CLEAN CITIES, BLUE OCEAN

Report of the

City of Galle Baseline Assessment of Waste Segregation Practices by Sectors and Assessment of Waste Management Services

PHOTO: HELP-O

Submission Date: November, 2023

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DISCLAIMER

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Abbreviations

3R	Reduce-Reuse-Recycle
CBO	Community-Based Organization
CCBO	Clean Cities, Blue Ocean
CCTV	Closed-Circuit Television
CEA	Central Environmental Authority
CLG	Commissioner of Local Government
FDG	Focus Group Discussion
GIS	Geographic Information System
GMC	Galle Municipal Council
HDPE	High-density polyethylene
HELP-O	Human and Environment Links Progressive Organization
HH	Household
JICA	Japan International Cooperation Agency
LAs	Local Authorities
LDPE	Low-density polyethylene
LED Bulb	Light-Emitting Diode Bulb
MEPA	Marine Environment Protection Authority
MOH	Medical Officer of Health
MSW	Municipal Solid Waste
MSWM	Municipal Solid Waste Management
MT/D	Metric Tons/ Day
NAPPWM	National Action Plan on Plastic Waste Management
NGO	Non-governmental organizations
PET	Polyethylene terephthalate
PHI	Public Health Inspector
PP	Polypropylene
PS	Polystyrene
PVC	Polyvinyl chloride
SPSS	Statistical Package for the Social Sciences
SWM	Solid Waste Management
SWMU	Solid Waste Management Unit
UDA	Urban Development Authority
UNESCO	United Nations Educational, Scientific and Cultural Organization
USAID	United States Agency for International Development

EXECUTIVE SUMMARY

"Collaborative Action for Clean City of Galle" is a project implemented in Galle by HELP-O (Human and Environment Links Progressive Organization) in collaboration with the Galle Municipal Council (GMC). The project is financed by the USAID Clean Cities, Blue Ocean (CCBO) to improve the Solid Waste Management (SWM) system in the city by reducing the generation of plastic waste and promoting an efficient city-wide waste management system.

The city of Galle is the administrative capital and the fastest growing urban center of the Southern Province of Sri Lanka. It acts as a service center for the entire southern region, and it daily attracts a large and diverse commuting population. As the governing body of the city of Galle, the GMC is currently managing plastic and polythene waste with many constraints in its SWM mechanism. For example, currently, the GMC collects segregated waste in two categories, 'wet' waste (degradable) and 'dry' waste (non-degradable) from all 15 Municipal Wards by employing approximately 120 municipal laborers, 10 waste compactors, and 30 tractors[1]. The GMC is managing 35 waste collection routes every day. However, there are certain areas, such as along canal banks and congested low-income communities, that the municipality's SWM service does not reach due to the poor road infrastructure and accessibility issues for the municipality's vehicles.

The residential, commercial, industrial, and service sectors in Galle generate a significant amount of waste, which has never been properly quantified or characterized by any of the governmental, non- governmental organization. In addition, the GMC does not have a mechanism to record waste data and information, or to maintain a database due to knowledge and resource limitations. Therefore, the GMC does not have up-to-date data and information regarding citywide waste generation, collection, and existing semi-formal and informal 3R/SWM practices. It is also difficult to find recent and reliable studies that address this data and information gaps. Therefore, the existing data and information do not provide an accurate assessment of the municipal and plastic waste challenges in the city.

This report presents the findings of the Waste Assessment conducted in the city of Galle during the November 2022 to January 2023 with an aim to address the above-mentioned data and information gap. This assessment focused on collecting current data and information on citywide waste generation, 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.

The assessment was planned and conducted in a scientific manner employing the mix-method approach, where both quantitative and qualitative methods were used in data collection and analysis. The samples for the assessment were identified based on the population size of each sector considered under the assessment, their geographical distribution, and resource availability. A detailed survey using questionnaires was conducted for the key sectors (e.g. residential, commercial, industrial, and service) and other specific sectors (e.g. religious places and fishery harbors). In addition, in-depth interviews and Focus Group Discussions (FGDs) were conducted with relevant stakeholders such as Non-Governmental Organizations

[1] Based on the interview conducted with the Municipal Commissioner and the SWM Unit at the GMC on 31st August 2021.

(NGOs), tourists, illegal waste dumpers, aggregators, and municipal officials attached to the municipal SWM unit.

The first and second chapters of the report contain background information on the waste challenges and the current SWM system in Galle and the methodology adopted in the waste assessment. The third, fourth, fifth, and sixth chapters showcase the present context of the waste generation, collection, management, and problems and challenges associated with key sectors in the city including residential, commercial, service, and industrial sectors. The seventh chapter presents data and information associated with the other specific sectors that were not considered under the above key sectors, such as religious places and fisheries harbors, and includes perceptions of diverse stakeholder groups such as Non-Governmental Organizations (NGOs), tourists, illegal waste dumpers, aggregators, and municipal officials attached to the municipal SWM unit. The eighth chapter summarizes the findings and presents recommendations for a more efficient SWM system for city of Galle.

PHOTO: HELP-O

CHAPTER 1: INTRODUCTION

Waste Problems in Galle, Sri Lanka

1.1 Waste Problem in Sri Lanka

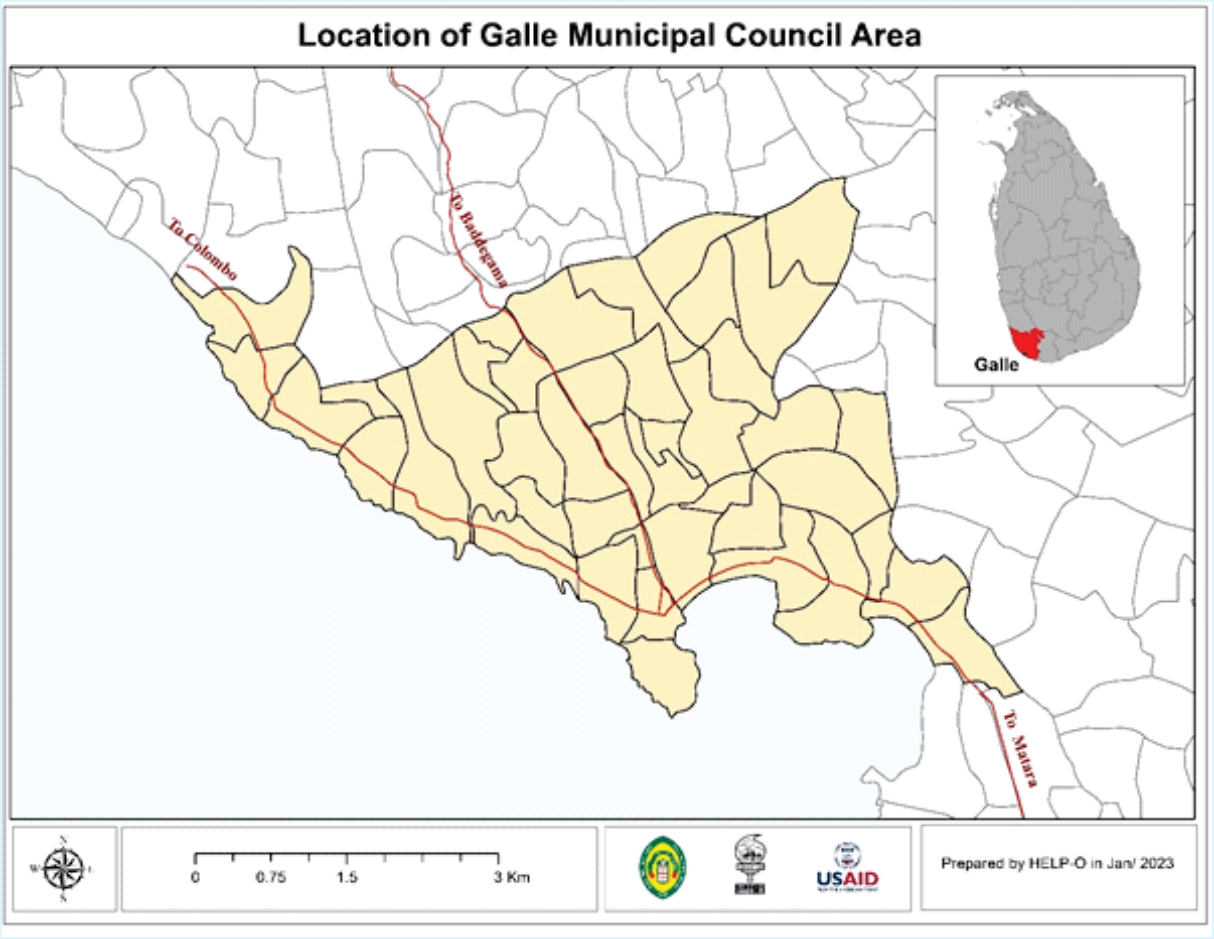
With inadequate waste management infrastructure, Sri Lankan cities have been contributing to the global waste problem by adding significant amounts of plastic and other waste to terrestrial and marine environments. Currently, the Local Authorities (LAs) in Sri Lanka have the capacity to collect only one-third of municipal solid waste, which is estimated to be around 7,110 metric tons/day (MT/D) from a generation of 21,331 MT/D (Kaza et. al., 2018). Much of the waste is disposed of within the premises or outside the source (e.g., residential and business units) by burning, burying, or other illegal means (Karunarathna et al., 2019). Similarly, from a wide range of polythene and plastic used in the country, 50% ends up in about 350 open dumpsites as post-consumer plastic waste (Dharmasiri, 2019; Jayasekera and Karunarathna, 2019). As per the National Action Plan on Plastic Waste Management in 2021 (NAPPWM), this waste includes recyclable thermoplastics, thermosetting plastics, composites, and laminated and coated plastics, which can include toxic chemicals that present high environmental and health risks.

With no reliable data available, NAPPWM has made several estimates based on the findings of the 2016 Japan International Cooperation Agency (JICA) survey of several local authorities in Sri Lanka to illustrate the size of the plastic waste problem in Sri Lanka. As per those estimates, the total plastic waste generated in 2020 in Sri Lanka would have been around 938.42 MT/D. About 32% of this is estimated as the amount of waste collected by Municipalities with a breakdown of 28% disposed of in open dumpsites and only 4% recycled. The remaining 68% is estimated to the uncollected waste with a breakdown of 1.3% discarded into water sources, 22.0% buried at sources, 65.7% openly burned at source, and 11.0% illegally dumped into the surrounding environment.

1.2 Waste Problems in Galle

Galle (Map 1) is the capital of the Southern Province in Sri Lanka. The city is considered a prominent tourist destination due to its designation as a UNESCO 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 population daily through the major arteries connecting other cities.

Similar to other cities, residential, commercial, industrial, and service sectors generate a significant amount of waste within the GMC area. This has never been studied or assessed by any of the governmental, nongovernmental organizations or citywide research. As per the Japan International Cooperation Agency (JICA) estimates, only one-third of this waste is collected and the rest disposed of in the environment through burning, burying, or discarding directly into the environment. 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.



Map 1: Location of Galle Municipal Council Area (Prepared by HELP-O)

According to the Department of Local Government, Southern Province, the GMC collected approximately 50 metric tons/ day (MT/D) of waste in January 2020. The same source states that about 43.4% of this collected waste is non-degradable, such as polythene and plastic (LDPE, PET, HDPE, PVC, PP, and PS), paper, glass, metal, and other dry waste. In addition to the usual non-degradable waste generators such as small businesses, supermarkets, daily marketplaces, recreational areas, and low-income communities, there are some specific waste generators and waste hotspots in Galle, which required additional attention due to the high number of users and visitors in these places. They include the Galle Fort area, hospitals, schools, tourist hotels, restaurants, fishing harbor, Galle prison, and Galle Naval base. Moreover, a significant amount of waste is generated by over 150,000 commuters who visit the city of Galle (SOSLC Project, 2018) every day.

Even though these estimates of citywide waste generation and collection are limitedly available in the GMC, government organizations, and other NGOs, they are either outdated, unreliable, or incomplete. Therefore, the existing data and information often portray an inaccurate overview of the actual situation of the waste generation, collection and SWM practices in the city. As per HELP-O's observation, the lack of data and information has led to improper management of waste and subsequent negative health and environmental impacts. The need for conducting this baseline assessment of waste segregation practices by sectors and assessment of waste management services arose because of this data and information gap.

1.3 Current Status of SWM in Galle

1.3.1 Statutory Provisions and Current Procedures for SWM

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

- Municipal Ordinance - Chapter 276, No. 29 of 1947,
- Provincial Councils and Local Government Circular 01/2015,
- Standard By-Laws of Southern Provincial Council (No. 1834 – 2013.10.25, No. 1834 – 2013.10.27),
- The National Environment Act (No. 1627/19 - 2009.11.10)
- The National Waste Management Policy (2019) in Solid Waste Management system.

Accordingly, the GMC follows the below procedures for citywide SWM.

- Divide the GMC area into 15 wards (which is now being reduced to 05 with the assistance from CCBO) for waste collection purpose.
- Door-to-door waste collection is in place for residential, commercial, industrial, and service sectors. Common waste disposal facilities are also in designated places (e.g. Bus terminals, Galle Fort). The waste collection vehicle fleet is deployed on a schedule to cover the 15 wards.
- GMC does not collect 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 (a GMC-owned land of approximately 1.72 Ha, which is currently used as a waste transition and a disposal site) on their own.
- Since 2010, the GMC collects only the segregated waste as Degradable (wet) and Nondegradable (dry). The GMC has educated all the generators in this regard and stopped collecting nonsegregated waste.
- Waste collection schedule has been distributed to each generator, household or Establishment. The schedule indicates specific days in the week for collecting degradable, non-degradable, and special wastes (e.g- Sanitary wastes, e-waste, etc.) for each route.
- 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 below the planned capacity.
- Collected wastes (except glass) are hauled to the GMC waste collection facility in Heenpendala. A maximum 23 MT of collected degradable waste is transported by GMC vehicles to “Monrovia Estate”, a common waste collection facility managed by the office of Commissioner of Local Government (CLG) in Southern Province. The ceiling limit of 23 MT has been given by a court order.
- The remaining degradable waste and total non-degradable waste are temporarily disposed at a designated separate location in Heenpendala site. The non-degradable waste is sold to third party recyclers in bulk, without being compressed/ bailed.
- GMC is planning to commission the “KAWASHIMA composting facility” in Heenpendala for degradable waste. The facility (building with machinery) has already been established with JICA assistance.
- The building waste is not collected under the regular collection scheme of GMC. The interest parties can transport, pay, and hand over building waste to the GMC owned building waste recycling facility at COWAM Center, Dadalla.

1.3.2 GMC Institutional Setup for SWM

The statutory responsibility of SWM is vested in the Solid Waste Management Unit (SWMU). established at the GMC. The unit operates as a division under the Health Department. Figure 1 shows the waste management institutional setup of the GMC.

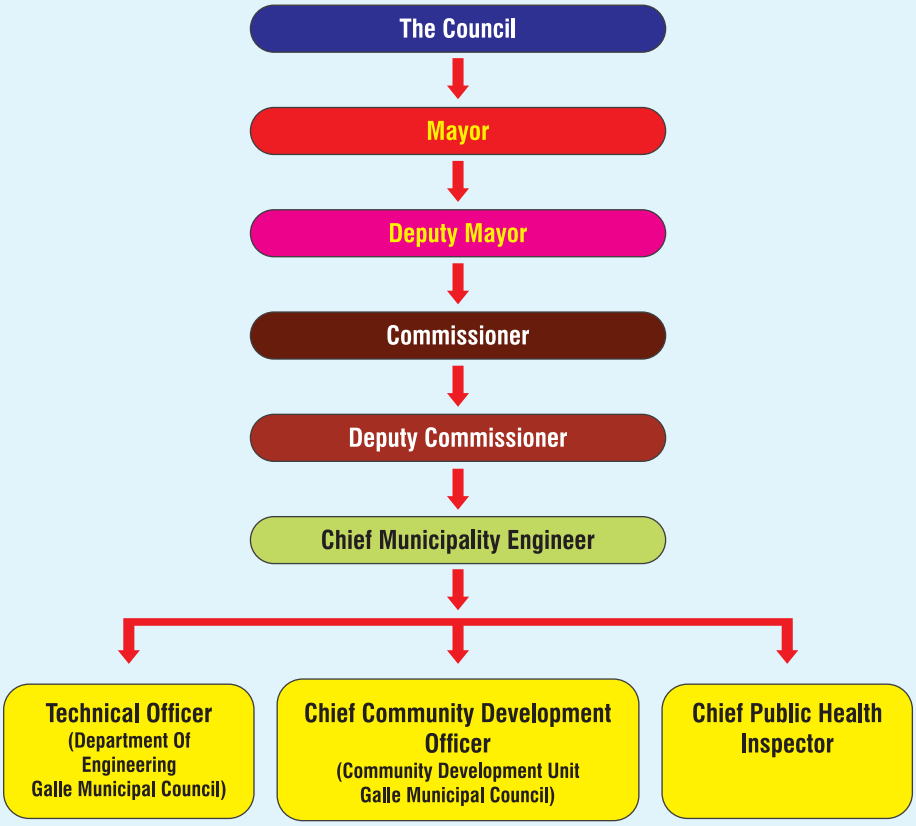


Figure 1: The SWM institutional setup of the GMC

The Mayor holds the statutory powers to execute the solid waste management tasks within the jurisdiction of GMC. He has delegated these powers to the Deputy Mayor. The Deputy Mayor with consent of the Mayor takes policy/ regulatory level decisions on SWM with the approval of Council as and when required.

The commissioner administers the SWM process as per the policy framework set out by the Council. The planning, financial & human resource management, progress monitoring, evaluation and adopting necessary changes to implementation set up are the key functions performed by the Commissioner.

These functions are delegated to the Deputy Commissioner and Municipal Medical Officer of Health for effective management purposes. The Deputy Commissioner is mainly responsible for coordinating with Commissioner and the Council and the Municipal Medical Officer of Health is responsible for overall implementation of the GMC SWM scheme with the assistance of subordinate staff, Technical Officer, Chief Community Development Officer, and Chief Public Health Inspector.

The Technical Officer in the Solid Waste Management Unit is responsible for operating the daily waste collection and handling scheme including human resource, vehicle fleet and infrastructural management. The Chief Public Health Inspector is responsible to monitor the efficiency of City wide SWM scheme, adopting necessary regulatory actions and assist management decision making. The Chief Community Development Officer is mainly responsible for education-awareness, complaint handling and community level infrastructural facility management on SWM.

1.3.3 Resource Availability for SWM at GMC

The overall resource allocation specifically for SWM by the GMC can be summarized as follows. Table 1 shows human resources allocated for SWM.

Table 1: Human Resources of SWM unit

Designation	No. of Employees
Public Health Inspectors	2
SWM Supervisors	16
Laborers	121
Drivers for the vehicles	15

Table 2 shows the vehicle fleet for solid waste management and table 3 shows infrastructural facilities available specifically for SWM

Table 2- Vehicles of SWM unit

Vehicle Types	Quantity
Compactors	15
Tractors	30
Tailors	30
Hand Tractors	3
Gully Bowser	2
Tipper Truck	5
Back-hoe	2
Truck	1

Table 3: Infrastructure facilities available for the solid waste management

Establishment	Location
Waste Transition Site and dumping area	Heenpandala
Kawashima Composting Plant	Heenpandala
Restroom and washrooms for Laborers	GMC, Heenpandala
Rest Room of Supervisors	GMC
Vehicle Garage	GMC

1.3.4 SWM Compliance Level of GMC with the National Requirements

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". Following are the key findings of this analysis as per the report published in August 2022.

The compliance requirement

The overall compliance requirement on SWM by a local government body (i.e. Municipal Council, Urban Council and Pradeshiya Sabha) is set out by the policies, regulations in the National and Provincial level as well as the by-laws in place in the local authority level. As per the CCBO Solid Waste Governance Gap Analysis, following are key National Level Public Authorities/ Regulatory bodies in terms of Environment Protection and Waste Management at local level.

1. Ministry of Environment Sri Lanka (National Environmental Act No 47 of 1980)

2. State Ministry of Provincial Councils & Local Government (MC Ordinance No 29 of 1947)

3. Central Environmental Authority (CEA; the enforcement Authority of National Environmental Act No. 47 of 1980 & Orders/Regulations of the National Environmental Act),

4. Marine Environment Protection Authority (MEPA) (Authority of Marine Pollution Prevention Act No. 25 of 2008),

5. Coast Conservation and Coastal Resource Management Department (Coast Conservation Act No. 49 of 2011),

6. Urban Development Authority – UDA (Authority of Urban Development Authority Act No. 41 of 1978)

7. Medical Officer of Health (Attached with Local Government Authorities) – MOH (Authority of Food Act No. 26 of 1980, Nuisance Ordinance No. 15 of 1862, Quarantine and Prevention of Disease Ordinance No. 03 of 1897)

8. Municipal Councils (& other Local Government Authorities) (Authority of Municipal Ordinance No. 29 of 1947).

9. National Solid Waste Management Policy 2019.

10. National Action Plan on Plastic Waste Management (NAPPWM) 2021.

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

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

1. Standard by-laws of solid waste management - Southern Province No. 1834 – 2013.10.29 (Annexure 01)

1.3.5 The status of SWM compliance of the GMC

The CCBO Solid Waste Governance Gap Analysis report presents the following 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.

Figure 2: A Photograph taken during the Assessment survey (Source: HELP-O)

Table 1: 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	-	-	-	-	02	-
Legal and Policy	07	01	-	02	-	02	-
Service Delivery	06	-	-	04	-	-	02
Human Resources	01	-	-	-	01	-	-
Community Engagement	06	-	-	02	01	-	03
Enforcement	05	01	01	02	-	01	-
Marine Debris	-	-		-		-	
Gender	-	-		-		-	-
Total		02	01	10	02	05	05
Grand Total	**25**	**03**		**12**		**10**	
Percentage		**12%**		**48%**		**40%**	

Source: Solid Waste Governance Gap Analysis - CCBO, USAID; 2023

Figure 3: Photograph taken during the Survey Design Workshop held at Radisson Blue Resort Galle on 09th November,2022

As illustrated in the above table, a total of 25 provisions that are related to Galle Municipal solid waste/ environment and /or specifically termed regulatory or obligatory requirements towards local government authorities (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.

GMC has got full compliance for 03 provisions (12%), partial compliance for 12 provisions (48%), and out of compliance for 10 provisions (40%), out of 25 provisions. Altogether, GMC should consider improving their 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 following recommendations to reach full compliance with national SWM requirements have been presented in the CCBO report.

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 of the atmosphere;

e. The control of noise pollution; and

f. The control of storage, transport and disposal of any material which is hazardous to health and environment;

g. Procedure and conditions for granting a permit/license to streamline and legal protection for the operations of informal waste collectors (permit) and Aggregators (Trade license);

h. No person shall dump municipal solid waste along sides of any national highway;

i. No person shall dump solid waste at any place other than places designated for such purpose by the relevant local authority or any person or body of persons authorized by them in that behalf;

j. No person shall collect or 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.

Figure 4: Photograph taken during the Survey Design Workshop held at Radisson Blue Resort Galle on 09th November 2022

k. The collection of domestic waste may be carried out by any person or body of persons authorized in that behalf, from the respective households, during the hours of 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).

The above discussion with regard to the waste problem in the GMC area and the analysis of the GMC's 3R/ SWM procedures, resource availability, and compliance gaps and recommendations led to this baseline assessment of waste segregation practices by sectors and assessment of waste management services in the GMC area. The methodology adopted and key findings of the assessment are presented in the following chapters.

Figure 5: Photograph taken during the Survey Design Workshop held at Radisson Blue Resort Galle on 09th November 2022

PHOTO: HELP-O

CHAPTER 2:
METHODOLOGY OF THE ASSESSMENT

Waste Problems in Galle, Sri Lanka

CHAPTER 2: METHODOLOGY OF THE ASSESSMENT

2.1. Introduction

The Waste Assessment in Galle Municipal Council area was conducted focusing on the key sectors such as residential, commercial, industrial, and service sectors. 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. This chapter extensively discusses the methodology applied in the waste assessment, from designing the methodology, to sample identification, questionnaire development, pilot assessment, data collection and analysis stages.

2.2. Assessment Methodology

The following figure illustrates the methodology adopted in the city-wide waste assessment in Galle.

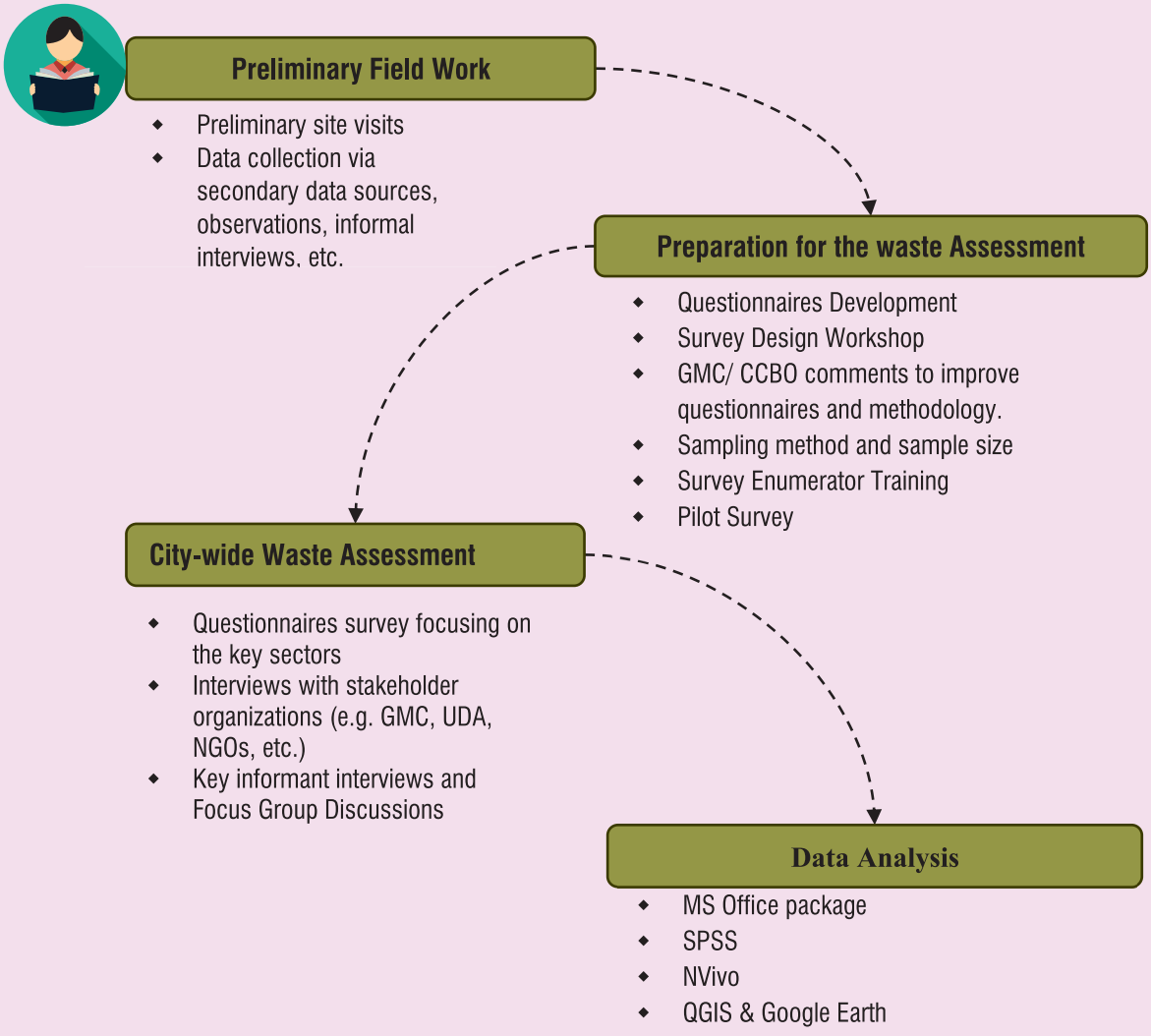


Figure 6: Methodology adopted in the city-wide Waste Assessment

2.2.1. Preliminary Field Work

The purpose of conducting a preliminary field work was to get familiarized with the existing context of the waste and waste management system in the city. Accordingly, the preliminary fieldwork focused on collecting data and information related to waste generation, management, and different problems faced by the GMC in relation to waste management. The preliminary fieldwork was conducted in October 2022, prior to the commencement of the city-wide waste assessment. The project team focused on identifying waste-related problems through field visits, identifying aggregators and illegal waste dumping areas, collecting secondary data and information related to SWM from different stakeholders, and taking photographs of locations, sites, and communities that are important in a city-wide waste management intervention.

Figure 8: Discussion with waste Aggregator - Navinna Area

Figure 7: Illegal Waste Dumping Near to the Entrance of Southern Expressway

Figure 9: Illegal Waste Dumping site near to the Karapitiya Hospital

Figure 10: Illegal Waste Dumping site near to the Katugoda

2.2.2. Preparation for the Waste AssessmentSurvey Design Workshop

As part of the Assessment, HELP-O in collaboration with the GMC organized a Survey Design Workshop for city stakeholders including CCBO, CEA, UDA, MEPA, Ceylon Fishery Harbors Corporation, and Karapitiya Hospital to discuss and gather ideas on the waste assessment to be conducted in the GMC area. In addition to materializing a comprehensive methodology for the assessment, the Survey Design Workshop also helped to draft the questionnaires used in the waste assessment. Specific sector-wise questionnaires were developed by the project team prior to the survey design workshop (for the sectors, such as residential, commercial, industrial, service, and so forth), which were then discussed at this workshop in detail (Refer the Questionnaire Booklet for final questionnaires).

Figure 11: A few photographs taken during the Survey Design Workshop held at Radisson Blu Resort Galle on 09th November 2022

Sampling Method

With the inputs received from the survey design workshop, the project team adopted a scientific method to decide the sample size from different sectors for the assessment. In addition, the identification of the sample units was also done in a scientific manner. The following table illustrates the method applied in identifying the sample.

