GALLE CITY



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September 2017

Community-based Solid Waste Management in Galle City

A Pilot Project in China Garden

Introduction

Municipal Solid Waste Management (MSWM) is one of the serious environmental pollution and public health issues in developing countries. The World Bank estimates that current global Municipal Solid Waste (MSW) generation is about 1.3 billion tons and it is expected to increase to 2.2 billion tons per year by 2025[1].

In general, MSWM is a responsibility of the Local Governments (LGs). It is one of the largest single budget allocation, estimated at about 40% of the city's operating budget in low and middle-income countries[2]. However, it was also evident that most of cities are struggling to provide at least the most basic level of MSWM service to its citizens. Typically, one to two-third of the MSW generated in low and middle-income countries are not adequately collected[3]. The uncollected waste is disposed indiscriminately in the streets and in drains, so contributing to flooding, breeding of insects and rodent vectors and the spread of diseases. Further, the collected waste is also disposed on open lands in an uncontrolled manner.

Figiure 1: Landfill site of Galle City





Figure 2: Waste collectors at work

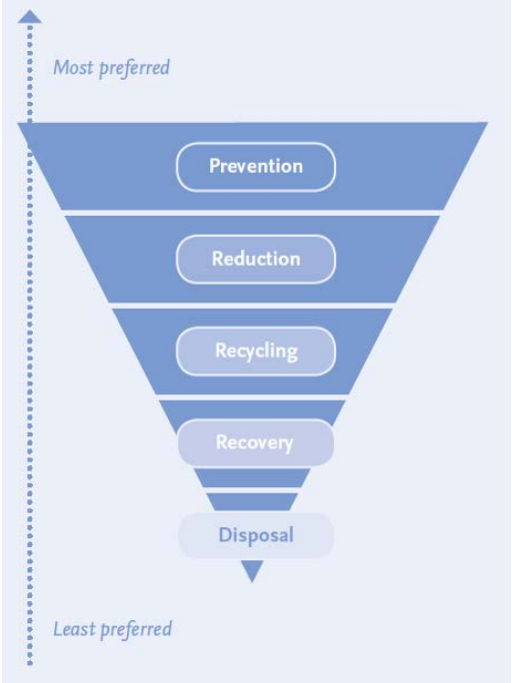
Such inadequate waste disposal is leading to the emission of methane gas, which not only add to global warming and associated climate change, but also leads to increase environmental pollution and public health risks. The global estimations show that MSW landfill is the third largest source of global methane emissions[4]. In this regards, improvement of MSWM in developing countries is getting global attention as one of the key drivers that contribute to achieve sustainable environmental agendas and commitments of the United Nations (UN) such as Pollution Free Plant, Paris Climate Agreement and the 2030 Sustainable Development Agenda/ Sustainable Development Goals (SDGs).

This is not exceptional in Sri-Lanka, one of the fastest growing countries in South Asia. Improving MSWM is now getting a higher national priority after two tragic situations taken-place in 2017 such as dengue epidemic outbreak and landfill collapse in Colombo City.

According to the Epidemiology Unit of the Ministry of Health (MoH) Sri Lanka, approximately 80,732 dengue fever cases, including 215 deaths were reported in the first-half of 2017, which is a 4.3 fold higher than the average number of cases in the same period between 2010 and 2016. It was also identified that a failure to collect MSW is one of the main reasons for standing water pools and other potential breeding grounds for mosquito larvae attribute to the higher number of cases[5].

Further, the Meethotamulla landfill, only a single landfill site owned and operated by the city of Colombo since 1989 was partly collapsed on 14 April 2017 causing a death toll of 32 with another 1,700 families lost their housing[6]. In this background, the Government of Sri Lanka has taken an immediate steps to sign new contracts with the private sector to establish two Waste to Energy (W2E) plants with 10 Megawatts each to incinerate MSW in Western Province aiming to reduce the waste to be landfilled at the end of the pipe. However, according to the Waste Hierarchy, the sustainable waste management system is depended more on following attempts to reduce, reuse and recycle waste at the source before promotion of final treatment and disposal. In this regards, strengthening the participation of citizens and the community-based organizations for MSWM is an important step.

Figure 3: Waste Hierarchy



City to City Cooperation for Improving MSWM in Galle City

Galle, a coastal city with a total population of 101,159 is situated on the southwestern belt of Sri Lanka[7]. The city was one of the major ports and a commercial center during 16th and 17th centuries. Galle is also famous as one of the UNESCO World Heritage Sites in the country for the existence of Galle Fort that was built by the Portuguese. However, like many other fast growing cities in the country, Galle City faces a great challenge in managing its MSW. According to the City Commissioner, a daily waste generation and collection is amounted up to 40 to 50 tons. The city also faces a challenge in finding land for waste disposal in future due to high-rate of urban growth and the current landfill site is also not ideal for dealing with the waste, which results in polluted urban water bodies and increased environmental pollutions. At the same time, the city has taken some efforts to introduce the waste separation at source (bio waste and non-bio waste) since November 2016, increase the waste collection coverage throughout the city, public awareness and reduction of waste to be landfilled by material recycling and composting.

In this background, CITYNET Yokohama Project Office in Japan partnered with the HELP-O, a local Non-Governmental Organization (NGO), to assist in improving the MSWM in Galle City based on the successful experience of Yokohama City, one of environmental model cities in Japan, in achieving a 40% waste reduction target within 5-7 years by making commitments from; citizens to separate waste, business to collect and recycle, and city government to create more sustainable 3R (reduce, reuse and recycle) system with public education.



Figure 4: Informal meeting with the community leaders in China Garden

Meeting with the community leaders in China Garden, Galle City

China Garden is one of the highly populated areas in Galle City. The name is believed to refer to Chinese migrant labourers who were brought to the area for agricultural work in the early 19th century by then the colonial Governor of the country. Currently 270 families are living in the area. Considering the challenges with the existing waste collection system in China Garden, it was selected as a pilot project to implement the community-based solid waste management system. A sample survey carried out by HELP-O identified that there is no regular waste collection service in this area. The majority (66%) put their household waste into the plastic (shopping) bags and bring them to the communal collection points in the main roads. Then, the city's vehicle will collect them from these points and transport to the landfill site. The rest (34%) is practiced throwing their waste into the nearby open spaces, burn or buried. Though, Galle City has been promoting waste separation, a majority (62%) is still not practiced the waste separation at source. However, some households (20%) separate recyclable materials (newspapers and bottles) and sell them to the buyers called Botal Pattare who have visited their houses. A very few families (11%) are doing backyard composting and use the product compost for gardening. Due to lack of space, the majority (66%) are not willing to do the composting at home. It was also observed that few families are doing paper bag making business using the used paper. According to these families, this is the only income in their family.

Figure 5: A member who makes the paper bags





Figure 6: Meeting with the City Commissioner

Project Activities

With the experience of Yokohama City, CITYNET-Yokohama Project Office and the Institute for Global Environmental Strategies (IGES), Galle City and the HELP-O have been implementing a community-based solid waste management project to achieve waste free city in Galle. The main objectives of the project are: (i) to organise an awareness programme, (ii) to strengthen the partnership among stakeholders, (iii) to mobilise the community, and (iv) to establish monitoring system.

Awareness programme

Like many other cities, one of the key challenges faced by the Galle City in improving its waste management system is changing attitudes of the citizens, business, city officials and workers. Citizens need to be changed their current attitudes from throw-away mind to waste reduction and separation at their households. Businesses need to change their production, collection and recycling activities. The political leaders, city officials and workers are also needed to change their attitude about the waste and need to take actions in applying positive changes in the planning and implementation of waste management programmes. Hence, a series of awareness and education programmes are designed and conducted targeting all the important stakeholders (citizens, businesses and city officials).

Partnership among key stakeholders

Building partnership among key stakeholders is necessary for the sustainable operation of the waste management in the city. The project has introduced some measures to strengthen the partnership with civil society groups (Women Groups and local political leaders in China Garden) to get their cooperation for awareness raising, planning and implementation of project activities at community level. The project also started new activities with the schools in the city, involving the environmental student societies, to train and mobilse them to get involve in awareness raising activities as Green Leaders. Further, the project strengthened the partnership with businesses in creating new recycling opportunities. For example, one recycling company called Random Global Private Company signed a new agreement with the city and purchased the separated glass waste (13 tons/ month) that is originally dumped in landfill. In addition, the Light House hotel and Lions Club provided their support for awareness raising and environmental education activities under the company's Corporate Social Responsibility (CSR) programmes.

Mobilise the community

Galle City is divided into 15 wards for administrative purposes. HELP-O and Galle City have selected China Garden, one of the ward among them, as a pilot project area for mobilising the residents to get their support for establishing a new waste management system considering the challenges in providing regular waste



Figure 7: Public awareness programme

collection service by the city in the area. Currently, the city's waste collection service is not available in this area due to the issue of access for waste collection vehicles. Residents are asked to bring their waste to the communal collection points located on the main roads. Due to the long distance to the communal collection points and the irregular collection pattern, most of residents are preferred in throwing their waste to nearby open areas. The pilot project therefore aimed to design a new waste collection system in consultation with the city's waste collection department and the community-based organisations. The new system is suggested to apply a community waste collection system with a bicycle which can come inside the community. The community would advise to separate their waste into wet and dry. Wet waste will be collected three times a week while dry waste will be collected once a week. Further, a project aimed to encourage residents to reduce the waste generation and promote more reuse and recycling activities for improving livelihood generation.



Figure 8: Awareness programme in China Garden

Project monitoring

It was evident that most of the externally supported programmes are failing due to lack of sustainable mechanisms to continue that project activities after the completion of support. Thus, this project aimed to establish the green leaders & sub-committees within the city to continue the programme activities.

Figure 9: Glass waste collection center at landfill site





Figure 10: Composting and bio-gas in Galle City

Lessons Learned and Future Considerations

Formulate a MSWM plan for the city considering the local needs and resources

Galle City has taken some innovative steps in partnership with HELP-O and other interested parties for improving the waste management system. Since November 2016, the city has been promoting the separated waste collection in all 15 wards. The city also set up a waste collection schedule and disposal plan. However, it was evident that these efforts are still in an ad-hoc manner without an integrated waste management plan. This has caused for lack of consistent collection and disposal, low cooperation from citizens, and caused illegal disposal of waste and unnecessary costs of daily operation.

Based on the experience of China Garden, city can develop an integrated waste management plan for the city involving all key stakeholders. The plan should consider all the aspects of waste management starting from waste separation, collection, recycling, treatment and disposal. The plan also needs to consider the relevant policy and financial requirements that are required for the effective implementation of the plan.

The bulk of Gale City's waste shows the potential of composting and bio-gas

According to the city office, the contribution of biodegradable waste is high in the total waste stream. It was estimated that biodegradable materials constituted about 77% of the total waste collected. Of this figure, 59% was made up of food, mostly fruits and vegetable waste, while yard waste contributed the remaining 18%. The recyclable materials such as glass bottles, plastics and aluminum cans were conspicuously low in the waste samples and this figure accounted only 12% in the entire sample. Other residual waste, made up mostly of clothing, broken pots, toys and non-recyclable packaging, constituted about the rest of other 11%.

Because of this large amount of organic waste, the most practical and effective strategy is promotion of composting (aerobic) or/and bio-gas (anaerobic) methods to recycle the organic waste before final dispose.

There is some evidence in practicing both composting and bio-gas methods in the city. A centralised composting facility has been operating by the Southern Provincial Council in Monrovia, 20 KM away from the city. This composting facility accepts the separated biodegradable waste from Galle and other neighbouring cities. Its capacity is 40 tonnes per day and used a windrow composting method. The facility uses back-loaders to make and turn the composting piles. All other operations, including screening and packaging are doing by manually. The observations show that the facility is at full capacity and to be scaled up it needs to introduce some mechanical improvements such as screening, in addition to physical construction. Further, city can promote the household composting, educating residents who have enough space.

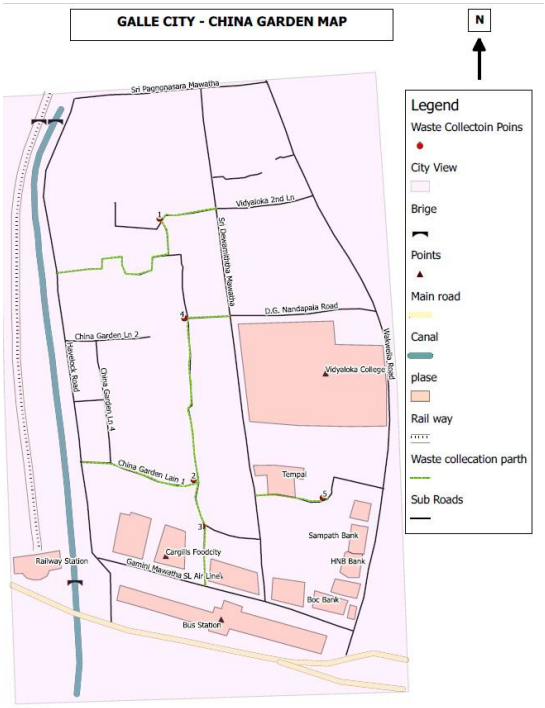


Figure 11: A map of the China Garden

for doing backyard gardening. In addition, HELP-O has been involved in promoting bio-gas at individual and community levels. The results show that bio-gas can also hep to reduce the biodegradable waste to be collected and disposed. Also, the generated methane gas can be collected and used for household cooking purposes, saving about 20% - 30% of family's monthly costs need for LP gases. The observation also identified that these backyard composting or bio-gas activities need a proper monitoring and follow-up advise to sustain the operation.

It can also be recommended to carry out the feasibility study jointly between the experts of CITYNET Yokohama Project Office, IGES, HELP-O and Galle City to identify the potential of a centralised bio-gas facility for Galle City using about 10 - 15 tons of organic waste, targeting the biodegradable waste from city markets. The experience of bio-gas in other Asian and European cities can be shared, but need to consider the capacity and appropriateness to the local conditions.

Engage Citizens and Others

This is a key step, since the sorting of waste is done at the individual household level. A public education program to educate residents about the economic, environmental and social benefits of the 3Rs is essential. Residents can also organise and mobilise to do backyard composting or bio-gas. To address the potential participatory barriers, the assistance of HELP-O and other NGOs, Civil Society Organisations (CSOs) and Community-Based Organisations (CBOs) can be secured through effective partnership building.

The experience of Yokohama City shows that comprehensive awareness and education programmes are important to educate the community about waste management system of the city. These activities need to target all ages and various types of households and continue until the secure of fully support from the citizens. In addition, city needs to build the partnership among other stakeholders such as businesses (formal and informal), schools and academic institutions.

Key steps for Community-Based Solid Waste Management

1 Preliminary Meetings
A series of preliminarily meetings need to be organized to consult and create awareness among city officials and citizens.

2 Development of Waste Profile
A sample survey is conducted to understand the waste characteristic and awareness.

3 Building partnership
Assign supportive sub-committees at the city and community level to strengthen the public, private and community partnership

4 Organizing community
Recruit Green Youth Leaders and community cluster leaders, conduct awareness programmes.

5 Develop a new MSWM system
Design a new system with citizen.

6 Introduce a new MSWM
Introduce the new waste separation and collection system.

7 Experience sharing
Experience of pilot project will be documented and shared with other neighbouring communities.

Figure 12: Environmental education programme at school





Figure 13: Community leaders meeting in China Garden

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CITYNET YOKOHAMA

IGES Institute for Global Environmental Strategies

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Integrated Solid Waste Management Action Plan
Galle Municipal Council, Sri Lanka (2024 - 2030)



Submission Date: November, 2023

This publication was produced for review by the United States Agency for International Development by Tetra Tech under the Clean Cities, Blue Ocean Program.

Contract Number: AID-OAA-I-14-00059/7200AA19F00016
Contract Period: August 29, 2019 to August 27, 2024
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This publication was produced for review by the United States Agency for International Development by Tetra Tech, through USAID Contract No. AID-OAA-I-14-00059/7200AA19F00016, USAID Clean Cities, Blue Ocean Program.

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This publication is made possible by the support of the American people through the United States Agency for International Development (USAID). The contents of this publication are the sole responsibility of Tetra Tech and do not necessarily reflect the views of USAID or the United States Government.

Executive Summary

This Integrated Solid Waste Management Action Plan was prepared by HELP-O (Human and Environment Links Progressive Organization) for the Galle Municipal Council of Sri Lanka, under the 'Collaborative Action For the Clean City of Galle' Project, which is collaboratively implemented by HELP-O and the GMC under the financial and technical support of the USAID, Clean Cities, Blue Ocean flagship programme implemented by Tetra Tech.

The aim of developing the ISWMAP is to have a single SWM Action Plan for the GMC with defined goals, objectives, strategies, actions, milestones, and roles and responsibilities covering the most impactful types of solid waste generated from all residential, industrial, commercial, and service sectors. This SWM Action Plan ensures that actions are being taken for an optimum and sustainable solution for the Municipal Solid Waste, to have a capable and knowledgeable Municipal Council for effective 3R-based (Reduce, Reuse, Recycle) SWM, to ensure collaborative support of a knowledgeable and dedicated team of stakeholders for the city-wide SWM, and finally, Galle to be a model city with replicable creative and innovative SWM solutions for local government bodies in Sri Lanka and around the world. In addition, this plan is a step forward from the current GMC practice of simply handling the waste generation to innovative approaches for ensuring circular economy principles.

Similar to other cities, residential, commercial, industrial, and service sectors generate a large amount of waste within the GMC area, contributing to significant health and environmental issues. This has never been studied or assessed by anyone prior to the Baseline Waste Assessment Study (BWAS) and the Waste Audit and Characterization Study (WACS) conducted by HELP-O under the CCBO support in between November 2022 and February 2023. The above two studies have found that approximately one-third (31.43%) of the waste generated in the GMC area is collected by the GMC and the rest was either collected through informal means or disposed of in the environment through burning, burying, or discarding, causing health and environmental problems.

As per the above studies, it was found that the residential, commercial, industrial, and service sectors together generate approximately 24,958.7 MT of waste annually. From this, 7,840.2 MT of waste (31.43%) is collected by the GMC by utilizing their available resources. In addition, there are specific waste hotspots in Galle MC area (e.g. hospitals, schools, tourist hotels, restaurants, fisheries harbor, prison, and Naval base) that require additional attention due to the high number of users/ visitors, high amount of waste generation, and having difficulties in properly managing their waste. Moreover, as per the findings of the BWAS, several underserved communities also face similar issues regarding managing their waste.

Furthermore, in a comprehensive Cost of Service Analysis (COSA) conducted focusing on the GMC, it was found that Rs. 21,359.00 per MT (US$ 67.81) is spent by the GMC to manage solid waste. Based on the Revenues Analysis, it was found that the income per Metric Ton of solid waste is Rs. 1365.64, which is significantly lower than the cost incurred in managing a single Metric Ton of solid waste (by Rs. 19,993.00). Hence, SWM has become not only a significant health and environmental issues but also a critical financial burden for the GMC over the years, showcasing similar experience to other local authorities in Sri Lanka.

To address these issues, the GMC (and also other Local Government Bodies) has dedicated with diverse legal provisions under the Municipal Council Ordinance No. 29 of 1947, Provincial Councils

and Local Government Circular 01/2015, the National Environment Act (No. 1627/19 - 2009.11.10), Standard By-Law of the Southern Provincial Council (No. 1834 – 2013.10.25, No. 1834 – 2013.10.27), and so forth. Under the CCBO Governance Gap Analysis study, it has been found that the GMC has full compliance with 03 provisions (12%), partial compliance for 12 provisions (48%), and out of compliance for 10 provisions (40%), out of 25 provisions, as mentioned above. The GMC also gets support from diverse governmental institutions, such as Ministry of Environment, Central Environmental Authority, Marine Environment Protection Authority, Urban Development Authority, and Coast Conservation and Coastal Resource Management Department for SWM. In addition, there are many stakeholders as well in the city who are with capacity and passion to collaboratively work with the GMC in SWM. Some of these stakeholders are highly important when it comes to SWM and some of them are highly influential when it comes to an SWM intervention.

Currently, the GMC implements a highly commendable Waste Management System with its available resources. The GMC has a comprehensive solid waste collection system, where it collects only the segregated waste in a regular pattern. Door-to-door waste collection service is in place for residential, commercial, industrial, and service sectors, covering 81%, 85%, 64%, and 78% of entities, respectively. Common waste disposal locations are also provided in designated places (e.g. Bus terminals, Galle Fort). The GMC also owns a waste collection center and a compositing yard (Kawashima) at Heenpendala and a dry recyclable waste collection, baling, and storing facility at Dadella (COWAM Center), both within the GMC area. In addition, with the help of the USAID, the GMC has attempted to improve its SWM system to provide a more sophisticated service for citizens. Waste collection route optimization, training and awareness for labor force, and improvements in the SMW vehicle fleet and infrastructure at Heenpendala are some of those developments that the GMC has achieved with the support of the USAID.

With all those improvements, the GMC still faces many challenges regarding SWM. For example, when it comes to waste collection, it has been found that the GMC still receives a significant amount of mix waste that is difficult to process and most of the waste collection vehicles shall be condemned or repaired as they are either too old or not in usable condition. Similarly, regarding processing of waste, most of the facilities are not functioning at their fullest and they are lacking sufficient sanitary and other facilities required for the laborers who work there, especially for women laborers. When it comes to waste disposal, there has been many public objections and concerns regarding disturbances and environment pollution, therefore, there shall be a more a sanitary and environmentally friendly disposal mechanism and a mechanism to hear community grievances regarding disposal of waste. Likewise, there are many challenges in the SWM process that need to be addressed, if the GMC to succeed in SWM.

Accordingly, this plan provides a framework for the overall SWM within the GMC area. Considering the significance of Galle as a city with a world heritage site (i.e. Galle Fort) and a well-liked tourism destination of Sri Lanka, the vision of the plan is "Galle: The Cleanest Destination of Sri Lanka". The vision is guided by the principles related to SWM: Circular Economy, Life Cycle Consideration, 3R Concept (Reduce, Reuse, Recycle), Polluter Pay, Beneficiary Pay and the Compensation, Responsibility Sharing, and Public Trust. Five goals have been formulated focusing on ensuring optimum and sustainable solution for the municipal solid waste, to have a capable and knowledgeable Municipal Council for effective 3R-based SWM, to ensure collaborative support of a knowledgeable and dedicated team of stakeholders for the city-wide SWM, and finally, Galle to be a model city with replicable creative and innovative SWM solutions for local government bodies in Sri Lanka and around

the world. Under each goal, several objectives have been formulated, considering diverse aspects associated with the goals. When formulating strategies, the attention was paid to make them more realistic and implementable. Considering the importance and urgency, the strategies were prioritized and the timeframe for implementing the strategies were decided based on their priority level. The roles and responsibilities associated with the implementation of the strategies were assigned to respective officials and bodies, that are existing or will be formed under this plan. All these goals, objectives, and strategies were formulated in a collaborative exercise that involved several rounds of consultations with city stakeholders and a comprehensive study of previous SWM plans and studies.

Currently, the SWM at GMC is simply a work of handling the waste generated within the GMC area with available resources. However, through the implementation of this plan, it is expected that the GMC will go a step forward, where it will depend on waste data and information when taking decisions, will appreciate a collaborative approach in SWM, will look into diverse cost-cutting and revenue generation paths, will adopt creative and innovative SWM practices and share that information with other cities, and finally, will led by the long-term vision to become the 'Cleanest Destination in Sri Lanka' for visitors.

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Acronyms

ISWMAP	Integrated Solid Waste Management Action Plan
HELP-O	Human and Environment Links Progressive Organization
GMC	Galle Municipal Council
CACG	Collaborative Action for Clean City of Galle
USAID	United States Agency for International Development
CCBO	Clean Cities, Blue Ocean
SWM	Solid Waste Management
BWAS	Baseline Waste Assessment Survey
WACS	Waste Audit and Characterization Study
UNESCO	The United Nations Educational, Scientific and Cultural Organization
JICA	Japan International Cooperation Agency
MT	Metric Tons
PS	Pradeshiya Sabha
GNDs	Grama Niladhari Divisions
3R	Reduce, Reuse, Recycle
SBC	Social Behaviour Change
MC	Municipal Council
NGOs	Non-governmental Organizations
CDCs	Community Development Councils
UDA	Urban Development Authority
MEPA	Marine Environment Protection Authority
FAO	Food and Agriculture Organization
UN	United Nations
LAs	Local Authorities
CEA	Central Environmental Authority
DS	Divisional Secretariat
CBOs	Community Based Organizations
HHs	Households
CLG	Commissioner of Local Government
MRF	Material Recovery Facility
SPLGD	Southern Province Local Government Department
EPR	Extended Producer Responsibility
SWOT	Strengths, Weaknesses, Opportunities and Threats
COSA	Cost of Service Analysis
LKR	Sri Lanka Rupee
PPP	Public Private Partnerships
PAYT	Pay as You Throw
KPIs	Key Performance Indicators
IWCs	Informal Waste Collectors

1. Introduction

This Integrated Solid Waste Management Action Plan (ISWMAP) is prepared by HELP-O (Human and Environment Links Progressive Organization) for the Galle Municipal Council (GMC) of Sri Lanka, under the 'Collaborative Action For the Clean City of Galle (CACG)' Project, which is collaboratively implemented by HELP-O and the GMC under the financial and technical support of the USAID (United States Agency for International Development), Clean Cities, Blue Ocean (CCBO) flagship programme implemented by Tetra Tech. The aim of the CACG project is promoting an efficient Solid Waste Management (SWM) system in the City of Galle via reducing the generation of plastic waste and promoting a city-wide waste management system.

The aim of developing the ISWMAP is to have a single SWM Action Plan for the GMC with defined goals, objectives, strategies, actions, milestones, and roles and responsibilities covering the most impactful types of solid waste generated from all residential, industrial, commercial, and service sectors, with the consensus of key stakeholders. This SWM Action Plan ensures that actions are being taken for an optimum and sustainable solution for the Municipal Solid Waste, to have a capable and knowledgeable Municipal Council for effective 3R-based (Reduce, Reuse, Recycle) SWM, to ensure collaborative support of a knowledgeable and dedicated team of stakeholders for the city-wide SWM, and finally, Galle to be a model city with replicable creative and innovative SWM solutions for local government bodies in Sri Lanka and around the world.

An ISWMAP can be a valuable tool for decision-makers to coordinate with the community in several ways. Here are some key benefits:

- Coordinate with community and stakeholders involved in waste management.
- Understand current waste management practices and systems in place.
- Identify challenges, deficiencies, and current system needs.
- Identify opportunities and set priorities for improvement.
- Identify resources, financial and budget needs (capital costs and operations costs)
- Set goals/targets and measure progress each year.
- Revisit and modify priorities as the plan is implemented.
- Communicate the plan goals, recommended improvements and implementation schedule to community, stakeholders, and external agencies.
- Develop social and behavior change programs.
- Provides a comprehensive and holistic approach to managing solid waste.
- Can guide decision-makers in the development of infrastructure for waste management.
- Include regulations and guidelines for waste management and can be used to enforce proper waste disposal practices within the community.

As ISWMAP serves as a roadmap for decision-makers to coordinate with the community in addressing waste management challenges. It promotes collaboration, educates the public, and ensures that waste management strategies are tailored to the specific needs and preferences of the community.

The preparation of the ISWMAP for the GMC was primarily based on the findings and recommendations of the several assessments.

I. Baseline Waste Assessment Survey (BWAS) conducted during November 2022 and February 2023,
II. Waste Audit and Characterization Study (WACS) conducted in January 2023,
III. Route Optimization and Test Run conducted for 3R/SWM service delivery August 2022 and May 2023.
IV. 3R/ Cost of Service Analysis conducted August 2023.
V. 3R/ Solid Waste Governance Management Funding Options conducted October 2023.
VI. 3R/Solid Waste Governance Management Gap Analysis August 2022
VII. The current practice of SWM by the GMC and diverse stakeholders in the city through a participatory approach.

In the preparation of the ISWMAP, an exposure visit was conducted to the Negombo Municipal Council area to study their SWM Plan, which was prepared in 2018-2019 with the guidance received from the Ministry of Environment. A group of 30 persons representing the GMC participated in a single day site visit and a consultation session at the Negombo Municipal Council area. The purpose was to capture lessons learned, and understand the challenges faced during the ISWMAP preparation and implementation. The knowledge and experience gained from this exposure visit was highly beneficial when developing more practical and sustainable ISWMAP for the GMC.

In addition to the above Exposure Visit, three (03) Consultation Sessions were conducted with key stakeholder groups in the city to get their insights for the preparation of the ISWMAP. These consultation sessions were conducted with (1) GMC representatives, (2) private, government, and non-government sector representatives, and (3) community representatives with technical input from the project team. The participation of women and other minority groups was ensured in these consultation sessions.

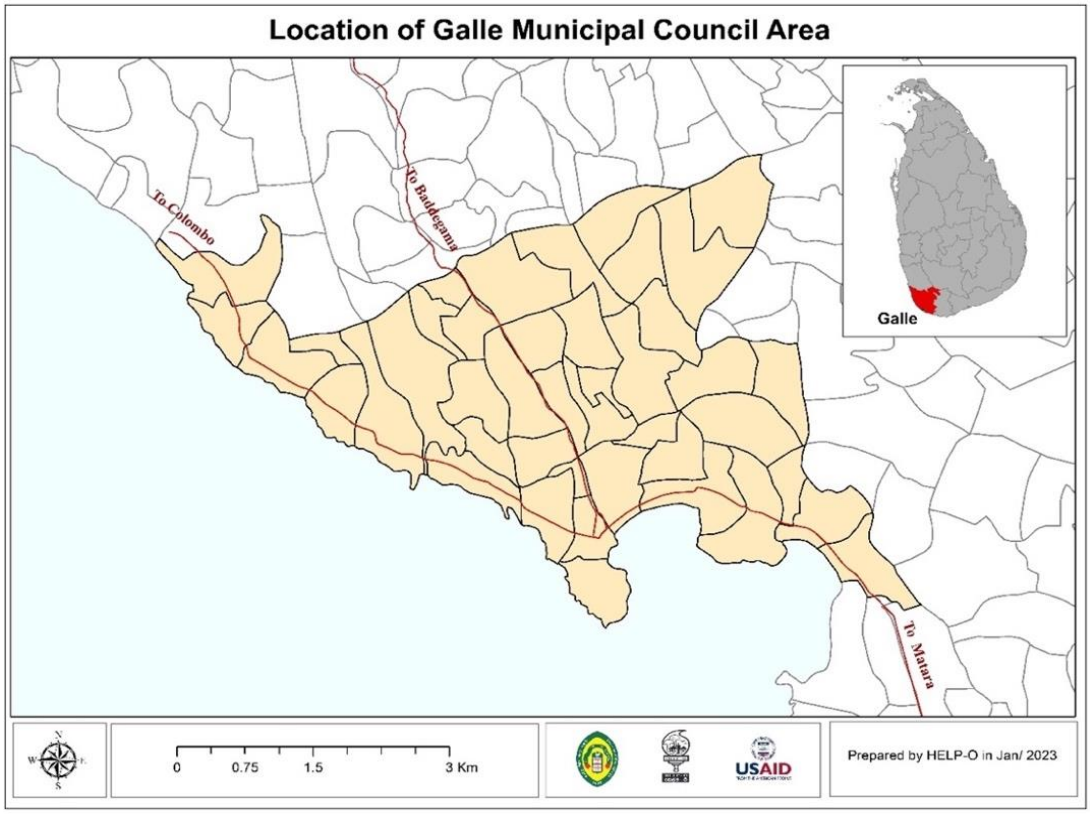
Local government bodies shall have their own ISWMAP to identify, evaluate and develop short and long-term strategies and options to best manage their waste in a cost-effective manner thus to ensure public health and the environment sustainability. Accordingly, this ISWMAP provides an overview of a need analysis done focusing on the current GMC SWM system, a review of applicable laws/ regulations, an assessment of ongoing trends and best practices related to 3R and SWM, and a compilation of short and long-term strategies and actions to manage waste in a cost-effective manner to ensure public health and the environment sustainability.

Moreover, this ISWMAP is a logical guidance and a long-term vision for the GMC in waste management practices, waste collection, and disposal. This will be a useful guiding manual to implement 3R practices and SWM principles in the GMC with stakeholder participation. Also, this will be a useful exercise to identify the required local policies, programs, approaches, and plans to strengthen the municipal SWM, including collection, transportation, disposal, and recycling. Implementation plan for the activities was developed by incorporating the ideas shared during the consultation sessions.

2. Background Information

Galle is the capital of the Southern Province in Sri Lanka (Map 1). The city is considered a prominent tourist destination due to its designation as a UNESCO (The United Nations Educational, Scientific and Cultural Organization) world heritage site. The city's culture and the colonial architecture of the Dutch Fort attract a large number of local and international visitors (Dharmasiri, 2019; Jayasekera and Karunarathna, 2019). Similarly, Galle is the fastest-growing urban and service center and the administrative capital of the Southern Province. It acts as a service center for the entire southern region and attracts a large number of commuting people daily through the major arteries connecting other cities.

As per the GMC Resource Profile, the current population of the GMC area is about 103,600. The Average population growth of the Galle Four Gravets (where the GMC is located) is approximately 0.75%, as per the 2012 survey data of the Department of Census and Statistics.



Map 1: Location of GMC Area (Prepared by HELP-O)

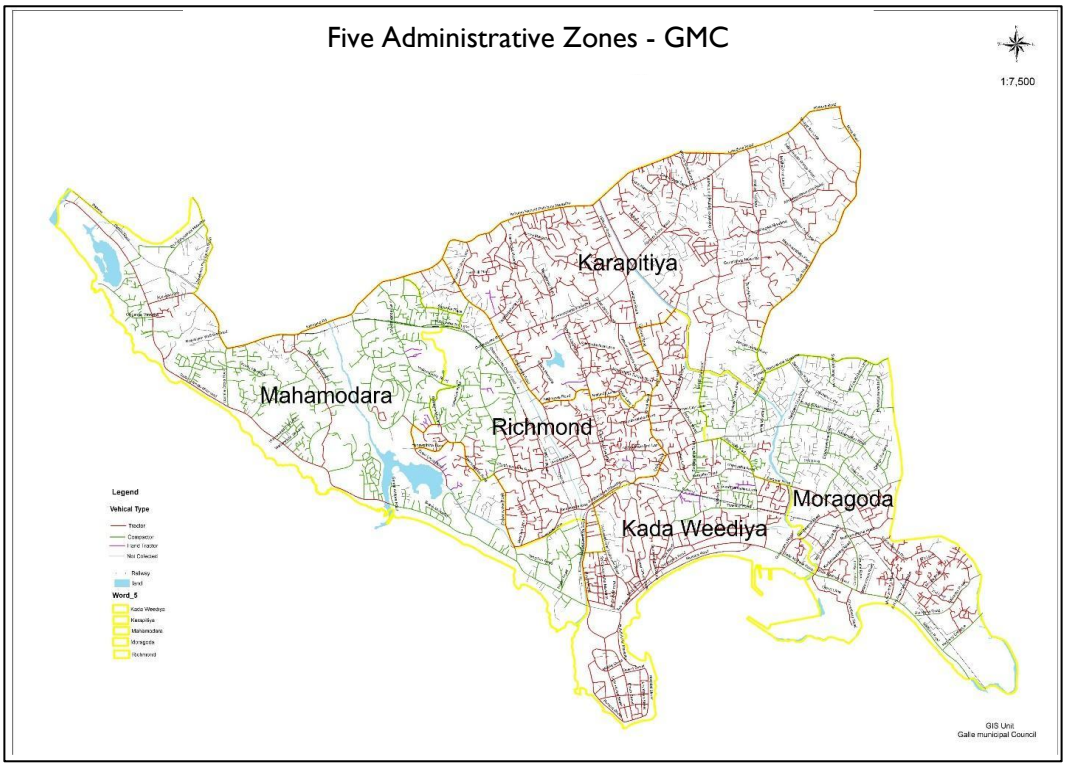
Similar to other cities, residential, commercial, industrial, and service sectors generate a significant amount of waste within the GMC area, contributing to significant health and environmental issues. This has never been studied or assessed by any of the governmental, nongovernmental organizations or citywide research prior to the BWAS and WACS conducted by HELP-O under the CCBO support in between November 2022 and February 2023. Confirming the estimates by the Japan International Cooperation Agency (JICA), the above two studies found that approximately one-third (31.43%) of the waste generated in the GMC area is collected by the GMC and the rest was either collected through informal means or disposed of in the environment through burning, burying, or discarding,

causing significant health and environmental problems. Frequent flash floods and major water bodies such as the Gin-Ganga, Moda-Ela, and Moragoda Ela carry most of the uncollected waste, both degradable and non-degradable, directly into the ocean.

As per the BWAS and WACS results, it was found that the residential, commercial, industrial, and service sectors together generate approximately 68.38 MT of waste per day. From this, 21.48 MT of waste (31.43%) is collected by the GMC by utilizing their available resources. In addition, there are specific waste hotspots in Galle MC area that require additional attention due to the high number of users/ visitors, high amount of waste generation, and having difficulties in properly managing their waste. These hotspots include the hospitals, schools, tourist hotels, restaurants, fisheries harbor, prison, and Naval base. Moreover, as per the findings of the BWAS, several underserved communities also face similar issues with regard to managing their waste.

Currently, the GMC holds the key responsibility in collecting and managing the waste within the GMC area under the powers vested to it under the Municipal Council Ordinance No. 29 of 1947 and subsequent amendments. The GMC was established under the gazette no. 357 on November 17 in 1866 as the third Municipal Council of Sri Lanka, after Colombo and Kandy. The land area of the GMC is about 16.5 Sq. Km. and is bounded by the ocean from the South and the Southwest, Hikkaduwa Pradeshiya Sabha (PS) from West and Northwest, Bope-Poddala PS from North, Akmeemana PS from East, and Habaraduwa PS from Southeast. The GMC consists of 20 Municipal Wards, from which the council members are elected from (Map 2), and 43 Grama Niladari Divisions (GNDs), which are the grassroot level administrative divisions in Sri Lanka.

For the ease of administration, the GMC area has further been divided into the five zones, namely Mahamodara, Richmond, Karapitiya, Moragoda, and Galle Bazar (Kadaweediya), each zone consisting of several Municipal Wards and an equal proportion of population (Map 3).



Map 2: Five Administrative Zones of the GMC (Prepared by the GIS Unit, GMC)

Besides the current national and local policies on SWM (e.g. The National Policy on Waste Management in 2016 and National Action Plan on Plastic Waste Management 2021), the above discussed challenges faced by GMC are found to be common in most of the local government bodies in Sri Lanka. As per the findings of the field level studies, insufficient knowledge and capacity of local government bodies and lack of awareness among the public on 3R/ SWM are the key causes of these challenges. Gaps in the enforcement of laws or lack of legal instruments regarding SWM to address unacceptable or illegal behaviors is also found to be a key challenge in this endeavor. Therefore, while looking for funding opportunities or alternatives for the existing resource gaps of local government bodies, a positive Social Behavior Change (SBC) among the public and the administrators towards a progressive 3R/ SWM system and ensuring that there are supportive legal and regulatory instruments to control illegal and unacceptable behaviors is essential.

3. Steering Committee

a. The Current Institutional Setup of the GMC for SWM

The Municipal Councils Ordinance No. 29 of 1947, under which the GMC has been established, mandates that MCs take responsibility for solid waste management within their respective areas. According to the Ordinance, the following are some of the responsibilities of Municipal Councils (MCs) in solid waste management:

- **Collection of waste:** MCs are responsible for collecting solid waste from households, businesses, and other establishments within their areas.
- **Transportation of waste:** MCs are responsible for transporting solid waste from collection points to disposal sites.
- **Disposal of waste:** MCs are responsible for disposing of solid waste in a safe and environmentally sound manner.
- **Public education:** MCs are responsible for educating the public about solid waste management practices.
- **Enforcement of regulations:** MCs are responsible for enforcing regulations on solid waste management.

The Ordinance also gives MCs the power to:

- Impose fines on those who violate solid waste management regulations.
- Close businesses that do not comply with solid waste management regulations.
- Take legal action against those who violate solid waste management regulations.

In an MC, Mayor, Deputy Mayor, and Municipal Commissioner are the three main officials and they hold different responsibilities regarding the above roles and responsibilities attached to an MC. Though, they all work together to ensure that the council functions effectively. The Mayor is the head of the municipal council. He/she is elected by the councilors and has the power to preside over council meetings and to make decisions on behalf of the council. The Mayor is also responsible for representing the council to the public and to other government agencies. The Deputy Mayor is the second-in-command of the Municipal Council. He/she assists the Mayor in his/her duties and takes over as Mayor if the Mayor is unable to fulfill his/her duties. The Deputy Mayor is also responsible for overseeing the day-to-day operations of the council. The Municipal Commissioner is the chief executive officer of the municipal council. He/she is appointed by the provincial government and is responsible for implementing the decisions of the council. The Municipal Commissioner is also responsible for managing the staff and resources of the council. The specific responsibilities of the Mayor, Deputy Mayor, and Municipal Commissioner are outlined in the Municipal Councils Ordinance No. 29 of 1947.

The Mayor, Deputy Mayor, and Municipal Commissioner play an important role in the administration in GMC. They are responsible for ensuring that the MC functions effectively and that they provide the services that the people need. Under the jurisdiction of the above three key roles, there are five Standing Committees within the GMC, each of which is led by a Committee Chairman. Standing Committees and their responsibilities are specified below.

- **Finance:** This committee is responsible for overseeing the financial affairs of the GMC, including budgeting, revenue collection, and expenditure.
- **Industry, City Development, Solid Waste Management, Planning, and Water and Electricity:** This committee oversees the matters related to industries, city development, SWM, planning and water and electricity service provision.
- **Housing, Community Development, and Child Welfare:** This committee is responsible for overseeing housing, community development, and child welfare.
- **Health and Sanitation: Roads and Buildings Committee:** This committee oversees the matters related to health and sanitation.
- **Environment, Public Parks, Sports, and Cultural Affairs:** This committee is responsible for overseeing the matters related to the environment, public parks, sports, and cultural affairs.

Each standing committee is chaired by a Council Member and has several other Council Members as members. The standing committees meet regularly to discuss and make recommendations on matters within their purview. The recommendations of the standing committees are then considered by the Council for approval.

As of December 2023, in the absence of an elected council, these Standing Committees are under the purview of the Municipal Commissioner. The overall responsibility of Waste Management is dedicated to the Municipal Engineering Department and other departments contribute to the overall SWM within their scope. The Municipal Engineer overlooks the overall human resource management, waste collection, and waste disposal, whereas the Chief Technical Officer is responsible for technical management. The Technical Officer is also responsible for supporting Municipal Engineer in managing human resources attached to the SWM System (e.g. Supervisors, Laborers, Drivers), such as in waste collection, transportation, and processing. The responsibility of the Community Development Officers is to organize public awareness programs on Waste Management, whereas the Chief Medical Health Officer overlooks health aspect of the SWM.

4. Stakeholder Analysis

Stakeholder analysis for 3R (Reduce, Reuse, Recycle) and Solid Waste Management (SWM) service delivery involves identifying and assessing the individuals, groups, and organizations that are affected by or can influence the success of waste management initiatives. The process of the Stakeholder Analysis was begun by identifying all relevant stakeholders involved in or affected by 3R/SWM service delivery. This was primarily conducted by the HELP-O team. Accordingly, the stakeholders include government agencies, local authorities, waste management companies, environmental organizations, businesses, community members, and regulatory bodies.

As the second step of the analysis, the following table was developed with the inputs received from the GMC and CCBO to identify the most influential and important stakeholders in the GMC area that are playing or can play a significant role in the SWM. A 1-5 Likert scale was used to rank the stakeholders and put them into four categories such as High Influence - High Importance, High Influence - Low Importance, Low Influence – High Importance, and Low Influence – Low Importance, based on their scope of work and the current engagement in the SWM related activities. It is possible to identify the most influential and important stakeholders just by looking at this table.

Table 1: Analysis of the Level of Engagement of Diverse Stakeholders in the SWM of the GMC

High Importance, High Influence	**High Influence, Low Importance**
1. Galle Municipal Council 2. HELP-O 3. Clean Cities Blue Ocean Program, USAID 4. Galle Four Gravets Divisional Secretariat 5. Environment Division, Police Station 6. Chief Secretariat, Southern Province 7. Department of Local Government, Southern Province 8. Ministry of Environment - Southern Province 9. Provincial Department of Education 10. Galle Heritage Foundation 11. Non-governmental Organizations (NGOs) (e.g.- DEIHERM, Janathakshan) 12. Central Environment Authority (CEA) 13. Community Development Councils (CDCs) established under the GMC 14. Marine Environment Protection Authority (MEPA), Galle 15. Urban Development Authority (UDA), Galle 16. Coast Conservation and Coastal Resource Management Department 17. Sri Lanka Tourism Development Authority (SLTDA) 18. Government Hospitals (e.g. Karapitiya Teaching Hospital, Mahamodara Teaching Hospital, Ayurveda Hospital - Megalle) 19. Private Hospitals (e.g.- Asiri Hospital, Corporative Hospital, Ruhuna Hospital, Queensbury Hospital) **20.** Hotels and Restaurants serving local and foreign visitors	1. Universities/ Higher Education Institutes (e.g.- University of Ruhuna, NIBM, ICBT, ESOFT etc.) 2. Chamber of Commerce 3. Department of Archaeology

High Importance, Low Influence	Low Influence, Low Importance
1. District Secretariat, Galle 2. Fishery Harbor, Galle 3. District Irrigation, Galle 4. Schools 5. Advocacy groups 6. Vulnerable groups 7. Underserved Settlements – e.g. Bombay Castle Watta, Mohideen Wattha, Salamiya Wattha (Gewal 70), China Garden, etc. 8. Waste Aggregators and Collectors (e.g. Sun Paper Pvt. Ltd.) 9. Informal Waste Collectors (IWCs) 10. Producers and Consumer Brands (e.g. Coca Cola, Insee Cement, Elephant House etc.)	1. Galle Fort Army Camp (Gemunu) 2. Southern Naval Base, Sri Lanka Navy 3. Provincial Department of Land 4. Galle Prison 5. Railway Stations (e.g.- Galle, Richmond Hill)

According to the above table, most of the stakeholders in the city are highly important when it comes to SWM, and they can make a great influence on the SWM as well. Only a few stakeholders have been identified as neutral, or in other words, with low importance and low influence on the SWM. This suggests the need for having a comprehensive mechanism at the GMC level to engage these important and influential stakeholders in the city-wide SWM via an institutionalized framework. Even though, many stakeholder forums and steering committees had been established under different donor funded projects, it has been observed that lack of legal provisions to institutionalize such forums to actively engage diverse stakeholders in SWM is a shortcoming in the current SWM system of the GMC. stakeholders can collectively shape the impact of 3R/SWM service delivery by contributing their expertise, resources, and efforts to create positive changes at various levels, from the local community to the global environment. Collaboration and engagement among diverse stakeholders are essential for the success of sustainable waste management initiatives.

5. Solid Waste Management Laws and Regulations

Waste management in Sri Lanka is a major challenge. According to the Food and Agriculture Organization (FAO) of the United Nations (UN), the country generates an estimated 7,000 metric tons of solid waste per day, with only half of that being collected. The remaining waste is either dumped in open landfills or burned in the open, causing environmental pollution and health problems. The main challenges to waste management in Sri Lanka include rapid population growth and urbanization, inadequate waste collection, lack of disposal facilities, and lack of public awareness on SWM. Currently, the population of Sri Lanka is growing at a rate of 1.2% per year, and the urban population is growing even faster (Census and Statistics Department 2011). This is putting a strain on the country's waste management infrastructure and demands more systematic approach for SWM, supported by a strong and comprehensive legal framework. Following is a description of the existing SWM policies/ laws in Sri Lanka, which are being adopted by Local Authorities (LAs) in Sri Lanka, including the GMC.

a. National Solid Waste Management Policies/ Laws

- Municipal Council Ordinance No. 29 of 1947,
- Provincial Councils and Local Government Circular 01/2015,
- The National Environment Act (No. 1627/19 - 2009.11.10)
- The National Environment Policy (Cabinet Decision No: wum/22/0711/523/011 - 28th June 2022) on Sustainable Management of Solid Waste
- The National Environment Action Plan 2022 to 2030 (Published in 2022)
- The National Environment Action Plan 2022 to 2030 (Published in 2022) - Theme 6 on Holistic Waste Management
- National Policy on Waste Management 2019 (approved by Cabinet Decision No. CP19/2049/104/044-1 - 01st October 2019) on Solid Waste Management
- National Policy on Sustainable Consumption & Production for Sri Lanka (2019) on Waste (Annex 3.4)
- The National Climate Change Policy of Sri Lanka on Waste management
- National Policy on Sustainable Consumption & Production for Sri Lanka (2019) on Waste (Annex 3.4)
- National Action Plan on Plastic Waste Management (NAPPWM) 2021-2030.

The SWM policy of the GMC has adopted the above statutory provisions through the procedures approved by the Council.

To understand the SWM compliance level of the GMC with the national requirements and standards, the CCBO with the assistance of USAID has conducted a "Solid Waste Governance Gap Analysis" in 2021/2022. Following sections illustrate the key findings of this analysis, as per the report published in August 2022.

b. The Compliance Requirement

The overall compliance requirement on SWM by a local government body (i.e. Municipal Council, Urban Council or Pradeshiya Sabha) is set out by the policies and regulations in the national and

provincial level as well as the by-laws in place at the local authority level. Per the CCBO Solid Waste Governance Gap Analysis, which was conducted by the CCBO to review National and Sub-national SWM governance-related documents (Ordinance/Acts/Laws/Policies) that stipulate requirements for compliance and standards by the GMC regarding solid waste management issues and determine whether those standards are being met, and, if not, propose a set of recommendations to close the compliance gaps, following are the key national level Public Authorities/ regulatory bodies responsible for environmental protection and Waste Management at the local government level.

