668	32,000	27,175	10,000	19,000	25,626
Average fee for waste collection from business enterprises	144,167	200,000	11,700	20,000	50,000	120,000

Source: Note de Synthèse sur la GDS à Conakry - Schéma Directeur GDS Grand Conakry, Juin 2020

PMEs discharge wastes into containers that are placed at collection points called “Regrouping points”. In this process, resources such as plastics, aluminum cans, and metals are sometimes collected from the containers.

Within the “Regrouping points”, there are 30 large scale collection points called “Transit Zones (ZTT)”. The Transit Zones are surrounded by walls and have ramps for unloading wastes, so they can be considered as small transfer stations. The “Regrouping points”, including the “Transit Zones”, are managed by UGPAC. The road cleaning is done by Albayrak, a Turkish company.



Source: photographs taken by local staff

(2) Secondary Collection

Once the wastes are stored in the containers and boxes located at the “Regrouping points,” they are collected by the respective communes and transported to the Miniere Landfill. On the other hand, Albayrak, a company under contract with the municipality and called “Professional Operator”, collects wastes dumped on roads and public spaces, and transports them to Miniere Landfill. The frequency of collection is not fixed and depends on the availability of collection vehicles for transportation.



Source: photographs taken by local staff

A weighbridge is installed at the Miniere Landfill to measure the amount of incoming waste to the landfill (i.e., collected waste). Table 5-12 shows the amount of waste collection in each commune for four months from November 2020 to February 2021. On average 787 ton/day of wastes are collected in Conakry City, of which Ratoma commune accounts for approximately 45% of the total.

Table 5-12 Waste Collection Amount (from November 2020 to February 2021)

					Unit: ton/day
Commune	November 2020	December 2020	January 2021	February 2021	Average
Ratoma	316	348	446	300	353
Matam	79	100	103	101	96
Matoto	163	201	203	193	190
Kaloum	96	84	87	73	85
Dixinn	34	78	77	66	64
Total	688	811	916	733	787

Source: prepared by JICA Study Team with data from Etude de caractérisation des déchets solides municipaux dans l'aire urbaine de Grand Conakry

5.3.5 Current Status of Intermediate Treatment / Recycling

Several private recycling companies have been identified within Conakry City, as shown in Table 5-13. According to the survey conducted by the SANITA project, the majority of recyclable materials collected in Conakry City are plastics, but scrap iron, aluminum cans, and tires are also collected and processed.

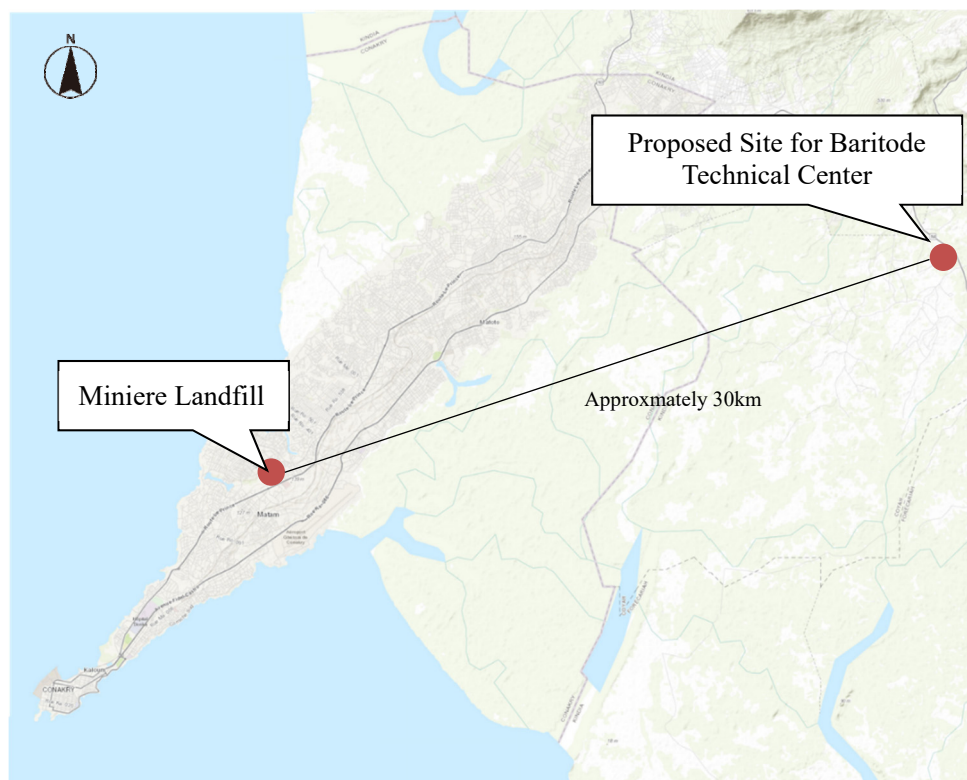
Table 5-13 List of Recycling Companies in Conakry City

