Kiribati Waste Characterization and Situation Analysis Report

Analysis of Waste Generation and Disposal Data and a Review of the Current Waste Management Systems in Kiribati

APWC 2021

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South Tarawa, Kiribati (Source: Harry Langley, 2021)

Report prepared by Asia Pacific Waste Consultants (APWC) on behalf of The World Bank

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Executive summary

In 2018, the Pacific Region Infrastructure Facility (PRIF)[1] researched the benefits and challenges of establishing a regional recycling network for the Pacific[2] as PICs move from a linear to a circular economy. Opportunities to improve social, environmental, and economic outcomes were identified. However, the absence of reliable data was a key constraint to both the design phase and to attracting public-private partnerships. As a result, a Pacific-wide auditing program is being funded by a range of agencies, including the United Nations Environment Programme (UNEP), SPREP (through the EU-funded PacWaste Plus programme), and with support from the Australian-funded Pacific Ocean Litter Project (POLP) and the Pacific Regional Infrastructure Facility (PRIF). The aim of the series of waste audits is to gather data that is robust, reliable, current and comparable across the region. The information and data gathered will be used by Pacific countries as a baseline to support the future development and monitoring of waste and resource-recovery projects, and to assist in the design and development of the required infrastructure and policy interventions. The regional dataset will also be used to identify and evaluate potential regional projects that would improve waste management in the region.

As part of this Pacific-wide activity, The World Bank is undertaking waste data collection in Samoa, Kiribati and Tonga. Asia Pacific Waste Consultants (APWC) was engaged to undertake this activity in 2020–2021. This technical report presents the results of the data-gathering exercise in Kiribati and is the second of three reports. The methodology used to undertake this work was as per the *Waste Audit Methodology – a step-by-step manual to conduct comprehensive waste audits in SIDs*, produced by PRIF[3] and published by SPREP.

About waste audits in Kiribati

The objective of the overall assignment was to collect accurate and current information on the waste stream composition and quantities for different waste streams, including performance analysis of different stages of the waste management chain. The project undertook two parallel activities:

- Audits on household waste, commercial waste, and landfill; and
- A systems analysis to understand the current status of waste management in Kiribati—the institutional arrangements, private-sector involvement and available infrastructure required to effectively manage waste and recycling outcomes in Kiribati, including participation in regional recycling activities.

This project included undertaking waste audits on three islands in Kiribati. This technical report presents the findings of the study and includes the following:

- Overview of the Kiribati waste sector, including the institutional framework
- Results of 2021 waste audit
- Estimates of the quantities and composition of waste generated across Kiribati

[1] https://theprif.org/what-we-do
[2] https://www.sprep.org/attachments/Publications/Presentation/cprt-2018/resource-recycle-pacific-prif.pdf
[3] https://www.sprep.org/sites/default/files/documents/publications/waste-audit-methodology-common-approach.pdf

- Current resource recovery, resource-recovery potential and the impacts on landfill life
- Current institutional arrangements, private-sector engagement and available infrastructure for both waste management and recycling
- Potential for Kiribati to contribute to regional-recycling and resource-recovery activities.

The work was conducted in the first quarter of 2021 after the COVID-19 pandemic led to the closing of the country's borders, and was carried out with support from Ministry of Environment, Lands and Agriculture Development (MELAD). This technical report completes Phase 1 of a three-phase process and it is anticipated the findings will provide the basis for future policy work, feasibility studies and other waste management treatment options in Kiribati.

Phase 2 comprises an Institutional Capacity Assessment and Phase 3 comprises a Feasibility Assessment of Establishing a Recycling Hub (*Phases 2 and 3 are not a part of this assignment).*

Summary of audit activities

- 208 household samples collected and sorted
- 53 commercial samples collected and sorted
- Nine (9) local government staff trained
- Data collected from 3 islands – South Tarawa, Abaiang, Maiana
- Landfill audit completed over the course of 14 days at Naanikai and 7 days at Betio covering Monday – Sunday
- Data collected for the following:
  - Household and commercial waste
  - Stockpiles
  - Recyclers
  - Producers

Waste generation rates – Kiribati

- Waste generation in South Tarawa from all sources is 0.368 kg/person/day of which 0.164 kg/person/day is disposed of at landfills through the collection services
- Waste generated in outer islands: 0.237 kg per person per day. No collection or disposal takes place. Households practice burning, burying and dumping of waste

Stockpiles in South Tarawa

- Most stockpiles are very small compared to the quantities found to be imported.
- Almost 10 years of end-of-life vehicles are stockpiled at the MRF.
- Stockpiled materials at the MRF include end-of-life vehicles, e-waste and white goods
- The Kaoki Maange system collects PET bottles, aluminium cans and car batteries. These are also stockpiled.

Materials of interest – generation

- Almost 16,005 tonnes waste is generated annually in Kiribati.
- Organics is the largest fraction of waste at 63% followed by paper and cardboard at 14%.
- Plastics account for 992 tonnes per year and almost 200 tonnes of PET bottles are stockpiled at the kaaoke Maange.

Landfill life

- Three landfills in South Tarawa are the only managed landfills in Kiribati.
- Each landfill has the following lifespan remaining:
  - Betio – 3 years
  - Naanikai – 10 years
  - Bikenibeu – 30–35 years
- Landfill fires are common. None of the landfills have weighbridges

Reduction in waste going to landfill – bans

- Plastic shopping bags, ice bags and nappies (diapers) have been banned as of October 2020. The ban yet to be implemented and alternatives are currently being explored.
- Single-use bags including shopping bags represent 1% of the overall waste in South Tarawa by weight and hygiene items represent 2.8% of the waste by weight.

Recovery of recyclables – potential future interventions

- Processing of organics and paper and cardboard should be prioritised as they form almost 80% of the waste stream.
- Compaction and transport of stockpiled materials such as PET, e-waste, metals and ELVs should be prioritized.

Challenges for Kiribati

- Inconsistent service delivery and duplication of solid waste collections
- Fee for services is not charged uniformally
- Landfills have no weighbridges and therefore data collection on waste disposal is challenging
- Landfill infrastructure is lacking, including equipment for compaction; regular fires occur at the landfills
- The Kaoki Maange system is up for review and faces challenges due to lack of markets

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Acronyms

ACRONYMS	
ADB	Asian Development Bank
APWC	Asia Pacific Waste Consultants
CDS	Container Deposit Scheme
BTC	Betio Town Council
ECD	Environment and Conservation Division
E-waste	Electronic waste
FAO	Food and Agriculture Organization of the United Nations
EDF 11	European Development Fund
EEZ	Exclusive Economic Zones
EIB	European Investment Bank
ELV	End-of-life vehicles
EU	European Union
HDPE	High-density polyethylene
JICA	Japan International Cooperation Agency
J-PRISM	Japanese Technical Cooperation Project for Promotion of Regional Initiative on Solid Waste Management
LDPE	Low-density polyethylene
LPB	Liquid paperboard
NZ-KSWaMP2	NZ-Kiribati Solid Waste Management Programme 2
MELAD	Ministry of Environment, Lands and Agriculture Development
MFED	Ministry of Finance and Economic Development
NZMFAT	New Zealand Ministry of Foreign Affairs and Trade
OEC	Observatory of Economic Complexity
PET	Polyethylene terephthalate
PICs	Pacific Island countries
PLCO	Pacific Liaison Coordination Office
POPs	Persistent organic pollutants
PP	Polypropylene
PPE	Personal protective equipment
PRIF	Pacific Region Infrastructure Facility
PS	Polystyrene
KOIL	Kiribati Oil Company Limited
PVC	Polyvinyl chloride
SIDs	Small Island Developing States
SPREP	South Pacific Regional Environment Programme
SWM	Solid waste management
TUC	Teinainano Urban Council
UNEP	United Nations Environmental Programme
US	The United States of America
USD	United States dollar

COVID impacts

Due to a pause on all international travel arising from the COVID-19 pandemic, a remote methodology was applied to the training and supervision to the in-country team recruited by MELAD.

Air travel to Kiribati's outer islands was also challenging. As a result, the outer islands chosen for the audit were close to South Tarawa and accessible by a 30-minute boat trip to lower the risk of the team getting stranded if travel restrictions were introduced on flights.

Key assumptions and limitations of the study

Time frame	• The audits were carried out to cover one week's waste from selected areas and two weeks at the landfill as a minimum. The data was then extrapolated using mathematical models to obtain the waste disposal and generation rate for the whole of the country. • Seasonal trends (e.g. warmer weather leading to increased consumption of beverages; Easter, Christmas) and weather events (e.g. high rainfall leading to grass growth) may change waste generation over time. • The results of this audit should be treated with caution when comparing the results with reports based on data taken at different times of year. Where weighbridge data was available, the changes in material quantities and times were used to ensure seasonal influences were taken into account.
Representative sample	• APWC audits are carried out using strict random sampling, stratified by geographic area, and population distribution to minimise the chance of this situation occurring. There is always a small probability of inadvertently collecting waste from atypical households, resulting in non-representative data. •The sample for this audit is necessarily small due to the high per-capita cost and resource-intensive nature of waste auditing. However, based on waste audits undertaken across the Pacific, three sample sizes with an estimated error range were provided by the statistician to the field team. The team chose the sample plan that could be achieved with the most success based on operational limitations of time and funds. •Substantial variation was found between disposal rates between rural and urban areas even after accounting for factors like income and consumption. This adds additional uncertainty when using the data we collected to estimate disposal rates for regions we were unable to cover. Modelling has been undertaken and where higher than expected sampling error was found, it was reported.
Sample size limitations	• All surveys carry an element of sampling error, which is the mathematical error associated with using a sample to represent a total population. The error rates associated with sampling are presented in the report.
Weight-based analysis and results	•The collection of data for this audit was recorded by weight. Weight-based analysis has been used in this audit because it is a standard procedure and is the most accurate way to collect data on a number of different types of materials. • This type of collection may cause some materials to appear to be present in quite small proportions due to their comparatively low densities (e.g. plastic beverage containers). They, however, take up large volume and for considerable part of the waste stream. Volumetric data has been provided in the supporting spreadsheets. •This study used waste auditing to determine the amount of material imported, waste generated, material recycled and exported. Leakage estimates have not been made but can be undertaken with further analysis of existing data.
Collection Method	•For areas with collection services, a household's regular rubbish load was picked up. If households were disposing of any rubbish via other means, this was not picked up in the survey. The numbers collected may be a reasonable estimate of waste going to landfill, but are unlikely to be a reasonable estimate of waste generation rates. •For areas without collection services, the households were given a bag into which to put three days worth of rubbish. Some households may have taken this opportunity to dispose of extra rubbish, with nappies being a particular concern.
Model Assumptions	• The study estimates the waste disposal rates for different islands based on the audit data collected. In order to do so, it was assumed that they displayed a similar pattern of variation to sites we did sample. •Relationships between variables were assumed to be linear.
Customs data	•Customs data was used to understand the total amount of material arriving in the country. The lifespan of materials was then used to determine the quantities that should be found in waste. This was benchmarked against the waste audit results to ensure accuracy and robustness of analysis as well as the sample collection methodology.

1 Introduction

1.1 Pacific waste management challenges

Waste is a global issue and is increasingly recognized as a major challenge for world communities. Proper waste management is essential for thriving societies, liveable cities and robust economies.

In addition to the ongoing waste management challenges of mainland countries, Pacific Island countries (PICs) are faced with a unique set of challenges. PICs are extremely vulnerable to the impacts of climate change and severe weather events, which generate shock loads to normal waste levels. PICs have particularly challenging circumstances relevant for solid waste management and recycling such as:

(i) high costs of transporting waste to processing and disposal facilities from geographically isolated areas such as islands, including the high cost of skilled labour;
(ii) limited availability of suitable land for the construction of waste management infrastructure;
(iii) high costs of servicing small and largely dispersed populations;
(iv) an inability to achieve critical mass (for efficiency and economic viability) due to a relatively small consumer base; and
(v) relative financial disadvantage, where eight of the 15 countries studied are in the lower to middle Gross National Income (GNI) bracket.

PICs are particularly vulnerable to the impacts of marine pollution as their economies, tourism and way of life are intrinsically linked with the health of the ocean. Addressing land-based and marine-based sources of pollution is therefore an environmental, social and economic priority.

Globalisation has had a substantial impact on the volume and diversity of waste generated within PICs, fuelled by increasing affluence and consumer-based lifestyles. Many PICs have become heavily reliant on international development assistance and imported goods, such as electronics, white goods and vehicles, and these goods require safe end-of-life disposal. Additionally, PICs import a significant (60-80%) proportion of their food, which is often supplied in single-use packaging. Imported food products are frequently cheaper than locally produced food, although local food is generally a healthier choice for islanders. Apart from the health implications arising from an increase in imported processed food, local production is also affected, contributing to long-term food insecurity (FAO, 2014).

Recycling is an important tool in combating the increasing volume and complexity of imported waste in island communities. Although it is possible to reclaim recyclable materials from the waste stream in PICs, the economic viability of shipping small quantities of low-value commodities over long distances for processing is a crucial challenge, with marine transportation costs accounting for as much as 30% of the commodity market value. Poor waste segregation, especially in outer island communities, coupled with an absence of local demand for local recyclable goods, has resulted in a lack of available markets for recyclables across the Pacific.

Although solid waste management (and specifically recycling and materials recovery) often requires higher government expenditures and increased collection of fees and levies from waste producers,

the health and environmental benefits overweigh the cost of developing and operating simple waste management systems (Kaza et al. 2018). Therefore, there is a strong motivation to explore the development of recycling systems for PICs.

