Maldives National Waste Accounts

2018 & 2019

Final Report

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Environmental Protection Agency

Ministry of Tourism

Health Protection Agency

Waste Management Corporation

Maldives National Defence Force

Parley

Secure Bag Pvt Ltd

Zero Waste Maldives

Local Government Authority

Male' City Council

Addu City Council

Fuvahmulah City Council

Kulhudhuffushi City Council

Atoll Councils

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ABBREVIATIONS

ADB	Asian Development Bank
ARC	Australian Red Cross
C&D	Construction and Demolition
CDE	Commerce, Development and Environment Pvt Ltd
CRC	Canadian Red Cross
EIAs	Environmental Impact Assessments
EMPs	Environmental Management Plans
EPA	Environmental Protection Agency
EPPA(4/93)	Environmental Protection and Preservation Act
ERC	Environment Research Centre
GEF	Global Environment Facility
HIES	Household Income and Expenditure Survey
HS Code	Harmonised System Code
ISIC	International Standard Industry Classification
IWMCs	Island Waste Management Centres
IWMPs	Island Waste Management Plans
LGA	Local Government Authority
MED	Ministry of Economic Development
MEE	Ministry of Environment and Energy
MoE	Ministry of Environment
MoT	Ministry of Tourism
NBS	National Bureau of Statistics
NGOs	Non-Governmental Organizations
NPHCWM2016	National Policy on Healthcare Waste Management 2016
NWMP2015	National Waste Management Policy 2015

PSUT	Physical Supply and Use Tables
RWMF	Regional Waste Management Facility
SAP2019-2023	Strategic Action Plan 2019-2023
SDGs	Sustainable Development Goals
SEEA	System of Economic and Environmental Accounting
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
URA	Utility Regulatory Authority
URAA	Utility Regulatory Authority Act
USD	United States Dollars
VIA	Velana International Airport
WAMCO	Waste Management Corporation
WMR2013	National Waste Management Regulation 2013

EXECUTIVE SUMMARY

The national Waste Accounts 2018 and 2019 for the Maldives focus on waste generation and management within the Maldives. The Waste Accounts was prepared using a framework developed for the purpose based on the System of Environmental-Economic Accounts (SEEA) methodology. Waste producers are classified according to the main economic industries most relevant to the Maldives. A total of 12 industries were identified for the Waste Accounts. In addition to the industries, households and import and export of waste are also included. Waste categories and management methods were derived based on national policies and legislation as well as published reports and existing waste management practices in the Maldives.

Most of the data that is presented in the Waste Accounts are estimations using waste generation rates and waste composition in policy documents and previous studies. Most of the data are related to the tourism industry and households, although some estimates were generated for construction, transport and health industries as well. For most of the remaining industries identified in the Waste Accounts Framework, there was no information available that could be sufficiently presented. Amounts of waste collected by public or private waste collectors are available, although there are issues with the method of estimating waste quantities. Waste management facilities whether at island level or at regional level, do not seem to maintain records of incoming waste and by management methods. The following tables show the data that could be captured at a glance.

Summary of Supply Table - Generation of waste by industry (tons)

Waste producer	2018	2019
Construction	182,500	182,500
Transport	3,431	3,431
Tourism	30,739	34,765
Health	6,296	6,296
Households	197,035	205,261
Imports	337	542
Total	420,338	432,795

Summary of Intermediate Use: Own Management of waste by waste producers (tons)

Own management	2018	2019
Recovery of reusables and recycables	131	117
Disposed to the sea	15,120	17,006
Incineration	6,296	6,296
Collection by public/private collectors	167,856	175,480
Self-transfer to designated site	25,705	26,235

Summary of Final Use Table - Waste managed at waste management facilities (tons)

Final use	2018	2019
Exported	17,217	1,831,608
Food waste	41	0
Green waste	0	0
Other organic waste	71	43
Plastic	-12	-846
Metal	-12,619	-48,054
Paper & Cardboard	1,337	585
Glass	43	34
Diaper and sanitary waste		
Textile		
Rubber		
Wood	3,062	2,675
E- waste	0	0
Discarded vehicles	0	0
Medical and biological waste	0	0
Hazardous & special category waste	-865	-1,765,241
Construction, Demolition and sand	54,600	72,453
Mixed and other waste	262,606	285,394

One of the main findings from the stakeholder consultations was the lack of data and record keeping in the waste management sector. Ministry of Environment (MoE) and the Environment Protection Agency (EPA), the two key agencies mandated with waste management policy formulation and monitoring waste management operations respectively, stated that only limited data is available and work is ongoing to standardise data collection and monitoring.

Each industry of the economy and households, are waste producers, generating different types of waste and in some cases, producing hazardous waste that needs special management practices to reduce risk to people and the environment. Providing waste

management services and monitoring waste generation and management is a challenge due to the disbursed nature of the communities and economic activities. To reduce the gap in data collection for the compilation of the Waste Accounts in the future, a key opportunity is the decentralised governance system and the National Statistical System (NSS). Data collection processes for waste management need to be producer-led and industry-specific. Local Councils and line ministries must be enabled to collect and report data while MoE will provide the technical expertise in standardizing data collection, waste types, and reporting processes.

1 INTRODUCTION

1.1 Purpose

In 2017, the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) commissioned a system-wide review of the national statistical system of the Maldives and, in line with the recommendations of the review supported Maldives to conduct an assessment of the priorities, opportunities, constraints and feasibility for environment statistics strengthening towards improved monitoring of the Sustainable Development Goals (SDGs). The assessment recommended to identify the data compilation priorities as a foundation towards developing a national mechanism for compilation of environment statistics.

Building on the initial assessment in 2017, Water and Waste were identified as the first step to focus on strengthening environmental statistics. During 2018 UNESCAP conducted a review on the current data availability and guided the working group on environment statistics to develop waste and water accounts by a local expert. It reviewed the available data through all sources and obtained data available on waste and water for 2017 and prepared test accounts for waste and water.

Based on the recommendations of the review and pilot accounts, UNESCAP is assisting the National Bureau of Statistics (NBS) and the Working Group in progressing the work on waste accounting, with an aim to compile and publish waste accounts for 2018 and 2019 according to SEEA.

The purpose of this report is to present the national waste accounts for the Maldives for the years 2018 and 2019. The specific objectives are to:

- Introduce a framework that serves as a basis in data collection and preparation of the waste accounts;
- Bring together different information sources into a holistic picture of waste generation, collection and treatment using an accounting framework;
- Develop a multi-purpose data system which serves user needs - government, service providers, Non-Governmental Organizations (NGOs), citizens;
- Identify key indicators and proxy indicators on waste for evaluating effectiveness of national policy and planning, as well as progress on SDGs;
- Identify data gaps and propose activities that will help improve data collection.

Hence, this work has looked at the waste management sector in-depth for the purpose of obtaining data that can be used in the compilation of the national waste accounts.

1.2 Scope

This report focuses on waste generation and management within the Maldives, including exported waste and any imported waste.

Data used was from existing data provided by the different stakeholders.

Geographic coverage of data sought was country-wide. Most data available from the stakeholders is limited to Greater Male' Area (Male', Villingili and Hulhumale'). Where available, data for other islands was also used in the analysis. Estimations were made for all inhabited islands across all the atolls where possible.

Period of data is time-bound to 2018 and 2019 unless specified otherwise.

1.3 Report layout

This report consists of eight chapters as follows:

Chapter 1 Introduction

Chapter 2 Context for waste-related data

Chapter 3 Framework for waste accounts

Chapter 4 Waste accounts 2018 & 2019

Chapter 5 Methodology

Chapter 6 Conclusion

Chapter 7 Recommendations

Chapter 8 References

2 CONTEXT FOR WASTE-RELATED DATA

This chapter provides a summary of waste management situation in the country and makes the case for data collection and analysis related to waste.

2.1 Existing situation of waste generation and management

Waste and the inadequate management of waste is stated as a pressing environmental concern in the State of the Environment 2016 (MEE 2017a). Table 1 provides a summary of the waste situation in the Maldives at present. The existing situation is described in the three categories of Greater Male' Area, the atolls and the industrial islands. Both Greater Male' Area and the atolls include households, government institutes and economic activities that are state or privately-owned. The industrial islands include islands used by the state as well as islands leased to private sector for long-term for commercial purposes.

Table 1 Waste generation and management in the Greater Male' Area, atolls and industrial islands

Component	Greater Male' Area	Atolls	Industrial islands
1. Waste generation	Waste producers include households, government institutes and the commercial sector. 1.7kg per capita per day (MEE 2015). Responsible for a significant proportion of waste generated in the country (MEE 2017a). From 2004 to 2014, a 155% increase in waste generation in Male' region (MEE 2017a).	Waste producers include households, government institutes and the commercial sector. 0.8kg per capita per day (MEE 2015). Between 20076 to 2015, a 57.4% increase in generation of municipal waste in the atolls (MEE 2017a).	Waste producers are the industrial operations carried out within the boundaries of the island. 3.5kg per bednight in resorts (MEE 2015). Generation rates for other industries have not been studied.
Waste composition	Organic waste constitutes the bulk of the waste generated. Total compostable waste is at nearly 80% (MEE 2017a). Households - food waste, green waste, plastic, metal, paper & cardboard, glass, sanitary waste, textile, E-waste, hazardous waste. Waste composition of government institutes are most likely similar to households. Economic activities generate waste types	Kitchen waste and green waste account for 88% of the total waste generated (MEE 2017a). Waste types of households is similar to Greater Male' Area. There are no studies or assessments undertaken which provides specific data on the quantities of waste from economic activities.	There are no assessments specific to economic activities in industrial islands. General waste is likely similar to households. In addition, hazardous and chemical waste may be generated that are specific to the industries.

