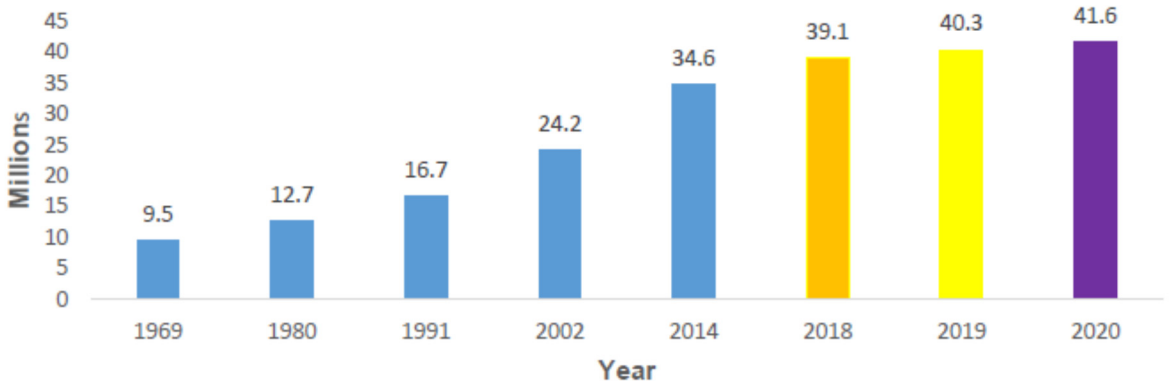
CHAPTER 6 Solid Waste Management in the Republic of Uganda

In the Republic of Uganda (hereafter referred to as "Uganda"), in addition to a remote survey conducted by a local consultant firm, J AND W AGENCIES (A) LTD, a field survey was implemented by the Japanese consultants. The results of the survey are presented in this chapter.

6.1 Overview of Target Country and City

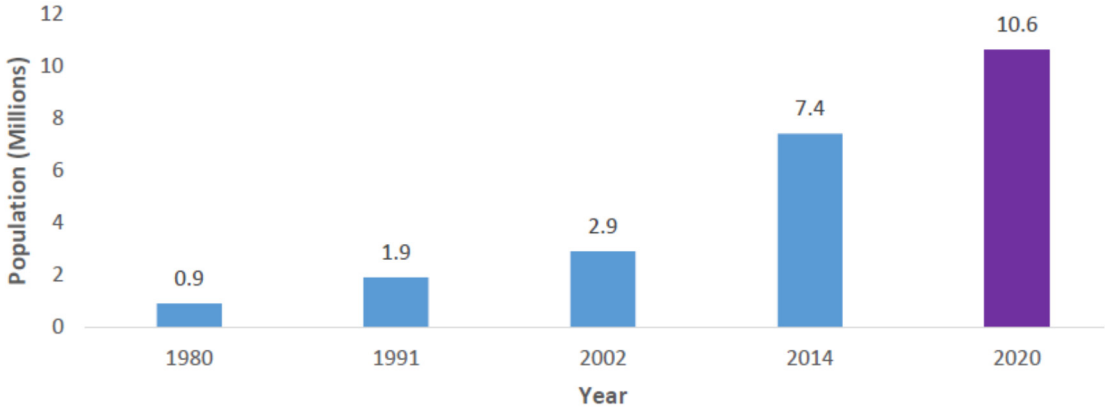
6.1.1 Population

In Uganda, a census was conducted in 2014 and the population has been estimated since then as shown in Figure 6-1. The population in 2020 is estimated to be 41.6 million people. The annual population growth rate between 2002 and 2014 is 3.0%. Figure 6-2 shows the trends and estimates of the urban population in Uganda. In 2014, the urban population was 7.4 million (21% of the total population) and it is estimated to increase to 10.6 million (25%) by 2020. The percentage of urban population is also expected to increase from 21% to 25%. As urbanization progresses, there are concerns that urban problems such as waste management will become more serious.



Source: Uganda Bureau of Statistics (UBOS), "2020 STATISTICAL ABSTRACT"

Figure 6-1 Trends and Estimates of Population in Uganda



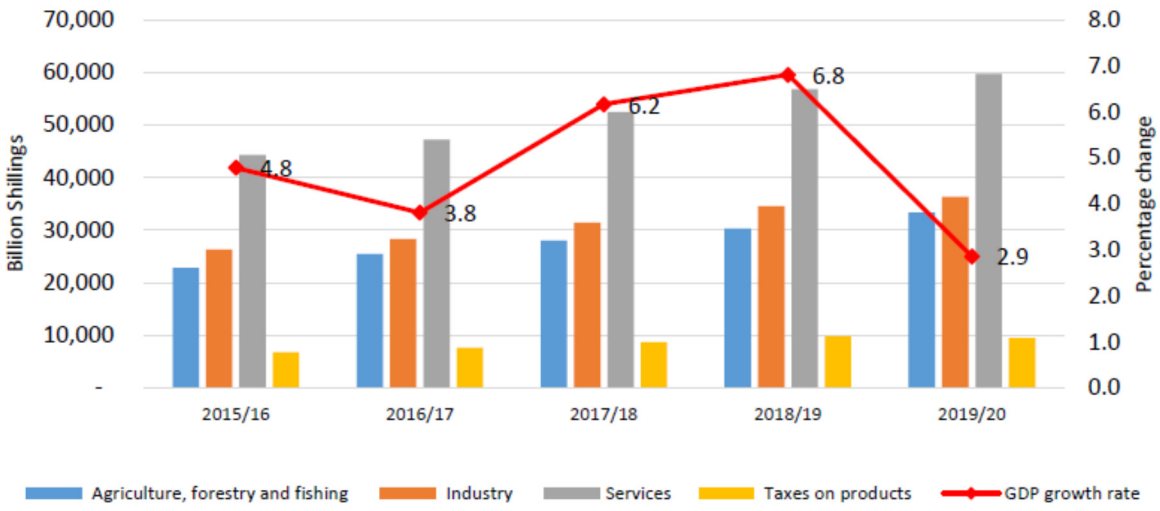
Source: Uganda Bureau of Statistics (UBOS), "2020 STATISTICAL ABSTRACT"

Figure 6-2 Trends and Estimates of Urban Population in Uganda

6.1.2 Economic Situation

Uganda's economy has been in confusion since independence in 1962 and up to the late 1980s due to repeated civil strife. However, since 1987, with the support of the World Bank and IMF, Uganda has actively pursued structural adjustment policies that have resulted in macroeconomic stability. As a result, Uganda has maintained a relatively high growth rate. In 2010, it formulated a five-year National Development Plan (hereinafter referred to as "NDP") focusing on growth and job creation, which was implemented from fiscal year 2010/11. The second NDP (2015/16-2020/21) was implemented from 2015, and implementation of the third NDP (2020/21-2024/25) started from 2021. During the third NDP period, Uganda aims to become a middle-income country[26].

GDP and economic growth rates by sector are shown in Figure 6-3. The economic growth in 2018/19 was high at 6.8%, but slowed down to 2.9% in 2019/20. GDP per capita in 2019/20 is USD910. In terms of sectors, the services sector is the largest, accounting for about 40% of the total.



Source: Uganda Bureau of Statistics (UBOS), "2020 STATISTICAL ABSTRACT"

Figure 6-3 GDP and Economic Growth Rate by Sector

In agriculture, Uganda is one of the leading coffee producers in Africa, accounting for 27% of total exports in 2002. Banana production is very high, and Uganda is the largest producer of culinary bananas in the world by far. As for industry, cement and other products are under rehabilitation, while plastics, soap, beer and other beverages are produced domestically[27].

[26] The website of Ministry of Foreign Affairs of Japan
[27] Wikipedia https://ja.wikipedia.org/wiki/%E3%82%A6%E3%82%AC%E3%83%B3%E3%83%80

6.1.3 Topography

The country has a land area of 241,000 km^2 (according to the website of the Ministry of Foreign Affairs of Japan), which is roughly the same size as the main island of Honshu in Japan. However, the land area is about 197,000 km^2, excluding the inland water area of 43,900 km^2 (18% of the total area) such as Lake Victoria. Lake Kyoga is located in the central part of the country, which is also a wetland as well as the southern part. The entire area is within the Nile Basin, and the waters of the Nile River follow Lake Kyoga and flow into Lake Albert on the border with the Democratic Republic of Congo, from where it flows north into South Sudan[28].

Source: Encyclopaedia Britannia

Figure 6-4 Map of Uganda

Uganda consists of 135 districts and the city of Kampala, which is equivalent to a district. Other cities fall under the districts.

6.1.4 Meteorological Conditions

Uganda is located just below the equator, but the climate varies slightly from place to place. In the south, rainfall is heavy all year round. Entebbe, on the northern shore of Lake Victoria, has a rainy season from March to June and November to December. In the north, the dry season is more common, and in Gulu, 120 km from the South Sudan border, November to February is very dry. Rwenzori in the southwest, near the Democratic Republic of Congo, has a lot of rain throughout the year. Lake Victoria greatly influences the climate, interfering with temperature changes and producing clouds and rain. The capital city of Kampala is located on the northern coast near Entebbe[29].

6.2 Laws, Regulation, Plans and Organizational Structures related to Solid Waste Management in the Country

6.2.1 Laws and Regulations related to Solid Waste Management

(1) National Environment (Waste Management) Regulations (2020)

National Environment (Waste Management) Regulations (2020) regulate solid waste management from four perspectives: compliance, storage, collection and disposal. The Regulations 2020 requires waste generators, managers and product manufacturers to; 1) manage waste so that it does not cause damage to public health, 2) adopt feasible and environmentally friendly solid waste management practices, and 3) maintain high resource efficiency based on solid waste management priorities (i.e., priorities for generation control, reuse,

[28] Wikipedia https://ja.wikipedia.org/wiki/%E3%82%A6%E3%82%AC%E3%83%B3%E3%83%80
[29] Wikipedia https://ja.wikipedia.org/wiki/%E3%82%A6%E3%82%AC%E3%83%B3%E3%83%80

etc.). In addition, the regulation establishes and stipulates the provisions in Table 6-1.

Table 6-1 Provisions in National Environment (Waste Management) Regulations (2020)

Item	Outline
Application for license to manage waste	Any person who wishes to engage in the business of processing, transporting, storing, handling, or disposing of waste, as well as any other person authorized by these Regulations, must apply for a license from the Authority.
Consent of local government	Any individual who wishes to store, handle, or dispose of waste must obtain the written permission of the local government in which the waste treatment facility will be situated. Before granting the consent, the local government office must ensure that the intended location of the waste management facility conforms to the requirements in the regulations, applicable laws, ordinances, by-laws and that the planning requirements are complied with.
Publication of notice of intention to issue a license	The Authority may at its discretion and at the expense of the applicant, publish its intention to grant a waste management license in a national newspaper or other media at least fifteen days before the license is issued.
Storage	A person who generates waste, a waste handler or product steward has a duty of care and shall take measures to ensure that waste is managed appropriately and securely in accordance with these Regulations, any other applicable law, environmental standards and conditions of the license;
Storage of hazardous waste	Where the waste streams involved are limited, an individual who produces hazardous waste or a waste handler can store waste for up to one year to collect quantities of waste material that can be transported for recycling, treatment, or disposal.
Collection	Local government is responsible for domestic and municipal waste. A local council must implement policies and procedures for the collection, transportation, and disposal of domestic and municipal waste created within its jurisdiction.
Collection of electrical and electronic waste by local governments	A local government may establish collection centers for the receipt of electrical or electronic waste generated within its jurisdiction. A local government may charge a fee for the receipt of electrical or electronic waste from industries, commercial enterprises or institutions.
Collection and transportation of hazardous waste	The waste handler handling hazardous waste must: (a) acquire the required licenses and permits for proper waste management in compliance with the Act and these Regulations; (b) create or retain necessary facilities for the relevant aspect of waste management licensed; and (c) ensure that the waste is properly managed in accordance with the Act and accompanying regulations.

Source: prepared by JICA Study Team according to National Environment (Waste management) Regulations (2020)

(2) National Environmental Decree (2019)

National Environmental Decree (2019), intended to update and revise the National Environmental Protection Law, also stipulates new environmental issues, especially those that have become problematic in recent years, such as climate change, management of hazardous substances, and marine plastics. This decree establishes punishment clauses, such as fines and imprisonment, as a new management approach. As it relates to waste management, the matters in Table 6-2 are stipulated.

Table 6-2 Provisions for Waste Management in National Environmental Decree (2019)

Item	Outline
Littering is prohibited	A person, who owns or occupies any dwelling or commercial premises, is responsible for waste generated at those premises until it is collected by the authorized person. A person driving a vehicle is responsible for the sanitary condition of the vehicle and for the waste generated in the vehicle. A person shall not place, deposit or allow any waste to be placed or deposited on his or her premises or on private property, on a public street, roadside, or in a ditch, river, stream, lake, pond, canal, channel, park, gulch, ravine, excavation, or other place where it may be, or become a public health nuisance.
Duty to manage waste.	Anyone who produces or manages waste is responsible for ensuring that it is properly managed in compliance with the waste management hierarchy and regulations. A person who dumps toxic waste on his or her own land, on a public street, by the side of the road, or in a ditch, river, creek, lake, pond, canal, channel, park, galley, etc. shall be committing littering. This is a crime punishable by a fine of not more than 5,000 currency points or a sentence of not more than ten years in jail if committed in an excavation or other place.
Record keeping	A person who handles Solid Waste shall keep records relating to environmental management, including, the amount of waste and by-products generated by the activity, if any, the amount of emissions and discharges, the utilization of environmental resources, the mitigation measures and residual impacts of the activity on the environment, environmental monitoring of the activity

Source: prepared by JICA Study Team according to National Environmental Decree (2019)

(3) Guideline for Landfill Management (2020)

The main objective of the Guideline for Landfill Management is to reduce the environmental impact of open dumping, which is practiced by many municipalities. This guideline provides technical methods to avoid health hazards and environmental problems caused by landfill operation. In particular, technical guidelines are provided for the following items

- Design criteria
- Priorities for Reduce, Reuse, and Recycle
- Final disposal of hazardous wastes
- Final disposal of non-hazardous waste
- Safety closure
- Securing financial resources

(4) Licensing System for Solid Waste Management

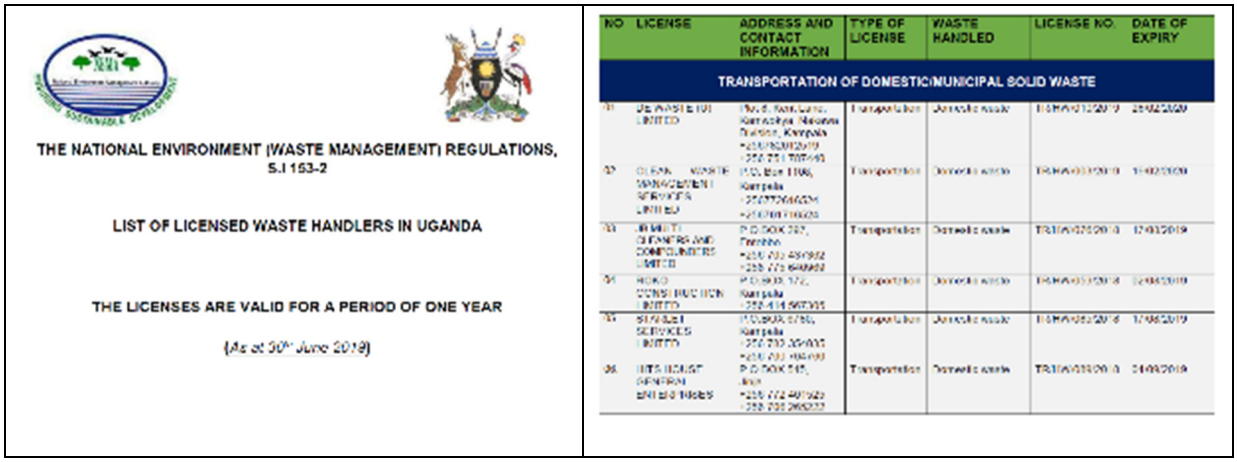
The central government of Uganda has established a licensing system for solid waste management, and the National Environmental Management Authority (hereinafter referred to as “NEMA”) is in charge of this licensing system. Private companies and municipalities engaged in solid waste management are required to obtain licenses for their operations from NEMA. The details of the licenses are shown in the following table. The licenses are obtained for each type of waste handled and the outline of the operations, and are renewed every two years. After obtaining a license, the company or municipality is required to submit an annual report to NEMA. The data released by the Uganda Bureau of Statistics (hereinafter referred to as “UBOS”) (refer to Figure 6-5), such as the amount of waste collected, is the result of NEMA's revision of this annual report.

Table 6-3 Outline of Licensing System for Solid Waste Management

Type of waste	Contents for operation	Renewal period
Municipal solid waste Hazardous waste (items to be specified)	Collection and transportation Storage Own/operate a waste treatment facility	Every two years

Source: NEMA

NEMA publishes a list of waste handers who have obtained licenses. The list below is as of June 2019, and there are 123 waste handlers registered for the entire country of Uganda. Among these, 71 are involved in collection and transportation, 17 in storage, and 35 in ownership and operation of treatment and final disposal facilities.



THE NATIONAL ENVIRONMENT (WASTE MANAGEMENT) REGULATIONS, S.I 153-2

LIST OF LICENSED WASTE HANDLERS IN UGANDA

THE LICENSES ARE VALID FOR A PERIOD OF ONE YEAR

(As at 30th June 2019)

NO	LICENSE	ADDRESS AND CONTACT INFORMATION	TYPE OF LICENSE	WASTE HANDLED	LICENSE NO.	DATE OF EXPIRY
TRANSPORTATION OF DOMESTIC/MUNICIPAL SOLID WASTE						
70	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
69	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
68	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
67	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
66	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
65	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Source: NEMA

Figure 6-5 List of Licensed Waste Handlers (as of June 30, 2019)

6.2.2 Policies and Plans for Solid Waste Management

In Uganda, there are policies related to solid waste management in Vision 2040 and the Third National Development Plan, but no plan has been developed specifically for solid waste management. In the Third National Development Plan, 18 programs are planned, and one of the targets in the "Sustainable Urbanization and Housing Supply Program" is to improve the efficiency of waste collection and transportation to 50% by 2025. Other than the Third National Development Plan, policies related to waste management are as follows.

(1) Promotion of Energy Recovery from Wastes (Waste to Energy)

In the National Energy Policy (2019), Waste to Energy (hereinafter referred to as "WtE") has been identified as one of the alternative energy sources. Refuse Derived Fuel (hereinafter referred to as "RDF"), biogas and power generation by incineration are examples of alternative energy choices. On the other hand, there are four issues that need to be addressed in order to promote WtE: 1) lack of data on the amount of municipal solid waste, potential energy, and its market; 2) poor management of waste collection and landfill sites, especially in the suburbs of Kampala, which hinders the promotion of WtE; 3) high cost of WtE technology;

and 4) lack of sewage and sludge treatment facilities with energy recovery equipment in urban areas.

The strategy for promoting WtE is to; 1) conduct a FS study to assess the potential economics of WtE in collaboration with relevant ministries and local governments, and 2) develop a legal framework for energy use and management of waste in cooperation with local governments.

The central government of Uganda has established a feed-in tariff system for electricity generated from renewable energy sources in order to promote the spread of renewable energy. The feed-in tariff is shown in Table 6-4. According to the Ministry of Energy, there is still a shortage of electricity in Uganda, and the demand for electricity generated from renewable energy sources is very high. As for the waste sector, it seems that that biogas power generation was being focused on, rather than incineration, due to the high percentage of food waste. Currently, five cities, including Kampala, are planning pilot projects for biogas power generation facilities from food waste. A power generation facility using incineration of hazardous waste is in operation in Nakasongola region and is already connected to the National Grid.

Table 6-4 Feed-in Tariffs for Renewable Energy (other technologies than hydropower)

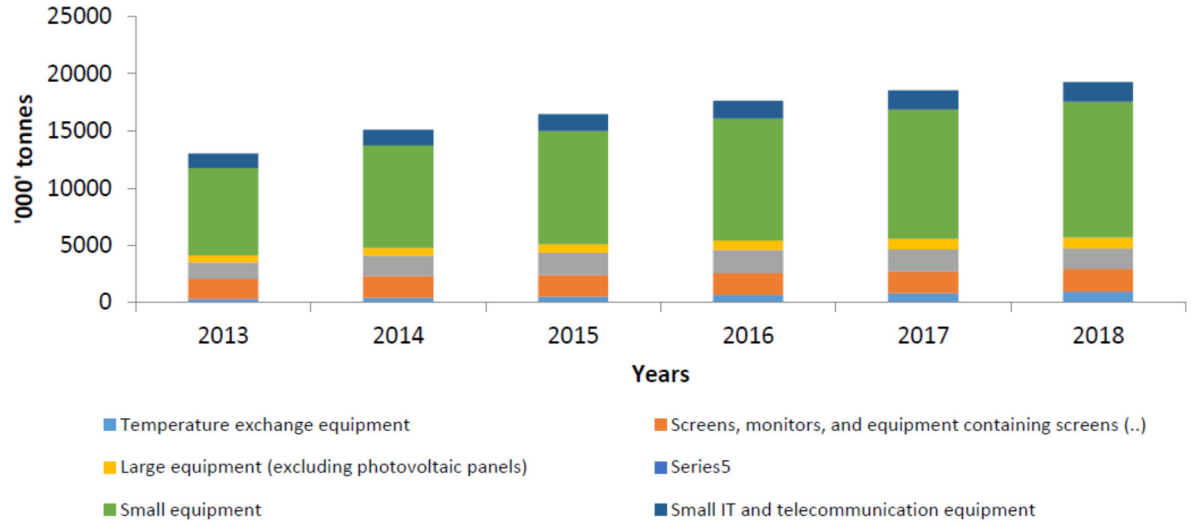
Technology	Maximum Return on Equity	Tariff Ceiling (USDc/kWh)
Biogas	13.5%	11.5
Landfill Gas	13.5%	6.6
Waste-to-Energy/Biomass	13.5%	9.5
Wind Power	13.5%	10.4
Solar PV	10.0%	7.1

Note: USDc/kWh stands for "United States Dollar Cent per kilo Watt Hour"
Source: Electricity Regulatory Authority https://www.era.go.ug/index.php/tariffs/generation-tariffs/feed-in-tariff

(2) Electronic Waste (E-Waste) Management

The National Information and Communication Technology (hereinafter referred to as "ICT") Policy (2014) promotes the development of infrastructure and provision of services in information and communication technology through PPP schemes. On the other hand, with the significant development of ICT in recent years, the central government has recognized the need for electronic wastes (hereinafter referred to as "E-Waste") management and is promoting E-Waste management.

The collection amount of E-Waste from 2013 to 2018 is shown in Figure 6-6. This collection amount is compiled by NEMA, and its data is published by UBOS, as discussed below. According to the UN's Global E-waste Monitoring Report 2020, E-Waste generation in Uganda was 17,000 ton/year in 2018 and is estimated to increase by 4,500 tons annually by 2022.



Source: Uganda Bureau of Statistics (UBOS), "2020 STATISTICAL ABSTRACT"

Figure 6-6 Generation Amount of E-Waste (EU's 6 categories)

The central government of Uganda provides guidance to the information and communication technology sector using the National E-Waste Policy (2012) as a norm. The National E-Waste Policy (2012) aims to achieve the following items;

1. To provide for establishment of e-waste facilities in the country.
2. To mobilize and sensitize the Government, private sector and the communities on the proper management and handling of e-waste on a sustainable basis.
3. To provide for the putting in place of specific E-waste standards, regulations and guidelines for the acquisition, handling and disposal processes;
4. To develop a critical human resource base knowledgeable in E-waste management;
5. To provide for resource mobilization for efficient management and disposal of e-waste.
6. To establish incentives for encouraging both local and foreign investors to establish e-waste facilities in Uganda.

In June 2021, Uganda's first E-Waste management center was put into operation as a pilot facility. The center was jointly developed by NEMA and National Enterprise Corporation. The rapid increase in the number of electrical and electronic equipment and their short life spans have resulted in a large generation amount of E-Waste. The center is operated by National Enterprise Corporation with the cooperation and supervision of NEMA.

The center aims to reduce environmental and health hazards through reusing components of collected E-Waste, and remanufacturing and recycling E-Waste. The facility takes in E-Waste and performs simple disassembly and storage. The stored E-Waste is only sold to the contracted recycling companies, and the center does not collect e-waste on its own. Government agencies in Kampala have instructed collectors to transport their E-Waste to the center before they dispose of them.


E-Waste management center

Source: The website of NEMA
https://nema.go.ug/media/ugandas-first-national-e-waste-management-centre-launched

(3) Other Related Policies

The National Industrial Policy (2020) promotes resource-efficient and environmentally sustainable industries. As policy issues, it focuses on the introduction of resource-efficient green technologies, the adoption of international environmental management methods and standards, the promotion of low-emission industries through capacity building of industries, and the promotion of low-carbon industries through the issuance of carbon footprint.

6.2.3 Organizational Structure for Solid Waste Management

The organizations involved in solid waste management and their roles are shown in Table 6-5. In line with the government's policy of decentralization, the local governments, such as municipalities have become the implementing bodies for solid waste management. NEMA is in charge of granting permits on waste management activities, regulating and developing technical standards for solid waste management businesses in accordance with the National Environmental Decree and with the environmental policy formulated by the Ministry of Water and Environment as the keynote. Under the Local Government Decree, municipalities and other local governments are responsible for solid waste management, and NEMA is responsible for enacting regulations for solid and hazardous waste.

Table 6-5 Organizations Involved in Solid Waste Management and their Roles

Organization	Roles
Ministry of Water and Environment	The Ministry of Water and Environment was established in 2007 and is responsible for the management of water and environmental resources, including waste management. The ministry is responsible for policy formulation, promotion and supervision.
NEMA	NEMA is responsible for formulating environmental policies, establishing regulations, rules and standards, and making recommendations to the country's environmental policy. In addition, NEMA is responsible for capacity building of local governments.
Ministry of Health	The Ministry of Health is responsible for health and medical care, and medical waste is included in its scope of responsibility.
Ministry of Local Government	The Ministry of Local Government promotes decentralization and oversees the administrative services of local governments, including waste management.
Ministry of Energy	Concerning waste management, the Ministry of Energy is in charge of policies related to waste power generation.
Ministry of Information and	Regarding waste management, the Ministry of Information and Communication Technology

Organization	Roles
Communication Technology	is in charge of policies related to e-waste.
Ministry of Trade and Industry	Relevant to waste management, the Ministry of Trade and Industry is responsible for policies related to the recycling industry.
Local Government	Waste management is implemented as a part of local administration.

Source: prepared by JICA Study Team

6.2.4 Financial Resources for Solid Waste Management

The budget formulation and management of local governments is regulated by the Local Government Decree and the Local Government Finance and Accounting Standards (2007). The budget of the local government includes the cost of various administrative services necessary for the livelihood of the residents, such as education, health, road maintenance and sanitation including solid waste management. The central government does not have a budget for solid waste management by local governments; it only has a budget for policy formulation, law making, licensing of waste management businesses, and capacity building, which are the responsibilities of the central government.

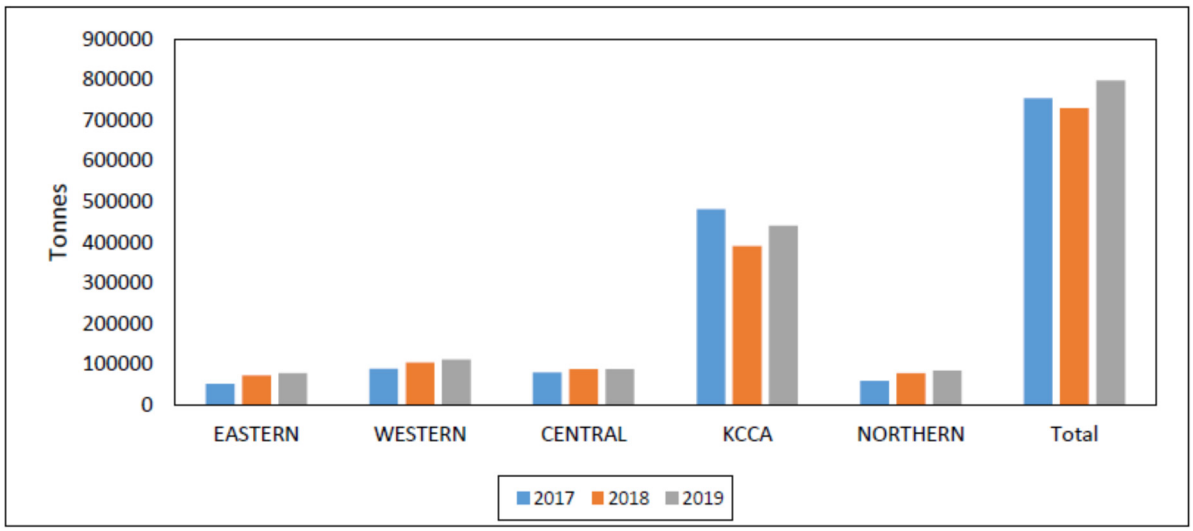
While a large part of the municipal budget consists of general or specific funds from the central government, the solid waste management budget is allocated from the municipality's own revenues. In the year 2017/18, 3,022 billion UGX of the total revenue for the municipalities in Uganda was composed by 2,980 billion UGX from funds from the central government and only 3 billion UGX from the municipalities' own revenue[30] (1 UGX=0.032800 JPY[31]). Waste management budgets are often developed as budgets for public health departments. Local governments are active in PPPs, and municipalities outsource waste collection to private companies, including the collection of fees from waste generators. Residents and offices pay fees every month for waste collection services. In addition, informal collectors sometimes provide collection services to the poor at low rates. Due to their low rates, informal collectors have a large share of the market. Waste collection fees for private collectors vary depending on the volume, but are generally between UGX 10,000 and UGX 30,000 per month.

6.2.5 Information Collection and Disclosure System for Solid Waste Management

UBOS collects data on the volume of collected municipal solid waste, the amount of collected hazardous waste, and the amount of generated E-Waste, and publishes these data as 2020 STATISTICAL ABSTRACT. NEMA provides these data to UBOS by compiling the figures from the annual reports submitted by licensed companies and municipalities for collection and transportation.

The amount of municipal solid waste collected by Kampala Capital City Authority (hereinafter referred to as "KCCA") was 481,082 ton/year in 2017, 390,737 ton/year in 2018, and 440,710 ton/year in 2019, as shown in Figure 6-7.

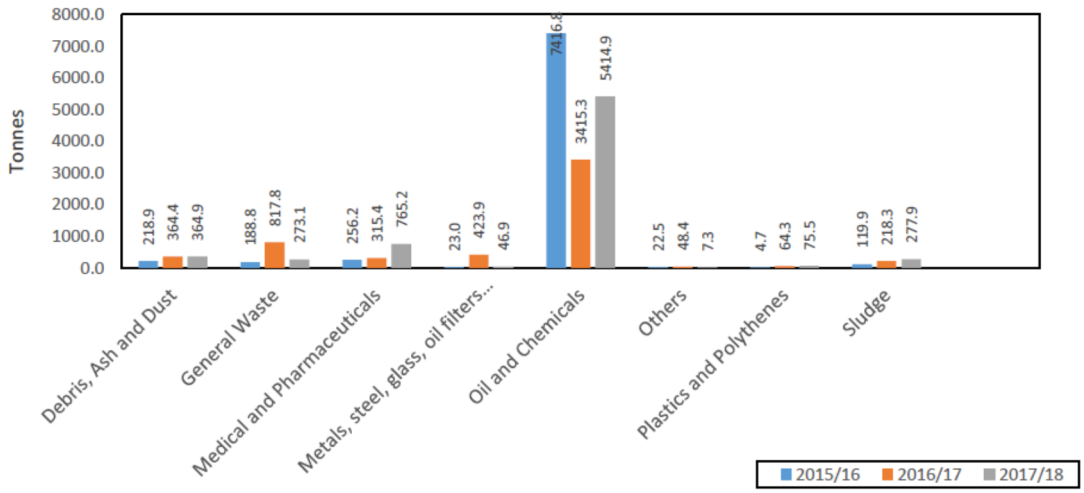
[30] Annual Government Finance Statistics - Last Updated on 18th January 2019, UBOS
[31] JICA's rate in March 2022



Source: Uganda Bureau of Statistics (UBOS), "2020 STATISTICAL ABSTRACT"

Figure 6-7 Collection Amount of Municipal Solid Waste by Region (major municipalities)

The collection amount of hazardous waste across the country for the three years 2015/16 to 2017/18 is shown in Figure 6-8. In 2017/18, petroleum and chemical related wastes were the most prevalent, accounting for approximately 75% of the collection amount of hazardous waste, followed by medical and pharmaceutical related wastes, which accounted for approximately 10%.



Source: Uganda Bureau of Statistics (UBOS), "2020 STATISTICAL ABSTRACT"

Figure 6-8 Collection Amount of Hazardous Waste in the Whole Country

6.3 Solid Waste Management Situation in Kampala

KCCA covers an area of 189 km^2 and consists of five Urban Divisions (Central, Kawempe, Rubanga, Kakindye and Nakawa) as shown in Figure 6-9.

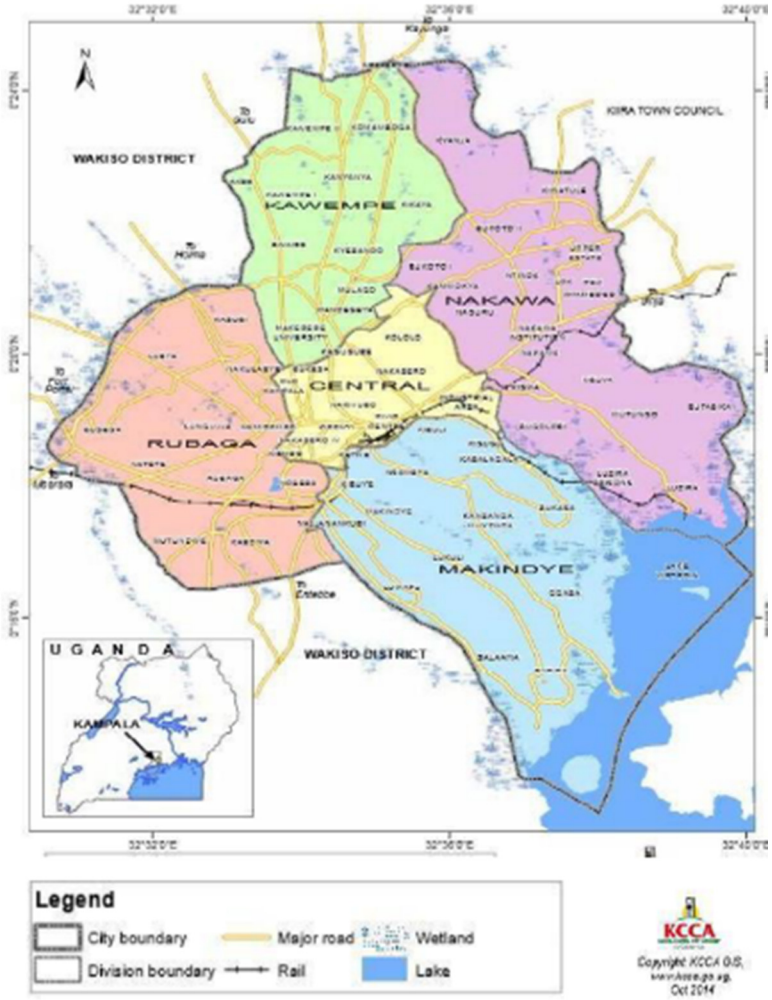
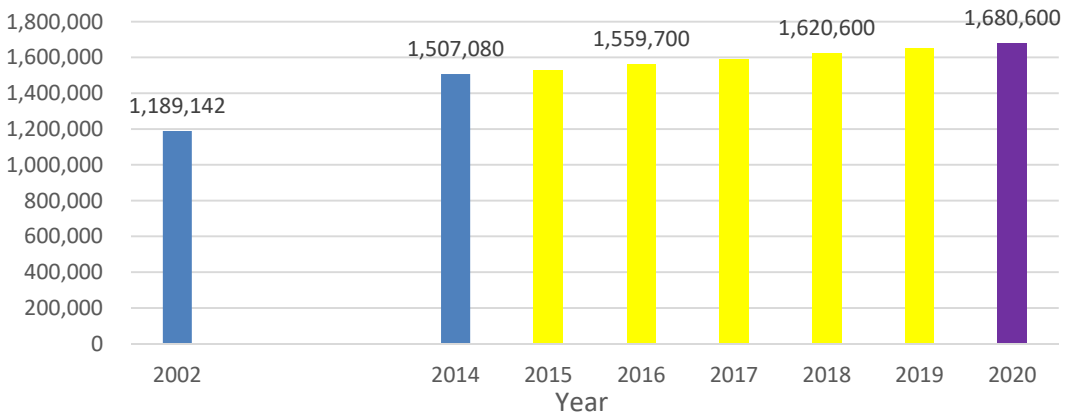


Figure 6-9 Map and Administrative Boundaries of Kampala

Population trends and estimates for Kampala City are shown in Figure 6-10. The population was 1,507,080 in 2014 and is estimated to be 1,680,600 by 2020.

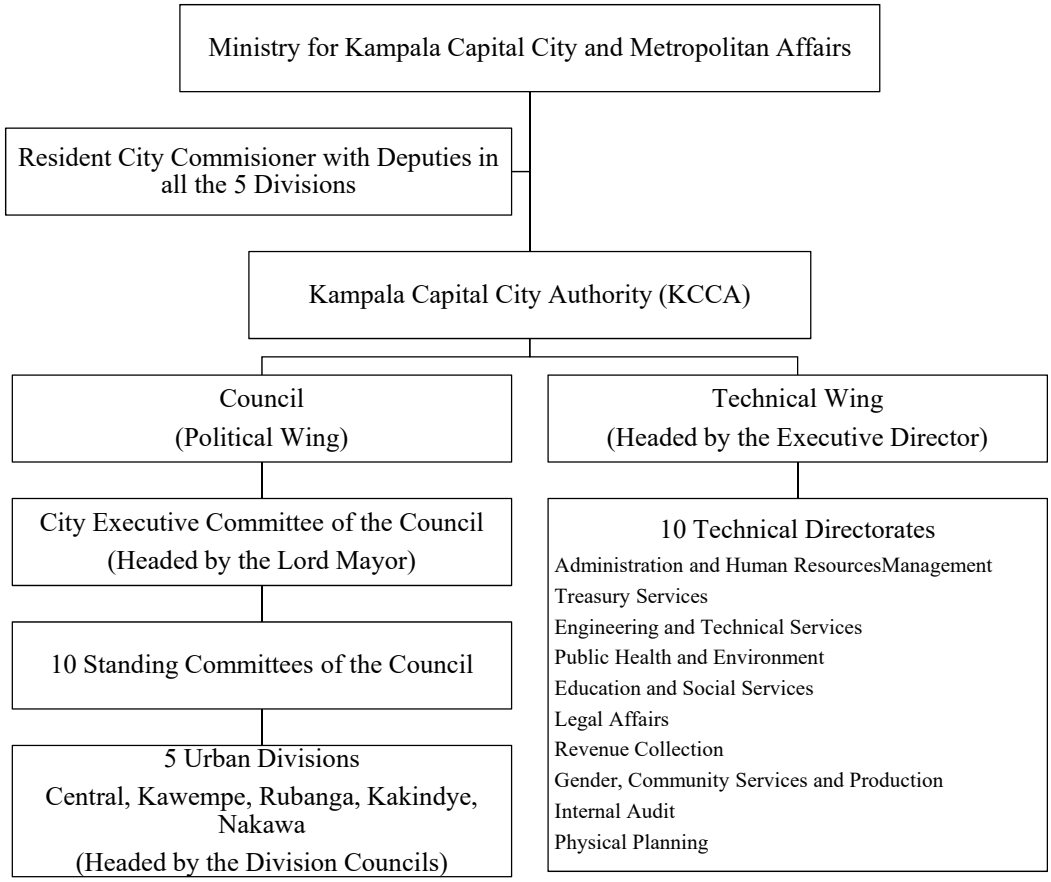


Source: Uganda Bureau of Statistics (UBOS), "2020 STATISTICAL ABSTRACT"

Figure 6-10 Population Trends and Estimates for Kampala

6.3.1 Organizations for Solid Waste Management

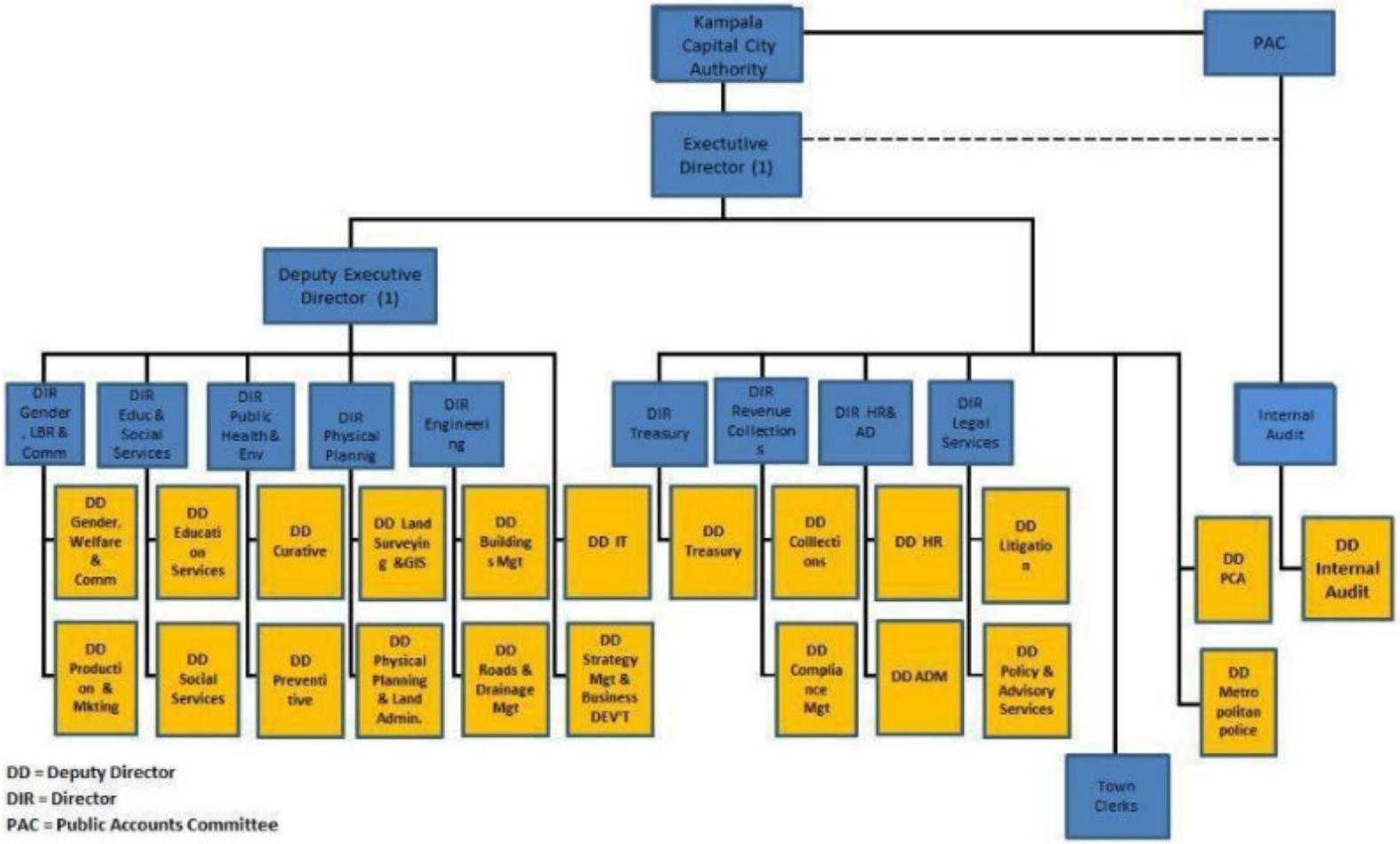
Figure 6-11 shows the organizational chart of Kampala City as a whole. KCCA is responsible for the administration of the capital city of Kampala on behalf of the central government. KCCA is largely composed of the Political Wing (parliamentary and political division), headed by the Lord Mayor, and the Technical Wing (administrative division), headed by the Executive Director.



Source: prepared by JICA Study Team according to Kampala City Statistics Abstract, 2019

Figure 6-11 Overall Organizational Chart of Kampala City

The organizational chart of the Technical Wing (administrative division) is detailed in Figure 6-12. As mentioned above, the Technical Wing consists of 10 Directorates and the Town Clerks of the Urban Divisions. The Town Clerk is the administrative and accounting head of each Urban Division. The Urban Division is responsible for the administration of waste management, road maintenance, medical services, education, and tax collection in each area.



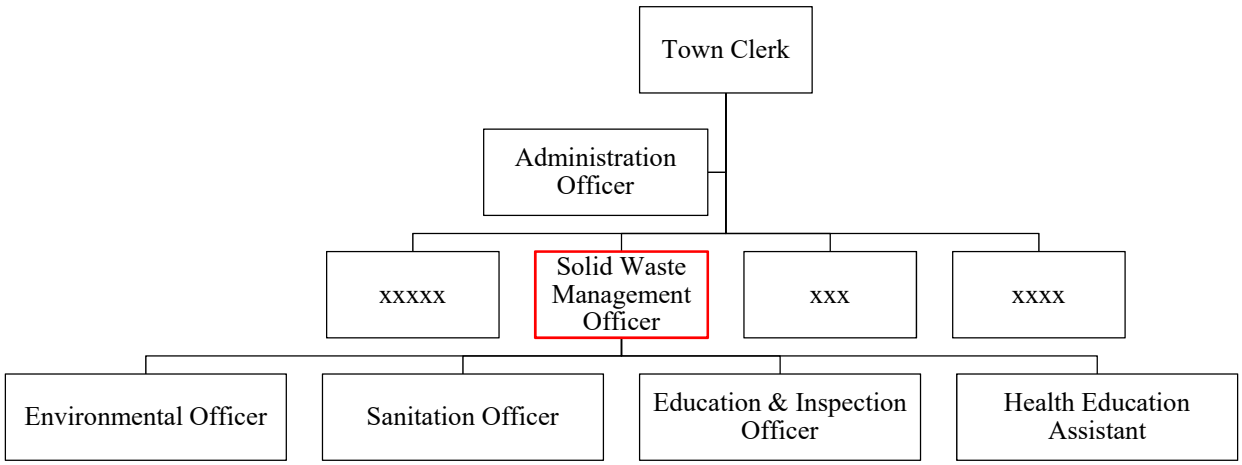
Source: *Kampala City Statistic Abstract, 2019*

Figure 6-12 Organizational Chart of Technical Wing (administrative division)

The system of waste management is shown in Figure 6-13 and Figure 6-14. Solid waste management in Kampala City is supervised by KCCA's Public Health Directorate and Environment, and waste management in each Urban Division is managed by the Solid Waste Management Officer of each Division. The operation of Kiteezi landfill site is managed by the landfill operation team of KCCA's Public Health Directorate and Environment.

Source: prepared by JICA Study Team

Figure 6-13 System of Solid Waste Management (KCCA Headquarters)



Source: prepared by JICA Study Team according to Kampala City Statistic Abstract, 2019

Figure 6-14 System of Solid Waste Management in Urban Division

The number of personnel involved in solid waste management is approximately 2,500, as shown in Table 6-6. The personnel are broadly classified into regular and temporary staff, and most of the workers, such as cleaners and drivers, are temporary staff whose numbers fluctuate depending on the need.

Table 6-6 Number of Staff Related to Solid Waste Management in KCCA

KCCA Headquarters	
Director, Public Health and Environment	1
Deputy director, Preventive Health	1
Manager, Sanitation and Environment	1
Urban Divisions	
Town clerks	5
Solid Waste Management officers	5
Casual workers (sweepers and loaders)	2,500
Kiteezi Landfill	
Landfill Officer	1
Environment officer	1
Leachate assistants	3
Data clerks	3
Track guides	5
Cleaners	5
Total	**2,531**

Source: prepared by JICA Study Team according to Ministerial Policy Statement, Ministry of Kampala 2017/2018/2019

6.3.2 Finance for Solid Waste Management

KCCA budgets for administrative services, including waste management, in accordance with the Local Government Decree and the Local Government Finance and Accounting Standards (2007). The KCCA budget is shown in Table 6-7 and the road sector has the largest share. This sector is supported by the World Bank's "Kampala Institutional and Infrastructure Development Project" and the Uganda National Road Fund. The budget for solid waste management is included in "Health" and "Sanitation and Environment". The percentage of the budget for both sectors is not large, less than 10% of the total budget. The KCCA budget, including solid waste management, is managed by the headquarters and allocated to each department on a quarterly basis.

According to KCCA, the collection and transportation cost per ton is 10.8 USD/ton and the final disposal cost is 2.6 USD/ton.

Table 6-7 Actual Budget of KCCA (unit: UGX (billions))

Sector	2017	2018	2019
Production	7.88	7.07	6.85
Education	36.50	37.96	46.28
Health	**6.88**	**20.31**	**19.32**
Water & Environment	**14.64**	**15.55**	**16.24**
Social Development	1.82	1.86	1.7
Revenue Collection	3.6	3.69	2.98
Human Resources and Administration	78.44	89.50	90.42
Legal Support	18.44	12.42	12.19
Political Governance	14.05	17.87	15.00
Treasury Services	3.95	2.98	2.35
Internal Audit	0.27	0.31	0.235
Executive Support	5.21	5.44	6.31
Urban Planning	3.05	3.46	3.02
Works and Transport	369.11	118.98	257.05
Grand Total	**563.84**	**337.39**	**479.94**

Source: Ministerial Policy Statement, Ministry of Kampala 2017/2018/2019

6.3.3 Ordinances and Policies related to Solid Waste Management

(1) Solid Waste Management Ordinance

An ordinance related to waste management is the Solid Waste Management Ordinance, 2000. This ordinance consists of 40 articles, which regulate storage, discharge, collection, transportation, and disposal. For collection and transportation, the ordinance stipulates introducing source separation and collection of separated wastes.

(2) Waste Management Policy

KCCA has been implementing the Kampala Waste Management Project (hereinafter referred to as "KWMP") since 2011, which consists of five components. Among them, component 4, the development of Ddundu landfill, is currently being promoted by KCCA as the Kampala Waste PPP Project with the support of the International Finance Corporation (hereinafter referred to as "IFC"). Under this component, the development and operation of Ddundu landfill is being planned using the PPP scheme. Furthermore, the Groval Green Growth Institute (hereinafter referred to as "GGGI") is assisting in the design of the transfer station under Component 3.

The five components are:

1. Improvement of collection and transportation
2. Closure of Kiteezi landfill
3. Construction of transfer stations
4. Development of Ddundu landfill (Kampala Waste PPP Project)
5. Study on long term waste management technology

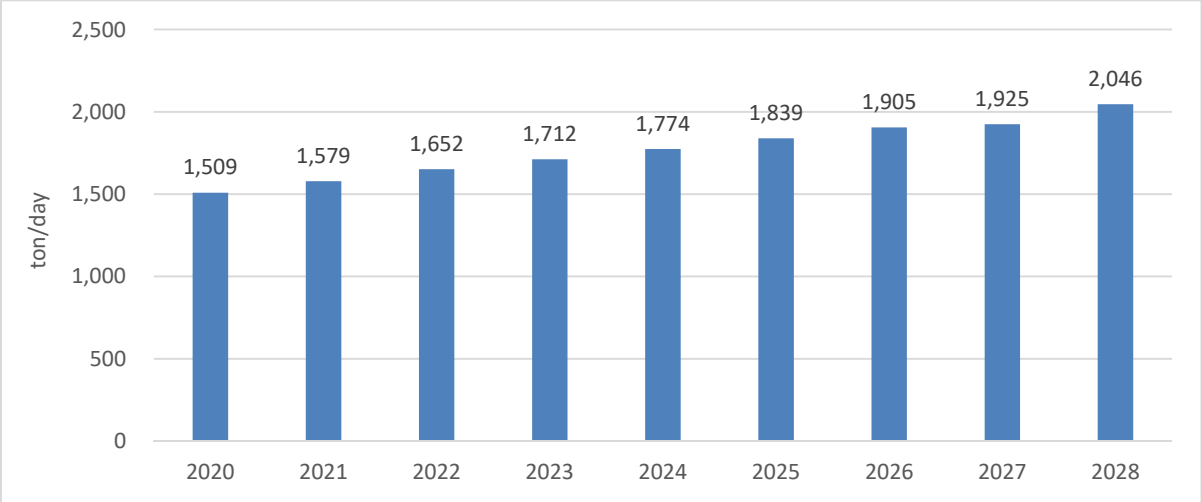
In addition to the above, KCCA, with support from GGGI is in the process of formulating a waste management policy, which is expected to be completed by July 2023.

6.3.4 Overview of Solid Waste Management

According to interviews with KCCA and other organizations, the amount of waste generation in Kampala City is between 2,000 ton/day and 2,500 ton/day, of which 1,300 ton/day to 1,500 ton/day are collected. The collection rate is approximately 60%. On the other hand, the Preliminary Information Memorandum of the Kampala Waste PPP Project, supported by IFC estimates the waste unit generation rate as 0.55 kg/person/day and the amounts of waste generation as shown in Figure 6-15. In accordance with this estimation the amount of waste generation in 2020 is calculated as 1,509 ton/day (refer to Figure 6-15). Furthermore, this report concludes that the waste collection rate is 60% in Kampala City, and approximately 1,300 ton/day of waste is collected. In this case, calculating backwards the amount of waste generation is 2,167 ton/day, which is close to the result of the interview with KCCA, but deviates from the estimated amount of waste generation by Kampala Waste PPP Project, of 1,579 ton/day for 2021 (refer to Figure 6-15).

In Kampala City, there are no weighbridges at the landfill site, and the waste collection amount is estimated

based on the number of incoming vehicles to the landfill. In addition, no recent survey on the unit generation rate of waste has been conducted. As for the waste collection amount, it is mostly in the range of 1,000 ton/day to 1,400 ton/day according to the statistical data, as described later in section 6.3.5. In this Study report, considering these statistics, the results of the interviews, and the report of the Preliminary Information Memorandum, JICA Study Team adopted the lower limit of the interview results, which is 2,000 ton/day of waste generation and 1,300 ton/day of waste collection. Since the estimated population of Kampala City is 1,680,600 people in 2020, the waste unit generation rate is accordingly calculated as 1.19 kg/person/day (2,000 ton/day / 1,680,600 people).



Source: Preliminary Information Memorandum, Kampala Waste PPP Project

Figure 6-15 Future Estimation of Waste Generation

The waste composition is shown in Table 6-8, with organic waste accounting for 40% of the total. The lower calorific value of the waste is 6.12MJ/kg.

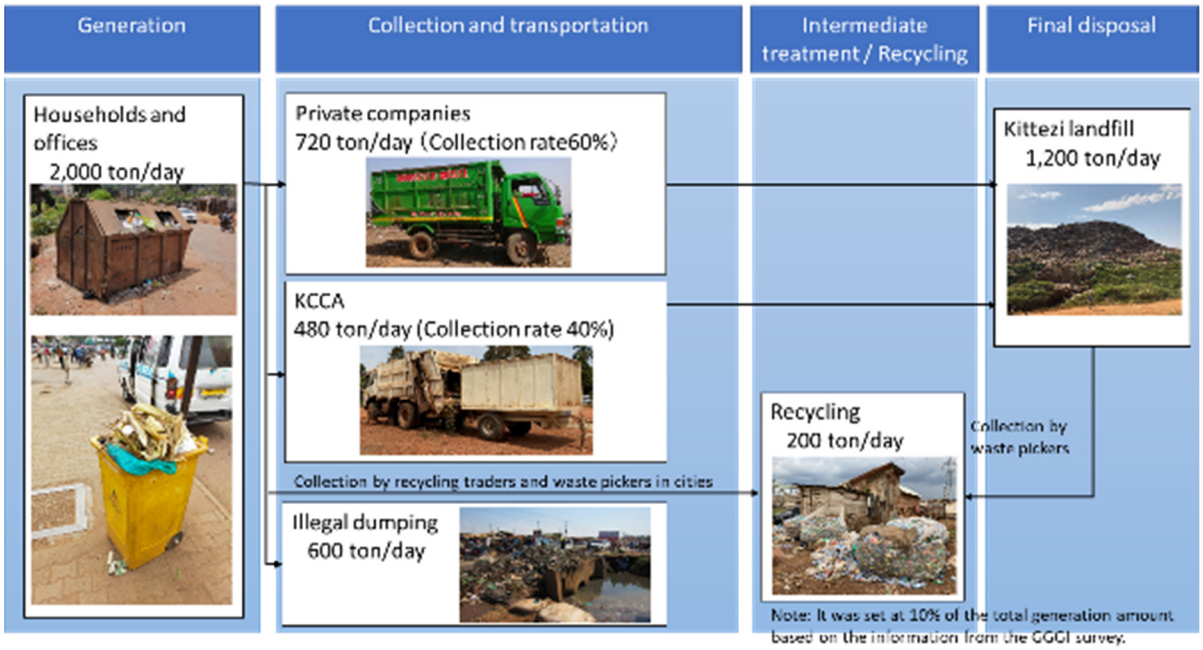
Table 6-8 Waste Composition

Category	Share (%)
Organic waste	43
Mixed fine waste	42
Plastics	6
Animal waste	3
Sanitary waste	3
Paper and cardboard	2
Textiles	1
Other	1

Source: Preliminary Information Memorandum, Kampala Waste PPP Project

The waste flow of Kampala City is shown in Figure 6-16. For the amount of waste generation and collection in this flow, JICA Study Team adopted the lower limit values based on the results of interviews with KCCA and others. The share of KCCA in the collected waste amount is assumed to be 40% based on the interview results, etc. The recycling amount was set at 10% of the generation amount based on the information from GGGI at this time. As a result, the waste collection rate in Kampala City is 40%. This means that 600 tons of

waste per day, which is equivalent to 30% of the total amount of waste generation, is not being collected and is being burned or illegally dumped. While it is true that illegal dumping was observed in Kampala City, especially in the suburbs and slum areas, however JICA Study Team felt that the waste collection rate of 60% was an underestimation, and the Study Team was under the impression that the waste collection rate was actually a bit higher. However, there is no recent data on the waste unit generation rate, and the collection amount of waste is estimated from the number of incoming vehicles to the landfill site, rather than measured values at present. Since it is not possible to examine the data more precisely, updating of the unit generation rate and collection waste amounts through the appropriate surveys will help to make a better determination of the waste collection rate. This is an issue for future consideration.