Table 5: General information about the sample selection (Source: Prepared by HELP-O)

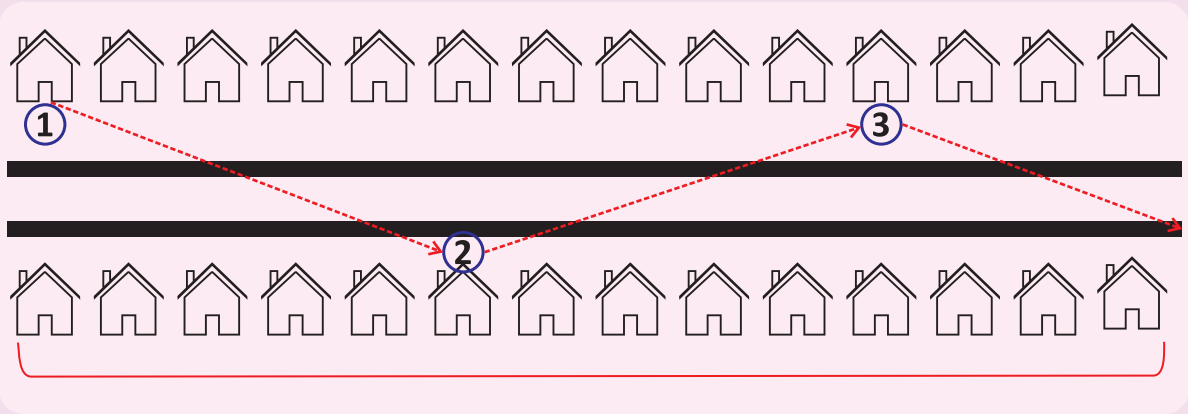
No	Sector/ Target Group	Sampling technique	Data Collection instruments used
I	**Residential sector** (Individual houses, Shanty areas, Condominiums)	Systematic Sampling	1) Questionnaire, 2) Formal Interviews 3) Photographic survey
II	**Commercial Sector:** Large Scale Establishments **Commercial Sector:** Small Scale Establishments (grocery and other small stores, small restaurants and hotels, & street vendors)	Stratified Random Sampling	1) Questionnaire 2) Formal Interviews 3) Photographic survey
III	**Industrial sector**	Stratified Random Sampling	1) Questionnaire, 2) Formal Interviews 3) Photographic survey
IV	**Service Sector:** Public sector institutes (Gov offices, Schools, Police, Railway station & prison, etc), Private sector institutes (Schools, Bank and financial companies etc.)	Simple Random Sampling	1) Questionnaire, 2) Formal Interviews 3) Photographic survey
V	**Other Sectors:** Health care institutions Fisheries harbor and fishing Ports Informal Waste Collectors/ Aggregators International Tourists Illegal waste dumping Religious Places	Simple Random Sampling	1) Questionnaire 2) Formal/ Informal Interviews

In the residential sector, the sample size was decided based on the systematic sampling method. In addition, the sample size was decided with a minimum confidence level of 99% and margin of error of 3%. Moreover, the sample sizes of commercial, industrial, and service sectors ware decided with a minimum confidence level of 95% and margin of error of 5%. However, the actual number of units surveyed was slightly different than the decided sample size due to matters such as the inaccuracy of population data included in the resource profile of the GMC, it was difficult to maintain the sample size when it was required to consider different categories of units under the same sector (e.g. commercial sector – large and small establishments), and so forth. The following table illustrates the population size of each sector (as per the Resource Profile of the GMC), minimum standards maintained when deciding the sample size, and completed number of units from each sector.

Table 6: Sample size selected from key sectors

Sector	Population size (as per Resource Profile of the GMC)	Minimum standards followed in deciding the sample	Size of the Sample as per the minimum standards	Actual size of the sample completed
Residential	21,291	99% & 3%	1,702	1,830
Commercial	3,440	95% & 5%	346	586
Industrial	942	95% & 5%	274	214
Service	646	95% & 5%	242	174
Total size of the completed sample			2,564	2,804

When identifying the households (HHs) for the sample, the following methodology was adopted. When there were houses on both sides of the road, every 10th house from either side was selected. When there are houses on one side of the road, every 10th HH was selected for the sample. This is illustrated in figure 7 below



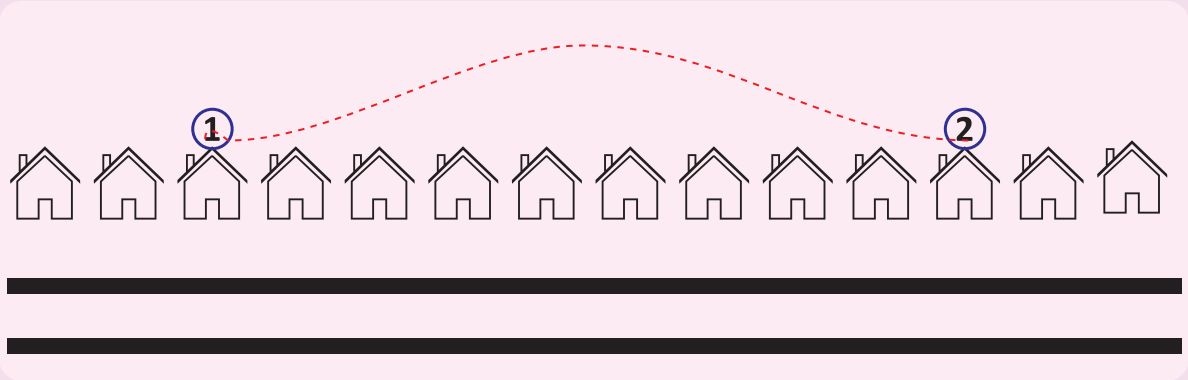


Figure 12: Residential sector sample selection

The commercial sector sample was identified using the Stratified Random Sampling method. The commercial sector was divided into two categories such as large-scale establishments and small-scale establishments. For the small shopsclustered in highly urbanized areas, every 5th shop/ unit was considered. Altogether, the number of establishments under the commercial sector taken for the survey was 586, including 515 small establishments and 71 large-scale establishments.

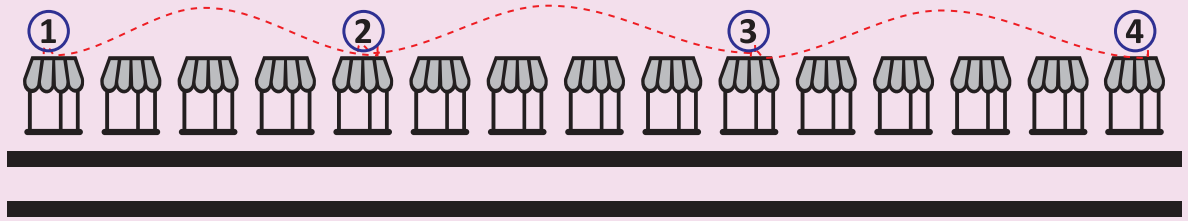


Figure 13: Small-scale establishments - commercial units' selection for the sample in highly urbanized areas

The industrial sector sample was identified through the Stratified Random Sampling method. In addition, different types of industries including food processing, garment/textile, machinery and equipment manufacturing, electronics manufacturing, chemicals manufacturers, metals and metal products, coir-based products, gunpowder related products, animal husbandry, and other specific industries were considered under the sampling. Representing all these categories and types, a sample of 214 units were surveyed under the industrial sector.

Again, the service sector sample was also identified through the Stratified Random Sampling method. Service sector included government institutions (e.g. government offices, banks, schools, camps, hospitals, police station, railway station and prison) and private sector institutions (e.g. private banks, schools and tuition classes). The total sample size was 174 establishments.

In addition to the above samples identified from the four key sectors, the assessment was extended to several other sectors (under other category) that were identified for playing a specific role in waste generation and management in the city. These categories include, religious sector, health sector (hospitals, pharmacies, nursing homes, etc.), aggregators, and fishing industry related establishments. Separate questionnaires were developed focusing on these specific sectors. Stratified Random Sampling method used to identify the sample from these sectors. Accordingly, the sample sizes of these sectors are as below.

- Health sector – 30
- Religious sector – 29
- Waste Aggregators – 21

Furthermore, a few other specific groups (e.g. GMC laborers/ supervisors, Illegal waste dumpers, visitors/ tourists) were involved in the assessment considering the importance of absorbing their inputs with regard to the waste generation and management in the GMC area.

Below is the list of these specific groups and the completed sample size of each of those groups.

- Illegal waste dumpers -16
- GMC labors -12
- GMC supervisors – 10
- Environment Police Officers - 2
- Tourists – 9
- CBOs/ NGOs – 09

Preparation for the Mapping Exercise

Mapping of waste generation and management related information was one of the key activities carried out under the waste assessment. The base map for the purpose of mapping was prepared (Map 1) by considering the GMC boundary, major and minor arteries, and GMC Waste Management Zones.

During the survey, the geo-coordinates of every HH unit and establishment were collected with the help of survey enumerators. These coordinates were then mapped and used in the data analysis. Required training was provided to the survey enumerators prior to starting the assessment.

Recruitment and Training of Survey Enumerators

The recruitment of the survey enumerators was done considering several aspects. First, to conduct the survey and collect data and information, enumerators were needed to be recruited from experienced and knowledgeable group. Hence, the project team in consultation with the GMC and CCBO decided to recruit university graduates and graduands from varied disciplines such as planning, environmental management, and sociology. The selection was done following a one-on-one interview process. Second, to build the rapport with the respondents of the survey and to help survey enumerators in way finding, it was decided to recruit Women Leaders from different community groups in GMC area. In addition to the above, other key objectives of selecting women leaders was to empower, train, building capacity, and ensure gender equality in the project activities. The selection of women leaders was done in collaboration with the GMC from the Community Development Councils established by the GMC.

Accordingly, for the Assessment Survey training, 25 university graduates and graduands and 15 women leaders were identified through the above-mentioned process.

Survey enumerator training was conducted in three (3) stages. First two stages were focused on training of enumerators on the residential and commercial sector assessment (including questionnaire and mapping), providing training on health and safety protocols (as per the CCBO guidelines, agreed Environmental Management and Mitigation Plan and HELP-O's covid-19 protocols as submitted to the CCBO), conducting pilot survey, and providing awareness on other general training on how to build rapport with respondents, how to get required information from the respondents, and so forth, based on the inputs from the sociologist hired under the project. The third stage training focused on discussing industrial, service, and other sectors questionnaires.

Figure 14: Survey Enumerator Training and Awareness At Samoda Reception Hall on 13 November 2022 and15 November 2022

2.2.3. City-wide Waste Assessment

After the preparation (including stakeholder consultation via Survey Design Workshop, questionnaire development, identifying the sampling methods and sample sizes, and recruiting and training of survey enumerators) of survey questionnaire, there was a field test to validate it and improve accordingly. The waste assessment was initiated in November 2022 and continued for approximately three (03) months until the mid-February 2023. Firstly, the residential and commercial sectors assessment was completed, whereas the industrial sector and service sector surveys started afterward. Questionnaire surveys, key informant interviews and focus group discussions were conducted at the later part of the waste assessment.

A Regular monitoring mechanism was implemented during the assessment to make sure the timely completion of the assessment and the collection of correct and reliable data and information throughout. The project team led this monitoring and evaluation mechanism, whereas two university students were engaged in data verification, clearance, and progress monitoring (e.g. to record the daily completion rate of survey questionnaires). Questionnaires which required corrections were referred back to the respective students who completed those questionnaires to make sure they are complete.

While the assessment is ongoing, three (03) university students were engaged in data entry and analysis. MS Office packages (MS Excel) were primarily used in data entry and the data entry formats were developed with the inputs received from the CCBO team. In addition, one university student engaged in mapping by plotting the points of every establishment surveyed throughout the assessment. More information of the assessment survey is presented in the chapters below when discussing the findings of the assessment.

2.2.4. Data Analysis

After entering the data, the analysis was also carried out by two (02) university students who were assisted by the consultant team with the inputs received from the CCBO. The majority of data was processed and presented in tables, charts, graphs, and other pictographs created using MS Excel. In addition, QGIS and Google Earth platforms were used in preparing maps to present data and some analysis. SPSS platform was also used in certain data analysis stages.

Data analysis was carried out focusing on the sectors taken under the assessment, Hence, the data presentation and discussion is also done in separate chapters, as in below. NVivo software was also used in some instances to analyze the qualitative data collection during the assessment. In addition, mapping was carried out focusing on the GMC area and the five (05) waste management zones.

Following chapters (chapter 3, 4, 5, 6, and 7) present the findings of the Waste Assessment supported by the outputs of the data analysis.

Figure 15: Survey Enumerator Training and Awareness At Samoda Reception Hall on 13 November 2022 and15 November 2022

PHOTO: HELP-O

CHAPTER 3
RESIDENTIAL SECTOR

Waste Problems in Galle, Sri Lanka

CHAPTER 03: RESIDENTIAL SECTOR
3.1. Findings of the Residential Sector

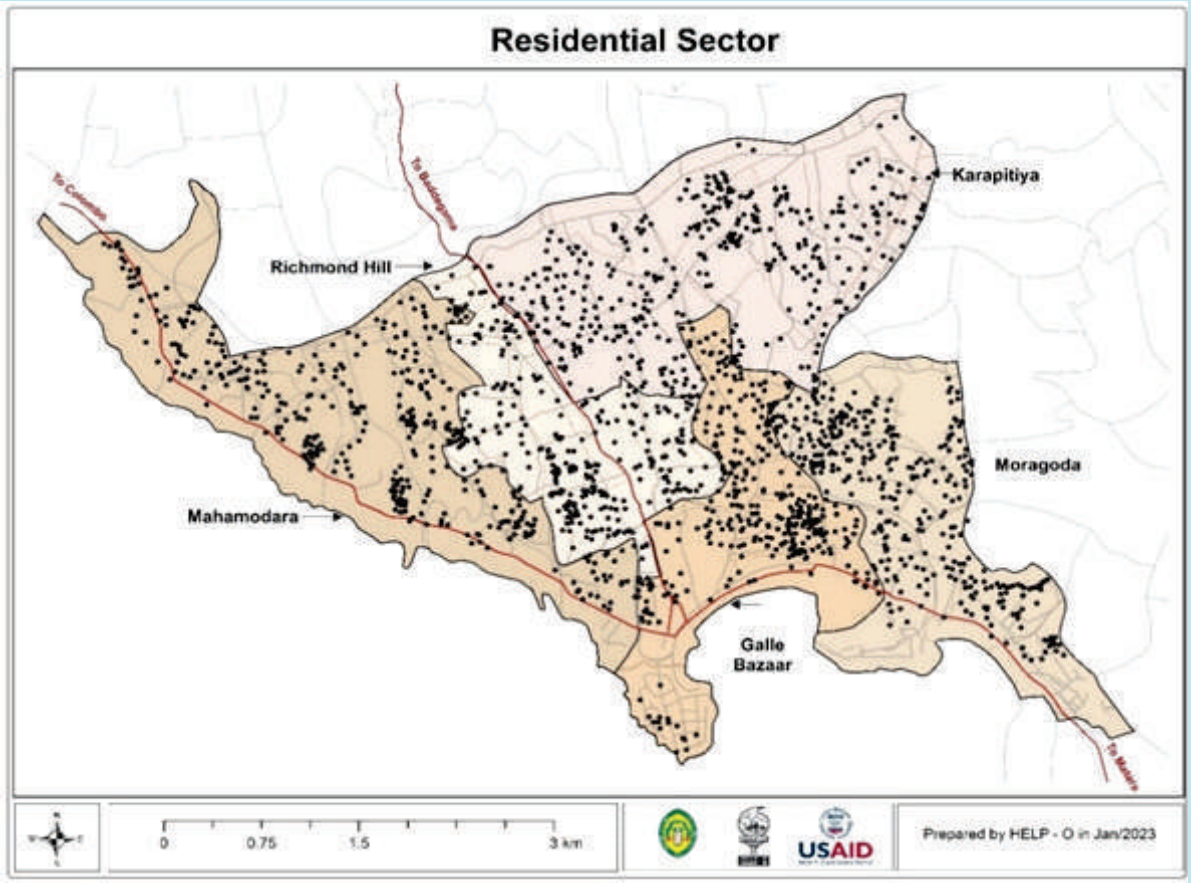
This chapter presents the findings of the city-wide assessment related to the residential sector.

The waste assessment in the residential sector was conducted focusing on data and information with regard to different solid waste management practices of HHs within the GMC area. The assessment was conducted focusing on all categories of HHs, including those in shanty areas and condominiums. The data was collected through questionnaire survey, interviews, and photographic survey.

Figure 16: Assessment survey of the residential sector 01 (Source: HELP-O)

Figure 17: Assessment survey of the residential sector 02 (Source: HELP-O)

Figure 18: Assessment survey of the residential sector 03 (Source: HELP-O)



Map 2: Distribution of the surveyed HHs under the residential sector (Prepared by HELP-O)

3.2. Waste Collection Practices of HHs

Under the residential sector, 1829 households were surveyed. Chart 01 shows the type of households surveyed under the five waste management zones. As per the chart, single and two-sotry houses are the most common types of houses in all WM Zones.

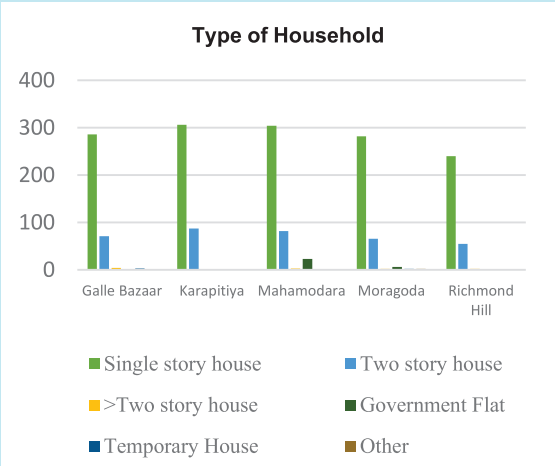


Chart 1: Type of Households

According to the survey data, GMC collects waste only from 81% of HHs in the GMC area (Chart 02).

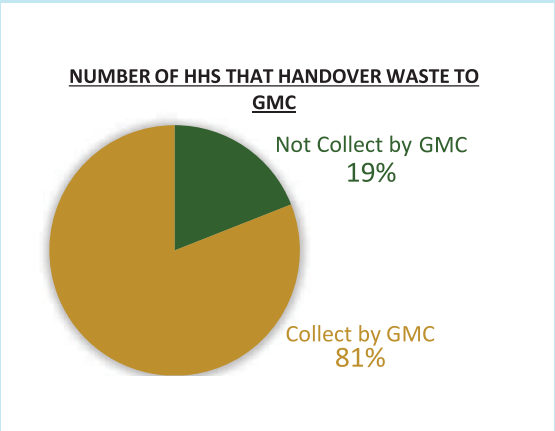


Chart 2: GMC Waste Collection

Figure 19: Assessment survey of the residential sector (Source: HELP-O)

Maps 3 below present the distribution pattern of GMC waste collection. As presented in the chart 3 above, it can be observed that Mahamodara and Moragoda zones have more HHs with no GMC waste collection service.

Chart 03 presents the zonal-wise waste collection by the GMC. As per the chart, the waste collection is highest in Karapitiya zone, whereas the lowest can be seen in the Moragoda zone.

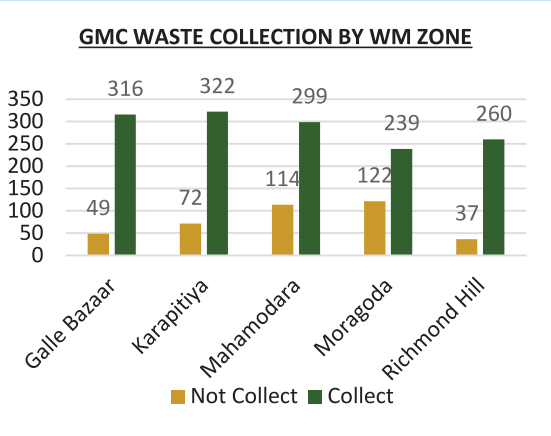
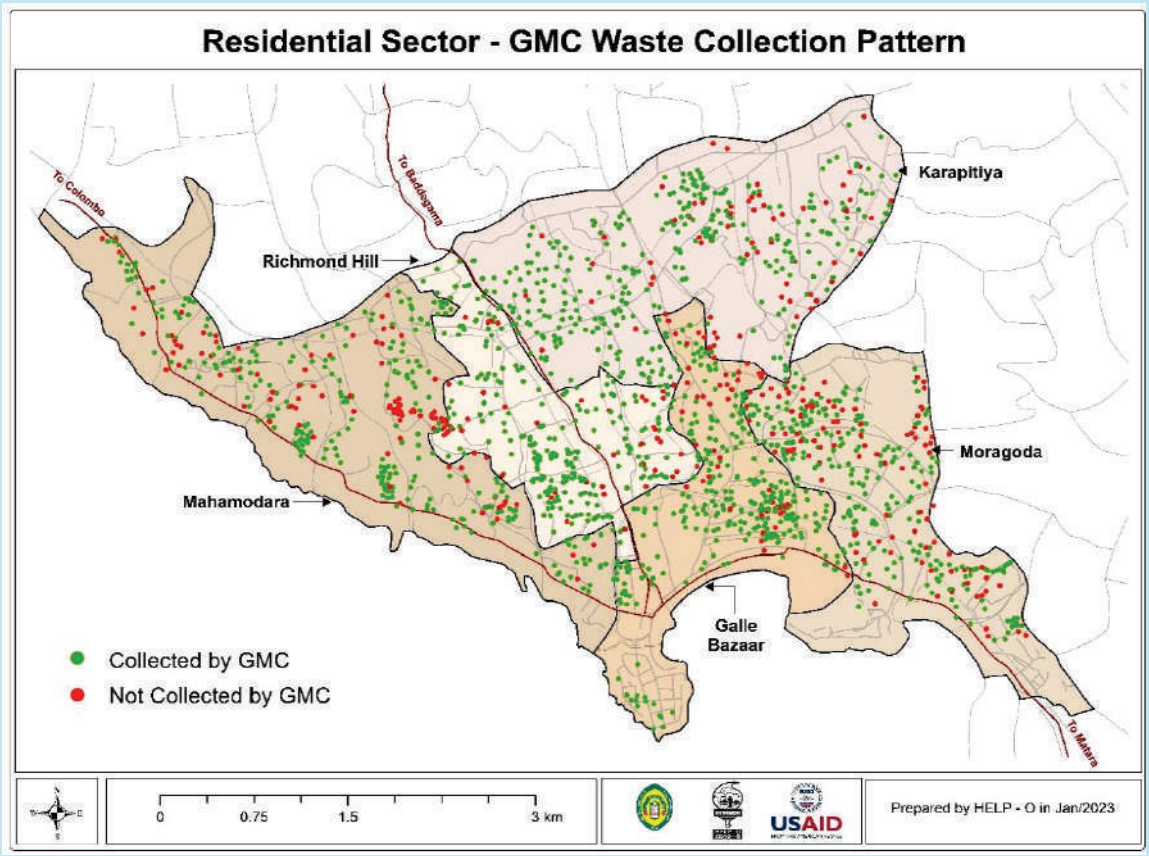


Chart 3: GMC waste collection - housing unit



Map 3:GMC Waste Collection Pattern in Residential Sector (Prepared by HELP-O)

3.3. Status of Waste Segregation

Chart 4 below shows the practice of waste segregation by HHs those that handover their waste to the GMC.

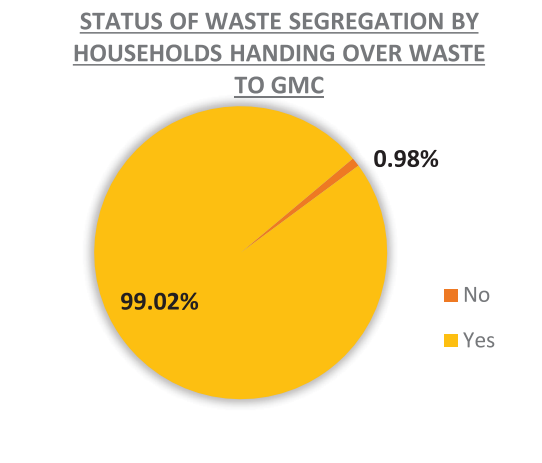


Chart 4: Status of waste segregation by HHs

Chart 5 shows the waste segregation method by HHs. According to the chart, 89.59% of HHs segregate waste into two categories such as degradable and non-degradable waste. 10.41% of HHs segregate waste into more than two categories.

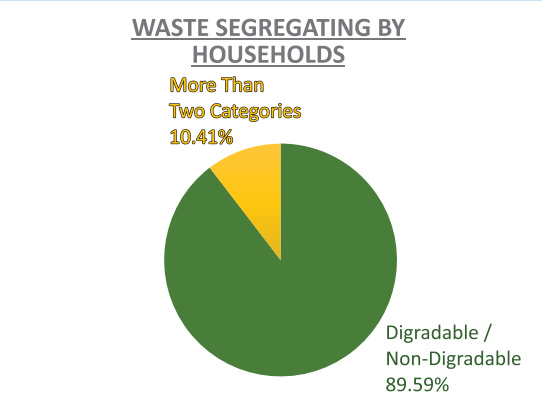


Chart 5: Waste categorization at HH level

Chart 6 shows the types of containers that are used for waste segregation. As per the chart, 56% use some kind of labelling in the bins, whereas the rest of the HHs use regular bins, waste bags, or any other kind of container to segregate waste.

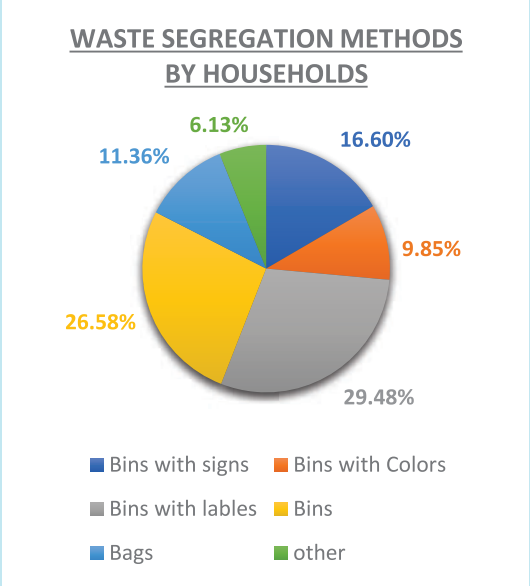


Chart 6: Waste segregation methods by households

Chart 7: Satisfaction of Waste Management Service

The purpose of this analysis was to determine the community satisfaction level according to the current service provided by GMC. Chart 07 shows overall satisfaction with the current waste management service in five zones. Karapitiya zone has the highest satisfaction level while the other four zones are having same satisfaction levels.

Chart 08 shows the overall satisfaction level of the GMC area in waste management service and 83% of the satisfaction level can be identified.

3.4. Problems in Waste Segregation

Chart 8: Overall Satisfaction Level in Waste Management Service

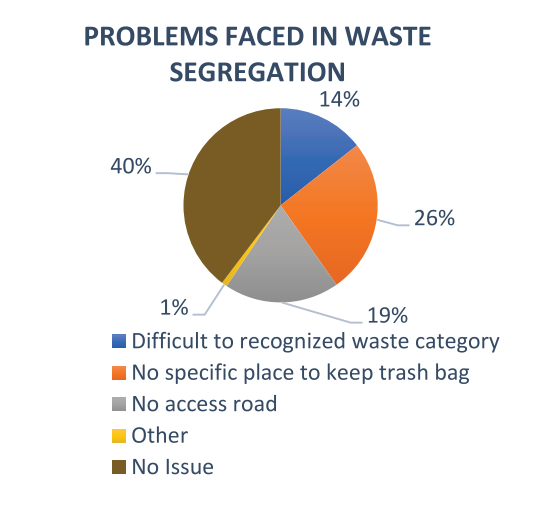
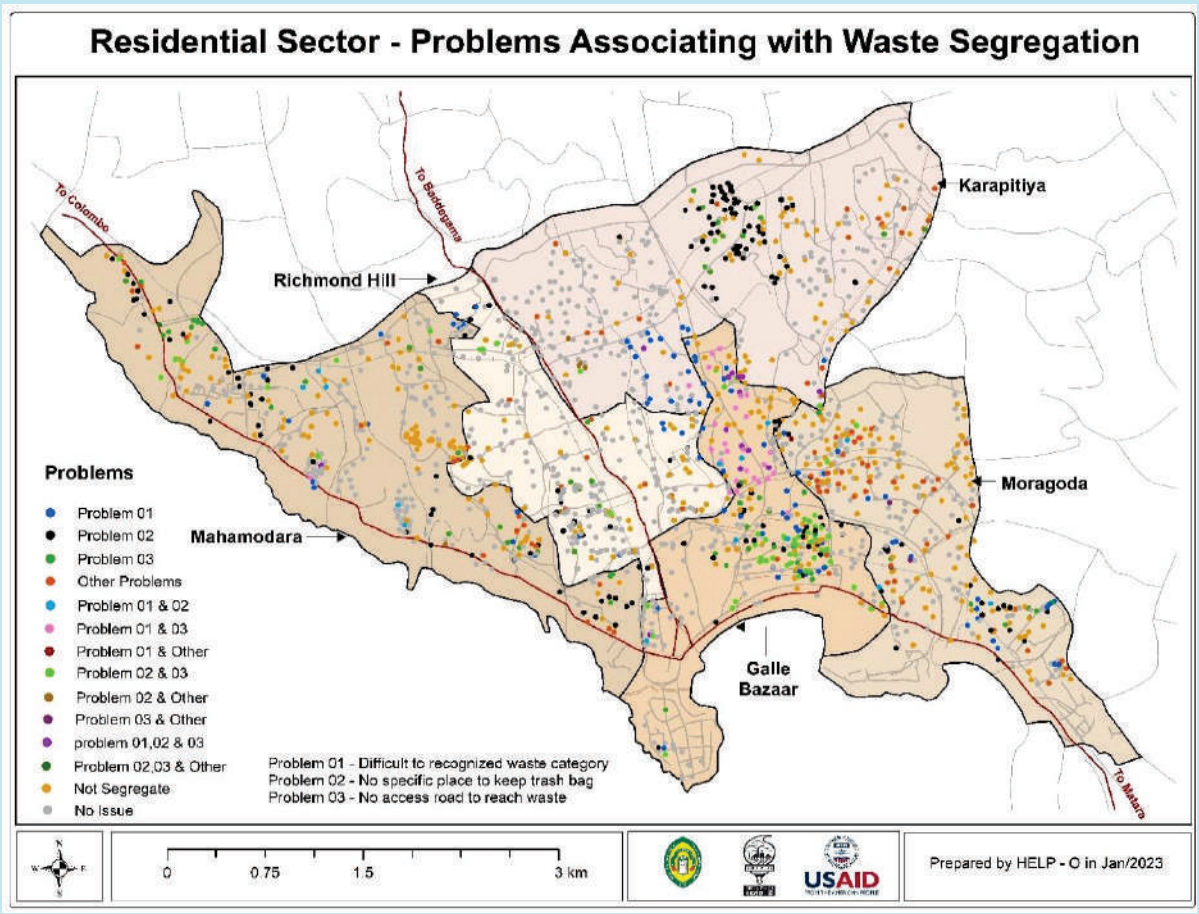


Chart 9: Problems faced in waste segregation

The Chart 9 shows the % of HHs that face problem with regard to waste segregation. 40% of HHs said they do not have a problem with waste segregation. From the rest of HHs with problems in waste segregation, 26% said they do not have a specific place to keep trash bags (mostly in Karapitiya, Mahamodara zones). Moreover, 19% HHs, mostly in Galle Bazar zone, lack of access roads to their areas of residence, leading them to dispose unsegregated waste to common dumping locations. 14% HHs find problems in recognizing different waste categories.

Map 05 shows the spatial distribution pattern of the above problems associated with waste segregation and some HHs are having two or more problems when segregating waste

Figure 20: Photos taken during the assessment survey of the residential sector (Source: HELP-O)



Map 4: Problem associated with waste segregation - residential sector (Prepared by HELP-O)

3.5 Waste Disposal Methods in Households

Degradable waste

As in the Chart 10, the majority of degradable waste (used scraped coconut and rice wastes > 60% and garden waste about 30%) is handed over to the GMC.