Company name
DIAPLASTIQUE
KIMPLAST
ORPLASTE
CEGEDI
PLATE FORME DE COMPOSTAGE (PP)
SOGUIPLAST
TOPAZ

Source: prepared by JICA Study Team

5.3.6 Current Status of Landfill Site

The wastes discharged and collected in Conakry City are transported to Miniere landfill site located in Ratoma / Dar es Salam (Concasseur) area. The summary of Miniere landfill site is shown in Table 5-14 and Figure 5-12. The remaining lifetime of the landfill is only 3 years, and for this reason, with the support of the EU and the French Development Agency (Agence Francaise de Developpement, hereinafter referred to as "AFD"), a F/S was conducted for the construction of a new landfill site and the "Baritode Technical Center" (hereinafter referred to as "BTC") including WtE facility.



Source: prepared by JICA Study Team

Figure 5-12 Location of the Landfill Site

Table 5-14 Outline of Miniere Landfill Site

Waste Accepted	General waste, Construction and demolition waste, Agricultural waste and Hazardous waste
Working days and hours	365 days and 24 hours
Area	10ha
Established year	1987
Remaining lifetime	3 years
Operation	Outsourcing to private company (PICCINI Operator)
Facilities and equipment	Weighbridges (2), Office (2), Cells
Waste pickers	Fifty waste pickers are salvaging recyclables

Source: prepared by JICA Study Team

The Miniere landfill site receives wastes from other cities as well as Conakry City. The actual amount of wastes delivered to this landfill site is approximately 800 ton/day to 900 ton/day, including wastes from other cities, as shown in Table 5-15. In 2017, a fatality occurred due to a waste collapse accident in this landfill, but the landfill is still in use. An Italian private company (PICCINI Operator Company), called “Professional Operators”, operates the Miniere landfill site, and disposes the wastes using bulldozers and other equipment. However, soil covering is not sufficiently applied, and spontaneous combustion and fires caused by waste pickers have occurred.

Table 5-15 Amount of Wastes Received in Miniere Landfill

Commune		November 2020	December 2020	January 2021	February 2021	Average
Conakry City	Ratoma	316	348	446	300	353
	Matam	79	100	103	101	96
	Matoto	163	201	203	193	190
	Kaloum	96	84	87	73	85
	Dixinn	34	78	77	66	64
Sub-total		688	811	916	733	787
Other Cities	Coyah	1	1	19	4	6
	Maneah	0	0	0	0	0
	Dubreka	0	0	0	0	0
	Others	23	15	10	9	14
	Unclassifiable	102	7	5	2	29
Sub-total		126	23	34	15	49
Total		814	834	950	748	837

Unit: ton/day

Source: prepared by JICA Study Team with data from Etude de caractérisation des déchets solides municipaux dans l'aire urbaine de Grand Conakry





Operation Conditions at Miniere Landfill

Source: photographs taken by GUINEENEWS.ORG and JICA Study Team

5.3.7 Activities by Other Donors

A summary of projects by other donors that have been identified in Conakry City is provided in Table 5-16.

Table 5-16 Summary of Projects by Other Donors in Conakry City

Project name	Donor	Project contents
SANITA Project	Enabel, EU	Support for the formulation of a waste management master plan for the Conakry metropolitan area.
Conakry City Environmental Sanitation Program	IDB	Support for improvement of collection and transportation equipment, construction of transfer stations, and construction of segregation facilities in Ratoma commune and Matoto commune.
Baritode Technical Center Construction Project	EU, AFD	Support for the construction of the Baritode Technical Center, which will receive wastes collected from the Conakry City urban area (8 zones).

Source: prepared by JICA Study Team

(1) ENABEL

Enabel, a Belgian aid agency, is implementing a project in Conakry City in collaboration with the EU called the SANITA project, which aims to establish a sustainable waste management system and strengthen the system's capacity. The SANITA project is being implemented in two phases. In Phase 1, the project to improve waste management in Conakry City was implemented with a financial assistance of 42 million Euros. In Phase 2, with an estimated funding of 63.4 million Euros, the target area covered under Phase 1 was expanded and the project started to improve waste management in Bubreka, Maneah and Coyah prefectures adjacent to Conakry City.