Source: prepared by JICA Study Team

Figure 6-16 Waste Flow in Kampala City

6.3.5 Current Status of Collection and Transportation

KCCA has divided the city area into seven zones as shown in Figure 6-17. In principle, three companies are allocated two zones respectively as shown in Table 6-9, and only Zone 6 is directly managed by KCCA's Urban Division for waste collection. In slum areas where private companies do not collect waste, the Urban Division of KCCA directly conducts waste collection. In all zones except Zone 6, waste collection has been privatized. The three companies contracted by KCCA provide waste collection services by collecting waste collection fees directly from residents and businesses without any consignment fees from KCCA. The contract period with the three companies is until June 2022. Until now, the zones have not been aligned with the Urban Division boundary, but KCCA has reviewed the zones to align with the Urban Division boundary and is in the process of conducting a bidding process for collection contractors. As of January 2022, KCCA is in the process of evaluating contractors who have submitted expressions of interest. Currently, KCCA

collects 40% of the total waste, but by promoting the use of private contractors, KCCA aims to achieve a system where by 2025, KCCA collects 20% of the waste and private contractors collect 80%.

There are no transfer stations in Kampala, and all waste is transported directly to the Kittezi landfill by waste collection vehicles. In a limited number of areas, primary collection of waste from households to waste collection points is carried out on an individual basis, but it is not widely deployed.

Source: Preliminary Information Memorandum, Kampala Waste PPP Project

Figure 6-17 Zones for Waste Collection in Kampala City

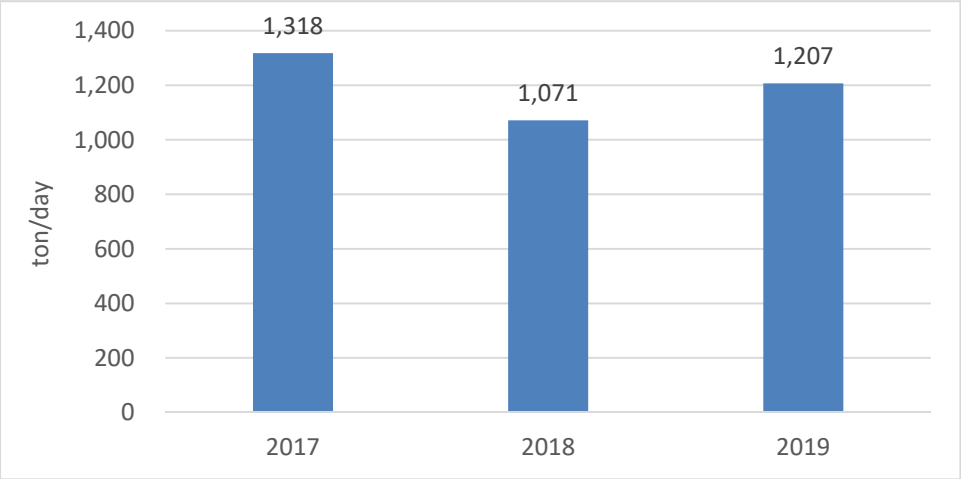
Table 6-9 Allocation of Waste Collection Areas

Operator	Zone
KCCA	6
Homeklin Uganda Limited	3, 4
Nabugabo Updeal Joint Venture	5, 7
Kampala Solid Waste Consortium	1, 2

Source: prepared by JICA Study Team according to Ministerial Policy Statement for Financial Year 2018/19

According to the interview with KCCA, the amount of waste collected in Kampala City is between 1,300 ton/day and 1,500 ton/day. The data from UBOS also shows that the amount of waste collected in Kampala City in recent years is almost consistent, as shown in Figure 6-18. KCCA's Statistical Abstract for Kampala City shows that in 2018/2019 (July 2018 to June 2019), the amount of waste collected was 1,038 ton/day, of which KCCA collected approximately 55% at 472 ton/day. This percentage has been decreasing year by year and is now approximately 40%. Since the figures for the amount of waste collected vary slightly according to various statistical data, this Study adopted the lower limit of the results of the interview with KCCA, as

described in section 6.3.4, and assumed the amount of waste generated to be 2,000 ton/day and the amount of waste collected to be 1,200 ton/day.



Source: Uganda Bureau of Statistics (UBOS), "2020 STATISTICAL ABSTRACT"

Figure 6-18 Trends in Waste Amount Collected in Kampala City (information from UBOS)

Table 6-10 Trends in Waste Amount Collected in Kampala City (statistics by KCCA)

Unit: ton/day

Urban Division	Year 2015/2016	Year 2016/2017	Year 2017/2018	Year 2018/2019
Collected by private companies	263	441	619	566
Collected by KCCA	743	791	571	472
Central Division	187	115	102	104
Kawempe Division	130	176	132	111
Rubaga Division	176	177	113	58
Makindye Division	137	165	93	89
Nakawa Division	113	158	131	110
Total	**1,006**	**1,232**	**1,190**	**1,038**

Source: Statistical Abstract for Kampala City

The waste collection vehicles owned by KCCA and allocated to each Urban Division are shown in Table 6-11. However, all the vehicles are aging and breakdowns are frequent. The maintenance and repair of the equipment is done in KCCA workshops, and not in the Urban Division, but this is a matter of concern because the repairs often take a long time.

Table 6-11 Waste Collection Vehicles of KCCA

Urban Divisions	Compactor (17 ton)	Container carrier (5 ton)	Truck (5 ton)	Total
Nakawa	2	1	2	5
Makindye	2	1	1	4
Rubaga	1	1	2	4
Central	2	1	2	5
Kawempe	1	1	3	5
Total	**8**	**5**	**10**	23

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

Three private waste collectors provide collection and transportation services under a contract with KCCA. The collection companies are managed by the respective Urban Divisions. The contractors are supposed to submit monthly reports to the Urban Division, but this system does not appear to be functioning well. The three waste collection companies set their waste collection fees according to the services they provide and collect directly from residents and businesses. In general, the premium service is UGX 30,000 per month and the regular service is UGX 3,000 (passing waste directly to the collection vehicle). Since the fees are not meter-based, the waste collection companies have recommended to KCCA to adopt a meter-based system. According to the Willingness-to-Pay Survey conducted by KCCA in the past, most residents consider a fee of UGX500/month to be reasonable. Since private waste collectors collect the fees themselves, they are also facing problems with residents and businesses who demand discounts at the time of collecting the fees.

On the other hand, in Zone 6, the Urban Division of KCCA directly collects wastes and does not collect fees from residents. Residents in Zone 6 do not have to pay garbage collection fees to KCCA, which is unequal to other zones. There are cases where waste collection vehicles directly operated by KCCA are collecting wastes from residents in zones other than Zone 6 at a lower price than private companies, causing conflicts between KCCA and private companies.

In the slum areas, KCCA collects wastes directly or private companies collect wastes at low cost as part of their CSR activities. Waste collection vehicles cannot enter the slums of Rubaga Division and Makindye Division, so Urban Division has set up special collection points to collect the waste. At the collection points, CBOs are collecting recyclable materials and producing fuels.

Waste collection points in slum area and recyclable materials collected by CBOs

Source: JICA Study Team

In Kampala City, it is estimated that 600 ton/day of waste, equivalent to 30% of the total generated waste amount, is not collected and is either burned in the open field or dumped illegally. In fact, in the suburbs and slum areas, waste is illegally dumped into rivers and other open spaces.


Illegal dumping

Source: prepared by JICA Study Team

Each Urban Division removes illegally dumped wastes on a continuous basis. Table 6-12 shows the status of illegal dumping removals in 2018 and 2019. In 2019, illegal dumped wastes were removed from 70 sites.

Table 6-12 Status of Illegal Dumping Removal Locations

Urban Divisions	Year 2018		Year 2019	
	Number of illegal dumping sites	Number of illegal dumping sites removed	Number of illegal dumping sites	Number of illegal dumping sites removed
Nakawa	34	18	21	10
Makindye	29	31	10	13
Rubaga	28	21	25	44
Central	31	38	7	1
Kawempe	26	29	14	2
Total	148	137	77	70

Source: prepared by JICA Study Team according to Ministerial Policy Statement for Financial Year 2018-2019

6.3.6 Current Status of Intermediate Treatment / Recycling

KCCA does not own or operate any intermediate treatment facility. On the other hand, recycling activities at the private level, including the informal sector, are very active. According to the GGGI survey, there are more than 20 recycling companies in Kampala City, but the actual collection amount of recyclables is not enough to meet the operating capacity. The recycling rate is estimated to be 8-12%.

A plastic recyclables collection company located next to the Kittezi landfill, buys plastic waste from waste pickers. The company then processes the plastic waste through sorting, shredding, and cleaning and then sells the processed plastic. The company has 50 employees and cooperates with a number of waste pickers. The company sells 120 tons of plastic every month to domestic and international markets. The Coca-Cola Company supports this operation and provides the necessary processing equipment.

Crushing and sorting process line and equipment procured from the Coca-Cola Company

Source: JICA Study Team

6.3.7 Current Status of Landfill Site

The only final disposal site in Kampala is the Kiteezi landfill site. However, the Kiteezi landfill site has very little remaining capacity, and KCCA is rushing to develop a new landfill site (Dbundu landfill site) under the PPP system as described earlier. The locations of both landfill sites are shown in Figure 6-19.

Source: Preliminary Information Memorandum, Kampala Waste PPP Project

Figure 6-19 Locations of Current and Future Landfill Sites

(1) Kiteezi Landfill Site

An outline of the Kiteezi landfill site is shown in Table 6-13. The Kiteezi landfill site has been in use since 1996, and was originally planned to be closed in 2006 after 10 years of use, but is still in operation. The Kiteezi landfill site is operated by KCCA, and only the operation of heavy equipment is outsourced to Nippon

engineering company.

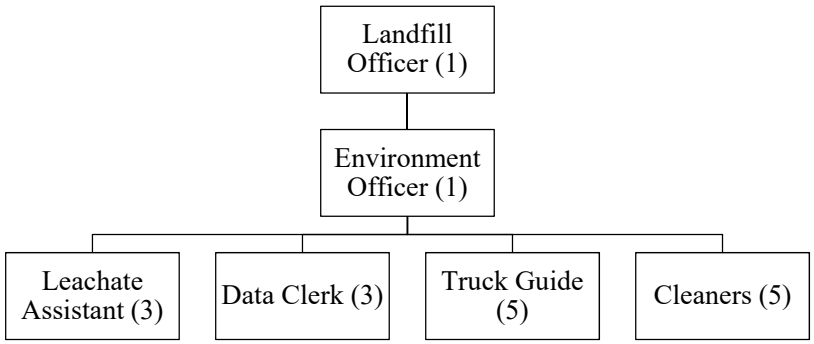
The Kiteezi landfill site does not have a weighbridge, so there is no measurement data for the incoming waste. The estimated daily incoming waste is 1,300 tons. The landfill site is equipped with a leachate treatment facility, but there is currently no quarterly monitoring of the treated water.

Table 6-13 Outline of Kiteezi Landfill Site

Item	Outline
Latitude and Longitude	0.4107° N, 32.5762° E
District	Wakiso
Sub-County	Nangabo subcounty
Site Area	36 acres
Landfill lifespan in an original plan	10 years (Commenced operations in 1996 and was supposed to be decommissioned by 2006)
Used area	36 acres
Remaining area	0 acres
Operator	(1) KCCA overall operation, (2) Nippon Engineering Company operates heavy equipment
Treatment facility	Leachate treatment
Number of operating staff	18
Number of waste pickers	700
Heavy equipment for operation	
Bulldozer	3
Excavators	3
Landfill compactor	2
Motor graders	1

Source: prepared by JICA Study Team

Eighteen staff members of KCCA's Landfill Management Unit are assigned to the landfill site, and the operating company carries out landfill works under the supervision of the Unit.



*Number of people in parentheses

Source: prepared by JICA Study Team

Figure 6-20 Organization of KCCA Kiteezi Landfill Management Team




Kiteezi Landfill Site

Source: prepared by JICA Study Team

(2) Dbundu Landfill Site

Dbundu sanitary landfill site is planned to be developed under the Kampala Waste PPP Project. Under the PPP, the Dbundu landfill site (with intermediate treatment) will be constructed and operated by a private operator. As of January 2022, the Ministry of Finance is still reviewing the FS report for the Dbundu landfill, and the construction has not yet been started.

(3) Waste Pickers at Kittezi Landfill Site and Influence of COVID-19

At the Kiteezi landfill site, waste pickers have been conducting activities for approximately 20 years by establishing the Kiteezi Landfill Salvagers Community (hereinafter referred to as “KLSC”) and registering as CBO. Currently, approximately 700 waste pickers have joined KLSC to collect recyclable materials. Any person who collects recyclable materials at Kiteezi landfill is required to register with KLSC, which prohibits the collection of recyclable materials by non-registered persons.

Waste pickers at Kiteezi landfill site and the nameplate

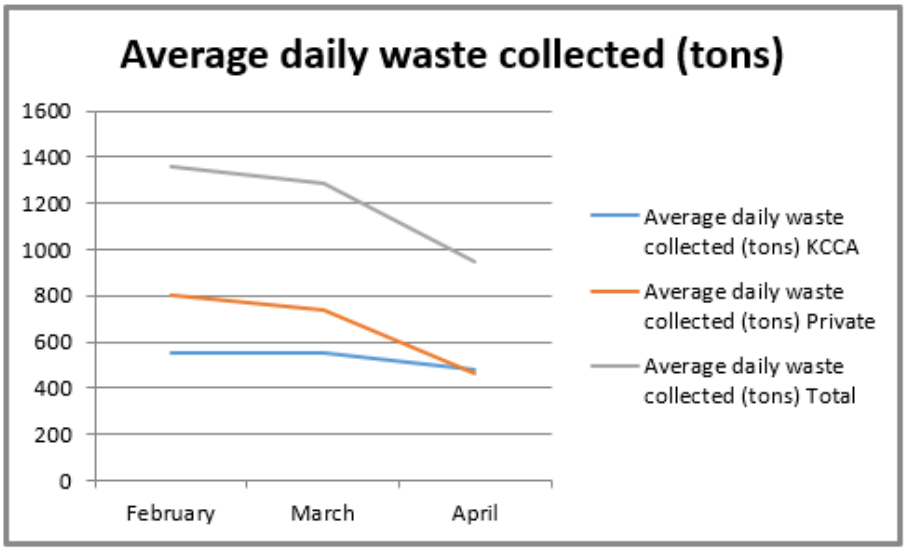
Source: prepared by JICA Study Team

The monthly collection of recyclable materials by waste pickers, before the COVID-19 epidemic ranged from approximately 2,000 tons per month to 2,600 tons per month as shown in Table 6-14. However, with the arrival of COVID-19 epidemic, the amount of incoming waste to the landfill decreased, especially during the April 2020 lockdown, by 20%, from approximately 1,300 ton/day to 1,000 ton/day, as shown in Figure 6-21. This situation resulted in a decline in business activity forcing KLSL to limit the number of waste pickers who can work at the landfill from 700 to 100 during the lockdown. According to the Chairman of KLSL, although there is no data available, the amount of recyclable materials recovered has been significantly reduced due to COVID-19. The Government of Uganda reportedly provided 100,000 UGX to the citizens whose incomes were greatly depressed due to COVID-19, but the waste pickers were not able to receive these payments. There are no hand washing facilities in Kiteezi landfill and the waste pickers are threatened by various infection risks such as cholera as well as COVID-19.

Table 6-14 Monthly Amount of Recyclable materials collected by Waste Pickers (before COVID-19 epidemic)

Recyclable material	Rainy season (ton/month)	Dry season (ton/month)
HD plastic	180	170
HD polyethene bags	600	400
LD polythene bags	150	100
Plastic bottles	360	350
White paper	80	70
Carton box paper	110	80
Plastic sacks	500	350
Metal	35	30
Rubber	600	400
Total	2,615	1,950

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



Source: KCCA

Figure 6-21 Amount of Incoming Waste to the Landfill from February to April 2020 and Impact of COVID-19

Following the identification of the first cases of COVID-19 infections on March 21, 2020, KCCA established a sub-committee on "Water, Wastewater Treatment and Sanitation" under the COVID-19 Task Force. The committee encouraged the citizens to wash their hands and set up several hand-washing stations.

6.3.8 Activities by Other Donors

The activities of other donors are summarized in Table 6-15. Among these donors, those specifically involved in waste management are GGGI, AFD and GIZ.

Table 6-15 Activities of Other Donors (sector of waste management, sanitation and environment)

Donor	Sector	Project overview	Scope (Euros)
AFD	WASH & Urbanization	Kampala Water Project; KCCA Urbanization; Masaka Corridor Water extension	375 M
Global Green Growth Institute (GGGI)	SWM	Designing SWM strategies	10.6 M
ACI	SWM	Feasibility Studies at Dbundu Project	
EIS	SWM	Feasibility Studies at Dbundu Project	
Kingdom of Netherlands	SWM	Feasibility Studies at Jinja Municipality	0.5 M
World Bank	SWM	Clean Development Mechanism	315M
GIZ	SWM	Clean Development Mechanism	45M
USAID	WASH	Faecal Sludge Management Project	87M
UNICEF	WASH	Faecal Waste	75 M
European Union	WASH		65 M

Source: prepared by JICA Study Team

GGGI is implementing two projects as shown in Table 6-16. Of the two, the EU-funded project is supporting (1) the development of waste management strategies and plans for Kampala City and (2) the design of a transfer station.

Table 6-16 Projects related to Solid Waste Management being Implemented by GGGI

Project name	Outline	Period	Scale and funding source
Green Rehabilitation Investment Project Faecal sludge management.	FS study and implementation of a project to construct a sewage sludge treatment facility in the Kampala Metropolitan Area.	From July 2021 to June 2024	5.6M Euros KOICA
Greening Uganda's Urbanization and Industrialization	Realization of green cities (4 cities), realization of green industries (4 areas), and improvement of waste management in Kampala Metropolitan Area	From January 2019 to December 2022	5M Euros European Development Fund

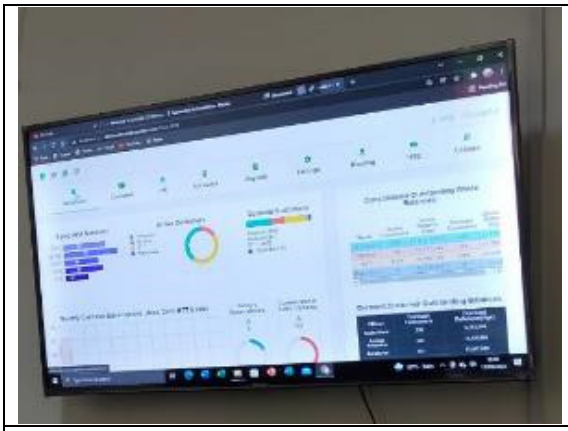
Source: prepared by JICA Study Team

AFD considers the water environment, energy, and urban development to be its main support sectors. In recent years, as a part of the water environment, AFD is involved in the field of wastewater. In the area of waste management, KCCA has requested the provision of waste collection equipment, and AFD is in the process of verifying the Concept Note.

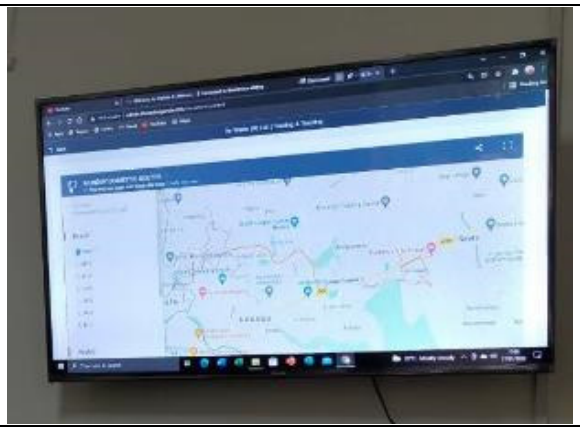
GIZ is implementing a project to promote recycling of plastics in Kampala City until around June 2023. The main C/P is the Ministry of Water and Environment with the participation of NEMA, KCCA, Coca-Cola Company, CBOs, etc. There are 10 project sites, and they are building a value chain, providing equipment, constructing simple sorting facilities, conducting public awareness activities for residents, and capacity building. In parallel, a project to promote recycling of organic wastes is ongoing in Gulu City.

6.3.9 Status of Initiatives related to DX

De Waste, a company that collects municipal solid waste and medical waste, has obtained a waste management license from NWMA, and is engaged in waste collection business in Kampala. Their customers are approximately 1,800 households for municipal solid waste and 800 hospitals for medical waste. They distribute QR codes to their customers to manage their customer information, and also use GPS to manage their collection vehicles. This is an extremely advanced example of customer management using QR codes.



Bulletin board for customer information



Vehicle tracking by GPS

Source: JICA Study Team

6.3.10 Status of Monitoring on SDGs' waste-related Indicators

UBOS monitors the progress of the SDG targets, and has published monitoring results in the 2020 STATISTICAL ABSTRACT. However, there is no mention of targets related to waste management; SDG items 1 to 9 and 15 to 17 are listed.

Table 6-17 shows the status of monitoring on the SDGs' waste-related indicators (11.6.1, 12.3.1, 12.4.2, 12.5.1 and 14.1.1).

Table 6-17 Monitoring Progress against SDGs Indicators Related to Waste

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 Kampala City, the percentage of municipal solid waste collected and disposed in controlled landfill is 60%. If collection in the informal sector is included, the percentage of disposed municipal solid waste is 70%.
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	Uganda is a member of the Basel Convention. Since there is no data on the amount of hazardous waste generated, the percentage of the treated amount cannot be calculated. On the other hand, the national hazardous waste collection and disposal amount in 2017/2018 was 7,226 tons/year. With a population of 39.1 million in 2018, the unit amount of hazardous waste collected and disposed is estimated to be 0.18 kg/year.
12.5.1	National recycling rate, tons of material recycled	The amount of recycling in Kampala City is estimated at 200 ton/day, which is equivalent to 10% 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. If 60% of the illegal dumping were to be dumped in rivers and washed into the sea, this would result in 11 ton/day of marine plastic. Amount of marine plastic = 600 ton/day x 6% (composition of plastic) x 30% = 11 ton/day

Source: prepared by JICA Study Team

6.4 Issues and Cooperation Needs of Solid Waste Management in Uganda and Kampala

6.4.1 Issues and Stages of Solid Waste Management

(1) Issues of Solid Waste Management

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

- In recent years, various laws and policies have been enacted and developed, however, enforcement and implementation of these laws and policies have not kept pace.
- Most of the areas in Kampala City have been privatized for waste collection and transportation. In slum areas where there is not enough capacity to pay for collection services, collection is not satisfactory and sanitary conditions are poor due to scattered waste. There is also accumulation of waste in the drains

and other areas due to illegal dumping. It seems to be necessary for public services and KCCA to provide waste collection in slum areas.

- Kittezi landfill has already exceeded its disposal capacity and is considered to be in a dangerous situation due to the possibility of slope collapse. Dbundu landfill should be constructed and Kittezi landfill should be closed as soon as possible.
- JICA Study Team was not able to identify any policies or measures related to recycling, etc. (it is thought that they have not been formulated). As a future challenge, it is required to develop policies and systems with a view to creating a sound material-cycle society. This may be addressed in the formulation of waste management policies supported by the GGGI.

(2) Stages and Priority Issues of Solid Waste Management

The status and stages of solid waste management in Kampala City are summarized in Table 6-18. In this study, based on the description in Table 1-13, the stages of solid waste management in Kampala City are generally evaluated as Stage 1 (improvement of public health).

Table 6-18 Stages of Solid Waste Management in Kampala City

Field	Stage	Status
Legislations	2	The National Environment (Waste Management) Regulations (2020) is the basic law for waste management. The Guideline for Landfill Management (2020), which is not a law, has also been established. As for policies for the formation of a sound material-cycle society, only e-waste and WtE are mentioned in the IT Strategy and Energy Strategy.
Collection and Transportation	1	The city is divided into six zones, and collection and transportation has been privatized in five zones. Three private collection companies contract individually with households and offices to provide collection services. The remaining one zone is directly managed by KCCA for collection. The waste collection rate is estimated at 60%, with particular challenges in waste collection in slum areas.
Final Disposal	1	The Kiteezi landfill is the only disposal site, but it has little remaining capacity and the slope is too steep that it may cause landslides. KCCA is planning to develop a new landfill (Dbundu landfill) under a PPP scheme, and the central government is currently reviewing the F/S study report.
Intermediate Treatment and Recycle	1	There is no intermediate treatment facility owned by KCCA, but an intermediate treatment facility is planned to be constructed in the new Dbundu landfill site that is planned to be developed under the PPP scheme.

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

Among the issues related to solid waste management that were raised in (1) above, both the development of a landfill site and intermediate treatment are being examined under the PPP system. If these facilities are developed as planned, the related issues can be resolved. Consequently, the remaining issue is collection and transportation, which is evaluated as a high priority issue.

<Priority issue>

- Since collection and transportation is privatized, there is inadequate waste collection in slum areas where the slum dwellers have low ability to pay service fees to private companies.

6.4.2 Good Practices on Solid Waste Management

In terms of solid waste management in Uganda and Kampala City, the following are considered to be good practices for other countries to refer to.

- Although the e-waste recycling center is not fully operated, it is considered to be an advanced initiative in the African region. It is also one of the good practices that has been realized despite the problems in implementing the policy.
- The waste collection in Kampala City has been privatized. Although there are many issues involved in privatization, such as the management of contractors and dealing with slum areas, it is one of the measures worth considering in Africa where there are financial constraints.

6.4.3 Proposed Cooperation Policy

In Kampala City, the issues described earlier were identified, but JICA Study Team considers that other donors are already providing some support and the scope of new support is limited. The proposed cooperation policy in waste management for the central government of Uganda and KCCA is shown in Table 6-19. The contents of cooperation related to the priority issues described in 6.4.1 are highlighted in red letters, and these are considered to have higher priority than others. However, in providing these high-priority support needs, the following self-help efforts by Uganda are considered indispensable.

- The Kiteezi landfill site, the only final disposal site in Kampala City, is already full and there is a concern that the slope may collapse. If the support for collection and transportation is provided and the collection amount increases, it may become impossible to continue to operate the current Kiteezi landfill site. Prior to anything else, KCCA needs to make self-help efforts, such as accelerating the construction of a new landfill or establishing a temporary disposal site. It is also necessary to collect basic information in preparation for strengthening collection of waste in slum areas.

Highlighted earlier as a good practice, Uganda is undertaking to recycle E-waste. This activity is an initiative not seen in other African countries and has been promoted through self-help efforts in Uganda. Accordingly, it is assumed that there is a possibility to spread the experience gained in Uganda to other African countries by supporting it as a model case.

Table 6-19 Proposed Cooperation Policy (Uganda)

Issue		Short-term assistance (text highlighted in red letters is related to priority issues)	Medium-term assistance
Central government	Implementation of various policies (E-Waste)	[Technical Cooperation Project] ➢ Examining E-Waste collection system (collection at stores, collection at government offices, etc.) and conducting pilot collection ➢ Strengthening the E-Waste value chain ➢ Expansion of the recycling center and capacity development through equipment procurement	
KCCA	Strengthening of waste collection including in slum areas	[Technical Cooperation Project] ➢ Identifying the coverage of waste collection by private companies and KCCA direct waste collection, and identifying uncollected (or insufficient) areas such as slums ➢ Examining and implementing KCCA direct waste collection in areas that cannot be serviced by private waste collection companies. ➢ Setting up collection points and containers in slum areas to introduce waste collection and collection of recyclable materials by CBOs	
	Development of Dbundu landfill and safe closure of Kittezi landfill	The F/S has been conducted with the support of IFC, and the Dbundu landfill will be developed through PPP. If this PPP project goes smoothly, there will be little space for new support.	
	Formulation of policies to create a sound material-cycle society	There is little space for new support, as policies for creating a sound material-cycle society will be examined in the development of waste management plans and strategies supported by GGGI.	

Source: prepared by JICA Study Team

CHAPTER 7 Solid Waste Management in the Republic of Botswana

In the Republic of Botswana (hereinafter referred to as "Botswana"), a remote survey including interviews with relevant organizations was conducted utilizing a local consultant, Mr. Kgotso Onneile. The results of the survey are presented in this chapter.

7.1 Overview of Target Country and Cities

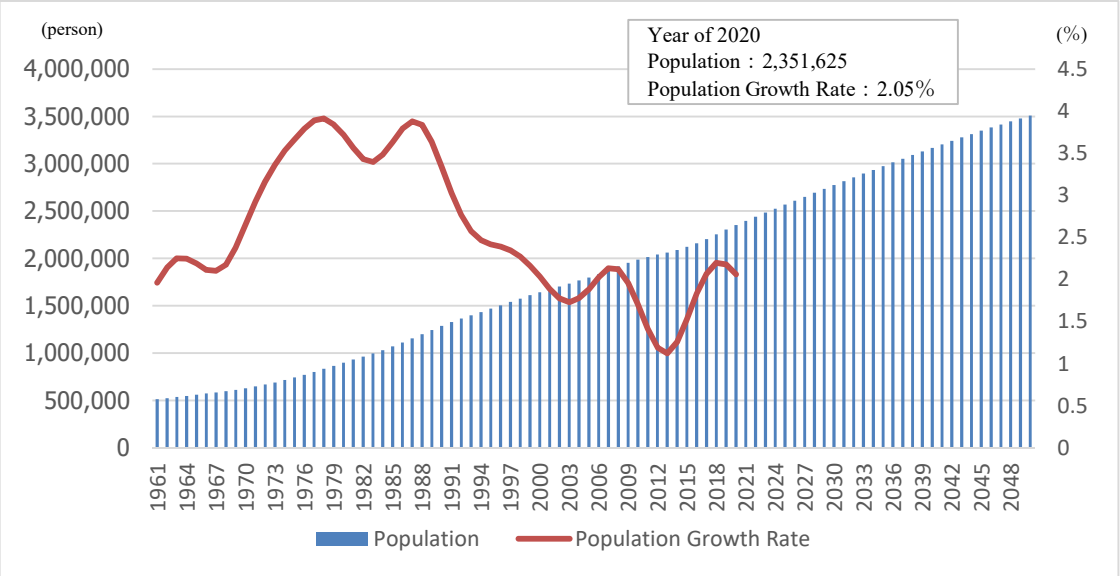
7.1.1 Population

In Botswana, the most recent census was conducted in 2011. The results are shown in Table 7-1. Although the census is supposed to be conducted every 10 years, it was not conducted in 2021 due to the impact of COVID-19 epidemic. In a World Bank report, published in 2021 past population and population growth rates data and forecasts up to 2048 are provided as shown in Figure 7-1. Based on the World Bank data, in 2020 the population of Botswana was approximately 2.35 million with a population growth rate of 2.05%.

Table 7-1 Population of Gaborone City, Kweneng District and the Whole Country

Area	Year of 2011
Botswana	2,024,904 people
Gaborone city	231,592 people
Kweneng district	304,549 people

Source: Statistics Botswana, "Botswana Population and Housing Census 2011" (2011)



Source: World Bank, "DataBank" (2021)

Figure 7-1 Population and Population Growth Rate in Botswana (estimated)

7.1.2 Economic Situation

The main economic indicators for Botswana are shown in Table 7-2.

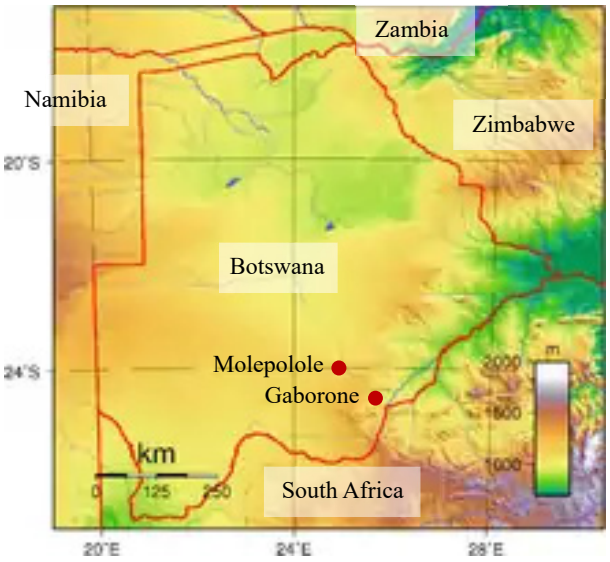
Table 7-2 Main Economic Indicators for Botswana

Indicator	Contents
Major industries[*1]	Agriculture: sorghum, maize Farming: cattle, sheep Mining: diamonds, copper, nickel, coal Industry: textiles, food processing
GDP (2019) [*2]	18.04 billion USD
GNI per capita (2019) [*2]	7,660 USD
Economic growth rate (2019) [*2]	3.0%
Price inflation (2019) [*2]	2.8%
Exports (2019) [*2]	6.16 billion USD
Imports (2019) [*2]	7.43 billion USD

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

7.1.3 Topography

Botswana is a landlocked country located in southern Africa, and bordered by Zambia to the north, Zimbabwe to the east, Namibia to the west, and South Africa to the south. It has a land area of 581,730km^2. Most of Botswana's land area is a flat plateau. The Kalahari Desert is located in the central and southwestern parts of the country, the Okavango Delta, one of the largest inland deltas in the world, is located in the northwest, and the Makgadikgadi Pan, a large salt field, is located in the north-central part of the country. The lowest elevation point in Botswana is 513m, and the highest is 1,494m. The major rivers in Botswana include the Chobe, Okavango, Boteti and Limpopo Rivers, and most of the other rivers dry up during the dry and early rainy seasons.



Note: Molepolole is the central of Kweneng district.
Source: Geography of Botswana, Wikipedia (as of September 10, 2021)

Figure 7-2 Topographic Map of Botswana

7.1.4 Meteorological Conditions

Gaborone city and Kweneng district are classified as steppe climate according to the Köppen climate

classification. They have a dry season (June to August) and a rainy season (November to March).The average temperature in Gaborone city is shown in Table 7-3 and Figure 7-3, and its average rainfall is shown in Table 7-4 and Figure 7-4.

Table 7-3 Average Temperature in Gaborone City (normal year)

Month	Temperature (℃)		Month	Temperature (℃)	
	High	Low		High	Low
JAN	32.7	19.7	JUL	22.9	4.4
FEB	32.1	19.3	AUG	26.2	7.5
MAR	30.8	17.4	SEP	30.0	12.3
APR	28.4	13.5	OCT	32.0	16.3
MAY	25.6	8.3	NOV	32.3	17.7
JUN	23.1	5.0	DEC	32.5	18.8
			AVE.	29.1	13.4

Source: Weather Atlas

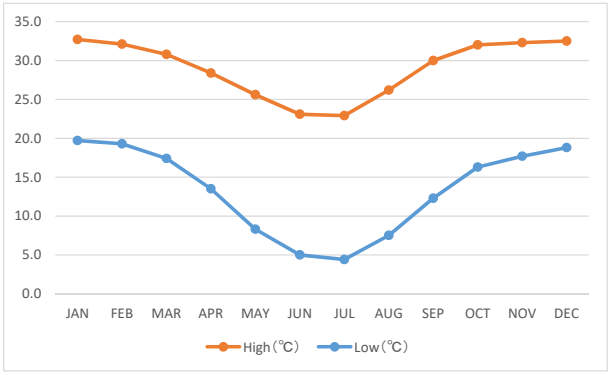


Figure 7-3 Average Temperature in Gaborone City (normal year)

Table 7-4 Average Rainfall in Gaborone City (normal year)

Month	Precipitation (mm)	Month	Precipitation (mm)
JAN	32.5	JUL	0.4
FEB	30.2	AUG	4.8
MAR	20.9	SEP	6.1
APR	12.9	OCT	13.1
MAY	8.4	NOV	17.3
JUN	10.2	DEC	32.9
		AVE.	AVE.

Source: Weather Atlas

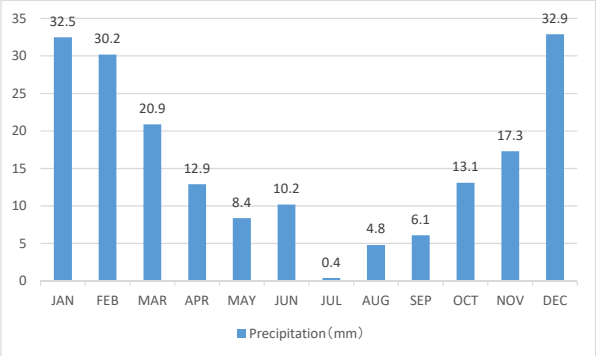


Figure 7-4 Average Rainfall in Gaborone City (normal year)

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

7.2.1 Laws and Regulations related to Solid Waste Management

Currently, the "Waste Management Act (1998)" is the law regulating solid waste management in Botswana. There are also related laws such as "the Environmental Impact Assessment Act (2011)" and "the Public Health Act (2013)". The major laws and regulations are shown in Table 7-5.

Table 7-5 Laws and Regulations related to Solid Waste Management in Botswana

Laws and regulations	Contents
Waste Management Act (1998)	This Act is composed of eleven chapters and provides for waste management planning, registration and licensing of waste collection and transportation, registration of final disposal sites, licensing of waste treatment facilities, roles and responsibilities of local governments in waste management, illegal dumping, annual reporting, and other waste management matters.
Environmental Impact Assessment Act (2011)	This Act stipulates that an environmental impact assessment shall be conducted for any activity that may have a significant adverse effect on the environment. The environmental impact assessment is stipulated to evaluate "(i) the health, safety, or quality of life of the people, (ii) archaeological, aesthetic, cultural, or sanitary environmental conditions, and (iii) the quality or diversity of natural resources".
Public Health Act (2013)	This Act relates to maintenance and improvement of public health and control of the spread of infectious diseases in Botswana. It partly refers to the need for removal and disposal of wastes in public places including roads, drains and rivers.

Source: prepared by JICA Study Team

7.2.2 Policies and Plans related to Solid Waste Management

Currently, Botswana has both a policy and strategy for solid waste management: "the Integrated Waste Management Policy (2020)" and "Botswana's Strategy for Waste Management (1998)". There is no master plan for solid waste management in Botswana. Major contents of the strategy and policy are described in Table 7-6.

Table 7-6 Policies and Plans related to Solid Waste Management in Botswana

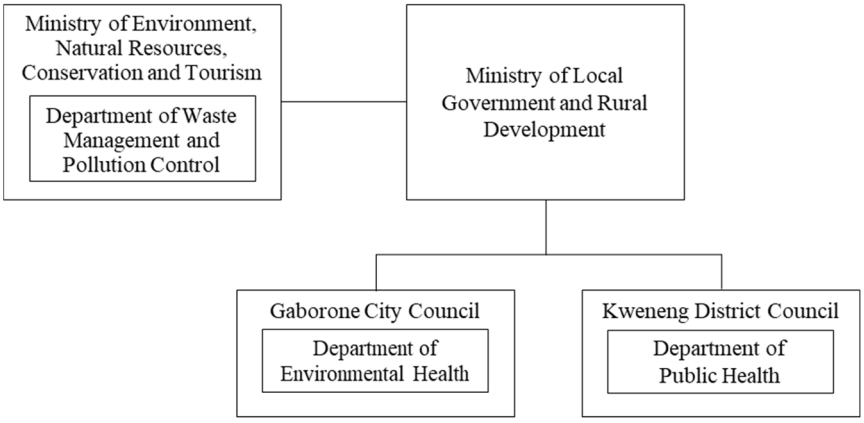
Policies and Plans	Contents
Botswana's Strategy for Waste Management (1998)	In addition to the definition of waste and the significance of the strategy for waste management, this strategy mentions specific measures to be taken at the stages of discharge, reuse and recycling, intermediate treatment, and final disposal. It also mentions the importance of waste reduction and recycling, appropriate technology for intermediate treatment and final disposal, and public awareness and environmental education in waste management.
Integrated Waste Management Policy (2020)	In addition to the definition of waste, the current status of waste in Botswana, the objectives and guidelines, this strategy describes approaches and strategies for appropriate waste management at each stage ("planning, generation and separation, collection and transportation, 3Rs, hazardous waste management, treatment and disposal, and finance"). It also states the necessity of environmental education, involvement of stakeholders (private sector, communities, NGOs, etc.), inter-organizational cooperation, role sharing, and monitoring.

Source: prepared by JICA Study Team

7.2.3 Organization Structure for Solid Waste Management

Currently, solid waste management in Botswana is managed by the Department of Waste Management and Pollution Control (hereinafter referred to as "DWMPC") in the Ministry of Environment, Natural Resources, Conservation and Tourism (hereinafter referred to as "MENT") and the Ministry of Local Government and Rural Development (hereinafter referred to as "MLGRD"). Waste management in Gaborone city is managed by the Gaborone City Council (hereinafter referred to as "GCC"), while waste management in Kweneng district is managed by the Kweneng District Council (hereinafter referred to as "KwDC"). The organizational

structure for waste management in Botswana is shown in Figure 7-5 and the roles of each organization are shown in Table 7-7.



Source: prepared by JICA Study Team

Figure 7-5 Organizational Structure for Solid Waste Management in Botswana

Table 7-7 Roles of Organizations for Solid Waste Management in Botswana

Organization	Role
Ministry of Environment, Natural Resources Conservation and Tourism (MENT)	MENT is the government agency responsible for the conservation of the environment and natural resources, protection of wildlife, and measures to combat climate change. In addition to the Department of Waste Management and Pollution Control (DWMPC), MENT also has the Department of Environment, Department of Meteorology, Department of National Museums, Department of Tourism, Department of Forest and Mountain Resources, Department of Wildlife and National Park Management, and Department of Corporate Services. In the field of waste management, MENT is mainly responsible for the development of policies, laws and regulations, plans, and budget allocation.
Department of Waste Management and Pollution Control (DWMPC)	DWMPC is a subordinate organization of MENT and its main responsibilities are as follows ・ Development of laws, policies, regulations, and guidelines ・ On-site inspection and supervision of final disposal sites and incineration facilities ・ Licensing and management of waste collection, transportation and recycling
Ministry of Local Government and Rural Development (MLGRD)	MLGRD is a government agency that oversees 16 local governments, municipalities including tribal administrations, and semi-autonomous local governments classified as district councils. MLGRD consists of the Department of Local Finance and Procurement, Department of Local Governance and Development Planning, Department of Tribal Administration, Department of Technical Services of Local Government, Department of Social Protection, Department of Rural Development and Department of Corporate Services. MLGRD cooperates with local governments and is responsible for substantive waste management (e.g., collection and transportation).
Ministry of Health and Wellness (MHW)	The Ministry of Health and Wellness (MHW) is the government agency in charge of providing medical services and promoting health to the people. For waste management, it is responsible for the collection, transportation, treatment and management of medical waste in cooperation with the local government.

Source: prepared by JICA Study Team

7.2.4 Licensing System

Botswana has introduced a licensing system for private companies that are engaged in waste collection and transportation or the operation of related facilities. The application procedures and forms are available on the website of the Government of Botswana. The applicant submits the application form and necessary documents to DWMPC, the ministry in charge, and after passing the inspection, the applicant is allowed to provide services.

Table 7-8 Summary of the Licensing System

Item	Target	Process	Document	Licensing Fee
Waste Carrier License	• General waste • Hazardous waste • Recyclables	(1) Download, complete and submit an application form to DWMPC (2) Bring vehicle for inspection (3) License will be issued within 5 business days after passing the inspection (4) Service launch	• Receipt of payment of licensing fee • Company Certificate of Incorporation • Vehicle Registration Book • Affidavit or sworn statement that the registered owner of the vehicle has leased it to the applicant • Training certificate(s) on Fire Fighting & First Aid • Training certificate(s) on Safety and Occupational Health • Accident response plan • Authorization from the final disposer	110.00 BWP/vehicle
Waste Management Facility License	• Waste Facility (Incinerator, transfer station, scrap metal yards, waste bailing sites, landfill etc.) • Recycling facility (Scrap, used oil, paper, plastic, glass etc.)	(1) Download, complete and submit an application form to DWMPC (2) Inspection (3) License will be issued within 10 business days after passing the inspection (4) Service launch *Permit is valid for one year.	• Location map and site plan • Environmental Assessment Report • Operation plan • Certificate of Incorporation • Land use authorization from local authorities (Zoning Permit) • Environmental Health report • Record keeping procedures • Facility closure or rehabilitation plan	1,000.00 BWP/company

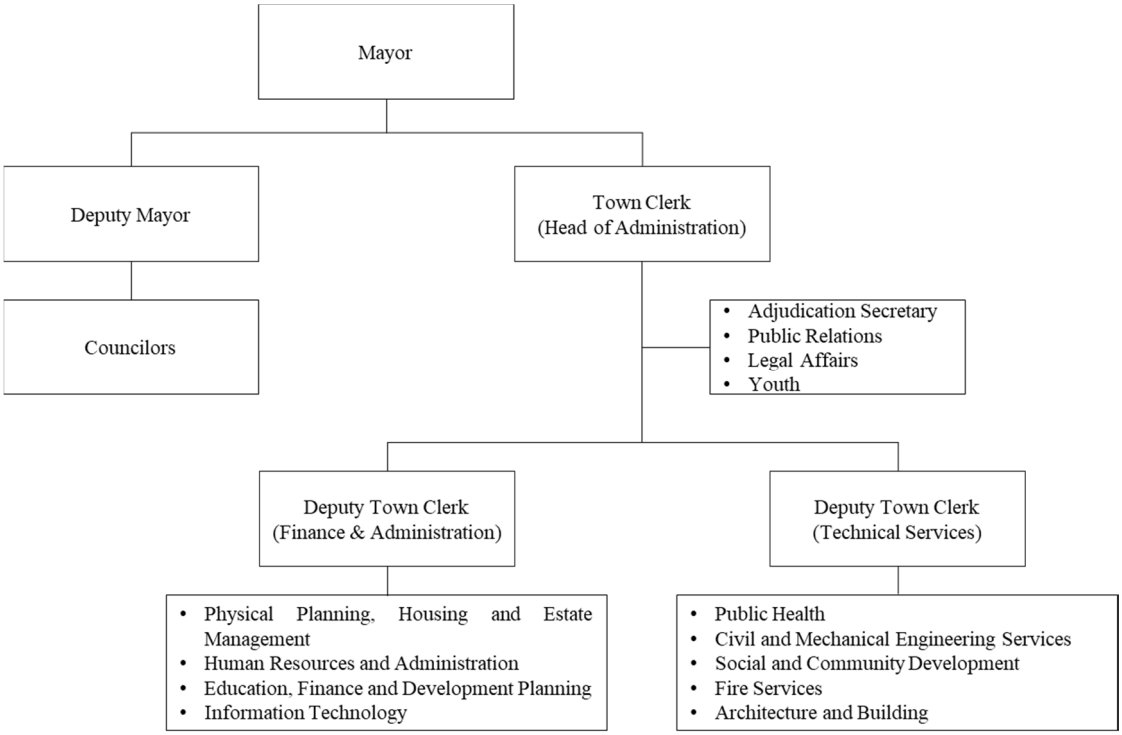
Source: prepared by JICA Study Team according to information provided by DWMPC

7.3 Solid Waste Management Situation in Gaborone City

7.3.1 Organization and Finance for Solid Waste Management

(1) Organization

The Department of Public Health is in charge of solid waste management in Gaborone city. There are about 16 employees in in the department, and they are in charge of waste collection, transportation, disposal, street cleaning, and development of related regulations in Gaborone city.



Source: prepared by JICA Study Team according to interviews with Gaborone City Council

Figure 7-6 Organization Structure of Gaborone City Council

(2) Finance

The financial resources for solid waste management in Gaborone city are (1) revenue from waste collection fees and (2) budget allocations from the central government and general funds. The waste collection fee is set at 25 BWP per household per collection (approximately 250 Japanese Yen per collection[32]). Since Gaborone city has set a service standard of one collection every two weeks, each household pays 50 BWP/month (approximately 500 Japanese Yen/month) to the Gaborone City Council. In the past census, the number of households in Gaborone city were surveyed. Based on these data, the estimated collection fee income of Gaborone city is shown in Table 7-9.

Table 7-9 Revenue from Waste Collection Fees in Gaborone City (estimated)

Year	Number of Households	Fee price (BWP/year/household)	Total (BWP)
2001	58,476	600 BWP	35,085,000 BWP
2011	74,957	600 BWP	44,974,200 BWP

Source: prepared by JICA Study Team according to interviews with Gaborone City Council, and Botswana Population and Housing Census 2011 by Statistics Botswana (2011)

7.3.2 Ordinances and Policies related to Solid Waste Management

Gaborone city has "Gaborone Waste Management Plan (2003)" and "Gaborone City Council (General) Bylaws (2008)" for waste management. The details of each are shown in Table 7-10.

[32] 1 BWP = 10.115800 JPY (as of March 2022, JICA)

Table 7-10 Bylaws and Plans for Solid Waste Management in Gaborone City

Bylaws and plans	Contents
Gaborone Waste Management Plan (2003)	This plan was developed by Gaborone city government in cooperation with DWMPC and covers the period from 2003 to 2009. It mentions waste classification, definitions, reduction targets (1% in 2003, 3% in 2006), and activities to raise public awareness.
Gaborone City Council (General) Bylaws (2008)	A part of the bylaws regulates waste management. As an example, the section on "Prevention of Waste Accumulation" prohibits illegal dumping of any waste into public places such as roads and rivers. Also, the section on "open burning of waste" prohibits the open burning of waste in public places.

7.3.3 Overview of Solid Waste Management

(1) Unit Amount and Generation Amount

The population and the waste generation amount in Gaborone city are shown in the following two tables. The population figures are those estimated from the census conducted in 2011. The population growth rate was calculated based on the estimated population. The collection rate of household waste was set at 80% based on the results of interviews with the Gaborone City Council.

Table 7-11 Population Growth Rate and Estimated Population in Gaborone City

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Population growth rate (%)	—	2.380	2.318	2.246	2.169	2.089	2.075	2.056	2.033	2.005
Estimated population (people)	231,592	237,105	242,601	248,051	253,432	258,726	264,094	269,524	275,004	280,519

Source: Statistics Botswana, "Botswana Population and Housing Census 2011" (2011)

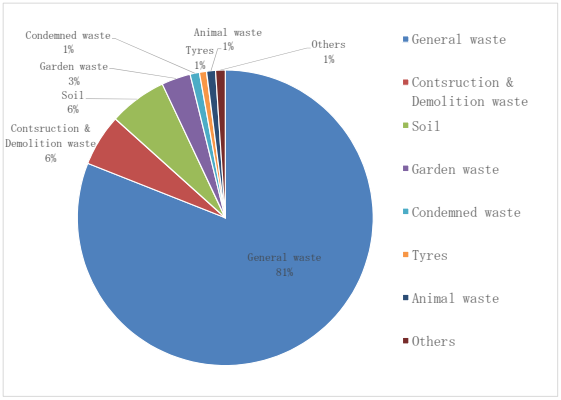
Table 7-12 Waste Amounts (at generation and landfill) and Unit Generation Rate in 2020

Item	Value
Waste disposal amount (at landfill)	144 to 176 ton
Collection rate	80%
Waste generation amount	180 to 220 ton/day
Served population	280,519 persons
Waste Unit Generation Rate	0.64 to 0.78 kg/person/day

Source: prepared by JICA Study Team according to information provided by Gaborone City Council and Kweneng District Council

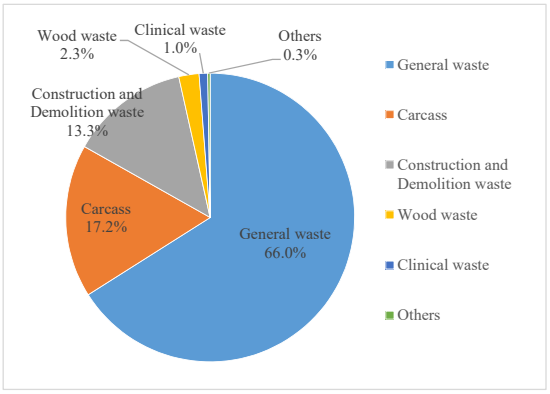
(2) Composition

The composition of waste delivered to the Gamodubu landfill is shown in Figure 7-7, and the composition of waste delivered to the South East sanitary landfill is shown in Figure 7-8.



Source: Kweneng District Council

Figure 7-7 Composition of Waste Delivered to Gamodubu Regional Landfill

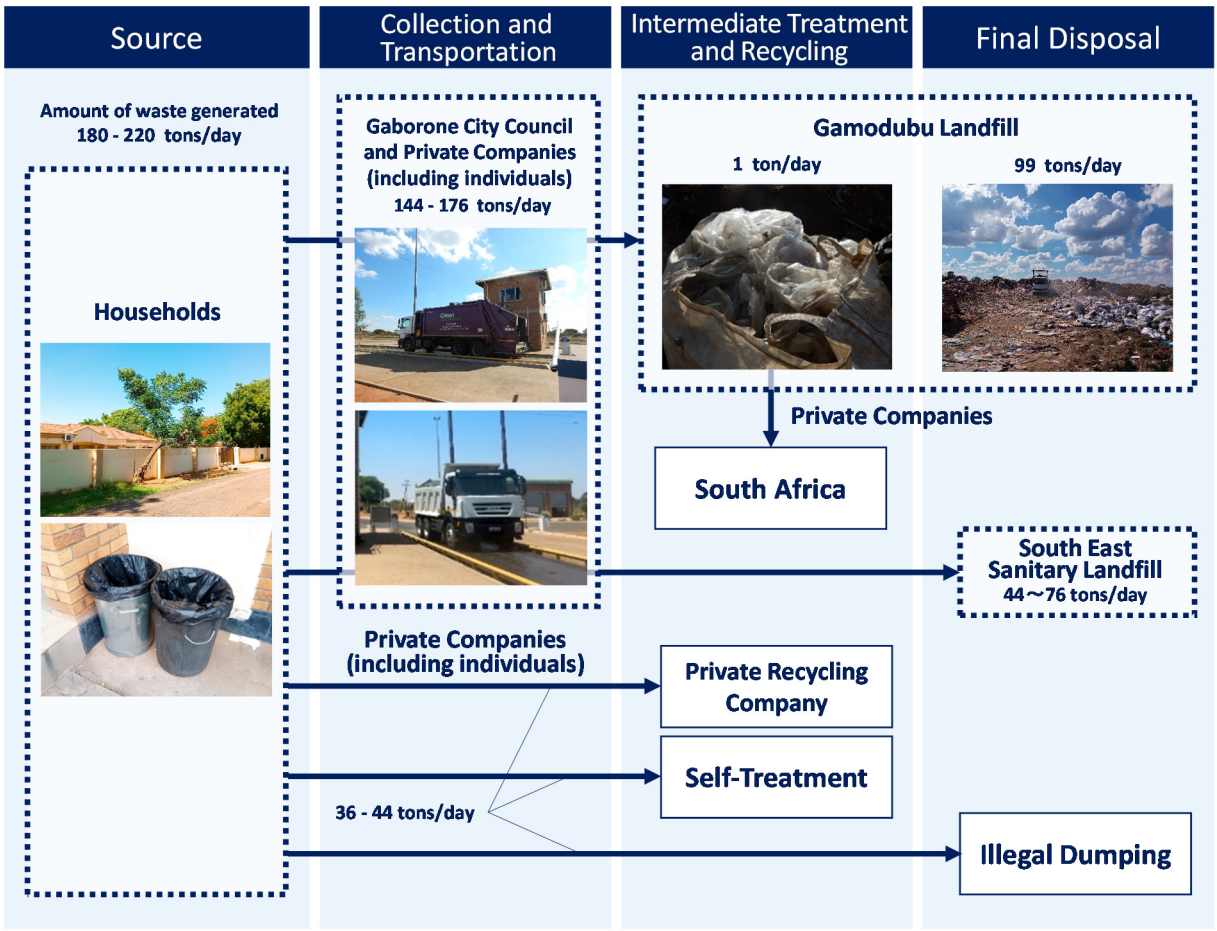


Source: Statistics Botswana, "Botswana selected Environmental Indicators Digest 2020"

Figure 7-8 Composition of Waste Delivered to South East Sanitary Landfill

(3) Waste Flow

The waste flow in Gaborone city is shown in Figure 7-9. The waste generation and collection rate (80%) in this flow are based on the results of interviews with Gaborone City Council. The amount of waste collection is estimated to be 144 - 176 ton/day. The amount of waste transported to Gamodubu Regional Landfill (amounts of waste landfilled: 100 ton/day, recyclables: 1 ton/day) was calculated based on waste measurement data at the landfill. Waste collected by Gaborone City Council and private contractors is also transported to South East Sanitary Landfill operated by South East Council. The amount of waste transported to South East Sanitary Landfill ranges from 44 to 76 ton/day. Some of the waste generated within Gaborone City is reportedly recycled, but the figures are not available. In addition, the amounts of waste dumped illegally and treated at source are not known. The sum of the waste recycled, self-disposed and illegally dumped is between 36 to 44 ton/day.



Source: Gaborone City Council

Figure 7-9 Waste Flow in Gaborone City

7.3.4 Current Status of Collection and Transportation

The collection and transportation of waste in Gaborone city is mainly carried out by the government, with part of the waste outsourced to some 15 private companies. The number of companies actually collecting and transporting the waste varies depending on the annual budget and other factors. Table 7-13 shows an overview of the collection and transportation companies that were interviewed in this Study.

In Gaborone city, door-to-door collection is adopted, and collection of waste separated at the source has not been introduced. On the collection day, residents discharge their bagged wastes along the road outside their property and receive collection service by either the government or private companies. As a service standard, residents are supposed to receive collection service once every two weeks.

Table 7-13 Summary of Private Companies for Collection and Transportation

Company name	Target wastes	Customer	Vehicle (type, number)	Number of operations and days
ACTION SYSTEMS	Hazardous wastes	Households and business offices	Compactor (18 m^3) 4 units	2 times/unit/day, 5 days/week
			Dump truck (3 m^3) 1 unit	5 times/unit/day, 5 days/week

Company name	Target wastes	Customer	Vehicle (type, number)	Number of operations and days
BID TRONIX SOLUTIONS	Municipal solid wastes	Households	Compactor (18 m^3) 2 units	10 times/vehicle/day, 5 days/week
BIN HIRE	Municipal solid wastes	Households	-	-
CLEAN CITIES AND TOWNS	Municipal solid wastes	Households	-	-
CLEANICO	Municipal solid wastes	Business offices and public facilities	Compactor (6 m^3) 4 units	2 times/vehicle/day, 5 days/week
			Dump truck 82t) 3 units	2 times/vehicle/day, 5 days/week
CLEANING WIZARDS	Municipal solid wastes	Households, business offices, public facilities and markets	Compactor (18 m^3) 2 units	Once/vehicle/day, 7 days/week
DAZY LOO	Municipal solid wastes	Households	-	-
EASY SKIPS	Municipal solid wastes	Households	-	-
ECO LEAP SOLUTIONS	Municipal solid waste	Households	-	-
GULFINO WASTE MANAGEMENT	Municipal solid wastes	-	Compactor (6 m^3) 5 units	5 times/vehicle/day, 6 days/week
HAND-IN-CLEANING	Municipal solid wastes	Households and business offices	Compactor (18 m^3) 2 units	5 times/vehicle/day, 5 days/week
			Dump truck (4 m^3) 1 unit	5 times/vehicle/day, 5 days/week
INTER WASTE BOTSWANA	Municipal solid waste	Households and public facilities,	Compactor (4 m^3) 2 units	-
LANCERT WASTE COLLECTION AND REMOVALS	Municipal solid wastes and industrial wastes	Households and business offices	Dump truck (6 m^3) 2 units	5 times/vehicle/day, 5 days/week
LEAF ENVIRONMENTAL SOLUTIONS	Municipal solid wastes	Business offices	Compactor (6 m^3) 1 unit	Once/month
PAKO WASTE	Municipal solid wastes, plastics and papers	Business offices	Compactor (4 m^3) 2 units	5 times/vehicle/day, 5 days/week
RECYCLE-IT			-	-
SANI CARE	Municipal solid wastes and construction wastes	-	Compactor (18 m^3) 3 units	6 times/vehicle/day, 6 days/week
SIMPLY RECYCLE	Plastics	Households, private companies and public facilities,	Compactor (6 m^3) 1 unit	4 times/vehicle/day, 5 days/week
SKIP HIRE	Municipal solid wastes	Households	-	-
WASTE TUNNEL	Municipal solid wastes and industrial wastes	Households and private companies	Compactor (5 m^3) 3 units	2 times/vehicle/day, 5 days/week

Source: prepared by JICA Study Team according to interviews with private companies and NGOs
Note: "-" indicates no answer.