The 3R application of degradable waste, such as composting (material recovery), producing biogas (energy recovery) and handing over to third party as animal feed (reuse) is significantly low as 20%, except for the coconut shells. Above 60% of coconut shells is reused at household level as a fuel for cooking as noted by enumerators. Improper disposal of degradable waste is significantly low as below 11%, except for the garden waste. About 44% of garden waste is improperly disposed by burying, burning or dumping in open environment.

Figure 21: Household Compost Bin (Source: HELP-O)

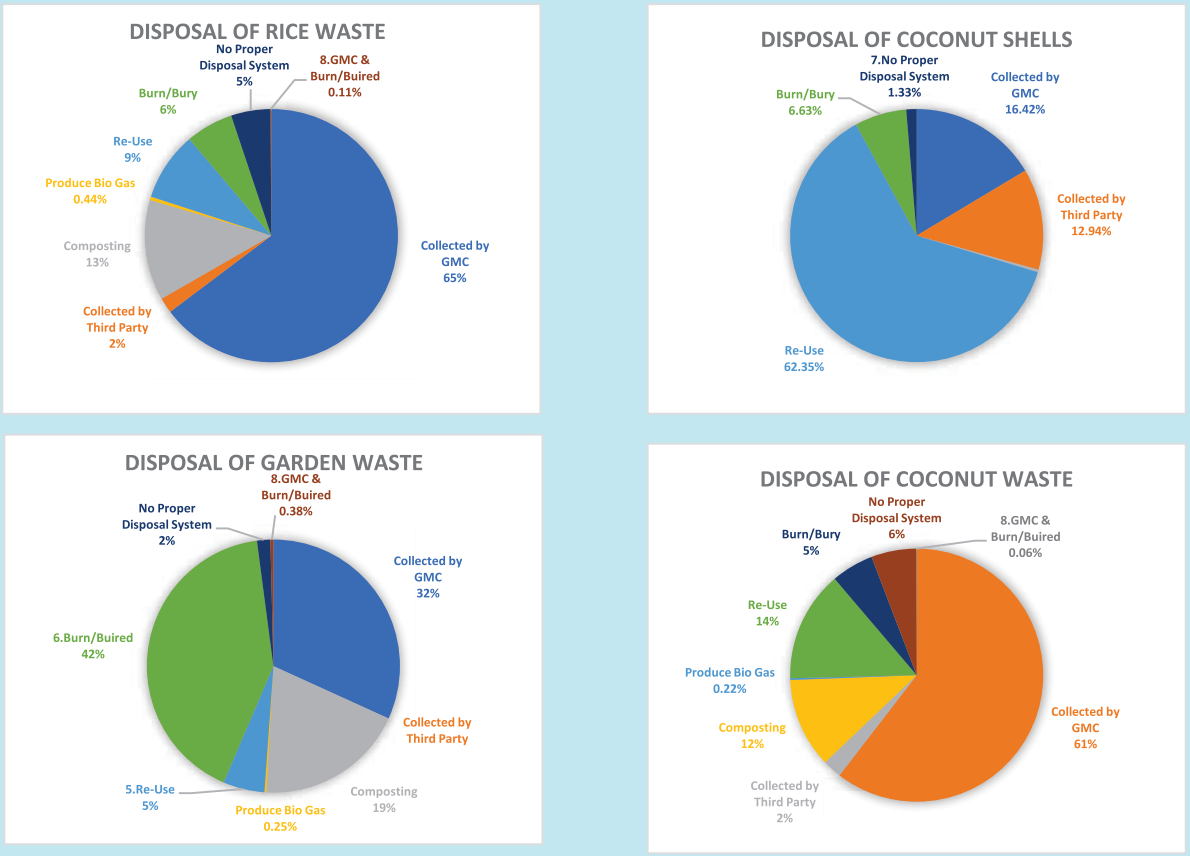


Chart 10: Waste Disposal Methods in Households - Degradable Waste

Non-degradable waste

As per the Chart 11, the majority of waste (plastic & polythene waste > 70% and used paper-cardboard, sanitary wastes & tin-can > 50%) is handed over to the GMC. This indicates low level of 3R application by generators on these categories.

Considerable amount of waste (scraped metal > 70%, glass and tin-can about 30% and used clothes and paper-cardboard about 15%) is handed over to third party collectors. They engage prominently in waste recycling industry.

The 3R application (i.e. reuse) by generators is high only for pottery waste (40%) and used clothes (25%). Absence of a proper disposal system is prominent for pottery and glass wastes.

Figure 22: Assessment survey of the residential sector 04 (Source: HELP-O)

chart 11:Waste Disposal Methods in Households – Non-Degradable

Hazardous waste [2]

As per chart 12 and 11 (for sanitary waste), a low amount of hazardous waste (Styrofoam ~ 30% & others like used chemical containers-drugs ~ 40% and e-waste ~ 25%) is handed over to GMC. Only the e-waste (~ 40%) and Styrofoam (~3%) are handed over to third party collectors. Improper disposal (including burning/ burying) is significant in Styrofoam (~60%), other wastes (40%), e-waste (38%) and sanitary waste (37%).

[2] Main hazardous waste types as per the definition of CEA were covered in the survey.

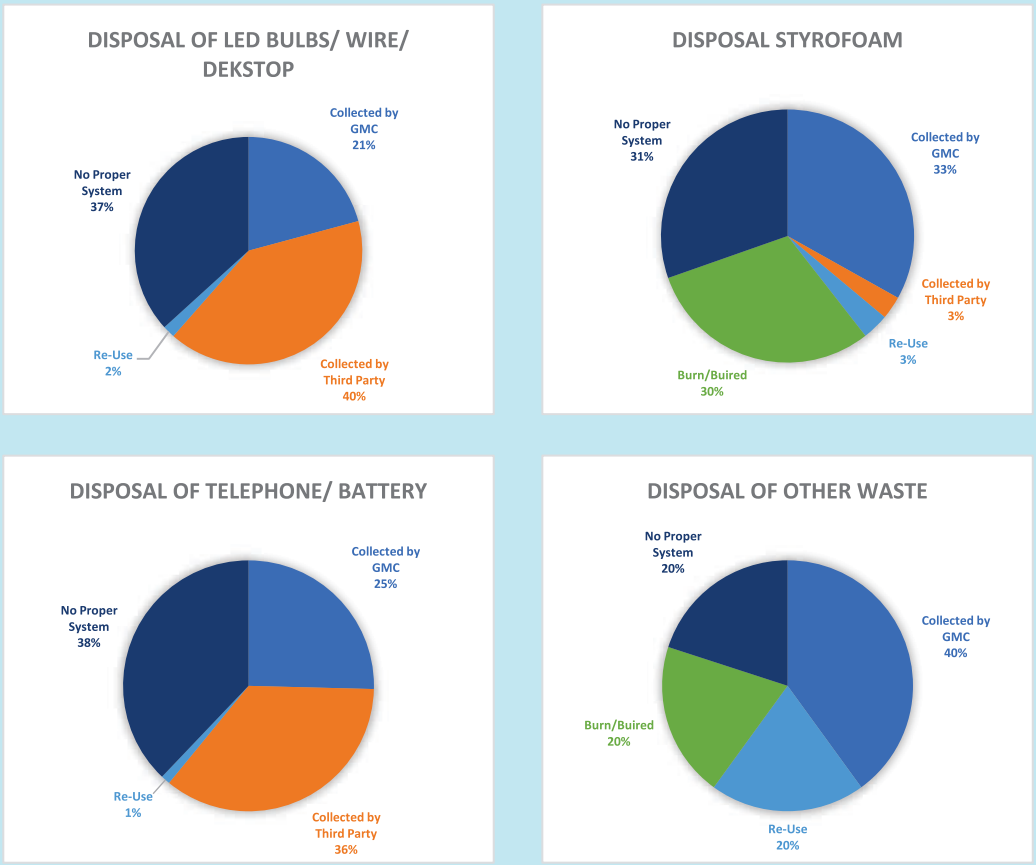


Chart 12: Waste Disposal Methods in Households - Hazardous Waste

3.6 Overall View of Household Waste Management

The Table 07 below illustrates an overview of household waste management practices on a single sheet. This information, which is presented on degradable, non-degradable, and hazardous waste for twenty waste types under these three categories are very useful for decision-making with regard to the SWM in GMC.

According to the Table, the practice of waste management for each waste type by the range of percentage of households can be identified through the color code.

Some of the key findings that could be important to improve the current solid waste management practices are as follows;

Degradable waste: Above 60% of households hand over the Rice and Coconut (scraped) wastes to GMC. Composting of Rice waste is low as 12% and reuse of Coconut waste is only 14%, while producing Biogas is less than 1%. However, the in-house reuse of Coconut shell is above 60%.

Non-degradable waste: Highest percentage of household hand over their Plastic (69%) and Polythene (71%) waste to the GMC while respectively 18% and 23% burn or burry. Similarly, a 60% hand over Sanitary waste (which is Hazardous) to the GMC.

Hazardous waste: As per Table 2, overall, the household tend to have a mix behavior like handing over to GMC or third party or adopting improper practice including burning & burying.

Table 7: Information on household waste management

		Degradable waste					Non - Degradable waste									Hazardous Waste				
		Rice waste	Coconut shell	Coconut waste	Other Food waste	Garden waste	Plastic	Polythene	Sanitary waste	Paper/ Cardboard	Used cloths	Tin/can	Glass	Ceramic waste	Pottery	Metal	LED bulb, wire, desktop	Telephone, battery, hot water flask	Other Hazardous Waste	Styrofoam	Other Waste
Waste disposal method	GMC	64.7%	16.4%	60.5%	40.0%	31.9%	69.4%	71.9%	60.7%	54.7%	25.0%	47.3%	13.1%	15.6%	12.3%	13.5%	18.8%	22.7%	44.4%	33.0%	40.0%
	Third -Party	2.0%	12.9%	2.4%	20.0%	**0.0%**	8.7%	2.4%	2.0%	11.8%	17.2%	26.3%	29.8%	13.8%	4.4%	73.0%	36.8%	31.8%	7.4%	2.9%	**0.0%**
	Compost	12.8%	0.3%	11.5%	20.0%	19.1%	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
	Biogas	0.4%	**0.0%**	0.2%	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
	Re-Use	8.8%	62.4%	14.2%	10.0%	5.3%	1.0%	1.1%	0.2%	3.4%	24.9%	1.5%	1.2%	0.9%	34.1%	1.7%	1.6%	1.1%	**0.0%**	3.4%	20.0%
	Burn/Buried	6.1%	6.6%	5.4%	10.0%	41.6%	18.3%	23.4%	35.4%	28.5%	21.8%	7.7%	6.6%	9.3%	14.3%	1.0%	8.9%	9.7%	18.5%	30.0%	20.0%
	No Proper System	5.0%	1.3%	5.8%	**0.0%**	1.7%	2.4%	1.2%	1.5%	1.4%	11.0%	17.1%	49.3%	60.3%	34.9%	10.9%	33.8%	34.7%	29.6%	30.7%	20.0%
	GMC & Burn/Buried	0.1%	**0.0%**	0.1%	**0.0%**	0.4%	0.2%	0.1%	0.2%	0.2%	0.1%	**0.0%**	**0.0%**	0.2%	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
Collection Frequency	1. Daily	32.2%	47.7%	32.2%	26.7%	37.1%	6.8%	8.3%	3.7%	8.8%	2.7%	1.9%	0.8%	1.5%	1.5%	0.4%	0.7%	0.4%	**0.0%**	1.0%	**0.0%**
	2a. Once a week	23.2%	14.0%	21.0%	33.3%	27.3%		51.3%	32.2%	38.6%	14.7%	22.9%	4.6%	5.0%	3.8%	4.9%	4.6%	5.7%	12.5%	8.0%	5.6%
	2b. Twice a week	41.0%	17.1%	39.7%	6.7%	21.0%	14.7%	16.2%	18.3%	11.6%	4.7%	8.0%	2.0%	2.2%	3.0%	3.1%	3.6%	5.2%	21.9%	7.5%	16.7%
	3a. Once a month	1.4%	10.8%	3.5%	13.3%	8.1%	14.2%	10.2%	30.3%	17.9%	15.0%	19.1%	12.4%	10.4%	17.9%	23.0%	12.3%	14.8%	12.5%	13.4%	5.6%
	3b. Twice a month	0.2%	1.2%	0.3%	**0.0%**	0.8%	1.6%	2.4%	6.6%	2.5%	0.8%	2.3%	1.2%	1.5%	1.7%	0.8%	0.8%	0.8%	**0.0%**	1.0%	**0.0%**
	3c. 3 times a month	**0.0%**	0.3%	0.1%	**0.0%**	0.1%	0.1%	0.2%	0.5%	0.3%	**0.0%**	**0.0%**	0.1%	**0.0%**	0.5%	0.2%	0.2%	0.1%	**0.0%**	0.2%	**0.0%**
	4. Once in three months	0.1%	3.1%	0.6%	**0.0%**	1.6%	7.8%	4.7%	1.4%	10.0%	26.9%	24.8%	35.8%	37.1%	32.0%	36.1%	36.6%	40.6%		36.1%	16.7%
	5. Other	1.9%	6.0%	2.7%	20.0%	4.0%	8.2%	6.7%	6.9%	10.3%	35.1%	20.9%	43.1%	42.3%	39.6%	31.6%	41.2%	32.4%	25.0%	32.7%	55.6%

60< 40-60 20-40 0-20 =0

Conceptual diagram for waste management & segregation in households

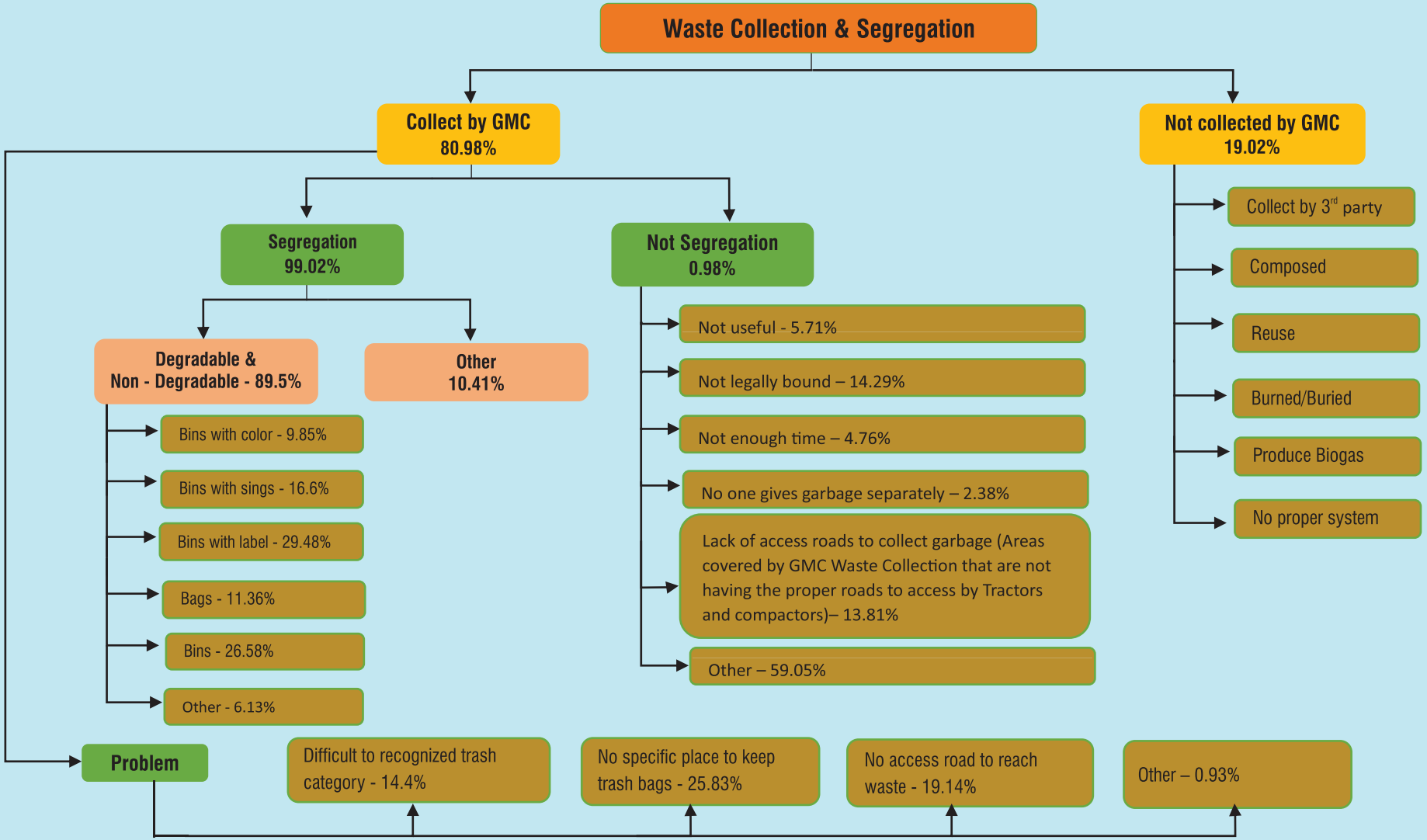


Figure 23: Conceptual diagram for waste management & segregation in households

3.7 Suggestions for improving the in-house waste management practices

The responses by HHs to eight suggestions included in the questionnaire to improve the residential SWM are presented in Table 9 below;

A high number of households respond positively to reducing plastic and polythene and material at home as they have the ability and knowledge for the same. However, the highest number of respondents disagreed to produce biogas as a suggestion for improving their waste management practices due to lack of knowledge and resource available.

Table 8: Suggestion for improve household sector waste management

Suggestion	Agree	Have knowledge	Have ability	Agree & have knowledge	Agree & have the ability	Have knowledge & ability	Agree, have knowledge & ability	Disagree
1. To reduce plastic, polythene, and goods at home	12.02%	2.29%	0.00%	11.75%	0.43%	89.06%	0.59%	0.05%
2. To use alternatives for plastic	12.98%	3.44%	0.00%	14.22%	16.45%	0.25%	21.39%	0.27%
3. To reduce unnecessary disposal and burning	12.67%	6.87%	1.22%	14.85%	5.19%	0.17%	17.86%	1.60%
4. To start segregation	11.52%	10.97%	2.44%	14.92%	7.36%	0.08%	18.32%	1.44%
5. To start reusing and recycling at home	13.39%	13.75%	6.10%	9.85%	29.87%	0.33%	9.36%	4.89%
6. To sell recycling	13.42%	16.20%	12.80%	7.67%	2.60%	0.08%	7.84%	6.41%
7. To produce compost	13.20%	13.42%	22.56%	11.40%	12.12%	2.51%	9.90%	4.38%
8. To produce biogas	10.80%	33.06%	54.88%	15.34%	25.97%	7.52%	14.74%	80.97%

	0
	0-20
	20-40
	40-60
	60-80
	>80

PHOTO: HELP-O

CHAPTER 4
COMMERCIAL SECTOR

Waste Problems in Galle, Sri Lanka

CHAPTER 04: COMMERCIAL SECTOR
4.1 Findings of the commercial sector

This chapter presents the findings of the city-wide assessment related to the commercial sector.

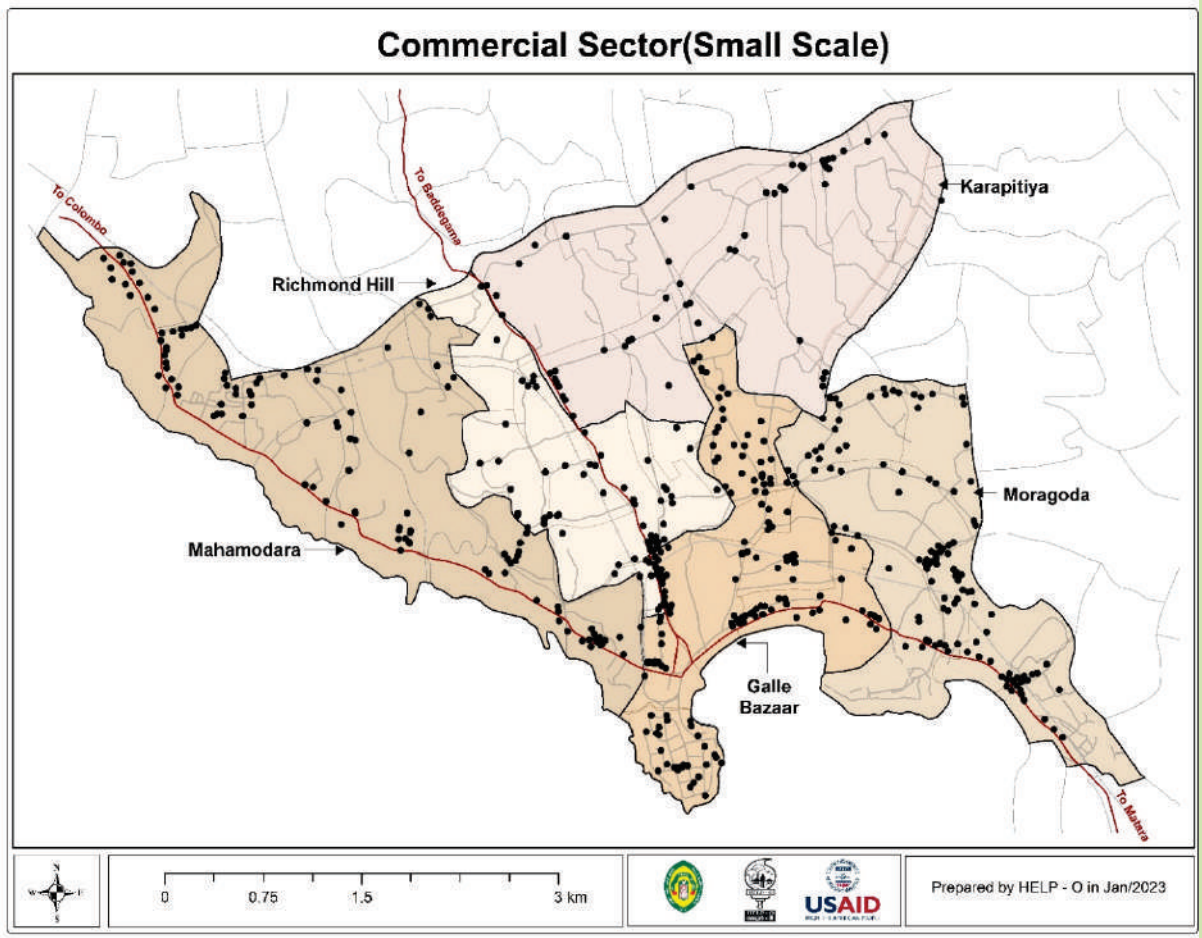
The waste assessment in the commercial sector was conducted focusing on data and information with regard to different solid waste management practices of commercial sector within the GMC area. Commercial sector was divided into two categories as small-scale establishments and large-scale establishments.

The small-scale establishments included grocery and other small stores, small restaurants & hotels and street vendors that are having employees lower than 14. The large-scale establishments included Private sector large-scale commercial establishments that are having employees more than 14 (e.g. Supermarkets, Company outlets, Hotels, Large shops, etc.).

Figure 24:Commercial sector survey (Source: HELP-O)

Figure 25: Commercial sector survey (Source: HELP-O)

Figure 26: Commercial sector survey (Source: HELP-O)



Map 5: Distribution of the surveyed small-scale establishments under the commercial sector (Prepared by HELP-O)

4.1.1 Findings of the small-scale establishments

Type and scale of business

There are ten types of small-scale establishments surveyed. According to the type of small-scale establishments in Chart 13 highest percentage (29%) was recorded in retail and wholesale.

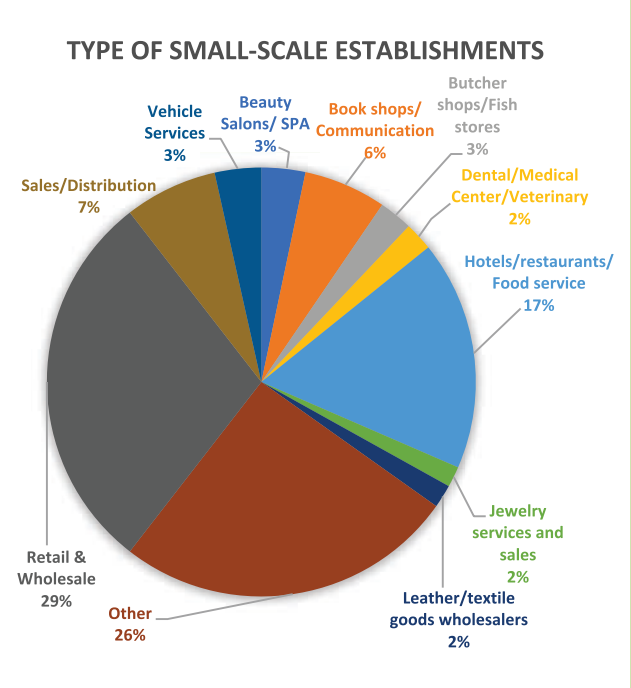


Chart 13: Type of small-scale establishments

Chart 14 shows the number of employees in small-scale establishments and the highest number (52.54%) of establishments are individual establishments. sale.

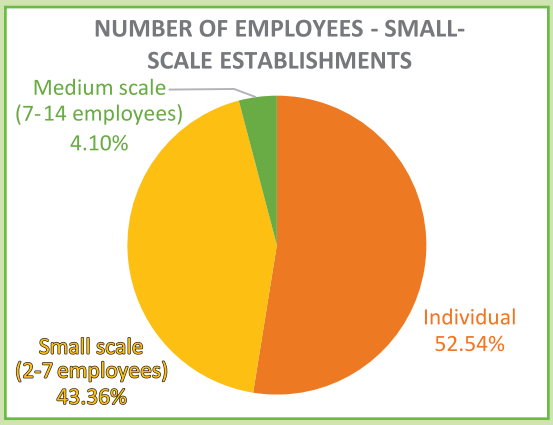


Chart 14: Number of employees in small-scale establishments

4.1.2 Waste Collection Practices

According to the survey data, GMC collects waste only from 84% of small-scale establishments in GMC area. (Chart 15).

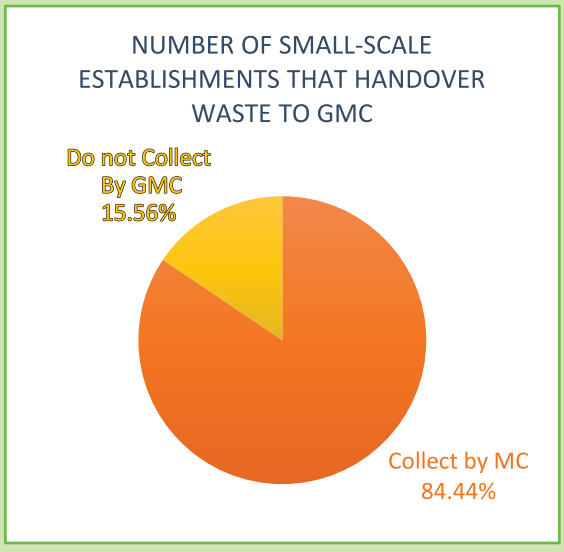


Chart 15: GMC Waste Collection

4.1.3 Status of Waste segregation in small-scale establishments

Chart 16 below shows the practice of waste segregation by small-scale establishments those that handover their waste to the GMC.

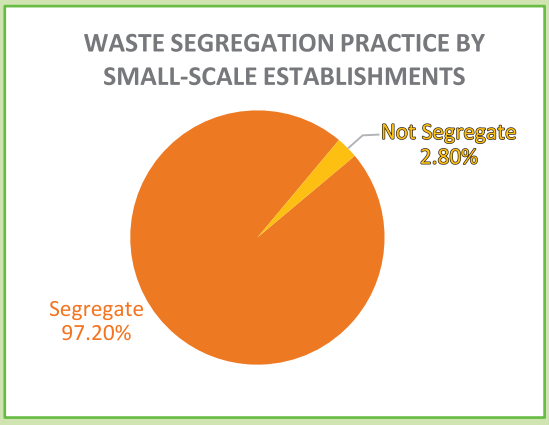


Chart 16: Status of waste segregation by small-scale establishments

Chart 17 shows the waste segregation method by small-scale establishments. According to the chart, 93.30% of small-scale establishments segregate waste into two categories such as degradable and non-degradable waste. 6.70% of small-scale establishments segregate waste into more than two categories.

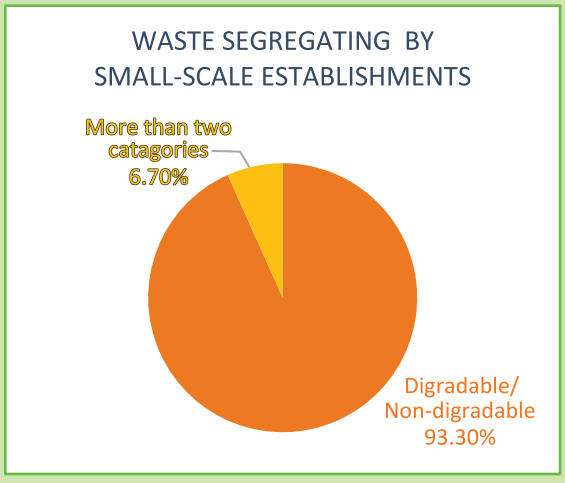
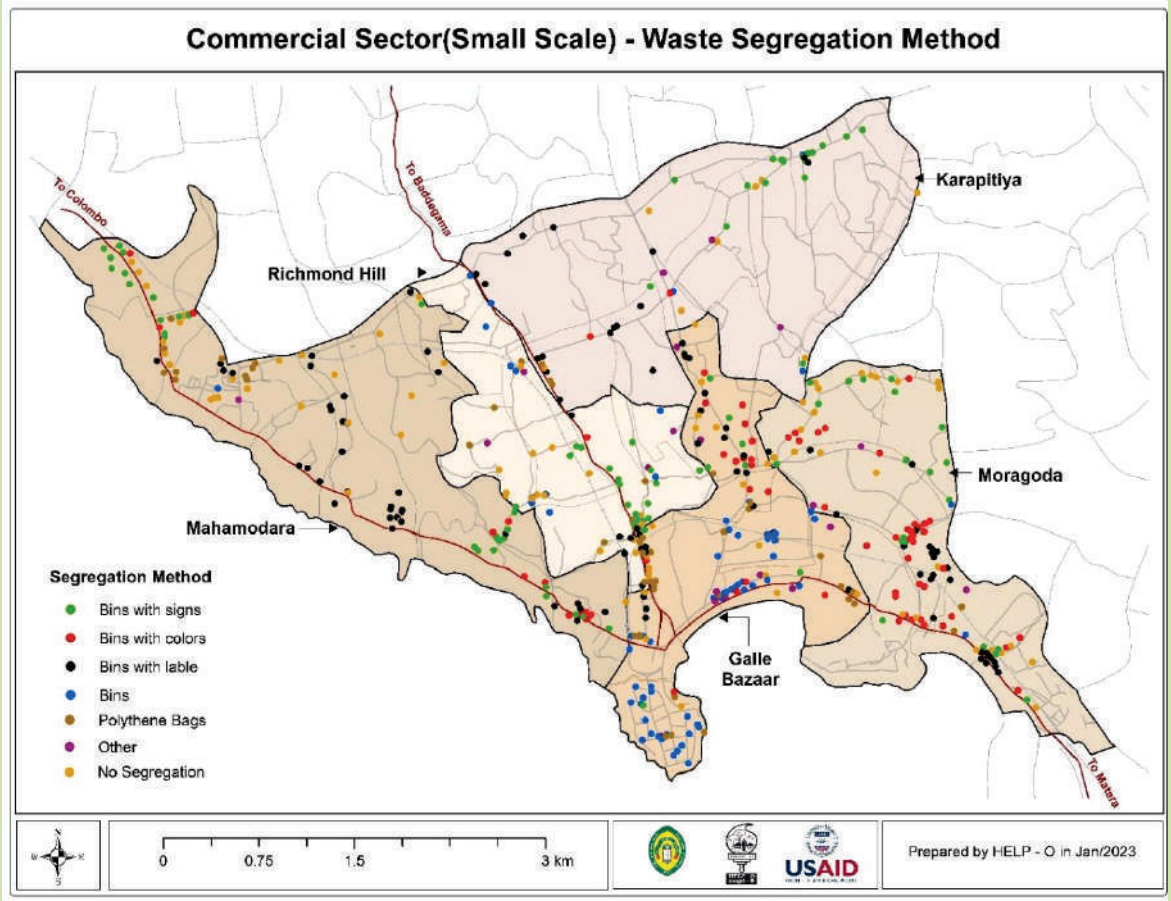


Chart 17: Waste categorization at small-scale establishments



Map 6: Waste segregation methods by small-scale establishments under commercial sector (Prepared by HELP-O)

Chart 18 indicates the types of containers that are used for waste segregation. As per the chart, 67% use some kind of labelling in the bins, whereas the rest of the small-scale establishments use regular bins, waste bags, or any other kind of container to segregate waste.