- Ministry of Environment, Sri Lanka (National Environmental Act No. 47 of 1980)
- State Ministry of Provincial Councils and Local Government (MC Ordinance No. 29 of 1947)
- Central Environmental Authority (CEA; the enforcement authority of National Environmental Act No. 47 of 1980 and Orders/Regulations of the National Environmental Act)
- Marine Environment Protection Authority (Authority of Marine Pollution Prevention Act No. 25 of 2008)
- Coast Conservation and Coastal Resource Management Department (Coast Conservation Act No. 49 of 2011)
- Urban Development Authority (Authority of Urban Development Authority Act No. 41 of 1978)
- Medical Office of Health (MOH) (Attached with Local Government Authorities) – (Authority of Food Act No. 26 of 1980, Nuisance Ordinance No. 15 of 1862, Quarantine and Prevention of Disease Ordinance No. 03 of 1897)
- Municipal Councils (and other Local Government Authorities)

The following are the Provincial and local authority level requirements as per the same CCBO Solid Waste Governance Gap Analysis report.

- Standard By-Law of the Southern Provincial Council (No. 1834 – 2013.10.25, No. 1834 – 2013.10.27)

Provincial Standard by-law has been resolved by the GMC through the Resolution No. 342 on 30.08.2016 and adopted through the gazette notification dated on 02.09.2016.

c. The Status of SWM Compliance of the GMC

The CCBO Solid Waste Governance Gap Analysis report presents a summary indicating the level of regulatory compliance by GMC based on the analysis of key components of SWM: Planning, Legal and Policy, Finance Management, Service Delivery, Human Resources, Community Engagement, Enforcement, Marine Debris, and Gender (Table 2). A total of 25 provisions related to Galle Municipal Solid Waste/ environment and /or specifically termed regulatory or obligatory requirements towards GMC have been analyzed by the CCBO against GMC's instruments including by-laws, council resolutions, internal policies, council committees, and special divisions and procedures. Notably, no provisions pertaining to finance management, marine debris (as MEPA does under the provisions of the Marine Pollution Prevention Act), and gender components were found that would have made GMC obligatory to incorporate in the SWM.

Table 2: Status of compliance of GMC in SWM key components (July 2022)

Category	Total Provisions	Full Compliance		Partial Compliance		Out of Compliance	
		Mandatory	National Policy Recommendation	Mandatory	National Policy Recommendation	Mandatory	National Policy Recommendation
Planning	02	-	-	-	03	02	-
Legal and Policy	07	01	-	02	01	02	-
Service Delivery	06	-	-	04	04	-	02
Human Resources	01	-	-	-	02	-	-
Community Engagement	06	-	-	02	03	-	03
Enforcement	05	01	01	02	01	01	-
Marine Debris	-	-		-		-	
Gender	-	-		-		-	-
Total		02	01	10	14	05	05
Grand Total	**25**	**03**		**24**		**10**	
Percentage		**12%**		**65%**		**40%**	

(Source: Solid Waste Governance Gap Analysis, USAID-CCBO, 2022)

GMC has full compliance for 03 provisions (12%), partial compliance for 12 provisions (48%), and out of compliance for 10 provisions (40%), out of 25 provisions. Accordingly, the CCBO recommends that the GMC should consider improving SWM system to adhere to 88% of either partial or out of regulatory compliances that are vital to make reliable and sound enforcement measures for 3R/SWM.

Based on the above detailed assessment of the level of compliance, the CCBO has included the following recommendations, which were developed in collaboration with the GMC, in their report to reach full compliance with national SWM requirements.

1. Develop and enact council by-laws that address the stated sections of the following as per above to strengthen GMC's enforcement measures.

    a. Prevention of burning of plastic and plastic bags
    b. prevention of using polythene for decorations as a must condition in permitting special events/functions
    c. Prevention of the display of posters or bills on walls or buildings or any other unauthorized places and regulations of the erection of advertising hoardings
    d. The control of pollution in the atmosphere and control of noise pollution
    e. The control of storage, transport, and disposal of any material which is hazardous to health and the environment.
    f. Procedure and conditions to streamline and legal protection granting a permit or the operations of informal waste collectors (permit) and trade license to aggregators.
    g. No person shall dump municipal solid waste along the sides of any national highway.
    h. No person shall dump waste at any place other than places designated for such purpose by the relevant local authority or any person/ body of persons authorized by them in that behalf;
    i. No person shall collect/ cause to be collected any municipal solid waste from any designated place along the national highway, other than during the hours of 6.00 p.m. to 6.00 a.m.
    j. The collection of domestic waste may be carried out by any person/ body of persons authorized in that behalf, from the respective households, during 6.00 a.m. to 6.00 p.m.

2. Develop an internal 3R/SWM Policy for GMC considering the stated sections of the above tables to strengthen GMC's standpoint on tackling 3R/SWM (A special reference to gender streamlining in SWM operations)

3. Present council paper/ council proposal to make a resolution to regularize waste collectors/ aggregators/ reuses/recyclers by providing permits/license in accordance with section 22 (i) of already adopted Standard By-law – Southern Province No 1834, 2013.10.25.

4. Look into possibilities to delegate powers to the PHI's related to sections of the Provincial Standard By-law/ MC Ordinance.

5. GMC to conduct a collection efficiency study to determine how best to consistently provide waste collection services to all households.

6. GMC to conduct a review of its current collection system to identify ways to increase the collection of recyclable materials that can be aggregated at GMC facilities for future sale (such as PET bottles, e-waste, and construction & demolition).

6. Waste Projections and Characteristics

The above discussion regarding the waste problem in the GMC area and the analysis of the GMC's 3R/ SWM procedures, resource availability, and compliance gaps and recommendations primarily led to conducting a Baseline Assessment on waste segregation practices by sectors and waste management services in the GMC area under the CACG project (BWAS). Moreover, considering the gaps in knowledge regarding the quantities of waste generated and collected within the GMC area and under the same CACG Project, a WACS was conducted. Key findings of the Baseline Assessment and the Waste Audit are presented in the following sections to comprehend the current context of SWM problem in the GMC area.

a. Demographic Profile

The population size of the GMC area, according to 2011 National Census, was 101,159. This showed a decline from the population recorded in 2001 National Census, which was 103,246. However, as per the 2022 Resource Profile of the Galle four Gravets Divisional Secretariat (DS) Office, population of the Galle Municipal Council Area is 103,600. Among this, the majority is Sinhalese (91%), followed by Tamils (7%) and Muslims (2%). Also, the majority of the population by religion is Buddhists (82%), followed by Christians (12%) and Hindus (6%).

According to the Census and Statistics Department, population growth rate of the GMC area is 0.75% per year. Therefore, the population can be expected to grow to 109,981 by the end of the planning period in 2030.

Table 3: Population forecast for the years 2023 to 2030

Year	2022	2023	2024	2025	2026	2027	2028	2029	2030
Predicted Population at 0.75% growth	103,600	104,377	105,160	105,949	106,743	107,543	108,349	109,162	109,981

In Galle, population growth has been significantly influenced by the expansion of tourism. The city is a well-liked tourist destination, and recent years have seen an increase in the number of visitors to Galle. As a result, the tourism sector has grown and attracted people from other regions of Sri Lanka, creating new employment opportunities. Manufacturing, agriculture, and fishing are a few of the industries that are located in Galle. People have been drawn to the area as a result of the rise of these sectors and the new jobs they have produced. The infrastructure of the city has been strained by the increase in population. Roads, schools, and hospitals in the city are all centrally located. Another element that has fueled Galle's population rise is the migration of residents from rural areas. Many people have relocated to Galle in quest of better possibilities because Sri Lanka's rural areas are frequently impoverished and underdeveloped.

b. Current Generation, Disposal and Recycling

To get a comprehensive understanding on the current waste generation, disposal, and recycling in the GMC area, the findings of the BWAS and WACS are of great importance.

The BWAS focused on collecting current data and information on citywide waste generation focusing on the key sectors such as residential, commercial, industrial, and service sectors; collection and transportation, disposal methods; current status of the 3R/ SWM practices, and community and other stakeholder perceptions regarding the current SWM system and problems and challenges associated with it. In addition, several other sectors that contribute to the waste problem and that play a significant role in solid waste management are also considered in the assessment. These sectors include waste aggregators, religious places, health sector, and so forth.

The BWAS was conducted as a sample survey involving 1,830 residential units, 586 commercial units, 214 industrial units, and 174 service sector establishments. In addition, representing health sector, religious sector, and waste aggregators, 30, 29, and 21 entities were selected for the BWAS. Moreover, 16 illegal waste dumpers, 12 GMC laborers, 10 GMC supervisors, 2 environment police officers, 9 tourists, and 9 Community Based Organizations (CBOs)/ NGOs were interviewed under the BWAS.

The key findings of the sectoral surveys and interviews are presented in detail in the BWAS Report.



Figure 1: BWAS Design Workshop (Source: BWAS Report, 2023)



Figure 2: BWAS Enumerator Training (Source: BWAS Report, 2023)



Figure 3: Sectoral BWAS (Source: BWAS Report, 2023)

As per the results of the interviews and focus group discussions conducted with key sectors, illegal waste dumpers, GMC officials attached to the Waste Management Unit, and visitors, following is a summary of key recommendations to improve the SWM in the city.

- Identify concerns/ needs of diverse stakeholder groups and incorporate them into a plan of actions to address those concerns/ needs for an effective implementation of the GMC SMW mechanism, minimize illegal waste dumping, and so forth.
- Establish an effective two-way communication mechanism to share information between the GMC and city stakeholders.
- Providing specific awareness raising and capacity building training and establishing a mechanism to promote active participation of diverse groups of actors (vulnerable groups such as women, children, youth, etc.) involved in SWM related activities, aiming for a social behavior change.
- Improving the GMC SWM system via expanding the service delivery, resources, and capacity of SWM workers.
- Providing space and opportunities for those who engage in SWM (outside the GMC SWM mechanism), such as aggregators, recyclers, alternative product developers, etc., and incorporating them into the GMC SWM system.
- While promoting mechanisms for social behavior change, ensure there is a proper implementation and monitoring/ evaluation mechanism for the entire SMW system, supported by legislative provisions.

The WACS was another key step towards developing the ISWMAP. Under the WACS, waste generation and collection pattern of the GMC area was analyzed. This study covered entire GMC area, including Mahamodara Zone, Richmond Hill Zone, Karapitiya Zone, Moragoda Zone, and Galle Bazar Zone. The key objectives of this study were to identify the composition of different types of municipal solid waste by sector, particularly focusing on the plastic waste, create a database of different types of municipal solid waste for the use of the GMC and other stakeholders for future SWM-related decision making and gather SWM data required for the preparation of the ISWMAP for the GMC.

Taking the Central Limit Theorem[1] as basis and considering the size of the total sector-wise population, 101, 70, 50, and 30 samples were identified for the WACS representing the key sectors residential, commercial, industrial, and service respectively, bringing the total for 251 units.



Figure 4: The process of wet waste mixing and dividing into quadrants (Source: WACS Report, 2023)

[1] Central Limit Theorem states that the sampling distribution of the mean will always be normally distributed, if the sample size is large enough. Sample sizes equal to or greater than 30 are often considered sufficient for the CLT to hold.

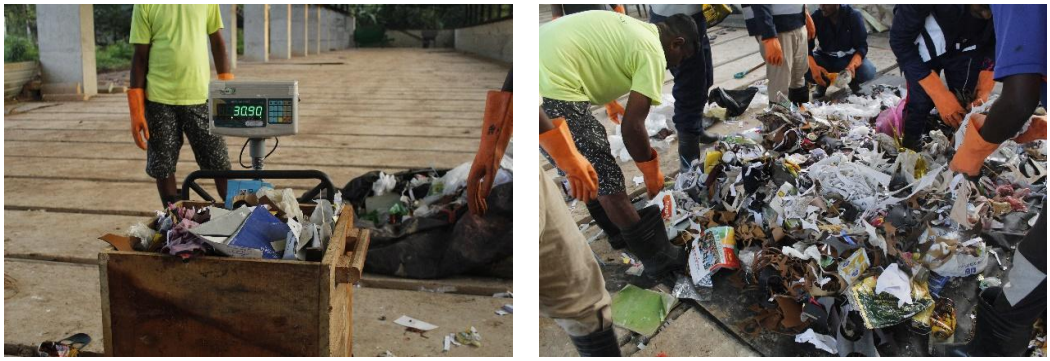


Figure 5: The process of dry waste segregation (Source: WACS Report, 2023)

As the second stage of the Waste Audit, weighing the daily waste collection fleets of the GMC was conducted at the Heenpandala site.



Figure 6: Weighing the Waste Collection Vehicle Fleet of the GMC (Source: WACS Report, 2023)

Through the WACS, waste generation of the residential sector, commercial sector, industry sector and service sector were calculated in a systematic process. Following table illustrates a summary of the results of the WACS for above sectors.

Table 4: Sectoral Generation of Waste in GMC Area (Source: WACS Report, 2023)

Sector	Daily total of waste generated in the GMC area (MT)	Annual total of waste generated in the GMC area (MT)	% Generation from the total
Residential	52.376	19,117.24	76.6
Commercial	11.145	4067.93	16.3
Industrial	2.600	949	3.8
Service	2.256	823.44	3.3
Total	68.377	24,957.6	100

Based on the above, per capita waste generation in the GMC area was calculated as 0.66 kg per day. The WACS was conducted in a challenging time when people and businesses were going through hardships due to high inflation and increase of cost of living. Accordingly, 066 Kg/ Day Per Capita Waste Generation may reflect a reduced waste generation due to the reduced consumption patterns of people and decreased sales and production of goods of commercial and industrial establishments.

At an annual growth of 0.75%, the population size in Galle MC area by 2030 would be 109,981. If the per capita waste generation remains the same, the total amount of waste generation in five years' time would be around 72.077 MT/day, recording a daily increase of 3.7 MT.

Table 5: Total Waste Generation Projection (Source: Based on the results of the WACS)

	2022	2023	2024	2025	2026	2027	2028	2029	2030	
Predicted Population at 0.75% growth	103,600	104,377	105,160	105,949	106,743	107,543	108,349	109,162	109,981	2024-2030
Population increase	-	-	783	789	794	800	806	813	819	5,534
Daily Increase of generation of waste (MT)	-	-	0.517	0.521	0.524	0.528	0.532	0.537	0.541	3.700

c. Waste Composition

Figure 7 illustrates the composition of the total waste components considered in the waste audit. Accordingly, 54% of the waste is wet (biodegradable, e.g. garden and kitchen waste) and 27% consists of dry recyclables (e.g. plastic, metal, and glass). Residual waste (e.g. leather, textile) and special waste (e.g. hazardous waste, healthcare, and bulky waste) compositions are 17% and 2%, respectively.

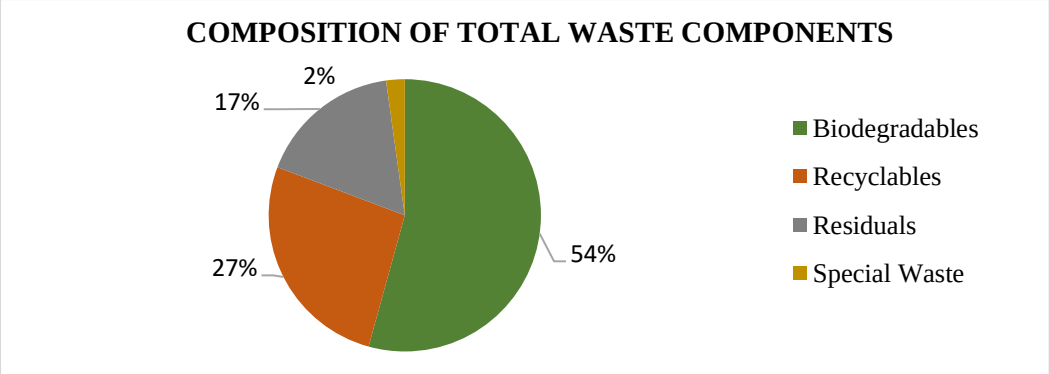


Figure 7: Composition of Total Waste Components (Source: WACS Report, 2023)

When the compositional data of non-degradable waste is considered (Figure 8), the highest amounts come from plastic, textile, and glass. In addition, paper also composes a significantly large amount (13%) of the total non-degradable waste.

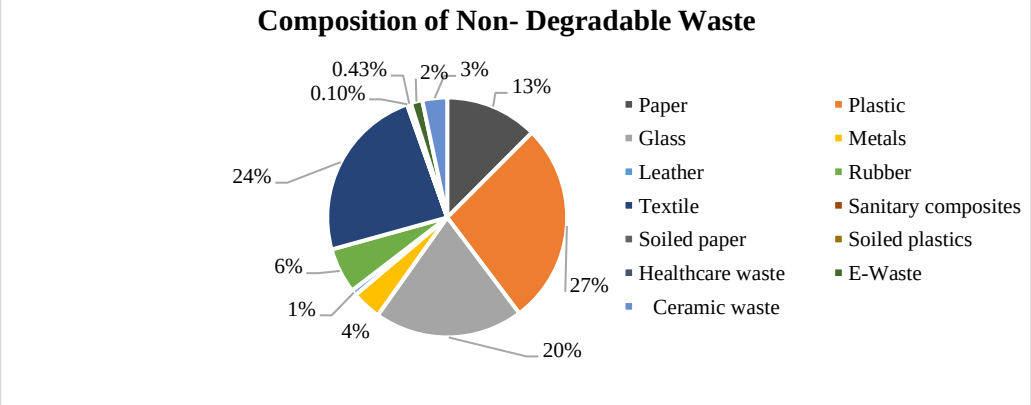


Figure 8: Composition of non-degradable waste (Source: WACS Report, 2023)

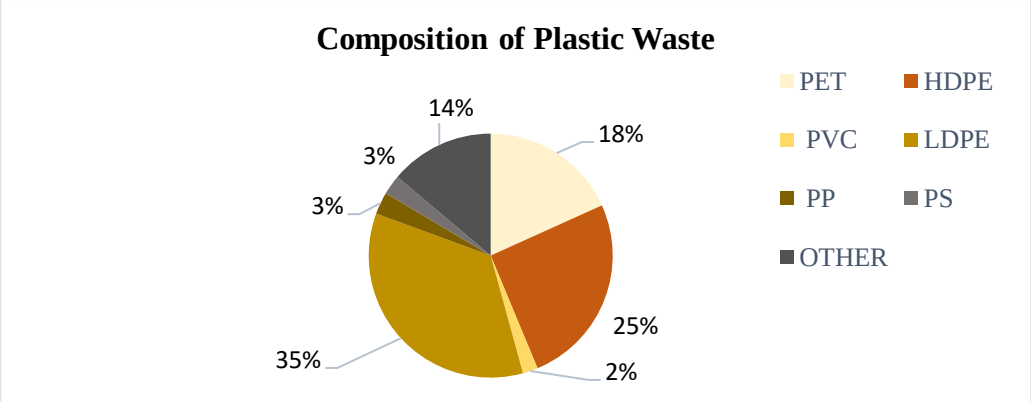


Figure 9: Composition of plastic waste (Source: WACS Report, 2023)

As in the figure 9, when analyzing the composition of types of plastic waste, LDPE constitutes the highest proportion at 35%. Second highest quantity was HDPE (25%) and constitute 18%, 25%, and 14% respectively. PVC, PP, and PS types of plastic constitute in small amounts.

With regard to the collection of waste in the GMC area, it has been found that the annual average collection of wet waste, dry waste, and mix waste is approximately 5,679.8 MT, 1,500 MT, and 721.2 MT, respectively. Accordingly, the total average collection by GMC per year accounts for 7,865.02 MT. Compared to the annual generation of waste, which is 24,957.6 MT, the rate of collection is 31.51% by weight.

The rate of collection of waste by the GMC, which is 31.51% of the total waste generation, is in par with the national average solid waste collection rate for Local Authorities in Sri Lanka (Kaza et. al., 2018). As Kaza et. al. state, the Local Authorities in Sri Lanka have the capacity to collect only one-third of municipal solid waste, which is estimated to be around 7,110 MT/Day from a generation of 21,331 MT/D. Accordingly, the accuracy and acceptability of the results of this WACS can be justified.

Results also indicate that 68.49% (by weight) of solid wastes generated in the GMC area is not handed over to the GMC. However, survey observations indicate that most of the streets and open areas of the GMC are clean and no visible signs of haphazard waste dumping. This leads to the question that if the GMC collects 31.51% waste from the whole GMC area, how the rest of the waste is being disposed or managed? As per the results of the Baselines Waste Assessment, it has been found that a significant amount of waste, particularly heavy waste such as degradable waste, glass, metals, clothes, etc. are managed by using alternative disposal methods, which can be both acceptable and unacceptable practices. Also, illegal waste dumping has been a practice within the GMC area. That way, GMC waste collection rate, which is close to the average waste collection rate by Sri Lankan local authorities, is justifiable.

d. Waste Projection

The following table 6 illustrates the annual estimated amount of waste generation by the type of waste from 2023 to 2030.

Table 6: Estimated amount of waste generation by type from 2023 to 2030 (Source: WACS results)

Type of Waste	%	Estimated Waste Generation (MT)							
		2023	2024	2025	2026	2027	2028	2029	2030
Biodegradable	54	13,777	13,880	13,984	14,089	14,194	14,301	14,408	14,516
Recyclable	27	6,339	6,387	6,434	6,483	6,531	6,580	6,629	6,679
Residuals	17	4,243	4,275	4,307	4,339	4,372	4,404	4,438	4,471
Special Waste	2	499	503	507	510	514	518	522	526
Total	100	24,858	25,045	25,232	25,421	25,611	25,803	25,997	26,192

7. Current Solid Waste Management System

In addition to the above findings of the BWAS and WACS, following is a summary of key features of the SWM service delivery in the GMC area and its current operation.

Collection

- Since 2010, the GMC collects only segregated waste. Waste must be bagged as Degradable (wet) or Nondegradable (dry). The GMC has educated all the generators in this regard and stopped collecting non-segregated waste.
- SWM service delivery had initially been planned based on 15 electoral wards, which has now been reduced to 5 Waste Management Zones with the assistance from CCBO. The waste collection vehicle fleet is deployed on a schedule to cover all Waste Management Zones (Refer Map 4 below).
- Door-to-door waste collection service is in place for residential, commercial, industrial, and service sectors, covering 81%, 85%, 64%, and 78% of entities, respectively. Common waste disposal locations are also provided in designated places (e.g. Bus terminals, Galle Fort).
- GMC does not provide collection services from certain bulk waste generators (e.g. Fisheries harbor, Army Camp, Navy Camp, Galle port). They transport and hand over waste at the GMC waste collection facility in Heenpendala on their own.
- Waste collection schedule has been distributed to all households and establishments. The schedule indicates specific days in the week for collecting degradable, non-degradable, and special wastes (e.g. Sanitary wastes, e-waste, etc.) from each route.
- GMC staff sort and remove valuable recyclable materials from the dry waste. They keep these materials and sell them as part of their compensation.
- Building waste (construction and demolition materials) is not collected under the regular collection scheme of GMC. Interested parties can transport, pay, and hand over building waste to the GMC at the COWAM Center, Dadalla. to be processed and used again.

Waste Facilities

- Heenpendala Waste Collection Site

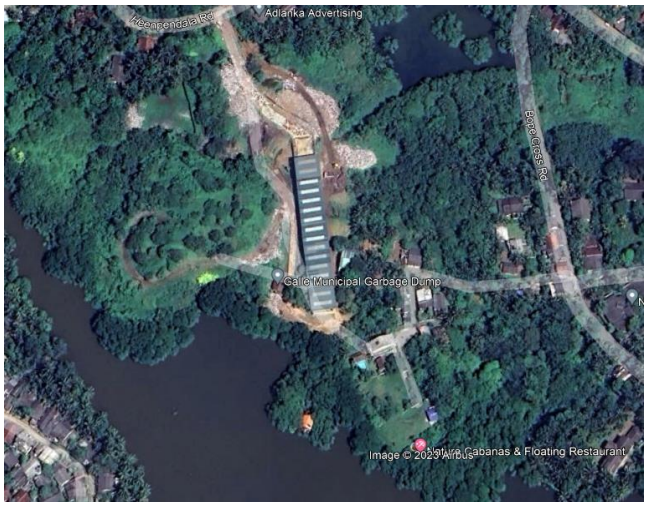


Figure 10: Aerial view of the site in 2022 (Source: Google Maps)

- Heenpendala is a GMC-owned land of approximately 1.72 Ha, which is currently used as a waste transition and disposal site.
- Separately collected wastes (wet, dry, special-sanitary waste and e-waste, and any unsegregated waste) and those waste transported by bulky waste generators (e.g. Fisheries harbor, Army Camp, Navy Camp, Galle port) are handled at this site.
- Wet waste is composted on site using the KAWASHIMA technology in a building and with machinery donated by JICA. It began operating in May 2023.
- The non-degradable dry waste is sorted to recover aluminum cans, PET plastic bottles. These separated materials are either sold to third party recyclers in bulk, without being compressed/ baled or transported to COWAN for baling and storage until they are sold. The residual waste is either transported to cement factory as a fuel or use for landfilling.
- While most collected waste is handled at this facility, a maximum of 23 MT of collected degradable waste is transported by GMC vehicles to "Monrovia Estate". Monrovia Estate is a common waste collection facility managed by the office of Commissioner of Local Government (CLG) in Southern Province located approximately 20 kilometers away. The ceiling limit of 23 MT has been given by a court order.
- Any materials that cannot be recovered for compost or sale is permanently stored at the site in sections designated for land disposal.

- COWAM Center at Dadella

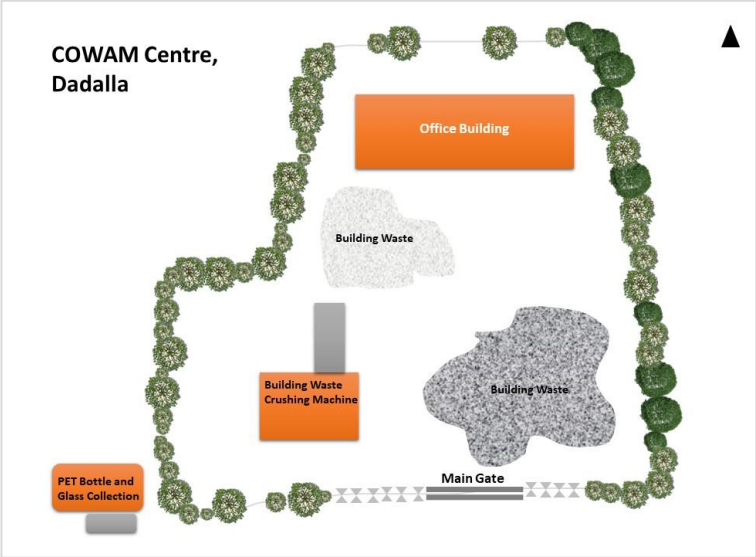


Figure 11: Aerial View of the COWAM facility (Source: COSA Report, 2023)

- Dry recyclable materials (PET plastic bottles, aluminum cans, etc.) are baled at this site and then marketed to private buyers.
- The collected glass waste is temporarily stored at COWAM Center, Dadalla, and handed over to a glass recycling company; "Random Global Trading Pvt. Ltd" (Colombo). The GMC has entered into an agreement with this company for selling glass waste. Field observations indicate that this system operates significantly below the planned capacity.

The GMC's overall SWM process Flow Diagram is presented in Figure 12 below indicating the percentages being handled at each pathway based on the data collected through the BWAS and WACS in 2022-2023.

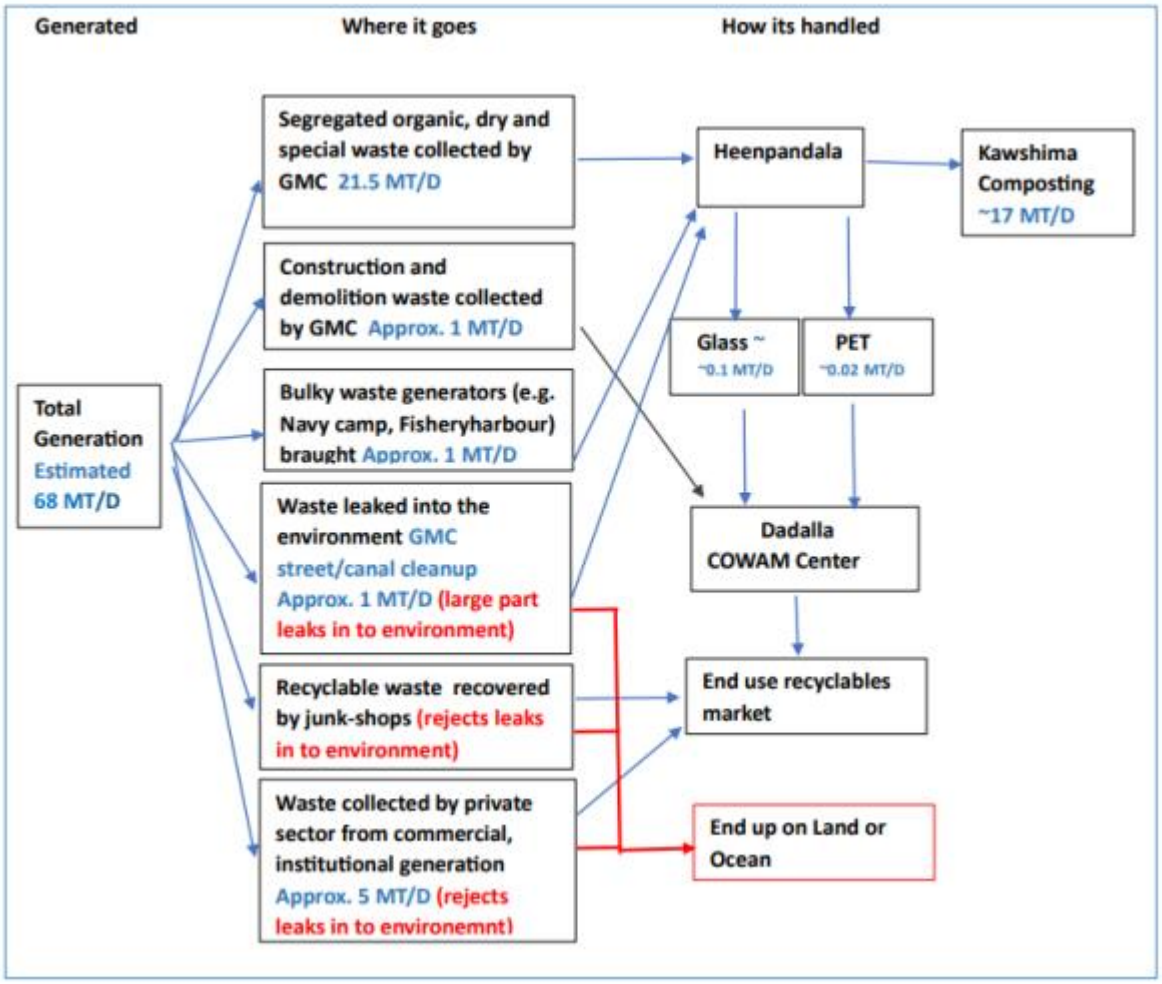


Figure 12: GMC's overall Waste Flow Diagram (Source: COSA Report, 2023)

a. Waste Collection and Operations

The segregated wastes from all neighborhood zones are collected from residences, businesses, institutions, and small industries on a weekly timetable that is communicated in both the prior and current systems. The most typical procedure is for GMC employees to transport the separated waste straight onto waste-hauling trucks to Heenpendala landfill. However, GMC workers collect waste at regular spots and load it into the collection vehicle in the case of narrow or impassable roadways and street sweeps. The GMC employed the following resources to collect waste in 2021 and 2022.

Table 7: The vehicle and machine fleet used for 3R/SWM Service Delivery (Source: COSA Report, 2023)

No	Type of vehicle/ machinery	No. in 2021	No. in 2022	Considered %
1	Tractor	28	28	100
2	Compactors	6	6	80
3	Trailer	26	28	100

Table 8: The workmen employed for 3R/SWM service delivery process
(Source: COSA Report, 2023)

No	Workmen category	No. in 2021	No. in 2022	Considered %
1	Technical Officer	2	2	80
2	Field Work Supervisor	8	8	100
3	Field Work Observer	6	6	100
4	Field Level Collection Workers	69	69	100
5	Drivers	-	6	80
6	Drivers	-	14	100
7	Field Level Collection Workers	18	18	80
8	Casual Collection Workers	23	23	100

Out of the 7 compactors, 80% of operational time was allocated for the waste collection operation. Similarly, the 80% of working time of 6 drivers, 2 technical officers engaged at supervisory tasks and 18 workers was allocated for the waste collection operation.

Waste Collection Route System

The Waste Collection Route System in the GMC area is designed to cover 14 demarcated collection zones within the municipal jurisdiction (Map 2). These zones encompass residential areas, commercial establishments, institutions, and small industries. The primary objective is to collect segregated waste directly from the source, encouraging the public to sort their waste into specific categories such as food waste, plastic and polythene, e-waste, and glass.

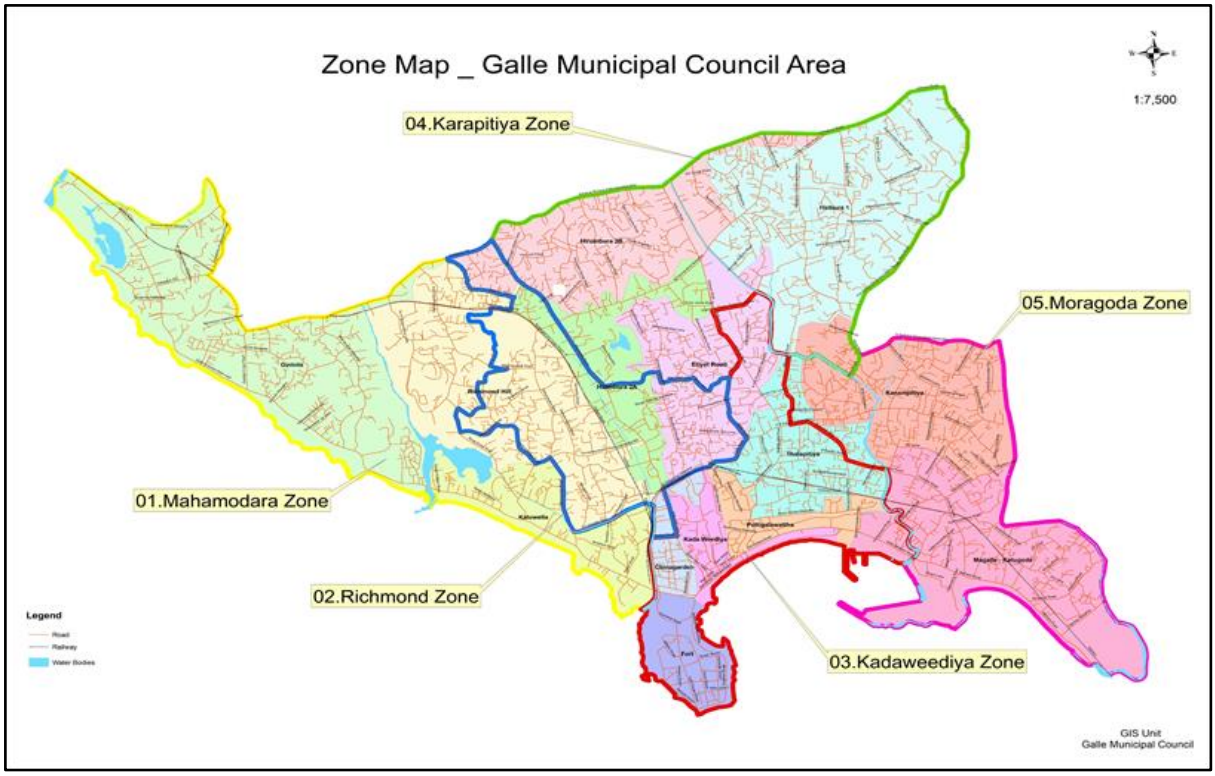
Recent Developments in the Waste Collection Route Optimization System

GMC has taken proactive steps to improve solid waste management in the area by seeking technical assistance from the CCBO program. Prior objective was the transformation of 14 collection zones into five administrative zones is aimed at enhancing waste collection efficiency.

The CCBO's initiative to conduct technical training workshops during the year 2022, involving various municipal council's officers as GIS unit staff, SWM unit staff, Technical Officers, Public Health Inspectors, supervisors, and drivers, demonstrates a holistic approach to capacity building. This ensures that everyone involved in waste management is equipped with the necessary skills and knowledge.

The successful demarcation of five waste collection zones with new waste collection routes based on the technical training provided by CCBO is a positive outcome. It implies that the efforts to improve solid waste management are translating into tangible results on the ground.

Overall, this initiative appears to be a comprehensive and well-thought-out approach to address the challenges in waste management, involving multiple stakeholders and leveraging technology for efficient planning and execution.



Map 3: Zone Map of Galle Municipal Council (Source: COSA Report, 2023)

The GMC requested technical assistance for improving waste collection efficacy in five specific zones from CCBO technical experts. The CCBO provided public awareness materials and introduced a waste collection vehicle monitoring system for supervisors, albeit manually. Waste collection vehicle monitoring system is currently manual, consider automating it for better efficiency. Implementing a digital tracking system can provide real-time data, making it easier for supervisors to manage and optimize routes. Ensure that supervisors and staff are adequately trained to use the new monitoring system. Provide ongoing support to address any technical issues and ensure a smooth transition.

Moreover, GMC requested certain equipment to enhance the 3R/SWM service delivery process in its jurisdiction. To enhance 3R/SWM segregation, collection, transportation, and processing in an efficient and effective manner, the CCBO provided material support under the In-Kind Grant assistance.

- Waste collection 50-wheel bins with wheels (240-liter capacity) for keeping common public places.
- Medium size 20 hand carts with 40 color bins for easy segregated waste collection.
- Five mini trucks for waste collection on narrow local roads.
- Five specially made by fixing noncorrosive checker plate tractor trailers.
- Two containers for compost and equipment storage at proposed Heenpendala Material Recovery Facility (MRF) center.
- Wood Chopper machine for making wood chips for mixing organic waste to control the moisture and maintain C-N ratio.
- Baler Machine for hard plastic, low value plastic, cardboard and aluminum cane baling at proposed Heenpendala MRF center.
- Mini Chainsaw for road site tree branches maintains and road clearance.

To improve waste collection efficiency and resource utilization, the waste collection incorporating the new system was started in April 2023 in the Mahamodara collection zone and progressively expanded to all 5 zones by August 2023. Corrective measures were adopted to remove certain issues that arose at the field level. The GMC staff regularly received assistance from the CCBO technical team when planning and doing fieldwork. The new waste collection and transportation system has been recognized of having the following potential and realized impacts. These impacts not only demonstrate the success of the optimization but also emphasize the positive changes brought about in various aspects of waste management.

I. Fuel Consumption and Operating Cost Reduction:
The redesign of collection zones and the reduction in traveled distances were anticipated to result in lower fuel consumption and operating costs. The optimization has successfully realized this expectation, contributing to more efficient resource utilization.

II. Increased Waste Collection:
The optimization efforts have led to a remarkable increase in daily wet and dry waste collection, ascending from 22 - 38 MT/d. This represents a substantial growth from 22% to 55%, reflecting the enhanced efficiency of the optimized collection routes.

III. Environmental Impact Reduction:
The optimization aims to reduce trash leakage into the environment, and the realized impact is evident. It is expected to increase the daily wet and dry waste collection ratio from 55% to 73%. (38 - 50 MT/d) by the end of 2024 which indicates a reduction trash leak into environment.

IV. Public Engagement for Waste Segregation:
The optimization has positively influenced public engagement in waste segregation at the source. As expected, the community is becoming more involved in proper waste disposal practices, aligning with the sustainability goals of the waste management program.

V. Elimination of Unlawful Dumping Locations:
By incorporating more non-collection routes, the optimization aims to eliminate unlawful dumping locations. This strategic move addresses environmental concerns and ensures that waste is disposed of properly, contributing to the overall sanitation of the municipality.

VI. Efficient Resource Deployment:
The optimization has successfully deployed resources more effectively, ensuring that collection vehicles and personnel are utilized efficiently. The establishment of a manual monitoring system has contributed to this efficiency, making the waste management process more reorganized.

VII. Extended Operational Lifespan:
Optimization has introduced a weekly maintenance plan for all collection vehicles, ensuring their durability and continued operational efficiency. This proactive approach reflects a commitment to sustaining the waste management infrastructure for the long term.

VIII. Enhanced Public Satisfaction:

The overall impact of the optimization is reflected in heightened public satisfaction. The delivery of proper 3R (Reduce, Reuse, Recycle) and solid waste management services has developed positively with the community, contributing to overall satisfaction and support for the municipal waste management program.

The overall impacts realized by the GMC's route optimization initiatives demonstrate not only successful operational improvements but also a commitment to sustainable waste management practices that benefit both the environment and the community.

Table 9: Outcomes of collection improvements

No	Criterial	Before	After
1	Total Collection Zones	14 Zones	05 Zones
2	Total Transit Distance	295 km p/d	237 km p/d
3	Total Daily Collection	21.5 MT/d	38.5 MT/d
4	Total Daily Collection Routes	21 MT/d	30 MT/d
5	Total Wet Waste Collection	15.5 MT/d	22 .3 MT/d
6	Total Dry Waste Collection	4 MT/d	7 .8 MT/d
7	Total Mixed Waste	2 MT/d	2 MT/d
8	Total PET Collation	200 Kg p/m	760 Kg P/m
9	Total Low Value Plastic sent to WtE	2.3 MT/d	3.1 MT/d
10	Total Collection Tractors	9 Nos	9 Nos
12	Total Compactors	5 Nos	4 Nos
13	Total Narrow Road Collection Mini Trucks	0 Nos	5 Nos

b. Transportation

The GMC waste transportation involves two key steps as follows.

Step1: Transporting collected waste from all the routes into the centralized GMC waste collection and handling facility at Heenpandala site.

As described above, the collected waste from the 15 waste collection wards was transported along a cumulative length of 294.62 km/day into Heenpendala, until April 2023. Since then, the new waste collection scheme based on the 05 administrative zones with route optimization was introduced, the cumulative travel length reduced to 237 km/day.

Step 2: Transporting both the dry and wet waste, which is in excess of the daily disposal capacity at the Heenpendala facility into the centralized composting and dry waste processing facility at Monrovia Estate, which is operated by the Southern Province Local Government Department (SPLGD). The quantity of total waste transported was 6,195 MT p/year. This consists of 5,475 MT p/year of wet waste and 720 MT p/year of dry waste as per the estimates based on waste audit results and the tipping records of SPLGD.

This operation includes three main sub activities as;

- ❖ Unloading waste delivered to Heenpendala by collection vehicle fleet and re-loading into the compactor, truck or lorry.
- ❖ Transporting to Monrovia Estate by vehicles.
- ❖ Unloading at Monrovia Estate composting & waste processing facility and recording no. of trips for calculating a tipping fee.
- ❖ Long term degradable organic waste (Tree Branches) dry waste was disposed in Heenpendal site until May 2023.

The resources given in the Tables 10 and 11 were mobilized by GMC for this operation in 2021 and 2022;

Table 10: The vehicle & machine fleet deployed for waste transfer from Heenpandala to Monrovia Estate (Source: COSA Report, 2023)

No	Type of vehicle/ machinery	2021	2022	Considered %
1	Large Compactors	2	2	20%
2	Small Compactors	4	4	20%
3	Trucks	2	2	100%
4	Lorry	1	1	100%
4	Excavator	1	1	80%

Table 11: The workmen employed for waste transportation from Heenpandala to Monrovia Estate (Source: COSA Report, 2023)

No	Workmen category	No in 2021	No in 2022	Considered %
1	Technical Officers (TO)	1	1	10%
2	Public Health Inspector (PHI)	1	1	5%
3	Heenpandala Site Supervisor	1	1	50%
4	Drivers	9	9	20%
5	Field Level Collection Workers	18	18	20%
6	Heenpandala Site Field Workers	4	4	80%

For transportation, a 20% of operational time of compactors was allocated while trucks and lorry were fully allocated. The excavator was shared for waste loading as the main task over 80% of operational time and for general waste handling within the site in the balance time. Similarly, a fraction of working hours given in table 8 was used by the respective category of GMC workmen for the supervision of loading and transportation operations. This operation was terminated in March 2023 with the commencement of the Kawshima Composting Facility in Heenpendala in April 2023.

c. Source Reduction and Reuse

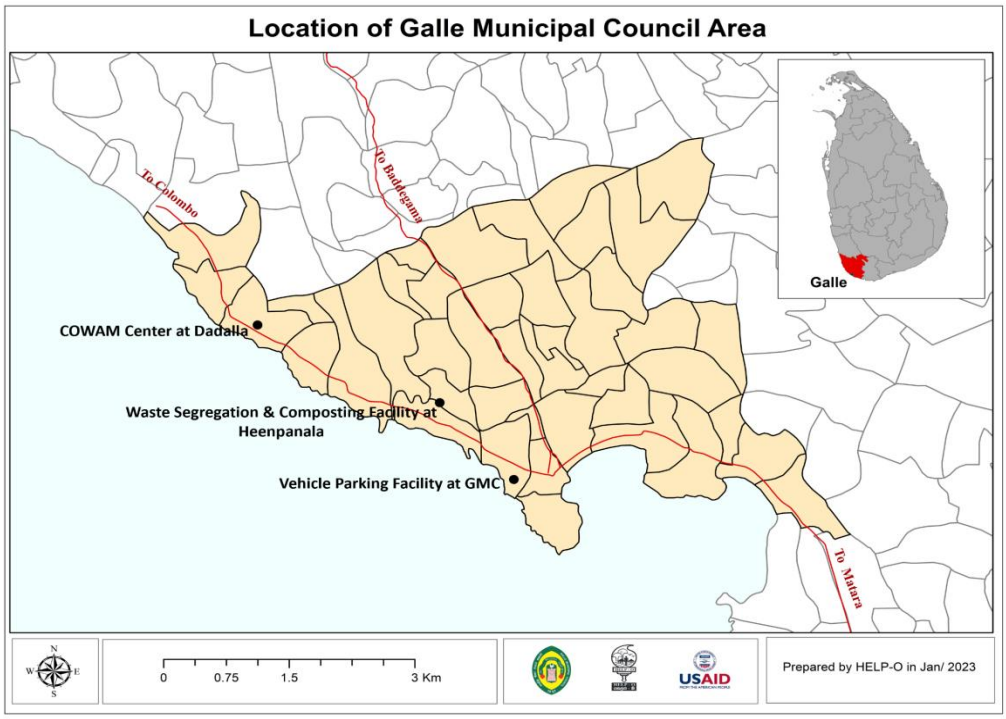
As per the WACS, the collection as a % of generation is 31.43%. One of the reasons for the low level of collection found to be the current capacity and resource gaps of the GMC SWM system. Hence, there is a great demand to reduce waste generation at source and to promote reuse of waste. However, other than irregular awareness programmes conducted by the Community Development

Unit of the GMC and rare collaborative projects implemented with the support of NGOs, there seems to have lack of strategic involvement from the side of the GMC to promote source reduction and reuse.

d. Solid Waste Infrastructure Facilities/ Processing and Markets

Solid waste infrastructure facilities that the GMC waste processing includes series of operations through the following key infrastructure facilities, which are shown on the map below.

1. Waste segregation and composting facility at Heenpendala.
2. Building waste recycling/ Glass waste and PET bottle Collection Facility at Dadalla COWAM Center.
3. Support services
    - Solid Waste Management Unit at GMC
    - Vehicle parking facility at GMC, Galle City
    - Vehicle service facility at Heenpandala.



Map 4: The main infrastructure facilities of the GMC for waste processing (Source: COSA Report, 2023)

Waste Handling at Heenpendala Site

Waste collected by GMC from all routes is transported and unloaded at the Heenpendala waste handling site. This site was initially used in early 2005 for burying discarded waste from the tsunami disaster and then continued to dispose and handle of municipal solid waste. This plot of 1.65 Ha land is situated in a low residential area, bordering to the Ginganga estuary named Heenpandala Lake. The facility has been operating without proper engineering control measures to prevent typical social-environmental impacts associated with a solid waste handling facility.

1. Wet Waste Processing/ Disposal at Heenpendala

The source segregated wet waste (degradable) through the GMC daily collection and from the bulk waste generators that is delivered to Heenpendala, unloaded at a predetermined location at the Heenpendala site, since the "Kawshima" composting plant was under construction in year 2022. The quantity of wet waste collection was 5,475 MT/Year from GMC collection and about 240 MT/ Year from bulk waste generators, as per the Waste Audit results in 2023. This total collection of 5,715 MT/ Year is transferred from transporting trucks from Heenpendala to Monrovia estate. This operation was terminated in April 2023 after commencement of the composting facility operations.

2. Non segregated (mix) waste processing/ disposal at Heenpendala

Approximately 720 MT/ Year of waste delivered to Heenpendala site has been reported to be nonsegregated (i.e mix of wet and dry) waste, as per the Waste Audit results in 2023. This has been mainly from the roadside dumps and the street sweeps in the GMC collection. So far, the entire waste was disposed of at the predetermined mix waste disposal location in the site. However, the GMC workmen recover recyclable items like metal, paper & cardboard, high & low value polythene and plastics inside the waste transporting vehicle itself or at the Heenpendala site. This quantity was insignificant as per the available information. Recently, the USAID-CCBO has provided new baler machine and chainsaw to improve the waste handling at Heenpendala.