Component	Greater Male' Area	Atolls	Industrial islands
	similar to households as well as waste related to specific economic and activities. Some hazardous waste types that can be easily identified includes waste oil from powerhouses, chemicals/solvents used in laboratories (both in schools and hospitals). Quantities of waste in general and specific types of waste may be high depending on what type of business or operation it is.	Economic activities generate waste types similar to households as well as waste related to specific economic and activities. Economic activities in the inhabited islands vary from manufacturing, fish processing, weaving, boat building, carpentry, tailoring, agriculture, bottling plants to tourism-related activities such as guesthouses and diving schools. Some hazardous waste types that can be easily identified includes waste oil from powerhouses, chemicals/solvents used in laboratories (both in schools and hospitals). Quantities of waste most likely depends the type of economic activity and scale.	Quantity of waste and what types of waste depends on scale and type of operations.
Waste segregation	No segregation at source because waste is collected mixed from households as well as institutes and commercial establishments.	About 25% of islands segregate waste at household level. In addition, partial segregation to combustible	Waste management within commercial establishments have not been assessed except for resorts.

Component	Greater Male' Area	Atolls	Industrial islands
	Some commercial establishments segregate reusable waste such as cardboard boxes, regiform boxes.	and non-combustible done by about 5% of islands (MEE 2017a). Food waste may be buried in the backyard or thrown in the lagoon. Green waste from sweeping is also usually left in the backyard for decomposing. Non-biodegradable fractions are usually supplied to waste collectors or taken by the households to the Island Waste Management Centre (IWMC). Waste is also found in vegetation areas of the islands.	Some commercial establishments may segregate reusable waste such as cardboard boxes, regiform boxes. Resorts usually segregate waste by regulation to food waste, green waste, plastics, metals, glass, wood, sanitary waste and other. Food waste is often dumped in the deep sea by the resort or a contracted party. Some resorts also carry out composting of organic waste. Plastics, metal cans, glass are shredded, compacted or crushed before transported out of the resort. Plastics are also sold or donated to plastic collectors. Crushed glass may be reused within the resort for construction. Sanitary waste and, paper and cardboard are usually burnt in the incinerator. However, some resorts transport all waste out of the resort.

Component	Greater Male' Area	Atolls	Industrial islands
Waste collection and transfer	Waste, usually mixed waste without segregation, from households, government institutes as well as commercial establishments is collected by Waste Management Corporation Limited (WAMCO). Despite the regular waste collection service by WAMCO, there are issues of random waste disposal in different areas of Male' City as well as Villingili and Hulhumale'. This is especially true for bulky waste such as furniture, refrigerators, washing machines and similar items. These types of waste are often found along the road side, open areas and unused land plots.	WAMCO operates collection service in Addu City and Fuvahmulah City. In some islands, waste collection may be by private contractors in agreement with Island Councils. In other islands waste producers transport waste to IWMCs by themselves. 80% of households stated that waste is taken to designated sites while 7% reported to dumping in the beachside and 6% in the bushes (MEE 2017a). About 5% stated that waste is burned in their house compound (MEE 2017a).	Some resorts transport waste to Thilafushi waste management site through contracts with WAMCO or other vessels registered for waste transportation. Some resorts also transfer waste to nearby inhabited islands through agreements with the local community. Maldives Airports Limited (MACL) has a contract with WAMCO to collect waste from Velana International Airport. Waste transportation arrangements from other industrial islands are not clear.
Recovery of reusable and recyclable waste	In partnership with NGOs and businesses. Some schools have collection points for plastics, specifically PET, HDPE and PP in partnership with Parley NGO. Recycling businesses or individuals collect reusable and recyclable waste directly from waste producers.	Similar to Greater Male’ Area.	Many resorts sell or donate their reuseables and recyclables to NGOs or small businesses that collect this type of waste including plastics, metals, glass, paper and cardboard. Used engine oil is also sometimes

Component	Greater Male' Area	Atolls	Industrial islands
			given to nearby communities for reuse.
Waste management at designated sites	All waste collected by WAMCO from Greater Male' Area is first transported to Transfer Stations and then to Thilafushi waste management site. Thilafushi waste management site is operated by WAMCO.	IWMCs have been established in 128 islands (MEE 2017a). According to EPA, 43 IWMCs have been registered. Hard waste and E-waste are stockpiled in the designated sites or along the coastal periphery of islands.	As per the regulation a dedicated waste management centre must be established at each resort and it should have a storage area, treatment facilities such as incinerators, compactors, bottle crushers. Open burning is prohibited in tourist resorts. Resorts do not landfill waste within their boundaries.
Regional waste management facilities	Thilafushi is to be established as the Regional Waste Management Facility (RWMF) for Zone III which encompasses Kaafu Atoll including Greater Male' Area, North Aril Atoll, South Ari Atoll and Vaavu Atoll. At present, waste received at Thilafushi is mostly burned openly and landfilled. There is some segregation to recover reusables and recyclables.	Vandhoo RWMF was established to serve Zone II which includes Noonu, Raa, Baa and Lhaviyani atolls. Vandhoo RWMF includes an incinerator and an engineered landfill area. Vandhoo RWMF is at present operated by WAMCO. Waste other than food waste is collected from islands by WAMCO under contract with Island Councils and transfered to	Some resorts transport their waste to Thilafushi especially those nearby. Construction and Demolition (C&D) waste is transported to Thilafushi from many islands.

Component	Greater Male' Area	Atolls	Industrial islands
	Government of Maldives is undertaking a project in Zone III with the assistance of Asian Development Bank (ADB) to establish the RWMF in Thilaufushi.	Vandhoo. Vandhoo incinerator is being upgraded. Combustible waste is shredded and baled until incinerator becomes operational. Waste such as metal, glass and plastic is segregated and stockpiled.	

2.2 Case for waste-related data

The quantity of waste generated in the country is unknown due to poor record keeping and lack of systematic monitoring mechanisms for the waste sector (MEE 2017a). A number of policies and legislation has been prepared and enacted in the past years. However, priority given for the use of data and evidence in evaluating policies is low. In addition, the Government has made significant investments in waste management and continues to fund the infrastructure for proper waste management across the country. Given the efforts by the Government and that waste remains a growing concern for the environment and public health, there is a need to evaluate the effectiveness of policies, legislation and investments implemented for waste management, for which, reliable and consistent data is crucial. Waste management with appropriate infrastructure and services has also been developed relatively recently, thereby also providing the opportunity to improve data through current interventions.

2.2.1 Policy and legislation

The policies and legislation in place provides for and mandates regular data collection on waste generation and waste management methods. The relevant policies and legislation are summarised below:

The Environmental Protection and Preservation Act (EPPA, Act No: 4/93) enacted on 19 March 1993 is the framework law related to environment protection in the Maldives. Articles 2, 7 and 8 are specifically relevant to waste management.

Decentralization Act (07/2010) mandates island and city councils to provide adequate waste management services.

National Waste Management Policy 2015 (NWMP2015) was formulated with the aim to formulate and implement guidelines and means for solid waste management in order to maintain a healthy environment. The NWMP2015 includes waste reduction, formulation and implementation of a waste management plan for all islands, establishing waste management systems in all inhabited islands including providing required resources, establish RWMFs and regional waste collection services, education and awareness and training as well as establishing a trust fund for waste management and maintaining statistics at island and national levels. The implementing agency of the NWMP2015 is MoE. As part of implementing the NWMP2015, the country is divided to seven zones and RWMF are to service one or more zones.

Waste Management Regulation 2013/R-58 (WMR2013) provides the main regulatory framework for waste management. Article 32 Data collection requires the Implementing agency of the regulation to maintain a database to record the amount of waste generated

and treated at island level and national level. Article 33 Reporting stipulates that an annual report on waste management based on the database described in Article 32 must be submitted to the Ministry. Annex E provides details of data that needs to be regularly collected and maintained by licensed waste management operators. The implementing agency for the Waste Management Regulation is the Environmental Protection Agency (EPA).

The Database provided by EPA comprises of information on the

1. Island Waste Management Plan (IWMP) Approved 2015 to 2021by locality of atoll and island and, approval status;
2. IWMC Registration 2015 to 2021 by atoll, island, category of IWMC and registration status;
3. Waste Management License 2015 to 2021 by location, waste management category and approval status;
4. Waste Transport Vehicle and Vessel Registration 2016 to 2021 by company, location, registration number, type of vehicle and approval status.

Strategic Action Plan 2019-2023 (SAP2019-2023 is the current policy and strategy document. There are four key policies with targets related to waste as follows:

> Policy 1: Promote waste as a valuable resource for income generation.
>
> Policy 2: Improve chemical and hazardous waste management practices to ensure protection of people and the environment.
>
> Policy 3: Reduce plastics pollution by phasing out single use plastics.
>
> Policy 4: Instill environmental values in the society and promote environmentally friendly lifestyle.

Under Policy 3, ban on single-use plastics (SUPs) was announced in January 2021 prohibits the import of certain types of plastics.

