

**Caribbean Region**

**Technical Cooperation Project on  
Advisor for Marine Plastic Litter Management  
in the Caribbean Region**

**Project Completion Report**

**(Annex C)**

**January 2024**

**Japan International Cooperation Agency  
(JICA)**

**EX Research Institute Ltd.  
Nippon Koei Co., Ltd.**

<b>GE</b>
<b>JR</b>
<b>24-005</b>

## Current Situation and Priority Issues

- C1 Current Situation, 2020
- C2 Current Situation, 2022
- C3 Agreement on activities to be carried out in the Project
- C4 Report on Inspection Visit to Proposed Land for Landfills in Guyana

## ANNEX C1

Current Situation, 2020

## A Current Situation (as of October 2020)

This section shows the information about the current situation of solid waste management in the countries obtained and organized in the Basic Study, “North and Latin America Data Collection Survey on Marine Plastic Litter in the Caribbean Region, October 2020”.

### A.1 Jamaica

#### A.1.1 Jamaica, described by the National Solid Waste Management Authority

Respondent: Mr. Edson Z. Carr

Position: Projects and Planning Manager

Organization: National Solid Waste Management Authority

##### A. Basic Information:

Item	Contents
Population	2,726,667 (Source: STATIN, Year: 2018)
Population growth (annual %)	-0.1 (Source: STATIN, Year: 2017-2018)
Urban population	477,201 (# of households) (Source: STATIN, Year: 2011)
Population density (people/km <sup>2</sup> )	248 (Source: STATIN, Year: 2018)
Average national rainfall (millimetres/year)	1,773 (Source: Met Office, Year: 1971-2000)
Annual frequency of hurricanes (times/year)	N/A, no adverse impact.


##### B. SWM Data:

Item	Contents
Waste generation amount (tons/day)	2,781 (Source: NSWMA, Year: 2018)
Waste generation rate (kg/person/day)	1.02 (Source: NSWMA, Year: 2017)
Plastic waste generation amount (tons/day)	0.16
Waste collection amount (tons/day)	2,641 (Source: NSWMA, Year: 2019)
Waste collection coverage (%)	70% per geographical area (Source: NSWMA, Year: 2020)
Recycling rate (%)	N/A
Recycling rate of plastic materials (%)	N/A
Final disposal amount (tons/day)	2,641 (Source: NSWMA, Year: 2019)
Waste composition (%)	yard: 22%, food: 26%, plastics: 16%, papers: 15%, Styrofoam: 1%, textile: 3%, metals/tin: 2%, glass: 4%, e-waste: 4%, wood/board: 2%, other: 5% (NSWMA: Year: 2017)
Main types of recycled materials	Glass bottles, aluminum cans, steel cans, PET bottles

##### C. Current Situation of SWM and MPL:

Item	Contents
1. Legal system	<ul style="list-style-type: none"> <li>• National Solid Waste Management Act, 2001</li> <li>• NSWMA (Disposal of Hazardous Waste) Electronic &amp; Electrical, 2020</li> <li>• NSWMA (Public Cleansing) Regulations, 2020</li> <li>• The Trade (Plastic Packaging Materials Prohibition) Order, 2018</li> <li>• The Natural Resources Conservation Authority (NRCA) Plastic Packaging Materials Prohibition Order, 2018: to ban the importation, distribution, manufacture and commercial use of certain types of single use plastics beginning January 1st, 2019.</li> </ul>



Item	Contents
2. Policy/plan	<ul style="list-style-type: none"> <li>• National SWM Policy, 2000</li> <li>• Solid Waste Management Enterprise Team, 2017</li> <li>• National Policy Environmentally Sound Management of Hazardous Waste (Green Paper): drafted and waiting for approval.</li> <li>• The (Draft) Regulatory Impact Assessment, 2020: proposed general and ultimate objectives is to prevent and reduce plastic waste entering the environment (land, air and water).</li> </ul>
3. Implementation system	<ul style="list-style-type: none"> <li>• National Solid Waste Management Authority (NSWMA): responsible for the collection, transportation &amp; disposal of SW. The NSWMA falls under the Ministry of Local Government and Community Development (MLGCD) and has four regional offices, namely : MPM Waste Management Ltd., SPM Waste Management Ltd., WPM Waste Management Ltd., NEPM Waste Management Ltd.<sup>1</sup>.</li> <li>• National Environment &amp; Planning Agency (NEPA): responsible for policy direction on SWM, especially for monitoring and enforcing compliance with the NRCA (Plastic Packaging Materials Prohibition) Order, 2018.</li> <li>• Medical Waste Management Unit, Ministry of Health: responsible for medical waste.</li> </ul>
4. Technical system	
Collection and transportation	<ul style="list-style-type: none"> <li>• Waste from household: collected once a week under the curbside collection system.</li> <li>• Waste from commercial area: collected 1-3 times a week.</li> <li>• Separated collection system: not yet in practice but NSWMA is working on separate collection of PET in some pilot communities. Also, separation of tetra pack material is under consideration.</li> <li>• Number of collection vehicles: 68 compactor trucks (27 compactor trucks of 20 cubic, 17 compactor truck of 19 cubic, 19 compactor truck of 14 cubic, 3 compactor truck of 30 cubic, 2 compactor truck of 7 cubic), 2 crane trucks, 9 tipper trucks, of which 12.6% is non-functional due to lack of maintenance and spare parts. New 20 compactor trucks have been handed over to NSWMA in July, 2020 and this number is excluded from above information.<sup>2</sup></li> </ul> <div data-bbox="512 1346 943 1503" style="text-align: center;">  </div> <p data-bbox="520 1514 730 1541" style="text-align: center;">Collection Vehicles</p>
Intermediate treatment	<ul style="list-style-type: none"> <li>• There is 1 Material Recovery Facilities (MRF)/Recycling Plant for PET (hand sorting) in the parish of St. Andrew, at the Riverton disposal site. The facility is currently not in use because the former company can no longer do their business. They need to find a new contractor to restart this business.</li> <li>• There is 1 composting facility (windrow method) owned by NSWMA. The facility is currently not in use but internal discussion for the promotion is ongoing under strong initiative from the Executive Director of NSWMA.</li> <li>• There is a proposed transfer station facility to be built in the parish of Trelawny. The construction site has been designated but the construction will be delayed due to Covid-19. Waste loaded at the facility will be transferred to the Retirement Disposal Site which covers four parishes: Westmoreland, Hanover, St. James,</li> </ul>

<sup>1</sup> <http://www.nswma.gov.jm/areas-served-and-services-offered/>

<sup>2</sup> <http://www.nswma.gov.jm/20-shacman-compactor-garbage-trucks-for-nswma/>

Item	Contents
	<p>Trelawny in WPM Region.</p> <ul style="list-style-type: none"> <li>• The waste tires are currently utilized as the energy source at the cement company.</li> </ul>
Final disposal	<ul style="list-style-type: none"> <li>• There is one controlled dump site in St. James parish called Retirement Disposal Site <ol style="list-style-type: none"> <li>1) Owner: NSWMA</li> <li>2) Location: Retirement St. James</li> <li>3) Area: 26.9 hectors</li> <li>4) Waste disposal amount: 638 tons/day</li> <li>5) Data source: estimated by volumetric carrying capacity of truck</li> <li>6) Installed facility: gate bar</li> <li>7) Operation in practice: spreading, compaction of waste with soil covering.</li> </ol> </li> <li>• There is one controlled dump site in St. Andrew parish called Riverton Disposal Site <ol style="list-style-type: none"> <li>1) Owner: NSWMA</li> <li>2) Location: Riverton Meadows, St. Andrew</li> <li>3) Area: 68.3 hectors,</li> <li>4) Waste disposal amount: 1,400 tons/day,</li> <li>5) Data source: estimated by volumetric carrying capacity of truck</li> <li>6) Installed facility: office space, fire suppression system, and manned gate for entrance control.</li> <li>7) Operation in practice: spreading and compaction of waste with soil covering.</li> </ol> <p>There was a big fire accident happened in 2015 but since then, NSWMA has been covering waste with extra soils and installed the fire suppression system at site.</p> </li> <li>• There are two controlled dump sites in St. Ann parish called Haddon and Tobolski. <ol style="list-style-type: none"> <li>1) Owner: NSWMA</li> <li>2) Location: Haddon and Tobolski St. Ann</li> <li>3) Area: 6.9 and 3.5 hectors respectively,</li> <li>4) Waste disposal amount: 219.5 &amp; 86 tons/day respectively,</li> <li>5) Data source: estimated by volumetric carrying capacity of truck</li> <li>6) Installed facility: gate bar (Haddon)</li> <li>7) Operation in practice: spreading and compaction of waste with soil covering.</li> </ol> </li> <li>• There is one controlled dump site in Portland parish called Doctor's Wood Disposal Site <ol style="list-style-type: none"> <li>1) Owner: NSWMA</li> <li>2) Location: Buff Bay, Portland</li> <li>3) Area: 14 hectors,</li> <li>4) Waste disposal amount: 84.6 tons/day,</li> <li>5) Data source: estimated by volumetric carrying capacity of truck</li> <li>6) Installed facility:</li> <li>7) Operation in practice: spreading and compaction of waste with soil covering.</li> </ol> </li> <li>• There is one controlled dump site in Manchester parish called Martins Hill Disposal Site <ol style="list-style-type: none"> <li>1) Owner: NSWMA</li> <li>2) Location: Martins Hill, Manchester</li> </ol> </li> </ul>

Item	Contents
	<p>3) Area: 17.7 hectors,</p> <p>4) Waste disposal amount: 134.5 tons/day,</p> <p>5) Data source: estimated by volumetric carrying capacity of truck</p> <p>6) Installed facility: gate bar</p> <p>7) Operation in practice: spreading and compaction of waste with soil covering.</p> <ul style="list-style-type: none"> <li>• There is one controlled dump site in St. Elizabeth parish called Myresville Disposal Site               <ol style="list-style-type: none"> <li>1) Owner: NSWMA</li> <li>2) Location: Myresville, St. Ann</li> <li>3) Area: 7.2 hectors,</li> <li>4) Waste disposal amount: 39.9 tons/day,</li> <li>5) Data source: estimated by volumetric carrying capacity of truck</li> <li>6) Installed facility:</li> <li>7) Operation in practice: spreading and compaction of waste with soil covering.</li> </ol> </li> <li>• There is one controlled dump site in St. Thomas parish called Church Corner Disposal Site               <ol style="list-style-type: none"> <li>1) Owner: NSWMA</li> <li>2) Location: Church Corner, St. Thomas</li> <li>3) Area: 1.5 hectors,</li> <li>4) Waste disposal amount: 38.5 tons/day,</li> <li>5) Data source: estimated by volumetric carrying capacity of truck</li> <li>6) Installed facility:</li> <li>7) Operation in practice: spreading and compaction of waste with soil covering.</li> </ol> </li> </ul>
5. Financial system	<ul style="list-style-type: none"> <li>• Ratio of SWM budget allocated within national budget: N/A</li> <li>• Main source of SWM costs: property tax, percentage depends on total revenue of the Central Gov. NSWMA do not charge collection fee from residents, but charge from commercial entities by trip. Private collection companies pay tipping fee at disposal site.</li> <li>• Cost required for collection/transportation: N/A</li> <li>• Cost required for intermediate treatment: N/A</li> <li>• Cost required for final disposal: N/A</li> </ul>
6. Donor support	<ul style="list-style-type: none"> <li>• Plastic Waste Minimization Project (2018 - 2021): funded by the Global Environment Facility (GEF), UNEP (Caribbean Sub-Regional Office, IETC, Global Program of Action for the Protection of the Marine Environment from Land-based Activities-Marine Litter). The main objective of the Project is to enhance the capacity of the country to carry out waste management activities and strengthen the policy and legislative framework for reduction of plastic, inclusive of polystyrene, and marine litter in Jamaica. These engagements will involve a regulatory impact assessment (led by NEPA) and development of a national strategy and action plan, development of a communication campaign, and increased awareness through community intervention.<sup>3</sup></li> <li>• Benioff Ocean Initiative and The Coca-Cola Foundation (2021~): The Ocean Cleanup (Dutch non-profitable organization) will collaborate with the Recycling Partners of Jamaica (RPJ) to deploy an Interceptor, its scalable and solar-powered solution that is capable of capturing 50,000 kg of trash per day. RPJ will operate</li> </ul>

<sup>3</sup> <https://jis.gov.jm/plastic-waste-management-project-gets-33-million/>

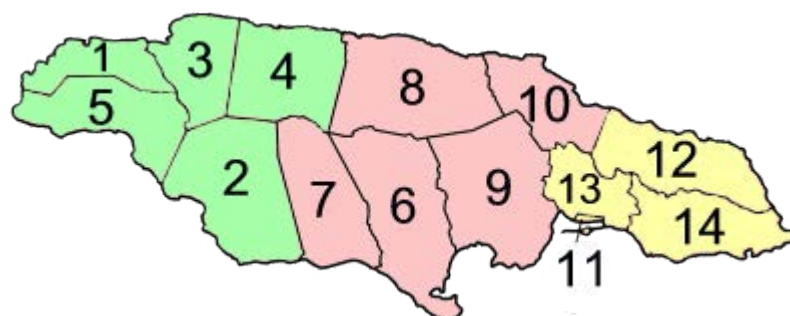
Item	Contents
	<p>the Interceptor and ensure the environmentally sound disposal of all collected plastics and materials.<sup>4</sup></p> <ul style="list-style-type: none"> <li>• Inter-American Development Bank (IDB) Support for Improvement of Solid Waste Management: still under preparation. This technical cooperation aims to assist the Gov. of Jamaica with the preparation of closure plans and designs for Riverton Disposal Site, preparation of studies to support the business case, and the re-orientation of NSWMA to support the preparation of a viable business case for improvement of SWM in Jamaica<sup>5</sup>.</li> </ul>
7. Social consideration	<ul style="list-style-type: none"> <li>• Policy or law for supporting the informal sector: No such legal support for informal sector.</li> <li>• Public awareness raising activities: Public Relation and Communication Dept. of the NSWMA is actively engaged in sensitization on Plastic Waste Minimization Project, waste separation of PET, and composting. These activities are being promoted through Public Relation Officers visiting community and schools, and social medias. The NSWMA also has introduced the mobile app for a faster response time regarding illegal dumping, burning and non-collection of garbage.<sup>6</sup> NSWMA also organizes a lot of campaign for cleaning the beach with community participation.</li> </ul>
8. MPL issues	<ul style="list-style-type: none"> <li>• There is a lot of garbage in several gullies that feed into Kingston harbor. The NSWMA is working with the communities along these main gullies to promote anti-littering and cleaning activities. As part of Plastic Waste Minimization Project, the National Work Agency has designed the waste trap to be set up at these gullies. Once they are procured, NSWMA will be implementing the waste trap system so that they can prevent waste from being washed into the ocean.</li> </ul>
9. Areas for improvement	<ul style="list-style-type: none"> <li>• More public awareness is necessary as to facilitate behavioral change in solid waste management best practices. Younger generation should be focused to have effective behavioral change in society.</li> <li>• The per capita generation of solid waste is expected to increase over the next few years; it is prudent to acquire additional transportation and collection equipment for the increased waste. The Central Government has committed to add another 100 collection trucks over the next 2 years. Before the new 20 additional trucks handed over in July, 15 trucks were given, and additional 30 will be given by the end of the year or the early 2021, and additional 50 will be given within the 2021 financial year.</li> </ul>
10. Other candidates for interview	<ul style="list-style-type: none"> <li>•</li> </ul>

<sup>4</sup> <https://buzz-caribbean.com/news/the-ocean-cleanup-gets-us-1-million-to-clean-kingston-harbour-jamaicas-most-polluted-water-body/>

<sup>5</sup> Information provided by the JICA Jamaica Office, <https://www.iadb.org/en/project/JA-T1182>

<sup>6</sup> <https://www.facebook.com/NSWMA876/>

<u>Cornwall County</u>		Capital	km <sup>2</sup>	<u>Middlesex County</u>		Capital	km <sup>2</sup>	<u>Surrey County</u>		Capital	km <sup>2</sup>
1	<u>Hanover</u>	Lucea	450	6	<u>Clarendon</u>	May Pen	1,196	11	<u>Kingston</u>	Kingston	25
2	<u>Saint Elizabeth</u>	Black River	1,212	7	<u>Manchester</u>	Mandeville	830	12	<u>Portland</u>	Port Antonio	814
3	<u>Saint James</u>	Montego Bay	595	8	<u>Saint Ann</u>	St. Ann's Bay	1,213	13	<u>Saint Andrew</u>	Half Way Tree	453
4	<u>Trelawny</u>	Falmouth	875	9	<u>Saint Catherine</u>	Spanish Town	1,192	14	<u>Saint Thomas</u>	Morant Bay	743
5	<u>Westmoreland</u>	Savanna-la-Mar	807	10	<u>Saint Mary</u>	Port Maria	611				



Administrative divisions of Jamaica<sup>7</sup>



Map of disposal site<sup>8</sup>

<sup>7</sup> Jamaica is divided into 14 parishes, which are grouped into three historic counties that have no administrative relevance. In the context of local government the parishes are designated "Local Authorities". These local authorities are further styled as "Municipal Corporations", which are either city municipalities or town municipalities. Any new city municipality must have a population of at least 50,000, and a town municipality a number set by the Minister of Local Government. There are currently no town municipalities.

<sup>8</sup> <http://www.nswma.gov.jm/collection-schedule/>

## A.1.2 Jamaica, described by the National Environment and Planning Agency



**Respondent:** Mr. Anthony McKenzie

**Position:** Director, Environmental Management and Conservation Division

**Organization:** National Environment and Planning Agency

Item	Contents
1. Legal system	<p data-bbox="507 443 1077 510">Solid Waste Management Authority Act, 2002 Natural Resources Conservation Authority Act, 1997</p> <p data-bbox="507 539 1439 600">Jamaica introduced legislation to ban the importation, distribution, manufacture and commercial use of certain types of single use plastics beginning January 1<sup>st</sup>, 2019:</p> <ul data-bbox="507 607 1380 696" style="list-style-type: none"> <li data-bbox="507 607 1257 636">• The Trade (Plastic Packaging Materials Prohibition) Order, 2018.</li> <li data-bbox="507 636 1380 696">• The Natural Resources Conservation Authority (Plastic Packaging Materials Prohibition) Order, 2018</li> </ul> <p data-bbox="507 730 1439 887"><i>There are several international environmental agreements relevant to plastic pollution. However, there is no legally binding global international agreement that governs the wholesale regulation and reduction of marine plastic pollution in a comprehensive manner. The following presents a summary of multilateral environmental agreements which are binding and their relevance to Jamaica:</i></p> <p data-bbox="507 920 1251 949"><b>United Nations Convention on the Law of the Sea 1982 (UNCLOS)</b></p> <ul data-bbox="507 956 1439 1046" style="list-style-type: none"> <li data-bbox="507 956 1439 1046">• Jamaica became a party to UNCLOS on 21 March 1983. Any legislation that Jamaica adopts to control land-based sources of marine pollution due to plastics, contributes to the fulfilment of the requirements of UNCLOS objectives.</li> </ul> <p data-bbox="507 1079 1439 1146"><b>The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (herein after referred to as the Basel Convention)</b></p> <ul data-bbox="507 1153 1439 1310" style="list-style-type: none"> <li data-bbox="507 1153 1439 1310">• Jamaica became a party to the agreement in 2003. Any actions that the Jamaican government does to minimize or prevent the generation of plastic waste will work towards meeting the requirements of the Convention. If Jamaica seeks to export any unrecyclable or contaminated plastic waste it would have to meet the requirements of the BASEL Convention.</li> </ul> <p data-bbox="507 1317 762 1346"><b>Cartagena Convention</b></p> <ul data-bbox="507 1352 1439 1442" style="list-style-type: none"> <li data-bbox="507 1352 1439 1442">• Jamaica ratified the Convention in 1987 and the Protocol in 2015. As a party to this agreement must seek to implement the action plan and conduct such activities to support regional goals and indicators.</li> </ul> <p data-bbox="507 1476 1439 1543"><b>International Maritime Organization Convention on Prevention of Marine Pollution by Dumping of Wastes and other Matter, 1972 (London Convention)</b></p> <ul data-bbox="507 1550 1066 1579" style="list-style-type: none"> <li data-bbox="507 1550 1066 1579">• Jamaica is not yet a party to the 1996 Protocol.</li> </ul> <p data-bbox="507 1610 1439 1639"><b>The International Convention for the Prevention of Pollution from Ships (MARPOL)</b></p> <ul data-bbox="507 1646 1439 1758" style="list-style-type: none"> <li data-bbox="507 1646 1439 1758">• Jamaica became a party to MARPOL in 1991 and must regulate the dumping of materials from ships through its national legislation. A Draft Shipping (Pollution Prevention and Control) Bill is to be enacted which will address the prevention of pollution, response to pollution incidents and compensation for pollution damage.</li> </ul> <p data-bbox="507 1789 1054 1818"><b>General Agreement on Tariffs and Trade (GATT)</b></p> <ul data-bbox="507 1825 1439 1892" style="list-style-type: none"> <li data-bbox="507 1825 1439 1892">• Jamaica's prohibition on the production and importation of single-use plastic products could be perceived as discriminatory.</li> </ul> <p data-bbox="507 1924 1219 1953"><i>Non-binding international resolutions to further regulate plastics:</i></p> <ul data-bbox="507 1960 1109 2049" style="list-style-type: none"> <li data-bbox="507 1960 1109 1989">• <b>United Nations Environment Assembly (UNEA-4)</b></li> <li data-bbox="507 1989 1007 2018">• <b>The UN Sustainable Development Goals</b></li> <li data-bbox="507 2018 707 2049">• <b>Polluter Pays</b></li> </ul>

Item	Contents
2. Policy/plan	<p>The (Draft) Regulatory Impact Assessment, 2020 - proposed general and ultimate objectives is to prevent and reduce plastic waste entering the environment (land, air and water). The immediate strategies include:</p> <ol style="list-style-type: none"> <li>1. To reduce the amount of single use plastic imported and manufactured in Jamaica.</li> <li>2. To improve the waste collection and disposal system in Jamaica.</li> <li>3. To minimise the amount of plastic entering the waste stream through adequate recovery and reuse.</li> <li>4. To change public attitudes and behaviour through sensitization, education and appropriate incentives</li> </ol>
3. Implementation system	<p>The National Environment and Planning Agency is responsible for monitoring and enforcing compliance with the Natural Resources Conservation Authority (Plastic Packaging Materials Prohibition) Order, 2018.</p> <p>NEPA led the preparation for the Regulatory Impact Assessment as an output of the Plastic Waste Minimization Project. The main objective of the Project is to enhance the capacity of the country to carry out waste management activities and strengthen the policy and legislative framework for reduction of plastic, inclusive of polystyrene, and marine litter in Jamaica.</p> <p>Additional Agencies responsible for implementation/ enforcement of the policy objectives include:</p> <ul style="list-style-type: none"> <li>• National Solid Waste Management Authority is the primary Agency responsible for the managing solid waste collection and disposal.</li> <li>• The Jamaica Customs Agency, inclusive of the Commissioner of Customs and customs officers are responsible for the enforcing the Customs Act, in particular, ensuring the payment of the relevant duties on goods imported into Jamaica at all ports of entry.</li> <li>• The Bureau of Standards and the National Compliance and Regulatory Authority would provide oversight and compliance by ensuring standards for verifying the composition and characteristics of alternatives are met.</li> <li>• The Trade Board Limited in the Ministry of Industry, Commerce, Agriculture and Fisheries is a regulatory agency of Government, operating under the legal authority of the Trade Act. They are Jamaica’s certifying authority for goods exported under various trade agreements. They are responsible for monitoring enforcement and compliance of the Trade (Plastic Packaging Materials Prohibition) Order, 2018. This Order focuses on the importation of the plastic material.</li> <li>• The National Compliance and Regulatory Authority (NCRA) conducts check at the different ports of entry to flag plastic items.</li> </ul>
4. Donor support	<ul style="list-style-type: none"> <li>• The Plastic Waste Minimization Project is being funded by the Global Environment Facility (GEF), and other executing partners, namely, the UN Environment (Caribbean Sub-Regional Office, IETC, Global Program of Action for the Protection of the Marine Environment from Land-based Activities-Marine Litter).</li> </ul>
5. MPL issues	<p><b>Issues:</b></p> <p>The overarching issue is inadequate solid waste management resulting in blocked drains which contributes to flooding and damage to coastal and marine ecosystems. Disposal of single use plastics particularly plastic bottles in addition to plastic bags accounts for the largest amount of plastic items. Plastic bag imports almost doubled from 2011 to 2015, going from 4 million kilograms (or 720 million bags) to 7 million kilograms, or approximately 1.3 billion bags.</p>

Item	Contents
	<div style="display: flex; justify-content: space-around;">   </div> <p>A- blocked drains, D – garbage on beach/shoreline</p> <p><b>Good practice recommendations:</b> Ban on manufacture, importation and production of single use plastic, Deposit Refund Scheme, use of alternative materials.</p>
6. Areas for improvement	<ul style="list-style-type: none"> <li>• Enforcement of the objectives of the plastic ban</li> <li>• Further studies may be useful to sample sections along the major gullies in the Kingston corporate area to determine what percentage is plastic to have a better understanding of the amount and nature of the waste that is entering the marine environment.</li> <li>• Waste characterization study to confirm if there have been actual reductions in the waste stream by the end of the 2021. This would provide enough time for all phases of the ban to be fully implemented and in effect.</li> <li>• Study to determine impact of micro plastics</li> <li>• Development of waste to energy technology</li> </ul>



## A.2 Saint Lucia

Respondent: Mrs. Emlyn Jean, Information & Communication Manager  
 Mrs. Cristal K Smith-Peter, Weighbridge Attendant  
 Organization: Saint Lucia Solid Waste Management Authority

### A. Basic Information:

Item	Contents
Population	179,995 (2019 midyear estimate provisional) - <b>Department of Statistics</b>
Population growth (annual %)	0.73% (2018-2019 growth rate) - <b>Department of Statistics</b>
Urban population	34,990 - <b>Department of Statistics</b> (Includes urban center and peripheral only available for 2010)
Population density (people/km <sup>2</sup> )	292.2 - <b>Department of Statistics</b>
Average national rainfall (millimeters/year)	Average Rainfall I based on the 30 year climatological mean from 1981 to 2010. In Saint Lucia average rainfall is sectioned into two parts because there are two monitoring stations: Hewanorra International Airport - 1491.9 millimeters George FL Charles Airport - 1900.2 - <b>Saint Lucia Meteorological Service</b>
Annual frequency of hurricanes (times/year)	Less than 1% per year (not any adverse impact) - <b>Saint Lucia Meteorological Service</b>

### B. SWM Data:

Item	Contents																								
Waste generation amount (tons/day)	216 tons (average data from weighbridge in Deglos Sanitary Landfill and in Vieux-Fort Solid Waste Management Facility, which includes all types of waste such as construction & demolition, green, hotel as well as municipal solid waste, 2019)																								
Waste generation rate (kg/person/day)	1.2 kg per/person/day (above total waste generation amount divided by population)																								
Plastic waste generation amount (tons/day)	N/A (not measured)																								
Waste collection amount (tons/day)	Household waste accounts for 90.95 tons/day out of total waste generation amount (Weighbridge data, 2019)																								
Waste collection coverage (%)	100% for residential waste																								
Recycling rate (%)	N/A																								
Recycling rate of plastic materials (%)	N/A																								
Final disposal amount (tons/day)	215 tons (average, 2019). This is a reflection of both sites Vieux-Fort Solid Waste Management Facility and Deglos Sanitary Landfill.																								
Waste composition (%)	<p>WACS has been done by SLSWMA in Gros Islet (urban collection zone) and Anse La Raya/Canaries (rural collection zone) in 2018<sup>9</sup>.</p> <table border="1"> <thead> <tr> <th>Component</th> <th>Percent</th> <th>Waste Quantity (tons)</th> </tr> </thead> <tbody> <tr> <td>Paper &amp; Paperboard</td> <td>12</td> <td>53</td> </tr> <tr> <td>Glass</td> <td>4</td> <td>18</td> </tr> <tr> <td>Metal</td> <td>3</td> <td>13</td> </tr> <tr> <td>Plastics</td> <td>20</td> <td>97</td> </tr> <tr> <td>Textile</td> <td>5</td> <td>22</td> </tr> <tr> <td>Organics</td> <td>53</td> <td>233</td> </tr> <tr> <td>C &amp; D Wastes</td> <td>1</td> <td>4</td> </tr> </tbody> </table>	Component	Percent	Waste Quantity (tons)	Paper & Paperboard	12	53	Glass	4	18	Metal	3	13	Plastics	20	97	Textile	5	22	Organics	53	233	C & D Wastes	1	4
Component	Percent	Waste Quantity (tons)																							
Paper & Paperboard	12	53																							
Glass	4	18																							
Metal	3	13																							
Plastics	20	97																							
Textile	5	22																							
Organics	53	233																							
C & D Wastes	1	4																							

<sup>9</sup> <https://www.slswma.org/>

## C. Current Situation of SWM and MPL:

Item	Contents
1. Legal system	<ul style="list-style-type: none"> <li>● Waste Management Act #8 of 2004</li> <li>● Styrofoam and Plastic Food Services Containers (Prohibition) Act No. 22 of 2019: partially banned for importation in 2019 and totally banned for use by August 1<sup>st</sup>, 2020.</li> <li>● Returnable Containers Bill: drafted by Dept. of Sustainable Development but waiting for approval.</li> <li>● Public Health Act No. 8 of 1975: enforced by the Ministry of Health. It also includes SWM in health aspect.</li> <li>● St Lucia is Party to the MARPOL Convention and accepts Ship Waste for Management on Island.</li> </ul>
2. Policy/plan	<ul style="list-style-type: none"> <li>● SWM Strategy : currently SLSWMA is developing strategy with the assistance of World Bank.</li> </ul>
3. Implementation system	<ul style="list-style-type: none"> <li>● Saint Lucia Solid Waste Management Authority (SLSWMA) has the responsibility for the collection of solid waste from households, government institutions, offices as well as biomedical waste collection and treatment.</li> <li>● The Ministry of Health has oversight responsibility for all solid waste management issues in health perspective.</li> <li>● Dept. of Sustainable Development: is a statutory body and oversees the activities of SLSWMA. They have the Coastal Zone Management Unit which oversees the marine litter management.</li> <li>● The National Conservation Authority has the responsibility for removing solid waste from parks and beaches. They engage in most of cleaning activities.</li> <li>● The Ministry of Infrastructure has the responsibility for desilting rivers and drains and maintenance of verges.</li> <li>● The town and village councils are responsible for drain cleaning and street sweeping in the respective communities while the Castries City Council is responsible for Castries.</li> <li>● Private sector has the responsibility for transporting their own waste to the disposal facilities.</li> </ul>
4. Technical system	
Collection and transportation	<ul style="list-style-type: none"> <li>● Waste from households and Government institutions: twice weekly collection with parts of the inner city receiving a thrice weekly- collection. The Authority oversees a privatized curbside and communal collection service.</li> <li>● Waste from commercial entities: The Authority is not mandated to collect commercial waste. The onus is on the generator as per Waste Management Act No. 8 of 2004.</li> <li>● Separated collection system: no separate collection exists. Only monthly bulky waste collection service offered to households and government institutions (white and brown goods).</li> <li>● Number of collection vehicles: N/A as collection is all outsourced to the private sectors.</li> </ul>
Intermediate treatment	<ul style="list-style-type: none"> <li>● Biomedical waste is treated in the autoclave housed at the Deglos Sanitary Landfill.</li> <li>● Transfer Station: Vieux-Fort Solid Waste Management Facility has no sorting system.</li> <li>● Tyre shredder: shredded materials are utilized as an intermediate cover at</li> </ul>

Item	Contents
	<p>Deglos Landfill site.</p> <ul style="list-style-type: none"> <li>● Woodchipper: donated through the Japanese International Cooperation System under Japan's Non-project grant aid for provision of Japanese SME's Products.</li> <li>● MRF (more like a stockyard of recyclables): cardboard, glass, paper, plastic materials etc. are separated at Deglos Landfill site.</li> </ul>
Final disposal	<ul style="list-style-type: none"> <li>● Deglos Sanitary Landfill is the only landfill in St. Lucia.</li> </ul> <ol style="list-style-type: none"> <li>1) Owner: SLWMA,</li> <li>2) Location: located in the north of the island, 5 miles away from SLWMA,</li> <li>3) Area: 9 hectors,</li> <li>4) Waste disposal amount: 215 tons/day,</li> <li>5) Data source: obtained by weighbridge,</li> <li>6) Installed facility: weighbridge, autoclave for medical waste, maintenance facility, wood chipper (SLWMA has a plan to implement compost facility), tyre shredder, MRF, and partially fenced.</li> <li>7) Operation in practice: compaction of waste with minimal covering with soil.</li> </ol>
5. Financial system	<ul style="list-style-type: none"> <li>● Ratio of SWM budget allocated within national budget: .0005/1 (7.7M/1.4B ECD)</li> <li>● Main source of SWM costs: collection fee is not charged from residents. The tipping fee is not charged from hotels, restaurants etc. but fee for special materials such as confidential documents, asbestos, ship waste etc. are charged for disposal. Some demolition waste is charged after certain amount. SLSWMA also receives subsidy from the Government and a percentage of head tax of visitors to the islands but currently no visitors due to Covid-19.</li> <li>● Cost required for collection/transportation: \$7.8 Million ECD annually</li> <li>● Cost required for intermediate treatment: N/A</li> <li>● Cost required for final disposal: \$3.5 Million ECD annually</li> </ul>
6. Donor support	<ul style="list-style-type: none"> <li>● Commonwealth Clean Ocean Alliance (CCOA): In Progress, (proposal is submitted, awaiting response)<sup>10</sup></li> <li>● Reduction of Marine Litter (REMLit) Project: Financing from Norwegian Ministry of Foreign Affairs toward the cost of the building resilience in the Eastern Caribbean. It deals with management of marine litters. The components cover SWM as the land sourced waste goes into the ocean environment. (proposal is submitted, awaiting response).</li> <li>● RePLAST OECS Project (2019 – 2021): focus on testing approaches and systems for setting up a plastic waste collection and recycling scheme through export from Saint Lucia to Martinique (the original destination was set to Martinique island but failed, instead they exported 2 containers (12 tons) of PET to Honduras). The project also includes public awareness raising activities for recycling and WACS (conducted in 2018) etc.<sup>11</sup></li> <li>● World Bank (ongoing): sector assessment has been done already to develop the SWM strategy. WACS will be completed island-widely in this project.</li> </ul>
7. Social consideration	<ul style="list-style-type: none"> <li>● Policy or law for supporting the informal sector: approximately there are 30 waste pickers in Deglos landfill. SLAWMA is currently looking at the formalization of informal sectors.</li> <li>● Public awareness raising activities: Saint Lucia joined the Commonwealth Clean Ocean Alliance (CCOA). SLSWMA collaborates with the Caribbean</li> </ul>

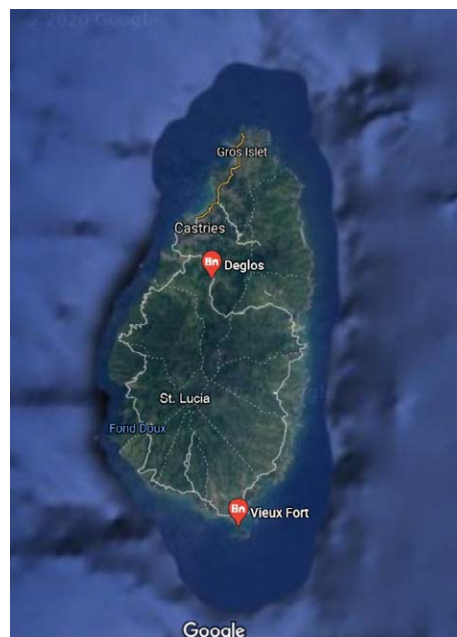
<sup>10</sup> <https://bluecharter.thecommonwealth.org/action-groups/marine-plastic-pollution/>

<sup>11</sup> <https://pressroom.oecs.org/plastic-recycling-project-replast-oecs-launches-in-saint-lucia>

Item	Contents
	<p>Youth Environment Network (CYEN) and other agencies in annual coastal cleanup throughout the island in recognition of the observance of International Coastal Cleanup (ICC).</p> <ul style="list-style-type: none"> <li>● (Good practice)</li> </ul> <p>Fulcrum, a mobile data collection platform was implemented in July, 2017. It is a hosted mobile forms platform which allows the Authority to build/design forms/custom apps for data collection from the field. Field Officers capture information with respect to public complaints; collection points; illegal dumps; and school, health care, garage audits etc. from their mobile devices.</p>
8. MPL issues	<ul style="list-style-type: none"> <li>● Poor management of whatever happens on land will inevitably enter the ocean through the drains and waterways.</li> </ul>
9. Areas for improvement	<ul style="list-style-type: none"> <li>● Public Awareness/Effective Public Education is necessary as people have bad behavior of littering.</li> <li>● Improvement of resident's waste discharging manner and collection system: especially the unplanned community where is densely populated area has collection points or bins for residents to discharge waste but there are always waste scattering around the bins as people discharge waste whenever they want. However, currently in one of the unplanned communities (Odlum City), microhaulers programme is proposed, which requires technology to facilitate the collection of waste along footpaths (the proposal provided by SLSWMA).</li> <li>● There is no collection system for green waste. SLSWMA is now looking for some collection system for this type of waste.</li> <li>● Landfill equipment have constant break down so currently renting them.</li> <li>● Sustainable recycling system should be established by incentivizing people to separate waste through rewarding system.</li> </ul>
10. Other candidates for interview	<ul style="list-style-type: none"> <li>●</li> </ul>



Administrative divisions in St. Lucia  
Vieux Fort SWM facility



Deglos Sanitary Landfill and  
Vieux Fort SWM facility



### REUSE AND RECYCLE PLASTICS BE A HERO

**RePLAST-OECS Project**

The RePLAST-OECS Pilot Plastic Recycling Project launched in May 2019, is a two-year public-private initiative, being implemented by UNITE Caribbean and is aimed at setting-up an incentivized plastic waste collection and recycling scheme. The plastic collected will be exported to a recycling plant in the Caribbean promoting a circular economy model. The first pilot country is Saint Lucia with subsequent replication in the OECS countries.

To date, the RePLAST-OECS Project has facilitated an experimental shipment working with local recyclers. This included two 40 foot containers of baled PET bottles of approximately 26,000 pounds (lbs). This exported plastic waste would normally be disposed of and as a result has increased the life of the Landfill.

Quantity of plastic diverted from Degra Landfill and exported from Saint Lucia: **26,000 lbs**

The RePLAST-OECS Project is headed primarily by the Republic of France in partnership with the Government of Saint Lucia (GOSL), the Public and Private Sector and Civil Society.



**Come Partner With Us!**

RePLAST-OECS Pilot Plastic Recycling Project | UNITE Caribbean Ltd. | Castries, Saint Lucia  
 RePLASToeocs.com | 758-460-3700 | RecyclePlastics@unite-caribbean.com

### Questions & Answers

Thank you for your interest in the RePLAST-OECS Pilot Plastic Recycling Project

- Can you provide more information about your company and the RePLAST-OECS Project in Saint Lucia?**  
 The RePLAST-OECS Pilot Plastic Recycling Project is being implemented by UNITE Caribbean, a pan-Caribbean technical assistance and sustainable development partner headquartered both in Guadeloupe and Saint Lucia. As a Caribbean, development cooperation consulting firm, UNITE Caribbean supports the social and economic development of Caribbean territories through regional technical cooperation. For more information visit [www.Unite-Caribbean.com](http://www.Unite-Caribbean.com).
- How can I recycle plastic bottles?**  
**Do you buy or collect plastic in Saint Lucia?**  
 The RePLAST-OECS Project aims to support the collection of plastic in Saint Lucia in select Communities, Institutions (Schools) and the Private Sector (Hotels). There will be RePLAST Collection Points (RCPs) in select communities where persons can bring in plastic bottles. The community collection will be undertaken through a non-monetary incentive scheme. Once registered a rewards card will be issued and points will be earned in exchange for plastic bottles returned. These points will be redeemable at RePLAST Business Partners. RCP locations will be announced in a subsequent project update.
- What type of plastic bottles will be collected?**  
 The RePLAST-OECS Project will be collecting PET bottles and HDPE containers.  
**PET** (Polyethylene terephthalate) is a form of polyester (just like the clothing fibres). It is extruded or molded into plastic bottles and containers for packaging foods and beverages, personal care products, and many other consumer products.  
**HDPE** (High Density Polyethylene) plastic bottles offer a mildly stiff impact resistant bottle, with a great moisture barrier. The HDPE plastic bottles are available in multiple shapes and sizes. Thinner plastic bottles are also available in white and a variety of colours.
- What do you mean by "Be a Hero"?**  
 A Hero is someone who is admired or idealized for courage, outstanding achievements, or noble qualities, a champion or advocate for a cause. The entire world including Caribbean territories are having difficulty managing plastic waste. The RePLAST-OECS Project encourages you, your family, your friends to "Be a Hero" through proper waste management practices in an effort to be good custodians of our environment.  
**Be a Hero! Reuse and Recycle Plastic!**
- What happens to the plastic collected?**  
 The plastic collected is transferred to local recyclers for processing and preparation for export to a Recycling Facility in the Caribbean. The RePLAST-OECS Project aims to create a sustainable supply chain and economic model in collaboration with local recyclers.



### How Can You Volunteer?

Volunteers are welcome to support the RePLAST Collection Points (RCPs). Please email to confirm your interest and provide your details.

758-460-3700  
[www.RePLASToeocs.com](http://www.RePLASToeocs.com)  
[RecyclePlastics@unite-caribbean.com](mailto:RecyclePlastics@unite-caribbean.com)  
[RePLASToeocs](https://www.facebook.com/RePLASToeocs)

Brochure for RePLAST OECS Project (2019 – 2021)

### **A.3 Antigua and Barbuda**

Antigua and Barbuda was not a target country for the detailed survey in the Basic Survey.