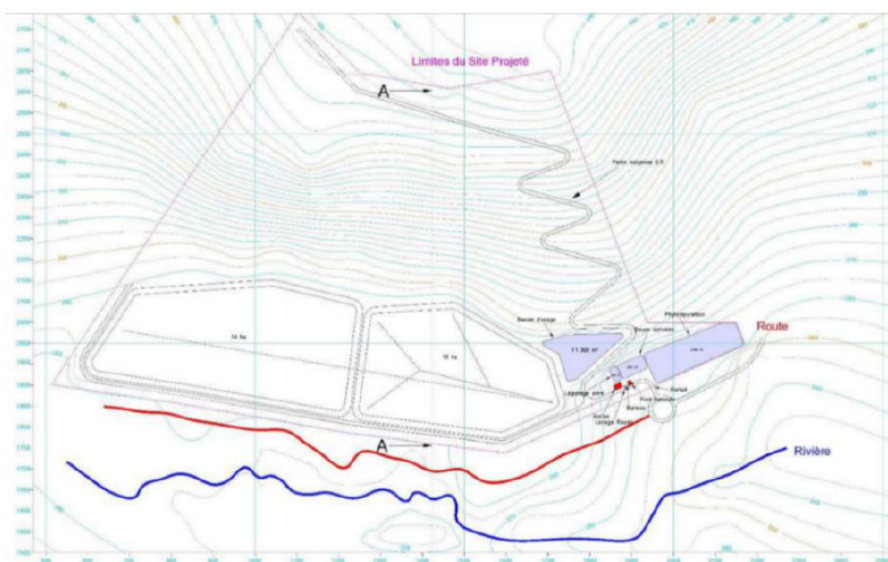
Table 5-17 Outline of SANITA Project

Phase	Target area	Objectives
Phase 1	Conakry City (approximately 2 million people)	<ul style="list-style-type: none"> • Conakry City residents' access to basic sanitation services will be improved. • Conakry City residents will have easy access to knowledge and information on how to develop a sustainable waste management system. • Capacity of government agencies and PMEs in waste management will be improved. • The waste management system will be improved by strengthening door-to-door collection • Infrastructure will be developed to facilitate management of wastes.
Phase 2	Conakry City Bubreka prefecture Maneah prefecture Coyah prefecture (approximately 2.5 million people)	<ul style="list-style-type: none"> • Access to basic sanitation services for the residents of Conakry City and Bubreka, Maneah and Coyah prefectures will be improved • Waste management infrastructure (BTC, etc.) for Conakry City and Bubreka, Maneah and Coyah prefectures will be constructed and operated.

Source: prepared by JICA Study Team

(2) AFD

AFD, in collaboration with the EU, is implementing a project to build “Baritode Technical Center (BTC)” to receive wastes collected from the Conakry metropolitan area. According to Enabel (in 2020), an F/S study was conducted in 2018 including calculation of costs, and study and evaluation of conditions and construction scale of BTC.



Source: ENABEL, “Note de Synthese – Informations et données disponibles sur la Gestion de Dechets Solides dans le Grand Conakry” (2020)

Figure 5-13 Plan of BTC to be Constructed

Table 5-18 Outline of BTC

Item	Content
Proposed construction site	Baritodé (an area in Coyah prefecture, about 50km northeast of the center of Conakry)
Landfill cell	2 cells (10hz, 14ha)
Equipment and facilities	Fence, weighbridge, workshop, leachate collection pipes, leachate treatment facility, access road, landfill compactor, backhoe loader, etc.
Intermediate facility	WtE facility (biogas)

Source: ENABEL, “Note de Synthese – Informations et onnees disponibles sur la Gestion de Dechets Solides dans le Grand Conakry” (2020)

5.3.8 Status of Monitoring on SDGs’ waste-related Indicators

Table 5-19 shows the status of monitoring on SDGs’ waste-related indicators (11.6.1, 12.3.1, 12.4.2, 12.5.1 and 14.1.1).

Table 5-19 Status of Monitoring on SDGs’ waste-related Targets (Conakry)

SDGs Indicators		Current Status
11.6.1	Proportion of urban solid waste regularly collected and with adequate final discharge out of total urban solid waste generated, by cities	Among the municipal solid waste generated in Conakry city, the percentage of municipal solid waste collected and processed in a controlled facility is approximately 56%.
12.3.1	a) Food loss index, and b) Food waste index	There are currently no laws, policies, or initiatives in place to reduce organic wastes including food (food products) and others.
12.4.2	(a) Hazardous waste generated per capita; and (b) proportion of hazardous waste treated, by type of treatment	Guinea is a member of the Basel Convention. However, there is no data on the amount of hazardous waste generated or collected.
12.5.1	National recycling rate, tons of material recycled	The amount of recycling in Conakry city has not been identified.
14.1.1	(a) Index of coastal eutrophication; and (b) plastic debris density	Data related to plastic waste being discharged into the ocean does not exist. If 30% of the illegal dumping were to be dumped in rivers and drainage channels and washed into the sea, it would result in 32 ton/day of marine plastic. Amount of marine plastic = 1,336 ton/day x approximately 8% (composition of plastic) x 30% = 32 ton/day

Source: prepared by JICA Study Team

5.4 Issues and Cooperation Needs of Solid Waste Management in Guinea and Conakry

5.4.1 Issues and Stages of Solid Waste Management

(1) Issues of Solid Waste Management

The issues of solid waste management in Conakry City are considered as follows.