However, due to the pandemic, the President's Office is at present reviewing and revising the SAP with the line ministries.

National Policy on Healthcare Waste Management 2016 (NPHCWM2016) stipulates that all health facilities have to be responsible for the safe management of health care waste in an environmentally sound manner that minimizes risk to the community and the staff involved in its management. The policy requires that quantities of hazardous health care waste and handling information be documented and reported to the relevant departments of MoH.

Regulation on the Protection and Conservation of the Environment in the Tourism Industry 2000 under the umbrella Maldives Tourism Act (2/99), was formulated to protect the environment related to the tourism industry. Section 5 of the Regulation details provisions for the management of solid waste in the tourism sector. The data reporting requirement is in

Section 5.3.5 Information relating to particulars of vessels, including the capacity and proper logs on trips made for waste disposal in an island or part of it leased for tourism purpose, shall be submitted to Ministry of Tourism.

Ministry of Tourism conducts inspection of the resorts regularly. Condition of waste management area and waste management practices are assessed during the inspection.

The Regulation on the Protection and Conservation of the Environment in the Tourism Industry is also under review at present.

Utility Regulatory Authority Act (URAA) (26/2020) ratified on 23rd November 2020, under which the Utility Regulatory Authority (URA) has been established as the official authority to regulate and oversee the proper management of public utility services in the country. Services related to waste management will also be governed under the URAA and regulated by URA.

2.2.2 High investments on waste

Since the tsunami of December 2004, waste sector has seen significant support by donor agencies with a total exceeding USD50 million to date. Listed below are some of the key donor-aided projects.

- ADB Greater Male' Environmental Improvement and Waste Management Project 2018-2023; funded by the Asian Development Bank;
- Maldives Environmental Management Project 2008-2016; funded by The World Bank;
- Waste Management Programme 2005-2006, funded by the Australian Red Cross and the Canadian Red Cross;
- Emergency Waste Clean Up 2005, funded by the United Nations Environment Programme.

The Government of Maldives has been expanding on the support and continuing expenditure on waste infrastructure as well as operational efforts. According to MoE, 92 IWMCs have been established in 92 islands across 18 atolls by 2021. Given the high investments on waste management, there is a need to assess and understand the effectiveness of the investments thus far against the WMR2013, NWMP2015 as well as SAP2019-2023.

2.2.3 Provision of waste-related services

Island and City Councils are responsible for providing waste management services in their respective communities. According to EPA, 55 IWMPs across 16 atolls have been approved as of 2020. A total 43 IWMCs have been registered across 15 atolls. Waste management license has been issued to applicants for IWMCs located in seven islands in five atolls for different waste management categories. A total 92 vehicles and vessels have been registered

to date for waste transportation, of which, 84 are vehicles, seven are landing crafts and one is a boat. Majority of vehicles and vessels are registered to WAMCO.

WAMCO is the waste management service provider for Greater Malé Area. This includes the daily transfer of waste from Malé to Thilafushi, the waste management of Villimalé, and the disposal of waste at Thilafushi landfill area. WAMCO operates two Transfer Stations in Male' City and Hulhumale', where WAMCO vehicles transit and waste transported by private vehicles is stockpiled until transportation to Thilafushi landfill area. WAMCO is also the operator for the Thilafushi landfill area where waste transferred from GMA as well as other inhabited islands, resorts and industrial islands are managed. In addition, WAMCO is also the service provider in Addu City and Fuvahmulah City. Operation of the Vandhoo RWMF is also outsourced to WAMCO at present. Despite being the largest waste management service provider in Maldives, WAMCO does not have an operating license and does not fall into a clear jurisdiction making it challenging for the organization to undertake their operations. At present, records are collected at Transfer Stations of Greater Male' Area, Thilafushi waste management site and waste management facility at Addu City. Any data collected is an approximate based on the carrying capacity of the vessel or vehicle in which the waste is transferred. This data is provided to government agencies upon request.

This loophole in the monitoring of waste management will now be addressed under the newly ratified Utility Regulatory Authority Act (Law no. 26/2020). A major component of the ADB funded Greater Male' Environmental Improvement and Waste Management Project involves upgrading Thilafushi waste management site.

Under the WMR2013, EPA and all waste management service providers are required to maintain and report data on waste management. According to EPA, waste management service providers are conditioned to provide data according to the WMR2013 upon approval of their license. However, EPA has not received data yet and EPA also has not carried out data collection from waste management service providers. The reporting under Article 33 of WMR2013 requires the report to have details of the organisation undertaking waste management activities and quantities of waste generated, type of waste, treatment methods and other relevant information at national, regional and island level.

Annex E of the WMR2013 states the following information to be regularly maintained by waste management operators;

1. Types and amount of waste carried to waste management zone.
2. Total weight of waste used to make compost.
3. Where waste is transported from waste management zones to other places, type and amount of waste transported.
4. Whether the waste is handled using incineration, burning, recycling or dumping etc.
5. Quantity of plastic bottles, glass bottles, cardboards, wood, metals.

3 FRAMEWORK FOR WASTE ACCOUNT

Upon review of published reports and consultation with key stakeholders related to waste, it was realised that a structure was needed to facilitate data collection in order to prepare the national Waste Accounts for the Maldives. Hence, a framework was prepared for the compilation of the Waste Accounts.

Waste Accounts Framework looks at who the producers of waste are, what type of waste is being generated by the waste producers and what is happening to the waste.

In addition to adopting a definition of waste, three main components were considered and finalized for the Waste Accounts Framework including waste categories, waste producers and waste management methods. Waste Accounts Framework is then presented as Physical Supply and Use Tables (PSUT) per SEEA. The Supply Table shows the generation of waste in the different sectors of the economy and households by waste fractions. The Use Table shows amounts of waste as managed by waste producers, waste collectors and operators of waste management facilities by waste categories and management methods.

The following sections provide details on the Waste Accounts Framework.

3.1 Definition of waste

WMR2013 of Maldives provides a definition for waste as - "things that are discarded, intended to be discarded or required to be discarded because they are no longer of use."

For the purpose of the waste accounts of Maldives, definition provided in the WMR2013 is used.

3.2 Waste producers

Waste producers are classified according to International Standard Industry Classification (ISIC) taking into account the main economic industries and important industries for waste generation in the Maldives. In addition to the industries, households and the import and export of waste is also included. The main industries are further subdivided into specific areas relevant to waste generation. Table 2 shows the main industries and subcategories for waste generators.

Table 2 Waste producers defined for the Waste Accounts Framework

ISIC Broad categories	ISIC codes	ISIC Sub categories
A: Fishing and Agriculture	011	Agricultural plots in inhabited islands
	01	Agriculture leased islands (crops and animals)
	031	Fisheries
	032	Aquaculture
C: Manufacturing	1020	Fish processing - tuna
	1020	Fish processing - sea cucumber
	1104	Bottling plants
	1410	Clothing
	301	Boat building
	1622 3100	Carpentry
	2592	Welding
D: Electricity	3510	Electricity
	4773	Gas
E: Water	3600	Water
	3700	Sewerage
	38	Waste management
F: Construction	4100	Resort construction
	4100	Residential construction
	42	Public infrastructure
G: Wholesale, retail Trade, repair vehicles	45 46 47	Wholesale and retail Trade
	4520 4540	Garage - vehicle repair
	4781	Fish and vegetable market
H: Transportation	50	Sea transport
	49	Land transport
I: Accommodation and food services	5510	Resorts
	5510	Guest houses
	5510	Hotels
	5510	Liveaboards
	56	Food outlets
J: Information and communication	61	Telecommunication

O: Public Administration	84	Public administration
P: Education	851 852 853	Schools
	8530	Colleges and university
	8541	Dive schools
Q: Health	8610	Hospitals (tertiary hospitals)
	8610	Health Centers (island health centers)
	8620	Clinics
S: Other service activities	9601	Laundry
	9602	Salons
Households		Male'
		Atolls
Imports		Waste incoming from the rest of the world
Exports		Waste exports

3.3 Waste categories

Waste categories are the different types of waste that are generated by waste producers. Waste categories are derived using the NWMP2015, 'Waste Classification - Working Document' drafted by the MoE, Australia Waste Accounts, Bhutan Waste Accounts and SEEA framework. WMR2013 differentiates between hazardous waste and special waste. For the purpose of the Waste Accounts Framework, both hazardous and special waste categories are combined as hazardous waste. Broad categories of waste were chosen under which sub-categories were determined as relevant to the Maldives.

Table 3 shows the broad waste categories and the respective sub-categories defined for the Waste Accounts Framework.