1.2 Project background and objectives

Several potential interventions to reduce the impacts of plastics and provide better resource recovery outcomes for PICs are being designed. Pacific Region Infrastructure Facility (PRIF)[4] is a multi-agency coordination mechanism aimed at improving the delivery of development assistance from donors and development partners to the infrastructure sector in the Pacific region.[5] As part of its technical assistance activities, PRIF has been investigating the benefits, challenges and feasibility of establishing a regional waste management and recycling network for the Pacific. It is expected this initiative would reduce the risk of plastic and toxic pollution from solid wastes, which would lead to health improvements of PIC populations and have benefits for the economy.

A regional waste management and recycling network would also provide numerous opportunities for public-private partnerships. The regional network, when designed, will aim to assert the efficiencies of treating waste through a regional-level intervention to increase economies of scale that could attract private sector and generate local employment.

An initial investigation conducted by PRIF identified several benefits of a regional waste management and recycling network, in addition to existing regulatory constraints of each PIC. This study informed the publication of Pacific country profiles in regard to solid waste management and recycling[6]. A shared methodology was developed as a model for future common audits and data collection with PICs and regional partners such as PacWaste, UNEP, J-PRISM, SPREP and PRIF partners.

The waste audits will provide crucial and important data, based on actual quantities of recycling material available in the region, to scope a tailored regional recycling network and other national and regional recycling initiatives.

A series of comprehensive waste audits is being funded by UNEP, SPREP (through PacWaste), PRIF and the World Bank. The scope of the audits is as follows:

- Audits were undertaken on household waste, commercial waste, and landfill
- A systems gap analysis was undertaken to understand the current status of waste management in Kiribati, including the institutional arrangements, private-sector involvement and infrastructure available to effectively manage waste and recycling outcomes, as well as participate in regional recycling activities.

As part of this collaboration, 13 waste audits were conducted: PRIF commissioned waste audits in the Cook Islands, Fiji and Tuvalu. PacWaste Plus commissioned audits in Nauru, Niue, Vanuatu, Solomon

[4] The PRIF Coordination Office (PRIF CO) is hosted by the ADB Pacific Liaison Coordination Office (PLCO) in Sydney, Australia. It follows procurement procedures and financial management in accordance with ADB practices.
[5] Current PRIF partners are Asian Development Bank (ADB), Australian Department of Foreign Affairs and Trade (DFAT), European Investment Bank (EIB), European Union (EU), the Japan International Cooperation Agency (JICA), New Zealand Ministry of Foreign Affairs and Trade (NZMFAT), United States Department of State and the World Bank Group
[6] https://www.theprif.org/sites/default/files/documents/prif_waste_book_web_0.pdf

Islands, PNG, Timor-Leste and UNEP in Palau. The World Bank commissioned APWC to undertake audits in Kiribati, Samoa and Tonga.

This technical report presents the outcomes of the audit conducted by the APWC consultants and the in-country team in Kiribati in Quarter 1, 2021. It is anticipated the findings from this report will provide the basis for further work on waste management policy, feasibility of recycling opportunities and other waste management treatment options in Kiribati and the wider Pacific region.

2 Overview of Kiribati

2.1 Background

The Republic of Kiribati is a independent, low-lying island nation located in the central Pacific Ocean. It is less than 100 kilometres from the equator and one of the most remote countries in Micronesia. Its 21 inhabited islands (of a total of 33 islands) are on average 6 metres above sea level. The three islands groups are the Gilbert Islands (90% of inhabitants), the Line Islands (three islands inhabited) and the Phoenix Islands (mostly uninhabited). Approximately 45% of Kiribati's population of 117,606 lives on urban South Tarawa, an island with a narrow reef on one side and a shallow lagoon reaching kilometres out to sea, with one road in the middle. The remaining 55% of Kiribati's population lives in rural outer islands (GoK 2016; Knoema 2015). Although Kiritimati Island is part of Kiribati, it is 2,000 kilometres from the capital in Tarawa and there are no direct flights between them.

Feature	Description
Official name	Republic of Kiribati
Total land area	811 km^2
Capital	Tarawa
Border countries	Maritime borders with Cook Islands, New Zealand, Tuvalu
Climate	Tropical
Population	117,606 (2019)
Language(s)	I-Kiribati, English
Ethnicity	I-Kiribati 96.2%, I-Kiribati/mixed 1.8%, Tuvaluan 0.2%, other 1.8% (2015 est.)
Government	unitary republic
Currency	Australian dollar ($A)
GDP per capita	1,655 (2019)
HDI	0.630 (2019)
Exports	Non-filleted frozen fish, fish fillets, fishing ships, coconut oil, live fish
Signed international agreements	Stockholm, Basel, Waigani, Montreal, Minamata, MARPOL 73/77, CLC 92, FUND 92, HNS 1996, BUNKER 2001, Vienna, Kyoto.

Figure 1: Houses on the lagoon side around the village of Eit, isolated by salt water from sea incursions and storm surges (*The Guardian*, 2017).

2.2 Socioeconomics

Kiribati has one of the largest exclusive economic zones (EEZ) in the world, with an area of 3.5 million km^2, and one of the most productive fisheries, accounting for 26.1% of the Kiribati US$200 million GDP in 2019.

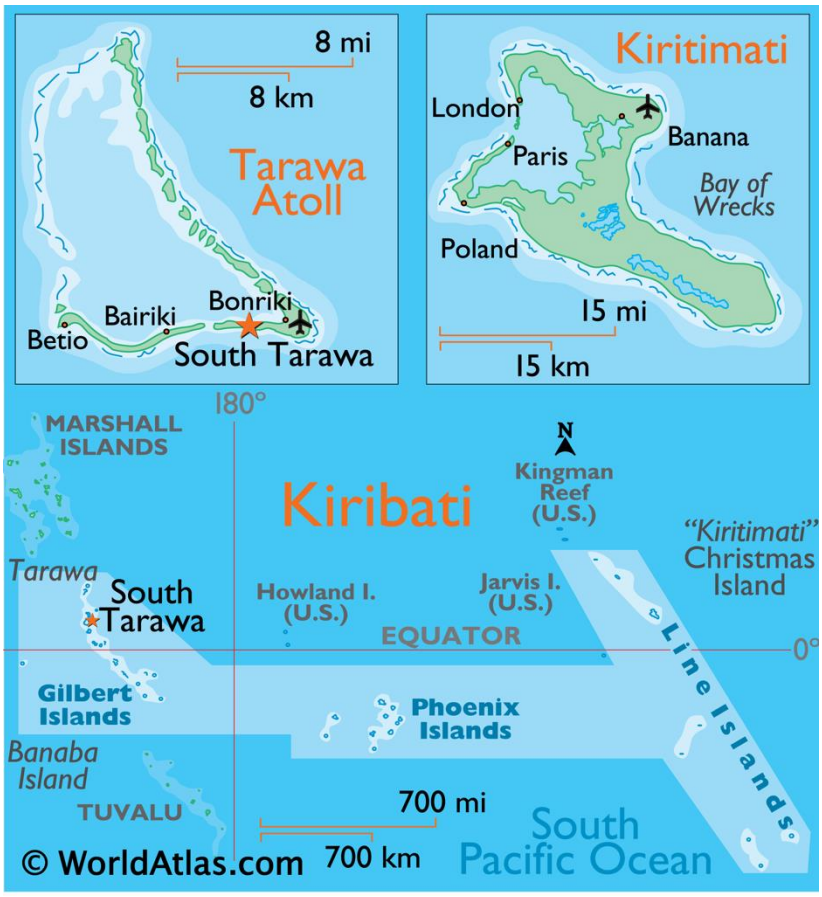


Figure 2: Map of Kiribati (source: https://www.worldatlas.com/maps/kiribati)

The Kiribati economy relies on foreign assistance, emigrants' remittances, sales of fishing licences, fish and coconut exports, and tourism. Tourism generates 21% of the country's GDP (2017), with the greatest economic benefit in Kiritimati Island and Tarawa, which both derive significant tourism returns. Agriculture, along with forestry and fishing, contributes 26% toward GDP. Most of the working population is involved in subsistence agriculture. The soil in Kiribati is considered among the most infertile in the world, however farmers have developed a sustainable farming system based on the traditional method of *te bwabwai* pits, which involves an extensive composting technique using pits filled with compost. This is significant when considering the future waste management of a solid waste profile which includes a pronounced green waste component (Government of Kiribati, 2019).

There has been a shift from traditional subsistence lifestyle towards reliance on imported consumer goods in Kiribati. These goods, together with their high levels of plastic packaging (1,000 tonnes in 2017), have greatly increased solid waste on the island, leading to increased pressure on the atoll's limited waste disposal capacity (Carden 2003; Redfern 2006).

2.2.1 Imports and exports

Exports in 2019 were valued at US$86 million and were dominated by frozen fish, fish fillets, fishing ships, coconut oil and live fish. Primary export destinations included Thailand, Philippines, South Korea, Japan and the USA. Imports in 2019 of US$100 million were dominated by refined petroleum, netting, raw sugar, rice and poultry meat. The primary import origins in 2019 included China, Fiji, Chinese Taipei and South Korea (OEC, 2019). Most imported food items and products were packaged in plastic, which contributed to more than 1,000 tonnes of plastic waste in 2017.

3 Kiribati institutional framework

3.1 National government

Kiribati has a mixed legal system of English common law and local customary law known as *unimane*, which is a well-respected system of traditional leadership. Sources of law are the Constitution (as the supreme law), ordinances, Acts and subsidiary legislation, as well as some prior UK statutes, common law, and customary law. There are 23 island (rural) councils, and three town (urban) councils: Betio City Council (BTC), Teinainano Urban Council (TUC) and Kiritimati Urban Council (KUC) (CLGF 2013).

3.1.1 International agreements

Kiribati has ratified numerous international and regional commitments related to the environment (Table 1). The Kiribati Government has taken steps to increase consistency between trade policy and environmental sustainability, including aligning approaches in various national strategies and plans (Table 3), building the capacity to facilitate the notification and reporting requirements under existing waste and chemical-related conventions and MEAs, and implementing a draft waste management strategy.

Table 1: Multilateral agreements and conventions ratified by Kiribati

MEAs	Ratification (r); Accession (a); Acceptance (A); Approval (AA); Signature (s)	Entry into force
1. Stockholm Convention on POPs	04/04/2002 (s), 07/09/2004 (r)	06/12/2004
2. Basel Convention	7/09/2000 (a)	06/12/2000
3. Minamata Convention on Mercury	28/07/2017 (a)	16/08/2017
4. Waigani Convention	16/09/1995 (s), 28/06/2001 (a)	21/10/2001
5. MARPOL 73/78 ANNEX I/II	5/022007 (a)	5/05/2007
6. ANNEX III	5/022007 (a)	5/05/2007
7. ANNEX 1V	5/022007 (a)	5/05/2007
8. ANNEX V	5/022007 (a)	5/05/2007
9. MARPOL PROTOCOL 97 ANNEX VI	5/022007 (a)	5/05/2007
10. London Convention 72	12/07/1979	12/07/1979
11. CLC Protocol 92	5/02/2007 (a)	30/05/1996
12. FUND Protocol 92	5/022007 (a)	5/02/2007(a)
13. Bunker Convention	29/07/2009 (a)	29/10/2009
14. Anti-Fouling Convention 2001	5/02/2007 (a)	17/09/2008
15. Ballast Water 2004	5/02/2007 (a)	8/09/2017

Of interest to this project are the Basel and Waigani conventions, which allow for the transboundary movement of materials. Both permit any collected recyclable material be transported overseas for recycling.

The Noumea Convention (Convention for the Protection of Natural Resources and Environment of the South Pacific Region, 1986) covers the prevention of dumping of waste into the ocean—Kiribati is currently not party to this convention. It would be useful for Kiribati to consider signing the convention, especially with the increased focus on plastic pollution in recent years.

3.1.2 Regional agreements

In addition to the MEAs mentioned, Kiribati has bilateral and multilateral relationships within the wider Pacific region, as shown in Table 2.

Table 2: Regional agreements and memberships

Regional agreements	Status
Pacific Islands Forum	Member
Secretariat of the Pacific Community (SPC)	Member
South Pacific Regional Environment Program (SPREP)	Member
Cleaner Pacific 2025: Pacific Regional Waste and Pollution Management Strategy 2016–2025	Member
Regional 3R Forum in Asia	Member
National Implementation Plan for the Stockholm Convention on POPs	Current (2019)

3.1.3 National regulation and strategy

No specific legislation for waste management currently exists in Kiribati and waste management measures are spread across various legislations. This includes general environmental legislation, public health regulations, customs legislation, disaster management legislation, and specific legislation for initiatives, such as the Kiribati Advance Recovery Fee (ARF) (Table 3) (SPREP 2020). A specific law establishes this system, which is regarded as effective in separating eligible containers and batteries from other waste streams and promoting their recovery (the Kaoki Maange, see page 18). An ***Environment Act 2021*** is in its draft stage and when implemented will bring a number of these regulations under one umbrella.

Overall, the legal responsibility for policy and planning for solid waste management falls under the Government's Ministry of Environment, Lands and Agriculture Development (MELAD) through the Environment and Conservation Division (ECD). MELAD's responsibilities include regulating, funding, and directly implementing the delivery of solid waste management services and systems (Table 4). The responsibility for waste collection and disposal lies with the Local Government councils, controlled through local by-laws. The Kiribati Waste Management and Resource Recovery Strategy (KWRRS 2020–2030) outlines a proposed restructure for national waste management governance, including a National Solid, Chemical and Hazardous Waste Management Steering Committee (NSCHWMSC), and a National Solid Waste Management Committee (NSWMC).