- The remaining lifetime of the Miniere Landfill is only 3 years. The construction of the Baritode Technical Center (BTC) (including a landfill, WtE facility, etc.) is under consideration, and this needs to be completed without delay.
- In the meantime, the Miniere Landfill will continue to be used at least for a few years until the BTC is ready. However, the current operating conditions of this landfill are not appropriate. Application of soil cover is insufficient, fires have occurred frequently, and a slope collapse resulted in a fatality in 2017.

- The rate of waste collection is low at 56%, and there is a high possibility that a large amount of waste is illegally dumped. In particular, there is a low fee collection rate for waste collection services paid by households and business establishments to PMEs, which are responsible for primary collection. There is a possibility that primary collection is not functioning well and hence the increased illegal dumping.

(2) Stages and Priority Issues of Solid Waste Management

The stages of solid waste management in Conakry are shown in Table 5-20. Based on the description in Table 1-13, this Study evaluates the stage of solid waste management in Conakry as generally Stage 1 (improvement of public health).

Table 5-20 Stages of Solid Waste Management in Conakry

Item	Stage	Situation
Legislations	1-2	There is no basic law specific to waste management in Guinea, but there are relevant laws such as “Environmental Code” formulated in 2019 and “Joint Decree on the Attribution of the Municipalities in the Management of Household and Similar Waste” prepared in 2020.
Collection and Transportation	1	PMEs have contracts with respective communes to collect waste from households. Communes and a private company collect and transport waste from regrouping points to Miniere landfill. The secondary collection rate is approximately 56%.
Final Disposal	1	Miniere landfill is currently the only disposal site and its remaining lifetime is approximately 3 years. The landfill is facing many challenges such as lack of cover soil application over the disposed waste, fire incidents and waste collapse.
Intermediate Treatment and Recycle	1	Currently there are seven private recycling companies in Conakry, but the amount of waste recycled is not known.

Explanation of Stages 1 : Improvement of public health, 2 : Reduction of environmental impact and prevention of pollution, 3 : Building a sound material-cycle society through the 3R activities

Source: prepared by JICA Study Team

As indicated in (1) above, the following are priority issues.

<p><Priority Issues></p> <ul style="list-style-type: none"> ➤ The waste collection rate is low and a large amount of waste is illegally dumped. In particular, the collection rate of waste collection fee by primary waste collectors is low and needs to be improved.
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5.4.2 Proposed Cooperation Policy

A number of donors are currently providing assistance in waste management in Conakry and some of them have already started their activities related to the issues described earlier. Table 5-21 shows the proposed cooperation policies of waste management for Conakry City. Cooperation related to the priority issues described in 5.4.1 is highlighted in red letters and these issues are considered to have higher priority than others. However, in order to provide the high-priority assistance, self-help efforts on the part of the Guinean government are essential. For example, it is important to collect basic data about SMEs, and investigate the cause and consideration of measures to deal with the issue in cases where primary collection is actually not functioning.

Table 5-21 Proposed Cooperation Polices (Guinea)

Issue		Short-team assistance (red letters are those related to priority issues)	Middle-term assistance
Conakry City	Developing a new landfill due to the short remaining lifespan of existing landfill	<ul style="list-style-type: none"> ➤ AFD has already supported the F/S of BTC construction, and there is little room for short-term assistance on this issue. 	<p>[Grant Aid Project/Japanese ODA Loan Project]</p> <ul style="list-style-type: none"> ➤ Construct transfer stations as BTC will be far from Conakry central area. ➤ Construct some of BTC's facilities (landfill and intermediate treatment facilities)
	Improving the operation of existing landfill	<p>[Dispatch of experts]</p> <ul style="list-style-type: none"> ➤ Conduct landfill survey to determine remaining capacity and develop/implement a landfill plan. ➤ Manage waste pickers and raise their awareness to prevent fires, and distribute protective equipment, etc. 	
	Strengthening waste collection capacity	<p>IDB is considering to procure equipment for collection and transportation, and if this is done, the infrastructure capacity will be strengthened.</p> <p>[Dispatch of experts]</p> <ul style="list-style-type: none"> ➤ Establish a management system for PMEs responsible for primary collection ➤ Establish and implement a monitoring system for secondary collectors 	

Source: prepared by JICA Study Team