3. Dry waste processing/ recycling at Heenpendala

The segregated dry waste delivered to the site, which is recyclable, was 1,440 MT/ Year from the GMC regular collection and about 96 MT/ Year from the bulk waste generators. This amount of 1,536 MT/ Year of waste was directly dumped on to designated locations in the site. Two GMC workmen used to recover the high value plastic, polythene, metal, paper-cardboard and others from the stockpile. The quantity extracted was considered to be insignificant.

4. Waste delivered on site by Bulk Generators:

The GMC accepts segregated waste delivered into the Heenpandala site by "bulk waste generators" (e.g. Navy camp, Karapitiya Teaching Hospital, Galle Fort Army Camp, Fishery Harbor, Commercial Harbor, Galle Navy Camp). Waste volume-based fee has been charged and this was decided by the GMC workmen (Supervisor) based on the waste volume. The total amount delivered in 2022 was approximately 336 MT, out of which 240 MT was wet waste and the balance was unsegregated wastes that was unofficially delivered to the site. The resource allocation for this process was unable to be identified and was considered to be part of the overall site management cost.

5. Transfer of Waste from Heenpendala to the Monroviwatta MRF

The total wet waste of 5,475 MT and 720 MT of dry waste in 2022 were transferred from the Heenpendala site to the Monrovia Estate composting and dry waste processing facility. The GMC also paid a tipping fee of 1,500 LKR per one load (total of 4,694,250.00 LKR in 2022) to the SPLGD. This operation was stopped in July 2023 with the commencement of Kawshima composting facility.



Figure 13: Waste Unloading at Monrovia Estate (Source: COSA Report, 2023)

In appreciation of the consistent request from the GMC and convinced importance of having such facilities, the CCBO is in the process of mobilizing the following additional facilities from the initially planned assistance to the GMC, for the Heenpendala facility;

- Assign two containers for the purpose of storing equipment and compost.
- Wood Chopper machine and Chainsaw machine for preparing tree branches to be fed into the compost facility.
- Assistance to prepare a plan to establish a complete Material Recovery Facility
- Include the concept plan for overall site improvement at Heenpendala as a part of the ISWMAP, which is being prepared for the GMC.

C&D Waste/ PET bottle Processing and Glass Waste Collection at Dadalla COWAM Centre

The COWAM (Construction Waste Management) center is a multi-task facility located over 0.5 Ac land, having building waste, glass, and PET bottle recycling infrastructures.

1. PET bottle Collection Facility

GMC collects PET bottles at Dadalla COWAM center, which has been equipped with a baler machine since 2021 with the assistance of Coca-Cola Pvt. Ltd. The GMC entered into an agreement with a recycler to sell collected and compacted PET bottles in 2011. However, this facility was operated well below its capacity (of 1 MT/ Day) in years 2021 and 2022 due to the lack of proper collection system and competitive pricing structure.

The GMC with the assistance of CCBO (school champion program), HELP-O, and some other parties has been working with approximately 33 government schools in GMC area in 2023, aiming to increase the output. The GMC transports collection from these schools to the PET collection facility. Table below illustrates the amount of PET bottle collection at Dadella COWAM center.

Table 12: PET bottle collection in 2023 at Dadella COWAM center

No	Month	Total PET Bottle Collection MT/Month
1	May	0.346
2	June	0.369
3	July	0.369
4	August	0.738
5	September	0.121
6	October	0.163

2. Construction and Demolition Waste Recycling

The building waste recycling facility located in Dadalla COWAM center, which was established in 2009 by the COWAM project funded by European Union, is the first and the only government-owned facility for building waste recycling in Sri Lanka. This facility is equipped for processing building waste for recycling through a set of crushing and screening units. Thus, this is an environment friendly and economical solution for building waste management. This facility, when in full capacity operation, has been the main raw material source for the earth work, pavements, and road renovations by the GMC.

However, the facility has been operating below its capacity, mainly due to poor publicity given, lack of proper collection system backed by law enforcement and lack of market price based competitive pricing scheme. Table below illustrates the amount of C&D waste collection at Dadella COWAM center.

Table 13: C&D waste collection in 2023 at Dadella COWAM center

No	Name Month	Total C&D Waste Collection MT/Month
1	May	-
2	June	12
3	July	12
4	August	14
5	September	14
6	October	4.9

3. Glass waste collection

The glass waste collection facility, that consists of a 100m^2 storage building was established in year 2009. with the assistance of CityNet Yokohoma the GMC enters into an agreement each year with third party agencies to sell the glass waste collected at the facility. Although well operated at the beginning, this also has been operating below the capacity due to reasons similar to that of the PET collection facility. The residual glass waste that cannot be sold are stocked in the same building until a proper solution is developed.

e. Outreach and Education

The Community Development Division and the Public Health Department of the GMC hold the responsibility of outreach and education with regard to SWM. The current scope of engagement includes conducting awareness programmes on Dengue prevention, public awareness raising on waste collection routes and timetables, and so forth. However, despite efforts to promote awareness and active community engagement, there is still a significant gap in the SWM system that needs to be addressed. For example, in waste segregation, a significant challenge exists as a considerable portion of the collected waste remains mixed. This could be attributed to factors such as a lack of public awareness, compliance issues, or difficulties in enforcing segregation practices.

8. Options for Improving the SWM System

The chapter 6 and 7 above explores the current context of waste generation and collection and the SWM System there to facilitate SWM in the GMC area. In the discussion, several issues have been highlighted that need attention in the ISWMAP when going for a sustainable SWM within the city. This chapter presents the improvements needed to the current SWM System and options for improving the SWM system, particularly paying attention to topics such as waste collection, transport/ transfer, processing, disposal, and recycling markets.

a. Improvements Needed to the Current SWM System

Improvement needs to the current SWM System have been identified under the topics, collection, transport/ transfer, processing, disposal, and recycling markets.

Collection

Collection of waste from sources has been a key task of the GMC. Currently, the GMC is facing many challenges associated with waste collection and those challenges need to be addressed when moving forward. These challenges have been highlighted in the previous chapters. Below is a summary of improvements needed in order to address those challenges associated with waste collection.

- Currently, the GMC only accepts segregated waste as wet and dry. However, it has been found that the GMC still receives a significant amount of mix waste, which is difficult to process. Solution is improving source segregation to ensure that waste is properly sorted into wet and dry categories.
- Most of the waste collection vehicles shall be condemned or repaired as they are either too old or not in usable condition. Solution is condemning or repairing existing vehicles and upgrade the waste collection vehicle fleet to improve efficiency.
- The waste collection work force (e.g. laborers and supervisors) lacks recognition and incentives. The solution is to provide recognition and incentives to the workforce (including laborers and supervisors) to motivate and appreciate their efforts.
- The relationship between residents and municipal waste collection work force needs improvement. Solution is working on improving communication and collaboration between residents and the waste collection workforce for better cooperation.
- USAID-CCBO has taken tremendous action for waste collection route optimization to minimize the costs incurred for collection and transportation. In a similar process, waste collection routes shall be regularly monitored and improved to save resources and well as to address the needs of the citizens.
- There shall be a sophisticated mechanism to collect waste disposed illegally and to curtail it from happening again.

Transport/ Transfer

Transportation/ transferring of waste is another key task regularly performed by the GMC in its SWM process. In general, collected waste from sources is transported to the Heenpendala waste processing and dumping site and some of this is again transferred to Monrovia Estate composting and dry waste

processing facility. In this process, several challenges have been noted that require improvements.

- The majority of waste transportation/ transferring vehicles shall be condemned or repaired as they are either too old or not in usable condition. Hence, the waste transportation/ transferring vehicle fleet needs to be upgraded.
- Need a comprehensive mechanism to record the amount of waste transported/ transferred from sources to Henpendala and Heenpendala to Monrovia Estate. This is important when projecting waste data for future, calculating tipping fees, and so forth.

Waste Processing

The main waste processing facilities operating under the purview of the GMC are; Waste segregation and composting facility at Heenpendala, Building waste recycling/ Glass waste and PET bottle Collection Facility at Dadalla COWAM Center, Vehicle parking facility at GMC, and Vehicle service facility at Heenpandala.

The following are the improvements required in these waste processing facilities and in the waste processing process.

- As has been identified in the BWAS and consultation sessions conducted with the GMC and other stakeholders, one of the key improvements required in material processing facilities is taking actions to operate them in full capacity. Currently, these facilities are either not functionating or functioning partially. The facilities have been operating below its capacity, mainly due to poor publicity given, lack of proper collection system backed by law enforcement and lack of market price based competitive pricing scheme. Therefore, improvement in those aspects is a must.
- Waste Processing facilities do not have sufficient sanitary and other facilities required for the laborers who work there, especially for women laborers, if the GMC is going to recruit women laborers in future. Therefore, physical improvement in and around material processing facilities are important.

Disposal

Currently, the disposal of collected waste within the GMC area primarily takes place in two places., one in Heenpendala within the GMC jurisdiction and the other in Monrovia Estate out of the GMC jurisdiction. When paying attention to the improvements required in the disposal process, following are the key suggestions.

- The disposal process shall be further improved to make it more a sanitary and environmentally friendly so to avoid as much as social and environmental damage.
- The waste disposed at these two locations are currently mix waste and there has been public objections and concerns regarding environment pollution. Hence, it is important that the disposal shall be done for the residual waste that cannot be used for any other purpose. Therefore, waste segregation, collection, and processing process shall be improved a lot to minimize the amount of waste disposed to the environment.
- There shall be a mechanism to hear community grievances regarding disposal of waste that is done with the GMC involvement.

- Encourage large scale waste generators to take responsibility for the disposal of their waste. Implement Extended Producer Responsibility (EPR) programs, where waste generators are accountable for the entire lifecycle of their waste materials, including disposal.
- Involve the community in waste management decisions. Establish platforms for community input, feedback, and involvement in waste disposal programs and policies.
- Enforce and strengthen waste disposal regulations. Implement fines for illegal dumping and provide incentives for businesses and individuals practicing responsible waste management.
- Invest in research and innovation for more sustainable waste disposal technologies. Explore new methods for waste reduction, recycling, and disposal that are environmentally friendly.

Recycling Markets (Formal and Informal)

Currently, the GMC is producing compost through its Kawashima composting plant situated in Heenpendala site. Moreover, the GMC collects a significant amount of materials through its daily collection of waste that is recyclable. Therefore, identifying recycling markets shall be a priority as a sustainable solution for recovered materials. Following are a few suggestions regarding reaching to recycling markets.

- Quality of the compost produced in Heenpendala shall be kept in a higher standard so the demand for compost will be increased. Moreover, publicity is important so the GMC will be able to reach enough buyers to purchase compost daily.
- Implement efficient and widespread collection systems for recyclable materials. This can include curbside recycling programs, drop-off centers, and partnerships with businesses for material collection.
- Develop or enhance sorting and processing facilities to efficiently segregate recyclable materials at Heenpendala site.
- Establish strong partnerships with recycling industry players, including recycling facilities, manufacturers that use recycled materials, and waste management companies. This collaboration can create a more seamless connection between collection points and recycling markets.
- Educate the public about the importance of recycling and the types of materials that can be recycled. Increased awareness can lead to better source separation and a higher quality of recyclables reaching the market.

b. Options for Improving the SWM System

Paying attention to the above improvements required in the SWM process of the GMC, following options have been presented in general to the whole process. Identification of options was done by comparing the least desirable option to the most desirable option.

- Compared to the existing institutional framework to manage the SWM system in the GMC, a new centralized entity with required powers and support of different departments and divisions in the GMC would work more efficiently and successfully. There shall be a key person responsible for overseeing the whole process of the SWM.
- Waste segregation and collection (e.g. curtailing illegal waste dumping) shall be streamlined with required legal enforcement under the legal provisions that the GMC already has, or

through new specific by-laws passed.

- A comprehensive mechanism shall be there to improve the waste reduction, re-use and recycling among citizens and other stakeholders through social behavior change.
- To enhance the service delivery and recognition for municipal laborers by improving the professional qualifications, experience, and social skills of municipal labor force.
- Utilize accessible funding options to improve the quality of infrastructure and vehicle fleet.
- GMC shall have a comprehensive mechanism to record waste data throughout the SWM process in order to plan SWM system by predicting future requirement of labor force, physical infrastructure and equipment.
- GMC shall encourage women and youth participation in the SWM process to not only provide employment opportunities for those categories but also to enhance the recognition for the profession and to enhance the rapport between GMC laborers and citizens via social behavior change.
- It is a must that a comprehensive plan is available to get the maximum output out of the available resources. This may lead to reduced costs and increased revenues.
- The GMC shall always look for alternative methods to re-use or recycle different waste types retrieved from their collection in order to minimize disposal. They can contact universities and higher governmental institutions (e.g. CEA) for technical support.
- Community support in the SWM process is significant if it to function smoothly. Therefore, the GMC shall consider having a comprehensive communication platform, in which community grievances are also heard.
- The GMC shall always look for cost management avenues, particularly by reducing costs and increasing revenues. The selling of compost and other materials recovered from the collection is one way to increase revenues. However, there must be a comprehensive mechanism to identify buyers, contact them regularly, and to make it more professional business model.
- Implement measures to prevent illegal dumping through increased surveillance, public awareness, and strict penalties for offenders.
- Promote a circular economy by encouraging the reuse of materials, product design for recyclability, and the development of markets for recycled products.
- Utilize technology solutions, such as mobile apps for waste collection scheduling, RFID (Radio-Frequency Identification) for tracking bins, and GIS (Geographic Information System) for optimizing collection routes.

These options proposed above have been considered when formulating goals, objectives, and strategies of the ISWMAP, as in the next chapter.

9. Vision, Goals, Objectives, and Strategies

When developing the Vision, Goals, Objectives, and Strategies, HELP-O in collaboration with the GMC and CCBO conducted several consultation sessions, with city-wide stakeholders, community representatives, and the GMC SWM staff to identify the directions to take in this endeavor and possible solutions for the existing and anticipated issues with regard to the SWM in GMC area. Following are a few captures of those consultation sessions conducted prior to developing this ISWMAP.



Figure 14: ISWMAP Preparation - Community Consultation Session (Source: HELP-O)



Figure 15: ISWMAP Preparation - Stakeholder Consultation Session (Source: HELP-O)



Figure 16: ISWMAP Preparation – GMC Staff Consultation Session (Source: HELP-O)

The project team also investigated the current trends around the world regarding SWM and different approaches and concepts towards sustainable SWM. Following are a few key principles that reflect the above trends, approaches, and concepts that were incorporated into the Vision, Goals, Objectives, and Strategies of the ISWMAP.

Circular Economy

Instead of produce, use and discard products under the linear economy approach in existing SWM system, the focus in circular economy is on reducing waste generation and maximizing resource utilization through repurpose as well as material recovery. The adoption of circular economy principles in Solid Waste Management can contribute to a more sustainable and resilient system, promoting economic, environmental, and social benefits. It requires a collaborative effort from various stakeholders to implement innovative solutions that prioritize resource efficiency and waste reduction.

Life Cycle Consideration

The key stages of the life cycle of a given waste stream, including generation, collection, segregation, handling, storage, transportation, sorting, treatment, recovery, and final disposal is considered in an integrated manner aiming to maximize the resource-use efficiency and in consideration on socio-economic as well as environmental aspects. By considering the entire life cycle of a waste stream in an integrated manner, waste management systems can be designed to minimize environmental impact, optimize resource utilization, and contribute to sustainable development, considering both socio-economic and environmental considerations.

The 3R Concept

The 3R concept refers to Reduce, Reuse and Recycle in the context of waste management with emphasizes on the need for reducing the number of materials ending up in landfills. Here, Reduce means 'Reducing the quantity of waste generated', Reuse means 'Finding new ways to use again for the items that would otherwise be discarded', and Recycle means 'Transforming discarded items into something new and valuable form'. There are extended versions of the 3R concept such as 5R (Refuse, Reduce, Reuse, Repurpose, Recycle) and 7R (Rethink, Refuse, Reduce, Reuse, Repair, Re-gift, Recycle). These have been recognized in the national environmental action plan as logical extensions of the 3R concept and are complementary to Life Cycle Principle and Circular Economy.

Polluter Pay, Beneficiary Pay and the Compensation

The Polluter Pays Principle assigns the liability so that those who are responsible for pollution must bear the associated external costs of waste management in the context of SWM, similar to the application of Extended Producer Responsibility (EPR). The Polluter Pays Principle is a fundamental environmental principle that assigns the responsibility for the costs of pollution and waste management to those who generate the waste or pollution. This principle is designed to internalize external costs and promote accountability among polluters. In the context of Solid Waste Management (SWM), the Polluter Pays Principle, along with the concepts of Beneficiary Pays and Compensation, can be applied to guide sustainable and equitable waste management practices.

Common but Differentiated Responsibilities

Adhering to common but differentiated responsibility of every institution and individual in the city and involve in all aspects of waste management is considered as a basic prerequisite in managing waste for healthy life for all the city communities.

Public Trust Doctrine

This is a promising legal norm upon which the citizens can rely to realize their right to a sound environment on the basis that the GMC being the local governance agency, is not an absolute owner, but as the trustee of the environment and hence must manage them in the sole interest of its citizens. The extensive community participation in SWM decision-making and collaborating with stakeholders are considered as integral part of new 3R/ SWM system on this basis.

In line with the above-mentioned principles associated with SWM, and considering the city's future development aspirations that are entangled with being one of the key tourist destinations of significant heritage values in Sri Lanka (e.g. Galle Fort), the vision of the GMC ISWMAP was formulated as,

"Galle: The **Cleanest Destination** of Sri Lanka"

Focusing on the above vision, a detailed SWOT (Strengths, Weaknesses, Opportunities, and Threats) was conducted, and the key strengths, weaknesses, opportunities, and threats associated with the above vision are presented in the table in Annexure 1.

Focusing on the vision, vision-oriented SWOT and SWM related improvement needs and options identified in relation to the GMC SWM System (e.g. collection of waste, transport/ transfer, processing, disposal, and recycling markets), five (05) goals were formulated to address the needs of the city's SWM system. These goals focus on the vision principles and the overall sustainability of the city's SWM system.

The working group that was actively engaging in preparing the ISWMAP identified that the goals of the ISWMAP shall focus on providing solutions for each and every type of waste generated within the GMC area, improving the capacity of the GMC to tackle SWM related issues, engage diverse stakeholders in the SWM process while improving their capacity, and applying creative and innovative tools in addressing SWM issues. Accordingly, the five goals developed for the GMC SWM are as follows.

Goal 1	**Management of the municipal solid waste primarily through a 3R-based collaborative approach**
Goal 2	**A capable and knowledgeable Municipal Council for effective 3R-based SWM**
Goal 3	**Knowledgeable and dedicated stakeholders for effective 3R-based SWM**
Goal 4	**Collaborative network of stakeholders dedicated for 3R/ SWM action**
Goal 5	**A model city with replicable, creative, and innovative SWM solutions**

Under each goal, several objectives were identified and under each objective, several strategies were identified. Timely execution of these strategies and actions will help Galle City to become the 'Cleanest Destination is Sri Lanka, as emphasized in the Vision.

The following table presents the objectives and strategies that come under each goal.

Table 14: Goals, Objectives, and Strategies

Objective	Strategies
Goal 1: Management of the municipal solid waste primarily through a 3R-based collaborative approach	
Objective 1: To improve and operationalize existing SWM facilities at the GMC (e.g. PET bottle collection center and COWAM Centre at Dadella, Heenpendala Kawashima) at full capacity by 2030.	1. Appoint a team consisting of GMC officers of Technical, Financial, Social, and Managerial disciplines and External Experts of the same disciplines to assess the current status of these facilities. 2. Prepare action plans for Heenpendala, Dadella COWAM Centre, and PET bottle Center with the below features to reach the full capacity; I. Required physical improvements in the facilities (e.g. sanitary and other facilities for women employees) II. Suitable management approach that enables self-financing and sustaining long-run III. Achievable time plan with identified milestones IV. Well define the role and responsibilities of the parties involved V. Effective collaboration with relevant stakeholders (i.e. with Government, Private, or Funding agencies) VI. Direct accountability towards GMC 3. Connect these with schools/ universities/ other academic institutions with these SWM facilities for education and future R&D/ expansion purposes
Objective 2: To lower the per-capita generation of waste from 0.66 kg/day to 0.5 kg/day by 2030	1. Introduce Incentive-based instruments to promote waste reduction I. Introduce a rating system/ annual awarding system with appropriate parameters for waste generators (A, B, C) II. Promote plastic-free entities (e.g. Rating hotels for tourists) III. Introduce a quantity-based charging system for waste management service delivery by GMC except for typical domestic solid wastes 2. Identify, assess, and introduce alternative low-cost solutions for material that quickly turns waste (e.g. plastic shopping bags)/ Registration of such alternative product developers in GMC to promote them 3. Advocate Social Behavior Change to promote waste reduction I. Awareness Raising/ Campaigns with the active involvement of women, youth, and children II. GMC-led digital advertisement boards 4. Improving manufacturers for green products (e.g. through women alternative product developers) 5. Promoting green manufacturing among industries/ commercial establishments

Objective 3: To ensure proper waste segregation and storage practices among all types of waste generators by 2025	1. Introduce a scientific and more practical waste segregation policy for each residential, commercial, industrial and service sectors 2. Incorporate regulatory and Incentive based instruments to implement such policy 3. Make bulk waste generators (including waste aggregators) must prepare and submit GMC a SWM plan for their operation 4. Introduce a mechanism to obtain MSW data from the bulk waste generators 5. Make it mandatory to indicate estimated waste quantity, waste collection, and temporary storage points in the plan when applying for building plan approval 6. Introducing standard waste bins to collect/ store waste 7. Establish waste collection centers (all waste categories) within the GMC area
Objective 4: To establish a comprehensive Material Recovery Facility (MRF) at the GMC area by 2030	1. Explore opportunities to run the MRF as a PPP model 2. Establish material collection and sharing centers at selected spots within the GMC area
Objective 5: To identify entities specialized in managing recyclable waste materials and develop links for proper recyclable waste management by 2026	1. Register all waste recyclers, collectors, transporters, and aggregators (in and out of the GMC area), which can be linked to the GMC SWM System
Objective 6: To identify and implement sanitary storage and disposal methods for waste types with no acceptable disposal methods by 2026 (e.g. Hazardous [e.g. diapers, Sanitary pads, discarded batteries], non-hazardous unusable mix waste, fiber, ceramic waste, pottery waste, etc.) by 2026	1. Design a collection and storage system for waste types that do not have a proper/ acceptable disposal method 2. Link with CEA, Ministry of Environment and Ministry of Local Government to explore possibilities to apply Extended Producer Responsibility (EPR) policy/ regulations to such waste items 3. Identify and establish links with organizations deal with these kinds of waste (in or outside the GMC area) and have acceptable disposal methods 4. Establish a mini waste incinerator in the Heenpandala site in consultation with CEA.
Goal 2: A capable and knowledgeable Municipal Council for effective 3R-based SWM	
Objective 1: To enhance the supportive material resources, infrastructure, and	1. Upgrade the existing SWM vehicle fleet of the GMC by 2030

services to increase the collection rate from 22% to 50% by 2030	2. Improve (e.g. with sanitary and other facilities for women employees/ to promote women participation) and operationalize existing SWM-related facilities owned by the GMC (e.g. Municipal Garage at GMC premises/ Kithulampitiya, Vehicle cleaning center at Heenpendala) by 2025 3. Evaluate the current waste collection mechanism, identify the gaps and improve by 2027 I. Route Optimization (upgrade existing collection route, GPS monitoring, etc.) II. Use Mobile Apps and Digital technologies to monitor waste collection and transportation III. Streamline Waste-based income generation. 4. Use underutilized machinery for waste management effectively 5. Set up ocean strainers to collect plastic and other waste that float into the ocean through canals within the city limits. 6. Establish a mini-incinerator to burn infectious waste in consultation with CEA
Objective 2: To elevate the acceptance for Municipal SWM workforce through enhancing professional competencies by 2026	1. Increase the composition of women and youth employees in the SWM workforce 2. Facilitate workforce to gain NVQ-level training on SWM 3. Promote Incentives and Welfare Facilities (e.g. Health Care) for the workforce 4. Provide necessary equipment and training for the workforce 5. Introduce an Insurance Scheme for temporary workers
Objective 3: To strengthen the managerial mechanisms and tools at the GMC with required improvements by 2026	1. Strengthen the municipal SWM Unit and assign a dedicated key person to coordinate and implement the ISWAMP in consultation with the key officials of the GMC, including municipal SWM data base management 2. Facilitate the SWM Unit at the GMC with required resource personnel and equipment 3. Establish a research and development unit in the SWM unit by 2027 (e.g. focusing on community-specific solutions, route changes, safety, and environmental improvement, etc.) 4. Maintain an up-to-date database for waste generation, collection, sorting, end-disposal, aggregators, etc. with the participation of a representative from each department (Need to develop a computer-based database and program) 5. Implement an emergency response mechanism (e.g. establishing a mobile service unit) 6. Establish a Grievance Redress mechanism for SWM-related matters (e.g. customize the e-Sabha app for this purpose) 7. Monitor Informal Waste Collectors and provide technical support while charging an annual registration fee
Objective 4: To uplift the financial capacity of the GMC via managing expenses and strengthening revenue generation by 2026	1. Introduce service fee charge for identified services that the GMC provides in relation to SWM (e.g. managing waste generated from a Carnival) - Charge scheme shall be well structured, and quantity based and shall be conveyed clearly to the service receiver (influencing to reduce or self-managing of waste). 2. Establish a solar panel system for waste processing centers at Heenpandala, dadalla, and PET bottle collection center

Objective 5: To uplift the powers of the GMC via required improvements in the current legal and regulatory instruments by 2026	1. Identify the gaps in the current legal instruments that must be filled with new by-laws or regulations, in order to properly manage the SWM system and to implement the ISWMAP 2. Draft and get the approval for by-laws drafted on the above gaps/ to implement the ISWMAP
Objective 6: To develop and implement a comprehensive Monitoring and Evaluation Mechanism for each step of the SWM process (e.g. to monitor waste generation, segregation, waste generators and handlers, etc.) by 2024	1. Develop a comprehensive Monitoring and evaluation mechanism with a reachable timeline to monitor and evaluate the SWM process. It is proposed a quarterly (3 monthly) evaluation against KPIs and adopting/ continuing the tools such as WACS, COSA, Governance Gap Analysis, and Funding options in regular intervals (e.g. once in every 3 years) 2. Monitor regular collection efficiency of the GMC through comparing data and validation 3. Reduction of 80% of illegal waste dumping through awareness raising and legal means.
Goal 3: Knowledgeable and dedicated stakeholders for effective 3R-based SWM	
Objective 1: To develop and implement a comprehensive and novel platform for speedy and effective two-way communication between the GMC and stakeholders by 2025	Establish a website/ webpage attached to the GMC website dedicated for SWM related matters 1. Promote E-Sabha app for speedy and effective two-way communication 2. Promote using WhatsApp groups/ Webpage/ Facebook pages for speedy and effective two-way communication 3. Add a GMC hotline telephone number for communication purpose
Objective 2: To ensure bulk and impactful waste generators/ event organizers have comprehensive SWM Action Plans prepared in line with the ISWMAP of the GMC	1. Develop a list of criteria to identify who are the bulk waste generators/ event organizers 2. Making it a legal requirement to prepare a SWM action plan by specifying actions for reducing waste generation (plastic waste in particular), waste recycling, waste segregation and providing and managing storage facilities, and proper disposal of different types of waste. 3. Make it a requirement for impactful waste generators/ event organizers (those who generate bulky and hazardous waste) to have a qualified (e.g. NVQ) 3R/ SWM official to handle 3R/ SWM at respective organizations.
Objective 3: To ensure a positive social behavior change among stakeholders through a comprehensive program for knowledge sharing and attitudinal change by 2030	1. Platform (affiliated to proposed R&D division of GMC) to absorb and share new knowledge created at universities, private sector entities, and other relevant parties on novel SWM-related practices 2. Continuous knowledge enhancement and training for diverse stakeholders based on a need assessment 1. Govt officials/ hotels/ industry community/ tourists, etc.

	3. Provision of training and awareness on 3R/ SWM for specific groups (e.g. women, youth, nurseries, schools, dhamma schools, youth, tuition classes, etc.) aiming for long-term social behavior change 4. Request relevant government agencies to promote SWM practices at school level and to look into the possibilities of including SWM-related knowledge in the school syllabus. 5. Provision of awareness on 3R/ SWM good practices for specific groups through innovative communication tools (e.g. digital boards and street dramas) 6. Organize specific awareness sessions for groups with unique and significant waste problems (e.g. religious places)
Objective 4: To absorb existing activists, volunteer groups, and tourists into the GMC SWM system to be 3R/ SWM role models (e.g. to act in SWM emergency situations, detecting and acting on wrong doings, etc.) by 2026	1. Recognize and facilitate (e.g. incentives, eco-tourism through SWM, and Health tourism) best practices, and utilize them in knowledge sharing and social behavior change 2. Establish an approval process at the GMC for volunteer activities 3. Engage activists, volunteers (e.g. Women/ Youth Leaders), and tourists in the GMC SWM System 4. Promote volunteer vigilante groups to detect and act on wrongdoings. 5. Promote student groups (at school level) as volunteers and vigilante groups. 6. Organize competitions, debates, and exhibitions on SWM at school level 7. Organize competitions among settlements to appreciate best practices and dedication towards a cleaner city 8. Provide incentives/ recognition for volunteer environmental groups and societies who work on SWM
Goal 4: Collaborative network of stakeholders dedicated for 3R/ SWM action	
Objective 1: To have a recognized Stakeholder Forum at the GMC that meets regularly to discuss 3R/ SWM matters affecting individual stakeholders and the city by 2024	1. Adopt the current Stakeholder Forum established under the CACG project into the GMC SWM institutional setup and to give it legal recognition via GMC by law 2. Define the composition, decision-making protocol, meeting frequency and role responsibility of the SHF (women and youth participation shall be encouraged) 3. Facilitate identified membership of SHF to take part in the decision-making process with regard to monitoring, evaluation and maintenance of the 3R/ SWM system in GMC
Objective 2: To establish a process to register and manage individuals/ institutions that engage in action/s related to MSW management within the GMC area by 2025	1. Make it mandatory to get GMC registration for engaging in MSW collection, transportation, preparation for recycling and end disposal as a business/ living/ volunteer action/ action of NGO with external funding and introduce a simple registration procedure 2. Establish a database with a mechanism to collect and update it with types/ quantities of MSW being handled by each individual/ institution

	3. Facilitate exchange of information and linking between agencies/ individuals as necessary for effective waste handling within GMC
Objective 3: To encourage alternative product developers and facilitate linking them with City stakeholders for effective 3R/ SWM by 2024	1. Inventorize alternative product developers to replace plastic/ polythene utensils reducing waste (e.g. women alternative product developers/ producers) and facilitating linking them with potential buyers (i.e. users like Hotels, Industries and Offices etc.) 2. Facilitate alternative product developers (especially women through Women-based organizations) using wastes as upcycling option and facilitate linking them with potential raw material suppliers (waste generators/ aggregators) and buyers/ market places 3. Strengthen new entrepreneurs (especially women and youth) in SWM and build a connection between GMC and new entrepreneurs
Objective 4: To establish/ enhance existing collaborative relationships with International/ National/ Regional establishments to facilitate effective 3R/SWM actions in the GMC by 2025	1. Nominate a responsible official within GMC SWM unit to work on this specific subject to build collaborative relationships with other partners and to achieve global and national recognition for 3R/ SWM good practices 2. Identify useful agencies and build collaborative actions/ mechanisms to enhance 3R/ SWM of GMC (e.g. CityNet-exchange of experiences, National Solid Waste Support Center-technical & financial support provider and Universities for technical inputs) 3. Identify suitable business models to enhance the 3R/ SWM system at the GMC (e.g. PPPs) by means of finding a solution to waste problems 4. Register aggregators/ waste collectors and look for opportunities to hand over specific parts of the SWM system to them while GMC remains the monitoring and evaluation agency. 5. Follow the guidelines from UNESCO to introduce specific SWM mechanism for Galle Fort to enhance its reputation as a World Heritage Site 6. Establish links with academia for the sustenance and development of current innovative 3R/ SWM practices and pilot new ones by 2025
Goal 5: A model city with replicable, creative, and innovative SWM solutions	
Objective 1: To maintain a comprehensive and user-friendly database/ collection of materials by 2025, which elaborates how the	1. Record and publish the transformation of the city along with the implementation of 3R/ SWM actions through 2030 2. Record and publish the overall process adopted and followed by the GMC towards being the cleanest city in Sri Lanka by 2025 3. Record and publish the new knowledge, tools, procedures, and technology used in improving the SWM system

Galle City is being transformed to be a Model City in 3R/ SWM	1. Record and publish role models in collaborative approaches, funding options, governance and 3R & safe disposal-like aspects of the process 4. Record waste management data and information of famous places/ tourist locations and special areas in Galle Municipal Council 5. Introduce a Monitoring and Evaluation System to record data and information
Objective 2: To establish a dedicated team in the GMC SWM Unit by 2024, to ensure sustainability through promoting and facilitating knowledge sharing for replication of the key models/ lessons learned in 3R/ SWM	1. Identify key officials, relevant stakeholder representatives, social groups, senior citizens, and volunteer expertise in technical, managerial, and social aspects of the 3R/ SWM innovations in GMC and train them as promoters/ ambassadors. 2. Establish links with key stakeholders in tourism, environment management and good governance sectors to absorb their 3R/ SWM innovations and to promote 3R/ SWM-related key models/ lessons learned in Galle through them. 3. Appoint trained staff for the proposed SWM unit and develop a system for the government staff transfer process
Objective 3: To achieve National and International "QUALITY STANDARDS" and "AWARDS" for effective 3R/ SWM innovative practices/ World heritage site management by 2030	1. Identify available "QUALITY STANDARDS" and "AWARDS" on the target areas by the SMW unit at the GMC and prepare an action plan to achieve the identified quality standards and awards.

10. Financial Analysis

The financial analysis presented in this chapter includes cost-of-service analysis for operating the overall solid waste collection; handling; and disposal mechanism, solid waste system cost analysis, and the analysis of revenues generated through the SWM system of the GMC. Interpretations on the above aspects have been based on the nature of operation and the availability/ accessibility of relevant data under the existing data management system in the GMC.

a. Cost of Service Analysis

As per the guidelines developed by the USAID-CCBO, a COSA tool (2022) was employed in analyzing the cost data and the overall summary table of the results is presented below.

Table 15: The overall summary results of the 3R/SWM COSA of GMC for year 2022 (Source: COSA Report, 2023)

No.	Path Description	Total Annual Cost (LKR)	% of Total Annual Cost	Units (metric tons)	Per Unit Cost (LKR)	USD 1=315
SWM/3R Service Delivery Costs			%			
1	Collection	102,430,113.72	59	8,030	12,756	40.50
2	Transfer/Transportation	17,906,427.00	10	8,030	2,230	7.08
3	Segregated Waste Processing (COWAM)	6,526,712.19	4	1260	5,180	16.44
4	Bio-degradable Waste Processing	2,194,456.33	1	5760	381	1.21
5	Landfill Disposal (Heenpendala)	4,694,250.00	3	684	6,863	21.79
6	Street Sweeping	658,809.68	0	180	3,660	11.62
7	Waterways and Illegal Dumping Clean Up	30,658,700.24	18	360	85,163	270.36
SWM/3R Administrative Costs					-	-
8	Community Outreach	952,800.00	4	8,030	119	0.38
9	Enforcement	Unable to captured data			-	-
10	Financial Management	6,665,992.00	4	8,030	830	2.64
11	Human Resources	Unable to captured data			-	-
12	Planning	Unable to captured data			-	-
13	Policy Development	Unable to captured data			-	-
Total System Costs		**172,688,261.16**		**8,030**	**21,359**	**67.81**

As presented in the table, results are given under two key aspects of GMC's 3R/ SWM as 3R/ SWM service delivery cost and 3R/ SWM administrative cost. However, some of the cost lines were unable to derive due to difficulty in finding the required data for the calculations. For instance, the enforcement, human resources, and planning were undertaken in the 3R/ SWM process of the GMC, whereas resource allocation and thus the respective costs were unable to identify from the current GMC cost centers.

The results based on the Cost Paths have been presented in detail under the Annex 2 and in the COSA Report.

b. Revenues Analysis

The GMC revenue through the 3R/SWM service delivery in 2022 were mainly from the waste collection fee, trade license fee, environment protection license fee, and income from waste recycling.

As per the analysis, the total revenue was 10,644,942.00 LKR, and it shares 81% from waste collection fee, 16% from waste recycling income and 3% from waste management fraction of trade and environment license fees.

Waste Collection Fee

A collection fee has been charged from the bulk waste generators (who generates large quantity). The amount of charge is proportionate to the waste load, which is judged by the relevant Supervisor based on visual observation. The annual zonal wise collection fee is given in the following table.

Table 16: The Zonal Wise Waste Collection Fee from Bulk Generators
(Source: COSA Report, 2023)

No.	Zone	Annual Revenue/ LKR	Percentage
1	Cheenakoratuwa	2,436,250.00	28
2	Galle fort	776,250.00	9
3	Kanampitiya	195,000.00	2
4	Hirimbura 1	936,225.00	11
5	Hirimbura 2	480,129.00	6
6	Magalla	300,000.00	3
7	Katogoda	300,001.00	3
8	Thalapitiya	248,750.00	3
9	Richmand Hill	178,750.00	2
10	Elight Road	107,500.00	1
11	Pettigalawatta	919,109.00	11
12	Kadaweediya	484,486.00	6
13	Ginthota	230,000.00	3
14	Kaluwella	1,030,000.00	12
	Total	**8,622,450.00**	**100**

Trade License Fee

The trade license fee is an annual fee charged from business entities within the GMC area. A fraction of 20% of the trade license fee is considered as revenue from 3R/ SWM sector, since this is related to providing guidelines and monitoring of the 3R/ SWM practices of the trade license holding entity. Accordingly, the 3R/ SWM related charge from the trade license fee is 215,192.00 LKR in 2022.

Environment Protection License Fee

The GMC is authorized the Central Environmental Authority (CEA) to issue the environmental protection license (EPL) for the low polluting industries that have been prescribed by CEA under the provisions of National Environmental Act. This fee is charged to cover the administrative expenditures related to desk study and site inspection based industrial pollution assessment and monitoring process by GMC. Therefore, 80% of the license fee is taken as 3R/ SWM revenue and is 100,800.00 LKR in 2022.

Income from Waste Recycling

The waste recycling revenue generated only from the Dadalla recycling facility, totaling to 1,706,500.00 LKR in 2022. This consists of 92.3 % from Building material recovery unit (i.e. cost savings on construction raw material from recovered material), 7.3% from Glass waste recycling and balance 0.4% from the PET collection unit.

c. Key findings of the COSA

The conclusions reflect the interpretations of COSA results in the context of existing 3R/ SWM service delivery practices as well as the administrative and financial management protocols of the GMC.

Collection cost

The annual average waste collection cost is 12,645 LKR/ MT (59% of total cost) while that of Wet, Dry and Mix wastes are 9,332 LKR/ MT, 24,469 LKR/ MT, 7,397 LKR/ MT respectively. The percentage of wet and dry waste collection costs out of the total annual cost are respectively 53% and 41%.
Cost breakdown shows the workmen expenses and machine-vehicle based costs are respectively 63% and 35%, totaling to 98%.

- ✧ The annual average waste collection cost being similar to the standard cost for Municipalities validate the accuracy of COSA tool application.
- ✧ However, it is clear that improving efficiency of workmen and machine-vehicle engagement will further reduce the average waste collection cost.
  - ✓ For workmen efficiency improvements shall cover the site workforce as well as the supervisors, drivers and technical staff too.
  - ✓ Insight of machine-vehicle (table 17) cost shows that high cumulative value (derived from COSA tool) of 1,863.58 LKR per Kilometer (Km) for waste collection. Out of this, vehicle maintenance and fuel costs are significantly high (refers chart 4 and 5). The followings are identified as root-courses;
    - ➢ The 34% of waste collection vehicles-machine were being used over the standard life span
    - ➢ Absence of a mechanism to record-analyze data on vehicles-machine operation as well as to use same for decision making are identified as key reasons for this high cost.

- ✧ The high share of total collection cost and the high unit cost of dry waste collection indicates the need for improving the dry waste collection efficiency with priority attention.
- ✧ The route optimization (completed in August 2023) has enhance efficiency of GMC waste collection from 32% (collecting 21.5 MT/ Day) in December, 2022 to 41% (collecting 28 MT/ Day) in October, 2023 and resource utility by reducing travel distance from 294 Km/ Day to 240 Km/ Day leading to save 100,633.00 LKR/ Day.

Transportation/ Transfer

The transport operation in 2022 was limited to transfer of collected waste from Heenpendala to Monrovia Estate (using the machine-vehicles in table 3). This operation was terminated in April 2023 after commissioning the Kawshima compost facility at Heenpendala and therefore this cost (which is 10% of total cost) does not exist in current 3R/ SWM system.
However, it is presumed that the understanding on the transport cost structure is useful for 3R/ SWM decision making and future planning and concluded as follows;

- ✧ The annual average waste transport cost is 2,890.00 LKR/ MT and that of wet and dry are respectively 2,289LKR/ MT and 7,461 LKR/ MT. This shows that the dry was transporting is significantly expensive.
- ✧ The overall annual average transport cost per kilometer (i.e. total transport cost/ annual distance traveled) is 210 LKR/ Km.
- ✧ Out of the transport cost 64% consists of wages and expenditures related to the workmen employed for this operation while the balance 36% is operational and depreciation costs of the vehicle fleet.

Segregated Waste Processing

The waste processing in 2022 was limited to Building material recovery, Glass waste and PET bottle collection at the GMC facility in Dadalla. The findings on resources (manpower, land and machines) allocation, percentage of usage, operational cost and revenue for Building material recovery, Glass waste and PET bottle collection facility as briefed in table 21 lead the following conclusions.

- ✧ All the facilities have been used well below their operational capacity.
- ✧ The building material recovery facility has recorded profit (i.e. saved funds more than expenditure) through the recovered raw material for construction of the GMC while both the Glass waste and PET bottle recycling facilities have recorded losses.
- ✧ It was revealed that gaps in pricing mechanism, institutional set up and strategies to promote this among City community are key reasons for operating at very low capacity.
- ✧ There is no specific data and financial information management system with administrative procedures to regularly assess operational efficiency and cost effectiveness.
- ✧ The operational efficiency and cost effectiveness of the facility is also unable to be easily derived through the existing Cost centers.
- ✧ The waste processing cost consists of wages and payments related to the workmen - 82%, machine depreciation - 15%, power electricity - 2% and other supplies 1%. Thus, effective management of human resources, machines and energy consumption will help increasing the operational efficiency.

Final Disposal

There were two final disposal sites in 2022. The disposal at Heenpendala was limited to half of dry waste and the total non-segregated waste collections. That of Monrovia Estate site was for entire wet waste and half of dry waste collections of GMC.
The final disposal cost of both dry and non-segregated waste at Heenpendala is 912 LKR/ MT. This splits between costs for workmen and machine-vehicle operation respectively as 54% and 46%.

The final disposal cost of wet waste is 2,889 LKR/ MT and dry waste is 9416 LKR/ MT through the Monrovia Estate disposal facility. This cost consists of waste transfer cost (from Heenpendala to Monrovia Estate) of 79% and tipping fee at Monrovia Estate of 21%. This operation was terminated in April 2023 saving 22,600,678.00 LKR per year.

Since at present, the entire wet waste collection is now used for composting through Kawshima plant, and the dry waste is subjected to segregation the final disposal is limited to the residuals and non-segregated waste at the Heenpendala.

Street Sweeping and Water ways/ Illegal dump clean up

The unit cost of street sweeping is 3,660 LKR/ MT and consists of expenses for the workmen engagement.

The unit cost of water ways and illegal dump clean-up is very high as 85,163 LKR/ MT, which is 18% (2nd highest) of total cost. This consists of 86% expenses for workmen and 14% for other supplies.

The presence of about 13 illegal dump sites, recorded 25 cases of illegal waste dumping incidents by Environmental Police and the high volume of wastes observed in waterways indicate that the GMC could adopt a participatory approach with the city community and stake holder agencies to control the illegal waste dumping at a comparatively lower cost.

Administrative costs

The administrative costs related to the 3R/ SWM system operations have not been recorded in the existing GMC Cost centers in a way that could be identified easily and accurately.
However, multiple engagements by CCBO and HELPO confirm that there are sizeable administrative expenses for operating the current 3R/ SWM system.

The GMC senior level staff endorsed the importance of improving current financial management system to clearly indicate the main service delivery and administrative cost streams related to 3R/ SWM system in order to establish data driven decision making culture ensuring the continuous improvement and sustainability of the system.

Revenue

The results indicates that out of total revenue of 10,644,942.00 LKR, the 97 % is from the direct 3R/ SWM based sources as waste collection fee and income from waste recycling and the balance from trade and environment license fees. Thus, the annual average revenue is 1325.64 LKR/ MT.

The COSA process clearly shows that there is a great potential to increase the revenue by overcoming following gaps in current revenue sources.

- ✧ There is no clearly defined criteria-based decision-making system for the selection of bulk waste generators.
- ✧ The current charging scheme from bulk waste generators is not based on a measured quantity but on a manual, observation bound judgment. This procedure also is not adequately transparent as well.
- ✧ The section 5.1.3 presents gaps in the current "waste recycling system".
- ✧ The trade license process is being implemented efficiently.
- ✧ The efficient enforcement of environment protection license scheme by identifying through data bases and unfulfilling all relevant industries to possess license, duly monitor and maintain database to ensure proper follow up actions including license renewal.

The Cost and Revenue Comparison

The total 3R/ SWM total cost is 172,688,261.16 LKR and the total revenue is 10,644,942.00 LKR in 2022. Thus, the annual revenue is 6% of the annual expenditure and therefore the GMC has to depend on external funding sources like other revenues of GMC itself and Central/ Provincial Government for budgetary purposes.

11. Funding Options

CCBO in collaboration with HELP-O and GMC conducted a Funding Options workshop in November 2023 with the participation of key stakeholders of the city. Key objective of the workshop was to identify critical and workable funding options for GMC's solid waste system that would enable environmentally and economically well-managed and collaborating system. Also, the funding options are considered as potential revenue sources necessary to continue operating the GMC's 3R/SWM infrastructure (operating expenditure) to consistently provide day-to-day service (CCBO, 2022). Finding options for SWM funding can be helpful in the long run to cut down costs incurred for health-related expenses. The baseline for the Funding Options workshop was the findings of the COSA.

The funding options covering the following sectors were developed through the Funding Options workshop and diverse consultation sessions conducted over the period of the project.

a. Self-generated funding options

- ✧ Freeing up funds by improving existing systems
- ✧ Waste system fees and taxes
- ✧ Sale of products generated from waste

b. Third party funding options

- ✧ Public Private Partnerships (PPPs)
- ✧ Informal waste collection and recyclables processing businesses
- ✧ Non-governmental organizations
- ✧ International funding agencies

a. Self-generated Funding Options

Freeing Up Funds by Improving Existing Systems

This means the options to recover funds through cost avoidance measures and finding efficiencies in the existing 3R/SWM system. By incorporating the COSA findings to identify excessive 3R/SWM expenses and adopting innovative approaches for service delivery, the GMC could achieve performance on this aspect through the following options.

a. Cost avoidance
b. Service efficiency cost savings
c. Better collection of payments from citizens/ generators

Cost avoidance:

I. Invest in public awareness and education campaigns to encourage residents and businesses to reduce, reuse, and recycle. A well-informed community is more likely to participate in these activities, reducing the volume of waste that needs disposal.

II. Encourage source separation of recyclables and organic waste at the household and business levels. This reduces contamination and makes it easier to recycle and compost, lowering processing costs.
III. Track the cost of operating the Kawashima plant and estimate how much will this save from landfill cost and how much revenue was earned by selling the compost.
IV. Implement office system automation (e.g. green procurement) practices to minimize waste generation in government and private sector operations, thus reducing the volume of waste that needs disposal.
V. Replace the outdated vehicles with new vehicles in the waste collection machine fleet thus avoiding the high operational cost for outdated vehicle maintenance and fuel (at low efficient level) as well.
VI. Introduce energy-efficient vehicles, machines and technologies to reduce high operational cost for fuel (e.g. green fuels for vehicles, heavy machinery) and for power electricity (e.g. solar system for Heenpendala and Dadalla waste processing facilities).
VII. Establish "Pay as You Throw" (PAYT) waste collection centers at public place and decide the charge (a) to cover the operational cost of the scheme and (b) to influence reducing amount of waste hand over to GMC. This will reduce GMC waste collection from water ways/ illegal dumps and hence high cost of 85,163 LKR/ MT in 2022.
VIII. Strengthen the law enforcement on SWM by GMC join in hand with Environment Police and Community volunteers. This action together with action I and VI above will lead to reduce illegal waste dumping (13 such locations are scattered within the GMC area and 25 law enforcement cases in 3 months by Environment Police). This will help reducing related very high cost of 85,163 LKR/ MT for illegal dump and waterways clean up.