Table 3 Waste types defined for the Waste Accounts Framework

Broad categories	Sub-categories
Food waste	All types of food waste
	Agricultural by-products of crops
Green waste	Landscaping, gardening
Other organic waste	Fish processing waste by products
	Animal waste
Plastic	Polyethylene terephthalate (PET)
	High density polyethylene (HDPE)

Broad categories	Sub-categories
	Polyvinyl chloride (PVC)
	Low density polyethylene (LDPE)
	Polypropylene (PP)
	Polystyrene (PS)
	Other plastics
Metal	Ferrous metals
	Non-ferrous metals
	Mixed ferrous and non-ferrous metals
Paper & Cardboard	Cardboard
	Newsprint & magazines
	Office paper
Glass	Glass
Diaper and sanitary waste	Diaper and sanitary waste
Textile	Textiles
	Leather
Rubber	Rubber (including tires)
Wood	Wood
	Saw dust
E- waste	Electronic waste
Discarded vehicles	Discarded vehicles
Medical and biological waste	Non-contaminated
	Contaminated (waste with blood, bodily fluids and other biological parts)
	Sharps such as needles, disposable scalpels, blades etc
Hazardous and special category waste	Fibre resin
	Insecticides
	Pesticides
	Chemical/paint solvents
	Mercury
	Lead
	Laboratory chemicals
	Asbestos
	Pharmaceutical waste
	Batteries
	Used engine oil (from vehicles, vessels, aircraft, machinery)
C&D waste	Asphalt
	Bricks
	Concrete

Broad categories	Sub-categories
	Rubble
	Plasterboard & cement sheeting
	Sand/soil
Mixed and other waste	Waste that is not segregated and could include any types of waste

3.4 Waste management methods

WMR2013 defines waste management as "the handling of waste in its different processing stages including its collection, transportation, treatment, storage, the management of waste disposal centres and land-filling." The different waste management methods are further defined in the WMR2013. For the purpose of the Waste Account framework, the WMR2013 and existing waste management practices in published reports are used in defining waste management methods. Table 4 lists the waste management methods considered for the Waste Account Framework.

Table 4 Waste management methods used in the Waste Accounts Framework

Waste management method	Definition
Waste collection service	The process of picking up waste from waste generators by public or private waste collectors and transporting the waste to WMC/RWMF or their own warehouse.
Self-transfer to TS/WMC/RWMF	The process of the waste producer taking their waste to a TS/WMC/RWMF.
Delivery to a reusable/recyclables collectors	Waste producers recover reusable and recyclables from their own waste to provide directly to collectors gathering reusables/recyclables specifically for that purpose.
Composting	Home composting, composting at WMCs manually or by means of machine at small-scale (less than 100kg per day).
Disposal of food waste to sea	Accepted or authorised disposal of small amounts of food waste to sea by some households; disposal of food waste to sea by resorts and liveaboards.
Open burning	Burning of waste to reduce volume in an open environment.
Incineration	Complete burning of waste using a burner or incinerator.
Landfill	Disposing waste to land or lagoon that is an engineered landfill or an enclosed area for the purpose.
Storage	Temporary stockpiling or storing of waste with or without processing for further treatment for more than one month.

Dumped into the environment	Act of throwing, placing, sticking, dropping of what may be constituted as waste to an area not authorised for waste disposal.
Exported	Waste transported to other countries.

3.5 Physical Supply and Use Tables

According to SEEA 2012, there are two main parts to the PSUT. The first part is the Supply Table where the generation of solid waste by industries and households is presented in addition to solid waste from the rest of the world (recorded as imports) and also solid waste recovered from the environment. The second part of the PSUT is the Use Table covering the collection and disposal of solid waste through various activities within the waste collection, treatment and disposal industry and through related activities in other industries.

For the Waste Account Framework, the Use Table is further detailed to capture the use of waste at the point of generation and use of waste at waste management facility or warehouse of collectors of reusables and recyclable waste.

The three tables prepared for the PSUT of the Waste Accounts Framework were as follows:

1. **Supply Table -** The Supply Table shows the generation of waste by different sectors of the economy, households and rest of the world (waste imports) by waste types. The broad industries in the Supply Table are aggregation of subcategories of each industry.
2. **Intermediate Use Table: Own Management Table -** The Own Management Table shows how waste producers are managing the different types of waste on their own. This includes waste supplied to public and private waste collectors and self-transfer by the waste producer to a waste management facility, waste recovered and delivered to reusable and recyclables collectors and, waste treated and disposed on their own.
3. **Final Use Table** - Final Use Table shows the final treatment of waste in the economy by IWMC/RWMF and waste collectors according to different waste types and waste management methods.

3.6 Availability of data

Table 5 to Table 7 shows what kind of data is available for both 2018 and 2019 through data records and estimations in comparison to the components in the Waste Account Framework, that can be used to compile the national Waste Accounts. The blank cells indicate that there is no data available for that particular industry, type and management method.

Table 5 Data availability by ISIC industries and waste types

Categories	A: Fisheries & agriculture	C: Manufacturing	D: Electricity	E: Water	F: Construction	G: Wholesale & Retail Trade	H: Transportation	I: Accommodation & Food Services	J: Information & Communication	O: Public Administration	P: Education	Q: Health	S: Other service activities	Households	Imports	Exports	Total Supply
Waste generation rates								X						X			
Food waste								X						X			
Green waste								X						X			
Other organic waste								X						X			
Plastic								X						X		X	
Metal								X						X		X	
Paper & Cardboard								X						X	X	X	
Glass								X						X			
Diaper and sanitary waste														X			
Textile														X	X		
Rubber														X			
Wood															X		
E- waste								X									
Discarded vehicles																	
Medical and biological waste												X					

Categories	A: Fisheries & agriculture	C: Manufacturing	D: Electricity	E: Water	F: Construction	G: Wholesale & Retail Trade	H: Transportation	I: Accommodation & Food Services	J: Information & Communication	O: Public Administration	P: Education	Q: Health	S: Other service activities	Households	Imports	Exports	Total Supply
Hazardous & special category waste														X		X	
Construction and Demolition					X												
Mixed and other waste							X	X						X			
Total																	

Table 6 Data availability by ISIC industries and own management methods

Categories	A: Fisheries and agriculture	C: Manufacturing	D: Electricity	E: Water	F: Construction	G: Wholesale & Retail Trade	H: Transportation	I: Accommodation & Food	J: Information & Communication	O: Public Administration	P: Education	Q: Health	S: Other service activities	Households
Supplied to Waste collection service					X		X	X						X
Self-transfer to WMC/RWMF					X									X
Own Delivery to reusable/recyclables collectors								X						X
Own Composting														
Own Disposal to sea								X						
Own Open burning														
Own Incineration														
Own Landfill														
Own Storage														
Dumped into the environment														

Table 7 Data availability by waste types and management methods

Categories	Reusables & recyclables recovery	Composting	Disposal to sea	Open burning	Incineration	Landfill	Storage	Dumped into the env	Export
Food waste									
Green waste									
Other organic waste									
Plastic									X
Metal									X
Paper & Cardboard									X
Glass									
Diaper and sanitary waste									
Textile									
Rubber									
Wood									
E- waste									
Discarded vehicles									X
Medical and biological waste					X				
Hazardous & special category waste									
Construction and Demolition									
Mixed and other waste									
Total									

4 WASTE ACCOUNT

This chapter presents the Waste Accounts for 2018 and 2019 using the available data. The Supply Tables, Intermediate Use: Own Management Tables and Final Use Tables for both years are presented in Section 4.1 and an analysis of the PSUTs are done in Section 4.2. The estimation methodologies and issues with the data are detailed in Section 4.3 and 4.4 respectively.

4.1 Waste Accounts for 2018 and 2019

Table 8 to Table 13 shows the Waste Account for 2018 and Table 12 to table 15 shows Waste Account for the year 2019. The Excel files of the PSUTs are given in Annex I.

The waste generation rates and waste composition that was used for the purpose of compiling of the Waste Account is given in Annex II.

Table 8 Supply Table 2018: Total supply of waste by industries & households by waste types

Categories	A: Fisheries and	C: Manufacturing	D: Electricity	E: Water	F: Construction	G: Trade	H: Transport	I: Tourism	J: Information &	O: Public	P: Education	Q: Health	S: Other	Households	Imports	Total supply
Food waste								16,599						106,005		122,604
Green waste								3,074						11,017		14,091
Other organic waste								3,074						6,947		10,021
Plastic								1,537						19,665		21,202
Metal								615						5,704		6,319
Paper & Cardboard								2,767						14,705	14	17,485
Glass								1,537						4,501		6,038
Diaper and sanitary waste								-						11,701		11,701
Textile								-						3,943	300	4,242
Rubber								-						636		636
Wood								-						890	23	913
E- waste								154						-		154
Discarded vehicles								-						-		-
Medical and biological waste								-				6,296		-		6,296
Hazardous & special category waste								-						2,339		2,339
Construction, Demolition & sand					182,500			-						-		182,500
Mixed and other waste							3,431	1,383						8,982		13,796
Total					182,500		3,431	30,739				6,296		197,035	337	420,338

Table 9 Intermediate Use: Own Management Table 2018 for industries & households

Categories	Reusables, recyclables recovery	Composting	Disposal to sea	Open burning	Incineration	Landfill	Storage	Dumped into the env	Supplied to waste collection	Self-transfer	Total
Food waste		-	15,120	-	-	-	-	-	79,695		94,815
Green waste		-	-	-	-	-	-	-	4,344		4,344
Other organic waste		-	-	-	-	-	-	-	274		274
Plastic	131	-	-	-	-	-	-	-	21,202		21,333
Metal		-	-	-	-	-	-	-	3,540		3,540
Paper & Cardboard		-	-	-	-	-	-	-	10,525		10,525
Glass		-	-	-	-	-	-	-	3,953		3,953
Diaper and sanitary waste		-	-	-	-	-	-	-	11,701		11,701
Textile		-	-	-	-	-	-	-	3,943		3,943
Rubber		-	-	-	-	-	-	-	636		636
Wood		-	-	-	-	-	-	-	890		890
E- waste		-	-	-	-	-	-	-	154		154
Discarded vehicles		-	-	-	-	-	-	-	-		-
Medical and biological waste					6,296				-		6,296
Hazardous & special category waste									254		254
Construction, Demolition & sand									-		-
Mixed and other waste									3,418		3,418
Total	131	-	15,120	-	6,296	-	-	-	167,856	25,705	215,108

Table 10 Final Use Table 2018: Total waste by waste types and treatment methods at waste management facilities

Categories	Rreusables, recyclables recovery	Composting	Disposal to sea	Open burning	Incineration	Landfill	Storage	Dumped into the env	Export	Total
Food waste										41
Green waste										-
Other organic waste										71
Plastic									189	-12*
Metal									15,774	-12,619*
Paper & Cardboard									220	1,337
Glass										43
Diaper and sanitary waste										-
Textile										-
Rubber										-
Wood										3,062
E- waste										-
Discarded vehicles										-
Medical and biological waste					6,296					-
Hazardous & special category waste									1,034	-865*
Construction, Demolition & sand										54,600
Mixed and other waste										262,606
Total									17,217	308,263

* Where there is a negative sign, export is greater than total collected, which shows that collection is underestimated.