## A.4 Grenada

Respondent: Ms. Myrna Julien  
 Position: Senior Public Relations Officer  
 Organization: Grenada Solid Waste Management Authority

### A. Basic Information:

Item	Contents
Population	110,000 (Ministry of Finance Statistical Dept., 2010)
Population growth (annual %)	2.3% (Ministry of Finance Statistical Dept., 2010)
Urban population	3,100 (National Census report. Ministry of Finance Statistical Dept., 2010)
Population density (people/km <sup>2</sup> )	306.80 (National Census report. Ministry of Finance Statistical Dept., 2010)
Average national rainfall (millimetres/year)	979.3 (Point Salines Meteorological services)
Annual frequency of hurricanes (times/year)	Grenada not considered in the Hurricane Belt. Last Hurricane 2005

### B. SWM Data:




Item	Contents																												
Waste generation amount (tons/day)	126.319 obtained by weighbridge data at Perseverance Landfill (Annual Report GSWMA, 2018)																												
Waste generation rate (kg/person/day)	1.9 (National Waste Management Strategy Review for Grenada, 2019. WACS was done by WSP, the Canadian consulting company with the financial support of Caribbean Development Bank)																												
Plastic waste generation amount (tons/day)	19 tons/day 7,134 tons/year (National Waste Management Strategy Review for Grenada, 2019)																												
Waste collection amount (tons/day)	126.31 (Annual Report GSWMA, 2018)																												
Waste collection coverage (%)	98% as a percentage of population (Annual Report GSWMA, 2018)																												
Recycling rate (%)	N/A																												
Recycling rate of plastic materials (%)	N/A																												
Final disposal amount (tons/day)	N/A																												
Waste composition (%)	<table> <tbody> <tr> <td>Organic waste -</td> <td>25.3%</td> </tr> <tr> <td>Hazardous Waste -</td> <td>2.5%</td> </tr> <tr> <td>Paper board/Cardboard -</td> <td>13.9%</td> </tr> <tr> <td>Special Waste* -</td> <td>5%</td> </tr> <tr> <td>Glass</td> <td>7.7%</td> </tr> <tr> <td>Refundable Glass</td> <td>1.9%</td> </tr> <tr> <td>Construction and demolition waste</td> <td>3.8%</td> </tr> <tr> <td>Non-ferrous metals</td> <td>2.0%</td> </tr> <tr> <td>Hard Plastics</td> <td>10.7%</td> </tr> <tr> <td>Soft Plastics</td> <td>3.7%</td> </tr> <tr> <td>Textiles</td> <td>6.2%</td> </tr> <tr> <td>E-waste</td> <td>3.7%</td> </tr> <tr> <td>White goods</td> <td>0.2%</td> </tr> <tr> <td>Non-recyclable non hazardous waste</td> <td>7.2%</td> </tr> </tbody> </table> (National Waste Management Strategy Review for Grenada, 2019)	Organic waste -	25.3%	Hazardous Waste -	2.5%	Paper board/Cardboard -	13.9%	Special Waste* -	5%	Glass	7.7%	Refundable Glass	1.9%	Construction and demolition waste	3.8%	Non-ferrous metals	2.0%	Hard Plastics	10.7%	Soft Plastics	3.7%	Textiles	6.2%	E-waste	3.7%	White goods	0.2%	Non-recyclable non hazardous waste	7.2%
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White goods	0.2%																												
Non-recyclable non hazardous waste	7.2%																												


\*Special waste: waste from cruise ship.




C. Current Situation of SWM and MPL:


Item	Contents
1. Legal system	<ul style="list-style-type: none"> <li>● Grenada Solid Waste Management Authority Act #11 1995</li> <li>● The Waste Management Act 2001: stipulates the definition of each type of waste.</li> <li>● The Abatement of Litter Act #24 2015</li> <li>● The Environmental Levy Act 1997</li> <li>● The Physical Planning and Development Control Act#25 of 2002</li> <li>● The Non-Biodegradable Waste Control Act 2018</li> </ul>
2. Policy/plan	<ul style="list-style-type: none"> <li>● National Waste Management Strategy 2002- Under review</li> </ul>
3. Implementation system	<ul style="list-style-type: none"> <li>● Grenada Solid Waste Management Authority (GSWMA): responsible for facilities for SWM, waste collection, and street and beach cleaning.</li> <li>● Ministry of Communication and Works: responsible for maintenance of drains.</li> <li>● Ministry of Agriculture, Lands, Forestry, Fisheries and the Environment: Fishery Department is responsible for designation of marine protected area. In the Waste Management Act 2001, people can be charged if they dump waste into these areas. Marine cadets under this department are responsible for patrolling these illegal activities. Department of Environment is responsible for legislation dealing with marine plastics such as the Non-Biodegradable Waste Control Act.</li> <li>● Environmental Health Department of Ministry of Health: Environmental health officers are in charge of enforcement of relevant legislation under the department. Royal Grenada Police Force: Enforcement in general.</li> </ul>
4. Technical system	
Collection and transportation	<ul style="list-style-type: none"> <li>● Waste from household: The GSWMA has contracted the services of eight private companies to provide garbage collection service in 8 Collection Zones throughout Grenada, Carriacou and Petit Martinique. <ul style="list-style-type: none"> <li>- Every household gets twice per week curbside collection service in the sparsely populated communities, whereas in the densely populated areas of the south, garbage is collected every day for residents along the main roads and three times per week in minor roads. Some communal bins are stationed at areas that cannot be accessed by collection teams.</li> <li>- Every household is entitled to the collection of 3 bulky items (furniture, appliances, e-waste etc.) for free per month through special collection service.</li> </ul> </li> <li>● Waste from commercial area: All Towns are provided with a daily collection service for small businesses, stores, fresh markets and food stands. The two major towns of St. George and Grenville are provided with twice daily collection service.</li> <li>● Separated collection system: There is no separation of residential waste currently in Grenada, as there are no recycling initiatives. Only the metal waste, tires and cardboard boxes from businesses arrive at the landfill separated through private collection company. Glass bottles which are refundable do not enter the waste stream but are retrieved by the respective beverage manufacturers/importers. Construction companies are required to transport construction and demolition waste by themselves to the disposal site. Shipping companies are required to make their own arrangement with private waste hauler to dispose waste generated on their vessels into the</li> </ul>







Item	Contents
	<p>disposal site.</p> <ul style="list-style-type: none"> <li>● Number of collection vehicles: There are 14 collection and street cleaning companies working in 6 cities (St. George, Grenville, Gouyave, Sauteurs, Victoria, and Hillsborough in Carriacou). Collectively, our contractors own 32 compactor trucks serving the three islands (30 for main island, 2 for Carriacou), 9 tipper trucks for heavy items and 1 boat for transportation of waste from Petit Martinique to Carriacou. They are all functional.</li> <li>● The Main GSWMA has one Compactor Truck and 2 tipper trucks and 1 skip truck. They are all functional.</li> <li>● There are 4 independent private waste haulage companies who operate 3 Compactor trucks, 4 Skip Trucks and an undisclosed number of tipper trucks.</li> </ul> <div style="display: flex; justify-content: space-between; align-items: flex-start; margin-top: 20px;"> <div data-bbox="560 678 970 983" style="width: 45%;">  </div> <div data-bbox="970 790 1412 882" style="width: 50%;"> <p>Grenada Solid Waste Management Authority Compactor Truck at Perseverance Landfill.</p> </div> </div> <div style="display: flex; justify-content: space-between; align-items: flex-start; margin-top: 20px;"> <div data-bbox="555 1070 967 1350" style="width: 45%;">  </div> <div data-bbox="967 1193 1412 1256" style="width: 50%;"> <p>Garbage collection by Rainbow Janitorial Services. South St. George</p> </div> </div> <div style="display: flex; justify-content: space-between; align-items: flex-start; margin-top: 20px;"> <div data-bbox="557 1411 963 1677" style="width: 45%;">  </div> <div data-bbox="970 1480 1342 1512" style="width: 50%;"> <p>Skip Truck operated by GSWMA</p> </div> </div>

Item	Contents
	 <p data-bbox="970 315 1407 548">Compactor Fleet of one Company contracted by GSWMA for the provision of residential collection service. Fleet in the process of being upgraded to new trucks. (Southern Waste Management Services Ltd)</p>
Intermediate treatment	<ul style="list-style-type: none"> <li>● Plastic pelletizing machine: the project will be launched on July 28<sup>th</sup>, 2020 in Carriacou island.</li> <li>● One metal baler is owned by GSWMA. Informal sector brings metals (iron, aluminum, copper, zinc roofing, vehicles, appliances etc.) to landfill site and GSWMA make a bale at the cost of 7 USD/bale to ship to Trinidad.</li> <li>● Composting facilities: GSWMA has given intensive composting trainings to school (under the Environmentally Friendly School Initiative), various institutions, hotel ground staff, prisoners, Homes for the Elderly, and Farmers Organization. The Farmers Organization is currently trying to expand their unit (windrow type) to a larger commercial scale with the assistance of Ministry of Agriculture and GIZ (GIZ donated 3 wood chippers), and seeking for the financial assistance of 200,000USD for composting unit (closed type), waste storage, packaging facility, and washrooms etc.</li> <li>● Large industrial wood chipper is owned by GSWMA to chip the logs brought into the landfill site. GSWMA also provides the service for chipping woods from land clearance for construction.</li> </ul>
Final disposal	<ul style="list-style-type: none"> <li>● There is one Landfill called Perseverance in Grenada. However, the two active cells are being operated as an open dump with no daily covering. The GSWMA currently is constructing a new semi-aerobic landfill which will use the Fukuoka method of landfilling. This construction is currently underway and is due for completion in May 2021. The current cell being developed will have a life expectancy of 5 years.             <ol style="list-style-type: none"> <li>1) Owner: GSWMA,</li> <li>2) Location: N12.10885 W61.74576,</li> <li>3) Area: 17 Acres,</li> <li>4) Waste disposal amount: avg. 126.3197 tons per day,</li> <li>5) Data source: obtained by weighbridge,</li> <li>6) Installed facility: weighbridge, fence, tire shredder, wood shredder, metal baler, and hazardous waste storage,</li> <li>7) Operation in practice: compaction of waste but no covering with soil</li> </ol> </li> <li>● The Authority has an open dump at Perseverance which has been used for 50 years but currently on fire for the past 5 months from January 2020 and not being used. Coordinates: N12.0623.3 W61.44506 Area: 11 acres</li> <li>● There is one landfill in Carriacou. Anaerobic landfilling method is used.</li> </ul>

Item	Contents
	<p>1) Owner: GSWMA,                  2) Location: N12.463229 W61.457882                  3) Area: 10.87 Acres,                  4) Waste disposal amount: Approximately 5 tons per day,                  5) Data source: no weighbridge, estimated by multiplying collection truck's capacity and number of trips.                  6) Installed facility: used to have litter fence but blown off by strong wind, therefore currently lots of plastic waste in landfill entering to drainage system and washed out into the sea. That is why the Carriacou was chosen as the pilot site for plastic pelletizing project.                  7) Operation in practice: compaction of waste but no covering with soil</p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;">  <p data-bbox="1038 786 1406 846">Tractor compacting waste at Perseverance Landfill, Grenada</p> </div> <div style="text-align: center;">  <p data-bbox="1038 1115 1406 1176">Extinguishing Fire at 11 acre Perseverance Open disposal site.</p> </div> <div style="text-align: center;">  <p data-bbox="1051 1615 1406 1704">Private waste hauler tipping waste at Perseverance landfill, Grenada.</p> </div> </div>

Item	Contents
	 <p data-bbox="1058 271 1415 365">Carriacou Landfill cell. Currently covered and new cells have been developed.</p>
5. Financial system	<ul style="list-style-type: none"> <li>● Ratio of SWM budget allocated within national budget: There is no budgetary allocations for waste management in Grenada.</li> <li>● Main source of SWM costs: Waste Management is financed by the Environmental Levy which is collected by the following means:               <ol style="list-style-type: none"> <li>a. Householders - Through electricity consumption - agent of collection is the Grenada Electricity Company.</li> <li>b. Cruise Passengers - Passenger head tax payable through cruise companies.</li> <li>c. Stay-over visitors head tax- Paid by Airlines - Agent is Grenada Airports Authority.</li> <li>d. Import levy - on goods, vehicles, appliances etc. - Agent is Customs and Excise department.</li> </ol> <p>All of these levies and paid directly to the GSWMA by the agents.</p> </li> <li>● Cost required for collection/transportation: N/A</li> <li>● Cost required for intermediate treatment: N/A</li> <li>● Cost required for final disposal: N/A</li> </ul>
6. Donor support	<ul style="list-style-type: none"> <li>● Caribbean Development Bank - Integrated Solid Waste Management Project for Grenada 2016 – 2021, budget for landfill project is 10.08 million USD.</li> </ul>
7. Social consideration	<ul style="list-style-type: none"> <li>● As part of the Integrated Solid Waste Management Project for Grenada, the GSWMA will give consideration to formalizing the practice of waste picking on the landfill. A waste pickers facility including shower room and appropriate equipment for waste pickers will be constructed as part of the project so as to regulate the operations of pickers to avoid unhealthy scavenging.</li> <li>● The Authority is currently financing salaries for beach cleaners on the eastern shoreline who are community groups engaged in the removal of Sargassom seaweed from coastal areas.</li> <li>● Policy or law for supporting the informal sector: N/A</li> <li>● Public awareness raising activities: The GSWMA has a sustained public awareness and education programme. This involves the extensive use of electronic and social media, school initiatives including in-house and public education, promotion of organic waste composting, identification of challenges and interventions, Beach adoptions &amp; adoption of public places, community activities, collaborations and regular staged activities and promotions.</li> </ul>
8. MPL issues	<ul style="list-style-type: none"> <li>● Issues associated with Marine Plastic litter include the following:               <ol style="list-style-type: none"> <li>a. Discarding of waste on land in rivers and streams and waste is washed out to sea when it rains.</li> </ol> </li> </ul>

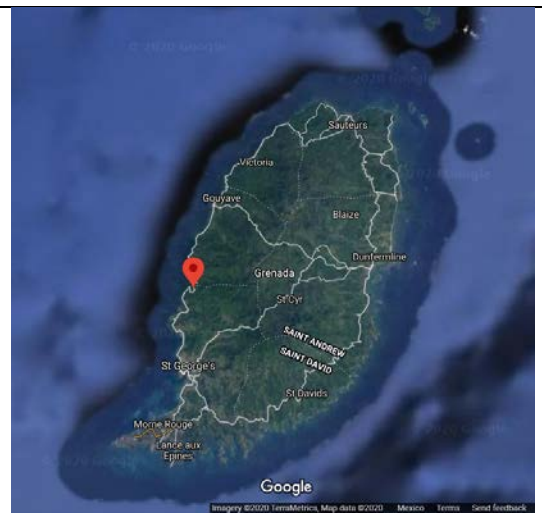
Item	Contents
	<p>b. Littering in drains in towns. When it rains, the low-lying towns become flooded and the waste is washed out to sea. E.g. Grenville, St. George and Grenville.</p> <p>c. Beach festivals and Marine recreation activities also contribute extensively to beach littering and contribute significantly to MPL.</p> <p>d. There is no implementation of the waste management act or the abatement of litter act, which can help to curb the problems of littering, improper waste disposal and pollution.</p> <div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div style="width: 45%;">  </div> <div style="width: 50%;"> <p>Plastic litter at the mouth of the Charlott River, in Gouyave St. John's.</p> </div> </div> <div style="display: flex; justify-content: space-between; align-items: flex-start; margin-top: 10px;"> <div style="width: 45%;">  </div> <div style="width: 50%;"> <p>Plastic Bottles in drain in Victoria, St. Marks about to enter the sea.</p> </div> </div> <div style="display: flex; justify-content: space-between; align-items: flex-start; margin-top: 10px;"> <div style="width: 45%;">  </div> <div style="width: 50%;"> <p>A beach Cleaner carts away beach waste including ropes and plastic bottles</p> </div> </div> <div style="display: flex; justify-content: space-between; align-items: flex-start; margin-top: 10px;"> <div style="width: 45%;">  </div> <div style="width: 50%;"> <p>Hundreds of plastic bottles among waste brought ashore after heavy tides</p> </div> </div>
<p>9. Areas for improvement</p>	<ul style="list-style-type: none"> <li>● Public awareness: although GSWMA has been putting so much effort in public education, it is lacking tools for editing, equipment for printing, manpower (there are only 2 staff in Public Relation Department), and dissemination of message is quite costly.</li> <li>● Implementation of legislation: legislations are in place but getting assistance from enforcement agencies (Police Force and Environmental Health Department of Ministry of Health) is difficult due to lack of manpower.</li> <li>● Clean-up operations: GSWMA is only responsible for the town area but other</li> </ul>



Item	Contents
	<p>coastal areas are left out for cleaning.</p> <ul style="list-style-type: none"> <li>● Installation of litter bins in towns and recreational beach areas to help prevent people from littering. Some litter bins were already installed in main beaches and will be installed in more areas soon.</li> <li>● Regulations governing marine sports/entertainment activities/festivals. These activities tend to produce a lot of plastic waste, especially beverage bottles, and vendors are required to be responsible for collecting their waste, but the spectator is a challenge.</li> </ul>
<p>10. Other candidates for interview</p>	<ul style="list-style-type: none"> <li>● Aria St. Louis, Ministry of Environment - arislouis1@gmail.com</li> <li>● Andre Worme, Chief Environmental Health Officer in the Ministry of Health - amworme@hotmail.com.</li> <li>● Dr. Spencer Thomas, Architect of Grenada's NDC (Nationally determined contributions) sthomas@ectel.int</li> </ul>



Map of Grenada



Perseverance Landfill in Grenada

The following photos were provided by Myrna Julien after interview.



Official opening of Carriacou plastic recycling

Official opening of Carriacou Plastic Recycling



Community plastic storage units.

Carriacou Plastic Project



Delivery of waste at small wharf in Petit Martinique for transport to Carriacou by boat



Waste is taken to wharf by a small dumper in Petit Martinique

Petit Martinique

Petit Martinique



Shipping waste from Petit Martinique to Carriacou



Shipping waste from Petit Martinique to Carriacou



Biogas in prison



Biogas in prison



Biogas in prison



Biogas in prison

## A.5 Guyana

Respondent: Mr. Satrohan Nauth  
 Position: Senior Engineer  
 Organization: Ministry of Communities

### A. Basic Information:

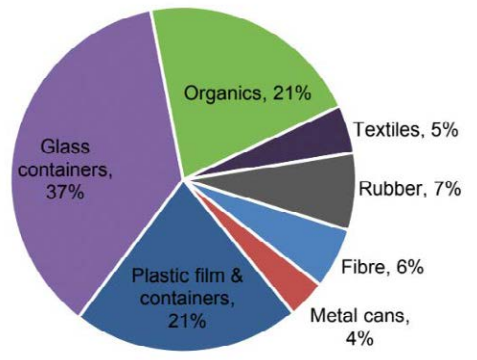
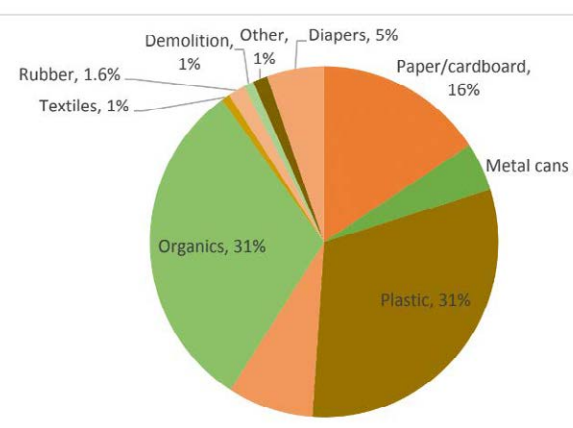
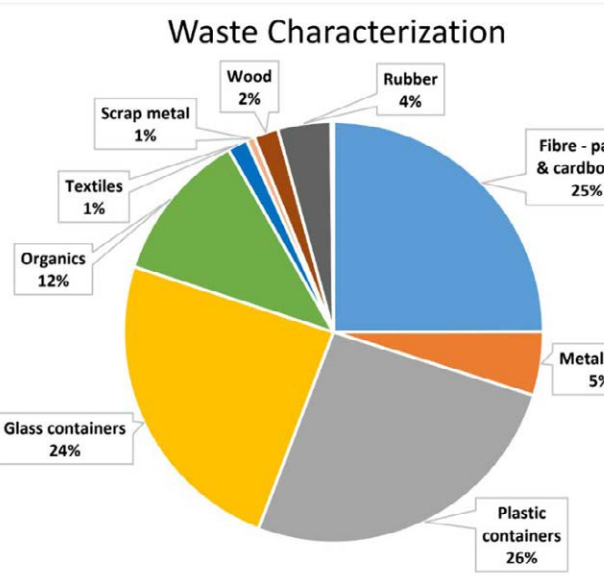
Item	Contents
Population	746,955 (Population Census, 2012)*
Population growth (annual %)	-0.04 (Population Census, 2012)
Urban population	191,810 (Population Census, 2012) - Georgetown
Population density (people/km <sup>2</sup> )	3.5 persons/km <sup>2</sup> (Population Census, 2012)
Average national rainfall (millimetres/year)	2,200 mm/year (Hydromet)
Annual frequency of hurricanes (times/year)	N/A

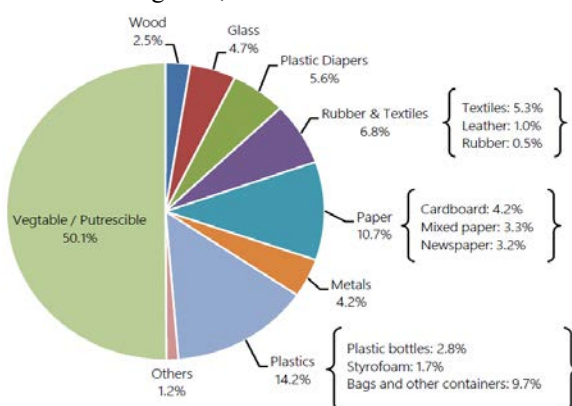
\*based on the latest available census in 2012. Next census will be in 2022.

### B. SWM Data:

Item	Contents
Waste generation amount (tons/day)	No data available on whole country. Region 4 – 546 t/day (Hydroplan, 2010) Mahdia in Region 8 – 825 t/year (WACS conducted in 2018) Bartica in Region 7 – 4,150 t/year (WACS conducted in 2018) Linden in Region 10 – 4,024 t/year (WACS conducted in 2017)
Waste generation rate (kg/person/day)	Region 4 – 1.35 kg/person/day (Hydroplan, 2010) Mahdia – 0.91 kg/person/day (WACS conducted in 2018) Bartica – 0.6 kg/person/day (WACS conducted in 2018)
Plastic waste generation amount (tons/day)	N/A
Waste collection amount (tons/day)	N/A
Waste collection coverage (%)	N/A
Recycling rate (%)	0
Recycling rate of plastic materials (%)	0
Final disposal amount (tons/day)	400 to 450 tons/day at Haags Bosch Sanitary Landfill Facility, Region 4



Item	Contents																																																										
Waste composition (%)	<p>NB: I have provided data from the WCS studies I got accessed to.</p> <ul style="list-style-type: none"> <li> <p><b>WCS Mahdia, 2018</b></p>  <table border="1"> <caption>WCS Mahdia, 2018 - Waste Composition</caption> <thead> <tr> <th>Category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Glass containers</td> <td>37%</td> </tr> <tr> <td>Organics</td> <td>21%</td> </tr> <tr> <td>Textiles</td> <td>5%</td> </tr> <tr> <td>Rubber</td> <td>7%</td> </tr> <tr> <td>Fibre</td> <td>6%</td> </tr> <tr> <td>Metal cans</td> <td>4%</td> </tr> <tr> <td>Plastic film &amp; containers</td> <td>21%</td> </tr> </tbody> </table> </li> <li> <p><b>WCS Linden, 2017</b></p> <p>Figure 2: Composition of Solid Waste (by Category)</p>  <table border="1"> <caption>WCS Linden, 2017 - Waste Composition</caption> <thead> <tr> <th>Category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Organics</td> <td>31%</td> </tr> <tr> <td>Plastic</td> <td>31%</td> </tr> <tr> <td>Glass containers</td> <td>8%</td> </tr> <tr> <td>Paper/cardboard</td> <td>16%</td> </tr> <tr> <td>Metal cans</td> <td>4%</td> </tr> <tr> <td>Diapers</td> <td>5%</td> </tr> <tr> <td>Demolition</td> <td>1%</td> </tr> <tr> <td>Other</td> <td>1%</td> </tr> <tr> <td>Rubber</td> <td>1.6%</td> </tr> <tr> <td>Textiles</td> <td>1%</td> </tr> </tbody> </table> </li> <li> <p><b>WCS Bartica, 2018</b></p> <p>Figure 1: Composition of Solid Waste (by Category)</p>  <p>Waste Characterization</p> <table border="1"> <caption>WCS Bartica, 2018 - Waste Composition</caption> <thead> <tr> <th>Category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Fibre - pap &amp; cardboa</td> <td>25%</td> </tr> <tr> <td>Plastic containers</td> <td>26%</td> </tr> <tr> <td>Glass containers</td> <td>24%</td> </tr> <tr> <td>Organics</td> <td>12%</td> </tr> <tr> <td>Metal c</td> <td>5%</td> </tr> <tr> <td>Rubber</td> <td>4%</td> </tr> <tr> <td>Wood</td> <td>2%</td> </tr> <tr> <td>Scrap metal</td> <td>1%</td> </tr> <tr> <td>Textiles</td> <td>1%</td> </tr> </tbody> </table> </li> </ul>	Category	Percentage	Glass containers	37%	Organics	21%	Textiles	5%	Rubber	7%	Fibre	6%	Metal cans	4%	Plastic film & containers	21%	Category	Percentage	Organics	31%	Plastic	31%	Glass containers	8%	Paper/cardboard	16%	Metal cans	4%	Diapers	5%	Demolition	1%	Other	1%	Rubber	1.6%	Textiles	1%	Category	Percentage	Fibre - pap & cardboa	25%	Plastic containers	26%	Glass containers	24%	Organics	12%	Metal c	5%	Rubber	4%	Wood	2%	Scrap metal	1%	Textiles	1%
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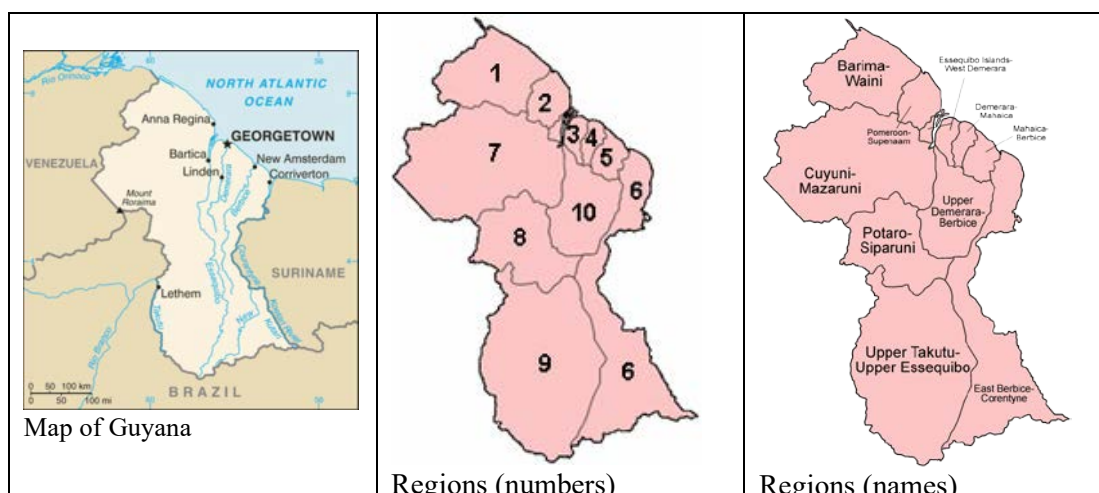
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	<ul style="list-style-type: none"> <li> <b>WCS Region 4, 2010</b>  <table border="1" data-bbox="766 291 1340 694"> <caption>Household Waste Composition for Region 4 (Hydroplan, CEMC)</caption> <thead> <tr> <th>Category</th> <th>Sub-category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td rowspan="10">Vegetable / Putrescible</td> <td>Vegetable / Putrescible</td> <td>50.1%</td> </tr> <tr> <td rowspan="3">Paper</td> <td>Cardboard</td> <td>4.2%</td> </tr> <tr> <td>Mixed paper</td> <td>3.3%</td> </tr> <tr> <td>Newspaper</td> <td>3.2%</td> </tr> <tr> <td rowspan="3">Plastics</td> <td>Plastic bottles</td> <td>2.8%</td> </tr> <tr> <td>Styrofoam</td> <td>1.7%</td> </tr> <tr> <td>Bags and other containers</td> <td>9.7%</td> </tr> <tr> <td rowspan="3">Rubber &amp; Textiles</td> <td>Textiles</td> <td>5.3%</td> </tr> <tr> <td>Leather</td> <td>1.0%</td> </tr> <tr> <td>Rubber</td> <td>0.5%</td> </tr> <tr> <td rowspan="2">Others</td> <td>Others</td> <td>1.2%</td> </tr> <tr> <td>Metals</td> <td>4.2%</td> </tr> <tr> <td rowspan="2">Glass</td> <td>Glass</td> <td>4.7%</td> </tr> <tr> <td>Wood</td> <td>2.5%</td> </tr> </tbody> </table> <p>Figure 1: Household Waste Composition for Region 4 (Hydroplan, CEMC)</p> </li> </ul>	Category	Sub-category	Percentage	Vegetable / Putrescible	Vegetable / Putrescible	50.1%	Paper	Cardboard	4.2%	Mixed paper	3.3%	Newspaper	3.2%	Plastics	Plastic bottles	2.8%	Styrofoam	1.7%	Bags and other containers	9.7%	Rubber & Textiles	Textiles	5.3%	Leather	1.0%	Rubber	0.5%	Others	Others	1.2%	Metals	4.2%	Glass	Glass	4.7%	Wood	2.5%
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Glass	Glass	4.7%																																				
	Wood	2.5%																																				

C. Current Situation of SWM and MPL:

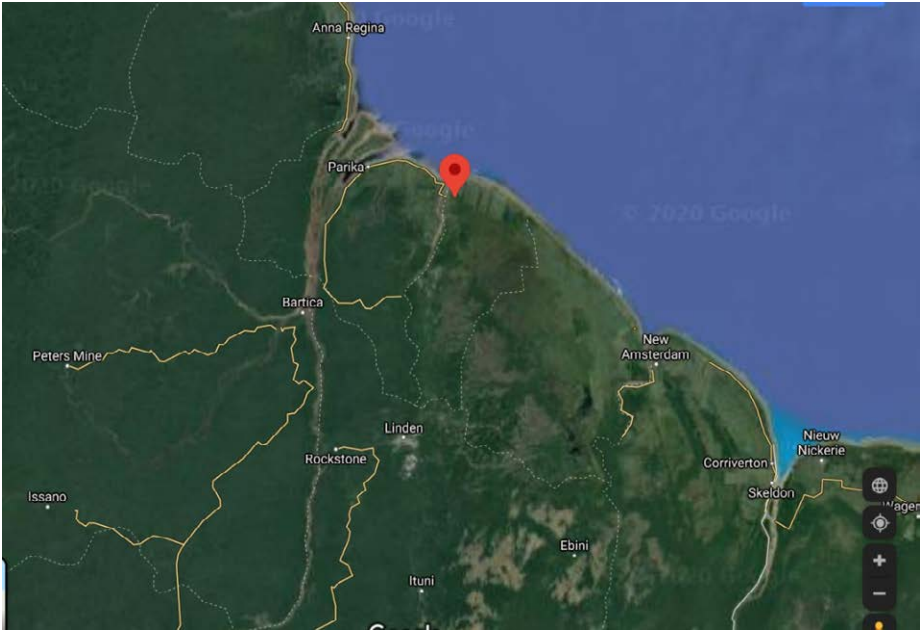
Item	Contents
1. Legal system	<ul style="list-style-type: none"> <li>● Municipal and District Councils Act, Chapter 28:01, Laws of Guyana</li> <li>● Environmental Protection Act, Chapter 20:05, Laws of Guyana</li> <li>● Environmental Protection litter enforcement regulations, 2013</li> <li>● Public Health Ordinance, Chapter 145, Laws of Guyana</li> <li>● Draft Solid Waste Management Bill, 2014</li> <li>● Regulations No. 8 of 2015 - The Environmental Protection (Expanded Polystyrene Ban) Regulations, 2015</li> </ul>
2. Policy/plan	<ul style="list-style-type: none"> <li>● National Integrated Solid Waste Management Strategy, 2017-2030</li> </ul>
3. Implementation system	<ul style="list-style-type: none"> <li>● Ministry of Communities (MoC): covers housing, water, and local governance sectors. Sanitation Management Unit is under the local governance and provides technical and financial supports in SWM and wastewater to Local Government. This unit was established by the IDB project in 2016.</li> <li>● Regional Democratic Councils (RDCs): there are 10 RDCs. They are the supreme Local Government Organ in each region with the responsibility for the overall management and administration of the Region and the coordination of the activities of all 80 Local Democratic Organs (LDO) within its boundaries. They provide all services required within its boundaries (services such as health, education, public works etc.).</li> <li>● Municipal Councils: there are 10 Municipal Councils. Each Council has the responsibility for solid waste collection and disposal, maintenance of infrastructure services (roads, bridges, etc.).</li> <li>● Neighborhood Democratic Councils (NDCs): there are 70 NDCs. They cover a small geographic area within each region with responsibility for the management and administration of these areas.</li> <li>● Environmental Protection Agency (EPA): Industry/Waste Management Department is in charge of all types of waste.</li> <li>● Ministry of Public Health, Allied Health Council: responsible for medical waste.</li> </ul>
4. Technical system (in case of Georgetown)	

Item	Contents
Collection and transportation	<ul style="list-style-type: none"> <li>● Waste from household: Once per week curbside collection system</li> <li>● Waste from commercial area: Daily collection</li> <li>● Separated collection system: None</li> <li>● Number of collection vehicles: N/A as collection service is contracted to private service providers and minimal LDO collectors.</li> </ul>
Intermediate treatment	<ul style="list-style-type: none"> <li>● None</li> </ul>
Final disposal	<ul style="list-style-type: none"> <li>● Haags Bosch Sanitary Landfill Facility is located just outside of the city (Eccles, East Bank Demerara). Operation started in 2011 and has life expectancy of 25 years. There are 64 scavengers interfering operation of landfill.</li> <li>1) Owner: Government</li> <li>2) Location: 6.764706, -58.147649</li> <li>3) Area: 26 Hectares only for disposal area</li> <li>4) Waste disposal amount: 400-450 tons/day</li> <li>5) Data source: Both weighbridge and estimation technique</li> <li>6) Installed facility: No liner in cell No.1, however cell No.2 is being constructed with liner presently, weighbridge, lined leachate treatment system, storm water ponds, gate, fence, administrative building, white goods and metal area, recyclers/scavenger area, security and spotter huts.</li> <li>7) Operation in practice: compaction of waste and covering with soil and clay (but not daily due to lack of covering materials).</li> <li>● Lusignan Landfill in Region 4: Controlled dump site</li> <li>● Espranar Landfill in New Amsterdam in Region 6: Open dump site</li> <li>● Rosehall Region 6: Open dump site</li> <li>● Linden Region 10: Open dump site</li> <li>● Latam Region 9: Open dump site</li> <li>● Bartica Region 7: Open dump site</li> </ul>
5. Financial system	<ul style="list-style-type: none"> <li>● Ratio of SWM budget allocated within national budget: N/A</li> <li>● Main source of SWM costs: SWM cost is supposed to be covered by Rates &amp; Taxes received by LDOs but the amount is so small. Therefore, Central Government gives Local Government subsidies. Waste collection fee is not charged for citizens but in some areas, residents pay for private collection (3USD per 40gal bin/week). No tipping fee is charged. Landfill operations are financed by the Government.</li> <li>● Cost required for collection/transportation: N/A</li> <li>● Cost required for intermediate treatment: None</li> <li>● Cost required for final disposal: N/A.</li> </ul>
6. Donor support	<ul style="list-style-type: none"> <li>● JICA: 2018 capacity building program in SWM.</li> <li>● Inter-American Development Bank (IDB): Georgetown SWM Project (2006-2014) the project includes; construction of Haags Bosch Sanitary Landfill, closure of Mandela dump site, formalization of informal sector(scavengers), establishing a Municipal Solid Waste Management Department in the Municipality of Georgetown, conducting a public awareness campaign in Georgetown and the NDCs, and reviewing and improving the contracts for</li> </ul>

Item	Contents
	solid waste collection in the Georgetown <sup>12</sup> .
7. Social consideration	<ul style="list-style-type: none"> <li>● Policy or law for supporting the informal sector: None However, the EPA is working along with all stakeholders to ban single use plastics e.g. straws, bags, eating utensils, cups, etc.</li> <li>● Public awareness raising activities: Green Generation Guyana Program focus on promoting SWM &amp; WASH in primary schools and at social events, SWM sensitization program by municipality, private groups also focus on beach and park cleaning activities, etc.</li> </ul>
8. MPL issues	<ul style="list-style-type: none"> <li>● No plastic recycling facility nor a market for such materials in our country.</li> <li>● The rivers, Atlantic Ocean and drainage network are being treated as a dumping ground for solid waste.</li> <li>● Citizens utilizing the river transportation services would litter the waterways with their garbage.</li> <li>● In other instances, the residents, businesses and miners residing along the embankments would dispose of their solid waste in the rivers.</li> <li>● During the rainy season, surface water runoff transports plastic materials as well as other waste materials into waterway, and onward into creeks, rivers and the Atlantic Ocean.</li> </ul>
9. Areas for improvement	<ul style="list-style-type: none"> <li>● Our country is not addressing the situation at its source. To begin with, Guyana needs laws and legislative framework as the key drivers for proper SWM. More so, specific regulations to drive the 3Rs programme (composting, waste separation etc.), MPL among others.</li> <li>● Secondly, we need a cost recovery mechanism for dealing with waste especially collection and disposal. We should start charging the disposal fee from business entities and then the collection fee from residents.</li> <li>● Continuous public awareness campaign targeting behavior change.</li> <li>● Guyana is not prepared to deal with waste generated from the oil and gas industry. There is no commercial nor hazardous waste disposal facility.</li> <li>● We need to build capacity within our institutions to deliver their mandate and promote good solid waste management practices.</li> </ul>
10. Other candidates for interview	<ul style="list-style-type: none"> <li>● Environmental Protection Agency – Odessa Duncan – Senior Environmental Officer, oduncan@epaguyana.org</li> </ul>



<sup>12</sup> <https://www.iadb.org/en/news/news-releases/2006-05-09/idb-approves-18-million-for-solid-waste-management-in-guyana%2C3051.html>



Location of Haags Bosch Sanitary Landfill

## ANNEX C2

Current Situation, 2022

## B Current Situation (as of March – April 2022)

This is information collected and updated during March and April 2022.

### B.1 Jamaica

#### B.1.1 Basic Information

Item	Contents
Population	2,726,667 (Source: STATIN, Year: 2018)
Population growth (annual %)	-0.1 (Source: STATIN , Year: 2017-2018)
Urban population	477,201 (# of households) (Source: STATIN, Year: 2011)
Population density (people/km <sup>2</sup> )	248 (Source: STATIN, Year: 2018)
Average national rainfall (millimetres/year)	1,773 (Source: Met Office, Year: 1971-2000)
Annual frequency of hurricanes (times/year)	N/A, no adverse impact.

#### B.1.2 Solid Waste Management Data

##### B.1.2.1 Waste Generation Amount

In Jamaica, waste generation amount from household and Institutional-Commercial-Industrial (ICI) sources is estimated as follows, according to the IDB draft report provided by NSWMA.

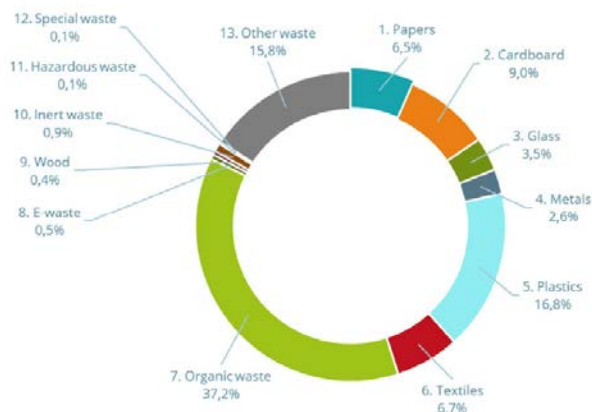
Table 1-1: Waste Generation Amount in Jamaica

Name of region (wasteshed)	Population (2019)	MSW generation amount [ton/year]	ICI production [ton/year]	Overall waste generation amount [ton/year]
Metropolitan Parks and Markets (MPM)	1,277,686	552,739	258,352	811,091
Southern Parks and Markets (SPM)	590,743	227,259	35,790	263,050
Western Parks and Markets (WPM)	492,600	152,861	73,878	226,739
North Eastern Parks and Markets (NEPM)	373,065	158,064	16,529	174,593
Jamaica	2 734,094	1 090,923	384,549	1 475,473

Source: IDB draft report (Waste Characterization Study in Jamaica), provided by NSWMA

##### B.1.2.2 Waste Composition

The waste characterization survey including physical composition has been implemented by IDB. The composition survey is implemented in each region including in Jamaica. The average physical composition is shown as following figure.



Source: IDB draft report (Waste Characterization Study in Jamaica), provided by NSWMA

Figure 1-1: Average Physical Composition in Jamaica

### B.1.2.3 Waste Disposal Amount

There is no weighing bridge in each final disposal site. Therefore, there is no accurate data of waste disposal amount. However, they estimate waste disposal amount based on the number of collection vehicles passing through their gates.

Table 1-2: Waste Disposal Amount in Jamaica (2020/2021)

Each Month in 2020/2021	Total [ton]	MPM [ton]	SPM [ton]	Total WPM [ton]	NEPM [ton]
April	76,196.0	44,639.5	5,460.5	14,208.0	11,888.0
May	72,337.5	42,219.5	4,959.0	13,836.0	11,323.0
June	94,638.0	48,079.5	5,273.5	29,385.0	11,900.0
July	102,243.0	48,851.5	5,274.0	35,532.5	12,585.0
August	101,174.5	45,293.5	5,707.0	36,485.0	13,689.0
September	103,390.0	46,161.5	5,702.0	35,975.5	15,551.0
October	104,950.0	40,566.5	5,374.0	41,220.5	17,789.0
November	89,863.5	43,149.5	7,239.0	19,146.0	20,329.0
December	74,622.0	44,514.0	6,140.5	1,089.5	22,878.0
January	94,327.0	45,010.5	6,230.0	17,030.5	26,056.0
February	67,898.5	28,135.0	7,343.0	16,324.5	16,096.0
March	84,532.5	46,047.0	10,055.5	16,776.0	11,654.0
Total	1,066,172.5	522,667.5	74,758.0	277,009.0	191,738.0

Source: NSWMA

### B.1.2.4 Preliminary Estimation of Waste Stream

Basically, collected waste is transported to solid waste disposal facilities in each area.