7.3.5 Current Status of Intermediate Treatment / Recycling

In Gaborone city, some private companies and NGOs are engaged in recycling. Table 7-14 shows an overview of the private companies involved in recycling that were identified in this study. One example of a facility that has been confirmed is a plant for recycling scrap and electronic waste (e-waste) operated by "AST Recycling Botswana". This private company is based mainly in South Africa (Johannesburg, Tshwane and Cape Town) and has a branch in Zambia as well as Botswana. However, the number of recycling plants in Botswana is small, and most of the resources are transported to South Africa for recycling.

Table 7-14 Summary of Private Companies and NGOs involved in Recycling

Company name	Target items	Treatment method	Treatment amount	Operation hours and days
AST RECYCLING BOTSWANA	Nonferrous metals	-	-	-
CHAMMPS RECYCLING	Hazardous wastes	-	5 to 10 ton/week	8 hours x 5 days
CLEANICO	Plastics and papers	Crushing and compacting	4 ton/day	8 hours x 5 days
FINTAX CONSULTING	Plastics	Crushing and compacting	2 ton/day	8 hours x 5.5 days
PAPER 4 AFRICA	Papers	Crushing and compacting	2 ton/day	8 hours x 5 days
RECYCLING WASTE SOLUTIONS	Plastics, papers, cardboard boxes and PET bottles	Crushing and compacting	4 to 6 ton/day	8 hours x 5 days
SOMARELA TIKOLOGO (NGO)	- (awareness-raising activities)	-	1 to 2 ton/day	-

Source: prepared by JICA Study Team according to interviews with private companies and NGOs
Note: "-" indicates no answer.

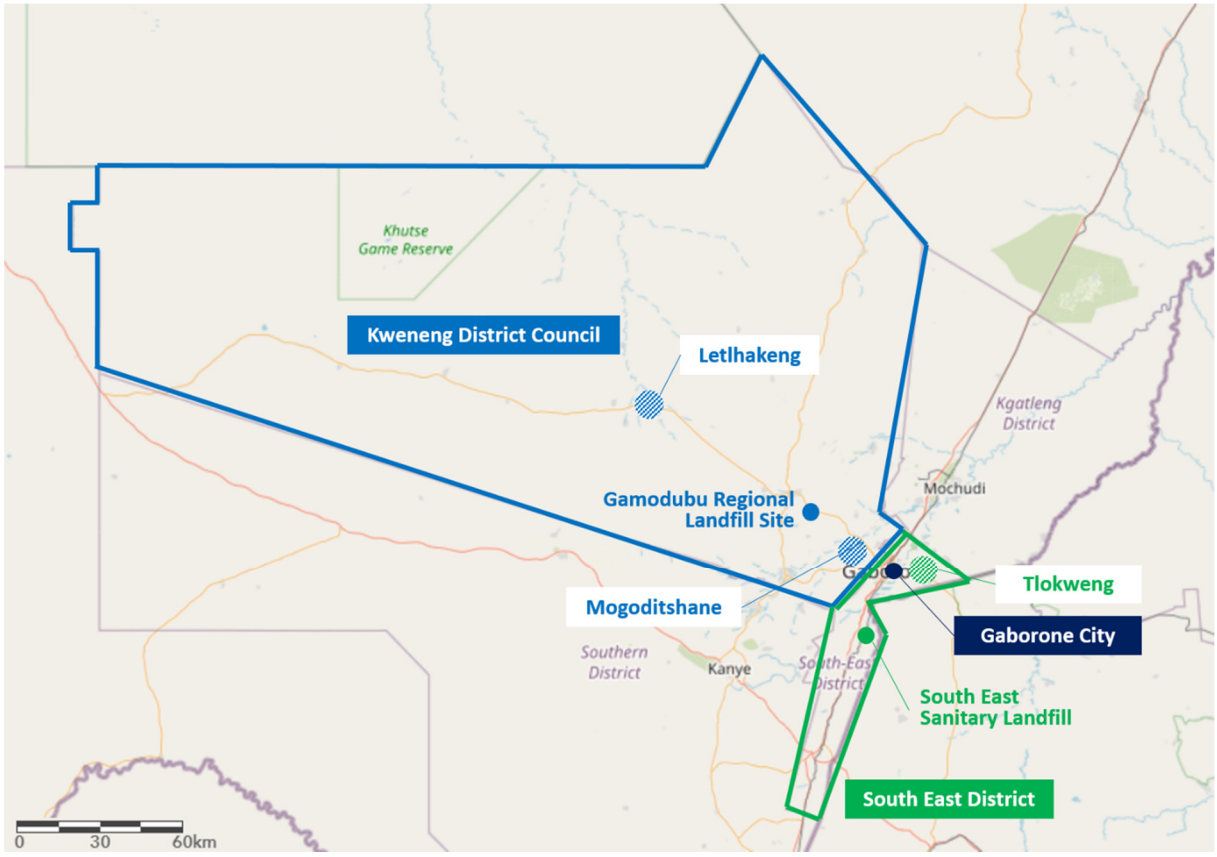
7.3.6 Current Status of Landfill Site

The waste generated and collected in Gaborone city is mainly transported to Gamodubu Regional Landfill site operated by Kweneng district council and South East sanitary landfill site operated by South East district council. Gamodubu Regional Landfill site is described in detail in section "7.4.6 Current Status of Landfill Site (in Kweneng district)", so it is not described here. An outline of the South East sanitary landfill site is shown in Table 7-15 and disposal fees are shown in Table 7-16. According to the interview with Gaborone City Council, the wastes are delivered to South East sanitary landfill site when Gamodubu Regional Landfill faces any of the following conditions.

Conditions under which wastes from Gaborone city will be transported to South East sanitary landfill site

(1) When Gamodubu Regional Landfill site has reached the limit of its allowable capacity.
(2) When there are many collection vehicles in Gamodubu Regional Landfill site.
(3) When disposal activities are temporarily suspended at Gamodubu Regional Landfill site because of rehabilitation works there.

The location map of the landfill sites in Gaborone City and Kweneng District is shown in Figure 7-10.



Source: prepared by JICA Study Team

Figure 7-10 Location Map of Landfill Sites in Gaborone City and Kweneng District

Table 7-15 Outline of South East Sanitary Landfill Site

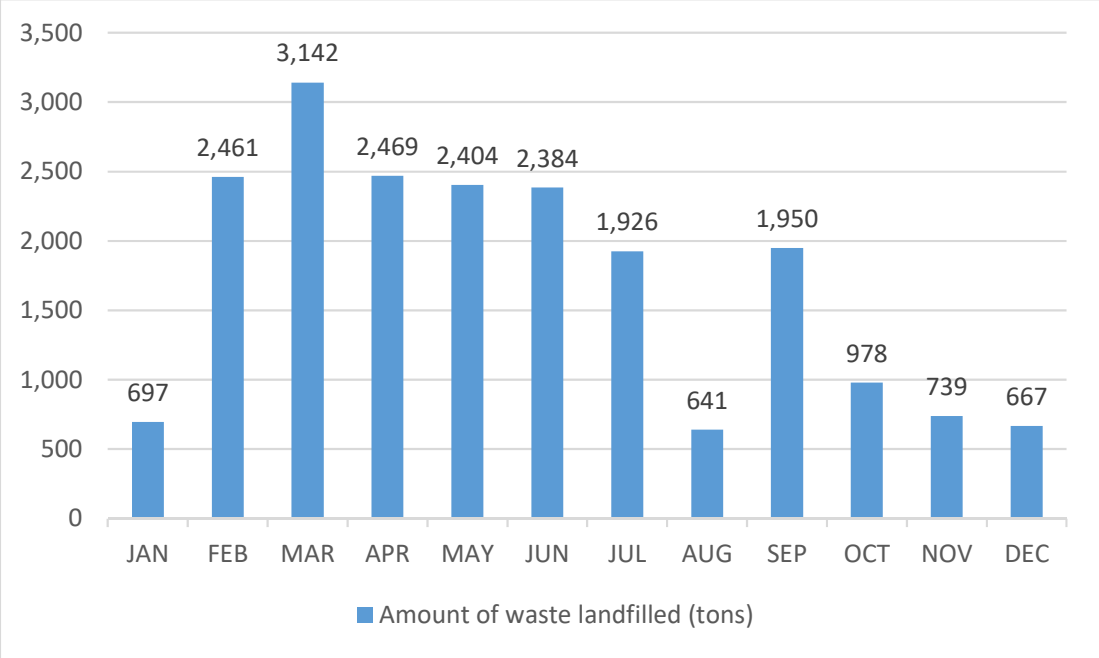
Item	Contents
Organization	South East District Council
Location	Ramotswa（Approximately 40 km from Gaborone city center）
Area	Approximately 36 ha
Operation commencement Year	Completion of construction: 2004, Start of operation: 2005
Working days / hours	7 days, 8 hour/day
Amount of incoming waste	Approximately 118 ton/day
Remaining lifetime	7 years (until 2029)
Number of staff	15 workers
Facility and equipment	Weighbridges, 2 incinerators for clinical waste (1. Capacity 160 kg/hour, 2. Capacity 220 kg/hour), Leachate collection pond
Leachate collection pond	Natural evaporation process
Heavy equipment	Bulldozer
Waste	General waste, Industrial waste (metal, tires, used oil, condemned food etc.), Construction and demolition waste, clinical waste
Recyclables	Metal, Aluminum cans, Tires
Fee collection method	Measured rate system (refer to Table 7-16)
Waste pickers	Approximately 10 waste pickers are salvaging paper, plastics and metals and selling the recyclables to private companies in Gaborone City
Initial cost (BWP/year)	21,000,000 BWP
Operational cost (BWP/year)	3,668,350 BWP

Source: prepared by JICA Study Team according to interviews with JICA Botswana Office and South East district council

Table 7-16 Waste Disposal Fees at South East Sanitary Landfill Site

Item	Price	Item	Price
General Waste	40 BWP/ton	Used Tires (Small)	1 BWP/tire
Construction and Demolition waste	30 BWP/ton	Used Tires (Medium)	1.5 BWP/tire
Garden Waste	60 BWP/ton	Used Tires (Large)	5 BWP/tire
Scrap Metal	50 BWP/ton	Special Risk Material / Carcass	2 BWP/kg
Condemned Food Stuffs	40 BWP/ton	Soil	50 BWP/ton
Clinical Waste / Expired Drugs	30 BWP/kg	Food Animal Products	1 BWP/kg

Source: prepared by JICA Study Team according to interviews with South East district council



Source: STATISTICS BOTSWANA, "BOTSWANA SELECTED ENVIRONMENTAL INDICATORS DIGEST 2020"

Figure 7-11 Municipal Solid Wastes Incoming to South East Sanitary Landfill Site (2017)

7.3.7 Activities by Other Donors

Regarding the related activities of other donors in Gaborone city, in the South East district including Gaborone city, the United Nations Development Programme (hereinafter referred to as "UNDP") implemented the project "Promoting Production and Utilization of Bio-Methane from Agro-Waste in South Eastern Botswana" from 2017 to 2019. The total cost of the project was 2.8 million USD, financed by the Global Environment Facility (hereinafter referred to as "GEF"), which is a trust fund established by the World Bank, with MENT as the beneficiary organization and Botswana Institute for Technology and Innovation (hereinafter referred to as "BITRI") as the implementing agency. A summary of this project is shown in Table 7-17.

Table 7-17 Summary of UNDP Project

Item	Contents
Project name	Promoting Production and Utilization of Bio-Methane from Agro-Waste in South Eastern Botswana
Period	From 2017 to 2019
Total cost	2.8 million dollars
Supporting organization	UNDP, GEF
Beneficiary organization	MENT
Implementing organization	BITRI
Purpose	Facilitation of low-carbon investments and public-private partnerships in the production and utilization of biogas from agro-waste in the districts of South-eastern Botswana
Components	(1) Creating an enabling environment that supports the market development of agro-waste management and biogas technology, stimulating investments in biogas technology and increasing uptake of such technologies through new policies, tools and financial incentives. (2) Institutional and private-sector strengthening and capacity development for biogas technology development and servicing, and improved agro-waste management and regulation through awareness-raising, training and dissemination sessions. (3) Facilitation and establishment of biogas installations: these include small, medium and utility-scale biogas plants in South-Eastern Botswana. (4) Facilitation and establishment of appropriate utilization and knowledge platforms.
Outputs	(1) Increased capacity of Government, private sector and community stakeholders to develop, finance and implement PPPs in the agro-waste sector (2) Increased capacity of Government authorities to properly monitor and enforce waste management regulations in the agro-industrial sector (3) Autonomous support systems in place for replication and scale-up of agro-waste technologies post project

Source: UNDP, "Mid Term Report: PROMOTING PRODUCTION AND UTILIZATION OF BIOGAS (BIO METHANE) FROM AGRO WASTE IN SOUTH EAST BOTSWANA" (2019)

Subsequently, in December 2020, UNDP posted a public notice on its website regarding the hiring of individual consultants for environmental policy formulation support. According to the draft announcement, the project is positioned as a continuation of the biogas project mentioned above, and its main objectives include "institutional strengthening and capacity development," "promotion of biogas plant implementation," and "establishment of a platform for opinion exchange".

7.3.8 Status of Monitoring on SDGs' waste-related Indicators

Table 7-18 shows the current status on the SDGs" waste-related indicators (11.6.1, 12.3.1, 12.4.2, 12.5.1 and 14.1.1) in Gaborone city.

Table 7-18 Status of Monitoring on SDGs' waste-related Indicators (Gaborone city)

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	Of the total generated municipal solid waste in Gaborone city, the percentage of collected and processed waste officially is approximately from 45 to 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	The amount of recycling in Gaborone city has not been identified.

SDGs Indicators		Current Status
12.5.1	National recycling rate, tons of material recycled	In 2008, the import, manufacture, sale, and use of plastic bags were made subject to taxation. And a decree banning the use of plastic bags was proposed in 2018, but has yet to be enforced.
14.1.1	(a) Index of coastal eutrophication; and (b) plastic debris density	This section does not apply to Botswana because it is a landlocked country without access to the ocean.

Source: prepared by JICA Study Team

7.3.9 Medical Waste Management

The management of medical wastes in Botswana is under the jurisdiction of the Ministry of Health and Wellness. Medical wastes in Gaborone city are generated from hospitals and clinics. Most of the large hospitals have incinerators and incinerate their own wastes at their respective hospitals. On the other hand, small clinics without incinerators transport their wastes to nearby large hospitals with incinerators or to private incineration facilities for treatment. Alternatively, the waste is collected by the Ministry of Health and Wellness or Gaborone City Council and incinerated at the Gamodubu Regional Landfill or South East Sanitary Landfill.

Hospitals and clinics should separate municipal solid wastes from medical wastes, and further separate medical wastes into needles and other items, and discharge them in their own special containers and bags. After that, the wastes are stored in a storage area set up within the premises. Although there are differences among clinics, in general, municipal solid wastes and medical wastes are stored without mixing, and medical wastes are discharged to a storage area surrounded by a fence or wall.

		
Indoor storage area of the clinic (Red bags are classified as gauze and other infectious medical waste, yellow boxes as infectious needles, and black bags as general waste.)	Outdoor storage area of the clinic (Medical wastes are disposed of in a locked storage area)	Medical waste collection vehicles (Collected and transported by the government from the clinic and taken to the incinerator in Gamodubu Regional Landfill)

Source: photo by local staff

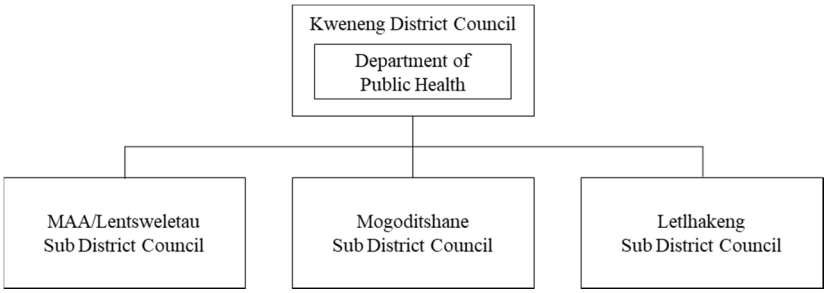
7.4 Solid Waste Management Situation in Kweneng District

7.4.1 Organization and Finance for Solid Waste Management

(1) Organization

Solid waste management in Kweneng district is carried out by the Kweneng District Council and its three sub-district councils. The sub-district councils practically provide waste collection services to the residents, and each sub-district council has its own collection vehicles. The number of staff in charge of solid waste

management in Kweneng district is 221 people.

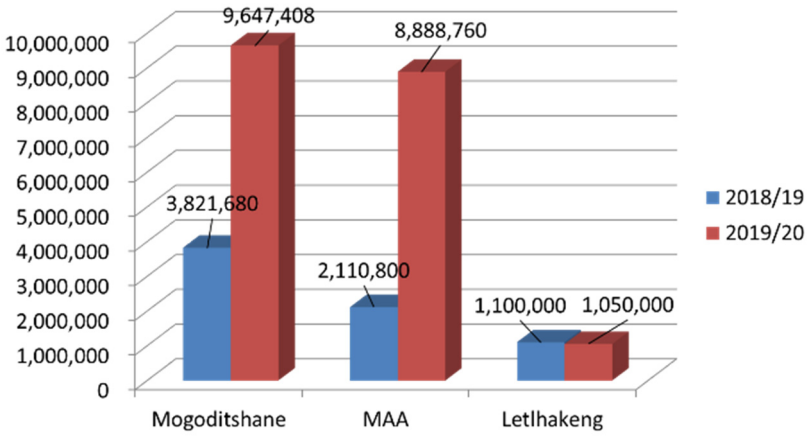


Source: prepared by JICA Study Team according to interviews with Kweneng District Council

Figure 7-12 Organizational Structure for Solid Waste Management in Kweneng District

(2) Finance

The financial resources for solid waste management in Kweneng district are (1) revenue from waste fees and (2) budgetary allocations from the central government and general funds. Figure 7-13 shows the budget for waste management by each sub-district council, each of which is practically in charge of waste management in Kweneng district. There is a significant increase in the budget for solid waste management in 2019/2020 compared to that of 2018/2019.



Source: Kweneng District Council

Figure 7-13 Comparison of Budgets for Solid Waste Management of Each District Council in Kweneng District

The waste collection fee is set at 10 BWP per household per month (approximately 100 Japanese Yen per month). At the end of the month, the waste collector verbally informs each household to pay the fee at the time of collection. Residents pay the fee at the counter of Kweneng District Council.

As for final disposal, waste disposal fees are set at Gamodubu Regional Landfill for the companies that bring in the wastes. The fee differs depending on the type of waste, and is calculated on the basis of the amount of waste delivered (metered system). The list of waste disposal fees is shown in Table 7-19.

Each time waste is brought in to the landfill, the type and weight of the waste are recorded in the system. In

addition to this information, a breakdown sheet with the fee amount is handed to the companies transporting in the waste. At the end of the month, an invoice is issued (either by mail or by hand), and the company that receives the invoice settles the invoiced amount at the counter of Kweneng District Council. Gamodubu Regional Landfill does not accept cash payments at the landfill and therefore it us up to the discretion of many self-employed companies using the landfill to go to Kweneng District Council and make the required payments. As a result, the rate of fee collection is low.

Table 7-19 List of Waste Disposal Fees at Gamodubu Regional Landfill Site

Item	Price	Item	Price
General Waste	40 BWP/ton	Wood Waste	40 BWP/ton
Garden Waste	60 BWP/ ton	Carcass	40 BWP ton
Clinical Waste	30 BWP/kg	Glass	40 BWP/ton
Pharmaceutical Waste	30 BWP/kg	Tires	50 BWP/ton
Food Animal Waste	1 BWP/kg	Confidential Items	40 BWP ton
Condemned Food Stuffs	20 BWP/ton	Scrap Metal	60 BWP/ton

Source: Kweneng District Council

In addition, the district council has a contract with a private company, which collects recyclables from the wastes brought to Gamodubu Regional Landfill and transports them to South Africa. The district council charges the private company 100 BWP per month as a permission fee to collect recyclables at Gamodubu Regional Landfill.

7.4.2 Ordinances and Policies related to Solid Waste Management

Kweneng District Council has developed a "Waste Management Strategy" in 2019. There are five components: (1) Public Awareness, (2) Waste Collection, (3) Recycling, (4) Waste Disposal, and (5) Action Plan. The strategy identified three numerical targets: to achieve 100% collection rate by 2023, to have 75% of Kweneng district residents install waste bins in their house premises by 2023 (to improve collection efficiency), and to increase the recycling rate by 10% by 2023. In order to achieve these targets, the following specific activity objectives are listed: to implement environmental education programs in schools and other institutions; to establish teams and provide training to implement the targeted projects; to implement the "My Bin My Waste" initiative which provides free collection service for 6 months if one purchases a waste bin for 200 BWP; and to introduce collection of wastes separated at schools.

7.4.3 Overview of Solid Waste Management

(1) Unit Amount and Generation Amount

The population and the waste generation amount in Kweneng district are shown below. The population figures are those estimated from the census conducted in 2011. The population growth rate was calculated based on the estimated population. The collection rate of household waste was set at 60% based on the results of interviews with the Kweneng District Council. The waste amount (at landfill) was calculated from the data measured at Gamodubu Regional Landfill.

Table 7-20 Population Growth Rate and Estimated Population in Kweneng District

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Population growth rate (%)	-	2.957	2.886	2.808	2.724	2.636	2.616	2.591	2.562	2.528
Estimated population (people)	304,549	313,554	322,604	331,663	340,697	349,679	358,826	368,123	377,553	387,096

Source: Statistics Botswana, "Botswana Population and Housing Census 2011" (2011)

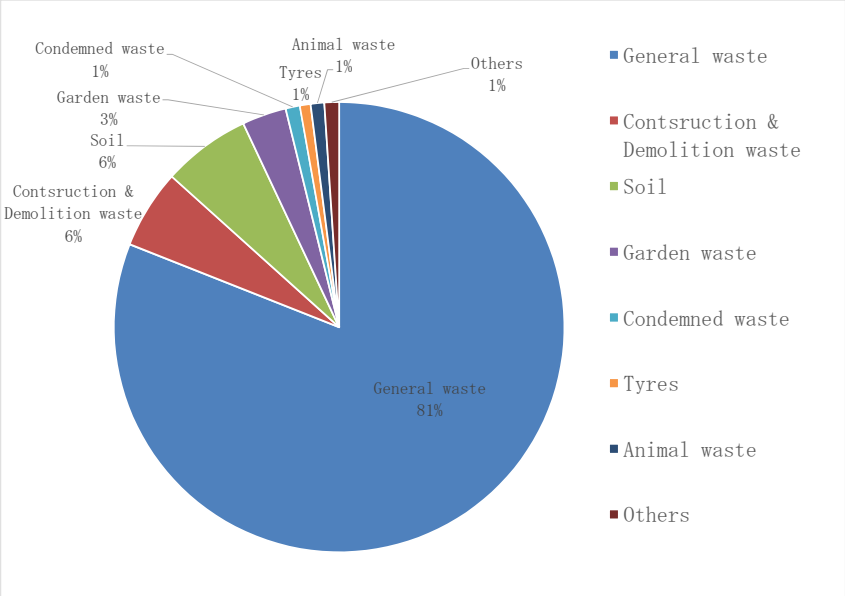
Table 7-21 Waste Amounts (at generation and landfill) and Unit Generation Rate in 2020

Item	Value
Waste disposal amount (at landfill)	139 ton
Collection rate	60 %
Waste generation amount	230 ton/day
Served population	387,096 people
Waste Unit Generation Rate	0.59 kg/person/day

Source: prepared by JICA Study Team with data provided from Kweneng District Council

(2) Composition

The composition of waste delivered to the Gamodubu Regional Landfill is shown in Figure 7-14.



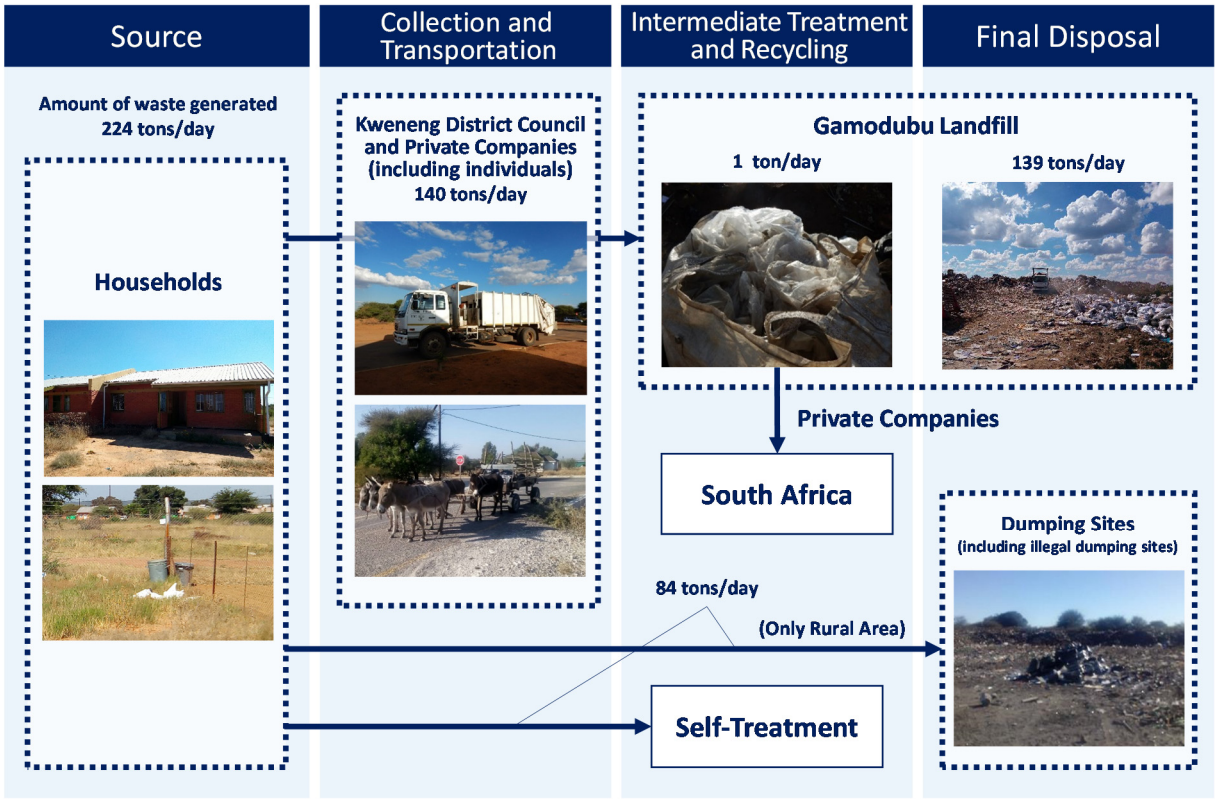
Source: prepared by JICA Study Team with data provided from Kweneng District Council

Figure 7-14 Composition of Waste transported to Gamodubu Regional Landfill Site (as shown previously)

(3) Waste Flow

The waste flow in Kweneng district is shown in Figure 7-15. The amount of waste transported to Gamodubu

Regional Landfill (amounts of waste landfilled and recycled are 139 ton/day and 1 ton/day respectively) was calculated based on the weighbridge data of the landfill. The amount of waste collected is equal to the amount of waste transported to Gamodubu Regional Landfill since the waste collection and transportation is done by the Sub-District Councils under Kweneng District Council and private companies. Based on the results of interviews with Kweneng District Council, the collection rate is approximately 60% and the amount of waste generated is 224 ton/day. In the rural areas of Kweneng District, the uncollected waste is dumped at several dump sites throughout the district (Although this is slightly different from illegal dumping, however it still means that the waste is not disposed of properly). The total amount of waste disposed at dumping sites and treated at source is 84 ton/day.



Source: prepared by JICA Study Team using data provided from Kweneng District Council

Figure 7-15 Waste Flow in Kweneng District

7.4.4 Current Status of Collection and Transportation

In Kweneng district, there is no waste separation at source. Waste collection is door-to-door and each household purchases a waste bin from the Kweneng District Council and installs it on their premises to discharge and store waste. Waste collection from households is basically carried out by the government, but there is also some outsourcing to private companies. The government-owned vehicles operated in Kweneng district are shown in Table 7-22. In addition, due to the shortage of collection vehicles, in small rural villages, collection is carried out by self-employed companies or other private companies using donkey-drawn wagons or small tractors, called donkey carts (refer to photographs below Table 7-23). The service standard is to

provide weekly collection service to the residents, but due to lack of human resources and collection vehicles, the collection service has not been provided as planned. In Kweneng district, a large amount of illegal dumping has been observed. In particular, illegal dumping is often found along the main road and in the bushes away from the main road. Consequently, Kweneng district has hired cleaners to collect the illegally dumped wastes along the main road almost on a daily basis.

Table 7-22 Collection Vehicles Operated in Kweneng District

Sub District Council	Compactor	Container carrier	Open truck	Total
Mogoditshane	4 units	1 unit	1 unit	6 units
MAA/Lentseletau	2 units	0 unit	1 unit	3 units
Lethlakeng	1 unit	0 unit	2 units	3 units

Source: prepared by JICA Study Team with data provided by Kweneng District Council

Table 7-23 Outsourcing Status in Kweneng District

Sub District Council	Private Company	Self-employed company	Total
Mogoditshane	21 companies	3 companies	24 companies
MAA/Lentseletau	7 companies	25 companies	32 companies
Lethlakeng	2 companies	28 companies	30 companies

Source: prepared by JICA Study Team with data provided by Kweneng District Council

Waste bins discharged by a household

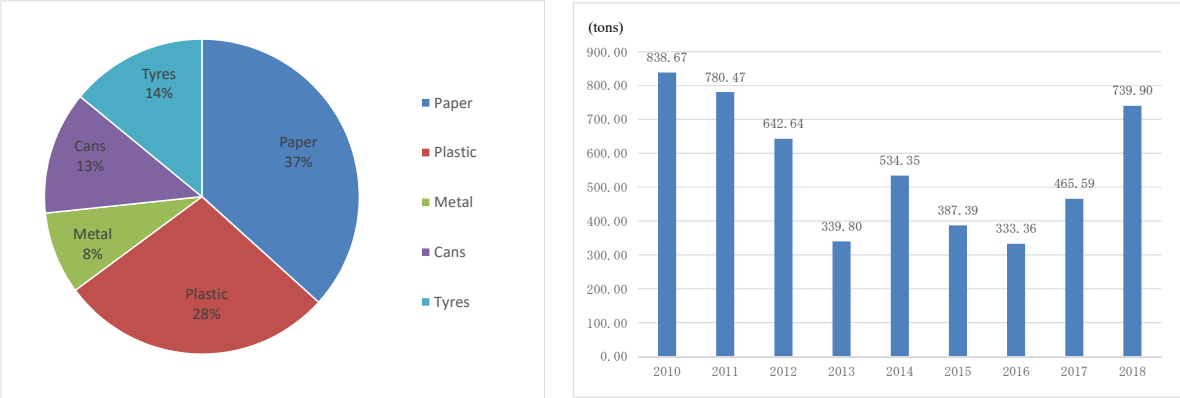
Compactor truck

Donkey carts

Source: photographs taken by local staff

7.4.5 Current Status of Intermediate Treatment / Recycling

There are no recycling facilities in Kweneng district, but individuals and organizations are making effective use of resources recovered from waste. In order to support these efforts, Kweneng District Council holds an annual "Waste Fair" to showcase the products made from the resources. At the fair, awards are given to individuals and organizations that are recognized as making excellent products or making important efforts. The Kweneng District Council has contracted with several private companies to recover resources from the wastes delivered to the Gamodubu Regional Landfill. The target resources include soft plastics and waste papers. The composition and quantity of resources at the Gamodubu Regional Landfill are shown in Figure 7-16. Approximately 563 tons/year on average were collected and recycled from 2010 to 2018.



Source: Kweneng District Council

Figure 7-16 Composition and Quantity of Resources at Gamodubu Regional Landfill Site (from 2010 to 2018)

		
Resource recovery at Gamodubu Regional Landfill site	Recovered soft plastics	Waste Fair

Source: photographs taken by local staff

Table 7-24 Recycling Companies at Gamodubu Regional Landfill Site

Company Name	Item	Number of Staff
Fintax Consulting T/A Simply Recycle	Plastic	12
LEK-LOP	Metal, Can	11
GASE MAK RECYCLING	Paper	7
KANKE BUSINESS	Metal	2
MORDERN SOLUTIONS	Plastic	6

Source: prepared by JICA Study Team based on data provided by Kweneng District Council

7.4.6 Current Status of Landfill Site

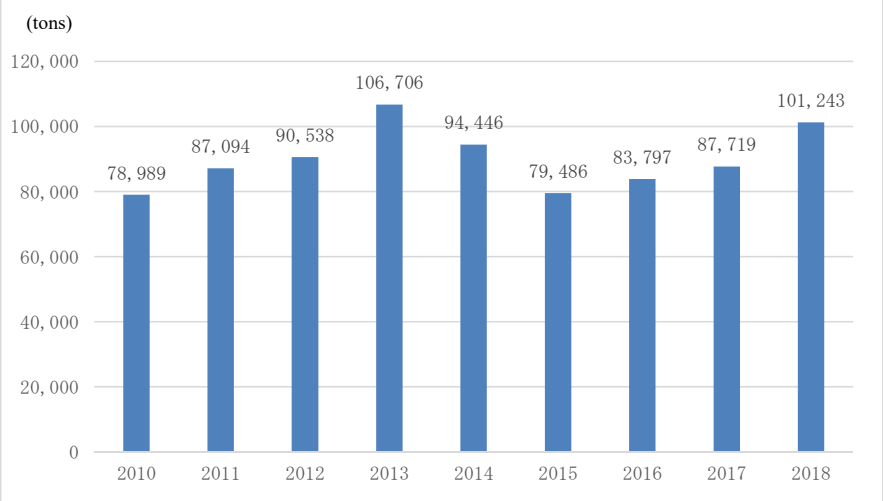
(1) Gamodubu Regional Landfill Site

The Gamodubu Regional Landfill site is one of the largest landfills in the country, and is operated and managed by Kweneng District Council. This landfill site accepts waste collected in Gaborone city and Southeast district as well as Kweneng district. An outline of Gamodubu Regional Landfill site is shown in Table 7-25. From 2010 to 2018, the landfill has been receiving on average approximately 81,000 ton/year of waste.

Table 7-25 Outline of Gamodubu Regional Landfill Site

Item	Outline
Year of operation commencement	2009
Operating entity	Kweneng District Council
Initial cost	100 BWP million - 63 BWP million landfill construction - 37 BWP million landfill equipment and plant
Operation and Maintenance cost	500,000 BWP / month - Maintenance of equipment - Fuel - Personal salaries - Other running expenses
Location	About 30 km northwest of Gaborone City and about 30 km southeast of Molepolole (the capital of Kweneng District)
Area	80 ha (30 ha has been developed)
Service period	20 years
Disposal Capacity	Approximately1,300,000 tons
Amount brought in	Approximately 80,000 ton/year
Operating hours	7:30-16:30 (Mon-Fri), 7:30-13:30 (Sat/Sun/Holidays)
Facilities	Gate, Fence, Security, Office, Room for workers, Weighbridges, Waterproofing liners, Leachate collection pipes, Leachate pond, Incinerators for clinical waste, boreholes, Rain gauge, Power generator, Tire shredder
Landfill area	5 cells（200 m^2 per cell）
Leachate treatment method	Natural evaporation process
Incinerator for clinical waste	2 incinerators (Capacity: 176 kg/hour)
Tire shredder	1 shredder (Capacity: 50 tires/hour)
Equipment	3 Dump truck, 1 Bulldozer, 1 Front-end-loader, 4 Landfill compactors
Accepted Items	General waste, Clinical waste, Construction and demolition waste, Garden waste, Tires, Metal, Carcass, Wood waste, Condemned food stuffs, Confidential items, Glass etc. (No hazardous waste)
Resource Items	Plastics, Paper, Cans, Tires
Fee Structure	Measured rate system (unit price of disposal is determined by waste types)
Waste pickers	No activities by waste pickers

Source: prepared by JICA Study Team according to interviews with Kweneng District Council



Source: prepared by JICA Study Team according to interviews with Kweneng District Council

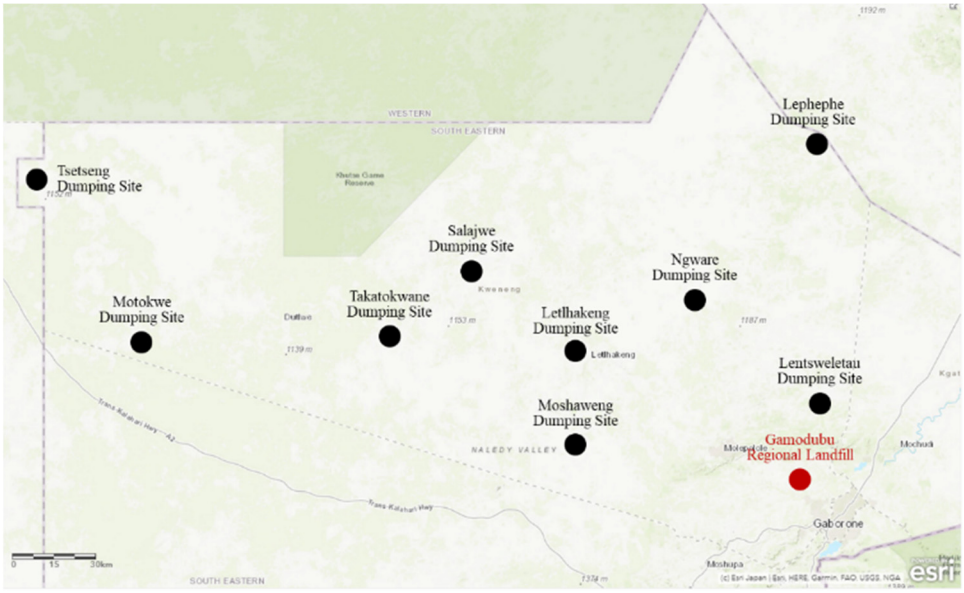
Figure 7-17 Amounts of Wastes Received at Gamodubu Regional Landfill Site (From 2010 to 2018)

		
Weighbridge	Landfill Area	Tire storage area
		
Leachate control pond	Tire shredder	Incinerator for clinical waste

Source: photographs taken by local staff

(2) Dumping Sites

Kweneng district covers a vast area of about 300 km from east to west and about 130 km from north to south. It is difficult to transport the wastes from all the villages in the district to the Gamodubu Regional Landfill site, therefore several dumping sites have been established in the district. The locations of these sites are shown in Figure 7-18.



Source: prepared by JICA Study Team according to interviews with Kweneng District Council

Figure 7-18 Locations of Dumping Sites in Kweneng District

7.4.7 Activities by Other Donors

Activities by other donors in Kweneng district have not been confirmed.

7.4.8 Status of Monitoring on SDGs' waste-related Indicators

Table 7-26 shows the current status on the SDGs' waste-related indicators (11.6.1, 12.3.1, 12.4.2, 12.5.1 and 14.1.1) in Kweneng district.

Table 7-26 Status of Monitoring on SDGs" waste-related Indicators (Kweneng District)

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 Kweneng district, the municipal solid waste collected and processed in a controlled facility is approximately 140 tons.
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	The Gamodubu Regional Landfill operated by Kweneng District Council has an incineration facility for medical waste. However, monitoring of substances emitted to the atmosphere has not been implemented. Also, ventilation pipes for methane gas in the landfill area have not yet been installed. Discussions are underway to introduce an air monitoring system and methane gas ventilation pipes in the future. On the other hand, Gamodubu Regional Landfill has six groundwater monitoring boreholes, four inside the site and two outside the site, and groundwater contamination is being monitored on a regular basis.
12.5.1	National recycling rate, tons of material recycled	In 2008, the import, manufacture, sale, and use of plastic bags were made subject to taxation. And a decree banning the use of plastic bags was proposed in 2018, but has yet to be enforced.
14.1.1	(a) Index of coastal eutrophication; and (b) plastic debris density	This section does not apply to Botswana because it is a landlocked country without access to the ocean.

Source: prepared by JICA Study Team

7.4.9 Medical Waste Management

As in Gaborone city, medical wastes are generated mainly from hospitals and clinics in Kweneng district. Most of the large hospitals have incinerators and incinerate their own wastes at their respective hospitals. In small clinics without incinerators, wastes are collected by the district council.

Clinics should separate municipal solid wastes from medical wastes, and further separate medical wastes into needles and other items, and discharge them in their own special containers and bags. After that, the wastes are stored in a storage area set up within the premises. Although there are differences among clinics, in general, municipal solid wastes and medical wastes are stored without mixing, and medical wastes are discharged to a storage area closed in by a fence or wall.

On the designated collection day, the district council collects the medical waste and treats it in the incinerator for medical waste at Gamodubu Regional Landfill.

		
Medical wastes before incineration	Incinerator for medical wastes at Gamodubu Regional Landfill (as shown previously)	Workers loading medical wastes into the incinerator

Source: photographs taken by local staff

7.5 Status of Waste to Energy Project in Botswana

There are no projects related to Waste-to-Energy (hereinafter referred to as "WtE") being implemented in Botswana. In 2020, a F/S study was conducted by the Energy Department of the Ministry of Minerals, Energy and Water Resources with the support of UNDP. The roadmap presented in this F/S study report is shown in Figure 7-19. The report states that it is necessary to investigate the status of recycling, to ensure that the legal system is in place, and to determine the quality and quantity of waste before implementing the WtE project. The items identified in this F/S study are summarized in Table 7-27.

Source: data provided by Gaborone city

Figure 7-19 Roadmap for Realizing WtE Project

Table 7-27 Confirmation Items for Realizing WtE Project

Item	Contents
Law	• A legal system is essential for WtE projects, but currently does not exist in the country of Botswana • None of the municipalities have developed a waste management plan (master plan). • In order to operate WtE facilities by municipalities independently, it is necessary to develop by-laws pertaining to WtE.
Institutional Framework	• The following are key institutions in the implementation of waste to energy projects. - Ministry of Mineral Resources, Green Technology and Energy Security - Ministry of Local Government and Rural Development - Ministry of Environment, Natural Resources, Conservation and Tourism - Ministry of Health and Wellness - Botswana Energy Regulatory Authority - Ministry of Finance and Development Planning - Department of Environmental Affairs - Ministry of Land Management, Water and Sanitation Services - Botswana Power Cooperation • Implementation of a WtE project requires skilled and qualified people throughout the project life cycle; Detailed Design, Construction and Commissioning, Operating and Maintenance and Decommissioning.
Recycling	• Recycling guideline exists in Botswana. • Activities related to recycling are also observed, and there is potential for expansion of the recycling business market.
Private Sector	• In order to secure waste amount, waste collection should be done by the municipalities, not by the private sector. Municipalities should collaborate with each other to ensure economies of scale.
Appropriate technology	• The technology to be introduced should be determined based on the properties and quantity of the waste, and the conditions and restrictions for introduction should be fully considered and discussed. (1) Incineration Combustible waste has to at least be more that 100 000 tons per year and the Low Calorific Value for the waste has to at least be more than 7 MJ/kg and not less. If the inert waste is more than 15% and the organic waste is more than 50% a thermal/incineration power plant will not be a feasible option. The high moisture content from the existing landfills also is not ideal for a municipal waste incineration plant as this results in high energy inputs to allow for drying of the waste by evaporating the water before heating the waste. Incineration is not a feasible technology for the landfills in Botswana mainly due to the quantities and quality of waste and the capital expenditure. (2) Anaerobic Digestion Segregation of waste at source is essential for anaerobic digestion. However, the percentage of organic waste in existing landfill sites in Botswana is currently small. Even though large-scale power generation is not expected, it is possible to generate power for private consumption. (3) Co-processing[33] Although Co-processing is a WtE technology that has already gained wide-spread acceptance amongst business communities and policy makers, a few successful examples exist also for the non-recyclable fraction of municipal solid waste. It is difficult to apply this technology to Botswana because it is not possible to recover the capital investment and operating costs. (4) Landfill Gas Capturing System LFG is generated over a period of 30-50 years. Theoretical gas production and the real capturing of gas do not coincide and in many cases real gas yield is well below expectations, which means that part of methane escapes to the environment. Currently, the percentage of organic waste at existing landfills is small, and the gas generated itself is likely to be small. The design and operational methods of final disposal facilities should also be considered.

Source: data provided by Gaborone city

In addition, the feasibility of introduction of WtE in Gaborone was evaluated based on the guideline for WtE prepared by JICA. Since there is no specific project plan in Gaborone, this evaluation is prepared using the

[33] An industrial process in energy-intensive industries, mainly cement and lime, using waste as a raw material or as an energy source, or both. The replacement of natural mineral resources and fossil fuels such as coal, oil, and gas.

basic information collected in this survey.

Table 7-28 Checklist for WtE in Gaborone City

Classification		Importance	Item	Assessment
1)	Social conditions	Most Important	Target city population	[1] The population of Gaborone City is approximately 280,000.
		Important	Social needs	[3] Gaborone City does not have any landfill sites, but they are allowed to transport their waste to some landfills which are owned by the surrounding municipalities. Those surrounding landfill sites have sufficient lifetimes.
		Recommended	Development status of social infrastructure	[1] Services for electricity, water and sewerage are supplied without any problem.
		Recommended	Environmental and social considerations	[1] Environmental and social considerations are regulated.
2)	Understanding of residents	Most Important	Cooperation of residents in waste sorting	[4] Basically, there is no segregation of waste at source.
		Most Important	Understanding of residents	[?] It is not clear through this survey whether the residents agree to the introduction of WtE.
3)	Institutional Aspect	Most Important	Development of laws, enforcement orders or rules	[1] Laws and regulations related to waste management have been properly established.
		Important	Stability of administrative organization	[1] Administrative organization in charge is clear and stable.
		Important	Adequacy of construction site	N/A
4)	Governance capability of the government	Most Important	Positioning of WtE in upper-level plan	[4] Nothing about WtE is mentioned in Botswana's strategy for waste management.
		Most Important	Stance of the head of local government	[?] It is not clear through this survey whether mayor of Gaborone City is positive about introducing WtE.
		Important	Performance capability of the government	N/A
		Important	Technical standards and operation pertaining to selling electricity	N/A
5)	Financial aspect	Most Important	Securing of financial resources	N/A
		Important	Tipping fee	N/A
		Important	Revenue by selling electricity	N/A
		Recommended	Project scheme	N/A
		Recommended	Project risks	N/A
6)	Technical aspect	Most Important	Collecting basic data concerning waste	[1] Responsible agencies and operators are currently collecting basic data in their routine work.
		Important	Technical capacities of manufacturers	N/A
		Important	Proper disposal of incineration residue	N/A
		Recommended	Environmental monitoring system	[1] Gaborone City has a public institute for environmental analysis.
		Recommended	Track record of similar facilities	[3] Introduction of biogas power generation has been under consideration but no official steps appear to have been taken for progressing to the development stages.
		Recommended	Securing of engineers	[1] Gaborone City has a high-level university.

Note: [1] = Satisfied, [2] = Slightly satisfied, [3] = Slightly not satisfiled, [4] = Not satisfiled, [?] = Not sure
Source: JICA Study Team assessed the project based on "Guideline for Promoting Waste to Energy Facility Projects", issued by JICA.

7.6 Issues and Cooperation Needs of Solid Waste Management in Botswana, Gaborone City and Kwenwng District

7.6.1 Issues and Stages of Solid Waste Management

(1) Issues of Solid Waste Management

The issues in solid waste management for the Central Government of Botswana are as follows:

- With regard to solid waste management in Botswana, there is a basic law on solid waste management, the "Waste Management Act", but it was formulated in 1998 and has not been updated. There is a concern that the basic law and other policies have become outmoded and insufficient to deal with issues and practices related to the current SWM situation. In particular, the Integrated Waste Management Policy (2020) includes source separation and 3Rs, but efforts to realize them have stagnated.

The issues in solid waste management for Gaborone City and Kweneng District are as follows:

- In Gaborone city, Kweneng District and the neighbouring municipalities, collection and transportation of waste is carried out individually by the city government and district councils (sub-district councils), either directly or through private contractors. However, only two sanitary landfills: Gamodubu Regional Landfill in Kweneng District and the South East Sanitary Landfill in South East District are available for final disposal of the waste, and the difficulties in transporting the waste of Gaborone City and Kweneng District, to these two landfills over long distances and without transfer stations is complicating the SWM system. It is necessary to plan for SWM from a regional perspective and include neighbouring municipalities in the planning process.
- The major issue in Kweneng District is to improve the operation of Gamodubu Regional Landfill. Although there have been a number of incidents of fires breaking out at Gamodubu Regional Landfill, the cause of the incidents could not be determined and appropriate measures could not be taken. It is thought that one of the reasons for the fires is that the landfill is not equipped with a gas venting system. In addition, the current waste disposal cell in operation is almost full and is in need of expansion. Furthermore, the incinerator for medical waste is installed and operating without air monitoring equipment, and the extent of air pollution cannot be ascertained.
- In addition, the waste collection rate in Kweneng District is low at approximately 60%, and illegal dumping has become a problem. Due to the vast area of Kweneng District, wastes from villages in the suburbs cannot be transported to Gamodubu Regional Landfill and are disposed of at numerous dumping sites in the district. In the future, it is necessary to close these dumping sites and consider a system to collect and transport wastes from the suburbs to properly operated sanitary landfills.

(2) Stages and Priority Issues of Solid Waste Management

The stages of solid waste management in Gaborone City and Kweneng District are shown in Table 7-29 and

Table 7-30. Based on the description in Table 1-13, this study evaluates the stage of waste management in Gaborone City as generally Stage 2 (Reduction of environmental impact and prevention of pollution) and the stage of waste management in Kweneng District as generally Stage 1 (Improvement of public health).

Table 7-29 Stages of Solid Waste Management in Gaborone City

Item	Stage	Situation
Legislations	2	The Waste Management Act (1998) is the basic law for waste management in Botswana.
Collection and Transportation	2	In Gaborone City, collection and transportation is done by the Gaborone City Council and contracted private companies. The waste collection rate is approximately 80%.
Final Disposal	2	Gaborone City Council does not have any landfills, and it disposes its waste at Gamodubu Regional Landfill owned by Kweneng District Council and at South East Sanitary Landfill owned by South East District Council.
Intermediate Treatment and Recycle	1	Although collection of recyclables is being conducted by private companies and NGOs, 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

Table 7-30 Stages of Solid Waste Management in Kweneng District

Item	Stage	Situation
Legislations	2	The Waste Management Act (1998) is the basic law for waste management in Botswana.
Collection and Transportation	1	In the Kweneng District, waste is collected and transported by Kweneng District Council and contracted private companies. The waste collection rate is low at about 60% and illegal dumping is a serious problem in Kweneng District.
Final Disposal	2	Gamodubu Regional Landfill, one of the largest in Botswana, exists in Kewneng District and is equipped with weighbridges, leachate pond, and an incinerator for clinical waste.
Intermediate Treatment and Recycle	1	Although collection of recyclables is being conducted by private companies and NGOs, the amount of waste recycled is not known. However, Kweneng District Council collects the recyclables salvaged from the waste at Gamodubu Regional Landfill.

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.

<Priority Issues (Gaborone City)>

- Since Gaborone city does not own a landfill and is dependent on other cities, it needs to plan for a regional solid waste management in cooperation with neighboring municipalities.

<Priority Issues (Kweneng District)>

- 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 Regional Landfill has a remaining lifespan, however, incidents of breakout of fires have occurred repeatedly, and the landfill's operation needs to be improved.

7.6.2 Good Practices of Solid Waste Management

The following are good practices of solid waste management in Gaborone City and Kweneng District Council

that can be used as references for other countries.

(1) Integrated Waste Management Policy (2020)

This policy provides definitions for waste, an analysis of the current status of waste management in Botswana, SWM objectives and guidelines, as well as approaches and strategies for appropriate waste management at each stage of the system (planning, generation and separation, collection and transportation, 3Rs, hazardous waste management, treatment and disposal, and finance). It also states that environmental education, involvement of stakeholders (private sector, communities, NGOs, etc.), inter-organizational cooperation, role sharing, and monitoring are necessary.

(2) Promotion for Segregation at Source

In Tolokweng, part of South East District, Tolokweng Sub District Council is taking initiatives for waste segregation at source based on the "Cleaner Tolokweng Strategy 2020-2025" which is the action plan prepared and developed by JICA trainees. They have been working to establish community drop-off points for recycling waste in Tolokweng. Currently, the project is underway with ongoing inspection of several candidate sites for drop-off points in urban areas (near main roads or schools) and residential areas (in densely populated residential areas).

7.6.3 Proposed Cooperation Policy

The proposed cooperation policy in waste management for Central Government of Botswana, Gaborone City Council and Kweneng District Council is shown in Table 5-21. Cooperation assistance related to priority issues described in section 7.6.1 is highlighted in red letters and these assistances are considered to be of higher priority than others. However, in order to effectively provide these high-priority assistances, self-help efforts by the Central Government of Botswana, Gaborone City Council and Kweneng District Council are essential. For example, it is important to discuss the roles and responsibilities of each organization in the context of regional collaboration between Gaborone City Council, Kweneng District Council, and South East District Council.

Table 7-31 Proposed Cooperation Policy (Botswana)

Issue		Short-term assistance (red letters are those related to priority issues)	Medium-term assistance
Central government	Strengthening the legal system	[Technical Cooperation Project] ➢ Assist in updating waste-related laws	
Gaborone city	Strengthening of regional waste management system and preparation of master plan	[Technical Cooperation Project] ➢ Establish a master plan that includes a regional cooperation system, such as joint use of landfills with neighboring municipalities, since Gaborone city does not have its own landfill. ➢ Examine 3R measures such as collection of separated recyclable materials, and implement pilot projects in the master plan.	
Kweneng district	Strengthening of regional waste management system and preparation of master plan	[Technical Cooperation Project] ➢ Establish a master plan that includes a regional cooperation system with neighboring municipalities, since Gamodubu Regional Landfill receives wastes from Gaborone city. ➢ Examine 3R measures such as collection of separated recyclable materials, and implement pilot projects in the master plan.	
	Improvement of waste collection	[Grant Aid Project] ➢ Establish transfer facilities for appropriate disposal of wastes in suburban areas at landfills. ➢ Procure collection and transport vehicles to enhance the waste collection capacity in urban as well as suburban areas. [Technical Cooperation Project] ➢ Review the waste collection and transportation plan, including the collection of wastes in the suburban areas, and implement pilot projects using equipment procured in the grant aid project.	
	Improvement of existing landfill	[Technical Cooperation Project] ➢ Review the landfill operation plan and implement an improvement project.	[Grant Aid Project/Japanese ODA Loan Project] ➢ Construct an expansion area for the existing landfill

Source: prepared by JICA Study Team

CHAPTER 8 Solid Waste Management in the Republic of South Africa

In the Republic of South Africa (hereinafter referred to as "South Africa"), the JICA Study Team implemented remote survey with the cooperation of the local consulting company, ERA, and held interviews with persons concerned with waste management using the web-meeting system. The results of this survey are described in this chapter.

8.1 Overview of Target Country and Cities

8.1.1 Population

According to the World Bank statistics the population in South Africa is above 59 million as of 2020 and its population growth rate during the recent 10 years is 1.5% per year on average.

Table 8-1 Population Trends in South Africa for the recent 10 years

Year	2011	2012	2013	2014	2015
Population	52,003,759	52,832,659	53,687,125	54,544,184	55,386,369
Growth rate (%)	-	1.59	1.62	1.60	1.54

Year	2016	2017	2018	2019	2020
Population	56,207,649	57,009,751	57,792,520	58,558,267	59,308,960
Growth rate (%)	1.48	1.43	1.37	1.32	1.28

Source: JICA Study Team prepared this table, based on the World Bank data

The Statistics South Africa (stats sa) set the population in Johannesburg, which is one of the target cities of this Study, at 4,949,347 based on the most recent census survey implemented in 2016. The next population survey is planned to be implemented in March 2022. World Population Review, a private survey organization, has analyzed the current population of Johannesburg, utilizing the information of UN World Urbanization Prospects 2018 and estimated that the population of Johannesburg is 5,926,668 and the population growth rate is 2.49% per year as of 2021.

The Statistics South Africa, set the population in Tshwane at 3,275,152 based on the most recent census survey implemented in 2016. Assuming that the average annual population growth rate of 2.31% for the period of 2011to 2016 remains unchanged up to 2021, the population in Tshwane is estimated to be about 3.7 million as of 2021.

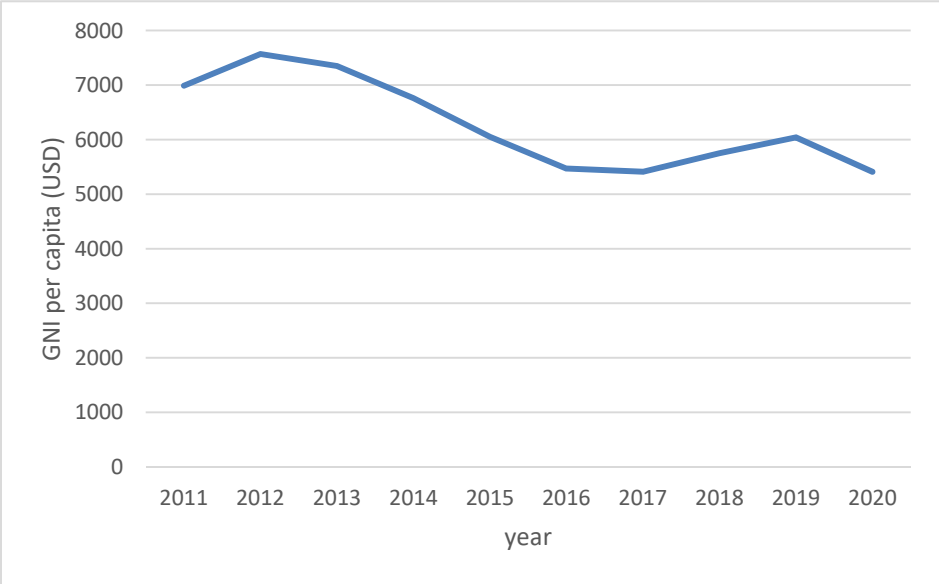
8.1.2 Economic Situation

South Africa is by far the economically richest country in Africa and its GDP is about 40% of the total GDP of sub-Saharan African countries. The country has rich natural resources and especially the reserves and production amounts of gold, chromium ore, platinum, vanadium etc. are the largest in the world. However, its economic growth is slowing down at present, and its real GDP growth rate was just 0.2% as of 2019. According to the World Bank statistics, GNI per capita of South Africa is 5,410 USD as of 2020（Atlas method, current USD）.