Service efficiency cost savings:

I. Optimize collection routes and schedules to improve collection efficiency and minimize fuel and labor costs. The route optimization was undertaken by GMC with CCBO assistance in 2023 resulting to reduce traveling distance for waste collection by 54 Km/ Day (by 18%) saving 100633.32 LKR/ Day (I.e.54 Km * 1863.58 LKR/ Km as per COSA findings).
II. Develop digital platforms and mobile apps to engage with the public. These platforms can facilitate scheduling of waste pickups, report issues, and provide community with information on recycling and waste reduction leading to reduce service inquiries and enhancing community involvement. This will improve service efficiency while reducing resource (manpower & machine-vehicles) wastage saving the excessive costs.
III. Rearrange the GMC's 3R/SWM machine-vehicle fleet and optimize the allocation/ use of machine fleet. This will lead to significantly reduce the vehicle-machine fleet-based cost, which is 35% of waste collection cost (refers chart 3 of COSA Report). In addition, regular breakdown of vehicles-machines disturbs the waste handling operation causing many issues at the site level and drastically reducing the GMC's 3R/ SWM system efficiency as well.
IV. Collaborate with aggregators and private companies to manage waste collection and recycling services like operating an MRF. This will lead to reduce the dry waste collection cost at the Dadalla, COWAM center which also operates bellow it's capacity and at Heenpendala as well.
V. Establish partnership with specialized private sector waste handling agencies for proper management of waste categories requiring specific technological and infrastructural capacities. This action will help reducing mixing of waste categories in to generic "wet" or "dry" waste collection, reducing the waste handling cost and increasing service efficiency of GMC.

Better collection of payments from citizens/ generators:

The COSA results show that annual revenue from 3R/ SWM process is merely a 6% of the annual expenditure, thus there is a significant need for increasing the revenue. The attention shall be paid to increase revenue from the "waste collection fees" and "waste recycling". The COSA indicates existence of the following gaps in current revenue sources and the proposed/ consented solutions at the funding options workshop are as follows.

I. Absence of clearly defined criteria-based decision-making system for the selection of waste generators liable for a service charge.
II. The current charging scheme from bulk/ special waste generators is not based on a measured quantity but on a manual, observation bound judgment. This procedure also is not adequately transparent as well.
III. Gaps in the current "waste recycling system" of GMC that consists of the dry waste recycling facilities in Dadalla and Heenpendala sites
IV. The efficient enforcement of environment protection license scheme by identifying through data bases and unfulfilling all relevant industries to possess licence, duly monitor and maintain database to ensure proper follow up actions including license renewal.

Waste System Fees and Taxes

The funding options associated with the 3R/ SWM services provide by the GMC through their built infrastructure, mobile and human resources are considered here.

Waste collection fees:

Followings are some proposals discussed at the funding option workshop.

I. The fee should be designed to cover the municipality's expenses related to solid waste collection, transportation, disposal, and recycling, as well as administrative costs. Consider conducting a thorough cost analysis to determine the actual expenses.
II. The municipality should set clear revenue goals that align with its budgetary needs. The service fee should be structured to meet these financial objectives while ensuring it is not a burden on residents. Ex: Impose a charge per Kg of waste per Day from Commercial, Service and Industrial establishments and fines from illegal waste dumpers.
III. Ensure that the fee structure promotes fairness. Different service fee structures, based on volume/ weight of the waste, can be considered. It's important to strike a balance between equitable charges for all waste generators and ensuring affordability for lower-and higher waste volume generators.
IV. Consider variable pricing based on the size of waste bins, frequency of collection, or the type of waste (e.g., recycling vs. non-recycling). This encourages waste reduction and recycling, which can lower GMC intervention and thus the disposal costs over time.
V. In addition to all the sectors mentioned in the above section for waste collection fee, the following specific sub sectors also to be considered;

- ✧ Introduce a 'Tourism Fee' to be charged directly from the tourist hotels, restaurants, etc.
- ✧ Charging an entry fee from local and foreign tourists at the "Galle port Entrance gate" for the purpose of environmental cleanliness can be a viable approach to fund environmental conservation and cleanliness efforts in the area.
- ✧ Construction and demolition projects generate large volumes of waste. GMC shall charge service fees for permits or waste removal from such sites.
- ✧ Events like festivals, fairs, and community gatherings generate temporary spikes in waste. GMC shall charge fees to cover the cost of providing additional waste collection and disposal services during these events.
- ✧ For the removal of large items like furniture and appliances, GMC may charge service fees to cover the additional labor and disposal costs.
- ✧ Non-hazardous waste generated by hospitals, clinics, and other healthcare institutions often requires specialized handling and disposal, leading to specific service fees.
- ✧ Provide shared collection bins or dumpsters for use by multiple households or businesses. GMC can charge fees to users for access to these facilities.
- ✧ In apartment complexes and multi-unit residential buildings, fees may be charged either to property owners, landlords, individual tenants, or private collectors for waste collection services.

VI. Involve the business community, community leaders, waste sector players (informal collectors, aggregators and MRF operators) and representatives from undeserved communities including women in the decision-making process by seeking public input through surveys or town hall meetings. This can help stakeholders' willingness to pay and their preferences for service levels.

VII. Develop a long-term financial plan for waste management to ensure sustainable funding options. This should account for factors like inflation and future infrastructure upgrades.

VIII. Be prepared to adjust the service fee periodically based on changing circumstances, such as inflation, shifts in waste generation, or changes in recycling markets.

Facility tipping fees:

This fee method is adopted at Heenpendala for bulk waste providers and at the building waste recycling facility at Dadalla. At Heenpendala, a tractor load is charged 500.00 LKR while at Dadalla biulding waste recovery facility a tractor load is charged approximately 2,000.00 LKR in 2022. However, these schemes are not well documented and thus the clear revenue records are also not easily accessible and not being utilized for budgeting purposes as well.

However, during the COSA process and the funding options workshop, it was proposed to elevate the functional status of both Heenpendala and Dadalla as MRFs with following scope;

- ✧ Heenpendala: Wet waste processing (Kawshima plant) and Recyclable waste recovery/ processing facility except Glass and building wastes.
- ✧ Dadalla: PET bottle, Glass and Building waste recovery/ processing facility.

At the funding option workshop, all the stake holders agreed that the tipping fee structure shall be decided incorporating the overall facility operational cost, prevailing market rates and the covenants in the GMC agreements with the collaborating partners.

Property taxes:

The GMC imposes property tax from all the residents within its jurisdiction while a "trade license fee" is charged from all the business entities within the same area. These two tax schemes are very effectively imposed through a well-organized institutional set up with data management scheme, which is a key for the budgetary purposes. It was discussed at the funding option workshop and relevant past consultative sessions that similar institutional and financial/ data management system with essential changes could be used for collecting the waste collection fee.

Sale of Products Generated from Waste

GMC is currently producing compost at the Heenpendala Kawshima plant. The compost produced there is yet to be distributed among buyers, however, testing and marketing of compost is in progress. It is difficult to foresee the amount of revenue that will be generated from selling compost, however, this can be considered one of the revenues that will be generated through selling products associated with waste.

In addition, there is a possibility that output of the glass and building waste processing facility at Dadella can be sold to third parties as materials and generate revenue in the future.

To improve the function at these facilities and to enhance the quality of products produced from these facilities, following suggestions can be made.

i. Operate the facilities at full capacity. Currently, the facilities are either not functioning or functioning at partial capacity.
ii. Enhance the quality of compost with the support of universities and/or any private sector and cater the needs of agriculture/ home gardening sector in and around Galle.
iii. Identify and negotiate with different buyers for crushed glass, shredded plastics, baled PET bottles, and so forth.

b. Third Party Funding Options

As per the stakeholder consultations and other studies, the following third-party funding sources were identified and can be presented as potential funding options for the successful implementation of the GMC SWM System.

1. PPP Model for identified parts of the SWM system
2. Corporate Social Responsibility (CSR) funds
3. NGOs
4. International donor agencies

PPP Model for identified parts of the SWM system

The GMC has the potential to go for PPP-based collaborations with private sector to manage certain parts of the SWM process. For example, it has been in discussion among senior staff of the GMC to find out possibilities of handing over the MRF development in Heenpendala site to a private aggregator who has the capacity to develop it up to the scale of an MRF and operate it with his investments, while

the GMC is responsible to overlook the entire operation at Heenpendala. Similarly, as some of the local authorities in Sri Lanka have already done (e.g. Colombo MC), handing over the collection and transportation of waste to a private company, aiming at reducing the burden on the GMC in waste collection and transportation. Therefore, PPP-based collaborations remain a potential third-party funding option.

CSR Funds

CSR is a strategy employed by private sector to not just grow profits via marketing but also take an active and positive role in the social responsibility that they have on the society that they are a part of. The GMC with a comprehensive proposal to private sector organizations with their own CSR funds can access certain amount of funding for the implementation of programmes designed to improve the SWM in the city. As an example, the CleanTech Pvt Ltd. Company, on a request of HELP-O through GMC donated significant amount of equipment (e.g. e-waste collection bins and other regular bins) to Karapitiya hospital and several other identified waste generators as an in-kind contribution.

Non-Governmental Organizations

There are many NGOs who work in the 3R/ SWM sector in and around the city of Galle (e.g. HELP-O) who will wish to work in collaboration with the GMC in projects with a focus on SWM. NGOs typically provide in-kind resources, including knowledgeable staff, to provide knowledge sharing and awareness programs and training to local government officials and citizens, including consulting services. They may also donate or provide funds to purchase equipment, conduct training programmes, and even to support an entire component of the SWM System, such as community capacity building via awareness and training. Hence, NGOs remain a potential third-party funding option for GMC for the successful implementation of the ISWMAP.

International Donor Agencies

There are many international donor agencies who fund SWM-related proposals submitted by local government bodies, NGOs, or any other organization that they have identified as their collaborators. Hence, with a comprehensive proposal, the GMC may be able to access such donor agencies to fund certain parts of the SWM process. Some donor agencies may accept proposals via a specific group of organizations (e.g. NGOs) and in such cases, the GMC may collaborate with such organizations and submit proposals to access funding.

12. Implementation Plan

Ref. No.	Strategy	Priority	Responsibility	Timeline						
				2024	2025	2026	2027	2028	2029	2030
Goal 1: Management of the municipal solid waste primarily through a 3R-based collaborative approach										
Objective 1: To improve and operationalize existing SWM facilities at the GMC (e.g. PET bottle collection center and COWAM Centre at Dadella, Heenpendala Kawashima) at full capacity by 2030.										
1.1.1	Establish SWM Technical Committee at the GMC to oversee matters related to SWM (e.g. to brainstorm, synthesis, and make collaborative decisions)	I	Municipal Commissioner							
1.1.2	Appoint a team consists of GMC officers of Technical, Financial, Social and Managerial disciplines and external experts of same disciplines to assess the current status of these facilities	I	SWM Technical Committee							
1.1.3	Prepare action plans for Heenpendala, Dadella COWAM Centre, and PET bottle Center with below features to reach the full capacity; I. Suitable management approach enabling self-finance and long-term sustainability II. Achievable time plan with identified milestones III. Well define role responsibilities of parties involved IV. Effective collaboration with relevant stakeholders (i.e. with Government, Private or Funding agencies) V. Direct accountability towards GMC	I	<u>Plan Preparation:</u> The team currently involved in with the operation of these GMC facilities <u>Plan Approval:</u> SWM Technical Committee							
1.1.4	Connect these SWM facilities with schools/ universities/ other academic institutions for education and future R&D/ expansion purposes	3	Municipal Secretary/ CDO Unit / Health Department/ Engineering Department							
Objective 2: To improve and operationalize existing SWM facilities at the GMC (e.g. PET bottle collection center and COWAM Centre at Dadella, Heenpendala Kawashima) at full capacity by 2025.										

1.2.1	Introduce Incentive-based instruments to promote waste reduction IV. Introduce a rating system/ annual awarding system with appropriate parameters for waste generators V. Promote plastic-free entities (e.g. Rating hotels for tourists) VI. Introduce quantity-based charging system for waste management service delivery by GMC except for typical domestic solid wastes	1	SWM Technical Committee								
1.2.2	Identify, assess, and introduce alternative low-cost solutions for material that quickly turns waste (e.g. plastic shopping bag)/ Registration of such alternative product developers in GMC to promote them	2	SWM Technical Committee								
1.2.3	Advocate Social Behavior Change to promote waste reduction III. Awareness Raising IV. Campaigns V. GMC-led digital advertisement boards	1	CDO Unit								
1.2.4	Promoting green manufacturing among industries/ commercial establishments	3	Engineering Department/ Health Department/ CDO Unit								
Objective 3: To ensure proper waste segregation and storage practices among all types of waste generators by 2025											
1.3.1	Introduce a scientific and more practical waste segregation policy for each residential, commercial, industrial and service sectors	1	Engineering Department/ Health Department/ CDO Unit								
1.3.2	Incorporate regulatory and Incentive based instruments to implement such policy	1	SWM Technical Committee, Legal Officer, CDO								
1.3.3	Make it is mandatory for bulk waste generators (including waste aggregators) to prepare and submit GMC a SWM plan for their operation	1	Engineering Department/ Health Department								
1.3.4	Introduce a mechanism to obtain MSW data from the bulk waste generators	1	Engineering Department/ Health Department/ CDO								
1.3.5	Make it is mandatory to indicate estimated waste quantity, waste collection, and temporary storage points in the plan when applying for building plan approval	2	Engineering Department/ Health Department								
1.3.6	Introducing standard waste bins to collect/ store waste	2	Engineering Department/ Health Department/ CDO								

1.3.7	Establish waste collection centers (all waste categories) within the GMC area	1	Engineering Department/ Health Department/ CDO								
Objective 4: To establish a comprehensive Material Recovery Facility (MRF) at the GMC area by 2030											
1.4.1	Explore opportunities to run the MRF as a PPP model	2	SWM Technical Committee								
1.4.2	Establish material collection and sharing centers at selected spots within the GMC area	1	Engineering Department/ Health Department/ CDO/ Accounts Department								
Objective 5: To identify entities specialized in managing recyclable waste materials and develop links for proper recyclable waste management by 2026											
1.5.1	Register all waste recyclers, collectors, transporters, and aggregators (in and out of the GMC area), which can be linked to the GMC SWM System	1	Engineering Department/ CDO/ Accounts Department								
Objective 6: To identify and implement sanitary storage and disposal methods for waste types with no acceptable disposal methods by 2026 (e.g. Hazardous [e.g. diapers, Sanitary pads, discarded batteries], non-hazardous unusable mix waste, fiber, ceramic waste, pottery waste, etc.) by 2026											
1.6.1	Design a collection and storage system for waste types that do not have a proper/ acceptable disposal method	1	Engineering Department/ Health Department								
1.6.2	Link with CEA, Ministry of Environment and Ministry of Local Government to explore possibilities to apply Extended Producer Responsibility (EPR) policy/ regulations to such waste items (could be in pilot scale)	1	SWM Technical Committee								
1.6.3	Identify and establish links with organizations deal with these kinds of waste (in or outside the GMC area) and have acceptable disposal methods	1	Engineering Department/ Health Department								
1.6.4	Establish a mini waste incinerator in the Heenpandala site.	3	Civil Engineer/ Mechanical Engineer/ Medical Officer of Health								
Goal 2: A capable and knowledgeable Municipal Council for effective 3R-based SWM											
Objective 1: To enhance the supportive material resources, infrastructure, and services to increase the collection rate from 22% to 50% by 2030											
2.1.1	Upgrade the existing SWM vehicle fleet of the GMC by 2030	2	Civil Engineer/ Mechanical Engineer								
2.1.2	Improve and operationalize existing SWM-related facilities owned by the	1	Civil Engineer/ Mechanical								

	GMC (e.g. Municipal Garage at GMC premises/ Kithulampitiya, Vehicle cleaning center at Heenpendala) by 2025		Engineer								
2.1.3	Evaluate the current waste collection mechanism, identify the gaps and improve by 2027 I. Route Optimization (upgrade existing collection route, GPS monitoring, etc.) II. Use Mobile Apps and Digital technologies to monitor waste collection and transportation III. Streamline Waste-based income generation.	2	Civil Engineer								
2.1.4	Use underutilized machinery for waste management effectively	1	Civil Engineer								
2.1.5	Establish a mini incinerator to burn infectious waste	3	Civil Engineer								
Objective 2: To elevate the acceptance for Municipal SWM workforce through enhancing professional competencies by 2026											
2.2.1	Facilitate workforce to gain NVQ-level training on SWM	2	Medical Officer of Health/ Municipal Secretary/ Civil Engineer								
2.2.2	Promote Incentives and Welfare Facilities (e.g. Health Care) for the workforce	1	Medical Officer of Health/ Municipal Secretary/ CDO								
2.2.3	Provide necessary equipment and training for the workforce	1	Medical Officer of Health/ Municipal Secretary/ Civil Engineer/ Mechanical Engineer/ CDO								
2.2.4	Introduce an Insurance Scheme for temporary workers	2	Municipal Secretary Department/ Accounts Department								
Objective 3: To strengthen the managerial mechanisms and tools at the GMC with required improvements by 2026											
2.3.1	Strengthen the municipal SWM Unit and assign a dedicated key person to coordinate and implement the ISWAMP in consultation with the key officials of the GMC, including municipal SWM data base management	1	SWM Technical Committee <u>Dedicated key person:</u> Municipal Commissioner								
2.3.2	Facilitate the SWM Unit at the GMC with required resource personnel and equipment	1	SWM Technical Committee								

2.3.3	Establish a research and development unit in the SWM unit by 2027 (e.g. focusing on community-specific solutions, route changes, safety and environmental improvement, etc.)	3	SWM Technical Committee								
2.3.4	Maintain an up-to-date database for waste generation, collection, sorting, end-disposal, aggregators, etc. with the participation of a representative from each department (Need to develop a computer-based database and program)	1	Municipal Commissioner/ Municipal Secretary Department								
2.3.5	Implement an emergency response mechanism (e.g. establishing a mobile service unit)	2	Civil Engineer/ Mechanical Engineer								
2.3.6	Establish a Grievance Redress mechanism for SWM-related matters (e.g. customize the e-Sabha app for this purpose)	3	SWM Technical Committee								
2.3.7	Monitor Informal Waste Collectors and provide technical support while charging an annual registration fee	2	Medical Officer of Health/ Civil Engineer/ Mechanical Engineer/ CDO								
Objective 4: To uplift the financial capacity of the GMC via managing expenses and strengthening revenue generation by 2026											
2.4.1	Introduce service fee charge for identified services that the GMC provides in relation to SWM (e.g. managing waste generated from a Carnival) - Charge scheme shall be well structured, and quantity based and shall be conveyed clearly to the service receiver (influencing to reduce or self-managing of waste).	1	Civil Engineer/ Accounts Department								
2.4.2	Establish a solar panel system for waste processing centers	2	Civil Engineer/ Mechanical Engineer								
Objective 5: To uplift the powers of the GMC via required improvements in the current legal and regulatory instruments by 2026											
2.5.1	Identify the gaps in the current legal instruments that must be filled with new by-laws or regulations, in order to properly manage the SWM system and to implement the ISWMAP	1	SWM Technical Committee								
2.5.2	Draft and get the approval for by-laws drafted on the above gaps/ to implement the ISWMAP	1	SWM Technical Committee								
Objective 6: To develop and implement a comprehensive Monitoring and Evaluation Mechanism for each step of the SWM process (e.g. to monitor waste generation, segregation, waste generators and handlers, etc.) by 2024											

2.6.1	Develop a comprehensive Monitoring and evaluation mechanism with a reachable timeline to monitor and evaluate the SWM process. It is proposed a quarterly (3 monthly) evaluation against KPIs and adopting/ continuing the tools such as WACS, COSA, Governance Gap Analysis, and Funding options in regular intervals (e.g. once in every 3 years)	1	SWM Technical Committee							
2.6.2	Monitor regular collection efficiency of the GMC through comparing data and validation	1	Municipal Secretary Department							
2.6.3	Reduction of 80% of illegal waste dumping through awareness raising and legal means.	1	Medical Officer of Health/ CDO/ Legal Officer							
Goal 3: Knowledgeable and dedicated stakeholders for effective 3R-based SWM										
Objective 1: To develop and implement a comprehensive and novel platform for speedy and effective two-way communication between the GMC and stakeholders by 2025										
3.1.1	Establish a website/ webpage attached to the GMC website dedicated for SWM related matters	3	Municipal Secretary/ CDO							
3.1.2	Promote E-Sabha app for speedy and effective two-way communication	1	SWM Technical Committee							
3.1.3	Promote using WhatsApp groups/ Webpage/ Facebook pages for speedy and effective two-way communication	1	Municipal Secretary/ CDO							
3.1.4	Add a GMC hotline telephone number for communication purpose	2	SWM Technical Committee							
Objective 2: To ensure bulk and impactful waste generators/ event organizers have comprehensive SWM Action Plans prepared in line with the ISWMAP of the GMC										
3.2.1	Develop a list of criteria to identify who are the bulk waste generators/ event organizers	1	SWM Technical Committee							
3.2.2	Making it a legal requirement to prepare a SWM action plan by specifying actions for reducing waste generation (plastic waste in particular), waste recycling, waste segregation and providing and managing storage facilities, and proper disposal of different types of waste.	1	CDO/ Medical Officer of Health							
3.2.3	Make it a requirement for impactful waste generators/ event organizers (those who generate bulky and hazardous waste) to have a qualified (e.g. NVQ) 3R/ SWM official to handle 3R/ SWM at respective organizations.	2	Engineering Department/ Health Department/ Accounts Department							

Objective 3: To ensure a positive social behavior change among stakeholders through a comprehensive program for knowledge sharing and attitudinal change by 2030										
3.3.1	Platform (affiliated to proposed R&D division of GMC) to absorb and share new knowledge created at universities, private sector entities, and other relevant parties on novel SWM-related practices	1	SWM Technical Committee							
3.3.2	Continuous knowledge enhancement and training for diverse stakeholders based on a comprehensive need assessment 1. Govt officials/ hotels/ industry community/ tourists, etc.	1	SWM Technical Committee							
3.3.3	Provision of training and awareness on 3R/ SWM for specific groups (e.g. nurseries, schools, dhamma schools, youth, tuition classes, etc.) aiming for long-term social behavior change	1	Municipal Secretary/ CDO							
3.3.4	Request relevant government agencies to promote SWM practices at school level and to look into the possibilities of including SWM-related knowledge in the school syllabus.	2	Medical Officer of Health/ CDO							
3.3.5	Provision of awareness on 3R/ SWM good practices for specific groups through innovative communication tools (e.g. digital boards and street dramas)	1	CDO							
3.3.6	Organize specific awareness sessions for groups with unique and significant waste problems (e.g. religious places)	1	CDO							
Objective 4: To absorb existing activists, volunteer groups, and tourists into the GMC SWM system to be 3R/ SWM role models (e.g. to act in SWM emergency situations, detecting and acting on wrong doings, etc.) by 2026										
3.4.1	Recognize and facilitate (e.g. incentives, eco-tourism through SWM, and Health tourism) best practices, and utilize them in knowledge sharing and social behavior change	2	Civil Engineer/ Medical Officer of Health/ CDO							
3.4.2	Establish an approval process at the GMC for volunteer activities	1	SWM Technical Committee							
3.4.3	Engage activists, volunteers (e.g. Women and Youth), and tourists in the GMC SWM System	1	SWM Technical Committee							
3.4.4	Promote volunteer vigilante groups to detect and act on wrongdoings	1	Medical Officer of Health/ CDO							
3.4.5	Promote student groups (at school level) as volunteers and vigilante groups	1	CDO							
3.4.6	Organize competitions, debates, and exhibitions on SWM at school level	2	Municipal Secretary/ CDO/							

			Medical Officer of Health								
3.4.7	Organize competitions among settlements to appreciate best practices and dedication towards a cleaner city	3	Medical Officer of Health/ CDO/ Municipal Secretary								
3.4.8	Provide incentives/ recognition for volunteer environmental groups and societies who work on SWM	2	SWM Technical Committee / CDO/ Medical Officer of Health/ Engineering Department								
Goal 4: Collaborative network of stakeholders dedicated for 3R/ SWM action											
Objective 1: To have a recognized Stakeholder Forum at the GMC that meets regularly to discuss 3R/ SWM matters affecting individual stakeholders and the city by 2024											
4.1.1	Adopt the current Stakeholder Forum established under the CACG project into the GMC SWM institutional setup and to give it legal recognition via GMC by law	1	SWM Technical Committee								
4.1.2	Define the composition, decision-making protocol, meeting frequency and role responsibility of the SF (e.g. quarterly meetings)	1	SWM Technical Committee								
4.1.3	Facilitate identified membership of SF to take part in the decision-making process with regard to monitoring, evaluation and maintenance of the 3R/ SWM system in GMC	2	SWM Technical Committee								
Objective 2: To establish a process to register and manage individuals/ institutions that engage in action/s related to MSW management within the GMC area by 2025											
4.2.1	Make it mandatory to get GMC registration for engaging in MSW collection, transportation, preparation for recycling and end disposal as a business/ living/ volunteer action/ action of NGO with external funding and introduce a simple registration procedure	1	SWM Technical Committee								
4.2.2	Establish a database with a mechanism to collect and update it with types/ quantities of MSW being handled by each individual/ institution	2	Municipal Secretary								
4.2.3	Facilitate exchange of information and linking between agencies/ individuals as necessary for effective waste handling within GMC	3	SWM Technical Committee								
Objective 3: To encourage alternative product developers and facilitate linking them with City stakeholders for effective 3R/ SWM by 2024											
4.3.1	Inventorize alternative product developers to replace plastic/ polythene	1	Civil Engineer/ Medical								

	utensils reducing waste and facilitating linking them with potential buyers (i.e. users like Hotels, Industries and Offices etc.)		Officer of Health/ CDO								
4.3.2	Facilitate alternative product developers using wastes as upcycling option and facilitate linking them with potential raw material suppliers (waste generators/ aggregators) and buyers/ market places	1	Civil Engineer/ Medical Officer of Health/ CDO								
4.3.3	Strengthen new SWM entrepreneurs and build links between them and the GMC	2	SWM Technical Committee								
Objective 4: To establish/ enhance existing collaborative relationships with International/ National/ Regional establishments to facilitate effective 3R/SWM actions in the GMC by 2025											
4.4.1	Nominate a responsible official within GMC SWM unit to work on this specific subject to build collaborative relationships with other partners and to achieve global and national recognition for 3R/ SWM good practices	1	Nominee: Deputy Municipal Commissioner								
4.4.2	Identify useful agencies and build collaborative actions/ mechanisms to enhance 3R/ SWM of GMC (e.g. CityNet-exchange of experiences, National Solid Waste Support Center-technical & financial support provider and Universities for technical inputs)	1	Deputy Municipal Commissioner								
4.4.3	Identify suitable business models to enhance the 3R/ SWM system at the GMC (e.g. PPPs) by means of finding a solution to waste problems	1	SWM Technical Committee								
4.4.4	Register aggregators/ IWCs and look for opportunities to hand over specific parts of the SWM system to them while GMC remains the monitoring and evaluation agency.	1	SWM Technical Committee								
4.4.5	Follow the guidelines from UNESCO to introduce specific SWM mechanism for Galle Fort to enhance its reputation as a World Heritage Site	1	SWM Technical Committee								
4.4.6	Establish links with academia for the sustenance and development of current innovative 3R/ SWM practices and pilot new ones by 2025	2	SWM Technical Committee/ Municipal Secretary Department								
Goal 5: A model city with replicable, creative, and innovative SWM solutions											
Objective 1: To maintain a comprehensive and user-friendly database/ collection of materials by 2025, which elaborates how the Galle City is being transformed to be a Model City in 3R/ SWM											

5.1.1	Record and publish the transformation of the city along with the implementation of 3R/ SWM actions through 2030	2	SWM Technical Committee/ Municipal Secretary Department								
5.1.2	Record and publish the overall process adopted and followed by the GMC towards being the cleanest city in Sri Lanka by 2025	I	SWM Technical Committee/ Municipal Secretary Department								
5.1.3	Record and publish the new knowledge, tools, procedures, and technology used in improving the SWM system II. Record and publish role models in collaborative approaches, funding options, governance and 3R & safe disposal-like aspects of the process	I	Municipal Secretary Department								
5.1.4	Record waste management data and information of famous places/ tourist locations and special areas in Galle Municipal Council	3	Municipal Secretary Department								
5.1.5	Introduce a Monitoring and Evaluation System to record data and information	I	Municipal Secretary Department								
Objective 2: To establish a dedicated team in the GMC SWM Unit by 2024, to ensure sustainability through promoting and facilitating knowledge sharing for replication of the key models/ lessons learned in 3R/ SWM											
5.2.1	Identify key officials, relevant stakeholder representatives, social groups, senior citizens, and volunteer expertise in technical, managerial, and social aspects of the 3R/ SWM innovations in GMC and train them as promoters/ ambassadors.	3	SWM Technical Committee								
5.2.2	Establish links with key stakeholders in tourism, environment management and good governance sectors to absorb their 3R/ SWM innovations and to promote 3R/ SWM-related key models/ lessons learned in Galle through them.	2	Medical Officer of Health/ Engineering Department/ CDO/ Municipal Secretary Department								
5.2.3	Appoint trained staff for the proposed SWM unit and develop a system for the government staff transfer process	2	SWM Technical Committee								
Objective 3: To achieve National and International "QUALITY STANDARDS" and "AWARDS" for effective 3R/ SWM innovative practices/ World heritage site management by 2030											
5.3.1	Identify available "QUALITY STANDARDS" and "AWARDS" on the target areas by the SMW unit at the GMC and prepare an action plan to achieve the identified quality standards and awards.	I	SWM Technical Committee								

13. Key Performance Indicators

This chapter presents the Key Performance Indicators (KPIs) that shall be used in measuring the success or progression of implementation of the ISWMAP during the targeted timeframe. These KPIs have been identified and quantified based on the goals, objectives, and strategies, and available data collected through BWAS, WACS, and COSA. It is important that there is a regular monitoring and evaluation system in place in the GMC with the representation of the key officials to assess whether the proposed KPIs have been achieved, if not, what challenges encountered and how those challenges were resolved to achieve the expected goals and objectives in the given timeframe.

Following table illustrates a summary of the KPIs developed to measure the success of the implementation of the ISWMAP. These KPIs could be revised (e.g. include new KPIs or change the KPI targets) by the Municipal SWM Unit in consultation with the key officials, after an evaluation of the change of amounts of waste generation/ collection and SWM process over time and resource availability at the GMC to achieve these targets.

Table 17: Current Status and Targets of KPIs

Ref. No.	KPI	Current Status	Target (by 2030)
1	Total reduction of waste generation within the GMC area	Current Per-capita Generation = 0.66 kg/ Day	0.5 kg/day
2	No of entities collectively work with the GMC for collaborative SWM	Approx. 40	75
3	Amount of material waste collected by aggregators/ IWCs	Approx. 61.9 MT/ Month (7.1% of dry waste generation)	173 MT/ Month (20% of dry waste generation)
4	Increase of women/ youth participation in SWM labor force	Minimum	Youth – 40% Women – 10%
5	No. of alternative producers/ product developers registered in the GMC	(No data)	100 (60/ 100 or more women and 30/100 or more Youth)
6	Amount of waste handled by volunteers/ volunteer groups	(No data)	7.5 MT
7	Increase of Municipal SWM Revenue	Total revenues count for 6% of the total SWM expenditure	Increase revenues to cover 50% of the total SWM expenditure
8	No. of legal instruments in place for the implementation of the ISWMAP	1	3
9	No. of Awards/ Certificates received by the GMC for SWM good practices	0	7
10	Amount of investment secured from external parties for SWM	(No data)	7,000,000 LKR
11	No. of events (e.g. campaigns, awareness raising sessions, competitions) organized aiming for Social Behavior Change	(No data)	20

Each of the above KPIs is described below establishing their relevance and importance.

1. Total reduction of waste generated within the GMC area

Total reduction of waste generated within the GMC area from all residential, commercial, industrial, service and other sectors is an indication of the overall success of the implementation of the ISWMAP within the GMC area. A noticeable reduction of waste generation is one of the key achievements of a 3R-based SWM system, which is the driving concept of this ISWMAP. As per the findings of the WACS conducted in the GMC area, the per-capita waste generation is 0.66 kg/ day. It is expected to reduce this amount to 0.5 kg/ day by 2030, which will be a great achievement under a comprehensive SWM.

2. No. of entities collectively work with the GMC for collaborative SWM

Number of entities collectively work with the GMC for collaborative SWM is an indication of to what extent the GMC is open to work with other stakeholder organizations within the city, and those organizations' dedication towards a collaborative SWM approach. The number can be obtained through the entities/ organizations collaborate with the GMC via actively engaging in Stakeholder Forum, providing financial and technical support, participating in GMC awareness raising programmes, SWM campaigns, etc. and improving their own SWM systems, collaborating with the GMC to undertake certain parts of the SWM System, participating as volunteers, and so forth. To count as an entity under this indicator, it is a must that either GMC or the respective entity has gained a visible mutual benefit through these collaborative actions.

3. Increase of the mount of material waste collected by aggregators/ IWCs

Amount of material waste collected by aggregators/ IWCs is an indication of direct involvement of the private sector/ individual entrepreneurs in waste collection, especially in recovering materials for re-use and recycling, and ultimately avoiding waste from getting into natural systems. To continuously record this information, it is also important that the GMC have a comprehensive mechanism to formally recognize aggregators/ IWCs and to link with them, which is again a good indication of the dedication and progression of SWM systems at the GMC. As per the results of the Rapid Assessment under the BWAS, aggregators collect 27.6 MT of metal, 7.8 MT of PET bottles, 4.7 MT of HDPE, 9 MT of Coconut Shells and 12.8 MT of Cardboards within the GMC area per month, accounting for approximately 61.9 MT of materials per month. This is approximately 7.2% of the monthly dry waste collection in the GMC area (61.9 MT out of 864.3 MT). For a collaborative and effective SWM within the city, this can be expected to be increased up to approximately 20% by 2030.

4. Increase of women and youth participation in SWM labor force

Increase of women and youth (between the age 18 to 24) participation in SWM labor force is an indication of the dedication of the GMC towards a participatory SWM process where active involvement of women and youth is ensured and to achieve sustainable development goals. At the moment, women and youth participation in the SWM workforce is minimal and it shall be increased up to 10% women and 40% youth by 2030. This initiative may also have a positively influence towards elevating the acceptance for Municipal SWM workforce through enhancing professional competencies.

5. No. of alternative producers/ product developers registered in the GMC

To reduce the generation of plastic and other waste, promoting alternative producers/ product

developers is important. To recognize the contribution of alternative product developers/ producers in this effort and to promote new alternative product developers, it has been proposed in objectives and strategies to establish a formal registration mechanism at the GMC level. This initiative will not only reduce the generation of certain types of waste but also will encourage local-resources-based entrepreneurships, particularly among women and youth, leading to successful SWM and local economic development. Currently, there is no mechanism to register such alternative producers/ product developers at the GMC. Once such mechanism is in place, it shall be expected to register at least 100 producers by 2030, from which 60/ 100 or more shall be women and 30/100 or more shall be youth.

6. Amount of waste handled by volunteers/ volunteer groups

One of the key initiatives that the GMC shall take for a successful SWM system is to encourage and actively engage volunteers/ volunteer groups in the SWM system. Currently, there is no mechanism to do so, hence, establishing a comprehensive mechanism shall be a priority. The GMC shall work collaboratively with them in awareness programmes and SWM campaigns throughout and that will lead to Social Behavior Change among citizens. These volunteer groups may include school children, Dhamma School children, tuition class attendees, representatives of environmental groups, well-wishers, and so forth. The active engagement of these volunteers/ volunteer groups will be assessed based on the amount of waste handled by them in joint activities with the GMC.

7. Increase of Municipal SWM Revenue

As per the COSA and Funding Options reports, it has been found that the annual revenue of the GMC from SWM-related avenues is 6% of the annual expenditure and therefore the GMC has to depend on external funding sources like other revenues of GMC itself and Central/ Provincial Government for budgetary purposes. The total 3R/ SWM cost is 172,688,261.16 LKR and the total revenue is 10,644,942.00 LKR in 2022. Hence, it is a must that initiatives are taken to increase municipal revenues generated from SWM-related avenues to at least cover 50% of its SWM expenditure by 2030, while looking for strategies to reduce the cost of service through other alternatives (e.g. PPP-based MRF).

8. No. of legal instruments in place for the implementation of the ISWMAP

In order to clear the way to implement the ISWMAP, the GMC shall have necessary and important legal and institutional powers in place, particularly targeting implementing strategies related to enforcement, revenue generation, ensuring women and youth participation, and so forth, depending on the challenges encountered in the process. Currently, most of the powers have been vested to the GMC (and other local authorities) through the Standard By-Law of the Southern Provincial Council (No. 1834 – 2013.10.25, No. 1834 – 2013.10.27). However, there may be situations where certain decisions will not be able to take within the provisions of this by-law, hence, new by-laws shall be enforced within the GMC jurisdictions. The GMC shall identify such requirements and formulate and pass appropriate by-laws when necessary.

9. No. of Awards/ Certificates received by the GMC for SWM good practices

The dedication of the GMC and its citizens towards a sustainable and comprehensive SWM will be indicated by the number of awards or certificates the GMC receives for its dedication and innovative

good practices applied in the SWM. Receiving awards/ certificates signals that the GMC is taking initiatives towards its vision to be the "Cleanest Destination in Sri Lanka". It is expected that the successful implementation of the ISWMAP may help the GMC to receive at least one award/ certificate each year until 2030.

10. Amount of investment secured from external parties for the SWM

While exploring fixed avenues to increase the revenue of the GMC, it is also important that the GMC build collaborations with external entities/ stakeholders for a successful SWM and to secure investment funding for certain improvements required in the SWM system. Currently, there is no such initiative taken at the GMC level to secure such investment funding, hence, with the establishment of such a mechanism, the GMC shall target securing investments over the years, amounting 7,000,000.00 LKR by 2030.

11. No. of events (e.g. campaigns, awareness raising sessions, competitions) organized aiming for Social Behavior Change

Focusing on Social Behavior Change among citizens, stakeholder groups, and GMC staff itself, it has been proposed in the ISWMAP to implement diverse activities (e.g. campaigns, awareness raising sessions, competitions). The dedication of the GMC towards such kind of social behavior change and the success of such initiatives may be reflected from the number of programmes conducted over time. Hence, it is expected that the GMC shall at least conduct 20 such programmes by 2030.

Annexure 1:

Table 18: Detailed Vision-oriented SWOT

Strengths:	**Weaknesses:**
- Existing SWM Mechanism of the GMC - Door-to-door regular waste collection service provided for residential, commercial, industrial, and service sectors a) Collection of segregated waste as degradable (Wet) and non-degradable (Dry) b) Daily Average Waste Collection by the GMC – 22 t/d (Wet -15.5 t/d / Dry - 4 t/d Mixed- 2 t/d) - Availability of infrastructure facilities for an effective SWM service delivery. a) 30 waste collection vehicles including tractors and compactors b) Availability of the GMC Vehicle Repair Workshop at GMC premises with trained technical staff - GMC-owned filling station at GMC premises for the effective SWM service provision. - Dedicated workforce at GMC for effective SWM service provision (e.g. Officials directly responsible for SWM - 15 SWM Supervisors and laborers - 110) - Heenpendala Waste Segregation and Dumping Yard with an extent of 1.72 Ha. - Existing Kawashima Composting Plant at Heenpendala with a capacity of 50 t/d. - Existing COWAM Center at Dadella with a capacity of 5 t/d for the collection of construction waste and glass waste - PET Bottle Collection and Processing Center at Dadalla with a capacity of 1 t/d - 23 number of waste aggregators within the city limits who are specialized in collecting plastic (approximately 16.5 MT/ month), metal (27.5 MT/ month), and Cardboard (12.8 MT/ month), - There are 40 biogas units operating at household-level and institutional level within the GMC area - There are three Ocean Strainers located in Morogoda Ela (Makuluwa), Moda Ela (Kandewaththa), Kapu Ela to stop plastic and other waste from floating into the ocean via major canals in the GMC area - Availability of a Standard By-Law (Southern Provincial Council) for the effective SWM. - Already enforced powers delegated to the GMC under the Standard By-law (e.g. Collection of	- Cost of service of the GMC is significantly high (Approximately 21,359.00 LKR/ MT) - Shortage of physical and financial resources at GMC to engage in effective SWM. a) The majority of waste collection vehicles have exceeded their useful time (Manufactured years of a considerable number of vehicles that are being used are 1987, 1989, etc. / Useful Time of 14 out of 30 SWM vehicles has already exceeded) b) Frequent machinery breakdowns and shortage of financial resources to amend them c) Lack of suitable waste collection vehicles to access narrow roads within the GMC area d) GMC does not own a vehicle cleaning area, and the necessary tools are not available. e) Unavailability of a sophisticated MRF facility and recycling facility. f) Lack of safety and sanitary equipment (e.g. PPE kits) for SWM supervisors and laborers - Available SWM facilities are not functioning at full capacity (e.g. Glass collection facility at COWAM center) - Issues related to SWM labor force at the GMC a) Lack of skilled and knowledgeable manpower for effective SWM (e.g. Current vacancies at the GMC for semi-skilled laborers – 40) b) Low job motivation among laborers due to below-average wages (Approx. Rs.30,000 – 40,000) and low social recognition (e.g. marginalization, unequal treatment, lack of appreciation, etc.) c) Reluctance to use safety and sanitary equipment (PPE) during working hours due to discomfort and lack of knowledge. d) Reluctance among GMC officials/ laborers for a progressive behavior change in SWM (e.g. reluctance to change the current waste collection routes, reluctance to use modern technology in SWM - use of GPS to monitor the vehicle movement) - Gaps in the current SWM-related policies/ laws a) Lack of regulations/ provisions as to how the GMC shall engage in SWM at waste hotspots in the city such as Commercial Harbor,

service fees from bulk waste generators, Residential Waste Segregation, Power of Encouraging 3R concepts, Responsibility to prepare integrated solid waste management action plan, power to issue Environment Permit license for waste recyclers as a responsibility, To take legal actions for Illegal Waste Dumping) - Availability of stakeholders (government, private, and non-governmental organizations) engaging in SWM-related activities (e.g. Environmental Division of the Police, NGOs such as HELP-O and DEIHERM) - Availability of small-scale recyclers, alternative product developers/ producers at community level (e.g- Sun Paper Pvt. Ltd.)	Fisheries Harbour, Karapitiya Hospital, Prison, Galle Fort, etc.) b) SWM solutions for certain waste types have not been specified in SWM policies/ laws (e.g. fish waste, fiber waste and fishing nets, etc.) - Inefficient solutions and mechanisms under 3R practices a) Inadequate attention/ policies on waste reduction options b) Overreliance on Landfills and Incineration c) Neglecting Hazardous Waste Disposal d) Weak Enforcement of Recycling Regulations and Insufficient Recycling Infrastructure e) Inadequate E-Waste Management - Lack of environmentally friendly waste disposal practices by community and institutions a) Unsafe open dumping into the Heenpandala site which is close to a freshwater source and wetland. (Contamination with groundwater, threat to biodiversity odor in the surrounding area) b) Illegal waste dumping in roads and non-resident areas. (Ex: Bombe Castle) c) Illegal burning (in Bombe Castle and Mohideenwatta) d) Food waste, garden waste, and non-degradable (sanitary waste, plastic and electronic waste) waste discharge into waste bodies, drainages, and vacant lands. (Ex: Mohodeenwatta and Salamiya watta) - Lack of knowledge and awareness on SWM and 3R practices in the citizens a) Lack of knowledge on adverse effects of the illegal & open burning, unsafe open dumping, and waste segregation. b) Lack of communication between GMC and the community. (Unaware of waste collection time and dates) c) Use and receive plastic bags while shopping (keels, Cargills) - Frequent flash floods within the GMC area that obstruct SWM-related activities. - Lack of staff and resources in the Environment Division of the Police to enforce law on people/ entities those violate laws related to SWM. - Lack of engagement of women in city-wide SWM (e.g. currently, only one woman has been employed by the GMC as a laborer engaged in SWM) - Gaps in the current Institutional Mechanism at the GMC level to actively engage/ get the

	participation of stakeholders and diverse community groups in the city-wide SWM
Opportunities: - National Plastic Waste mgt action plan - Monrowiyawatta waste management Center (Plastic and food waste) - Funding opportunities for SWM (UASID/CCBO, IGES) - National, provincial and local policies a) proposed rules and regulations for single-use plastic - University research - Opportunities for Public-Private Partnerships (PPP) b) INSEE (Residual waste) c) Sisili Hanaro Encare (Pvt) Ltd (Health care waste) d) Outside waste aggregators (Ginthota, Nawinna) e) Coca Cola and Eco Splinders (PET bottles) - Availability of integrated Waste Management Action Plans and proper SWM practices in other cities (Negombo, Kurunegala, Kandy) - Availability of innovative SWM practices and methods (e.g. Smart Waste Bins, Upcycling, Waste banks) - Circular economy (resource reuse) - Increasing commodity markets for recyclable material - CSR Funds - Being a world heritage City a) High potential to get funding for SWM b) High potential for earnings through alternative products/ processes reducing SW c) Get extra earning sources for effective SWM d) High potential to be a Model City in SWM	**Threats:** - Marian Waste from other countries - Waste from nearby local authorities a) Contamination of water sources owing to Waste disposal into canals - Unavailable solution for Slaughterhouse waste, E-waste, hazardous waste - Increase waste volume by Floating population of 150,000 daily. (Including tourists) a) Illegal dumping (20 cases per month- Police Division) - Low market price for recyclable items (Ex: Cardboard, Tin) - Inadequate proper enforcement of regulations related to SWM - Inflation - Increased energy costs (Electricity) - Increased vehicle purchase costs - Climate change - Limited landfill capacity - Bulk and hazardous waste disposal by ships arrived into Commercial harbor - Urban flood and high tide - Availability of much cheaper and easy to use imported products in the market. - Lack of public awareness

Annexure 2:

The 3R/ SWM Service Delivery Costs

The service delivery costs related to the SWM is discussed under the titles waste collection, transportation, processing, street sweep, waterways/ illegal dumps cleaning, and end disposal.

Collection Cost

The solid waste collection cost of the GMC covers the cost incurred for collecting solid waste generated by households, commercial, service and industrial sector establishments, street sweepings, waterways & illegal dumps clean-ups as well as for transporting the collected waste to the central collection and disposal facility at Heenpendala (in COSA base year, 2022).

Thus, the GMC waste collection cost includes the salaries and other benefits for the waste collection workmen (103 permanent and 23 casual employees) and operation cost of the vehicle and waste handling machine fleet (38 vehicles and 2 machines).

The total annual cost is 102,430,113.72 LKR for collecting overall 8030 MT of wet, dry and street sweep with waterways cleaning waste quantity. Hence, the overall average cost for collecting 1 MT of waste is 12,755 LKR/ MT.

The table below presents the contribution of cost categories to the collection cost.

Table 19: The categorical distribution of collection cost
(Source: COSA Report, 2023)

Cost Category	Annual Cost	%
1. Salaries and Wages	72,901,648.39	63
2. Employee Benefits	1,130,070.00	1
3. Operations & Maintenance (O&M)	17,344,474.24	23
4. General and Administrative	1,317,292.52	1
5. Fees (Tipping)	-	
6. Contracted Services	-	
7. Other Costs	-	
8. Depreciation	9,736,628.57	12
9. Debt Service	-	
10. Capital Expenditures	-	
Total Collection Costs	102,430,113.72	100

Transportation/ Transfer

The GMC waste transportation cots in 2022 included cost of transportation of collected waste from Heenpendala to Monrovia Estate site. This transport cost includes fuel, Operation & Maintenance cost and depreciation of the truck that was in use for this operation.

The total annual cost is 17,906,427.00 LKR for transporting overall 6,195 MT of we and dry waste Hence, the overall average cost for transporting 1 MT of waste is 2,890.50 LKR/ MT.

The Table below presents the contribution of cost categories to the transportation cost.

Table 20: GMC Waste transportation cost
(Source: COSA Report, 2023)

Cost Category	Annual Cost
1. Salaries and Wages	11,402,875.00
2. Employee Benefits	
3. Operations & Maintenance (O&M)	4,363,552.00
4. General and Administrative	-
5. Fees (Tipping)	-
6. Contracted Services	-
7. Other Costs	-
8. Depreciation	2,140,000.00
9. Debt Service	-
Total Transfer-Transportation Costs	**17,906,427.00**

The cost of vehicle-machine fleet and workmen who were engaged for waste reloading operation at Heenpendala site for sending to Monrovia Estate is also included in this cost.

Segregated Waste Processing - COWAM center

The segregated waste processing cost refers to the cost incurred by the materials recovery facility for its operation and maintenance. This includes payments for workforce including wages and employee benefits as well as for maintenance and other operating and depreciation expenses of machine-equipment in use.

Table 21: Cost of Segregated Waste Processing at COWAM
(Source: COSA Report, 2023)

Object of Expenditure	Cost (LKR)
Personal Services	
Salaries and Wages	1,801,253
Employee Benefits	
Maintenance and Other Operating Expenses	
Electricity	42,720
Fuel, Oil and Lubricants	
Other Supplies and Materials	29400
Financial Expenses	
Interest Expense	
Non-Cash Expenses	
Depreciation (Building Crusher/Baler/Bob cat)	321,083
Land Value (Maintenance Value)	-
Leasing Value	
Total	1,873,373.00

The cost proportionate to the percentage of engagement of resources for the three main dry waste processing units at the site is given in the table below.

Table 22: The cost breakdown for waste processes at GMC COWAM facility, Dadalla (Source: COSA Report, 2023)

Facility	Resource Engaged (%)	Quantity processed (MT)	% of Capacity Used	Annual cost (LKR)	Annual revenue (LKR)	Profit or Loss (-)	Unit cost (LKR/MT)
Building material recovery	40	450	22.5%	877,782	1,575,000	697,218	1950
PET collection	40	630	12.33%	877,782	6,500	-871,282	1393
Glass waste collection	20	45	0.17%	438,891	125, 000	-313,891	9753

Final Disposal Cost

The final disposal of waste includes two approaches as follows.