MELAD, through the ECD, is responsible for enforcing the ***Environment Amendment Act 2007*** and the **Environment Regulations 2017**, and gives powers for environmental inspectors to enforce penalties for pollution, including fines of between $500 to $100,00 and imprisonment (*see Appendix A: Kiribati solid waste management*) (SPREP, 2018a). These fines are rarely enforced, however. A proposal to appoint private security firms to enforce the Act have been put forward in the past (ECD, 2016).

The ***Public Highways Protection Act 2018*** provides powers to the Kiribati Land Transport Authority to prohibit or control the dumping of rubbish or litter on any public highway. The **draft Environmental Act 2021** is wide ranging, covering waste management, littering, littering from a vehicle, bulky waste and illegal dumping as well as designation of landfill sites and damage to waste receptacles.

Legislative instruments with waste management impacts include the ***Public Health Act Ordinance*** and ***Local Government Act 1984*** (amended 2006), which allocate control of waste collection and disposal services to the local councils, including authorizing by-laws to be issued for waste management fees.

The legislation regulating the CDS in Kiribati, the Kaoki Maange, is the ***Special Fund (Waste Materials Recovery) Act 2004,*** coordinated by MELAD, and administered by Ministry of Finance. It is accompanied by Special Fund (Waste Material Recovery Regulations) 2005 and the Deposit Order 2005.

The ***Customs Act 2019*** (replaced 2005) controls the movement of goods into and out of the country, including a list of restricted and prohibited imports and exports. This came into effect in October 2020 and prohibits the import of the following:

- Ice-block bags
- Non-biodegradable nappies (diapers)
- Single-use plastic shopping bags including carrier bags (dispensed from a roll and often used to separate meat, fruit and vegetables from other groceries—it does not include green garbage bags).

The **National Quality Policy 2017,** launched by the Kiribati government in 2018, seeks to raise the quality and safety levels of locally manufactured and imported products and services in Kiribati. Among other priorities, the policy seeks to regulate vessel tank discharges near the lagoon; develop, regulate or promote the use of energy-efficient and energy-smart standards; continued implementation of the recycling measures and assessment of the need to regulate items not yet covered (e.g. plastic bags, packaging); introduce an import regulation for used cars (pre-shipment inspection, age limits, wreckage tax), and continue the elimination of car wrecks (ELVs). The **Kiribati Trade Policy Framework 2017–2027** seeks to implement measures, including waste-related goals and an environmental licensing system, to support waste management and pollution control. It also aims to build capacity to facilitate the notification and reporting requirements under existing waste- and chemical-related conventions. The trade policy broadly seeks to ensure trade and environmental sustainability.

The ***Maritime Act 2017*** addresses issues affecting internal and marine waters, toxic and hazardous substances, conservation, and social impact. The **Carriage of Goods by Sea Ordinance Cap 7** requires every contract for transporting goods by sea to set out the rights and responsibilities of the carriers and shippers, such as seaworthiness of the vessel, responsibilities for accidents, and handling of the goods.

The Kiribati Government recognizes the growing and significant issue of plastic pollution. A prohibition or ban on the entry of ice-block bags, non-biodegradable nappies (diapers) and single-use plastic (SUP) bags came into force in October 2020 through ***Kiribati Customs Act 2019***. However, MELAD has identified compliance challenges for the private sector until viable alternatives to the items included in the ban are available. Consultation is essential in identifying viable alternatives to single-use plastic bags and to ensuring the ongoing success of the ban. MELAD is also seeking support from the Pacific Ocean Litter Project (POLP) for support for identifying alternatives.

Kiribati's recent **Kiribati Waste Management and Resource Recovery Strategy (KWMRRS 2020–2030)** governs the management of solid, chemical and hazardous waste, and replaces the old National Solid Waste Management Strategy (NSWMS 2007–2009). The Strategy sets the country's vision for long term planning to respond to the increasing threat from waste and pollution which undermines the country's resilience and efforts to achieving sustainable and inclusive socio-economic development. The development of the Strategy is timely with the formulation of the Kiribati Development Plan (KDP 2020-23) and the Kiribati integrated Environment Policy (KIEP 2020-2036) and therefore, the Strategy essentially informs the thematic area on waste management and pollution control priorities under these important national documents. The Strategy also directly contributes to the national overarching policy, the Kiribati Vision 2016-2036 (KV20) through protecting and enhancing fisheries and tourism, two priority sectors identified under the policy. Additionally, the Strategy demonstrates the Government's commitments to implementing the sustainable development goals (SDG 2030) and Cleaner Pacific 2025 and fulfilling Kiribati's obligations under the chemical and waste cluster treaties which Kiribati is party to.

Table 3: List of national policies and legislation related to waste management in Kiribati

Type of document	Name
National legislation	Environment Amendment Act 2007
	Environment Regulations 2017
	Special Fund (Waste Materials Recovery) Act 2004
	Special Fund (Waste Material Recovery Regulations) 2005
	Deposit Order 2005
	Public Highways Protection Act 2018
	Public Health Act Ordinance
	Local Government Act 1984
	Kiribati Ports Authority Act 1990
	Customs Act 1984 and Customs Act 2019
	Customs Amendment Bill
	Maritime Act 2017
	Carriage of Goods by Sea Ordinance Cap 7
	National Quality Policy 2017
National policies	Kiribati Waste Management and Resource Recovery Strategy (KWMRRS 2020–2030)
	Kiribati Integrated Environment Policy in 2012
	Kiribati Trade Policy Framework 2017–2027
	Kiribati 20-Year Vision 2016–2036 (KV20)
	Kiribati Development Plan (KDP) 2016–2019
	Kiribati Joint Implementation Plan 2019–2028
	Kiribati National Implementation Plan for POPs (2019)
	National Quality Policy 2017–2023

A comprehensive list of policies, legislation, strategies, and multilateral agreements addressing solid waste management and pollution control in Kiribati is provided in *Appendix A: Kiribati solid waste management*.

3.2 Stakeholders – roles and responsibilities

Table 4 below outlines the roles and responsibilities of each stakeholder managing municipal solid waste in Kiribati, including decision-making, implementation, and compliance and monitoring.

Table 4: Stakeholder roles and responsibilities

Stakeholder	Responsibility
Government of Kiribati	
Ministry of Environment, Lands and Agriculture Development (MELAD) through the Environment and Conservation Division (ECD)	Meeting obligations under MEAs Chemical and Solid Waste management, legislation, policy and planning Enforcing the *Environment Amendment Act 1997* and *Environment Act 1999* Pollution Prevention Chemical and Waste management Prevent pollution to land and sea, littering, environmental licences CDS coordination
Ministry of Finance	Administers the special fund for the CDS
Kiribati Customs Service (KCS)	Plastic bans Meeting Basel and Waigani Conventions export requirements Detection of illegal imports and export of POPs
Kiribati Land Transport Authority (KLTA)	Littering and illegal dumping on highways
Healthcare Waste Management Committee	Healthcare waste
Ministry of Internal and Social Affairs	Oversight and funding of local government councils
Kiritimati Island Waste Management Committee (KIWMC)	Waste management
Local councils	
TUC	Solid waste collections on South Tarawa from Tanaea town in the east to Bairiki Local by-laws regulating collections (TUC Control of Waste by-law 2015)
BTC	Solid waste collection on Betio islet, which is linked to Bairiki by a causeway.
Kiritimati Urban Council (KUC)	Kiritimati Island solid waste collections, disposal and recycling
Private-sector recyclers	
One Stop	Kaoki Maange Recycling Program

Key findings

- Kiribati is party to the Stockholm, Basel and Waigani conventions but has not yet signed the Noumea Convention.
- There is no specific legislation for waste management in Kiribati, and waste management measures are spread across various pieces of legislation. The government recognized the need for this, leading to the development of the Kiribati Waste Management and Resource Recovery Strategy (KWMRRS 2020–2030).
- A draft *Environmental Act 2021* has been prepared, which includes wide-ranging reform for waste management, littering, illegal dumping and other matters.
- The *Special Fund (Waste Materials Recovery) Act 2004* is coordinated by MELAD, and administered by Ministry of Finance. This Act regulates the current advance recovery fee (ARF) system that includes PET bottles, aluminium cans and lead-acid batteries.
- A prohibition on the entry of ice-block bags, non-biodegradable nappies (diapers) and single-use plastic (SUP) bags came into force in October 2020 through the *Kiribati Customs Act 2019*.

4 Situation analysis: waste management

4.1 Waste management services overview

Kiribati's solid waste management has progressed substantially over the past three decades, with significant improvements to open dumps that were previously spilling from the beach into the ocean during the 1990s Overall, Kiribati has a sound legislative framework for waste management and recycling, including an established CDS scheme that has been in place since 2012 on the main island of South Tarawa.

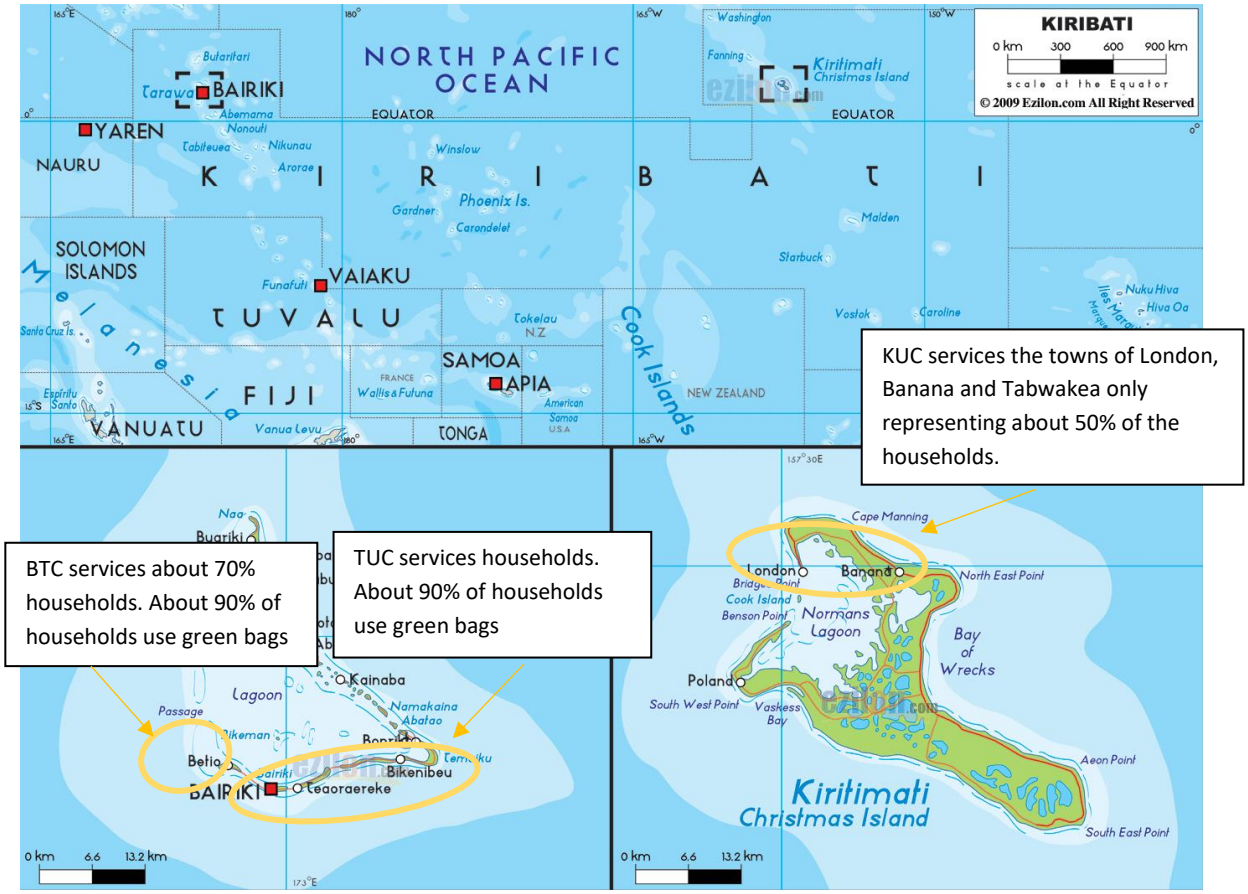


Figure 3: Collection responsibilities in Kiribati

4.1.1 Waste service provision

Waste collection in Kiribati is available only on the islands of South Tarawa and Kiritimati. The collection service is provided by local councils (see Table 5).