Table 11 Supply Table 2019: Total supply of waste by industries & households by waste types

Categories	A: Fisheries and	C: Manufacturing	D: Electricity	E: Water	F: Construction	G: Trade	H: Transport	I: Tourism	J: Information &	O: Public	P: Education	Q: Health	S: Other	Households	Imports	Total Supply
Food waste								18,773						110,743		129,517
Green waste								3,477						11,377		14,854
Other organic waste								3,477						7,091		10,567
Plastic								1,738						20,486	443	22,667
Metal								695						5,917	21	6,634
Paper & Cardboard								3,129						15,262		18,391
Glass								1,738						4,672	0.04	6,411
Diaper and sanitary waste								-						12,324		12,324
Textile								-						4,153		4,153
Rubber								-						670		670
Wood								-						938	78	1,016
E- waste								174						-		174
Discarded vehicles								-						-		-
Medical and biological waste								-				6,296		-		6,296
Hazardous & special category waste								-						2,395		2,395
Construction, Demolition & sand					182,500			-						-		182,500
Mixed and other waste							3,431	1,564						9,234		14,229
Total					182,500		3,431	34,765				6,296		205,261	542	432,795

Table 12 Intermediate Use: Own Management Table 2019 for industries & households

Categories	Reusables & recyclables Recovery	Composting	Disposal to sea	Open burning	Incineration	Landfill	Storage	Dumped into the env	Provided to waste collection service	Self-transfer to WMC/RWMF	Total
Food waste		-	17,006	-	-	-	-	-	84,148		101,154
Green waste		-	-	-	-	-	-	-	4,614		4,614
Other organic waste		-	-	-	-	-	-	-	327		327
Plastic	117	-	-	-	-	-	-	-	22,224		22,342
Metal		-	-	-	-	-	-	-	3,776		3,776
Paper & Cardboard		-	-	-	-	-	-	-	11,300		11,300
Glass		-	-	-	-	-	-	-	4,283		4,283
Diaper and sanitary waste		-	-	-	-	-	-	-	12,324		12,324
Textile		-	-	-	-	-	-	-	4,153		4,153
Rubber		-	-	-	-	-	-	-	670		670
Wood		-	-	-	-	-	-	-	938		938
E- waste		-	-	-	-	-	-	-	174		174
Discarded vehicles		-	-	-	-	-	-	-	-		-
Medical and biological waste					6,296				-		6,296
Hazardous & special category waste									268		268
Construction, Demolition and sand									-		-
Mixed and other waste									3,708		3,708
Total	117	-	17,006	-	6,296	-	-	-	175,480	26,235	225,135

Table 13 Final Use Table 2019: Total waste by waste types and treatment methods at waste management facilities

Categories	Reusabl, recyclables recovery	Composting	Disposal to sea	Open burning	Incineration	Landfill	Storage	Dumped into the env	Export	Total
Food waste										-
Green waste										-
Other organic waste										43
Plastic									991	-846*
Metal									51,769	-48,054*
Paper & Cardboard									217	585
Glass										34
Diaper and sanitary waste										-
Textile										-
Rubber										-
Wood										2,675
E- waste										-
Discarded vehicles										-
Medical and biological waste										-
Hazardous & special category waste									1,778,631**	-1,765,241*
Construction, Demolition and sand										72,453
Mixed and other waste										285,394
Total									1,831,608	-1,452,958*

* Where there is a negative sign, export is greater than total collected, which shows that collection is underestimated. **Total of waste oil and waste/scrap of primary cells/batteries/accum; spent primary cells, batteries from export data provided by MCS. Total of waste oil is 1,127,385.8, which is 1800 times higher than that of 2018. This number needs to be rechecked.

4.2 Analysis

Table 14 and 15 shows that there are significant differences between Supply Table and Use Table of the Waste Accounts. The main reason for this discrepancy is the lack of availability of data. Data was available from only few sources and data was not available to complete either Supply Table or Use Table.

Table 14 Comparison of Supply and Use tables and measurement of their discrepancies 2018

Categories	Total supply	Total use	Discrepancy
Food waste	122,604	15,161	107,444
Green waste	14,091	-	14,091
Other organic waste	10,021	71	9,950
Plastic	21,202	119	21,084
Metal	6,319	(12,619)	18,938
Paper & Cardboard	17,485	1,337	16,148
Glass	6,038	43	5,995
Diaper and sanitary waste	11,701	-	11,701
Textile	4,242	-	4,242
Rubber	636	-	636
Wood	913	3,062	(2,148)
E- waste	154	-	154
Discarded vehicles	-	-	-
Medical and biological waste	6,296	6,296	-
Hazardous & special category waste	2,339	(865)	3,203
Construction, Demolition and sand	182,500	54,600	127,900
Mixed and other waste	13,796	262,606	(248,809)
Total	420,338	329,810	90,528

Table 15 Comparison of Supply and Use tables and measurement of their discrepancies 2019

Categories	Total supply	Total use	Discrepancy
Food waste	129,517	17,006	112,511
Green waste	14,854	-	14,854
Other organic waste	10,567	43	10,524
Plastic	22,667	(729)	23,395
Metal	6,634	(48,054)	54,688
Paper & Cardboard	18,391	585	17,806
Glass	6,411	34	6,377

Categories	Total supply	Total use	Discrepancy
Diaper and sanitary waste	12,324	-	12,324
Textile	4,153	-	4,153
Rubber	670	-	670
Wood	1,016	2,675	(1,659)
E- waste	174	-	174
Discarded vehicles	-	-	-
Medical and biological waste	6,296	6,296	-
Hazardous & special category waste	2,395	(1,765,241)	1,767,636
Construction, Demolition and sand	182,500	72,453	110,047
Mixed and other waste	14,229	285,394	(271,165)
Total	432,795	(1,429,538)	1,862,333

In the Supply Table, estimates for waste compositions were derived for households and tourism sector. Total waste generation for transport and construction sector was also available. However, data for the rest of the industries were not available and this includes data for industries that are likely to produce significant amount of waste such as manufacturing sector, agriculture and fisheries and health sector.

No data was available at the industry level for the Use Table and the method of waste treatment was also not available for the Use Table. Total Use of waste collected by WAMCO for greater Male' region was included in the Use Table. The classification of this data by waste categories were not accurate given that 80% of waste collected is classified as mixed and other waste. Data on waste collection was not available for any atolls and hence significant amount of data on waste collected is not included in the Use Table. It will not be accurate to compare the discrepancies in Supply Table and Use Table according to waste categories as WAMCO does not properly record data according to waste categories. Furthermore, there is not enough data for either tables to use a residual method to estimate missing data.

Figures 1 and 2 show the waste composition of the total waste generated presented in the Supply Tables for 2018 and 2019 respectively.