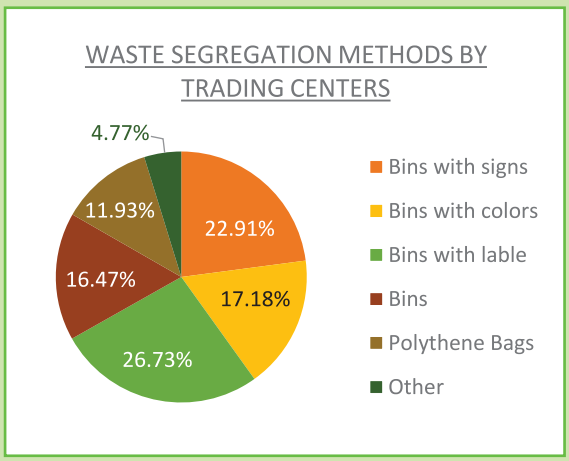
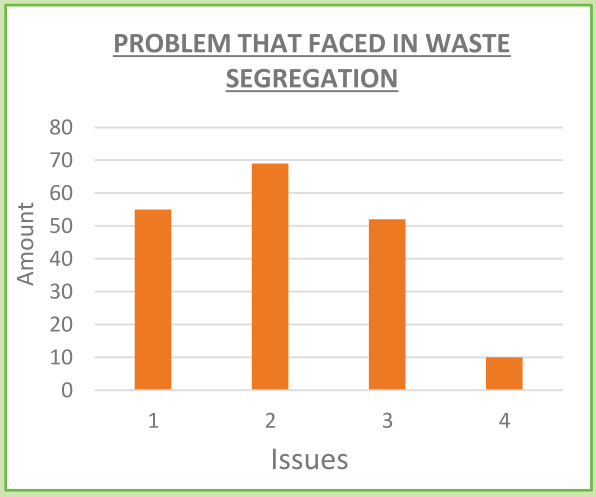


Chart 18: Waste segregation methods **4.1.5**

4.1.4 Problems in Waste Segregation

The chart 19 shows the problems faced in waste segregation. Accordingly, the highest amount responded (37%) having no specific place to keep trash bags.

Figure 27: Photo taken during the commercial sector survey (Source: HELP-O)



Issues
1.Difficult to recognized waste category
2.No specific place to keep trash bag
3.Lack of access roads to collect segregated waste to GMC
4. Other

Chart 19: Problems in waste segregation

4.2 Waste disposal methods in small-scale establishments Degradable waste

(Chart 20): The majority of waste (rice & scraped coconut waste about 85%, other food waste 68%, coconut shells 55% and garden waste 47%) is handed over to the GMC.

Reuse (in house) and recycling (via third party) is notable as coconut shells (39%), other food waste (20%), garden waste (19%) and rice waste (8.4%).

Improper practice are significant in garden waste (burning-34%) and less than 12% in all other waste types.

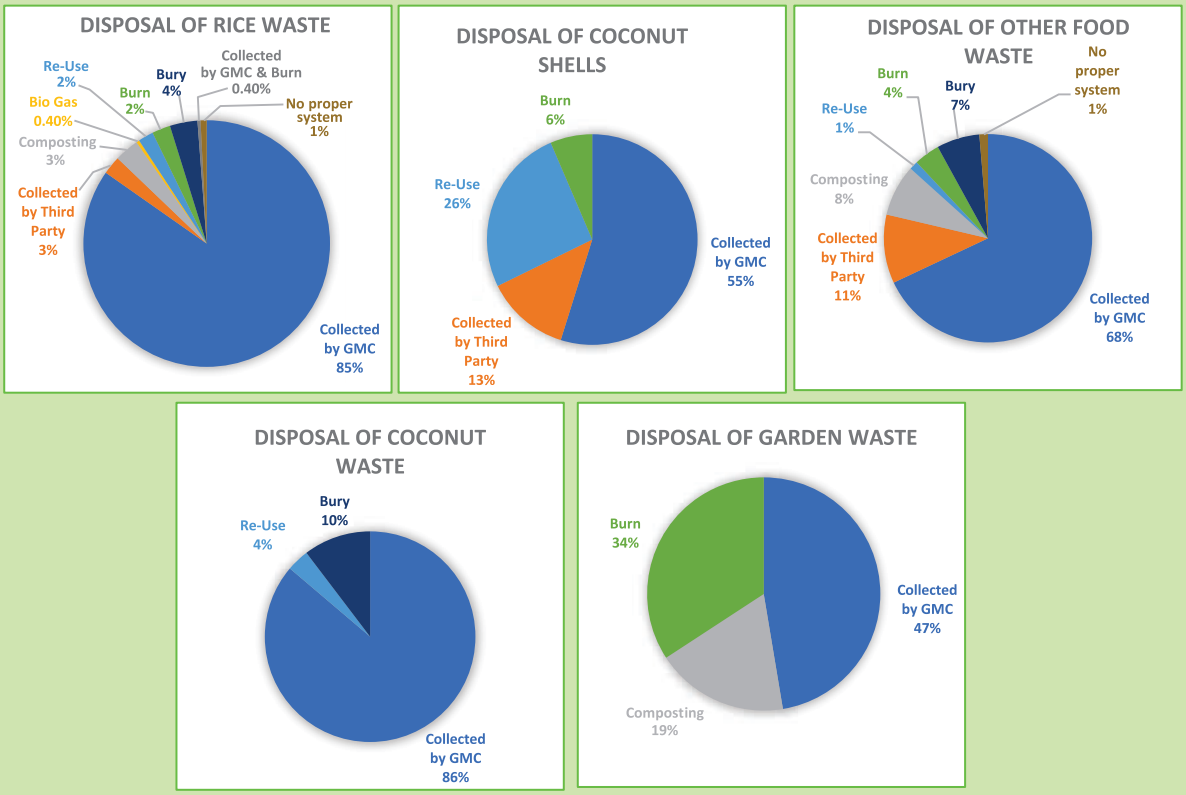


Chart 20: Degradable Waste disposal methods of small-scale establishments

Non-degradable waste

As per chart 21, a significant amount of waste (plastic & polythene > 79%, paper-cardboard 64%, glass waste & used clothes ~ 40% and pottery waste 28%) is handed over to GMC.

Application of 3R practices (in-house reuse & mainly via third party recyclers) is high in tin- can (91%), metal (78%) and low in glass waste (28%), paper-cardboard waste (24%), used clothes (20%) and plastic & polythene (~5%).

Improper disposal practices are notable in ceramic waste (dumping, burying-59%), used clothes (burning, burying-40%), glass waste (burning, burying-27%) and plastic & polythene (burning, dumping-13%).

Chart 21: Non-Degradable Waste disposal methods of small-scale establishments

Hazardous waste

As per chart 22 (and 21 for sanitary waste), A notable amount of waste (Styrofoam waste 50%, LED bulb-wires-desktop 40% and other waste like used containers-drugs 31%) is handed over to GMC.

Application of 3R practices of waste mainly through third-party recyclers is significant on telephone-used batteries (63%), LED bulb-wires-desktop (50% with 10% in-house reuse) and other waste like used containers-drugs (36%).

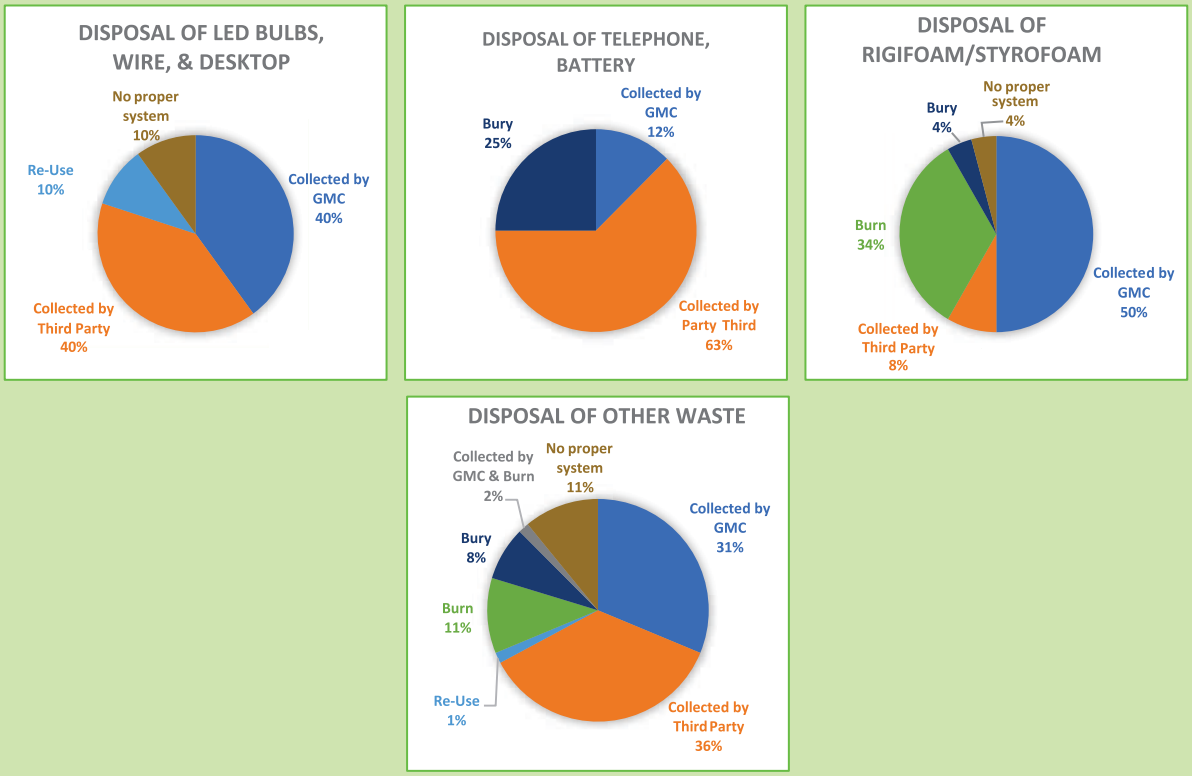


Chart 22: Hazardous Waste disposal methods of small-scale establishments

4.3 Overall view of small-scale establishments waste management

The table 10 illustrates the overview of small-scale establishment waste generation and management under 3 waste categories as degradable, non-degradable, hazardous waste, and the source of waste generation for twenty waste types.

Accordingly, more than 50% of waste is generated through the commercial operations of the establishments. Concerning about the waste disposal methods of all waste categories, the GMC collection is the prominent. Absence of proper disposal system for ceramic waste, burning of Styrofoam, used clothes and garden waste are also other important findings.

Figure 28: Commercial sector survey (Source: HELP-O)

Table 9: Overall status on small-scale trading sector waste management

		Degradable Waste					Non-Degradable waste										Hazardous Waste				
		Rice Waste	Coconut shells	Coconut waste	Other Food Waste	Garden Waste	Plastic	Polythene	Sanitary Waste	Paper/Cardboard	Used Clothes	Tin/Can	Glass	Ceramic	Pottery	Metal	LED bulb, wire, desktop	Telephone, battery, hot water flask	Styrofoam	Other Hazardous Waste	Other Waste 1
Way of waste generation	1. By the institution	30%	57%	54%	51%	64%	55%	55%	40%	59%	66%	62%	51%	68%	79%	**85%**	85%	**100%**	75%	**85%**	18%
	2. By the workers	36%	3%	4%	14%	3%	4%	10%	27%	9%	16%	7%	11%	11%	7%	**0%**	**0%**	**0%**	**0%**	8%	68%
	3. By the institution and the workers	34%	40%	43%	35%	33%	41%	34%	33%	33%	19%	31%	38%	21%	14%	15%	15%	**0%**	25%	8%	15%
Waste Disposal Methods	1. GMC	**85%**	53%	**86%**	68%	47%	77%	**82%**	**86%**	64%	40%	2%	45%	24%	29%	15%	40%	13%	50%	36%	31%
	2. Third Party	2%	13%	**0%**	11%	**0%**	7%	4%		21%	10%	**91%**	20%	12%	7%	74%	40%	63%	8%	36%	36%
	3. Compost	3%		**0%**	8%	18%	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**
	4. Bio Gas	0%	3%	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	7%	**0%**
	5. Re-Use	2%	25%	3%	1%	**0%**	1%		**0%**	3%	10%	**0%**	8%	6%	7%	4%	10%	**0%**	**0%**	**0%**	2%
	6. Burn	2%	6%	**0%**	4%	34%	11%	12%	7%	12%	37%	**0%**	**0%**	**0%**	**0%**	**0%**	3%	**0%**	33%	7%	11%
	7. Buried	4%	**0%**	10%	7%	**0%**	**0%**	0%	7%	1%	3%	5%	11%	18%	29%	7%	**0%**	25%	4%	7%	8%
	8. Disposed to water bodies	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**
	9. GMC & Burn	0%	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**		**0%**	14%	**0%**	3%	**0%**	**0%**	**0%**	2%
	10.No proper system	1%	**0%**	**0%**	1%	**0%**	4%	1%	**0%**	1%	**0%**	2%	15%	41%	14%	**0%**	3%	**0%**	4%	7%	11%

80-100
60-80
40-60
20-40
0-20
0

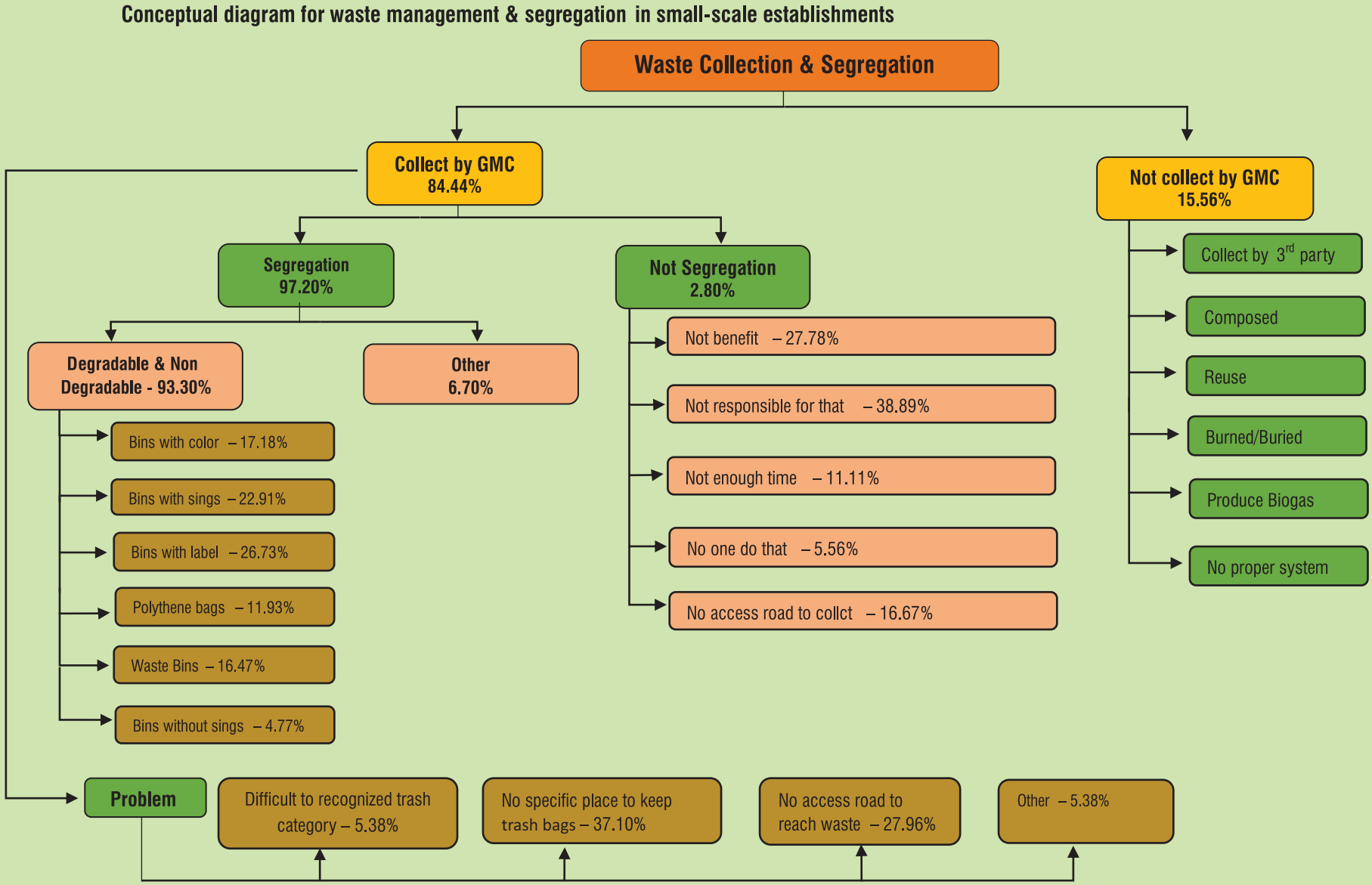


Figure 29: Conceptual diagram for waste management & segregation in small-scale establishments

4.4 Findings of Commercial Sector; large-scale establishments

Type and scale of business

Nine types of large-scale establishments were surveyed. As per chart 23, highest percentage (34%) record by hotels, restaurants, and food preparation sub-sector in large-scale establishments. As per chart 24, 78.57 % of large-scale establishments are having employees from 15 to 34.

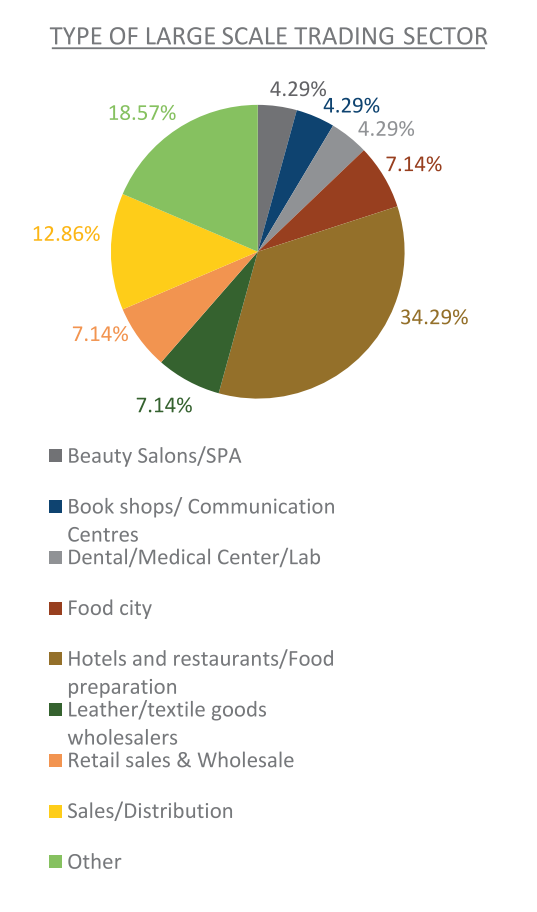


Chart 23:Type large scale trading sector

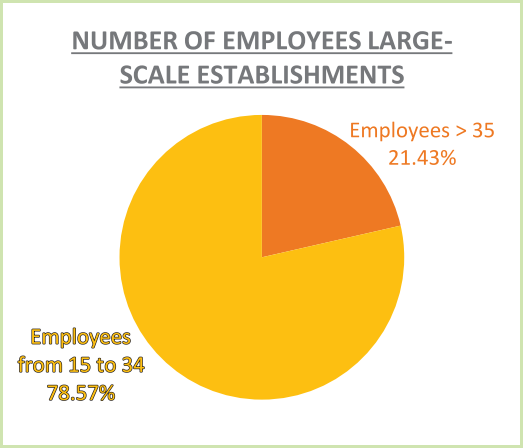


Chart 24: Number of employees large-scale >35 and Employees from 15 to 34 establishments

4.4.1 Waste collection practices of large-scale establishments

As per Chart 25, GMC collects waste from 81% of large-scale establishments.

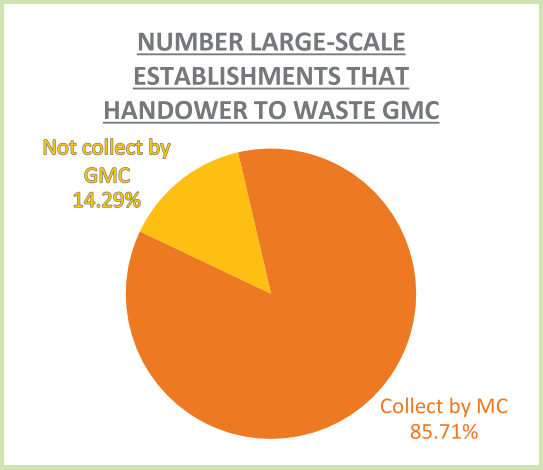


Chart 25: GMC Waste Collection in large-scale establishments

4.4.2 Status of Waste Segregation in large-scale establishments

Chart 26 shows the practice of waste segregation by large-scale establishments that handover their waste to the GMC. A 98.36% segregates their waste.

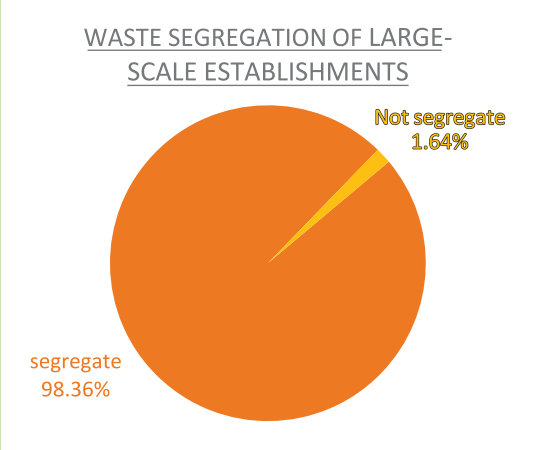


Chart 26: Status of waste segregation by large-scale establishments

As per chart 27, 68.33% of large-scale establishments segregate waste into two categories such as degradable and non-degradable and 31.67% segregate waste into more than two categories.

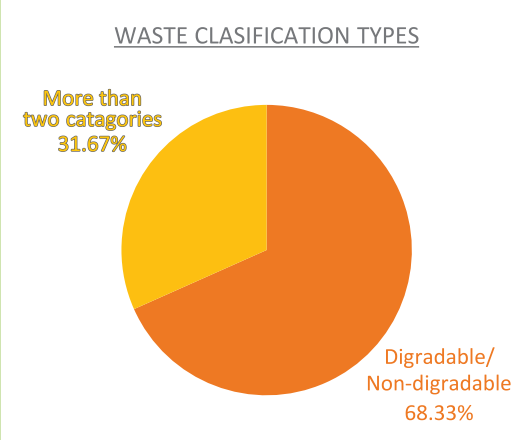


Chart 27: waste classification types

As per chart 28.67% use some kind of labelling in the bins, whereas the rest of the large-scale establishments use regular bins, waste bags, or any other kind of container to segregate waste.

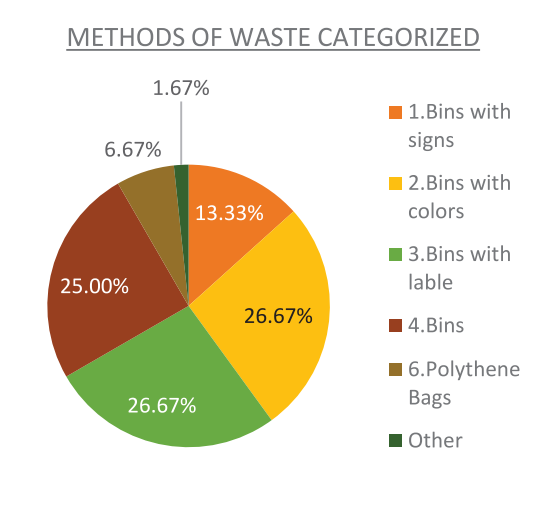


Chart 28: Methods of Waste Categorized

4.4.3 Problems in waste segregation

The chart 29 below show problems faced in waste segregation. According to that, the highest amount (19) responses as absence of specific place to keep trash bags as the key problem.

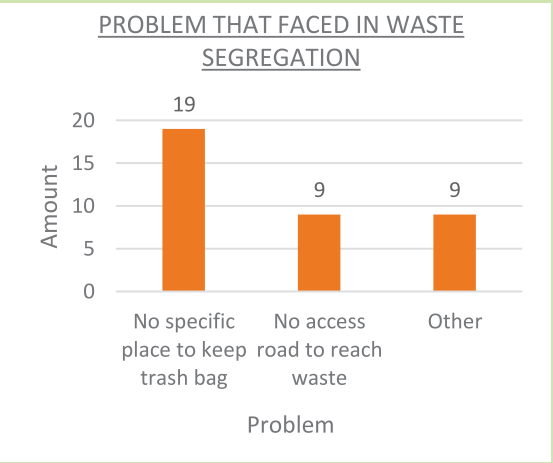


Chart 29: Problem faced in waste segregation

4.5 Waste disposal methods in large-scale establishments

Degradable waste

As per chart 30, the majority of waste (other food waste 91%, rice waste 76%, coconut shells & scraped coconut ~60% and garden waste 50%) is handed over to the GMC.

Application of 3R practice is notable on garden waste (composting, reuse-50%), coconut shells (reuse, third party recyclers-40%), scraped coconut waste (composting, biogas making 38%) and rice waste (composting, biogas making, third party recyclers-18%). Improper disposal practices are insignificant.

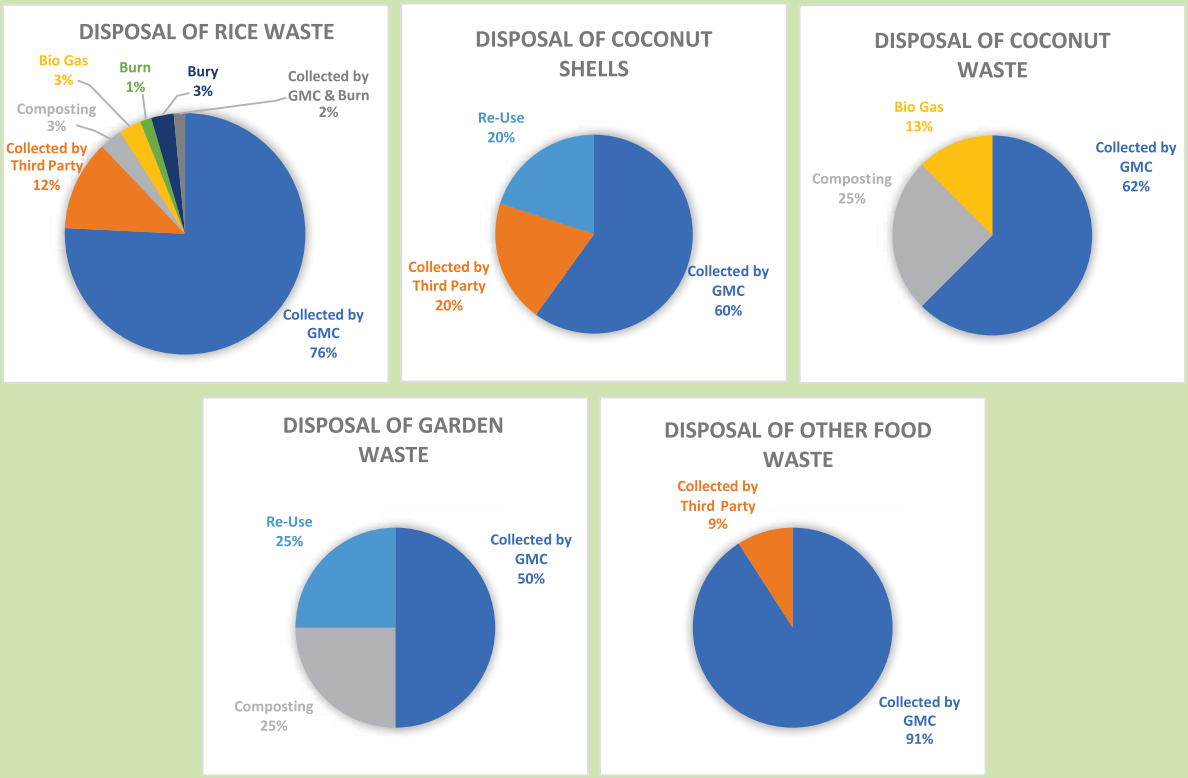


Chart 30: Degradable Waste disposal methods of large-scale establishments

Nondegradable waste

As per chart 31, a significant amount of waste (plastic, polythene & paper-cardboard > 67%, used clothes 50%, tin-can 46% and glass & and pottery waste ~25%) is handed over to GMC.

Application of 3R practices (in-house reuse & mainly by third party recyclers) is notable on ceramic & metal waste (50%), tin-cane (36%), glass waste (28%), paper-cardboard waste, used clothes & plastic waste (~25%) and polythene (19%).

Improper disposal practices are high on pottery waste (dumping-100%), scrap metal (dumping-50%), glass (dumping, burying-44%) and low on ceramic (dumping-25%) and tin-cane (dumping-18%).

Chart 31: Non-Degradable Waste disposal methods of large-scale establishments

Hazardous waste

As per chart 32 (and 31 for sanitary waste) a significant amount of waste (sanitary waste 100%, Styrofoam waste 80%, other waste like used containers-drugs 40% and LED bulb-wires-desktop 18%) is handed over to GMC.

Application of 3R practices of waste by in-house reuse is noted on telephone-used battery waste category (50%) and by third party recyclers is noted on LED bulb-wires-desktop waste (46%), other waste like used containers-drugs (40%) and Styrofoam waste (20%).