Table 5: Collection services in Kiribati

Area	Collection coverage (%)	Service provider	Service provision	Collection receptacle	Fee charged	Frequency	Collection vehicle	Destination
South Tarawa (Tanaea to Bairiki)	70%	Teinainano Urban Council (TUC)	All wastes that don't go in the green bag. Mix of organic and inorganic	In an empty sacks/bags, 200L drum, open-top lid	Different for commercial premises, based on size. Rates also differ for household type	Households: twice a week Commercial: Once a week	**Council truck**: Skip type, tip type, flatbed type, **Private business truck**: Flatbed type, tip type, tricycle, pickup.	Nanikaai Landfill Bikenibeu Landfill Whichever is closer depending on schedule
	90%	MOEL	Non putrescible ONLY, i.e. glass bottles, nappies (diapers), plastics	Green bags	Pre-paid. 30c for a green bag	Once a week	Compactor truck at the beginning; moved to flatbeds in 2021.	
South Tarawa (Betio islet)	70%	Betio Town Council (BTC)	All wastes that don't go in the green bag. Mix of organic and inorganic	In an empty sacks/bags, 200L drum, open-top lid	$27/yr for households and $596/yr for large commercial premises	Households: twice a week Commercial: Once a week	**Council truck**: Skip type, Tip type, flat bed type, **Private business truck**: Flatbed type, tip type, tricycle, pickup.	Betio Landfill
	90%	MOEL	Non putrescible ONLY i.e. glass bottles, nappies (diapers), plastics	Green bags	Pre-paid. 30c for a green bag	Once a week	Compactor truck at the beginning; moved to flatbeds in 2021.	
Kiritimati Island (towns of London, Banana and Tabwakea only)	50%	Kiritimati Urban Council (KUC)	All waste (no segregation)	In an empty sacks/bags, 200L drum, open-top lid	Fee is charged	Once a week	Flatbeds	Tabwakea dumpsite
Other inhabited islands					No collection service. All waste is dumped, buried or burned			

Figure 4: (a) Green bags being unloaded at the landfill; (b) an example of text on green bag; (c) residents self-hauling waste at the landfill. (Source: MELAD, 2020)

Teinainano Urban Council (**TUC)** is responsible for waste collection in South Tarawa, from Tanaea town in the east to Bairiki, covering approximately 128 kilometres of road length. **Betio Town Council (BTC)** is responsible for waste collection on Betio islet (covering about 20 kilometres of road length). **Kiritimati Urban Council (KUC)** is responsible for solid waste management services to 1,017 households on Kiritimati Island, including rubbish collection and recycling (towns of London, Banana and Tabwakea only). Kiribati's outer islands have no waste collection systems, so residents simply bury, burn or dispose of waste directly into the sea. This represents approximately 50% (8,878) of Kiribati's households.

Figure 5: 200-litre open-top drums used for pubic waste disposal in Kiribati. (Source: APWC in-country consultants, 2020)

Households put out waste in either empty sacks/bags, a 200-litre drum with an open-top lid or in purchased green bags. Waste is collected by local councils using a range of truck types (see Table 5). Commercial businesses either pay the local council a fee for waste collection or self-haul their waste to the landfills. No tipping fees were charged at Kiribati's landfills for disposal when the audit was conducted but a fee of $20 per load commenced in May 2021. The fee is paid to the relevant council.

The **Green Bag user-pays scheme (GUPS)** is a user-pays system started in 2012. Green garbage bags are purchased at 30 cents per bag, which covers collection and disposal costs. It is currently operated on a contractual basis between MFAT and a private company, MOEL. Householders buy green bags from shops on South Tarawa and place non-putrescible waste in the bag for collection by 'green bag trucks', only collecting green bags. According to MELAD, the green bag waste collection system is currently on trial to determine the optimum cost of the bag and the best collection vehicle to use. The GUPS has proven to be very successful, however it has also introduced an additional waste collection system alongside the council service (*see Appendix A: Kiribati solid waste management for more information on the Green Bag scheme*). The Green Bag Scheme (GUPS).

Waste from fee-paying households is collected by municipal councils (BTC, TUC, and KUC) (see Table 5 for fees charged). However, the fee recovery rate is very low, at about 25%. Household waste is also collected from residents using the Green Bag collection system operating on South Tarawa only.

4.1.2 Waste disposal behavior

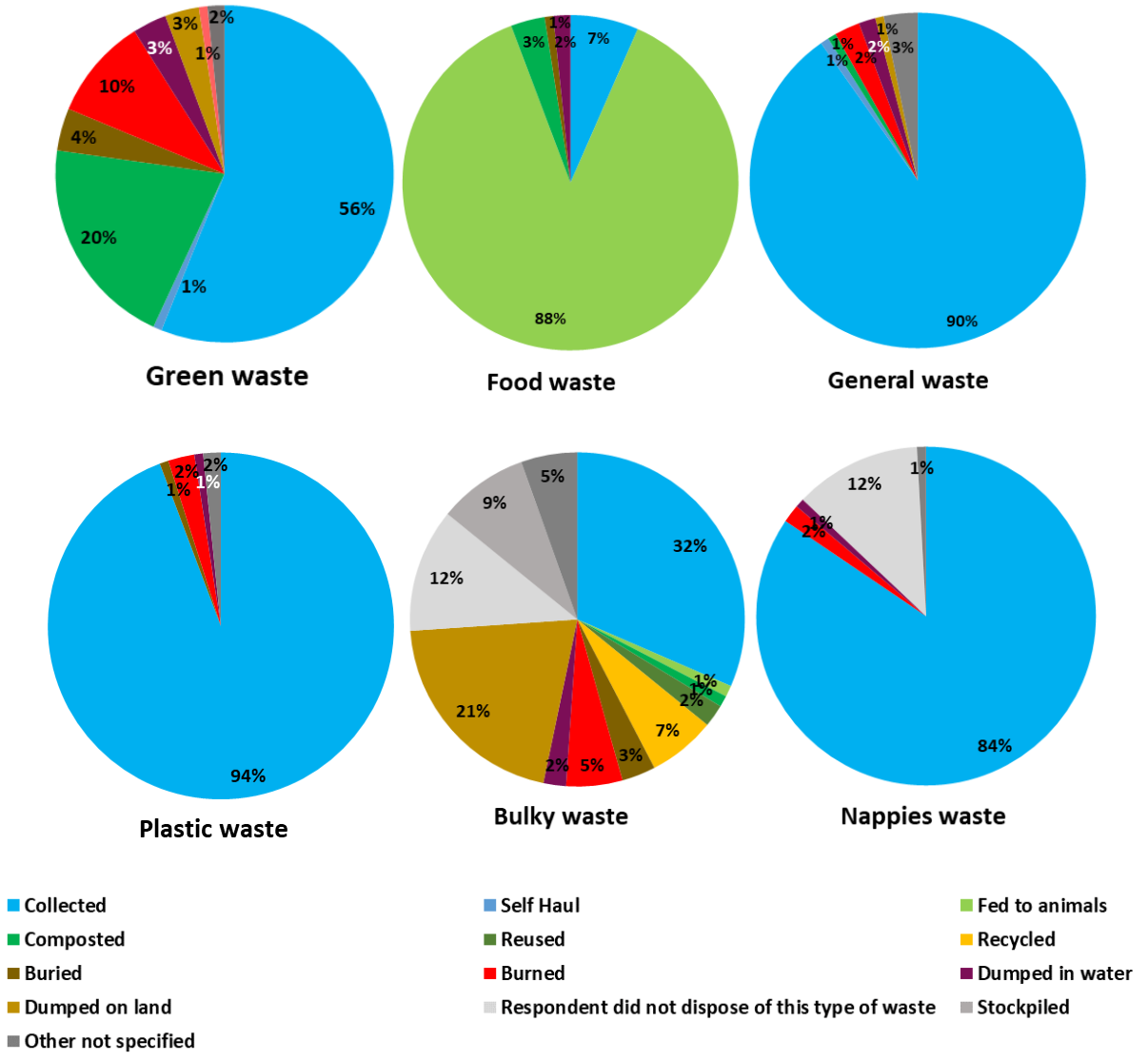
Implementing a nationwide waste collection service in Kiribati continues to be a fundamental challenge. Not all households in South Tarawa and Kiritimati are provided with collections and outer island services are non-existent. Households often resort to illegally disposing of waste through burning or dumping. Twenty per cent (20%) of all Kiribati households prefer burning as their main form of solid waste management, with an estimated 1,888 tonnes of domestic waste burned every year (GoK, 2016; MELAD, 2019a) (*see Appendix A for a description of how this calculated by MELAD*). Every year, the total quantity of waste burned is 3.4 times more than the total cumulative amount of waste recycled under Kiribati's Kaoki Maange program in more than 10 years of operation (550 tonnes in total). This demonstrates that Kiribati can potentially recycle higher quantities of material than is currently undertaken.

Interview data from households within the area serviced by the collection crew shows that on South Tarawa 10% of households burn their green waste, and 2% burn their general and plastic waste. The collection services are highly utilised for general waste (90%), plastic waste (94%) and nappies (84%) and least for food waste with 88% of households reporting composting their food waste.

The material that is not being disposed of through the collection services appears to be bulky goods, such as white goods, furniture, end of life vehicles, and tyres of which only 32% are placed outside for collection services and 21% are self-hauled to the landfills. This indicates almost 50% of the bulky goods are dumped. Nonetheless, 7% of the households indicated that they try to recycle or reuse their bulky goods, mostly furniture.

The study also found that 10% of green waste is burned and almost 12% is either dumped buried or stockpiled.

Figure 6: Disposal practices for households in South Tarawa



Between 31% and 75% of the waste from commercial premises is collected in South Tarawa and a 8% of the commercial premises reported self-hauling waste to the landfills.

With no collection services available on the outer islands, between 20% of the households burn their green and bulky waste and more than 40% of the households burn their general and plastic waste. 32% reported burning of nappies. Interestingly, almost 100% of the food waste is beneficially used either through composting or feeding to animals.

This is particularly noteworthy, as a large amount of general waste, plastic waste and nappies (diapers) are either being burned or dumped in the water, inflicting serious environmental harm.

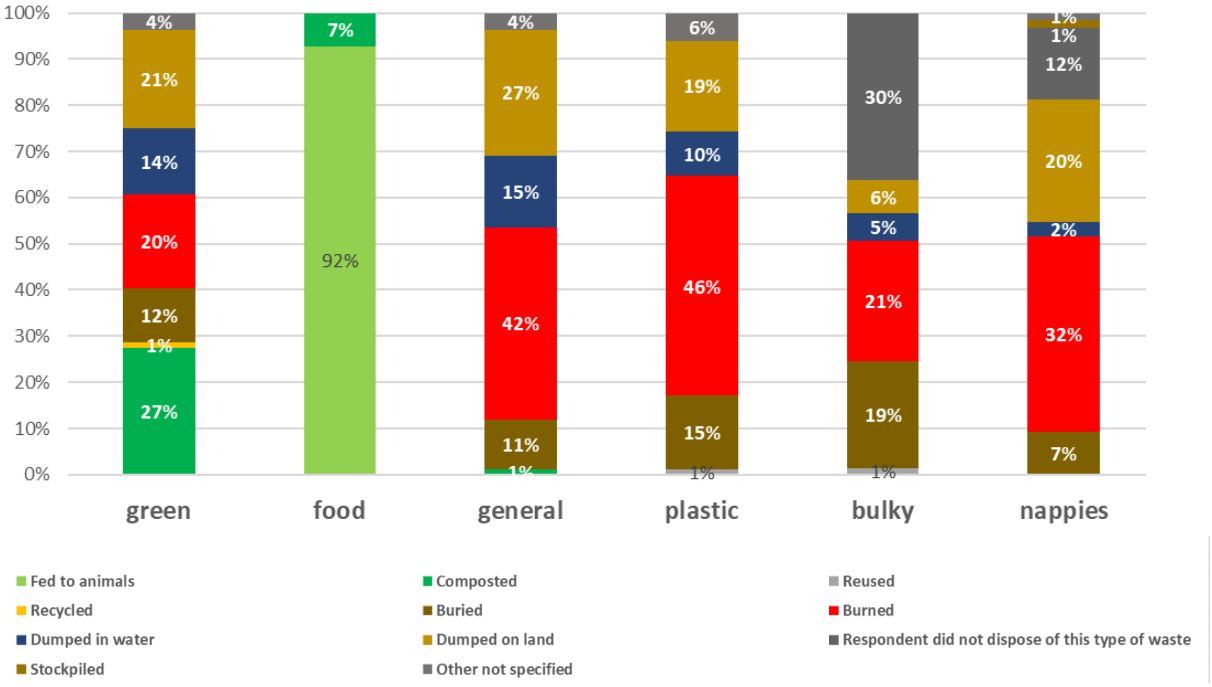


Figure 7: Disposal practices on outer islands without collection services

Key findings – collection services

- Only those living in South Tarawa and Kiritimati receive a collection service. Outer islands still practise burning, burying, and ocean-dumping of waste.
- There are no data-collection systems in place to track and quantify the various materials entering landfills and recycling facilities.
- Although functional, collection services need to be upgraded and made more uniform to prevent doubling up and to alleviate confusion.
- Collection vehicles need to be appropriate and require an upgrade.

4.2 Waste management infrastructure

All waste collected by councils and private operators on **South Tarawa Island** is transported to one of three approved landfills or 'controlled dumpsites': Betio Landfill, Nanikaai Landfill, and Bikenibeu Landfill. There is one material recycling facility (MRF) located near the Betio landfill, Kaoki Maange facility, operating for the collection of container deposit scheme (CDS) items and other materials like e-waste and white goods. On **Kiritimati Island**, there is one approved (formal) dumpsite at Tabwakea

and one unapproved hazardous dumpsite, neither of which is regulated or managed by the counicl. **Kiribati's outer islands** have no approved landfill nor waste collection systems, therefore residents bury, burn or dispose of waste directly into the sea.

Figure 8: Location of end-of-life infrastructure on South arawa Island showing all built into tidal sand flats (Source: MELAD)

Details on the recycling facilities and landfills in Kiribati are provided in Table 6 below.