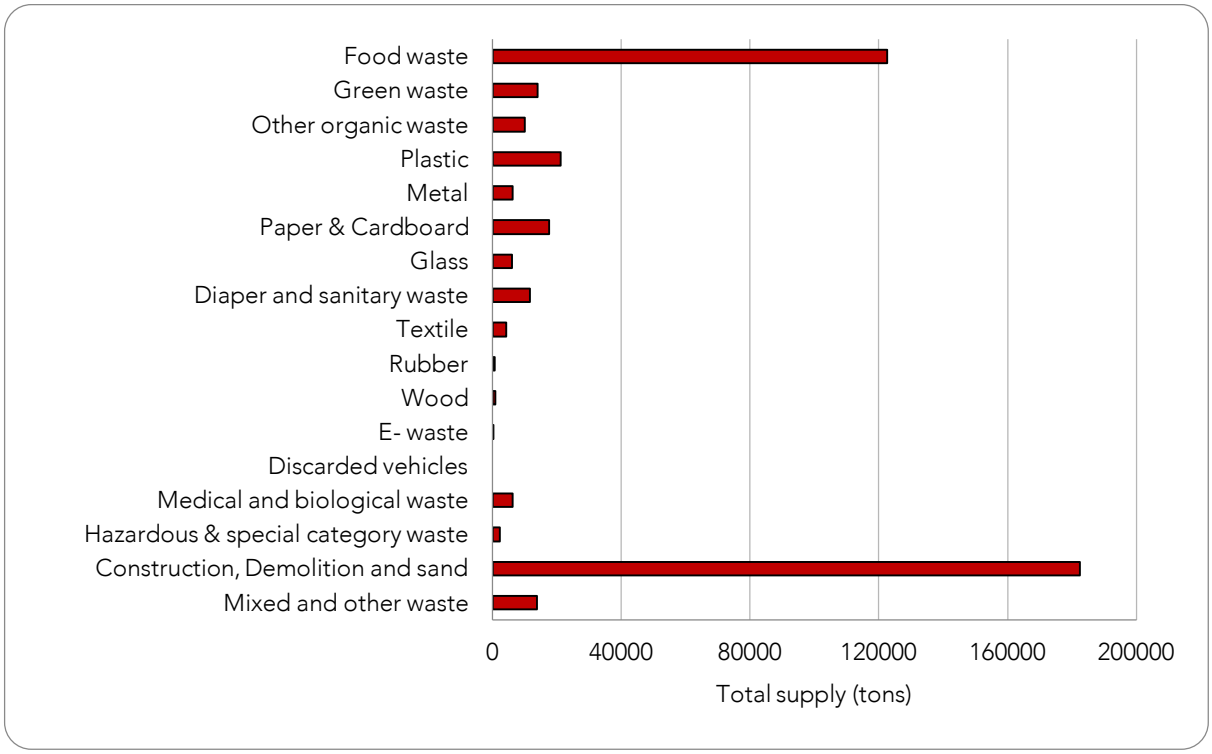

Figure 1 Breakdown of total waste generated in the Supply Table by waste types for 2018

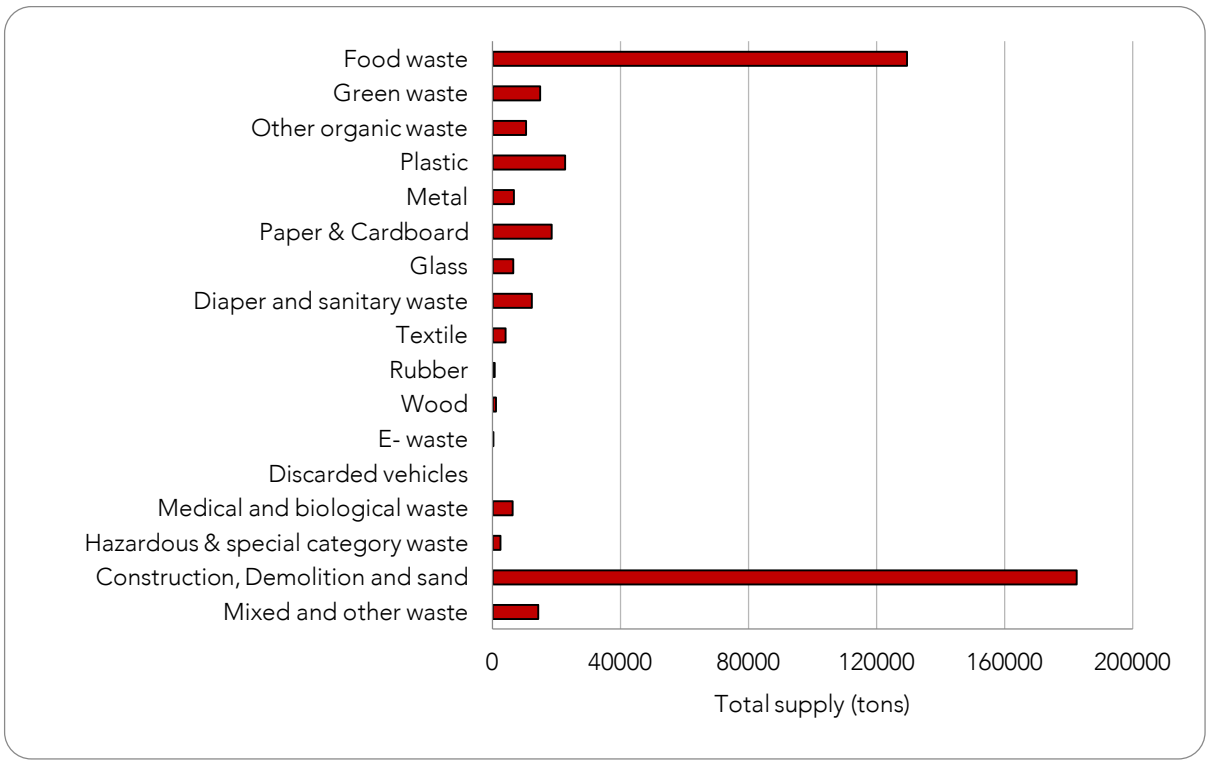

Figure 2 Breakdown of total waste generated in the Supply Table by waste types for 2019

According to Figures 1 and 2, C&D waste is the highest, followed by food waste and plastics in both 2018 and 2019. Given that estimates could be made for only four industries, households and imports Figures 1 and 2 are not considered as depicting a true picture of total waste generated and its composition.

4.3 Estimation methodology and assumptions

The sections below detail how quantities were estimated for the PSUT.

4.3.1 Households

Total waste generated by households is estimated using the waste generation rate per person indicated in the NWMP2015 and population distribution of Male' and atolls (NBS 2018). NWMP2015 indicates 1.7 kg per person per day as the waste generation rate for Male' and 0.8 kg per person per day for other inhabited islands.

The total waste generated is divided into different waste categories for Male' based on the waste compositions taken from WAMCO Villimale' Household Waste Audit (WAMCO 2019) and for atolls, waste was divided into different categories using ADB Zone III Feasibility Study (MEE 2017b) as these breakdowns are the most similar to the Waste Account Framework from published reports.

For the Intermdiatel Use: Own Management Table, all waste generated by households in Male' were assumed to be collected by waste collection services. However, this assumption does not hold for atolls. There is no data available for the proportion of waste supplied to waste collection service, self-transfer to waste management facility and on the proportion of waste managed on their own for households in atolls. Hence, no assumptions were made.

For the Intermediate Use Table, WAMCO provided data on the amount of waste taken to Thilafushi by WAMCO waste collection operations from Male', Villingili and Hulhumale'. This data is a total of the waste taken from the locations and does not differentiate between the residential and commercial customers of WAMCO. In addition, this data is an estimation based on the carrying capacity of the vehicles and vessels and, not an actual measurement of the waste by weight or volume. Therefore, this is not considered a reliable method of estimating waste quantities.

4.3.2 Tourism

Total waste generated by resorts and guest houses were estimated using the waste generation rate per bed night given in the NWMP2015 and total bednights of resorts and guest houses for 2018 and 2019. NWMP2015 indicates waste generation rate as 3.5 kg per guest night.

The total waste generated is divided into different waste categories based on the assumptions given in ADB Zone III Feasibility Study (MEE 2017b).

For the Final Use table, WAMCO has provided data on the amount of waste transferred to Thilafushi from resorts by contracted waste transporters or by the resort. The number of

resorts that have transported waste to Thilafushi is not indicated. In addition, WAMCO does not have facilities to weigh incoming waste and only records the carrying capacity of the vessel rather than the actual quantity of waste. Therefore, this is not considered a reliable estimate of waste received at Thilafushi from resorts.

4.3.3 Transport

Waste generation is estimated for Velana International Airport (VIA) under air transport. According to the ADB Zone III Feasibility Study (MEE 2017b), the airport management reported waste generation as 9.4 tonnes per day in 2016. Therefore, waste generation at the Velana International Airport for the Supply Table is estimated using the waste generation rate from the above-mentioned study.

WAMCO provides data on waste collected from VIA which is nine times higher than the estimated annual waste generated at the airport using the 9.4 tonnes per day from the ADB Zone III Feasibility Study. Data from WAMCO is presented in the Use Table.

4.3.4 Health

Waste generation rates for medical waste from ADB Zone III Feasibility Study (MEE 2017b) is used to estimate the total medical waste generated in tertiary hospitals. According to the report, the two tertiary hospitals in Male' City produces 1.5 tonnes of stabilised autoclaved waste per day. This rate is used to estimate total medical waste from 23 tertiary hospitals in the Maldives i.e. atoll hospitals, regional hospitals and three tertiary hospitals in the Greater Male Area'. It is assumed that the generation rate for stabilised autoclaved waste in a tertiary hospital is 0.75 tonnes per day. Medical waste given the ADB Zone III Feasibility Study is assumed to be infectious waste only as it is presented as stabilised autoclaved waste. This rate is likely an overestimate for atoll and regional level hospitals as these hospitals would receive less number of patients than the tertiary hospitals in Male' City.

4.3.5 Construction

ADB Zone III Feasibility Study (MEE 2017b) provides a daily waste generation rate for construction waste for residential and infrastructure waste in Male' city and Hulhumale'. Daily waste generation rates of 300 tonnes per day for Male' and 200 tonnes per day for Hulhumale' are used to estimate total construction and demolition waste generated in the construction industry. However, this could be an underestimation of construction and demolition waste generated for the whole country annually. There is no data available for construction waste generation in other parts of the country. Construction waste from Greater Male' Area will contribute to most of residential construction waste. Waste generated from

resort construction and infrastructure projects across the atolls will also add to the total construction waste.