There are no statistics for waste stream in Jamaica, as a general matter, estimation of waste stream in Jamaica might be shown as below.

1. Approximately 70% of the total waste generated in the country is collected, while a remaining 30% of uncollected waste is disposed of in an environmentally unsound manner.



2. Approximately 80% of the collected waste is dealt with by four Parks and Markets Companies (companies wholly owned by the Government), while approximately 20% is handled by private collectors.
3. For the opportunity of recycling of several valuables, each recyclable is sold to the recycling market in overseas countries / domestically. The ratio of recycling rate is few, and most of the recycling activities are implemented in dumpsites owned by NSWMA.

### B.1.3 Laws, Policies and Plans

#### a. **The National Solid Waste Management Act (2001 revised in 2003)**

This Act is to safeguard public health as well as the collection, transportation, re-use and recycling of waste in an environmentally sound manner. The major points prescribed in the Act is shown below.

Table 1-3: The major points in the National Solid Waste Management Act

Item	Point
Establishment and Functions	Establishment of the National Solid Waste Management Authority The constitution, duties and powers of the Authority The Authority's role to manage, promote public awareness and advise the Minister on solid waste. The Authority's power in relation to the collection, treatment, disposal, resource recovery, planning and implementation of programmes, formulation of standards and guidelines, financial support, training and consulting, and defining specifications.
Administration	Appointment and employment of an Executive Director, a Secretary, officers and employees under specified conditions.
Financial Provisions, Accounts and Reports	The funds and resources of the Authority The Authority's power to invest moneys and its duty to keep accounts and conduct an audit. Publish annual financial reports and operating plan
Inspection	Appointment of inspectors Functions of inspectors
Application, Grant, Refusal, Renewal, Modification, Suspension and Revocation of Licenses	Application eligibility, fee, required documents and exemptions. The process of application (inspection, comments and recommendations, report submission, granting/refusal of a license) The license can be applied by every person who operates or proposed to operate a disposal facility, provide collection or transfer services or manage solid waste.
Financial Assurance and Insurance	The situations in which financial assurance is required in the licensing Forms, amount and duration of financial assurance
Recycling of Waste	The provision of premises and receptacles by the Authority for recycling and considerations
Special Provisions in Relation to Litter	The provision of receptacles by the Authority and its power

The following regulations are expected to bolster the parent act of 2001 (revised in 2003).

#### **The National Solid Waste Management (Public Cleanliness) Regulations (2003)**

These Regulations concern fixed penalty notices in relation to offences against public cleanliness as defined by section 53(2) of the National Solid Waste Management Act. Forms of Fixed Penalty Notice and Fixed Penalty Certificate are attached to the regulations.

Final instructions for The National Solid Waste Management (Public Cleanliness) Regulations (2020) were forwarded to the MLG- CD and the Office of the Parliamentary Council (OPC) for review and imminent approval.<sup>1</sup>

### **National Solid Waste Management (Disposal of Solid Waste Facilities) Regulations (2020)**

As of 2020, final consultation with the Minister of Local Government is to be convened after which the chairman of NSWMA's board of directors is expected to facilitate the regulation being gazette.<sup>2</sup>

### **National Solid Waste Management (Disposal of Hazardous Waste) (Electronic and Electrical) Regulations (2020)**

As of 2020, final consultation with the Minister of Local Government is to be convened after which the chairman of NSWMA's board of directors is expected to facilitate the regulation being gazette.<sup>3</sup>

#### **b. Waste related act**

##### **Public Health (Nuisance) Regulations (1995)**

In these Regulations "nuisance" includes any nuisance specified in the Schedule. It includes the accumulation of waste, keeping of animals so as to become hazardous to health, lack of water or a water supply system, a water supply system not properly maintained, the waste of water, the accumulation of stagnant water, excess vegetation or overgrowth of the bush which harbours or is likely to harbour vermin. This regulation specifies that no person shall cause or permit nuisance on any premises owned or occupied by him (reg. 3). Officials specified in regulation 4 may serve a notice on owners or occupiers of premises requiring to abate the nuisance or to implement proposed measures to abate the nuisance. Non-compliance with such notice may cause legal action by the Local Board (reg. 4).

#### **c. Plastic related orders**

##### **c.1 The Trade (Plastic Packaging Materials Prohibition) Order (2018)**

This order bans the importation, distribution, manufacture, and use of commercial quantities of single-use plastic. It defines single-use plastic by thickness, material and product, and specifies the date of effect and exceptions.

##### **c.2 The Natural Resources Conservation Authority (Plastic Packaging Materials Prohibition) Order (2018)**

Together with The Trade Order (2018), this order bans importation, distribution, manufacture and use of commercial quantities of single-use plastic. After defining single-use plastic, this order further details exceptions. Also, it stipulates the power of Minister of Economic Growth and Job Creation to give approval to a person to manufacture or use single use plastics subject to terms and conditions.

#### **d. Environmental law**

##### **The Natural Resources Conservation Authority Act (1993)**

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<sup>1</sup> National Solid Waste Management Authority (2020) *Annual Report 2019/2020*. p.96

<sup>2</sup> National Solid Waste Management Authority (2020) *Annual Report 2019/2020*. p.96

<sup>3</sup> National Solid Waste Management Authority (2020) *Annual Report 2019/2020*. p.96

The Natural Resources Conservation Authority Act provides for the management, conservation and protection of the natural resources of Jamaica. The Act establishes the Natural Resources Conservation Authority, a body of persons appointed by the Minister of the Environment. The functions of the Authority include the taking of such steps that are necessary to ensure the effective management of the physical environment of Jamaica; and the management of marine parks and protected areas. Section 9 of the Act creates a Ministerial discretion to declare parts of or the entire island a ‘prescribed area’, in which specified activities require a permit, and for which activities an environmental impact assessment may be required. Section 10 stipulates the power of the Authority to request environmental impact assessment in which specified activities require a permit and the use of a notice in the process. Section 11 states that if there has been a breach of any term or condition subject to which the permit was granted, or if such person fails or neglects to submit to the Authority, a permit may be revoked or suspended. Section 12 addresses the requirement for licenses for sewage and trade effluent discharges. In addition to sewage and trade effluent discharges, the Act also addresses air emissions. Regulations are being developed to specifically address these sources of pollution. Under the new regulations the polluter pays principle will be incorporated.

**e. Policies and Plans**

**National Solid Waste Management Policy**

This Policy supports EMS through initiatives such as waste minimization, waste processing, public education and enforcement of related legislation. These strategies are geared towards overall waste management. While the policy is on the list of national policies provided in.<sup>4</sup>

**National Policy (white paper) on Environmental Management Systems (EMS)**

This Policy aims to promote certification, implementation, monitoring and evaluation of EMS to reduce or mitigate environmental impacts and increase efficiencies. In addition, EMS principles will be mainstreamed into all sectors at the national and local levels to assist with the creation of a green economy. The objectives of the Policy on EMS are:

- To establish a framework that facilitates the promotion and implementation of EMS by 2030;
- To increase the number of private sector organizations that are implementing EMS, and attaining related local and international certification;
- To introduce EMS programmes and principles to ministries, departments and agencies in an effort to improve the environmental stewardship of Government operations; and
- To increase awareness of EMS principles and to effect culture change with respect to sound environmental stewardship practices within the society.

In the policy, the proposed roles of specific ministries, departments and agencies (MDAs) with respect to the implementation, monitoring and evaluation (policy review every 5 years) are highlighted. Proposed policy applications include EMS Plans and Programmes, Corporate Plans of MDAs and the Private Sector.

**National Energy from Waste Policy 2010-2030 (draft)**

This is a sub-policy of the National Energy Policy. The main objective is to achieve affordable and clean energy from waste that contributes to Jamaica’s energy security and efficient waste management. The policy includes a Strategic Framework that outlines the policy’s short, medium and long-term goals, strategies, and actions, as well as Institutional Framework that outlines the major stakeholder’s roles and responsibilities. The Strategic Framework has the following objectives: development of an energy-from-waste sector as part of Jamaica's

<sup>4</sup> National Policy on Environmental Management Systems (EMS) (draft), 2019

renewable energy (RE) sector, contributing to the achievement of 2030 RE targets; promotion of modern, environmentally friendly technology; safe and effective solid waste management; and establishment of governance, institutional, legal, and regulatory frameworks for a waste-to-energy generation. The policy also outlines key frameworks and indicators for monitoring and evaluation.

#### **NATIONAL POLICY FOR THE ENVIRONMENTALLY SOUND MANAGEMENT OF HAZARDOUS WASTES (GREEN PAPER) (2017)**

This Policy covers the Environmentally Sound Management (ESM) of hazardous waste. It is in keeping with Jamaica's National Development Plan-Vision 2030 Jamaica, in particular, Goal 4: Jamaica has a Healthy Natural Environment. The goal of this Policy is for the environmentally sound management of hazardous wastes in Jamaica in keeping with international and regional best practices, to ensure the protection of human health and the environment. The Policy is based on an integrated life cycle approach to hazardous wastes management from generation to reuse/recovery/refurbishment/final disposal. It also provides guidance to public sector decision-makers, the private sector, public interest non-governmental organizations and the general public on issues related to the management of hazardous wastes, including the special requirements for labelling, packaging, storage, transportation and treatment. The strategic component of the Policy outlines actions to be undertaken and, where possible, the timeframe for their implementation by various stakeholders to ensure that the policy goal and objectives are realized. Accordingly, Implementation Road Map is provided to specify priority categories of Hazardous Waste and activities and measures for the policy implementation.

### **B.1.4 Implementation Structure of Solid Waste Management**

#### **a. Solid waste management**

The National Solid Waste Management Authority (NSWMA) is a statutory body established in 2002 under the NSWM Act to regulate and manage solid waste sector in Jamaica. The NSWMA oversees the operation of the Western Parks and Markets (WPM) Waste Management Limited, Metropolitan Parks and Markets (MPM) Waste Management Limited, Northeastern Parks and Markets (NEPM) Waste Management Limited and Southern Parks and Markets (SPM) Waste Management Limited. These companies equip the NSWMA with the necessary manpower to provide waste collection services to over 70% of Jamaica's populous. Together with the companies, The NSWMA collects residential and commercial solid waste, enforce the NSWM Act and manages of eight disposal sites. Residential solid waste is collected via house-to-house servicing but also through community bins, and curbside pick-ups.<sup>5</sup>

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<sup>5</sup> National Solid Waste Management Authority (2019) *Annual Report 2018/2019*.

Table 1-4: The four regional companies' coverage

Regional Companies	Parishes Served
Metropolitan Parks and Markets (MPM)	<ul style="list-style-type: none"> <li>St. Catherine</li> <li>St. Andrew</li> <li>Kingston</li> <li>St. Thomas</li> </ul>
Southern Parks and Markets (SPM)	<ul style="list-style-type: none"> <li>St. Elizabeth</li> <li>Manchester</li> <li>Clarendon</li> </ul>
Western Parks and Markets (WPM)	<ul style="list-style-type: none"> <li>Westmoreland</li> <li>Hanover</li> <li>St. James</li> <li>Trelawny</li> </ul>
Northeastern Parks and Markets (NEPM)	<ul style="list-style-type: none"> <li>St. Ann</li> <li>St. Mary</li> <li>Portland</li> </ul>

Source: NSWMA Website<sup>6</sup>

The NSWMA is mandated to manage all disposal sites until divestment occurs. To date, there are eight (8) disposal sites under management located in Portland, St. Ann (2 sites), Kingston & St. Andrew, St. Thomas, St James, St Elizabeth and Manchester.



Source: NSWMA Annual Report Final 19-20 (2020)

Figure 1-2: Disposal Sites under Management of NSWMA

<sup>6</sup> <http://www.nswma.gov.jm/collection-schedule/>

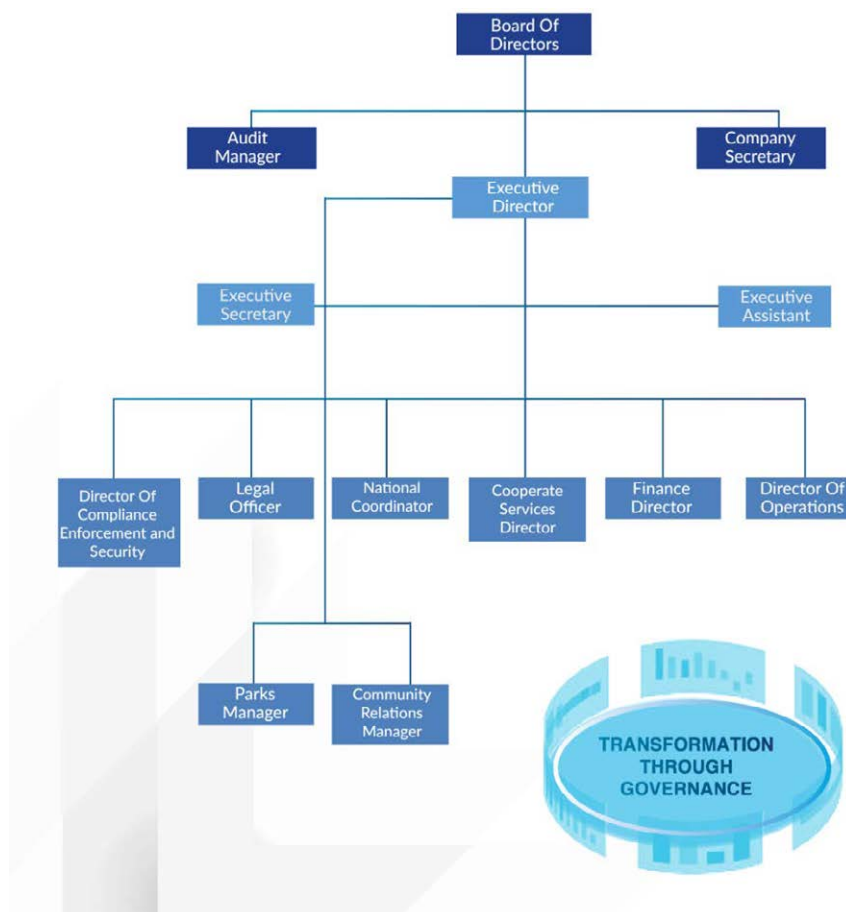


Figure 1-3: NSWMA organizational chart

**b. Enforcement**

The National Solid Waste Management Act Fixed Penalty Notice (Litter Ticket) was promulgated on May 1, 2007. Through the Fixed Penalty Notice, the NSWMA has the power to ticket and charge offenders with fines as high as \$10,000.00 per violation.

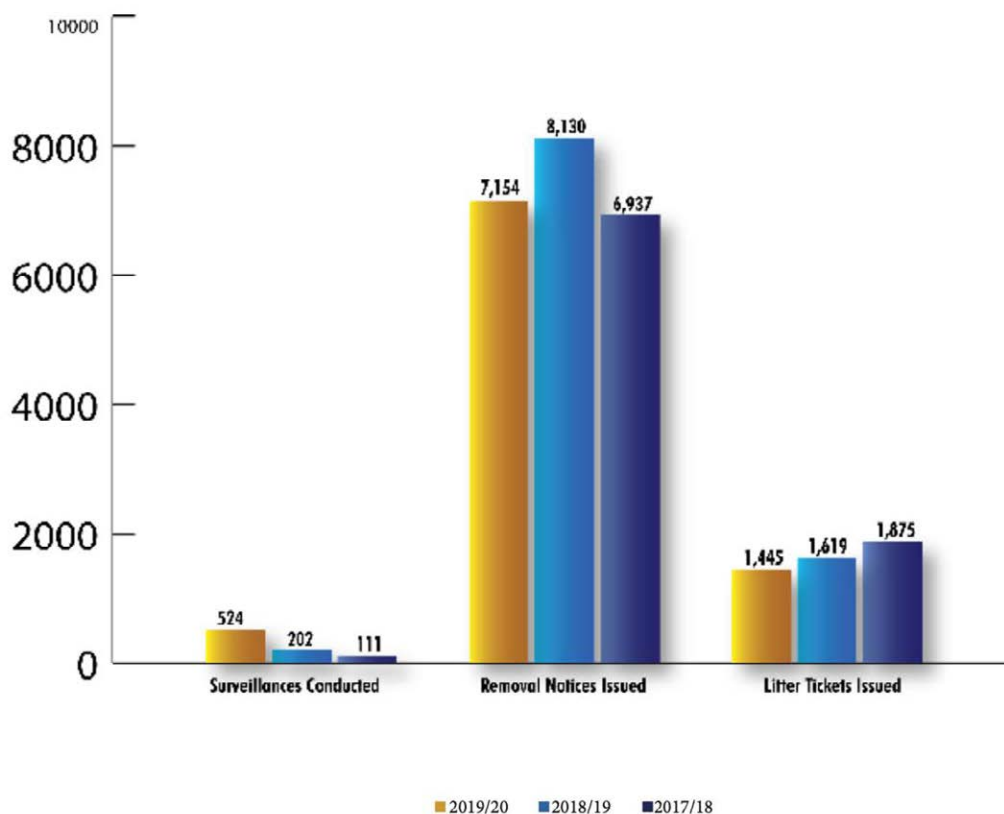
A list of the offences which attract a ticket/fine and the corresponding penalties are illustrated in the table below:

OFFENCE	PENALTY
Littering or disposing of garbage in any public space	\$2,000.00
Wilfully breaking any bottle or article made of glass in or on any public place without having lawful authority or reasonable excuse to do so	\$5,000.00
Littering or disposing of garbage in or on any premises owned or occupied by another person without the consent of that person	\$5,000.00
Defacement of public property or public space by erecting, displaying, depositing or affixing anything on any building, wall, fence or structure	\$3,000.00
Employing persons to deface public property or public space by erecting, displaying, depositing or affixing anything on any building, wall, fence or structure	\$10,000.00

Source: (NSWMA, 2022)<sup>7</sup>

<sup>7</sup> NSWMA (2022) *IF YUH LITTER, YUH LIFE A GO BITTER!*, NSWMA. Available at: <http://www.nswma.gov.jm/if-you-litter-you-life-a-go-bitter/> (Accessed: 7 March 2022).

As a means of enforcing the NSWMA Act, the Authority conducted several activities to ensure compliance. The surveillance target of 480 was surpassed through the execution of 524 surveillance activities for the reporting period. This means an increase of 322 surveillance activities over the previous FY and an increase of 413 against that recorded in 2017/18. The Authority recorded the issuance of 7,154 removal notices in 2019/20, which surpassed its target of 4,800 by 2,354 but was 976 fewer than the 8,130 removal notices that were issued in 2018/19 but an increase of 217 notices over the number issued in 2017/18. A total of 1,445 fixed penalty anti-litter tickets issued which represented an achievement of 90% of the target set at 1,600 but 174 fewer than the prior year. There was an increase of 73 litter tickets issued in 2019/20 over the number issued in the previous FY.<sup>8</sup>



Source: National Solid Waste Management Authority (2020)

Figure 1-4: Enforcement Activities

### c. Cleansing

Public Cleansing is conducted through extensive collaboration with Municipal Corporations across Jamaica. This symbiotic relationship has granted the NSWMA permanent membership on the Public Health and Disaster Preparedness Committee of each Municipal Corporation.

The NSWMA through funding from the Parochial Revenue Fund (Property Tax) provides the Public Cleansing services of sweeping and residential collection of solid waste.

NEPA (National Environment and Planning Agency) has set environmental standards for waste management in National Policy (white paper) on Environmental Management Systems (EMS).

<sup>8</sup> National Solid Waste Management Authority (2020) *Annual Report 2019/2020*.



**d. Parks and Garden Management**

The Parks & Gardens Division was established in 2008 in order to generate revenue for the Authority.

The Division provides employment for over four thousand Individuals islandwide and is fully self-sufficient, that is, it is not a recipient of government subvention.<sup>9</sup>

**e. Recycling**

Following is the description of “Recycling Partners of Jamaica”.

Items	Descriptions
Key organization	Recycling Partners of Jamaica (RPJ) <ul style="list-style-type: none"> <li>The designated national recycling entity formed by public and private partnerships with the Government of Jamaica.</li> </ul>
Organizations in partnership	<ul style="list-style-type: none"> <li>Wisynco Ltd.</li> <li>Pepsi Jamaica Ltd.</li> <li>Grace Kennedy Foods and Services Ltd.</li> <li>Jamaica Beverages Ltd.</li> <li>Lasco Manufacturing Ltd.</li> <li>SEPROD Ltd.</li> <li>Trade Winds Citrus Ltd.</li> <li>The Jamaica Environment Trust (JET)</li> </ul>
Activities	The programme establishes satellite depots in strategic locations around the island to facilitate collection. These depots will receive the reclaimed PET bottles and will bulk and bale them so as to increase efficiencies in the handling, storage and transportation. The collectors will be paid on a weight basis. PET bottles purchased from collectors will be weighed, baled and shipped overseas for further processing. (see figure x for satellite depots)
Recycles products	PET bottles, HDPE bottles

Source: (Recycling Partners of Jamaica, 2022)<sup>10</sup>

The following figure shows the list of recycling partners.

<sup>9</sup> NSWMA (2022) *Parks and Gardens, NSWMA*. Available at: <http://www.nswma.gov.jm/parks-gardens-division/> (Accessed: 7 March 2022).

<sup>10</sup> <https://recyclingja.com/> and <https://www.facebook.com/RecycleJA/>



**RECYCLING PARTNERS OF JAMAICA**

**TAKE YOUR PET AND HDPE BOTTLES TO ANY OF THE FOLLOWING LOCATIONS TO BE RECYCLED. LET'S PUT PLASTIC BOTTLES WHERE THEY SHOULD BE AND NOT IN OUR GULLIES, ON OUR STREETS OR OUR SHORELINES!**

<p><b>Kingston &amp; St. Andrew</b></p> <ul style="list-style-type: none"> <li>RPJ Depot - 21 Rousseau Road</li> <li>Total Service Station - Red Hills Road</li> <li>Total Service Station - 29 Mackville Terrace</li> <li>Total Service Station - Manor Park</li> <li>Total Service Station - Stanton Terrace</li> <li>Jamaica Environment Trust (JET) - Constant Spring Road</li> <li>Chillitos Jamaican Food - 88 Hope Road</li> <li>Seventh Day Adventist Church - Seaview Gardens</li> <li>Mona Anglican Church of Ascension - 1A Daisy Avenue</li> <li>Boys Town Football Club</li> <li>Pembroke Hall Primary School</li> <li>Tarrant Primary School</li> <li>The Queen's School</li> <li>Convent of Mercy Academy</li> <li>St. Peter &amp; Paul Preparatory School</li> <li>Holy Childhood Preparatory School</li> <li>Allman Town Primary</li> <li>Half Way Tree Primary</li> <li>Norman Manley High School</li> <li>St. George's College</li> <li>Haile Selassie High School</li> <li>Meadowbrook Preparatory School</li> </ul>	<p><b>St. Catherine</b></p> <ul style="list-style-type: none"> <li>RPJ Depot - Lakes Pen</li> <li>New Testament Church of God - Braeton, Portmore</li> <li>Total Service Station - Brunswick Ave, Spanish Town</li> <li>Harrison's Preparatory School</li> <li>Southborough Primary School</li> <li>Portsmouth Primary School</li> <li>Greater Portmore Primary School</li> <li>Eltham High School</li> <li>Naggo Head Primary School</li> </ul>	<p><b>St. James</b></p> <ul style="list-style-type: none"> <li>RPJ Depot - Greenwood</li> <li>Coldfield Manufacturers - Flankers</li> <li>Corinaldi Primary School</li> <li>Hosanna Preparatory School</li> <li>Anchovy Primary School</li> </ul>
<p><b>St. Ann</b></p> <ul style="list-style-type: none"> <li>LFA Country Store - Richmond, St. Ann</li> <li>Ocean Village Shopping Center - Ocho Rios</li> </ul>	<p><b>St. Elizabeth</b></p> <ul style="list-style-type: none"> <li>Lacovia Primary School</li> <li>Sandy Bank Primary School</li> <li>Newell High School</li> <li>Munro Preparatory School</li> <li>Geneva Primary School</li> </ul>	<p><b>Trelawny</b></p> <ul style="list-style-type: none"> <li>Falmouth All Age School</li> </ul>
<p><b>Manchester</b></p> <ul style="list-style-type: none"> <li>RPJ Depot - Martin's Hill</li> <li>Mount St. Joseph High School</li> </ul>	<p><b>Clarendon</b></p> <ul style="list-style-type: none"> <li>Woodhall All Age School</li> <li>Clarendon College</li> <li>Mineral Heights Primary School</li> </ul>	<p><b>St. Mary</b></p> <ul style="list-style-type: none"> <li>RPJ Depot - Trinity, Port Maria</li> <li>Cool Oasis Service Station - Rio Nuevo</li> </ul>
	<p><b>Hanover</b></p> <ul style="list-style-type: none"> <li>Esher Primary School</li> <li>Cove Primary School</li> <li>Lucea Primary School</li> </ul>	<p><b>Portland</b></p> <ul style="list-style-type: none"> <li>Fellowship Square</li> <li>Boston Jerk Centre</li> <li>Manchioneal Fishing Village</li> <li>Miguel's Garage</li> <li>Piggy's Jerk Centre</li> </ul>
		<p><b>Westmoreland</b></p> <ul style="list-style-type: none"> <li>RPJ Depot - Whitehall</li> <li>Charela Inn</li> </ul>
		<p><b>St. Thomas</b></p> <ul style="list-style-type: none"> <li>RPJ Depot - Morant Bay</li> <li>Lieth Hall Baptist Church</li> <li>2 John's Town Road</li> </ul>

To learn more about other recycling locations visit us online [f](https://www.facebook.com/RecycleJA/) [i](#) [t](#) @recyclingja or 876-948-7381

Source: (Recycling Partners of Jamaica, 2021) <sup>11</sup>

#### f. Public Education

##### Conduct an islandwide public education campaign/initiative

Compost Before you Dispose sensitization campaign was launched; the Plastic Separation Initiative was launched in 16 communities in Kingston & St. Andrew; over 15,000 pounds of plastic were diverted from disposal sites through the Plastic Separation Initiative; and the Website was upgraded for easier updating of information.

##### Sensitize 20% of Jamaica's population on illegal dumping and composting

25.1% (730,391 of Jamaica's populous) were sensitized about illegal dumping and composting; Mobile app was launched for reporting illegal dumping, littering in public spaces and non-collection of garbage; and the Stamp Out Littering and Illegal Dumping (SOLID) campaign was launched. <sup>12</sup>

#### g. Partnership with NSWMA

##### Rae Town-Plastic Separation

The NSWMA forged partnerships with the Jamaica Social Investment Fund (JSIF), Social Development Commission and National Works Agency to implement a Plastic Recycling Pilot

<sup>11</sup> <https://www.facebook.com/RecycleJA/>

<sup>12</sup> National Solid Waste Management Authority (2020) *Annual Report 2019/2020*.

Project in the community of Rae Town, Kingston. The pilot project is part of a wider Plastic Waste Minimization Project, which is being directed by the NEPA. It is a two-year project which is funded by the Japanese Government through the United Nations Environment Programme. The project is expected to commence in the FY 2020/2021.

#### **Integrated Community Development Project**

The NSWMA has had a long-standing partnership with the JSIF. In the project, the Authority received two compactor units from the JSIF for use within the targeted communities.

#### **Participation in the annual International Coastal Clean-up Day**

As a means to support and participate in the exercise, the Authority extended the use of its collection units to transport the waste collected across the island. Staff members of the NSMWA came out in their numbers to remove the solid waste identified on the Palisadoes strip.

#### **h. Training**

Over 1,400 employees of the Authority and the regional companies participated in training and professional development sessions. Approximately 40 employees enrolled in Heart Trust/NTA Adult Education Division.<sup>13</sup>

### **B.1.5 Financial System**

#### **a. Group (NSWMA and 4 regional companies)**

Following tables show the revenue and expenditure of NSWMA and 4 regional companies.

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<sup>13</sup> National Solid Waste Management Authority (2020) *Annual Report 2019/2020*.

Table 1-5: Revenue composition of the Group and NSWMA (\$'000)

Item	2020		2019		2018	
	Group	NSWMA	Group	NSWMA	Group	NSWMA
<b>GOVERNMENT SUBVENTION</b>						
Subvention - primary allocation	4,904,479	1,839,579	4,661,578	1,996,502	4,331,114	2,251,826
Subvention - emergency & special projects	1,903,016	-	1,304,919	-	1,034,009	-
Constituency Development Fund	5,000	-	6,000	-	-	-
Subvention – statutory liabilities paid	56,536	-	158,992	40,898	-	-
<b>TOTAL GOVERNMENT SUBVENTION</b>	<b>6,869,031</b>	<b>1,839,579</b>	<b>6,131,489</b>	<b>2,037,400</b>	<b>5,365,123</b>	<b>2,251,826</b>
<b>COMMERCIAL INCOME</b>						
Landfill	41,106	23,567	34,826	21,020	-	-
One-off	801	-	726	-	-	-
Shipwaste	16,745	-	15,878	-	-	-
Compost	41	40	38	38	-	-
Plant sales	1,264	1,264	190	190	-	-
E-waste	1,097	1,097	2,166	2,166	-	-
Residence, business etc.	635,307	-	476,095	204	-	-
<b>TOTAL COMMERCIAL INCOME</b>	<b>696,361</b>	<b>25,968</b>	<b>529,919</b>	<b>23,618</b>	<b>410,150</b>	<b>21,451</b>
<b>OTHER INCOME AND GAINS</b>						
Rental income	6,374	6,374	2,381	2,381	2,405	2,702

Item	2020		2019		2018	
	Group	NSWMA	Group	NSWMA	Group	NSWMA
Fees and fines	3,875	3,186	625	179	1,981	574
Insurance settlement	12	12	-	-	-	-
E – Waste income	1,156	-	2,166	2,166	-	-
Processing fee and other	42,067	42,011	5,327	1,342	114,620	1,301
Write back of accrual	125,035	-	-	-	-	-
Write-off of SPM payable	-	140,668	-	-	-	-
TOTAL OTHER INCOME AND GAINS	178,519	192,251	10,499	6,068	119,006	4,577
INTEREST INCOME	3414	3241	3642	3550	3415	3317
TOTAL INCOME	7,747,325	2,061,039	6,675,549	2,070,636	5,897,694	2,281,171

Table 1-6: Expense composition of the Group and NSWMA (\$'000)

Item	2020		2019		2018	
	Group	NSWMA	Group	NSWMA	Group	NSWMA
Landfill operations	770,292	-	494,719	124	450,126	2,035
Supplementary fleet – Landfill contractors	1,006,269	-	763,705	-	706,311	-
Public cleansing	75,503	2,211	70,267	2,028	449,267	5,787
Beautification and special projects	1,441,408	668,349	1,272,189	591,182	792,816	523,384
STAFF COSTS						
Salaries and wages	2,365,837	504,604	2,080,945	564,475	1,764,508	573,375

Item	2020		2019		2018	
	Group	NSWMA	Group	NSWMA	Group	NSWMA
Motor vehicle allowances	244,043	80,933	201,997	58,735	77,655	49,351
Payroll taxes – employer's portion (NIS, NHT)	96,430	25,441	92,780	26,488	72,458	29,258
Staff welfare - health, life and pension	186,508	24,755	114,046	12,831	53,247	26,630
TOTAL STAFF COSTS	2,892,818	635,733	2,489,768	662,529	1,967,868	678,614
Retirement benefit adjustment	-3493	-3,493	-3,705	-3,705	1,013	1,013
Directors' fees	3,661	3,661	2,508	2,508	3,291	3,291
Motor vehicle expense	452,742	58,050	442,793	113,158	442,839	91,848
Repairs and maintenance-property & equipment (NSWMA trucks)	91,274	10,912	129,378	28,972	5,079	3,904
Depreciation - Property, plant and equipment	250,523	227,799	177,833	157,763	104,090	87,072
Depreciation – Right-of-use asset	2,416	-	-	-	-	-
Security services	41,833	10,466	45,511	10,091	43,247	10,232
Rental, leasing and hireage	23,312	551	29,691	502	16,113	53
Utilities	47,535	21,586	41,403	22,726	35,063	21,349
Industrial & other claims	47,928	47,928	39,020	39,020	53,499	53,499
Legal and professional fees	24,627	27,546	23,531	19,284	23,548	15,395
Auditor's remuneration	2,900	3,930	7,000	2,500	0	-
Advertising, promotion and training	21,656	10,306	8,300	5,456	4,672	2,354
Stationery and office supplies	23,126	7,798	18,509	6,825	31,272	9,198
Bank charges	3,601	1,840	3,396	1,927	2,510	1,941

B Current Situation (as of March – April 2022)

Item	2020				2019				2018			
	Group		NSWMA	Group	Group		NSWMA	Group	Group		NSWMA	Group
Allowance for credit losses	84,149	1.12%	-	111,747	1.77%	-513	190,182	3.40%	63,452			
Interest and penalties — payroll taxes	55,885	0.74%	2,178	38,735	0.61%	13,309	117,677	2.11%	-			
General Consumption Tax (GCT)	97,626	1.29%	33,298	57,596	0.91%	30,040	85,545	1.53%	26,147			
3% Withholding tax	603	0.01%	603	1,440	0.02%	1,440	299	0.01%	299			
Food, drink meetings and function	18,304	0.24%	5,646	12,178	0.19%	4,424	-	0.00%	-			
Uniform	37,232	0.49%	-	1,497	0.02%	-	-	0.00%	-			
Community outreach program	868	0.01%	-	-	0.00%	-	-	0.00%	-			
Transportation of staff	281	0.00%	-	-	0.00%	-	-	0.00%	-			
Sanitising, staff welfare & other expenses	30,469	0.40%	14,318	41,670	0.66%	36,757	-	0.00%	-			
Administrative expense **	-	0.00%	-	-	0.00%	-	52,049	0.93%	7,045			
Site rehabilitation***	-	0.00%	-	-	0.00%	-	7,780	0.14%	-			
<b>TOTAL EXPENSES</b>	<b>7,545,348</b>	<b>100%</b>	<b>1,791,216</b>	<b>6,320,679</b>	<b>100%</b>	<b>1,748,347</b>	<b>5,586,156</b>	<b>100%</b>	<b>1,607,912</b>			

\*The amount includes casual workers, courier service, subscriptions, Internet, medicine etc

\*\*The amount includes staff welfare, casual workers, courier, subscriptions, Internet, medicine etc.

\*\*\*The 2018 expenditure was for rehabilitation of SPM Waste Management Limited's landfill roads

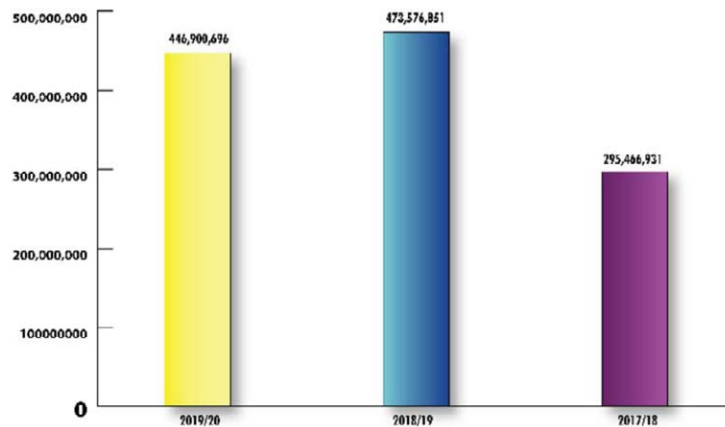
The following are the financial overview of NSWMA and 4 regional companies in 2019/2020.<sup>14</sup>

**Revenue**

The NSWMA and its four regional companies received a subvention of \$6.87 billion for the Financial Year (FY) 2019/20. This represents an increase of \$738 million or (12%) over the previous year when a subvention of \$6.13 billion was received. Own source revenue equated to \$696 million, this reflects an increase of \$166 million or (31%) over the previous financial year. Total revenue for the reporting period was \$7.75 billion compared to \$6.68 billion in the prior year. This was an increase of \$1.08 billion or 16%.

**Commercial Revenue**

The NSWMA was able to earn \$446,900,696 in revenue, which was \$39,790,696 (9%) above the target of \$407,110,000. The Authority earned less revenue when compared to the previous FY because of the COVID-19 pandemic. During March 2020, the Authority was unable to conduct regular collection of revenue owed as there was a reduction in physical contact with non-staff members.



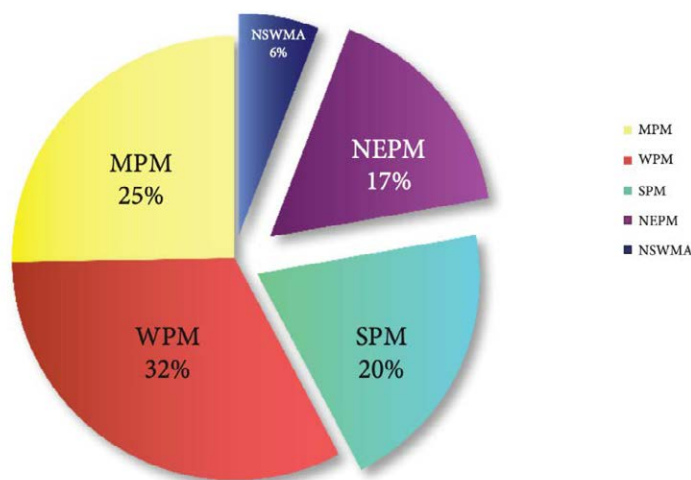
Source: National Solid Waste Management Authority (2020)

**Figure 1-5: Commercial Revenue Earned**

The chart above illustrates the percentage contribution of the Authority and the regional companies to the overall commercial revenue generated in 2019/20. WPM raked in the most commercial revenue, earning in excess of \$122 million, an equivalent of 32% of the overall target set for the reporting period.

<sup>14</sup> National Solid Waste Management Authority (2020) *Annual Report 2019/2020*.





Source: National Solid Waste Management Authority (2020).

Figure 1-6: Figure x: Commercial Revenue Contribution (2019-2020)

At the close of the 2019/20 FY, \$7.6 million was generated through the provision of beautification services and the sale of plants, compost and wood chips. There was a shortfall of \$2,400,000 (24%) based on a revenue target of \$10 million. However, a much-needed crew truck was acquired to further improve service delivery. The Authority continued its longstanding partnership with the Tourism Product Development Company (TPDCo). The maintenance contract with the TPDCo covered a significant area of the north coast and selected areas of the south coast. The scope of work included the cutting of verges, tree pruning, desilting and drain cleaning. At its peak, the project employed over 900 workers in various capacities: supervisors, whacker operators, machete men and sweepers.<sup>15</sup>

#### Main revenue sources

1. Regular subvention of \$4.90 Billion (63% of total budget)
2. Special and Seasonal Projects \$1.90 Billion (24.5% of total budget)
3. Own source revenue of \$696 Million (9% of total budget).
4. Statutory liabilities paid on NSWMA'S behalf of \$57 Million (1.1% of total budget).
5. Other income of \$187 Million (2.4% of total budget)

The \$1.08 billion or (16%) increase in total revenue was due to:

1. An increase in the number of projects undertaken by the Parks and Garden Division in collaboration with the Tourism Product Development Company Limited and the Tourism Enhancement Fund to conduct islandwide beautification work.
2. Special funds were received for the following project
  - To pay increases in salary of 4% for regular workers and 25% for drivers and general workers on average plus retroactive payments.
  - Special covering and stockpiling of cover material to reduce the likelihood of fires on our landfills.

<sup>15</sup> National Solid Waste Management Authority (2020) *Annual Report 2019/2020*.

- Special dengue eradication projects.
3. Supplementary funding of \$985 million was received to clear urgent public cleansing bills and satisfy legal obligations due to budget shortfall.
  4. Greater strategic focus to improve the own source revenue operations including staffing, updating contracts and more timely billing resulted in the increase.

## Expenses

The total expenses of \$7.55 billion, inclusive of depreciation charges of \$251 million reflected an increase of \$1.23 billion (19%) more than the \$6.32 billion that was recorded over the previous 2018/19 FY.

Expenses	2020	2019	Var	Per
	\$M	\$M	\$M	%
Staff costs	2,892	2,490	-402	38.33%
Public Cleansing	1,852	1,329	-523	24.55%
Beautification & special projects	1,441	1,272	-169	19.10%
Motor vehicle expense	452	443	-9	5.99%
Interest & penalties - payroll taxes	56	39	-17	0.74%
GCT irrecoverable	98	58	-40	1.3%
Other administration expense	504	513	9	6.68%
<b>Total Operating Expense</b>	<b>7,295</b>	<b>6,143</b>	<b>-1151</b>	<b>96.69%</b>
Depreciation	250	178	-72	3.31%
<b>TOTAL EXPENSES</b>	<b>7,545</b>	<b>6,321</b>	<b>-1224</b>	<b>100%</b>

The \$1.23 Billion or (19%) increase in total expenditure was attributed to the following:

1. Staff costs increased by \$402 Million or (16.14%). This was due to the payment of a 4% increase on salaries and allowances for Admin Staff, 28% increase in salary for Sweepers and General Workers and 21% increase in salary for Drivers.
2. The Agency engaged key vacant posts
3. Special covering and stock piling of cover material for Landfills to reduce the likelihood of fires in the sum of \$355 Million
4. Dengue eradication project of \$279 Million 5. Beautification and special projects operating costs increased by \$169 Million or (13.29%).

This was a result of an increased number of projects conducted during the reporting year.

## Statement of Financial Position

The net asset base of the NSWMA and the four regional companies, as at March 2020, was \$1,040 billion which represents an increase of \$190 million (22.31%) over the 2018/19 reporting period. The asset base is broken down as follows:

### Property, Plant and Equipment

The property, plant and equipment were valued at \$1.2 Billion for the reporting period. The was a minimal reduction over the prior year.

### Cash and Cash Equivalents

In the 2019/20 FY cash and cash equivalents amounted to \$717 million which is an increase of \$69 million over the previous FY. This is mainly due to subventions received for dedicated projects that were not completed at the end of 2019/2020 FY and general subventions received close to the year-end not being spent.

### Accounts Receivable and Prepaid Expenses

Accounts receivable and prepaid expenses totaled \$646 million during the 2019/20 FY. There was an increase of \$280 million or (76.46%) which was mainly due to the following: \$142 million deposit on 20 compactor trucks \$75 million deposit on Riverton bridge \$2.5 million deposit on land in St. Thomas to relocate landfill.