Table 8-2 Minerals production amounts and reserves in South Africa as of 2019

Minerals	Production			Reserves		
	Production amount (tons)	Global share	Ranking	Reserves (tons)	Global share	Ranking
Gold	90	2.7%	13	3,200	6.4%	2
Chromium ore	17,000	38.6%	1	200,000	35.1%	2
Platinum	130,000	72.2%	1	63,000,000	91.3%	1
Vanadium	8,000	11.0%	3	3,500,000	15.9%	4

Source: JICA Study Team prepared this table, based on the information of Mineral Commodity Summaries 2020.



Source: JICA Study Team prepared this graph, based on the World Bank information

Figure 8-1 Trend of GNI per capita in South Africa

Table 8-3 Major economic indicators in South Africa

Indicators	2017	2018	2019
GDP growth rate (real)	1.4 (%)	0.8 (%)	0.2 (%)
GDP total amount (nominal)	4,653,579 (mil ZAR)	4,873,899 (mil ZAR)	5,077,625 (mil ZAR)
GDP per capita (nominal)	6,120 (USD)	6,354 (USD)	5,978 (USD)
Inflation rate	5.3 (%)	4.7 (%)	4.1 (%)
Export amount (FOB price)	1,168,509 mil ZAR)	1,247,225 (mil ZAR)	1,303,145 (mil ZAR)
Import amount (FOB price)	1,103,570 (mil ZAR)	1,222,944 (mil ZAR)	1,263,824 (mil ZAR)
Current balance (international balance basis)	△118,234 (mil ZAR)	△172,962 (mil ZAR)	△153,176 (mil ZAR)
Trade balance (international balance basis)	64,939 (mil ZAR)	24,281 (mil ZAR)	39,321 (mil ZAR)

*1 ZAR = 7.633530 JPY[34]

Source: JETRO "General conditions and basic statistics in South Africa" (as of 1st September 2021)

The major industries in South Africa are mining, automobile manufacturing, metal processing, machinery manufacturing, textile, steel, chemical, fertilizer, food, and commercial ship maintenance, etc.

[34] JICA exchange rate: March 2022

Unemployment rate is high at 28.7% as of 2019.

8.1.3 Topography

South Africa is located at the southernmost part of the African continent with its coastal line facing both the Indian Ocean and Atlantic Ocean. Its total area is about 1.219 million km^2, about 80% of which is used for agriculture, mainly as pastureland. The forest area is about 8% of the country's total area.

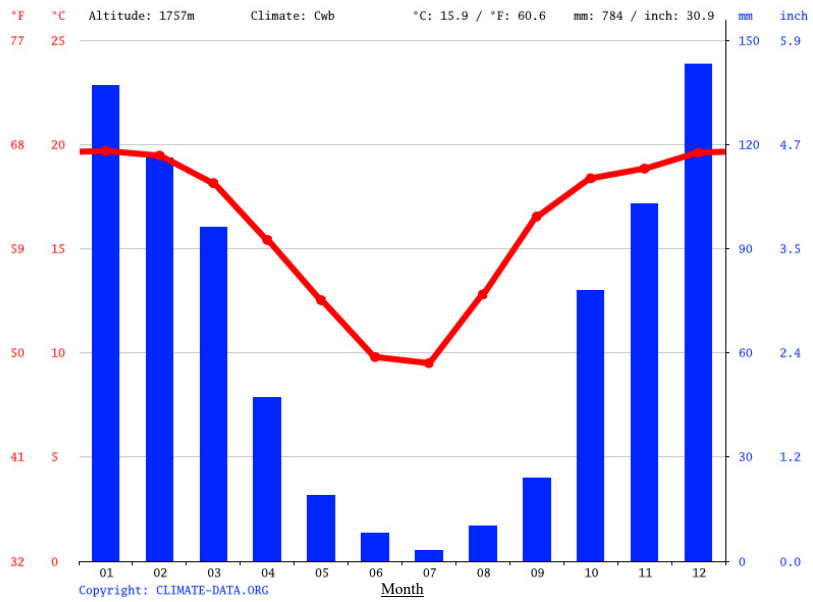
Source：CIA The World Factbook

Figure 8-2 Location of South Africa

8.1.4 Meteorological Conditions

South Africa has many sunny days throughout the year and is called the "Country of the Sun", and has a mostly warm climate. The country has a variety of animals and plants supported by the diverse natural topography; 2,000 meters-high mountain range, desserts, forests, hills and fields and climate. Most of South Africa falls in the Steppe climatic zone, but some parts along the eastern coast belong to the subtropic climatic zone.

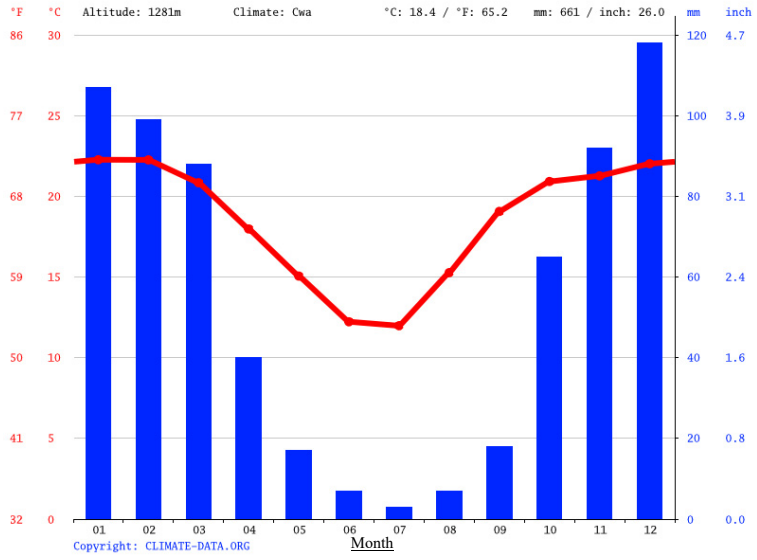
The altitude of Johannesburg city is higher than 1,700 meters and it belongs to Cwb climatic zone, which is characterized by warmth and much rain in the summer. Information on temperature and precipitation in Johannesburg is shown in the following figure. The temperature in Johannesburg is about 16ºC on average and precipitation is about 800 millimeters annually. Precipitation in Johannesburg is lowest in July and highest in December.



Source：Climate-Data.org

Figure 8-3 Temperature and precipitation in Johannesburg

The altitude of Pretoria, which is part of Tshwane city, is about 1,280 meters and is more than 400 meters lower than Johannesburg city. It belongs to Cwa climatic zone, which is warm and has much rain in summer and its highest monthly average temperature is higher than 22 degrees Celsius. Temperature and precipitation in Pretoria are shown in the following figure. The average temperature is about 18 degrees Celsius, and precipitation is about 660 millimeters in a year. Precipitation in Pretoria is lowest in July and highest in December.



Source: Climate-Data.org

Figure 8-4 Temperature and precipitation in Pretoria, Tshwane

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

8.2.1 Laws and Regulations related to Solid Waste Management

In South Africa, solid waste management is mainly regulated by the "National Environmental Management: Waste Act (NEMWA)", which was established in 2008 and revised a few times after that. The "National Waste Management Strategy (NWMS)" was established as NEMWA's implementation strategy. NEMWA has 9 chapters, and the contents of each chapter are summarized in the table below.

Table 8-4 Outline of each chapter of NEMWA in South Africa

Chapter	Title	Chapter Outline
1	Interpretation and Principles	Definitions, Objects of Act, Application of Act, etc.
2	National Waste Management Strategy, norms and standards	Establishment of national waste management strategy, national norms and standards, provincial norms and standards, waste service standards
3	Institutional and planning matters	Designation of waste management officers, preparation and implementation of integrated waste management plan, etc.
4	Waste management measures	Part 1 : Priority wastes Part 2 : General duty Part 3 : Reduction, re-use, recycling and recovery of waste, extended producer responsibility (EPR) Part 4 : Waste management activities Part 5 : Storage, collection and transport of waste Part 6 : Treatment, processing and disposal of waste Part 7 : Industry waste management plans Part 8 : Contaminated land Part 9 : Other measures
5	Licensing of waste management activities	Licensing authority, cooperative governance, application, procedure, factors to be taken into account, renewal, revocation and suspension, surrender of waste management licenses, waste management control officers etc.
6	Waste information	Establishment of national waste information system and provincial waste information system etc.
7	Compliance and enforcement	Waste impact reports, offenses, penalties etc.
8	General matters	Part 1 : Regulations, general regulatory powers Part 2 : Consultative process Part 3 : Exemptions and appeals
9	Miscellaneous	Delegation and assignment, repeal and amendment of laws etc.

Source: JICA Study Team prepared this table, based on the contents of NEMWA

According to NEMWA, in principle the responsibility of provincial government related to waste management falls under the Members of Executive Council (MEC). The municipalities are responsible to implement the waste management services.

Aside from NEMWA, there are some other laws related to waste management. In addition, some regulations have been established under NEMWA. South Africa has also ratified some international treaties related to solid waste management. Laws and regulations related to solid waste management in South Africa are listed in the table below.

Table 8-5 Major laws and regulations related to waste management in South Africa

Name	Year	Remarks
【International treaties】	(Effectuation)	
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal	1992	Regulating transboundary movement of hazardous waste
Stockholm Convention on Persistent Organic Pollutants (POPs)	2004	Regulating discharge of POPs
Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade	2004	Regulating the process of international trade of hazardous chemicals and pesticides
Vienna Convention for the Protection of the Ozone Layer	1988	Regulation for protecting Ozone layer
Montreal Protocol on Substances that Deplete the Ozone Layer	1989	Regulating the production, consumption and trade of Ozone Depleting Substances (ODS)
Minamata Convention on Mercury	2017	Regulating collection, use, and discharge of mercury and mercury waste
【Domestic laws】	(Establishment)	
The Constitution of the Republic of South Africa	1996	In chapter 24, the description about waste management is included.
National Environmental Management Act (NEMA)	1998	
National Environmental Management: Waste Act (NEMWA)	2008	Revised a few times after establishment
Municipal Systems Act	2000	Regulating municipal systems
Waste Tire Regulations	2009	Regulating management of waste tires
The Regulations for the control of import and export of waste	2019	Regulating import and export of waste
Waste classification and management Regulations	2013	Regulating classification and management of waste
National Waste Information Regulations	2012	Regulating to provide information on waste
Regulations regarding the planning and management of residue stockpiles and residue deposits	2015	Regulation for residue stockpiles and deposits

Source: JICA Study Team prepared this table.

8.2.2 Policy and Plans related to Solid Waste Management

The “National Waste Management Strategy 2020” (NWMS2020) was issued by DFFE as the policy and plan for solid waste management in South Africa. NWMS2020 was established based on the description in Chapter 5 of the “National Development Plan: Vision 2030” (NDP) and it focuses on environmental sustainability and promotion of fair transition towards low carbon economy. The following table shows the NDP outcomes and NWMS2020 responses.

Table 8-6 Outline of NDP Outcomes and NWMS2020 Responses

National Priority	NDP Outcomes	NWMS2020 Responses
✓ Economic Transformation and Job creation ✓ Education and Skills ✓ Health ✓ A better Africa and World	✓ Greenhouse Gas emission reduction ✓ Just Transition to a low carbon economy ✓ Municipal preparedness to deal with climate change, and ✓ Enhanced national implementation of the Sustainable Development Goals (SDGs) Agenda 2030 and Agenda 2063	✓ Implementation of the Chemical and Waste Economy (CWE) Phakisa ✓ Implementations of the Oceans Economy Phakisa ✓ Just Transition to a low carbon and circular economy ✓ Environmental Management Education and Awareness campaigns in schools including on waste management ✓ Advancing the SDGs in 10 areas of waste management ✓ Supporting the implementation of waste management programmes of local governments

Source: JICA Study Team prepared this table, based on the description of NDP and NWMS2020

The NWMS2020 developed 5 key principles and provided brief explanation for each. The following table summarizes these principles.

Table 8-7 Five Principles of NWMS2020

Key Principles	Summary
Waste Minimization	Avoiding the amount and toxicity of waste
Waste Prevention	Avoiding the generation of waste and avoiding toxicity in waste
Waste as a resource	Resource conservation of waste through reuse, recycling, treatment, and recovery to reduce the amount and the toxicity of waste
Sustainable strategic partnerships	Government establishes and sustains collaborative working relationships with non-government stakeholders involved in the management of waste, including the private sector, academia, civil society organizations and other development funding institutions.
Environmentally sound socio-economic growth and development	Ensuring that the intent and commitments of the NDPs and the SDGs are continuously integrated and aligned to all environmental protection consideration, and that environmental protection programmes contribute to improving the socio-economic lives of the citizens.

Source: JICA Study Team prepared this table, based on the description of NWMS2020

NWMS2020 classified waste into two categories; “general waste” and “hazardous waste”. In this context, general waste includes commercial waste, industrial waste, and construction waste, etc. without any hazardous objects. Hazardous waste includes infectious waste, e-waste, asbestos, and mercury, and etc. and it mainly consists of fly ash (63.9%) and bottom ash (11.3%) generated from power plants.

Waste-to-Energy is regarded mainly as the effective way to utilize organic waste, and biogas power generation is very positively evaluated by NWMS2020. On the other hand, NWMS2020 also describes thermal pyrolysis and incineration technologies, which target plastics and other burnable waste, and have the potential to be alternative waste treatment technologies. However, the strategy maintained that recycling should have the higher priority.

Department of Forestry, Fisheries, and Environment (DFFE) together with the Department of Planning,

Monitoring and Evaluation initiated "Operation Phakisa: Chemicals and Waste Economy: (CWE)" Programme from 24th July to 24th August 2017. CWE Phakisa requested the collaboration of various concerned persons to prepare the "Good Green Deeds Programme", which encouraged behavior change by the citizens to manage their waste more responsibly and keep their neighborhood clean, green and safe.

CWE Phakisa identified 3 key objectives as follows.

(a) Reduce the negative environmental and health impacts of waste and risks posed by chemicals
(b) Increase commercialization of the circular economy and create values from resources currently discarded as waste
(c) Foster inclusive growth through positioning of South Africa as a globally competitive manufacturer of sustainable products

Moreover, CWE Phakisa focuses on the technologies listed below, considering the opinions from private sectors, related organizations, and specialized institutions, etc.

(i) Biological Treatment
(ii) Material Recovery and Reutilization
(iii) Composting and Biomass at household level
(iv) Waste-to-Energy Facilities
(v) Thermal Pyrolysis
(vi) Utilization of ash, sludge etc. as soil conditioner in agricultural land

8.2.3 Organization Structure for Solid Waste Management

Waste Management Officers (WMOs) on the national, provincial and municipality levels are assigned as supervisors of solid waste management. The role of each WMO is as follows.

Table 8-8 Major Roles of each Waste Management Officer

Organizations	Major roles of WMO
DFFE	Decision of Waste Management Policy, Establishment of strategy, Assessment of implementation of municipality projects
Provincial government	Coordination of Waste Management Activities in the province
Municipality	Integrated Management of Waste Management Activities in the municipality, including establishment of waste management policies

Source: JICA Study Team prepared this table, based on the results of interviews from each organization

The roles of each related organization are as follows.

Table 8-9 Major Organizations and their Roles related to Solid Waste Management

Organizations	Abbreviations	Major roles
【National Government】		
Department of Forestry, Fisheries and Environment	DFFE	・Establishment and implementation of NWMS ・Issue of State of Waste Report (SoWR) ・Adjustment and approval of related organizations ・Establishment of policy and strategy for Waste-to-Energy
Department of Trade, Industry and Competition	DTIC	・Promoting reduction of waste generation during manufacturing ・Impact Assessment of EPR ・Promoting recycling industry ・Standardization of products ・Awareness raising of consumers
Department of Mineral Resources and Energy	DMRE	・Management and Regulation of Waste-to-Energy projects ・Establishment of policy and strategy for Waste-to-Energy
Department of Agriculture, Land Reform and Rural Development	DALRRD	・Establishment of strategy for reducing food loss ・Management of agricultural waste
Department of Health	DoH	・Management of Health Risk Waste, Absorbable Sanitary Waste (such as diapers) and so on
Department of Human Settlement, Water and Sanitation	DHSWAS	・Regulation of Domestic Waste, Sewerage, Contaminated land
Department of Basic Education	DBE	・Promotion of 3R awareness raising campaigns at schools
Department of Transportation	DoT	・Tracking imported and exported waste
Department of Science and Innovation	DSI	・Study and Research for promoting technical innovation in the field of waste management
【Provincial Government】		
Members of Executive Council	MECs	・Establishment of Integrated Waste Management Plans (IWMPs)
Division of Pollution and Waste Management	－	・Regulation of Waste Management in the province ・Monitoring waste management activities implemented by municipalities and private sector in the province
【Municipality】		
City Government	－	・Construction of Waste Management Facilities ・Providing collection, transportation and treatment services ・Regulation of waste management

Source: JICA Study Team prepared this table.

The Information Control Team of DFFE established “South Africa Waste Information System” (SAWIS), based on NEMWA. This system comprehensively collects and analyses waste information and it also publicizes this information through the on-line platform named “South Africa Waste Information Center” (SAWIC). Currently, DFFE is improving the system to make it function better.

8.2.4 On-going Projects

DFFE is presently considering introduction of Alternative Waste Treatment Technologies in collaboration with some municipalities and the project in Johannesburg is in the final stage (refer to section 8.3.5). Many cities have shown interest in introducing Alternative Waste treatment Technologies and DFFE is especially supporting projects for the three big cities of Johannesburg, Tshwane and Ekurhuleni in Gauteng Province. Various organizations such as the Investment and Infrastructure Office (IIO) of the Presidency, DFFE,

Division of Pollution and Waste Management and Department of Economic Development of Gauteng Provincial Government are involved in the projects for introducing Alternative Waste Treatment Technologies.

Moreover, DFFE has positioned the "Waste Management Flagship Programme" as one of the mid-term key programmes, in response to South Africa Climate Change White Paper. As one of the activities in this programme, Deutsche Gesellschaft fur Internatuonale Zusammenarbeit GmbH (GIZ) implemented a survey on the current situation of waste management and the SWM sector positions in the countermeasures against Climate Change in South Africa.

After that, each municipality submitted proposals to participate in this programme. As the result of evaluation of proposals, 6 local municipalities, namely Rustenburg LM, Emfuleni LM, eMhkathuze LM, Msunduzi LM, Mbombela LM, and Mangaung LM were selected as target cities of the pilot project. Surveys were implemented in the 6 local municipalities to understand the current situation of waste management. Organic waste was identified as the main cause of the lack of capacity of final disposal sites and accordingly the diversion of organic waste from the disposal sites through volume reduction and treatment has become the main challenge of this programme. Five (5) technologies such as open composting, in-vessel composting, heron-type composting, nutrition upcycle, and anaerobic digestion, are being considered for treatment of organic waste.

Green Climate Fund (GCF) implemented a feasibility study for this programme and concluded the need for utilization of private funds.

DFFE has organized the "Programme Control Office" for this programme which is supporting municipalities implement the program through dispatch of engineers. In addition, this programme includes technical transfer for municipalities to continue implementing the programmes by themselves.

8.2.5 Actions against COVID-19

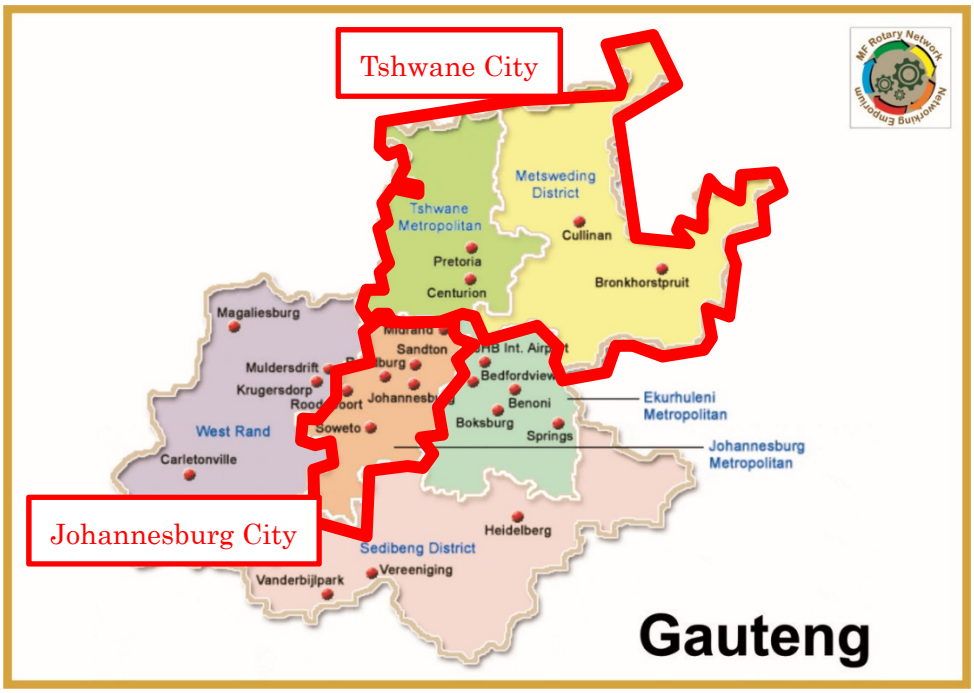
DFFE established stakeholders' platform against COVID-19 in 2020 and held meetings for information sharing as necessary.

DFFE is providing food and Personal Protective Equipment (PPE) for SWM related workers to protect them against negative effects caused by COVID-19 pandemic. About 14,000 waste pickers have already benefited from this activity.

In addition, DFFE is developing educational materials to protect against COVID-19 in collaboration with a non-profit organization named "Seas trust".

8.3 Roles of Gauteng Provincial Government

The locations of Johannesburg City and Tshwane City are shown in Figure 8-5.

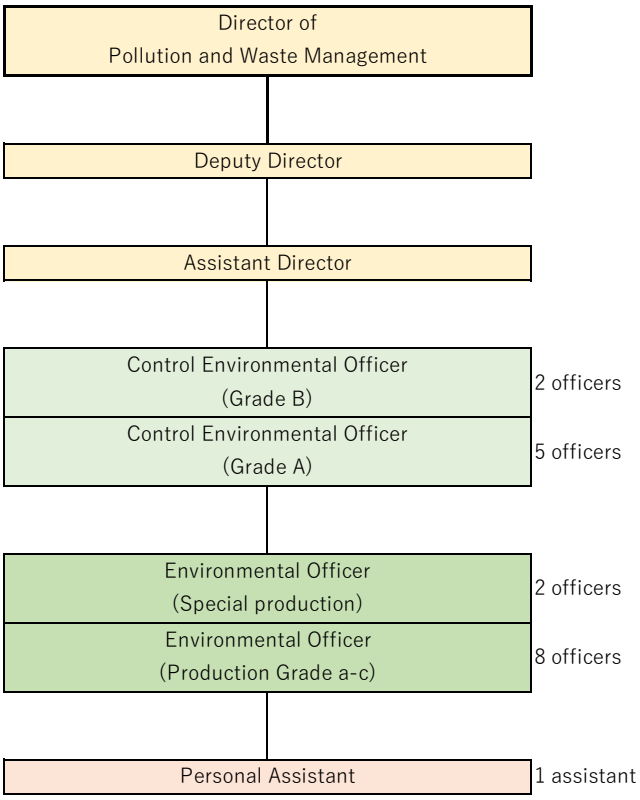


Source: JICA Study Team prepared this figure, using map of MF Rotary Network

Figure 8-5 Location of Johannesburg and Tshwane in Gauteng Province

8.3.1 Organization and Finance related to Solid Waste Management

Gauteng Province is located in the north-eastern part of South Africa and consists of 3 metropolitan municipalities; Johannesburg, Tshwane and Ekurhuleni, and 2 districts. In Gauteng Provincial Government, the main role of the Division of Pollution and Waste Management (DPWM) is to understand the actual situation of waste management implemented by each municipality and to support them as necessary. The organization chart of DPWM is shown below.



Source: JICA Study Team prepared this figure, based on the documents provided by Gauteng Provincial Government

Figure 8-6 Organization Chart of Division of Pollution and Waste Management in Gauteng Provincial Government

The Gauteng Provincial Government budget for solid waste management is quite limited and most of it is used for the payment of staff salaries.

Gauteng Provincial Government has established a waste information system and the persons who handle waste are required to register with this system in order to be issued with a certification. Waste handlers must renew this registration every 2 years. The information collected by this system is shared with SAWIC.

8.3.2 Major Activities

Major activities of Gauteng Provincial Government are to communicate with municipalities in Gauteng Province and to support them as necessary.

Moreover, they hold “Gauteng Province Waste Management Forum” every 3 months for sharing information among persons concerned. They also hold “Gauteng Province Waste Information System Workshop” twice a year.

They are also providing financial and technical support to the municipalities participating in the project for introduction of Alternative Waste Management Technologies, described earlier in section 8.2.4.

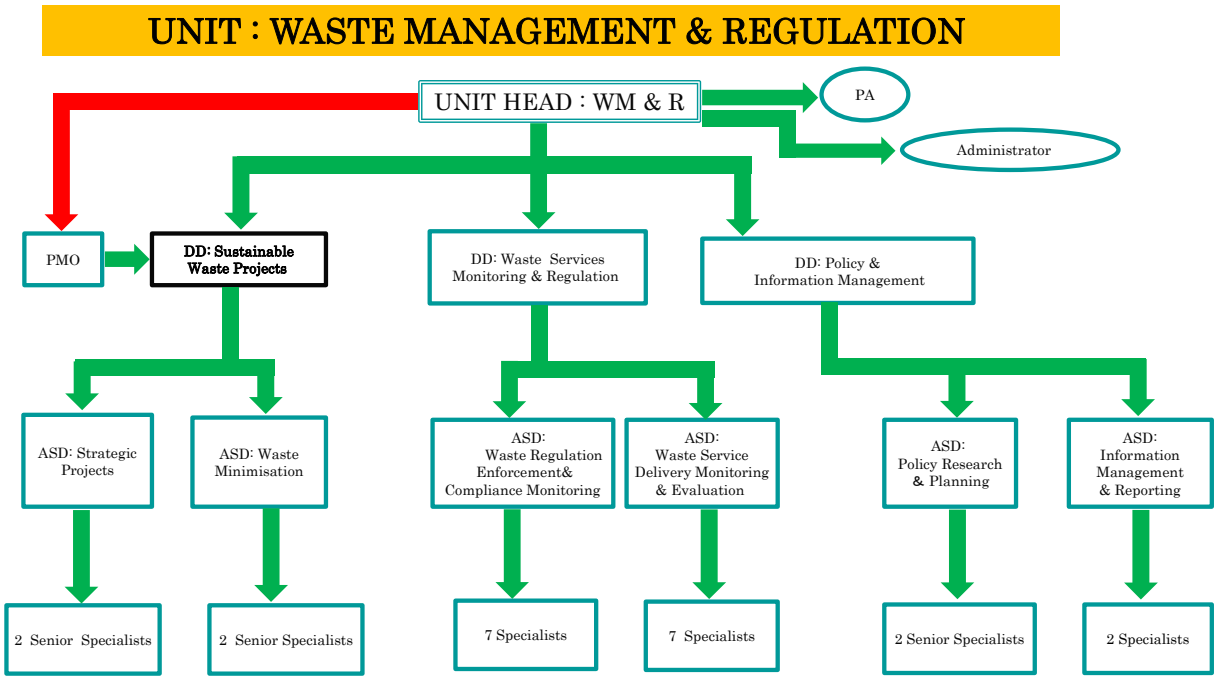
8.3.3 Actions against COVID-19

The officers of Gauteng Provincial Government are trying to raise the SWM workers' awareness on COVID-19 protection measures using the website. However, as some of the workers cannot use personal computers, wall posters have been put up in the working areas and brochures were prepared for distribution to the workers.

8.4 Solid Waste Management Situation in Johannesburg City

8.4.1 Organizations and Finance for Solid Waste Management

Based on Article 108 of the Constitution of the Republic of South Africa and Article 32 of Municipal Systems Act, the City of Johannesburg (CoJ) has a responsibility to implement collection, transportation and disposal of waste generated in Johannesburg city. The figure below shows the organization chart of the department in charge of waste management in CoJ.



Source: JICA Study Team prepared this figure, based on the documents provided by CoJ.

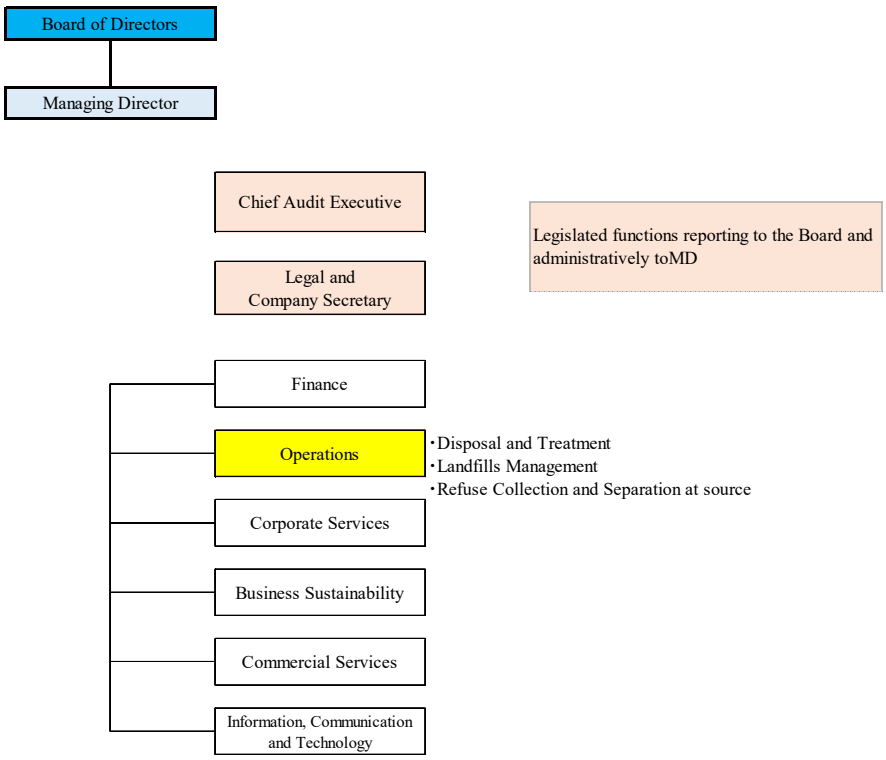
Figure 8-7 Organization Chart of Waste Management and Regulation Unit of CoJ

CoJ consigns collection, transportation, and disposal of waste in Johannesburg to Pikitup Johannesburg (SOC) Ltd. (hereinafter referred to as "Pikitup"). Pikitup was established in 2001 as an entity owned by CoJ under the terms of Companies Act. Pikitup exchanged an indefinite agreement with CoJ for service provision. The budget of Pikitup is allocated by CoJ.

Pikitup has 5,082 employees and more than 200 trucks. Their target service area covers all of Johannesburg city, 1,625 km^2, and includes cleaning of roads, with a total length of about 9,000 km.

The figure and the table shown below are their organization chart and recent financial situation, described in

their business plan issued in 2021.



Source: JICA Study Team prepared this figure, based on the figure shown on page 65, Fig. 9.3.1, "2021/2022 BUSINESS PLAN" (prepared by Pikitup, approved in May 2021）.

Figure 8-8 Organization Chart of Pikitup

Table 8-10 Financial Situation of Pikitup (Unit: thousand ZAR)

	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24
	Actual	Actual	Actual	Forecast	Allocated Budget	Allocated Budget	Requested Budget
Income	2,330,707	2,483,954	2,793,402	3,083,680	3,183,406	3,382,922	3,825,216
Expenditure	2,151,175	2,348,798	2,723,935	3,232,178	3,183,406	3,382,922	3,825,216
Surplus	179,532	135,156	69,467	▲148,498	0	0	0

Source: JICA Study Team prepared this table, based on the table shown on page 58, Table 6.11.10.1, "2021/2022 BUSINESS PLAN" (prepared by Pikitup, approved in May 2021)

The budget of Pikitup has recently fluctuated within the scale of 3 billion ZAR and about 50% of income comes from collection of domestic waste. About 40% of expenditure is spent on staff costs. Presently, Pikitup has maintained a surplus financially, but in the fiscal year of 2020/21, they posted a deficit of about 5% due to the increase of cost for fleet and third-party contractors.

CoJ established their own waste information system, and they report the collected information to Gauteng Provincial Government.

8.4.2 Ordinances and Policies related to Solid Waste Management

CoJ established Waste Management Bylaws in 2013 and they were revised and publicized in 2021. The outline of bylaws is shown in the table below. According to CoJ, it will be their challenge to secure the execution of bylaws in future.

Table 8-11 Outline of Waste Management Bylaws-CoJ

Chapter	Title	Outline
1	Interpretations, principles and objects	Definitions, principles and objectives of by laws
2	Integrated waste management	Designation of WMO, Preparation of IWMP, annual progress reporting, waste information system
3	Handling of different waste types	Part-1：Event waste Part-2：Building waste Part-3：Hazardous and health care risk waste Part-4：Garden waste Part-5：Bulky waste Part-6：Industrial waste and special waste Part-7：Tires, disused vehicles or machinery and scrap metal Part-8：Recyclable waste Part-9：Agricultural and farm waste
4	Waste minimization and recycling	Mandatory source separation of recyclables, collection, transportation and disposal of recyclables, establishment of waste pickers association, accreditation
5	Municipal service	Part 1：Providing access to the municipal service Part 2：Using the municipal service
6	Commercial services	Part 1：Provision of commercial services by accredited service providers and flow control Part 2：General business waste and industrial waste Part 3：Organic waste and un-compactable waste
7	Transportation, treatment and disposal of waste	Transportation and treatment of waste
8	Accreditations of service providers	Accreditation permit requirements etc.
9	Accumulating waste, littering, dumping and abandoned articles	Accumulating waste and dumping
10	Authorized official	Powers of authorized officials, observance of human rights
11	Miscellaneous	Offences and penalties etc.

Source: JICA Study Team prepared this table, based on the description of "Waste Management By law- CoJ 2021"

CoJ established "Integrated Waste Management Plan" (IWMP-CoJ) in 2011, based on NWMS2020. In this plan, 8 primary goals related to waste management are promoted as follows.

Table 8-12 Primary Goals of IWMP-CoJ 2011

	Primary Goals	Outline
1	Waste Minimisation	Reuse, Recycling and Recovery of waste shall be promoted through the promotion of source separation and composting of waste etc.
2	Waste Treatment and Disposal	Requirements for proper treatment of waste shall be secured so as to reduce environmental impact and extend the lifetime of landfill sites.
3	Integrated Planning	Sustainable, ecological development shall be promoted, through economic and social development such as infrastructure related to waste management.
4	Effective Service Delivery	Existing service coverage shall be expanded in order to secure effective waste service access to all citizens.
5	Waste Information System	Information from generation to disposal of waste shall be managed effectively.
6	Capacity Building and Awareness Raising	Public awareness raising shall be implemented for promoting 3R.
7	Compliance and Enforcement	Compliance with regulations shall be ensured through prosecution when required.
8	Pollution Control	Strategic intervention is necessary to control illegal dumping and generation of hazardous waste.

Source: JICA Study Team prepared this table, based on the description of IWMP-CoJ-2011.

IWMP-CoJ-2011 describes composting and Waste-to-Energy as options to be considered for alternative waste treatment technologies and decrease direct disposal of waste at landfill sites. Furthermore, the plan describes the construction of Waste-to-Energy facilities in addition to the extension of landfill sites.
CoJ intends to revise the IWMP-CoJ plan and has started the tender process for outsourcing the revision work. The contractor was to be decided in March 2022.

8.4.3 Overview of Solid Waste Management

According to the business plan prepared by Pikitup in fiscal year of 2021/2022, the amounts of waste collected for the previous two years were reported as follows.

Table 8-13 Amounts of waste collected in Johannesburg (tons)

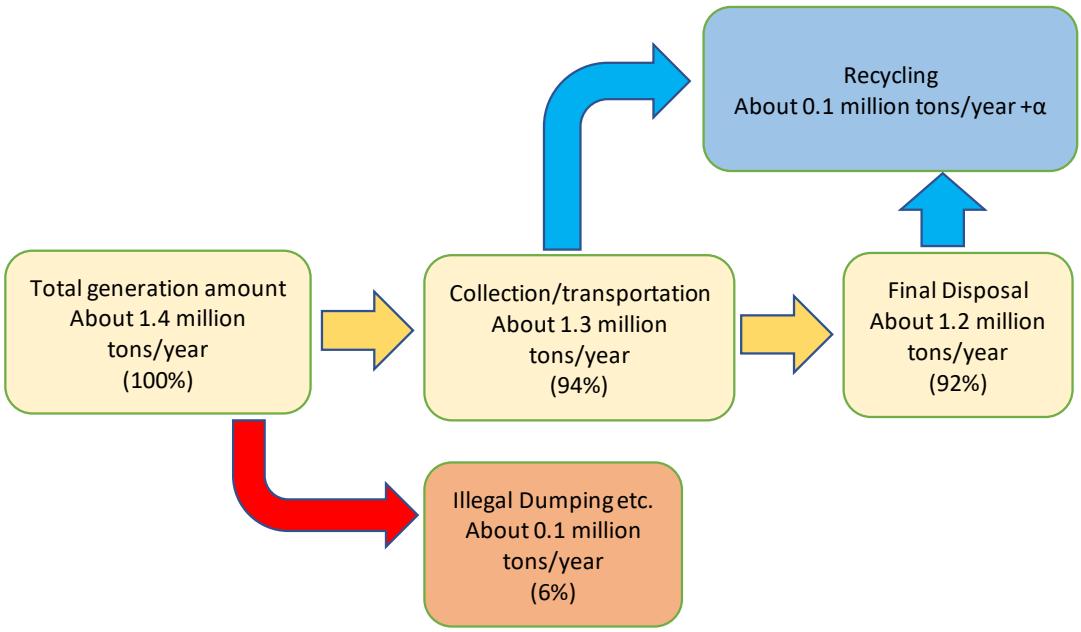
Activities	2018/2019	2019/2020
Refuse Collection Rounds	612,818	710,537
Road cleaning	82,839	101,025
Illegal dumping	291,751	319,577
Hostels	4,699	5,042
Recognised Informal Settlements	51,711	52,143
Garden Sites	57,262	96,474
TOTAL	**1,101,080**	**1,284,798**

Source: page 24, Table 5.3.2, "2021/2022 BUSINESS PLAN" (prepared by Pikitup, approved in May 2021）

The collection rate in the urban area of Gauteng Province was estimated to be about 94% in "State of Waste Report", which was issued in 2018, and therefore the total amount of generated general waste was calculated at about 1.4 million tons in 2019/2020.
According to World Population Review, the population in Johannesburg in 2020 is estimated at about 5.8 million. Therefore, the waste generation rate is calculated to be about 0.66 kg/capita/day in 2020.

In the "Africa Solid Waste Management Databook 2019" issued by JICA, the average waste generation rate for 23 cities in Africa was 0.6 kg/capita/day. Compared with this value, the estimated waste generation rate of Johannesburg City is slightly higher.

JICA Study Team prepared the Waste flow in Johannesburg, based on the result of this survey, as shown below.

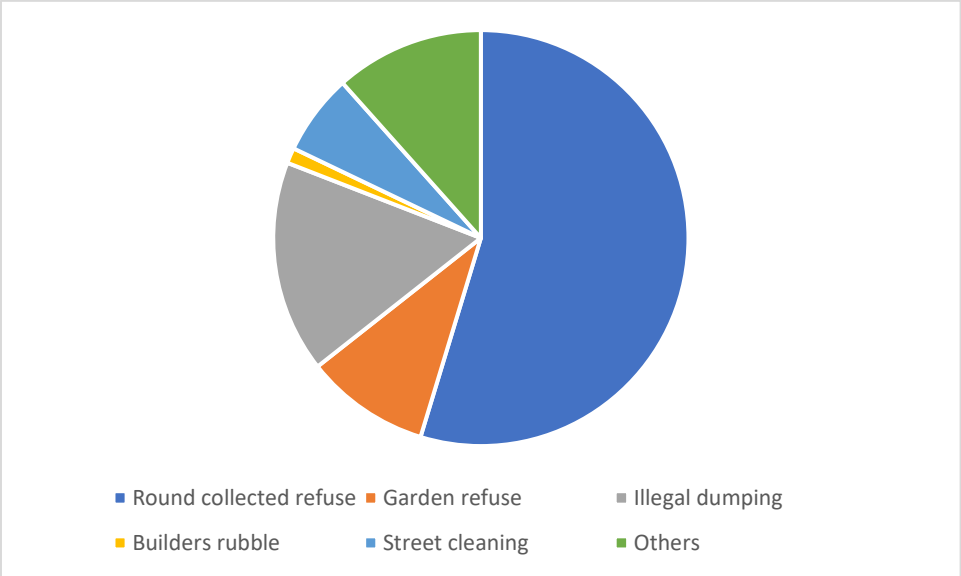


Source: JICA Study Team prepared this figure.

Figure 8-9 Waste flow in Johannesburg City

In this flow, the amount which is not collected and transported corresponds to 6% of total generation amount. This waste amount is illegally dumped or burnt. The amount of collected waste which does not go to the final disposal site is regarded as recycling amount. However, in reality some recyclables are separated by households or business entities, and directly discharged as recyclables and are not counted in the total waste generation amount. Besides, some amount of recyclable are collected by waste pickers from final disposal site and transported to recycling facilities. While these amounts cannot be quantified at this time, they will contribute to an increase in the recycling amount officially reported. Therefore, the reported recycling amount has been adjusted as shown in the figure by adding the expression of "+ α ".

The waste composition, as described in IWMP-CoJ-2011 is shown in the following figure.



Source: JICA Study Team prepared this figure, based on page 28, Fig. 7, IWMP-CoJ-2011.

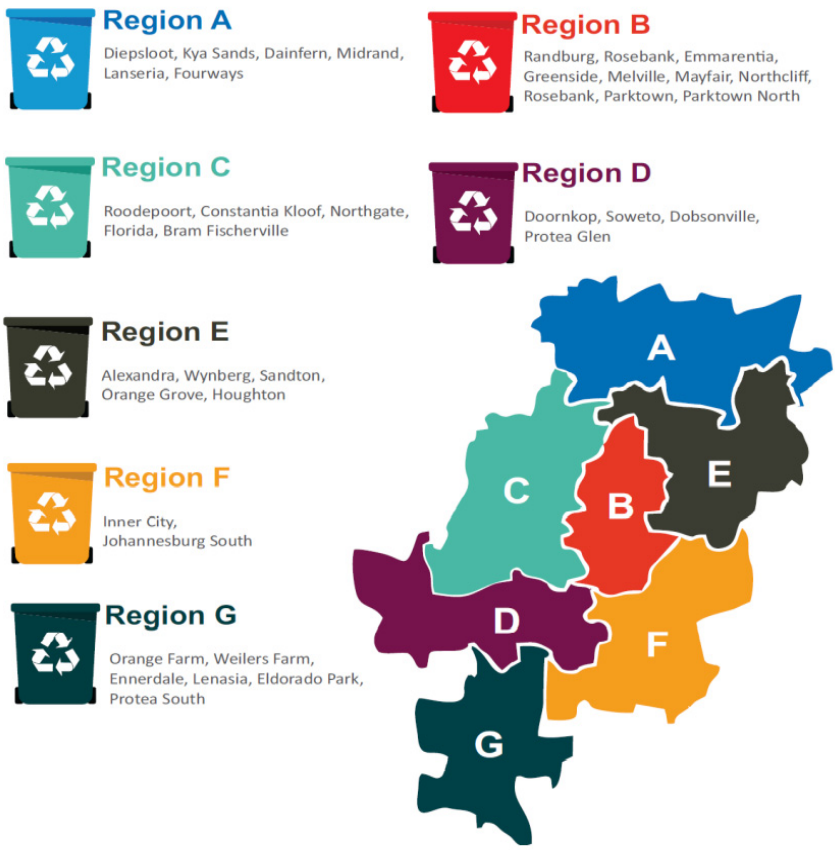
Figure 8-10 Source of waste generated in Johannesburg

This figure identifies the shares of waste generation sources and not the details related to the waste composition. While this graph can provide a rough idea of the waste composition, unfortunately the detailed waste composition could not be grasped through this survey.

8.4.4 Current Status of Collection and Transportation

Pikitup divides Johannesburg city into 7 regions from A to G and collects and transports waste by collection trucks. While Pikitup's service coverage area is the whole city of Johannesburg, they do not provide service to some households in the city. Providing service to informal settlements will become a challenge for Pikitup in the future.

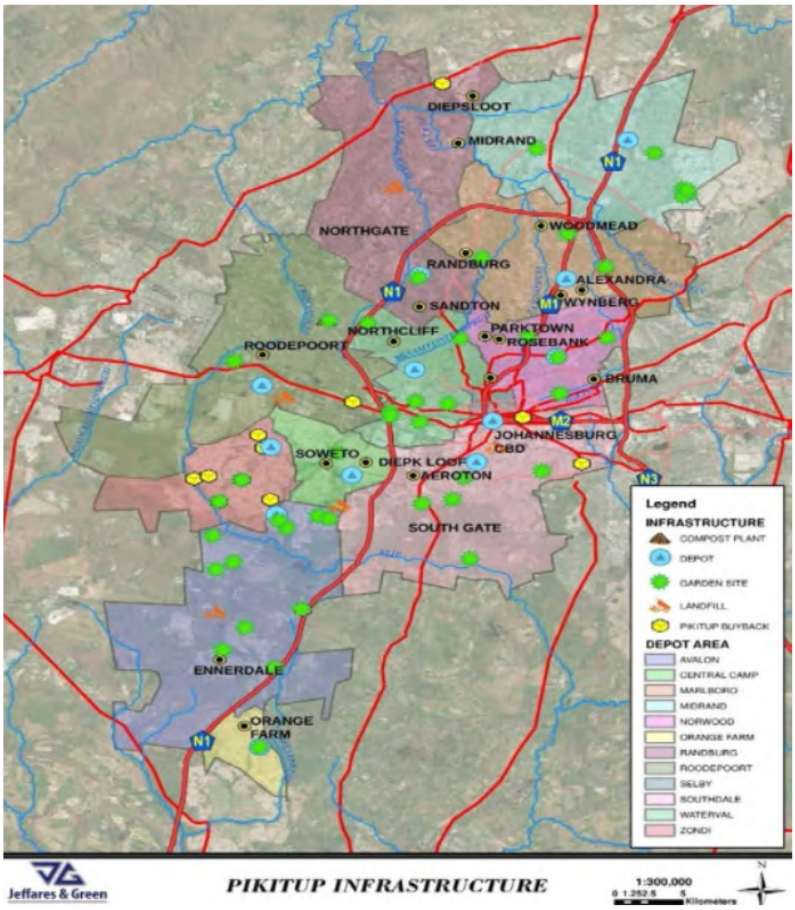
In principle Pikitup directly operates waste collection and transportation without outsourcing. They have multi-year contracts with private companies for providing some equipment.



Source: p13, Fig. 2, "2021/2022 BUSINESS PLAN" (prepared by Pikitup, approved in May 2021)

Figure 8-11 Classification of Regions by Pikitup

Pikitup has 12 waste management depots and 42 drop-off sites in Johannesburg city, where waste is unloaded for transporting it to landfill site, using more than 200 vehicles. There are no transfer stations with machines for compressing waste. However, Pikitup considers that transfer stations are necessary for operating more efficiently and sites have been secured for constructing transfer stations. The challenge will be to secure necessary budget for construction and operation of the transfer stations.



Source: page 11, "2020/2021 BUSINESS PLAN"(prepared by Pikitup)

Figure 8-12 Location of Pikitup Facilities

On their website, Pikitup show their weekly collection schedule by community. Waste is collected 5 days per week, and there is no waste collection service on Saturday and Sunday.

Pikitup is implementing a "Separation@Source Programme", which promotes source separation by each household, utilizing "3 receptacle models". Recyclable bags are provided for paper waste, transparent bags for other recyclables in addition to regular black bins, 240 litres capacity, to the households in the target area of this programme. This programme started as a pilot project in 2009 and it covers about 490 thousand households as of now. Since there are about 2.1 million households in Johannesburg as of 2021 and 18% of these households are in informal settlements, (according to the result of community survey in 2016) about 30% of formal households are the target of this programme and implement source separation. In fiscal year of 2014/2015, it was reported that more than 20 thousand tons of dry waste such as papers and plastics etc. were collected separately. Organic waste such as food waste are presently not the target of source separation, but Pikitup is considering including separation of organic waste in the future.

Separation of waste

Source: website of Pikitup

8.4.5 Current Status of Intermediate Treatment / Recycling

In Johannesburg, there are no Waste-to-Energy facilities. However, a feasibility (F/S) study has been implemented with the objective to study solutions for the issue of the rapid decreasing lifetime of the landfill sites. As a result of this study, Johannesburg City is implementing the "CoJ - Alternative Waste Treatment Technologies Project".

The outline of the project described in the website of Gauteng Infrastructure Financing Agency (GIFA) is shown in the table below.

Table 8-14 Outline of "CoJ - Alternative Waste Treatment Technologies Project"

Items	Outline
Promotor	CoJ
Estimated Project Cost	3.5 billion ZAR
Expected Delivery Model	PPP
Status	F/S completed, and the project is in construction bidding phase
Estimated generation capacity	25MW
Project background and scope	Johannesburg is experiencing challenges of waste management and disposal. This project is a solution to the challenges and aims to reduce waste disposal at landfill (about 500,000 tons per year) and generate about 25MW of energy from municipal solid waste material generated from municipal areas.

Source: JICA Study Team prepared this table, based on the information from GIFA website.

The F/S report concluded that it is valid to introduce dMRF facility for Marie Louise landfill site and to introduce dMRF facility and Waste-to-Energy facility with incineration for Robinson Deep landfill site. The project is being prepared in line with the F/S conclusions. When JICA Study Team had an interview with DFFE in May 2021, DFFE informed the Study team that the first case of introduction of Waste-to-Energy facility with incineration in Johannesburg will be in Robinson Deep landfill site.

Development Bank of Southern Africa (DBSA) is cooperating with CoJ on the financial and technical aspects of the project and are now reviewing the results of the latest feasibility study. As the result of a tender called

by DBSA, CAPIC SA was selected as a transaction advisory company for this project. Contract amount is about 23 million ZAR. Persons concerned with this project were interviewed and the following information was obtained.

- DBSA was assisted financially by European Union (EU) for this project.
- Since the project is now in the procurement stage, details, such as expected tipping fee are highly confidential at present.
- The project is now in the final phase of procurement stage, and its financial close is expected to be in 2023 or 2024.
- The procurement process of this project was delayed from the original schedule due to financial issues. Currently, the project is proceeding smoothly thanks to the financial assistance provided by UNEP. However, technical assistance is also required due to lack of appropriate persons in CoJ that can manage the project.
- This project is expected to be implemented as a PPP model, but the detailed scheme has not been decided yet. It is considered likely that the project will be implemented under a BOT scheme. Project period may be more than 20 years after construction.
- Responsibility of management and supervision of this project is under CoJ.
- Some private companies are expected to be interested in this project. Domestic financial organizations may collaborate with domestic or foreign private companies. Especially, foreign private companies are anticipated to participate in this project, because African private companies lack the needed technical capabilities.
- Some environmental organizations have raised objections to introduce incineration facilities as well as to construct new landfill sites.

A private sector company, ORICOL Environmental Services, headquartered in Durban and with a branch office in Johannesburg, is handling the utilization of liquid waste and sludge, which is obtained from landfill sites, as a fuel for Kiln furnace in cement factories. However, the details of this activity and experience are unclear.

Recycling activities are led by the private sector and there are some associations for recycling in Johannesburg. The outline of recycling situation in Johannesburg is described in the table below. In this survey, some interviews were conducted with private recycling companies in Johannesburg and Tshwane. The results of each interview are also described below.

Table 8-15 Current Recycling Status in Johannesburg

Objects	Outline
Organic waste	In Johannesburg, there are some private companies for collecting and composting organic waste. (e.g.) ORICOL, Joraform Africa, Earth Probiotic, Waterfall Management Company
Plastics	In Johannesburg, there are some private companies for recycling plastic waste, and they belong to South Africa Plastics Recycling Organization (SAPRO). One of the largest companies in this industry, PETCO is located in Johannesburg, and they collect, reuse, and recycle PET bottles. (e.g.) SD Plastics, Multi Plastic Recycling, Remade Recycling
Paper	In Johannesburg, there are some private companies for collecting and recycling paper. (e.g.) Recycle Paper ZA, Planet Waste Paper Recyclers, Remade Recycling

Objects	Outline
E-waste	In Johannesburg, there are some private companies for reusing and recycling e-waste. (e.g.) ORICOL, S&V e-waste management

Source: JICA Study Team prepared this table.

Private recycler-1: Earth Probiotic

Web-address: https://www.earthprobiotic.co.za

Business: On-site composting (Bokashi fertilizer: Anearobic digestion)

- They distribute vessels and Earth Bokashi to each contractor. Each contractor adds Earth Bokashi to organic waste and Earth Probiotic collect them periodically. Earth Probiotic transports them to composting companies, whom they have partnerships with.
- They also sell Earth Cycler, which is an in-vessel composting machine, to business entities.

Features: They can deal with waste from small-scale (10kg/month) to large scale (60 tons/month).

Associations affiliated with: Organic Recycling Association of South Africa (ORASA), Institute of Waste Management of South Africa (IWMSA)

Target area: South Africa and surrounding countries (collection service is only for designated area)

Private recycler-2: Remade Recycling

Web-address: https://www.remade.co.za

Business: Collection of paper, plastics, glass, metal, and e-waste

- They collect recyclables extracted from waste, from contractors (estate, business entities) and sell them after compaction.
- They plan to export recyclables to foreign countries in future.

Features: They only shred and compact waste as a treatment. They utilize waste pickers for collecting recyclables.

Collection amount (per month): Paper 2,000 tons, plastics 200 tons, glass 700 tons, metal 6 tons, e-waste 2 tons

Associations affiliated with: None

Permission: They implement their business after receiving permission from each municipality.

They are one of the MPact Group companies (website address is https://www.mpact.co.za). They implement packaging and recycling of paper and plastics as their business.

Target area: Johannesburg city, Tshwane city etc. in South Africa

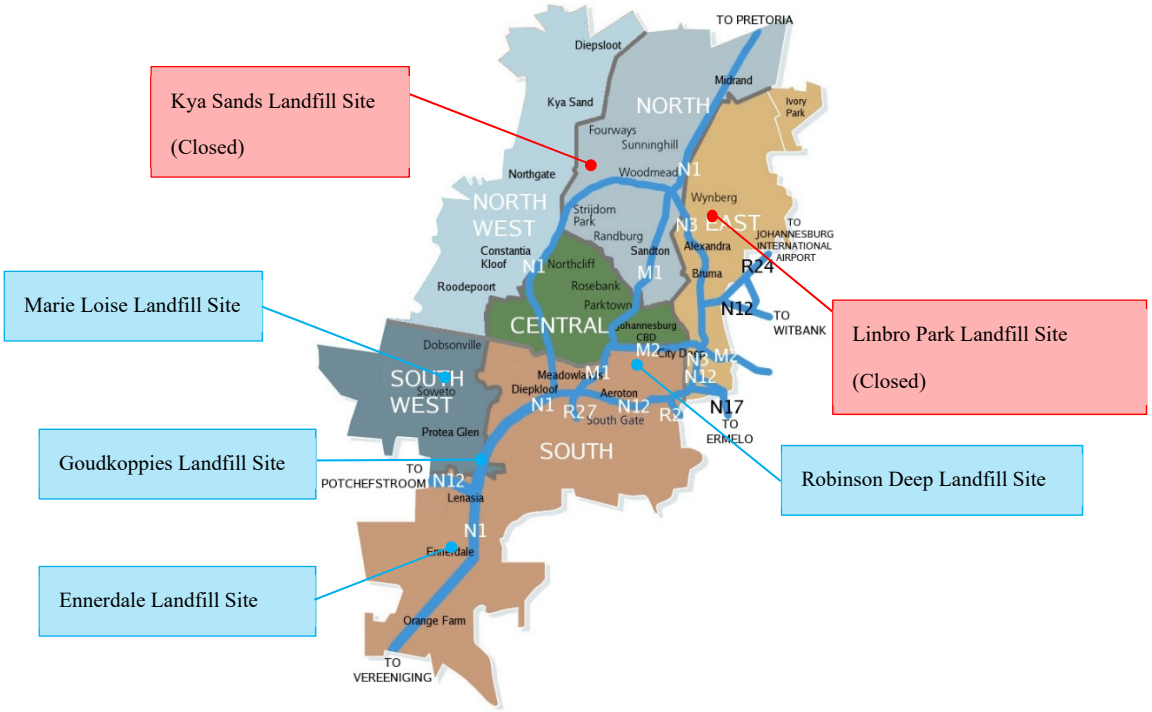
Private-recycler-3: Waterfall Management Company
Web-address: None
Business: Management of Waterfall estate
- They outsource collection of organic waste.

Features: They manage Waterfall estate, which is one of the largest estates in South Africa. Currently, they outsource collection of organic waste and make Bokashi fertilizer. Pikitup collects the other municipal waste.
Target area: Waterfall estate, Johannesburg city in South Africa
Challenges: Their biggest concern is the flood caused by illegal dumping upstream of Jukskei river. It is difficult to be solved.

*Prepared by JICA Study Team, based on the results of the interview with Waterfall Estate.

8.4.6 Current Status of Landfill Site

In Johannesburg, there are 6 public landfill sites, which include 2 closed sites, and 3 private landfill sites located in North Region. All these landfill sites have been granted operating permissions under the law. Pikitup has made a service contract with 2 private landfill sites. Locations of public landfill sites are shown in the following figure. Locations of private landfill sites in North Region were unclear.



Source: JICA Study Team prepared this figure.

Figure 8-13 Location of Public Landfill Sites in Johannesburg

	
Ennerdale Landfill site	Marie Louise Landfill site

Source: provided by ERA

Amount of waste transported to the 4 public landfill sites is shown in the table below.

Table 8-16 Amount of Waste transported to Public Landfill Sites (tons)

Name of landfill sites	2018/19	2019/20
Robinson Deep	255,655	278,116
Marie Louise	296,241	166,956
Goudkoppies	329,207	313,678
Ennerdale	70,388	203,082
Total	**951,491**	**1,227,422**

Source: p24, Table 5.3.4, "2021/2022 BUSINESS PLAN" (prepared by Pikitup, approved in May 2021)

There are many waste pickers at the landfill sites in Johannesburg and presently CoJ is working to formalize their activities by supporting South Africa Waste Pickers Association (SAWPA).