Table 6: Recycling infrastructure in Kiribati

	Material recycling facility	Kaoki Maange
Location	Betio Harbour	Inside the MRF. See Figure 13
Materials accepted	End-of-life vehicles; e-waste; white goods	Aluminium cans, batteries and PET containers (deposit levy)
Equipment	N/A	1 PET baler and 1 aluminium can-crushing machine

Table 7: Landfill functions at Kiribati's landfills and dumpsites

	Betio Landfill, South Tarawa	Nanikaai Landfill, South Tarawa	Bikenibeu Landfill, South Tarawa	Tabwakea dumpsite, Kiritimati	Hazardous dumpsite, Kiritimati
Disposal	Accepts solid waste from households, businesses, infrastructure constructions and industries. Officially, no landfills accept hazardous waste and bulky waste (car bodies, shipping containers, white goods, etc.), used oil, e-waste, school, hospital chemicals.			Accepts all waste except hazardous waste	Hazardous waste
Separation and collection	Separated bulk organic waste Wood chipping occurs of large green waste Public can buy wood chip for $1/15 litre bag			No	No
Equipment	One bulldozer shared across all three (3) landfills; tractor, trailer wood-chipper; three-wheeled motorbike-trailer				
Incinerator for healthcare waste	No – healthcare waste burned in drums Have a healthcare waste incinerator but needs to be commissioned.				No – healthcare waste burned in drums
Leachate pond	Inoperable and abandoned leachate pumping system	Inoperable and abandoned leachate pumping system	Inoperable and abandoned leachate pumping system	No	No

	Betio Landfill, South Tarawa	Nanikaai Landfill, South Tarawa	Bikenibeu Landfill, South Tarawa	Tabwakea dumpsite, Kiritimati	Hazardous dumpsite, Kiritimati
Environmental monitoring	Landfill water testing			None	None
Capacity and Size	54,000m³	27,000 m³ 220 m x 42 m x 3 m deep	42,000 m³ 132 m x 108 m x 2.5 m deep	N/A	N/A
Remaining capacity	10% or three (3) years	30% remaining or 10 years	71% remaining 30–35 years	Not yet determined	Not yet determined

4.2.1 Landfills and dumpsites

Betio Town Council (BTC) manages Betio Landfill, a seaside tip that has been operating beside the port area for 37 years. It was enclosed in 1997 by a seawall and later fenced to prevent waste blowing into the sea (Figure 9). Like all landfills in Kiribati, these containment walls are concrete-covered sand berms and have been constructed to enable landfills to be built into the lagoon tidal flats. Waste is retained behind the walls and compacted with a large excavator. The walls and floor of the landfill are deliberately designed to be permeable, allowing water to filter slowly through both the walls and the floor. The landfill is gated, with access via a side road in poor condition, which becomes impassable after heavy rain. Historically, no tipping fees have been charged for waste disposal but recently (since May 2021) the is a charge of $20 per load. Weight-based tipping fees cannot be charged because landfills in Kiribati are not equipped with weighbridges.

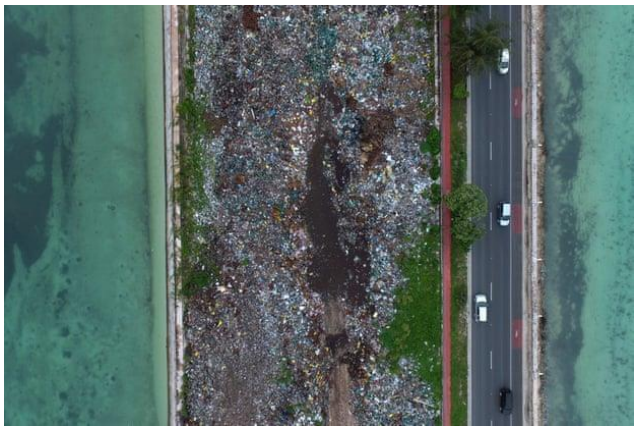


Figure 9: Betio Landfill (Source: Guardian, 2017)

There is no segregation of waste except for bulk green waste. An onsite shredder chips green waste into 90-millimetre pieces, which is then sold to the community for garden use. There is non-secure access to the landfill for the public to use as a shortcut, which leaves the site susceptible to scavenging. Betio Landfill has only 10% capacity remaining and will need to be extended in the near future, either northwards or westwards of the existing site. Currently, there is one bulldozer used for compacting across all three landfills on South Tarawa. Other equipment includes an ageing fleet of tractors and trailers. Betio Landfill is the only landfill in Kiribati that has a vehicle maintenance workshop.

Teinainano Urban Council (TUC) manages two landfills, Nanikaai and Bikenibeu. Historically, no tipping fees have been charged at these landfills but a fee of $20 per load has been introduced from May 2021. No vehicle maintenance takes place at TUC owing to a lack of workshop facilities.

Figure 10: Betio Landfill (Source: APWC in-country team 2020)

Nanikaai Landfill was purpose-built in 2004 and has been operating for 17 years. It is located beside the Anderson Causeway behind a seawall and is well fenced. This site has good access off the main road with lockable gates. The organics waste cell at the landfill accepts green waste, cardboard and nappies/diapers but it now at capacity.

Figure 11: Paper and cardboard, e-waste, PET bottles mixed with general waste at Nanikaai Landfill, South Tarawa (Source: APWC in-country team, 2020)

Bikenibeu Landfill was completed in 2004 and is situated behind the main power station and contained by a seawall. Until recently, the landfill was used as a milk fish farm. It contains approximately 1.2 metres of water due to the very high water table. The landfill is fenced (although contains some human-size holes) and is a secured by a lockable gate to exclude unauthorized vehicles.

On **Kiritimati Island**, the KUC operates two dumping areas for domestic waste, as well as a remote dumping area for more hazardous waste. The two dumping areas are not controlled and spontaneous fires occur frequently. The largest and most heavily utilized formal dumpsite is **Tabwakea** or 'main dumpsite'. The site is unfenced and while a daytime watchman has been employed, it is still operating very much as an uncontrolled dumpsite (MFAT, 2019). No tipping fees are charged and no monitoring of incoming waste occurs. As a consequence, actual quantities of waste dumped is unknown. Burning of waste on Kiritimati has been actively used by KUC in the past in an effort to reduce waste quantities. This burning activity also represents a significant source of unintended persistent organic pollutants (uPOPs) in Kiribati (MELAD, 2019a).

Landfill fires have occurred occasionally at all three landfills on South Tarawa, although 2020 they occurred only at the Betio and Nanikaai. Two uncontrolled fires were reported in 2018 at each of these landfills. Fires can destroy a large part of the waste that sits on top of the landfill but not affect the waste below ground level. Estimates suggest that fires destroy approximately 50% of the annual waste coming into the Betio Landfill, and approximately 30% of annual waste coming into the Nanikaai Landfill. Fires are a significant source of uPOPs (MELAD, 2019a). MELAD has noted that large construction projects in Kiribati are threatening landfill longevity. Developers are not required to make their own arrangements for disposal of demolition and construction waste and instead make 'unplanned' use of scarce landfill space. Feedback from staff at MELAD is that while landfill management has increased significantly from a decade ago, in recent years the management of the landfills have decreased, often due to the lack of a specific skill set in landfill management, insufficient equipment maintenance, an inability to bury waste below ground, and a lack of proper cover material. This is further exacerbated by poor coordination, particularly in relation to conducting the required number of hours of compaction (MFAT, 2019).

Green waste

Some food waste is composted in home gardens in South Tarawa, however the majority of household green waste is disposed of in the general waste collection, where it is buried in the landfill along with non-putrescible waste. Green waste is also open dumped or burned if not collected (Government of Kiribati, 2019).

All three landfills on South Tarawa provide designated areas for placement of separated organic waste and bulky waste. Betio Landfill also has a shredder for chipping green waste and the woodchip is sold to the community. Interviews with MELAD staff also indicate that a new shredder has also been procured for the Nanikaai landfill in 2021.

Initiatives encouraging composting of organic green waste to grow bananas or pawpaws, or households compost heaps started in the early 2000s have not continued. A green-waste composting trial run by the Temaiku Farmers' Cooperative Association in collaboration with BTC and TUC was ultimately unsuccessful due to lack of cooperation by local councils.

Figure 12: Wood-chipping at Betio Landfill (Source: APWC in-country consultants, 2020)

4.2.2 Material Recovery Facility (MRF)

Kiribati has only one material recycling facility (MRF) located on the main road to Betio Port on South Tarawa (Figure 13).

Figure 13: Line diagram of the MRF yard (left) and the location of the yard with respect to landfill (right)

The MRF is used as a storage yard for end-of-life vehicles (ELV) and other bulky wastes, including e-waste and white goods. The Kaoki Maange Waste Recycling Facility for the CDS is also located within the MRF precinct (*see 4.2.3 Kaoki Maange*).

Figure 14: Betio MRF showing processed bales of CDS-collected PET bottles and stockpiles of ELVs and gas bottles (Source: APWC in-country team, 2020)

4.2.2.1 Wastes processed at the MRF

Scrap metal and bulky waste: The MRF at Betio is used as a storage yard for ELVs and other bulky wastes. ELVs and large white goods constitute a large portion of the non-recyclable waste stream that remains inadequately addressed. Steel and metal products such as cars, refrigerators and air-conditioners suffer accelerated corrosion in Kiribati, exacerbated by the prevalent winds and salty air. MELAD reports the average life of a car in Kiribati is approximately five years after arrival owing to the corrosive effects of the environment (MELAD, 2001). As a result, there is an influx of cheap but relatively old second-hand vehicles. The accumulation and disposal of EVLs and other EOL bulky materials is an ongoing and concerning issue.

Based on Kiribati's customs data, MELAD estimates 800 vehicles (sedans) were imported in 2019. In September to October 2008, the Bulky Waste Pilot Project undertaken by Lagoon Motors collected 2,000 tonnes of bulky scrap waste (mainly ELVs) from Kiritimati Island and South Tarawa and shipped it to Indonesia for recycling. The cost of shipping this low-value waste offshore (exporting) is not commercially viable (Government of Kiribati, 2019). These materials are currently stored at the MRF awaiting further processing. Through MELAD, a contract has been awarded to Macaulay Metals Ltd NZ to undertake compaction and transportation of scrap metal out of Kiribati, however the contractor is still awaiting the border opening due to COVID-19. Arrangements and negotiations are still underway between the GoK and MFAT for this project and therefore scrap metals are not compacted or exported at the time of writing of this report. Removal and export of ELVs also has health implications for Kiribati, as abandoned vehicles situated close to settlements act as mosquito breeding sites, as does other accumulated solid waste.

E-waste is regularly disposed of at the open landfills in either Nanikaai or Betio, although officially the KWMRRS 2020–2030 states that no e-waste is accepted at landfills. There is some separation of e-waste in South Tarawa or Betio, where consumers can call the council to pick up e-waste or it is placed on the roadside or under office stairwells for a council pick-up. BTC is attempting to have a permanent location for members of the public to place their e-waste, and previously e-waste collection points were available in Betio, however these are not currently operational. There are small e-waste

collection points at landfills but are not working successfully. Collected e-waste is taken to the MRF (sometimes it undergoes a level of dismantling) where it is stockpiled. Currently, no e-waste is recycled or exported, and no parts are dismantled for reuse or sale (MELAD, 2019b). Although there are valuable metal materials to be recovered in e-waste, there is either lack of interest or lack of knowledge, partly due to the small volumes available in Kiribati. There is also a noticeable lack of formal and informal repair workshops on South Tarawa.

Waste oil (used lubrication oil): Kiribati Oil Company Limited (KOIL) made three shipments of used oil to India between 2014 and 2016 using flexi-tank bladders in containers. Jhoola Refineries Ltd no longer accepts used oil from Kiribati because of the high water content. Part of the used oil in the shipments was sludge from fuel tanks and this sludge can typically contain large amounts of water. KOIL no longer accepts used oil from local generators as it lacks storage capacity. It is, however, aware of the problem caused by capacity issues and is actively working with MELAD to arrange an export shipment.

The Public Utilities Board is managing its used oil independently of KOIL and stores used oil in 200-litre drums in a tidy storage area at the Betio plant (see Figure 13). It also has a full tank container (tanktainer) of 23,000 litres of used oil awaiting Waigani paperwork shipment clearance.

Figure 15: (Left) Tank container (tanktainer) awaiting shipment; (right) PUB Betio used oil drum storage (Source: MELAD, 2019a)

Healthcare waste: Waste generated by healthcare facilities includes used needles and syringes, soiled dressings, body parts, diagnostic samples, blood, chemicals, pharmaceuticals, medical devices, and radioactive materials. Healthcare waste from Nawerewere Hospital on South Tarawa is usually burned in steel drums at a remote location. The odour from the drums is strong and unpleasant and the drums regularly corrode and need to be replaced (MELAD, 2019a). Two incinerators were supplied under the EU PacWaste regional project (SPREP, 2017).

Estimates of waste produced from Nawerewere Hospital are around 12 full bags per day of clinical waste, weighing an average of 13 kilograms. This is clinical waste only and excludes accumulating pharmaceutical waste.

On Kiritimati Island, waste from London Hospital is burned at one of the dumpsites. This situation transpired after the SPREP PacWaste Project provided an incinerator but the burners and control box went missing before they reached the island (MELAD, 2019a). Quarantine waste is currently disposed of in a small incinerator at the Agriculture and Livestock Division in Tanaea and Betio.

4.2.3 Kaoki Maange (Keep Kiribati Beautiful) Program

Kiribati's most successful recycling initiative is the **Kaoki Maange (Keep Kiribati Beautiful) Program,** which operates as a **container deposit system (CDS)** under contract to a private-sector business. 'One Stop' recycling collects aluminium cans, PET bottles, and lead-acid batteries. Since the program was introduced in 2003, approximately 550 tonnes of waste has been exported—more than 200 tonnes of aluminium cans, 90 tonnes of PET bottles and more than 200 tonnes of scrap car batteries (SPREP, 2018b). See Table 8 for a detailed outline of the system. No PET bottles have been exported since 2018 due to lack of markets.