### Accounts Payable and Provisions

Accounts payable and provision were valued at \$1.5 billion in 2019/20 FY. This was a minimal increase over the prior year, the Authority received \$985M in support from supplementary appropriation. This was mainly used to clear supplementary and landfill contractors' debt. The high accounts payable and provisions balance is negatively affected by our constant budget shortfall for 2019/20 FY \$9,832,158 was re- requested to provide twice-weekly garbage collection, but only \$4,261,006 was approved. \$320 million was also provided to purchase 20 new garbage trucks during the year.

#### b. The breakdown of NSWMA and 4 regional companies

The following is the breakdown of the revenue and expenditure of NSWMA and 4 regional companies consisting of MPM, SPM, WPM and NEPM. While revenue and expenditure in 2019/2020 for NSWMA, SPM and NEPM are provided in the NSWMA report 2019/2020<sup>16</sup>, the financial statements for MPM and WPM for 2019/2020 are not provided. Thus, statements for 2018/2019 are shown for MPM and WPM below<sup>17</sup>.

Table 1-7: NATIONAL SOLID WASTE MANAGEMENT AUTHORITY (NSWMA)  
2018-2020

Item	2020		2019		2018	
	Thousand \$	%	Thousand \$	%	Thousand \$	%
INCOME						
GOVERNMENT SUBVENTION	1,839,579	89.25%	2,037,400	98.39%	2,251,826	98.71%
COMMERCIAL INCOME	25,968	1.26%	23,618	1.14%	21,451	0.94%
OTHER INCOME AND GAINS	192,251	9.33%	6,068	0.29%	4,577	0.20%
INTEREST INCOME	3,241	0.16%	3,550	0.17%	3,317	0.15%
TOTAL INCOME	2,061,039	100%	2,070,636	100%	2,281,171	100%
EXPENSES						
Direct, administrative and general	(1,791,216)	99.94%	(1,745,539)	99.88%	(1,607,912)	99.84%
Finance cost	(1,133)	0.06%	(2,142)	0.12%	(2,597)	0.16%

<sup>16</sup> National Solid Waste Management Authority (2020) *Annual Report 2019/2020*.

<sup>17</sup> National Solid Waste Management Authority (2019) *Annual Report 2018/2019*.

Item	2020		2019		2018	
TOTAL EXPENSES	(1,792,349)	100%	(1,747,681)	100%	(1,610,509)	100%
Surplus for the year	268,690		322,955		670,662	
OTHER COMPREHENSIVE INCOME						
Item that will not be reclassified to income in subsequent periods:						
Revaluation of land and building	-		-		135,038	
Retirement benefit adjustment as restated	-		-		(197,633)	
Retirement benefit adjustment	(9,209)		(9,818)		-	
TOTAL OTHER COMPREHENSIVE INCOME	(9,209)		(9,818)		(62,595)	
TOTAL COMPREHENSIVE INCOME	259,481		313,137		608,067	

**MPM WASTE MANAGEMENT LIMITED 2018-2019**  
(a company limited by guarantee)

**STATEMENT OF COMPREHENSIVE INCOME**  
**YEAR ENDED 31 MARCH 2019**  
(Expressed in Jamaican dollars unless otherwise indicated)

	Note	2019 \$'000	2018 \$'000
<b>INCOME</b>			
Government subvention	6	2,075,702	1,580,527
Commercial income	7	136,213	128,410
Other income	8	1,194	12,379
Interest income		34	32
		<u>2,213,143</u>	<u>1,721,34</u>
<b>EXPENSES</b>			
Direct, administrative and general expenses	9	(2,077,440)	(2,107,624)
Surplus (deficit) being total comprehensive income/(loss) for the year		<u>135,703</u>	<u>(386,276)</u>

## SPM WASTE MANAGEMENT LIMITED 2019-2020

**STATEMENT OF COMPREHENSIVE INCOME**  
**YEAR ENDED 31 MARCH 2020**  
**(Expressed in Jamaican dollars unless otherwise indicated)**

	Note	2020 \$'000	2019 \$'000
<b>INCOME</b>			
Government subvention	6	800,073	569,139
Commercial income	7	162,708	139,432
Other income	8	955	469
Interest income		23	16
		<u>963,759</u>	<u>709,056</u>
<b>EXPENSES</b>			
Direct, administrative and general expenses	9	<u>(1,088,120)</u>	<u>(706,574)</u>
Surplus/(deficit) being total comprehensive income/(loss) for the year		<u>(124,361)</u>	<u>2,482</u>

**WPM WASTE MANAGEMENT LIMITED 2018-2019**  
**(a company limited by guarantee)**

**STATEMENT OF COMPREHENSIVE INCOME**  
**YEAR ENDED 31 MARCH 2019**  
**(Expressed in Jamaican dollars unless otherwise indicated)**

	Note	2019 \$'000	2018 \$'000
<b>INCOME</b>			
Government subvention	6	877,762	667,908
Commercial income	7	156,837	115,227
Other income	8	2,655	101,445
Interest income		34	37
		<u>1,037,288</u>	<u>884,617</u>
<b>EXPENSES</b>			
Direct, administrative and general expenses	9	<u>(1,102,786)</u>	<u>(807,556)</u>
(Deficit) surplus being total comprehensive income for the year		<u>(65,498)</u>	<u>77,061</u>

## NEPM WASTE MANAGEMENT LIMITED 2019-2020

**STATEMENT OF COMPREHENSIVE INCOME**  
**YEAR ENDED 31 MARCH 2020**  
 (expressed in Jamaican dollars unless otherwise indicated)

	Note	2020 \$'000	2019 \$'000
<b>Income</b>			
Government Subvention	6	739,142	571,486
Commercial Income	7	71,411	73,819
Other Income	8	240	113
Interest Income		13	8
		<u>810,806</u>	<u>645,426</u>
<b>Expenses</b>			
Direct, administrative and general expenses	9	<u>(781,444)</u>	<u>(688,340)</u>
Surplus/(Deficit), being total comprehensive income/(loss) for the year		<u>29,362</u>	<u>(42,914)</u>

## B.1.6 Technical System

### B.1.6.1 Public Area Cleansing

Waste cleansing in the public area such as streets or parks is implemented by waste management implementation company in four regions such as Metropolitan Parks and Markets (MPM) Waste Management Limited, Western Parks and Markets (WPM) Waste Management Ltd., Northeastern Parks and Markets (NEPM) Waste Management Ltd. and Southern Parks and Markets (SPM) Waste Management Ltd. supervised by NSWMA. However, many peoples discharge waste in public areas especially, gullies and open spaces along roads, which cause the deterioration of surrounding environment.

There are many gullies connected with Kingstone Bay, The Ocean Cleanup, which is NGO in Holland, is supporting the pilot project in the estuary of the gullies to collect the waste including plastic waste discharged into the gullies (left below picture) by utilizing machine with belt conveyer under water. In other areas, waste is manually collected by the floating fence to protect the waste.

Within Kingston Bay, floating debris such as empty cans, PET bottles, and plastic pieces were observed, but the quantity of marine debris floating in the ocean seemed to be relatively small. On the other hand, a lot of floating debris was seen along the shoreline of Kingston Bay, especially near the southern shoreline (right below picture), where plastics and other marine debris drift ashore. In addition, bulky debris and driftwood were also observed along ashore. These bulky marine debris seem to have been drifted along ashore during strong winds or hurricanes period.



### B.1.6.2 Storage and Discharge

The residents discharge waste along each road by utilizing waste bins (see left picture) or plastic bags. In some areas, the meshed metal box is put as left below picture for the plastic bag discharge. In addition, the skip or container is installed in collection points as right below picture.

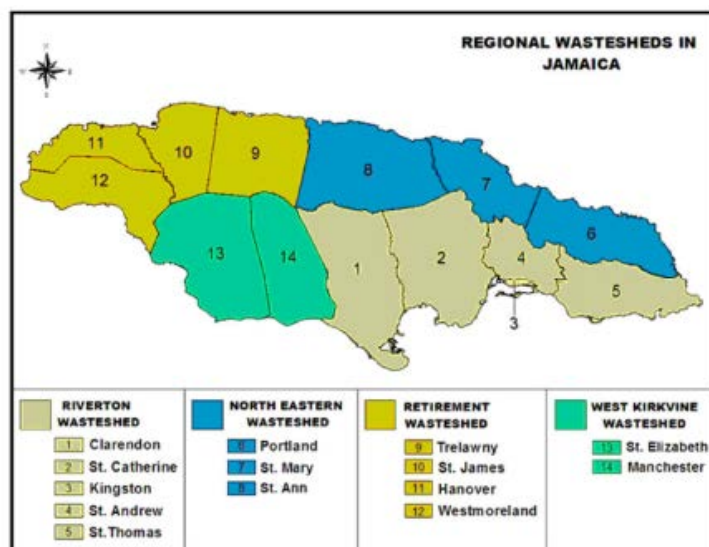
In the case of plastic bags only discharge, some of waste scatters in the road. In addition, there are cases of that discharged waste is over the capacity of waste bin.





**B.1.6.3 Collection and Transport**

- Residential, institutional and commercial waste are collected by MPM Waste Management Limited for Riverton Wasteshed, WPM Waste Management Ltd. for Retirement Wasteshed, NEPM Waste Management Ltd. for North Eastern Wasteshed and SPM Waste Management Ltd. for West Kirkvine Wasteshed with supervision of NSWMA. Each area of wasteshed is shown as following figure.



Source: NSWMA

Figure 1-7: Waste Collection Area for Each Wasteshed in Jamaica

- The collection frequency is once a week by kerbside collection and they publicize the collection schedule for each area. Commercial waste is collected for 1 to 3 times a week.



- The collection system of residential and institutional waste is mainly kerbside collection service by Refuse Compactor Vehicles (RCV) to collect waste near the waste generator's property.
- In narrow road areas such as along gullies, only small tipper can collect the waste. Therefore, collection frequency seems to be not sufficient.
- In the data in 2020, the number of collection vehicles are 88 compactor trucks, 2 crane trucks, 9 tipper trucks. In 2021, NSWMA tried to purchase new 20 RCVs. In addition, 3 RCVs were donated by Japanese government.

#### **B.1.6.4 Recycling**

There are many companies or organizations related to recycling activities. They mainly just collect recyclable waste, export them to the other countries after packaging them. The main activities regarding plastic waste are shown as follows.

- Recycling Partners of Jamaica Limited (RPJL) a private sector collected recyclable by preparing collection points in public areas such as schools or churches, where many people gather and provide the collection service of recyclable. Since 2016, RPJL has collected plastic wastes for export. RPJL has implemented PET bottle collection programs in more than fifty schools across the island and operates two collection depots in Montego Bay and in Kingston.
- NEPA implements Plastic Waste Minimization Project with the support of UNEP. As a subcomponent of the project, the pilot project is implemented in Rae Town, which is one of sixteen communities within Central Kingston. Through the project, plastic recyclable waste is collected.

#### **B.1.6.5 Treatment**

- There is 1 Material Recovery Facilities (MRF)/Recycling Plant for PET (hand sorting) in the parish of St. Andrew, at the Riverton disposal site. The facility is currently not in use because the former company can no longer do their business. They need to find a new contractor to restart this business.
- There is 1 composting facility (windrow method) owned by NSWMA. The facility is currently not in use but internal discussion for the promotion is ongoing under strong initiative from the Executive Director of NSWMA.
- There is a proposed transfer station facility to be built in the parish of Trelawny. The construction site has been designated but the construction will be delayed due to Covid-19. Waste loaded at the facility will be transferred to the Retirement Disposal Site which covers four parishes: Westmoreland, Hanover, St. James, Trelawny in WPM Region.

#### **B.1.6.6 Final Disposal**

- All eight disposal sites were covered for the period April 2019 - March 2020. Disposal sites covering is scheduled to be executed four times yearly at the Riverton and Retirement disposal sites and three times yearly at the smaller landfills such as Martins Hill, Myersville, Haddon, Doctors' Wood, Tobalski and Church Corner. The Authority covers to ensure that all landfills are monitored, maintained and organized to meet local and international safety and health standards. Due to financial challenges the Authority is unable to achieve coverage of three to four times yearly, instead bi-weekly covering is done at the larger disposal sites, Riverton and Retirement and once per year at the smaller sites (Myersville, Martins Hill, Haddon, Doctors Wood, Tobalski and Church Corner). The material used during the process of covering is a mixture of limestone and

soil. Limestone greatly increases the stability of the landfill as a cover material, however by itself, it is not the best choice for covering waste.

- There is one controlled dump site in St. James parish called Retirement Disposal Site
  - 1) Owner: NSWMA
  - 2) Location: Retirement St. James, 18°26'9.12"N, 77°52'34.06"W
  - 3) Area: 26.9 hectares
  - 4) Waste disposal amount: 638 tons/day
  - 5) Data source: estimated by volumetric carrying capacity of truck
  - 6) Installed facility: gate bar
  - 7) Operation in practice: spreading, compaction of waste with soil covering.
  - 8) In July 2018, in December 2020, in March 2021 and in March 2022, there were fires in the site.
  - 9) There is a plan to relocate the landfill.
  
- There is one controlled dump site in St. Andrew parish called Riverton Disposal Site
  - 1) Owner: NSWMA
  - 2) Location: Riverton Meadows, St. Andrew, 18° 0'42.39"N, 76°50'59.21"W
  - 3) Area: 68.3 hectares,
  - 4) Waste disposal amount: 1,400 tons/day,
  - 5) Data source: estimated by volumetric carrying capacity of truck
  - 6) Installed facility: office space, fire suppression system, and manned gate for entrance control.
  - 7) Operation in practice: spreading and compaction of waste with soil covering.

There was a big fire accident happened in 2015 and in 2018 but since then, NSWMA has been covering waste with extra soils and installed the fire suppression system at site.

Carib Cement signed a memorandum of understanding in 2019 to undertake the activity in collaboration with the Ministry of Economic Growth and Job Creation and the Ministry of Local Government and Community Development regarding combustion of waste tyres as fuel for a cement factory. However, it was implemented in project basis, now they are waiting for the next project.

A 128,000-gallon water storage tank for fire suppression has been installed since 2015.
  
- There are two controlled dump sites in St. Ann parish called Haddon and Tobalski.
  - 1) Owner: NSWMA
  - 2) Location: Haddon and Tobalski St. Ann, 18°18'30.89"N, 77°23'13.83"W (Tobolski), the coordinates of Haddon's location is unclear.
  - 3) Area: 6.9 and 3.5 hectares respectively,
  - 4) Waste disposal amount: 219.5 & 86 tons/day respectively,
  - 5) Data source: estimated by volumetric carrying capacity of truck
  - 6) Installed facility: gate bar (Haddon)
  - 7) Operation in practice: spreading and compaction of waste with soil covering.
  - 8) In May 2016, there was a fire at Haddon site
  
- There is one controlled dump site in Portland parish called Doctor's Wood Disposal Site

- 1) Owner: NSWMA
  - 2) Location: Buff Bay, Portland, 18°12'9.49"N, 76°29'7.66"W
  - 3) Area: 14 hectares,
  - 4) Waste disposal amount: 84.6 tons/day,
  - 5) Data source: estimated by volumetric carrying capacity of truck
  - 6) Installed facility:
  - 7) Operation in practice: spreading and compaction of waste with soil covering.
  - 8) In July 2014 and in June 2017, there was a fire at the site.
- There is one controlled dump site in Manchester parish called Martins Hill Disposal Site
    - 1) Owner: NSWMA
    - 2) Location: Martins Hill, Manchester, 18° 4'41.97"N, 77°28'55.35"W
    - 3) Area: 17.7 hectares,
    - 4) Waste disposal amount: 134.5 tons/day,
    - 5) Data source: estimated by volumetric carrying capacity of truck
    - 6) Installed facility: gate bar
    - 7) Operation in practice: spreading and compaction of waste with soil covering.
  - There is one controlled dump site in St. Elizabeth parish called Myersville Disposal Site
    - 1) Owner: NSWMA
    - 2) Location: Myresville, St. Ann, the coordinates of Haddon's location is unclear.
    - 3) Area: 7.2 hectares,
    - 4) Waste disposal amount: 39.9 tons/day,
    - 5) Data source: estimated by volumetric carrying capacity of truck
    - 6) Installed facility:
    - 7) Operation in practice: spreading and compaction of waste with soil covering.
    - 8) In June 2016 and in April 2017, there was a fire at the site.
  - There is one controlled dump site in St. Thomas parish called Church Corner Disposal Site
    - 1) Owner: NSWMA
    - 2) Location: Church Corner, St. Thomas, 17°53'3.03"N, 76°25'13.42"W
    - 3) Area: 1.5 hectares,
    - 4) Waste disposal amount: 38.5 tons/day,
    - 5) Data source: estimated by volumetric carrying capacity of truck
    - 6) Installed facility:
    - 7) Operation in practice: spreading and compaction of waste with soil covering.
    - 8) In October 2021, there was a fire at the site.

### **B.1.6.7 Other wastes**

Since there are no legal frameworks for hazardous waste management in Jamaica, there are no practical treatment methods adopted in this country. In the coming years the new regulation for hazardous waste management will be enacted to manage it properly.

Regarding medical waste, Ministry of Health has the responsibility of preparation of law and regulations of medical waste but there is no specific regulations or guidelines for medical waste. In addition, steam sterilization technology is used for infectious medical waste before final disposal in landfill sites.

### **B.1.7 Donor Support**

The Development Bank of Jamaica considers Integrated Solid Waste Management project<sup>18</sup>.

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18

<https://www.globalinfrastructure.org/sites/gif/files/2021-03/Jamaica%20Presentation%20-%20Investing%20in%20a%20Resilient%20Future%20for%20the%20Caribbean%20%20January%2028%202021%20%28final%29%20.pdf>

## B.2 Saint Lucia

### B.2.1 Basic Information

Item	Contents
Population	179,995 (2019 midyear estimate provisional) - <b>Department of Statistics</b>
Population growth (annual %)	0.73% (2018-2019 growth rate) - <b>Department of Statistics</b>
Urban population	34,990 - <b>Department of Statistics</b> (Includes urban centre and peripheral only available for 2010)
Population density (people/km <sup>2</sup> )	292.2 - <b>Department of Statistics</b>
Average national rainfall (millimetres/year)	Average Rainfall based on the 30-year climatological mean from 1981 to 2010. In Saint Lucia average rainfall is sectioned into two parts because there are two monitoring stations: Hewanorra International Airport - 1491.9 millimetres George FL Charles Airport - 1900.2 millimetres- <b>Saint Lucia Meteorological Service</b>
Annual frequency of hurricanes (times/year)	Months from June to November are hurricane season, and it is very unlikely to have direct run-overs by hurricanes. Less than 1% per year (not any adverse impact) - <b>Saint Lucia Meteorological Service</b>

### B.2.2 Solid Waste Management Data

#### B.2.2.1 Waste Generation Amount

There is no official data of waste generation amount. However, based on the waste collection rate by world bank 2019, the waste generation amount is estimated as follows.

Waste Generation Amount [ton/day] = Waste Collection Amount [ton/day] / Waste Collection Rate [%]

In the assumption that waste collection amount is waste disposal amount in Deglos landfill site, each waste amount in 2021 is shown as follows.

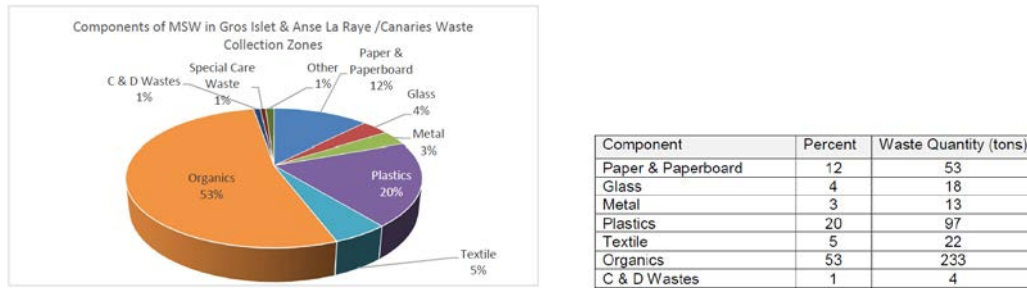
Table 1-8: Waste Amount

Item	2017	2018	2019	2020	2021
Waste disposal amount [ton/day]	226	206	215	219	180
Waste collection amount [ton/day]	226	206	215	219	180
Waste collection rate [%]	96%	96%	96%	96%	96%
Waste generation amount [ton/day]	235	215	224	228	188

Source: JAT based on the information of SLSWMA

#### B.2.2.2 Waste Composition

Waste composition survey of residential and institutional waste including households, government offices, schools, health care institutions, prisons, etc in two (2) of the eleven (11) waste collection zones was conducted in 2018. The study was undertaken in an urban collection zone namely Gros Islet and a rural collection zone, namely Anse La Raye/Canaries. The summary of result is as follows.



Source: Waste Characterization Study Report by SLSWMA (2018)

Figure 1-8: Waste Composition Survey Data at Selected Councils in Saint Lucia

**B.2.2.3 Waste Disposal Amount**

The amount of waste disposal is measured in the weighing bridge in Deglos landfill site. Each type of waste is respectively recorded according to the registration number of collection vehicles as well as loaded waste amount, arriving time of collection vehicle, etc. The trend of waste disposal amount in Saint Lucia is shown as following figure. As shown in the below figure, the profile of disposed waste amount at landfill is almost flat figuring 70,000 – 80,000 tons/year. The latest amount of disposed waste in 2020-2021 year, approximately decreased 14,000 tons/year. Comparing with each category of waste, almost all of the waste categories tended to decrease other than green waste. Among these decreasing categories, waste from hotels and ships are main items of the total decrease of waste amount of disposal.

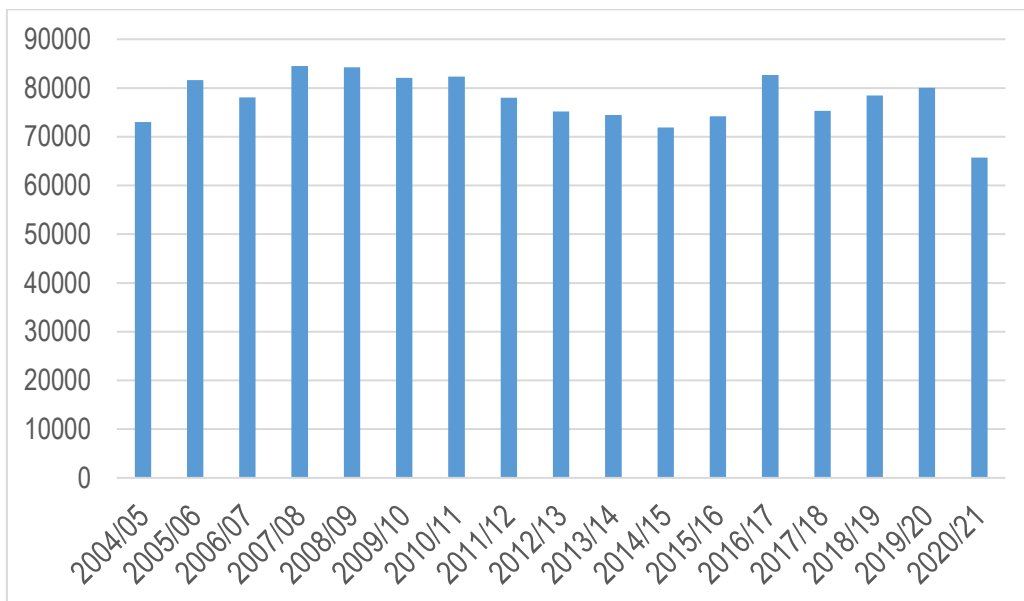


Figure 1-9: Waste Amount (Ton/year) Disposed of at Landfills in Saint Lucia



Figure 1-10: Waste Categories Disposed of at Landfills in Saint Lucia in 2020/2021

Table 1-9: Waste Categories Disposed at Landfills in Saint Lucia

WASTE CATEGORY	Waste Amount [ton/year]					Ratio				
	2016/17	2017/18	2018/19	2019/20	2020/21	2016/17	2017/18	2018/19	2019/20	2020/21
Aircraft	83.1	70.7	65.5	76.7	24.9	0.1%	0.1%	0.1%	0.1%	0.0%
Asbestos	0	5.4	23.5	0	2.7	0.0%	0.0%	0.0%	0.0%	0.0%
Biomedical	77.7	58	48.2	52.6	50.7	0.1%	0.1%	0.1%	0.1%	0.1%
Beach Cleaning	592.5	419.9	378.8	332.3	257.9	0.7%	0.6%	0.5%	0.4%	0.4%
Bulky	2371.8	2421.7	3029.4	3101.6	2682.7	2.9%	3.2%	3.9%	3.9%	4.1%
Coconut waste	2562.1	2380.6	2141.9	2704.5	1705.8	3.1%	3.2%	2.7%	3.4%	2.6%
Commercial	13071.1	10961.5	12537.8	12763.9	9236.2	15.8%	14.6%	16.0%	15.9%	14.0%
C & D	7873.2	5826.9	8158.5	5682.5	5504.6	9.5%	7.7%	10.4%	7.1%	8.4%
Condemned Foods	167.3	221.2	233.7	560.8	436.6	0.2%	0.3%	0.3%	0.7%	0.7%
Derelict Vehicles/Scrap Metal	290.1	256.8	302.1	305.5	171.35	0.4%	0.3%	0.4%	0.4%	0.3%
Farm	1088.1	1124	1188.2	1328.4	1114.3	1.3%	1.5%	1.5%	1.7%	1.7%
Fiberglass	0	10.5	15.3	15.9	24.8	0.0%	0.0%	0.0%	0.0%	0.0%
Green	6339.9	6244.5	6735.9	6391.9	6556.1	7.7%	8.3%	8.6%	8.0%	10.0%
Hotel	7775.2	5527.3	6414.8	5996	1931.7	9.4%	7.3%	8.2%	7.5%	2.9%
Pharmaceuticals	8.8	3.4	24.5	82.6	21.9	0.0%	0.0%	0.0%	0.1%	0.0%
Residential/Institutional	33279.1	32349	30328.2	33970.9	32790.7	40.3%	43.0%	38.7%	42.4%	49.9%
Ship	1624.7	1484.9	1970.6	2655.7	59.15	2.0%	2.0%	2.5%	3.3%	0.1%
Street Cleaning	4465.3	4482.6	3404	3011.7	2558.5	5.4%	6.0%	4.3%	3.8%	3.9%
Tires	818.3	806.6	829.8	891.2	577.1	1.0%	1.1%	1.1%	1.1%	0.9%
Other	176.1	648.9	629.5	139.5	38.3	0.1%	0.9%	0.8%	0.2%	0.1%

Source: SLSWMA

### B.2.2.4 Preliminary Estimation of Waste Stream

Basically, collected waste are transported to Deglos landfill site or Vieux Fort solid waste management facility. Bulky waste including E-waste, tyre and construction and demolition waste is filled in Vieux Fort solid waste management facility.

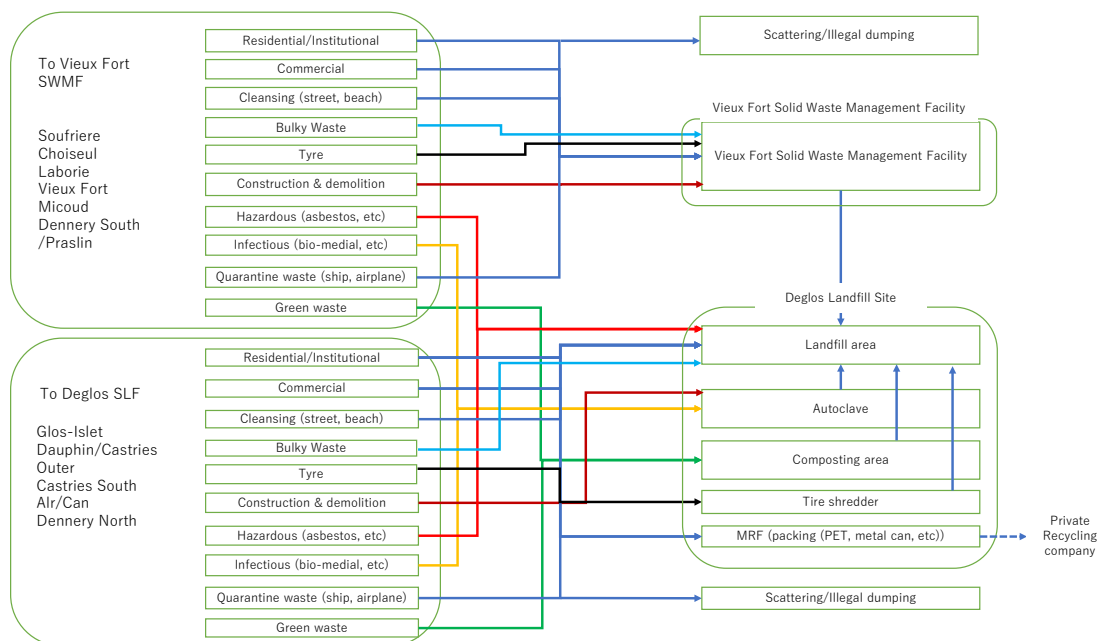


Figure 1-11: Current Waste Stream in Saint Lucia

### B.2.3 Laws, Policies and Plans

#### a. Waste Management Act (2004, revised in 2007)

This Act is to provide for the management of waste in conformity with best environmental practices and to provide for matters incidental thereto.

The major points prescribed in the Act is shown in the below.

Table 1-10: Major Points in the Waste Management Act

Item	Point
Establishment of the Solid Waste Authority	<ul style="list-style-type: none"> <li>● Establishment of the Saint Lucia Solid Waste Authority</li> <li>● The constitution, duties and powers of the Authority</li> </ul>
Waste Management Planning	<ul style="list-style-type: none"> <li>● Formulation of solid waste inventory and National Waste Management Strategy</li> <li>● Content and structure of National Waste Management Strategy</li> </ul>
Waste Management Facilities	<ul style="list-style-type: none"> <li>● Approval process for establishment of waste management facilities</li> <li>● Environmental impact assessment guidelines</li> <li>● Waste management plans required for development applications</li> <li>● Waste Management Facility License</li> <li>● Waste Haulage License</li> </ul>
Waste Management Operations	<ul style="list-style-type: none"> <li>● Liability for and ownership of waste</li> <li>● Requirements for waste handling, separation and processing</li> <li>● Industrial, commercial and institutional waste generators</li> <li>● Littering and illegal dumping of wastes</li> </ul>



Item	Point
Solid Waste Management Authority	<ul style="list-style-type: none"> <li>● Schedule 3 prescribes responsibility, members and role of the board, account and so on of the Authority.</li> </ul>
Hazardous Waste	<ul style="list-style-type: none"> <li>● Schedule 1 Annex I prescribes Wastes Classified as Hazardous Wastes.</li> <li>● Schedule 1 Annex II prescribes List of Hazardous Characteristics (UN Class Code Characteristics)</li> </ul>
Environmental Plan	<ul style="list-style-type: none"> <li>● Schedule 5 prescribes List of Issues to be Covered in any Environmental Plan submitted with Application for Waste Management License. It includes procedure on environmental impact assessments (for new facilities) and environmental plans (for existing facilities).</li> </ul>
Design and Operating Standards	<ul style="list-style-type: none"> <li>● Schedule 6 prescribes General Siting, Design and Operating Criteria for Waste Management Facilities and Haulage Systems. It covers landfill, compost facilities, recyclables materials processing facilities, steamsterlization (autoclaving) facilities, incineration facilities and waste haulage systems.</li> </ul>

**b. Environmental related law**

**b.1 Environmental Protection Levy Act (2000)**

The Environmental levy is a revenue source that is derived from a charge placed on every visitor to Saint Lucia through both our air and sea ports. This is done pursuant to the provisions of the Environmental Order of 1996. The Saint Lucia Air and Sea Ports Authority administers the collection of that levy and remits EC\$4.08 per visitor to the Saint Lucia Solid Waste Management Authority<sup>19</sup>.

**b.2 Styrofoam and Plastic Food Containers (Prohibition) Act (2019)**

This Act prohibits the following activities on the Styrofoam and Plastic Food Service Containers;

- Import
- Manufacture, sale, use and distribution
- Sale of food in styrofoam and plastic food service container

The Returnable Containers Bill is drafted and sent to the Attorney General’s office.

**b.3 Public Health Act (1975, revised in 2019)**

This Act covers collection, removal and sanitary disposal of rubbish.

Ministry of Health has a power of entry to premises and authentication of documents.

**c. Local government related law**

**c.1 Local Authority Ordinance Act (1947)**

Draft Local Authorities Act is under discussion<sup>20</sup>.

Local government comprises one city council (Castries) and 13 ‘quarter’ councils<sup>21</sup>.

<sup>19</sup> SLSWMA, Annual Report 2018-2019

<sup>20</sup> <http://www.govt.lc/news/legislation-to-improve-lga-functions>

<sup>21</sup> [https://www.commonwealthgovernance.org/countries/americas/st\\_lucia/local-government/](https://www.commonwealthgovernance.org/countries/americas/st_lucia/local-government/)

**d. Policies and Plans**

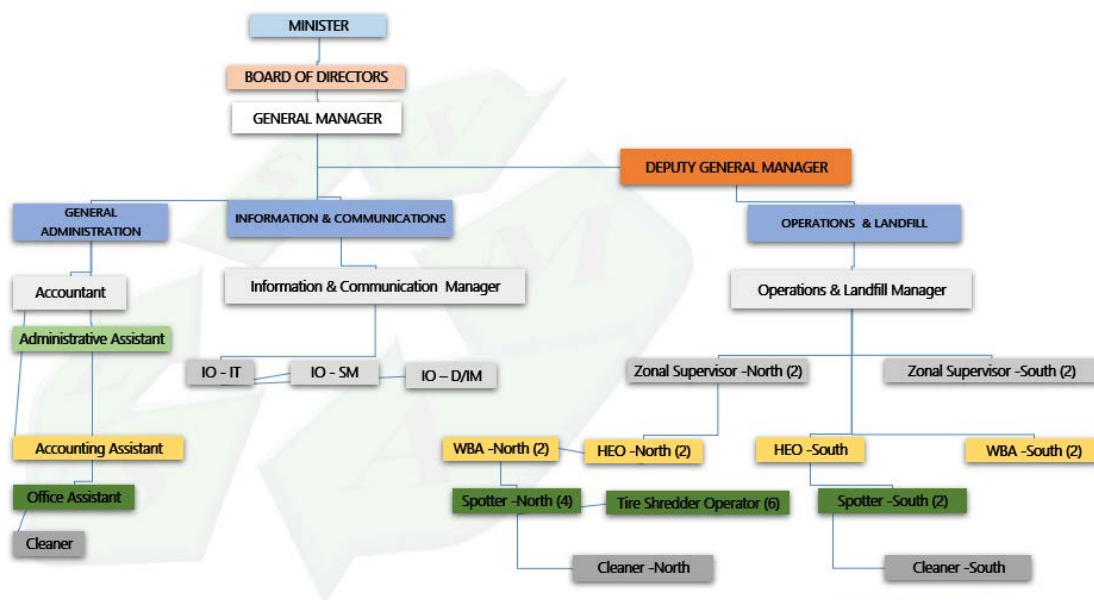
The Waste Management Act requires SLSWMA to prepare a National Waste Management Strategy and prescribes the content and structure of the National Waste Management Strategy. So far, the National Waste Management Strategy is not formulated but will be formulated with the assistance of World Bank which is to be agreed in 2022.

**B.2.4 Implementation Structure of Solid Waste Management**

**a. Solid waste management**

Solid waste management is implemented by SLSWMA, which is supervised by the Ministry of Sustainable Development, Energy, Science and Technology. The Board of Directors of SLSWMA are from or nominated/appointed by Minister of Sustainable Development, Energy, Science and Technology, Department of Sustainable Development, Ministry of Health, Department of Finance, Department of Local Government and Creative Industries, Attorney General, Association of Professional Engineer, Saint Lucia Chamber of Commerce,

SLSWMA has 34 staffs and its structure is as follows.



(Note) IT: Information Technology, SM: Social Media, D/IM: Data/Information Management, WBA: Weigh Bridge Attendant, HEO: Heavy Equipment Operator, Spotter: staff guiding unloading operation

Figure 1-12: Organization Chart of SLSWMA

Waste collection is conducted by the private contractors. Collection by SLSWMA covers residential and public institutions. Contractors cover other waste generators by charging to the generator. The collection contractors are designated on the collection zone and type of waste. The number of collection contractors is 29 in total; 8 for residential waste, 23 for waste from private, 3 for bulky waste, 1 for biomedical waste and 1 for ship chandler (some contractors cover 2 or more type of waste). A Waste Haulage License is required to transport waste.

A Waste Management Facility License is required to operate a waste management facility (not active in actual). Heavy equipment is owned and operated by the private contractors at the Vieux Fort Waste Management Facility.

There are recycling institutions/companies such as Unite Caribbean, Bio Helps Ltd. and Renew St. Lucia Inc.

The Environmental Health Division of Ministry of Health, Welfare and Elderly Affairs is going to start the monitoring of landfill through the Public Health Act.

Following figure shows the relation among the stakeholders.

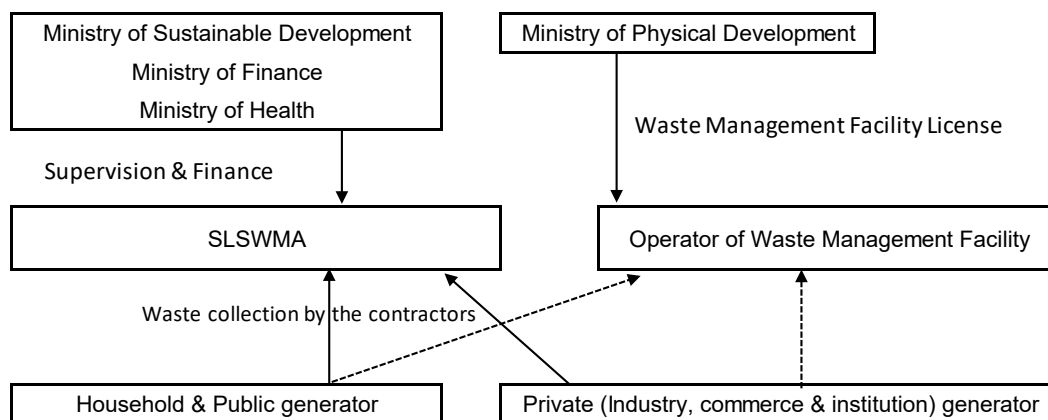


Figure 1-13: Relation of Stakeholders on SWM

**b. Cleansing**

Town councils take care of street cleansing.

The National Conservation Authority takes care of beach cleaning in tourism area. NGOs and tourism sector work on beach cleaning.

**B.2.5 Financial System**

Income and expenditure figure is in the following table.

Major income sources (2020) are:

- Government subvention – 62%
- Environmental levy on visitors – 27%
- User fees – for special waste disposal – 4%

Observed major yearly changes in income and expenditure are:

**Income**

- There is a decline of the Environmental Levy affected by the decrease of tourist arrivals caused by COVID-19.
- 2019/20 saw a major upturn in Government Grant. This was provided as a special subvention to defray expenses relating to the closure of the Vieux-Fort Disposal Facility, and for the first phase of the pyrolysis equipment procurement agreement.
- There are contributions/donations allocation by a donation of waste bins from the Japanese Government in 2020.

**Expenditure**

- In 2020, landfill operating costs almost doubled from \$3,455,172 in 2019 to \$6,194,999. It became necessary to close the Vieux-Fort Waste Disposal Facility, which meant that the

Deglos Landfill would be required to receive and manage all waste generated in the south and it is necessary transporting of waste to the Deglos site in the north.

- Expenditure on waste collection has been relatively stable over the years with the lowest being \$ 6,976,222 in 2016 and the highest being \$7,916,949 in 2020. However, the occupancy rate of the waste collection against the total expenditure varies from 59.6% in 2018-19 and 47.9% for 2019-20.
- Salaries and staff benefits have shown a steady increase over the years from \$989,396 in 2016 to \$1,354,121 in 2021.
- Environmental levy deductions have been unstable with a decline from \$1,259,219 to \$338,407 from 2017 to 2018 followed by an increase to \$158,373 in 2019 with the fall to \$384,140 in 2020.

#### Balance of Income and Expenditure

- From 2018, total income continues to exceed total expenditure.

Table 1-11: Income and Expenditure of Saint Lucia Solid Waste Management Authority

	2016	2017	2018	2019	2020*	2021
<b>INCOME</b>						
Amortisation of deferred funding assistance		86,131	115,143		65,040	331,914
Amortisation of fixed assets fund				79,387	79,386	82,971
Environmental levy	4,212,720	4,382,088	4,757,011	5,017,459	4,918,703	251,496
Government of Saint Lucia	6,479,200	6,879,200	7,179,216	7,839,024	11,170,274	18,205,216
Interest income	14,101	1,315				
Ship Generated Waste				522,101	696,451	15,470
Release of fixed assets fund	444,226	444,239	51,905			
Contributions/donations					723,254	617,443
Other Income	712,951	1,013,211	686,395	197,006	349,130	261,107
<b>TOTAL INCOME</b>	<b>11,863,198</b>	<b>12,806,184</b>	<b>12,789,670</b>	<b>13,654,977</b>	<b>18,002,238</b>	<b>19,765,617</b>
<b>EXPENDITURE</b>						
Advertising and public relations	82,562	135,939	171,959	83,264	126,155	58,049
Audit fees	16,345	14,264	17,634	17,915	18,023	19,974
Bank charges	4,048	3,169	3,323	3,506	4,037	5,041
Board expenses	20,600	20,850	19,800	23,800	22,200	19,750
Communal bins					203,189	161,168
Depreciation	725,968	712,338	302,013	176,335	205,874	1,302,686
Environmental levy deductions	1,239,156	1,259,219	338,407	158,373	384,140	
Landfill operating costs:			2,248,543	3,455,172	6,194,999	3,358,795
- Operating costs	2,116,999	2,470,978				
- Legal fees		82,313				
- Loss on write-off of prepayments		77,386				
Office expenses	29,385	24,904	25,651	33,481	42,523	46,056
Office rental	36,000	36,000	39,500	42,000	42,000	42,000
Professional fees	15,728	16,525	6,000	11,800	15,236	6,000
Salaries and staff benefits	989,396	1,110,946	1,089,128	1,134,542	1,246,736	1,354,121
Service contracts/maintenance	13,148	7,739	5,723	4,391	1,033	2,963
Training/overseas travel/consultations	5,634	1,640	2,350	26,466	13,523	150
Travel and entertainment	23,997	30,848	27,371	23,291	32,375	20,102
Utilities	38,148	32,432	44,539	50,961	53,901	51,664
Waste Collection	6,976,222	7,141,985	7,174,459	7,751,516	7,916,949	7,717,451
Miscellaneous	7,163	14,473	7,446	10,405	15,785	21,295
<b>TOTAL EXPENDITURE</b>	<b>12,422,812</b>	<b>13,111,635</b>	<b>11,523,846</b>	<b>13,007,218</b>	<b>16,538,678</b>	<b>14,187,265</b>
<b>EXCESS OF EXPENDITURE OVER INCOME FOR THE YEAR</b>	<b>(559,614)</b>	<b>(305,451)</b>	<b>1,265,824</b>	<b>647,759</b>	<b>1,463,560</b>	<b>5,578,352</b>

Source: Financial Statement, 2016-2017, 2017-2018, 2018-2019, 2018-2019, 2019-2020 and 2020-2021

## B.2.6 Technical System

### B.2.6.1 Public Area Cleansing

Public area clean-up activities are mainly divided into tourist beaches and other areas, with the former being carried out by National Conservancy Authority (NCA) and the latter by the Council.