Current tipping fee at the landfill site is from 180 to 220 ZAR per ton. There is a plan to extend the areas of both Marie Louise landfill site and Robinson Deep landfill site and CoJ is now engaged in the related process.

Pikitup implemented SWOT analysis in their latest business plan. Through this analysis, Pikitup has identified their "Internal/Weakness" is a lack of remaining capacity of the landfill sites and their "External/Opportunities" are biogas and Waste-to-Energy projects as countermeasures to the landfills' capacity problem.

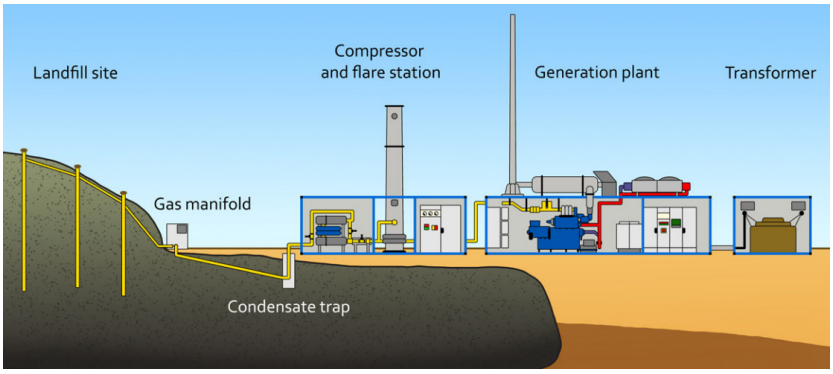
CoJ has been implementing the "Joburg Landfill Gas Project" since 2007 for utilizing gas generated from landfill sites. The following is the outline of the project.

Table 8-17 Outline of Joburg Landfill Gas Project

Developers	CoJ, ENER-G Systems
Department in charge in CoJ	Environment, Infrastructure, Services Department
Buyer of power generated	Through Renewable Energy Independent Power Producers Procurement Programme (REIPPPP), the power is sold to Eskom.
Implementer	ENER-G Systems
Contract Period	20 years
Project Delivery Model	BOOT (Build, Own, Operate, Transfer Model)
PPA	August, 2015
Indexed price of electricity	94 c / kWh
Target sites	5 public landfill sites (Robinson Deep, Marie Louise, Linbro Park(Closed), Ennerdale, Goud Koppies)

Planned Capacity	18.6MW（Robinson Deep：5.5MW, Marie louise：6.0MW, Linbro Park：3.3MW, Ennerdale：0.5MW, Goud Koppies：3.3MW）
CAPEX	250 million ZAR
OPEX	50 million ZAR / year

Source: JICA Study Team prepared this table based on the project brochure issued by South Africa Local Government Association (SALGA) in February 2016



Source: Brochure issued by SALGA

Figure 8-14 Concept drawing of this project

This project has been implemented by ENER-G systems and both the UK and Holland provided financial support. Plants have already been constructed in Robinson Deep landfill site, Marie Louise landfill site and Goudkoppies landfill site and they started generating electricity. Although total capacity of power generation by these 3 plants was expected to be 14.8MW, only 7.3MW (49% of the expected amount) is generated at present. They will also construct plants in Linbro Park landfill site and Ennerdale landfill site in future.

8.4.7 Activities by Other Donors

CoJ is currently supported financially by European Union (EU), United Nations Environmental Programme (UNEP) and Development Bank of Southern Africa (DBSA) for implementing Alternative Waste Treatment Technologies project.

8.4.8 Status of Initiatives related to DX

In South Africa, waste information systems are established at the National Level, in some Provinces and in some municipalities. Collected information can be accessed from SAWIC website, under DFFE. Gauteng Provincial Government and CoJ have their own waste information systems and their information is shared with the higher-level systems.

JICA Study Team monitored the latest information of waste collection amount in Johannesburg and calculated the total amount of municipal waste collected in fiscal year 2019/2020 at about 900 thousand tons. This value corresponds to about 70% of the amount reported by Pikitup, which was 1.3 million tons. This discrepancy indicates that currently there is some uncertainty in the collected waste information.

CoJ is challenged to improve the waste information collection and analysis system in order to attain higher accuracy and utilize the results of the data base with more confidence.

8.4.9 Actions against COVID-19

In Johannesburg, health and safety department of Pikitup is in charge of preventive activities against the spread of COVID-19 and they are implementing public awareness raising by distributing brochures. Personal Protective Equipment (PPE) are supplied to workers engaged in waste collection.

8.4.10 Status of Monitoring of SDGs' waste-related Indicators

The current situation for SDGs indicators related to waste management in Johannesburg city is shown in the table below.

Table 8-18 Status of Monitoring on SDGs' waste-related Indicators (Johannesburg City)

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	CoJ monitor the discharge of municipal waste and hazardous waste properly and also try to reduce waste. The rate of general waste amount collected and treated at the managed facilities to the total amount of general waste generated in Johannesburg city is about 94%.
12.3.1	a) Food loss index, and b) Food waste index	At the National level, the importance of food waste reduction is addressed in NWMS2020 as one of the targets of the national strategy, and strategic measures are described to realize the reduction. IWMS-CoJ promotes composting of organic waste, but the reduction of food waste is not specifically addressed. (It aims to minimize total amount of waste) Pikitup has implemented Food Waste Programme in 2012 and Food For Waste Programme in 2015.
12.4.2	(a) Hazardous waste generated per capita; and (b) proportion of hazardous waste treated, by type of treatment	South Africa has acceded to the Basel Convention. In Johannesburg city, the discharge of municipal waste and proper discharge of hazardous waste are monitored and efforts are being made to reduce waste. Introduction of concepts of Extended Producers Responsibility (EPR) is also promoted. In some landfill sites, generated gas is utilized effectively, but most of landfill sites should be improved.
12.5.1	National recycling rate, tons of material recycled	In Johannesburg city, reduction of waste and promotion of recycling are positively implemented. Amount of waste recycled is about 100 thousand tons in a year and it corresponds to 7% of waste amount generated in the city.
14.1.1	(a) Index of coastal eutrophication; and (b) plastic debris density	Johannesburg city is far from the ocean and has no major rivers but small rivers such as Limpopo River and Orange River. Therefore, a program to prevent illegal dumping into these small rivers is needed.

Source: JICA Study Team prepared this table.

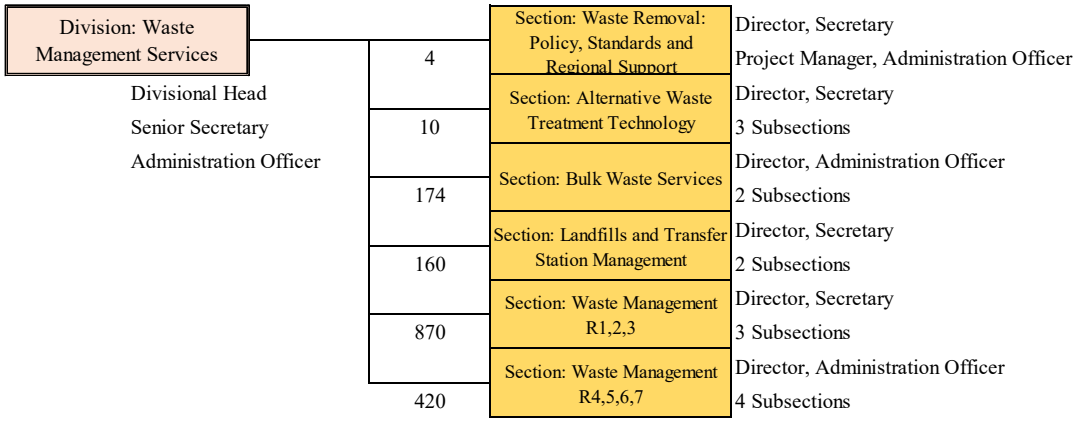
8.5 Solid Waste Management Situation in Tshwane city

8.5.1 Organizations and Finance for Solid Waste Management

Based on Article 108 of the Constitution of the Republic of South Africa and Article 32 of Municipal Systems Act, it is the responsibility of the City of Tshwane (CoT) to implement collection, transportation and disposal of waste generated in Tshwane city. Waste management in Tshwane city is under the supervision of the Department of Agriculture and Rural Development in Gauteng Provincial Government (GDARD).

According to CoT, Division of Waste Management Services under Department of Environmental and Agriculture Management Services (EAM) is mainly in charge of waste management in CoT.

Capacity Development of CoT staff is implemented by Department of Human Capital (DHC) and they hold workshops for administrators and staff related to waste management as necessary.
The Organization chart of the Division of Waste Management Services in CoT is shown below.



Source: JICA Study Team prepared this figure, based on the documents provided by CoT

Figure 8-15 Organization chart of Division of Waste Management Services in CoT

Financial affairs in CoT are managed in accordance with the Municipal Finance Management Act (MFMA) and their information is not disclosed.
CoT does not have their own waste information system and they utilize the waste information system in Gauteng Provincial Government. Presently they do not have any plan to establish their own waste information system.

8.5.2 Ordinances and Policies related to Solid Waste Management

CoT has established the Waste Management By-law - CoT in 2016. The following is the structure and the outline of this by-law.

Table 8-19 Structure and Outline of Waste Management By-law - CoT

Chapter	Title	Outline
1	Principles, separation of waste and responsibilities	Regulating principles, classification of waste and the allocation of responsibility
2	Regular business waste and domestic waste collection service	Regulating distribution of collection containers, periodical collection of waste, compaction, service standards
3	Industrial waste	Regulating storage and treatment of industrial waste
4	Garden waste, special domestic waste and bulky waste	Regulating collection and disposal of garden waste, special domestic waste and bulky waste, and irregular business and domestic service
5	Builders' waste (Construction and demolition waste)	Regulating allocation of responsibility of construction and demolition waste, containers and treatment
6	Special industrial waste, hazardous waste and health care risk waste	Regulating notification of generation, storage, treatment of special industrial waste, hazardous waste and health care risk waste

Chapter	Title	Outline
7	Disposal sites	Regulating management of disposal sites
8	Littering, waste management in functions and events, dumping and abandoning of waste and waste material	Regulating prohibition of littering, waste management in functions and events with more than 20 participants, and unauthorized disposal and abandoning of waste etc.
9	General provisions	Regulating prohibition of incineration of waste, recycling, ownership of waste, reporting of waste information etc.
10	Private Service Providers	Regulating permission of private service providers
11	Tariffs and charges	Regulating tariff system
12	Enforcement	Regulating enforcement of prevention of illegal dumping based on by-law etc.
13	Repeal of by-laws	Regulating repeal of by-laws and short title

Source: JICA Study Team prepared this table based on "Waste Management By laws-CoT".

CoT has developed the Integrated Waste Management Plan in 2014 (IWMP-CoT-2014) based on NWMS2020 and Tshwane Vision 2055. This plan covers the 7 fields related to waste management as described in the following table. IWMP was expected to be revised every 5 years however the revision of IWMP-CoT-2014 has been delayed. Nevertheless, the plan is continuing to be implemented. A CoT officer has indicated that IWMP-CoT-2014 is not expected to be significantly revised as the present situation of SWM in CoT was not much different from that when the present plan was developed. CoT plans to outsource the revision of IWMP-CoT-2014 to a private company within the fiscal year of 2021. CoT will confirm the contents of draft revised plan prepared by the contractor, instruct the contractor to make any necessary revisions then approve the new plan.

Table 8-20 Major Targets of IWMP-CoT-2014

	SWM Field	Priority issues	Plan
1	Collection and transportation	Establishment of new collection and transportation system after 2015	Survey will be implemented, and it will be approved by Congress by July 2015
2	Disposal	・Securing remaining capacity of landfill sites ・Treatment facilities accessibility ・Proper management of landfill sites ・Procedure for closure of landfill sites	・Transportation plan will be prepared for transporting waste to landfill sites and recycling facilities, separately ・Construction of transfer stations ・Proper management of security of landfill sites, control of reception, removal of waste pickers ・Permission for closure or utilization of landfill sites will be applied
3	Cleaning	Prevention of illegal dumping	Implementation of strategy to eliminate illegal dumping
4	Separation, minimization, and recycling of waste	・Promoting waste minimization and recycling ・Construction of infrastructure for promoting separation of waste ・Action against mixed waste ・Promoting Green Economy Initiatives related to waste management ・Introduction of Waste-to-Energy facilities ・Introduction of Recycling facilities ・Introduction of composting facilities for garden waste	・Separation of waste will be promoted in households, organizations, institutions, etc. ・Investment for SWM infrastructure development will be promoted. ・Enact a by-law prohibiting discharge of fluorescent lamps and recyclables into municipal waste bins ・Procurement process for the Green Economy Initiatives will be determined. ・Feasibility study for Waste-to-Energy will be implemented.

	SWM Field	Priority issues	Plan
			・ Waste buy-back centres will be established near communities. ・Garstkloof landfill site will be diverted into storage site for garden waste and composting facilities.
5	Awareness raising	Promoting awareness raising in communities	Awareness raising and environmental education will be expanded in communities.
6	Information control	・ Waste information system is not functioning. ・Weighbridges are not installed in landfill sites.	・ Waste management system will be established. ・ Weighbridges will be installed in landfill sites.
7	Finance, organizational capacity	・Budget for service is not secured. ・ Capacity of waste management organizations at central and local levels is low.	・ Financial analysis related to waste management will be implemented. ・ Organizational structure will be reviewed and new system will be established including assignment of persons responsible for waste management and persons in charge.

Source: JICA Study Team prepared this table based on IWMP-CoT-2014

8.5.3 Overview of Solid Waste Management

Waste information of Tshwane city is managed by utilizing the waste information systems in Gauteng Provincial Government and SAWIC, since CoT does not have its own waste information system. Statistics of waste in Tshwane are calculated based on the information obtained from SAWIC website and are shown in the following table.

Table 8-21 Statistics of Solid Waste in Tshwane City

	Types	2018	2019	2020
Intermediate Treatment	Metal	0.0	41,550.0	5,519.1
	Paper	8,875.3	1,860.1	9,150.1
	Organic waste	78,722.5	63,479.1	34,812.3
	Sub total (General waste)	87,597.8	106,889.2	49,481.5
	Hazardous waste (Chemical substance)	5.1	1.4	0.0
	Hazardous waste (infectious waste etc.)	1,933.9	22.7	59.7
	Hazardous waste (Pathological waste)	21.0	9.6	0.0
	Sub total (Hazardous waste)	1,960.0	33.7	59.7
	Sub Total	89,557.8	106,922.9	49,541.2
Final Disposal	Urban waste	1,051,247.0	1,626,782.0	1,647,915.0
	Business/industrial waste	9,758.0	21,773.0	39,794.0
	Building/demolition waste	8,391.7	28,594.0	60,657.9
	Sub total (General waste)	1,069,396.7	1,677,149.0	1,748,366.9
	Sub Total	1,069,396.7	1,677,149.0	1,748,366.9
Recycling	Business/industrial waste	0.0	3,699.0	0.0
	Building/demolition waste	0.0	3,072.0	0.0
	Glass	17,754.9	18,619.4	4,312.4
	Metal	11,898.3	8,273.4	949.2
	Mineral	3,830.3	0.0	0.0
	Organic waste	0.0	9,696.8	2,562.3
	Paper	74,167.1	820,892.4	37,792.9
	Plastics	9,983.4	7,102.9	6,135.5
	Slag	6,209.6	7,137.1	5,141.0
	Others	1,216.5	10,604.0	1,766.3
	Sub total (General waste)	125,060.1	889,097.0	58,659.6
	Hazardou waste (liquid)	0.0	5,732.8	0.0
	Sub total (Hazardous waste)	0.0	5,732.8	0.0
	Sub Total	125,060.1	894,829.8	58,659.6
Total	Sub total (General waste)	1,282,054.6	2,673,135.2	1,856,508.0
	Sub total (Hazardous waste)	1,960.0	5,766.5	59.7
	Total	1,284,014.6	2,678,901.7	1,856,567.7

Source: JICA Study Team prepared this table based on the information of SAWIC

Total amount of general waste collected in Tshwane in fiscal year of 2020 is about 1.8 million tons. Since collection rate of waste in urban area of Gauteng Province is about 94%, according to SoWR issued in 2018, total amount of general waste generated in Tshwane is estimated to be 1.9 million tons. Population in Tshwane in 2020 is estimated to be 3.6 million by applying the population growth rate of 2.3% per annum to the 2016 population of Tshwane. After calculating the generated waste amount for 2020 and the population of the same year, the waste unit generation rate was calculated to be 1.45 kg/capita/day.

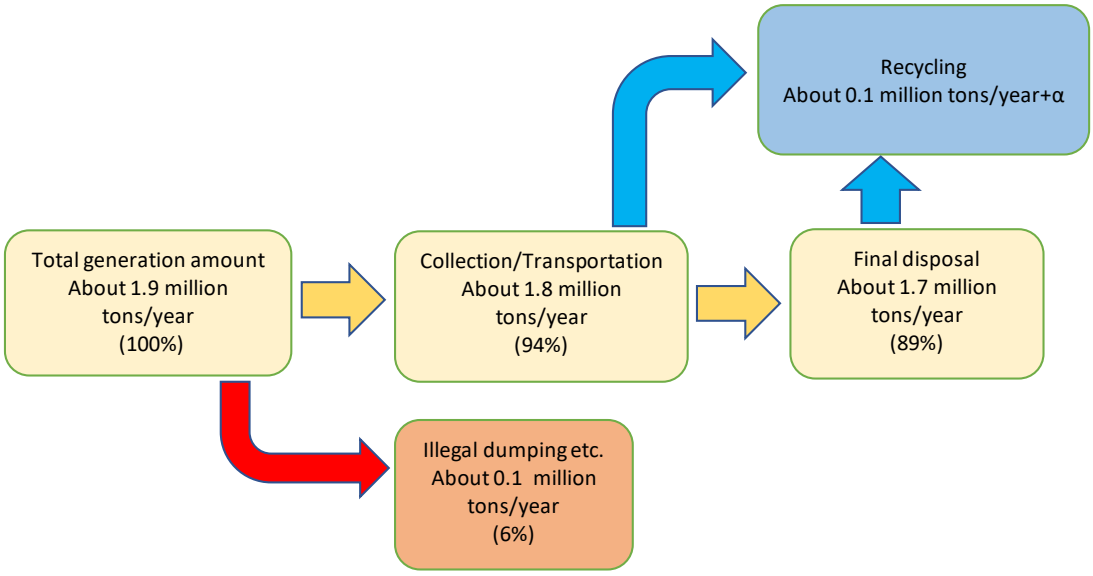
According to “Africa Waste Management Databook”, average waste generation amounts in 23 cities is 0.6 kg/capita/day and the estimated amount in Johannesburg city is 0.66 kg/capita/day. The calculated amount in

Tshwane is much larger than both of these values. In discussing these values with the officers of CoT, the officers put forward the following reasons to explain why the unit waste generation rate of Tshwane is much larger than that of Johannesburg.

(i) There is a large amount of construction and demolition waste in Tshwane city due to the development boom the city is presently witnessing

(ii) Johannesburg city has made progress in developing composting activities which reduces the amount of waste to landfill sites

Waste flow in Tshwane city, prepared by JICA Study Team based on the result of this survey is as follows.



Source: JICA Study Team prepared this figure.

Figure 8-16 Waste flow in Tshwane City

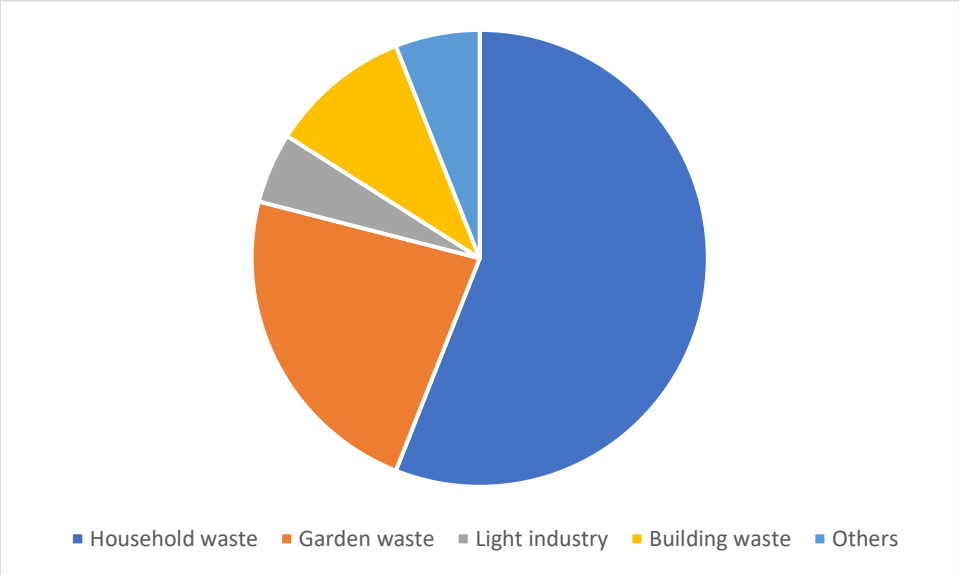
In this waste flow, the amount which is not collected and transported corresponds to 6% of the total generation amount. This waste amount is illegally dumped or burnt. The amount of collected waste which does not go to the final disposal site is regarded as recycling amount. However, in reality some recyclables are separated by households or business entities, and directly discharged as recyclables and are not counted in the total waste generation amount. Besides, some amounts of recyclable are collected by waste pickers from final disposal site and transported to recycling facilities. While these amounts cannot be quantified at this time, they will contribute to an increase in the recycling amount officially reported. Therefore, the reported recycling amount has been adjusted as shown in the figure by adding the expression of "+ α ".

The information described hereafter, was obtained during the interview with officers of CoT.

- About 10% of household waste is organic waste. Household waste includes a large amount of packaging materials and plastics.
- Composition of municipal waste fluctuates by seasons. About 56% of general waste is from households. Since the number of construction projects increases in winter, the share of construction

and demolition waste reaches 15% to 25%. Otherwise, there are large amounts of garden waste and waste from light industry.

- Hazardous waste and medical waste are transported by private companies and brought into specific landfill sites.



Source: JICA Study Team prepared this figure based on the result of interview with CoT

Figure 8-17 Source of waste in Tshwane City

8.5.4 Current Status of Collection and Transportation

In principle, CoT and their contractors are collecting and transporting general waste. CoT confirmed that some private companies are collecting and transporting waste on their own in some specific areas, however details of their activities are not known by CoT. According to CoT, they directly collect and transport waste from 30% of the service receivers and outsource the collection service for 60% of service receivers to contractors. The remaining 10% of service receivers are served by private companies working on their own. The number of CoT contractors are from 12 to 20 and bids are made every 3 years.

Waste collection by CoT or their contractors is done by either door-to-door system or curbside system. In general, domestic waste is collected once a week while business waste is collected daily. CoT have some flexibility to respond to requests from service receivers to adjust collection frequencies.

CoT owns the vehicles and equipment it operates. Contractors and other private companies who collect waste on their own basically use their own vehicles and equipment. CoT can lease vehicles and equipment to them as necessary. Contractors maintain vehicles and equipment as required in workshops owned by CoT.

CoT has an approved waste tariff system which is annually renewed and approved. Under this tariff system, service is classified into 7 categories from A to G and waste collection fee and landfill disposal fee etc. are regulated. The tariff system is described in the following table.

Table 8-22 Tariff System in Tshwane City (FY 2020/2021) (excerpt)

Item	Fee
① Removal of domestic and business refuse	(ZAR/month)
【Weekly service charge】	
85 litres × 1 day per week	107.19
85 litres × 2 days per week	214.38
140 litres × 1 day per week	176.50
240 litres × 1 day per week	302.61
1,100 litres × 1 day per week	1,387.15
【Daily service】	
240 litres× 5 days per week	1,513.04
240 litres × 6 days per week	1,815.65
240 litres × 7 days per week	2,118.26
1,100 litres × 5 days per week	6,935.76
1,100 litres × 6 days per week	8,322.91
1,100 litres × 7 days per week	9,710.06
B. Removal of refuse in bulk containers	(ZAR)
Tariff per cubic meter	315.35
C. Garden Refuse Transfer Stations	(ZAR/month)
Vehicles with a payload (carrying capacity) of up to 1 ton	Free of charge
Light commercial vehicles and trailers with a payload of more than 1 ton but less than 1.3 tons	268.86
Vehicles with a payload of more than 1.3 tons	704.18
D. Dumping of refuse at waste disposal site	(ZAR/month)
【Garden refuse】	
At special designated sites	Free of charge
At general waste disposal sites (vehicles with a payload of more than 1.3 tons)	704.19
【Construction and demolition waste】	
At special designated sites	Free of charge
At general waste disposal sites (vehicles with a payload of more than 1.3 tons)	0.23 per kg
【Domestic waste】	
At general waste disposal sites (vehicles with a payload of more than 1.3 tons)	0.23 per kg
E. Disposal of large waste units	
Large waste units will be disposed of at designated collection spaces at waste transfer stations, garden refuse sites and waste disposal sites	Free of charge
F. Cleaning of illegal dumping	(ZAR)
Loading and removal of illegally dumped refuse and construction waste	7,041.88
G. Temporary services	(ZAR)
Container rental 240 litres	75.52 per day
Container rental 1,100 litres	325.72 per day

Source: JICA Studyy Team prepared this table based on "Tariff for Refuse Removal Services, 2020/2021, City of Tshwane".

CoT is currently promoting source separation for white paper only.

In Tshwane city, they have 9 transfer stations which accept only green waste and 2 transfer stations which accept both green waste and household waste. The following table shows the transfer stations and their equipment.

Table 8-23 Transfer Stations and their Equipment

	Name of transfer station	Equipment
1	Menlopark Garden Site	Shredder, Loader, 5 Tipper trucks (14m^3)
2	Magalieskrui Garden Site	Shredder, Loader, 5 Tipper trucks (14m^3)

	Name of transfer station	Equipment
3	Mountainview Garden Site	Shredder, Loader, 5 Tipper trucks (14m^3)
4	Rooihuskraal Garden Site	Shredder, Loader, 5 Tipper trucks (14m^3)
5	Kruger Park Garden Site	Shredder, Loader, 4 Tipper trucks (14m^3)
6	Watloo Garden Site	Container (30m^3)
7	Phillip Nel Garden Site	Container (30m^3)
8	Eersterust Garden Site	Container (30m^3)
9	Dorantia Garden Site	Container (30m^3)
10	Cullian Transfer Station	Container (30m^3)
11	Mabopane Transfer Station	Container (30m^3)

Source: JICA Study Team prepared this table.

8.5.5 Current Status of Intermediate Treatment / Recycling

In Bronkhorstpruit, located in a suburban area of Tshwane city, Bio2Watt plant generates biogas from organic waste and converts it into electricity. This plant sells electricity to Rosslyn factory of BMW as power for manufacturing vehicles. The capacity of this plant is 4.6MW. This plant is managed by Bronkhorstpruit Biogas Plant, and it commenced operation in October 2015.

Bronkhorstpruit Biogas Plant

Source: website of Bio2Watt

CoT does not have any Waste-to-Energy (incineration) plant. However, they are implementing the "CoT-Alternative Waste Treatment Technology Project", similar to CoJ. The outline of the project described on the website of GIFA is as follows.

Table 8-24 Outline of "CoT-Alternative Waste Treatment Technology Project"

Items	Outline
Promoter	CoT
Estimated Project Cost	8.5 billion ZAR
Expected Delivery Model	Municipal PPP
Status	F/S completed, and the project was determined to be not feasible
Estimated power generation capacity	88MW
Project background and scope	Tshwane is experiencing challenges in waste management and disposal. This project is a solution to the challenges and aims to reduce waste disposal at the landfill and generate about 88MW of energy from municipal solid waste materials generated from municipal areas.

Source: JICA Study Team prepared this table based on the website of GIFA

CoT has reported that the completed feasibility study of this project suggested it be stopped. Therefore, this project is currently suspended. At present, CoT is analyzing its financial situation for proceeding with this project. CoT realizes the serious challenge it would face to secure the necessary funding for the project without any support from donors.

Another project CoT is promoting is the "Tshwane Bio-Energy Project". This project aims to generate electricity utilizing gas generated from landfill sites. The outline of the project described on the website of GIFA is as follows.

Table 8-25 Outline of "Tshwane Bio-Energy Project"

Items	Outline
Estimated Project Cost	250 million ZAR
Expected Delivery Model	It will be considered based on the result of feasibility study.
Status	Feasibility study is completed.
Project background and scope	The project calls for construction of a Waste-to-Energy facility utilizing mixed urban waste in landfill sites in Tshwane city. It expects to adopt technologies such as anaerobic digestion, MBT, thermal treatment and gas extraction, etc.

Source: JICA Study Team prepared this table based on the website of GIFA.

The feasibility study for this project has already been completed and has identified issues related to the financial situation of CoT and the lack of support for the project. Therefore, the project is presently at a standstill. Time will be required before implementation can start. Target sites are not decided yet, but landfill sites near the industrial area may become candidate sites.

Recycling activities are led by the private sector and there are some associations for recycling in Tshwane. The outline of recycling situation in Tshwane is described in the following table. The results of interviews conducted in this survey are referred to in section 8.4. CoT supports Buy Back Centers by providing them with recyclables, but the centers must find buyers by themselves.

Table 8-26 Current Situation of Recycling in Tshwane City

Objects	Outline
Organic waste	There are some private companies for collecting and composting organic waste. Examples are The Waste Group, and Smart Waste
Plastics	There are some private companies for recycling plastics, and they belong to SAPRO. Examples are Plastic Recycling Tech, and Mohlopi Recycling
Paper	There are some private companies for collecting and recycling paper. Examples are Africa Plastic, Paper and Glass Recycling
e-waste	There are some private companies for reusing and recycling e-waste. Examples are E-waste SA, and Tshwane Electronic Waste Company

Source: JICA Study Team prepared this table.

8.5.6 Current Status of Landfill Site

In Tshwane city, there are 10 landfill sites including 6 landfill sites which have already stopped receiving waste. In the 4 operating landfill sites, CoT utilizes private companies to operate the heavy equipment for

waste placing and compaction, etc. The current situation of landfill sites is shown in the following table.

Table 8-27 Current Status of Landfill Sites

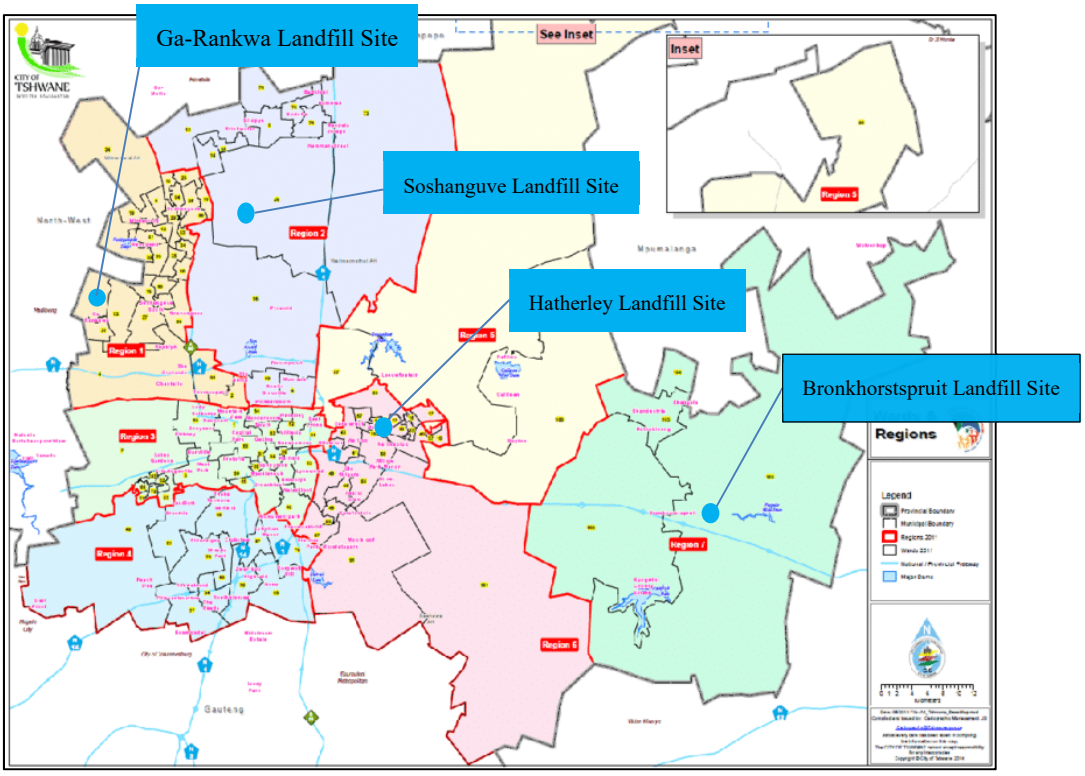
Name of landfill	Area (km^2)	Operation	Number of staff	Estimated remaining years	Construction year
Hatherley	0.90	Under operation	15	5-10	1998
Soshanguve	0.39	Under operation	11	3-7	1995
Ga-Rankuwa	0.42	Under operation	9	5-10	1995
Bronkhorstpruit	0.16	Under operation	6	5-7	1996
Onderstepoort	-	Stopped receiving waste	-	-	1997
Kwagassrand	-	Closed	-	-	1965
Valhalla	-	Closed	-	-	1964
Garstkloof	-	Closed	-	-	1980
Derdepoort	-	Closed	-	-	1997

Source: JICA Study Team prepared this table.

Table 8-28 Equipment at Landfill Sites under Operation

Name of landfill sites	Equipment
Hatherley	3 Compactors, 3 Bulldozers, 1 Wheel loader 6 Dump trucks (ADT) (30 tons), 3 Backhoes 2 Water Tankers, 1 Grader
Soshanguve	3 Compactors, 2 Bulldozers, 1 Wheel loader 3 Dump trucks (ADT) (30 tons), 2 Backhoes 1 Water Tanker
Ga-Rankuwa	2 Compactors, 2 Bulldozers, 1 Wheel loader 3 Dump trucks (ADT) (30 tons), 2 Backhoes 2 Water Tankers
Bronkhorstpruit	1 Compactor, 1 Bulldozer, 1 Wheel loader 1 Dump truck (ADT) (30tons), 1 Backhoe 1 Water Tanker

Source: JICA Study Team prepared this table.



Source: JICA Study Team prepared this figure.

Figure 8-18 Locations of Landfill Sites under Operation in Tshwane City

The amounts of waste received in the landfill sites in 2019 and 2020 are shown in the following table.

As cover soil is reportedly applied within two hours of waste disposal there are no concerns for emission of odours or attraction of insects. Although working conditions at the landfills become very difficult during the rainy season it does not appear to be a major concern as the working conditions are usually improved within a few days.

Table 8-29 Amount of Waste received in Landfill Sites in Tshwane City (tons)

Name of landfill sites	2019	2020
Hatherley	839,823	783,628
Soshanguve	578,001	626,837
Ga-Rankwa	104,767	161,088
Bronkhorstspruit	87,711	95,497
Total	**1,610,302**	**1,667,050**

Source: JICA Study Team prepared this table.

	
Harthley Landfill site	Soshanguve Landfill site

Source: provided by ERA

8.5.7 Activities by Other Donors

According to CoT, they are not receiving any assistance from other donors at present.

8.5.8 Status of Initiatives related to DX

In South Africa, waste information systems are established at the National Level, in some Provinces and in some municipalities. Collected information can be accessed at the website of SAWIC under DFFE.
JICA Study Team monitored the information of waste collection amount in Tshwane in fiscal year of 2019/20 and calculated that the total amount of municipal waste collected was about 1.7 million tons. This amount corresponds to about 94% of the amount reported by the landfill (refer to the earlier Table 9-29). This indicates that waste information in Tshwane was properly shared with SAWIC.

8.5.9 Actions against COVID-19

CoT has distributed brochures for awareness raising on prevention against infection by COVID-19. They also periodically engage in awareness raising activities against COVID-19, targeting SWM related workers

8.5.10 Status of Monitoring on SDGs' waste-related Indicators

Current situation for SDGs indicators related to solid waste management in Tshwane city is shown in the following table.

Table 8-30 Status of Monitoring on SDGs' waste-related Targets (Tshwane City)

SDGs target		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	CoT properly monitors the discharge of municipal waste and hazardous waste. The rate of general waste collected and treated by the managed facilities of the total amount of general waste generated in Tshwane city is about 94%.
12.3.1	a) Food loss index, and b) Food waste index	At the National level, the importance of food waste reduction is addressed in NWMS2020 as one of the targets of national strategy, and strategic measures are described to realize the reduction. IWMS-CoT promotes composting of organic waste, but the reduction of food waste

SDGs target		Current status
		is not specifically discussed . (There are aims to minimize total amount of waste)
12.4.2	(a) Hazardous waste generated per capita; and (b) proportion of hazardous waste treated, by type of treatment	South Africa has acceded to the Basel Convention. In Tshwane city, the discharge of municipal waste and hazardous waste are properly monitored. In some landfill sites, there are plans to effectively utilize generated gas, but most of landfill sites should be improved.
12.5.1	National recycling rate, tons of material recycled	In Tshwane city, reduction of waste and promotion of recycling are only partially implemented. Amount of waste recycled in Tshwane city is about 100 thousand tons in a year which corresponds to 5% of general waste amount generated in the city.
14.1.1	(a) Index of coastal eutrophication; and (b) plastic debris density	Tshwane city is located far from the ocean but there are many rivers flowing through it. Therefore, it is necessary to implement programmes for preventing illegal dumping into these rivers. Currently, CoT clears up part of the waste dumped illegally into rivers.

Source: JICA Study team prepared this table.

8.6 South African Waste Pickers Association (SAWPA)

In South Africa, South African Waste Pickers Association (SAWPA) has been established with the aim to protect the rights of waste pickers and integrate them officially in one organization so that they can work with more ease and safety. SAWPA was established with the aim to integrate the waste pickers and provide them a platform to have their views heard by the central government and municipalities. SAWPA is financially supported by the central government, municipalities, and other organizations. It is regarded as quite an innovative case, and it can become a good practice for other countries in Africa aiming to integrate waste pickers. The outline of SAWPA is shown as follows.

Table 8-31 The outline of SAWPA

Name	South African Waste Pickers Association (SAWPA)
Web address	https://wastepickers.org.za/
Establishment year	2009
Supporting organizations	Seas Trust, Friends of Earth, Wiego, GroundWork, GAIA etc.
Activities	Protection of the rights of waste pickers and their integration
Features	SAWPA carries out activities supported by municipalities and international organizations such as UNEP. They have a right to participate in the governmental conferences related to waste management.
Target area	South Africa
Number of registrants	More than 33,000 (There are more than 200 thousand waste pickers not registered yet in South Africa.)

Source: JICA Study Team prepared this table based on website of SAWPA, and result of interview with SAWPA

8.7 Possibilities and Issues for Introduction of Waste-to-Energy

8.7.1 Johannesburg City

As described earlier in section 8.4, the “CoJ-Alternative Waste Treatment Technology Project” in Johannesburg is in progress. JICA Study Team assessed this project based on “Guideline for Promoting

Waste-to-Energy Facility Projects" issued by JICA. Assessment result of this project is shown in the table below.

Table 8-32 Feasibility Assessment of Waste-to-Energy Project in Johannesburg City

Classification	Importance	Item	Assessment
1) Social Conditions	Most Important	Target city population	[1] Target population is unclear, but waste amount received by the target landfill site in the past is about 800 tons per day. Even considering that the target amount for incineration will be smaller than that amount due to introduction of dMRF, this is not considered to be a problem.
	Important	Social Needs	[1] Remaining lifetimes of landfill sites are insufficient.
	Recommended	Development status of social infrastructure	[1] Services for electricity, water and sewerage are supplied without any problem.
	Recommended	Environmental and social considerations	[1] Environmental and social considerations are regulated.
2) Understanding of residents	Most Important	Cooperation of residents in waste sorting	[3] In some parts of the city, waste is sorted by residents.
	Most Important	Understanding of residents	[?] It is not clear through this survey whether the residents are in agreement to introduce Waste-to-Energy.
3) Institutional Aspect	Most Important	Development of laws, enforcement orders or rules	[1] Laws and regulations related to waste management have been properly established.
	Important	Stability of administrative organization	[1] Administrative organization in charge is clear and stable.
	Important	Adequacy of construction site	[1] A part of landfill site is secured for construction.
4) Governance capability of the government	Most Important	Positioning of WtE in upper-level plan	[3] It is not described clearly in the national waste management strategy to positively introduce Waste-to-Energy.
	Most Important	Stance of the head of local government	[?]It is not clear through this survey whether mayor of CoJ is positive to introduce Waste-to-Energy.
	Important	Performance capability of the government	[1] CoJ can obtain cooperation from DBSA and private consulting company for implementing the project.
	Important	Technical standards and operation pertaining to selling electricity	[2] They have a Feed-in-Tariff (FIT) system. Adjustment of electricity price will be implemented in the near future.
5) Financial aspect	Most Important	Securing of financial resources	[1] They can be supported financially from UNEP and DBSA.
	Important	Tipping fee	[?] JICA Study Team could not get information about expected tipping fee through this survey.
	Important	Revenue by selling electricity	[?] Validity of income by selling electricity could not be assessed through this survey.
	Recommended	Project scheme	[1] CoJ has rich experiences in implementing projects under PPP scheme.
	Recommended	Project risks	[?] Project risks and business demarcation point could not be confirmed through this survey.
6) Technical aspect	Most Important	Collecting basic data concerning waste	[1] CoJ collected basic data in the feasibility study.
	Important	Technical capacities of manufacturers	[3] CoJ expects participation of foreign companies to handle technical aspects.

Classification	Importance	Item	Assessment
	Important	Proper disposal of incineration residue	[2] They treat fly ash and bottom ash as hazardous waste. However, it is not clear how they treat and dispose of them.
	Recommended	Environmental monitoring system	[1] There are some private companies for environmental analysis.
	Recommended	Track record of similar facilities	[1] They have experiences to construct Thermal power plants and biogas power plants.
	Recommended	Securing of engineers	[1] There are some high-level engineering universities.

Note: [1] = Satisfied, [2] = Slightly satisfied, [3] = Slightly not satisfiled, [4] = Not satisfiled, [?] = Not sure
Source: JICA Study Team assessed the project based on "Guideline for Promoting Waste to Energy Facility Projects", issued by JICA.

Though there are some unclear information because of the degree of confidentiality in this stage of review of feasibility study and preparation of bidding, CoJ are believed to have very carefully considered technical and financial aspects under the support of DBSA. Therefore, the project is thought to be highly feasible. Consensus building among residents and persuasion of the environmental organizations remain a challenge.

8.7.2 Tshwane City

As described in section 8.5, the "CoT-Alternative Waste Treatment Technology Project" feasibility study was completed in Tshwane. However, the project was found to be not feasible due to financial issues of CoT and lack of support for the project. Therefore, JICA Study Team could not assess the feasibility of this project in detail through this survey.

CoT is facing a serious challenge to identify proper organizations for supporting them technically and financially in order to proceed with this project.

8.8 Issues and Cooperation Needs of Solid Waste Management in South Africa, Johannesburg City and Tshwane City

8.8.1 Issues and Stages of Solid Waste Management

(1) Issues of Solid Waste Management

Solid waste management in South Africa is functioning well at the National level, as there are established and managed SWM elements of waste information system, legal system, strategies, and plans. Establishment and management of advanced waste information system has become a good practice to be learned by other African countries. However, the Study found that some information provided by SAWIC was different from the information provided by municipalities. Therefore, it is important to improve the accuracy of the information system in future.

Moreover, a noteworthy fact is that there is an association for waste pickers. SAWPA established in 2009 has carried out various activities aiming to protect the rights of waste pickers and promote their official integration into the SWM sector. Other activities include improvement of working environment and awareness raising on sanitation issues for the waste pickers. Though SAWPA was established on a voluntary

basis, it has been supported not only by NGOs, but also governmental organizations, municipalities and international organizations and it is very energetic. Their representatives sometimes participate in the governmental meetings related to waste management. It is also thought to be a good practice for other African countries which aim to integrate waste pickers.

CoJ plans to revise current IWMP in 2022 and is now in the stage of selection of Contractor. Waste collection, transportation and final disposal are outsourced to Pikitup, which is owned by CoJ, and they manage waste properly. Pikitup implements campaigns for promoting source separation of waste and its target is almost 30% of the total service receivers. It will be a challenge for them to expand this campaign to the whole city area and to obtain precise information on waste amounts for monitoring the effect of source separation campaign in future.

CoJ understands the need for mechanical transfer stations, but is not able to construct the stations due to financial problems.

Biogas power generation plants have been introduced at 3 of the 4 operating public landfill sites, but they are not achieving their power generation targets.

Moreover, CoJ will face significant challenges on how to implement bidding, select contractor, manage construction and operation, and accumulate experience utilizing PPP scheme for the “Alternative Waste Treatment Technology Project”, which is now in the phase of preparation of procurement, because it will be the first case to introduce Waste-to-Energy facilities with incineration in South Africa.

CoT also plans to revise the current IWMP, although they do not intend to make fundamental revisions. They will be challenged to establish practical plans for waste management in the city. CoT promotes source separation only for white paper, but implementation is not adequate. Collection and disposal of waste are partially outsourced to private companies, but the system in place is unclear and even the CoT officers do not grasp the actual operational aspects of these private companies. This situation should be improved in the near future. Besides, CoT has plans to implement projects for introducing alternative waste treatment technology and biogas power generation plants, but the projects are at standstill due to the financial problem of CoT. It will also be a challenge to gain the support of donors in order to realize these projects which are important for solving waste management issues in Tshwane.

Since current conditions of landfill sites in Johannesburg and Tshwane are not very good because of problems of waste pickers and lack of leachate treatment, it is necessary to consider how to improve the landfill situation.

(2) Stages and Priority Issues of Solid Waste Management

Conditions and stages of solid waste management of Johannesburg city and Tshwane city are analyzed in Table 8-33 and Table 8-34, respectively. In this survey, stages of solid waste management in Johannesburg city and Tshwane city are evaluated as stage-3, “establishment of sound material cycle society through 3R”, and stage-2, “reduction of environmental footprint and prevention of pollution”, respectively. It is a priority issue to construct intermediate treatment facilities for securing the remaining capacity of landfill sites in both cities. In Tshwane city, in addition, it also is a priority issue to implement source separation of waste.

Table 8-33 Stages of Solid Waste Management in Johannesburg City

Field	Stage	Conditions
Legislations	3	At the national level, there is a law for waste management and regulations related to waste management. In Johannesburg city, they have by-laws related to waste management.
Collection and Transportation	3	Pikitup, owned by the municipality, collects and transports waste properly. Source separation of waste has started in about 30% of the city area.
Final Disposal	2	Landfill sites have leachate collection ponds, but no treatment facilities. Their remaining capacities are not enough. On the other hand, they have operated biogas power generation plants in some landfill sites.
Intermediate Treatment and Recycle	2	The private sector implements recycling utilizing waste pickers. Construction project for dMRF and Waste-to-Energy (incineration) plants as intermediate treatment facilities is proceeding.

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

<Priority Issues (Johannesburg City) >

- The final disposal site has little remaining capacity, necessitating a project to construct an intermediate treatment facility.

Table 8-34 Stages of Solid Waste Management in Tshwane City

Field	Stage	Conditions
Legislations	3	At the national level, there is a law related to waste management. In Tshwane city, they have by-laws related to waste management.
Collection and Transportation	2	CoT and private companies collect and transport waste. Source separation of waste is implemented only for paper in a limited area.
Final Disposal	2	Landfill sites have leachate collection ponds, but no treatment facilities. Their remaining capacity is not enough. On the other hand, CoT planned to construct Landfill gas-to-Energy plant, but the project is currently at standstill.
Intermediate Treatment and Recycle	2	Private sector companies implement recycling utilizing waste pickers. Project for Waste-to-Energy (incineration) plant is also planned, but currently at standstill.

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

<Priority Issues (Tshwane City)>

- 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.

8.8.2 Proposed Cooperation Policy

Draft cooperation policy related to solid waste management in South Africa and target cities is proposed in Table 8-35.

Table 8-35 Proposed Cooperation Policy (South Africa)

Challenges		Short-term support (red letters are those related to priority issues)	Middle-term support
DFFE	Implementation of Waste Management Flagship Programme	【Dispatch of Experts】 ➢ Technical transfer of composting method (Takakura-method) for treatment of organic waste	
CoJ	Expansion of Source separation area and promotion of recycling	【Technical Cooperation Project】 ➢ Public awareness raising for residents living in the area where source separation of waste has not been implemented yet. ➢ Establishment of proper route for recycling of waste after source separation	
	Improvement of Waste Information System	【Technical Cooperation Project】 ➢ Understanding of actual situation of registration of waste information and finding out issues for its improvement ➢ Improvement of Waste Information System	
	Management of Waste-to-Energy (incineration) facilities after construction	【Technical Cooperation Project】or【Dispatch of Experts】and【Knowledge Co-Creation Programme (KCCP)】 Capacity development of officers in charge of supervising operation by Special Purpose Company (SPC) after construction of Waste-to-Energy (incineration) facilities	
CoT	Thorough implementation of source separation and promotion of recycling	【Technical Cooperation Project】 ➢ Establishment of basic policy for source separation of waste ➢ Public awareness raising for source separation of waste ➢ Establishment of proper route for recycling of waste after source separation	
	Review of IWMP	【Technical Cooperation Project】 ➢ Finding out issues for waste management in Tshwane and selection of action policy to solve them ➢ Essential review of IWMP	
Construction of Waste-to-Energy (incineration) facilities Construction of Landfill-gas-to-Energy facilities		Since both projects (LFG power generation facility and WtE incinerator) are currently at standstill due to the financial problems, it should be urgent issue to establish financial support system. At the same time, technical support for proper implementation of the project is also desired.	

Source: JICA Study Team prepared this table.

CHAPTER 9 Solid Waste Management in the United Republic of Tanzania and the Federal Republic of Nigeria

9.1 Solid Waste Management in the United Republic of Tanzania

For the United Republic of Tanzania (hereafter referred to as Tanzania), this Study conducted a remote survey utilizing a local consultant, J and W Agencies (A) Ltd. The results of the survey are presented in this section.

9.1.1 Natural Conditions

(1) Topography

Tanzania is located in the African Great Lakes Region in East Africa, with a land area of 945,000 km^2, approximately 2.5 times the size of Japan. It is bordered by Kenya and Uganda to the north, Rwanda, Burundi, and the Democratic Republic of Congo to the west, Zambia, Malawi, and Mozambique to the south, and the Indian Ocean to the east. Most of the country is on a plateau over 1,000 meters above sea level, and Kilimanjaro Mountain, the highest mountain in Africa, is located in northeastern Tanzania.

Tanzania is a federated republic of the mainland (Tanganyika) and the islands off the Indian Ocean (Zanzibar). Zanzibar has its own judicial, legislative and administrative autonomy. The Tanzanian mainland is divided into 26 regions (Figure 9-1). In 1996, the legislature's seat was moved to the new legal capital Dodoma, but other government offices are located in the former capital Dar es Salaam.

Dodoma Region, is the target area of this study. Dodoma Region consists of seven districts, with Dodoma Municipal as the region's capital as shown in Figure 9-2.

Source: prepared by JICA Study Team with data from Wikipedia

Figure 9-1 Administrative Boundaries in Tanzania

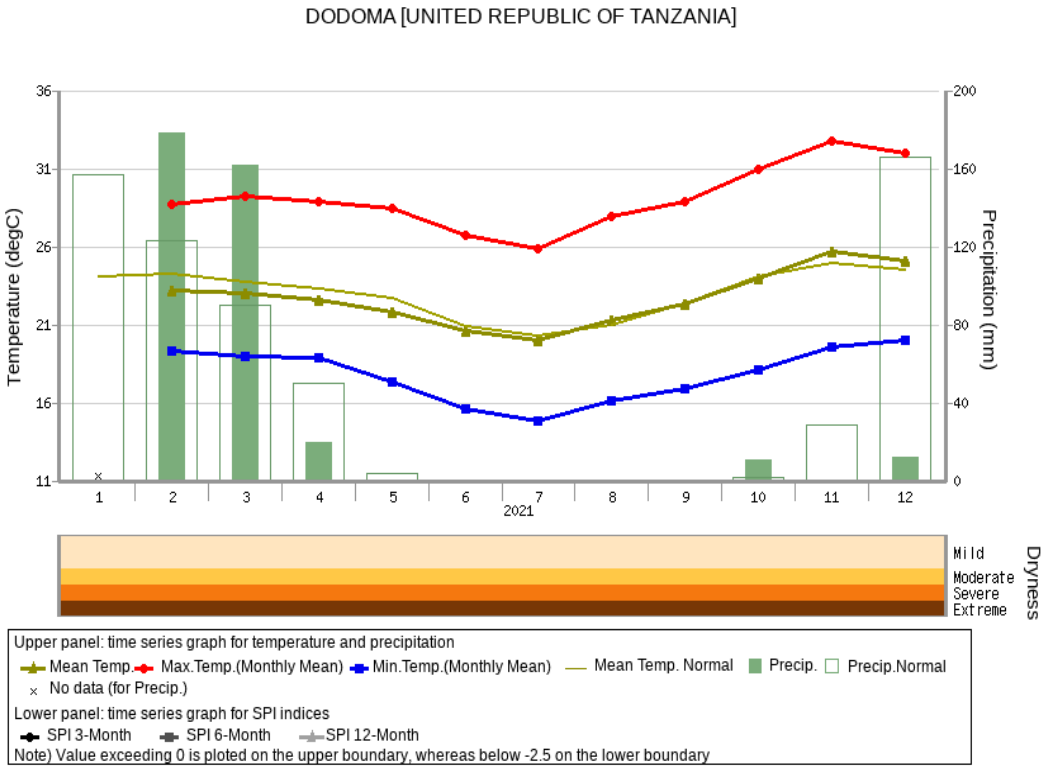
Source: prepared by JICA Study Team with data from Dodoma Region Basic Demographic and Socio-Economic Profile 2016

Figure 9-2 Administrative Boundaries in Dodoma Region

(2) Meteorological Conditions

Most of the country has a savanna climate, with a steppe climate in the central part, and a subtropical dry winter climate in the southern and northern highlands. In the coastal areas, along the shores of Lake Victoria and around Kilimanjaro, precipitation exceeds 1,000 mm, while inland precipitation is usually around 500 mm.

The Dodoma Region belongs to the steppe climate and is relatively warm throughout the year. The graph of temperature and precipitation in Dodoma Municipality is shown in Figure 9-3. The average monthly maximum temperature in 2021 ranges from 26°C to 33°C, and the average minimum temperature is 15°C to 20°C, never dropping below 10°C. The average annual precipitation from 1991 to 2020 is 620 mm, most of which is due to the rainy season from December to March. The remaining eight months are dry season.



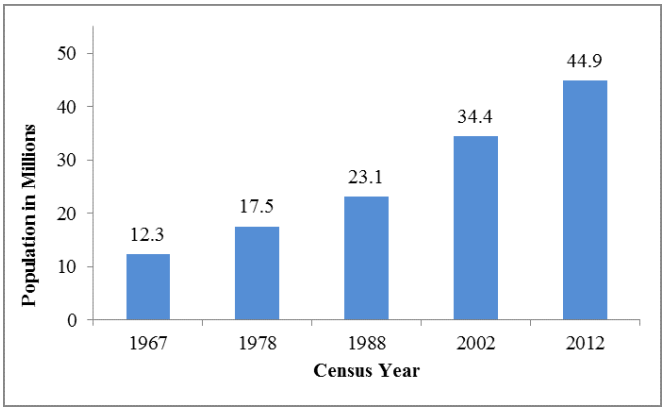
Source: Japan Meteorological Agency, "ClimatView - a tool for viewing monthly climate data"

Figure 9-3 Graph of Temperature and Precipitation in Dodoma Municipality (2021)

9.1.2 Social and Economic Situation

(1) Population

The population trends of Tanzania (1967-2012) are shown in Figure 9-4. The population in 2012 was 44,928,923, with an average annual population growth rate of 2.7% between 2002 and 2012. In addition, the National Bureau of Statistics estimates that the population in 2020 was 57.63 million.



Source: National Bureau of Statistics, "2012 POPULATION AND HOUSING CENSUS"

Figure 9-4 Population Trends in Tanzania

Table 9-1 shows the population, area, and population density of the Dodoma Region and the seven districts that make up the Dodoma Region. A population of 2.08 million people lived in the Dodoma Region in 2012, and the population density was 50.4 persons/km^2. The National Bureau of Statistics estimated that the population of Dodoma Region in 2020 would be 2.65 million.

Table 9-1 Population, Area and Population Density of Dodoma Region

Region name	District name	Population (2012)	Area (km^2)	Population density (persons/km^2)
Dodoma Region		2,083,588	41,311	50.4
	Dodoma Municipality	410,956	2,576	159.5
	Bahi District	221,645	5,949	37.3
	Chamwino District	330,543	8,056	41.0
	Chemba District	235,711	7,653	30.8
	Kondoa District	269,704	5,557	48.5
	Kongwa District	309,973	4,041	76.7
	Mpwapwa District	305,056	7,479	40.8

Source: National Bureau of Statistics, "2012 POPULATION AND HOUSING CENSUS"

(2) Economic Indicators

The main economic indicators for Tanzania are shown in Table 9-2. After independence, Tanzania pursued a socialist economic policy, but in the 1980s, the economy fell into a state of crisis. From 1986, with the support of the World Bank and IMF, Tanzania shifted from a socialist economy to a market economy and promoted economic reform through deregulation and other measures. Although the economy stagnated in the 1990s, it entered a period of economic growth around 2000. Industries such as mining, information and communication, transportation, and construction have been growing steadily, and a certain degree of balanced growth has been observed. In addition, in order to reduce poverty, Tanzania is striving to increase growth and productivity in the agricultural sector, which accounts for approximately 70% of the working population.
The main industries are services (36.8% of GDP), mining, manufacturing, and construction (28.6% of GDP), and agriculture, forestry, and fisheries (26.5% of GDP)[35].

[35] JETRO, "Overview of the United Republic of Tanzania" (June 25, 2021)

Table 9-2 Main Economic Indicators in Tanzania

Indicator	Contents
GDP (World Bank, 2019)	63.2 billion USD
GNI per capita (World Bank, 2019)	1,080 USD
Economic growth rate (World Bank, 2019)	5.8%
Price inflation (World Bank, 2019)	3.5%
Unemployment Rate (World Bank, 2019)	2.0%
Major Trade Items (Central Bank of Tanzania, 2018)	Exports: gold, cashew nuts, tobacco, sisal hemp, coffee, etc. Imports: petroleum, machinery, transportation equipment, construction materials, etc.