Table 8: Summary of CDS system in Kiribati, the Kaoki Maange program

Kiribati CDS system detail	
Name	Kaoki Maange (Keep Kiribati Beautiful) Program
Legislation	*Special Fund (Waste Materials Recovery) Act 2004* http://www.parliament.gov.ki/docs/acts/2004/SpecialFund(WasteMaterialRecovery)Act2004.pdf *Special Fund (Waste Material Recovery Regulations) 2005* Deposit Order 2005
Legislation to enable collection of deposit/fee	Deposit Orders prescribe materials (Class of Materials) for which a deposit is levied, and the amount (Scale of Deposit)
Key stakeholders identified in regulations	- Ministry of Environment, Lands and Agriculture Development (MELAD) and Environment and Conservation Division (ECD) – regulates the system and audits system operator against Environmental Licence, and Govt-provided facilities and land. - MELAD – Planning and Project Unit (PPU) – administers the contract. Oversees monitoring and auditing. - Minister of Environment – makes orders in respect of materials covered, broad powers to make regulations as to administration and finance. - Waste recovery operator (private sector acting as System Operator). This is currently One Stop, who has been the System Operator since commencement of the program. - Kiribati Customs Service – a person who can receive import duty under the customs legislation. - Minister for Finance – responsible for administering and managing the Special Fund and preparing annual reports.
Scheme operated by 'System Operator'	One Stop – a private sector business (via contract) via Environmental Licence.
Items included and refund	(AUD) PET beverage container – 5c pellet of PET (or preform) – 5c PET cooking oil container – 5c aluminium beverage container – 5c lead-acid batteries – $5 Legislation allows MELAD to expand the list of goods covered by amending the schedule.
Process (system set-up)	1. ARFD collected by Customs upon import of certain goods 2. ARFD deposited into 'Special Fund' administered by Finance 3. Five collection points in operation (1 central and 4 small satellite) managed by the System Operator (One Stop) under contract to MELAD 4. Community reimbursed 4c / $4 upon return of item to a collection point 5. System Operator makes claim to MELAD each week for reimbursement of 4c / $4 deposits 6. MELAD verifies claim, and undertakes audit as necessary, and recommends Finance to make payment to System Operator

Kiribati CDS system detail	
	System Operator arranges processing and export of material when quantity ready for shipment
Collection of fees and deposits (ARFD)	Customs collect Fees and Deposits paid to Special Fund. System is aligned with import duties under customs legislation. Deposit – 4c / $4 Operation – 1c / $1 Special Fund is coordinated by MELAD under *Waste Material Recovery Fund Act* but administered by Finance and subject to strict financial provisions in accordance with the Constitution and the *Public Finance (Control and Audit) Ordinance.*
Comments on finances	- The Minister for Environment is given powers to charge a deposit on materials when they are imported under the *Special Fund (Waste Materials Recovery) Act 2004* (Ecolex, 2004) and - The Minister is given powers to make regulations determining how the deposits are paid back to the people when the materials are returned for recycling. - Deposits are paid into and held in a Special Fund at the Ministry of Finance while awaiting refund. - The System Operator makes claims to Ministry of Finance on a weekly basis. - The Act allows the Special Fund to use any excess funds that accrue for other waste management purposes. It is expected that 'Unredeemed Deposits' remaining in the Special Fund will slowly accrue to provide capital for recycling equipment replacement over time, which will occur as there will not be a 100% return rate of cans, bottles or batteries.
Collection process	- Community members self-haul items accepted to the community drop-off facilities. - Beverage containers are deposited in cages - The System Operator consolidates the deposits made by community members, and makes a claim to MELAD via a receipt-system process on a weekly basis. - The System Operator transports collected items from the satellite collection points for compaction to the Kaoki Maange Waste Recycling Facility (next to MRF). - A 10 m by 8 m hanger facility provides cover for the baler and the processing of recyclables, later to be containerized prior to transfer to the port. - These are then collected by international recyclers in a barge for direct transfer to market.
Stockpiles	- Currently aluminium, batteries and PET bottles are compacted into bales and stockpiled at the Kaoki Maange - Stockpiling space at the MRF is becoming insufficient.
Infrastructure	- The collection receptacles are standard-size steel cages. Cages capable of housing 500 aluminium beverage cans. - Kaoki Maange Waste Recycling Facility located adjacent to the MRF on the main road to Betio Port. - A 10 m by 8 m hanger facility provides cover for the baler and the processing of recyclables. - A truck transports collected items from the collection points to the main site. Failure of this truck is an ongoing issue.
Collection centre operation	- Five collection points/depots on South Tarawa Island. - 1 Central Base in operation 5 days/week, Monday to Friday. - 4 satellite collection points (Bonriki, Bikenibeu, Teaoraereke, and Bairiki) in various communities in operation 1 day/week on a rotating basis. - Collection points operated by private sector under contract with MELAD. - Land for collection points provided by government.
Kiritimati Island	Participation is through their local council (KUC), which collects and pays them the deposit on the containers. Materials are then transferred to Betio or sent direct to market and the local council receives the income from the contractor of the Kaoki Maange MRF.
Outer islands	Not currently included

Kiribati CDS system detail	
Offences	Offences exist for individuals (importers) failing to pay deposit, taking a refund benefit they are not entitled to or contravening the Act or Regulations.
Export arranged by	System Operator
Exporting comments	- Estimates for exports costs are A$3,000 per 20-foot container; no additional government duties are payable on this. - Factors affecting the purchasing and sale of recyclable materials are transportation, global market variations/market downturn, weather and material quality (from APWC 2020 Stakeholder Interviews).
Seed funding provided by	Financially supported by UNDP
Strengths	Act and Regulation establish a scheme that is capable of capturing a broad range of goods and materials. Presently, it only applies to PET, aluminium and lead-acid batteries. Government may expand the list of goods covered by amending the schedule to the Regulation.
Opportunities for improvement	Completion of Annual Report Involvement of outer islands/communities (+50% of population) Expansion of items included in the ARFD No current efforts aimed at controlling the types of materials entering Kiribati, to support the existing AFRD materials accepted

Figure 16: Kaoki Maange, showing collection points for CDS system (Source: APWC in-country team, 2020)

Figure 17: Kaoki Maange, containing equipment and housing stockpiles of lead-acid batteries (Source: APWC in-country team 2020)

Figure 18: Kaoki Maange showing collected aluminium cans awaiting export in shipping containers (Source: APWC in-country team, 2020)

According to MELAD, other materials to be considered for inclusion in the Kaoki Maange program under the *Material Recovery Act 2004* could include scrap metal end-of-life vehicles (ELVs), e-waste,

used tyres, and glass bottles. MELAD suggests that the two most recommended potential recyclable materials to be added are scrap metal and e-wastes, as it has been part of ECD ongoing programs with useful information and data currently available (MELAD, 2020). At the time of writing of this report, SPREP is engaged in the process of providing technical assistance to Kiribati for the development of a feasibility study to extend the current CDS.

Key findings – End-of-life infrastructure

- All three managed landfills are in South Tarawa – two are reaching capacity. Spontaneous fires are common
- All landfills require proper compaction equipment and installation of weighbridges
- All other islands use dumpsites
- In South Tarawa, the MRF and Kaoki Maange receive and stockpile various recyclable materials
- No materials (included those collected through the CDS) have been exported for recycling since the China import ban (except for batteries)
- Large stockpiles of PET and other materials pose a fire hazard, including more general OHS risks
- The CDS scheme is effective in allowing for collection of materials eligible within the scheme. A review should be considered to allow for expansion to other materials, change in the amount of import levy to help support recycling of collected materials, and expansion to other islands.

4.3 Current financial mechanisms

4.3.1 Waste budgets

The Government budget provisioned for **MELAD**'s annual operations in 2019 was $A4.2 million, of which 20.6% ($0.8M) was allocated to ECD. Of MELAD's annual budget, 4.3% is used for ECD operations and 16.3% for ECD staff salaries. The ECD budget is presented in Table 9. As outlined in the *Stakeholder roles and responsibilities, Table 4*, MELAD (through ECD) uses this budget for planning and coordination at a national level only.

Table 9: Annual budget of ECD

	2018	2019
Income		
Government budget to ECD	$819,372	$874,788
Expenditure		
ECD operations	$233,390	$180,206
	(28.5%)	(20.6%)
ECD staff salary, including other benefits such as leave grant, allowance, etc.	$585,982	$695,774
	(71.5%)	(79.5%)

Currently, waste collections and disposal are carried out by **local councils** on South Tarawa and Kiritimati Island only. Revenue is raised by households paying a fee for services. BTC charges $A27/year for private and government houses and up to $A596/year for large commercial establishments. However, recovery of these charges is very low, with only 25% of the billed properties

paying the charges. The proportion of charges recovered from ministries and commercial establishments is much higher, but payment is often delayed (MELAD, 2020). As can be seen from the TUC and BTC waste budgets below (Table 10 and Table 11), the operating budgets for both councils are relatively small and no fees were charged for waste disposal at landfills in 2019. In May 2021, landfills have commenced charging a levy.

Table 10: TUC waste management budget (Source: MELAD, 2021[7])

	2017	2018	2019	2020
Revenue	$186,143	N/A	$202,680	$202,680
Expenditure	$87,395		$154,933	$102,660
Difference	+$98,748		$47,747	$100,020

Table 11: BTC waste management budget (Source: MELAD, 2021)

	2015	2016	2017	2020
Revenue	$63,751	$108,487	$100,000	$97,000
Expenditure	$100,466	$117,017	$136,798	$160,441
Difference	-$36,715	-$8,530	-$36,798	-$63,441

4.3.2 User-pays collections and CDL

The Green Bag Scheme (GUPS) is a user-pays system started in 2012. Green garbage bags are purchased at 30 cents per bag, which covers collection and disposal costs. It is currently operated on a contractual basis between MFAT and a private company, MOEL. Householders buy green bags from shops on South Tarawa and place non-putrescible waste in the bag for collection by 'green bag trucks', only collecting green bags. According to MELAD, the green bag waste collection system is currently on trial to determine the optimum cost of the bag and the best collection vehicle to use. Annual income is estimated at around $A60,000/year, and expenses at $A30,000. Initially subsidized, MFAT has discussed with MELAD the formal hand-over of the contract to the Government of Kiribati (KWMRRS, 2020). The Kaoki Maange program (Section 4.2.3) is a sustainable finance mechanism for the end-of-life disposal of PET and aluminium containers as well as batteries. This successful program has the potential to be extended to manage other materials.

Key findings – Financial systems

- MELAD and councils have distinct responsibilities, and both rely on general budgetary support from the general funds. No ring-fencing of collected fees and levies occurs.
- A landfill levy has been introduced as a source of income for councils in 2021.
- The collection fees charged are varied and inconsistent. The Green Bag scheme generates a self-sustaining source of income and is independently managed.
- The CDS system is managed through the *Customs Act*.
- A reform of financial systems allowing for a clear delineation of responsibilities and funds, including ring-fencing of collected fees and levies, would help improve waste sector management in Kiribati.
- Kiribati would also benefit from the creation of a waste management authority responsible for all waste-related activities.

[7] MELAD, 2021. TUC and BTC waste management budget. Provided by MELAD, 2021.

4.4 Current waste management initiatives

A number of previous and current waste management initiatives and opportunities exist in Kiribati, with some well placed to form the basis for future developments.

4.4.1 Green waste composting initiative by Temaiku Farmers' Cooperative Association

Previously, MELAD's waste minimisation officer worked with TUC and BTC to run a green-waste collection trial. Residents could have their green waste collected bi-weekly, which would then be transported to an informal green-waste disposal site managed by the Temaiku Farmers' Cooperative Association. After some initial success, trials within both councils no longer function. Lack of enthusiasm from the responsible council (BTC) was identified as the key obstacle for the success of the trial, and it is understood that the Cooperative offered to collect green waste in the BTC council area also but this was rejected. An offer was also made to TUC, and the farmers continued to collect the organic waste directly (MFAT, 2019). According to the MFAT evaluation study conducted in 2019, there is current JICA expertise in this area (school gardens), and previous support from the Australian Commonwealth Institute of Agricultural Research and under-utilized equipment from the previous JICA program. One study recommendation is to continue green-waste collection and roll it out to the across South Tarawa. This includes relocating the shredder from BTC to the Farmers' Cooperative, which has already been costed (with operational maintenance support and fuel). This initiative has the potential for multi-donor support but needs to be proposed by GoK.

4.4.2 'Ice bag free schools' campaign

Daily consumption of single-use ice bags in Kiribati is large, including the sale of drinks to children at school canteens. This led to the the 'ice bag free schools' campaign led by the ECD in 2018, which encouraged schools to shift away from using ice bags to instead use water bottles (PET bottles) and cups to sell drinks (World Bank, 2019[8]). Ice bags have been banned as per the *Customs Act 2019*, which came into force in October 2020. Negotiations are currently ongoing to help support the introduction and use of alternatives.

4.4.3 Seeds for Plastic exchange program

In 2018, MELAD, local councils and a team from Taiwan started a plastic/vegetable exchange program. Once a week during the four-month-long school break, a number of communities collected plastic waste in exchange for seedlings (sourced from boarding schools). The program saw an average of 170 kilograms of plastic waste per exchange i.e. within the one week period that the program was run for (World Bank, 2019).