In tourist beach and conservation area, NCA, the main cleaning areas are 17 coastal areas, where around 80 employees of NCA staff conduct cleansing the area. They clean the beach regularly. In the beach, there are waste bin and the litter in the bin is collected by contractors.

In other areas such as road, drainage and beach which is not for tourists, the workers in each council conduct cleansing there. The cleaners sweep and clean roads and drainage by utilizing wheel barrow (see picture) or other equipment. The cleaned and collected waste was transported by contractors to Deglos landfill site or Vieux Fort Solid Waste Management Facility.



### **B.2.6.2 Storage and Discharge**

Waste from residents and institution is discharged in three manners such as kerbside , collection point and communal bin (large garbage bin). In case of kerbside collection, waste dischargers put the waste on the kerbside of road. The discharge manners are various such as the discharge by plastic bags and garbage bins. The size and colour of plastic bags and garbage bins are various. Garden waste, bulky waste such as mattress, debris are discharged but not collected by regular service of residential and institutional waste collection. Cardboard or food waste are discharged from plastic bag or waste bin due to large volume. The discharge situation is shown as following pictures.



### **B.2.6.3 Collection and Transport**

#### **a. Collection and transport**

Residential and institutional waste is collected by 11 waste collection zones by outsourcing to private company. The collection frequency is twice weekly without Sunday. Bulky waste is collected once a month. Commercial waste is collected on-demand basis. The collection system is like this.

The collection system of residential and institutional waste are three types of collection system, namely a kerbside collection service, collection point service and a communal bin service by outsourcing to private company. Kerbside service is undertaken where the road network makes it possible for refuse collection vehicles (RCV) to collect waste near the waste generator's property. A communal bin service is provided where the road network makes it impossible for waste collection vehicles to collect waste at the generator's property as well as communal bin.

SLSWMA Annual Report 2019-2020 mentioned that location for residents to discharge waste is stipulated and the waste collection is conducted only on the scheduled collection day. A collection point service is provided where a kerbside service and a communal bin service cannot be provided. Residents instead transport their waste to a designated location for collection on the scheduled collection day. The preferred method of collection is a kerbside service as it eliminates some of the issues such as waste scattering or overflow of waste from communal bins, associated with the other two above-mentioned methods.

SLSWMA mainly utilizes Refuse Collection Vehicles (RCVs: compactor vehicle), dump trucks, skip/container vehicles. Currently, SLSWMA contract with 29 private contractors for collection and transportation for all the waste. The contractors for residential and institutional waste for each zone are shown as follows.

Table 1-12: Waste Contractors for each Zone in Saint Lucia

Zone / Area	Collection company	Transport destination
Glos-Islet	J303 Garbage Disposal, Green R Us, C. K. Gaston & Son Waste Disposal, Bio – Helps Limited	Deglos Landfill Site
Dauphin/Castries Outer	Sadoo & Sons Trucking Co., C. K. Gaston & Son Waste Disposal, U D Haulers	Deglos Landfill Site
Castries Inner	SLECL Ltd.	Deglos Landfill Site
Castries South	Fleet Garbage Removal	Deglos Landfill Site
Alr/Can	U D Haulers, T. Regis Enterprise	Deglos Landfill Site
Dennerly North	South Shore Auto Services Limited	Deglos Landfill Site
Soufriere	Sadoo & Sons Trucking Co., Ltd.	Vieux Fort Solid Waste Management Facility
Choiseul	South Shore Auto Services Limited	Vieux Fort Solid Waste Management Facility
Laborie	South Shore Auto Services Limited	Vieux Fort Solid Waste Management Facility
Vieux Fort	Sadoo & Sons Trucking Co., Ltd.	Vieux Fort Solid Waste Management Facility
Micoud	Sadoo & Sons Trucking Co., Ltd.	Vieux Fort Solid Waste Management Facility
Dennerly South	South Shore Auto Services Limited	Vieux Fort Solid Waste Management Facility





**b. Transfer**

The waste collected at Vieux Fort Solid Waste Management Facility is transported to Deglos Landfill Site. The container of secondary transportation vehicle is estimated around 70m<sup>3</sup> (8mL x 2.5mW x 3.5mH). After unloading from collection vehicle, waste is loaded by excavator to secondary transportation vehicle (see left below picture). Once waste is loaded to secondary transportation vehicle, waste is transported to Deglos and disposed of (see right below picture).



**B.2.6.4 Recycling**

There are some companies regarding recycling business in Saint Lucia. However, most of them are collection and packing or storage of recyclable waste to export the packed recyclable waste and no implementation of material recovery in St. Lucia. According to the previous survey about recycling implemented by Taiwan ICDF volunteer, there are 19 recyclers which handles metal, glass, paper, plastic etc. Many recyclers have baling machines for packing and transport equipment such as dump truck (see right picture of packed PET bottle in a recycler). According to SLSWMA, the number of recycling companies is 17 and currently recycling activities seems to be no active due to economic crisis by COVID-19 and export restriction by the revised Basel Convention. For example, there are collected recyclable waste in Deglos landfill site due to the difficulty of selling the recyclable waste to recyclers. The detail condition of recycling activities and market such as the amount of handled recyclable, its price and destination, are under investigation.



On the other hand, RePLAST project which is the project of collection of plastic bottles, especially PET and HDPE bottle is implemented by Caribbean Unite with financial support by OECS, etc (see right picture). The project began on January 16, 2021 by establishing the first of six collections points in Saint Lucia.



**B.2.6.5 Treatment**

There is no permanent intermediate waste treatment system but biomedical waste in the country. The medical waste is treated by an autoclave installed in the same plot as the sanitary landfill. For the preparation of biomedical waste, as seen in Japan, there is a refrigerator nearby the treatment house.



For tyre waste, there is an exclusive shredder for tyres, and it is operated 3 or 4 times per week. Shredded materials are utilized as an intermediate cover at Deglos Landfill site.



For green waste, there is a woodchipper donated through the Japanese International Cooperation System under Japan's Non-project grant aid for provision of Japanese SME's



Products. It has been operated by some supervisors at the landfill, and after green waste shredding, accumulations are made and stayed for a while to be completely matured.



Unfortunately, there are no MRFs that separated and treated with recyclables such as cardboard, glass, paper, plastic materials. Some recyclables are separated manually.

#### **B.2.6.6 Final Disposal**

Deglos Sanitary landfill is the only landfill in the country. There are 3 leachate collection ponds in the downstream of a main landfilling cell. Leachate is poured in the ponds and experiences a certain retention time to be discharged to the environment. Since there is no emission standard for effluent from point sources, thus the authority follows the international standards in any media not only effluent but emission gas standards.

Landfilling practices are good with specified dumping area guided by supervisors for each incoming waste vehicles, and there is another good practice to keep a working space for the vehicles with durable earth pavement. Internal access roads are asphalt paved and are maintained well.

For daily soil cover, some dumping areas are covered with soil, however, not all the dumping areas are covered with soil.



### B.2.6.7 Other Wastes

Various types of waste are handled by SLSWMA including hazardous waste like biomedical waste, asbestos, pharmaceuticals, and commercial waste, construction and demolition waste, quarantine waste such as waste from and aircraft and bulky waste including e-waste and tires as well as cleansing waste from street and beach, etc.

In hazardous, infectious waste such as biomedical and pharmaceuticals are treated by the autoclave as described above. The other waste such as asbestos is filled in landfill site.

Bulky waste is dumped in a specified pit designated in Veaux Fort Transfer Station. Sometimes the bulky waste is crushed by an excavator to reduce its volume, and soil cover will be implemented after filling up with this bulky waste pit.

Construction waste is collected and landfilled with other residential waste.

Green waste is stored in the composting area after tipping.

### B.2.7 Awareness-raising

The Saint Lucia Solid Waste Management Authority (SLSWMA) has been conducting a number of awareness-raising initiatives. These initiatives include clean-up campaigns of beaches, highways, schools, parks, communities etc., community outreach, tours of landfills, production of public service announcements, creation of a website, utilization of Social Network Services, such as WhatsApp, Facebook, Instagram, Twitter and Youtube, radio and TV talk shows, workshops for children and community meetings.

#### **Public service announcements (PSAs)**

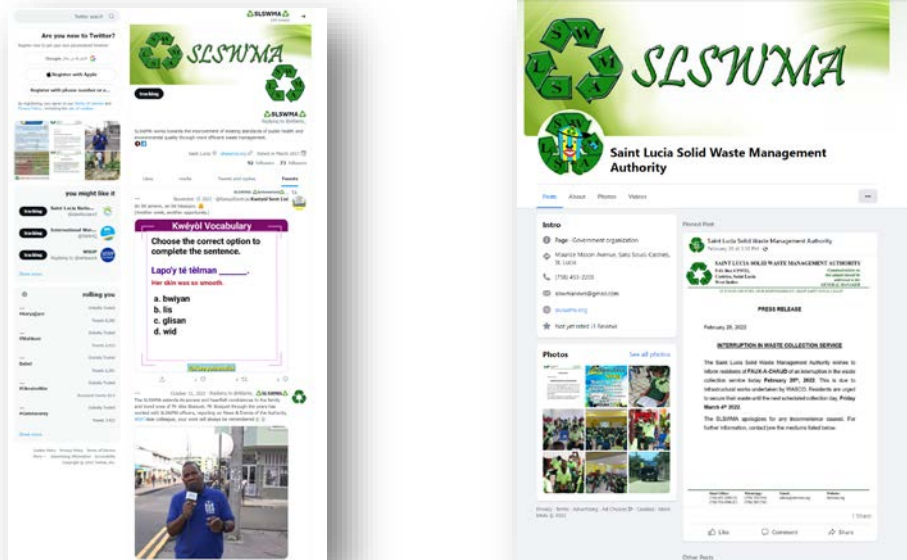
Public service announcements (PSAs) on Radio broadcasting to provide regular and bulk waste collections, as well as collection during the Christmas.

#### **Social Media**

SLSWMA increased its presence on its various social media platforms which included WhatsApp, Facebook, Twitter, Instagram and Youtube since 2018. Frequent updates



highlighted the activities of SLSWMA as well as notifications with respect to the status of the solid waste collection service.



### Signage

Signage complemented targeted community interventions and highlighted messages such as ‘No Dumping’, ‘No Dumping, No Littering’, ‘No Dumping at this Location’, ‘Place Garbage Here Before 7:00 a.m.’



### Community Clean-up Activities

Community groups were assisted with cleaning supplies during voluntary community clean-up activities intended to improve the aesthetics of the targeted communities.

### Tours of Deglos Sanitary Landfill

Student tours of Deglos Sanitary Landfill were conducted as part of an assignment or school course to raise awareness of the young generation.



**Community Outreach Initiatives**

Community outreach exercises were undertaken in collaboration with schools, community groups or government agencies. They included meetings, presentations and workshops to students, youth and adults.



**B.2.8 Social and Environmental Considerations**

**a. Environmental and social impact from waste management facilities**

Schedule 5 List of Issues to be Covered in any Environmental Plan submitted with Application for Waste Management License in the Waste Management Act prescribes requirements for conduct of Environmental Impact Assessments (EIAs) and Environmental Plans (EPs) in support of a waste management facility. Waste management facility covered is, Landfills, Transfer stations, Composting facilities, Facilities for processing recyclable materials, Steam Sterilization (Autoclaving Facilities) and Incinerators and Thermal Treatment Facilities.

Procedure of EIAs and EPs include proposed facility description, facility site environment description, possible impacts and mitigation measures, consideration of alternative, undertaking of public consultation and conclusion with recommendations.

Direct impact typically addressed covers pollution, natural environment, social and disaster aspects.

**b. Environmental issues related to solid waste**

It was observed that the principal sources which pose risks to raw water are piggeries; poorly managed solid waste recycling facilities; disposal sites (for construction spoil, derelict vehicles and chemicals); agro-processing and chemical industries in a 2016 study investigated the presence of point sources of pollution in 15 of the 37 watersheds<sup>22</sup>. There is no environmental health issue raised on SWM these years, according to the Ministry of Health,

**c. Social issues related to solid waste**

The siting criteria in Schedule 6 General Siting, Design and Operating Criteria for Waste Management Facilities and Haulage Systems in the Waste Management Act, covers social factors such as encroachment on communities, purchase or expropriation of private property, resettlement of squatters, archaeological or other heritage resources and buffer distance.

The Authority provides informal sector a space in the warehouse to separate recyclables at the Deglos landfill.

### **B.2.9 Donor Support**

- **Reduction in Marine Litter (ReMLit) Project (2019 - 2022):** This OECS (Organisation of Eastern Caribbean States) project is financed by Norwegian Ministry of Foreign Affairs toward the cost of building resilience in the Eastern Caribbean. It deals with management of marine litters, and the project is implemented in Antigua and Barbuda, Commonwealth of Dominica, Grenada, Montserrat, Saint Lucia and, Saint Vincent and the Grenadines. The components cover solid waste management as waste on the land sometimes goes into the marine environment. In Saint Lucia, the “Project to Establish A Micro Haulers Solid Waste Collection Programme” has been implemented for five months (August - December 2021), and it seeks to reduce solid waste reaching the marine environment in the capital city of Castries through improved storage and collection services in select unplanned developments in the Castries Basin. The project pursues this objective with a programme to replace communal bins with a curbside collection system in communities that are inaccessible to refuse collection vehicles. The project will be completed in March 2022.
- **RePLAST-OECS Project (2019 - 2023):** mainly funded by the Government of France, focuses on testing approaches and systems for setting up a plastic waste collection and recycling scheme through export from Saint Lucia to Martinique (the original destination was set to Martinique island, but failed. Instead, they exported 2 containers (12 tons) of PET to Honduras). The project also includes public awareness raising activities for recycling and WACS (Waste Amount and Composition Survey was conducted in 2018), etc.<sup>23</sup> The first phase of the project was concluded at the end of August 2021, but project partners sought to maintain momentum and continued operations in Saint Lucia. Recently, the additional funding has been secured for another two years, and the pilot project will be replicated in other OECS countries.
- **GEF ISLANDS (Implementing Sustainable Low and Non-Chemical Development in Small Island Developing States (SIDS)) (2020 - 2025):** implemented by UNEP, IADB, FAO, and UDNP. 33 SIDS participated the programme, including nine Caribbean nation: Antigua and Barbuda, Barbados, Belize, Dominican Republic, Guyana, Saint Kitt and Nevis, Saint Lucia, Suriname, and Trinidad and Tobago. The programme focuses on circular economy approaches to the

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<sup>22</sup> Global Water Partnership-Caribbean, Impact of land use change on water resources, availability and water quality in Saint Lucia, 2021

<sup>23</sup> <https://pressroom.oecs.org/plastic-recycling-project-replast-oecs-launches-in-saint-lucia>



management of e-waste, end-of-life vehicles and plastics, as well as the environmentally sound phasing-out of harmful chemicals and materials. ISLANDS also supports SIDS to develop policies to control the import of chemicals, materials, and products that lead to the generation of hazardous waste. The GEF ISLANDS has four components.

- Component 1: Preventing future build-up of chemicals in the SIDS environment;
  - Component 2: Safe management and disposal of existing, historically produced wastes posing an immediate risk to people and natural resources;
  - Component 3: Promoting systems for future management of wastes and chemicals entering SIDS by adopting and putting into practice 3R approaches including increased recovery of resources from wastes by adopting the principles of sustainable consumption and production;
  - Component 4: Sharing knowledge and experience across all regions to address issues common to all SIDS and to stimulate inter regional cooperation to combat major global level challenges posed by wastes such as plastics, electronics and other major pollutants.
- Plastic Waste Free Islands project of IUCN (International Union for Conservation of Nature) (2019 - 2022), supported by Norwegian Agency for Development Cooperation (Norad), is a three-year project working in six islands in the Caribbean and Pacific. Implemented in Fiji, Vanuatu and Samoa in Oceania and Antigua and Barbuda, Saint Lucia and Grenada in the Caribbean, the project seeks to promote island circular economy and to demonstrate effective, quantifiable solutions to addressing plastic leakage from Small Island Developing States (SIDS). By understanding volumes of plastic waste, the project seeks to provide practical solutions based on local knowledge and best practices. The project focuses on addressing plastic at the source while ensuring financial returns to the tourism, fisheries and waste management sectors. Expected outcomes are:
    - Improved knowledge of waste generation among six target islands
    - Increased policy effectiveness in reducing plastic waste generation
    - Enhanced adoption of plastic leakage reduction measures by tourism, fisheries and waste management sectors, through alternate value-chain development
    - Creation of new value-chains and jobs
    - Supported and facilitated investment in waste management and
    - Development of Plastic Waste Free Island blueprint and endorsement by regional bodies.
  - Unleashing the Blue Economy of the Caribbean (UBEC) (2022 - 2027), a regional investment project financed by the World Bank, is designed to strengthen the enabling environment for the blue economy and to enhance resilience of selected coastal infrastructure in and across participating countries (Grenada, Saint Lucia, and St Vincent and the Grenadines). These countries will benefit from improved competitiveness of their economies in three critical and interconnected sectors: Tourism, Fisheries and Aquaculture and Waste Management. These efforts are expected to boost economic recovery, help create jobs, and reduce marine pollution. The related part of this project planned in Saint Lucia includes:
    - Development of a Waste Management Strategy and
    - Feasibility study and environmental study of a new landfill in the southern part of the country.
  - EU Action Programme (2022-2025): “Support to the effective and sustainable management of Solid Waste in the Caribbean” is aimed at CARIFORUM Member States (Antigua and Barbuda, The Bahamas, Barbados, Belize, Dominica, Dominican Republic, Grenada, Guyana, Haiti, Jamaica, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, Trinidad and

Tobago and Cuba). The planned budget is 8 million EUR, and the Programme is implemented by UNEP, AFD, and GIZ. Expected results are:

1. Robust solid waste management legal and strategic frameworks are developed;
2. Capacity for sustainable consumption and sustainable waste management in targeted areas is enhanced;
3. Investment opportunities in the solid waste sector are defined and facilitated; and
4. Increased awareness of the EU-CARIFORUM partnership including on waste management and circular economy.

### B.3 Antigua and Barbuda

This is information as of March 2022.

Respondent: Mr. F. Daryl Spencer

Position: General Manager, National Solid Waste Management Authority

#### B.3.1 Basic Information

Item	Contents
Population	98,000 (the UN world population prospects)
Population growth (annual %)	0.84 from 2020-2021 (the United Nations interpolation data 2022)
Urban population	N/A
Population density (people/km <sup>2</sup> )	223 (Food and Agriculture Organization and the World Bank)
Average national rainfall (millimeters/year)	1640 (Antigua Meteorological Services Climatic Data)
Annual frequency of hurricanes (times/year)	Based on the country's location in the eastern Caribbean Antigua and Barbuda is prone to annual tropical storms and hurricanes, with the last major hurricane, Irma, lead to the total evacuation of all the residents of Barbuda. The hurricane season typically runs from June to November; however, September and October are most active.

#### B.3.2 SWM Data

Item	Contents
Waste generation amount (tons/day)	393.29 (this was calculated based on per person generation and population) see the attached breakdown. See Appendix for waste amount by type of waste generator.
Waste generation rate (kg/person/day)	3.54 (Source: NSWMA waste characterization study, Year: 2017)
Plastic waste generation amount (tons/day)	18.68 (calculation based on 2017 NSWMA data)
Waste collection amount (tons/day)	N/A
Waste collection coverage (%)	97 % (Source: NSWMA, Year: 2017)
Recycling rate (%)	N/A
Recycling rate of plastic materials (%)	N/A
Final disposal amount (tons/day)	369.23 (Source: NSWMA, Year: 2020)



**B Current Situation** (as of March – April 2022)

Waste composition (%)	<p>Paper-7.9%                  Plastic-4.4%                  Glass-4.2%                  Metal-3.2%                  Organics-45.1%                  Construction-22.2%                  Wood-8.6%                  Consumer-4.2%                  Hazardous-0.3%</p> <div data-bbox="635 524 1398 931" style="text-align: center;"> <p><b>Waste Categories</b></p> <table border="1"> <thead> <tr> <th>Category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Paper</td> <td>7.9%</td> </tr> <tr> <td>Plastic</td> <td>4.4%</td> </tr> <tr> <td>Glass</td> <td>4.2%</td> </tr> <tr> <td>Metal</td> <td>3.2%</td> </tr> <tr> <td>Organics</td> <td>45.1%</td> </tr> <tr> <td>Construction</td> <td>22.2%</td> </tr> <tr> <td>Wood</td> <td>8.6%</td> </tr> <tr> <td>Hazardous</td> <td>0.3%</td> </tr> </tbody> </table> </div>	Category	Percentage	Paper	7.9%	Plastic	4.4%	Glass	4.2%	Metal	3.2%	Organics	45.1%	Construction	22.2%	Wood	8.6%	Hazardous	0.3%
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Construction	22.2%																		
Wood	8.6%																		
Hazardous	0.3%																		
Main types of recycled materials	Glass bottles, aluminum cans, steel cans, PET bottles, tyres, metals (derelict vehicles)																		

**B.3.3 Current Situation of SWM and MPL:**

Item	Contents
1. Legal system	<p>Solid Waste Management Act is the main legislation on solid waste management. Following are some waste management related legislations. See the detail in Appendix.</p> <ul style="list-style-type: none"> <li>• Public Health Ordinance 1957</li> <li>• Solid Waste Management Act 1995 (amended in 2005)</li> <li>• Environmental Protection Levy Act 2002</li> <li>• Environmental Protection and Management Act 2019</li> <li>• Litter Prevention and Control Act #3 2019</li> </ul> <p>In 2016, Antigua and Barbuda became the first country within the Americas to ban single use plastics and Styrofoam containers. The government of Antigua and Barbuda followed this up by amending the Litter Act of 1983 in April of 2019. The amended Litter Control and Prevention Act #3 of 2019 increased the fines for individuals and companies who are in breach of the legislation. Following are the plastic waste legislation.</p> <ul style="list-style-type: none"> <li>• External Trade (Shopping Plastic Bangs Prohibition) Order 2017</li> <li>• External Trade (Expanded Polystyrene) (Prohibition) Order 2018</li> </ul>
2. Policy/plan	<ul style="list-style-type: none"> <li>• National Waste Management plan is obsolete, need to be updated</li> </ul>

Item	Contents
	<ul style="list-style-type: none"> <li>• Biomedical waste plan being developed, first draft due in April</li> <li>• Zero waste policy</li> </ul>
3. Implementation system	<ol style="list-style-type: none"> <li>1. National Solid Waste Management Authority (NSWMA) has responsibility for solid waste management in Antigua and Barbuda. This includes waste collection, transportation and treatment also as of 2014 NSWMA now has responsibility for street and drain cleaning, beach sanitation and general sanitation of communities.</li> <li>2. Central Board of Health, Environmental Health Department of Ministry of Health Wellness and the Environment, and the Public Health Inspectors attached thereto has responsibility for monitoring and enforcement of relevant legislation under the Public Health Ordinance and share responsibility under the litter act.</li> <li>3. Royal Police Force of Antigua Barbuda: Enforcement in general.</li> <li>4. Ministry of Agriculture, Lands, Forestry, Fisheries and Barbuda Affairs is responsible for designation of marine protected and forested areas.</li> <li>5. Department of Environment is responsible for legislation Environmental Protection and Management</li> <li>6. National Parks Authority manages all activities within historically significant and protected areas.</li> <li>7. Department of Analytical Services monitors and provides sound scientific data to support planning and implementation of programmes.</li> </ol>
4. Technical system	
Collection and transportation	<p><b>Collection systems</b></p> <ol style="list-style-type: none"> <li>1. Waste from household collected once a week under the curbside collection system in rural and suburban communities</li> <li>2. Waste from urban communities collected 2- 3 times weekly.</li> <li>3. Waste in the St. Johns Commercial district collected daily</li> <li>4. Separated collection system of collection of PET bottles throughout the island.</li> <li>5. Separate system of collection for cardboard in St Johns commercial district. Fall in global prices have led to the recycler refusing to accept, cardboards are collected and stockpiled.</li> <li>6. Bulk waste collection scheduled developed</li> <li>7. Designated trucks for collecting and transporting sanitation (green) waste</li> <li>8. 80 % of collection is by contactors.</li> </ol>

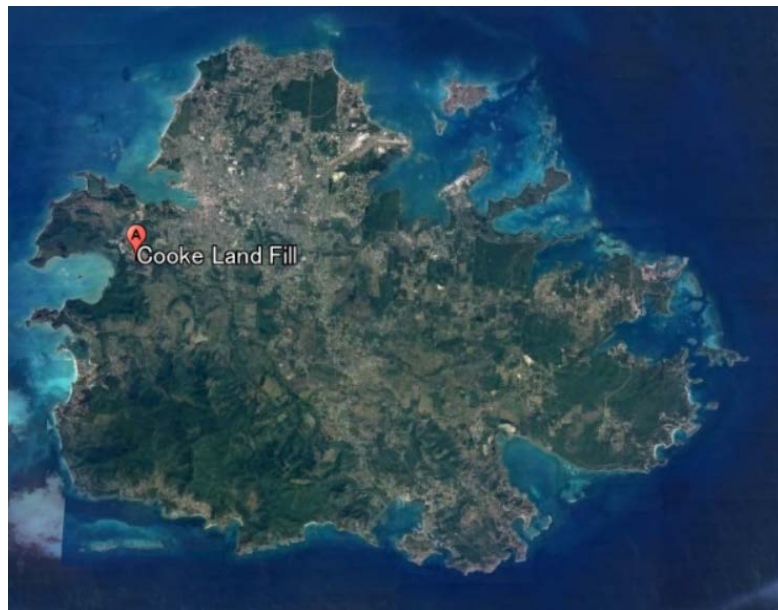
Item	Contents
	<p><b>Transportation system</b></p> <ol style="list-style-type: none"> <li>1. Private haulers to authority equipment reflects an 80% -20% arrangement</li> <li>2. Sixteen contracts issued to private haulers for residential waste collection</li> <li>3. The NSWMA has custody of seven (7) compactor trucks, four (4) operational</li> <li>4. 1 crane truck (mechanical issues)</li> <li>5. The NSMWA current has NO open back trucks</li> <li>6. Transportation cost is high and not sustainable</li> </ol> <p>Barbuda contracts a waste hauler to transport waste</p>
Intermediate treatment	<ol style="list-style-type: none"> <li>1. Tyre shredder: tyre shredding operation commenced in 2020. At that time, it was estimated that there are five million spent tyres stored at the cooks disposal site. The shredder has the capacity to process 2500-3000 tyres daily. The company was contracted to assist with the management of tyres. The processed tyres are stored after processing. There was a fire at the pile of shredded tyres.</li> <li>2. Derelict vehicles: Derelict vehicles are identified by litter wardens and the police, if not claimed these vehicles are collected and transported to a designated storage and processing area at the landfill. Cars are dismantled, plastics and electrical components removed, and the metal is crushed then bailed for export.</li> <li>3. Antigua Barbuda Waste Recycling Corp. (ABWREC) recycles PET bottles, Aluminum and steel cans, Lead acid batteries (mainly from institutions). All PET bottles and can are diverted to ABWREC for recycling to a brewer.</li> <li>4. NSWMA Compost project: windrow compost piles were developed at the landfill to assist with the large quantities of organic waste delivered to the site. This was achieved as part of project to manage POPs within the Caribbean region under the GEF 5558.</li> <li>5. Ministry of Health, Wellness and the Environment started to collect PET bottles by providing 20 cent per bottle incentive at 3 locations under the IUCN Plastic Waste Free Islands Project (See detail in Appendix).</li> </ol> <p style="text-align: center;">Information on recycling companies are shown in the Appendix.</p>
Final disposal	<ol style="list-style-type: none"> <li>1. Antigua has one approved disposal site; the sanitary landfill site was commissioned in 1999 and reached its end of life in 2016. Currently, the authority has reverted to dumping on the old site which lacks appropriate leachate management facility (see location map). Additionally, as mentioned before the Cooks Landfill Site sits overlooking the “flashes”, a species rich mangrove swamp leading to the pristine western coastline.</li> <li>2. Cooks landfill site occupies 25 acres of real estate, and in 2021 the government through a cabinet decision has expressed an interest in purchasing and additional 20 acres</li> </ol>

Item	Contents
	<ol style="list-style-type: none"> <li>3. Cooks landfill is partially fenced and have experienced both vandalism and destruction of landfill equipment in recent times. In 2016, the landfill compactor (trackloader) was completely destroyed by fire. 1 excavator 1 and 1 bulldozer by private contractor are used. 35,000 plants transplanted at Cooks' landfill to improve slope stability while also functioning to remove heavy metals and other pollutants.</li> <li>4. The access road into the landfill also presents a challenge, it is almost one mile in length and treacherous to road users. The very nature of the road has been destructive to vehicle traversing it daily</li> <li>5. Though tipping is done on the old site daily, it has been on fire for over a decade. Therefore there is a constant fear of blaze erupting when weather conditions render it difficult if not impossible at time to institute good landfilling practices</li> <li>6. Barbuda also has one approved landfill site call Plantation. The Barbuda Council is responsible for the management of waste on the sister isle. However, lack of technical training and equipment shortages have led to the inefficient running of the waste management system. Furthermore, the passage of hurricane Irma in 2017 has overwhelmed the council's ability to cope. Assistance is provided by the authority, however, the absence of a trained officer and no landfill equipment provides much challenges</li> <li>7. The daily activity of all incoming waste is capture when the vehicle enters the weighbridge. During times to weighbridge malfunction or power outages, the landfill technicians rely on historical data and estimates</li> </ol>
<p>5. Financial System</p>	<ol style="list-style-type: none"> <li>1. A portion of the Central Board of health's budget is allocated for residential waste collection. The fund for the allocation is collected when householders pay property taxes</li> <li>2. NSWMA also receives funding from what is referred to as the head tax, collected at air and sea ports. Each visiting Non-</li> </ol>



Item	Contents
	<p>Caricom passenger to Antigua pays between US\$1- US\$1:50, while Caricom visitors pay xcd\$1:00</p> <ol style="list-style-type: none"> <li>3. WMA also received revenue from what is called the Bottle can Levy. This is limited however as only beverages are covered under this act</li> <li>4. Tipping fees</li> <li>5. Barge services to cruise ships</li> <li>6. In recent times, since 2014, NSWMA received funding from the Citizen by Investment Programme (CIP). The CIP funds the Beautification Programme managed by NSWMA</li> <li>7. Commercial waste fee based on quality and quantity is proposed and under debate and presentation</li> </ol>
6. Donor support	<ul style="list-style-type: none"> <li>- GEF5558 management of POPs and UPOPs</li> <li>- OECS ReMLit: Reduction of Marine Litter (see Appendix.)</li> <li>- ZWAB: Zero Waste Antigua Barbuda</li> <li>- British High Commission</li> <li>- Caribbean Union of Churches</li> <li>- Japan International Cooperation Agency (JICA)</li> <li>- Department of Environment, Antigua and Barbuda</li> <li>- IUCN Plastic Waste Free Islands (Construction of treatment facility for plastic waste is planned)</li> </ul> <p>(Above are technical and material support)</p>
7. Social consideration	<ol style="list-style-type: none"> <li>1. Informal waste pickers sector as it relates to safety on the landfill and the management and consequences of POPs and UPOPs. The Authority provides safety training to waste pickers.</li> <li>2. Waste separation during a global pandemic</li> <li>3. Entrepreneurship within the waste sector</li> <li>4. Public awareness campaigns geared towards environmental education and waste management</li> </ol>
8. MPL issues	<ol style="list-style-type: none"> <li>1. Transboundary movement of plastic waste, especially during storms</li> <li>2. Land based pollution affecting coastal areas during flooding</li> <li>3. Littering</li> <li>4. Plastics should be clearly defined, although there is an urgency to manage single use plastics, importers are targeting fence-line products which have proven difficult to categorize</li> <li>5. Department of Fisheries is in charge of MPL issues. The Authority provides transportation service on collected waste by beach cleansing.</li> </ol>
9. Areas for improvement	<ol style="list-style-type: none"> <li>1. Waste separation and waste recovery is not enough.</li> <li>2. Need training to operational staff on collection, supervising contractors, landfill management, maintenance of machines, solid waste financing and education.</li> <li>3. Need education to public and private on storage and separation and littering.</li> <li>4. Updating national waste management plan to respond to zero waste policy and request budget.</li> </ol>

Appendix 1: Maps



Appendix 2: Waste data

Table: Break down of Waste Generation Rates by 'Waste Generator'

Waste Generator	Total Weight (lb)	Mean (%)	Lower Bound (%)	Upper Bound (%)
Household	474.34	28.8%	18.8%	38.8%
Hospitality	370.44	16.2%	10.7%	21.7%
Commercial	300.38	19.1%	15.3%	23.0%
Industrial	327.48	16.9%	10.9%	22.9%
Institutional	1.92	0.2%	0.1%	0.3%
Agricultural	289.49	15.3%	12.2%	18.4%
Ship/Air Lines	84.05	3.5%	-1.7%	8.7%

Appendix 3: Waste related law

● National Solid Waste Management Authority Act

This Act is to establish the National Solid Waste Management Authority. Major points of the Act are as follows.

- The responsibility of the Authority is to own, operate or contract waste management facility and equipment for management of non-hazardous and hazardous waste. Also, the responsibility includes public education, introducing cost recovery methods and preparing plans/programmes to address SWM issues.
- Preparing and maintaining a strategic plan and operational plan
- The Authority's compliance with the Public Health Act
- Funds and resources of the Authority
- Members of the Authority
- Category and characteristics of hazardous waste (in Annex)

● Litter Prevention and Control Act

This Act is to control and prevent various acts of littering and for other connected purposes. Major points of the Act are as follows.

- Responsibility of the owner of premises to keep premises clean and tidy
- Power of the Litter Prevention Warden to issue removal order and clean-up order
- The local authorities may remove and dispose derelict vehicles
- Offences and penalties including the case of illegal dumping and disposal of waste from construction sites

● Environmental Protection and Management Act

This Act is to provide for sustainable environmental protection and management of natural resources, to allocate administrative responsibility for the management of environmental matters. Major points of the Act on waste management are as follows.

- A pollution control permit issued by the Department of Environment shall be obtained to deposit or release a pollutant on or into land, water or the air
- The Department of Environment may request to carry out a strategic environmental impact assessment process on a proposed policy, plan or programme which may have a significant negative impact on the environment. Through the section 23 (2) of the Physical Planning Act 2003, the Chief Town and Country Planner shall request the Director of Environment to conduct a screening exercise to determine if the proposed activity or development would require an Environmental Impact Assessment or EIA.
- The Schedule II specifies pollutants including Waste and other matter requiring special permit for dumping and the Schedule III specifies the Categories of Hazardous Substances including Waste Streams.
- The schedule VII specifies the Water Quality Criteria and Guidelines and the schedule VIII specifies the Air Quality Criteria.

Appendix 4: Collection of PET bottles by the Ministry of Health, Wellness and the Environment<sup>24</sup>

The Ministry started collection of PET bottles in July 2021. Clean with no caps and transparent PET soda and water bottles are collected for 20 cents per bottle at three locations. Phase 2 will see additional locations. Collected bottles will be processed by ALPLA into raw materials.

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<sup>24</sup>

[https://antiguanewsroom.com/now-we-can-get-cash-for-our-plastic-trash/#:~:text=Giving%20new%20life%20to%20your,\(0.20\)%20cents%20per%20bottle.](https://antiguanewsroom.com/now-we-can-get-cash-for-our-plastic-trash/#:~:text=Giving%20new%20life%20to%20your,(0.20)%20cents%20per%20bottle.)





Appendix 5: Information on recycling companies

Name of company	Recycling item
<b>Themba Biofuels Ltd.</b>	Waste oils
Wills Recycling	Metals
Tot Heavy Duty Equipment Services	Metals
Sirius Structures	Construction waste

Appendix 6: ReMLit project supported by OECS<sup>25</sup>

- Outline

The project, Sound Land Based Waste Management Technologies leading towards a Pollution Free Marine Environment in Antigua and Barbuda, is a one-year (2021 to 2022) project to implement a Community Based Waste Management System leading towards the reduction of marine debris (including Plastic).

The Project is being implemented by the National Solid Waste Management Authority (NSWMA) with funding support by OECS Commission under the Building Resilience in the Eastern Caribbean through Reduction in Marine Litter (ReMLit) Project. The ReMLit Project is funded by the Government of Norway through the Norwegian Ministry of Foreign Affairs.

- Project activity
  - Community Mobilization and Public Education
  - Community Workshops (sorting and separation)

<sup>25</sup> OECS, Sound Land Based Waste Management Technologies in Antigua and Barbuda



## **B Current Situation** (as of March – April 2022)

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- Monitoring and evaluation with a view to inform on potential scale-up of activities that had a high positive impact on the other communities
- Establishment of a Biogas plant will be explored
- Implementation of collection and transportation system for recyclables and organics
- Procurement and distribution of waste storage bins to each Householder in the Fitches Creek

## B.4 Grenada

### B.4.1 Basic Information

Item	Contents
Population	110,000 (Ministry of Finance Statistical Dept., 2010)
Population growth (annual %)	2.3% (Ministry of Finance Statistical Dept., 2010)
Urban population	3,100 (National Census report. Ministry of Finance Statistical Dept., 2010)
Population density (people/km <sup>2</sup> )	306.80 (National Census report. Ministry of Finance Statistical Dept., 2010)
Average national rainfall (millimetres/year)	979.3 (Point Salines Meteorological services)
Annual frequency of hurricanes (times/year)	Grenada not considered in the Hurricane Belt. Last Hurricane 2005

### B.4.2 Solid Waste Management Data


Item	Contents																												
Waste generation amount (tons/day)	126.319 obtained by weighbridge data at Perseverance Landfill (Annual Report GSWMA, 2018)																												
Waste generation rate (kg/person/day)	1.9 (National Waste Management Strategy Review for Grenada, 2019. WACS was done by WSP, the Canadian consulting company with the financial support of Caribbean Development Bank)																												
Plastic waste generation amount (tons/day)	19 tons/day 7,134 tons/year (National Waste Management Strategy Review for Grenada, 2019)																												
Waste collection amount (tons/day)	126.31 (Annual Report GSWMA, 2018)																												
Waste collection coverage (%)	98% as a percentage of population (Annual Report GSWMA, 2018)																												
Recycling rate (%)	N/A																												
Recycling rate of plastic materials (%)	N/A																												
Final disposal amount (tons/day)	N/A																												
Waste composition (%)	<table> <tbody> <tr> <td>Organic waste -</td> <td>25.3%</td> </tr> <tr> <td>Hazardous Waste -</td> <td>2.5%</td> </tr> <tr> <td>Paper board/Cardboard -</td> <td>13.9%</td> </tr> <tr> <td>Special Waste* -</td> <td>5%</td> </tr> <tr> <td>Glass</td> <td>7.7%</td> </tr> <tr> <td>Refundable Glass</td> <td>1.9%</td> </tr> <tr> <td>Construction and demolition waste</td> <td>3.8%</td> </tr> <tr> <td>Non-ferrous metals</td> <td>2.0%</td> </tr> <tr> <td>Hard Plastics</td> <td>10.7%</td> </tr> <tr> <td>Soft Plastics</td> <td>3.7%</td> </tr> <tr> <td>Textiles</td> <td>6.2%</td> </tr> <tr> <td>E-waste</td> <td>3.7%</td> </tr> <tr> <td>White goods</td> <td>0.2%</td> </tr> <tr> <td>Non-recyclable non hazardous waste</td> <td>7.2%</td> </tr> </tbody> </table> (National Waste Management Strategy Review for Grenada, 2019)	Organic waste -	25.3%	Hazardous Waste -	2.5%	Paper board/Cardboard -	13.9%	Special Waste* -	5%	Glass	7.7%	Refundable Glass	1.9%	Construction and demolition waste	3.8%	Non-ferrous metals	2.0%	Hard Plastics	10.7%	Soft Plastics	3.7%	Textiles	6.2%	E-waste	3.7%	White goods	0.2%	Non-recyclable non hazardous waste	7.2%
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Textiles	6.2%																												
E-waste	3.7%																												
White goods	0.2%																												
Non-recyclable non hazardous waste	7.2%																												






\*Special waste: waste from cruise ship.