Source: JETRO, "Overview of the United Republic of Tanzania" (June 25, 2021)

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

(1) Laws and Regulations related to Solid Waste Management

In Tanzania, there is no national basic law on management of municipal solid waste, however Part IX of the Environmental Management Act (2004) covers waste management. The Act stipulates on the sustainable management of the environment; pollution prevention and control; waste management; compliance default; impact and risk assessment; and environmental impact assessment. It also defines "solid waste" and various types of waste. The contents of the Environmental Management Act are shown in Table 9-3 and the definitions in Table 9-4.

Table 9-3 Contents of Environmental Management Act

Item	Contents
Title	The environmental Management Act, 2004
Frame	Part I Preliminary Provisions Part II General Principles Part III Administration and Institutional Arrangement Part IV Environmental Planning Part V Environmental Management Part VI Environmental Impact Assessment and Other Assessments Part VII Strategic Environmental Assessment Part VIII Pollution Prevention and Control Part IX **Waste Management** Part X Environmental Quality Standards Part XI Environmental Restoration, Easements and Conservation Orders Part XII Analysis and Records Part XIII Environmental Information, Education and Research Part XIV Public Participation in Environmental Decision Making Part XV International Agreements Part XVI Compliance and Enforcement Part XVII Environmental Appeals Tribunal Part XVIII National Environmental Trust Fund Part XIX Financial Provisions Par XX General and Transitional Provisions

Source: Environmental Management Act, 2004

Table 9-4 Definitions of Waste in the Act

Term	Definitions
Solid waste management	means an essential service that is provided to protect the environment and public health, promote hygiene, recover materials, avoid waste, reduce waste quantities, decrease emission and residuals and prevent spread of diseases
Solid waste	means non-liquid materials arising from domestic, street, commercial, industrial and agricultural activities; and includes refuse or garbage, non-liquid materials arising from construction and demolition activities, garden trimmings and mining operations, dead animals and abandoned cars scraps;
Industrial waste	means waste emanating from processing industries or non-processing industries that is the source of energy, water, treatment plants or communication and includes any other solid waste referred to under Part. IX;
Litter	Litter includes any refuse, rubbish, animal remains, glass, metal, plastics, garbage, debris, dirt, filth, urine, rubble, ballasts, stones, earth, sewage, or waste matter, or any other thing of a like nature;
Gaseous Waste	means gaseous emissions referred to under section 132(l) and includes other emissions which may be prescribed;
Hazardous waste	means any solid, liquid, gaseous or sludge waste which by reason of its chemical reactivity, environmental or human hazardousness, its infectiousness, toxicity, explosiveness and corrosiveness is harmful to human health, life or the environment;

Source: Environmental Management Act, 2004

Part IX on waste management consists of (a) solid waste management, (b) waste management, (c) liquid waste management, (d) gaseous waste management, and (e) hazardous waste management. In "(a) Solid waste management", the role of local government authority is regulated to manage and minimize solid waste, implement appropriate waste management and to carry out environmental impact assessment associated with SWM. The main sections of Part IX of Environmental Management Act and other laws and regulations related to waste are shown in Table 9-5.

Table 9-5 Laws and Regulations related to Waste

Laws and Regulations	Sections, Articles and parts related to waste management and environment
Constitution of the United Republic of Tanzania, 1977	• Article 14 states that "every person has the right to live and to the protection of his life by the society in accordance with the law," which may be interpreted to mean that Tanzanians are entitled to a healthy environment. • Article 27 (1) specifically states that "every person has the duty to protect the natural resources of the United Republic" where natural resources may be interpreted as the environment.
Environmental Management Act (EMA), 2004	Section 114: (1) For the purposes of ensuring minimization of the solid waste in their respective areas of jurisdiction, local government authorities shall prescribe: (a) for different types or kinds of waste or refuse or garbage to be separated at the source; (b) for standards to guide the type, size, shape, color and other specifications for refuse containers used; and (c) for mechanisms to be put in place to involve the private sector and Non-Governmental Organizations on planning, raising awareness among producers, vendors, transporters, manufacturers and others on the need to have appropriate containers and enhance separation of waste at source. (2) The local government authorities shall, with respect to their areas of respective jurisdiction: (a) cause to be conducted appropriate Environmental Impact Assessment for all new major activities leading to proper management of solid waste; (b) manage solid waste generated in accordance with sustainable plans produced by respective local government authority; and (c) ensure the appropriate sorting of waste is made right at the source and in accordance with standards or specifications prescribed by the local government authority concerned.

Laws and Regulations	Sections, Articles and parts related to waste management and environment
	Section 119 - The local government authorities shall in choosing the best method of solid waste disposal for their areas of jurisdiction consider the following matters: (a) climatic conditions; (b) economic ability; (c) interest of the community; (d) environmental, hygienic and social benefits; and (e) availability of tipping sites. Section 134. (1) Each local government authority shall, with respect to its area of jurisdiction, ensure that: (a) standards prescribed for the hazardous waste management are in place and operational at all the time; (b) premises producing hazardous wastes are adequately ventilated and are in compliance with prescribed standards; (c) waste effluents are treated or are so modified as to comply with prescribed standards before final disposal; and (d) hazardous liquid wastes are treated to conform with prescribed environmental standards at factory or on site before their discharge into public sewers or municipal oxidation ponds or in an open land or into receiving water bodies.
Industrial and Consumer Chemicals (Management and Control) Act, No. 3, 2003	• control of production, importation, exportation, transportation, storage of and dealing in chemicals (Part III) • management of industrial and consumer chemicals including associated wastes.
Land Acquisition Act, 1967	• the president to acquire any land for any public purpose and defines the circumstances in which public interest could be invoked • the acquisition of the land for landfill • requirements before land acquisition such as investigations, issuing notice of intention to take land and the requirements for, and restrictions on compensation.
Land Act No. 4, 1999	The Ministry of Lands, Housing and Human Settlement Development is responsible for implementing the Act. The Land Act provides for: • particular areas to be designated as “hazardous land”, the development of which is likely to pose a danger to life or lead to the degradation or destruction of the environment on a site or on land adjacent to the site. Hazardous land includes: ➢ mangrove swamps ➢ coral reefs ➢ wetlands ➢ offshore islands ➢ land designated or used for dumping of hazardous wastes ➢ land within 60 m of a riverbank, shoreline of an inland lake, beach or coast ➢ land on slopes with a gradient exceeding acceptable angle ➢ land specified by appropriate authority as fragile nature or of environmental significance • the protection of hazardous land: Landfill facility may not be constructed in sensitive sites
The Village Land Act No. 5, 1999	The Ministry of Lands, Housing and Human Settlement Development is responsible for implementing the Act. Section 6. -(I) The Minister may declare any area of a village land to be hazard land subject to the provision’s subsection of subsection (3). (3) For purposes of this Section, hazard land is land the development of which is likely to pose a danger to life or to lead to the degradation of or environmental destruction on that or contiguous land and includes but is not limited to- (c) land designated or used or the dumping of hazardous waste;
Land Use Planning Act No.6, 2007	• procedures for the preparation, administration and enforcement of land use plans; to facilitate an orderly management of land use, empower land occupiers and users to make better and more productive use of land, to enhance security and equity in accessing land and its resources • a legal framework for planning authorities with the mandate to prepare and implement land use plans following the laid-out procedures • the requirement for projects to be integrated in land use plans of region(s) and district(s) is of relevance to the project. This Act requires waste disposal sites to be included in land use plans.

Laws and Regulations	Sections, Articles and parts related to waste management and environment
Occupational Health and Safety Act, 2003	• the safety, health and welfare of persons working in factories and all other places of work • the protection of persons, other than persons at work, against hazards to health and safety arising out of, or in connection with, activities of persons at work • safe means of access, safe working conditions, fire prevention, health and welfare provisions, the provision of personal protective equipment, first aid and firefighting training. The Ministry of Labour and Employment is responsible for implementing the Act.
Public Health Act, 2009	• prohibits the discharge of oil, grease, ballast, waste, sewage or any other polluting substance into waters of the seaport, lake, port or river port (Section 37(1)) • prohibits dumping or discharge of waste into the land within the defined port area (Section 38(1)) • provides for addressing nuisances, such as noise, waste, workplaces in poor condition (Part IV(a)) • stipulates that construction and industries producing dust and gaseous wastes should be situated far from residential areas (Section 84 (1)) • provides for hazardous and health care wastes management (Section 87). • provides for welfare and health of workers (Sections 168–169).
Tanzania Investment Act, No. 26, 1997	• established the Tanzania Investment Centre (TIC) to promote, coordinate and facilitate investment into Tanzania, and governs investment activities. This Act is relevant for Private Investors investing in waste management
Urban Planning Act No. 8, 2007	• the orderly and sustainable development of land in urban areas to preserve and improve amenities • consent to develop land, and controlling the use of land in urban areas.
Worker's Compensation Act, No 20, 2008	• right to compensation and protection (Part IV) • claims for compensation (Part V) • determination of compensation (Part VI) • obligations of employers (Part VIII).
Public Private Partnership Act, 2010	The Act gives effect to the public-private partnership policy; to provide for institutional frameworks for the implementation of public-private agreements between public sector and private sector entities; to set rules, guidelines and procedures governing public-private procurement, development and implementation of public private partnership and to provide for other related matters. Public Private Partnership Co-ordination Unit shall deal with promotion and co-ordination of all matters relating to public-private partnership projects undertaken within the Mainland Tanzania. (g) Environment and Waste Management (section 6 (3));
Atomic Energy Act, 2003	The Act provides for establishment of the Tanzania Atomic Energy Commission and to provide for its functions in relation to the control of the use of ionizing and nonionizing sources, the promotion of safety use and peaceful uses of atomic energy and nuclear technology, and to repeal the Protection from Radiation Act, 1983. Section 34, no person shall, except in accordance with an authorization granted in that behalf under section 35 of the Act, dispose of any radioactive waste on or from any premises which were used for the purposes of an undertaking carried on by him, or cause or permit any radioactive waste to be so disposed of, if he knows or has reasonable grounds for believing it to be radioactive waste.

Source: National Solid Waste Management Strategy, 2018

(2) Policies and Plans related to Solid Waste Management

In Tanzania, the National Environmental Policy was formulated in 1997. The following are the items related to waste in this policy.

- Technology: Promotion of environmentally friendly technology.
- Private sector: Improvement of production systems with technologies and processes to reduce waste generation.
- Public health: Provision of waste treatment services and promotion of hazardous waste separation.

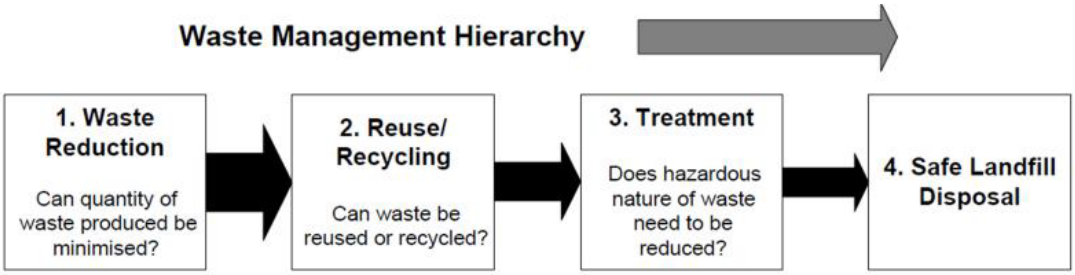
- Human housing: development of environmentally friendly waste management system in urban areas
- Industry: Management of hazardous waste and other wastes.

Furthermore, the National Solid Waste Management Strategy was developed in 2018. This strategy aims to establish a common platform for action by the various business entities to systematically improve waste management in Tanzania. The objectives of this strategy are shown in Table 9-6 and the ideal waste management system is shown in Figure 9-5.

Table 9-6 Objectives of National Solid Waste Management Strategy

Item	Description
Overall Strategy Goals	a) Protection of human health b) Reduction of poverty c) Reduction of waste management costs d) Protection of the environment
Guiding principles	Promotion of circular economy (Waste is a source that can be harnessed to create wealth, employment and reduce pollution of the environment)
Long-term-goals	Achieve approximately 80% waste recovery (re-use, recycling, composting and energy recovery) and 20% landfilling in a Sanitary landfill (inert material) by 2030
Medium-term-goals	Achieve 50% waste recovery (re-use, recycling, composting and energy recovery) and 50% semi-landfilling by 2025
Short-term-goals	Achieve 30% waste recovery (re-use, recycling, composting) and 70% controlled dumping (tipping, compacting and covering) in key urban areas by 2020
Key priority areas	a) Preparation of LGAs' waste management action plans that are consistent with this NSWMS and other relevant policies. b) Capacity building at all levels of planning and decision making (national and the local government levels) to promote transformative leadership. c) Enactment of local government laws to regulate waste recovery and disposal to serve as a regulatory regime for the use of waste as a resource.

Source: The National Solid Waste Management Strategy, 2018



Source: The National Solid Waste Management Strategy

Figure 9-5 Ideal Waste Management System

(3) Organizational Structure for Solid Waste Management

The Vice President's Office is responsible for all aspects of environmental management including solid waste management in Tanzania, and local government authorities are responsible for implementing solid waste management.

In the Environmental Management Act, the committees and councils shown in Table 9-7 are listed as management organizations, and their roles are specified.

Table 9-7 Organizations related to Solid Waste Management

Institution	Role, Responsibilities and Demarcation on SWM
National Environmental Advisory Committee	The National Environmental Advisory Committee, an advisory entity to the minister, having its mandate derived from the Environmental Management Act 2004, including advising the Minister with restocking and limitation of stock, watering, grazing, DE pasturing and moving stock, make recommendation on degradation of the environment, review and advise on any environmental standards, guidelines and regulations, receive and deliberate reports from sector ministries on the protection and management of the environment. Key role is to perform environmental advisory services to the Minister.
Minister Responsible for Environment	Environmental minister articulates and issues general policy guidelines for promotion, protection, sustainable management. Key role gives general guidelines to sector ministries, Government Departments, the Council, National Environment Advisory Committee, City, Municipal or District Environmental Management Committee, agency or any other public or private institution necessary for the purposes of implementation of, or giving effect to the provisions of this Act.
Director of Environment	Director of Environment coordinates several environment management activities with other agencies, promotes the integration of environment considerations into development policies, plans, programmes, strategies, projects, undertakes strategic environmental risk assessment to ensure proper management and rational utilization of environmental resources on a sustainable basis for the improvement of the quality of human life. Key role is to advise the government on international environmental agreements, manage and assess environmental activities.
National Environment Management Council	Under this act NEMC undertakes enforcement, compliance, review, monitor the environmental impact assessment, facilitate public participation in environmental decision making, exercise general supervision. Key role is to coordinate matters relating to the environment assigned to the Council and submit a bi-annual report.
Sector Ministries	Coordinate, integrate, develop planning and Project implementation, collaborate with other institutions or agencies. Key role is to evaluate existing laws and proposed policies by ensuring compliance with various regulations, guidelines and procedures.
Regional Secretariat	Responsible for advising the local regional authorities on issues relating to the implementation and enforcement of the Act. Key role regional coordination on environmental management.
Local Government Authorities	Advise on the issues relating to environment, promote environmental awareness in the locality on the protection of the environment and conservation of natural resources, collect information on the environment and utilization of natural resources in the area, provide periodic reports on state of the local environment, monitor, review and approve Environmental impact assessments for local investments. Key role is to report to the Director of Environment and the Director General on the implementation of the Act.

Source: Environmental Management Act, 2004

9.1.4 Solid Waste Management Situation

(1) Solid Waste Management Situation in Tanzania

In the National Solid Waste Management Strategy, the Roles and Responsibilities of Key Stakeholders in Solid Waste Management are shown in Table 9-8.

Table 9-8 Roles and Responsibilities of Key Stakeholders in Solid Waste Management

Stakeholder	Roles / Responsibilities
Central Government	• Guidance to municipal council • Provision of resources (finance, equipment, etc.)
City Council	• Coordination of solid waste management • Management of solid waste final disposal • Awareness creation of solid waste management

Stakeholder	Roles / Responsibilities
Municipal Councils	• Primary responsibility for waste management • Refuse collection and night soil removal from households • Law enforcement
Private Sector/ Contractors	• Collect waste from their respective service areas as directed by the Municipal Council (as per contract)
Residents/Public	• Cooperate in the waste management programs and pay their refuse collection charges • Segregation of waste and keeping surroundings clean
Informal sector	• Collect and dispose wastes to the designated solid waste collection point • Sort recyclable materials and sell to recyclers

Source: Environmental Management Act, 2004

The National Bureau of Statistics report in 2015, stated that domestic waste management data was limited, and that difficulties remained in quantitatively measuring the amounts of waste generated and treated.
As for the National Solid Waste Management Strategy of 2018, although only Dar es Salaam was used in developing this Strategy, it was observed that waste challenges were similar in all other Municipalities thus suggesting that the systems introduced in the Strategy could be replicated in other councils countrywide.
The NSWM identified the national daily waste generation at more than 10,000 tons, and the daily waste discharge per person at 0.1 to 1.0 kg.

(2) Solid Waste Management in Dodoma Region

1) Implementation Agency of Solid Waste Management

The Dodoma Region consists of seven districts, and each district council under department of environment management implements waste management independently. The summary of waste management in each district is shown in Table 9-9.

Table 9-9 Summary of Solid Waste Management in each District

Items	Dodoma	Bahi	Chamwino	Chemba	Kondoa	Kongwa	Mpwapwa
Served population to the total population (Approx.)	90%	80%	70%	2%	30%	80%	70%
Generated waste amount	Approx. 412.0t/d	Approx. 0.6t/day	Approx. 1.0t/day	Almost 2.96t/day	Approx. 0.5t/day	Approx. 0.95t/day	Approx. 0.95t/day
Waste amount generated from household	0.5 kg/capita/day	N/A	N/A	3.7 kg/household/day	N/A	N/A	N/A
Flow of municipal wastes	Waste generators ↓ Bins and Skips ↓ Landfill	Waste generators ↓ Dumping area (unauthorized dump)	Waste generators ↓ Dumping area (unauthorized dump)	Waste generators ↓ Dumping area (unauthorized dump)	Waste generators ↓ Dumping area (unauthorized dump)	Waste generators ↓ Dumping area (unauthorized dump)	Waste generators ↓ Dumping area (unauthorized dump)
Data Collection	Data is recorded only at the Chidaya Sanitary Landfill weighbridge	There is no data collection system	There is no data collection system	There is no data collection system	There is no data collection system	There is no data collection system	There is no data collection system
Issues for proper MSWM	- Critical shortage of equipment/ facilities for temporary storage, transport to collection centers and specialized vehicles for transportation to the landfill i.e., street bins, hand carts, tri-cycles, tippers, skips etc. - Education among the population in households and commercial centers	Not properly managed due to lack of funds	Not properly managed due to lack of funds	- Low community awareness on proper solid waste management - Shortage of staff - Inadequate funds - Lack of working gear	Not properly managed due to lack of funds	Not properly managed due to lack of funds	Not properly managed due to lack of funds
Collection and Transportation	Public 60% Private 40%	Public 0% Private 100%	Public 0% Private 100%	Public 100% Private 0%	Public 0% Private 100%	Public 0% Private 100%	Public 0% Private 100%
Coverage rate of population	Approx. 80% of the total population	Approx. 20% of the total population	Approx. 40%	25% of the served population	Approx. 80%	Approx. 85%	Approx. 70%
Service fee	Service fee may be collected from some waste generators as per DCC 2013 by-laws. Only 50% of the fee is collected and it is not sufficient to cover expenditure	Waste generators pay the fee directly to the private local waste collector	Waste generators pay the fee directly to the private local waste collector	In Chemba town, small groups of youth are formulated and engage in solid waste collection from households and vendors whereby, household level contribute 500 Tsh/ bag while 1,000 Tsh/bag at vendor place. The respective fees are used to facilitate purchase of fuel and wages payment for workers.	Waste generators pay the fee directly to the private local waste collector	Waste generators pay the fee directly to the private local waste collector	Waste generators pay the fee directly to the private local waste collector
Collection vehicles	4 Dump trucks (16 m^3), 2 Dump trucks (10 m^3)	1 Pickup car (4 m^3)	1 Pickup car (2.5-3 m^3)	1 Lorry (4 m^3)	2 Lorries (7 m^3)	1 Lorry (4 m^3)	Pickup car (2.5 m^3)

Items	Dodoma	Bahi	Chamwino	Chemba	Kondoa	Kongwa	Mpwapwa
Collection frequency	1 time/day /vehicle x 7 times/week /vehicle	1 time/day /vehicle x 5 times/week /vehicle	3 times/day /vehicle x 2 times/week /vehicle	1 time/day /vehicle x 1 times/week /vehicle	3 times/day /vehicle x 7 times/week /vehicle	3 times/day /vehicle x 2 to 3 times/week /vehicle	2 times/day /vehicle x 2 times/week /vehicle
Intermediate Treatment and Recycling	No outsourcing agreements, but two private recycling companies were identified	None	None	None	None	None	None
Final Disposal	Chidaya sanitary landfill site	Open space used as dump site	Open space used as dump site	Open space used as dump site	Open space used as dump site	Open space used as dump site	Open space used as dump site
Clean-up campaign	Campaigns are conducted 3 times/month	No activity	No activity	There are cleaning campaigns on every last Saturday of the month	There are cleaning campaigns on every last Saturday of the month	There are cleaning campaigns on every last Saturday of the month	There are cleaning campaigns on every last Saturday of the month
Industrial waste	Industries (as waste generators) treat and manage their own wastes under the guidance of DCC Management	all local industries are responsible to deal with their own waste	all local industries are responsible to deal with their own waste	all waste that include industrial waste are deposited at proposed site and no further actions regarding treatment are taken	all local industries are responsible to deal with their own waste	all local industries are responsible to deal with their own waste	all local industries are responsible to deal with their own waste
Hazardous waste	waste generators treat and manage their own waste under the guidance of DCC Management	No appropriate treatment for hazardous waste, hazardous waste are treated at the site by producers	No proper treatment for hazardous waste	Only local community awareness on proper handling of hazardous waste is conducted, some pesticides, insecticide, fungicide and weedicides are being used by some local people	No appropriate treatment for hazardous waste, hazardous waste are treated at the site by producers	No proper treatment for hazardous waste	No proper treatment for hazardous waste
Medical waste	Medical facilities (as waste generators) treat and manage their own waste under the guidance of DCC Management, WHO and Ministry of Health guidance	Medical waste are incinerated by hospital incinerator	Medical waste are incinerated by an incinerator at the District health Centre	There are burning chambers used by health service provider facilities for medical waste treatment, even though, burning chambers are not recommended as final facility to be used to treat medical waste, but due to financial constraints, it is not easy to install and operate incinerators at health facilities.	Medical wastes are incinerated by hospital incinerator	Medical wastes are incinerated by an incinerator at the District health Centre	Medical wastes are incinerated by an incinerator at the District health Centre
Donors	Loan for landfill construction (provided by World Bank)	None	None	None	None	None	None

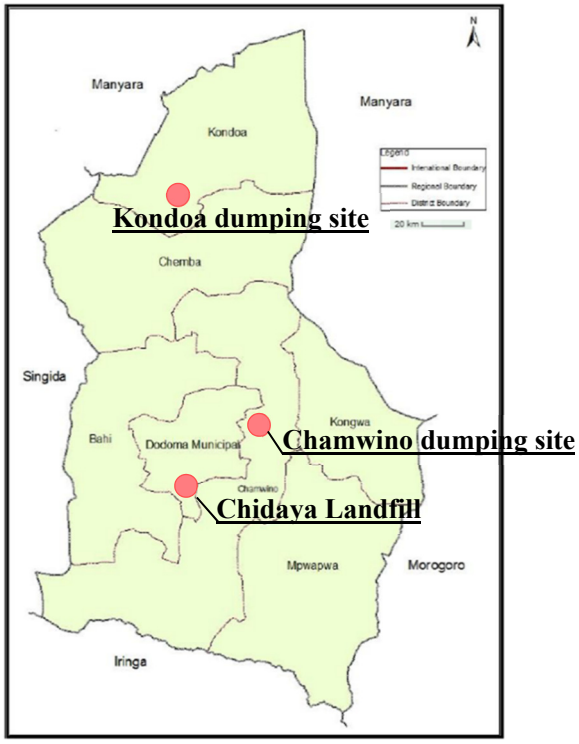
Source: Hearing by local consultant

Landfill sites and other SWM activities in the districts are shown below.

	
Sanitary landfill site in Dodoma district, Dodoma region	Open dumping area in Bahi district, Dodoma region
	
Open dumping area in Chamwino district, Dodoma region	Open dumping area in Chemba district, Dodoma region
	
Open dumping area in Kondoa district, Dodoma region	Open dumping area in Kongwa district, Dodoma region
	
Open dumping area in Mpwapwa district, Dodoma region	Recycling in Bahi district, Dodoma region

	
Pickup car in Chamwino district, Dodoma region	Medical waste incinerator of the District health Centre, in Chamwino district, Dodoma region

Source: photographs taken by local staff



Source: prepared by JICA Study Team with data from "Dodoma Region Basic Demographic and Socio-Economic Profile 2016"

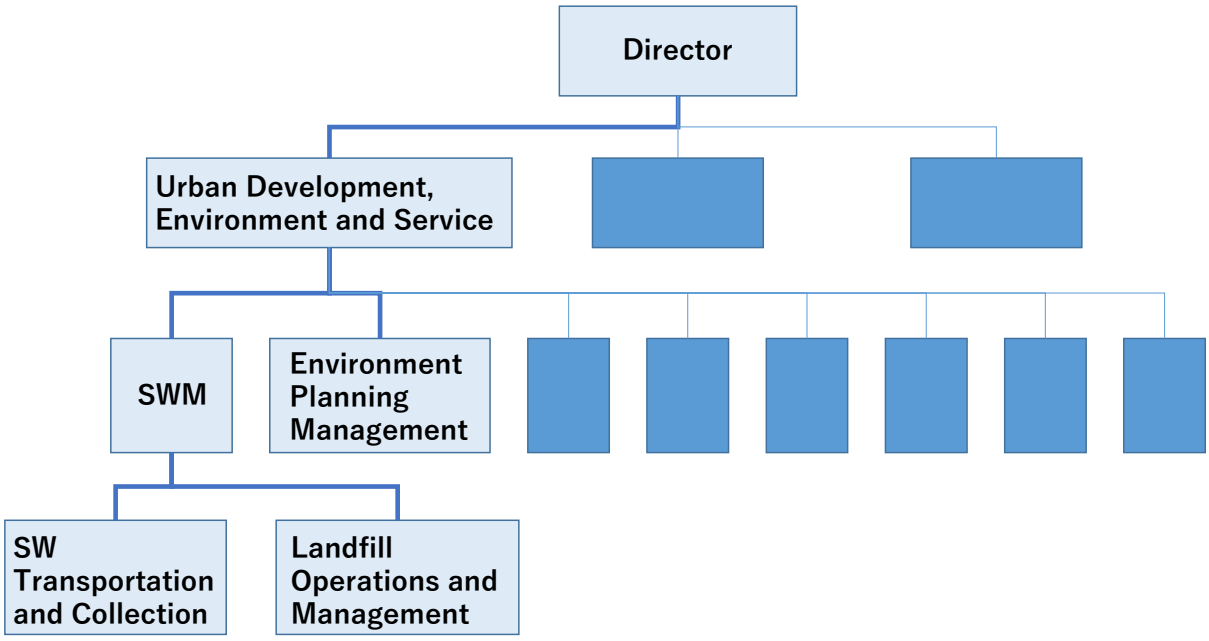
Figure 9-6 Location Map of Landfill Sites in Kondoa District, Chamwino District and Dodoma District

The following sections describe the situation in Dodoma district.

2) Organization for Solid Waste Management

Under the DCC Director, there are there are three departments, one of which is the Urban Development, Environment and Service department. This department has eight sections, of which 2 sections deal with Environmental management, i.e., SWM and Environment Planning Management. The SWM section has two

units, i.e., SW Transportation and Collection (City Hygiene Officer) and Landfill Operations and Management (Landfill Manager). Refer to organization chart below.



Source: Hearing by local consultant

Figure 9-7 Organizational Structure for Environmental Management

3) Finance for Solid Waste Management

The local governments are responsible for budgeting for SWM within their own available resources. The president's office does not budget for SWM in local governments. The local government takes financial responsibility for roles within their mandate which include; policy, regulation, licensing and capacity building. A part of the SWM Fee collection System (households, business entity, etc.) is shown in Table 9-10.

Table 9-10 SWM Fee collection System (households, business entity, etc.)

No.	Type	SWM Fee (Zone A)
1	Residential area per month per household	4,000 TZS
2	Tea Room per month	5,000 TZS
3	Cafe per month	10,000 TZS
5	Restaurant per month	15,000 TZS
6	Guest houses	10,000 TZS
10	Hotels per month	100,000 TZS
11	Hospital (Non-infectious waste) per month	30,000 TZS
33	Markets	
	- 4.5m^3	6,000 TZS
	- 6m^3	10,000 TZS
	- 10m^3	15,000 TZS
34	Street food vendors per month	6,000 TZS

Source: Hearing by local consultant

In 2018 and 2019, the budgets requested were 1.5 billion Tanzanian shillings for each year, while the actual

allocated budgets were 750 million Tanzanian shillings and 600 million Tanzanian shillings, respectively. Table 9-11shows the percentage of waste management expenditures in Dodoma district.

Table 9-11 Percentage of expenditure

Items	Rate
1. Segregation	0%
2. Collection and road sweeping	20%
3. Transportation	40%
4. Intermediate treatment	0%
5. Final disposal	40%

Source: Hearing by local consultant

4) Current Status of Collection and Transportation

Wastes discharged from households and markets are stored in containers in locations around the city, and from there trucks mount the containers on the truck bed and transport them to the final disposal site. The amount of waste collected is less than 50% of the waste generated.

Transportation of the waste from households to the container locations (primary collection) is done by community-based organizations using handcarts.

Primary collection

Skip bins placed on the streets

Skip bin in market area

Secondary collection

Source: photo by local staff

Some of the collection and transportation operations are outsourced to the private sector (Table 9-12).

Table 9-12 Demarcation of Public and Private waste collection

	Organization	Ratio	Number of wards
Public	Community Based Organization	50%	12 wards
Private	Large company – Green Waste Pro	40%	8 wards
	Medium companies - MoroGreen	10%	1 ward

Source: Hearing by local consultant

5) Current Status of Intermediate Treatment / Recycling

There is no information on intermediate treatment facilities or recycling plants for wastes in the municipality or the city as a whole, although there is some use for field burning and animal feed at the household level. Recyclable materials are recycled by private recyclers. Information on private recyclers in Dodoma district is shown in the following table.

Table 9-13 Information on Private Recyclers

Name of facility	Tull Plastics Ltd	VASE General Investment Ltd
Location of facility	Kizota Industrial Area	Kizota Industrial Area
Year of Establishment	2010	2013
Target waste	Plastics	Plastics
Method of treatment	Shredder	Shredder
Details of Facility / equipment	Shredder machine	Shredder machine
Capacity (ton/day)	3 ton/day	3 to 5 ton/day
Working hours and days	9 hours/day×6 days/week	9 hours/day×4 days/week
Summary of service	Plastic waste is collected from the generation areas to the treatment site, crushed into the desired size for recycling, then transported to the recycling industries.	Plastic waste is collected from the generation areas to the treatment site, crushed into the desired small size for recycling, then transported to the recycling industries.

Source: Hearing by local consultant

6) Current Status of Landfill Site

There are several dumping sites managed by each district in Dodoma region. Among these sites, only Chidaya Landfill, which is managed by Dodoma district, is implementing sanitary landfilling. The summary of Chidaya Landfill site is shown in Table 9-14.

Table 9-14 Outline of Chidaya Landfill Site in Dodoma District

Item	Contents
Name	Chidaya Landfill
Construction period	From 2016 to 2018 (start of operation: 2017)
Target waste	General waste (plastics, paper, metal, grass)
Type of final disposal	Sanitary landfill
Heavy Equipment	Bulldozer, compactor, excavator, bull loader, 2 tippers
Facilities	Lab for monitoring, leachate ponds where leachate is collected and urban afforestation
Area	Site area: Approx. 45 hectares, Dumping area: Approx. 20 hectares
Remaining capacity	Landfill contains 2 large cells which each contain 3 sub-unit cells. 2 of the sub-unit cells of the first cell have already been completely filled with waste in the last 5 years. Due to the increase in population the landfill is expected to be completely full after 10 years and not 25 years as it was originally expected.
Incoming waste amount	180 ton/day
Working hours and days	9 hours/day × 7 days/week

Item	Contents
Disposal fee	TSh 10 /kg
Construction cost	TSh 7.8 billion
Operational cost	TSh 766,500,000 /year
Waste pickers	There are approximately 60 waste pickers, approximately 30 of them work in one shift. The waste pickers are not under the control of the government.

Weighbridge (center of photo)

Cell before use

Cell after landfilling

Leachate collection system

Source: photo by local staff

9.1.5 Medical Waste Management and Impact related to COVID-19

According to Johns Hopkins University, the accumulated number of COVID-19 infections in Tanzania is 33,230 (as of February 7, 2022), which is the 155th highest among 225 countries and territories that have confirmed COVID-19 infections. Considering that Tanzania ranks 25th out of 193 countries in terms of population, the number of people infected with COVID-19 is relatively low. In addition, although there have been closures of educational institutions in Tanzania, no lockdown policies have been implemented.

Under such circumstances, there has been no change in the amount of medical waste discharged from hospitals, no infection of medical waste treatment workers with COVID-19, and no significant impact on waste management administration.

9.2 Solid Waste Management in the Federal Republic of Nigeria

For the Federal Republic of Nigeria (hereinafter referred to as "Nigeria"), this Study conducted a remote survey utilizing local consultants; Ms. Abieyuwa Lgbinoghene, Ms. Kate Okhihie and Ms. Coletta Osumade. The results of the survey are presented in this section.

9.2.1 Natural Conditions

(1) Topography

Nigeria faces the Gulf of Guinea in West Africa, has a land area of 923,768 km^2 (of which 910,768 km^2 is land), and is bordered by four countries: Benin, Niger, Chad, and Cameroon, as shown in Figure 9-8. Nigeria has a federal system of government, consisting of 36 states and the Federal Capital Territory. The states are further divided into 774 local government areas.

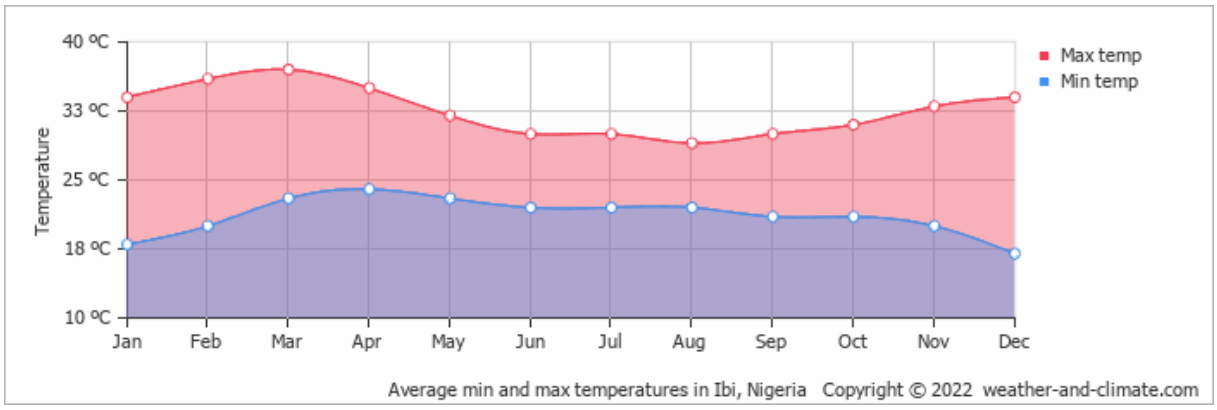
Source: prepared by JICA Study Team according to Wikipedia

Figure 9-8 Administrative Area in Nigeria

The coastal areas of southern Nigeria are the lowest in the country, at 0 m above sea level. Except for the Jos Plateau in the center and the Adamawa Plateau on the eastern border, Nigeria is flat and does not rise 500 m above sea level. The Niger River, a major river, flows through the center of the country from north to south, forming a huge delta at its mouth. The highest point in the country is Mt. Chappal Waddi (2,419 m) near the eastern border. The average elevation of the country is 380 meters.

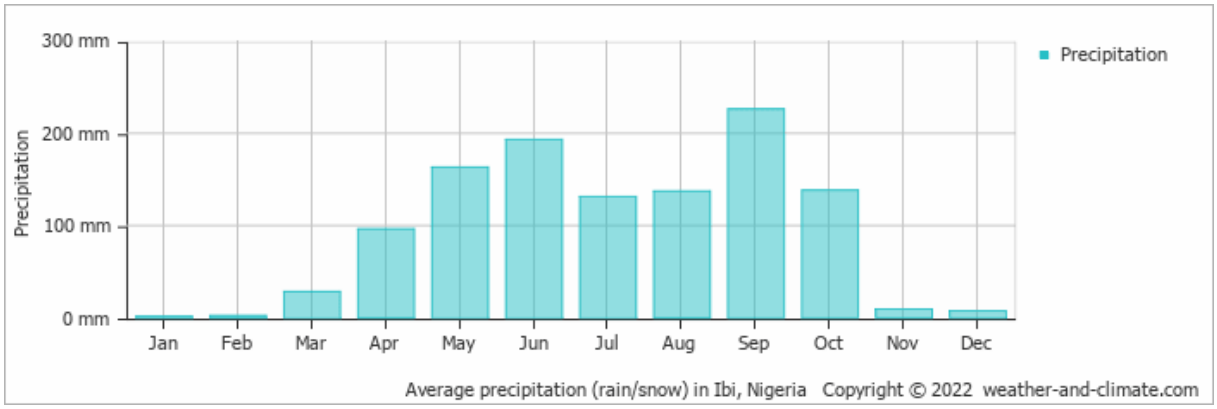
(2) Meteorological Conditions

According to the Köppen climate classification, Nigeria basically belongs to the savanna climate (Aw), while parts of the southern coastline are distributed in the tropical monsoon climate (Am). In the savanna climate (Aw), the rainy and dry seasons can be clearly identified, and the vegetation is characterized by tropical grasslands with sparse growth of drought-resistant trees (called savanna). Abuja belongs to the savannah climate (Aw). The following figures of temperature (Figure 9-9) and precipitation (Figure 9-10) show that the temperature is high throughout the year, while precipitation is clearly low in some periods (November to March).



Source: https://weather-and-climate.com/average-monthly-Rainfall-Temperature-Sunshine,abuja,Nigeria

Figure 9-9 Annual Temperature in Abuja



Source: https://weather-and-climate.com/average-monthly-Rainfall-Temperature-Sunshine, Abuja, Nigeria

Figure 9-10 Annual Precipitation in Abuja

9.2.2 Social and Economic Situation

(1) Population

The population trends in Nigeria as a whole (2014 - 2020) are shown in Table 9-15. Table 9-15 also indicates that the population growth rate for the target year in Nigeria is approximately 2.57-2.68%. In addition, as mentioned in section 9.1.1, the land area of Nigeria[36] is 910,768 km^2, and the population density is calculated to be approximately 226 persons/km^2 (in 2020). Compared to Japan's population density (335 persons/km^2 as of 2020), this is not a high value.

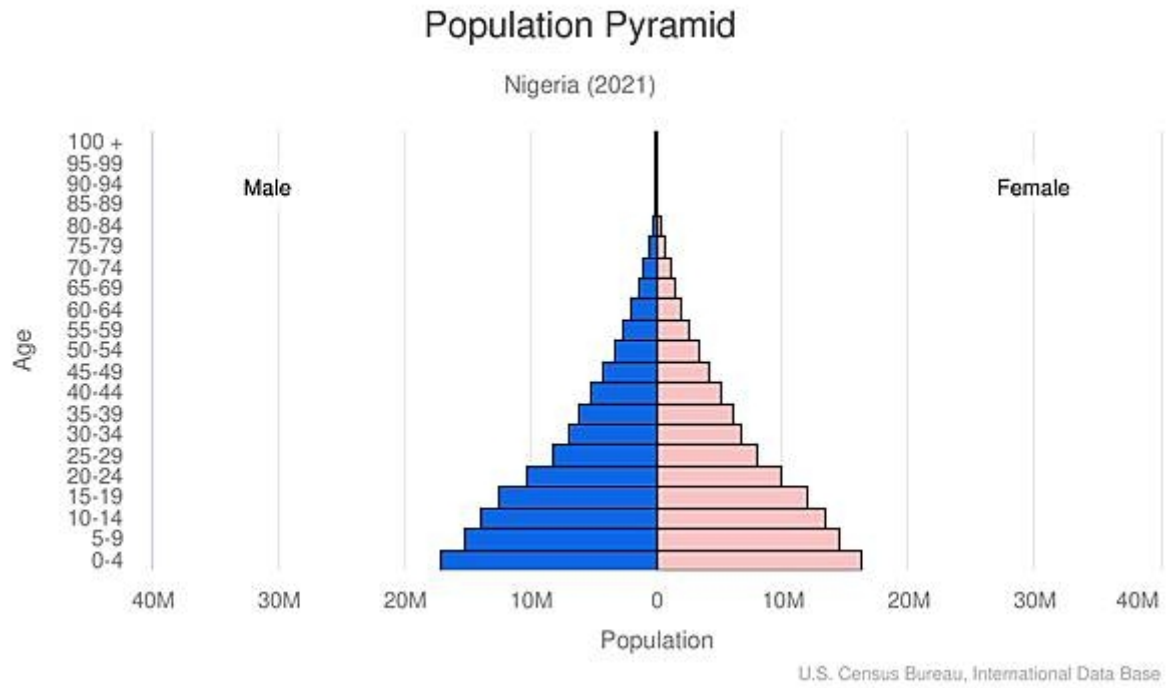
Table 9-15 Population Trends in Nigeria

Year	2014	2015	2016	2017	2018	2019	2020
Population (person)	176,404,931	181,137,454	185,960,244	190,873,247	195,874,685	200,963,603	206,139,587

Source: World Bank

[36] CIA The World Factbook

Figure 9-11 shows the population pyramid of Nigeria, which is "pyramidal" in shape, indicating that the population is in a state of high birth and death rates (a stage of population explosion).



Source: CIA, "The World Factbook"

Figure 9-11 Population Pyramid in Nigeria

Abuja, the capital of Nigeria, consists of 14 districts. Table 9-16 shows the projected population of Abuja from 2014 to 2020. The table also shows the population growth rate calculated from the population.

Table 9-16 Projected Population and Population Growth Rate in Abuja

Year	2014	2015	2016	2017	2018	2019	2020
Projected population (person)	2,300,736	2,441,691	2,750,037	2,918,518	2,918,518	3,095,118	3,277,740
Population growth rate (%)	-	6.13	12.63	6.13	0.00	6.05	5.90

Source: https://worldpopulationreview.com/world-cities/abuja-population

Table 9-15 and Table 9-16 show that Abuja has a population concentration of approximately 1.6% of the total population in Nigeria (2020).

(2) Economic Situation

The main economic indicators for Nigeria are shown in Table 9-17.

Table 9-17 Main Economic Indicators for Nigeria

Indicator	Year 2018	Year 2018	Year 2018
GDP growth rate (real)	1.92 (%)	2.21 (%)	Negative 1.79 (%)
Total GDP (nominal)	421.7 (billion USD)	448.1 (billion USD)	429.4 (billion USD)
GDP per capita (nominal)	2,153 (USD)	2,230 (USD)	2,083 (USD)
Consumer price inflation (average for the period)	12.09 (%)	11.40 (%)	N/A
Exports (FOB prices)	66,999 (million USD)	67,800 (million USD)	45,764 (million USD)
Imports (FOB prices)	42,175 (million USD)	46,204 (million USD)	41,084 (million USD)
Current account balance (balance of payments basis)	6,261 (million USD)	Negative 14,627 (million USD)	Negative 16,976 (million USD)
Trade balance (balance of payments basis)	20,467 (million USD)	2,868 (million USD)	Negative 16,402 (million USD)

Source: JETRO, "Nigeria Country Profile and Basic Statistics" (as of August 31, 2021)

The main industries in Nigeria are agriculture, crude oil, and natural gas. Nigeria's main exports are mineral fuels, ships, and oilseeds, while its main imports are machinery, mineral fuels, and vehicles.

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

(1) Laws and Regulations related to Solid Waste Management

Currently, the National Environmental Standards and Regulations Enforcement Agency (hereinafter referred to as "NESREA") in Nigeria has established several regulations related to the environment, as follows.

- National Environmental (Wetlands, River Banks and Lake Shores) Regulations (2009)
- National Environmental (Watershed, Mountainous, Hilly and Catchments Areas) Regulations (2009)
- National Environmental **(Sanitation and Wastes Control) Regulations (2009)**
- National Environmental (Permitting and Licensing System) Regulations (2009)
- National Environmental (Access to Genetic Resources and Benefit Sharing) Regulations (2009)
- National Environmental (Mining and Processing of Coal, Ores and Industrial Minerals) Regulations (2009)
- National Environmental (Ozone Layer Protection) Regulations (2009)
- National Environmental (Food, Beverages and Tobacco Sector) Regulations (2009)
- National Environmental (Textile, Wearing Apparel, Leather and Footwear Industry) Regulations (2009)
- National Environmental (Noise Standards and Control) Regulations (2009)
- National Environmental (Chemicals, Pharmaceuticals, Soap and Detergent Manufacturing Industries) Regulations (2009)
- National Environmental (Standards for Telecommunications/Broadcasting Facilities) Regulations (2011)
- National Environmental (Soil Erosion and Flood Control) Regulations (2011)
- National Environmental (Desertification Control and Drought Mitigation) Regulations (2011)
- National Environmental (Base Metals, Iron and Steel Manufacturing/**Recycling Industries**) Regulations (2011)
- National Environmental (Control of Bush/Forest Fire and Open Burning) Regulations (2011)
- National Environmental (Protection of Endangered Species in International Trade) Regulations (2011)
- National Environmental (Domestic and Industrial Plastic, Rubber and Foam Sector) Regulations (2011)
- National Environmental (Coastal and Marine Area Protection) Regulations (2011)
- National Environmental (Construction Sector) Regulations (2011)
- National Environmental (Control of Vehicular Emissions from Petrol and Diesel Engines) Regulations (2011)
- National Environmental (Non-Metallic Minerals Manufacturing Industries Sector) Regulations (2011)
- National Environmental (Surface and Groundwater Quality Control) Regulations (2011)
- National Environmental (Electrical/Electronic Sector) Regulations (2011)
- National Environmental (Hazardous Chemicals and Pesticides) Regulations (2014)

- National Environmental (Energy Sector) Regulations (2014)
- National Environmental (Air Quality Control) Regulations (2014)
- National Environmental (Dam and Reservoirs) Regulations (2014)

Among the above regulations, "the National Environmental (Sanitation and Wastes Control) Regulations, 2009", are the regulations related to waste management. In addition to the above, there are descriptions related to the environment in the Constitution and ordinances. Table 9-18 summarizes the laws and regulations related to the waste and environment.

Table 9-18 Laws and Regulations related to Solid Waste and Environment in Nigeria

Laws and regulations	Description of waste management and environment
Harmful (Toxic) Waste Criminal Provision Decree 42, 1988	This Act prohibits the carrying, depositing and dumping of harmful waste on any land and territorial waters in Nigeria. It also regulates and prohibits activities related to hazardous waste.
The National Environmental Protection (Management of Solid and Hazardous Waste) Regulations, 1991	This law stipulates the collection, treatment and disposal of solid and hazardous wastes generated in the city and by industry.
Constitution of the Federal Republic of Nigeria, 1999	In relation to the environment, the Constitution provides in Article 20 that "The National Government shall protect and improve the environment and conserve the water, air, land, forests and wildlife of Nigeria."
National Environmental (Sanitation and Wastes Control) Regulations, 2009	This regulation consists of seven chapters and 18 annexes. The main outlines of waste management are as follows. ● Chapter 1: Defines the scope and object of application. The purpose of this regulation is adoption of sustainable and environmentally friendly practices in sanitation and waste management in order to minimize pollution. This regulation applies to issues related to environmental hygiene, in particular food, market and industrial hygiene, and to all types of waste generated therefrom, in particular household wastes, end-of-life products, hazardous wastes, health care wastes, industrial wastes, radioactive wastes, leaf and yard wastes, solid wastes, and used packaging containers. ● Chapter 2: Defines general cleanliness, responsibilities of owners and occupants of buildings and properties, obligations of citizens, extended producer responsibility, polluter-pays principle, and pesticides or chemicals prohibited for use in domestic fumigation. ● Chapter 3: Provides details on the management of solid waste, wastewater, and hazardous and medical wastes. And it stipulates that the Agency will ensure that the National Environmental Sanitation Policy and Guidelines of 2005 are implemented at all levels of government ● Chapter 5: Provides for efficient implementation of laws and regulations through public-private partnerships (hereinafter referred to as "PPP"), promotion of stakeholder participation, etc. ● Chapter 6: As part of the Strategic Alliance Programme of environmental sanitation and waste management agencies, all state and local governments are required to align their programmes with those of the central government.
The National Health Care Waste Management Guideline (NHCWMG, 2013),	● Medical waste is defined as any waste generated by human and animal health care facilities (including research and testing facilities). Waste from home health care is also considered medical waste. ● This guideline classifies medical waste into (1) non-hazardous medical waste (general waste), (2) hazardous medical waste (infectious waste, pathological waste, chemical waste, pharmacological waste, mercury waste), and (3) ultrahazardous medical waste (sharp knives and other super-infectious waste). It further recommends that waste should be separated into four types of containers for each characteristic: black, yellow, red, and brown containers.

Laws and regulations	Description of waste management and environment
The National Environmental (Health care Waste Control) Regulation 2016	● Chapter 1 (Purpose and Scope): Six objectives are listed, including "promotion and protection of physically and socially healthy living" and "prevention of health hazards caused by environmental pollution. ● Chapter 2 (Facility Sanitation): Facility owners are required to obtain a certificate of fitness for continued habitation or certificate of fitness for continued use from the Environmental Health Officer. ● Chapter 3 (Collection and Disposal of Waste): stipulates that waste collectors must obtain a license (3 years) and transport to a designated location (landfill, etc.). It also stipulates that waste collectors must register their collection vehicles and collect waste collection fees. ● Chapter 4 (Food Hygiene): stipulates items to be complied with by facilities that handle food products. ● Chapter 5 (Sanitation in Meat Centers): specifies items to be complied with by facilities that handle meat. ● Chapter 6 (Recreational Facilities and Workplace Sanitation): Establishments are subject to inspection by an Environmental Health Officer, and so on. ● Chapter 7 (Sanitation for Pest Control): Specifies items that must be complied with by facilities that handle meat. ● Chapter 8 (Other Environmental Pollution Facilities): stipulates monitoring of exhaust gas at factories and other facilities, noise regulations (80 decibels or less), etc. It also stipulates that the management of radioactive waste, etc. should follow the guidelines. ● Chapter 9 (Cleaning Services): stipulates that cleaning service providers must obtain a license annually, etc. It also stipulates that cleaning workers must wear protective equipment during work in accordance with guidelines. ● Chapter 10 (General Provisions): General provisions including "reporting to the Environmental Health Authority if waste is disposed of in an undesignated area", "placing the obtained license in a visible place", and so on. ● Chapter 11 (Miscellaneous): defines the terms used in this regulation.

Source: The Project for Integrated Solid Waste Management System in Federal Capital Territory in the Federal Republic of Nigeria (JICA, 2014), Project Monitoring Sheet (The Project for Integrated Solid Waste Management System in Federal Capital Territory in Federal Republic of Nigeria, 2015), Constitution of the Federal Republic of Nigeria, 1999, The National Environmental (Health care Waste Control) Regulation 2016

(2) Policies and Plans related to Solid Waste Management

In Nigeria, "the National Policy on Solid Waste Management, 2020" has been established as a strategy specifically for waste management. Other environmental policies also include references to waste. Plans related to waste management and the environment are shown in Table 9-19. According to the interview survey, there are policies and plans related to waste management in Nigeria, but they have not been implemented in practice. It has been pointed out that one of the main reasons for this is the lack of awareness among residents.

Table 9-19 Plans Related to Waste Management and Environment in Nigeria

Plan	Description of Solid Waste Management
National Environmental Sanitation Policy 2005	It defines waste management as one of the key areas of environmental sanitation and establishes the following policy on waste management. • <u>Objective</u> Ensure the quality of an economical, sustainable, and healthy environment, and improve and protect public health and welfare through efficient and sanitary waste management practices. • <u>Goals</u> ➢ Develop policy guidelines for efficient and sustainable waste management in Nigeria ➢ Promote a healthy environment by ensuring sanitary waste management

Plan	Description of Solid Waste Management
	➢ Reduce waste generation and promote source separation, reuse, recycling and energy recovery ➢ Safe and nuisance-free generation of household, medical, and industrial waste in urban and suburban areas to protect public sanitation during and after the collection, transportation, treatment, and final disposal of waste. ➢ Promote effective stakeholder participation in waste management ➢ Reduce poverty by generating employment opportunities and improving living standards ➢ Optimize labor and equipment for waste management and increase productivity ➢ Support cost recovery of investments in waste management to ensure project expansion and sustainability ➢ Develop an institutional framework to ensure an efficient waste management system ➢ Develop and maintain a waste management system based on the physical and socio-cultural characteristics of the community ➢ Maintain affordable, adequate and regular waste management services • <u>Strategy</u> ➢ Promote waste reduction at the household and community level through reduction at source, reuse, recycling and resource recovery ➢ Develop and promote appropriate technologies for the recycling of waste items such as bottles, glass, metals, paper, plastics and organics ➢ Encourage the development of small-scale recycling facilities at the household and community level as places to collect and dispose of recyclables ➢ Develop technical capacity in the area of waste management in the public and private sectors ➢ Conduct surveys to determine unit waste amounts and establish a waste management database. ➢ Establish rules, penalties, and enforcement mechanisms for waste management from source to landfill. ➢ Develop a waste management master plan as a blueprint for effective national-level waste management ➢ Establish practical and sustainable financial mechanisms ➢ Raise public awareness on efficient waste management practices ➢ Ensure effective monitoring and evaluation of waste management systems ➢ Set sanitary standards for manual sorting of waste at the household and community level. The policy also proposes the establishment of a Technical Committee on Environmental Sanitation at the national, state, and municipal levels. The national-level committee will be responsible for compiling a strategy for implementation of the national policy, monitoring and evaluating activities, and periodically reviewing policies and guidelines.
National Policy on Environment (Revised in 2016)	This policy is a revised version of the Environmental Policy established in 1991 (revised once in 1999). The policy covers general environmental issues including air quality, etc., and also includes the following policies related to waste management. • Enforce the implementation of the Hazardous Waste Act (2004) and other national laws and regulations related to waste management • Establish facility standards for the disposal of waste in residences, apartment complexes, and public facilities. • Regulate, register, and permit all major waste-related facilities and systems. • Determine the use of environmentally safe and technically sound techniques for the disposal of hazardous and radioactive wastes. • Reduce the generation of hazardous, radioactive, and other wastes. • Achieve sustainable waste management and landscape maintenance. • Enact laws pertaining to the banning of plastic bags. • Increase the scale of waste management pilot projects in each region. • Secure funding for PPP waste management facilities in selected urban areas. • Promote and support “waste to wealth” initiatives at all levels.

Plan	Description of Solid Waste Management
	• Strengthen the capacity of the National Oil Spill Detection and Response Agency (NOSDRA) to effectively treat oily wastes.
National Policy on Solid Waste management, 2020	The policy states that solid waste must be used as a resource to promote economic growth and managed to improve human health and environmental quality. The policy identifies the following items as priorities ● Protect the environment ● Protect public sanitation ● Strengthen the institutional arrangements and capacity of federal, state, and local governments to effectively handle domestic waste management ● Foster an environment that encourages investment and PPPs in the domestic waste management sector ● Facilitate waste-to-wealth schemes, thereby contributing to increased gross domestic product ● Increase resource efficiency and encourage zero waste ● Educate stakeholders on effective and safe solid waste management ● Develop national standards for waste reduction and energy recovery, and promote recycling and reuse processes in the manufacturing process, including the introduction of appropriate technology options ● Foster a sustainable environmental attitude and culture ● Assist local governments in developing the capacity to enact ordinances to improve sanitation ● Develop a database that will serve as the foundation for policy decisions based on objective data for sustainable solid waste management. ● Develop a platform for developing strategies to reduce greenhouse gas emissions generated by landfill disposal and other processes. ● Fulfill national obligations to international protocols, agreements, and treaties

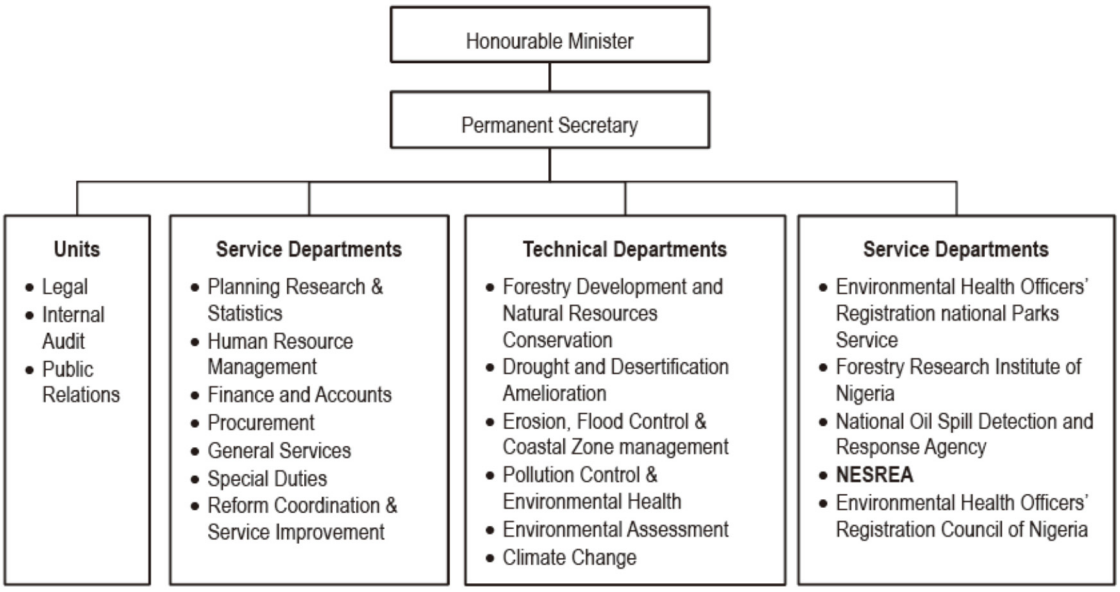
Source: The Project for Integrated Solid Waste Management System in Federal Capital Territory in the Federal Republic of Nigeria (JICA, 2014), Project Monitoring Sheet (The Project for Integrated Solid Waste Management System in Federal Capital Territory in Federal Republic of Nigeria, 2015), National Policy on Environment (Revised in 2016), National Policy on Solid Waste management, 2020

(3) Organizational Structure for Solid Waste Management

Nigeria consists of 36 states and the Abuja Federal Capital Territory (hereinafter referred to as "FCT"), with a total of 774 local governments nationwide. The Federal Ministry of Environment (hereinafter referred to as "FMoE") and the National Environmental Standards and Regulations Enforcement Agency (hereinafter referred to as "NESREA") are responsible for waste management at the national level. Local governments are responsible for waste management, and state governments provide necessary technical, financial, and logistical support to local governments.