4.3.6 Imports and Exports

Imports and exports from the Maldives Customs Services database are available according to different waste categories. Import and Export data was used in Supply Tables and Use Tables for both 2018 and 2019. The Harmonised System (HS) Code for the import data is listed in Table 16. It is not confirmed that this data corresponds to waste.

Table 16 Harmonised System Codes for import data

HS code	HS description
4004000000	Waste, paring & scraps of rubber (other than hard rubber), powders & granules obtained
4401390000	Saw dust, wood waste & scrap (agglomarated)
4401400000	Sawdust and wood waste and scrap (not agglomarated)
5202990000	Cotton waste, nes
7204290000	Waste and scrap of alloy steel (excl. Stainless)
3915900000	Waste, parings and scrap, of other plastics, nes
7404000000	Copper waste and scrap
7602000000	Aluminium waste and scrap
7802000000	Lead waste and scrap
7001000000	Cullet and other waste and scrap of glass; glass in the mass

4.3.7 Reusable and recyclable waste

Data from all establishments that collect reusables and recyclables in the Maldives was used to estimate waste recovered for reuse and recycling in the Intermediate Use Table. Data on plastics, metals, paper, batteries, used oil and glass is available for both 2018 and 2019. Total recovered waste is added to the Total Intermediate Use table. Furthermore, industry level data is available for households and tourism. These data are included in respective industry Use Tables.

4.3.8 Waste collection

Data from three waste collection services are included in the Final Use Table of the PSUT. It includes data from the main waste collection service provider WAMCO and two other reusable and recyclable waste collectors. Data is not available at industry level for any waste collectors, hence only total waste collected according to waste types is presented.

4.4 Data gaps and quality issues

One of the main findings from stakeholder consultations was the lack of data and record keeping in the waste management sector as well as the lack of demand for data by regulators and policy makers. MoE and EPA, the two key agencies mandated with waste management policy formulation and monitoring waste management operations respectively, stated that only limited data is available and work is ongoing to standardise data collection and record keeping.

One of the key stakeholders that could provide data for the compilation of Waste Account for the Maldives is the public waste collection company WAMCO. However, at present, WAMCO does not maintain waste data categorized by industries, although some data is available by types of waste collected. WAMCO was able to provide aggregate data on waste transported to Thilafushi from Greater Male' Area, Addu City and some resorts. Furthermore, method of estimation i.e. recording the carrying capacity of the vehicle or vessel regardless of the actual quantity of waste loaded, used by WAMCO is considered unreliable because it is not a measurement of quantity of waste by weight or volume.

Most of the data that is presented in the PSUT are estimations based on generation rates and waste composition in the NWMP2015, WAMCO Villimale' Waste Audit and ADB Zone III Feasibility Study.

Waste generation

- Quantity of waste generated by industries is not available from record keeping and data reporting. Waste generation is therefore estimated using waste generation rates, where it is available.
- Waste generation rate for industries other than tourism is mostly unavailable. Generation for tourism industry is for resorts only.
- There are discrepancies in the waste generation rates found in different publications. Waste generation rates found in published reports between 2007 and 2017 for Male' and Greater Male' Area range from 0.71 to 2.97 kg per person per day and for the atolls the range is between 0.7 and 1.3 kg per person per day. Waste generation rates in the tourism industry, particularly resorts, are stated as per bednight or per person per day in published reports and therefore are not comparable.

Waste types

- Waste composition studies are limited to households, resorts and healthcare facilities. Types of waste that may be generated in other industries are not found in existing publications.
- Waste categories are different in different studies and therefore are not comparable across studies and atolls.

Waste collection by public and private collectors or own transfer to waste management facilities

- WAMCO customers are in limited geographic areas of Greater Male' Area, Addu City, Fuvahmulah City and Island Councils in Zone II (N, R, B, Lh atolls).
- WAMCO collects waste mostly as mixed waste from residential and commercial as waste is not segregated at source before collection.
- Waste collection data is not available at industry level, hence only the total waste collected is included in the PSUT. Waste data is available for different types of waste, however, 57% of the waste collected is included in mixed waste category as the waste collected is not properly segregated.
- Data from WAMCO on waste transported to Thilafushi and Addu City WMC is a record of the carrying capacity of the vehicle or vessel and therefore, inaccurate.
- Data on waste collection in other inhabited islands is not available.
- Data on the waste amount received at the IWMC of three islands is available. However, it does not provide information on how the waste fractions were managed at the IWMC.
- Data on waste collected by or delivered to recyclable collection centres are not by industry. Only data for tourism facilities and households could be included.

Own management by waste producers

- Resorts are required to maintain a log on waste transported out of the resort and report data to Ministry of Tourism (MoT). However, this data is not available through MoT.

Waste management at IWMCs/RWMFs

- Data is not available from IWMCs of inhabited islands by management methods.
- WAMCO does not collect data according to management methods.

5 METHODOLOGY

This chapter details the work undertaken for the preparation of the Waste Accounts including data sources, assumptions and challenges in data. Waste Accounts was prepared through five key actions:

1. Documentation of data and data sources
2. Consultations with key stakeholders
3. Drafting of framework for Waste Accounts
4. Waste Accounts compilation
5. Making recommendations

Each of the key activities are described below.

5.1 Documentation of data sources

Data used in the compilation of waste accounts are from data records maintained by some of the stakeholders and published reports. Data was then further considered as data based on frequency, waste audits and estimations made using published data. Data sources are presented in Table 17, Table 18 and Table 19 by waste generation, waste types and composition and waste management methods respectively.

Table 17 Data sources for waste generation

Types of sources	Details	Year
Assessments on waste management situation	ERC - Waste Audit	2007 & 2008
	IDA MEMP Social Assmt for SWM	2010
	Commerce, Development and Environment (CDE) Pvt Ltd – Environmental Impact Assessment (EIA) for solid waste management facility at Thilafushi	2011
	Feasibility Study North Province RWMF	2011
	MEE National Waste Management Policy	2015
	MoT SWM Assmt	2015
	ADB Zone III Feasibility Study (Kaafu, Vaavu, Alif Alif, Alif Dhaalu)	2016
	MoE/MEECO Zone 1 EIAs	2017

Table 18 Data sources for waste types and composition

Types of sources	Details	Year
Waste audits	WAMCO Villimale Waste Audit Survey	
	Global Environment Facility (GEF) and Unoted Nations Industrial Development Organization AA. Bodufolhudhoo, AA.Mathiveri, AA.Maalhos	2019
	ERC Waste Audit - waste composition in percentage households, guesthouse - Male' City	2007,2008
Secondary sources	ADB Zone III Feasibility Study C&D waste - Male', Hulhumale' Hazardous healthcare waste - two main hospitals Male' City Lube oil waste Industrial waste Thilafushi Industrial Area	2017
	State of the Environment Report: Waste composition in percentage for Male' City	2016
	EIAs and Environmental Management Plans (EMPs): Waste composition in percentage	

Table 19 Data sources for waste management methods

Types of sources	Details	Year
Waste collection monthly or annual data	WAMCO data provided to NBS: Waste transported to Thilafushi - Greater Male' Area, resorts, inhabited islands, VIA, Industrial islands, Construction waste Waste transported to Addu City WMC	2015-2020
Waste received at recyclables collectors	Parley collection tracking monthly records	2017-2020
	Secure Bag collection annual data	2018 & 2019
Waste export annual data	Maldives Customs Service Export data	2018 & 2019

5.2 Stakeholder consultations

A list of stakeholders was identified for consultation based on key policy and legislations as well as civil society organizations and businesses involved in the waste sector. Hence, stakeholder meetings were conducted with policy makers, regulators, third party recyclers, NGOs and waste collectors given in Table 20. During the meetings, stakeholders were asked about relevant policy and legislative framework, existing practices for waste management, including disposal, treatment, available data, method of data collection, gaps and challenges in collecting data.

Table 20 Stakeholders consulted and their role

#	Stakeholder	Role
1	Ministry of Environment	Policy maker
2	Environmental Protection Authority	Regulator
3	Ministry of Tourism	Policy maker
4	Health Protection Agency	Regulator for health care waste
5	Local Government Authority	Local Administration
6	Atoll Councils	Local Administration
7	City Councils	Local Administration
8	Waste Management Corporation	Waste collector
9	Maldives National Defence Force	Regulator for hazardous chemicals
10	Parley	NGO, recycler
11	Secure Bag Pvt Ltd	Business
12	Zero Waste Maldives	Waste NGO

Based on findings of the consultation, available data that could be useful for the assignment was requested from each stakeholder. It is noted that no data was requested from the Local Government Authority (LGA), City Councils and Atoll Councils which are not involved in providing waste collection services. WAMCO or the Island Councils with or without contractors, provide waste collection services. Similarly, the Zero Waste NGO has not carried out primary data collection activities and therefore, data was not requested from the NGO.

5.3 Development of framework for Waste Accounts

To prepare the framework for Waste Accounts, the methodology in the SEEA framework was first reviewed in order to understand how it can be applied to the context of the waste sector

in the Maldives. The NWMP2015 and the WMR2013 was reviewed to adopt a definition of waste. Waste generators, waste categories and waste management methods were then identified using the ISIC classification, NWMP2015, WMR2013 and other published reports and guidance from MoE.