4.4.4 National pilot projects for e-waste and healthcare waste

An e-waste collection point was previously available at the ECD-operated Kaoki Maange facility in Betio. The collection point was set up in 2012 with support from NZAID, and then later supported by the SPREP EU-funded PacWaste project. Currently, however, there is no funding for an e-waste officer at ECD and collections are on hold. The e-waste collection point in the MRF has been collecting and dismantling e-waste intermittently since 2012. Under the SPREP PacWaste program (2014–2017),

[8] World Bank, 2019. News feature story—Meet the Meet the Innovators Battling Plastic Waste in Kiribati: Raitiata Cati. Available at: https://www.worldbank.org/en/news/feature/2019/06/02/meet-the-innovators-battling-plastic-waste-in-kiribati-raitiata-cati

there was an e-waste pilot project conducted during 2014–2018 for the safe dismantling of e-waste, shipping and logistical support, a community awareness campaign, and assistance in developing a national e-waste strategy (SPREP, 2017). Collected e-waste gets broken down and sorted into commercial categories of parts for export. A full container-load of e-waste is currently sitting at the MRF awaiting export. It will require funding and a Basel permit, along with a buyer.

4.4.5 Reuse of existing stockpiles

Local councils and Kiribati citizens are reusing waste stockpiles, including used tyres that are currently repurposed for public playgrounds and parks.

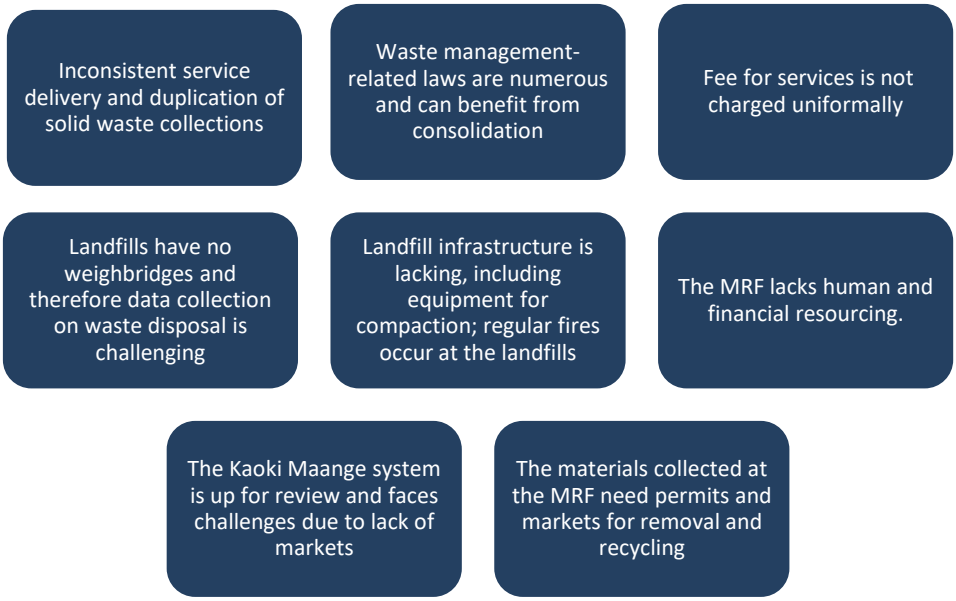
Figure 19: Used tyres repurposed for use in parks in Kiribati (Source: APWC in-country team, 2020)

Key findings – Waste management initiatives

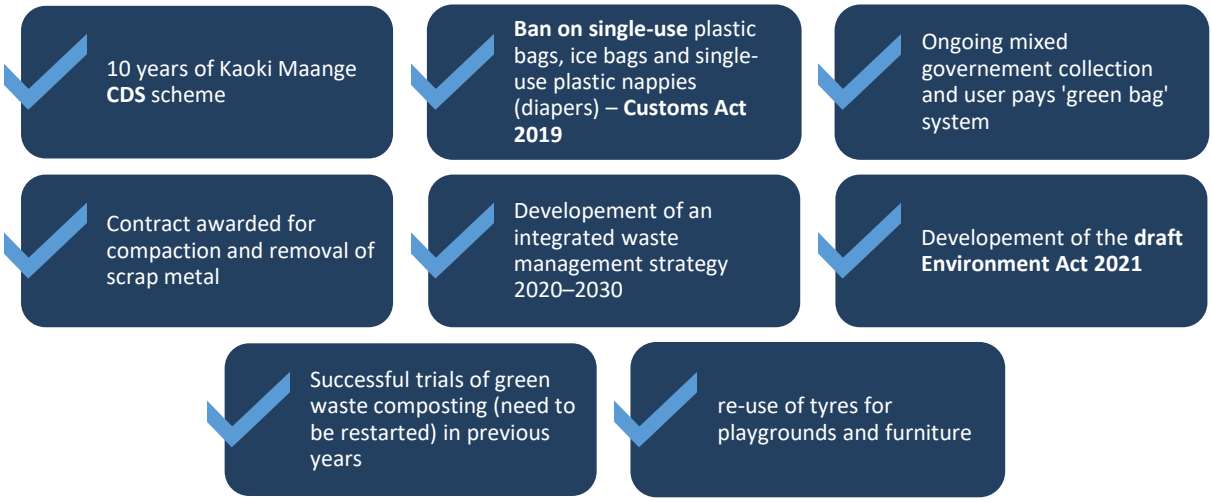
- Although a number of initiatives and trials have been successful, a consistent and sustainable solution to appropriate disposal, recycling, or reuse of different waste streams remains a challenge.
- Future projects would benefit from understanding the factors behind the success of the initiatives and providing long-term support to those with high success rates.

4.5 Challenges of delivering waste management services

Many challenges exist for the waste management industry in Kiribati, as summarized below:



Kiribati's main achievements in relation to waste management and recycling have been established for some years, and are as follows:



There is an opportunity for Kiribati to develop waste legislation and other initiatives. These include:

- CDS system to expand to include ELV, e-waste, solar panels and glass
- Introduce policy measures to control type of goods entering Kiribati
- Education on impacts of burning, burying and dumping of waste
- Institutional and funding support for existing green waste initiative Temaiku Farmers' Cooperative Association
- Extending CDS scheme to support collection from outer islands
- Education of value of composting green and food waste for enriching nutrient poor soils

Figure 20: Waste tyre reuse in Kiribati (Source: APWC in-country team)

5 Waste audits – Methodology

5.1 Methodology

5.1.1 Sampling methodology

The Secretariat of the Pacific Regional Environment Program (SPREP) *Waste Audit Methodology: A Common Approach Audit (SPREP, 2020)* was implemented to undertake the waste sample collection and waste sorting. The full breakdown of the methodology and the project-planning process is provided in the Appendix C to Appendix M, Work health and safety.

An integrated management system was used during audits, which covers quality, health, safety and environment (QHSE). This system has been developed to be consistent with the requirements of the international standards ISO9001 (Quality), ISO14001 (Environment) and AS4801 (Occupational Health and Safety). No injuries or incidents were reported during the audit.

5.1.2 Waste sampling distribution and sample collection

The samples were stratified by population, household distribution, and income category, as well as consideration given to the ability to sample safely and within the time frame during the COVID-19 pandemic. During the waste data sample collection undertaken during March to April 2021 in Kiribati, a wide range of data was collected from households and commercial premises through audits and interviews. In addition, landfill and stockpile audit assessments were also undertaken, as summarized in Table 12.

Table 12: Kiribati household sampling distribution*

Urban/ rural		Income category	Samples required	Samples collected	Total	Collection systems	Collection frequency
Urban	South Tarawa households	Low	39	37	116	Yes – door-to-door at set collection points	Twice a week
		Middle	39	42			
		High	37	37			
	South Tarawa commercial	N/A	60	53	53	Yes – door to door and self-haul	Once a week
	Landfills	14 days at Naanikai and 7 days at Betio					
Rural	Abaiang island households	Low	50	21		No collection service	Not applicable
		Middle		21			
		High		9			
	Maiana island households	Low	35	21			
		Middle		15			

* 1% of the overall households in Kiribati were sampled. This represents 1.2% of the households in south tarawa and 0.75% of the households living in outer islands.

The project plan (see Appendix C) was developed by the in-country team following their online audit training, to ensure the smooth implementation of the waste audit operations. Samples were collected on South Tarawa, Abaiang and Maiana islands; of these, only South Tarawa has a collection system in place. The location of samples is shown below.

Figure 21: Map of collection area on South Tarawa Island

Figure 22: Map of collection area on Abaiang Island (left) and Maiana Island (right)

An online tool was used to capture data as the samples were collected. A collection sheet is provided in Appendix E.

Figure 23: Example of how household waste is stored prior to collection on South Tarawa Island (Photo: MELAD, 2021)

5.1.2.1 Commercial premises

Commercial samples required for the audit and collected are outlined in Table 13.

Table 13: Commercial samples collected

Sample type	Samples required	Samples collected	Interviews	Waste pick-up frequency	Destination
Food outlet	10	8	8	Once a week	Waste disposal site
Admin/office	10	10	10		
Supermarket	10	11	11		
Hotel	10	6	6		
Retail	10	10	10		
Public bar	10	8	8		
TOTAL	**60**	**53**	**53**		

A total of 53 commercial premises were sampled simultaneously with households in South Tarawa. At the request of the in-country team, public bars were added as an additional commercial premises due to their popularity on the island. The methodology for commercial collection is described in Appendix D: Project Methodology.

5.1.2.2 Landfill samples

Although the household waste generation audit covers the waste generated through everyday consumption of products, a landfill audit was also undertaken to collect data on materials that are not usually found in the household bins, for example, bulky, commercial and construction waste.

Table 14: Landfill samples collected

	Sampling days	
Collected	Nanikaai	Betio
	14 days	7 days

Two of the three landfills on South Tarawa Island—Nanikaai and Betio—were assessed during the audit period in March 2021. Nanikaai Landfill was chosen as the audit site for 14 days as it is located along the main road and caters to both households and businesses, therefore receiving the most traffic.

Betio Landfill is located in the commercial centre and therefore accommodates predominantly commercial disposal. Both Nanikaai and Betio landfills open Monday to Sunday from 6 a.m. to 6 p.m. While conducting the landfill audit, the in-country team followed stringent health and safety requirements and were equipped with appropriate personal protective equipment (PPE) (see Appendix C for further details).

Data collected – Summary

- 208 household samples collected and sorted
- 53 commercial samples collected and sorted
- Nine (9) local government staff trained
- Data collected from three islands – South Tarawa, Abaiang and Maiana
- Landfill audit completed over the course of 14 days at Nanikaai Landfill and seven (7) days at Betio Landfill – covering Monday to Sunday

5.1.3 Interviews

5.1.3.1 Household and commercial

Interviews were conducted with households and commercial operators to assess self-reported waste disposal behaviour. Interviews sought to understand what happens to uncollected waste, why certain waste is disposed of using municipal waste collections and the reason for these behaviours. Further information can be found in Appendix D Project Methodology.

Figure 24: Team supervisor, Mr Harry Langley, interviewing resident on Maiana Island (Photo: MELAD, 2021)

Figure 25: In-country team interview household residents on South Tarawa Island (Photo: MELAD, 2021)

5.1.3.2 Producer interviews

There are only two producers on Tarawa Island (Table 15), with the majority of goods imported. The in-country team interviewed both companies to obtain a more accurate understanding of their production and generation of waste, including recyclable materials.

Table 15: List of producers on South Tarawa

Producers
Kiribati Coconut Development Company (KCDL)
Kiribati Fish Limited (KFL)

As well as collecting data from the producers, an interview was also conducted with the one recycler currently operating in Kiribati to determine the amount of recyclable material collected. An audit of all current stockpiled material was also conducted. The size and location of each stockpile was audited and the data recorded for analysis.

5.2 Sample sorting

All South Tarawa Island samples were transported to an area at the entrance to Bikenibeu Landfill, where the team set up a marquee and area for sorting. All Maiana Island samples were sorted in Tebanga village, with a sort site at Kiebu Station Lagoon. The only transport available on Abaiang Island is bikes. The samples were then sorted at the time of collection.

On South Tarawa and Maiana islands, all samples were bagged and tagged to avoid misidentification. The collected samples were lined up to ensure none were missing. All samples were cross-referenced with the collection sheet to ensure consistency between sample collection and sorting. On Abaiang Island, bag tags were not necessary because samples were collected, sorted and householders interviewed at the same time.

Each waste sample was opened and the individual materials within each bag sorted into different trays according to the pre-defined categories. Separated materials were weighed using an electronic scale and the weight measurement recorded on a sorting sheet on KoBoToolbox using digital tablets/smart phones. Due to the COVID-19 travel restrictions, the team was unable to supply pre-calibrated electronic scales from Australia used for analysing weights. The in-country team therefore sourced accurate, calibrated scales in Kiribati.

A separate count of beverage containers for all general waste samples was also undertaken. Beverage containers from the samples were stored and counted separately. Containers were stored and labelled to ensure no cross-contamination took place, and all were sorted by size, material (e.g. plastic, aluminium) and product type (e.g. milk, juice).

Furthermore, all plastic bags were sorted into different types and all containers were sorted by size, material type and product type. Cigarette butts, coffee cups and takeaway containers were also segregated. All sort data was added to the sorting form on the tablet using the categories listed in Appendix H.

Figure 26: In-country team sort site next to Bikenibeu Landfill, South Tarawa Island (Photo: MELAD, 2021

Figure 27: In-country team sorting at Bikenibeu Landfill (Photo: MELAD, March 2021)

5.3 Staff training

A remote online training was conducted with local MELAD staff in collecting waste samples, conducting waste audits, conducting interviews, and in landfill assessments. The names of staff trained and the training received can be located in Appendix D.

Figure 28: Remote training for the in-country team facilitated by the World Bank consultants (Photo: World Bank, February 2021)

6 Results of the 2021 waste audit

During the mission to Kiribati in March–April 2021, a wide range of data was collected, as summarized in Table 16.