1) Federal Ministry of Environment (FMoE)

FMoE is the central ministry responsible for all aspects of the environment, including waste management. Table 9-19 shows the organizational structure of FMoE.



Source: The Project for Integrated Solid Waste Management System in Federal Capital Territory in the Federal Republic of Nigeria (JICA, 2014)

Figure 9-12 Organizational Structure of FMoE

2) National Environmental Standards and Regulations Enforcement Agency (NESREA)

NESREA is the agency responsible for the enforcement of environmental standards, regulations, and guidelines. It is also the agency responsible for environmental protection and development, biodiversity conservation, sustainable development of the country's natural resources in general, and environmental technology, including coordination and collaboration with national and international stakeholders. The specific roles of NESREA are as follows

- Ensure compliance with environmental laws, guidelines, policies, and standards
- Coordinate and contact with national and international stakeholders regarding environmental standards, regulations, and enforcement.
- Ensure compliance with the provisions of international agreements, conventions, treaties, and other environmental agreements in effect from time to time regarding climate change, biodiversity conservation, desertification, forestry, oil and gas, chemicals, hazardous waste, ozone depletion, marine and wildlife, pollution, sanitation, etc.
- Promote compliance with policies, standards, laws, and guidelines related to water quality, environmental sanitation, and pollution prevention.
- Enforce compliance with guidelines and laws regarding sustainable management of ecosystems, conservation of biodiversity, and exploitation of the country's natural resources.
- Enforce compliance with laws regarding sound chemical management, safe use of pesticides, and disposal of used packages.
- Enforce compliance with regulations regarding the import, export, production, distribution, storage, sale, use, handling, and disposal of hazardous chemicals and waste except in the oil and gas sector.

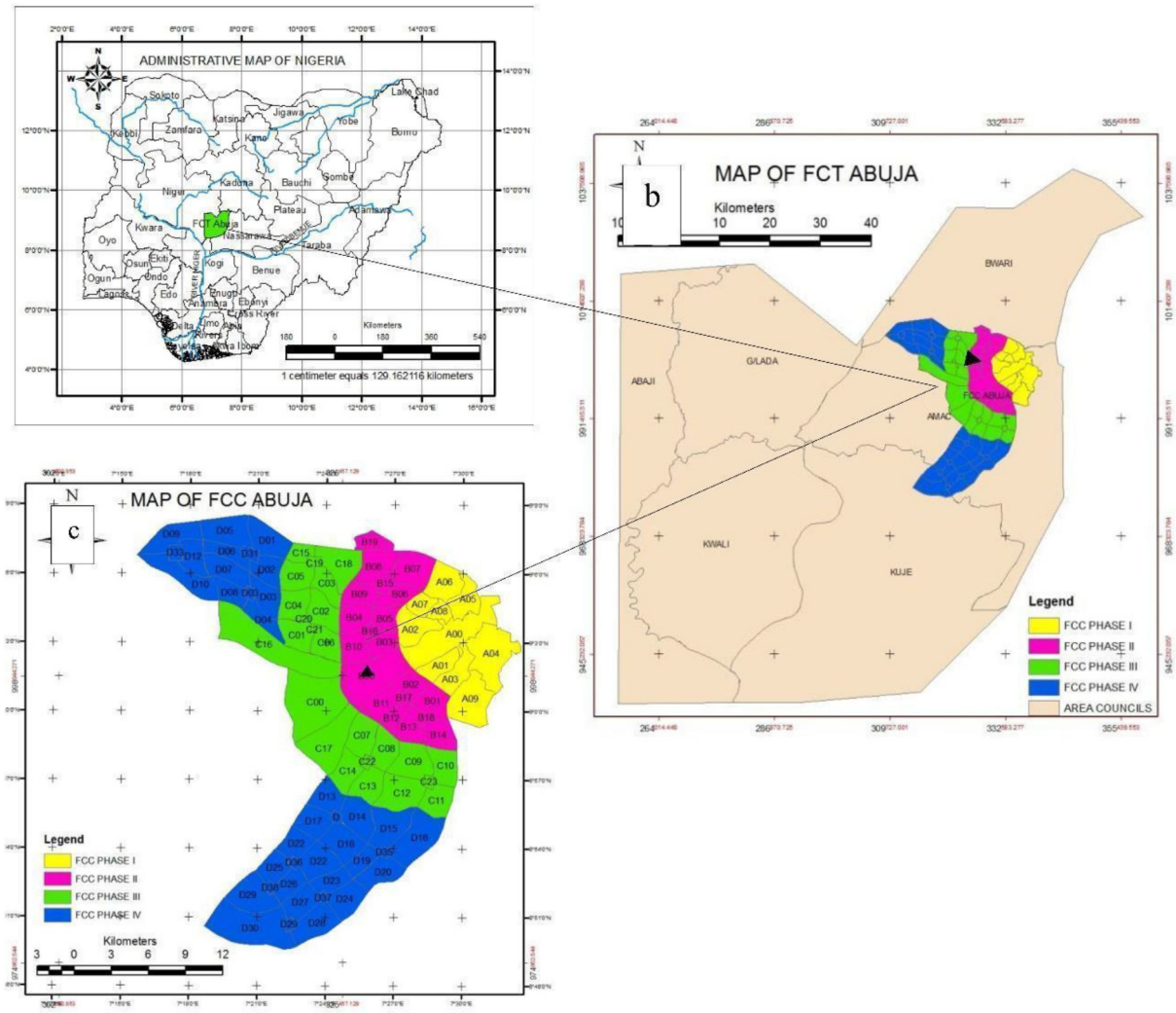
- Monitor compliance with environmental regulations and standards for noise, air, land, sea, ocean, and other bodies of water.
- Ensure that environmental projects funded by donor agencies and external support agencies comply with environmental safety and protection regulations.
- Enforce environmental management measures through registration, licensing, and permitting systems (except in the oil and gas sector).
- Conduct environmental audits and establish a data bank on regulatory and enforcement mechanisms for environmental standards except in the oil and gas sector.
- Raise public awareness and provide environmental education on sustainable environmental management, promote compliance with environmental regulations in the private sector excluding the oil and gas sector, and publish data and other information as a result of the performance of its duties.
- Conduct any activities necessary to carry out its duties.

NESREA also consists of the following departments

- Inspection & Enforcement (I&E) Department: monitors existing environmental laws and regulations for companies and factories.
- Planning and Policy Analysis (PPA) Department
- Environmental Quality Control (EQC) Department
- Partnership & Education (P&E) Department
- Special Duties (SD) Department
- Administration and Finance (A&F) Department
- Legal Department

9.2.4 Solid Waste Management Situation in Abuja

FCT was established in 1976 and consists of six Area Councils (hereinafter referred to as "ACs") ((1) Kuje AC, (2) Kwali AC, (3) Gwagwalada AC, (4) Bwari AC, (5) Abuja Municipal AC, and (6) Abaji AC), as shown in Figure 9-13. Abuja Federal Capital City (hereinafter referred to as "FCC") is part of Abuja Municipal AC and is divided into four Phases according to its development plan. Phase 1 consists of a central business district and four residential districts. In addition, there are satellite towns in AC as core cities.

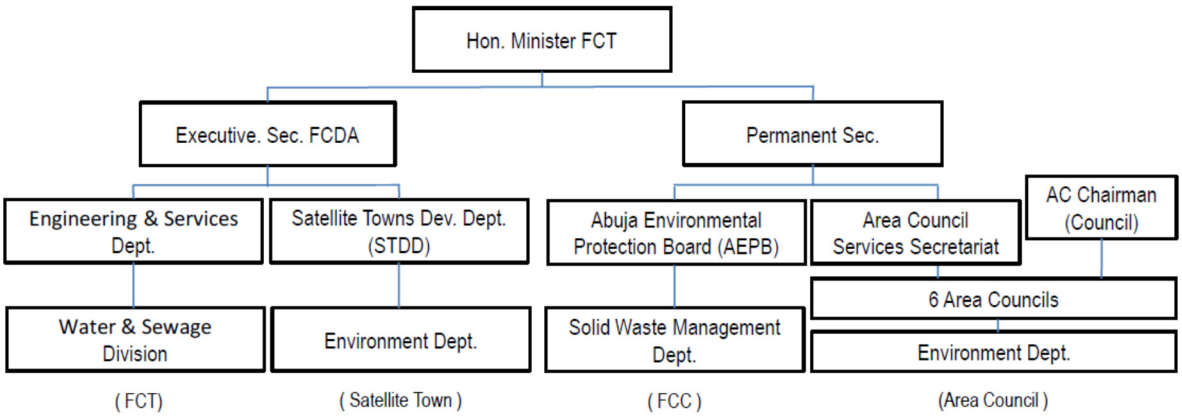


Source: JICA, "Data collection survey for the feasibility study for an IT enabled recycling ecosystem in the federal capital territory, Abuja" (January 2021)

Figure 9-13 Compositions and Boundaries of FCT and FCC

(1) Organizations for Solid Waste Management

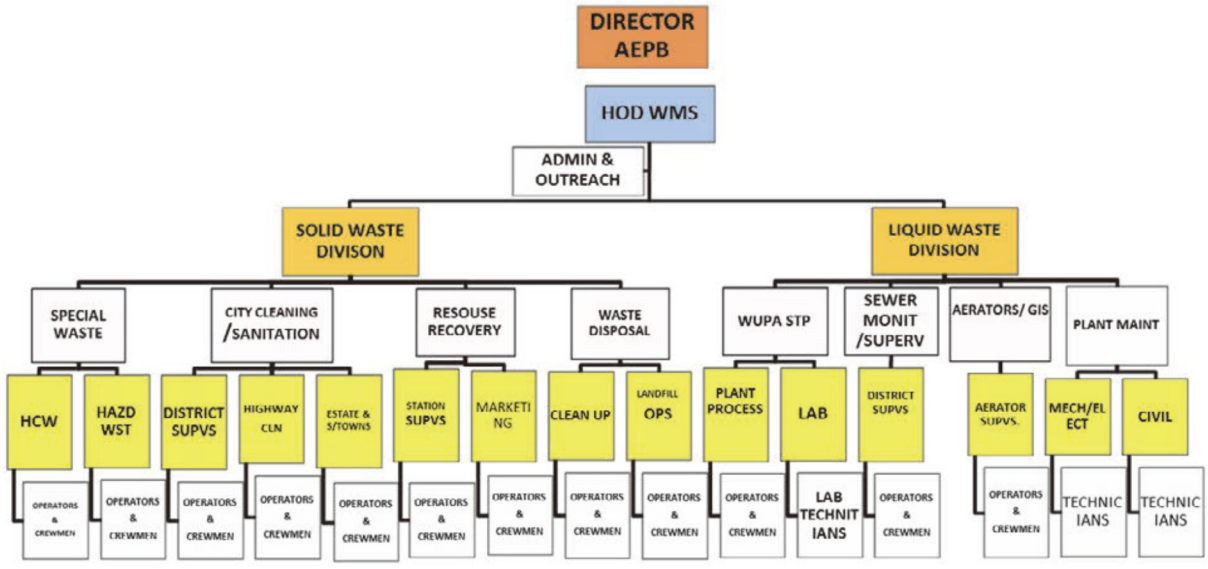
The administration of FCT is carried out by the Federal Capital Territory Administration (hereinafter referred to as "FCTA"), headed by the Minister of FCT (equivalent to the governor in state government). The organizational structure for waste management in FCT is shown in Figure 9-14.



Source: JICA, "Data collection survey for revision of urban development master plan in Abuja of the Federal Republic of Nigeria" (March 2019)

Figure 9-14 Organizational Structure for Waste Management in FCT

Abuja Environmental Protection Board (hereinafter referred to as "AEPB") is responsible for solid waste management within the FCC, Satellite Towns Development Department (hereinafter referred to as "STDD") is in charge of waste management in satellite towns, and the ACs are in charge of solid waste management in the six ACs. For municipal solid waste (hereinafter referred to as "MSW") generated in FCC, the waste generators themselves purchase several types of waste bins sold by AEPB, and private waste collectors and AEPB collects them individually. The organizational structure of AEPB is shown in Figure 9-15.



Source: Final report of the study on detailed plan for the project for Integrated Solid Waste Management in Federal Capital Territory in the Federal Republic of Nigeria

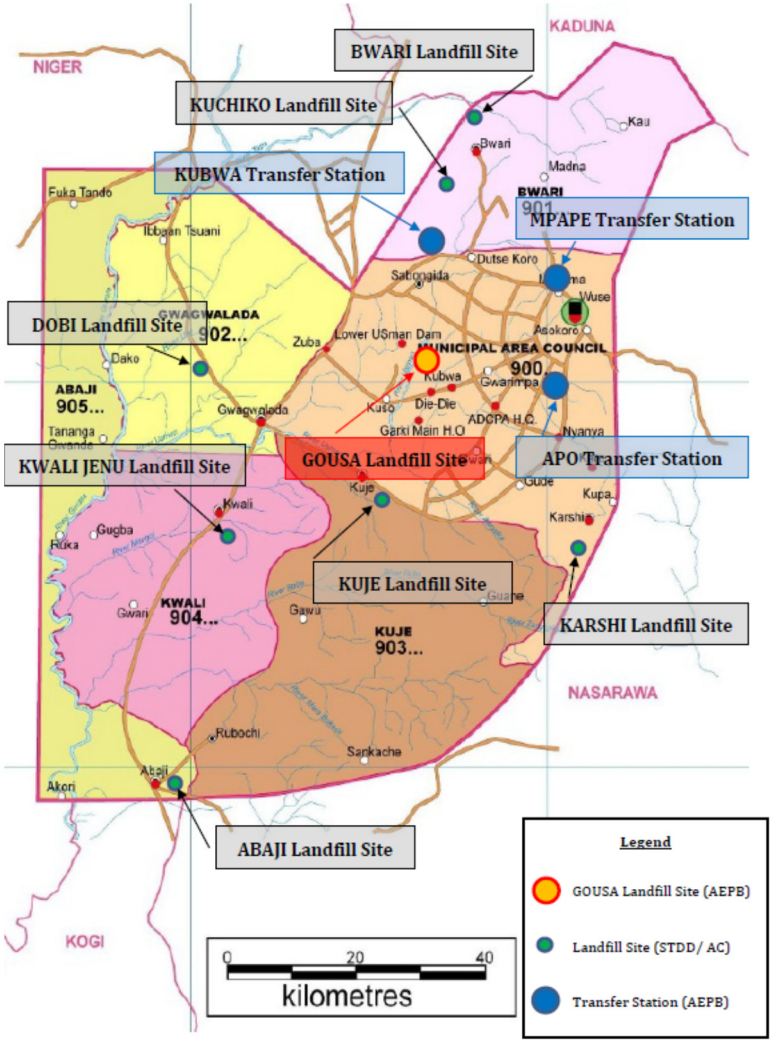
Figure 9-15 Organizational Structure of AEPB

The FCTA disburses 8 billion NGN to waste management contractors (64 companies) for providing waste management services in FCC and satellite towns. Of the 8 billion NGN, it is roughly estimated that

approximately 6 billion NGN is distributed to AEPB and 2 billion NGN to STDD.[37]

(2) Overview of Solid Waste Management

The locations of solid waste management transfer stations and landfill sites in FCT are shown in Figure 9-16. The Gousa landfill, where waste from FCC is disposed, is located within FCC. There are also several landfills in ACs and satellite towns.

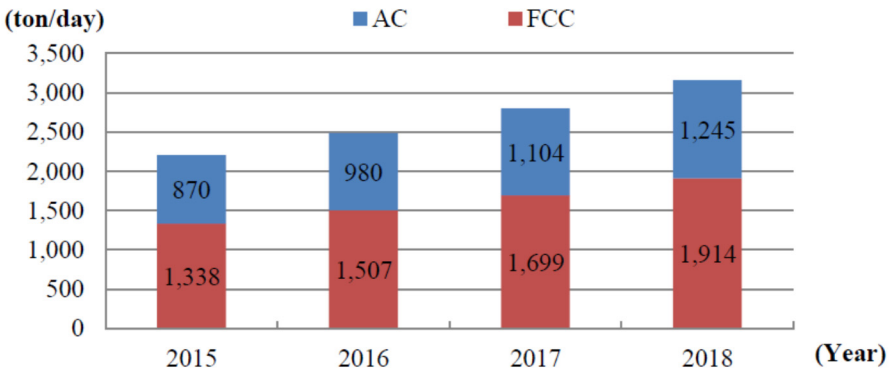


Source: JICA, "Data collection survey for revision of urban development master plan in Abuja of the Federal Republic of Nigeria" (March 2019)

Figure 9-16 Location Map of Solid Waste Management Facilities in FCT

According to the estimation reported in "Data collection survey for revision of urban development master plan in Abuja of the Federal Republic of Nigeria", the amount of waste generation in FCT is increasing every year, as shown in Figure 9-17. It was estimated that 1,914 ton/day of waste was generated in FCC and 1,245 ton/day in ACs in 2018.

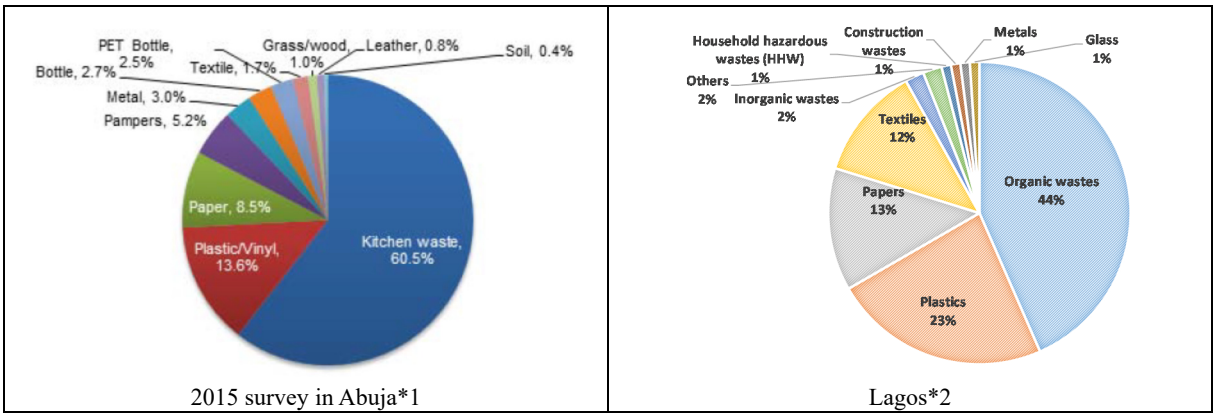
[37] Article in the Guardian on August 1, 2021, https://guardian.ng/news/fcta-spends-n8bn-on-waste-management-annually-minister/



Source: JICA, "Data collection survey for revision of urban development master plan in Abuja of the Federal Republic of Nigeria" (March 2019)

Figure 9-17 Waste Generation Amount in FCT

The composition of MSW is shown in Figure 9-18. In addition to the result of the 2015 composition survey in Abuja city, the result of the survey in Lagos is also included for reference.



2015 survey in Abuja*1 | Lagos*2

Source: *1: JICA, "Data collection survey for revision of urban development master plan in Abuja of the Federal Republic of Nigeria" (March 2019),
*2 Ministry of Economy, Trade and Industry of Japan, "Local Needs Report for Recycling and IT" (December 2020)

Figure 9-18 Composition of MSW

(3) Current Status of Collection and Transportation

In FCT, private waste collection companies are contracted by AEPB and others to collect waste. On the other hand, in FCC, the following three systems are mainly used for waste collection: (1) collection by private companies under contract with AEPB (lot contract: all waste discharged from households, hotels, restaurants, offices, etc. within a lot); (2) collection by private companies registered with AEPB (waste discharged from contracted houses, hotels, offices, markets, etc.); and (3) collection by AEPB (wastes discharged from markets, and wastes uncollected and illegally dumped). For the solid waste collection in the central area of FCC, AEPB set up 27 lots and contracted them out to private companies. For collection of solid waste from housing complexes (estates), private companies registered with the AEPB collect wastes under a contract with the housing management association. Waste collection at the markets is implemented either by private

companies under contract with the market management board or directly by AEPB. Table 9-20 shows a summary of the private companies that were interviewed.

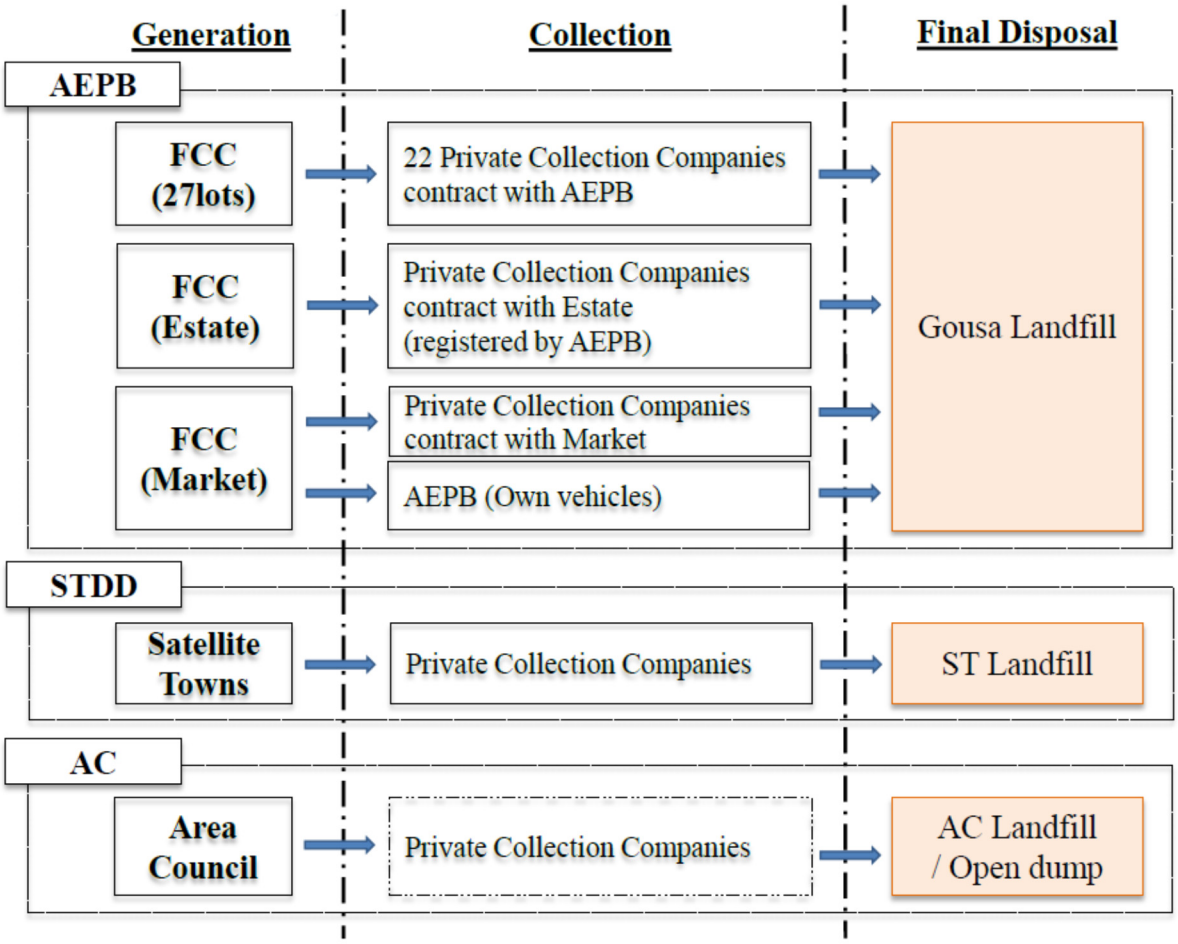
Table 9-20 Summary of Interviewed Private Waste Collection Companies

Company name	Inex Cleaners Limited	Interproject NIG Ltd	Sams Engineering Ltd	Alba Nigeria Ltd	Primrose Enterprise Ltd
Collection area	Wuse II2A	Wuse II2B	Asokoro, Utako	Wuse 1B	Garki 2B, Area 11
Collection amount	N/A	90 m^3/day	N/A	N/A	N/A
Collection equipment	Compactor: 3 units Dump truck: 1 unit Tipper truck: 1 unit	Compactor (30 m^3): 5 units Side loader: 1 unit Tipper truck: 1 unit	N/A	Compactor: 5 units	Compactor: 3 units Dump truck: 2 units
Destination	landfill	landfill	landfill	landfill	landfill
Measures against COVID-19	Wearing uniforms, work shoes, and face masks	Wearing uniforms, frequent hand washing instructions, and weekly truck wash	Wearing face mask and gloves, and providing disinfectant solution	Washing trucks, providing disinfectant solution, and checking body temperature before and after work	Instructions for wearing protective clothing, etc. (especially for infectious waste)

Company name	Environmental Expression Ltd	Wastepoint Ltd	Cosmopolitan Cleaners Ltd	Laurmann & Company Ltd
Collection area	2nd Avenue Gwarinpa	Apo-gudu District	AMAC	CBD, Onex, Kaura, Ring Road
Collection amount	N/A	N/A	1,500 m^3	N/A
Collection equipment	Compactor (40 m^3): 6 units Dump truck: 1 unit Tipper truck: 4 units Side loader: 2 units	Compactor (20 m^3): 3 units Dump truck (25 m^3): 1 unit	Compactor (15-20 m^3): 3 units	Compactor (28 m^3): 3 units Dump truck (24 m^3): 5 units
Destination	landfill	landfill	landfill	landfill
Measures against COVID-19	Wearing appropriate protective clothing against COVID-19	Nothing in particular	Obligation to wear protective clothing	Obligation to wear protective clothing

Source: results of the interview survey

The Gousa landfill site, managed by AEPB, is the only official disposal site in FCT. For MSW generated within the six ACs, STDD and ACs are responsible for managing the waste collection and have their own landfill sites within their respective AC areas.



Source: JICA, "Data collection survey for revision of urban development master plan in Abuja of the Federal Republic of Nigeria" (March 2019)

Figure 9-19 Flow of Waste Collection in FCT

In Abuja, illegal dumping is often observed, and AEPB and many ACs during the interviews of this Study indicated that the removal of illegal dumping is an issue. Illegal dumping has caused fires, clogged drains, waste scattering on the streets, and odour.



Illegal Dumping in Abuja

Source: photographs taken by local staff

Three transfer stations are planned in APO, MPAPE, and KUBWA in FCT. MPAPE transfer station is

currently under construction, but progress is slow due to budget constraints. The construction of transfer stations in APO and KUBWA has not yet started. The current status of these transfer stations is shown below.

Table 9-21 Summary of Transfer Stations

Item	APO transfer station	MPAPE transfer station	KUBWA transfer station
Location	1589/1590, Cadastral CAD ZONE, A09, Guzape	3139, Cadastral ZONE, FO4, Mpape	Plot No2, Cadastral ZONE, F12, Jibi, Kubwa
Land owner	National land	National land	National land
Site area	1.8ha	1.6ha	3.2ha
Construction situation	Not yet started	Under construction	Not yet started

Source: prepared by JICA Study Team according to the results of the interview survey, and "Data collection survey for revision of urban development master plan in Abuja of the Federal Republic of Nigeria" (JICA, March 2019)

(4) Current Status of Intermediate Treatment / Recycling

There are no intermediate treatment facilities in FCT. On the other hand, there are several recycling companies which purchase recyclable materials from waste pickers and sell them to domestic and foreign manufacturers. The most common recyclable materials handled are plastics, followed by cardboards, cans, and others.

Based on interviews with 10 recycling companies in FCT during the 2021 JICA survey, the purchase and sale prices of recyclable materials were identified and are shown in Table 9-22.

Table 9-22 Purchase and Sale Prices of Recyclable materials

Unit: NGN

Material	Purchase price	Sale price
PET bottles	15,000 - 25,000	50,000 - 85,000
LDPE	10,000 - 35,000	30,000 - 60,000
HDPE	25,000 - 40,000	50,000 - 75,000
Cardboard	30,000 - 50,000	60,000 - 85,000
Cans	100,000 - 250,000	200,000 - 350,000
Textiles	-	7,000,000 - 8,000,000
Agricultural wastes	30,000	600,000

Source: JICA, "Data collection survey on the feasibility study for an IT enabled recycling ecosystem in the federal capital territory, Abuja in the federal republic of Nigeria" (January 2021)

Table 9-23 also provides a summary of the recycling companies that were interviewed in this study. The recyclable materials covered include electronic waste (hereinafter referred to as "E-waste") and agricultural waste.

Table 9-23 Summary of Interviewed Private Recycling Companies

Company name	Municipal Waste Recycling Industry Limited	Redin Global	The Ecobarter Company	Chanja Datti Ltd.
Target waste	Industrial wastes, agricultural wastes	E-wastes	Plastic wastes, paper wastes and metal wastes	Plastic wastes, paper wastes and metal wastes
Collection method	-	Collection by trucks (25 ton)	-	Collation at the two collection points in FCT by trucks (2 units owned)
Recycling methods	-	-	Processing by sorting and bailing machine	Processing by bailing machine (packing machine) and pellet making machine
Treatment amount	-	2 ton/day	100 kg/day	6 ton/day
Operation hours	-	6 days a week	5 days a week, 8 hours a day	6 days a week, 8 hours a day

Source: results of the interview survey

(5) Current Status of Landfill Site

The landfills in FCT are managed by AEPB, STDD, and ACs. Gousa landfill, which accepts wastes generated in FCC, has fences, gates, and a small office, but no environmental protection facilities such as seepage control work or gas vent pipes, as outlined in Table 9-24.

Table 9-24 Summary of Gousa Landfill Site

Item	Gousa Landfill
Start year of operation	2005
Site area	90.8 ha
Landfill type	Open dumping
Amount of incoming waste	900 to 1,200 ton/day
Facility	Outbuilding, office, weighbridge
Operation hours	7days a week, 10 - 12 hours a day
Target waste	MSWs and medical wastes
Waste pickers	Activities confirmed

Source: prepared by JICA Study Team according to the results of the interview survey, and "Data collection survey on the feasibility study for an IT enabled recycling ecosystem in the federal capital territory, Abuja in the federal republic of Nigeria" (JICA, January 2021)

Situation in Gousa landfill

Waste pickers in Gousa landfill

Fires in Gousa landfill

Moving wastes in Gousa landfill | Leachate pond in Gousa landfill

Source: photographs taken by local staff

Furthermore, several landfills (dumping sites) are operated in ACs and satellite towns. According to the interviews conducted in this study, landfills operated by ACs are as follows.

- Kuje AC: Gudabe landfill (type: open dumping, target waste: MSWs and agricultural wastes)
- Kwali AC: Yangoji landfill (type: open dumping, target waste: MSWs)
- Abaji AC: Toto Road landfill (type: open dumping, target waste: MSWs)
- Gwagwalada AC: Paiko landfill (type: open dumping, target waste: MSWs and medical wastes)
- Abuja Municipal: Karishi landfill (type: controlled landfill, target wastes: MSWs)

9.2.5 Medical Waste Management

(1) Laws, Registrations and Organizational Structures related to Medical Waste Management in the Country

Laws and regulations related to medical waste management include “The National Health Care Waste Management Guideline 2013”, “The National Environmental (Heath care Waste Control) Regulation 2016” and “The FCT Health Care Waste Management Policy 2017”. The medical waste management is conducted in accordance with these laws and regulations.

Table 9-25 Organizations related to Medical Waste Management

Organization	Responsibility for medical waste management
Ministry of Environment	The Ministry of Environment, in collaboration with the Ministry of Health and NESREA, leads the relevant agencies.
Ministry of Health	Ministry of Health is not directly involved in medical waste management. It develops laws and guidelines in collaboration with relevant ministries and agencies. FCTA is responsible for licensing medical institutions in FCC.
NESREA	NESREA monitors medical waste management to ensure that it is being done according to medical waste management guidelines.
AEPB	AEPB is the supervising agency for medical waste management in FCC, which collects medical wastes, provides the guidance and designated colored waste bags/containers, fines violators, and issues licenses to medical facilities.

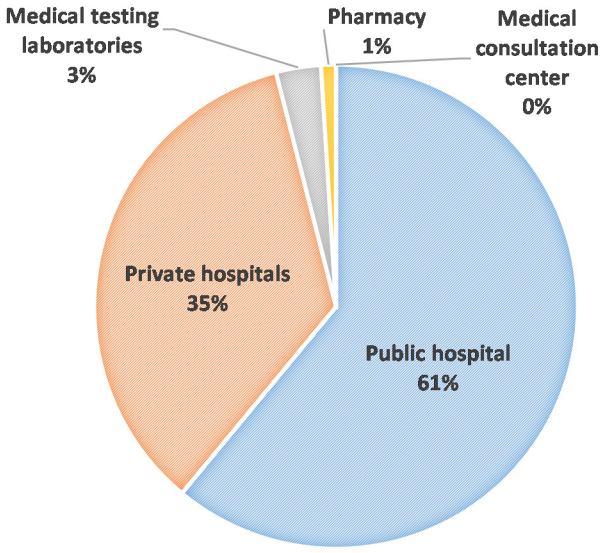
According to the 2019 JICA survey, the amount of medical waste generated in FCC and its breakdown are shown in Table 9-26, Figure 9-20 and Figure 9-21.

Table 9-26 Amount of Medical Waste Generated by Source and Type

Unit: kg/day

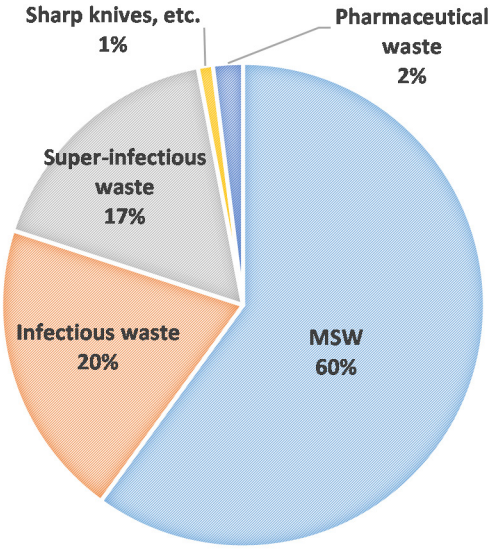
Item	MSW	Infectious waste	Super-infectious waste	Sharp knives, etc.	Pharmaceutical waste	Total
Public hospital	532.7	128.7	166.8	18.3	12.0	858.5
Private hospitals	268.0	127.3	67.4	3.2	17.7	483.6
Medical testing laboratories	22.1	24.2	0.0	0.0	0.0	46.3
Pharmacy	7.3	0.0	0.0	0.3	0.0	7.6
Medical consultation center	3.6	0.0	0.0	0.0	0.0	3.6
Total	**833.7**	**280.2**	**234.2**	**21.8**	**29.7**	**1,399.6**

Source: JICA, "Basic data collection survey for analysis of medical waste collection and treatment in FCC, Abuja" (July 2019)



Source: JICA, "Basic data collection survey for analysis of medical waste collection and treatment in FCC, Abuja" (July 2019)

Figure 9-20 Amount of Medical Waste Generation by Medical Institution



Source: JICA, "Basic data collection survey for analysis of medical waste collection and treatment in FCC, Abuja" (July 2019)

Figure 9-21 Amount of Medical Waste Generation by Waste Type

The medical institution separates the medical waste generated within the institution and discharges it in color-coded waste bags. Infectious waste is disposed of at the hospital's treatment facility, while other medical waste is discharged into waste containers with designated colors and stored at designated collection sites. AEPB is supposed to collect medical wastes and transport them to Gousa landfill for disposal. However, in reality, separation of wastes within the hospitals is not adequately carried out. In addition, the disposal facilities in the hospitals are also inadequate.

According to the 2019 JICA survey, in FCC only three public hospitals (National Hospital, Maitama District Hospital and Gwarimpa General Hospital) have medical waste incineration facilities, two hospitals have needle crushers and three have autoclaves. AEPB is in charge of medical waste collection, and the collected medical wastes are transported to Gousa landfill for disposal. AEPB collects a monthly fee ranging from 9,375 NGN to 31,250 NGN. National Hospital is the only one that outsources the collection of medical waste to a private contractor.

The interview survey conducted in this study revealed that the privately owned hospital Amana Medical Centre also incinerates waste in the hospital. A summary of the hospitals interviewed in this study is shown in Table 9-27. Two hospitals did not know the processing amount. In this interview survey, even those hospitals, which knew the processing amount, did not indicate that there was any particular change in the amount or method of processing compared to before the COVID-19 outbreak.

Table 9-27 Summary of Interviewed Hospitals

Hospital name	National Hospital	Garki Hospital	Wuse District Hospital	Amana Medical Centre	Alliance Hospital
Public / private	Public hospital	Public hospital	Public hospital	Private hospital	Private hospital
Number of staff	2,043 people	900 people	393 people	34 people	239 people
Number of doctors	383 people	144 people	82 people	8 people	26 people
Number of beds	628 beds	106 beds	129 beds	9 beds	52
Waste generation amount Disposal Cost	-	-	-	-	Approximately 80 kg/day
Treatment method	Incineration (operation: 6 days a week and 6 hours a day)	-	Incineration (outsourced) (operation: approximately twice a week)	Incineration (operation: 6 days a week and 6 hours a day)	Incineration (outsourced)
Treatment amount	150 - 250 kg/day	-	-	150 - 250 kg/day	50 kg/day (outsourced)
Disposal cost	5.2 million NGN/year	519,000 NGN/year	-	360,000 NGN/year	-

Source: results of the interview survey

CHAPTER 10 Lessons Learned from Existing Projects in the Federal Republic of Nigeria and the Republic of Kenya

10.1 Lessons Learned from Existing Project in Nigeria

10.1.1 Overview of Existing Project

Recently Japan implemented a technical cooperation project titled; "The Project for Integrated Solid Waste Management System in Federal Capital Territory in the Federal Republic of Nigeria" (hereinafter referred to as "Project for ISWM System in FCT", which is related to waste management in Nigeria. Table 10-1 provides a summary of the project.

Table 10-1 Summary of Project for ISWM System in FCT

Item	Outline
Project name	Project for Integrated Solid Waste Management System in Federal Capital Territory in the Federal Republic of Nigeria
Term of Cooperation	Phase 1: June 2015 to March 2016 Phase 2: April 2016 to September 2018
Counterparts	FCTA and AEPB
Overall Goal	Sustaining the integrated waste management in FCT
Purpose of the Project	Improving the integrated waste management in FCC
Outcomes of the Project	(1). AEPB's capacity for issue analysis related to waste management will be improved. (2). AEPB's capacity for waste collection will be improved. (3). AEPB's capacity for safe and sanitary landfill disposal will be improved. (4). AEPB's organizational structure and financial management capacity for the integrated waste management will be strengthened. (5). Awareness of residents regarding the integrated waste management including 3Rs will be improved.
Main project Activities	(1). Review the current status of policies, laws and plans related to waste management, identify and analyze issues, and prepare a draft action plan. (2). Identify the current status of waste generation, collection and transportation, and the status of contracts with private companies, develop a plan of collection and transportation, operation manual, and contract manual with private companies, and monitor the private companies. Also, start collection in areas where the collection and transportation service has not yet been provided. (3). Investigate the current status of existing dumping sites, formulate an improvement plan and operation manual, and conduct pilot projects based on this plan. (4). Analyze the organizational and financial situation related to waste management, formulate an improvement plan, and conduct financial improvement pilot projects. (5). Conduct a baseline survey on residents' environmental awareness and a survey on recycling activities, plan public awareness activities, and conduct pilot projects.

Source: JICA, "The Project for Integrated Solid Waste Management System in Federal Capital Territory in the Federal Republic of Nigeria"

10.1.2 Outcomes, Results and Good Practice of Existing Project

In the "Project for ISWM System in FCT", over three years various initiatives were implemented to achieve the five outputs, and lessons have been learned from each of them. The main lessons learned through the above project are summarized by output in Table 10-2.

Table 10-2 Key Lessons Learned from the Project of ISWM System in FCT

Outcome		Key lessons learned
General overview	<Project Purpose> Improve the waste management system in FCT	Regular meetings attended by all departments of AEPB were basically held once/week (even during the absence of Japanese experts), and inter-departmental coordination to achieve the project purpose was regularly conducted (92 meetings over 3 years). Through these activities, a waste management action plan for FCT was prepared, the work of AEPB was improved and its capacity was developed. It is expected that regular meetings will continue to be held in the future.
		Although collection services in FCT are contracted out to the private sector, the project recognized improvements in the management of AEPB and in the work of the private collectors. Appropriate management and operation by AEPB is expected to continue in the future.
		For landfill, management of receiving wastes and landfill operations during the rainy season were improved by the project. In the future, improvements to the sanitary landfill (Fukuoka method) are required.
		Training in Japan was conducted three times, and C/Ps were able to acquire Japanese experience and knowledge to assist them in considering appropriate technologies (including intangible aspects) for Abuja and apply them to waste management operations.
Output 1	AEPB's capacity for problem analysis and planning is improved.	A waste management action plan covering FCT was developed in 2017 in collaboration with AEPB and STDD and approved by the FCTA in July 2018. Interdepartmental coordination through the regular meetings mentioned above also helped to put this plan into practice. Future tasks include taking necessary budgetary measures to implement the plan.
Output 2	AEPB's capacity for waste collection is improved.	The collection rate in the pilot area (Life Camp) was improved from the original 82% to 95% (target), and the collection rate of recyclable materials by AEPB in some parts of the pilot area was improved from 0% to 5% (target). As for the improvement of collection, AEPB has implemented the management of private collectors through introduction of job cards, as well as the improvement of collection in slum areas, which was included in the contract with the private companies.
Output 3	AEPB's capacity for safe and sanitary waste disposal is improved.	Monthly data necessary for landfill operation and management was collected and submitted regularly to the AEPB Director General by the department in charge as landfill operation and management reports. Based on the data, the AEPB Director General issued suitable instructions to the departments in charge. In particular, the pilot project developed measures to resolve the issue of access to the landfill during the rainy season, and it contributed to the reduction of off-site waste dumping, etc. In addition, a plan for a sanitary landfill was presented and the future structure of the landfill was shared.
Output 4	The institutional settings and the capacity for financial management of AEPB concerning ISWM are enhanced.	A report on the organizational, institutional and financial improvements of AEPB was prepared by AEPB and submitted by the AEPB Director General to the EPRS Director General in July 2018. Organizational strengthening has already been initiated by AEPB at the time of the project and should be continued in the future.
Output 5	Public awareness about ISWM including 3Rs is improved.	The cooperation rate of the residents in the pilot area on source separation has increased from the initial 9% to 33% (target: 25%). Recyclable materials collected in the pilot area were delivered to the station set up in the landfill, contributing to the promotion of recycling.

Source: prepared by JICA Study Team

10.1.3 Current Status of Outcomes of Existing Project

The current status and issues of outcomes of the Project for IWM System in FCT are shown in Table 10-3. It has been confirmed that under the jurisdiction of AEPB, improvements in waste management have continued in FCC, which was directly covered by the project team, after the project was completed. In particular, it

should be noted that the C/Ps have expanded the collection area, improved managing and monitoring private companies by AEPB, increased the collection rate of waste fees, managed waste data, and initiated the construction of Mpape transfer station. It was also confirmed that the Blue Bin Project, an original recycling activity, is being implemented by C/Ps in an expanded area. On the other hand, several items that have not been implemented due to COVID-19 and lack of budget were identified, and further involvement of FCT is necessary. For ACs under the jurisdiction of the STDD, the ISWM action plan was developed in collaboration with AEPB, but due to the influence of COVID-19, many of the indicators set for each item have not been achieved (the above-mentioned project team assisted in the preparation of the ISWM action plan).

Table 10-3 Current Status and Issues of Outcomes of the Project for ISWM System in FCT

Action		Performance Indicator	Activities carried out by the Responsible Agencies up to 2021	Achievement of the Performance Indicators up to 2021	Challenges and/or issues to achieve the Performance Indicators
1	Review of AEPB Act No.10 of 1997	AEPB Act No. 10 of 1997 is modified and approved.	AEPB Act No. was reviewed in 2019	Waiting for action from the Legislative and Senate to agree to the review	Further involvement of FCT and spread of Covid 19
2	Preparation of Roadmap & Master Plan on ISWM in FCT	Policy Guideline on SWM in FCT is enacted. Roadmap and Master Plan in FCT are prepared.	The ISMW Action Plan was approved by the FCT in 2018. The Waste Management Master Plan has not been confirmed	-	Further involvement of FCT
3	Expansion of Waste Collection Services Area	(FCC) Contract of Waste Collection Services is made in 31 Districts.	(FCC) AEPB now have 44 Lots/Districts expansion made in 2019 till date	(FCC) Improvement in city cleaning activities within the FCC Extension of contractors' contracts	(FCC) 1. Inability of AEPB to get approval from BPP to procure new contracts on Waste Management in FCC 2. Bureaucratic challenges from the Executives and Legislative due to inadequate funding
		(AC) Contract of Waste Collection Services is made in ACs.	(AC) STDD has intervened in waste management activities in all the area councils since the Area Councils lack the capacity to carry out waste Management activities	(AC) Maintenance of healthy environment in the ACs thereby reducing outbreak of disease such as cholera etc.	(AC) 1. Inadequate funding for the sector by the Federal Government 2. ACs do not get the direct funds procured during the budget year
4	Improvement of Waste Collection Services	All waste collection companies implement waste collection service in line with implementation plan	(FCC) Contracted city cleaning contractors carry out daily city cleaning, waste collection and disposal. These activities are monitored daily by AEPB supervisors in all the districts.	(FCC) Achieved a cleaner city especially under the covid 19	(FCC) AEPB carry out city cleaning intervention activities in areas where some contractors have challenges to provide services due to trucks breakdowns
			(AC) STDD carry out regular interventions, on a monthly base in all ACs	(AC) Achieved cleaner ACs	(AC) Inadequate and limited waste management equipment to manage all the 6 ACs
5	Construction of Transfer Stations	(FCC) Transfer Stations start operation in Apo, Kubwa & Mpape	(FCC) In 2021 the Hon. Minister FCTA through the Engineering Department gave approval for the construction of the Waste Transfer station in Mpape	(FCC) Mpape Transfer Station is currently under construction	(FCC) The process is slow due to funding through the budgeting process
		(AC) Transfer Stations start operation in Kuchiko, Kuje, Dobi & Ajata	(AC) 1. STDD and ACs operate the Central Waste Collection system	(AC) There is a reduction in the indiscriminate dumping of waste on the roads, streets and in drainages facilities	(AC) 1. Inadequate sensitization and awareness tools on the need to have a

Action		Performance Indicator	Activities carried out by the Responsible Agencies up to 2021	Achievement of the Performance Indicators up to 2021	Challenges and/or issues to achieve the Performance Indicators
			2. No plan or approval for technical transfer station		safe and clean environment 2. Lack of capacity
6	Development of Landfill Site	(FCC) Necessary facilities are installed at Gousa Landfill Site	(FCC) The FCTA Hon. Minister in 2020/2021 gave approval through the Engineering Department to construct a two-phase waste dumping platform at the Gousa Landfill	(FCC) The Platform is currently in use, to serve both dry and rainy seasons	(FCC) 1. Lack of appropriate plan by the FCTA administration to construct sanitary landfill 2. No installation of weighbridge hence no daily, monthly waste data for FCC
		(AC) Construction of Karshi Landfill Site, Necessary facilities are installed at Kwali, Abaji & Bwali Dumping Sites	(AC) Plan in view	(AC) Currently practicing controlled landfilling method of waste management	(AC) Lack of funding
7	Improvement of Landfill Management and Recycling Management	Landfill management is implemented in line with the Operation Manual	(FCC) Currently operating in controlled landfilling method	(FCC) The use of the new waste platform has contributed to properly disposing all incoming waste from the city and reduction in illegal dumping.	(FCC) Management Challenges, funding, inadequate equipment
			(AC) Open dumping practice	(AC) Landfill contract to ensure wastes dumped are pushed to create embankment and manage the dumping space	(AC) Inadequate equipment on site
8	Introduction of Recycling Activities	(FCC) Blue Bin Project is introduced in 10 LOTs.	(FCC) The Blue Bin project is still ongoing, the Recycling Recovering Unit carries out collection of recyclables in profiled areas in the city three times every week	(FCC) The RR unit expanded the coverage area from Life Camp to other districts and locations in the Federal capital City as listed below Areas of Coverage a) Embassies of European Countries (CBD) b) Fraser Suite (CBD) c) Dantata Quarters (Life Camp) d) African Development Bank (CBD) e) Chicken Cottage (Wuse 2) f) Tophills School (Wuse zone 5) g) Raberto School (Wuse 2 & Life Camp	(FCC) 1. The Recycling Guideline has not been approved by the Hon. Minister FCTA 2. Inadequate funding 3. Lack of Capacity 4. Unsustainable public awareness and sensitization on waste recycling 5. Thriving informal recycling sector

Action		Performance Indicator	Activities carried out by the Responsible Agencies up to 2021	Achievement of the Performance Indicators up to 2021	Challenges and/or issues to achieve the Performance Indicators
				District) h) Chelsea Hotel	
		(AC) Recycling Program (Blue Bin) is introduced in 20 LOTs.	(AC) Recycling is done informally	(AC) Recycling is done informally	(AC) The AEPB waste recycling Guideline has not been approved
9	Data Management of ISWM	Statistical information is compiled and released.	(FCC) Estimated Waste Data	(FCC) The use of dumpsite register (collection data) of the total number of waste trucks that enter the landfill daily and monthly	(FCC) Delay in completion of the installation of weighbridge for accurate measurement at the dumpsite
			(AC) Not Available	(AC) No tools for data recording and collection at the dumpsite	(AC) Lack of capacity
10	Strengthening of Financial Management	(FCC) Collection rate of waste management service fee is 30%.	(FCC) 1. Increase in waste billing service area within the FCC - Dawaki, Lokogoma, Idu, Lugbe, Gaduwa and Dutse-Apo 2. Establishment of five more Area Offices located at Asokoro, Gudu, Kado, National Hospital and Wuye 3. Introduction of Remita Payment Gateway: The FCTA in March 2021 in furtherance of Government Single Treasury Account (TSA) policy directed all its Revenue generating SDAs to collect their Revenues through Remita Platform only. The implementation of above directive has significantly enhanced the Board's Revenue inflow and reduced payment reconciliation issues.	(FCC) 1. Successful completion of distribution of 2021 bills to Commercial and Residential service users in all Districts within the Federal Capital Territory. The Total number is 73,594 2. Billing service in the FCC and remita revenue increaseed in value by 20% from the 60% 2021 target for the year	(FCC) 1. Constant Amac Area Council interference in collecting waste bills from districts serviced by AEPB 2. Reduction in customized billing leaflet procurement 3. Inadequate funding of the department by the AEPB/FCTA year budget 4.AEPB in dire need of application software upgrade so as to be in tandem with the latest technology.
		(AC) New billing system is introduced and the target is 25%.	(AC) Engaged Private Service Providers (PSPs) through Public Private Partnership (PPP)	(AC) PSPs directly collect waste bills from residents and commercial complexes	(AC) No data on waste amount generated and collected in the Area Councils

Action		Performance Indicator	Activities carried out by the Responsible Agencies up to 2021	Achievement of the Performance Indicators up to 2021	Challenges and/or issues to achieve the Performance Indicators
11	Dissemination of Public Awareness & Environmental Education on ISWM including 3Rs	(FCC) More than 3 programmes are held in a year	(FCC) Planned activities on awareness and sensitization in schools and neighborhoods in 2021	(FCC) Planned activities could not be achieved due to inter bureaucratic challenges	(FCC) 1. No Budget for planned activities for the year 2. Covid19 concerns
		(AC) More than 6 programmes are held in a year	(AC) No Activities planned by STDD	(AC) Local NGOs carry out awareness and sensitization in ACs	(AC) Activities not planned by ACs due to lack of annual budget provisions
12	Dissemination of Composting Techniques	(FCC) More than 3 demonstrations are implemented in a year.	(FCC) Committee setup to identify composting techniques activities to be demonstrated in ACs	(FCC) Activities target could not be achieved in 2021	(FCC) Due to lack of budgeting
		(AC) Demonstration in each AC is implemented in a year.	(AC) Committee was setup to carry out composting techniques activities to be demonstrated in the 6 ACs	(AC) Internal training conducted for STDD staff in 2021	(AC) Activities could not be achieved due to inadequate budgeting to implement the activities in the 6 ACs

Source: prepared by JICA Study Team

10.2 Lessons Learned from Existing Project in Kenya

10.2.1 Overview of Existing Project

In Kenya, JICA implemented a technical cooperation project, named "Project for Capacity Development for Solid Waste Management of Nairobi city", in Kenya. The outline of the project is described in the table below.

Table 10-4 Overview of "Project for Capacity Development for Solid Waste Management of Nairobi city"

Item	Description
Project name	Project for Capacity Development for Solid Waste Management of Nairobi city
Period	From February 2012 to March 2016
Target Group	Department of Environment (DOE), in Nairobi City County (NCC)
Overall Goal	Waste collection and transportation services in Nairobi city are expanded by NCC.
Project Purpose	Capacity of NCC on solid waste management is strengthened.
Output	(1) Capacity of NCC on solid waste collection and transportation is strengthened. (2) NCC's capacity is strengthened in terms of involvement of private sector for solid waste collection and transportation. (3) NCC's capacity is strengthened in terms of involvement of CBOs for solid waste collection and transportation. (4) Capacity of DOE on financial management is strengthened. (5) Challenges and roadmaps of DOE are clarified.
Activities	(1) To make the improvement plan of collection and transportation of solid waste, to conduct improvement activities, and to monitor, evaluate and feedback the result of improvement activities (2) To design a pilot project for the purpose of introduction of franchise system and awareness raising, to conduct activities, and to monitor, evaluate and feedback the result of pilot project (3) To design a pilot project of CBOs involvement in waste collection including awareness arising, to implement, to monitor and evaluate, and to make recommendations for future expansion (4) To draw the plan for operationalizing SWM special Account, to implement the plan, to monitor, to analyze and to make recommendations for improvement of financial status (5) To review collection and transportation activities implemented under the Project, to re-design a roadmap of NCC and to make recommendations for better solid waste management

Source: JICA Study Team prepared this table based on the final report of "Project for Capacity Development of Solid Waste Management of Nairobi city"

10.2.2 Outcomes, Result and Good Practice of Existing Project

This project implemented various activities for achieving the 5 project outputs during the 4 years of the project duration and obtained lessons learned from each activity. The following table shows the major lessons learned through this project.

Table 10-5 Major Lessons learned from Existing Project

	Output	Major lessons learned
Common	—	Technical understanding can be deepened through construction of small pilot facilities and facilitate the construction of landfill in the future.
		It is important to exchange views at the working level with local counterparts and to secure necessary budget before starting the work.
		Since local officers tend to rely on conceptual or qualitative results, it is important to convince them of the necessity of quantitative results as well, by always showing quantitative results.
Output 1	Capacity of NCC on solid waste collection and transportation is strengthened.	In case of vehicle breakdown, it is necessary to understand the main causes of the breakdown and take appropriate mitigating actions such as improvement of access road to landfill, and not only procure spare parts for repair.
Output 2	NCC's capacity is strengthened in terms of involvement of private sector for solid waste collection and transportation.	To notify residents and private companies for introducing franchise system, it is important to talk with them individually for obtaining their cooperation, not only to speak in the workshop.
Output 3	NCC's capacity is strengthened in terms of involvement of CBOs for solid waste collection and transportation.	In case of making important decisions such as selection of contractor, it is important to encourage the counterparts to express their opinions and respect those opinions in order to foster counterpart ownership.
Output 4	Capacity of DOE on financial management is strengthened.	Technical transfer is more effective when the Japanese experts are working with the counterparts in the same office every day.
		It is important to separate SWM special account from ordinal account and ordinal organizational management and to enable quick action for managing the SWM account smoothly.
Output 5	Challenges and roadmaps of DOE are clarified.	It is necessary to extract challenges through understanding current situation and to consider direction of improvement. Workshops make it possible to deepen mutual understanding of persons concerned. (Participatory Approach)

Source: JICA Study Team prepared this table based on the final report of "Project for Capacity Development of Solid Waste Management of Nairobi city"

This project tried to introduce a franchise system for collecting and transporting waste as an innovative effort, but existing contractors in specific areas reacted by raising a case in court which resulted in the suspension of the franchise system. Thus, it is required to seek consensus in advance when a new system is tested or launched, in order to ensure cooperation from all concerned organizations and to consider how many contractors can participate in the system. If such measures are not taken existing contractors will have strong opposition as this is a matter that directly effects their livelihoods.

On the other hand, this is a good practice for other African countries as it resulted in NCC's effective support to CBOs' activities and strengthened their collaboration by establishing an umbrella organization for CBOs through their pilot activities. Before starting the project NCC and CBOs had a minimal relationship.

CHAPTER 11 Interest of Japanese Private Companies in Solid Waste Management Business in African Countries

In this survey, JICA Study Team confirmed the interest of Japanese private companies, engaged in waste management business such as Waste-to-Energy business, in entering the African countries market. Nine Japanese private companies that have their headquarters in Japan, are plant engineering companies or business entities engaged in the waste management sector, and have rich overseas business experience were selected to be targets of this survey. The Study distributed a request letter and questionnaire to each of these nine Japanese private companies on 28th January 2022 and collected the filled in questionnaires by the set deadline of 4th February 2022. Eight of the nine companies provided replies, a collection rate of 89%.
The results of this survey are analysed in this chapter.

11.1 Result of Questionnaire Survey and Analysis

11.1.1 Interest in Waste Management Business in African Countries

Question 1 aimed to confirm the interest level of the Japanese companies in waste management business in African countries. Interest levels were classified from 1 to 5, with level 5 indicating most intense interest and level 1 no interest. The results of this question are analyzed in Table 11-1.

Table 11-1 Interest of Japanese Private Companies in Waste Management Business in African Countries

No.	Interest	Number of answers	Percentage
1	No interest	1	12.5%
2	Interested, but taking no action	5	62.5%
3	Collecting information, considering business entry in future	1	12.5%
4	Implementing site survey, considering business entry in future	0	0.0%
5	Considering participation in a specific project	1	12.5%
No answer		0	0.0%
Total		**8**	**100.0%**

Source: JICA Study Team prepared this table.

All 8 companies answered this question. Average level of interest was 2.375 which shows that many companies have an interest in doing business in African countries, but have not taken any action yet.

11.1.2 Potential Field

In Question 2, the companies were asked to select the potential fields they would be interested to work in, in African countries. The company that selected reply 1 in Question 1 was requested to skip Question 2, and the remaining companies were allowed to select multiple answers.