### B.4.3 Current Situation of Solid Waste Management and Marine litter Pollution

Summary Table

Item	Summary
Laws, Policies and Plans	<ul style="list-style-type: none"> <li>● Grenada Solid Waste Management Authority Act #11 1995</li> <li>● The Waste Management Act 2001: stipulates the definition of each type of waste.</li> <li>● The Abatement of Litter Act #24 2015</li> <li>● The Environmental Levy Act 1997</li> <li>● The Physical Planning and Development Control Act#25 of 2002</li> <li>● The Non-Biodegradable Waste Control Act 2018</li> <li>● “National Sustainable Development Plan 2020-2035” is published in 2019. In the strategy, waste-to energy technology is focused for the future introduction.</li> </ul>
Implementation Structure	See an organization chart below this table.
Financial System	<ul style="list-style-type: none"> <li>● Ratio of SWM budget allocated within national budget: There is no budgetary allocations for waste management in Grenada.</li> <li>● Main source of SWM costs: Waste Management is financed by the Environmental Levy which is collected by the following means:               <ol style="list-style-type: none"> <li>a. Householders - Through electricity consumption - agent of collection is the Grenada Electricity Company.</li> <li>b. Cruise Passengers - Passenger head tax payable through cruise companies.</li> <li>c. Stay-over visitors head tax- Paid by Airlines - Agent is Grenada Airports Authority.</li> <li>d. Import levy - on goods, vehicles, appliances etc. - Agent is Customs and Excise department.</li> </ol> <p>All of these levies and paid directly to the GSWMA by the agents.</p> </li> <li>● Cost required for collection/transportation: N/A</li> <li>● Cost required for intermediate treatment: N/A</li> <li>Cost required for final disposal: N/A</li> </ul>
Technical System	
Public Area Cleansing	<p>Ministry of Infrastructure Development, Transport and Implementation is responsible for public area cleaning.</p> <p>4 private contractors clean the public areas including coastal area and collect garbage, then transport to the current landfill under the contract.</p>
Storage and Discharge	<p>GSWMA is responsible for solid waste storage and discharge from waste generators.</p> <ul style="list-style-type: none"> <li>● Waste from household: The GSWMA has contracted the services of eight private companies to provide garbage collection service in 8 Collection Zones throughout Grenada, Carriacou and Petit Martinique.</li> <li>- Every household gets twice per week curbside collection service in the sparsely populated communities, whereas in the densely populated areas of the south, garbage is collected every day for residents along the main roads and three times per week in minor roads. Some communal bins are stationed at areas that cannot be accessed by collection teams.</li> </ul>

	<ul style="list-style-type: none"> <li>- Every household is entitled to the collection of 3 bulky items (furniture, appliances, e-waste etc.) for free per month through special collection service.</li> <li>● Waste from commercial area:             <ul style="list-style-type: none"> <li>All Towns are provided with a daily collection service for small businesses, stores, fresh markets and food stands.</li> <li>The two major towns of St. George and Grenville are provided with twice daily collection service.</li> </ul> </li> </ul>
<p>Collection and Transport</p>	<ul style="list-style-type: none"> <li>● Separated collection system:             <ul style="list-style-type: none"> <li>There is no separation of residential waste currently in Grenada, as there are no recycling initiatives. Only the metal waste, tires and cardboard boxes from businesses arrive at the landfill separated through private collection company. Glass bottles which are refundable do not enter the waste stream but are retrieved by the respective beverage manufacturers/importers.</li> <li>ReMlit –OECS project is on-going. Pilot waste separation to retrieve plastics and recycle in some form. Colour coded litter bins</li> </ul> </li> <li>● Transport             <ul style="list-style-type: none"> <li>Construction companies are required to transport construction and demolition waste by themselves to the disposal site.</li> <li>Shipping companies are required to make their own arrangement with private waste hauler to dispose waste generated on their vessels into the disposal site.</li> </ul> </li> <li>● Number of collection vehicles:             <ul style="list-style-type: none"> <li>There are 14 collection and street cleaning companies working in 6 cities (St. George, Grenville, Gouyave, Sauteurs, Victoria, and Hillsborough in Carriacou). Collectively, our contractors own 32 compactor trucks serving the three islands (30 for main island, 2 for Carriacou), 9 tipper trucks for heavy items and 1 boat for transportation of waste from Petit Martinique to Carriacou. They are all functional.</li> </ul> </li> <li>● The Main GSWMA has one Compactor Truck and 2 tipper trucks and 1 skip truck. They are all functional.</li> <li>● There are 9 independent private waste haulage companies who operate 3 Compactor trucks, 4 Skip Trucks and an undisclosed number of tipper trucks.</li> </ul> <div style="display: flex; align-items: center; margin-top: 10px;">  <div style="margin-left: 10px;"> <p>Grenada Solid Waste Management Authority Compactor Truck at Perseverance Landfill.</p> </div> </div>

	 <p>Garbage collection by Rainbow Janitorial Services. South St. George</p> <ul style="list-style-type: none"> <li>● Special collection for Bulky waste is commenced in monthly basis.</li> <li>● Construction and demolition waste; There is no collection by the authority. Private haulers pick up it and transport to the landfill.</li> </ul>  <p>Skip Truck operated by GSWMA</p>  <p>Compactor Fleet of one Company contracted by GSWMA for the provision of residential collection service. Fleet in the process of being upgraded to new trucks. (Southern Waste Management Services Ltd)</p>
<p>Recycling</p>	<p>GSWMA is responsible for waste recycling. There is no permanent recycling system in the country.</p> <ul style="list-style-type: none"> <li>● Composting promotion activities have started. There are engagements with local private entity to re-introduce the manufacture of animal feed from food waste from fisheries, poultry, brewery and fresh produce farmers.</li> </ul>   <ul style="list-style-type: none"> <li>● Food waste recycling is under discussion in the authority.</li> </ul>
<p>Treatment</p>	<ul style="list-style-type: none"> <li>● Plastic pelletizing machine: the project will be launched on July 28<sup>th</sup>, 2020 in Carriacou island. It is on-going under internal discussion. Prospects for</li> </ul>

	<p>preventing plastic leakage into the marine environment and establishing businesses out of waste, eg manufacture of plastic slabs for park benches, chairs etc.</p> <ul style="list-style-type: none"> <li>● One metal baler is owned by GSWMA. Informal sector brings metals (iron, aluminum, copper, zinc roofing, vehicles, appliances etc.) to landfill site and GSWMA make a bale at the cost of 7 USD/bale to ship to Trinidad.</li> <li>● Composting facilities: GSWMA has given intensive composting trainings to school (under the Environmentally Friendly School Initiative), various institutions, hotel ground staff, prisoners, Homes for the Elderly, and Farmers Organization. The Farmers Organization is currently trying to expand their unit (windrow type) to a larger commercial scale with the assistance of Ministry of Agriculture and GIZ (GIZ donated 3 wood chippers), and seeking for the financial assistance of 200,000USD for composting unit (closed type), waste storage, packaging facility, and washrooms etc.</li> <li>● Large industrial wood chipper is owned by GSWMA to chip the logs brought into the landfill site. GSWMA also provides the service for chipping woods from land clearance for construction.</li> </ul>
Final Disposal	<ul style="list-style-type: none"> <li>● There is one Landfill called Perseverance in Grenada. However, the two active cells are being operated as an open dump with no daily covering. The GSWMA currently is constructing a new semi-aerobic landfill which will use the Fukuoka method of landfilling. This construction is currently underway and is due for completion in May 2021. The current cell being developed will have a life expectancy of 5 years. <ol style="list-style-type: none"> <li>1) Owner: GSWMA,</li> <li>2) Location: N12.10885 W61.74576,</li> <li>3) Area: 17 Acres,</li> <li>4) Waste disposal amount: avg. 126.3197 tons per day,</li> <li>5) Data source: obtained by weighbridge,</li> <li>6) Installed facility: weighbridge, fence, tire shredder, wood shredder, metal baler, and hazardous waste storage,</li> <li>7) Operation in practice: compaction of waste but no covering with soil</li> </ol> </li> <li>● Integrated Solid Waste Management Project is conducted by CDB and the government including: <ul style="list-style-type: none"> <li>-Design and construction of the Final Perseverance Landfill Cell.</li> <li>-Leachate/ storm waster treatment facilities</li> <li>-Closure and rehabilitation of open Dump</li> <li>-Rehabilitation of old Landfill cells</li> <li>-Waste pickers facility.</li> </ul> <p>It is in the commissioning process and the new cell will be open in July 2022.</p> </li> <li>● The Authority has an open dump at Perseverance which has been used for 50 years but currently on fire for the past 5 months from January 2020 and not being used. <p>Coordinates: N12.0623.3 W61.44506</p> <p>Area: 11 acres</p> </li> <li>● There is one landfill in Carriacou. Anaerobic landfilling method is used. <ol style="list-style-type: none"> <li>1) Owner: GSWMA,</li> <li>2) Location: N12.463229 W61.457882</li> <li>3) Area: 10.87 Acres,</li> <li>4) Waste disposal amount: Approximately 5 tons per day,</li> </ol> </li> </ul>

	<p>5) Data source: no weighbridge, estimated by multiplying collection truck's capacity and number of trips.</p> <p>6) Installed facility: used to have litter fence but blown off by strong wind, therefore currently lots of plastic waste in landfill entering to drainage system and washed out into the sea. That is why the Carriacou was chosen as the pilot site for plastic pelletizing project.</p> <p>7) Operation in practice: compaction of waste but no covering with soil</p>  <p>Tractor compacting waste at Perseverance Landfill, Grenada</p>  <p>Extinguishing Fire at 11 acre Perseverance Open disposal site.</p>  <p>Private waste hauler tipping waste at Perseverance landfill, Grenada.</p>  <p>Carriacou Landfill cell. Currently covered and new cells have been developed.</p>
<p>Other Wastes</p>	<ul style="list-style-type: none"> <li>● The Ministry of Health is responsible for medical waste. Medical waste is treated by an incinerator in Grenada and Carriacou respectively. However, medical waste from private clinics is not treated properly, different from ones from National hospitals.</li> <li>● GSWMA is responsible for hazardous waste. All hazardous waste to be discharged at the landfills must be done after an appointment is made with the landfill and a date set up for the receipt of the hazardous waste.             <ul style="list-style-type: none"> <li>- Based on the hazardous waste type to be deposited, the Landfill attendants will prepare a special area for disposal.</li> </ul> </li> </ul>



	<ul style="list-style-type: none"> <li>- There are several methods used for disposal once the waste arrives and are documented in the data system.</li> <li>- Such methods of disposal include:             <ol style="list-style-type: none"> <li>1. Burial in a special plot of land specially prepared for the waste.</li> <li>2. Entombment. It creating a hole in the ground, filling it with soft concrete mix then discharging the hazardous material deep into the soft concrete mix.</li> <li>3. Storage in the Household Hazardous Waste Building in special containment until a suitable means of disposal is recommended then disposed. (hardly happens in Grenada as we do not get quite a lot of such waste to dispose- currently Lead storage from our Bulb crusher)</li> <li>4. Placing in a metal container or in a hole and burn then ashes buried as final disposal.</li> <li>5. Items like Asbestos is placed in sealed tarpaulin sheets and buried. All special disposal sites are marked to prevent future disturbance.</li> </ol> </li> <li>● GSWMA is responsible for construction and demolition waste that are disposed of at the landfill.</li> <li>● National water and sewage authority runs sewage water treatment system including sludge from the process.</li> </ul>
Awareness-raising	<ul style="list-style-type: none"> <li>● Public awareness: although GSWMA has been putting so much effort in public education, it is lacking tools for editing, equipment for printing, manpower (there are only 2 staff in Public Relation Department), and dissemination of message is quite costly.</li> <li>● ReMlit Ctd project also includes public Awareness education, clean-up initiatives and provision of promotional material</li> </ul>
Social and Environmental Considerations	<ul style="list-style-type: none"> <li>● As part of the Integrated Solid Waste Management Project for Grenada, the GSWMA will give consideration to formalizing the practice of waste picking on the landfill. A waste pickers facility including shower room and appropriate equipment for waste pickers will be constructed as part of the project so as to regulate the operations of pickers to avoid unhealthy scavenging.</li> <li>● The Authority is currently financing salaries for beach cleaners on the eastern shoreline who are community groups engaged in the removal of Sargassom seaweed from coastal areas.</li> <li>● Policy or law for supporting the informal sector: N/A</li> <li>● Public awareness raising activities: The GSWMA has a sustained public awareness and education programme. This involves the extensive use of electronic and social media, school initiatives including in-house and public education, promotion of organic waste composting, identification of challenges and interventions, Beach adoptions &amp; adoption of public places, community activities, collaborations and regular staged activities and promotions.</li> </ul>
Donor Support	<p>The ministry of Foreign Affairs is responsible for all the donor supports.</p> <ul style="list-style-type: none"> <li>● CDB (Barvado) is conducting “Integrated Solid Waste Management Project” supporting:             <ul style="list-style-type: none"> <li>- Construction of a new landfill cell</li> <li>- Review of 5-Year National Waste Management Strategy.</li> </ul> </li> </ul>



	<ul style="list-style-type: none"> <li>- Monitoring and Evaluation of Project.</li> <li>- Institutional Strengthening and Capacity Building</li> <li>- Public Awareness and Education</li> <li>- Composting feasibility study</li> <li>- Landfill Equipment Upgrade.</li> <li>● Plastic waste recycling in Carriacou. NSU/Paddies/GSWMA –Pilot – Funded by UNDP &amp; GIZ. – Current Status – Expansion of project - PPP.</li> <li>● ICUN Plastic waste free islands.             <ul style="list-style-type: none"> <li>- Prospects for preventing plastic leakage into the marine environment and establishing businesses out of waste, eg manufacture of plastic slabs for park benches, chairs etc.</li> </ul> </li> <li>● ReMlit –OECS project.             <ul style="list-style-type: none"> <li>- Pilot waste separation to retrieve plastics and recycle in some form. Colour coded litter bins</li> <li>- Public Awareness education</li> <li>- Clean-up initiatives</li> <li>- Promotional material</li> </ul> </li> </ul>
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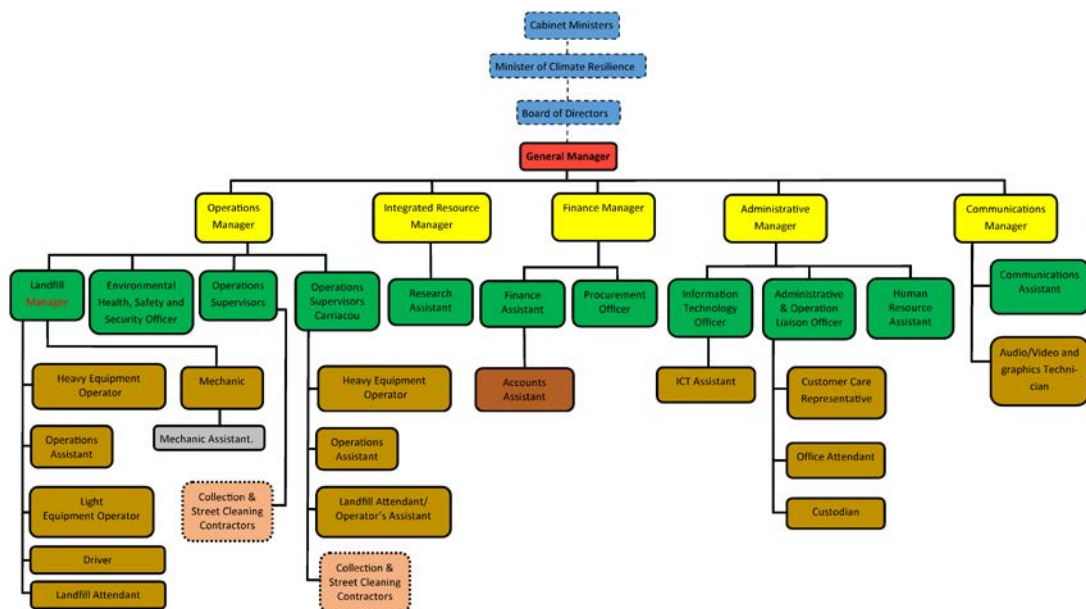


Figure Grenada Solid Waste Management Authority - Organization chart – Revised 18.12.2020

## B.5 Guyana

### B.5.1 Basic Information

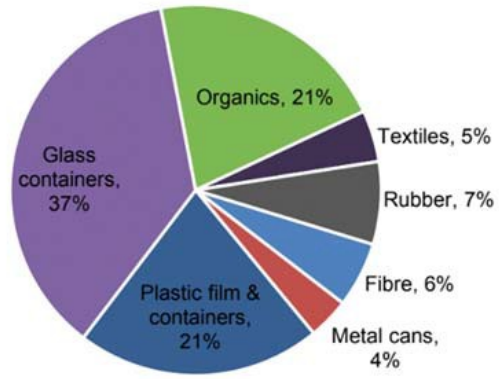
Item	Contents
Population	746,955 (Population Census, 2012)* 793,031 (Population data, 2022) **
Population growth (annual %)	-0.04 (Population Census, 2012)
Urban population	191,810 (Population Census, 2012) - Georgetown
Population density (people/km <sup>2</sup> )	3.5 persons/km <sup>2</sup> (Population Census, 2012)
Average national rainfall (millimetres/year)	2,200 mm/year (Hydromet)
Annual frequency of hurricanes (times/year)	N/A

\*based on the latest available census in 2012. Next census will be in 2022 and started in May, 2022.

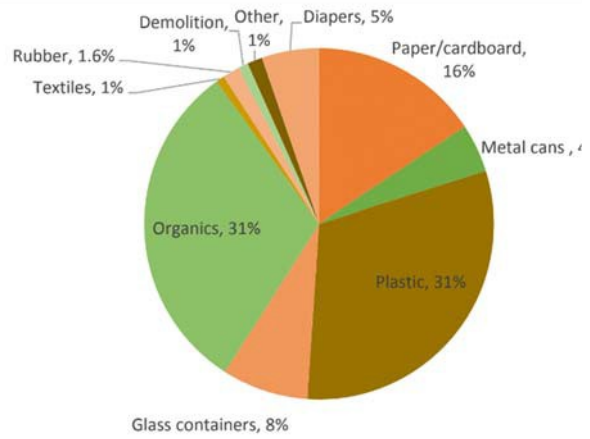
\*\*<https://www.worldometers.info/world-population/guyana-population/>

### B.5.2 Solid Waste Management Data

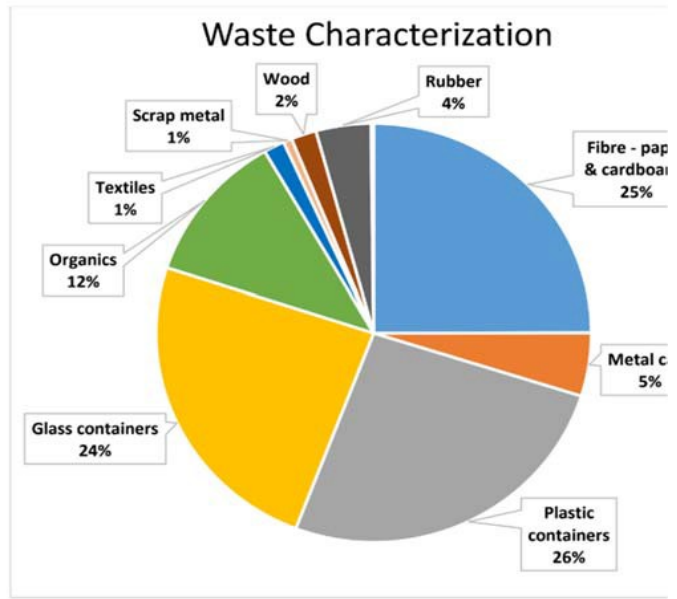
Item	Contents
Waste generation amount (tons/day)	No data available on whole country. Region 4 - 546 t/day (Hydroplan, 2010) Mahdia in Region 8 - 825 t/year (WACS conducted in 2018) Bartica in Region 7 - 4,150 t/year (WACS conducted in 2018) Linden in Region 10 - 4,024 t/year (WACS conducted in 2017)
Waste generation rate (kg/person/day)	Region 4 - 1.35 kg/person/day (Hydroplan, 2010) Mahdia - 0.91 kg/person/day (WACS conducted in 2018) Bartica - 0.6 kg/person/day (WACS conducted in 2018)
Plastic waste generation amount (tons/day)	Region 4 - 77.5 t/day (Estimation based on Hydroplan, 2010) Mahdia in Region 8 - 173 t/day (Estimation based on the WACS conducted in 2018) Bartica in Region 7 - 1079 t/day (Estimation based on the WACS conducted in 2018) Linden in Region 10 - 1247 t/day (Estimation based on the WACS conducted in 2017)
Waste collection amount (tons/day)	N/A
Waste collection coverage (%)	George town is around 90% based on the municipality Coastal area is around 60% based on resource of local authorities Hinter land is around 20% based on resource of local authorities
Recycling rate (%)	7% in George town (metal and glass)
Recycling rate of plastic materials (%)	Almost 0 % (privately done)
Final disposal amount (tons/day)	Around 700 tons/day at Haags Bosch Sanitary Landfill Facility, Region 4, Year 2021
Waste composition (%)	NB: I have provided data from the Waste Characterization Study (WCS) studies I got accessed to. <ul style="list-style-type: none"> <li>WCS Mahdia, 2018</li> </ul>



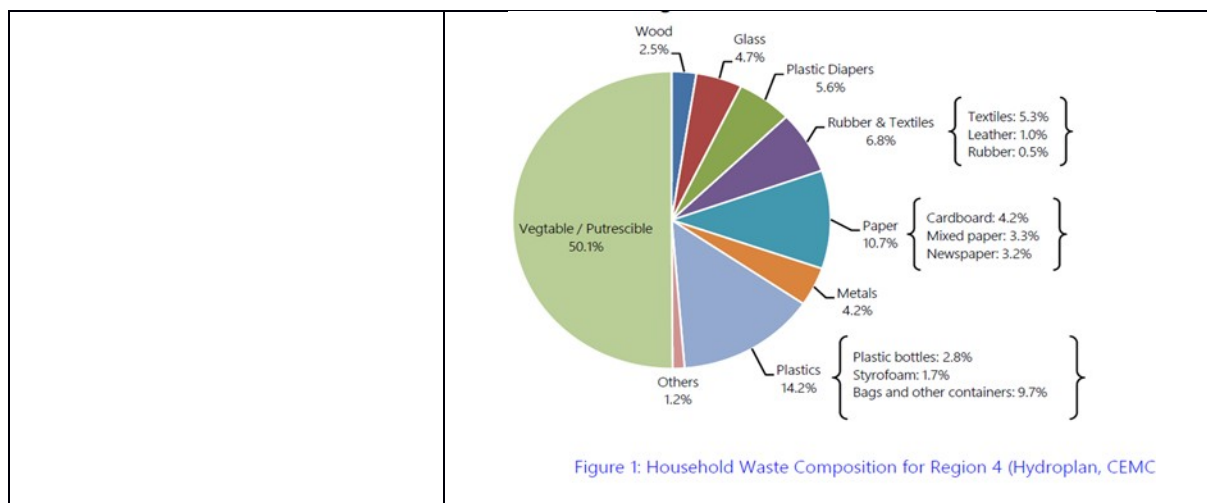
WCS Linden, 2017  
 Figure 2: Composition of Solid Waste (by Category)



WCS Bartica, 2018  
 Figure 1: Composition of Solid Waste (by Category)



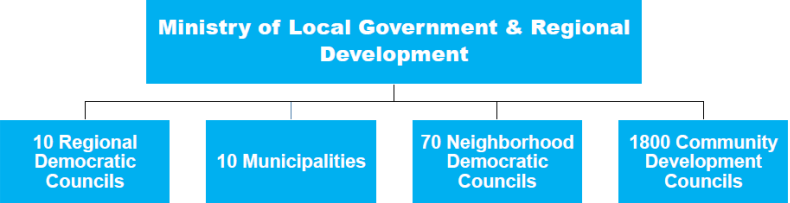



WCS Region 4, 2010



### B.5.3 Current Situation of Solid Waste Management and Marine litter Pollution

Summary Table

Item	Summary
1. Legal system	<ul style="list-style-type: none"> <li>● Municipal and District Councils Act, Chapter 28:01, Laws of Guyana</li> <li>● Environmental Protection Act, Chapter 20:05, Laws of Guyana</li> <li>● Environmental Protection litter enforcement regulations, 2013</li> <li>● Public Health Ordinance, Chapter 145, Laws of Guyana</li> <li>● Draft Solid Waste Management Bill, 2014</li> <li>● Regulations No. 8 of 2015 - The Environmental Protection (Expanded Polystyrene Ban) Regulations, 2015</li> </ul>
2. Policy/plan	<ul style="list-style-type: none"> <li>● National Integrated Solid Waste Management Strategy, 2017-2030</li> </ul>
3. Implementation system	<ul style="list-style-type: none"> <li>● Ministry of Local Government and Regional Development (MLGRD) : covers local governance sectors. Sanitation Management Unit is under the local governance and provides technical and financial supports in SWM to Local Government. This unit was established by the IDB project in 2016 but changed the name.</li> <li>● Regional Democratic Councils (RDCs): there are 10 RDCs. They are the supreme Local Government Organ in each region with the responsibility for the overall management and administration of the Region and the coordination of the activities of all 80 Local Democratic Organs (LDO) within its boundaries. They provide all services required within its boundaries (services such as health, education, public works etc.).</li> <li>● Municipal Councils (MCs): there are 10 Municipal Councils. Each Council has the responsibility for solid waste collection and transportation, maintenance of infrastructure services (roads, bridges, etc.).</li> <li>● Neighborhood Democratic Councils (NDCs): there are 70 NDCs. They cover a small geographic area within each region with responsibility for the management and administration of these areas.</li> <li>● Community Development Councils (CDCs): there are 1800 CDCs. They cover a small community area within each region with responsibility for the management and administration of these areas.</li> </ul> <p>The relationship between MLGRD, RDCs, MCs, NDCs, NDCs and CDCs are as follows.</p>

	<div style="text-align: center;">  </div> <ul style="list-style-type: none"> <li>● Environmental Protection Agency (EPA): Industry/Waste Management Department is in charge of all types of waste.</li> <li>● Ministry of Public Health, Allied Health Council: responsible for medical waste.</li> </ul>
<p><b>4. Technical System</b></p>	
<p>Collection and transportation (in case of Georgetown)</p>	<ul style="list-style-type: none"> <li>● Waste from household: Once per week curbside collection system</li> <li>● Waste from commercial area: Daily collection</li> <li>● Refuse Compactor Vehicle (RCV) are typically used to transport waste, however, dump trucks and flatbed trucks are also used in some areas.</li> </ul> <div style="display: flex; justify-content: space-around;">   </div> <ul style="list-style-type: none"> <li>● Separated collection system: None</li> <li>● Number of collection vehicles: local authorities (about 90 vehicles) have own vehicles and private collectors (two major collectors, around 200 vehicles).</li> </ul>
<p>Treatment</p>	<ul style="list-style-type: none"> <li>● Oil and gas waste treatment plant (2 plants)</li> <li>● A community composting pilot was being implemented in Region 4 as part of the GSWMP implementation. Participating households were asked to bring their organic waste to the communal composting site where it was composted and the finished compost was distributed to the residents.</li> <li>● Scrap metal recycling waste has been implemented through the coordination of the Guyana Metal Recycler’s Association which has a membership of scrap metal dealers.</li> </ul>
<p>Final Disposal</p>	<ul style="list-style-type: none"> <li>● Haags Bosch Sanitary Landfill Facility is located just outside of the city (Eccles, East Bank Demerara). Operation started in 2011 and has life expectancy less than 25 years.</li> <li>● There are 80 scavengers interfering operation of landfill.</li> </ul> <div style="display: flex; align-items: center;">  <div style="margin-left: 10px;"> <p>Landfill operation of existing cell (Cell No.1)</p> </div> </div> <ol style="list-style-type: none"> <li>1) Owner: Ministry of Local Government and Regional Development</li> <li>2) Location: 6.764706, -58.147649</li> <li>3) Area: 60 ha (26 ha for disposal)</li> </ol>

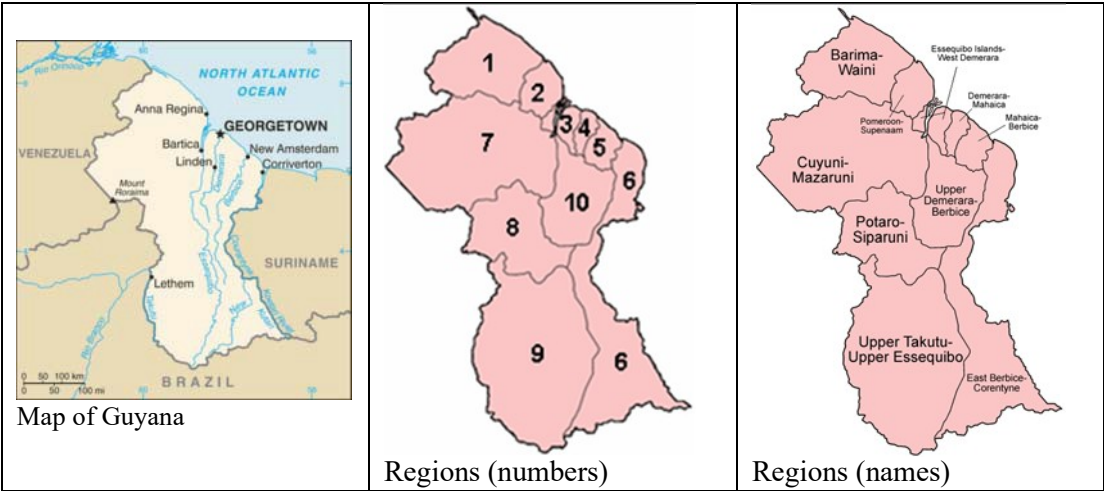
	<p>4) Waste disposal amount: around 7000 tons/day (data source: Both weighbridge and estimation technique)</p> <p>5) Operation period : from 2011 to now</p> <p>6) Installed facility: No liner in cell No.1, however cell No.2 is being constructed with liner presently, weighbridge, lined leachate treatment system, storm water ponds, gate, fence, administrative building, white goods and metal area, recyclers/scavenger area, security and spotter huts.</p>  <p>7) Operation in practice: compaction of waste and covering with soil and clay (but not daily due to lack of covering materials).</p> <ul style="list-style-type: none"> <li>● Lusignan Landfill in Region 4: Controlled dump site</li> <li>● Esplanade Landfill in New Amsterdam in Region 6: Open dump site</li> <li>● Rosehall Region 6: Controlled dump site</li> <li>● Linden Region 10: Open dump site</li> <li>● Lethem Region 9: Controlled dump site</li> <li>● Bartica Region 7: Controlled dump site</li> </ul> <p>The most of final disposal sites including sanitary landfill sites, controlled dumping site and open dumping site are located in northern coastal areas like below.</p> 
<p>5. Financial system</p>	<ul style="list-style-type: none"> <li>● Ratio of SWM budget allocated within national budget: N/A</li> <li>● Main source of SWM costs: SWM cost is supposed to be covered by Rates &amp; Taxes received by LDOs but the amount is so small. Therefore,</li> </ul>



	<p>Central Government gives Local Government subsidies. Waste collection fee is not charged for citizens but in some areas, residents pay for private collection (3USD per 40gal bin/week). No tipping fee is charged. Landfill operations are financed by the Government.</p> <ul style="list-style-type: none"> <li>● Cost required for collection/transportation: 18.5US\$/ton (2.5US\$/barrel)</li> <li>● Cost required for intermediate treatment: No data due to privately implemented (oil and gas treatment facility)</li> <li>● Cost required for final disposal: Total O&amp;M cost of 806 million G\$ for 8 landfill sites managed by the Ministry of Local Government and Regional Development</li> </ul>
6. Donor support	<ul style="list-style-type: none"> <li>● JICA: 2018 capacity building program in SWM.</li> <li>● Inter-American Development Bank (IDB): Georgetown SWM Project (2006- 2014) the project includes; construction of Haags Bosch Sanitary Landfill, closure of Mandela dump site, formalization of informal sector(scavengers), establishing a Municipal Solid Waste Management Department in the Municipality of Georgetown, conducting a public awareness campaign in</li> <li>● Georgetown and the NDCs, and reviewing and improving the contracts for solid waste collection in the Georgetown.</li> </ul>
7. Social Consideration	<ul style="list-style-type: none"> <li>● Policy or law for supporting the informal sector: None, however, the EPA is working along with all stakeholders to ban single use plastics e.g. straws, bags, eating utensils, cups, etc.</li> <li>● Public awareness raising activities: Green Generation Guyana Program focus on promoting SWM &amp; WASH in primary schools and at social events, SWM sensitization program by municipality, private groups also focus on beach and park cleaning activities, etc.</li> </ul>
8. MPL issues	<ul style="list-style-type: none"> <li>● Most of final disposal sites is open dumping without cover soil or control dumping and it cause plastic litter scattering.</li> <li>● No plastic recycling facility nor a market for such materials in Guyana, which causes lifetime of final disposal to be shortened</li> <li>● The rivers, Atlantic Ocean and drainage network are being treated as a dumping ground for solid waste.</li> <li>● Citizens utilizing the river transportation services would litter the waterways with their garbage.</li> <li>● In other instances, the residents, businesses and miners residing along the embankments would dispose of their solid waste in the rivers.</li> <li>● During the rainy season, surface water runoff transports plastic materials as well as other waste materials into waterway, and onward into creeks, rivers and the Atlantic Ocean.</li> </ul>
9. Areas for improvement	<ul style="list-style-type: none"> <li>● The government consider new waste disposal facility as sanitary landfill site by semi-aerobic system in every region for suitable waste management as well as plastic litter scattering in landfill site.</li> <li>● To establish the system of waste diversion with consideration of current waste composition and recycling market</li> <li>● To begin with, Guyana needs waste management plan as well as legal framework for proper SWM. More so, specific regulations to drive the 3Rs programme (composting, waste separation etc.), MPL among others.</li> <li>● Guyana also needs a cost recovery mechanism for dealing with waste especially collection and disposal. We should start charging the disposal fee from business entities and then the collection fee from residents.</li> <li>● Continuous public awareness campaign targeting behavior change.</li> <li>● Guyana is not prepared to deal with waste generated from the oil and gas industry. There is no commercial nor hazardous waste disposal facility.</li> </ul>



	<p>We need to build capacity within our institutions to deliver their mandate and promote good solid waste management practices.</p>
<p>10. Other candidates for interview</p>	<ul style="list-style-type: none"> <li>● Environmental Protection Agency – Odessa Duncan – Senior Environmental Officer, oduncan@epaguyana.org</li> </ul>



## ANNEX C3

Agreement on activities to be carried out in the Project

Technical Cooperation Project on Advisor for  
Marine Plastic Litter Management in the Caribbean Region  
- Agreement on activities to be carried out in the project for Jamaica -

1. Work Plan (Version 1)

During the Kick-off Meeting held in Jamaica on 7 April 2022, the Work Plan (Version 1) was explained by JICA Advisory Team (JAT) and was agreed between the Jamaica side (National Environment and Planning Agency and National Solid Waste Management Authority) and the JAT.

2. Proposed Pilot Projects

List of proposed pilot projects to be conducted under this Project


No.	Proposed Pilot Projects	Problems / Reasons
1	Clarification of plastic waste material flow in the Kingston Metropolitan Area	Jamaica introduced legislation to ban the importation, distribution, manufacture and commercial use of certain type of single-use plastics in 2019. In order to further develop policies on Marine Plastic Litter Management, quantified information is definitively necessary to identify and evaluate causes and effects regarding this issue.
2	Prevention of plastic waste being disposed into the marine environment (specifically the Kingston Harbour) by means of improvement of waste collection service	Plastic waste is being disposed into the drains and gullies that traverse the city of Kingston. This is caused by such as characteristics of community infrastructure (narrow streets, etc.) and behaviour of residents. Some residents are willing to separate recyclable wastes, however there is no separate collection system which leads to prevention of plastic waste into the marine environment.
-	Integrated Marine Plastic Litter Prevention Pilot Project	No.1 and No.2 are to be conducted in a integrated manner under the name of "Integrated Marine Plastic Litter Prevention Pilot Project". The project aims to make political suggestions for prevention of plastic waste into the marine environment.


3. Persons in charge

No.	Proposed Pilot Projects	NEPA / NSWMA	JAT
1	Clarification of plastic waste material flow in the Kingston Metropolitan Area	[NEPA] Anthony McKenzie Director, Environmental Management & Conservation Division	Taisuke Watanabe, Ikuo Mori
2	Prevention of plastic waste being disposed into the marine environment (specifically the Kingston Harbour) by means of improvement of waste collection service	[NSWMA] Edson Carr Projects & Planning Manager, Garfield Murray Senior Planning & Research Officer Kimberly Blair Community Relations Manager	

Note: The above mentioned are subject to approval of JICA Headquarters.

25 April 2022

  
\_\_\_\_\_  
Anthony McKenzie  
Director, Environmental  
Management & Conservation  
Division, NEPA

  
\_\_\_\_\_  
Edson Carr  
Projects & Planning Manager,  
NSWMA

  
\_\_\_\_\_  
Ikuo Mori  
Team Leader of  
JICA Advisory Team





Technical Cooperation Project on Advisor for  
Marine Plastic Litter Management in the Caribbean Region  
- Agreement on activities to be carried out in the project for Saint Lucia -

1. Work Plan (Version 1)

During the workshop held in Saint Lucia between March 14 and 18, 2022, the Work Plan (Version 1) was explained by JICA Advisory Team (JAT) and was agreed.

2. Issues to be tackled

List of problems and issues to be tackled under this Project

No.	Issues to be tackled	Problems / Reasons
1	Remediation of the current disposal site, Deglos Sanitary Landfill	There are several environmental problems to be improved. Remaining life period is unclear. It is necessary to use the landfill as long as possible because there is no new development plan of a new sanitary landfill.
2	Encouragement of waste minimization through source separation and composting	To minimize plastic waste running out to the sea. To prolong the remaining life period of the landfill

3. Persons in charge

No.	Issues to be tackled	SLSWMA	JAT
1	Remediation of the current disposal site, Deglos Sanitary Landfill	Marie Dalsan (Ms.), Operations / Landfill Manager	Yukihisa SAKATA (Mr.)
2	Encouragement of waste minimization through source separation	Marie Dalsan (Ms.), Operations / Landfill Manager Emlyn Jean (Ms.), Information and Communication Manager	Satoshi HIGASHINAKAGAWA (Mr.)

4. Proposed activities to be conducted in the 2nd Stage

<ul style="list-style-type: none"> <li>● SLSWMA and JAT jointly prepare plans of the pilot projects, "Remediation of Deglos Sanitary Landfill" and "Encouragement of waste minimization through source separation". Tentative schedule is shown in the "Attachment 1".</li> <li>● SLSWMA will provide information/data required for the planning listed in the "Attachment 2: Check list of data/information required for planning the pilot projects".</li> <li>● If there is no data or such data is insufficient for the planning, it may be considered to newly conduct survey(s) to get such data.</li> <li>● Once the budget from April 2022 to March 2023 related to proposed activities is approved, SLSWMA will inform JAT, and the implementation schedule of the pilot projects will be set.</li> </ul>
--

Note: Activities above are subject to approval of JICA Headquarters.

29 March 2022



Laurianus Lesfloris  
Acting General Manager  
Saint Lucia Solid Waste Management Authority



Ikuo Mori  
Team Leader of  
JICA Advisory Team

Attachment 1: Tentative Schedule in 2022

Note: Preparation for planning will be conducted via internet.

1. Remediation of Deglos Sanitary Landfill

Work item	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1. Preparation for planning	■ ■ ■ ■ ■ ■ ■ ■ ■ ■								
2. Planning				■ ■ ■ ■ ■ ■ ■ ■ ■ ■					
3. Implementation							Feb – Apr 2023		
4. Evaluation							Aug – Oct 2023		

2. Encouragement of waste minimization; source separation

Work item	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1. Preparation for planning	■ ■ ■ ■ ■ ■ ■ ■ ■ ■								
2. Planning					■ ■ ■ ■ ■ ■ ■ ■ ■ ■				
3. Implementation							Feb – Apr 2023		
4. Evaluation							Aug – Oct 2023		






Attachment 2: Check list of data/information required for planning the pilot projects

1. Remediation of Deglos Sanitary Landfill

Item	Exitance / Action	Check
1. As-built drawings of the disposal site	Not exist.	-
2. As-built drawings of facilities	Not exist.	-
3. Estimation of the 20-years landfill life (the original plan of the landfill)	This is to be provided by SLSWMA.	
4. Specifications of leachate treatment system	Not exist.	-
5. Site map with boundary	This is to be provided by SLSWMA.	
6. Survey drawings of the current site for estimating the remaining life period	This is to be provided by SLSWMA.	
7. Heavy equipment inventory	This is to be provided by SLSWMA.	
8. Disposal amount by category for the last 5 years or more	This has been already provided, i.e., weighbridge data.	✓
9. Waste composition by category at landfill	This has been already provided, i.e., Report 2018.	✓
10. Cost estimation of the improvement works	This is to be provided by SLSWMA.	
11. Drone photos before improvement	Information of companies are to be provided.	
12. Leachate quality before improvement	Historical data is to be provided.	
13. Remaining life period before improvement	Calculation is to be provided.	

2. Encouragement of waste minimization; source separation

Item	SLSWMA	Check
1. Population of the target area, Gros Islet	The latest data is to be provided by SLSWMA.	
2. Waste amount by category of the target area	Weighbridge data has been provided.	✓
3. Waste composition by category of the target area	Report in 2018 has been provided.	✓
4. Chemical analysis, if composting and other treatment method are considered	No data exists.	-
5. Actual handling manner of recyclable materials at sources, to conduct a Public Opinion Survey	No data exists.	-
6. Updated information of recycling, i.e., updating the report in 2013 prepared by a Taiwan volunteer	This will be carried out jointly by SLSWMA and JAT in April 2022.	
7. Manual of RCVs donated by the Japanese Gov.	This is to be provided by SLSWMA.	
8. Manual of woodchipper by the Japanese Gov.	This is to be provided by SLSWMA.	
9. Original plan how to use the refuse collection vehicles donated by Japan	This is to be provided by SLSWMA.	






Technical Cooperation Project on Advisor for  
Marine Plastic Litter Management in the Caribbean Region

- Agreement on activities to be carried out in the project for Antigua and Barbuda -

1. Work Plan (Version 1)

During the workshop held in Saint Lucia between March 14 and 18, 2022, the Work Plan (Version 1) was explained by JICA Advisory Team and was agreed.

2. Issues to be tackled

List of problems and issues to be tackled under this Project


No.	Issues to be tackled	Problems / Reasons
1	Waste separation and resource recovery: seek to carry out a pilot project involving the private sector	Household waste is co-mingled. Public education is necessary on waste discharge, separation, etc.
2	Improvement of capacity for supervising collection service and attending customers	Need to understand waste management financing. Need to improve collection schedule and efficiency. Need to improve management of complaints and communication with customers.
3	Training on landfill management and maintenance of machines	Machines are often broken down. Few repair shops for heavy equipment.
4	Planning of collection service for a new community	No collection schedule has been established in the new community.
5	Updating the existing solid waste management plan	The existing SWM plan is obsolete.

3. Proposed activities to be conducted in the 2<sup>nd</sup> stage

Item	Contents
No. 1	- JAT will assist in planning the pilot project on separation and resource recovery.
No. 2 - 5	- An information sharing workshop to provide opportunities to obtain knowledge and experiences of other countries. - JAT will provide relevant information.

Note: Activities above are subject to approval of JICA Headquarters.

18 March 2022

  
 F. Daryl Spencer  
 General Manager  
 National Solid Waste Management Authority  
 Antigua and Barbuda

  
 Ikuo Mori  
 Team Leader of  
 JICA Advisory Team

Technical Cooperation Project on Advisor for  
Marine Plastic Litter Management in the Caribbean Region

- Agreement on activities to be carried out in the project for Grenada -

1. Work Plan (Version 1)

During the workshop held in Saint Lucia between March 14 and 18, 2022, the Work Plan (Version 1) was explained by JICA Advisory Team and was agreed.