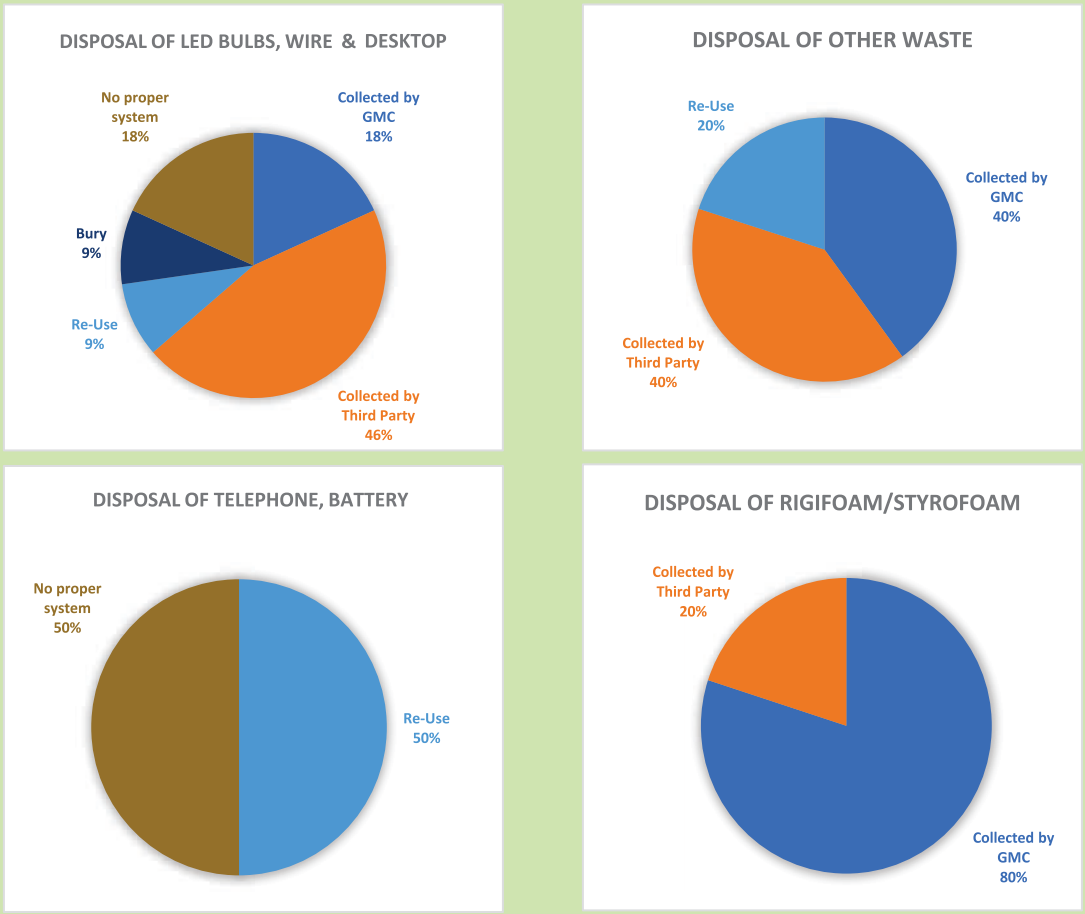


Chart 32: Hazardous Waste disposal methods of large-scale establishments

4.6 Overall view of large-scale establishments waste management

Table 12 illustrates the information on waste generation and management of large-scale establishments under the degradable, non-degradable, hazardous waste categories for twenty waste types.

As per table 12, garden, sanitary and metal wastes are generated by the commercial operations of establishments and a high amount of food waste is generated by its work force.

Concerning the waste disposal methods in all waste categories majority of waste types are handover to the GMC. Ceramic, metal and other hazardous waste (i.e. used containers, drugs) are prominently handed over to the third-party collectors. Absence of proper disposal method for pottery, metal, telephone-desktop like hazardous waste and glass waste is also observed.

Table 10: Overall status on waste management in large-scale establishments

		Degradable Waste					Non-Degradable waste									Hazardous Waste				
	80<	Rice Waste	Coconut shells	Coconut waste	Other Food Waste	Garden Waste	Plastic	Polythene	Sanitary Waste	Paper/Cardboard	Used Clothes	Tin/Can	Glass	Ceramic	Pottery	Metal	LED bulb, wire, desktop	Telephone, battery, hot water flask	Rigifoam Styrofoam	Other Hazardous Waste	Other Waste 1
	60-80																				
	40-60																				
	20-40																				
	0-20																				
	=0																				
Way of waste generation	By the institution	5%	14%	13%	25%	50%	31%	22%	50%	22%	20%	50%	23%	33%	100%	50%	54%	0%	33%	83%	90%
	By the workers	43%	43%	50%	33%	0%	10%	15%	0%	14%	20%	0%	23%	33%	0%	0%	0%	0%	67%	17%	10%
	The institution and the workers	52%	43%	38%	42%	50%	59%	63%	50%	63%	60%	50%	55%	33%	0%	50%	46%	100%	0%	0%	0%
Waste Disposal Methods	1. GMC	76%	60%	63%	91%	50%	70%	76%	100%	67%	50%	42%	26%	25%	0%	0%	18%	0%	80%	0%	40%
	2. Third Party	12%	20%	0%	9%	0%	23%	16%	0%	23%	25%	33%	26%	50%	0%	50%	45%	0%	20%	100%	40%
	3. Compost	3%	0%	25%	0%	25%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	4. Bio Gas	3%	0%	13%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	5. Re-Use	0%	20%	0%	0%	25%	3%	3%	0%	3%	0%	0%	0%	0%	0%	0%	9%	50%	0%	0%	20%
	6. Burn	2%	0%	0%	0%	0%	3%	3%	0%	3%	25%	8%	5%	0%	0%	0%	0%		0%	0%	
	7. Buried	3%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	5%	0%	0%	0%	9%	0%	0%	0%	0%
	8. Disposed to water bodies	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	9. GMC & Burn	2%	0%	0%	0%	0%	3%	1%	0%	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	10.No proper system	0%	0%	0%	0%	0%	0%	0%	0%	2%	0%	17%	37%	25%	100%	50%	18%	50%	0%	0%	0%

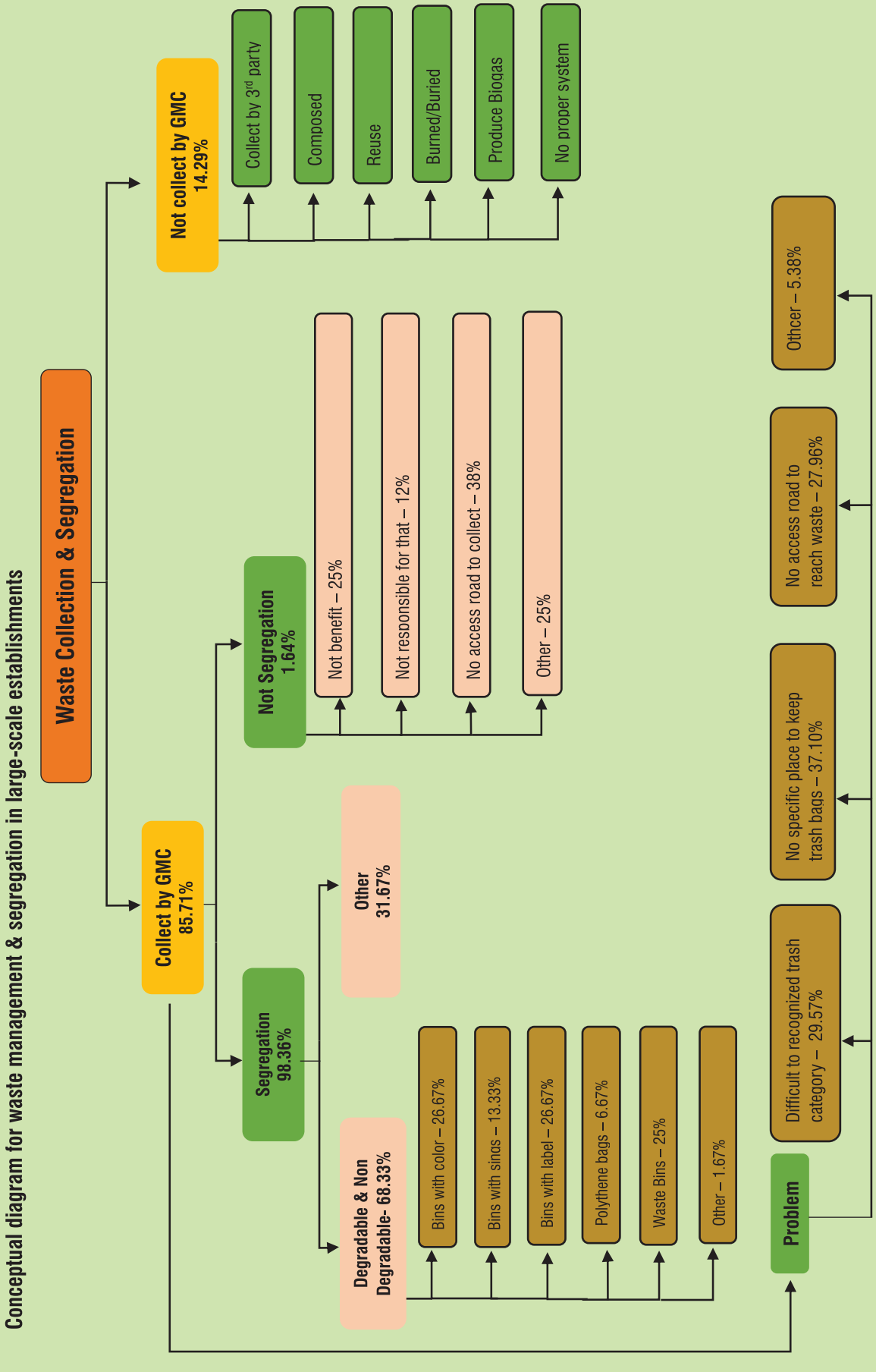


Figure 30: Conceptual diagram for waste management & segregation in large-scale establishments

PHOTO: HELP-O

CHAPTER 5
INDUSTRIAL SECTOR

Waste Problems in Galle, Sri Lanka

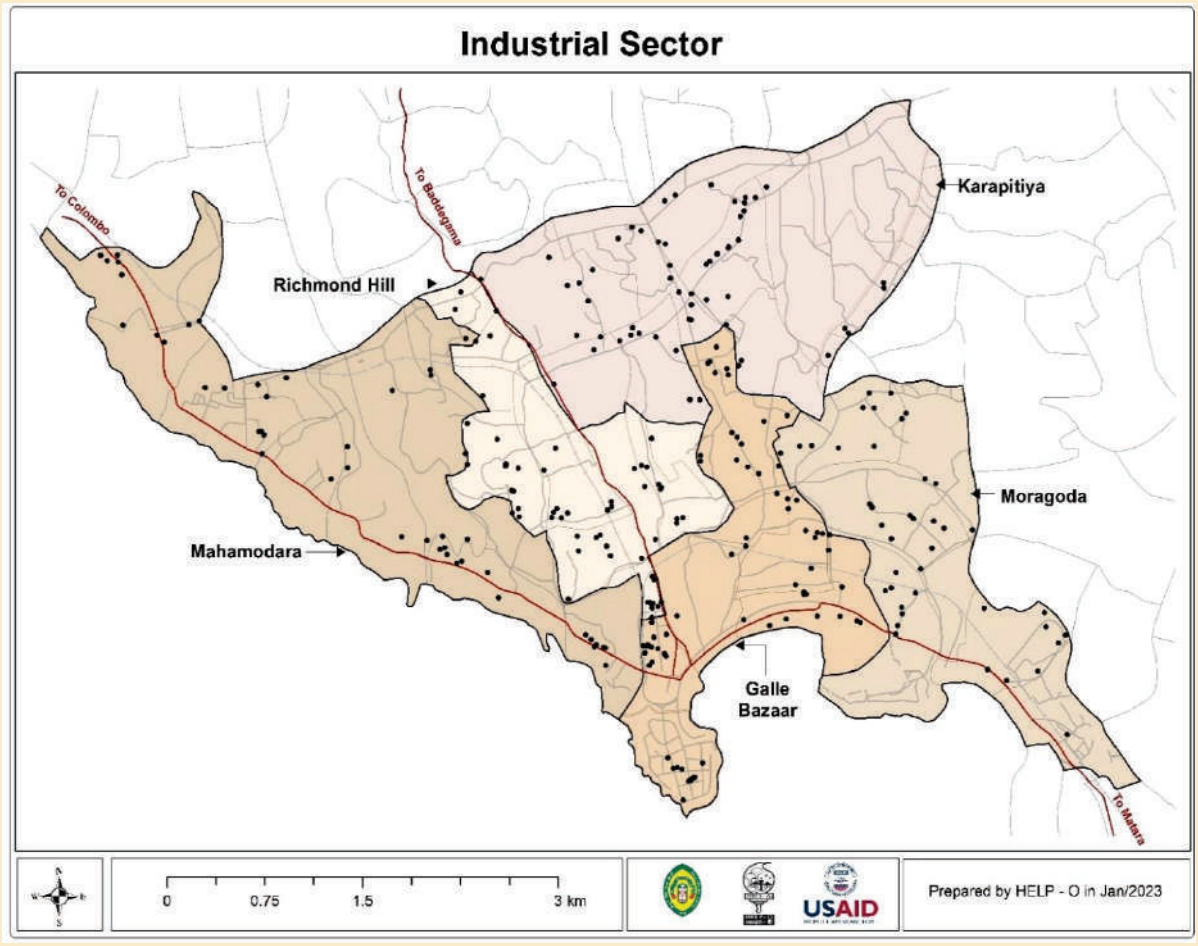
CHAPTER 05: INDUSTRIAL SECTOR
5.1 Findings of the industrial Sector

This chapter presents the findings of the city-wide assessment related to the industrial sector.

The waste assessment in the industrial sector was conducted focusing on data and information with regard to different solid waste management practices of industries within the GMC area. The assessment covered all categories of industries under 8 sectors as food, animal husbandry, wood & wood crafting, jewelry manufacturing, concrete, textile/ clothing and other (like shoe manufacturing and handicraft etc.). The data was collected through questionnaire survey, interviews, and photographic survey.

Figure 31: Industrial sector survey (Source: HELP-O)

Figure 32: Photos taken during the Industrial sector survey (Source: HELP-O)



Map 7: Distribution of the surveyed units of industrial sector (Prepared by HELP-O)

Type and scale of the industries

As per charts 33, out of the 8 types of industries, the highest percentage records from clothing and textile industries. A 80% of industries fall under the large or medium scale in terms of the number of employees.

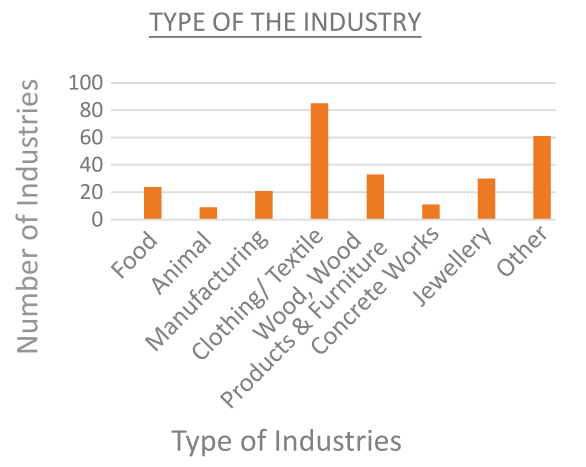


Chart 33: Types of the industries

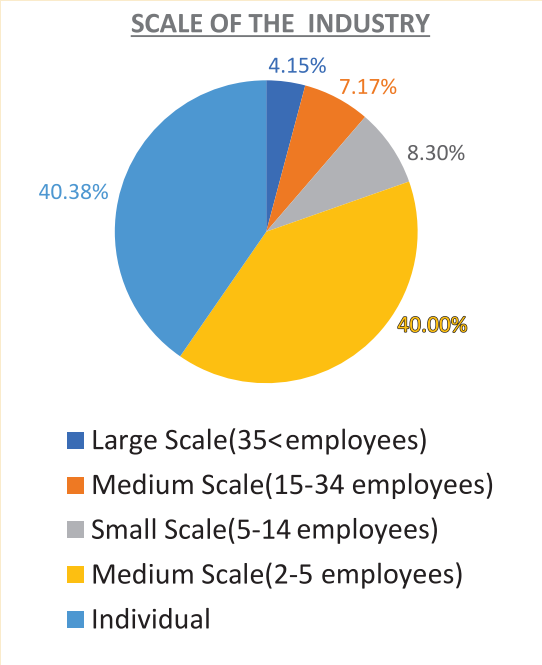


Chart 34: Scale of the industries

5.1.1 Availability of waste management policy in the industries

As per chart 35, a 82% of industries have responded as they have their own waste management policy.

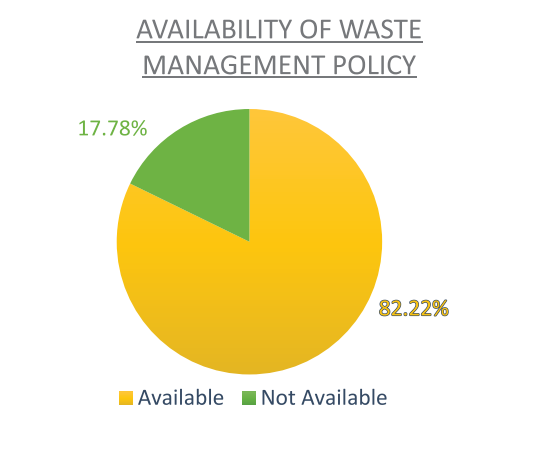


Chart 35: Availability of waste management policy

5.1.2 Waste Collection Practices of industries

As per chart 36, a 64.10% of waste from industries is handed over to the GMC.

Chart 36: Waste Disposal Practices of industries

5.1.3 Status of Waste Segregation in industries

Chart 37 indicates 98.26% of industries that handover their waste to the GMC, practice waste segregation.

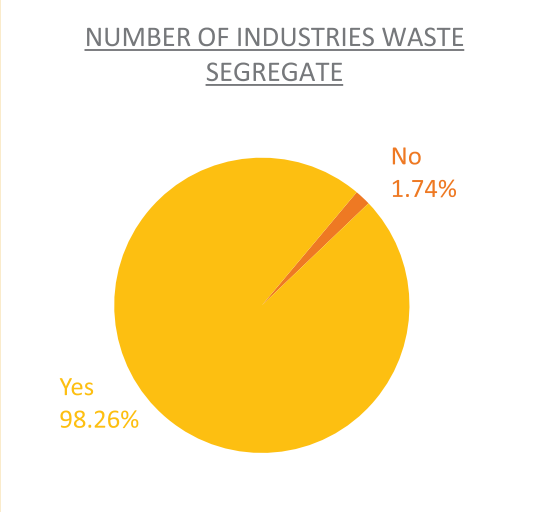


Chart 37: Number of industries waste segregate

Chart 38 indicates, 92.90% of industries segregate waste into two categories such as degradable and non-degradable. A 7.10% segregate waste into more than two categories.

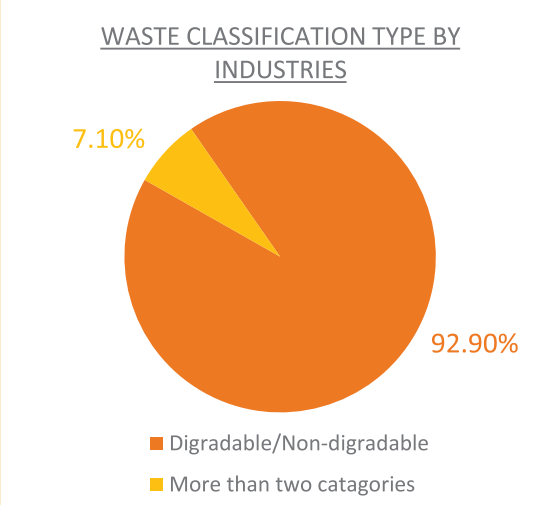


Chart 38: Waste categorization in t industries

As per chart 39, a 69% of industries used bins with some kind of labeling and others used regular bins, polythene bags or other kind of utensils for waste segregation.

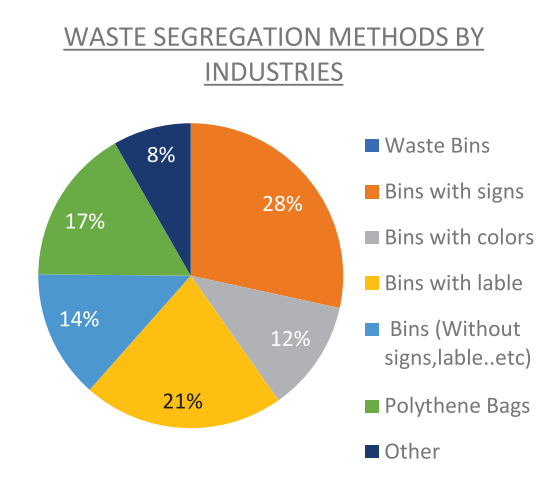


Chart 39: Waste segregation methods by industries

5.1.4 Problems in Waste Segregation

Chart 40:Problem that faced in waste segregation

Chart 40 indicates, a 47% of industries recognize absence of a specific place to keep trash bags as the problem in waste disposal. A 25% find problems in recognizing different waste categories and 15% industries having problems in access roads for waste collection by GMC.

5.2 Waste disposal methods in Industrial Sector

Degradable waste

As per Chart 41, the majority of waste (rice wastes & other food waste > 67% and garden waste & coconut shells about 35%) is handed over to GMC.

3R application like reuse and recycling practices are low for all types as coconut shells (34%), garden waste (29%), food waste (20%) and rice (10%) waste. Improper disposal is significant for coconut shell (33%) and garden waste (21%).

Figure 33: Industrial sector survey- Coir industry (Source: HELP-O)

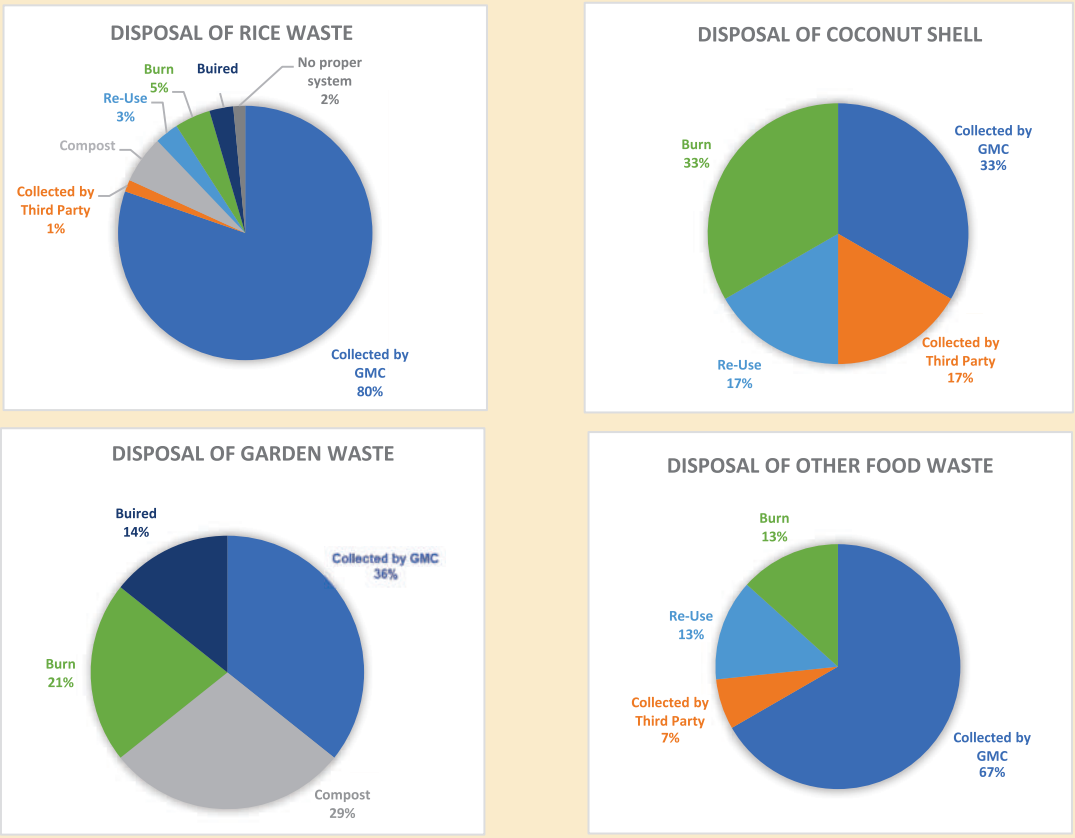


Chart 41: Degradable Waste disposal methods in Industrial Section

Non-degradable waste

As per chart 43 and 42 (for sanitary waste), majority of waste (used telephone battery 100%, desktop- wires-led bulbs 60%, sanitary waste 40%, and Styrofoam 37%) is handed over to third-party collectors. These (except sanitary waste) enter into the recycling process. In-house reuse is notable in desktop-wires-led bulbs (40%) and Styrofoam (18%) wastes.

A significant amount of other hazardous wastes (e.g. used chemical containers-drugs; 100%) and sanitary waste (60%) is handed over to GMC. Improper disposal is limited to Styrofoam waste (36%).

Figure 34: Industrial sector survey (Source: HELP-O)

Figure 35: Industrial sector survey (Source: HELP-O)

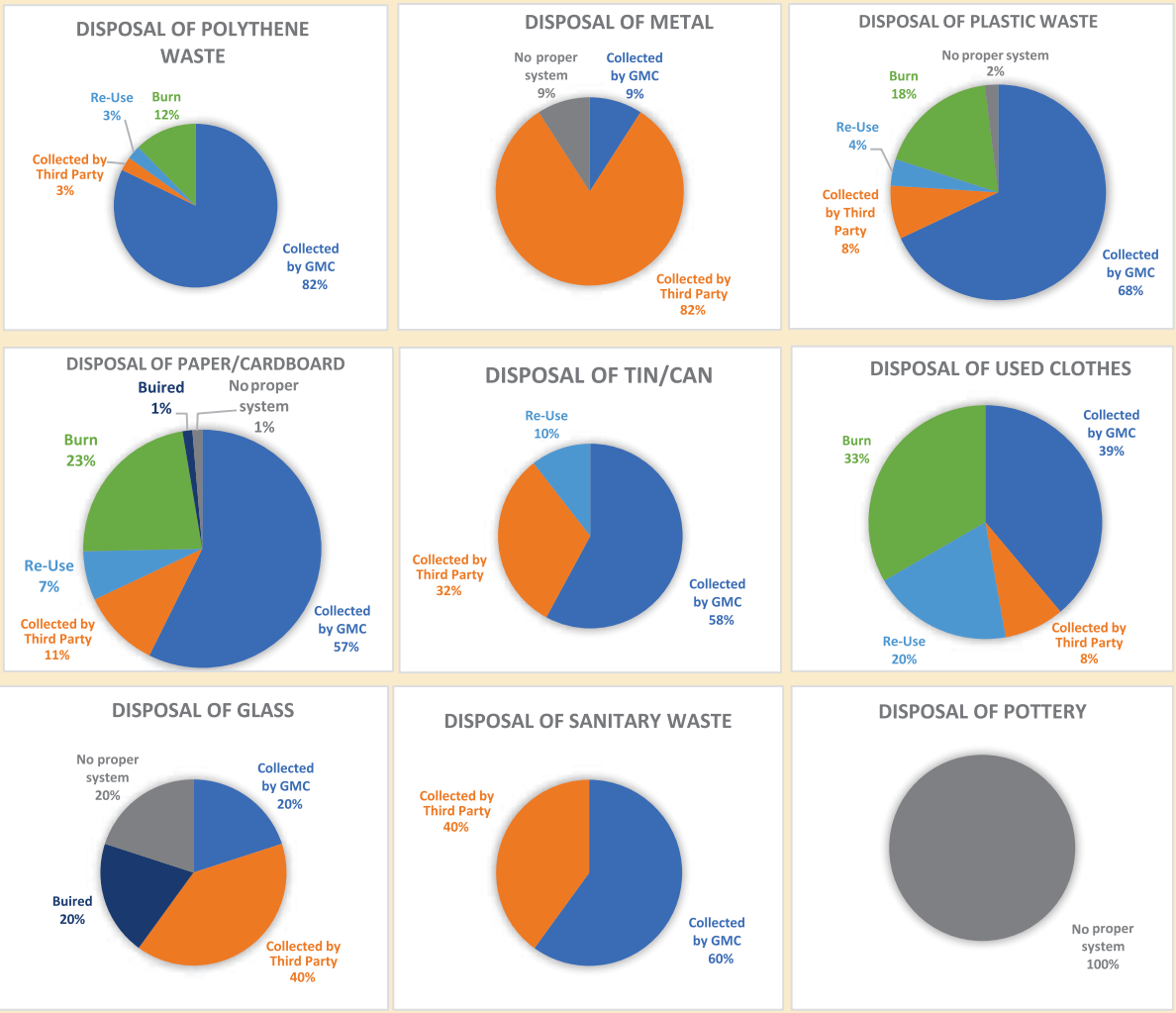


Chart 42: Non-Degradable Waste disposal methods in Industrial Sector

Hazardous waste

As per chart 43 and 42 (for sanitary waste), majority of waste (used telephone battery 100%, desktop- wires-led bulbs 60%, sanitary waste 40%, and Styrofoam 37%) is handed over to third-party collectors. These (except sanitary waste) enter into the recycling process. In-house reuse is notable in desktop-wires-led bulbs (40%) and Styrofoam (18%) wastes.

A significant amount of other hazardous wastes (e.g. used chemical containers-drugs; 100%) and sanitary waste (60%) is handed over to GMC. Improper disposal is limited to Styrofoam waste (36%).