- ✧ Disposing portion of residual/ mix/ non-recyclable waste at Heenpendala GMC site and
- ✧ Disposing total collection of wet waste and balance portion of dry waste though the composting and waste recovery facility in Monrovia Estate.

Based on the analysis, the cost for final disposal of waste at Heenpendala is equivalent to 20% of the total Heenpendala site operation cost. Below table illustrates the waste processing cost breakdown at Heenpendala site

Table 23: The waste processing cost Breakdown at Heenpendala site. (Source: COSA Report, 2023)

Cost Category	**Annual Cost**
1. Salaries and Wages	3,546,712.19
2. Employee Benefits	-
3. Operations & Maintenance (O&M)	-
4. General and Administrative	-
5. Fees (Tipping)	-
6. Contracted Services	-
7. Other Costs	-
8. Depreciation	2,980,000.00
9. Debt Service	
10. Capital Expenditures	-
Total Waste Processing	**6,526,712.19**

Thus, the final waste disposal cost within Heenpendala site equals to 1,305,342 LKR (20% of 6,526,712.19 LKR).

The cost of waste disposal through Monrovia Estate Facility is the waste transfer cost (i.e. waste handling cost at Hennpendala and transporting cost from Heenpendala to Monrovia Estate) as given above, amounting to 17,906,427 LKR.

The cumulative tipping fee paid by GMC to Southern Province Department of Local Government (SPDLG) for sending waste to Monrovia Estate was 4,694,250 LKR in 2022. It must be noted that this fee was calculated by the SPDLG based on the recorded number of trucks by the Monrovia Estate management but not based on measured waste quantities by weight or volume.

According to the calculations the waste category wise final disposal cost can be summarized as follows.

Table 24: Breakdown of Disposal Cost per waste category and location
(Source: COSA Report, 2023)

Disposal Site	Waste Category	Quantity (MT)	Cost (LKR)	Unit cost (LKR/MT)
Heenpendala	Dry waste	720	656,671	912.04
	Non-Segregated waste	720	656,671	912.04
Monrovia Estate	Wet waste	5475	15,820,473	2,889
	Dry waste	720	6,780,203	9,416

Street Sweeping

The street sweeping cost includes the wages and other employee benefits as given in the table below.

Table 25: Cost breakdown of Street Sweeping
(Source: COSA Report, 2023)

Object of Expenditures	Cost (LKR)
Personal Services	
Salaries and Wages	658,809.68
Employee Benefits	
Maintenance and Other Operating Expenses (Equipment purchasing cost)	
Other Supplies and Materials	
Total	658,809.68

The street sweeping cost includes the salaries and wages of the 2 workmen deployed for this task. Since the waste collected was transported by the routine waste collection vehicles on respective route, no additional transport cost involves in this cost category. As per the analysis, the total annual collection from street sweeping is 180 MT, hence the unit cost is 3,660 LKR/ MT for street sweeping.

Waterways and Illegal dump Clean-Up

Waterways and illegal dump clean-up costs are costs incurred related to the clean-up of rivers creeks, drainages, and ditches in and around the city prior to collection. It also includes clean-up of garbage dumped in areas not legally designated as waste collection spots.

Table 26: Breakdown of Waterways and Illegal Dump-Clean Cost
(Source: COSA Report, 2023)

Object of Expenditures	Cost (LKR)
Personal Services	
Salaries and Wages	19,316,232.00
Employee Benefits	
Maintenance and Other Operating Expenses	
Other Supplies and Materials	318,7069
Total	21,949,540

This operation was undertaken by a team of 79 workers including supervisors, who are attached to the Engineering Department of the GMC. Since this is a major task, 60% of their time allocation was considered for the cost calculations together with other supplies like light equipment for the operation. Since collected items were transported by waste collection vehicles no additional transport cost involve for this operation. As per the analysis, the total annual collection is 365 MT and hence the unit cost is high as 85,163 LKR/ MT.

Administrative Costs

As per the COSA tool guidebook (2022), the administrative cost shall include sectors-based expenditures for managing the overall 3R/SWM system of GMC, such as community outreach, enforcement, financial management, human resources, planning, and policy development. However, it was understood that the data sets for calculating these costs were unable to derive to get a realistic value from the existing cost centers.

However, with the data collected from the existing cos centers, the cost of community outreach is 952,800.00 LKR (124 LKR/MT), while the cost of financial management is 6,665,992.00 LKR (865 LKR/ MT) in the year 2022.

The GMC senior staff including the Chief Accountant endorsed the benefit of having this information and the need for updating the 3R/ SWM related financial data management system to facilitate this exercise.

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WASTE AUDIT AND CHARACTERIZATION STUDY (WACS) GALLE MUNICIPLE COUNCIL



PHOTO: HELP-O

SUBMISSION DATE: DEC / 20 / 2023

THIS PUBLICATION WAS PRODUCED FOR REVIEW BY THE UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT BY TETRA TECH UNDER THE CLEAN CITIES, BLUE OCEAN PROGRAM.



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WASTE AUDIT AND CHARACTERIZATION STUDY

(WACS) GALLE MUNICIPLE COUNCIL

Contract Number: AID-OAA-I-14-00059/7200AA19F00016
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This publication was produced for review by the United States Agency for International Development by Tetra Tech, through USAID Contract No. AID-OAA-I-14-00059/7200AA19F00016, USAID Clean Cities, Blue Ocean Program.

DISCLAIMER

This publication is made possible by the support of the American people through the United States Agency for International Development (USAID). The contents of this publication are the sole responsibility of Tetra Tech and do not necessarily reflect the views of USAID or the United States Government.

ACKNOWLEDGMENT

Conducting the Baseline Waste Audit and Characterization Study under the Collaborative Action for the Clean City of Galle (CACG) project was a difficult task, and it would not have been possible without the financial and technical support extended to us by the USAID Clean Cities, Blue Ocean Program. Therefore, I am grateful to the Sri Lanka and Maldives USAID-CCBO team, Mrs. Nilanka Wijayanayake, Country Director; Mr. Roshan Delabandara, Grant Specialist; Mr. U. G. Ekanayake, Solid Waste Specialist; Mr. Rajah Shanmugarajah, Capacity Development and Governance Manager; Ms. Kalani Ranasinghe, Monitoring, Evaluation, and Learning Specialist; and Mr. Logaramanan Thillaindarasa, Finance & Administration Manager.

I extend my special gratitude to the former Mayor of the Galle Municipal Council, Mr. Priyantha G. Sahabandu, Deputy Mayor Mr. Fawzul Niyaz, and all the council members for their tremendous support extended to us in initiating the CACG project in Galle in an impactful manner.

Also, my special thanks go to Mrs. Thushara Rasnayake, Municipal Commissioner, Ms. Dilini Sumali, Deputy Municipal Commissioner, Dr. C.D Pathirage, Chief Medical Officer of Health, Mr. Sawmar Adili, Chief Community Development Officer, Mr. Sujeewa Pethangoda, Assistant Engineer, and all other senior and junior staff of the Galle Municipal Council for their valuable contribution extended to us in successfully completing this Assessment.

Furthermore, I would like to extend my special thanks to our own HELP-O project team, Monitoring, Evaluation, and Learning consultant Dr. Rohana Rathnayake, Solid Waste Management Specialist Mr. Padmasiri Moonamale, Institutional Coordinator and Mobilizer Mr. Lasitha Udaya Kumara, Community Coordinator and Mobilizer Mr. Buddhika Somaratne, Project Officer Mr. Lahiru Maduranga Udumalagala, Project Officer Ms. Thakshala Witharanage, Project Office Ms. Hansi Sandu Tharaka, Former Project Officer Mrs. Dilshani Dinushika, IT Officer Mr. Chamoth Teran, Chief Accountant Mr. Gunathilaka Panambalana, and Accountant Miss. Chandi Devaki for their excellent support throughout the assessment. In addition, I appreciate the contribution made by Plastic Waste Expert Mr. P.L Lloyed, LIYOGHE Machines (Pvt) Ltd, all the enumerators, waste collecting workers, and university students for their excellent commitment in completing this activity.

Finally, I thank Graphic Designer Miss. Tharushika Perera of Neo Graphic (Pvt) Ltd for completing this well-designed report.



Chathura Walivitiya

CEO HELP-O / Project Manager CACG Project

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ABBREVIATIONS

HELP-O	Human and Environment Links Progressive Organization
GMC	Galle Municipal Council
CACG	Collaborative Action for Clean City of Galle
CCBO	Clean Cities, Blue Ocean
MSW	Municipal Solid Waste
SWM	Solid Waste Management
ISWMAP	Integrated Solid Waste Management Action Plan
PET	Polyethylene terephthalate
HDPE	High-density polyethylene
PP	Polypropylene
LDPE	Low-density polyethylene
PVC	Polyvinyl chloride
PS	Polystyrene
WACS	Waste Audit and Characterization Study
USAID	United States Agency for International Development
HH	Household

EXECUTIVE SUMMARY

"Collaborative Action for Clean City of Galle" is a project implemented in the City of Galle by HELP-O (Human and Environment Links Progressive Organization) in collaboration with the Galle Municipal Council (GMC) for an efficient Solid Waste Management (SWM) system in the city via reducing the generation of plastic waste and promoting a city-wide waste management system. USAID (United States Agency for International Development), Clean Cities, Blue Ocean (CCBO) flagship programme implemented by Tetra Tech, provides the financial and technical support for the said project.

The Waste Audit and Characterization Study (WACS) is a key step towards the development of the Integrated Solid Waste Management Action Plan (ISWMAP), one of the key deliverables under the project. Under the WACS, waste generation and collection pattern of the GMC area was analyzed. This study covered entire GMC area, including Mahamodara Zone, Richmond Hill Zone, Karapitiya Zone, Moragoda Zone, and Galle Bazar Zone. The key objectives of this study were to identify the composition of different types of municipal solid waste by sector, particularly focusing on the plastic waste, create a database of different types of municipal solid waste for the use of the GMC and other stakeholders for future SWM-related decision making and gather SWM data required for the preparation of the ISWMAP for the GMC.

The ASTM Standard Test Method and Rothenberg method were used as the key guides to develop the methodology of the Galle WACS. In addition, several other WACS toolkits and literature were used in finetuning the methodology. Sample selection was done in a scientific manner by paying attention to both population size and geographical distribution of units of the key sectors considered under the WACS. Accordingly, 101 households, 70 commercial units, 50 industries and 30 service units were selected for the WACS from all five Municipal Solid Waste Management Zones in the GMC area.

A comprehensive training sessions and awareness programs were conducted prior to the commencement of the WACS. Appropriate Health and Safety Protocols to be followed during the WACS were included in these training and awareness sessions. The first stage of the WACS was started on 23rd January 2023 and continued until 31st January over a period of eight days. During the first stage, waste generation quantities, composition of the generated waste, volume and density of the waste were measured. 05 GMC supervisors, 10 University Students and 09 laborers were engaged in the first stage. The second stage of the WACS continued from 1st March to 7th March for eight days. Weighing of the GMC waste collection vehicle fleet was carried out during the second stage by a reputed third-party contractor. 02 University Students and 02 GMC supervisors were engaged in the second stage. The findings of both stages of the WACS helped the CACG project team to calculate daily wet and dry waste generation and collection with a more emphasis on the plastic waste and come to important conclusions regarding municipal solid waste generation and collection that will be helpful in developing the ISWMAP in the next stage of the project.

CHAPTER 1



PHOTO: HELP-O

INTRODUCTION

The Waste Audit and Characterization Study (WACS) is a required deliverable milestone under the "Collaborative Action for Clean City of Galle" project (CACG), which is undertaken by the HELP-O (Human and Environment Links Progressive Organization) in collaboration with the Galle Municipal Council (GMC) under a grant from the USAID Program Clean Cities, Blue Ocean (CCBO) managed by TetraTech. The Waste Audit was conducted to understand the composition (wet and dry portions) of Municipal Solid Waste (MSW) collection of the GMC as well as the quantity of daily MSW being collected by the GMC. Thus, the audit consists of two main components as (1) Waste Characterization Study and (2) Waste Quantification Study.

The Waste Characterization Study measured and recorded the compositional data of city-wide MSW generated and collected by GMC in residential, commercial, industrial, and institutional sectors. The Waste Quantification Study is the survey to measure and record the quantity (by weight) of the city-wide MSW collection by the GMC vehicle fleet for each waste collection route in each of the five (05) MSW management zones of the GMC. The planned overall time span of the WACS was sixteen (16) days, which was divided in to two parts as first eight (08) days for the Compositional Analysis of the GMC waste collection and next eight (08) days for the Waste Quantification Study of GMC waste collection.

The WACS was planned with the CCBO technical guidance and was designed within the framework of, the internationally recognized standards and methodologies.

The audit was commenced with a comprehensive training session conducted by the Solid Waste Specialist, followed by a detail planning process to understand the methodology and then to train the waste audit team. The audit team consisted of the CACG Project team, selected GMC staff and HELP-O staff and select 10 University graduates. Simultaneously, a comprehensive coordination effort was established with the key Solid Waste Management (SWM) staff of the GMC. In addition, a comprehensive awareness campaign with a site identification scheme was undertaken for the selected city-wide MSW generators representing all key sectors (residential and commercial) as part of the planning process in advance of commissioning the audit.

A reputed third-party agency (LIYOCHE Weighing Machines Pvt. Ltd) was selected as the sub-contractor for measuring and recording the weight of selected GMC waste collection vehicles under the part two of the audit. They provided the portable weigh bridge at Heenpandala waste yard, and their staff did all the weighing in the presence of the CACG project team.

The entire audit consists of a well-planned data collection, recording, validation, and continuous monitoring mechanism with the participation of CACG project team, including consultants, as well as the guidance and physical participation of the CCBO experts. Further details of the methodology adopted in the waste audit are elaborated below.

The audit findings in this report are important in decision making in relation to enhance the efficiency of current MSW management scheme in the GMC as well as for developing and sustainably implementing an Integrated Solid Waste Management Action Plan (ISWMAP) in the GMC as part of the CACG project with this ongoing CCBO-USAID intervention.

CHAPTER 2

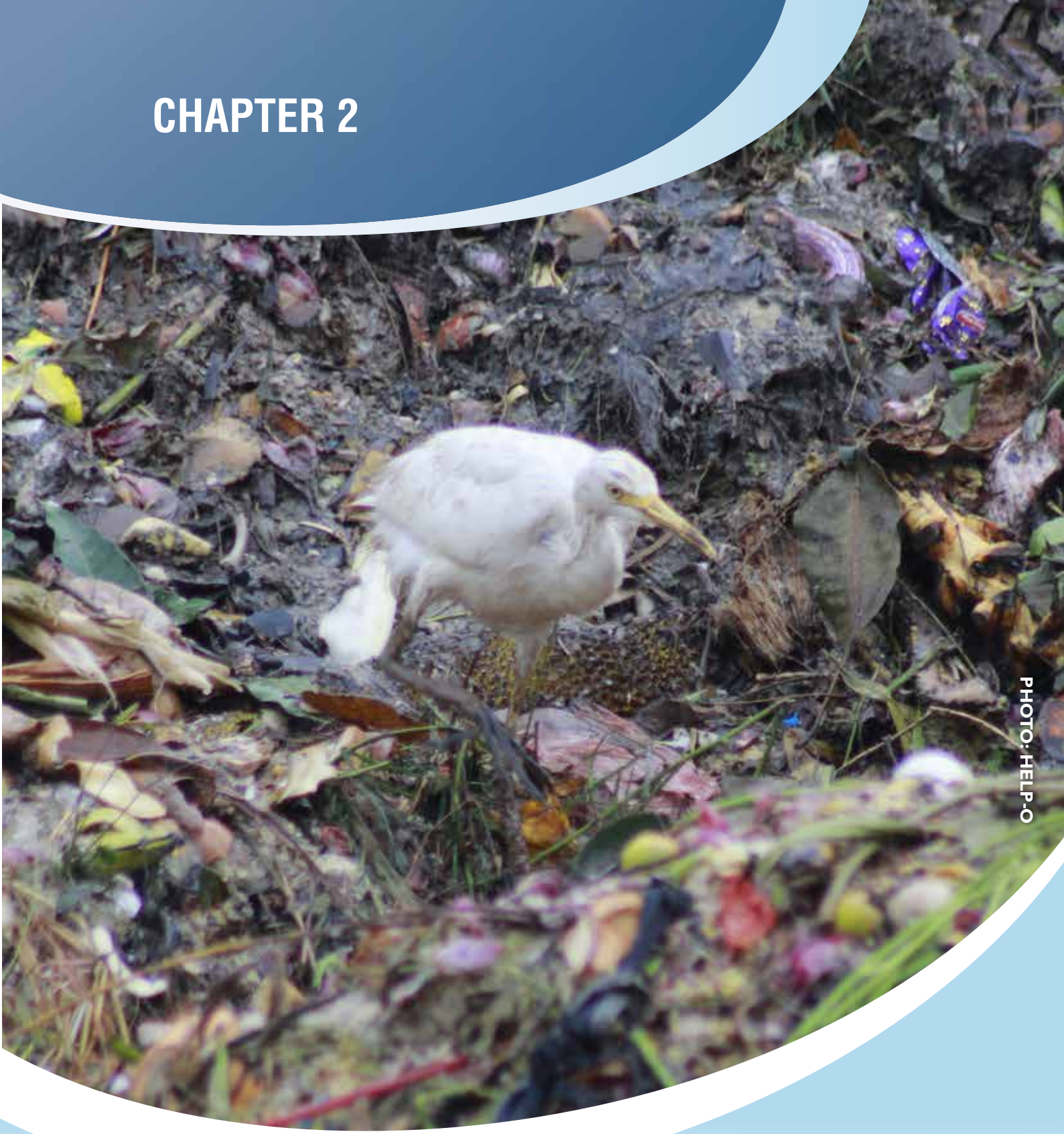
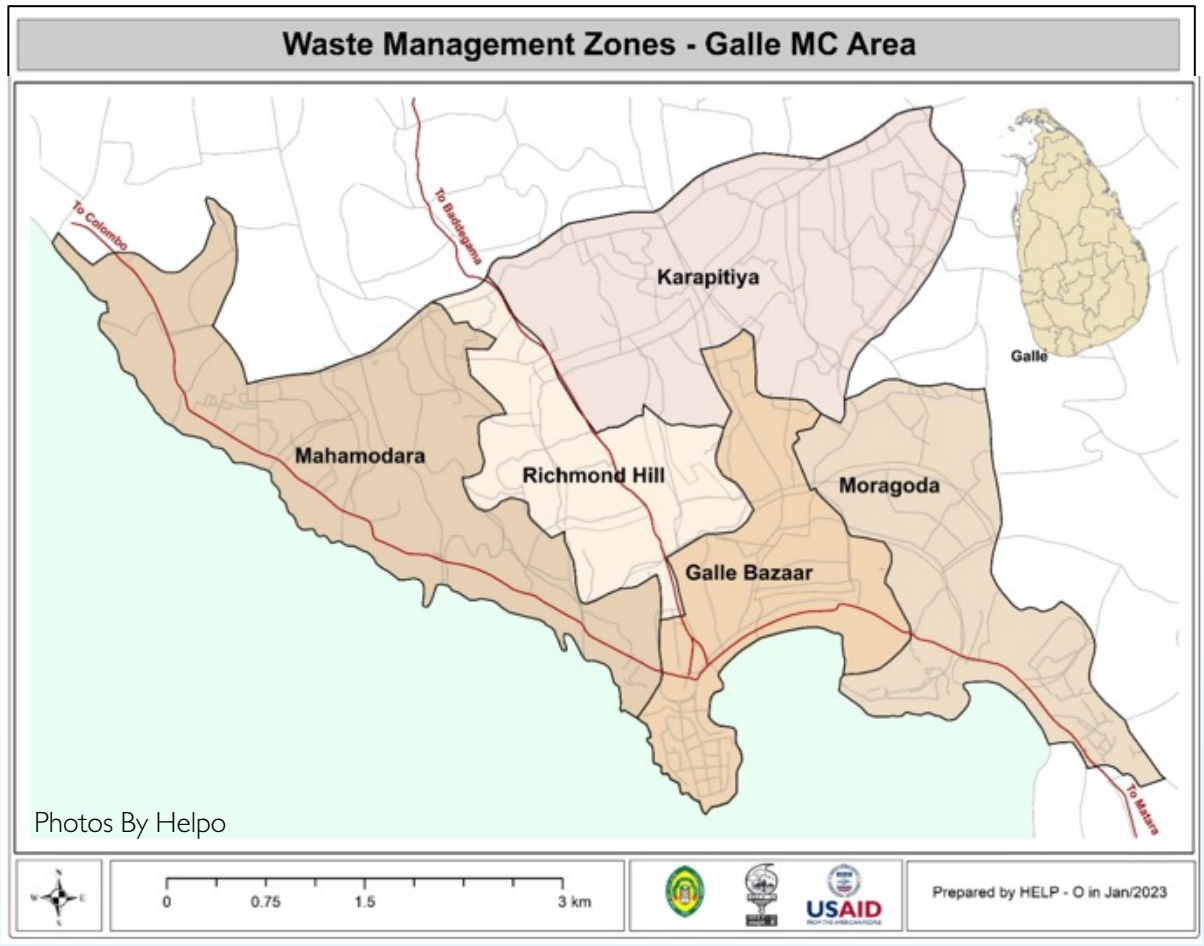


PHOTO: HELP-O

SCOPE AND OBJECTIVES OF THE WASTE AUDIT

2.1. Scope of the Waste Audit

The Waste Audit was conducted covering the entire GMC area, including Karapitiya, Mahamodara, Moragoda, Galle Bazaar, and Richmond Hill Municipal Waste Management Zones. These zones have been identified internally by the GMC for the convenience of administering the SWM process. The map below illustrates the locations of these Waste Management Zones.



Map 1: The focused area of the audit with five internally defined MSW management zones

In addition to other types of solid waste and recyclables generated, the Waste Audit focused on assessing the quantity of plastic waste generated in the city to improve the recycling rate and reduce plastic entering water bodies and eventually the ocean.

All residential, commercial, industrial, and service sectors were covered in the proposed Waste Audit. A fair representative samples were taken so that the Waste Audit could be based on a statistically representative sample of the existing number of establishments under each sector. In addition to the usual non-degradable waste generators under the above sectors, such as residences, small businesses, supermarkets, daily marketplaces, small industries, and so forth, specific attention was given to generators from the Waste Hotspots identified under the assessment survey such as low-income high-density settlements, tourist areas, communities where specific industries are being carried out, such as China Garden residential area, for the Waste Audit by making sure that a reasonable number of establishments from these hotspots were included in the samples.

2.2. Objectives

The objectives of conducting the Waste Audit include the following.

1. To identify the composition of the different types of municipal solid waste by sector in GMC area, particularly focusing on the plastic waste generation and collection
2. To create a database of different types of municipal solid waste for the use of the GMC and other stakeholders for future SWM-related decision making
3. To gather waste data required for the preparation of the ISWMAP for GMC under the CACG project.

CHAPTER 3



PHOTO: HELP-O

METHODOLOGY

3.1. Conceptualizing the Waste Audit Process

As part of the Waste Audit process and before planning the ground activities, a literature review was undertaken to understand the current methods and practices related to the waste categorization and quantification. Accordingly, two of the key methods studied and modified for the Waste Audit were the ASTM Standard Method and the Rothenberger Methods. In addition, a few more related studies, handbooks, and toolkits were reviewed to further strengthen the methodology adopted in this Waste Audit conducted in Galle (BOMA, n.a.; Danielle Ralph, n.a.; Prif Coordination Office, n. a.; ASTM International, n. a.)

As per the literature, a Waste Audit is "collecting, sorting and categorizing waste in order to obtain a statistical picture of the quantities of waste generated at a particular site along with their methods of disposal" (BOMA, n.a., p4). The main requirement in a waste audit is "one-week survey of a sufficient number of households randomly selected in the community" (Rothenberge et al, 2006).

Based on the literature review and conceptualization, the following flow chart (Figure 1) was developed to illustrates the step-by-step process that was followed in planning and conducting the Waste Audit in GMC area. This was developed by taking not only the Standard and Rotenberg methods but also other related studies, into consideration.



Figure 1: Step by step process developed for the Waste Audit in GMC Area

3.2. Preparation for the Waste Audit

The Waste Audit being an activity involving multiple stakeholders covering waste generators, the GMC waste collectors, CACG project team, externally contacted manpower (e.g. University graduates), and subcontracted agencies, well-planned preparation was the key to the success of the program. Therefore, the following key preparatory steps were adopted well in advance of the Waste Audit in Galle with consistent guidance of the CCBO.

- **Development of the Inspectional Waste Audit Plan**

The Inspectional Waste Audit Plan with a road map of key events was developed by the CACG team on 09th January 2023 and shared it with the CCBO technical advisors for comments. The plan was reviewed through a virtual session and finalized the road map. Annex 1 shows the timeline of activities planned to be implemented under the WACS.

- **Selection of the Samples for the Waste Audit**

Due to the limited resources and time constraints, CACG team decided to go for a manageable sample size for the purpose of the Waste Audit. However, the selection of the sample size and distribution of the sample was decided per statistical procedures.

As per the 'Central Limit Theorem' which has been widely used in statistical studies, the distribution of a sample variable approximates a normal distribution as the sample size becomes larger, assuming that all samples are identical in size, and regardless of the population's actual distribution shape. The same theory

suggests that a sample size of thirty (30) often increases the confidence interval of a population data set enough to warrant assertions against findings. Therefore, the sample size of thirty (30) is considered a large sample size and it is widely used as a rule of thumb amongst many researchers (Karunarathna, 2012; Turney, 2022).

Taking the above Central Limit Theorem as the basis and considering the size of the total sector-wise population, CACG team decided to go with the following sample sizes for the Waste Audit.

Table 1: Samples selected from key sectors for the Waste Audit

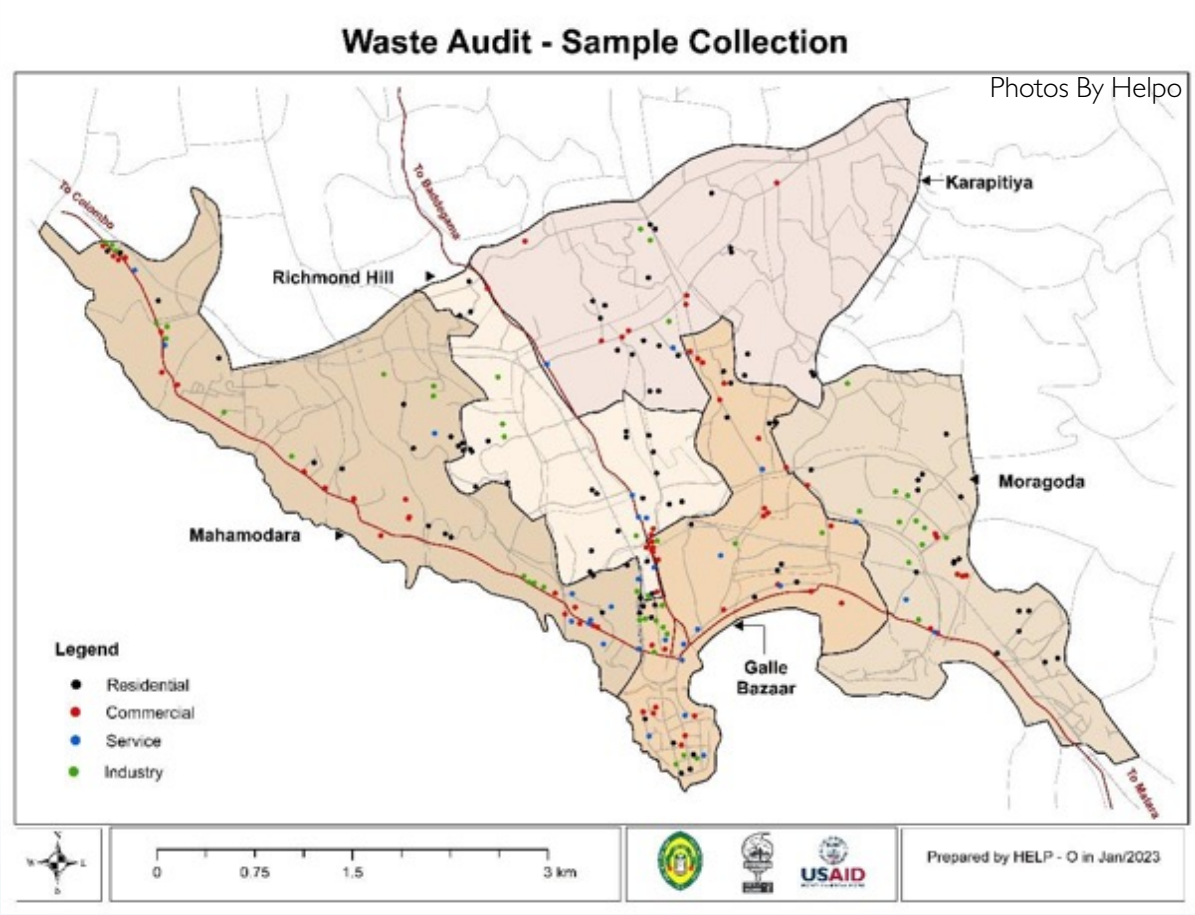
Sector	Total Population	Sample Size selected for the Waste Audit
Residential (Households)	21,291	101
Commercial (Small, medium, and large)	3,440	70
Industrial (Small, medium, and large)	942	50
Service	646	30
Total sample size		251

A total of 251 establishments under each residential, commercial, industrial, and service sector were identified from the locations distributed over the GMC area, representing the five MSW management zones as shown in Table 3 and Map 2 below.

Table 2: Samples selected from each Waste Management Zone

Zone	Residential	Commercial	Industrial	Service
Mahamodara Zone	20	19	10	8
Galle Bazar	20	21	20	12
Moragoda	20	14	12	5
Karapitiya	21	6	5	2
Richmond Hill	20	10	4	3
Total	101	70	50	30

The map below shows the distribution of the samples selected under each sector from all five (05) MSW management zones. A fair spatial distribution was ensured when identifying the samples.



Map 2: Distribution of the identified samples in the GMC area

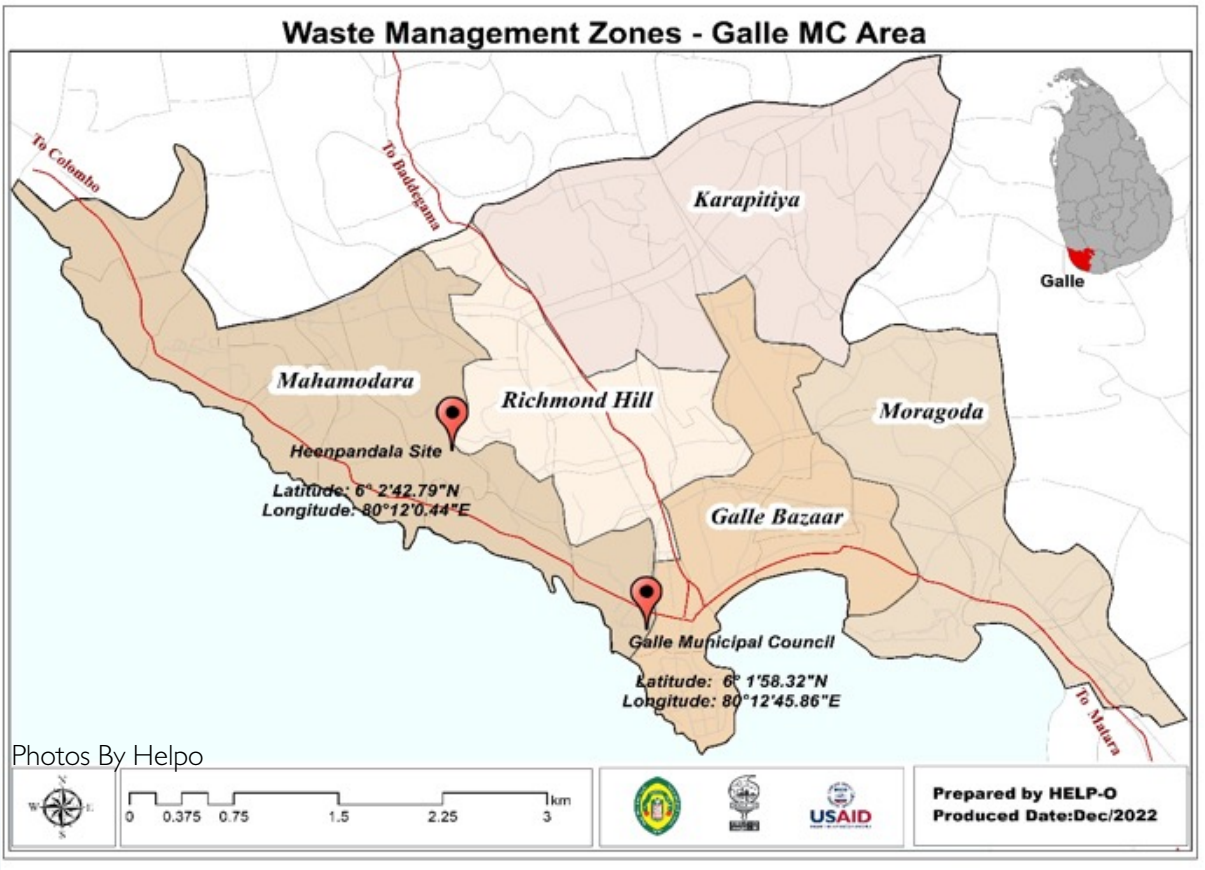
• Selection of the Site for the Waste Audit

In consultation with the GMC, an adequate space at the Heenpendala Waste Transfer and Disposal Site (Heenpandala) owned by the GMC was selected as the waste sorting and weighing area under the Waste Audit.

This location was selected by considering the following key factors;

- Availability of adequate and suitable space for the activities of waste audit including vehicle maneuvering, waste stacking, segregation and ensuring the standard final disposal,
- Convenience of access by the MSW collection vehicle fleet of the GMC.

Heenpandala, which is in Mahamodara zone is shown in the Map 3 below.



Map 3: Heenpandala Waste Transition and Disposal Site

As it was clear that the available CACG project team and GMC-SWM staff alone would not be able to carry out the activities of the audit, it was therefore planned to recruit manpower of suitable capacity externally. With several university graduates, it was decided to engage several staff from the GMC, who were also familiar with the GMC area, to conduct the waste audit. Accordingly, an interview was conducted and a team of Ten (10) university students were selected. Similarly, a team of five (05) Supervisors, including the Supervisor in-charge of the Heenpendala Site and four supervisors in-charge of Waste Management Zones with nine (09) SWM Laborers from the GMC were selected for the Waste Audit as supportive staff.

Special attention was paid for the segregation of plastic waste in the dry component of MSW collection into the standard seven (07) of recyclable plastics fall under the categories of HDPE, PET, PP, LDPE, PVC, PS and Other during the waste characterization. Therefore, the need to provide training to the team members for accurate segregation of plastic waste was recognized from the start. Accordingly, a Solid Waste Management expert (P. L. Loyd, Plastic Waste Specialist) having practical experience in doing the proper segregation and training as well over decades was also hired at the beginning to train the Waste Audit team.

Weight information is key to tracking the amount of waste collected. Monitoring inputs and outputs during materials recovery, extracting energy and disposing of waste is all equally important. Weight data plays a crucial role in all waste management or recycling industries. From tracking the amount of waste collected, to monitoring inputs and outputs during materials recovery, through to extracting energy and disposing of waste, weight information is key to legislative compliance and operational efficiency. Therefore, it was also noticed that the inputs of a competent agency is essential to properly carry out the Weighing of GMC-MSW transporting vehicle fleet. Through a rigorous process, LIYOCHE Weighing Machine (Pvt) Ltd was selected as the sub-contracting party for this task. The weighing bridge was fixed at the Heenpendala site

the entire duration and had the ability to transfer weighing measurements directly to the computer data sheet used by the company.

- Training the Waste Audit team
- Preliminary Awareness and Training for the Waste Audit Team

The need of providing an intensive training program was recognized since the waste audit was a new activity to both the planning and implementing personnel, including the CACG team. Thus, a training program was organized by HELP-O with the technical support of CCBO Solid Waste Specialist. The program was conducted on 4th January 2023 at a local venue, with participation of GMC, CACG and the externally recruited team as a one-day training session. The training covered management (planning, preparation, staffing, resource supply and inter institutional coordination etc.) and technical (means of theoretical applications to conduct waste audit to internationally accepted standards) aspects essential to be incorporated in the planning and implementation of the audit. The CCBO Solid Waste Specialist, U.G. Ekanayaka, and the Capacity Development and Governance, Shan Rajah were the key resource personnel for the session.

Followed by the training workshop, the "Waste Audit Plan" of the CACG was duly updated to comprehensively indicate overall process including resource, funding, manpower and time management aspects, enabling to organize the rest of the activities based on the plan.



Figure 2: Training session on waste audit at Hotel Hasara, Galle on 04.01.2023

• Special training on plastic waste segregation

A special training was conducted for the waste audit team (consisting of University and GMC personnel) on 23rd January 2023 at the Heenpendala waste audit site by a nationally reputed subject expert (P. L. Loyd) based in Sri Lanka. The training, which was a demonstration and the trainer supervised actual

segregation event was focused on practical approach of onsite plastic waste segregation to seven plastic types.



Figure 3: Demonstration by the resource person on Waste Segregation

• Supply of Supplementary Material for the Waste Audit

Following material were identified as essential to conduct the waste audit accurately, effectively and efficiently.

- Waste collection source identification signs (stickers with category name and number),
- Waste collection bags (of suitable material and dimensions),
- Data recording formats (to accurately & easily keep on time records at the site),
- Data/ process monitoring and verification system, waste collection and segregation equipment.
- Vehicle for waste collection and Personal protection equipment for the waste audit team.







Figure 4: The Waste Audit team is preparing the material for the Waste Audit at HELP-O office

• Awareness Program for the Selected Waste Collection Sources



Figure 5: Awareness program for the waste collection sources

A comprehensive awareness program was conducted to educate the sources of selected sample units under the waste audit. They were educated on why and how the audit was planned to be conducted with their role in correct filling of designated bag in house with value of their role, during the planned eight (08) consecutive days. The awareness was undertaken over two (02) days with the participation of nine (09) GMC staff members (Community Development Officers engaging in SWM work), Ten (10) university personnel and CACG project staff.

Specifically prepared Leaflets (see Annex 1) together with coded poly-sack bags for large scale waste generators and generic waste bags small scale generators (putting segregated Dry and Wet waste) were given to the owners of the selected sources.

The selection sample location was coded with numbered stickers to identify it easily within the waste collection process for both the waste audit team and GMC waste collector. A systematic coding method was followed for coding waste bags and stickers to easily identify the correct sample units in the waste audit process.

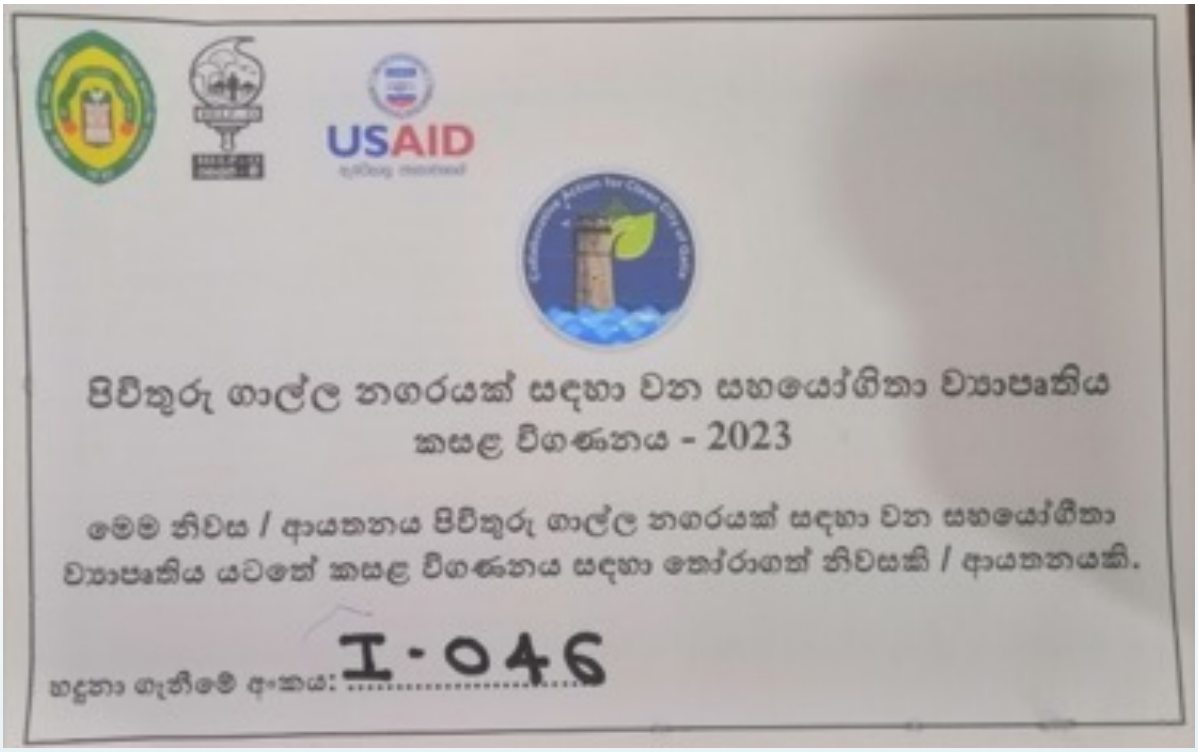


Figure 6:Picture of coded sticker

The numbers of the stickers were designed in selecting and distributing the samples as follows.

- Residential (Household) sector – H01 to H101
- Commercial sector – C01 to C70
- Industrial sector – I01 to I50
- Service sector – S01 to S30

Although theoretically, waste segregation is not encouraged in an audit, it was decided to collect wastes in to two (02) categories as "Wet" and "Dry" as this has been the standard practice by the residents and business in GMC over last three years. The findings of City-Wide Waste Assessment conducted from November 2022 to February 2023 also indicates that this source segregation is well followed by waste generators across all the sectors. The "Wet" component consists of degradable wastes covering, kitchen waste, food waste, and garden waste while the "Dray" component consist of all others like plastic, polythene, PET bottles, PVC, Metal, Glass, Paper, Cardboard, and others such as diapers, shoes, electronics, etc.

3.3. Implementation of the Waste Audit

The two key components of the waste audit are the "Waste Characterization Study" and the "Waste Quantification Study". The process involved in implementing these two components is described below.

3.3.1. Waste Characterization Study

This task being the first stage of the waste audit was to measure the waste generation of GMC. This was conducted over a period of consecutive eight (08) days from the date of commissioning the program on 23rd January 2023. The details of the sequential steps followed are as follows.

• Waste Collection and Transportation up to the Heenpandala

Four vehicles were deployed to collect waste bags from the sample locations and four university students, four laborers, and drivers were engaged for the process. The initially planned route covering five waste management zones (Galle bazaar, Richmond Hill, Mahamodara, Moragoda, and Karapitiya), of each waste collection vehicle was reviewed at the end of Day 1 to optimize the collection efficiency and continued for the following seven (07) days with minor changes to further improve collection efficiency as and when required. After optimizing, three (03) vehicles were deployed to collect waste from five (05) zones from residential, industrial, and service sectors while one vehicle was deployed to collect waste from the commercial sector (which were noticed to be accessible after 9.00 A.M in general).

The coded two waste collecting bags were delivered to the sources during the awareness session of sources for Dry and Wet Waste. Each day, after collected two samples, empty numbered two bags were given to the sources.

The team led by the University graduates, visited each waste collection source, and handed over the designated bags for the following day, very briefly discuss to inform or understand any concerns in process, mark the data sheet which used to record the waste bags (seen annexure 02) and collect the filled bag (with the support of GMC worker) and deliver to Heenpandala site for follow up actions. The waste collection process took about six hours (from 6.00 A. M. to 12.00 Noon) each day. Measuring and sorting process was started afterwards.



Figure 7: Waste Collection and Transportation by Waste Audit Team

• Waste Unloading from the Vehicle and Stacking at Heenpendala

After transported the collected dry and wet waste bags from each source safely unloaded by the GMC worker assign to the Vehicle under the supervision of university graduates. Simultaneously, two (02) University personnel on the site observed and marked on the data sheet the due receipt of unloaded bags. The bags were then stacked on the queue in order of the delivery to the location.

A simultaneous verification process was in place to ensure that the samples are received from each designated source by cross checking the designated sample location numbers within the respective zone covered by the vehicle that delivered the bags. When an issue like absence of bags from a sample was noted, the WACS team members in charge at Heenpendala (CACG staff member and the university personnel) discussed with the team member of the respective Vehicle to resolve the issue.



Figure 8: Waste Bags Unloading

• Weighing unloaded waste bags

The bags on the queue were then weight using the electronic scale (Figure 09) by two team members (one to keep on the scale while other read out the weight) and the weight was recorded on respective data sheet (Annex 03) by the designated member for the respective sector. Simultaneously, all the records were entered into the excel sheet according to the numbers assigned to each sample unit. This recorded the Wet and Dry weight of waste by each sector.



Figure 9: Weighing of unloaded waste bags

• Mixing and Measuring Volume of Waste

This process was followed separately for both the Wet and Dry wastes.

Example: Process of measuring the volume of 'wet' portion of the wastes

First the designated location at the site was prepared by laying the polythene sheet on the floor and then the "wet waste" collected from all the sectors were disposed on the tarpaulin sheet. Then the heap of wet waste was mixed well by assigned workers with the support of other team members to get a homogenous mixture of the wet waste collection of the day as shown in Figure 09 above. Simultaneously the dry waste materials that were mistakenly added to the wet waste (e.g. plastic, metal, etc.) were also removed. Loads were contaminated with a negligible amount of dry materials.



Figure 10: Mixing of waste collection of the day

As per the standard approach to measure the volume, it was planned to prepare a collection of 50 kg of waste portion and to measure the volume of the same. The following steps were followed to get a homogeneous wet waste mixture of 50 kg.

The well mixed, flattened waste heap was divided into four (04) quadrants and then the two (2) of the crossing quadrants were removed and the other two were mixed again and measured the weight. If the weight was 50 kg it was used for the volume measurements. If weight exceeded 50 kg, the same process was repeated until a portion of 50 Kg of waste is separated from the total collection as shown in Figure 11.

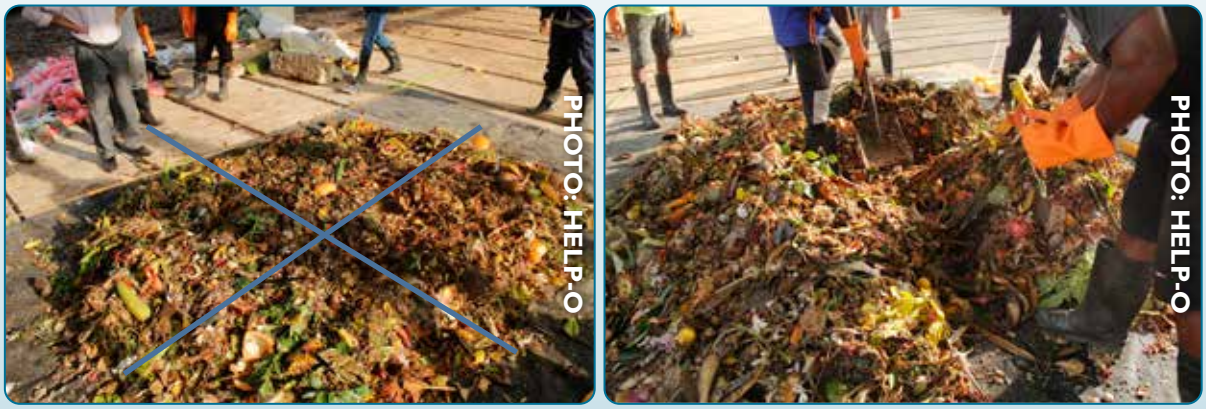


Figure 11: Mixing the waste and getting 50kg portion by separating wet waste into quadrants

Example:

Total weight of the received waste - 400 kg
First separation into quadrants - 400 /4 = 100 kg
Second separation into quadrants by taking the crossing quadrants - 100/4 = 25 kg
Mix crossing quadrants to get 50 kg as the final portion for measuring the volume

• Measuring of Waste Volume

To measure the waste volume, three (3) wooden containers of 50cm x 50cm x 50cm were made as shown in Figure 12.



Figure 12: Wooden Box for taking the volume of the waste

The weighted portion of 50 Kg of wet waste was loosely put into the box and the volume is recorded on the respective data sheet.

The similar procedure was followed in all seven (7) days, except the day 1, to record the daily volume of the wet portion of the waste.

• Calculating the Waste Density

After completing the above-mentioned steps, the density of the wet waste was calculated using the below equation.

$$\text{Density} = \frac{\text{(Weight (50kg))}}{\text{(Volume (m3))}}$$

Note: The same sequential steps discussed above were repeated to measure the volume and to calculate the density of the dry waste taking the dry waste collected from the sources.

• Segregation and sorting the 'Dry' Waste into Categories

The measured portion of 50 kg of the dry waste was then manually sorted into the following categories by dispersing on the same tarpaulin sheet by team members and then the weight of each category was measured and recorded on the respective data sheet.