Attempts were made to expand and contextualise the sub-categories of waste generators i.e. the industries to suit the situation of the Maldives by using information such as business registration and tax registration. Business registration is undertaken by Ministry of Economic Development (MED). Tax registration is with MIRA. However, this information was not available during the preparation of the Waste Account Framework.

5.4 Compilation of the Waste Accounts

The Waste Accounts for 2018 and 2019 were compiled using the Waste Accounts Framework developed specifically for this purpose. Both estimations based on assumptions as well as data records of some of the key stakeholders were used in compiling the Waste Accounts. Estimation methodologies are detailed in Section 7.1.

5.5 Devising recommendations

The recommendations are based on the findings of the exercise to compile the Waste Accounts for 2018 and 2019.

After the compilation of the draft Waste Account additional meetings were held with MoE where challenges in data, opportunities to improve and recommendations were presented for discussion. MoE informed that work related to some of the recommendations are underway. Hence, this is taken into account in the formulation of recommendations given in this section.

6 Conclusion

National Waste Accounts for the years 2018 and 2019 have been compiled based on the SEEA methodology using available data. In the effort to compile the national Waste Accounts, a framework has been introduced that helps understand a holistic picture of the flow of waste within the economy. The Waste Accounts Framework reiterates that each industry of the economy as well as households is a waste producer and that each waste producer generates more than one type of waste. Furthermore, the Waste Accounts Framework helps to understand that waste management begins at producer level before all or part of it flows through to waste management facilities.

Despite identifying that the various industries produce waste of different types, due to limitations in data management and availability, Waste Accounts 2018 and 2019 could be presented mainly for tourism industry and households. For most of the remaining industries identified in the Waste Accounts Framework, there was no information available or the data available was insufficient to be presented in the Waste Accounts. On the other hand, amounts of waste collected by public or private waste collectors could be included, although there are issues with the method of estimating waste quantities, particularly by WAMCO. Waste management facilities whether at island level or at regional level, do not seem to maintain records of incoming waste and by management methods.

The NWMP2015, WMR2013, SAP2019-2023 among other policy and legislation provide strong basis to develop a statistical system for the waste management sector. In addition to policy targets, there is a significant amount of investments in the infrastructure and services related to waste. While the amount of waste generated in the country is only expected to increase, waste reduction is also one of the main goals of waste-related policies. Collection and analysis of data on waste is therefore crucial to evaluate the effectiveness of current and planned interventions. Given the scarcity of data in the Waste Accounts for 2018 and 2019 and the inconsistencies in the methods used in the previous studies, the Waste Accounts is not yet adequate for policy analysis by multiple users such as the Government, service providers, NGOs and businesses.

It is widely recognised that capacity building within the relevant Government agencies is needed in order to strengthen enforcement and monitoring related to waste sector. Developing the Waste Account Framework and the Waste Account has made it clearer that the waste situation is under-studied and under-reported in most of the industries of the economy. This also may be due to the fact that waste management as a service similar to water and electricity, has only started comparatively recently. The exercise of preparing the Waste Accounts has also helped in recognising that there are opportunities to improve the process of data collection through ongoing and planned work of key agencies of the Government.

It is also important to recognise that both the governance system and the statistical system are decentralised. Waste producers are across all industries and dispersed throughout the country. All waste producers have to manage waste starting from within their own boundaries. Therefore, waste data collection system needs to be designed to be producer-led and industry-specific with waste producers, Local Councils and line ministries enabled to collect and report data. NBS is required to build in-house capacity specific to waste management and waste account compilation in order to lead the waste data collection at national level. Furthermore, NBS will need to collaborate with different organizations in order to ensure adequate data can be collected to improve the compilation of the Waste Accounts.

7 Recommendations

This chapter the presents the recommendations for establishing a strong waste data system for the Maldives.

Recommendation 1: Establish the necessary institutional arrangements for implementation of the compilation of Waste Accounts.

1.1 Establish a unit within NBS dedicated to waste and environmental accounts and, assign staff.

1.2 Conduct training for the staff of NBS on waste management in the Maldives and linkages to the Waste Account.

1.3 Form a committee to coordinate the compilation of waste data. The committee shall include focal points from MoE, MED, LGA, URA and NBS.

1.4 Identify staff who will compile waste data according to existing legislation and policies such as NWMPS2015, WMR2013, NPHCWM2016.

1.5 Mobilise funding for immediate and long-term activities related to compilation of waste account through sources such as the ongoing project Greater Male' Improvement and Waste Management Project funded by ADB, national government budget as well as other sources such as CSR components of SOEs and grant programmes of the Government and donor agencies.

Recommendation 2: Introduce the new Waste Account Framework to stakeholders and seek their understanding and commitment.

2.1 Identify and map policy and industry-specific stakeholders using the draft Waste Account Framework.

2.2 Carry out consultations with key stakeholders to educate and agree on the purpose of the Waste Accounts and their roles and responsibilities including budget allocation and the opportunities for collaboration through ongoing and planned work.

2.3 Prepare a stakeholder engagement strategy for stakeholders to work in partnership with NBS for future waste surveys.

2.4 Identify potential incentives schemes such as existing loan schemes, national awards etc. that can help encourage waste producers to collect and report data.

Recommendation 3: Assess the existing waste management situation of the waste producers identified Waste Account Framework.

3.1 Develop industry-specific questionnaires to assess current waste management situations of different organizations and establishments from each industry and introduce them to existing NBS surveys.

3.2 Gather qualitative industry-specific information on waste management practices to prepare baseline for each industry through on-going and planned surveys of NBS and line ministries.

3.3 With policy makers, develop a list of waste types that is realistic to use when developing waste data collection systems covering the production, collection, and treatment of these different types of waste with an emphasis on strengthening waste reduction and material recovery of reusable and recyclables.

Recommendation 4: Conduct at-source waste audits of industries and households in collaboration with relevant government agencies, local councils and waste-related service providers to test and improve the Supply Table.

4.1 Prepare waste audit methodology, questionnaire and data collection and reporting protocols for the pilot surveys.

4.2 Develop a database for data collection and reporting of the waste audits from producers in accordance with the Waste Account Framework.

4.3 Carry out waste audits and collect data from the different waste producers.

4.4 Analyse data collected through the waste audits to improve the Supply Table.

Recommendation 5: Capture waste quantities received at selected Waste Management Facilities of WAMCO and IWMCs by waste types and management methods to test and improve Use Table.

5.1 Revise current customer registration at WAMCO, Island Councils, NGOs and private service providers to conform with the Waste Account Framework.

5.2 Revise the waste types classifications used by WAMCO, Island Councils, NGOs and private service providers to conform with the Waste Account Framework.

5.3 Prepare a strategy to segregate and measure waste by categories according to the Waste Account Framework.

5.4 Harmonise the waste audit methodology of the MoE with the Waste Account Framework.

5.5 Develop a database for data collection and reporting of the waste audits from waste management facilities in accordance with the Waste Account Framework.

5.6 Conduct periodic waste quantification surveys at WAMCO waste management facilities and selected IWMCs.

5.7 Analyse data collected through the waste audits to improve the Use Table.

Recommendation 6: Endorse the proposed Waste Account Framework as the basis for future data collection and reporting related to waste.

6.1 Conduct workshops to review and revise the Waste Account Framework with suggestions from stakeholders, findings of industry-specific waste management situation assessments and pilot waste audits, with the objective to get the Framework endorsed by all stakeholders.

6.2 Review the ongoing and planned data collection activities and ensure conformity with the new Waste Account Framework.

6.3 Collaborate with MoE to amend data collection and reporting under existing waste regulations to conform with the endorsed Waste Account Framework.

Recommendation 7: Prepare tools and mechanisms for producer-led industry-specific waste data collection.

7.1 Identify priority industries to undertake baseline assessments in 2021 based on the industry-specific waste management situation assessments and test waste audits.

7.2 Collaborate with MoE to ensure that waste data collection protocols and methodology developed under the Initiative for Climate Action Transparency (ICAT) project addresses industry-specific situations and includes deadlines, reporting procedures, and data handling and editing and related tools for data collection and reporting.

7.3 Establish responsibilities of different organizations for the data collection, reporting, processing and dissemination including planning, budget allocation and staff resources.

Recommendation 8: Establish baseline waste quantities by waste types for priority industries and geographic locations.

8.1 Review ongoing projects and planned activities within key agencies that can be utilised for Waste Account data collection in 2021.

8.2 Identify industry-specific priority waste producers to undertake data collection and reporting.

8.3 Develop industry-wise monitoring and reporting mechanisms for the collection of data from industries.

8.4 Undertake data analysis to generate baseline figures according to the Waste Account Framework.

Recommendation 9: Create a data collection and reporting network with City Councils, Island Councils and Atoll Councils.

9.1 Conduct training on Waste Account related data collection and reporting for the staff of City, Atoll and Island Councils.

9.2 Assist the Local Councils to mobilise resources for Waste Account data collection and reporting.

9.4 Develop a a system for data reporting by the Local Councils.

Recommendation 10: Disseminate the results and findings on the waste generation and management situation of the Maldives based on the Waste Account.

10.1 Establish a window on the NBS website to share information on the Waste Account processes and results.

10.2 Evaluate the current waste management policies using the Waste Account.

10.3 Conduct workshop with stakeholders to present the findings of the Waste Account and the policy evaluation.

10.4 Publish the Waste Account on NBS website.

8 References

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End of Report