Figure 36: Industrial sector survey (Source: HELP-O)

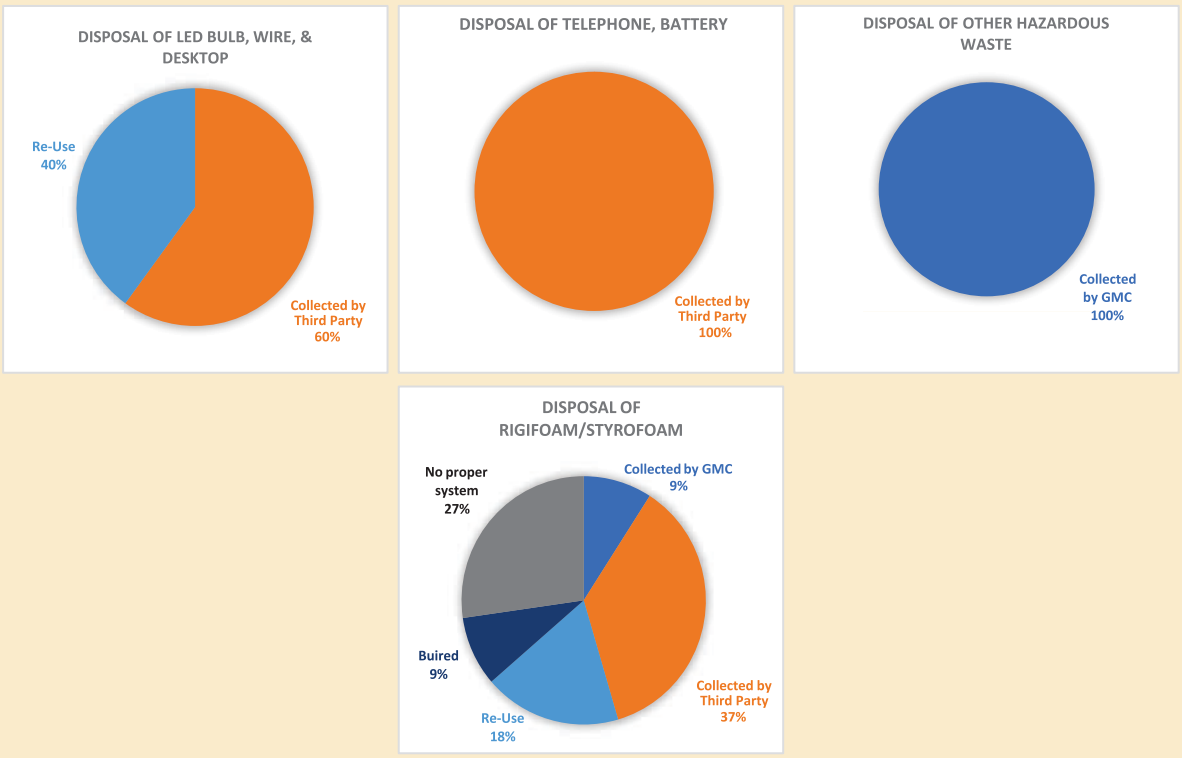


Chart 43: Hazardous Waste disposal methods in Industrial Sector

5.3 Overall view of industrial sector waste management

The table 18 illustrates information on industrial sector waste generation and management under the degradable, non-degradable and hazardous waste categories for twenty waste types.

Accordingly, the industrial process generates high quantity in all waste types except rice waste, sanitary waste, telephone-battery wastes and Styrofoam waste categories. These wastes are generated prominently by the workforce in the industries.

Concerning the waste disposal methods majority of waste types are handover to the GMC. Metal LED bulb-wire-desktop and other hazardous waste (i.e. used containers, drugs) are prominently handed over to the third-party collectors. Absence of proper disposal method for pottery is also observed.

Figure 37: Industrial sector survey (Source: HELP-O)

Figure 38: Industrial sector survey (Source: HELP-O)

Table 11: Overall status on waste management in industrial sector

		Degradable					Non-Degradable										Hazardous				
		Rice Waste	Coconut shells	Coconut waste	Other Food Waste	Garden Waste	Plastic	Polythene	Sanitary Waste	Paper/Cardboard	Used Clothes	Tin/Can	Glass	Ceramic	Pottery	Metal	LED bulb, wire, desktop	Telephone, battery, hot water flask	Styrofoam	Other Hazardous Waste	Other Waste 1
Way of waste generations	1. By the institution	15%	78%	75%	75%	55%	66%	37%	11%	52%	82%	89%	69%	0%	100%	59%	67%	0%	50%	85%	91%
	2. By the workers	69%	22%	25%	10%	23%	18%	25%	67%	15%	7%	0%	15%	0%	0%	12%	11%	50%	50%	0%	1%
	3. Visitors	0%	0%	0%	0%	0%	0%	3%	0%	2%	0%	0%	0%	0%	0%	0%	11%	0%	0%	0%	1%
	4. By the garden	0%	0%	0%	10%	5%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	5. By the institution and the workers	6%	0%	0%	0%	5%	9%	14%	22%	12%	5%	11%	8%	0%	0%	29%	11%	0%	0%	15%	7%
	6. Workers and visitors	7%	0%	0%	5%	14%	3%	12%	0%	12%	2%	0%	0%	0%	0%	0%	0%	50%	0%	0%	0%
	7. By institution, workers and visitors	3%	0%	0%	0%	0%	3%	7%	0%	5%	0%	0%	8%	0%	0%	0%	0%	0%	0%	0%	0%
	8. By the institution and visitors	0%	0%	0%	0%	0%	1%	2%	0%	3%	4%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Waste Disposal Methods	1. GMC	80%	33%	60%	67%	36%	68%	81%	60%	57%	39%	58%	20%	0%	0%	9%	0%	0%	100%	9%	19%
	2. Third Party	2%	17%	0%	7%	0%	8%	3%	40%	11%	8%	32%	40%	0%	0%	82%	60%	100%	0%	36%	45%
	3. Compost	6%	0%	0%	0%	29%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%
	4. Bio Gas	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	5. Re-Use	3%	17%	20%	13%	0%	4%	3%	0%	7%	19%	11%	0%	0%	0%	0%	40%	0%	0%	18%	16%
	6. Burn	5%	33%	20%	13%	21%	18%	12%	0%	23%	33%	0%	0%	0%	0%	0%	0%	0%	0%	0%	10%
	7. Buried	3%	0%	0%	0%	14%	0%	0%	0%	1%	0%	0%	20%	0%	0%	0%	0%	0%	0%	9%	5%
	8. No proper system	2%	0%	0%	0%	0%	2%	0%	0%	1%	0%	0%	20%	0%	100%	9%	0%	0%	0%	27%	4%

80-100
60-80
40-60
20-40
0-20
=0

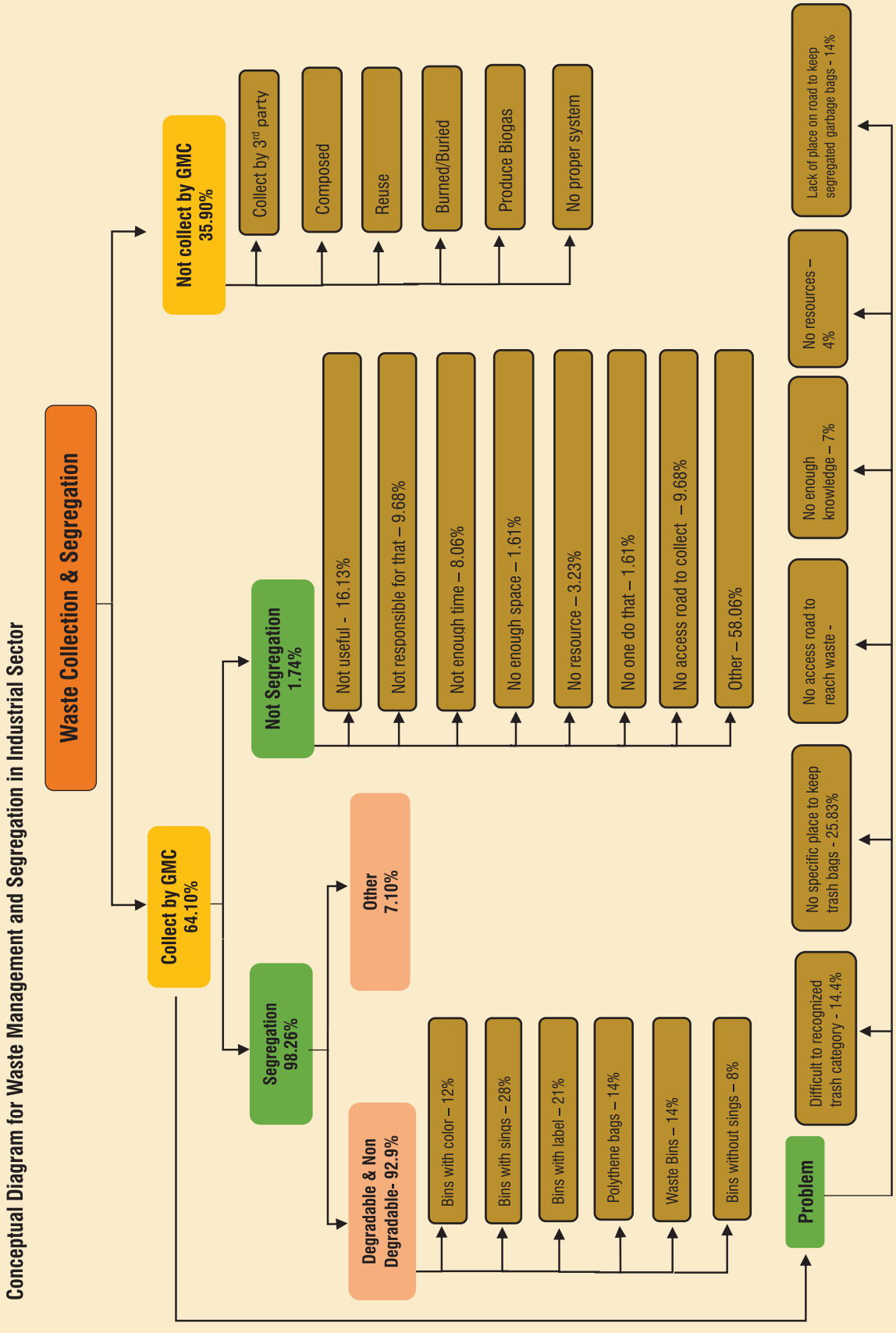


Figure 39: Conceptual Diagram for Waste Management and Segregation in Industrial Sector

PHOTO: HELP-O

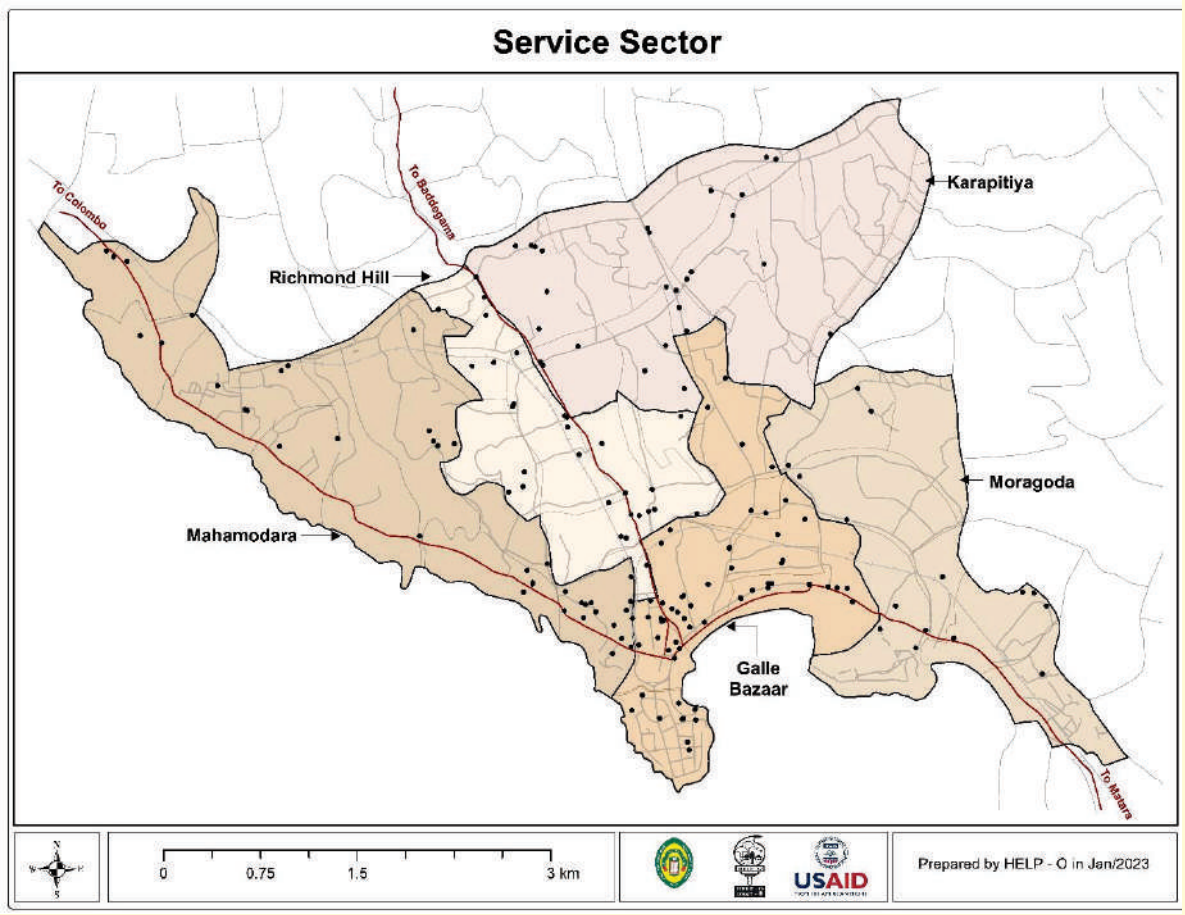
CHAPTER 6
SERVICE SECTOR

Waste Problems in Galle, Sri Lanka

CHAPTER 06: SERVICE SECTOR
6.1 Findings of the Service Sector

This chapter presents the findings of the city-wide assessment related to the industrial sector.

The waste assessment in the industrial sector was conducted focusing on data and information with regard to different solid waste management practices of industries within the GMC area. The assessment covered all categories of industries under 8 sectors as food, animal husbandry, wood & wood crafting, jewelry manufacturing, concrete, textile/ clothing and other (like shoe manufacturing and handicraft etc.). The data was collected through questionnaire survey, interviews, and photographic survey.



Map 8: Distribution of the surveyed units of service sector (Prepared by HELP-O)

Figure 40: Service sector survey Zonal Education Office (Source: HELP-O)

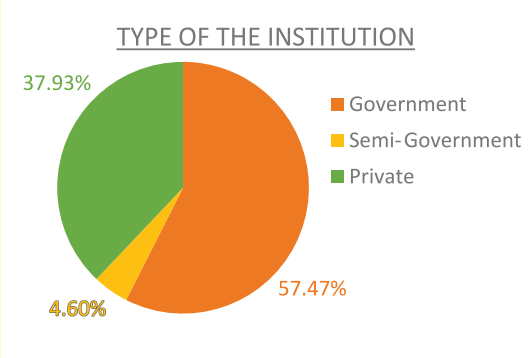


Chart 44: Type of institute

The service sector establishments are considered under three categories as government, semi-government, and private. In the service sector, the highest percentage was recorded (57.4%) of government institutions, as per chart 44.

6.1.1 Waste collection practices of Service Sector

As per chart 45, 78.74% of service sector institutes hand over their waste to GMC.

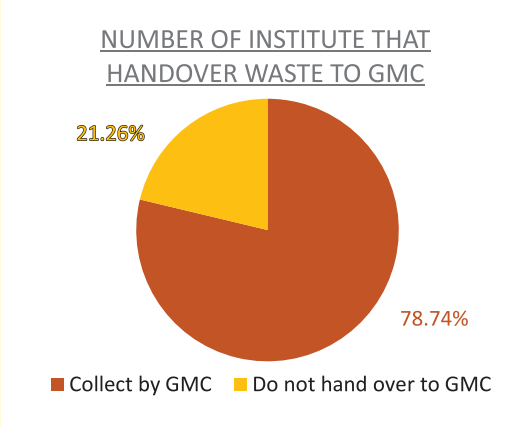
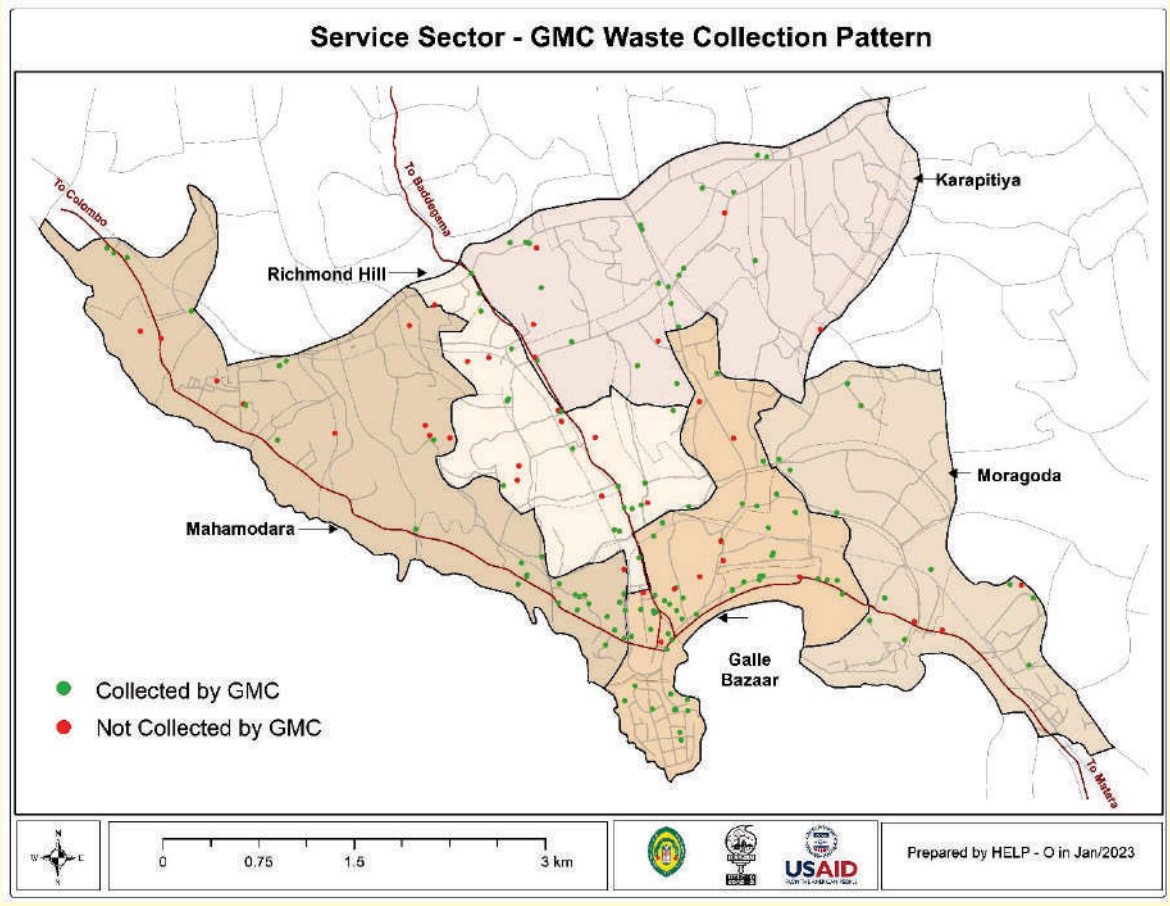


Chart 45: GMC Waste Collection in Service Sector



Map 9:GMC waste collection pattern (Prepared by HELP-O)

6.1.2 Status of Waste Segregation in Service Sector

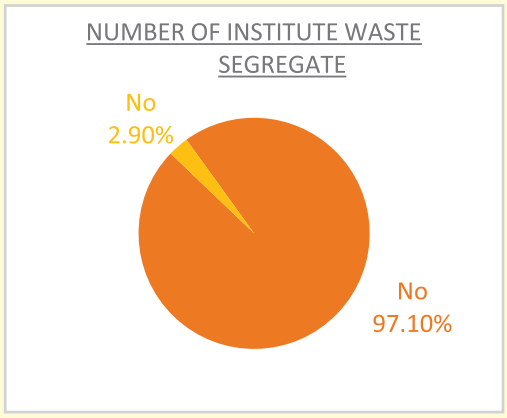


Chart 46: Status of waste segregation by Service Sector

As per chart 46, a 97.10% of institutes that handover their waste to the GMC segregate waste.

Chart 47 indicates, 96.95% of institutes categorize waste as degradable and non-degradable. A 3.05% of them categorize waste into more than two categories.

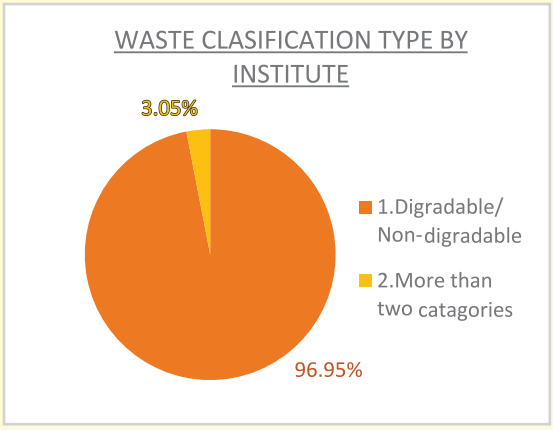
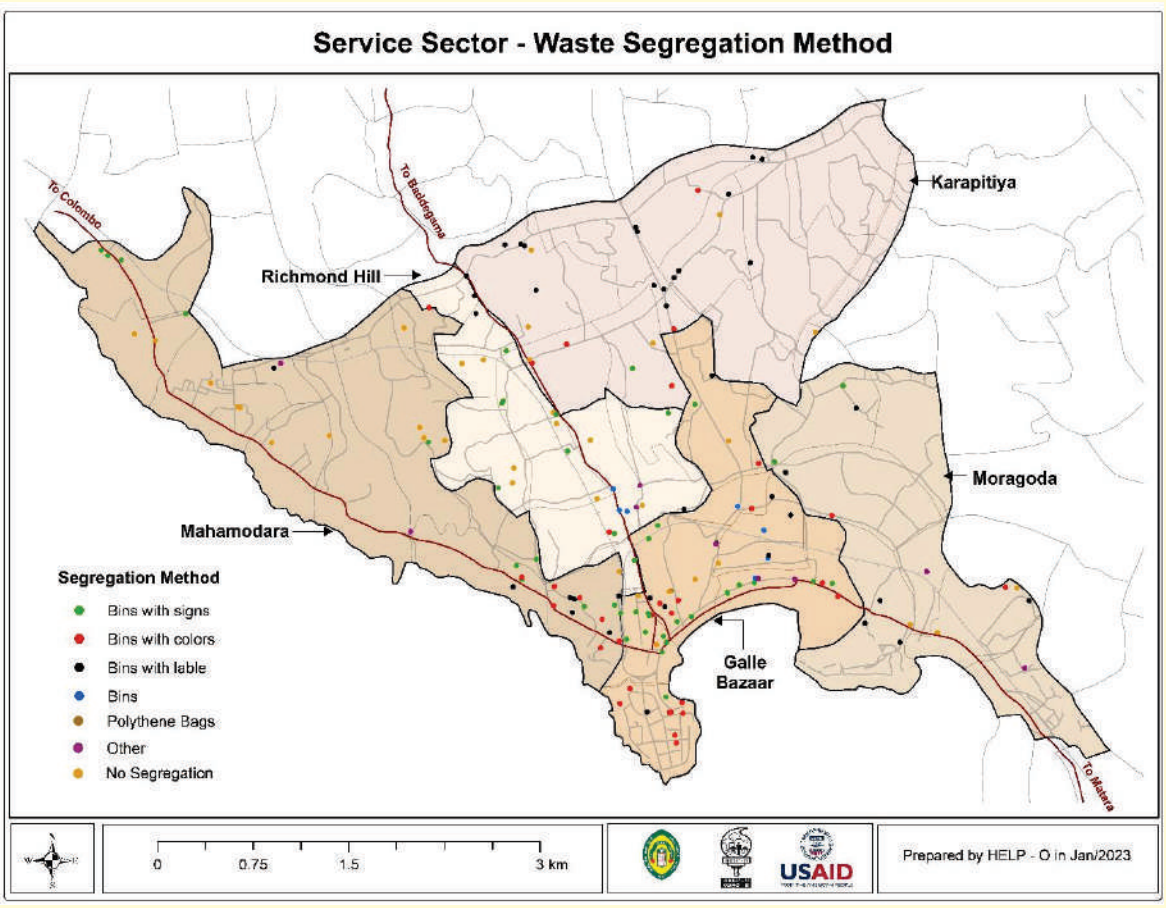


Chart47 : Waste classification type by institute



Map 10: Waste segregation method by institute (Prepared by HELP-O)

As per chart 48, a 92% of institutes use bins with some kind of labeling and others used regular bins, polythene bags or other kind of utensils for waste segregation.

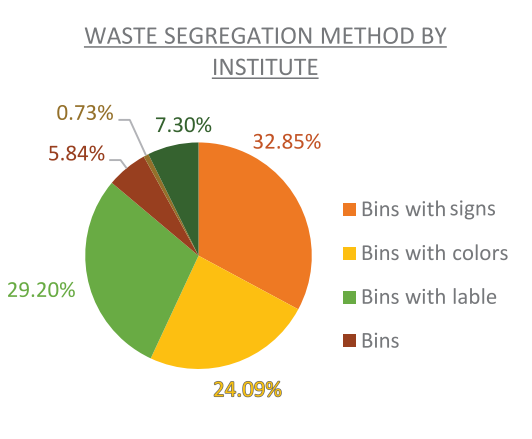


Chart 48: Waste segregation method by institute

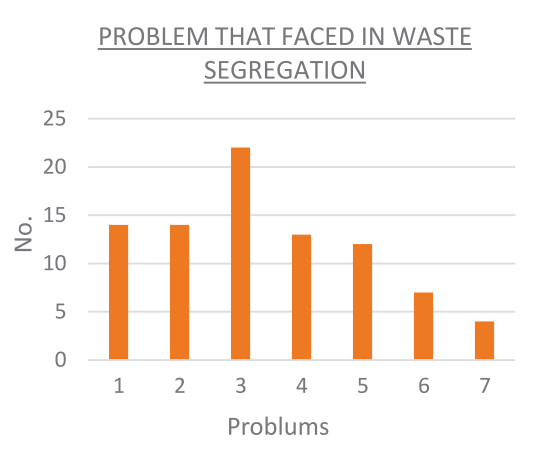
6.1.3 Problems in Waste Segregation

The chart 49 indicates the problems faced in waste segregation by the responses given to the 7 problems asked in the questionnaire. The problems asked are given in table 19.

As per chart 19, inadequate provision of facility to segregate waste for public is the main problem. Difficulty in understanding the garbage classification and Inadequate staffing for segregation are the other main problems.

Figure 41: Service sector survey Department of Provincial Revenue Southern Province (Source: HELP-O)

Figure 42: Service sector survey Department of Health Services Southern Province (Source: HELP-O)



1	Difficulty in understanding the classification of garbage
2	Inadequate staffing for segregation
3	Inadequate provision of facility to segregate waste for public
4	Lack of space on the premises to store segregated garbage bags
5	No proper place on the road to place segregated garbage bags
6	No access routes to collect segregated waste
7	Other

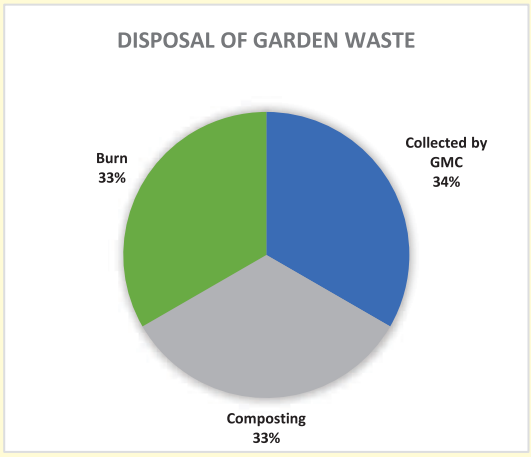
Chart 49: Problems faced in waste segregation

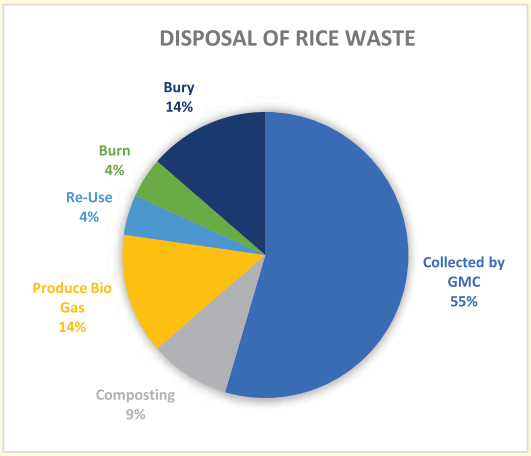
6.2 Waste Disposal Methods in Service Sector

Degradable waste

As per chart 50, a significant quantity of waste (rice waste 55%, garden waste 34% and food waste 33%) is handed over to the GMC. Composting and biogas producing (in-house 3R applications) is prominent in food waste (67%), garden waste (33%) and rice waste (23%).

Low level of improper disposal is noticed in garden waste (33%) and rice waste (18%).





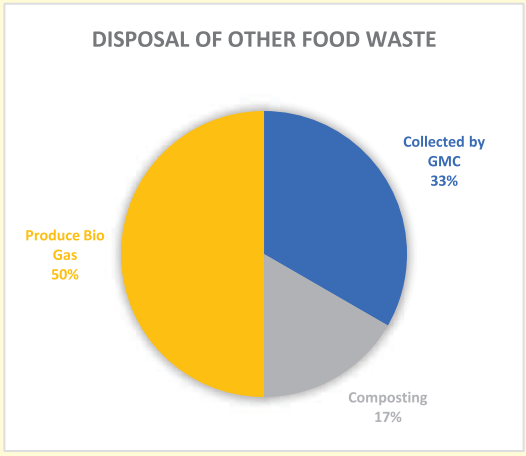


Chart 50: Degradable Waste Disposal Methods in Service Sector

Non-degradable waste

As per Chart 51, the majority of waste (tin-can, used clothes & plastic > 70%, glass waste 67%, polythene & paper-cardboard >55% and scrap metal 20%) is handed over to the GMC.

Application of 3R practices is low and limited to handing over of metal waste (80%), glass waste (33%) and tin-can (20%) to third party for reuse/ recycling.

Improper waste disposal is notable in polythene (43%-burning & burying), paper-cardboard (40%-burning) and plastic (28%-burning & dumping).

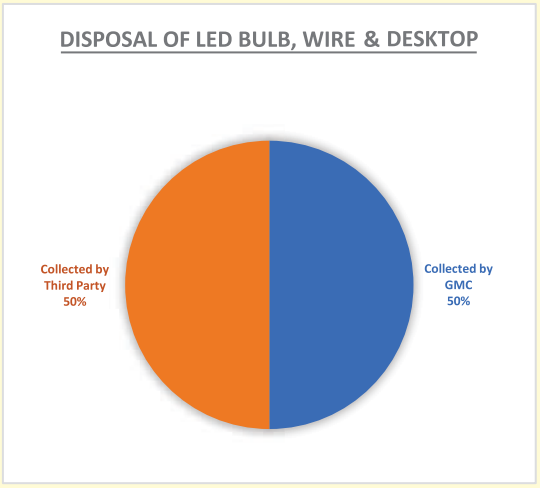
Chart 51: Non-Degradable Waste Disposal Methods in Service Sector

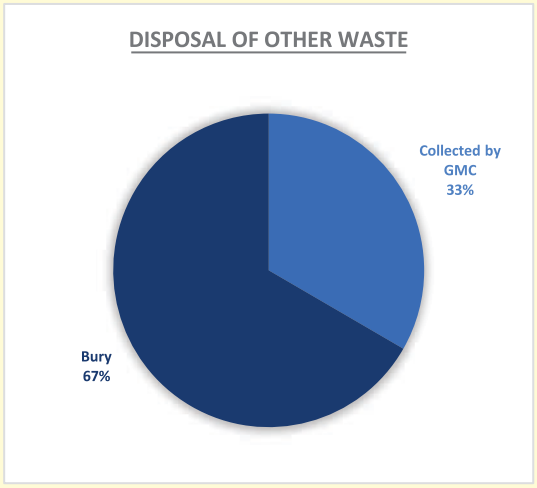
Hazardous waste (as per CEA definition)

As per chart 52 and 51 (for sanitary waste) a low amount of waste (sanitary waste 78%, LED bulb-desktop-used wires 50%, and other wastes like used chemical containers-drugs 33%) is handed over to GMC.