2. Issues to be tackled

List of problems and issues to be tackled under this Project

No.	Issues to be tackled	Problems / Reasons
1	Training of landfill staffs for efficient application of standards specific to several areas critical to landfill operations inc., ground water monitoring and leachate treatment, application of semi-aerobic filling plan, heavy equipment maintenance, gas venting, standards for handling specific waste types, waste classification fundamentals, organizational structure, occupational health and safety (OHS) standards specific to landfills, quality assurance.	Provided that the new landfill cell is in commissioning stage, however, little experience would make improper operation of a semi-aerobic landfill.
2	Capacity building to strengthen enforcement of Waste Management Act. and Litter Abatement Act.	Compliance with the legislations is lacking and it leads to low quality of effectiveness.
3	Feasibility study, including the necessary data to determine considerations for the introduction of Waste to Energy (WTE).	There is interest in with it but no knowledge of what is required to facilitate this process.
4	Upgrading GSWMA's collection machinery and improving capacity to maintain – training.	-
5	-	-


3. Proposed activities to be conducted in the 2<sup>nd</sup> stage

<p>JAT will:</p> <ul style="list-style-type: none"> <li>- conduct virtual tours on the landfill in Grenada</li> <li>- hold web meetings with engineers at a landfill</li> <li>- formulate operation and maintenance manual for the landfill</li> <li>- hold web meetings with engineers for collection vehicles</li> <li>- provide WTE information including bad lessons</li> <li>- hold information sharing a workshop in one of five countries</li> </ul>
---

Note: Activities above are subject to approval of JICA Headquarters.

18 March 2022

  
 Myrna Julien  
 Communications Manager  
 Grenada Solid Waste Management Authority  
 Grenada

  
 Ikuo Mori  
 Team Leader of  
 JICA Advisory Team



Technical Cooperation Project on Advisor for  
Marine Plastic Litter Management in the Caribbean Region

- Agreement on activities to be carried out in the project for Guyana -

1. Work Plan (Version 1)

During the workshop held in Saint Lucia between March 14 and 18, 2022, the Work Plan (Version 1) was explained by JICA Advisory Team and was agreed.

2. Issues to be tackled

List of problems and issues to be tackled under this Project

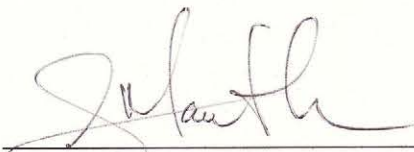
No.	Issues to be tackled	Problems / Reasons
1	Design and operation of waste disposal facilities including semi-aerobic landfill and 3R facility.	The government plans to develop 10 new waste disposal facilities (landfill sites) in every region. Semi aerobic system for landfill and composting facility for 3R will be applied for 10 disposal facilities.
2	Landfill gas management	Anaerobic cell does not have gas collection treatment system. Then, there is odour problem.
3	Confirmation of recycling flow with consideration of waste composition	Waste diversion is important with stable recycling flow to extend landfill expectancy because almost 100% of waste is disposed of in landfill sites.
4	Waste management plan (ex. for region 4)	There is no waste management plan in Guyana. Therefore, it is necessary to prepare it.
5	-	-

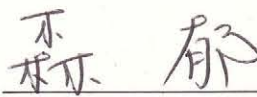
3. Proposed activities to be conducted in the 2<sup>nd</sup> stage

Item	Contents
No. 1	- Online training workshop for design and operation for semi-aerobic landfill site - Online training workshop for design and operation for composting facility
No. 2	- JAT will provide an opportunity to share information like the workshop conducted in the 1 <sup>st</sup> stage.
No. 3	- Providing a manual of waste amount and composition survey - Providing a manual of recycling flow survey - Providing a manual of time and motion study
No.4	- Guideline of waste management planning

Note: Activities above are subject to approval of JICA Headquarters.

18 March 2022

  
Satrohan Nauth, Director of Sanitation  
Ministry of Local Government & Regional  
Development

  
Ikuo Mori  
Team Leader of  
JICA Advisory Team

## ANNEX C4

### Report on Inspection Visit to Proposed Land for Landfills in Guyana

Japan International Cooperation Agency

**Technical Cooperation Project on  
Advisor for Marine Plastic Litter Management  
in the Caribbean Region  
Report on Inspection Visit to Proposed Land  
for Landfills in Guyana**

**April 2023**

**EX Research Institute Co.  
Nippon Koei Co.**

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## ANNEX

Site Visit and design review report in Guiana, March 2023

# 1 Purpose of the Visit

## 1.1 Background

In Guyana, rapid urbanization has increased the need for proper waste disposal, and in response, the Ministry of Local Government and Regional Development (MLGRD) has planned to establish final disposal sites in each region of the country and plans to construct the disposal sites in order.

Guyana's landfill technology was originally based on an anaerobic landfill method. That is used a Euro-American technology, to develop a sanitary landfill site and implement final disposal. The final disposal cell of the Haags Bosch Sanitary Landfill incorporates a semi-aerobic landfill structure (Fukuoka method), and started operation as part of a Japanese technology transfer in 2019. This technology transfer occurred simultaneously in Trinidad and Tobago, which has been evaluated as being as more suitable for the Caribbean's rainy and humid climate.

The MLGRD has not received any additional technical assistance for the operation of the final disposal site after the technology transfer. They have been practicing it on their own and has requested technical assistance from JICA Advisory Team (JAT). The JICA experts have provided technical assistance since 2022 in terms of solutions to specific technical items like functional explanations of impervious structures and odour countermeasures.

## 1.2 Purpose of the Survey

The purpose of the survey is for JICA experts to actually visit several proposed sites that have been identified as proposed disposal sites, including visit of existing disposal sites, to identify the landfilling technologies that Guyana lacks, and to provide technical advice on the future development and operation of a final disposal site.

## 1.3 Survey Schedule

The survey schedule is shown in the table below:

Table 1-1: Survey schedule

Date	Day	Activity
Feb 27th	Mon	Assist with the design of semi-aerobic cell #3 for Haags Bosch Sanitary Landfill
Feb 28th	Tue	Visit to Blairmont Landfill site, Region 5, and assistance with preliminary design
Mar 1st	Wed	Visit to Zorg-en-Vlygt Landfill Site, Region 2, and assistance with preliminary design
Mar 2nd	Thu	Visit to Bartica Landfill Site and review of design
Mar 3rd	Fri	Site visit and design review report

## 1.4 Location of the Survey

The location of the survey visit is shown in the figure in the next page.



Location of the Survey

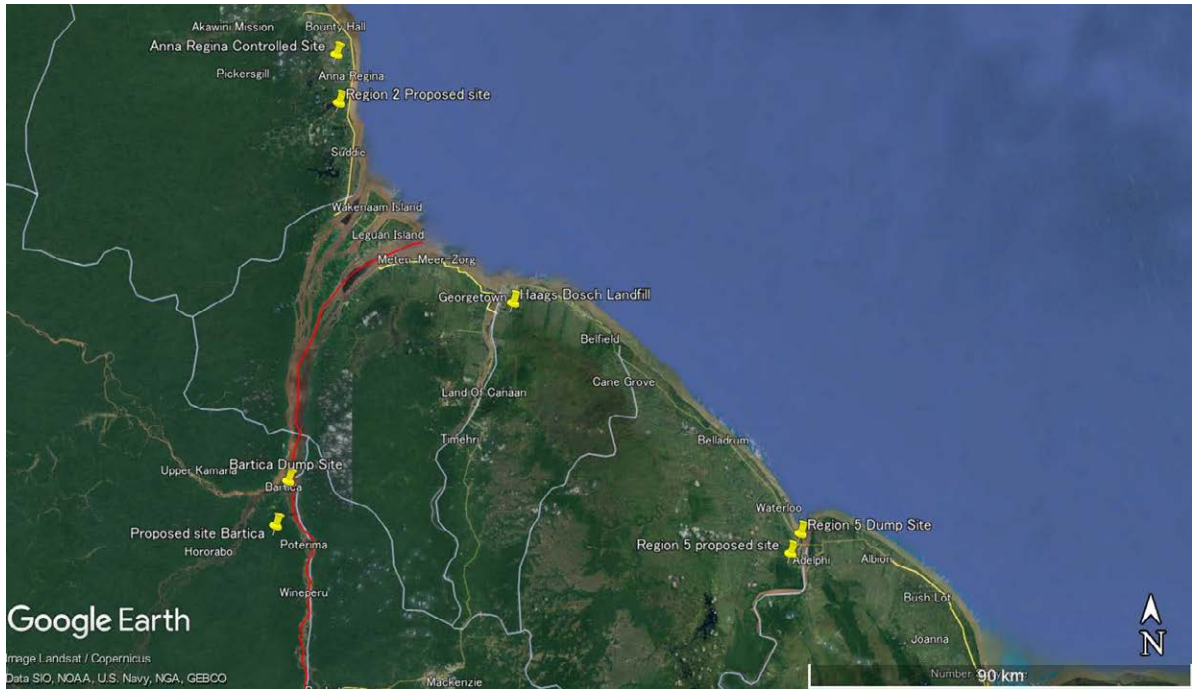


Figure 1-2: Location of the Survey

## 2 Results of Site Visit

- 3 Only one site visit in a region could be conducted per day. Guyana has a small population density relative to its vast land area. Therefore, travel to each of the regions other than the capital, Georgetown, took several hours thus making the survey an entire day's work. In addition, the journey to Bartica in Region 2, was accompanied by the movement of water bodies that crossed the river. The results of all the sites that were visited are stated below:

### 3.1 Haags Bosch Sanitary Landfill

The first day of the site visit consisted of an inspection and design review of the Haag Bosch Sanitary Landfill in Georgetown. The layout of the landfill (initial design) is shown in the figure below. The cell locations and leachate treatment facilities for Cells #1-#4 are almost as originally designed. Notwithstanding, there is a plot in the upper part of the figure that has been landfilled with cinders. This area began operations in 2016, but was eventually closed as a result of a large fire in Cell#1. There is also a plot where industrial waste is landfilled. JICA has provided assistance mainly through issue-specific training. Several trainees to date have applied the knowledge garnered to their daily work.

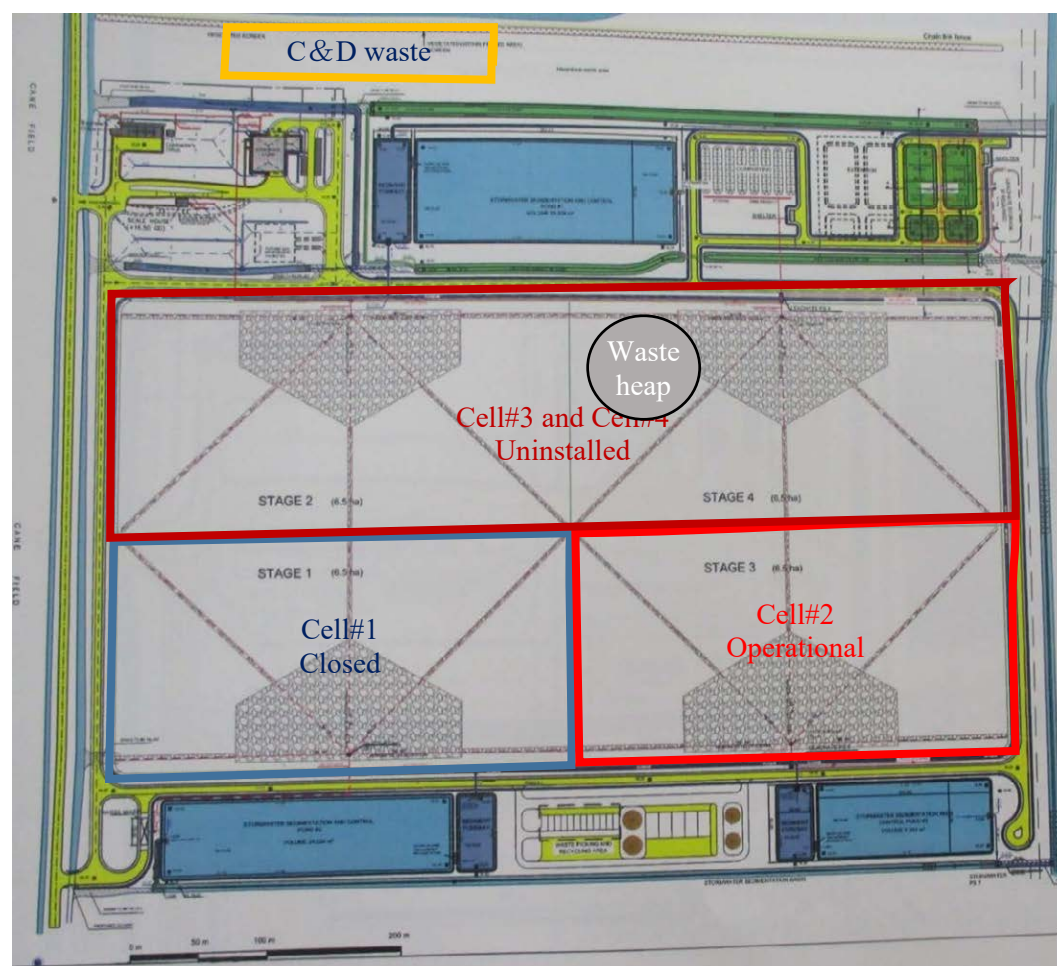


Figure 2-1: Haag Bosch Landfill Layout (Initial Design)

### 3.1.1 Facility Overview

Currently, Cell#2 is the only cell that is in operation and is supposed to be a landfill cell that introduces a semi-aerobic landfill structure (Fukuoka method) with technical assistance from Japan.

Presently, the Fukuoka method in Cell#2 is not functioning based on interviews with the CPs. It must be noted that prior to this it was effective in promoting rapid decomposition of organic pollutants, which is a feature of the Fukuoka method. The mouth of the leachate collection pipe was submerged in the leachate drainage channel, preventing air intake from the collection pipe outlet into the landfill layer. Lowering the water level in the leachate channel would allow air intake, however, it could result in overload operation relative to the leachate transfer pump capacity currently in operation.

It was confirmed with the CP in an interview that the gas ventilation pipes were initially placed in the proper manner in Cell#2 where the Fukuoka method was adopted. The gas ventilation pipes were placed at the edge of the first layer where the waste had been compacted. In the current situation, one can see where the landfill has progressed to the second layer and they are not structured to actively take in oxygen which leads to the decomposition of contaminants.



Figure 2-2: Haag Bosch Sanitary Landfill (top left: uncovered refuse surface layer, top right: small section of refuse layer 1, middle: Cell#2 loading dock, bottom: leachate treatment pond)



The leachate treatment system is in operation as designed, and the pumps are 'functioning well. They are not shut down to facilitate the conservation of electricity which is a frequent case in the developing countries.

In Cell#1 which is closed, the surface water is mixed with leachate and the mixed leachate is treated. Thus, the leachate treatment facility does not have a higher pollution load. However, it does have a higher water load. In addition, all the stormwater in the landfill cells other than Cell#2 is being mixed with leachate and treated. The stormwater should be separated and eliminated from entering the leachate treatment system to ensure proper leachate treatment.

The survey team was consulted prior to the site visit on the matter of complaints from the neighbourhood regarding odours being emitted from the site. Upon investigation, no odour was detected from Cell#1 but odour emanated from Cell#2 in tandem with the waste being transported.

To be certain that there was no odour being emitted, the JICA expert measured several locations with a gas detector, however. However, this resulted in no odour being detected. Since the human body can detect unusual odours even with minute amounts of unusual odour substances, the above measures should be implemented as soon as possible.

## 3.2 Blairmont Landfill site, Region 5 and Assistance with Preliminary Design

### 3.2.1 Facility Overview

The target population of the disposal site is assumed to be 20,000 - 30,000 people, and the expected disposal volume is about 15 tons/day. Compared to the Haags Bosch Sanitary Landfill, a much smaller landfill is expected to be developed.

The proposed landfill site is shown in the figure below. Blairmont, a proposed site in Region 5, is a long east-west site occupied along the boundary of a sugarcane field, with a site bordering an irrigation canal and a drainage channel.

There is a plan in the pipeline for access to the site to be via a bridge from the opposite bank of the sugarcane field drainage channel.

An access road from the nearest highway is currently being developed and the access road will be built on the other side of the drainage channel, therefore, loading and unloading to and from the site will be implemented through a road bridge over the drainage channel.

Because of its low elevation, flat land, and proximity to the Berbice River, this is an area where sluice gates are closed, and flood control measures are taken when the water level rises.



Figure 2-3: Proposed Blairmont Landfill site (upper left is the site, a drainage channel is in the foreground)

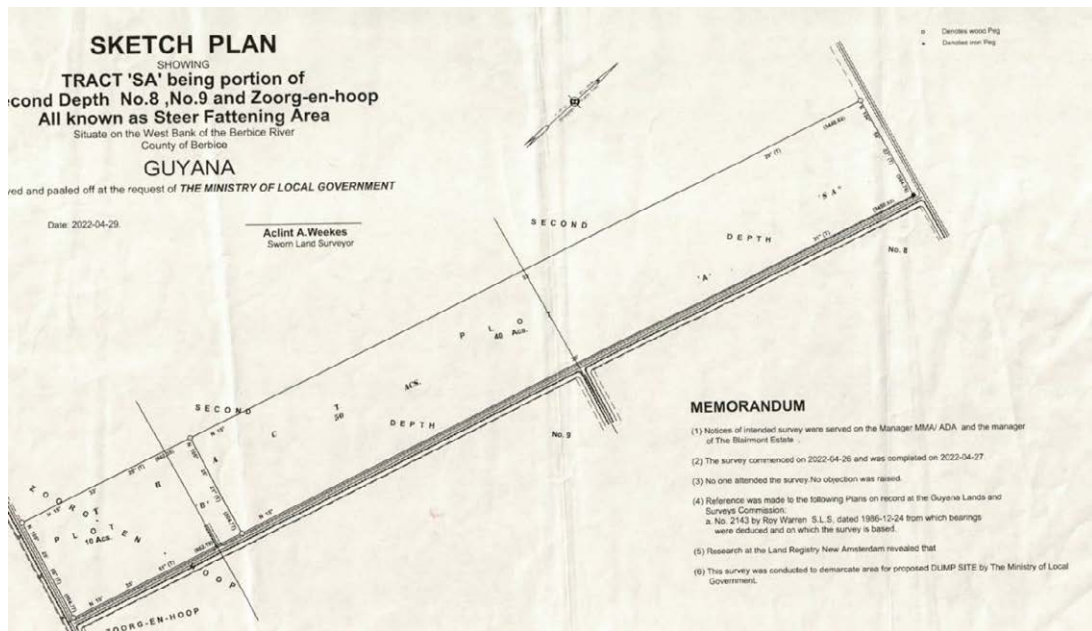


Figure 2-4: Blairmont Proposed Landfill Site

### 3.2.2 Findings

Prior to the site visit, the CP approached the survey team with the intention of disposing of the waste at the proposed site as soon as possible, since the current landfill site is located close to a residential area.

This "Temporary Landfill" idea has become common not only in Guyana but also in the Peruvian experience. Notwithstanding, the Counterpart's (CP's) intention is not to secure a landfill as a temporary site, given a Fukuoka-style landfill will be developed.

On the other hand, since the amount of target waste is not so large (about 14 t/day), it is possible to make the installation in stages in order to accept waste for one or two years, which is the typical construction period for a landfill of this size. Specifically, a landfill area of 1 ha would result in a landfill capacity of 1 year, assuming a 2m layer in thickness. Assuming that 4-6 months are required for the installation of this 1 ha, the new landfilling work in the first phase can be implemented after the fifth month. In this case, it is expected that a model development plan for small-scale landfill sites will be implemented, such as aiming for full-scale operation of leachate treatment from the second phase onward.

## 3.3 Zorg-en-Vlygt Landfill Site, Region 2

### 3.3.1 Facility Overview

The proposed landfill site is a site consisting of a sandy layer of ground close to the sea level. As far as the condition of storm water drainage facilities around the site is concerned, surface water is close to the ground, making it difficult and not appropriate to install a dug-in waste landfill structure.

The shape of the proposed site is rectangular with a longitudinal length of 600 meters.

In addition, the access road from the main road to the proposed site is narrow, making it impossible for regular vehicles to pass each other. The area near the entrance to the access road is a well-developed residential area, which prevents the road from widening easily. If this is not implemented, the installation of the landfill itself will be affected. Therefore, it is necessary to appoint a traffic guide at the junction of the access road and the main road, or to install multiple passing places.

The existing landfill in Region 2 is currently treated as a temporary dumpsite for incoming waste, and the plan is to relocate the waste as soon as the new landfill is completed.

For the new landfill design, it is recommended that the stability of the storage structure be outsourced to a private design consulting firm because the stability of the storage structure is the most important factor as mentioned above. It is clear that the design of Cell#2 at the Haags Bosch Sanitary Landfill has been implemented almost exclusively by direct management and that the CP has the capability to design most of the contents directly. However, the stability calculations for the structure with the final shape of landfill or during seismic events in operation require specialized skills. The CP should focus on accurately communicating operational ideas, design concepts and requirements in the design to the design contractor.



Figure 2-5: Proposed Zorg-en-Vlygt Landfill Site (top: access road, bottom: on site)

### 3.3.2 Findings

On land where there is no difference in elevation from the surrounding surface water, it is common to develop a landfill structure with a storage structure with the current ground as the base plate and the surrounding storage structures raised. On the other hand, when installing the structures on sandy layer, the stability of the structure's foundation and slope is an important design consideration. Therefore, the method of structure installation and the height of the landfill should be carefully considered. In addition, for leachate control structures, HDPE liner sheets should be installed except under the conditions of sufficient clay layers with impermeability.







Figure 2-7: Bartica new landfill (left: access road, right: site entrance)

Regarding the existing landfill (Byderade dumping site), the entire site is fenced and has a certain level of control. The waste that is brought in is dumped openly. In addition, a portion of the site is adjacent to a residential area, which is not available for landfilling.



Figure 2-8: Byderade existing landfill

### 3.4.2 Findings

The selection of the proposed landfill site is rarely scientifically optimal; it is often selected through negotiations with the landowner or by the social conditions of the neighbourhoods. There is also an aspect of general public sentiment that people want waste to be located as far away from their living area as possible (NIMBY = Not In My Back Yard).

Therefore, it cannot be helped that the proposed Bartica site is far from the urban area (mainly around Stelling). However, there is a concern that the selection of the proposed site in the forest will result in significantly longer road development for access.

The proposed site and the access road to the site have sand layers as the ground, and ensuring soil stability is of great importance when installing a landfill storage structure. Reinforcing structural techniques, etc., that were not needed in the construction of flat areas such as Haag Bosch Sanitary Landfill may be required along with the design and construction skills of a competent private company, rather than direct management work.

Regarding construction technology to ensure the stability of civil engineering structures in mountainous areas, it is assumed that there is a certain level of technology that is needed. Japan for example, has several structures in mountainous areas like dams for power generation.

## **4 Discussion and Technical Recommendations for the Design of Each Site**

### **4.1 Haags Bosch Sanitary Landfill**

#### **4.1.1 Current Issues and Solutions for the Fukuoka Method not Functioning**

As discussed in Chapter 2, the natural purification of waste in Cell#2 of the Haags Bosch Sanitary Landfill is not a function of semi-aerobic landfill structure. It is noteworthy that the Fukuoka Method does not refer to landfill technology in general, and thus the dysfunction of the Fukuoka Method is not related to sanitary landfill management at the final disposal site.

#### **4.1.2 Issues on Cell#2**

First, the most important feature of a semi-aerobic landfill structure is the absence of external air inflow through the leachate collection pipes. The outlet of the leachate collection pipe drains into the leachate conveying channel around the perimeter of Cell #2. However, the leachate collection pipe outlet is below the surface of the water in an open water channel around this conveying channel. Therefore no incoming air can enter.

Gas ventilation pipes are also only placed around the landfill layer at the height of the first small stage (H=3m), and no gas ventilation pipes are installed in the second layer, which is currently being landfilled. According to MLGRD, although the gas ventilation pipes were placed at regular intervals when Cell#2 was first completed, landfilling work by the private operator, which began after the facility started operation, continued without considering the function of the gas ventilation pipes, and eventually the gas ventilation pipes were damaged and buried.

To solve these problems, several improvements are to be recommended as shown in the figure on the next page.

First, Cell#2 is currently piled up halfway through the second layer, and leachate collection pipes will be installed on the surface of the current second layer to promote stabilization of the waste piled up in the third and fourth layers in the future. Installation timing depends on MLGRD's landfilling work plan.

Gas ventilation pipes should also be installed at appropriate intervals in the second layer to promote air intake from the surface layer.

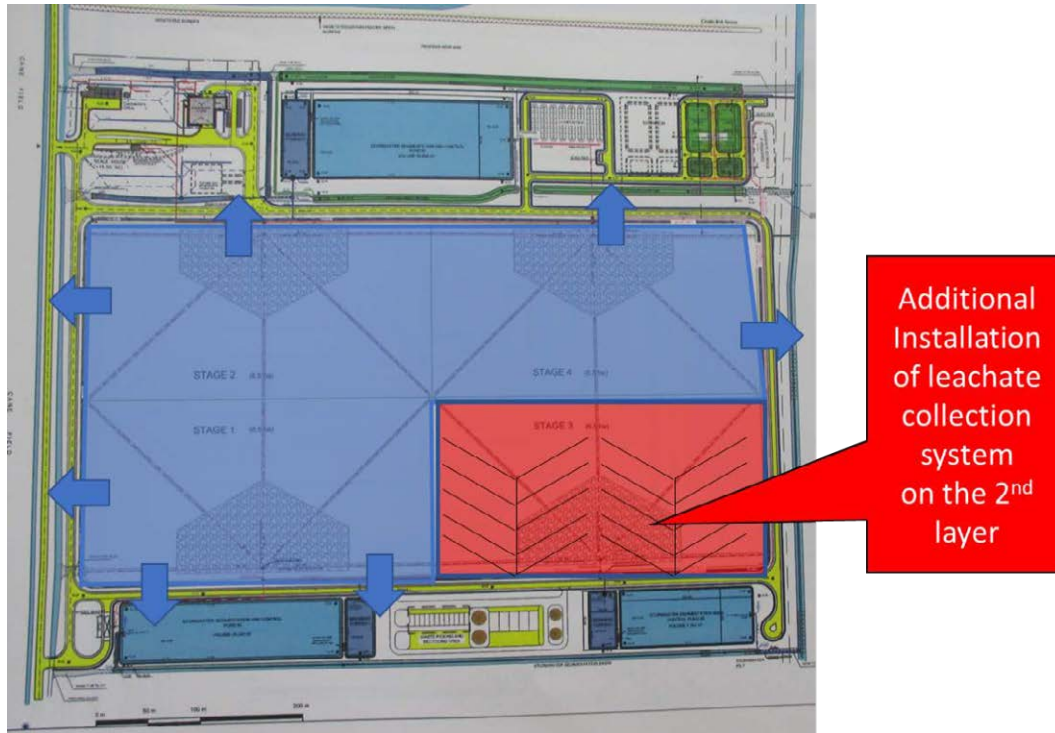


Figure 3-1: Improvement of Cell#2

#### 4.1.3 Odour Exposure from Closed Cell#1

According to the observation from the perimeter of Cell #1 (on February 27, 2023) and the additional on-site inspection conducted (on March 9, 2023), Cell #1 has been covered with vegetation since the landfilling was completed, and there are no noticeable cracks in the final cover. Therefore, it is unlikely that odour is leaking from Cell #1.

#### 4.1.4 Issues Related to Cell #3 Development (Landfill Area Expansion)

The current Haags Bosch Sanitary Landfill area (Cells #1-#4) does not have a clear separation between stormwater and leachate, and all rainfall to this landfill area is treated as leachate through the same route as leachate. Therefore, even if the landfill structure in Cell#3 is developed as is, the amount of leachate is not expected to change.

Although the pollutant load of leachate will remain the same, a decrease in leachate volume will reduce the volume of water in the leachate treatment system, resulting in an increase in hydraulic retention time of leachate, which is expected to increase the effectiveness of pollutant purification. Therefore, complete separation of storm water and leachate in the landfill area is proposed. The initial design (at the basic design level) conducted by a German design consultant, separated stormwater from leachate. However, this was not reflected in the construction, which is a necessary improvement for proper leachate and stormwater management in the future (see **Figure 3-1**).



## 4.2 Blairmont

**4.3** It was stated in the general overview that putting the project into service at an early date was being considered. It was proposed that the construction area be divided into four (4) construction zones that would be built sequentially.

The area near the irrigation drainage channel, which will be the entrance, will be equipped with the necessary office, weighing functions and leachate treatment functions from the beginning of operation. At the same time, the first landfill cell will be developed.

Once the number of service years for the first landfill cell is determined, the second landfill cell (Cell 2) and the third landfill cell (Cell 3) could be expanded so that they can be used effectively and quickly.

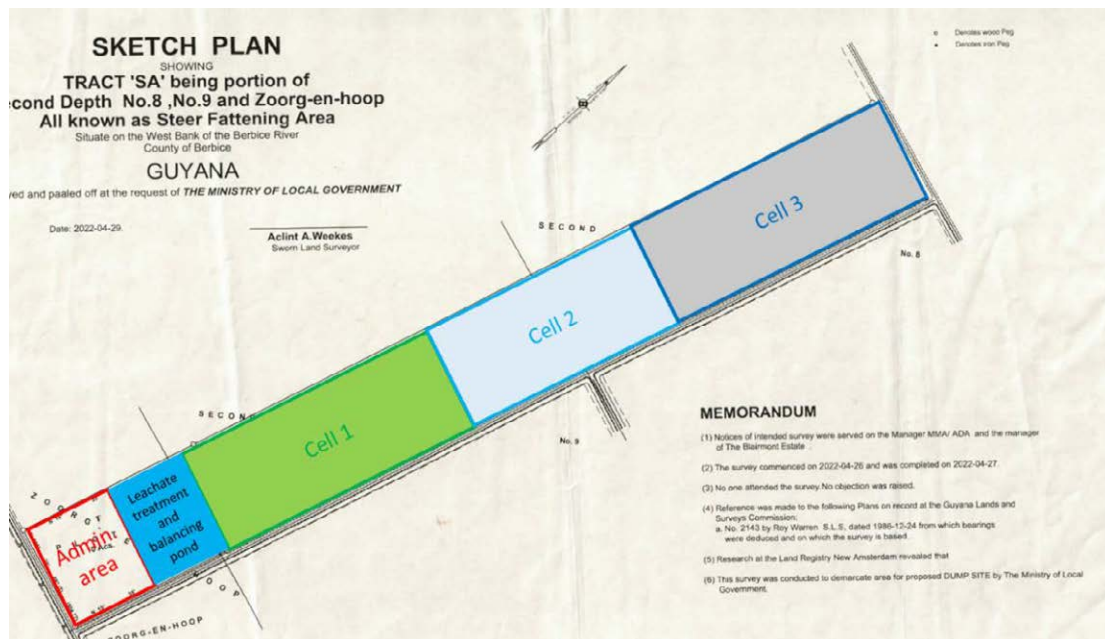


Figure 3-2: Blairmont Land Use Plan

## 4.4 Technical Level of Civil Works in Guyana

In our observation, it is appropriate to describe the results of the inspection separately for civil engineering design and civil engineering construction.

First, regarding the civil design, the basic design for Cell#1 was performed by a German design consultant<sup>1</sup>, and although it was not intended to be a semi-aerobic landfill structure, it can be evaluated as being at a general basic design level. In particular, for systems related to rainwater drainage and leachate treatment, continuous operation with minimal power use is considered when diagramming the system, for example using the difference in elevation and minimizing the number of pumps.

For Cell #2, a semi-aerobic landfill structure was implemented, and an engineer who could draw standard drawings of landfill structure was in charge of the design of Cell #2 under the guidance of a Japanese expert (Professor Matsufuji) in person or on the web. Although it is difficult to order drawings from this standard drawing alone, it is possible to assess that the development of a semi-

<sup>1</sup> HYDROPLAN Ingenieur-Gesellschaft mbH

aerobic landfill structure on a flat site at Haags Bosch is feasible and in good quality, as long as the basic concepts are understood and construction proceeds.

Next, regarding the level of civil engineering construction, it is presumed that the construction techniques required by landfill technology are available, considering the installation of small steps in the landfill layer and the development of roads on loose ground.

## 4.5 Measures for Discharge of Treated Leachate

When treating water, not just leachate, the design usually uses elevation differences and natural flow by gravity from upstream to downstream. On the other hand, if leachate is collected at the bottom of the landfill storage structure, it could be pumped up and then treated by natural flow.

In addition, it is assumed that the capacity of the adjacent drainage channel will not be sufficient for discharging the treated water, and it is necessary to install a discharge pipe to discharge the water into the marine ambient water.

# 5 Issues Related to Landfills

## 5.1 Common Challenges in the Caribbean Region

Common issues include these facts i. mixed waste is disposed of in landfills without source separation, ii. recycling is not advanced, iii. final disposal is implemented without any intermediate treatment and iv. hazardous and industrial waste are disposed of at the same site.

In order to ensure proper landfill disposal under this system of waste treatment and disposal, the following issues must be addressed:

- Continuation of sanitary landfilling: Due to food waste, which makes up a large portion of the mixed waste, the landfill is infested with flies and is not sanitary. Therefore, it will be considered to be a major contributor to the odour. To control this, regular soil covering is necessary, and to ensure effective soil cover, daily landfill work area must be clearly defined. Specifically, a plan should be prepared and implemented by (1) establishing the area of the required work area, (2) making the landfilling work area successive on a weekly or monthly basis, etc.
- Leachate control and proper treatment: The five countries in the project have a relatively high level of technology and do not have the worst landfill conditions seen in developing countries in Asia and Africa. However, in some cases, leachate and rainwater are mixed and treated, increasing the volume of treated water by the amount of rainwater. Since leachate treatment in mechanized advanced countries is not a function of purification, with sufficient residence time and agitation in the system, separation treatment and elimination of rainwater and leachate to reduce the volume of leachate is necessary.

In order to properly treat leachate, it is necessary to have a functioning leachate treatment system that has at least the ability to purify organic materials.

The figure below shows the standard leachate treatment flow in Japan. However, coagulation sedimentation treatment by chemical injection and advanced treatment are not realistic for introduction in the Caribbean countries due to high operational costs and different characteristics of leachate raw water quality. Therefore, it is necessary to pay attention to the pre-treatment and post-treatment (natural sedimentation of



pollutants) and biological treatment shown in the figure in the next page and introduce them.

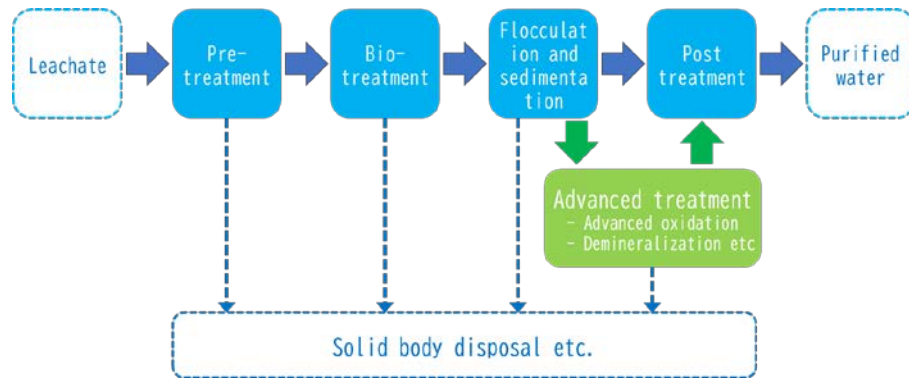


Figure 4-1: Standard leachate treatment flow

The following are typical examples of biological treatment methods:

[Activated sludge method]

A method to obtain cleanly treated water by aeration to allow aerobic microorganisms to decompose pollutants, and by properly controlling the concentration of pollutants and the amount of aeration to allow the growth of flocculating bacteria for settling and separation. <sup>2</sup>

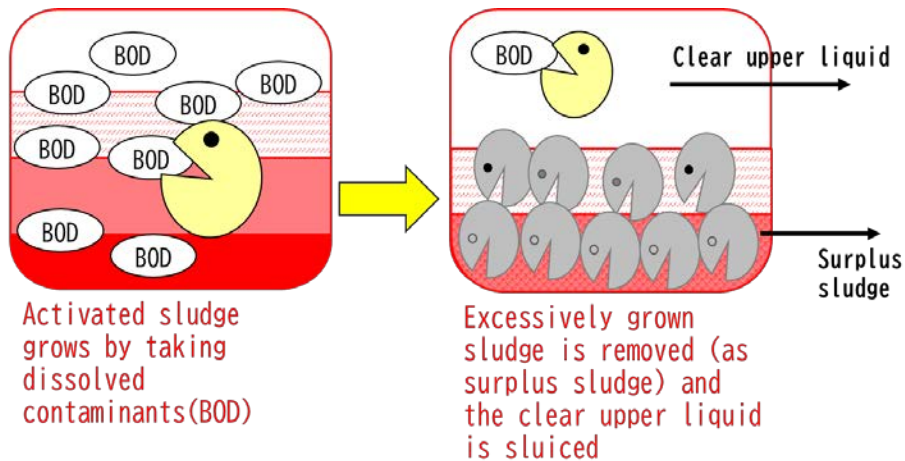
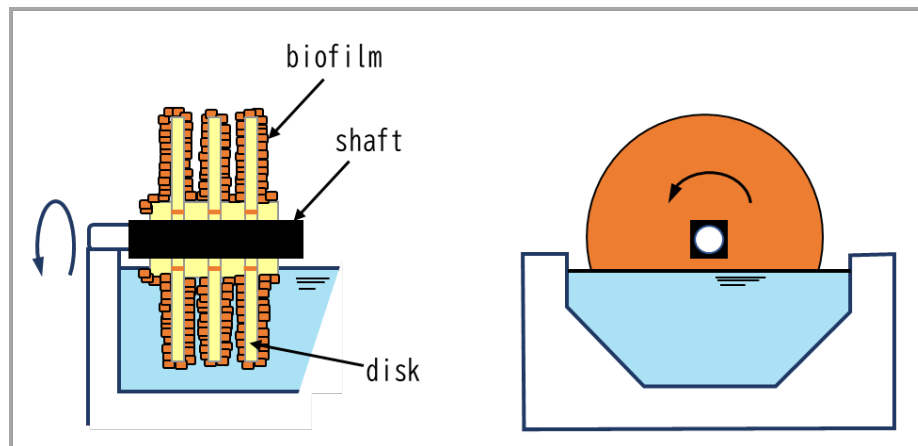


Figure 4-2: Principle of activated sludge method

[Rotating disk method]

In the rotating disk method, wastewater is purified using a microbial membrane adhered to a disk body. The disks rotate slowly with approximately 40% of their area submerged in the wastewater, absorbing oxygen when exposed to the atmosphere and adsorbing pollutants from the wastewater for aerobic decomposition. New microorganisms continue to grow by attaching to the disks, while old microorganisms drop off from the less active ones.

<sup>2</sup> <https://www.chikusan-kankyo.jp/osuiss/kiso/0027.htm>

Figure 4-3: Principle of Rotating Disk Method <sup>3</sup>

In addition, it is a common practice in developing countries to take oxygen from the atmosphere into the water by using the drop-off in the leachate flow process and crafting it like a small waterfall, not relying on the above methods. This is called gravity aeration, and some examples are shown below.

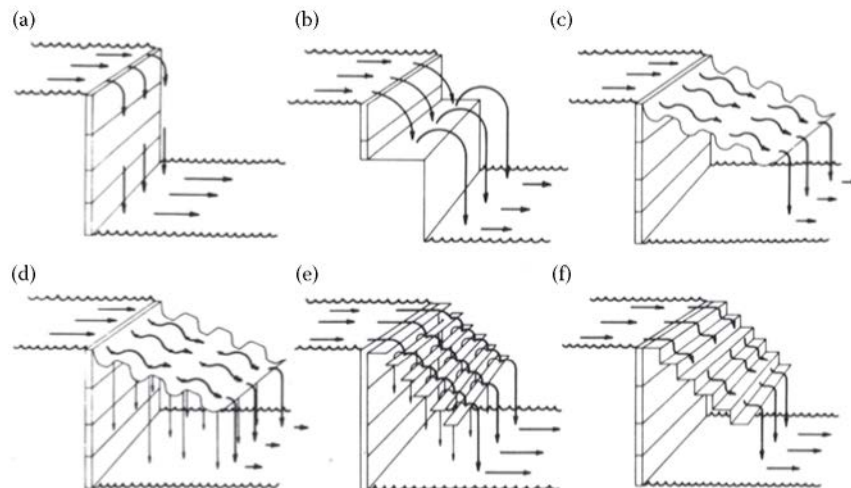


Figure 4-4: Gravity Aeration

## 5.2 Guyana's Unique Challenges

Guyana is unique among the five target countries. It is not an island nation, but a continent, and most of the region is at a low elevation.

In addition, the ground is sandy in some areas. While there are no problems in supporting structures designed and constructed under proper design conditions, even in sandy soil, forming landfill structures by excavation of the ground is not recommended because of the fundamental difficulty in stabilizing sandy slopes. Therefore, the waste storage structure should be raised above the local bedrock (see figure on the next page). In the case of sandy soil, there would be a risk of a landslide (collapse) of the structure during earthquakes. This does not occur frequently under normal conditions, therefore, it is important to confirm the stability of the structure, and a specialized structural analysis should be performed.

<sup>3</sup> <https://www.sekisuia.co.jp/plant/lotation/>

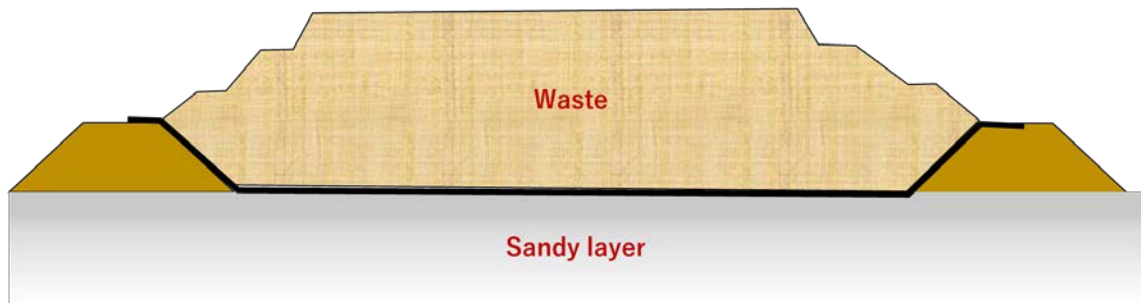


Figure 4-5: Raised structure

The following is an example of landfills with raised structure that has been constructed in Japan. The landfill cell is divided into three sections, with the circular perimeter being the main storage structure (embankment), and sub-cells separating the three sections from the center.