Table 3: Categories considered in sorting the dry waste

No	Waste Category		Description/ examples
1	Biodegradable	Kitchen Waste	Liquid food waste, Fruit and Vegetable Scraps, Spoiled Foods
2		Garden Waste	Grass, Bushes, Plants
3	Recyclables	Paper	White Paper, Cardboards, Cartons, Newspaper, Textbooks, Magazine, Pamphlets, Mixed paper
4		PET	PET bottles
5		HDPE	HDPE plastics, detergent containers, shampoo containers, bottle caps
6		LDPE	LDPE plastics, plastic bags
7		PVC	PVC plastics, water pipes
6		PP	PP plastics (yogurt boxes, straws, spoons, cups)
8		PS	PS plastics (Styrofoam box, plastic coffee cup)
8		Others	Synthetic plastic items, snack packaging, instant noodle
9		Glass	All kinds of glass (except for medicine bottles)
10		Metals	Tin cans, Aluminum cans & Trays, Copper tubes and Wires, Steels
11	Residual	Flexible Plastics	Packaging Papers, Wrappers
12		Leather	Leather Products
13		Rubber	Slippers, Mats
14		Textile	Cloths and Clothes
15		Sanitary Composites	Napkins, Dippers, Soiled Tissue Papers
16		Soiled Paper	Coated Papers, Food contaminated papers
17		Soiled Plastics	Lab
18		others	Asbestos
19	Special Waste	Hazardous waste	Pesticides, WEE, Cleaning Containers, Paint, and Chemical Containers
20		Health care waste	Grouses, Masks, Expired medicine
21		Bulky Waste	Bulky Yard waste
22		e-waste	Computer monitors, Printers, Scanners, Keyboards, Mice
23		Ceramic	Wall and floor tiles, Bricks and Roof tiles, Household ceramics,

The steps followed in dry waste sorting (after measuring the initial weight of delivered dry waste bags) are as follows.

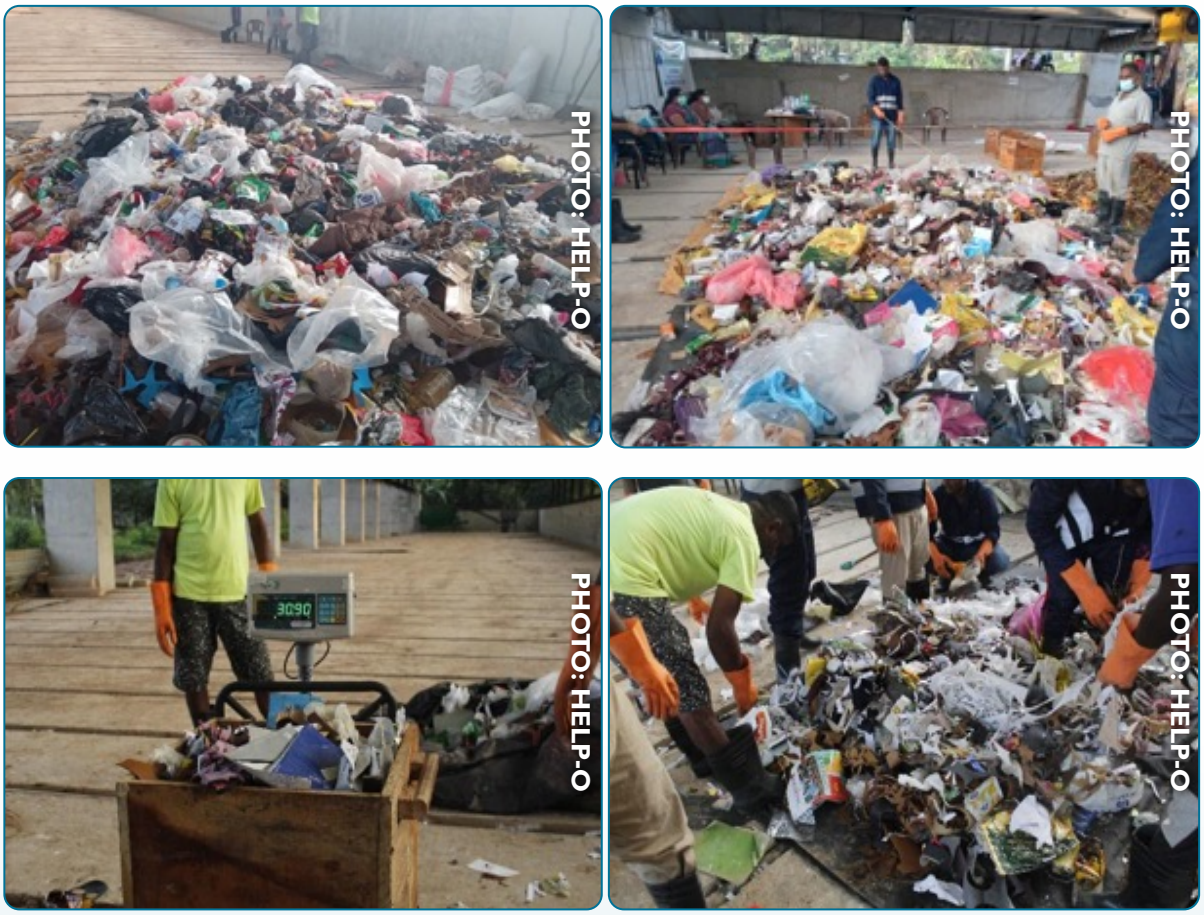


Figure 13: The entire process of dry waste characterization

3.3.2. Waste Quantification Study

As the second stage of the Waste Audit, weighing the daily waste collection fleets of the GMC was conducted at the Heenpandala site. Under this process, the collection vehicle fleet of the GMC were weighted using a vehicle measurement scale and recorded collection details by two university students. A standard data entry format was used to enter measurements. 23 vehicles are used in the waste collection of the GMC daily. Below were the sequential steps followed in this process.

- **Preparation**

The project team had a discussion with the transport unit and waste management unit of the GMC on this waste collection audit. Coded stickers were attached to the collection vehicles to identify the vehicles. The above activities were done on the first day.



Figure 14: Preparation for the Waste Audit

• Weighing the loaded vehicles

The loaded vehicle was weighed and recorded in the given data entry sheet by university graduates. Also, they recorded the collected waste type in that sheet.



Figure 15: Weighing the loaded vehicles

• Weighing the unloaded vehicles

After measuring the loaded vehicle, the unloaded measurement of the same vehicle was taken. Weight of unloaded vehicles were recorded daily as there could be some changes mainly due to the available quantity of fuel or changes in the trailers and so forth.



Figure 16: Weighing the unloaded vehicle

• Calculating the net weight of the waste

After recording the unloaded weight of vehicles, the net weight of the waste was calculated using the below equation. All the records were entered into an MS Excel database.

Waste Weight = Weight of the Loaded vehicle – Weight of the Unloaded Vehicle

CHAPTER 4

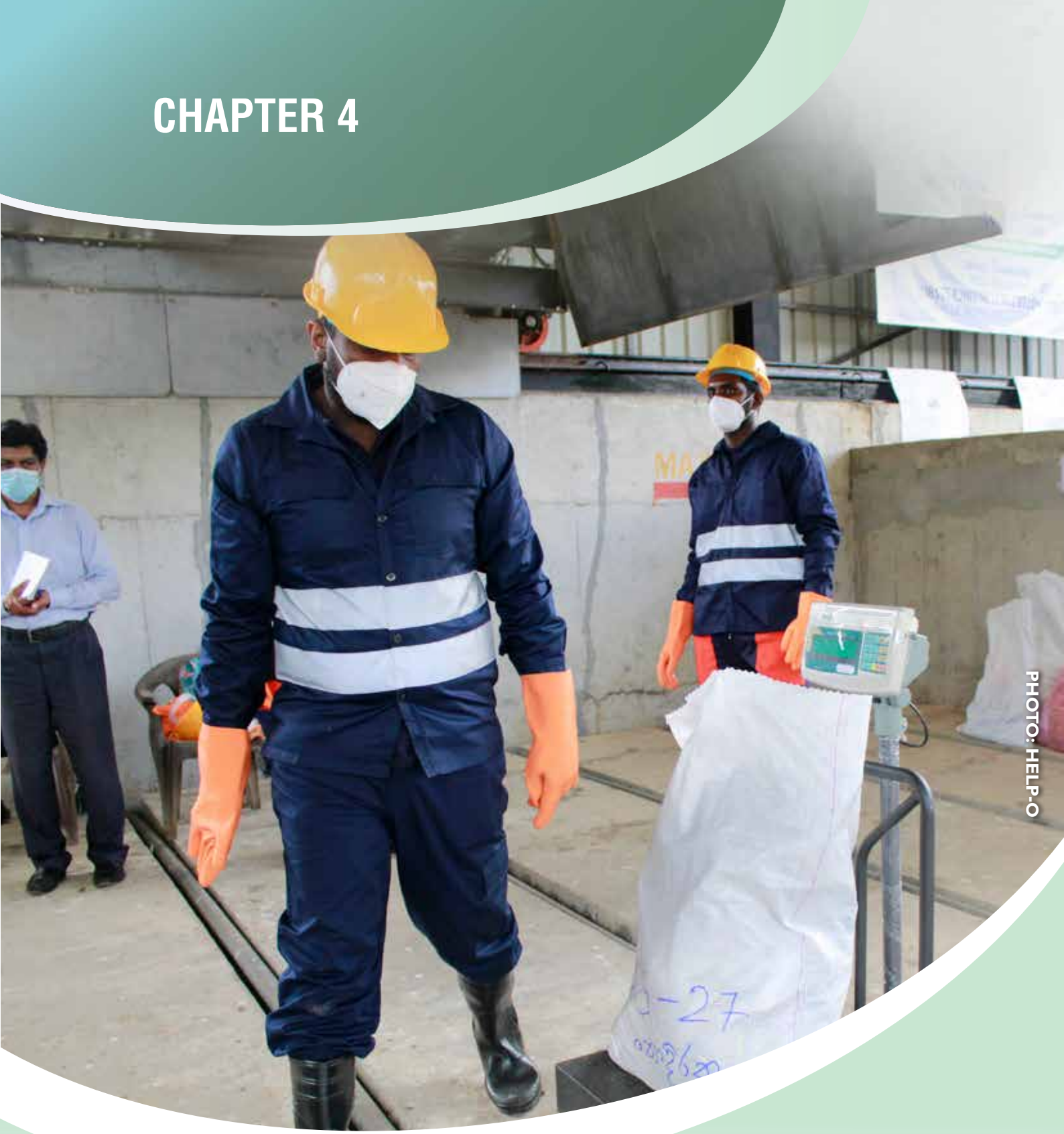


PHOTO: HELP-O

RESULTS AND DISCUSSION: WASTE CHARACTERIZATION STUDY

4.1. Waste Generation of Key Sectors in the GMC Area

In the first stage of the WACS, the WACS team recorded the waste generation of the GMC area using a scientific approach. Accordingly, the amount waste generated by residential, commercial, industrial, and service sectors were measured by taking a sample of 251 units (including 101 houses, 70 commercial units, 50 industrial units, and 30 service sector establishments).

4.1.1. Residential Sector: Key Findings

Figure 16 below illustrates the collected waste quantities within the eight (08) days of the Waste Audit in the residential sector. The GMC collects waste as wet and dry and the same procedure was applied for the Waste Audit.

According to the literature, handbooks and toolkits that provide guidelines for conducting a Waste Audit, the first day of the audit provides space for the audit team to get familiar with the process. Also, since the audit team does not know for how many days the waste has been accumulated, the data collected during the day one will be exempted from calculations (Rothenberger, 2006, pg 26). With that basis, the first day of the Waste Audit in Galle was considered a trial day. Therefore, the collection of waste was comparatively lower in the first day. It can be observed a regular waste collection pattern from the second day onwards.

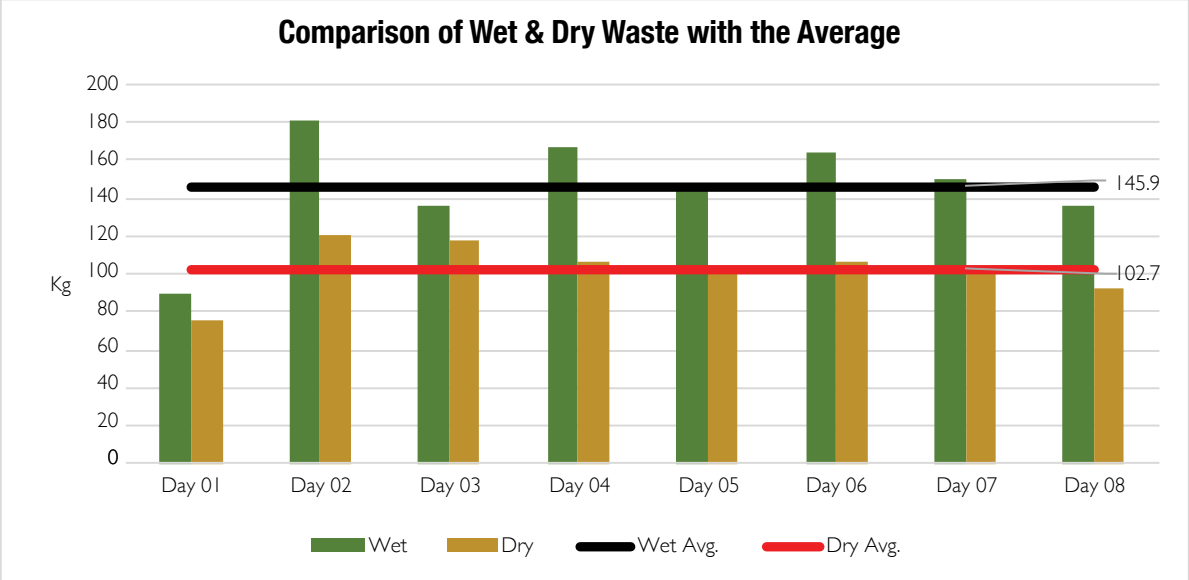


Figure 17: Comparison of the daily wet & dry waste generation with the average: Residential sector

As per the figure, per-day average weight of wet waste collected from the household sample is recorded as 145.9 kg, whereas per-day average weight of dry waste collection is 102.7 kg. Using this information, quantities can be estimated for how much residential waste is generated on a daily basis in the GMC and by each household per day (on average.) According to that data, average wet and dry waste generation can be calculated as follows,

Quantities Generated Per HH per Day

Daily per-HH 'wet' waste generation

= Average weight of wet waste generation sampled from HHs per day / Sample size

= 145.9 kg per day/ 101 HHs

= 1.44 kg/ HH/ day

Daily per-HH 'dry' waste generation

= Average weight of wet waste generation sampled from HHs per day / Sample size

= 102.7 kg per day / 101 HHs

= 1.02 kg/ HH/ day

Total Quantities of HH Waste Generated in GMC per Day

According to the above calculations, average wet waste generation of a unit is 1.44 kg and Average dry waste generation is 1.02 kg. Using the average wet and dry waste generation of a unit, total wet waste generation of GMC area and total dry waste generation in GMC area were calculated.

Daily total of 'wet' HH waste generated in the GMC area

= Kg of wet waste Per-day x Total HHs in GMC

= 1.44 kg/day x 21,291 HH

= 30,659 kg/day of Residential Wet Waste

Daily total of 'dry' HH waste generated in the GMC area

=Kg of dry waste per HH per day x Total HHs in GMC

= 1.02 kg/ day x 21,291HH

= 21,717 kg/day of Residential Dry Waste

Daily total of waste generated in the GMC area

= Total kg of 'wet' waste/day + Total kg of 'dry' waste/day

= 30,659 kg/day + 21,717 kg/day

= 52,376 kg/day of Residential Waste

GMC Residential Waste	Kg/ Household/ Day	Total Kg/ Day
Wet Waste	1.44	30,659
Dry Waste	1.02	21,717
Total Waste	2.46	52,376

4.1.2. Commercial Sector: Key Findings

Figure 18 demonstrates the collected waste quantities from commercial establishments within the 08 days span of the Waste Audit. It can be identified that there is a high waste quantity collected from the second day to the fourth day compared to other days and a gradual decrease from the fifth day to the eighth day. Also, a regular collection can be seen in dry waste compared to the wet waste throughout the audit.

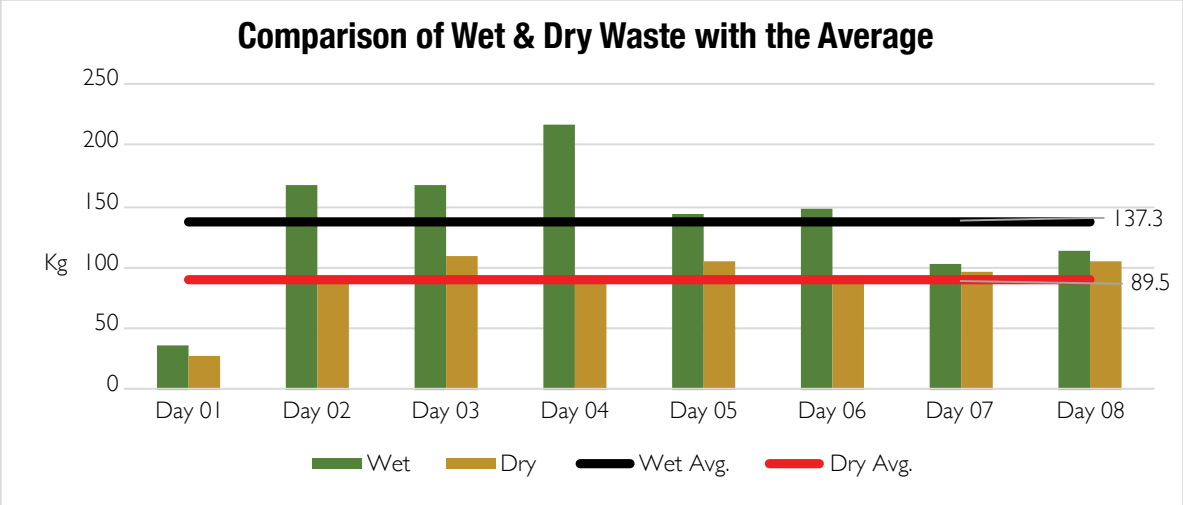


Figure 18: Comparison of the daily wet & dry waste generation with the average: Commercial sector

As per the figure, per-day average of wet waste collection in the commercial sector is recorded as 137.3 kg, whereas per-day average of dry waste collection is recorded as 89.5 kg /day. Using this information, quantities can be estimated for how much waste is generated by commercial units on a daily basis in the GMC and by each commercial unit per day (on average.)

Quantities of Waste Generated Per Commercial Unit per Day

Daily per-unit 'wet' commercial waste generation

=Average weight of commercial wet waste sampled per day / Sample size

= 137.3 kg per day/ 70 commercial units

= 1.96 kg/ commercial unit/ day

Daily per-unit 'dry' Commercial waste generation

= Average weight of Commercial dry waste sampled per day / Sample size

= 89.5 kg per day/ 70 commercial units

= 1.28 kg/ commercial unit/ day

Total Quantities of Commercial Waste Generated in GMC per Day

Daily total of 'wet' Commercial waste generated in the GMC area

= Per-unit Commercial wet waste generation per day x Total no. of units

= 1.96 kg/ per day x 3,440 units

= 6,742 kg/ day

Daily total of 'dry' Commercial waste generated in the GMC area

= Per-unit Commercial dry waste generation per day x Total no. of units

= 1.28 kg/ per day x 3,440 units

= 4,403 kg/ day

Daily total of Commercial waste generated in the GMC area

=Total Commercial 'wet' waste + Total Commercial 'dry' waste

= (6,742 kg + 4,403kg)/ day

= 11,145 Kg/ day Commercial Waste

GMC Commercial Waste	Kg/ Unit/ Day	Total Kg/ Day
Wet Waste	1.96	6,742
Dry Waste	1.28	4,403
Total Waste	3.24	11,145

4.1.3. Industrial Sector: Key Findings

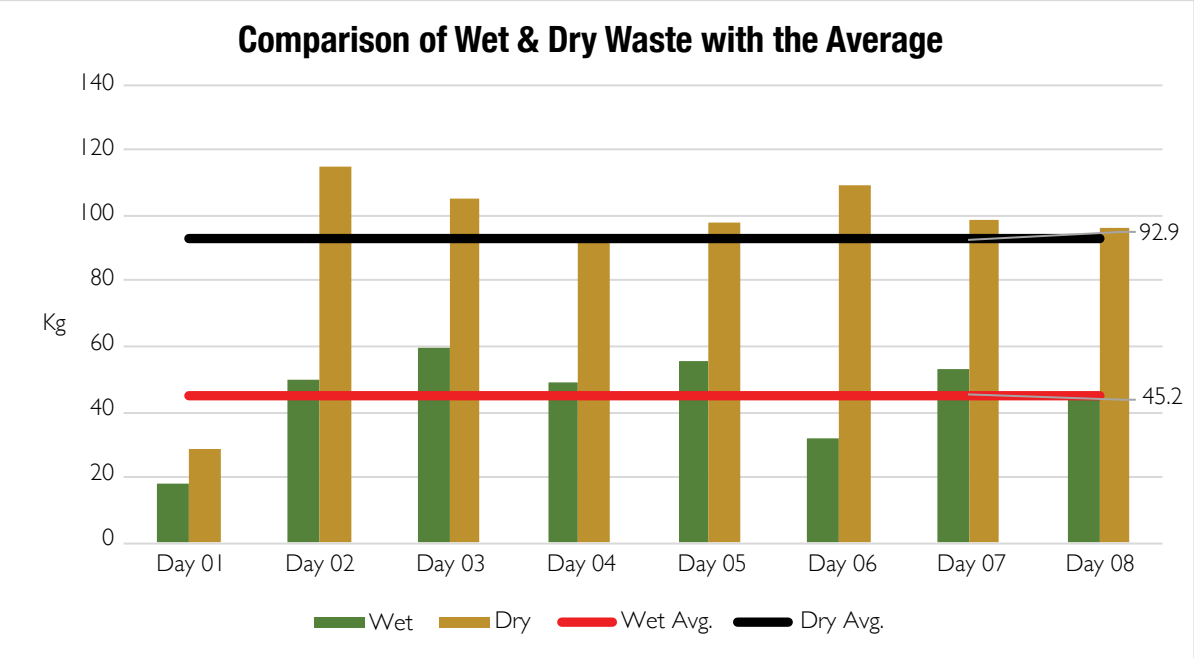


Figure 19: Comparison of the daily wet & dry waste generation with the average: Industrial sector

As in the residential and commercial sectors, Figure 19 above shows a similar variation in the wet and dry waste generation in the industrial sector during the period of waste audit. As per the figure, there is a higher but more or less a regular waste generation from the second day onwards. As per the results of the Waste Audit, per-day average of wet waste collection in the industrial sector is recorded as 45.2 kg, whereas per-day average of dry waste collection is recorded as 92.9 kg/day. Using this information, quantities can be estimated for how much waste is generated by industrial units on a daily basis in the GMC and by each industrial unit per day (on average.)

Quantities Generated Per Industrial Unit per Day

Daily per-unit Industrial 'wet' waste generation

= Average weight of Industrial wet waste sampled per day / Sample size

= 45.2 kg per day/ 50 units

= 0.90 kg/ Industrial Unit/ day

Daily per-unit Industrial 'dry' waste generation

= Average weight of Industrial dry waste sampled per day / Sample size

= 92.9 kg per day/ 50 units

= 1.86 kg/ Industrial Unit/ day

Total Quantities of Industrial Waste Generated in GMC per Day

Daily total of 'wet' Industrial waste generated in the GMC area

= Per-unit Industrial wet waste per day x Total no. of Industrial units

= 0.90 kg per day x 942 units

= 848 kg/ day of Industrial Wet Waste

Daily total of 'dry' Industrial waste generated in the GMC area

= Per-unit Industrial dry waste per day x Total no. of Industrial units

= 1.86 kg per day x 942 units

= 1,752/ day of Industrial Dry Waste

Daily total of Industrial waste generated in the GMC area

= Total 'wet' Industrial waste + Total 'dry' Industrial waste

=(848 kg + 1,752kg)/ day

= 2,600 kg/ day of Industrial Waste

GMC Industrial Waste	Kg/ Unit/ Day	Total Kg/ Day
Wet Waste	.09	848
Dry Waste	1.86	1,752
Total Waste	1.95	2,600

4.1.4. Service Sector: Key Findings

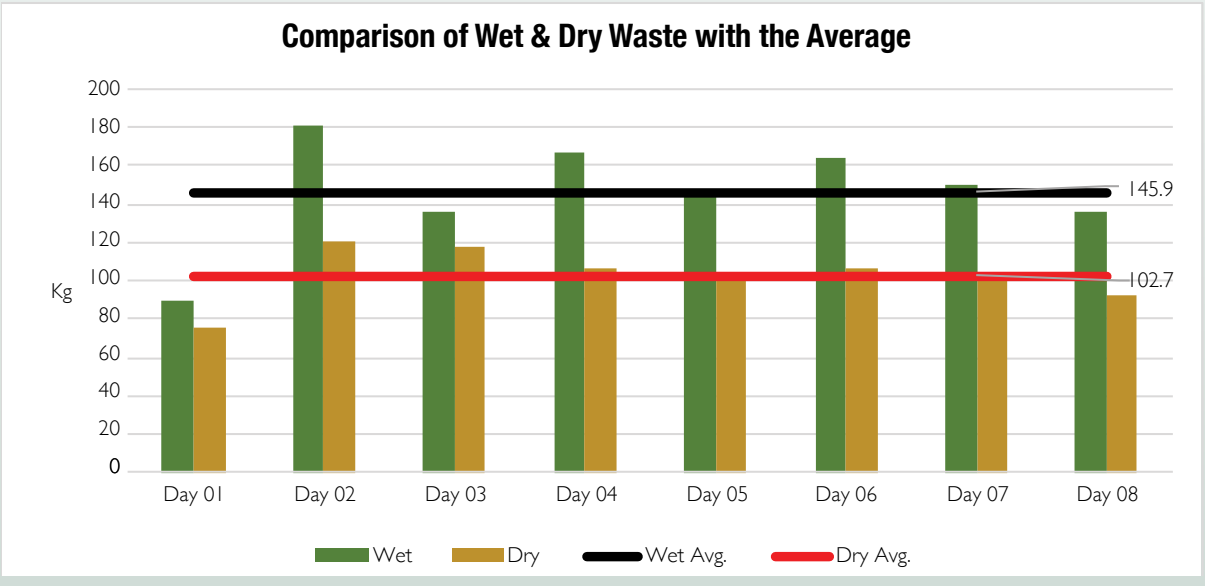


Figure 20: Comparison of the daily wet & dry waste generation with the average: Service sector

Figure 20 below illustrates the wet and dry waste generation in the service sector during the waste audit. As per the analysis, it is possible to observe an irregular pattern of waste generation throughout. However, per-day average of wet waste collection in the service sector is recorded as 61.2 kg/day, whereas per-day average of dry waste collection is recorded as 43.4 kg/day. Using this information, quantities can be estimated for how much waste is generated by service sector units on a daily basis in the GMC and by each service sector unit per day (on average.).

Quantities Generated Per Service Unit per Day

Daily per-unit 'wet' Service waste generation

= Average weight of Service wet waste sampled per day / Sample size

= 61.2 kg per day/ 30 units

= 2.04 kg/ Service Unit/ day

Daily per-unit 'dry' Service waste generation

= Average weight of Service dry waste sampled per day / Sample size

= 43.4 kg per day/ 30 units

= 1.45 kg/ Service Unit/ day

Total Quantities of Service Waste Generated in GMC per Day

Daily total of 'wet' Service waste generated in the GMC area

= Per-unit Service wet waste per day x Total no. of Service units

= 2.04 kg per day x 646 units

= 1,318 kg/ day of Service Wet Waste

Daily total of 'dry' Service waste generated in the GMC area

= Per-unit Service dry waste per day x Total no. of Service units

= 1.45 kg per day x 646 units

= 938 kg/ day of Service Dry Waste

Daily total of Service waste generated in the GMC area

= Total 'wet' Service waste + Total 'dry' Service waste

= (1,318kg + 938kg)/ day

= 2,256 kg/ day of Service Waste

GMC Service Waste	Kg/ Unit/ Day	Day
Wet Waste	2.04	1,318
Dry Waste	1.45	938
Total Waste	3.49	2,256

4.1.5. Total GMC Waste: Key Findings

From the information provided in 4.1.1 - 4.1.4, an estimation of the daily totals of waste generated in the GMC can be calculated.

Daily total of sectoral waste generation in GMC area

= HH + Commercial + Industrial + Service

= 52,376 kg/ Day +11,145 kg/ Day +2,600 kg/ Day +2,256 kg/ Day

= 68,377 kg/ Day (68.34 MT/ Day)

GMC Waste	Kg/ Unit/ Day	Total Kg/ Day
Total Household Waste	2.46	52,376
Total Commercial Waste	3.24	11,145
Total Industrial Waste	1.95	2,600
Total Service Waste	3.49	2,256
Total GMC Waste	11.14	68,377

Based on the above, per capita waste generation in the GMC area can be calculated as below. The population size of the GMC area is taken as 103, 600 (GMC Resource Profile, 2021) for this purpose.

Daily Per Capita Waste Generation = Waste Generation/ Total Population of the GMC Area

= 68,377/ 103,600

= 0.66 kg/ Day

The Waste Audit was conducted in a challenging time where people and businesses were going through many hardships due to high inflation and subsequent increase of cost of living. Accordingly, the above Per Capita Waste Generation (0.66 Kg/ Day) may reflect the reduced waste generation due to the reduced consumption patterns of people and decreased sales and production of goods of commercial and industrial establishments.

4.2. Findings Related to Different Waste Components

4.2.1. Composition of the total waste components

Below figure 21 illustrates the composition of the total waste components considered in the waste audit. Accordingly, 54% of the MSW is wet (biodegradable, e.g. garden waste and kitchen waste) and 27% consists of dry recyclables (e.g. types of Plastic, metal and glass). Residual waste (e.g. leather, textile) and special waste (e.g. hazardous waste, healthcare and bulky waste) compositions are 17% and 2%, respectively.

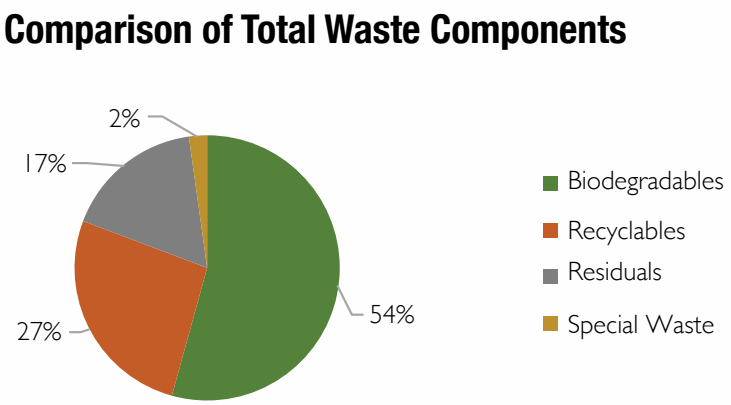


Figure 21:Composition of Total Waste Components

4.2.2. Composition of Biodegradable Waste

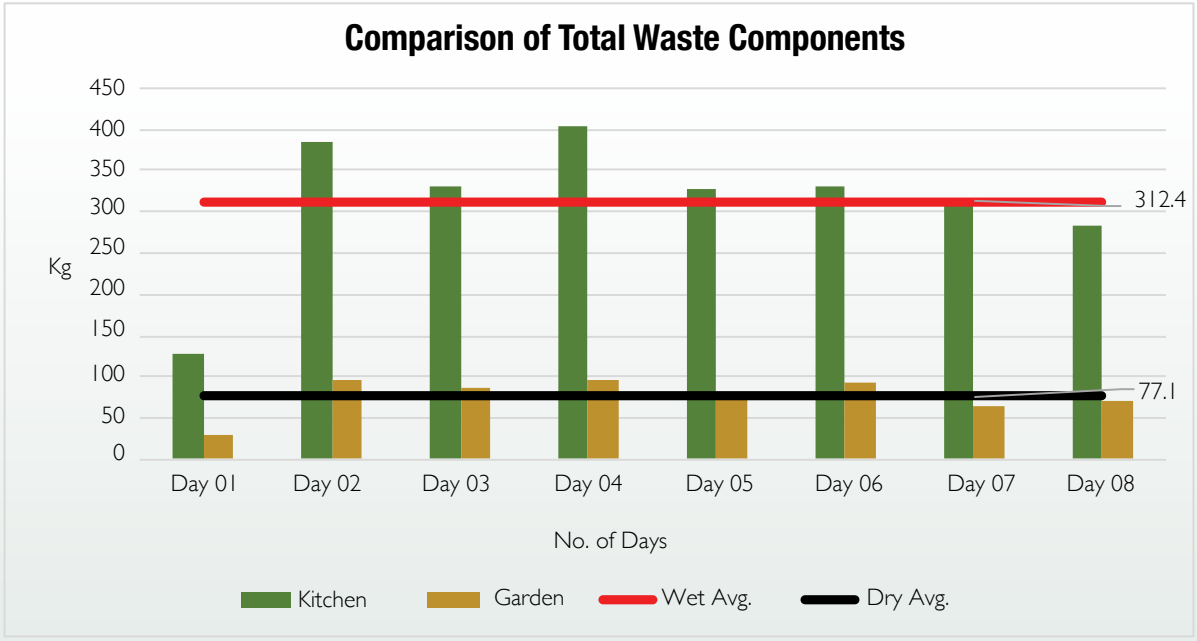


Figure 22: Composition of Biodegradables Waste

Above figure 22 is an illustration of the composition of the biodegradable waste generated by the samples selected from the four (04) key sectors. As per the figure, it is observed that there is a high amount of kitchen waste compared to the garden waste.

4.2.3. Composition of Non-Degradable Waste

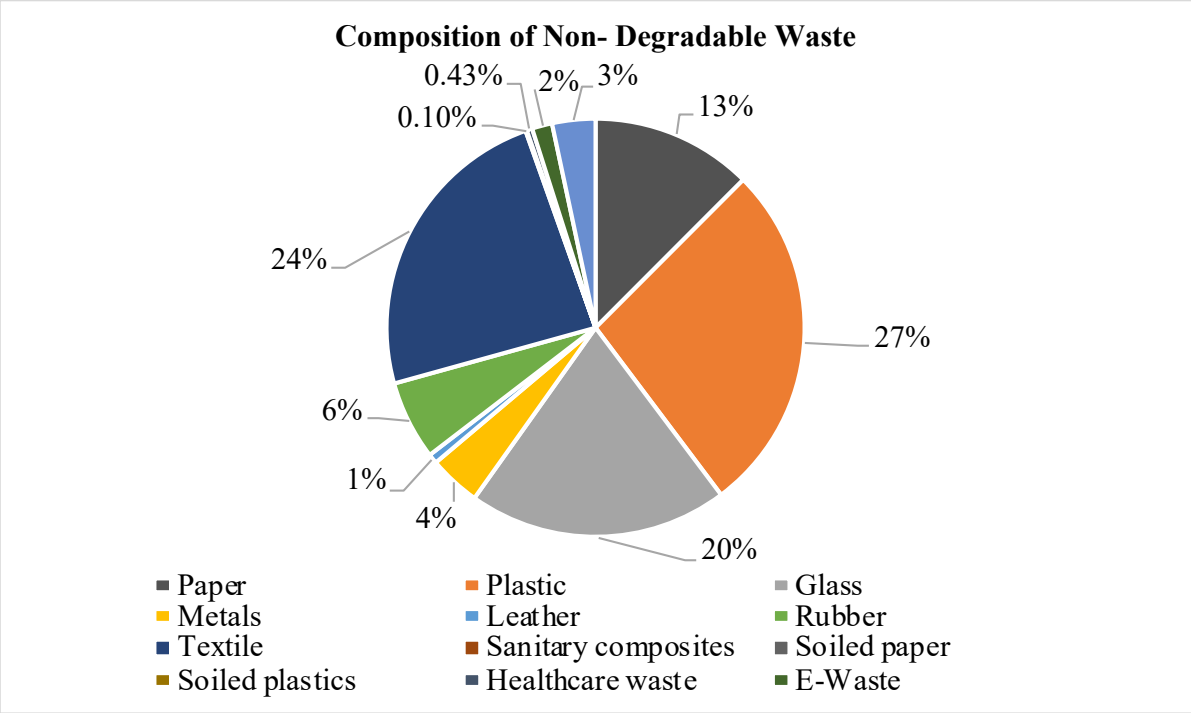


Figure 23:Composition of non-degradable waste

When the compositional data of non-degradable waste is considered (Figure 23), the highest amounts come from plastic, textile, and glass. In addition, paper also composes a significantly large amount (13%) of the total non-degradable waste.

4.2.4. Composition of Plastic Waste

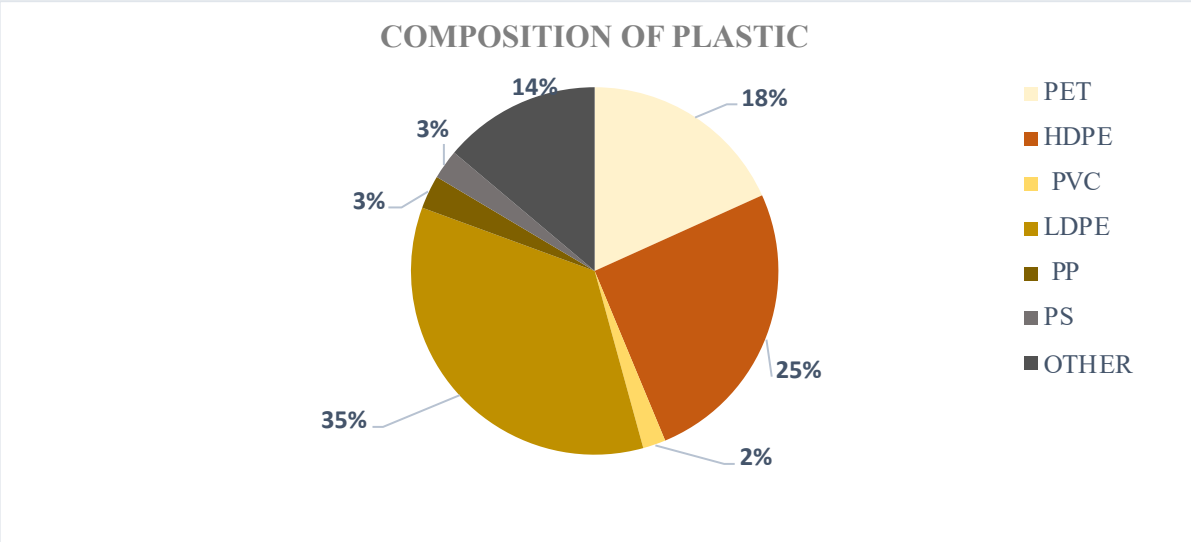


Figure 24: Composition of plastic waste

As in the figure 24, when analyzing the composition of types of plastic waste, LDPE constitutes the highest proportion at 35%. Second highest quantity was HDPE (25%) and constitute 18%, 25%, and 14% respectively. PVC, PP, and PS types of plastic constitute in small amounts.

4.3. Calculation of Waste Density

The following figure 25 presents the volume of 50 kg of wet and dry waste in m3. This figure can be used in calculating the density of wet and dry waste separately.

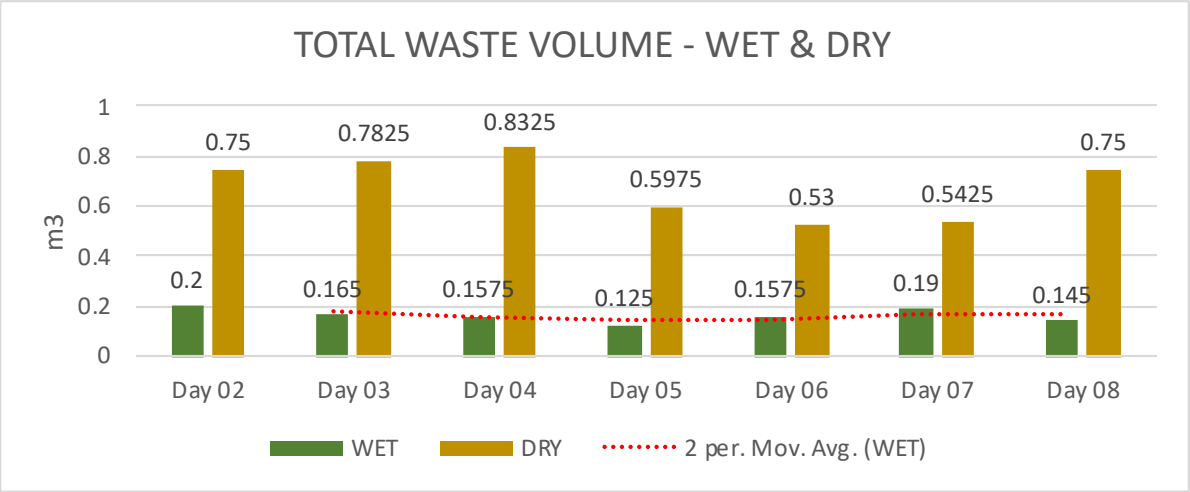


Figure 25: Total Waste Volume - Wet & Dry

As per the above information, the density of wet and dry waste collected daily was calculated and presented in the following figure 26.

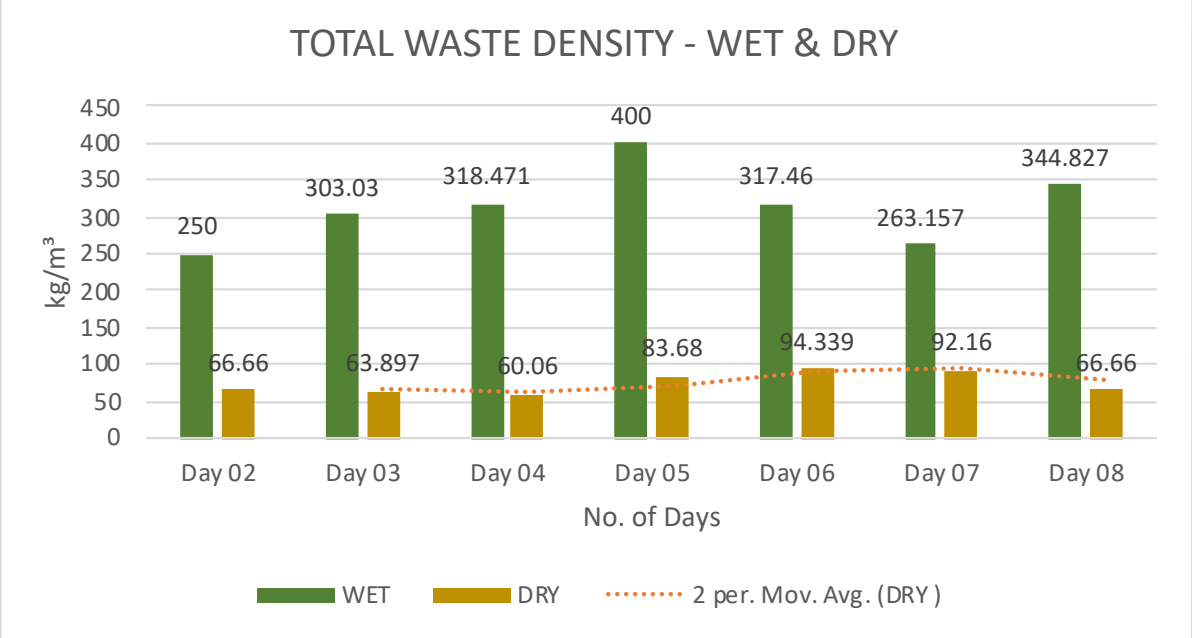


Figure 26: Density of wet and dry waste

CHAPTER 5



PHOTO: HELP-O

RESULTS AND DISCUSSION: WASTE QUANTIFICATION STUDY

5.1. Results

The weighing of the GMC vehicle fleet that collect and transport solid waste from all residential, commercia, industrial, and service sector units was conducted for eight (8) days from 1st February to7th February 2023. The GMC collects solid waste from 54 different locations. The 'Wet' and' Dry' waste is often collected and transported separately, and in some instances, mix waste is collected. Following table (table 5) illustrates the collection of the sector-wise solid waste by the GMC during the week of the waste quantification study.

Table 4: Net weight of sector-wise waste collected by the GMC vehicle fleet

Day	Wet (Degradable) Waste Collection (kg)	Dry (Non-Degradable) Waste Collection (kg)	Mixed (Wet and Dry) Waste Collection (kg)	Total Waste Collection (kg)
Day 1	15,627	4,634	2,787	23,048
Day 2	11,056	1,518	1183	13,757
Day 3	23,179	683	721	24,583
Day 4	11,285	10,886	1,059	23,230
Day 5	8,789	6,017	1,027	15,833
Day 6	21,509	2,849	2,505	26,863
Day 7	15,461	3,035	4,549	23,045
Total	106,906	29,622	13,831	150,359

According to the collected data,

Daily average collection of the 'Wet' waste = 106,906 kg / 7

= 15,272.3 kg (15.3t/d)

Daily average collection of the 'Dry' waste = 29,622 kg / 7

= 4,231.7 kg (4.2t/d)

Daily average collection of the 'Mix' waste = 13,831 kg / 7

= 1,975.8 kg (2 t/d)

Daily average collection of the total waste = 150,359 kg / 7

= 21,479.9 kg (21.5 t/d)

Accordingly,

Rate of collection of waste by GMC = (Average daily collection/ Total waste generation) x 100

(By Weight) = (21,479.9kg /68,377 kg) x 100

= 31.43 %

Note: Daily Weighing Data base – Vehicle attached as an attachment

5.2 Discussion

The rate of collection of waste by the GMC, which is 31.43% of the total waste generation, is in par with the national average solid waste collection rate for Local Authorities in Sri Lanka (Kaza et. al., 2018). As Kaza et. al. state, the Local Authorities in Sri Lanka have the capacity to collect only one-third of municipal solid waste, which is estimated to be around 7,110 MT/Day from a generation of 21,331 MT/D. Accordingly, the accuracy and acceptability of the results of this WACS can be justified.

Results also indicate that 68.57% (by weight) of solid wastes generated in the GMC area is not handed over to the GMC. However, survey observations indicate that most of the streets and open areas of the GMC are clean and no visible signs of haphazard waste dumping. This leads to the question 'how the rest of the waste that is not collected by the GMC is being disposed or managed?'

The findings of the Baseline Waste Assessment, which was conducted as a sample study from November 2022 to January 2023 illustrate to what extent the residential, commercial, industrial, and service sectors are served by the GMC. Accordingly, 81% of residential units, 84% of small-scale commercial establishments, 86% of large-scale commercial establishments, 64% of industrial establishments, and 79% of service sector establishments are served by the GMC Waste Collection Service. This indicates that 19% of residential units, 16% of small-scale commercial establishments, 14% of large-scale commercial establishments, 36% of industrial establishments, and 21% of service sector establishments manage their own waste without handing over to the GMC.

In addition to the above, the findings of the Baseline Waste Assessment indicates that some of the waste types under residential, commercial, industrial, and service sectors are not handed over to the GMC and managed at the source. Since the waste audit focused on the weight-based calculations, the baseline survey findings related to the waste disposal methods of some of the heavy weight waste types such as degradable wastes, iron/ scrap metal, glass, ceramic waste, etc. are presented below as evidence to the above claim.

For example, in addition to handing over to the GMC, rice waste of all four sectors is disposed using the following methods.

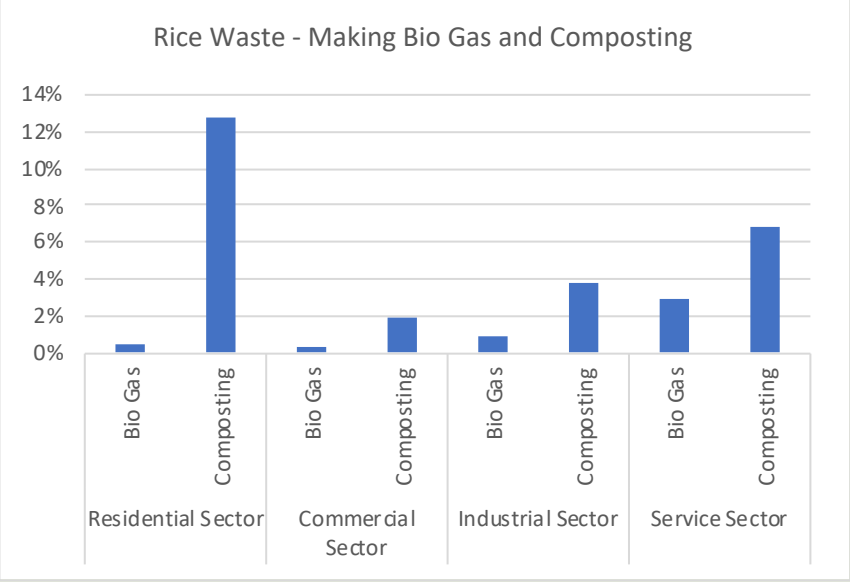


Figure 27: Rice Waste- Making compost and biogas

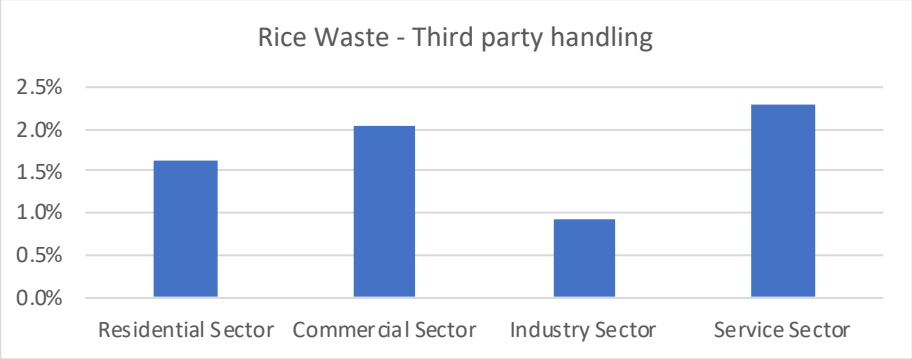


Figure 28: Rice Waste - Handing over to third-party

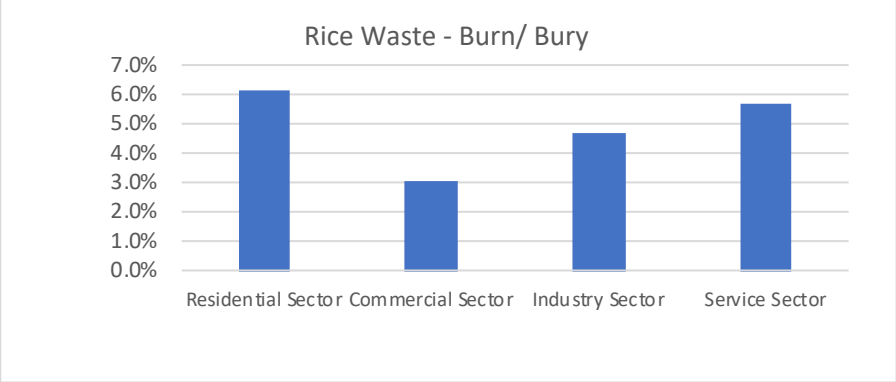


Figure 29: Rice Waste - Burning or Burying practic

According to the above figures, while handing over to the GMC, some parts of the rice waste generated in all four sectors have been disposed by using other methods, such as composting, making biogas, handing over to a third-party, burning and burying. This is a significant amount of the rice waste generated in the GMC area.