Table 11-2 Potential Field

No.	Field	Number of answers	Percentage
1	Waste-to-Energy facility (incineration) for municipal waste	6	85.7%
2	Waste-to-Energy facility (gasification) for municipal waste	1	14.3%
3	Biogas power generation facility, utilizing organic waste	1	14.3%
4	Material Recovery Facility (MRF)	0	0.0%
5	Mechanical and Biological Treatment (MBT) facility	0	0.0%
6	Composting facility for organic waste	0	0.0%
7	Industrial waste treatment facility (including medical waste treatment facility)	1	14.3%
8	E-waste treatment facility	1	14.3%
9	Collection equipment	0	0.0%
10	Others	0	0.0%
No answer		0	0.0%

Source: JICA Study Team prepared this table.

All seven companies answered Question 2. Many of the companies selected Waste-to-Energy facility (incineration) as the potential field they would target, but one company selected industrial waste treatment facility as a potential field of business in African countries.

11.1.3 Expected Business Scheme

In Question 3, the companies were asked on their preferred business scheme for entering the business market in African countries. The company that selected reply 1 in Question 1 was requested to skip Question 3, and the remaining companies were allowed to select multiple answers.

Table 11-3 Expected business scheme

No.	Business scheme	Number of answers	Percentage
1	Engineering, Procurement and Construction (EPC)	3	42.9%
2	Design, Build, Operate (DBO) scheme	1	14.3%
3	Public-Private Partnership (PPP) scheme (excluding investment to SPC)	1	14.3%
4	PPP scheme (including investment to SPC)	0	0.0%
5	Private ownership	0	0.0%
6	Others	5	71.4%
No answer		0	0.0%

Source: JICA Study Team prepared this table.

Detailed descriptions of the five business schemes that were proposed in item 6 “Others” were as follows.

- Engineering, Procurement and Supervision (EPS) for furnace and boiler
- Initially, only construction by forming a consortium with local companies
- Basic design, supply of some equipment and dispatch of supervisors
- Only supply of main equipment
- Decide depending on project risks and actual situation of site. Considering adoption of Free-On-Board (FOB) scheme

All 7 companies answered this question. Many companies consider partial participation such as supply of equipment only, at first.

11.1.4 Predicted Issues for Business Entry

In Question 4, the companies were asked to predict what issues they may face when entering the business market in African countries. And in Question 5 the companies were requested to identify the most serious issue they predict they would face. The company that selected reply 1 in Question 1 was requested to skip both Question 4 and Question 5. The remaining seven companies were allowed to select multiple answers for Question 4 and only one answer for Question 5. The results of the replies are analyzed in Table 11-4.

Table 11-4 Predicted issues for entering business in African countries

No.	Issues	Question 4 (multiple answers allowed)		Question 5 (most serious issue)	
		Number of answers	Percentage	Number of answers	Percentage
1	Legal system related to waste management	7	100.0%	0	0.0%
2	Environmental regulations	4	57.1%	0	0.0%
3	Financial base of country / municipality	7	100.0%	3	42.9%
4	Language, communication	1	14.3%	0	0.0%
5	Local partner companies	6	85.7%	1	14.3%
6	Living environment	2	28.6%	0	0.0%
7	Security situation	6	85.7%	2	28.6%
8	Telecommunication	1	14.3%	0	0.0%
9	Opposition of residents	2	28.6%	0	0.0%
10	Others	3	42.9%	1	14.3%
No answer		0	0.00%	0	0.0%
Total		―	―	**7**	**100.0%**

Source: JICA Study Team prepared this table.

Detailed descriptions of the three issues predicted by the companies that selected “Others” were as follows.

- Conditions of selling electricity (selling price etc.), finance composition, business bankability
- Medical system for Japanese workers
- Legal system for electricity, situation of infrastructure for power distribution, legal system for construction, compliance risks

All 7 companies answered both questions 4 and 5. The companies were found to have concerns over various risks they may face when doing business in Africa, with the strongest concern being the financial base of government and municipalities.

11.1.5 Desired support of Japanese government

In Question 6, all eight participating companies were asked to describe the support they desired from the Government of Japan (hereafter “GOJ”) and any requests they may have for the government. Six of the eight

companies detailed their requests to the GOJ, as explained below.

- Support for basic survey of various issues
- Flexible financial support by GOJ such as Joint Credited Mechanism (JCM) etc.
- Support to local government and municipalities for their establishment of legal system and environmental standards etc.
- To convince local government of the necessity and importance of proper treatment of waste to protect the environment and public health, and support decarbonization, etc. (In Japan, treatment of municipal waste is under the responsibility of local government. However, in some foreign countries, proper waste treatment has not yet been established, since it is regarded in some countries as a private business.)
- Financial support or investment support for business entry into African countries, such as subsidies for feasibility study, or enabling 100% financing not only for off-shore portion but also for construction.
- Support of feasibility study, construction project and operation business
- Grant aid project for waste management business, increase of yen loan projects and JCM partnership countries in Africa
- Study of conditions of pollution by waste in African countries and strengthen awareness raising activities for energy conservation by Waste-to-Energy facilities and CCU/S
- Even if the legal system in the African countries is well established as in Japan, some uncertainty still remains as to the extent municipalities would abide by the legal system and honour their responsibilities to regulate and execute the legal conditions in the mid and long-term, and not commit any actions in violation of the laws governing the business. Therefore, it is necessary to establish a stable legal foundation for the business including capacity development. Support by GOJ on safety issues and in crisis management is required because there are some security risks at each phase of the business when Japanese staff are dispatched to the African countries for a period of time to provide proper management and monitoring of the business.

11.2 Comparison of Demands of African Cities

11.2.1 Demands of African Cities

At present the diminishing disposal capacity at landfill sites has become a very serious issue in developing countries. These countries are turning their attention to the need to develop various waste intermediate treatment facilities such as Waste-to-Energy facilities which require high-level technologies during construction and operation. This situation is particularly serious in African countries as their economies improve and the amounts of generated wastes increase.

This Study has found that some cities in African countries are considering introduction of high-level technologies for solving various issues related to waste management. The major SWM challenges each of the cities covered in this Study, face and the technologies which may contribute to overcoming these challenges, are described in the Table 11-5. In addition, expected risks, which may occur when business entities introduce these technologies, are also described in the table. In case of introducing PPP or privatization scheme, private companies need to have an appreciation of these risks.

Table 11-5 Major Challenges and Technologies to help overcome them in each city

Country	City	Major Challenges	Technologies which may contribute to overcome the challenges	Expected risks when these technologies are introduced
Cote D'ivoire	Abidjan	Improvement of waste collection in some districts	Collection equipment such as compactor trucks, container carriers etc.	Collection system may not be established. Collection equipment may not be maintained well.
		Review of collection system including the introduction of transfer system	Transfer stations using compression equipment	Compression equipment may not be maintained well.
		Promotion of recycling	Waste sorting and recycling technologies such as MBT, MRF and composting etc. Introduction of Waste-to-Energy technologies in future	Adequate budget may not be secured. Public monitoring and control may not be executed sufficiently due to adoption of PPP scheme. Equipment may not be maintained well.
Angola	Luanda	Strengthening of management of private sector	ICT technologies for introducing monitoring system for private sector	Necessary laws and regulations may not be established. Monitoring and controlling system may not be established.
		Establishment of waste data management system	ICT technologies for establishing waste data management system	Necessary laws and regulations may not be established. Monitoring system may not be established.
		Capacity development of waste collection	Collection equipment such as compactor trucks, container carriers, etc. Transfer stations using compression machine	Collection system may not be established. Compression machine and collection equipment may not be maintained well.
		Strengthening of final disposal system	Sanitary landfill method (Fukuoka method)	Maintenance system may not be established well. Existence of waste pickers
Ethiopia	Addis Ababa	Proper treatment of incineration ash	Cement solidification technologies for incineration ash Melting and slugging method for incineration ash Chelating method	Adequate budget may not be secured. Lack of understanding for proper treatment
		Sustainable management of Waste-to-Energy (incineration) facility	Management system of Waste-to-Energy facility	Adequate budget may not be secured. Lack of skilled engineers
		Strengthening of collection and transportation of waste	Collection equipment such as compactor trucks, container carriers etc. Transfer stations using compression machine	Collection system may not be established. Compression machine and collection equipment may not be maintained well.
		Closing existing landfill site / Construction of new landfill site	Sanitary landfill method (Fukuoka method) Weighbridge, Monitoring	Adequate budget may not be secured. Equipment may not be

Country	City	Major Challenges	Technologies which may contribute to overcome the challenges	Expected risks when these technologies are introduced
			system	maintained well. Existence of waste pickers
	Hawasa	Improvement of waste collection	Collection equipment such as compactor trucks, container carriers etc. Transfer stations using compression machine	Collection system may not be established. Compression machine and collection equipment may not be maintained well.
		Improvement of final disposal sites	Sanitary landfill method (Fukuoka method), weighbridge, management system	Adequate budget may not be secured. Equipment may not be maintained well. Maintenance system may not be established. Existence of waste pickers
Guinea	Conakry	Improvement of final disposal sites	Sanitary landfill method (Fukuoka method), weighbridge, management system	Adequate budget may not be secured. Equipment may not be maintained well. Maintenance system may not be established. Existence of waste pickers
		Capacity development of waste collection	Collection equipment such as compactor trucks, container carriers etc. Transfer stations using compression machine	Collection system may not be established. Compression machine and collection equipment may not be maintained well.
Uganda	Kampala	Expansion and strengthening of e-waste recycling center	Proper treatment and recycling technologies for e-waste	Laws and regulations providing legal basis for collection of e-waste may not be established. Collection system may not be established. Adequate budget may not be secured.
		Capacity development of waste collection	Collection equipment such as compactor trucks, container carriers etc. Transfer stations using compression machine	Collection system may not be established. Compression machine and collection equipment may not be maintained well.
		Improvement of final disposal sites	Sanitary landfill method (Fukuoka method), weighbridge, management system	Adequate budget may not be secured. Equipment may not be maintained well. Maintenance system may not be established. Existence of waste pickers
Botswana	Gaborone, Kweneng	Improvement of waste collection	Collection equipment such as compactor trucks, container carriers etc. Transfer stations using compression machine	Collection system may not be established. Compression machine and collection equipment may not be maintained well.
		Improvement of final disposal sites	Sanitary landfill method (Fukuoka method), weighbridge, management	Adequate budget may not be secured. Equipment may not be

Country	City	Major Challenges	Technologies which may contribute to overcome the challenges	Expected risks when these technologies are introduced
			system	maintained well. Maintenance system may not be established. Existence of waste pickers
South Africa	Johannesburg	Promotion of source separation of waste and recycling	Waste sorting and recycling technologies such as MBT, MRF and composting	Adequate budget may not be secured. Public monitoring and control may not be executed sufficiently due to adoption of PPP scheme. Equipment may not be maintained well.
		Improvement of waste information system	ICT technologies for improvement of waste information system	System may not be maintained well.
		Management after construction of Waste-to-Energy (incineration) facilities	Management system for Waste-to-Energy (incineration) facilities	Adequate budget may not be secured. Public monitoring and control may not be executed sufficiently due to adoption of PPP scheme. Lack of skilled engineers Equipment may not be maintained well.
	Tshwane	Promotion of recycling	Waste sorting and recycling technologies such as MBT, MRF and composting etc.	Adequate budget may not be secured. Public monitoring and control may not be executed sufficiently due to adoption of PPP scheme. Equipment may not be maintained well.
		Construction of Waste-to-Energy (incineration) facilities	Waste-to-Energy (incineration) facilities	Adequate budget may not be secured. Public monitoring and control may not be executed sufficiently due to adoption of PPP scheme. Lack of skilled engineers Equipment may not be maintained well.
		Construction of biogas power generation plants	Biogas power generation plant	Adequate budget may not be secured. Public monitoring and control may not be executed sufficiently due to adoption of PPP scheme. Lack of skilled engineers Equipment may not be maintained well.

Source: prepared by JICA Study Team

The Study has found that most Japanese private companies doing business related to the SWM sector, such

as Waste-to-Energy business, are interested in entering the African countries business market, but hesitate due to various risks. In particular, the Japanese companies' strongest concern is the financial base of local government and municipalities in African countries. However, the expected growth of the economies in the African region are expected to propel the Africa to potentially emerge as a new market after Asia.

11.2.2 Gap in Interest of Japanese Companies

The Study identified both the focused interest of Japanese private companies on the Waste-to-Energy business in African countries, as well as the hesitancy of these companies to enter the African business markets because of various risks.

Furthermore, while the interest of the Japanese private companies is focused on Waste-to-Energy business, the needs of the African cities range widely from collection, transportation and final disposal to introduction of intermediate treatment technologies in the near future. This indicates that there is a gap between the sole interest of the Japanese companies and the diverse needs of the African cities in the SWM sector.

11.2.3 Conclusion (risks for entering African business and major challenges)

As explained earlier this Study has identified the diverse needs of the African cities surveyed as well as the mainly sole interest of the Japanese private companies in developing Waste-to-Energy facilities in these cities, and the risks that need to be mitigated for the Japanese companies to transform their interest into reality.

The development of SWM in Japan through highly reliable intermediate treatment of the waste by incineration, coupled with the proper collection and transport of the waste has greatly contributed to the improvement of the environment and sanitation. In order for the SWM system to function effectively many system elements had to be developed together in a coordinated manner. Today the SWM system in Japan is very highly evaluated. Regarding final disposal, Japan has established the semi-aerobic landfill method called "Fukuoka method" which has been recommended for introduction in many developing countries by various organizations such as the United Nations. Besides, various recycling technologies are developed in Japan toward the establishment of sound material cycle society. A simple and effective composting method called "Takakura method" was developed in Japan and it has been introduced in many countries.

High technologies in various aspects of SWM developed in Japan may meet the needs of developing countries such as African countries and the introduction of these technologies will be beneficial to both Japan and the African countries.

Expected risks as barriers to enter African business are listed in Table 11-5. To understand actual conditions and risks at site, it is necessary for Japanese private companies to visit the sites first hand. However, African cities are located far from Japan and so it is not easy for Japanese companies to implement field surveys.

It is desired that the Japanese government provide financial support for Japanese private companies to implement such basic surveys and investment support for business entry to African countries, and to develop capacity of local governments and municipalities to better prepare for, develop and operate the new systems that Japanese private companies can introduce.

Japanese private companies are required to find proper local partner companies for reducing their risks. If

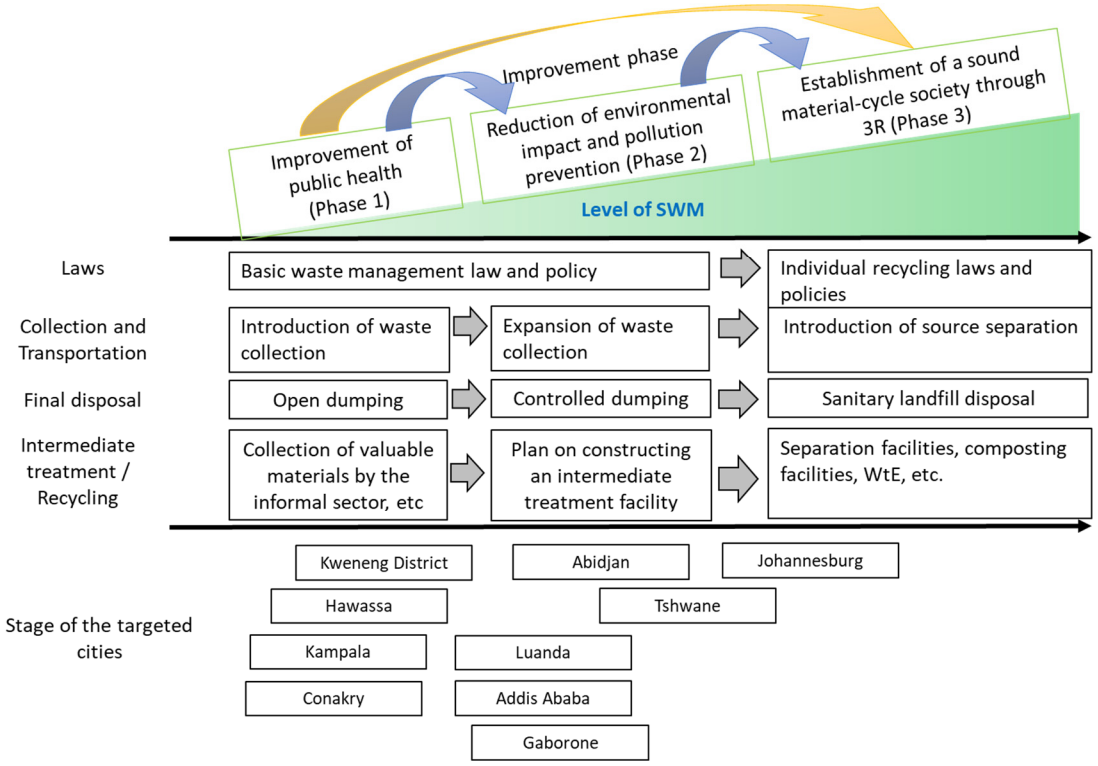
opportunities can be provided to match Japanese companies with local companies by establishing a platform to disclose the information of local companies which are interested in working with foreign partners in African countries through the framework of ACCP, for instance, it will increase the opportunities much more for Japanese companies to participate in the SWM business in African countries.

CHAPTER 12 Draft Cooperation Framework towards ACCP Member Countries

12.1 Summary of Study Results

12.1.1 Stages of Solid Waste Management in Target Countries of Field Survey

In order to compare and verify SWM conditions of multiple cities from various perspectives, this Study uses Table 1-13 to evaluate "stages (levels) of solid waste management," based on the "measures according to the country's development stage" as indicated in "Waste Management Sector Position Paper (4th Edition) (JICA, June 2017)". The field survey results for the target countries are shown in Table 12-1. 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". The stages of waste management in the target countries are illustrated in Figure 12-1.



Source: prepared by JICA Study Team

Figure 12-1 Stages of Solid Waste Management in the Target Cities

Table 12-1 shows the priority issues and good practices for each target city. In the cities of Johannesburg and Tshwane, which are at a higher level of solid waste management, priority issues are the development of intermediate treatment facilities and collection of separated wastes. Good practices for both cities are also at a higher technical level and cost more to introduce, and include data systems for solid waste management and biogas power generation at final disposal sites. On the other hand, for cities in Stages 2 and 1, priority

issues are more basic, such as strengthening collection and transportation, and improving and upgrading landfills. Similarly, good practices in the cities of Stages 1 and 2 are more related to collection, transportation, and final disposal, with the exception of E-waste recycling in Kampala City.

Among the target countries, there are many common problems, such as low waste collection rates, short remaining lifespans of final disposal sites and the inadequate management of these sites. The JICA study team has identified the issues of the current SWM conditions and policies that are triggering these problems and need to be tackled in each country. With regard to the low waste collection rates, specific issues such as extending collection service to suburbs and slums, and improvement of collection and transportation equipment and primary collection were raised. As for the final landfill shortage, which is a problem in Addis Ababa and South Africa, the report suggests both the development of new final landfills and the introduction of intermediate treatment facilities to reduce the amount of waste to be ultimately disposed at the landfill, taking into consideration of the current situation and policies.

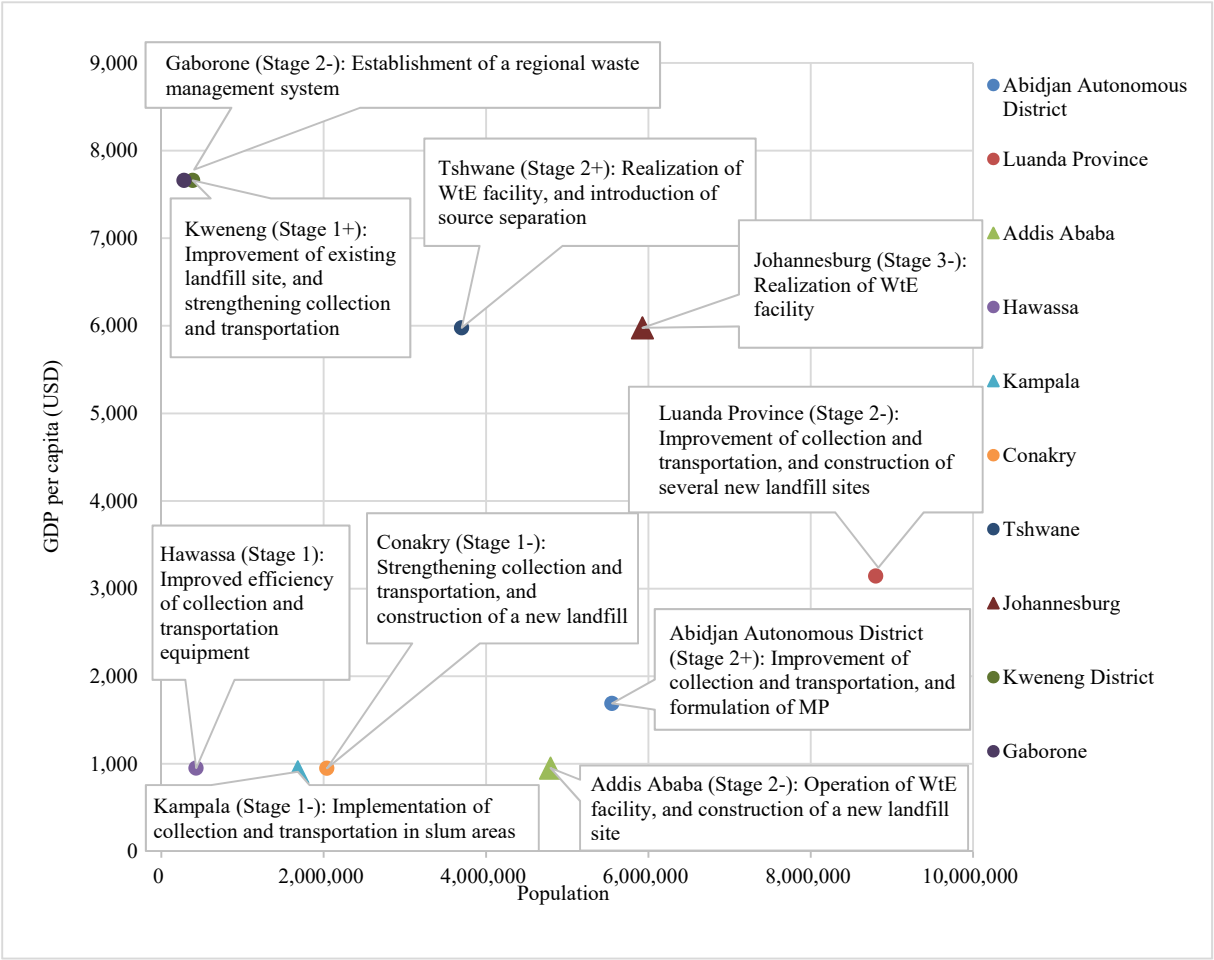
Table 12-1 Comparison of Survey Results of Field Survey Countries

City	Population GDP per capita	Solid Waste Management Components					Priority Issues	Good Practice
		Legisla-tions /Plan	Collection and Transportation	Final Disposal	Intermediate Treatment / Recycle	Comprehensive Evaluation*		
Abidjan Autonomous District (Cote d'Ivoire)	5,551,934 persons USD1,691	Stage 1	Stage 2 Collection Amount: 4,000 t/day (90%) Private outsourcing collection	Stage 3 Leachate collection pipes and treatment facilities are installed. LFG power generation facility is being constructed. Plans for regional landfill site and transfer stations for Greater Abidjan are available	Stage 2 Recycled Amount: 222 t/day (5%) Plans for regional landfill site and transfer stations for Greater Abidjan are available	Stage 2 In transition to the level for Stage 3	➢ 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.	• Outsourcing waste collection/ transportation and final disposal to private sector
Luanda Province (Angola)	8,801,035 persons USD3,145	Stage 1 - 2	Stage 1 Collection Amount: 6,167 t/day (70%) Both direct collection and private outsourced collection	Stage 2 - 3 Leachate collection and drainage pipes, leachate reservoirs and recirculation facilities are installed and covering soil is properly applied. The remaining capacity is 16 years.	Stage 2 Recycled Amount: 450 t/day (5%) A plan to develop a recycling facility utilizing PPP scheme is available.	Stage 2 [-] The level of assurance for the implementation of Stage 2	➢ 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.	• Landfilling operation and, management of the landfill site
Addis Ababa (Ethiopia)	4,793,699 persons USD953	Stage 2	Stage 2 Collection Amount 2,508 t/day (75%) Private outsourcing collection	Stage 1 - 2 Part of the disposal area has been rehabilitated by the Fukuoka method, however, most areas are open dumping sites. The remaining capacity is 2 years.	Stage 2 Incinerated Amount: 649 t/day Recycled Amount: 200 t/day Recycling Rate (including power generation): 25% The WtE facility treats half of the planned volume	Stage 2 [-] The level of assurance for the implementation of Stage 2	➢ 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.	• Improvement of the landfill site with the Fukuoka Method (improvement of a part of the landfill site)
Hawassa (Ethiopia)	429,170 persons USD953	Stage 2	Stage 1 - 2 Collection Amount: 196 t/day (80%) collection and transportation is mainly by donkey carts Direct collection and private outsourcing collection	Stage 1 The landfill site is open dumping and almost no remaining capacity. Information on the development of a new landfill site by WB is available.	Stage 1 - 2 Recycled Amount: 15 t/day (6%)	Stage 1 The level for Stage 2	➢ The collection ratio is estimated to be approximately 80%. However, waste collection and transportation is mainly by donkey carts, which are inefficient and unsanitary, and mechanized equipment should be introduced. In conjunction with the introduction of mechanized equipment, the collection and transportation plan needs to be modified. ➢ The final disposal site is open dumping, and its operation needs to be improved.	-
Conakry (Guinea)	2,039,725 persons USD950	Stage 1 - 2	Stage 1 Collection Amount: 787 t/day (55%) Direct collection and private outsourcing collection	Stage 1 The landfill site is open dumping and remaining capacity is 3 years. A plan to develop new landfill site is available.	Stage 1 No data regarding recycling A Plan to develop WtE facility is being considered	Stage 1 [-] The lowest level in Stage 1	➢ 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.	-
Kampala (Uganda)	1,680,600 persons USD910	Stage 2	Stage 1 Collection Amount: 1,200 t/day (60%) Direct collection and privatization	Stage 1 Covering soil is implemented, however, there is a possibility of slope collapse. There is almost no remaining capacity. A plan to develop a new landfill site utilizing PPP scheme is available.	Stage 1 Recycled Amount: 200 t/day (10%) A plan to develop a recycling facility utilizing PPP scheme is available	Stage 1 [-] The lowest level in Stage 1	➢ Since collection and transportation is privatized, there is inadequate waste collection in slum areas where the slum dwellers have low ability to pay service fees to private companies.	• Treatment of e-waste • Privatization of waste collection service

City	Population GDP per capita	Solid Waste Management Components					Priority Issues	Good Practice
		Legisla-tions /Plan	Collection and Transportation	Final Disposal	Intermediate Treatment / Recycle	Comprehensive Evaluation*		
Gaborone (Botswana)	280,519 persons USD7,660	Stage 2	Stage 2 Collection Amount: 100 t/day (80%) Direct collection and private outsourcing collection	Stage 2 Leachate collection and drainage systems are installed and covering soil is carried out. The remaining capacity is over 7 years.	Stage 1 No data regarding recycling	Stage 2 [-] The level of assurance for the implementation of Stage 2	➢ Since Gaborone city does not own a landfill and is dependent on other cities, it needs to plan for a regional solid waste management in cooperation with neighboring municipalities.	• Enacting the integrated waste management policy • Promotion of segregation at source
Kwenwng District (Botswana)	387,096 persons USD7,660	Stage 2	Stage 1 Collection Amount: 139 t/day (60%) Many dumping sites exist in the suburbs Direct collection and private outsourcing collection	Stage 2 Leachate collection and drainage systems are installed and covering soil is applied. The remaining capacity is over 10 years.	Stage 1 No data regarding recycling	Stage 1 [+] The level just before Stage 2	➢ 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 Regional Landfill has a remaining lifespan, however, incidents of breakout of fires have occurred repeatedly, and the landfill's operation needs to be improved.	
Johannesburg (South Africa)	5,926,668 persons USD5,978	Stage 3	Stage 3 Collection Amount: 3,562 t/day (94%) Source separation has been promoted for implementation in approx. 30% of all households. Direct collection	Stage 2 There are 7 landfill sites (3 of which are owned by private companies.). LFG power generation facility is being operated.	Stage 2 Recycled Amount: 274 t/day (7%) Plans for dMRF and WtE facility are in progress.	Stage 3 [-] The level of assurance for the implementation of Stage 3	➢ The final disposal site has little remaining capacity, necessitating a project to construct an intermediate treatment facility.	• Introduction and operation of waste information system • Establishment of South African Waste Pickers Association (SAWPA) with support from the government etc. • Introduction and operation of biogas power generation at the landfill site
Tshwane (South Africa)	3,700,000 persons USD5,978	Stage 3	Stage 2 Collection Amount: 4,932 t/day (94%) Paper waste is segregated in some areas. Direct collection and private outsourcing collection	Stage 2 There are 4 landfill sites. A plan to develop LFG power generation plant was aborted.	Stage 2 Recycled Amount: 274 t/day (5%) The plan regarding WtE incineration facility was aborted.	Stage 2 [+] The level just before Stage 3	➢ 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.	

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
( ) in "Collection and Transportation" and "Intermediate Treatment / Recycling" columns indicate collection and recycling rates
*: [+] is a higher level than the standard, [-] is a lower level than the standard
Source: prepared by JICA Study Team

The main issues in the target cities of this study are summarized in Figure 12-2, using population and GDP per capita as indicators. Many of the cities raised collection/transportation of waste and development and improvement of landfill sites as issues. South African cities with high GDP (Johannesburg city and Tshwane city) listed issues related to the development and operation of intermediate treatment facilities. The challenges in Botswana (Gaborone City and Kweneng District), which has the highest GDP per capita, are more basic compared to South Africa, as the challenges are regional waste management and improvement of waste collection and disposal site. In a country with high state revenues from oil and mineral resources, there may be a discrepancy between GDP per capita and citizens' living standards. In this Study, no strong relationship was found between GDP per capita and the stage of waste management.



*The number next to the city name indicates the stage of solid waste management.
Source: prepared by JICA Study Team

Figure 12-2 Main Issues for Each Target City

The results of this study, considered from the perspective of proposed cooperative policies through ACCP, can be summarized as follows.

- The level of solid waste management in the surveyed cities is different, and each city faces different challenges. The activities and good practices of cities in higher levels of solid waste management can be useful for countries in lower levels of solid waste management.

- South Africa, in particular, has a high level of solid waste management and has many experiences and good practices that can be useful for other ACCP member countries. South Africa can be seen as a resource for other member countries as well as a target for assistance from the ACCP. The same applies to Morocco, which is not a target country for this study and hosted the first general meeting of ACCP in 2018.
- As for the member countries in Stage 1 and Stage 2, mutual learning and horizontal linkages through training and dispatch of experts within the African region will help to improve common basic problems of solid waste management such as collection, transportation, and final disposal. On the other hand, for countries such as South Africa that are in Stage 3 or aiming for Stage 3, few good examples are available from ACCP countries, and more input from Japan and other developed countries, such as dispatching experts and providing training in Japan, is considered necessary.
- Regarding intermediate treatment/recycling among the component technologies, few or none of the member countries are capable of developing and properly operating WtE facilities. Therefore, input from developed countries will be important for the planning, maintenance and operation of intermediate treatment facilities, as well as for the knowledge related to the introduction of separate collection.
- In some of the target countries, the development of final disposal sites and intermediate treatment facilities is actively planned and promoted through PPPs. In addition, waste collection is actively utilizing private sector outsourcing and privatization, and part of the problems associated with waste collection can be attributed to the lack of management by private companies. Thus, the private sector is becoming a major stakeholder in solid waste management, and the promotion of private-sector cooperation and the supervision and management of private companies by the public sector are issues that need to be addressed.

12.1.2 Achievement Status of SDGs

Table 12-2 shows the current status of the SDGs' waste-related indicators in the field survey countries and recommendations for improving the solid waste management stages.

Table 12-2 Current status of SDGs' Waste-related Indicators and Recommendations for improving Solid Waste Management Levels in Field Survey Countries

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	Although the waste collection and proper disposal rates differ among the field survey countries, each country has taken a positive attitude toward improving their waste collection and proper disposal rates through measures such as the utilization of private companies. For example, in Cote d'Ivoire, the waste collection rate, which was originally 48%, has increased to 80-90% through outsourcing to private companies. It is necessary to take measures to improve the waste collection rate and proper disposal rate and to reduce the amount of generated waste.
12.3.1	a) Food loss index, and b) Food waste index	No laws, policies, or initiatives for reducing food and other organic waste have been implemented in the field survey countries except for South Africa. Laws, policies, and initiatives for the reuse of food

SDGs Indicators		Present Situation
		waste (e.g., processing residuals, leftovers, uneaten food, etc.), such as utilizing food waste as feed or fertilizer, are needed.
12.4.2	(a) Hazardous waste generated per capita; and (b) proportion of hazardous waste treated, by type of treatment	Although all field survey countries are members of the Basel Convention, data on the amount of hazardous waste generated and collected has not been compiled. Meanwhile, some countries have taken their own measures, such as enacting laws and regulations on hazardous waste management (Cote d'Ivoire), introducing a licensing system (Angola), collection of e-waste (Uganda), and introducing EPRs (South Africa). Proper management of hazardous waste as well as general waste is necessary.
12.5.1	National recycling rate, tons of material recycled	Although many of the field surveyed countries recognized the necessity of recycling, the recycling rate was low and recycling was not well promoted. There are many difficulties in introducing the separate collection of recyclable materials in developing countries due to the high cost of collection, and the countries are in fact relying on the activities of the informal sector. Recycling should be promoted gradually by investigating examples from developed countries and other countries and formulating strategies/plans to promote the circular economy.
14.1.1	(a) Index of coastal eutrophication; and (b) plastic debris density	Especially in the field survey target countries facing the ocean (e.g., Cote d'Ivoire and Angola), spillage and pollution into the ocean from illegal dumping have become a problem. Even in inland countries not facing the ocean, spillage and pollution of waste into rivers and lakes have occurred, which in turn have led to pollution of the ocean. It is necessary to take actions such as enacting laws and regulations aimed at preventing marine pollution, improving waste collection rates (including reducing illegal dumping), improving recycling rate, and properly disposing of waste (application of soil cover at the final disposal sites).

Source: prepared by JICA Study Team

12.2 Draft Framework for Cooperation with ACCP Member Countries

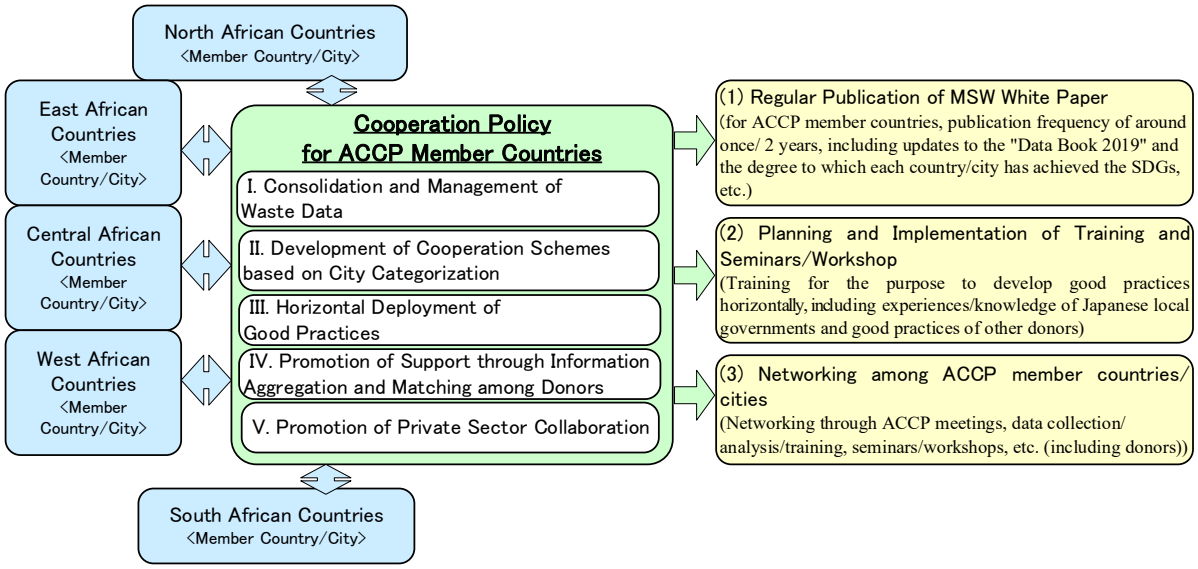
Based on findings of this study, the expected roles, contributions, and the draft cooperation policy framework of ACCP are summarized as follows

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.

(1) Consolidation and Management of Waste-related Data
(2) Development of Cooperation Schemes based on City Categorization
(3) Horizontal Deployment of Good Practices
(4) Promotion of support through information aggregation and matching among donors
(5) Promotion of Private Sector Collaboration

The image of the draft cooperation policy framework is shown in Figure 12-3 and contents of each item are described as follows.



Source; prepared by JICA Study Team

Figure 12-3 Image of Cooperaion 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 also be 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)[38] for cities where a sufficient amount of information is available.

ACCP"s 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 Tools for MSW

[38] It was established by UN-Habitat for grasp solid waste management in developing countries.

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 development of good practices, as described 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 solid 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 solid 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)".

[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.

Table 12-3 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 in one city have the potential to be horizontally transferred to other cities, especially those in the same city category. For example, the data management system in Johannesburg could be horizontally deployed in any country. In addition, the operation of the final disposal facility in Luanda can be used as a reference case for Conakry and Hawassa, among others.

Table 12-3 Categorization of Targeted Cities

Stage	Large cities (more than 2 million)	Medium and small cities (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 Development 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 development 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 for 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 by 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. In ACCP member countries, input from Japan and other developed countries will be important for the future gradual introduction. Concretely, training in developed countries and the development 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

In ACCP member countries, various donors are currently planning and implementing assistance programs. 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 currently 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 (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

The results of this survey 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, inventorying 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.

12.3 Direction of Improvement in Solid Waste Management by JICA

Based on Table 12-1, "Draft Cooperation Policy Framework for ACCP Member Countries (section 12.2 of Chapter 12)" and JICA's proposed cooperation policy (short and middle terms)[39], which was examined in the target countries and cities of this study, the following table shows the direction of improvement in solid waste management by JICA.

Table 12-4 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 Item		● 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	● Training at ACCP Training Center ● Inventory of relevant laws, regulations, standards etc. of ACCP countries ● Dissemination of the "Identification Tools for MSW Management Overview".	● Establish laws and ordinances related to ensuring public health ● Develop waste management plans and action plans ● Identify waste flows
	Phase 2	● Ditto	● 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	● Training in developed countries including Japan	● 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	● Dispatch of experts to Africa ● Training in Africa	● 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	● Ditto	● Provide collection services to low-income communities
	Phase 3	● Training in developed countries including Japan	● Introduce source separation at the storage and discharge stages ● Introduce collection of separated wastes
Intermediate and recycling	Phase 1	● Training in developed countries including Japan	● Identify waste pickers and improve working conditions ● Identify and register recycling companies

[39] 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)
	Phase 2	● Ditto ● Publication of bid notices on PPP projects etc. and business matching	● Define the role of recycling companies in waste management projects ● Develop intermediate treatment facilities
	Phase 3	● Ditto	● 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	● Dispatch of experts to Africa ● Training in Africa ● Development of guidebook for landfill improvement and operation ● Pilot project for landfill improvement by Fukuoka method	● Identify and eliminate illegal dumping sites ● Identify and improve open dumping sites
	Phase 2	● Ditto ● Development of guidelines for safe closure and site use	● Arrange the final disposal sites according to the plan ● Construct final disposal sites (controlled disposal sites) ● Consider regional disposal sites (if needed)
	Phase 3	● Training in developed countries including Japan	● Construct landfill sites (sanitary landfill sites) ● 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	● Training at ACCP Training Center	● 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	● Ditto ● Development of guidelines to be used for private sector outsourcing and management (collection and transportation)	● 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	● Training in developed countries including Japan	● 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	● Training at ACCP Training Center	● Secure budget (facility development and equipment procurement) ● Develop financial management system
	Phase 2	● Ditto	● Secure budget (facility maintenance and equipment procurement)

Item	Phase	Support by ACCP (Draft)	Support by Donors (including JICA)
			● Improve and strengthen financial management systems ● Introduce a fee collection system
	Phase 3	● Training in developed countries including Japan	● Secure budget (facility maintenance and equipment procurement) ● Improve tipping fee ● Introduce FIT
Society and community	Phase 1	● Dispatch of experts to Africa ● Training in Africa ● Provision of guidelines for environmental education	● Raise residents' awareness of waste management ● Identify the informal sector
	Phase 2	● Ditto	● Promote citizens' participation in waste management ● Conduct environmental education and awareness activities ● Increase rate of fee collection
	Phase 3	● Training in developed countries including Japan ● Pilot project for raising public awareness to support source separation	● 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 following are JICA's support schemes. The capacity of C/P agencies, project scale, contents, etc. will be examined for each project, and the scheme to be applied will be determined.

- Technical cooperation project (Dispatchment of individual expert, Training in Japan (including issue-specific training and collaboration with local governments), third country training (including south-south cooperation)) for preparation of solid waste management plan and action plans; implementation of pilot projects; and capacity development
- 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

The ACCP and the proposed direction of donor support described above, when applied to the main issues in the field survey countries, can be summarized as shown in Table 12-5. And, the support scheme of JICA, which is expected as a donor, is listed in the table. The ACCP and JICA support schemes (draft) have similar schemes, such as training and dispatching of experts. In some cases, either ACCP or JICA may provide support, while in other cases, both parties may provide support on a collaborative basis. Therefore, it is

necessary to clarify the division of roles between ACCP and JICA when providing assistance. In addition, in considering the development of facilities and equipment under JICA's assistance, the "Major Challenges and Technologies to help achieve them in each city (refer to Table 11-5)" shown in Chapter 11 will be helpful for the consideration.

Table 12-5 ACCP and JICA Support Schemes for Priority Issues in the Target Countries

City	Comprehensive Evaluation (See Table 12-1)	Priority Issues (See Table 12-1)	Self-help Efforts to be addressed upfront	Assistance Scheme of ACCP*	Assistance Scheme of JICA*	Technologies which may contribute to overcome the challenges (See Table 11-5)
Abidjan Autonomous District (Cote d'Ivoire)	Stage:2	Establishment of fundamental laws and regulations for solid waste management and recycling is urgently needed.	Survey of similar cases in developed countries, etc.	Training at ACCP Training Center Training in developed countries Provision of inventory of relevant laws, regulations, standards etc. of ACCP countries	Technical Cooperation (project, dispatch of expert and training etc.)	
		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.	Organize a framework for regional waste treatment Identification of actual conditions of recycling companies, etc.	Training at ACCP Training Center Training in developed countries	Technical Cooperation (project, dispatch of expert and training etc.)	
		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.	Identification of current status of waste collection system and actual conditions Review of waste collection and transportation plans	Guidelines for private sector outsourcing and management (collection and transportation) Dispatch of experts to Africa	Technical Cooperation (project, dispatch of expert and training etc.) Grant aid	Waste collection vehicles (compactor trucks and container carriers etc.)
Luanda Province (Angola)	Stage 2-	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.	Identification of actual conditions of recycling companies, etc.	Training at ACCP Training Center Training in developed countries	Technical Cooperation (project, dispatch of expert and training etc.)	
		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.	Analysis of problems at transfer stations that have been out of operation and preparation for restarting operations at these stations	Guidelines for private sector outsourcing and management (collection and transportation) Guideline for environmental education Dispatch of experts to Africa	Technical Cooperation (project, dispatch of expert and training etc.) Grant aid	Waste collection vehicles (compactor trucks and container carriers etc.)
Addis Ababa (Ethiopia)	Stage 2-	An environmental standard for Fly Ash disposal needs to be developed.	Survey of similar cases in developed countries, etc.	Training in developed countries	Technical Cooperation (project, dispatch of expert and training etc.)	Cement solidification Melting and slugging method Chelating method
		Koshe final disposal site has little remaining capacity, and development of new final disposal facilities will be needed.	Consideration of potential sites for new landfill sites	Dispatch of experts to Africa Training in Africa	Technical Cooperation (project, dispatch of expert and training etc.)	Sanitary landfill method (Fukuoka method) Weighbridge, management system
		The Rappi WtE Facility is only treating about half of its planned capacity and needs to be improved.	Comparison of design waste quality and actual waste quality, technical study on waste quality change	Training in developed countries	Technical Cooperation (project, dispatch of expert and training etc.)	
Hawassa (Ethiopia)	Stage 1	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.	Review of collection and transportation plan Discussion with collection and transportation companies	Guidelines for private sector outsourcing and management (collection and transportation) Dispatch of experts to Africa	Technical Cooperation (project, dispatch of expert and training etc.) Grant aid	Waste collection vehicles (compactor trucks and container carriers etc.) Transfer stations using compression machine

City	Comprehensive Evaluation (See Table 12-1)	Priority Issues (See Table 12-1)	Self-help Efforts to be addressed upfront	Assistance Scheme of ACCP*	Assistance Scheme of JICA*	Technologies which may contribute to overcome the challenges (See Table 11-5)
		The final disposal site is open dumping, and its operation needs to be improved.	Identification of the amount of waste transported to the landfill site, and management of waste pickers.	Guidebook for landfill improvement and operation Pilot project for landfill improvement with Fukuoka method Dispatch of experts to Africa Training in Africa	Technical Cooperation (project, dispatch of expert and training etc.)	Sanitary landfill method (Fukuoka method) Weighbridge, management system
Conakry (Guinea)	Stage 1-	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.	Basic data collection and problem analysis for primary collectors Review of collection and transportation plans	Guidelines for private sector outsourcing and management (collection and transportation) Guideline for environmental education Dispatch of experts to Africa	Technical Cooperation (project, dispatch of expert and training etc.)	Waste collection vehicles (compactor trucks and container carriers etc.) Transfer stations using compression machine
Kampala (Uganda)	Stage 1-	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.	Collection of basic information on slum areas (size, basic infrastructure, etc.) Review of collection and transportation plans	Guidelines for private sector outsourcing and management (collection and transportation) Dispatch of experts to Africa	Technical Cooperation (project, dispatch of expert and training etc.) Citizen participation project (Grassroots technical cooperation etc.)	Waste collection vehicles (compactor trucks and container carriers etc.) Transfer stations using compression machine
Gaborone (Botswana)	Stage 2-	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.	Discussions on roles, responsibilities, financial burdens, etc. of each party for regional collaboration (Organizing the framework for regional treatment)	Training at ACCP Training Center Dispatch of experts to Africa Training in Africa	Technical Cooperation (project, dispatch of expert and training etc.)	
Kwenwng District (Botswana)	Stage 1+	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.	Review of collection and transportation plans Identification of current conditions and problem analysis of dump sites located in suburban areas	Guidelines for private sector outsourcing and management (collection and transportation) Dispatch of experts to Africa	Technical Cooperation (project, dispatch of expert and training etc.) Grant aid	Waste collection vehicles (compactor trucks and container carriers etc.) Transfer stations using compression machine
		Gamodubu Regional Landfill has a 10-year remaining lifespan, however, fire accidents are frequent, and the landfill operation needs to be improved.	Problem analysis of the maintenance and management system of the landfill site	Guidebook for landfill improvement and operation Pilot project for landfill improvement by Fukuoka method Dispatch of experts to Africa Training in Africa	Technical Cooperation (project, dispatch of expert and training etc.)	Sanitary landfill method (Fukuoka method) Weighbridge, management system
Johannesburg (South Africa)	Stage 3-	The final disposal site has little remaining capacity, necessitating a project to construct an intermediate treatment facility.	Promotion of a city-led project to construct a WtE facility and establishment of a post-construction operational monitoring structure	Training in developed countries Promotion of private collaboration (Publication of bid notices on PPP projects etc. and business matching)	Technical Cooperation (project, dispatch of expert and training etc.) ODA loan Private sector collaboration	Management system for Waste-to-Energy (incineration) facilities
Tshwane (South Africa)	Stage 2+	The final disposal site has little remaining capacity, necessitating a project to construct an intermediate treatment facility.	Analysis of the current financial situation upon construction of an intermediate treatment facility	Since both projects (LFG power generation facility and WtE incinerator) are currently at standstill due to financial problems, establishing financial support system is an urgent issue. At the same time, technical support for proper implementation of the project is also desired.		Waste-to-Energy (incineration) facilities Biogas power generation plant
		Due to the very limited implementation of source separation, household waste is not being recycled, and these efforts need to be expanded.	Identification of actual recycling conditions in the private sector and formulation of a basic policy for separate collection	Guideline for environmental education Training in developed countries	Technical Cooperation (project, dispatch of expert and training etc.) Private sector collaboration	Waste sorting and recycling technologies such as MBT, MRF and composting etc.

* These are the possible support schemes for the priority issues, and do not take into account the feasibility of implementation as a support project or the degree of maturity of the project.

Source: prepared by JICA Study Team

CHAPTER 13 Tool for Identifying the Overview of Municipal Solid Waste Management

13.1 Purpose and How to Use

This tool provides examples of the basic data and information required to assess the target region's waste management situation. In order to objectively assess the current situation, issues, and priorities of waste management in the region, it is recommended that the survey be conducted jointly by the respective country/city waste management organization and JICA personnel.

This tool consists of a checklist and standard survey items, with the below features and contents for each.

13.2 Checklist

The checklist is intended for countries/cities where waste management issues have been recognized to a certain extent, and should be used to organize basic information. In general, it is assumed that the checklist will be used by the JICA office as well as the person responsible for waste management in the respective country or city, and items have been narrowed down to those that can be checked by persons without any particular waste management expertise. Although precise data is not necessarily required, this checklist will provide a big-picture view of the entire waste flow, confirming the location of problems at each stage. It is also considered useful in determining a general approach to improvement and serving as the foundation (local capacity, etc.) for collaborative projects

Checklist items cover general overviews of waste management issues and waste management operations, the donor support situation, and six items on basic waste management information. Table 13-1 and Table 13-2 show the items and their contents.

Table 13-1 Checklist (General Overview)

Item		Content
1	Target country/region/city	
2	Issues and key factors in waste management*1	Issue: Key factor: 1) Organization 2) Policy 3) Legislation 4) Finance 5) Collection and transport 6) Intermediate treatment 7) Final disposal Details:
3	Overview of Waste Management*1	Total general waste generated (kg/day), per capita waste generation (kg/habitant/day), service coverage ratio for general waste collection (ratio of population served to total population of the target area) Intermediate treatment amount/ratio, recycling amount/ratio, final disposal amount/ratio ("ratio" is the ratio of amount disposed to amount of total general waste generated)
4	Donor support	Support activities/support plans in the waste field by donors, NGOs, etc. (including JICA)

*1: Municipal solid waste means municipal waste generated by homes, businesses, etc. In general, industrial waste is excluded. If data other than municipal solid waste is included, it should be noted.

Source: prepared by JICA Study Team

Table 13-2 Checklist (Basic Information)

Major item	Sub item	Content
1 Organization/institution	1-1 Organizational structure	・Waste-related organization chart, number of staff assigned to each department
	1-2 Laws and regulations	・Laws and regulations related to waste management ・Laws and regulations related to environmental assessment ・Laws and regulations related to environmental protection standards
	1–3 Policies	・National waste management strategy ・Waste management plan (master plan)
2 Finance	2-1 Financial management	・Annual budget ・Annual income and expenses ・Fee collection system
3 Society/ community	3-1 Resident participation	・3R and resource recycling efforts in society/the community
	3-2 Environmental education and awareness-raising activities	・Environmental Week, environmental events ・Environmental education programs in schools
	3-3 Informal sector	・Waste picker existence and activity locations (in town, transfer station, final disposal site, etc.)
4 Collection and transport	4-1 Overview of collection	・Emission and waste separation rules ・Collection service area ・Flow of collection and transport from households to final disposal site (existence of primary collection, existence of a transfer station, etc.)
5 Intermediate treatment/ recycling	5-1 Intermediate treatment facilities	・Existence of intermediate treatment facilities, their location, and treatment methods
	5-2 Recycling facilities	・Existence of recycling facilities, their location, and marketable waste being handled (including operation by a non-governmental organization such as a private contractor or NGO)
6 Final disposal	6-1 Final disposal site	・Location, total area, and years of use ・Number of open dump sites (dump sites where waste is just dumped)

Source: prepared by JICA Study Team

13.3 Standard Survey Items

Because more comprehensive and detailed information is required when considering specific cooperation, the survey items have been organized systematically to provide an overall picture of the waste management situation. As the survey is expected to be used primarily for JICA project planning, it is preferable to have specialized knowledge in the waste field to ensure validity of the survey results. However, because the survey is also expected to be useful as a tool for C/Ps to deepen their understanding of the current situation and issues in their country/city through the process of information and data collection, the survey should be used flexibly according to the needs of each region, such as a basis to prepare reports the waste management situation of participants' countries in Group and Region-Focused Training, etc.

Standard survey items have been set for each country and city to organize their respective roles and information. Table 13-3 and Table 13-4 show the standard evaluation items for countries and cities.

Table 13-3 Setting of Standard Survey Items – Country level

Major item	Sub item	Content
1 General Information	1-1 Population	Population, population growth rate
	1-2 Topography	Area, elevation, and land use
	1–3 Climate	Temperature, rainfall, and existence of a rainy or dry season
	1–4 Economy	GDP, GDP growth rate, GNI per capita, major industries
	1-5 Basic infrastructure	Sewerage system coverage, internet penetration rate
	1-6 Donor support	Support activities/support plans in the waste field by donors, NGOs, etc. (including JICA)
2 Organization/institution	2-1 Organizational structure	・Waste-related organization chart, relationship with local government organizations ・Education and human resource development system ・Business licensing system for private contractors
	2-2 Laws and regulations	・Laws and regulations related to waste management ・Definition of waste (whether there is a distinction between general waste, industrial waste, and hazardous waste) ・Entity responsible for waste management and disposal ・Environmental assessment-related legislation, implementation status, target activities, procedures ・Laws and regulations related to environmental protection standards ・Technical guidelines
	2-3 Policies and plans	・National waste management strategy, positioning of waste in the national plan, target values, implementing entities, and national data ・Implementation status of the waste management strategy
3 Finance	3-1 Financial management	・Budget decision-making mechanism, financial management system ・Subsidy system ・Investment plan

Source: prepared by JICA Study Team

Table 13-4 Setting of Standard Survey Items – City level

Major item	Sub item	Content
1 General Information	1-1 Population	Population
	1-2 Topography	Area, elevation, and land use
	1–3 Climate	Temperature, rainfall, and existence of a rainy or dry season
	1–4 Economy	Major industries, income levels (high/middle/low income neighborhoods, etc.)
	1-5 Basic infrastructure	Public health status, sewer system coverage, internet penetration rate
	1-6 Donor support	Support activities/support plans in the waste field by donors, NGOs, etc. (including JICA)
2 Organization/institution	2-1 Organizational structure	・Waste-related organization chart, number of staff assigned to each department, relationship with central government-level organizations ・Road cleaning, collection and transport, intermediate treatment, final disposal, number of staff assigned to each section of the waste management department, frequency of

Major item	Sub item	Content
		staff reassignment, retention rate, education/human resource development system ・ Business licensing system for private contractors, outsourcing status to private companies, monitoring system
	2-2 Laws and regulations	・Ordinances related to waste management, implementation status
	2-3 Policies and plans	・ Waste management-related policies in urban planning master plans, etc. ・Waste management plan (master plan) ・Implementation status of master plan and action plan
3 Finance	3-1 Financial management	・Budget decision-making mechanism, financial management system, status of budget securing ・Investment plan
	3-2 Expenses	・Expenses and their breakdown (by expense category) ・ Facility maintenance costs, equipment purchase costs, O&M costs for each facility, outsourcing contract costs, depreciation
	3-3 Income	・ Income and its breakdown (budgeted amount/collection fees, subsidies from the central government) ・ Collection fees (rate setting, collection method, amount collected, collection rate) ・Transfer station and final disposal site fees (rate setting, collection method, amount collected, collection rate)
4 Society/community	4-1 Resident participation	・Level of understanding of waste operations, compliance with waste disposal rules, status of payment of waste fees, status of 3R implementation
	4-2 Environmental education and awareness-raising activities	・School education (implementing organization, number of implementing schools, existence of teaching materials), social education (target, method, medium, scale), campaign activities, NGO involvement
	4-3 Informal sector	・Number of waste pickers, rules, marketable waste handled, living conditions, relationship with neighboring residents ・Informal recyclers and junk shops
5 Waste management	5-1 Overview of waste management	・ Whether there is a distinction between general waste, industrial waste, and hazardous waste ・Waste amount, waste composition, waste flow, overview and location of related facilities
6 Storage and disposal	6-1 Waste separation/disposal, and primary collection	・Storage and disposal rules, waste separation rules, disposal methods, whether primary collection is used, whether there is a distinction between industrial waste, and hazardous waste
	6-2 Road cleaning	・Target areas, equipment, machinery, workforce size, system, frequency
7 Collection and transport	7-1 Overview of secondary collection	・Collection areas, collection frequency, collection methods, collection rate, collection equipment, collection work management, equipment maintenance
	7-2 Overview of transfer stations	・Existence of transfer stations, location, total area, manager, transfer method, target waste, transport volume, usage fees, access (road pavement and driving conditions)
	7-3 Transfer station operation and maintenance	・ Operation and maintenance manuals, including O&M status, work management, equipment maintenance, maintenance costs, O&M of facilities and equipment
8 Intermediate treatment/recycling	8-1 Overview of intermediate treatment and	・ Existence of intermediate treatment/recycling facilities, location, treatment methods, targeted waste, transport volume, usage fees, recycling rate, and marketable waste

Major item	Sub item	Content
	recycling facilities	being handled (For WtE projects) ・Treatment capacity, amount and quality of incoming waste, facilities/equipment, power generation capacity, amount of power generated, activities income/expenses ・Electricity purchasing scheme, electricity selling unit price ・Operation and maintenance manuals, including O&M status, work management, equipment maintenance, maintenance costs, O&M of facilities and equipment
	8-2 Venous industry	・Status of domestic venous industry (venous industry major companies, recycling technology and system, issues)
9 Final disposal	9-1 Overview of final disposal sites	・Location, total area, administrator, landfill method, target waste, transport volume, remaining capacity, remaining years, remaining landfill life, operating years, facilities, equipment, usage fees, access to final disposal site, access within the site (road pavement and driving conditions)
	9-2 Operation and maintenance of final disposal site	・Operating hours (days of the week, hours), staffing (affiliation) ・Operation and maintenance manuals, including O&M status, work management, equipment maintenance, maintenance costs, O&M of facilities and equipment ・Status of environmental pollution by leachate or landfill gas and remedial measures
	9-3 Open dump site	・Number and locations of open dump sites (dump sites where waste is just dumped), estimated amount of waste received, status of environmental contamination around the open dump site, and open dump site safe closure plan

Source: prepared by JICA Study Team