Application of 3R practices is low and limited to handing over of LED bulb-desktop-used wires (50%) category for reuse/ recycling.

Improper disposal practices are notable in telephone-battery waste (100%), other wastes like used chemical containers-drugs (burying-





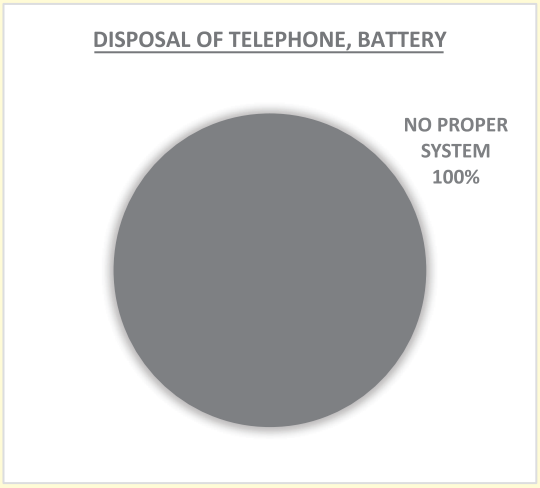


Chart 52: Hazardous Waste Disposal Methods in Service Sector

6.3 Overall view of service sector waste management

The table 20 illustrates the information on service sector waste generation and management under degradable, non-degradable, hazardous waste for twenty waste types.

As per chart 20, all degradable and non-degradable wastes except ceramic, glass and metal waste are generated by institutional process, workers and visitors of institutions. The metal, tin-can, glass, used telephone-battery, LED bulb-desktop are prominently generated by the institutional process.

Majority of wastes are handed over to GMC. Metal, LED bulb-wire-desktop wastes prominently and less than 30% of glass, tin-can waste are handed over to third party collectors. In-house composting (from 9% to 33%) and biogas making (from 14% to 50%) of degradable waste is also observed.

Burning of plastic, polythene, cardboard-paper, used clothes, used telephone-battery wastes ranging from 20% to 40% and burying polythene and sanitary waste ranging from 4% to 11% is a significant improper disposal practice observed.

Table 12 : Overall status on waste management in service sector

		Degradable Waste			Non - Degradable Waste										Hazardous Waste				
		Rice Waste	Other Food Waste	Garden Waste	Plastic	Polythene	Sanitary Waste	Paper/Cardboard	Used clothes	Tin/Can	Glass	Ceramic	Pottery	Metal	LED bulb, wire, desktop	Telephone, battery, hot water flask	Styrofoam	Other Hazardous Waste	Other Waste
Way of waste generation	1. By the institution	4%	0%	50%	15%	9%	0%	6%	0%	80%	67%	0%	0%	100%	100%	100%	0%	0%	0%
	2. By the workers	35%	0%	0%	23%	22%	30%	11%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	3. Visitors	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	4. By the garden	0%	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	5. By the institution and the workers	0%	0%	10%	8%	22%	0%	22%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
	6. Workers and visitors	9%	0%	0%	0%	4%	10%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	7. By institution, workers and visitors	48%	100%	20%	46%	43%	30%	61%	20%	20%	17%	0%	0%	0%	0%	0%	0%	0%	0%
	8. By the institution and visitors	4%	0%	0%	8%	0%	30%	0%	80%	0%	17%	0%	0%	0%	0%	0%	0%	0%	0%
Way of waste disposal	1. GMC	55%	33%	33%	71%	57%	78%	55%	75%	80%	67%	0%	0%	20%	50%	0%	0%	0%	33%
	2. Third Party	0%	0%	0%	0%	0%	0%	0%	0%	20%	33%	0%	0%	80%	50%	0%	0%	0%	0%
	3. Compost	9%	17%	33%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	4. Bio Gas	14%	50%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	5. Re-Use	5%	0%	0%	0%	0%	0%	5%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	6. Burn	5%	0%	33%	21%	39%	11%	40%	25%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%
	7. Buried	14%	0%	0%	0%	4%	11%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	67%
	8. Disposed to water bodies	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	9.No proper system	0%	0%	0%	7%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

	80-100
	60-80
	40-60
	20-40
	0-20
	=0

Conceptual diagram for waste management & segregation in service sector

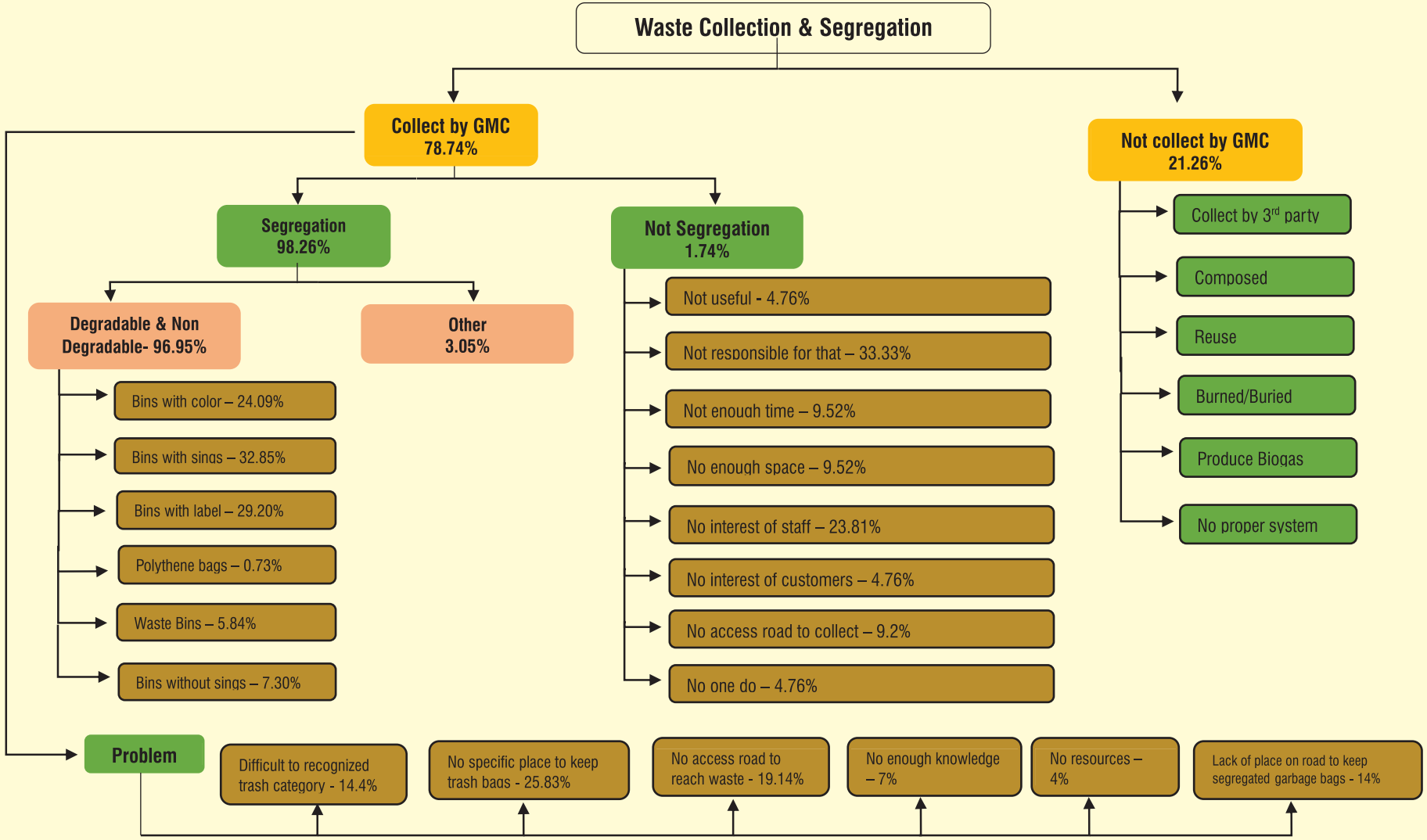


Figure 43: Conceptual Diagram for service Waste Management and Segregation

PHOTO: HELP-O

CHAPTER 7
OTHER SECTOR

Waste Problems in Galle, Sri Lanka

CHAPTER 07: OTHER SECTORS

7.1 Findings of other sectors

Specially designed survey segment was conducted focusing on important sectors for citywide waste management improvement like healthcare, religious, fishery sectors and expatriate tourists, informal waste aggregators, officials of GMC-environment police and people offenders on illegal waste dumping.

The Figure 39 shows the types of other sectors under this study including 141 of the total sample.

7.2 Healthcare Sector

The healthcare sector institutions of 7 types as; teaching hospital, general hospital, private hospital, Ayurveda hospital, medical center, medical laboratory and others were considered under four categories as large, medium, small, and minor in scale for this study.

The data was collected through a questionnaire, formal interviews, and a photographic survey.
The data was collected through a questionnaire, formal interviews, and a photographic survey

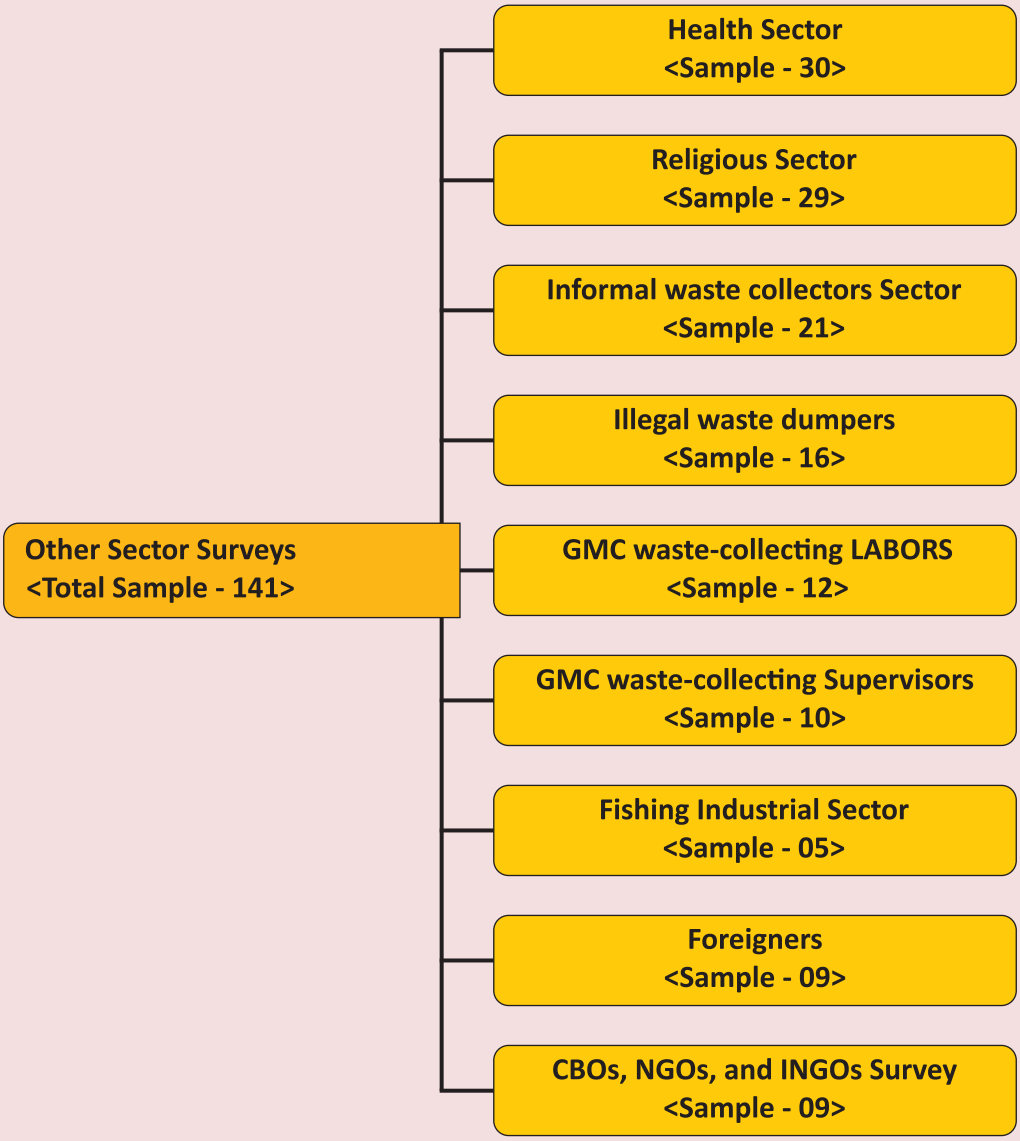
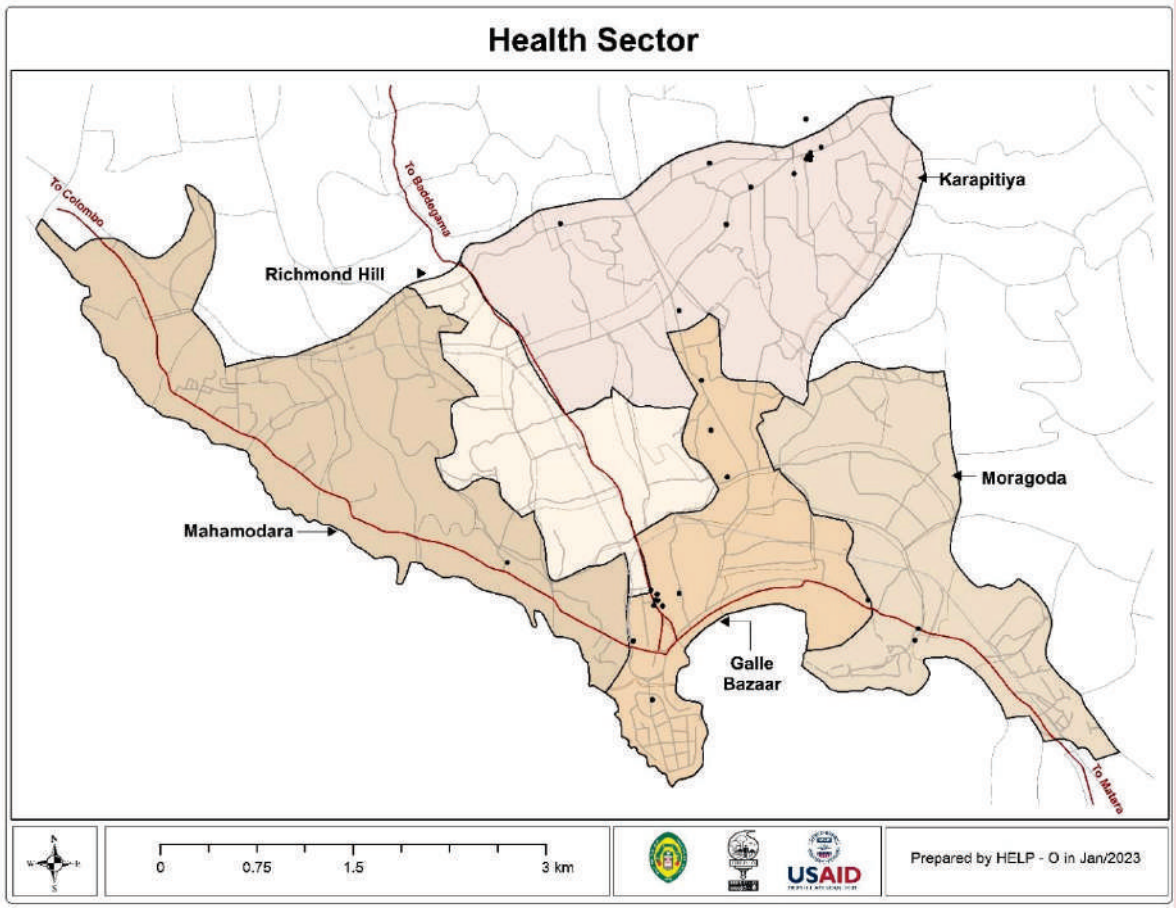


Figure 44: Selected parties under the other sectors for survey



Map 11: Distribution of the surveyed units under the health sector (Prepared by HELP-O)

7.2.1 Type and scale of the healthcare institutions

For the survey, seven types of healthcare institutions were selected as in chart 54.

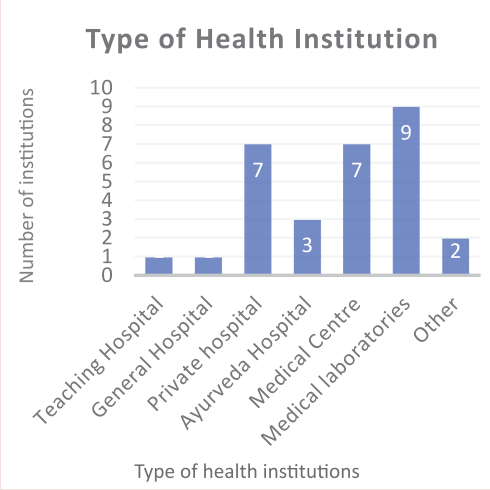


Chart 53: Type of health institutions

The institutions were brought under four main categories as in the chart 56 and 31% of the institutions are minor scale institutions.

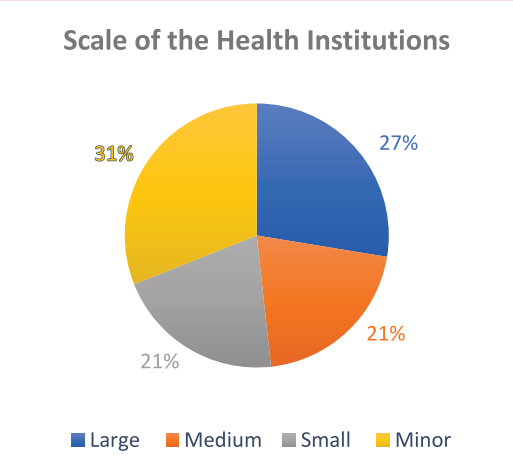


Chart 54: Scale of the health institutions

7.2.2 Waste generation and disposal practices of the healthcare sector

The chart 58 illustrates an overview of generation and management of twenty waste types under the degradable, non-degradable and hazardous categories.

As per chart 55 majority of waste types are generated by the hospital operations except, rice-wastes, plastic, polythene, paper-cardboard and sanitary wastes. Latter waste types are generated mainly by the patients (includes visitors) and workforce.

Majority of hospital wastes (rice waste, other food waste, garden waste, paper and cardboard waste, polythene waste, Styrofoam waste > 60% and sanitary waste, used cloths, tin-can waste, glass waste from 20% to 33% and 10% of e-waste, 60% of and 4% of clinical hazardous waste form the healthcare institutions. Is collected by GMC.

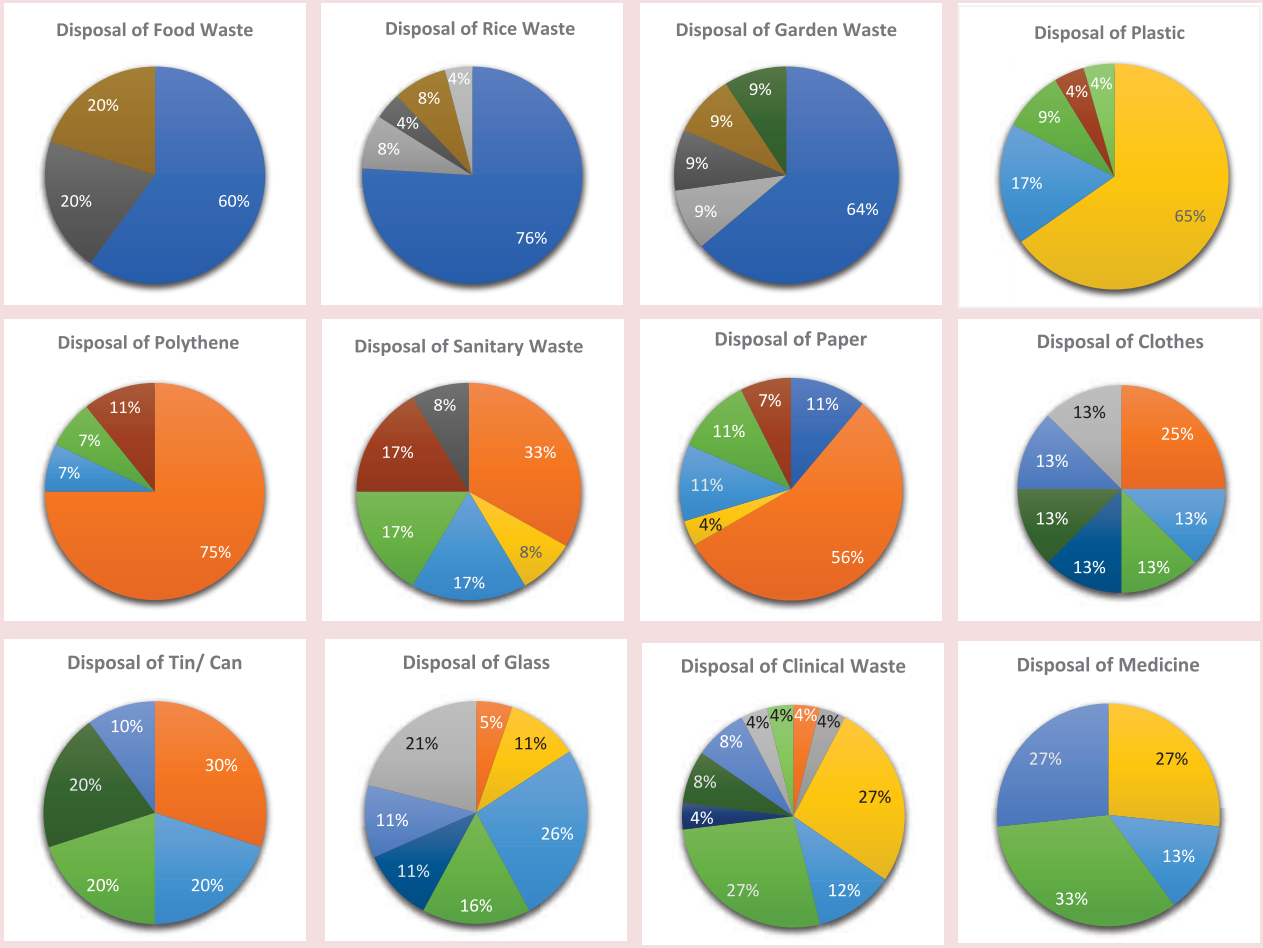
Figure 45: Surveying in health sector Photo 01(Source: HELP-O)

Degradable waste types ranging from 4% to 20% are utilized for in-hose composting and 8% to 20% are utilized for in-house biogas making.

Burning or burying of used cloths, Styrofoam waste, and clinical hazardous waste is observed. Absence of proper disposal methods for ceramic waste, 60% and e-waste is also observed.

Figure 46: Surveying in the health sector - Photo 02 (Source: HELP-O)

7.2.3 Waste Disposal Methods in Health Sector



- Organic waste collected by GMC
- Clinical not hazardous waste collected by GMC
- Organic waste collected by Third-party waste collector
- Clinical hazardous waste collected by Third-party waste collector
- Clinical not hazardous waste collected by Third-party waste collector
- All the waste collected by Third-party waste collector
- Clinical waste is disposed of as per government regulation
- Clinical waste is disposed not as per government regulation
- Compost
- Bio Gas
- Re-Use
- Burn
- Buried
- Disposed to water source
- No proper system
- Part of Organic waste is collected by GMC and the Rest for Bio Gas
- Part of Organic waste is collected by GMC and the Rest Re-Use
- Waste Burn and Buried

Chart 55: Waste disposal methods in health sector

Table 13: Overall status on waste management in health sector

80-100	60-80	40-60	20-40	0-20	=0

	Degradable Waste		Non - Degradable Waste									HAZARDOUS WASE								
Way of Generation	Rice Waste	Other Food Waste	Garden Waste	Plastic	Polythene	sanitary Waste	Paper Cardboard	Clothes	Tin Can	Glass	Metal	E Waste	Hazardous Water Mixed Waste	Styrofoam	Ex medicine	Clinical waste	Clinical waste Mixed with Body Parts	Other Waste	
By the institution	0%	50%	75%	22%	21%	0%	23%	28%	90%	70%	75%	89%	100%	80%	100%	71%	82%	100%	
By the workers	36%	0%	0%	0%	0%	8%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Patients	0%	25%	0%	0%	0%	17%	0%	29%	0%	0%	0%	0%	0%	0%	0%	8%	9%	0%	0%
Other	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
By the garden	0%	0%	8%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1,2,3	4%	0%	0%	0%	4%	0%	4%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2,3	4%	25%	0%	0%	0%	8%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1,2 (By the institution & by the workers)	8%	0%	9%	17%	25%	0%	23%	0%	10%	12%	25%	11%	0%	0%	0%	4%	0%	0%	0%
2,3	20%	0%	0%	4%	4%	34%	0%	0%	0%	0%	0%	0%	0%	0%	0%	4%	9%	0%	0%
3,4	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1,2,3	28%	0%	8%	35%	28%	33%	31%	29%	0%	6%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1,4	0%	0%	0%	9%	7%	0%	8%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
1,2,4	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	20%	0%	0%	0%	0%	0%
1,3	0%	0%	0%	9%	11%	0%	11%	14%	0%	12%	0%	0%	0%	0%	0%	13%	0%	0%	0%
1,3,4	0%	0%	0%	4%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

7.3 Fisheries Sector Findings

The fisheries sector survey was conducted within the Galle Fishery Harbor and four small fisheries harbors located in the GMC area. The data was collected through questionnaire, formal interviews and photographic survey.

Types of places

750 multi-day fishing (i.e. Troller) boats are operated only by Galle Fishery Harbor. The other harbors facilitate single (same) day fishing boats.

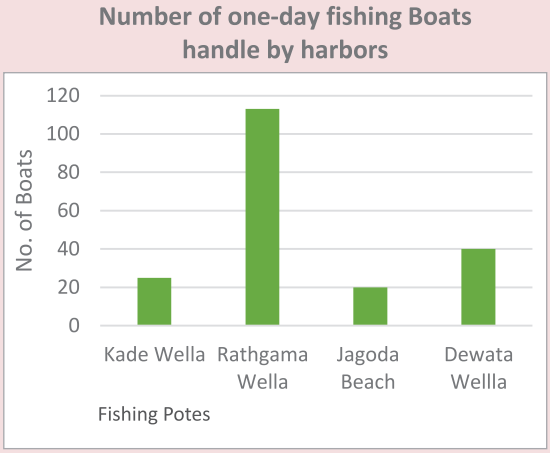
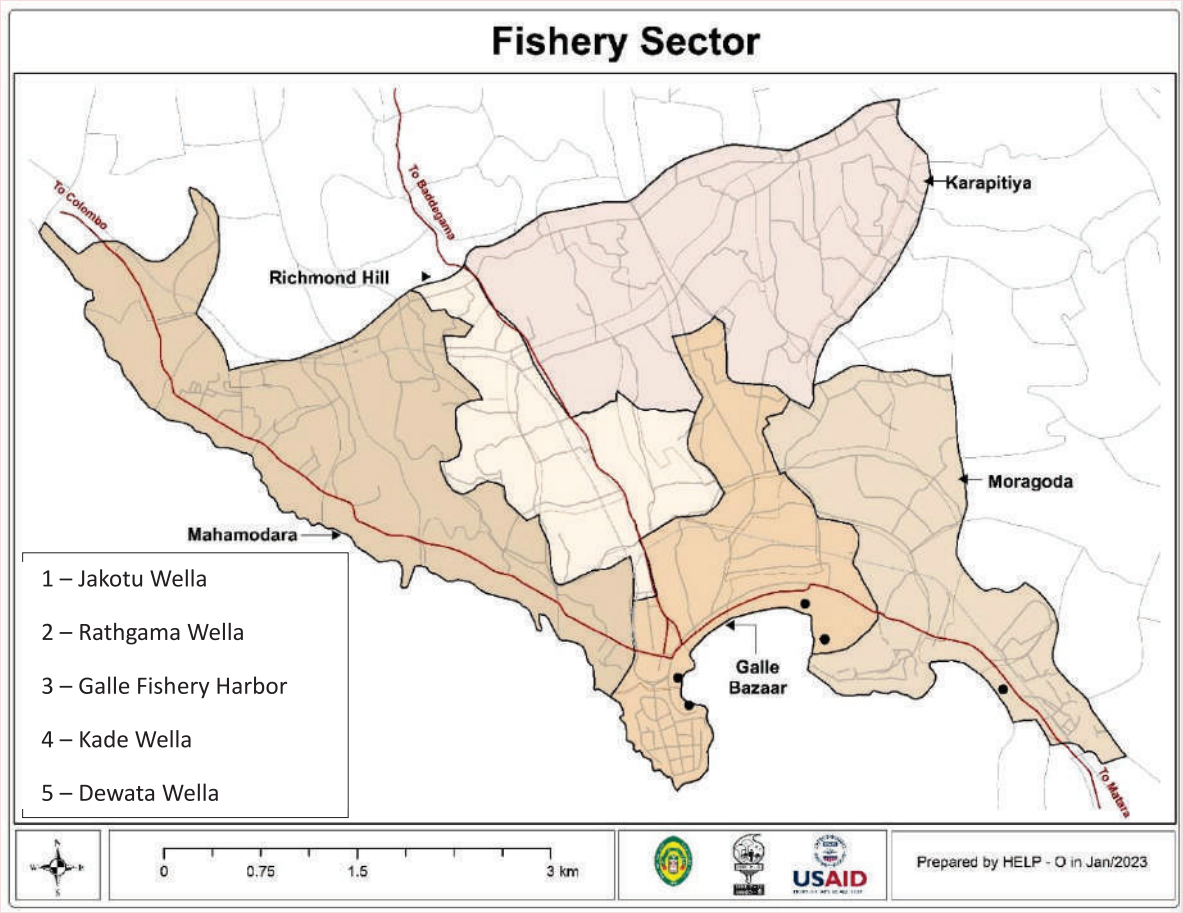


Chart 56: Number of one day fishing boat handled by harbors

Chart 56 indicates the numbers of single day shing boats in operation at each small fishery harbor.

Figure 47: Focus Group Discussion with GMC waste collecting supervisors



Map 12: Distribution of the surveyed units under the Fishery sector (Prepared by HELP-O)

7.3.1 Waste generation and disposal practices of the fisheries sector

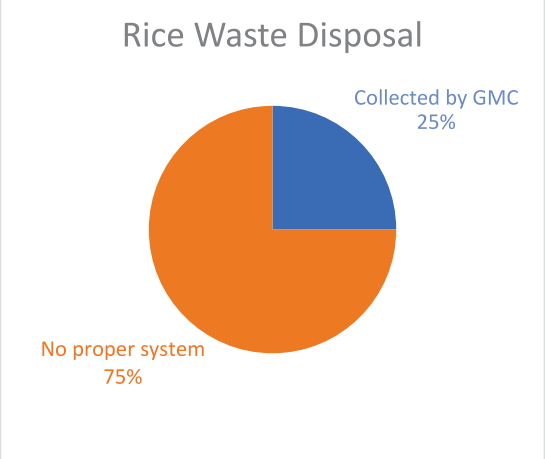
The survey indicates that fishing boats regularly carry numerous plastic items in to the sea and dump those in to the sea most of the time.