Also, based on the results of the Baseline Waste Assessment, it has been found that 08 out of 1840 housing units have biogas units established in their premises, resulting an estimated number of 92 biogas units (8/1840 x 21,291) in the entire GMC area. Accordingly, these units seemingly use 128.8 kg of degradable waste every day to produce biogas, which is again a significant amount of waste that is not handed over to the GMC. Similarly, 10 religious places and 09 service establishments that were surveyed have their own biogas units and use degradable waste to generate biogas. Commercial and industrial sectors have less number of biogas units (02 units in each sector), perhaps due to the fact that they do not generate large quantities of degradable waste.

Moreover, according to the GMC Community Development Unit, 350 compost bins have been donated to residential units in the GMC area under their supervision. Also, according to a survey conducted by the GMC Community Development Unit, 100 more compost generation units (other than the ones they have distributed) have been identified. Accordingly, it can be estimated that approximately 450 households are using compost bins to produce compost. Accordingly, the daily total wet waste used to produce compost is 630 kg. (1.4 kg x 450).

Another important kitchen waste disposal method is using them to feed animals. Most kitchen waste generated in service stations, hotels, and restaurants are collected daily by farmhouses to feed animals. For example, the amounts of kitchen waste collected by 03 major piggery farms in the GMC area and surrounding, namely Sukara Farmhouse, Boossa Farmhouse and Bope Farmhouse are 350 kg, 200 kg, and 450 kg, respectively. In addition, small farmhouses also collect kitchen waste from residential and other commercial, religious, and service establishments to feed animals.

Similar situation can be observed with regard to garden waste as well. For example, based on the survey results, over 35% of residential garden waste is either burnt or buried.

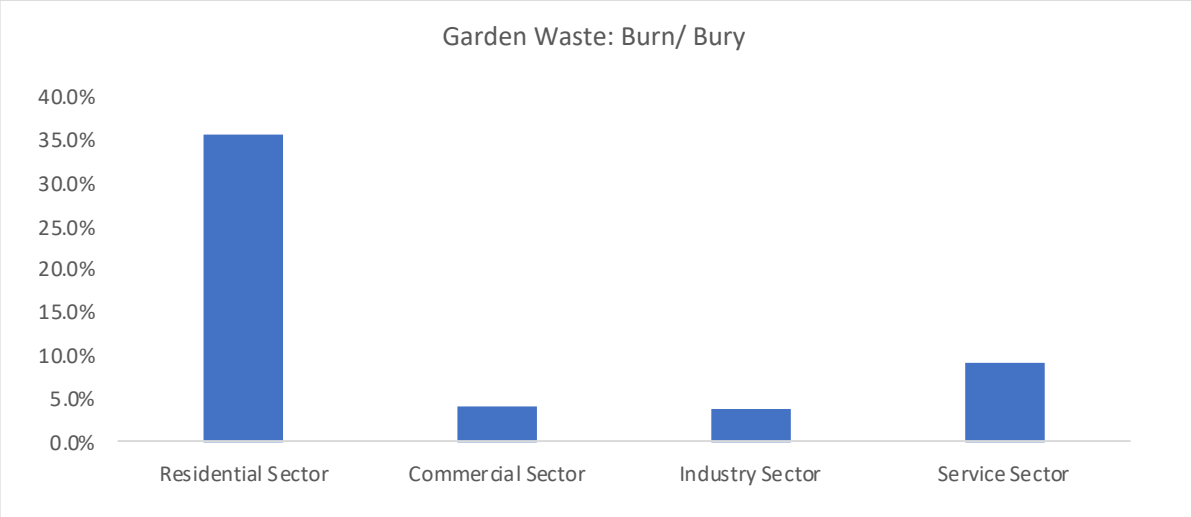


Figure 30: Garden Waste – Burning or Burying practice

According to the baseline assessment results, similar situation can be seen with regard to non-degradable waste as well. For example, following charts (Figure 31) illustrate the % of different waste types (e.g. Cardboards, clothes, glass and metal) handed over to a third party under four key sectors.

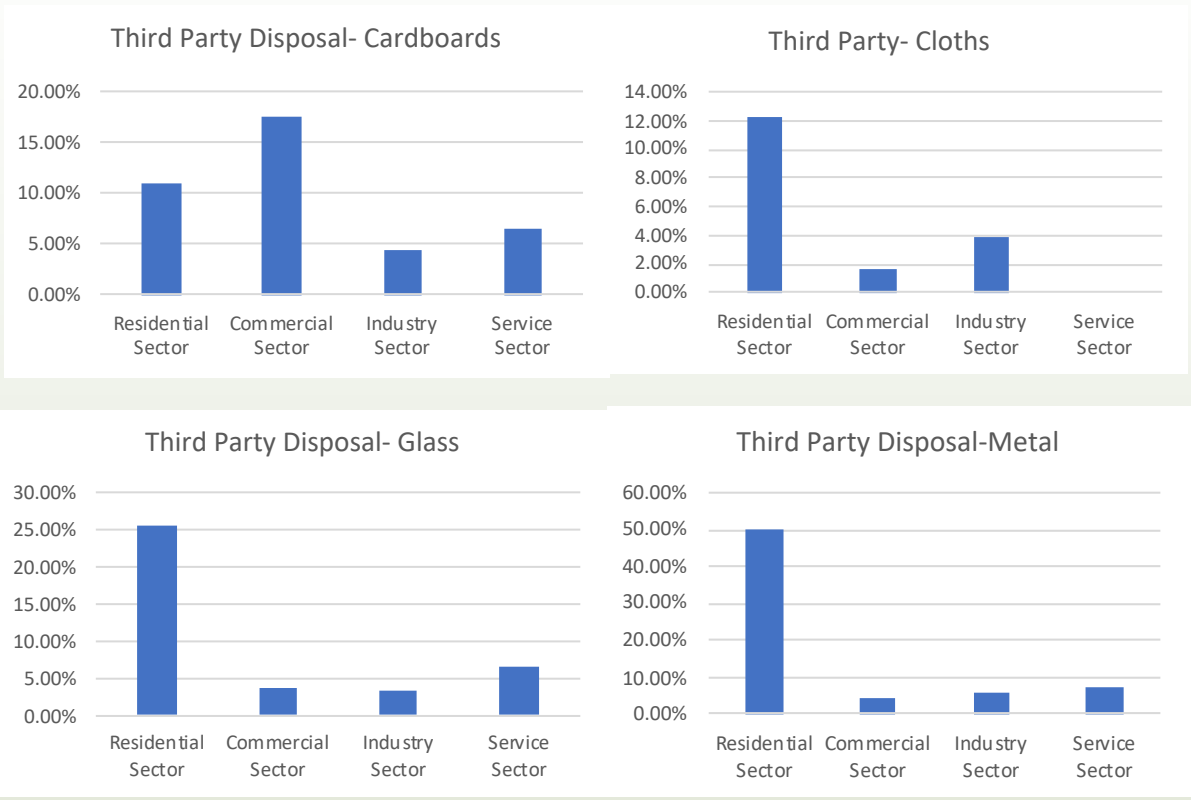


Figure 31: Percentage of different types of waste handled by a third party under the four key sectors

Accordingly, significant percentage of household units, ranging from 10% (cardboard) to 50% (metal), hand over non-degradable waste to the third-party collectors. A similar, perhaps with different waste amounts, can be observed in other types of non-degradable waste.

As in the degradable waste, burning and burying is another major waste disposal practice in relation to nondegradable waste.

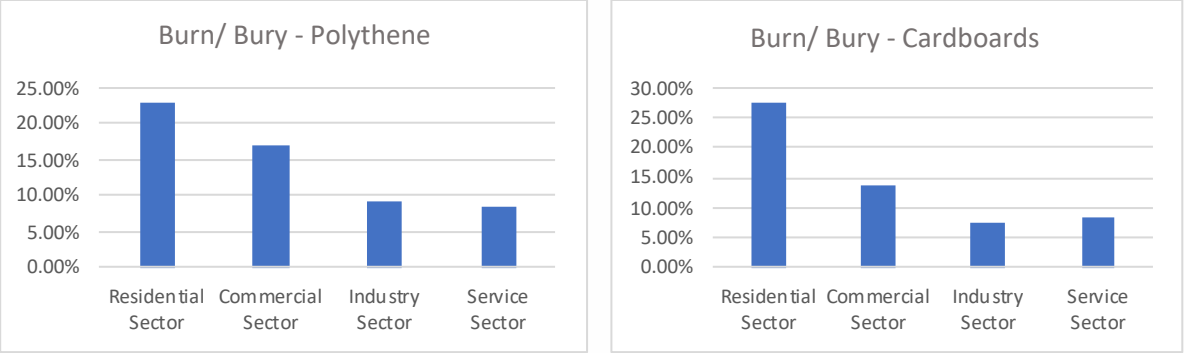


Figure 32: Percentage of different types of waste disposed by burning or burying

Furthermore, field observations focus group discussion with the GMC and Environment Police officials confirmed illegal waste dumping has been a regular practice within the GMC area. The interview with illegal waste dumpers indicated absence of access road for waste collection and irregularities or mismatching of waste collection schedule with their presence at residence as reason for adopting illegal disposal.

For example, HELP-O has identified several large-scale waste generators in the GMC area, which manage waste on their own. These waste generators include Navy Camp, Army Camp, Galle Prison, Karapitiya Teaching Hospital, Mahamodara Hospital, Galle Commercial Harbor, Fishery Harbor, and Galle Railway Station. The waste generated by these generators were not included in the WACS. The following table illustrates the amount of waste generated by these large-scale establishments that were not included in the GMC waste collection data.

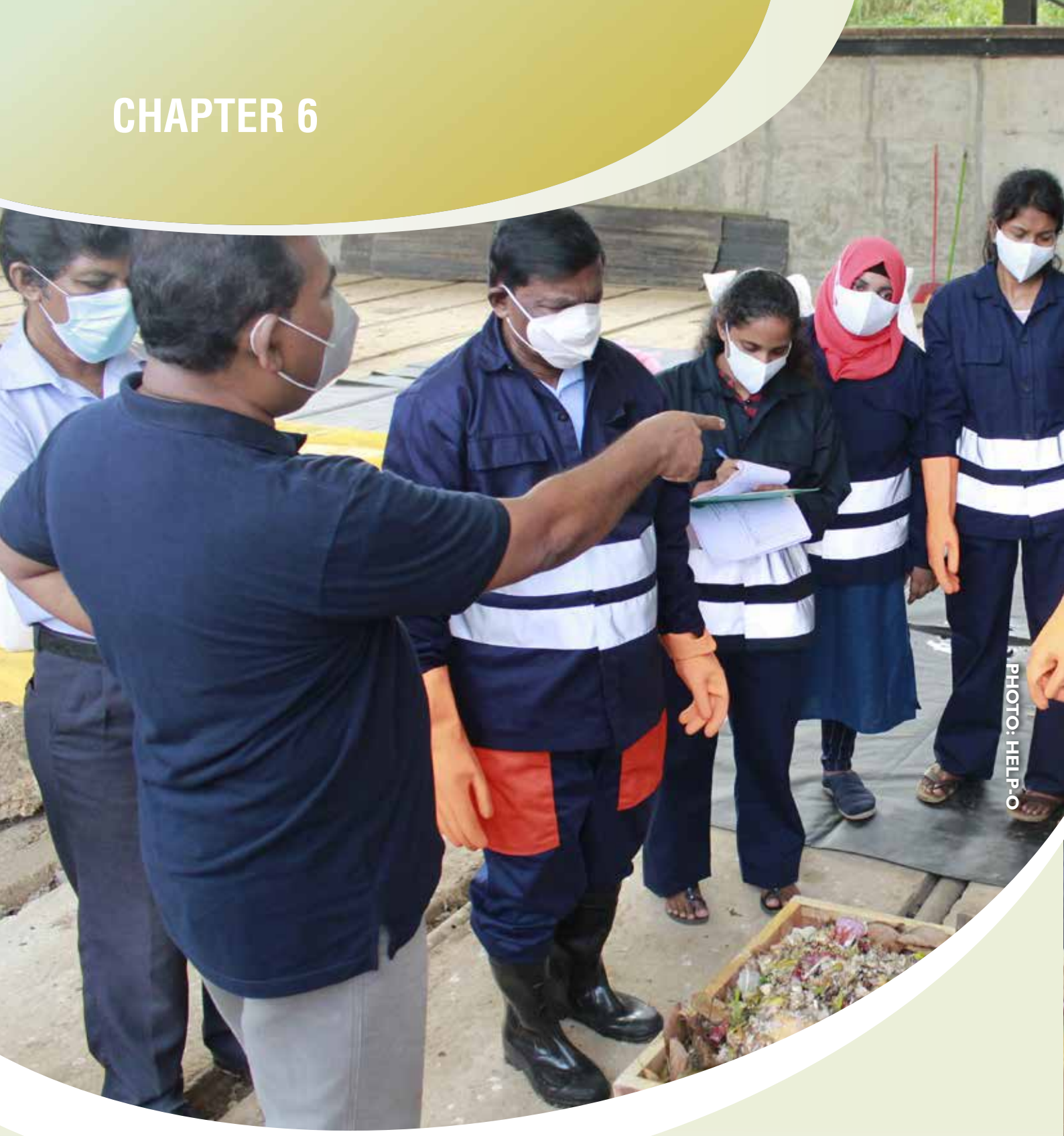
Table 5: Amount of Waste Generated by Large-scale Waste Generators

Institution	Wet Waste Weight	Dry Waste Weight
Army Camp	650 kg	60 kg
Navy Camp	1100 kg	90 kg
Mahamodara Hospital	4500 kg	1100 kg
Karapitiya Hospital	9500 kg	2500 kg
Fishery Harbor	50 kg	1500 kg
Galle Railway Station	500 kg	3500 kg
Galle prison	6000 kg	500 kg

Similarly, based on the Rapid Assessment conducted for Waste Aggregators with the Guidance of CCBO, other than the GMC, waste aggregators also contribute to the waste collection and management. Aggregators collect waste materials such as metal, PET bottles, HDPE and Cardboard, etc. with some value for them. As per the results of the Rapid Assessment, aggregators collect 27.6 T of metal, 7.8 T of PET bottles, 4.7 T of HDPE, 9T of Coconut Shells and 12.8 T of Cardboards within the GMC area per month.

As a summary, the waste that is not handed over to the GMC is being subjected to acceptable 3R practices (prominently composting or giving to a third party for recycling) or unacceptable practices like burning, burying, or dumping in the open environment. Thus, a considerable portion of comparatively heavy weight materials are not being handed over to GMC but being deposed as described above. The weights of the waste disposed using some of these alternative methods are not available. Hence, the percentage of waste managed by using these alternative methods (other than handing over to the GMC) cannot be calculated. However, it is clear with evidence that even though the GMC waste collection rate is found to be 31.43%, which is close to the average waste collection rate by local authorities in Sri Lanka (Kaza et. al., 2018), the rest of the waste is disposed either through acceptable or unacceptable means, as discussed above.

CHAPTER 6



CONCLUSION

The Waste Audit and Characterization Study for Galle Municipal Council Area was carried out under the "Collaborative Action for Clean City of Galle" project implemented by HELP-O in collaboration with the Galle Municipal Council for an efficient SWM system via reducing the generation of plastic waste and promoting a city-wide waste management system. The CCBO flagship programme of the USAID implemented by TetraTech provides the financial and technical support for the said project.

The Waste Audit and Characterization Study (WACS) is a key requirement for the development of the Integrated Solid Waste Management Action Plan (ISWMAP) to be prepared under the project. Under the WACS, waste generation and collection pattern of the GMC area was analyzed by employing a comprehensive methodology developed through a thorough literature review. The ASTM standard method and Rothernberg method were used as the key guides to develop the methodology. The WACS covered the entire GMC area, including Mahamodara Zone, Richmond Hill Zone, Karapitiya Zone, Moragoda Zone, and Galle Bazar Zone.

A comprehensive training sessions and awareness programs were conducted prior to the commencement of the WACS. Appropriate Health and Safety Protocols, as per the USAID guidelines, to be followed during the WACS were included in these training and awareness sessions. During the first stage of the WACS, waste generation quantities, composition of the generated waste, volume and density of the waste were measured. The second stage of the WACS focused on weighing the GMC waste collection vehicle fleet.

According to the findings of the two stages of the WACS, several important measures with regard to the municipal waste generation and collection were calculated. Following is a summary of those measures under key sectors of residential, commercial, industrial, and service.

Residential Sector:

- Daily total of 'wet' waste generation in the GMC area is about 30.7 MT.
- Daily total of 'dry' waste generation in the GMC area is about 21.7 MT.
- Daily total of waste generation in the GMC area is about 52.4 MT.

Commercial Sector:

- Daily total of 'wet' waste generation in the GMC area is about 6.7 MT.
- Daily total of 'dry' waste generation in the GMC area is about 4.4 MT.
- Daily total of waste generation in the GMC area is about 11.1 MT.

Industrial Sector:

- Daily total of 'wet' waste generation in the GMC area is about 0.85 MT.
- Daily total of 'dry' waste generation in the GMC area is about 1.75 MT.
- Daily total of waste generation in the GMC area is about 2.6 MT.

Service Sector:

- Daily total of 'wet' waste generation in the GMC area is about 1.32 MT.
- Daily total of 'dry' waste generation in the GMC area is about 0.94 MT.
- Daily total of waste generation in the GMC area is about 2.56 MT.

In addition to sectoral measures, the following important measures were derived in relation to the GMC waste generation and collection.

- Daily total waste generation in the GMC area is about 68.34 MT.
- Per capita waste generation in the GMC area is about 0.66 Kg/ Day

When compared the waste generation data with collection data, the following important measures were derived.

- Daily average collection of the waste by GMC is about 21.5 MT.

Accordingly,

- The rate of collection of waste by GMC is approximately 31.43%

This leads to the question that if the GMC collects 31.43% waste from the whole GMC area, how the rest of the waste is being disposed or managed? As per the results of the Baselines Waste Assessment, it has been found that a significant amount of waste, particularly heavy waste such as degradable waste, glass, metals, clothes, etc. are managed by using alternative disposal methods, which can be both acceptable and unacceptable practices. Also, illegal waste dumping has been a practice within the GMC area. That way, GMC waste collection rate, which is close to the average waste collection rate by Sri Lankan local authorities, is justifiable.

The above measures derived from the data collected from the WACS paint a reasonable picture of the waste generation and collection within the GMC area. These findings, however, may not reflect the accurate picture of the waste generation due to several reasons. These include,

- Some commercial establishments and industries may have temporary stopped operating due to Covid19 pandemic and subsequent economic downturn in the country during the last 2-3 years.
- High inflation rate during the time of the WACS may have influenced HHs and commercial and industrial establishments to have reduced consumption levels and reduced waste generation rates, compared to other times of the year.
- Some large commercial establishments and industries manage waste on their own so the impact of those waste generators may have a considerable impact on the measures derived. Due to resource limitations, large industries and commercial establishments were not taken for the WACS.

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ANNEXURES

Annexure 01:

No		Activity	December 2022		January 2023				February 2023	
1		Preparatory work -Discussions with the CCBO and GMC -Purchasing equipment and tools -Identifying the sample -Recruiting field staff for the WACS -Training the field staff								
2		WACS -Make aware the sample -Distribution of empty waste bags -Preparation of the sorting area -Commencement of the WACS								
3		Data analysis and reporting								

Annexure 02:

Leaflets distributed among the participants of the waste audit during the awareness.







Collaborative Action for Clean City of Galle (CACG) Project

Waste Characterization Study (WACS) - 2023

Galle Municipal Council Area

Waste Bags Receipt Format - *Commercial Sector*

✓ - Received X - Not Received

Commercial Ref.No	Day		Day 2		Day 3		Day 4		Day 5		Day 6		Day 7		Day 8	
	WET	DRY	WET	DRY	WET	DRY	WET	DRY	WET	DRY	WET	DRY	WET	DRY	WET	DRY
C001																
C002																
C003																
C004																
C005																
C006																
C007																
C008																

Annexure 04:

Format used to record the collection of waste from HHs and other establishments

Collaborative Action for Clean City of Galle (CACG) Project

Waste Characterization Study (WACS) - 2023

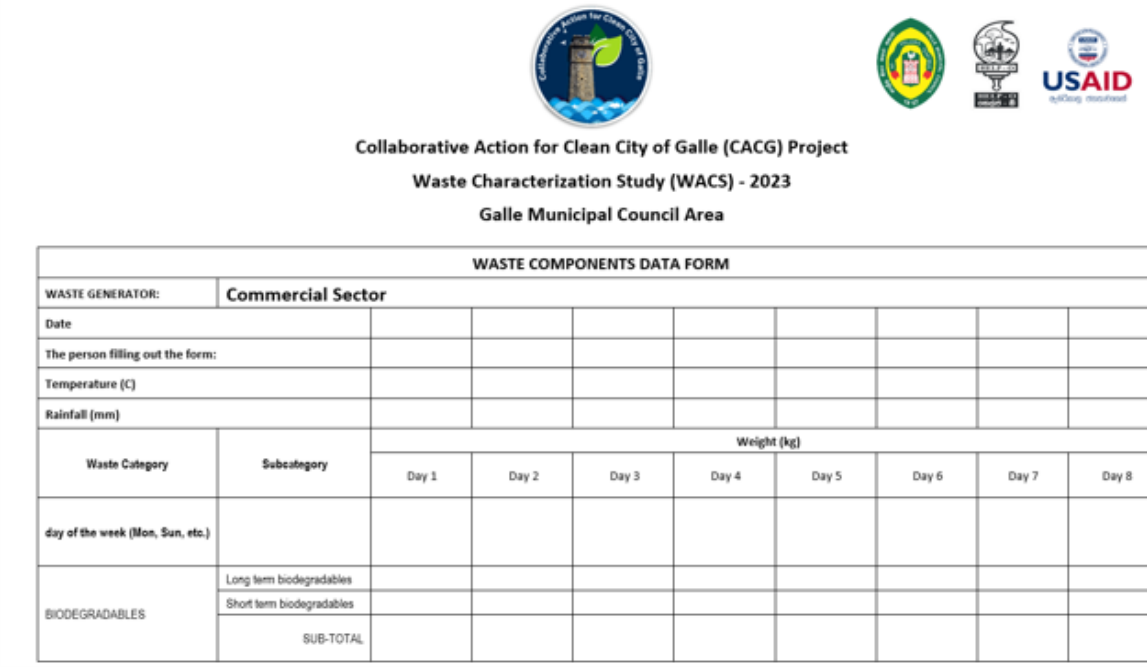
Galle Municipal Council Area

Record of Total Waste Received - *Residential Sector*

HH Ref.No	Family Size	Day 1(kg)		Day 2(kg)		Day 3(kg)		Day 4(kg)		Day 5(kg)		Day 6(kg)		Day 7(kg)		Day 8(kg)		*Total (kg)*	
		WET	DRY	WET	DRY	WET	DRY	WET	DRY	WET	DRY	WET	DRY	WET	DRY	WET	DRY	*WET*	*DRY*
H001																			
H002																			
H003																			
H004																			
H005																			
H006																			

Annexure 05:

Format used to record the waste components commercial sector and other establishments



Collaborative Action for Clean City of Galle (CACG) Project

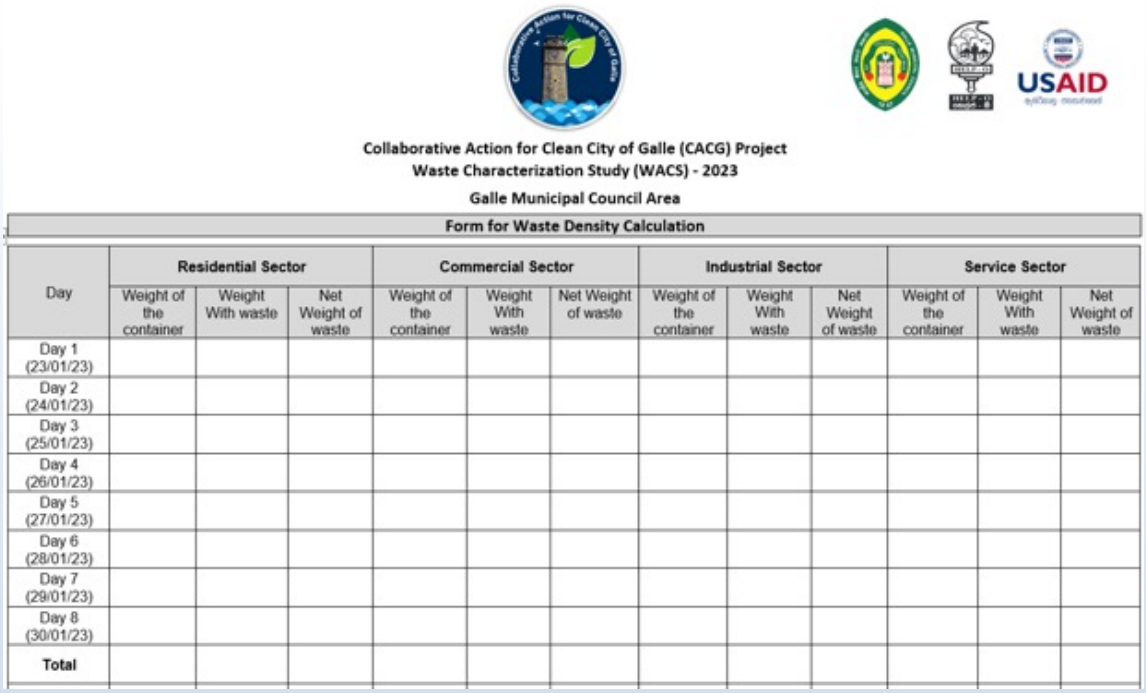
Waste Characterization Study (WACS) - 2023

Galle Municipal Council Area

WASTE COMPONENTS DATA FORM									
WASTE GENERATOR:	Commercial Sector								
Date									
The person filling out the form:									
Temperature (C)									
Rainfall (mm)									
Waste Category	Subcategory	Weight (kg)							
		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8
day of the week (Mon, Sun, etc.)									
BIODEGRADABLES	Long term biodegradables								
	Short term biodegradables								
	SUB-TOTAL								

Annexure 06:

Format used to record the waste density calculation in all sectors



Collaborative Action for Clean City of Galle (CACG) Project

Waste Characterization Study (WACS) - 2023

Galle Municipal Council Area

Form for Waste Density Calculation

Day	Residential Sector			Commercial Sector			Industrial Sector			Service Sector		
	Weight of the container	Weight With waste	Net Weight of waste	Weight of the container	Weight With waste	Net Weight of waste	Weight of the container	Weight With waste	Net Weight of waste	Weight of the container	Weight With waste	Net Weight of waste
Day 1 (23/01/23)												
Day 2 (24/01/23)												
Day 3 (25/01/23)												
Day 4 (26/01/23)												
Day 5 (27/01/23)												
Day 6 (28/01/23)												
Day 7 (29/01/23)												
Day 8 (30/01/23)												
Total												



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TOWARDS PLASTIC FREE HOSPITALITY

A GUIDE TO MANAGE PLASTIC WASTE AT SMALL AND MEDIUM HOTELS IN SRI LANKA



Norwegian Ministry of Foreign Affairs

BASEL / ROTTERDAM / STOCKHOLM CONVENTIONS

BASEL CONVENTION

IGES Institute for Global Environmental Strategies

Ministry of Environment, Sri Lanka

Towards Plastic Free Hospitality

A Guide to Manage Plastic Waste at Small and Medium Hotels in Sri Lanka

Ministry of Environment

Sri Lanka

2024

Towards Plastic Free Hospitality - A Guide to Manage Plastic Waste at Small and Medium Hotels in Sri Lanka

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First Edition: March 2024

ISBN: 978-624-5817-43-6

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Funded by: The BRS-Norad-1 project that is facilitated by the BRS Secretariat and financed by the Norwegian Agency for Development Cooperation (Norad) with additional funding provided by the Government of the Netherlands.

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Citation

Ministry of Environment (2024). Greening Hospitality - A Guide to Manage Plastic Waste at Small and Medium Hotels in Sri Lanka

FOREWORD



Plastic pollution represents a multifaceted environmental crisis with far-reaching implications for ecosystems, wildlife, and human health. As plastics persist in the environment for centuries, they accumulate in our oceans, soil, and air, posing a threat to biodiversity and exacerbating climate change. Effectively managing the plastic problem requires concerted efforts across various sectors, from industry innovation to policy reform and individual action. By prioritizing the reduction, reuse, and recycling of plastics, we can forge a path towards a cleaner and healthier planet for present and future generations.

The Guideline book titled “Towards Plastic Free Hospitality: A Guide to Manage Plastic Waste at Small and Medium Hotels in Sri Lanka” was prepared by the Ministry of Environment in collaboration with the Institute for Global Environmental Strategies (IGES) under the project on “Marine Litter and Microplastics (Norad-1)”.

The purpose of this guideline is to use it as a directive for policy makers, administrators, all the stakeholders and public to empower the Sri Lankans in the Hospitality sector to become responsible and advocates for a plastic waste-free future. This guideline has been prepared using the key steps namely; Learn, Plan, Involve and Measure to empower hotels in effectively managing their plastic waste. Establishing guidelines for the hotel sector to minimize plastic waste is essential due to its significant contribution to pollution. By reducing plastic usage, hotels can attract environmentally conscious guests, save costs, and demonstrate their corporate responsibility. This move aligns with consumer preferences, enhances reputation, and sets industry standards while fulfilling the objective of environmental conservation, cost savings, and leading to more sustainable future.

I am enraptured to share this message upon completion of this guideline which shows clear path to manage plastics which is essential for fostering a sustainable future. I take this opportunity to thank the Institute for Global Environmental Strategies (IGES), BRS Secretariat and Human and Environment Link Progressive Organization (HELP-O) for their technical and financial support as well as all the staff of the Environment Pollution Control and Chemical Management Division of the Ministry of Environment for their remarkable support in completing this task.

I hope the hospitality community will adhere to this guideline and thus effectively manage plastic waste in the country.



B. K. Prabath Chandrakeerthi

Secretary

Ministry of Environment

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1. INTRODUCTION

1.1. BACKGROUND

The global hospitality industry is at a pivotal juncture, confronting a pervasive challenge — the menace of plastic pollution and marine litter. The Global Tourism Plastics Initiative (GTPI) notes that approximately 80 percent of all tourism activities occur in coastal areas, positioning the hotel industry as a significant contributor to the roughly 8 million tonnes of plastic entering our oceans annually[1]. According to the United Nations Environment Programme (UNEP), the cost of oceanic plastic pollution exceeds 7 billion euros (EUR)[2]. If current trends persist, the production and incineration of plastic waste are projected to contribute 10 to 13 percent of global carbon dioxide emissions[3].

In Sri Lanka, the tourism sector stands as a cornerstone of national economic development, impacting both employment generation and the country's long-term economic outlook. Despite challenges such as the aftermath of the civil war, the COVID-19 pandemic, and the recent Easter Sunday attacks, the tourism sector has experienced a significant growth of 27 percent in 2022[4]. As shown in Fig 1, small and medium hotel operators, including guest houses, homestays, and bungalows, collectively comprise the majority of registered establishments, accounting for 36, 26.4, and 22.4 percent respectively[5].

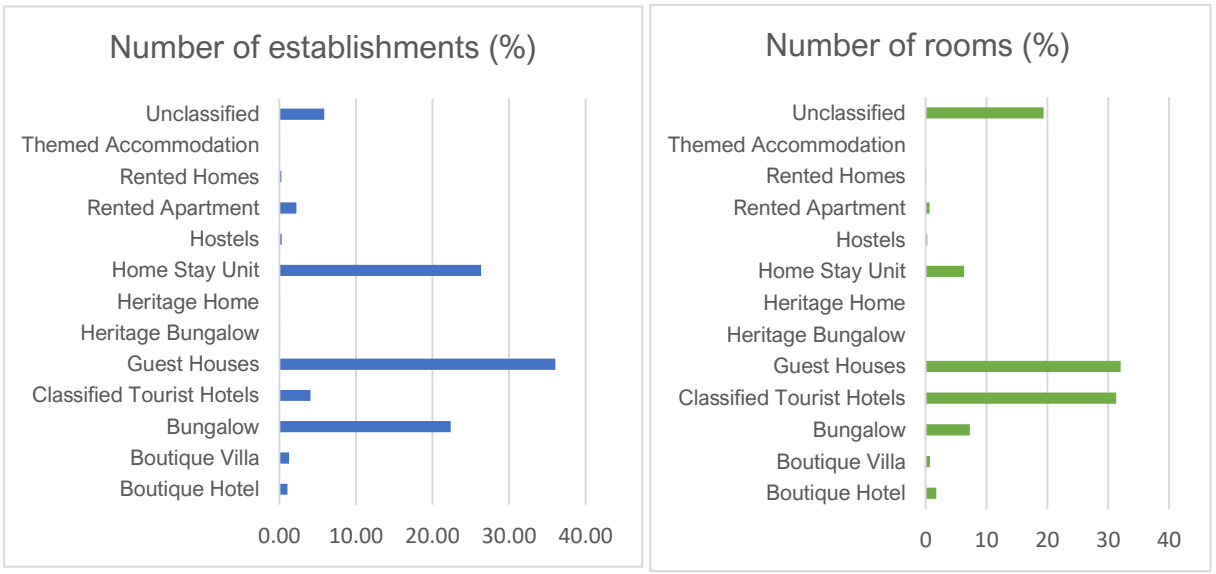


Figure 1: A Distribution of Registered Hotels in Sri Lanka, 2022 (Percentage of number of establishments and number of rooms)

[1] Global Tourism Plastics Initiative (GTPI), 2021: GTPI Brochure. https://www.oneplanetnetwork.org/sites/default/files/from-crm/GTPI%2520Brochure_Final_En.pdf
[2] WWF. 2029: Solving Plastic Pollution by Accountability.
[3] Hamilton, Lisa Anne et al. 2019: Plastic & Climate: The Hidden Costs of a Plastic Planet,
[4] https://www.cbsl.gov.lk/sites/default/files/cbslweb_documents/publications/annual_report/2022/en/6_Chapter_02.pdf
[5] SLTDA. Tourism Growth Trends-1985-2022. https://www.sltda.gov.lk/storage/common_media/Tourism-Growth-Trends-1985-2022.pdf. https://www.sltda.gov.lk/storage/common_media/Handbook_Eng.pdf

Against the backdrop of increasing environmental awareness and the rapid expansion of the hospitality sector, small and medium-sized hotel operators in Sri Lanka stand at a unique crossroads. Hotel operators in Sri Lanka have the opportunity to substantially reduce their plastic footprint and waste while concurrently enhancing their brand image and improving operational efficiency.

1.2. PURPOSE

Acknowledging the global emphasis on sustainable tourism, the Sri Lanka Tourism Development Authority (SLTDA) has launched the National Sustainable Tourism Certification (NSTC) scheme[6]. Specifically designed for small and medium hotel operators, its primary objective is to safeguard Sri Lanka's unique natural and cultural heritage. The NSTC scheme plays a crucial role in Sri Lanka's commitment to achieving balance between environmental, socio-cultural, economic, and other impacts on the local community.

To obtain NSTC certification, hotel operators must demonstrate a clear dedication to environmentally and socially responsible tourism practices. This involves, among others, implementing sustainability actions, maintaining comprehensive documentation and data collection, providing thorough training and education for staff, and actively engaging with local communities and suppliers.

This guide serves as a valuable resource for hoteliers, offering guidance through the intricate process of reducing plastic usage by adopting sustainable alternatives. It also provides insights into ensuring the Environmentally Sound Management (ESM) of plastic, especially for waste items that are difficult to eliminate. Tailored for small and medium hotel operators, this guide empowers them with essential knowledge and tools to transition towards sustainable practices and minimize plastic usage and waste generation. Embracing sustainability not only contributes to a cleaner environment



Figure 2: A View of Main Street in Galle Fort

[6] For more information: https://www.sltda.gov.lk/en/sustainable-tourism

and the protection of ecosystems, but also enhances the hotel's brand, attracts eco-conscious guests, and strategically reduces operational costs.

This guide has been developed by the IGES Centre Collaborating with UNEP on Environmental Technologies (CCET), the Ministry of Environment, Sri Lanka, the Secretariat of the Basel, Rotterdam and Stockholm Conventions (BRS Secretariat) and HELP-O, a local non-governmental organization (NGO). It is implemented as part of an umbrella project entitled “Marine litter and microplastics: promoting the environmentally sound management of plastic waste and achieving the prevention and minimization of the generation of plastic waste’ (BRS-Norad-1), which is being implemented in Sri Lanka and Ghana, and also features global activities. The BRS-Norad-1 project is facilitated by the BRS Secretariat and financed by the Norwegian Agency for Development Cooperation (Norad) with additional funding provided by the Government of the Netherlands.

The guide comprises seven sections. Following this brief introduction, Section 2 outlines the key principles and steps involved in managing plastic waste at hotels. Section 3 offers a straightforward guide to kick-start a sustainability journey by conducting a comprehensive plastic audit within hotels. This audit covers areas marked by excessive plastic usage, extending from guest rooms and restaurants to reception and back-of-house operations. Section 4 guides hotels in initiating the development of a customized Plastic Management Action Plan. This involves leveraging their unique capacities and resources, a process detailed further in this section. These action plans are pivotal for hotel operators, providing a structured approach to establish clear targets and measures for reducing plastic usage and effectively managing plastic waste. Section 5 underscores the importance of forming partnerships with staff, guests, and suppliers for the successful implementation of the plastic waste reduction action plan. Regularly monitoring and measuring the progress of plastic reduction initiatives, based on the developed action plan, is crucial, as outlined in Section 6. Finally, Section 7 concludes by identifying a range of supportive national activities and policies for small and medium hotel operators. These initiatives aim to assist them in their efforts to reduce plastic usage, promote sustainability, and contribute to a cleaner and more environmentally-friendly tourism sector.

2. MANAGING PLASTIC WASTE AT HOTELS

2.1. KEY PRINCIPLES

The following principles provide a strategic framework for minimizing plastic use and effectively managing plastic waste within hotels (Fig 3). This involves upstream initiatives targeting the prevention of plastic waste generation through reduce and reuse methods, integrating sustainable alternatives. Simultaneously, downstream efforts concentrate on ensuring proper plastic waste management through recycling and employing appropriate treatment and final disposal methods.

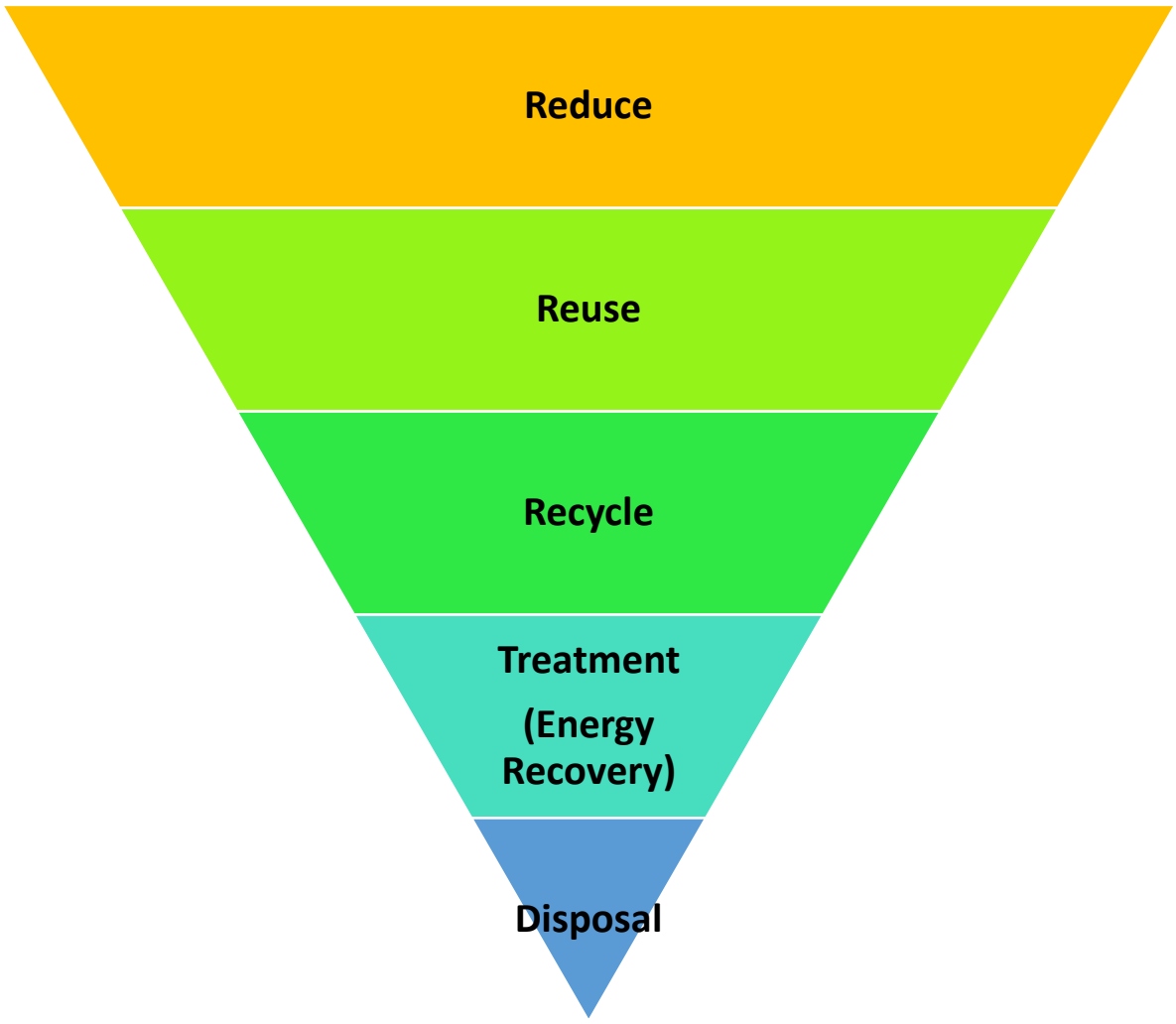


Figure 3: A Hierarchy of Sustainable Plastic Waste Management at Hotels

2.2. KEY STEPS TO MANAGING PLASTIC WASTE AT HOTELS

Reducing plastic use and effectively managing plastic waste can be particularly challenging for small and medium-sized hotels working to efficiently manage plastic waste. These challenges arise from limitations in knowledge, awareness, capacities related to prevention planning and identifying sustainable alternatives, financial considerations, limited supplier options, data management and monitoring, waste management infrastructure, and the adoption of effective communication strategies. To address these challenges, we propose a four-step approach designed to empower hotels in effectively managing their plastic reduction efforts as shown in Fig 4. This action plan also serves as a strategic preparation for hotels aiming to attain the National Sustainable Tourism Certification (NSTC) scheme.

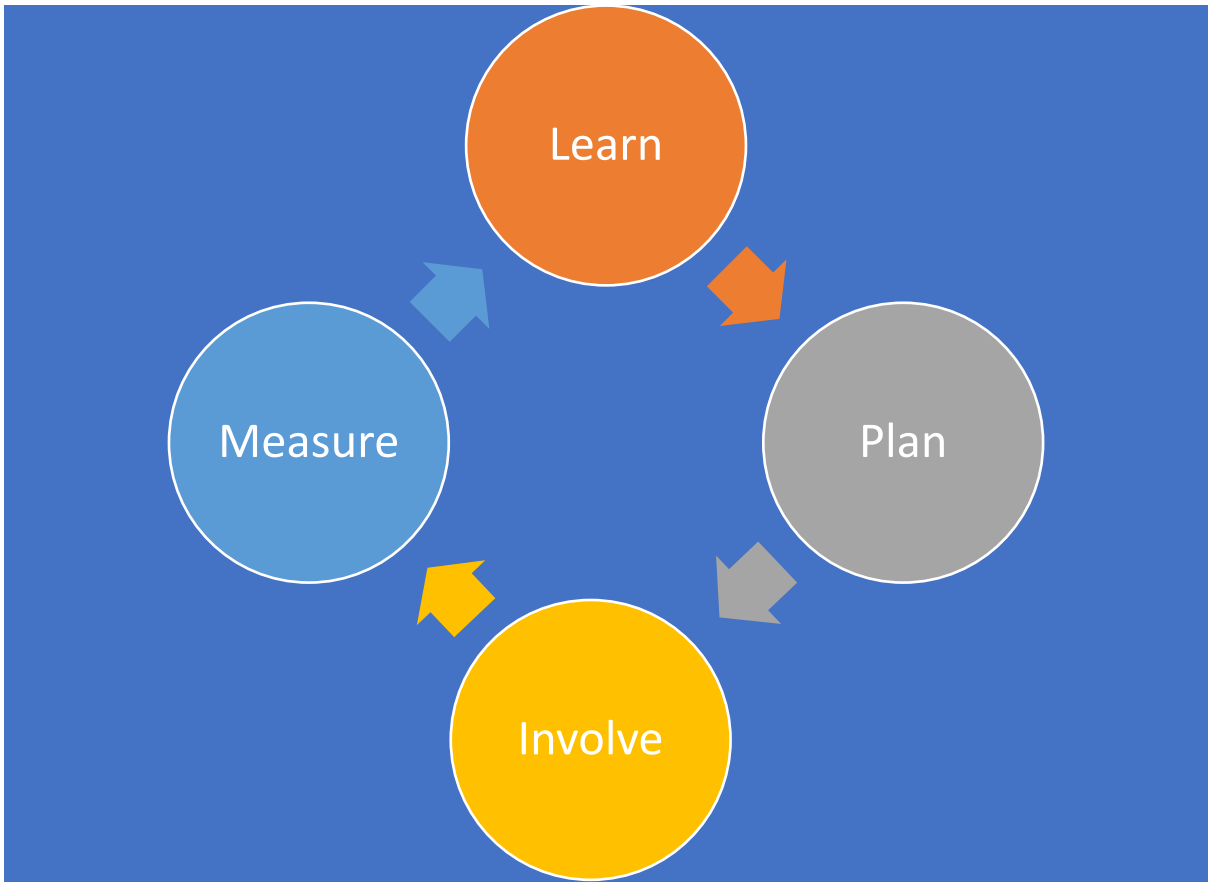


Figure 4: Four-step Plan to Manage Plastic Waste at Hotels

3. LEARN – UNDERSTAND YOUR PLASTIC FOOTPRINT

3.1. ISSUE OF PLASTIC POLLUTION

Plastic pollution poses a significant threat to our planet, contaminating our oceans, causing harm to marine life, and contributing to global warming[7]. The enduring damage on ecosystems is exacerbated by the persistence of plastic waste, which takes hundreds of years to fully decompose. Globally, an estimated 310 million tonnes of plastic waste are generated annually, equivalent to 2,200 plastic bottles for every individual[8]. Recent studies have found that seas and oceans currently contain approximately 86 to 150 million tonnes of plastic[9], with an additional 8 million tonnes entering the marine environment every year[10]. A substantial 80 percent of this pollution originates from land[11]. The top 10 plastic products most commonly found on beaches include, but are not limited to, cigarette butts, food wrappers, and beverage bottles (Table 1).

Table 1: Top 10 Plastic Products Most Commonly Found on Beaches[12]

1. Beverage bottles, caps and lids	6. Plastic bags
2. Cigarette butts	7. Cutlery, drinking straws, and stirrers
3. Cotton swabs	8. Cups and lids
4. Bags and packaging for chips and sweets	9. Balloons and balloon holders
5. Hygiene products (wet wipes, tampon etc.,)	10. Food packaging

Notably, in Sri Lanka, the use of cotton swabs, cutlery, drinking straws, and stirrers made out of plastic which are single-use has already been banned. Furthermore, the production and use of single-use plastic food containers, plates, cups, spoons, food wrappers (lunch sheets from polythene), and grocery bags/ shopping bags (any bag of high-density polyethylene) are prohibited in the country under the Gazette Notifications 2034/34, 2034/35, and 2034/38 (more information see Annex 8.1). Nevertheless, a recent sample study conducted in 56 locations across the country to assess the composition of plastic waste in different areas determined that a number of banned materials are still being used and disposed of. PET bottles emerged as the most prevalent, constituting the highest percentage at 23.8 percent, particularly on Sri Lankan beaches[13]. Common

[7] https://news.un.org/en/story/2021/10/1103692
[8] WWF (2019): Solving Plastic Pollution by Accountability.
[9] https://oceanconservancy.org/trash-free-seas/plastics-in-the-ocean/
[10] Jambeck et al. (2015): Plastic waste inputs from land into the ocean, Science (347),
[11] http://plastic-pollution.org/, accessed on 3.11.2019
[12] https://www.oneplanetnetwork.org/knowledge-centre/resources/stop-flood-plastic-effective-measures-avoid-single-use-plastics-and
[13] Rangika Bandara and Yohan Mahagamage (2023): Less Plastic Movement – National Campaign 2023. Presentation made at the Workshop on Basel Amendments and Plastic Inventory on 14 June 2023

items found on beaches mainly include shopping bags, food packaging and wrappings, yogurt cups, and straws, as illustrated in Figure 5.