Figure 4-6: Clean Park Kinu, final landfill

This landfill used to be a pig farm, and the local residents were troubled by the foul odour. When the landfill was set up, the facility owner promised the residents a landfill structure and sanitary landfilling, and also provided a campground and other facilities to harmonize the community.

## 6 Possible Support Plan

The following support measures are expected in the future:

- Model development of new landfills : A grant aid project for a landfill that could be horizontally expanded among the current proposed sites, depending on the size of the project. It includes environmental impact studies, geological studies, basic and detailed facility design, construction bidding support, and construction supervision.

Note: Considering the scale of the landfill, there are possibilities such as the Waste Management Capacity Improvement Project, which is a pilot project for the development of one landfill site.

- Haag Bosch Sanitary Landfill improvement project : Technical assistance for leachate and stormwater separation and sanitary landfill including (1) development of a landfill work plan, (2) training on compaction and soil covering, (3) assistance with installation of additional gas ventilation pipes, (4) implementation of environmental monitoring, and assistance with improvements to other existing landfills for sanitary landfill.

The end



**Site visit and design review report in Guyana  
for  
the “Technical Cooperation Project on Advisor for Marine Plastic  
Litter Management in the Caribbean Region**

3rd of March 2023  
JICA Advisory Team



***NIPPON KOEI***

## **Itinerary**

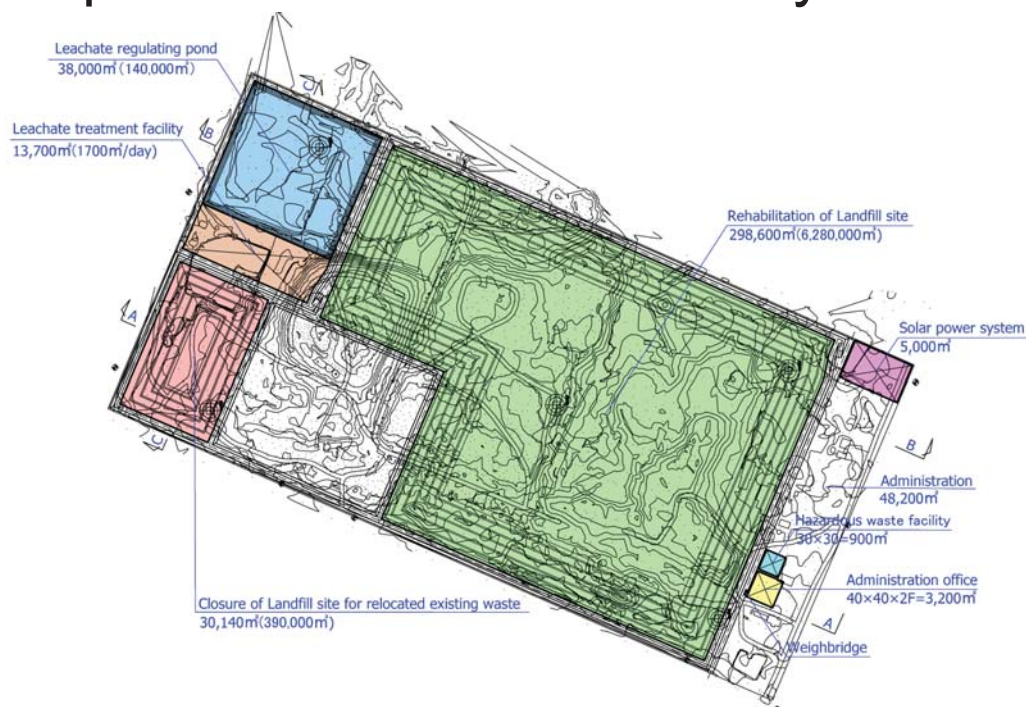
- Feb 27th - Assist with the design of semi-aerobic cell #3 for Haags Bosch Sanitary Landfill
- Feb 28th - Visit to Blairmont Landfill site, Region 5 and assistance with preliminary design
- Mar 1st - Visit to Zorg-en-Vlygt Landfill Site, Region 2 and assistance with preliminary design
- Mar 2nd - Visit to Bartica Landfill Site and review of design

# Suggestions in common with each landfill

- Develop landfilling work standards should be specified. Once you have the operation standard, such a necessary thing like the continuous exposure to the atmosphere through gas venting and leachate collection pipes could be a common thing for all the relevant staff members.
- For the first step of the design after a land acquisition, necessary infrastructure such as electricity, fresh water and waste water discharge measure shall be confirmed.
- (Additional suggestions)

3

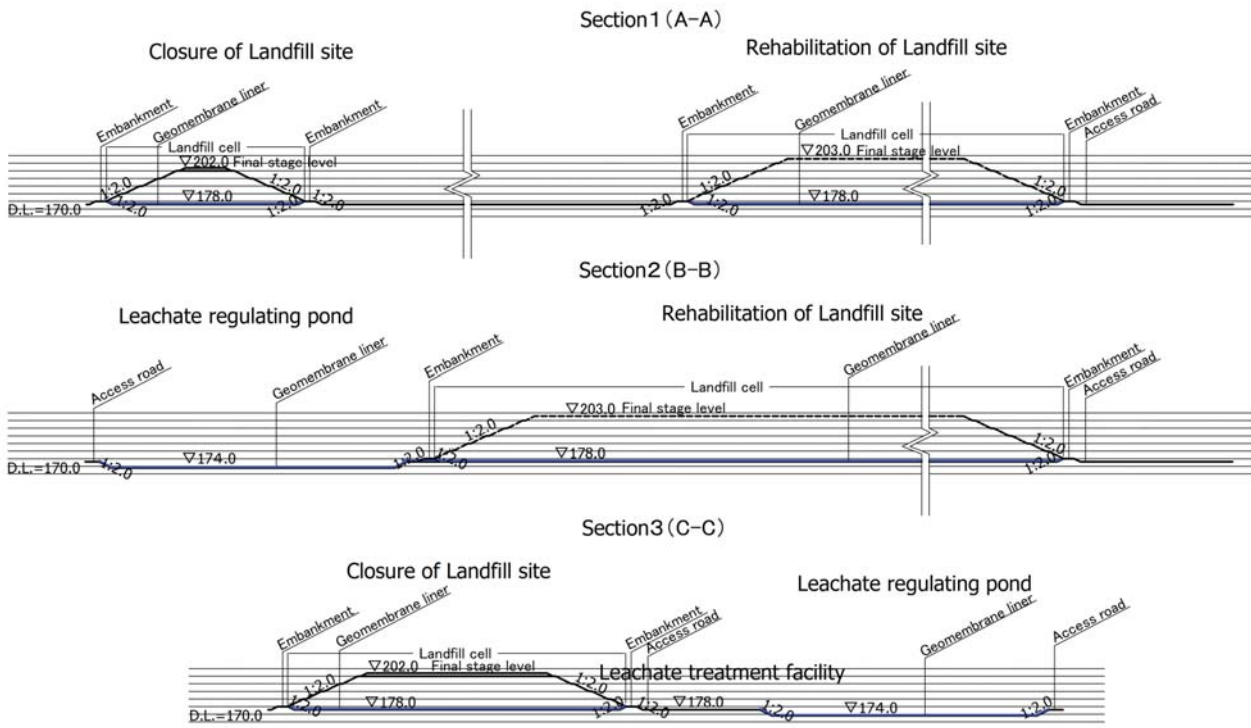
# Example of a landfill in a marshy area



4



# Example of a landfill in a marshy area



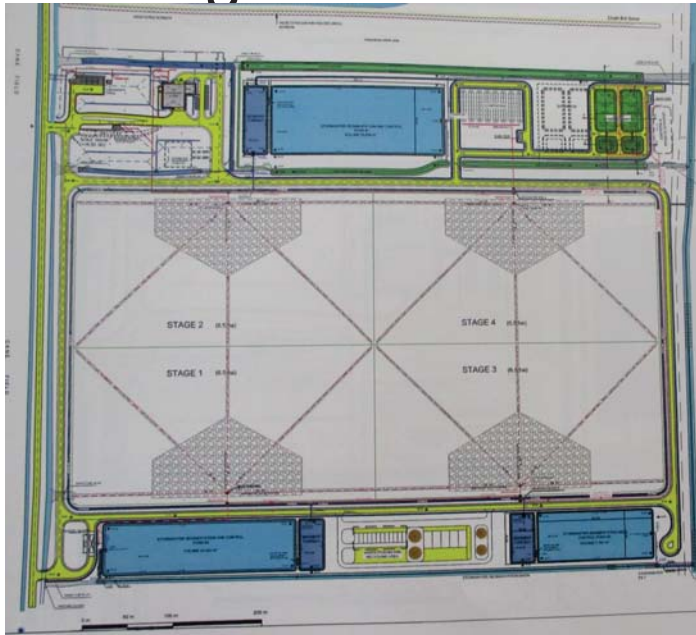
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## Daily cover soil



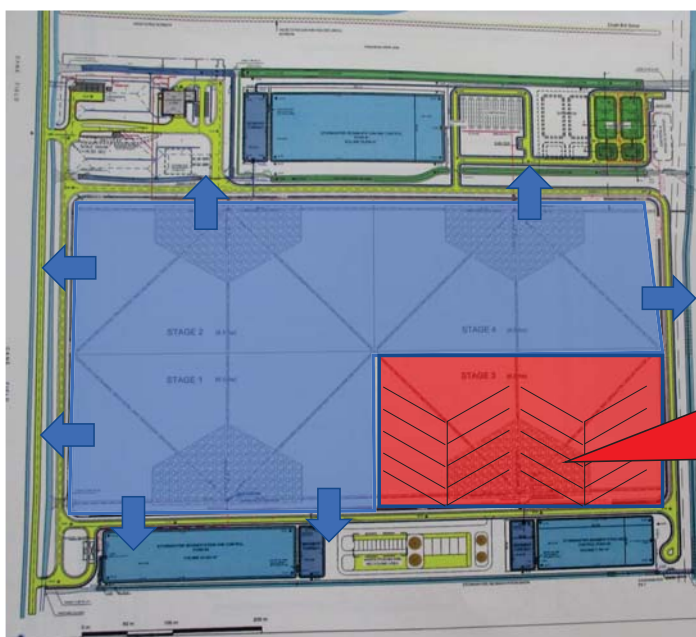
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# Assist with the design of semi-aerobic cell #3 for Haags Bosch Sanitary Landfill



7

## Suggestion on the current state improvement with separation of storm water and leachate



Additional Installation of leachate collection system on the 2<sup>nd</sup> layer

8

# Haag Bosch

- Leachate treatment is operational as designed.
- The surface water in Cell 1 is currently mixed with leachate and treated, resulting in a high water load. If this were diverted and stormwater eliminated, the leachate treatment load would be reduced.
- Similarly, the surface drainage in Cell 3 and Cell 4 is treated as leachate and should be treated as stormwater.
- The Fukuoka method in Cell 2 is not currently functional. The mouth of leachate collection pipe is submerged in the canal and air intake from the collection pipe is not possible. Lowering the water level in the leachate canal might enable air intake, but it is not recommended because the pump may become overloaded.
- The gas vent pipe is also only installed at the end of the first layer, where waste compaction has been completed, and is not structured to actively take in oxygen and lead to the decomposition of pollutants.

# Haag Bosch-2

- Regarding odor complaints from the neighborhood, no odor was observed from Cell 1, but leaked from Cell 2 or during transportation of waste.
- Countermeasures include (1) narrowing down the working area, (2) covering waste with soil, and (3) covering the waste with tarps or other protection sheets during transportation to prevent odor leakage.
- We have measured several locations using a gas detector, but there was no reaction. The above measures need to be implemented as soon as possible, since the human body can detect odors even in trace amounts of different odor substances.







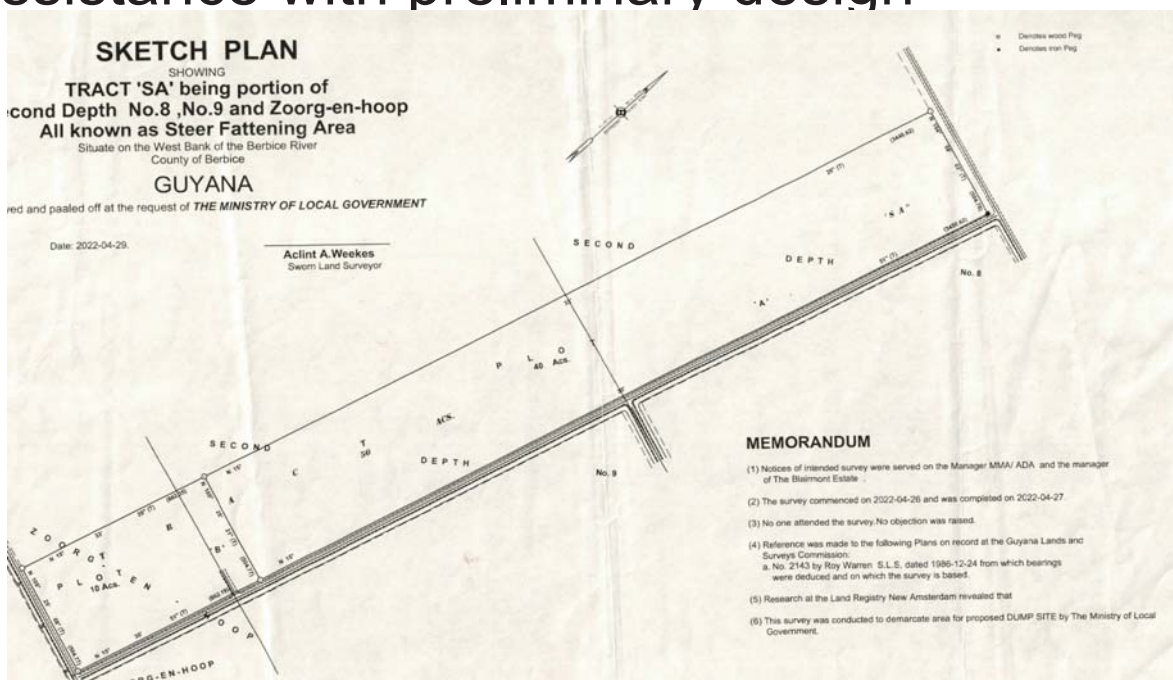






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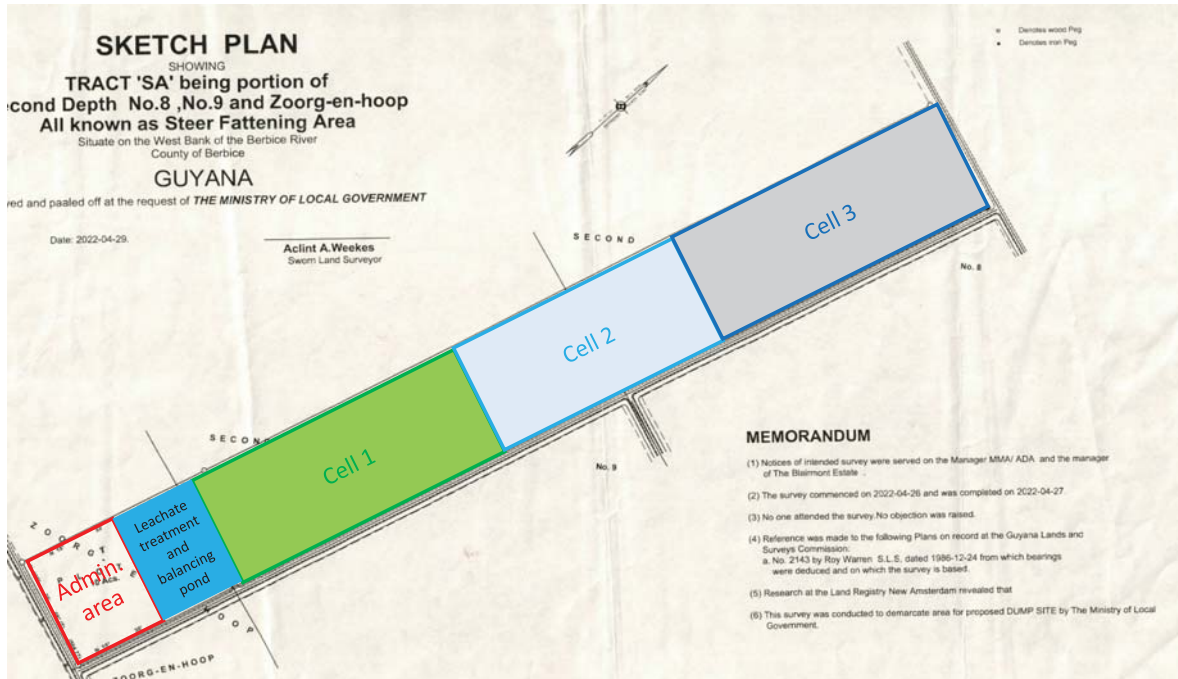
## Visit to Blairmont Landfill site, Region 5 and assistance with preliminary design



16



# Suggestion for land use as a long-term life landfill



17

## Blairmont

- The target population is 20,000 to 30,000 people, we assume.
- Access to the site will be provided by a bridge from the opposite bank of the sugar cane field drainage channel.

18



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## Visit to Zorg-en-Vlygt Landfill Site, Region 2 and assistance with preliminary design



20

# Zorg-en-Vlygt

- Sand layer site.
- As far as we observe the state of the storm water drainage, deeply excavated waste storage structures are unsuitable.
- The shape of the proposed site is a rectangular site with a longitudinal length of 600 meters.
- Access road is narrow and requires a couple of car pools.
- The existing disposal site is an as-is temporary dumpsite.
- For design, it is recommended to be outsourced because the stability of the storage structure is the most important aspect, as mentioned above. Ideas and design concept should be accurately communicated to the design contractor.

21

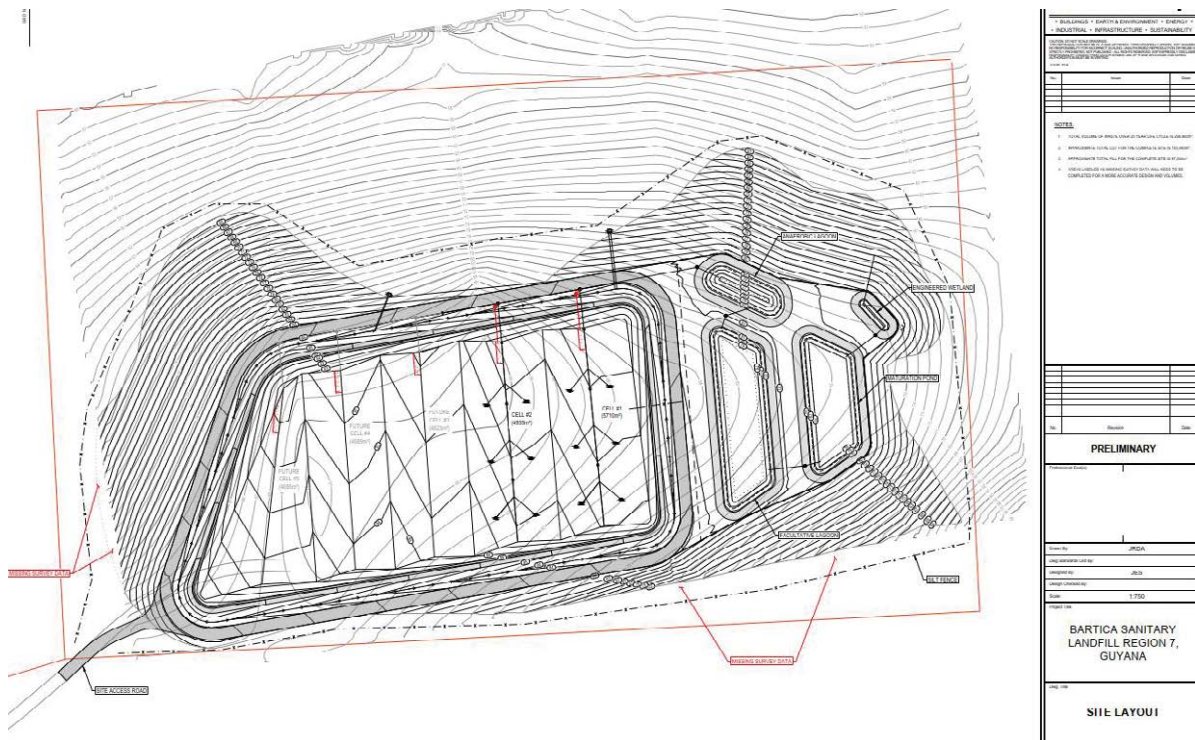








# Visit to Bartica Landfill Site and review of design



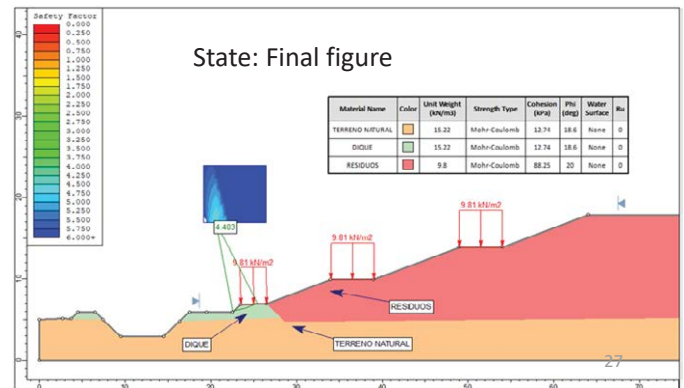
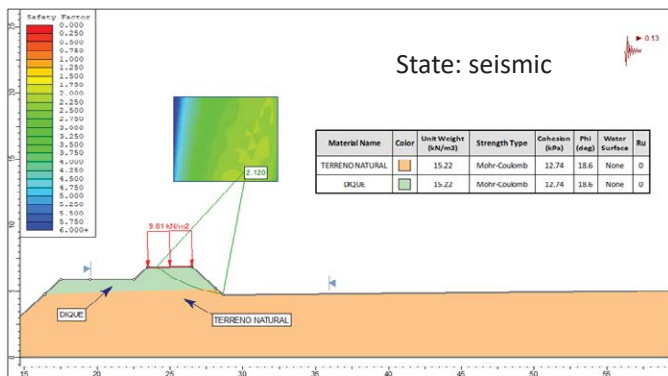
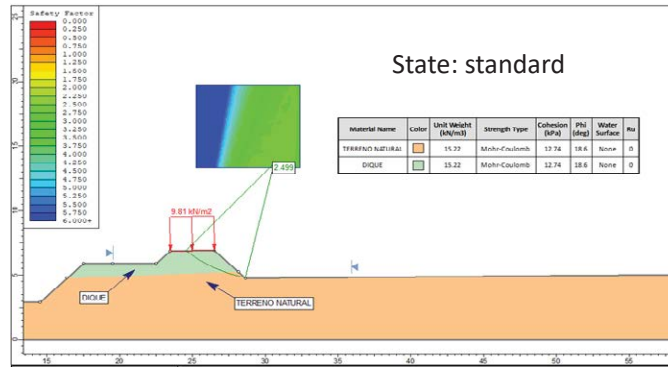
25

## Bartika

- The target population is about 8,000, and will be 15,000 in the future. Existing disposal sites are small and do not have sanitary landfills, and new sites are needed.
- The entire area around the proposed site is a white sand layer, which must be sufficiently stable for the structure to be installed.
- Access road is long. It is a considerable distance from the existing public road. The site was selected based on EPA's evaluation, but it may be too far from residential areas. As a result, access to electricity and water is also not current.
- The last approach section at the entrance to the disposal site has a steep slope and needs to be devised to prevent stacking.
- Structural calculations should be performed to determine if arc-slip is avoided during normal and seismic events with respect to slope stability.
- Do you want to use ground anchor installation?
- The upper side of the structure should have greenery cover with sufficiently gentle gradient.
- For design, it is recommended to be outsourced because the stability of the storage structure is the most important aspect, as mentioned above. Ideas and design concept should be accurately communicated to the design contractor.

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# Example: Structural stability simulation on an embankment



## Bartika - 2

Existing landfill (Byderado dumpsite)

- All fencing around the plot. (Good)
- Open Dump
- No covering soil was used.
- Part of the site is unusable because of the proximity of the houses.

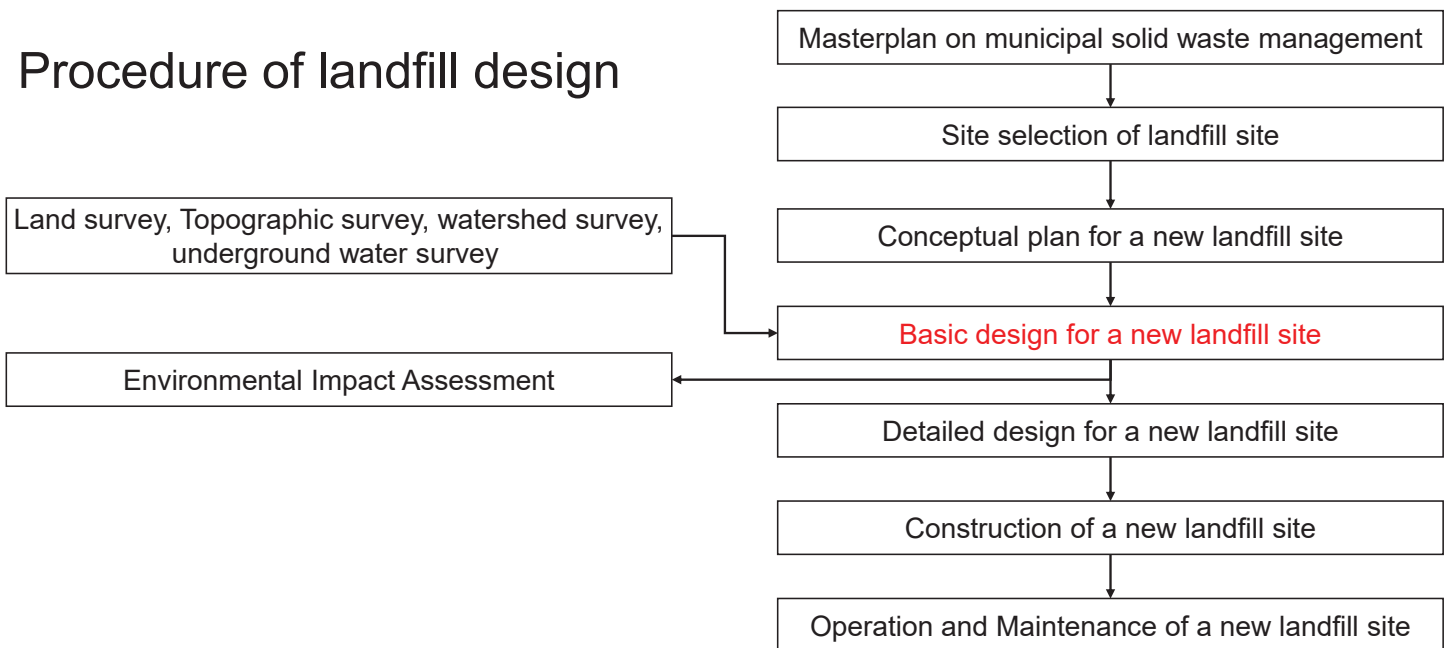






# Final disposal plan and design

## Procedure of landfill design





# Final disposal plan and design

## Items of the design

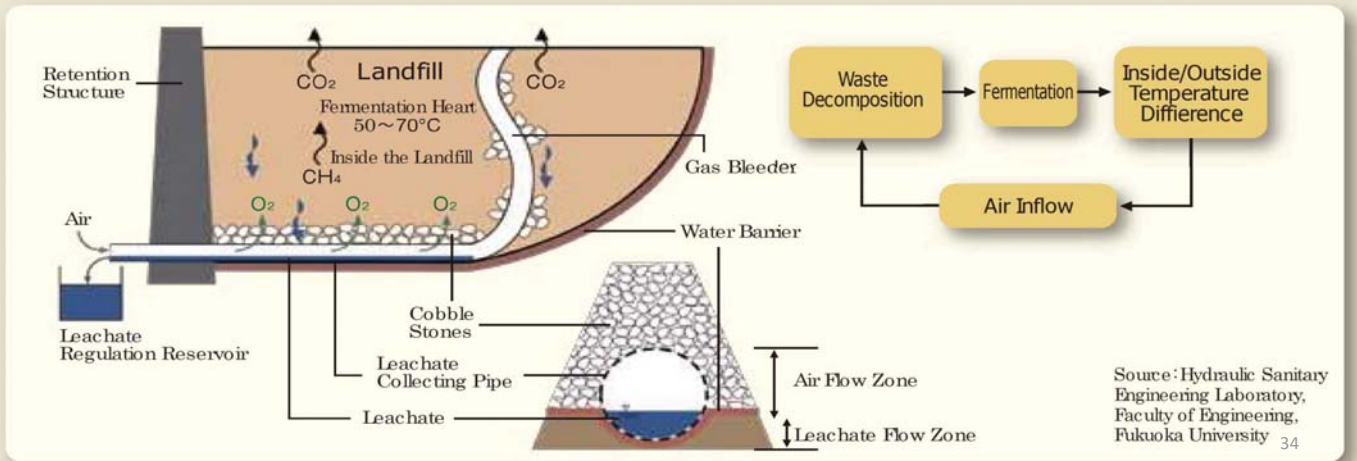
Confirmation of solid waste to be landfilled Specific gravity	Leachate collection system
Grand layout plan	Leachate treatment system
Land improvement design	Gas ventilation system
Storage structure	Weighing system
Underground water collection system	Monitoring system
Liner structure	Administration building
Storm water drainage system	Internal roads

# Semi-aerobic landfill structure

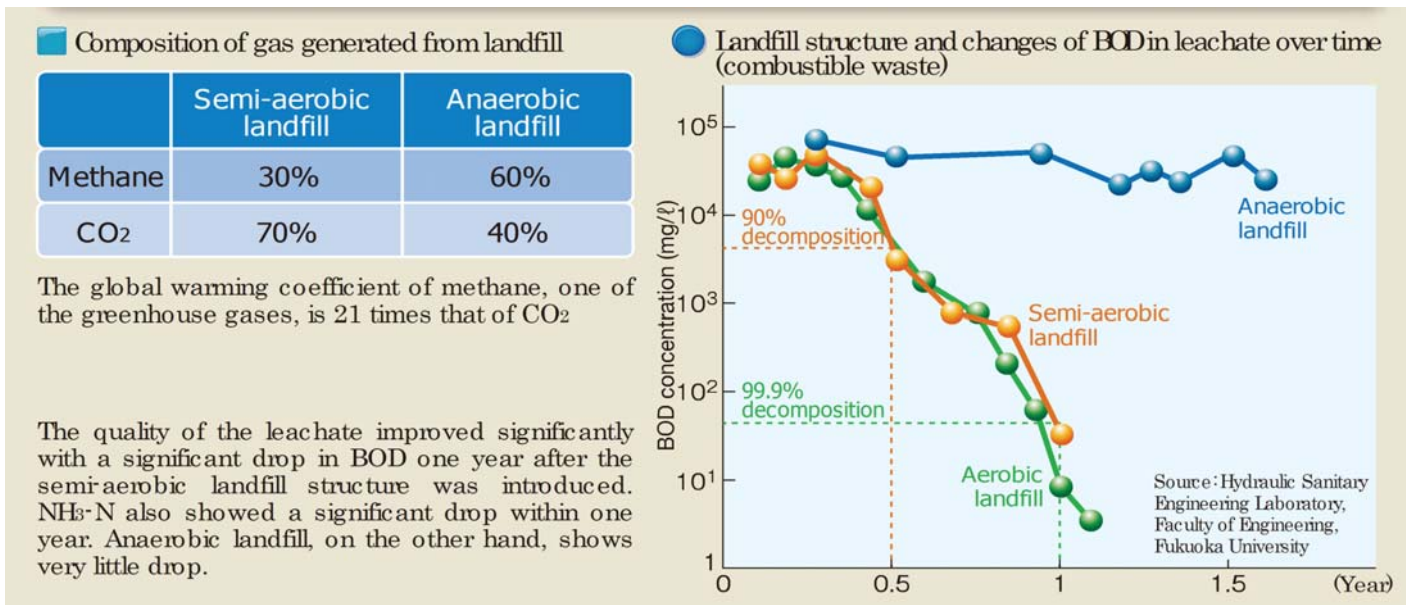
### Features of Semi-Aerobic Landfill

- 1 Better leachate quality than anaerobic landfill
- 2 Low emission of greenhouse gases
- 3 Landfill stabilizes faster than anaerobic type
- 4 Less underground water pollution from leachate
- 5 Cheaper to operate and manage

### Mechanism of semi-aerobic landfill structure



# Semi-aerobic landfill structure



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# Semi-aerobic landfill structure

## Comparison of Landfilling methods

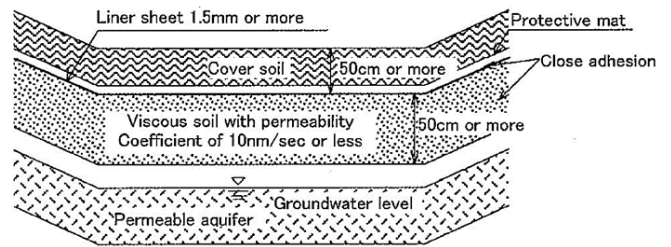
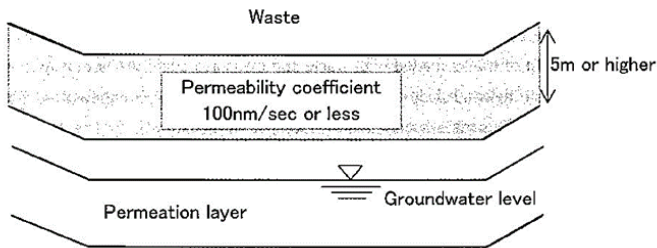
	Semi-Aerobic	Anaerobic
Lead time for land use after closure	Short 5-10 years	Long 10-20years
Generated gas	CO <sub>2</sub> , H <sub>2</sub> O	CH <sub>4</sub> , H <sub>2</sub> S
Odor	Less	More
Capacity of leachate treatment facility	Big	Small

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# Landfill facility

## Liner structure (1)

- Landfill waterproofing systems (structures) – acceptable examples to the regulation

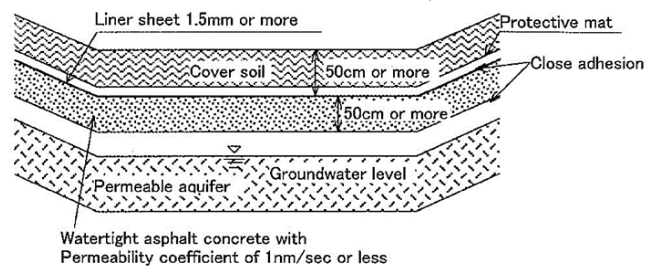
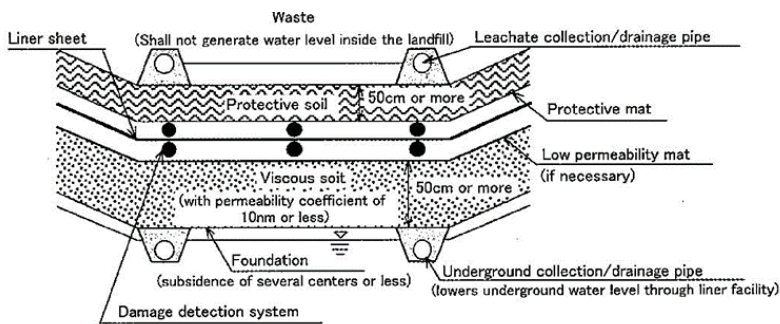


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# Landfill facility

## Liner structure (2)

- Landfill waterproofing systems (structures) – acceptable examples to the regulation



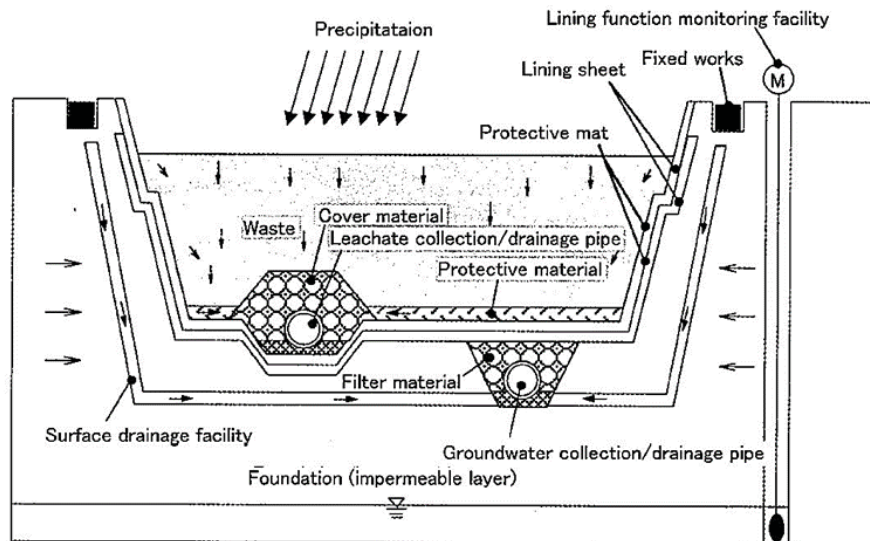
38



# Landfill facility

## Liner structure

- Comprehensive concept for liner structure



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# Landfill facility

## Liner structure

	Standard	Simple	Natural clay layer exists
Type of liner structure			
Unit cost of liner structure	Unit cost XXUSD/m <sup>2</sup> (100%)	Unit cost XXUSD/m <sup>2</sup> (70%)	Unit cost XXUSD/m <sup>2</sup> (50%)

40

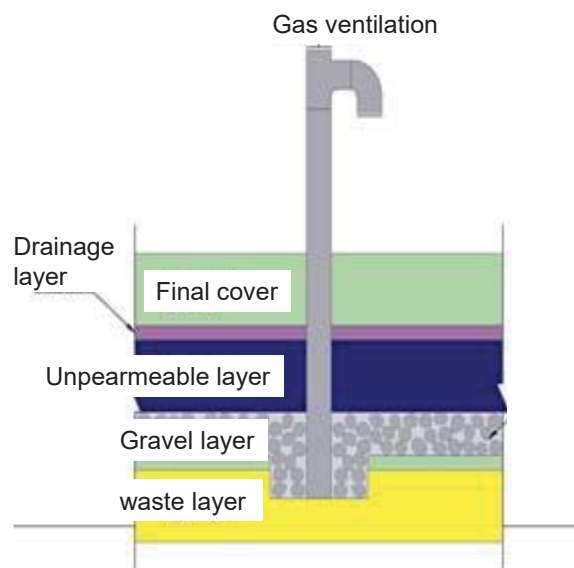
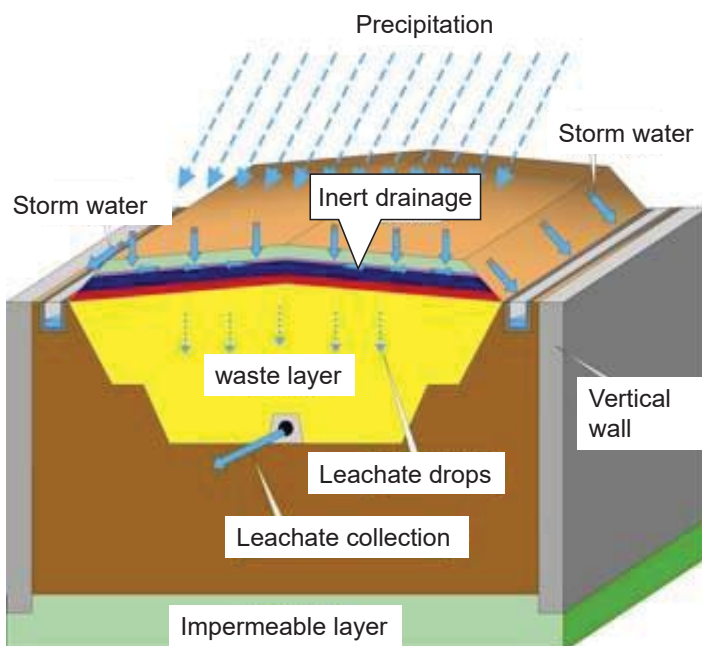


# Landfill facility

## Extension of gas ventilation units



# Safe closure of landfills





# Maintenance of landfills

Good example (from Deglos)



45

# Maintenance of landfills

Practical recovery



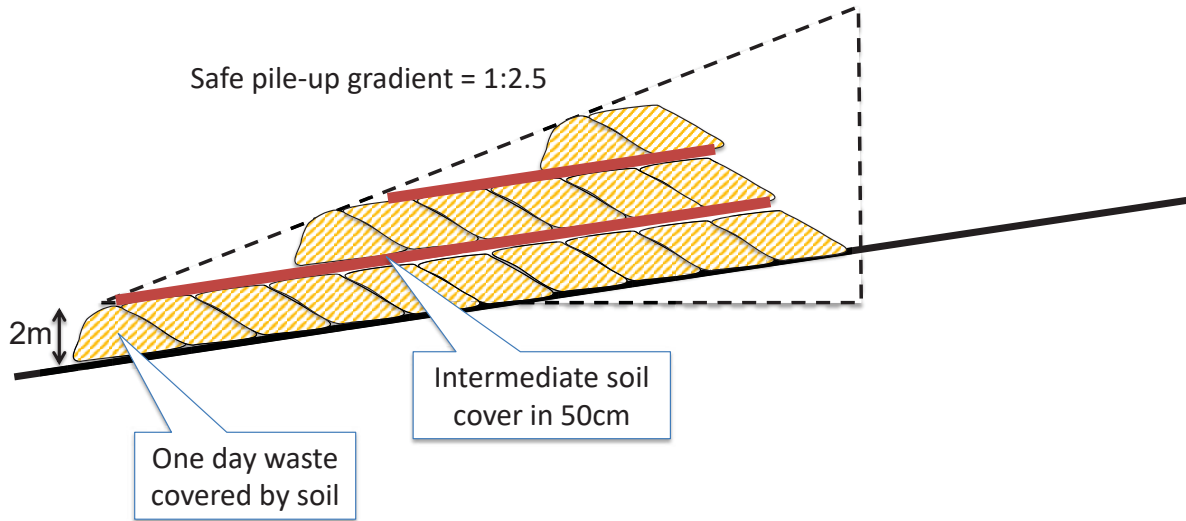
Substitute of Calvert, "Gabion"

46

# Maintenance of landfills

## Practical recovery

### Pile-up waste practice and soil cover



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Thank you for your attention.

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