The main waste categories generated from the fishery sector are rice waste, garden waste, (boat/ fishing gear) manufacturing waste, plastic, polythene, paper and cardboard waste, tin-can, glass waste, Styrofoam waste, oil mixed solid waste, fiber waste, fish waste and used nets.

In this sector, 100% of Paper and Cardboard waste, 25% of rice waste, 20% of plastic waste, 20% of polyethylene waste, and 20% of Styrofoam waste are collected by the GMC.

As per the survey, 100% of garden waste, 40% of polythene waste, and 20% of Styrofoam waste are disposed of by burning. There is no proper system to dispose of 75% of rice waste, 75% of fiber waste, 40% of polythene waste, and 20% of Styrofoam waste.

Figure 48: Survey in fisheries sector (Source: HELP-O)



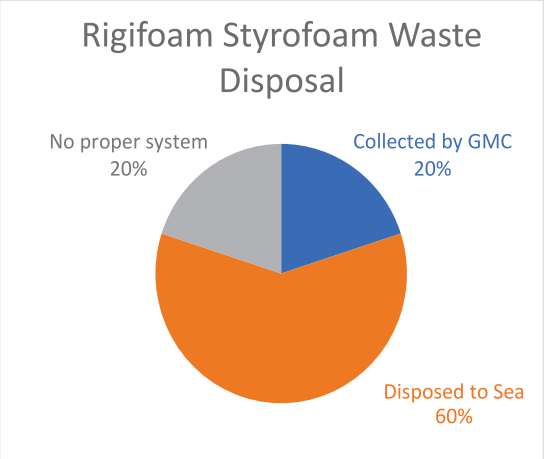
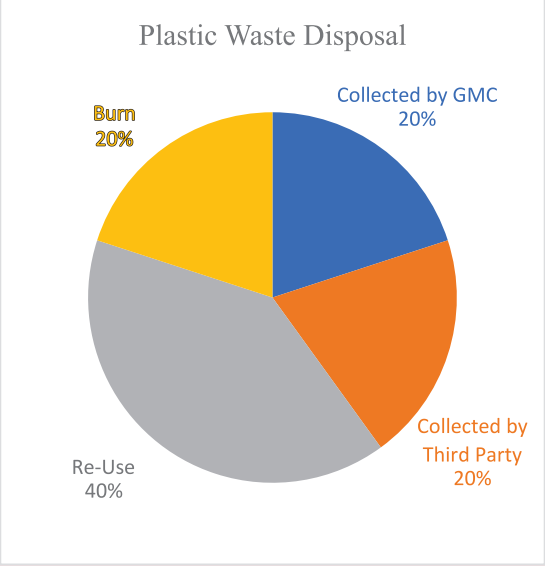


Chart 57: Fisheries Sector Waste Disposal Methods



Fishing nets, which are made of Nylon is a main waste type associated with fishing harbors.

When the nets are damaged (torn to pieces) fishermen repair them by knitting. When nets are beyond repair, those are disposed of by burning or open dumping or giving/ selling (sometimes) to other needful parties (e.g. farmers for fencing).

Table 14: Waste Generation Methods in Fisheries Sector

	DEGRADABLE WASTE		NON - DEGRADABLE WASTE						HAZARDOUS WASTE				
Description	**Rice Waste**	**Garden Waste**	**Manufacturing Waste**	**Plastic Waste**	**Polythene Waste**	**Paper and Cardboard Waste**	**Tin and Can Waste**	**Glass Waste**	**Styrofoam Waste**	**E-waste**	**Fiber Waste**	**Fish Waste**	**Other Waste**
1 By fishery Industry	0	0	1	0	0	0	0	0	4	3	4	2	2
2 By Workers	4	1	0	0	0	1	1	1	0	0	0	0	1
3 By Visitors	0	0	0	0	0	0	0	0	0	0	0	0	0
1,2,3	0	0	0	1	1	0	0	0	0	0	0	0	0
1,2	0	1	2	4	4	0	0	0	0	0	0	1	0
SUM	**4**	**2**	**3**	**5**	**5**	**1**	**1**	**1**	**4**	**3**	**4**	**3**	**3**

1 – Jakotu Wella

2 – Rathgama Wella

3 – Galle Fishery Harbor

4 – Kade Wella

5 – Dewata Wella

Table 23 shows the details regarding waste generation methods in above 5 harbors.

Figure 49: Survey in fisheries sector (Source: HELP-O)

Table 15: Waste Disposal Methods in Fisheries Sector

	DEGRADABLE WASTE		NON - DEGRADABLE WASTE						HAZARDOUS WASTE				
Description	Rice Waste	Garden Waste	Manufacturing Waste	Plastic Waste	Polythene Waste	Paper and Cardboard Waste	Tin and Can Waste	Glass Waste	Styrofoam Waste	E-waste	Fiber Waste	Fish Waste	Other Waste
Collected by GMC	**1**	0	0	**1**	**1**	**1**	0	0	**1**	0	0	0	0
Collected by Third Party	0	0	0	**1**	0	0	**1**	**1**	0	0	**1**	**1**	**3**
Compost	0	0	0	0	0	0	0	0	0	0	0	0	0
E-waste, Third party	0	0	0	0	0	0	0	0	0	0	0	0	0
Bio Gas	0	0	0	0	0	0	0	0	0	0	0	0	0
Re-Use	0	0	**1**	**2**	0	0	0	0	0	**1**	0	0	0
Burn	0	**3**	0	**1**	**2**	0	0	0	0	0	0	0	0
Buried	0	0	0	0	0	0	0	0	0	0	0	0	0
Disposed to Sea	0	0	**2**	0	0	0	0	0	**3**	**2**	0	**2**	0
No proper system	**3**	0	0	0	**2**	0	0	0	**1**	0	**3**	0	0
1&7	0	0	0	0	0	0	0	0	0	0	0	0	0
1&8	0	0	0	0	0	0	0	0	0	0	0	0	0
1&10	0	0	0	0	0	0	0	0	0	0	0	0	0
SUM	4	3	3	5	5	1	1	1	5	3	4	3	3

7.3.2 Fisheries sector recommendations for improving the present GMC waste management system

The summary of recommendations to improve GMC solid waste management system as given in the responses to the fisheries sector questionnaire is as follows;

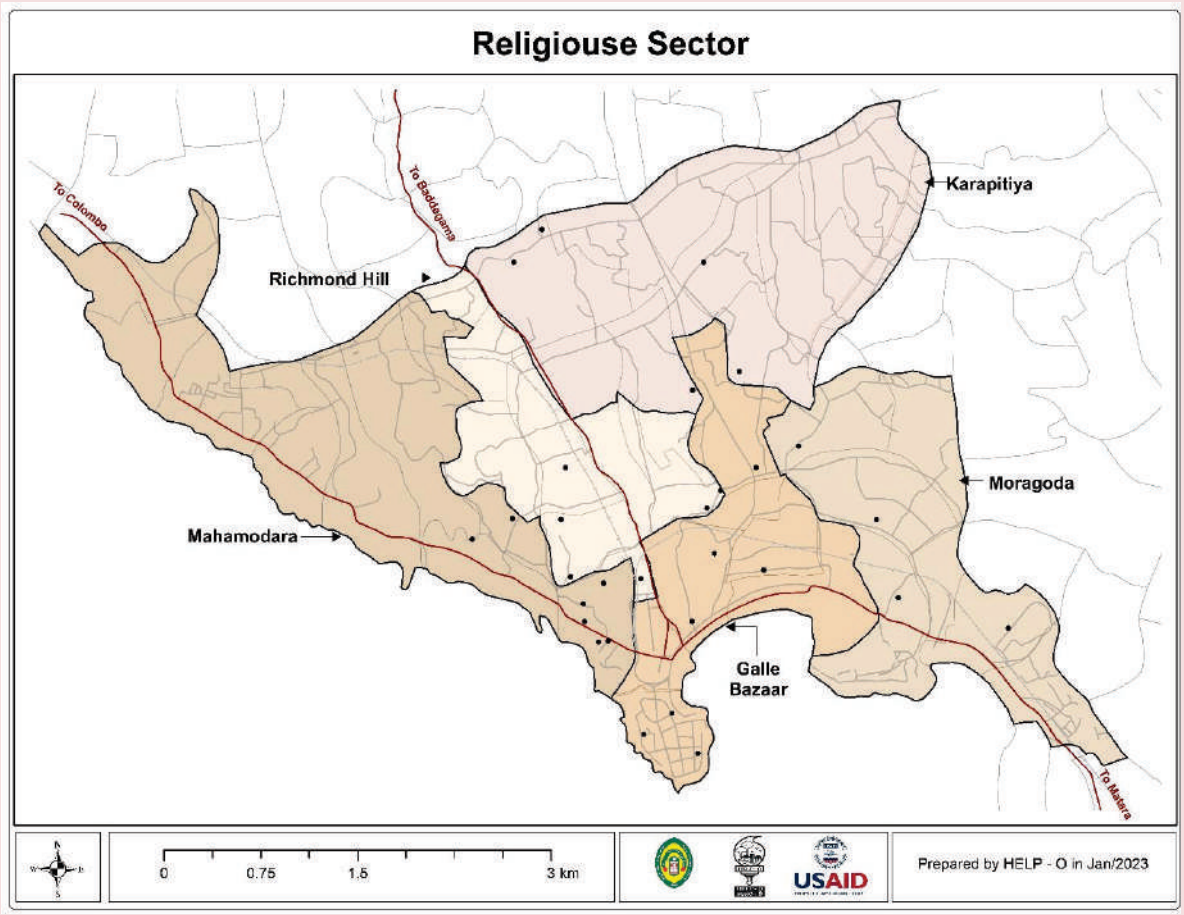
- Provide garbage bins for the disposal of waste.
- Set up composting facility to dispose of fishing waste.
- Improved GMC waste collection and frequency of the collection.
- Install CCTV cameras for tracking illegal waste dumping near public binges.
- Provide solutions for fiber waste.

The main highlighted problems of this sector are waste segregation, fishing net and fiber waste management.

7.4 Religious Sector Findings

The main religious places located in the GMC area include Buddhist and Hindu Temples, Mosque, Roman Catholic and Christian Churches.

Figure 50: Survey in Religious Sector -Sri Kathirvelayutha Swami Kovil (Source: HELP-O)



Map 13: Distribution of the surveyed units under the religious sector (Prepared by HELP-O)

Waste Collection Practices in Religious Sector

As per chart 57, 83% of the religious sector waste is handing over to the GMC.

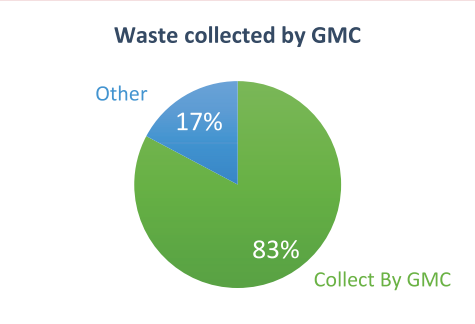


Chart 58: Waste collected by GMC

Status of Waste segregation

Chart 58 shows that 52% of religious establishments use bins with some kind of labeling for waste segregation. Others use regular bins or polythene bags (31%).

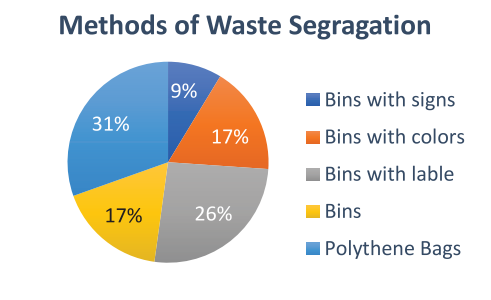


Chart 59: Methods of Waste segregation

As per chart 59, 79% of religious establishments segregate their waste in house.

-

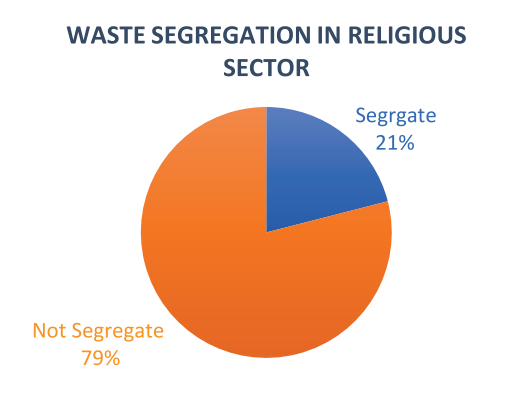


Chart 60: WASTE SEGREGATION IN RELIGIOUS SECTOR

7.4.1 Religious sector institutions recommendations for improving the present GMC waste management system

The summary of recommendations to improve GMC solid waste management system as given in the responses to the religious sector questionnaire is as follows;

- Donate or provide separate garbage bins.
- Provide sponsorship or grants to install biogas and composting facilities and help to set up market linkage.
- GMC waste workers to come to the place and collect garbage from the inside of the institution.
- Conduct awareness and provide printed guidelines like leaflets for public on proper SWM practices.
- Encourage the public to reduce the use of polythene.
- Frequently clean the roads near the religious institution.
- GMC waste collection needs to function in a reliable and accurate manner.
- Set up a proper waste collection supervision system.
- GMC waste collection needs to reach the community and places. Facilitate for in-house composting and producing biogas.

7.5 Informal Waste Collectors/ Aggregators

A specific study was designed on this, since the informal waste collectors play an important role in the municipal solid waste management, in particular for waste collection, segregation, reuse, recycling and end disposal like steps.

The survey was conducted within the five waste management zones and nearby areas of GMC focusing to collect data and information related to waste collection, processing within GMC area and to understand their supply chain.

The data was collected through a questionnaire, formal interviews, and a photographic survey.

Chart 60 indicates the types of waste collected by informal waste collectors as plastics, polythene, paper, cardboard, glass, metal (copper, aluminum, iron etc.) and coconut shells Majority are collecting metal, plastic, paper and cardboard.

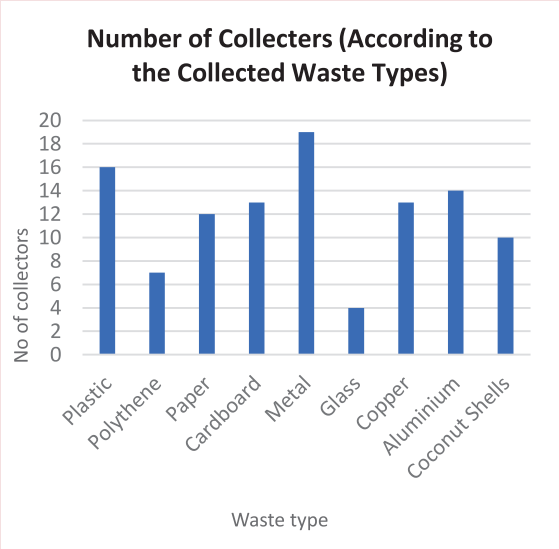


Chart 61: Number of Collectors (According to the Collected Waste Types)

Their daily income from waste collection varies from LKR 500.00 to LKR 5,000.00 or above asper chart 61.

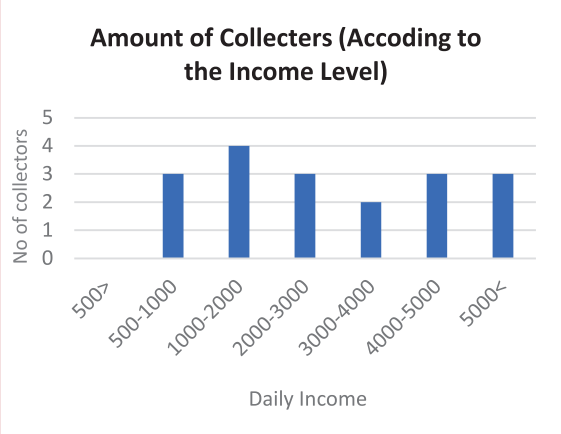


Chart 62: Number of Collectors (According to the Income Level)

7.5.1 Suggestions for the improvement of informal waste collector operation

Followings were proposed by them during the interviews.

- Their requirements for improving their current recycling facility
  - Arrangements for immediate waste disposal (Residual Waste) to GMC to obtain more space for the business
  - Daily basis waste collection system in their (IWCs operating) areas by GMC
  - Expansion of GMC waste collection vehicle service
  - Provide space/ land for storing waste temporarily by aggregators
- Government assistance for purchasing machines for waste recycling
- Facilitate them to bid for relevant Government tenders.
- Provide capacity building training.

The interview responses indicate that they have resource gaps (e.g. containers for waste collection, facility for transportation) and knowledge gaps (e.g. safety risks associated with various waste types, proper segregation/ dismantling method and up-cycling opportunities etc.) to improve and expand their business.

7.5.2. IWCs contribution to the GMC integrated solid waste management plan.

As disclosed during the interviews, informal waste collectors are willing to provide their support to proposed integrated solid waste management plan of GMC. They are willing to expand collection capacity, collect wastes that are not collected by GMC and improve the waste market chain.

7.6 The Finding of the Illegal Waste Disposal Personals

Some of the key places of GMC areas are polluted with illegally dumped waste. Generally, 50 illegal waste dumping incidents are reported in every month. The environmental unit of Galle Police has recorded 52 cases in the month of January 2023. 16 individuals who dumped waste illegally were randomly selected for the survey. Reasons for illegal waste dumping, waste disposal, rout cause/ issues for such practice, and their suggestions were collected through this survey.

7.6.1 Reasons for illegal waste dumping

As per the information collected, majority of illegal waste dumpers don't have a systematic methods for waste disposal and an adequate space to temporary store waste. Some of them mentioned problems in the municipal waste collection system as the reason.

7.6.2 Proposals to reduce illegal waste dumping

Following is the summary of proposals by illegal waste dumpers as per their responses;

- Establishing collection points at key junctions based on assessment,
- Establishing waste collection points in some residential areas, where households do not have adequate space for waste storing,
- The majority's proposal was to improve the municipal waste collection plan based on need assessment of community group level.

7.7. The finding of the development organizations and community-based organizations

The survey was conducted with development organizations and other community-based organizations using survey questionnaires. Focus was to collect information on the role of organization on SWM in GMC area and how the organization manages own waste.

Only 67% of the organizations are handing over their waste to the Galle Municipal Council and the other 33% do not generate or manage waste by themselves.

Most waste generated by organizations is domestic organic waste and followed by paper waste, polythene, and plastic waste.

Apart from those organizations, 67% of the organizations are dissatisfied with the current Galle Municipal Council waste management practices for the reasons below.

- Waste collectors are not coming to the particular office premises.
- The GMC waste handling staff do not practice proper waste collection.
- Low frequency of the weekly waste collection, which is limited to two days a week.
- Lack of communication system for informing waste collection and vehicle transportation roads to the residents.
- The waste collection is not functioning as scheduled.
- Galle Municipal Council waste collectors request money from the resident to collect their waste.

Development Organizations and Civil Society Organizations provide the below-listed suggestions for the improvement of GMC waste collection system.

- Provide labeled garbage bins to needful residents for waste segregation.
- Encourage residents to implement domestic biogas plants and composting to reduce waste generation.
- Improve the GMC waste collection system with more frequent waste collecting.
- Set up proper communication mechanisms for aware waste collection and vehicle arrivals.
- Increase the number of public garbage bins in Galle city for the public to dump their waste.
- Frequently clean the city, roads, public places, and drainage for a cleaner city.
- Conduct multi-level public awareness about 3R concepts and encourage reduction and reuse.
- Contact multi-level public awareness about health and safety issues related to illegal waste dumping.

7.8 Findings from International Tourists

The survey was conducted with Nine (from Germany, Russia, South Africa, England, America, and the Czech Republic) International Travelers within one day to obtain their perceptive on MSWM in Galle. The sample age range was from 20 to 70 years, covering both males and females.

According to them, commonly dispose waste by them are Polythene and plastic waste followed by domestic organic waste and paper waste.

Most (i.e. 8 out of 9) of them explained that their home countries are cleaner than Galle city.

Majority (i.e. 8 out of 9) of them were dissatisfied with the waste disposal facilities available in Galle city and proposed increase number of waste collection bins in common areas like Galle fort.

A summary of their proposals to improve waste management in Galle city are as follows;

- Teaching children how to dispose of waste properly in schools and increasing social awareness at a young age will help to improve the waste management system in Galle city.
- Increase the number of waste collection bins in place at Galle city.
- Conducting advertising and other methods to increase social awareness to reduce illegal waste dumping in the city.
- Improve social initiatives toward waste management. For example, teaching people how to manage waste and possible financial benifits through proper waste management.
- Installing waste collection points, especially for plastic bottles, and giving rewards to the people who bring them.
- Restricting plastic bags in supermarkets.

Figure 51: Survey – Tourists (Source: HELP-O)

A Russian tourist suggested, "Start collection points for collecting wastes such as plastic and giving rewards to the people who bring them. Keep separated bins for each category."

7.9.Root Cause Analysis Findings for "Unauthorized Waste Disposal Practices of the Public" – Galle City

Unauthorized waste disposal was a major concerning factor for GMC waste management. There are several places people use for unauthorized waste disposal.

To identify the root cause of this problem, focus group discussions were conducted with relevant government institutions and the affected community members.

The focus group discussions include Public Health Inspectors (PHI) of GMC, Waste Supervisors and waste workers of GMC, Environment Police officers and the communities living adjoining to waste management hotspots (e.g. Devata beach front, surrounding of Karapitiya hospital) Four FGD were done under this.

As per the findings, the root cause for this problem can be categorized into five main problems, and those are;

- Institutional and governing system weakness.
- Lack of public awareness about waste segregation and disposal.
- People's behaviors toward environmental conservation and biodiversity.
- Lack of financial and resource availability and poor management of existing services and resources.

Institutional and governing system weakness.

The gaps in governance on SWM are as follows;

- PHIs are excluded from the council's regular planning committee (Housing and Town Improvement Ordinance specifies the role of PHIs in the planning committee). Their absence cause disregarding environment considerations including SWM aspects in building/ development planning and approval process.

- Excluding the informal settlements/ slums (generally a SWM hotspot) are not included in the development plans.
- Poor monitoring of waste supervisors by the SWM unit.
- Lack of capacity and motivation among waste supervisors for higher performance.
- Lack of reach and impact of the Environment Police.
- Absence of a proper system in place to cater to mixed waste from the floating population.
- Absence of regulation or standard for the haulers/ private contractors who transfer waste and disposal sites.
- Gaps in GMC routine SW collection to properly reach the community.
- Absence of regulation or standard for the haulers/ private contractors who have been contracted to clear wastes from the vessels/ships.
- Absence of a solution for poultry waste, which are not accepted by GMC.
- Lack of community bins are in place to cater to the public who are visiting the city.
- There is lack of equipment and facilities available for GMC waste workers.

Lack of public awareness about waste segregation and disposal

The main public awareness gaps were;

- The more significant mismatch between people's behavior and the public's education level regarding waste disposal practices.
- Lack of public knowledge and awareness regarding the importance of waste worker and their duties.
- People's behaviors toward environmental conservation and biodiversity.
- Private landowners carelessly develop any cultivation or building on their bare land.
- People are lazy about segregating their waste and handing it to GMC waste collectors.

Lack of financial and resource availability and poor management of existing services and resources

- Environment police do not have enough staff to oversee and apprehend the culprits.
- GMC does not have a vehicle replacement plan in the event of vehicle breakdowns and doesn't have a stock of extra truck trailers.
- There are shortages in PHI cadre positions at the council, as out allotted 9, only four are presently covering 15 wards.

Figure 52: Focus Group Discussion Governmental Institutions-Municipal Health Department (Source: HELP-O)

Figure 53: Focus Group Discussion with environment Police Galle (Source: HELP-O)

PHOTO: HELP-O

CHAPTER 8
CONCLUSION AND REECOMMENDATIONS

8. Conclusion and Recommendations

Baseline Assessment of Waste Segregation Practices by Sectors and Assessment of Waste Management Services for Galle Municipal Council Area was carried out under the "Collaborative Action for Clean City of Galle" project implemented by HELP-O funded by USAID CCBO. The project collaborates 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 Baseline Assessment is a key requirement for the development of the Integrated Solid Waste Management Action Plan (ISWMAP) to be prepared under the project. Under the Baseline Assessment, sector-wise (e.g. residential, commercial, industrial, and service) waste generation patterns, waste disposal methods, waste segregation practices and problems in waste segregation, waste collection by the GMC and user satisfaction on the GMC service delivery was studied by employing a scientific approach developed through a thorough literature review. The sector-wise Baseline Assessment covered the entire GMC area, including five Waste Management Zones, namely Mahamodara, Richmond Hill, Karapitiya, Moragoda, and Galle Bazar. Furthermore, a comprehensive analysis of the waste generation patterns, SWM practices, SWM related problems, and perceptions regarding the GMC service was carried out focusing on a few specific sectors, such as the health care sector, fisheries sector, and religious places. Waste collectors/ aggregators, and tourists were interviewed and gathered their perceptions regarding the problems and potentials of the current SWM system and their suggestions for improvement. Illegal waste dumpers were interviewed and gathered data regarding the toot causes that led them to perform those illegal acts, also focusing on directions for overall social behavior change amongst citizens and visitors. Complementary to the above assessments, a thorough study of the national, provincial, and local level statutory provisions for SWM, the GMC procedures adopted for the SWM, and the compliance level of the GMC SWM procedures with national requirements was carried out based on the CCBO's 'Waste Governance Gap Analysis' conducted in 2022 with the assistance of the USAID.

According to the Waste Assessment, 81% of the residential sector waste collection is covered by the GMC SWM service. However, due to some reasons such as lack of proper access roads to reach certain residential areas and lack of resources (e.g. waste compactors and tractors), the GMC has not been able to provide house-to-house service to the rest of the residential units. Amongst those who have been receiving the GMC service, the satisfaction level on the service is recorded as 83%. The commercial sector assessment was conducted focusing on two categories of establishments: the first category was large-scale establishments with more than 14 employees, which included supermarkets, large wholesale and retail enterprises, and so forth, whereas the second category was small-scale establishments with less than 14 employees, which included small grocery stores, restaurants and hotels, street vendors, and so forth. It was decided to go for these two categories based on the fact that their waste generation, collection and management practices are different to each other, primarily due to the scale of their businesses. According to the assessment, the GMC covers 84.44% of small commercial units and 85.71% large commercial units in the city. Both the small and large categories (among those who have been receiving the GMC service) have expressed high level of satisfaction for the GMC service. Similarly, the GMC covers 64.1% of industrial establishments and 78.74% of service sector establishments located in the city. As per the interview findings, many industries manage their waste on their own, hence only 64.1% of establishments handover their waste to the GMC. This is comparatively a smaller percentage than the other residential, commercial, and service sectors. As in the residential and commercial sectors, satisfaction levels of industry and service

sectors on the GMC service were recorded high. These key findings suggest that even though the GMC provides a better collection service for the HHs, there is still room for improvement by expanding the GMC service to the rest of the HHs and commercial; industrial and service sector establishments that are not covered at the moment. Furthermore, taking actions to improve the service delivered to the HHs via conducting regular and timely collections, providing better knowledge on waste types; waste segregation and 3R, training and empowering their laborers to maintain a good relationship with citizens, and so forth, is important when assuring a high satisfaction level on the GMC service delivery.

Besides the GMC collection service, many HHs, commercial; industrial and service establishments have adopted other methods to dispose their degradable and non-degradable waste. The most common degradable waste disposal methods used by all these sectors (other than the GMC service) include composting, re-use and selling to a third party. In addition to the above methods, burning and burying is another common disposal method used, specially by HHs, when disposing nondegradable waste. The same practice can be observed among religious places under other specific sectors, however, health care sector obliged to handle their hazardous waste according to the standard procedures established by the Health Ministry. Except for the hazardous waste disposal procedures, it is beneficial to study and adopt these alternative methods of waste disposal that are already being practiced by HHs and commercial; industrial and service sector establishments in the city. These methods can be further strengthened and incorporated into the GMC SWM system to provide sustainable and long-lasting solutions for the waste problem in the city of Galle.

As per the interviews conducted focusing on the key sectors and other specific sectors, another important finding was that the majority of HHs and establishments practice waste segregation. The GMC's policy to collect only the segregated waste as degradable (Wet) and nondegradable (Dry) must have led to this positive behavioral change. Among those who practice waste segregation, the large majority segregate waste into degradable and nondegradable categories, whereas some separate waste into more categories, mostly considering the economic value of the waste. For example, as per the survey results, coconut shells from degradable waste and metals from nondegradable waste are segregated at the source as those can be sold to a third party and earn money rather than just handing over to the GMC or burning or burying. However, difficulty to recognize waste categories and lack of space to keep segregated waste have been the common problems faced by everybody when practicing waste segregation. Paying attention to these problems, awareness raising, building networks between HHs/ establishments with diverse waste collectors, and improving the GMC waste collection mechanism by planning for regular collections, providing segregation facilities at common disposal areas, and so forth would further motivate and systematize the waste segregation.

Finally, 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 (including 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.

REFERENCES

- USAID, CLEAN CITIES, BLUE OCEAN: 3R/SWM and Marine Debris Reduction Strategy Alignment Assessment | Sri Lanka, 2021
  https://pdf.usaid.gov/pdf_docs/PA00XWPS.pdf

- JICA, Data Collection Survey on Solid Waste Management in Democratic Socialist Republic of Sri Lanka, 2016.
  https://openjicareport.jica.go.jp/pdf/12250213.pdf

- WHAT A WASTE 2.0 A Global Snapshot of Solid Waste Management to 2050
  https://espas.secure.europarl.europa.eu/orbis/sites/default/files/generated/document/en/211329ov.pdf

- Karunarathna, A., Singh, R. K., Rajapaksha, T., Premakumara, D. G. J. & Onogawa, K. (2019). State of Municipal Solid Waste Management in Negombo, Sri Lanka, United Nations Environmental programme. https://www.unep.org/ietc/resources/report/state-municipal-solid-waste-management-negombo-city-sri-lanka

- Dharmasiri, 2019; Jayasekera and Karunarathna, 2019, as cited in NAPPWM, 2021.
  http://env.gov.lk/web/images/pdf/policies/National_Action_Plan_on_Waste_Management.pdf

- Ministry of Environment, National Action Plan on Plastic Waste Management 2021 – 2030, 2021.
  http://env.gov.lk/web/images/pdf/policies/National_Action_Plan_on_Waste_Management.pdf

- Department of Local Government Southern Province, January (2020).

- Integrated Development Plan by Active Citizen Participation in Local Governance Galle Municipal Council (2020 - 2022)
  http://env.gov.lk/web/images/pdf/policies/National_Action_Plan_on_Waste_Management.pdf

- CCBO Solid Waste Governance Gap Analysis, August (2022)

- Development Plan for Grater Galle Area 2019 – 2030
  https://www.uda.gov.lk/attachments/devplan_detailed/for_public_comments/Galle%20Dev.%20Plan%20Volume%20I.pdf

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