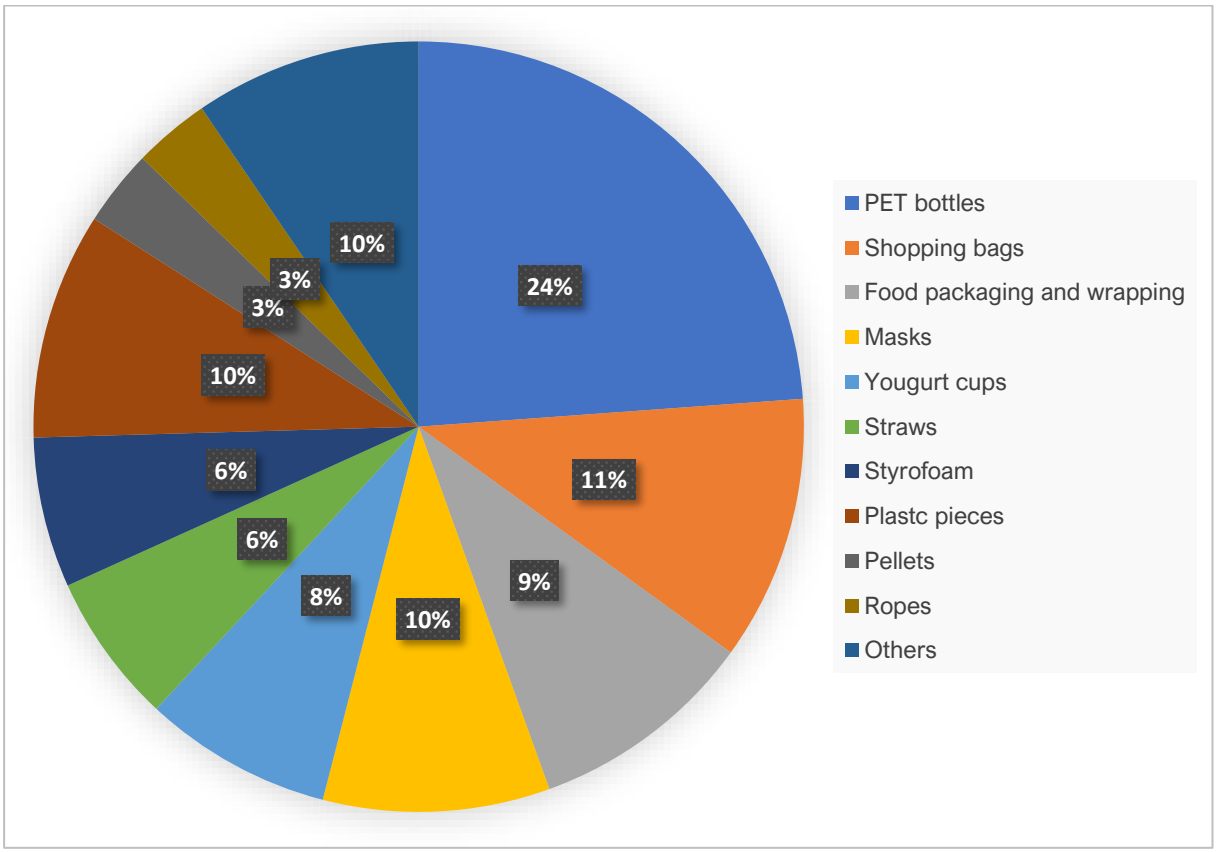


Figure 5: Main Categories of Plastic Waste Collected from Selected Beach Sites in Sri Lanka

3.2. UNDERTAKE A SELF-ASSESMENT OF YOUR PLASTIC FOOTPRINT

Initiate your sustainability journey by conducting a comprehensive plastic audit within your hotel. Identify areas marked by excessive plastic usage, spanning from guest rooms and restaurants to reception and back-of-house operations. Table 2 shows the key departments and breakdown of commonly used plastic items in the hotels.

Table 2: Popular Plastic Usage in Key Departments/Sections of Small-Medium Hotels in Galle City, Sri Lanka[14]

Department	Popular types of plastic products
Lobby/ Front Desk	Flower baskets/ Table mats/ Dust bins/ Ornaments/ Pens/ Writing pads/ Key cards
Restaurants/ Cafeteria/ Kitchen	Ashtrays/ Tissue holders/ Plates/ Baskets/ Water bottles/ Other Drinking Bottles/ Straws/ Mixing sticks/ Dust bins/ Toothpick holders/ Table mats/ Cups/ Paper & Salt filters/ Trays/ Flower pots/ Pens/ Menus / Shopping bags/ Packaging/ Food items
Guest Rooms	Dustbins/ Water bottles/ Wrapped plastic cups/ Hangers/ Tissue holders/ Table mats/ Spoons & Forks/ Pens/ Boxes/ Keys/ Key holders/ Sign boards/ Lamps/ Ornaments/ Cups/ Trays/ Laundry bags/ Slippers/ Hotel directory/ Communication materials
Washrooms	Dustbins/ Sanitary boxes/ Shampoo kits/ Shaving kits/ Tissue holders/ Soap boxes/ Tooth brush kit/ Cups/ Shower kits

Table 3 gives a sample checklist to collect data on your current plastic consumption to establish a baseline, enabling effective tracking of progress during implementation of reforms. When entering the data, it is important to follow these steps to capture relevant information about your plastic consumption:

- **Daily/Weekly/Monthly Purchases:** Input the ***frequency of your purchases***, whether it's on a ***daily***, ***weekly***, or ***monthly*** basis. For each purchase frequency, ***record the quantity*** of plastic items acquired.
- **Items per Case:** ***Specify the number*** of plastic items contained in each case or packaging unit. This information helps ***quantify the scale*** of plastic usage.
- **Units per Month:** Calculate the ***total number of units*** consumed in a month by ***multiplying the purchase frequency by the items per case***. This provides an overview of your monthly plastic consumption.
- **Weight per Unit:** ***Record the weight*** of each plastic item in standard units (e.g., grams, kilograms). This information contributes to understanding the overall weight of plastic used.
- **Volumes of Recycled or Compostable Materials:** If applicable, ***document the quantities*** of plastic items that are recycled or composted. This reflects your sustainability efforts and progress in adopting environmentally friendly practices.
- **Consistent Updates:** Regularly ***update the spreadsheet*** to maintain an accurate and up-to-date record.

[14] For more information: https://www.iges.or.jp/en/pub/partnership-reduce-plastic-use-tourism-sector-galle-srilanka/en

Table 3: Sample Checklist for Plastic Waste Calculation for Hotels

Items	Units per month	Weight per unit (kg)	Total weight per month (kg)	Recycled (kg)	Composted (kg)	Disposed (kg)
Restaurant/ Cafeteria/ Kitchen						
Plastic bottles <1L						
Plastic bottles >1L						
Liquid bags or pouches						
plastic sealed tea bags						
Coffee cups/sachets						
Milk/creamer in plastic						
Sugar in plastic						
Plastic wrapped snacks						
Plastic straws						
Plastic stirrers						
Single-use plastic cutlery						
Single-use plastic plates or bowls						
Lids for bowls						
Single-use plastic cups						
Lids for cups						
Single-use paper cups						
Cereals in plastic						
Miniature spreads						
Pastry roundels						
Sauces in plastic sachets						
Cling film roll						
Single-use plastic deli containers						
Other single-use plastic packaging						
Sub-Total						
Washroom and Personal Care						
Miniature body lotion						
Miniature conditioner						
Miniature shampoo						
Miniature soap						
Soap bar						
Toothpaste						
Toothbrush						
Plastic cotton buds						
Plastic packaging for slippers						
Other plastic packaging in bathroom						
Sub-Total						

Items	Units per month	Weight per unit (kg)	Total weight per month (kg)	Recycled (kg)	Composted (kg)	Disposed (kg)
Guest Room/ Housekeeping						
Detergent refill packaging						
Detergent bottles <1L						
Detergent bottles >1L						
SUP trigger spray tops for detergents						
Plastic laundry bags						
Bin liners						
Gloves						
Single-use hygiene wipes						
Other plastic packaging in housekeeping						
Sub-Total						
Lobby/ Front Desk/ Back Office						
Key cards / wrist bands						
Plastic binders / insert cases						
Pencils						
Souvenirs or giveaways						
Other single-use plastic packaging						
Sub-Total						

4. PLAN – PREPARE A PLASTIC WASTE MANAGEMENT ACTION PLAN

4.1. MEASURES TO MANAGE PLASTIC WASTE

After establishing a comprehensive plastic use and waste inventory, hotels can initiate the development of a tailored Plastic Management Action Plan, leveraging their unique capacities and resources. These action plans are pivotal for hotel operators, providing a structured approach to establish clear targets and measures for reducing plastic usage and effectively managing plastic waste, as detailed in Table 4. When crafting these action plans, it is imperative to consider the following key points:

- **Specific Goals:** Clearly define the specific objectives the hotel aims to achieve in terms of plastic reduction.
- **Measurable Targets:** Identify measurable targets aligned with the established objectives. Acknowledge any existing goals or targets set by national or local governments or within the hotel industry sector to ensure alignment with broader sustainability initiatives and/or regulations.
- **Implementation Strategy:** Outline a practical and feasible strategy for achieving the defined objectives and targets, considering the unique context and operational aspects of the hotel.
- **Timeline:** Determine the timeframe within which these objectives and targets should be realized, providing a clear roadmap for implementation and monitoring.

Table 4: Setting Specific Goals, Targets, Strategies and Timeline – A Sample Framework

Specific Goals	Measurable Targets	Implementation Strategy	Expected timing
Restaurant/ Cafeteria/ Kitchen			
Eliminating plastic straws	100% reduction compared to baseline	Using paper straws	Medium term
Eliminating disposables	90% reduction compared to baseline	Whilst finishing the stock, identify sources for reusable alternatives or eliminate entirely	Medium term
Eliminating plastic trash bags	70% reduction compared to baseline	Use of reusable cloth bags	Medium term
Reducing plastic packaging	90% reduction compared to baseline	Buying ingredients from local markets to reduce plastic packaging when goods are being transported	Medium term
Guest Room/ Housekeeping			

Specific Goals	Measurable Targets	Implementation Strategy	Expected timing
Eliminate laundry plastic bags	100% reduction compared to baseline	Use of cotton canvas or m,esh laundry bags	Long term
Reducing bin liners in rooms	50% reduction compared to baseline	Placing recycling bins in hallways and providing only 1 small residual waste bin per room	Short term
Eliminate plastic bathroom amenities like plastic combs, toothbrushes, and ear swabs	100% reduction compared to baseline	Use environment friendly bathroom amenities or save money with eco-friendly alternatives for example bamboo combs, wooden toothbrushes, and wooden ear swabs	Long term
Reducing plastic packaging of toiletries	100% reduction compared to baseline	Considering installing refillable dispensers in every room for shampoo, foam bath, lotion etc	Medium term
Eliminating rubber mates in bathtubs	100% reduction compared to baseline	Use of wooden beads	Long term
Lobby/ Front Desk/ Back Office			
Eliminating plastic key cards	100% reduction compared to baseline	Update to mobile keyless entry	Long term
Eliminating plastic stationery	100% reduction compared to baseline	Use of pencils and metal rulers in office	Medium term
Reducing hard copies in the office	50% reduction compared to baseline	Recycling in the office or use of soft copies and drives for storage	Short term
Reduce hazardous chemicals to environment	70% reduction compared to baseline	Use of Bio-friendly chemicals	Medium term

4.2. UPSTREAM AND DOWNSTREAM MEASURES

In addressing the multifaceted challenge of plastic waste, hotels can strategically employ a range of Upstream and Downstream Strategic Measures as summarized below.

Upstream Measures

Upstream, the focus is on prevention, with an emphasis on reducing and reusing. Hotels can identify and minimize unnecessary plastic products, particularly single-use items, striving to diminish or eliminate their presence. Reusable alternatives, such as cups and cutlery, can also be explored, although careful consideration is given to their environmental footprint (Fig 6).

- **Reduce:** Identify and minimize the utilization of plastic products, including single-use items, that are deemed unnecessary. When feasible, strive to diminish or completely eliminate their use in hotel operations.

- **Reuse:** Instead of throwing plastic after single use, explore opportunities to replace disposable plastic items with reusable alternatives. For example, consider adopting reusable glass/ ceramic cups or metal cutlery to minimize dependence on single-use items. However, it's essential to recognize that in specific instances, certain alternatives may have a larger overall environmental footprint across the life cycle when compared to corresponding plastic items



Figure 6: Use of reusable materials at the hotels

Downstream Measures

- **Recycle:** Prioritize materials that can be recycled for items that must remain in hotel operations.
- **Local Waste Regulations Compliance**: Familiarize yourself with and adhere to the specific rules and protocols set by national and local authorities for recycling and the safe disposal of non-recyclable plastics, thereby avoiding any legal or environmental repercussions (Annex 8.2).
- **Segregation and Identification**: Establish an effective waste segregation system at the source to accurately identify recyclable and non-recyclable plastics. Clearly label bins or containers to distinguish between recyclable and non-recyclable materials, ensuring that both staff and guests are well-informed.
- **Explore Alternative Treatment Methods**: Investigate alternative treatment approaches, including waste-to-energy technologies (such as Refuse Derived Fuel (RDF) or Incineration) with energy recovery. While these methods require careful consideration of emissions, they may offer a sustainable option for managing specific non-recyclable plastics.

- **Final Disposal:** Proper treatment and final disposal of plastics that cannot be recycled are crucial components of a comprehensive waste management strategy.



Figure 7: Municipal Waste Collection service in Galle City

4.3. PRIORITIZE THE STRATEGIC OBJECTIVES

To prioritize strategic objectives and ensure practical implementation based on the unique capacities and resource availability of hotels, Table 5 provides a sample evaluation checklist based on five key criteria. This evaluation tool aids hotels in assessing the feasibility and impact of each objective, allowing for a tailored and effective approach to plastic reduction efforts.

Table 5: A Sample Checklist of Evaluation Criteria to Priorities the Strategic Objectives

Criteria	Description	Valuation Indices
Urgency to change	e.g. upcoming legislation, complaints, hazardous, self-motivation	1 (no urgency) to 5 (very urgent)
Necessity of the item(s)	e.g. you need a cup to drink, but not necessarily the lid or straws	1 (item is necessary to 5 (unnecessary item)
Financial impact	e.g. purchasing cost, cost for service, maintenance cost	1 (expensive replacement) to 5 (less expensive or profitable)
Volume (Impact)	How much plastic volume can be avoided?/ How big is the impact?	1 (small volume) to 5 (large volume)
Availability of sustainable alternatives	Are sustainable alternatives available in your region? Or Can easily access?	1 (no local availability/ hard to find) to 5 (locally available/ easy to find)

To effectively utilize the evaluation criteria provided in Table 5, follow these steps:

- **Actionable Goals:** Begin by recording the actionable goals formulated previously into the table.
- **Scoring:** Assign scores to each goal across all criteria using a scale of 1 to 5, where 1 signifies low priority, and 5 denotes high priority. Consider the following criteria: Urgency to change, Necessity of the items, Financial impacts, Volume (Impact), and Availability of Sustainability Alternatives.
- **Prioritization:** Prioritize goals with the highest overall scores in your strategy. High-scoring goals are those that are easy to implement in the short term, have a substantial volume or impact, are urgent, and are financially attractive. Goals with medium scores are suitable for mid-term implementation, while those with low scores may require further consideration due to factors such as unavailability, high investment costs, or small volume, making them suitable for mid-to-long-term implementation.
- This approach ensures a strategic and nuanced prioritization of goals based on their feasibility and impact, considering the specific context of each hotel (Table 6).

Table 6: A Sample of Multi-Criteria Scoring on Actionable Goals

Actionable goals	Urgency to change	Necessity of the item(s)	Financial impact	Vol ume	Availability of alternatives	Total score
Reducing dustbins & bin liners	3	1	4	2	5	15
Eliminating disposables	5	1	5	5	5	21
Reduce disposable bathroom & personal care products	3	3	4	1	4	15
Reduce in room Food and Beverage products	1	2	3	3	3	12
Reduce use of plastic stationary	3	3	5	1	3	15
Reduce Single-use plastic in the Kitchen	3	1	2	3	2	11
Eliminate plastics items in floor area and open areas	3	3	1	1	2	10
Introduce recycling opportunities	5	1	4	4	1	15

4.4. IDENTIFYING SUSTAINBLE ALTERNATIVES

Hotels possess a significant opportunity to substitute Single-Use Plastic Products (SUPPs) with more sustainable alternatives, prioritizing reusability and minimizing environmental impacts across their life cycle. Sri Lanka, enriched with a heritage of crafting essential daily-life products, has historically relied on traditional craft items as a crucial component of its economy. While these traditional crafts may have lost their value and the popularity in the market, ongoing initiatives seek to revive and promote them.

The National Crafts Council, established by the Parliamentary Act No. 35 of 1982, plays a pivotal role in fostering entrepreneurship and markets for traditional craft products. Encouraging innovative designs and ideas, the council trains craftspeople to think differently, producing alternative products that contribute to the preservation of handicrafts and uplift the social and economic status of craftspeople. Table 7 showcases some sample alternatives available at the National Craft Council, contributing not only to reduced plastic usage but also celebrating and preserving Sri Lanka's rich heritage of traditional craftsmanship. Annex 1 provides a more detailed list of alternative products for plastic use in hotels.

Table 7: Plastic Items and Their Alternatives Available at the National Craft Council, Sri Lanka[15]

Plastic Items	Alternatives available at National Craft Council
Lamp shades	Cane/Wood/Bamboo/Reed/Jaggery palm/ paper products
Baskets (flower/ fruit/ bread)	Cane/Wood/Bamboo/Reed/Jaggery palm/ paper products
File folders/ covers	Cane/Wood/Bamboo/ Jaggery palm products
Dustbins	Reed/cane
Ornaments	Clay/Wood/Brass
Key tags/ display boards	Wood/ Coconut Shells/ Bamboo
Tables/ chairs	Cane/Wood/Bamboo/ Jaggery palm chairs
Tablemats	Cloths mats



Figure 8: Use of Craft Products at Hotels

Although alternative products exist in the market, they are often not locally available, posing accessibility challenges. Additionally, these alternatives tend to be more expensive than their plastic counterparts. Despite the cost-effectiveness of single-use plastic, a thorough evaluation through Life-Cycle Assessments (LCA) demonstrates potential cost savings and sustainability benefits associated with adopting alternative solutions. LCA involves assessing the environmental impact of a product or service throughout its entire life cycle, from raw material extraction to disposal. This analytical tool provides valuable insights into the overall environmental footprint of plastic usage. The following estimations in Fig 9 highlight the potential savings achievable through the use of sustainable alternatives. For example, hotels can save up to €4,475 a year and reduce CO2 emissions by 1,497 kg by opting for refillable bottles with filtered tap water instead of single-use plastic bottles[16].

[15] https://www.iges.or.jp/en/pub/partnership-reduce-plastic-use-tourism-sector-galle-srilanka/en
[16] https://www.oneplanetnetwork.org/sites/default/files/from-crm/Futouris%2520Plastic%2520Guide_compressed.pdf

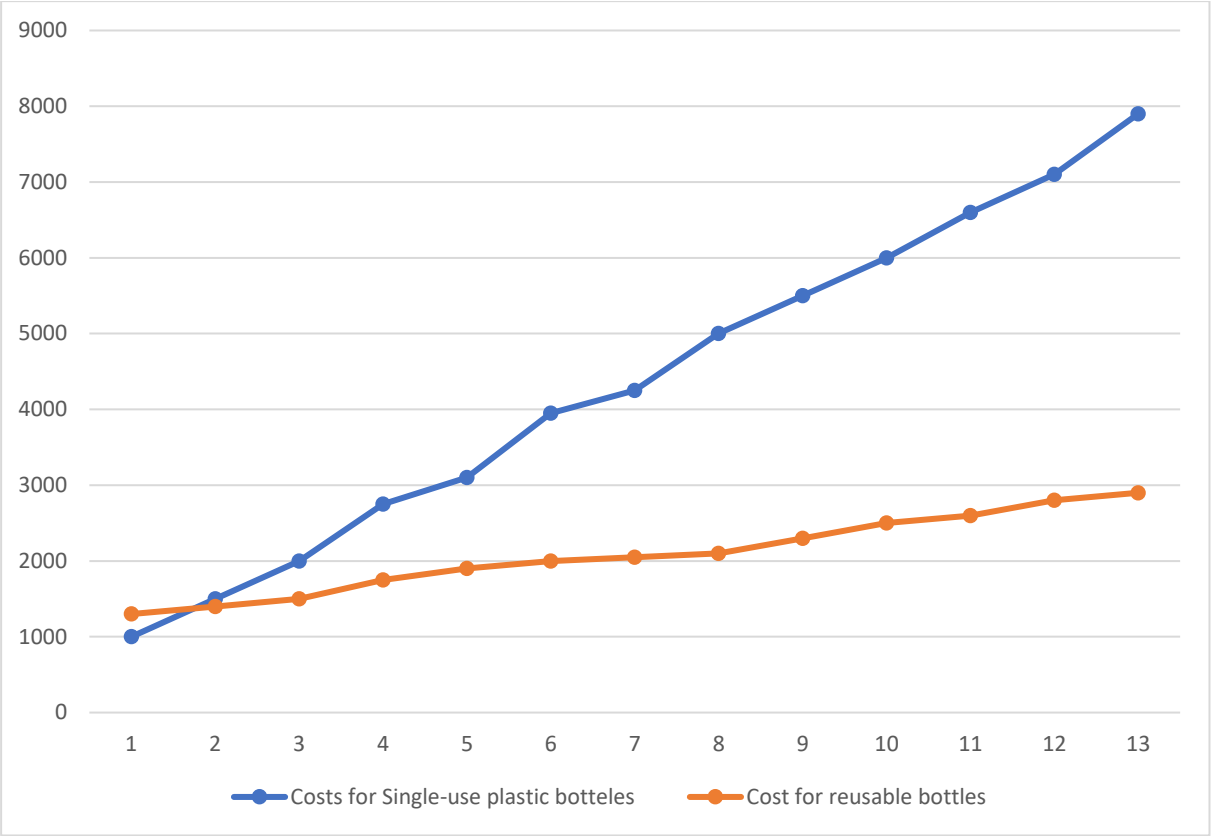


Figure 9: Single use water bottles Vs Reusable bottles (50 bottles per day)[17]

Note: (i) Cost reduction = Euro 4,475/year, (ii) Waste material reduction = 100% and (iii) Climate impacts = 1,497 CO_2 reduction

[17] https://www.oneplanetnetwork.org/sites/default/files/from-crm/Futouris%2520Plastic%2520Guide_compressed.pdf

5. INVOLVE – MAKING PARTNERSHIP FOR EFFETIVE IMPLEMENATION

5.1. INVOLVE STAFF

Engaging your staff in sustainability mission is crucial for successful implementation of the plastic waste reduction action plan. Train them on the significance of reducing plastic waste and adopting sustainable alternatives. Encourage them to lead by example and advocate these practices to guests. Effective plastic management action plans require that all hotel staff comprehend their roles, actively participate in identifying strategies and interventions, and possess the capacity and motivation to achieve desired results.

Some Hints to Involve the Staff:

- **Regular Staff Meetings**: Convene regular staff meetings to discuss progress, address challenges, and establish fundamental principles (e.g., no plastic bags, no single-use plastic bottles) for every employee to follow.
- **Educational Workshops**: Conduct workshops to enhance understanding of sustainability concepts and share success stories from within the industry.
- **On-the-Job Training (OJT):** Implement on-the-job training where experienced employees mentor newer staff in sustainability practices. This can be especially effective for understanding the practical application of reducing plastic waste in their specific roles.
- **Site Visits:** Organize visits to recycling centers or sustainable facilities to provide firsthand exposure to the waste management process and reinforce the importance of their role.
- **Guest Engagement Training**: Provide guidance on engaging and advising guests regarding the effective implementation of the action plan.
- **Incorporate Sustainability Goals in Performance Reviews**: Align sustainability goals, including plastic waste reduction, with individual and departmental performance reviews. This integration emphasizes the organizational commitment to sustainability.
- **Certification Programs:** Offer certification programs related to sustainability and plastic reduction. Employees can complete these programs to enhance their knowledge and skills, and the certifications can be recognized and rewarded by the hotel.
- **Collaboration with Environmental Organizations:** Collaborate with environmental organizations to provide specialized training sessions. These organizations often have specific programs designed for educating the hospitality industry on sustainable practices.



Figure 10: Training sessions to introduce alternative products to hotel staff

5.2. INVOLVE THE GUESTS

Effectively communicating your sustainability efforts to guests is crucial. This includes integrating information into guest welcome packets, explaining your commitment to reducing plastic waste. Additionally, highlight your sustainable practices on your website, social media, and in-room materials. Transparency regarding hotel goals, principles, and management efforts to reduce plastic waste inspires guests to actively contribute.

Some Hints to Involve the Guests:

- **Interactive Platforms:** Utilize interactive platforms like social media to share real-time updates and engage with guests on sustainability initiatives.
- **Interactive Displays:** Implement interactive displays in common areas to showcase your efforts and educate guests about sustainable practices.
- **Feedback Mechanisms**: Encourage guest feedback and suggestions to continuously improve sustainability initiatives.
- **Educational Signage and Materials**: Display informative signs, brochures, or information cards in guest rooms, lobbies, restaurants, and other common areas. These materials can educate guests about the hotel's sustainability goals, the importance of reducing plastic use, and how they can contribute.

- **Welcome Letters or Packets**: Include a welcome letter or packet in guest rooms that outlines the hotel's commitment to sustainability, including its plastic reduction efforts. Encourage guests to participate and explain how they can support these initiatives during their stay.
- **Promotions and Incentives:** Offer promotions or incentives to guests who actively participate in sustainability efforts. For example, a discount on future stays, complimentary amenities, or a tree planted in their name for supporting the hotel's sustainability goals.
- **Participation Contests:** Organize contests or challenges where guests can participate by suggesting innovative ideas to reduce plastic usage. Reward the best ideas with prizes, creating a fun and engaging way to involve guests.
- **In-Room Recycling Program:** Implement an in-room recycling program and provide clear instructions to guests on how they can separate recyclables from general waste, promoting responsible waste management.
- **Green Guest Pledges:** Encourage guests to take a pledge for eco-friendly practices during their stay. Provide a platform, either online or in-person, where they can commit to reducing plastic use and other sustainable actions.
- **Collaboration with Local Environmental Organizations:** Partner with local environmental organizations to conduct informative sessions for guests, discussing plastic pollution and the importance of responsible tourism. This can include presentations, workshops, or interactive sessions.
- **Collaborative Community Projects**: Initiate community projects in collaboration with guests, such as beach cleanups or tree planting events, where they can actively participate and contribute to the local environment.

5.3. INVOLVE THE SUPPLIERS

Sourcing plastic-free products is a critical step in your sustainability journey. Start by assessing your current supplier's offerings. If they don't have suitable alternatives, explore online options or inquire with local suppliers for recommendations. Collaborate with local suppliers to purchase in bulk, driving down costs.

Some Hints to Involve the Suppliers:

- **Supplier Communication and Education:** Regularly communicate with suppliers regarding your sustainability goals, including plastic reduction. Educate them on the environmental impact of plastic and your hotel's commitment to minimizing it.
- **Sustainable Sourcing Requirements:** Establish clear sustainability criteria for your suppliers, including a preference for products with minimal or no plastic packaging. Make these requirements a part of your procurement contracts.

- **Supplier Code of Conduct:** Develop a supplier code of conduct that includes guidelines on sustainable practices, including reducing plastic use. Encourage suppliers to adhere to these guidelines in their operations and product packaging.
- **Collaborative Workshops and Seminars:** Organize workshops or seminars where you invite suppliers to discuss sustainable practices, especially related to reducing plastic. Provide them with information on alternative packaging options and best practices.
- **Preference for Plastic-Free Products:** Clearly express a preference for products that have minimal or no plastic packaging when placing orders. Make it known that you prioritize suppliers who align with your sustainability goals.
- **Incentives for Plastic Reduction:** Offer incentives, such as longer-term contracts or preferred supplier status, to suppliers who actively reduce or eliminate plastic from their products or packaging.
- **Supplier Feedback and Idea Sharing:** Encourage suppliers to provide feedback and ideas on how your hotel can further reduce plastic use in its operations. Create a channel for ongoing dialogue and collaboration.

6. MEASURE – MONITOR PROGRESS AND KEEP IMPROVING

6.1. MONITORING PROGRESS

Regularly monitor and measure the progress of your plastic reduction initiatives based on the developed action plan. Analyze the data collected during your plastic audit to identify areas of success, as well asthose requiring improvement. Understand the impact of the changes you've implemented and take stock of whether they align with your goals for reducing plastic usage.

Ways to Monitor Progress:

- **Key Performance Indicators (KPIs):** Track the reduction of specific plastic items over time to accurately quantify your progress. Table 8 provides a sample performance monitoring checklist.
- **Feedback from Staff:** Engage your staff to gather insights into the effectiveness of new practices and areas that need refinement.
- **Customer Feedback:** Solicit feedback from guests to gauge their perceptions of your sustainability efforts and identify potential areas for enhancement.
- **Benchmarking:** Compare your hotel's plastic reduction efforts with industry benchmarks at the national/global level and best practices to assess your progress and identify areas for improvement.

Table 8: Sample Performance Monitoring Checklist

Performance Monitoring Period:						
	Baseline numbers		Impact Audit numbers		Any difference	
	Absolute	Per guest	Absolute	Per guest	Absolute	Per guest
Food and beverage						
Units						
Weight						
Bathroom and personal care						
Units						
Weight						
Housekeeping						
Units						
Weight						
Back office						

Units						
Weight						
Sustainable sourcing						
Recycled content						
Compostable/renewable						
Total targets from all actions						
Units						
Weight						

6.2. COMMUNICATION AND EXPERINCE SHARING

Consistently communicate your experiences and overall achievements in reducing plastic waste with the staff, guests and the wider audience. Sharing success stories and lessons learned can inspire other hotels and businesses to embark on similar sustainability journeys. Consider leveraging various platforms to disseminate this information, including social media, industry conferences, and sustainability forums.

Ways to Share:

- **Case Studies:** Develop case studies that outline your journey, challenges faced, and successful outcomes, and share them on relevant platforms.
- **Collaborate with Hotel Industry Networks**: Engage with industry networks to share your experiences during webinars, workshops, or conferences dedicated to sustainability in hospitality.
- **Leverage Social Media:** Utilize social media platforms to regularly update your audience on milestones achieved and lessons learned.
- **Visual Dashboards:** Create visual dashboards displaying key plastic reduction metrics for easy monitoring and understanding by stakeholders.

6.3. PARTNER WITH NATIONAL AND INTERNATIONAL SUSTAINABILITY PLATFORMS

Collaborate with national and international tourism platforms leading sector-wide initiatives to combat plastic pollution. By participating in endeavours like the UN Tourism (UNWTO) International Tourism Plastic Pledge and the Global Sustainable Tourism Council, you can access valuable resources, share best practices, and contribute to a collective effort to reduce plastic usage in the tourism industry.

Benefits of Joining Platforms:

- **Knowledge Sharing:** Gain access to the latest research, best practices, and innovative solutions for reducing plastic use in the hospitality sector.
- **Networking Opportunities:** Connect with like-minded individuals, organizations, and experts in the field, fostering collaboration and idea sharing.
- **Visibility and Recognition:** Showcase your commitment to sustainability and gain recognition for your efforts on a broader scale.
- **Sustainability Certifications:** Pursue sustainability certifications that include criteria related to plastic reduction. Compliance with these certifications indicates progress in sustainability efforts[18]



Figure 11: Small entrepreneur making alternatives for single-use plastic products

[18] For further information: (I) Sri Lanka Tourism Development Authority's Online Registration Portal: https://www.sltda.gov.lk/en/register-with-us; (II) Asian Ecotourism Standard for Accommodations (AESA): https://www.asianecotourism.org/ecotourism-standard; (III) Hotel sustainability Certifications: https://sustainablehospitalityalliance.org/wp-content/uploads/2021/06/Certifications-factsheet.pdf; (IV) Global Tourism Plastics Initiative: https://www.unwto.org/sustainable-development/global-tourism-plastics-initiative

7. CONCLUSION

In conclusion, embracing sustainable practices and minimizing plastic usage in your hotel not only demonstrates environmental responsibility but also serves as a means to enhance your brand and reduce operational costs. The potential impact is substantial, leading to the reduction of packaging volumes and the elimination of unnecessary single-use plastic products. Concurrently, hotel operators have the opportunity to educate guests and communities on environmentally responsible behavior, fostering a collective effort to reduce plastic waste in the environment. By applying this guide, hotel operators can take immediate actions to mitigate plastic waste in their operations, contributing to a greener future while delivering exceptional hospitality experiences. To facilitate and incentivize small and medium hotel operators in their quest to reduce their plastic footprint, government agencies can implement a range of supportive activities and policies. Here are key initiatives that governments can introduce, significantly aiding small and medium hotel operators in their efforts to reduce plastic usage, promote sustainability, and contribute to a cleaner and more environmentally-friendly tourism sector.

- **Public Awareness Campaigns**: Launch campaigns to educate hotel operators and the public about the environmental impact of plastic pollution and the benefits of reducing plastic usage.

- **Regulatory Framework:**
    - Plastic Use Regulations: Enforce regulations limiting or banning certain single-use plastics in the hospitality sector, such as plastic straws, bags, and cutlery.
    - Extended Producer Responsibility (EPR): Implement EPR policies, holding producers accountable for product lifecycles and encouraging reduced plastic use and proper disposal.
    - Deposit-Return Systems: Introduce systems incentivizing the return and recycling of plastic bottles and containers.

- **Financial Incentives and Grants:**
    - Grants for Sustainable Initiatives: Provide financial incentives to hotels implementing sustainable practices and effectively reducing plastic usage.
    - Tax Benefits: Offer tax incentives to hotels significantly reducing plastic waste and adopting sustainable alternatives.

- **Capacity Building and Training:**
    - Training Programs: Organize programs and workshops for hotel operators, educating them on sustainable practices and alternatives to plastic use.
    - Technical Support: Provide technical support to help hotels transition to sustainable alternatives and manage plastic reduction initiatives effectively.

- **Research and Development Support:**
    - Funding for Research: Allocate funds for research and development of sustainable alternatives to plastics tailored for the hospitality industry.
    - Collaboration with Institutions: Collaborate with research institutions to develop innovative solutions for reducing plastic usage in hotels.

- **Recognition and Awards:**
    - Sustainable Tourism Awards: Establish awards for hotels demonstrating exceptional efforts in reducing their plastic footprint and adopting sustainable practices.
    - Sustainable Certification Programs: Encourage hotels to obtain certifications promoting sustainable practices, including reduced plastic usage.

- **Partnerships and Collaboration:**
    - Public-Private Partnerships: Encourage collaboration between the government, private sector, and non-profit organizations to reduce plastic waste in the hospitality sector.
    - Industry Associations Involvement: Collaborate with industry associations to promote and advocate for reduced plastic usage within the sector.

- **Waste Management Infrastructure:**
    - Recycling Facilities: Invest in or provide incentives for the establishment of recycling facilities catering to the needs of hotels and other hospitality businesses.

- **Market Access and Promotion:**
    - Promote Sustainable Suppliers: Create a platform or database of sustainable product suppliers, making it easier for hotels to source sustainable alternatives to plastic

8. ANNEXES

8.1. A LIST OF REGULATIONS ON POLYTHENE AND PLASTIC MANAGEMENT

Gazette Number	Description
1466/5 Microsoft Word - Regulations on Polythene.doc (cea.lk)	With effect from 1st of January 2007, prohibit- (i) the manufacture of polythene or any polythene product of twenty (20) microns or below in thickness for in country use; and (ii) the sale or use of polythene or any polythene product which is twenty (20) microns or below in thickness. For the purposes of this Order, "Polythene" means any solid products, bags, material or contrivances manufactured using all forms of polyethylene, polypropylene, polystyrene, poly vinyl chloride, polyethylene terepthalate or any other similar raw material used for the purpose of carrying, packing, wrapping or packaging.
2034/33 PG 3676 (E) I - I- Gove. Noti.pmd (cea.lk)	1. Prohibit - (i) the manufacture of polythene or any polythene product of twenty (20) microns or below in thickness for in country use; or (ii) the sale, offer for sale, offer free of charge, exhibition or use of polythene or any polythene product which is twenty (20) microns or below in thickness within the country. Provided that polythene or any polythene product of twenty (20) microns or below in thickness may be permitted to be used with the prior written approval of the Authority for the purposes specified in the Schedule hereto.
2034/34 PG 3677 (E) I - I- Gove. Noti.pmd (cea.lk)	Prohibit the activities specified in Schedule hereto Activities:- (i) the manufacture of food wrappers from polythene as a raw material for in country use; and (ii) the sale, offer for sale, offer free of charge, exhibition or use of food wrappers manufactured from polythene as a raw material within the country. For the purposes of this Order- • ''food wrappers'' means lunch sheets. • ''Polythene" includes high density polyethylene, low density polyethylene and polypropylene

Gazette Number	Description
2034/35 PG 3678 (E) I - I- Gove. Noti.pmd (cea.lk)	Prohibit the activities specified in Schedule I hereto and exempt the items specified in Schedule II hereto. Schedule 1: Activities :- (i) manufacture of any bag of high-density polyethylene as a raw material for in country use; and (ii) sale, offer for sale, offer free of charge, exhibition or use of any bag manufactured from high density polyethylene as a raw material within the country. For the purposes of this Schedule bags manufactured from high density polyethylene as a raw material, means bags of any dimension with or without handles for the purpose of carrying products or goods and includes grocery bags generally referred to as ‘‘sili - sili bags’’.
2034/36 PG 3679 (E) I - I- Gove. Noti.pmd (cea.lk)	Regulations 1. These Regulations may be cited as the National Environmental (Prohibition of open burning of refuse and other combustible matters inclusive of plastics) - Regulations No. 1 of 2017. 2. No person shall burn openly or cause to, allow or permit the open burning of refuse or other combustible matters inclusive of plastics. 3. 3. Any person who fails to comply with the regulations above shall be liable to an offence and punishable under Section 31 of the National Environmental Act, No. 47 of 1980
2034/37 PG 3680 (E) I - I- Gove. Noti.pmd (cea.lk)	Prohibit the use of all forms of polyethylene, polypropylene, polyethylene products or polypropylene products as decoration in political, social, religious, national, cultural or any other event or occasion.
2034/38 PG 3681 (E) I - I- Gove. Noti.pmd (cea.lk)	Prohibit the activities specified in Schedule hereto: Activities:- (i) the manufacture of food containers, plates, cups and spoons from expanded polystyrene for in country use; and (ii) the sale, offer for sale, offer free of charge, exhibition or use of food containers, plates, cups and spoons manufactured from expanded polystyrene within the country. For the purposes of this Order- • “food containers” means lunch boxes

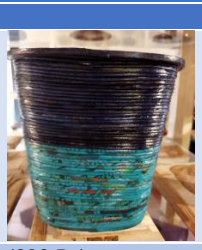
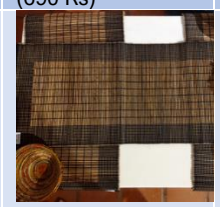
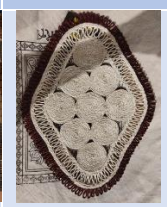
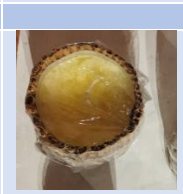
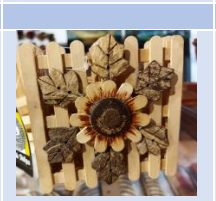
Gazette Number	Description
2211/51 PG 5278 (E).pub (cea.lk)	With effect from March 31st, 2021, prohibit the use of: A) Polyethylene terephthalate (PET) or polyvinyl chloride (PVC) material for packing agrochemicals used for any process, trade or industry; and B) any plastic item specified herein for any process, trade or industry: (i) Sachets having less than or equal to a net volume of 20ml/ net weight of 20g (except for packing food and medicines). (ii) Inflatable toys (except balloons, balls, water floating/pool toys and water sports gear). (iii) Cotton buds with plastic stems (except plastic cotton buds used for medical/clinical treatment). For the purposes of this Order- • "agrochemicals" means all chemicals used in Agriculture including Pesticide, growth regulators, liquid fertilizer; • "plastic item" means a product manufactured using polyethylene terephthalate, high density polyethylene, low density polyethylene, polyvinyl chloride, polypropylene, polystyrene, biodegradable plastic or any other similar raw material or any mixture thereof; • "process" includes manufacturing; and • "trade" includes sale and offer for sale.
2341/30 Scanned Image (cea.lk)	Prohibit the use of the following plastic items and the use of the said items in any process, trade or industry for in country use, with effect from October 01, 2023, (i) Single-use drinking-straws and stirrers. (ii) Single-use food containers, plates, cups, spoons, forks and knives, except in air travels. (iii) Garlands, (iv) String hopper trays. For the purposes of this Order- • "cups" includes drinking cups but does not include yoghurt cups; • "food containers" means the meal boxes manufactured from expanded polystyrene for in country use, • "plastic" means all forms of polyethylene terephthalate (PET), high density polyethylene (HDPE), low density

Gazette Number	Description
	polyethylene (LLDPE), polyvinyl chloride (PVC), polypropylene (PP), polystyrene, expanded polystyrene, biodegradable plastic or any other similar raw material or any mixture thereof, • "process" includes manufacturing; • "single-use" means a product designed or intended to be used once, before being disposed off; • "straw" means all straws including straws attached to products; and • "trade" includes importation for local use, sale, offer for sale, display for sale, offer free of charge or to exhibit.

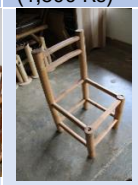
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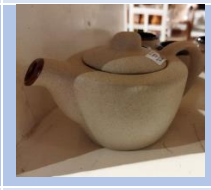
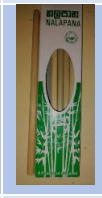
Constitution of Sri Lanka ,1978
Penal Code Act No. 2, 1883 (as last amended)
Code of Criminal Procedure Act No. 15, 1979
Import & Export Control Act No. 1 of 1969 (as amended 16 July 2020)
Sri Lanka Ports Authority (SLP) Act No. 51, 1979
The National Environmental Act (NEA) No. 47, 1980
The Environmental Protection License (EPL) under the provisions of the National Environmental Act No. 47, 1980
The Environmental Impact Assessment under the National Environmental Act No: 47, 1980
National Environmental (Ambient Air Quality) Regulations, 1994
Regulations for the Management of Hazardous Waste, 1996, (amended in 2008)
National Environmental Policy (NEP), 2022
Cleaner Production Policy, 2004
Marine Pollution Prevention Act No.2, 2008
Environment Conservation Levy, 2008
National Environmental (Protection & Quality) Regulation No. 01, 2008
National Green Reporting system (NGRS), 2011
Plastic Ban of 2017 [Gazette Notification No. 2034/33, 2034/34, 2034/35, 2034/37, 2034/38, 2034/36 of 1 September 2017
National Sustainable Consumption & Production Policy, 2019
Vehicle import regulations (air pollutant emissions): 2018. Gazette Notification No. 2079/42 dated 12.07.2018
National Policy on Waste Management, 2020
National Policy on Management of Chemicals, 2023
National Environmental (Plastic Material Identification Standards) Regulations No. 01, 2021
National Action Plan on Plastic Waste Management 2021-2030.
Order (under section 23W(1)(a): prohibit the use of PET or PVC material for packaging agrochemicals used for any process, trade or industry; Sachets having less than or equal to a net volume of 20ml/ net weight of 20g (except for packing food and medicines); Inflatable toys (except balloons, balls, water floating/pool toys and water sports gear) and Cotton buds with plastic stems (except plastic cotton buds used for medical/clinical treatment).

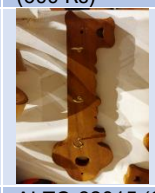
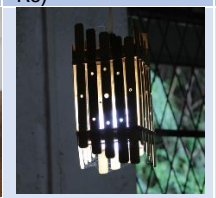
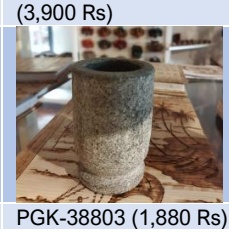
8.3. A LIST OF ALTERNATIVES AVAILBLE FOR PLASTIC PRODUCTS AT THE NATIONAL CRAFT COUNCIL, SRI LANKA (SEPTEMBER, 2023)[19]

Plastic Items	Existing Alternatives				
Lobby/ front desk					
Flower baskets	Papers/ Bamboo				
			SLR-24467 (690 Rs)	KISK-32701 (1,950 Rs)	(690 Rs)
Table mats	Palm/ Coconut/ Flax/ Vatakeiya				
		DWTC-36602 (650 Rs)	HGW-43004 (9,150 Rs)	NBND-2407 (310 Rs)	RKKW-887 (260 Rs)
Dust bins	Palm				
					New arrivals
Ornaments	Coconut shell/ Clay				
		GVSN-39004 (1,200 Rs)	GK-14605 (580 Rs)	RMP-90722 (1,500 Rs)	RMP-30720 (2,850 Rs)
Pens/ Pencils	Paper/ Wooden				
			SLR-24464 (140 Rs)	SRW-19507 (120 Rs)	KAG-8722 (680 Rs)
Writing pads	Wooden/ Paper				
				KAG-8718 (650 Rs)	KAG-8720 (3,450 Rs)

[19] For more information and prices: https://craftscouncil.gov.lk/

Plastic Items	Existing Alternatives				
Key Tags	Wooden/ Bamboo/ Coconut shell				
			AMDN-9738 (130 Rs)	MDWP-2561 (130 Rs)	MDWP-2561 (130 Rs)
File folders/ covers	Cane/ Palm				
				(1,800 Rs)	
Table/ chairs	Wood/ Bamboo/ Cane				
Restaurants/ Cafeteria/ Kitchen					
Ashtray	Ceramic/ clay/coconut shell				
		ISUW-0527 (360 Rs)	ISUW-0526 (340 Rs)	WVIPK-13139 (980 Rs)	PHKP-29510 (720 Rs)
Tissue holders	Palm/ Cane				
			AWTC-36509 (1,500 Rs)	GK-14603 (800 Rs)	SRV-12004 (290 Rs)
Plate	Coconut shell/ clay/ ceramic				
		(1,500 Rs)	PHKP-2999 (590 Rs)	KAHDL-30018 (2,700 Rs)	MD-11601 (130 Rs)
Baskets	Cane/ bamboo/ paper				
		SRL-24460 (1,220 Rs)	NCCHOWAWP (3,640 Rs)	KS-27801 (2,600 Rs)	SLR-24460 (1,220 Rs)

Plastic Items	Existing Alternatives				
Water bottles	Ceramic/ clay/ bamboo				
		ISUW-0542 (2,630 Rs)	KHIRW-19802 (1,780 Rs)	KHIRW-19801 (1,890 Rs)	
Other drinking items	Clay				
		JUGS-ADIM-44608 (608 Rs)	ADIM-44601 (210 Rs)	WVIPK-13108 (1,430 Rs)	ISUW-0540 (2,400 Rs)
Straws	Bamboo				
Mixing sticks	Bamboo/ wood				
			KAHDL-30015 (980 Rs)	KAHDL-30010 (1,500 Rs)	
Cups	Clay				
		ADIM-44603 (180 Rs)	ADIM-44606 (150 Rs)	(240 Rs)	ABIM-44610 (190 Rs)
Paper and salt filters	Coconut shell				
					ALTC-32011 (830 Rs)
Trays	Clay/ bamboo				
					RMP-30715 (6,750 Rs)

Plastic Items	Existing Alternatives				
Flower pots	Clay				
					ADIM-44612 (280 Rs)
Shopping bags	Palm/ cloths/ slack/ cane				
			(1,300 Rs)	(1,500 Rs)	(1,050 Rs)
Guest rooms					
Spoons/ Forks	Wooden/ bamboo/ coconut shell				
		KAHDL-30016 (1,050 Rs)	KHDL-30013/30014 (600 Rs)	KAHDL-70011 (1,280 Rs)	
Key holders	Bamboo/ wooden				
			ALTC-32015 (630 Rs)	SCDPS-16103 (1,040 Rs)	
Lamp **shade**	Bamboo/ cane/ palm/ ceramic				
				ISJWU-528 (4,280 Rs)	KLSCL-8601 (2,860 Rs)
Washrooms					
Soap boxes	Coconut shell/ clay				
				New arrival	MWVCD-67703 (3,900 Rs)
Tooth brush kit	Bamboo/ stone				
					PGK-38803 (1,880 Rs)



FURTHER INFORMATION

MINISTRY OF ENVIRONMENT

SOBADAM PIYASA, 416/C/1, ROBERT GUNAWARDANA
MAWATHA, BATTARAMULLA, SRI LANKA

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