Table 16: Data collected for audit

Sample type	Number of samples
Household samples	208
Commercial samples	53
Landfill samples	14 days at Nanikaai and 7 days at Betio
Stockpiles	All known stockpiles on South Tarawa and Abaiang

Based on the data gathered, the following information has been presented in this section:

a) The quantity of waste generated and disposed of on South Tarawa by households and commercial premises
b) The quantity of waste generated and disposed of on the outer islands of Abaiang and Maiana
c) Estimates of the quantity of waste generated on the remaining islands of Kiribati, based on population distribution
d) The quantity of waste entering the landfills in South Tarawa and the characterisation results
e) The total amount of material entering Kiribati and the corresponding amounts disposed, recycled, stockpiled and available for recovery.

6.1 Waste generation in Kiribati

The aim of the waste audit was to determine the total amount of material being generated in various parts of each country so that the quantities to be collected, compacted and moved can be projected as accurately as possible. A model of waste generation rates was constructed based on the household and commercial data collected. It also included available disposal data to determine waste generation characteristics and its variation with households or the commercial sector. The following features were investigated as predictors of household waste generation.

Household-level predictors are:

- Total monthly household income (from all employed members of the household);
- Monthly household spending on groceries;
- Number of people in the house;
- Number of children in the house;
- Household rating of collection service.

Town-level predictors are:

- Whether or not there is a collection service in the household area;
- How often waste is collected, if there is a service;
- Average household income for the town where the house is located;
- Average grocery spending for the town where the house is located;
- Population of the town where the house is located.

Table 17: Waste generated and disposed of in Kiribati

Area	Average waste generation rates (grams/capita/day)***	Average waste disposal through collection services (grams/capita/day)	95% Confidence interval* (grams/capita/day)	Average number of people in a household (census 2020)
South Tarawa	328	164	119–210	6.6
Other islands**	237	N/A	77–397	5.1

** Sampling error only*

***Other islands don't have waste collection, so all waste is dumped.*

**** Assuming 50% of overall waste by weight is collected in South Tarawa (based on interviews and previous audits). This number includes waste that is not collected as in presumably buried, burnt or otherwise disposed.*

The very large interval for the other islands is due to a wide variance found in the quantity of rubbish collected from households on these islands. While half the sample (43 houses) returned 0.8 kilograms of waste after one week, 18% of the sample (15 houses) returned more than 5 kilograms. Investigation of collection data indicates that some households used the bags provided to dispose of more than one week's waste (in some cases up to one month's worth of waste). Because of these 15 household samples with more than 5kgs per household collected from outlying islands, the following formula was used to determine the average household generation rate in outlying islands:

$$Other\ islands\ household\ generation\ rate = median\ other\ islands\ household\ generation\ rate \frac{mean\ South\ Tarawa\ household\ generation\ rate}{median\ South\ Tarawa\ household\ generation\ rate}$$

The reason for this calculation is that the median is not affected by outliers in the same way that the mean is, but it provides an estimate that is biased downwards from the correct value. Thus, it was rescaled by the ratio of the mean to the median on South Tarawa (where such concerns about biases in which the waste was collected for auditing did not exist).

The current waste audit study for Kiribati, and previous island-nation waste audits, found that:

- The rate of generation of ***household*** waste is closely related to the population density in the area where the house is situated
- The rate of generation of waste ***overall*** is closely related to the GDP per capita of the country.

The generation rate of **household waste** was **less** closely related to GDP per capita than it was to population density. Countries with higher GDP tend to produce much more **non-household** waste.

South Tarawa, the most populous area of Kiribati, disposed of household waste at a substantially lower rate than other areas of similar population density. The outer islands audited disposed of household waste at a similar rate to areas of similar population density Figure 29.

$$Householdwastegeneration\left(\frac{kg}{hh \cdot day}\right) = 0.36ln(settlementpopulation) - 1.8$$

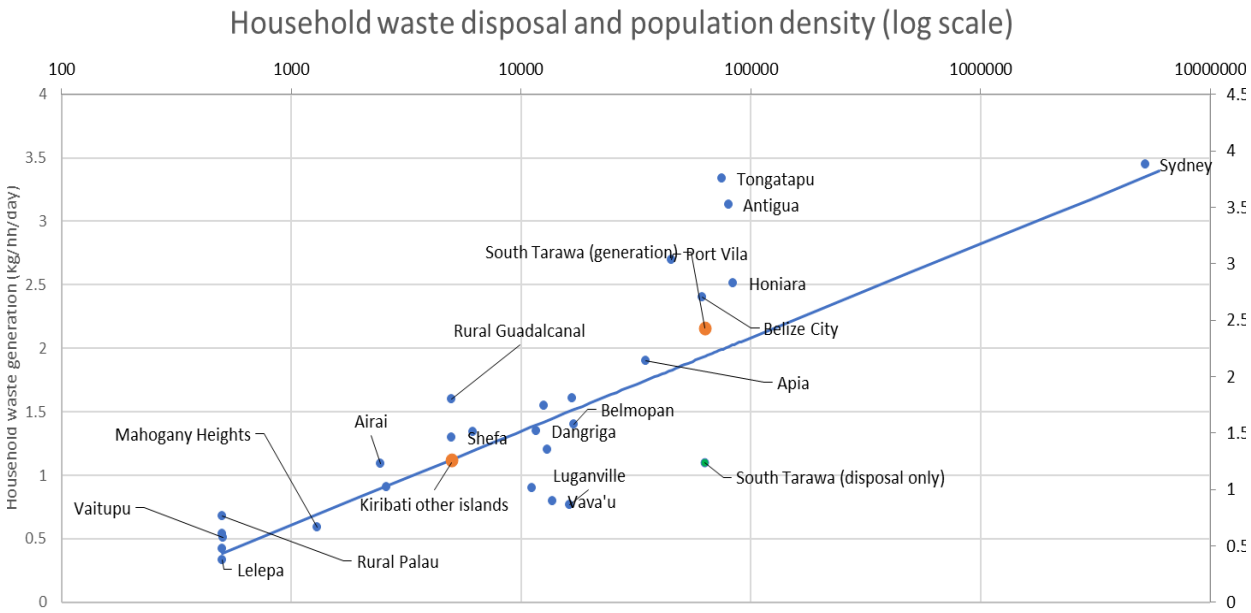


Figure 29: Household waste and population density – Kiribati population centres highlighted in orange

The total waste generated (as opposed to just the household waste) was found to be closely related to GDP per capita and was modelled by the following equation:

$$totalwaste\left(\frac{kg}{person \cdot day}\right) = 0.0001 GDPpercapita(\$US) + 0.51$$

These results suggests that non-household waste generation is much more closely related to a country's GDP than the amount waste generated by households. Kiribati's total waste generation rate is in line with model predictions.

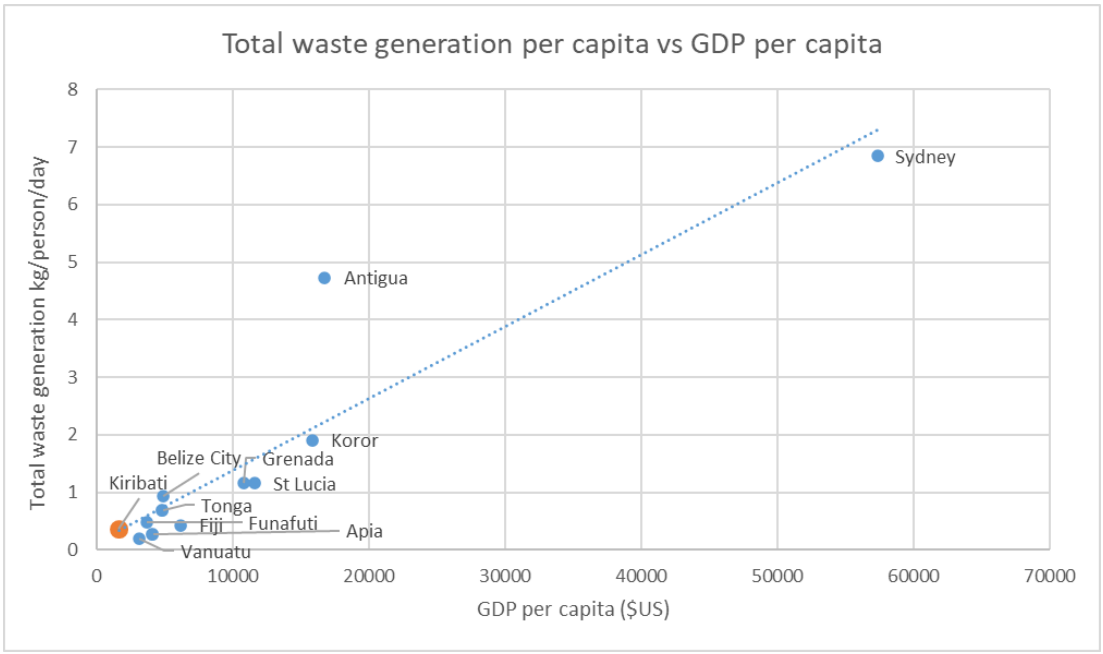


Figure 30: Waste generation in Kiribati and other audited countries vs GDP

6.2 Waste disposal at landfills and dumpsites

Betio, Nanikaai and Bikenibeu are the only managed landfills in Kiribati. There is an unmanaged dumpsite at Kiritimati landfill with a partial collection service for the island. On the remaining islands—which have different population patterns to South Tarawa and Kiritimati—waste management is performed via informal dumpsites, burning, burying, and littering. The other areas do not have proper, organized collection and disposal waste management services. However, a waste audit was undertaken for this project on Abaiang and Maiana islands.

The waste disposed of on the outer islands is based on the average between Abaiang and Maiana islands. These figures represent how much waste would be collected if a collection service were set up. It is not an estimate of total waste generation.

Table 18: Materials disposed at existing dumpsites by source

	Betio Landfill	Nanikaai Landfill	Bikenibeu Landfill	Abaiang dumpsite	Maiana dumpsite	Other islands material collection potential
Commercial, construction and institutional (T/yr)	987	1,260	1,123	317	113	2,783
Hotel (T/yr)	81	222	152	26	9	230
Household (T/yr)	1,504	1,035	1,269	482	172	4,242

A full breakdown of material entering the landfills in South Tarawa is presented below. Estimates for materials potentially available for landfilling are provided in the full dataset.

Table 19: Breakdown of material entering landfills in South Tarawa

	Betio (T/y)	Betio (%)	Nanikaai (T/yr)	Nanikaai (%)	Bikenibeu (T/t)	Bikenibeu (%)
PET	9.4	0.37%	3.5	0.14%	6.5	0.3%
HDPE	2.8	0.11%	1.0	0.04%	1.9	0.1%
LDPE	0.1	0.00%	0.0	0.00%	0.1	0.0%
PP	1.6	0.06%	0.4	0.01%	1.0	0.0%
PVC	10.2	0.40%	0.9	0.04%	5.5	0.2%
PS	11.1	0.43%	8.6	0.34%	9.9	0.4%
Flexibles/film	11.6	0.45%	10.9	0.43%	11.2	0.4%
Other plastic	46.7	1.82%	138.2	5.49%	92.5	3.6%
Single-use plastic bags	32.0	1.24%	1.2	0.05%	16.6	0.7%
Plastic bags reusable	20.3	0.79%	1.3	0.05%	10.8	0.4%
Single-use plastic items	2.8	0.11%	0.1	0.01%	1.4	0.1%
Glass bottles	28.5	1.11%	14.9	0.59%	21.7	0.9%
Glass other	10.2	0.40%	5.9	0.23%	8.0	0.3%
Aluminium cans	3.5	0.14%	0.1	0.01%	1.8	0.1%
Steel cans	38.0	1.48%	2.3	0.09%	20.1	0.8%
Aluminium other	3.6	0.14%	0.1	0.00%	1.9	0.1%
Metal other	214.5	8.34%	44.2	1.76%	129.4	5.1%
Hygiene	39.4	1.53%	74.2	2.95%	56.8	2.2%
Paper and cardboard	420.0	16.33%	173.0	6.88%	296.5	11.7%
E-waste	1.0	0.04%	0.1	0.00%	0.5	0.0%
Hazardous	13.8	0.54%	0.8	0.03%	7.3	0.3%

	Betio (T/y)	Betio (%)	Nanikaai (T/yr)	Nanikaai (%)	Bikenibeu (T/t)	Bikenibeu (%)
Textiles (clothing, fabric)	3.1	0.12%	0.3	0.01%	1.7	0.1%
Organics	1608.7	62.56%	1716.6	68.21%	1662.6	65.4%
Lithium-ion batteries	0.0	0.00%	0.0	0.00%	0.0	0.0%
Other batteries	1.1	0.04%	0.1	0.00%	0.6	0.0%
Used lead-acid batteries	0.0	0.00%	0.0	0.00%	0.0	0.0%
Used oil	0.0	0.00%	23.9	0.95%	11.9	0.5%
Fishing	0.0	0.00%	0.0	0.00%	0.0	0.0%
EOL renewable equipment	0.0	0.00%	0.0	0.00%	0.0	0.0%
End-of-life vehicles (inc. heavy machinery)	0.0	0.00%	0.0	0.00%	0.0	0.0%
White goods	5.9	0.23%	1.4	0.06%	3.6	0.1%
Tyres	1.3	0.05%	1.7	0.07%	1.5	0.1%
Wood	12.8	0.50%	7.1	0.28%	9.9	0.4%
Construction (cement, clean fill, plasterboard, rocks, tiles)	6.9	0.27%	283.2	11.25%	145.0	5.7%
Other	11.0	0.43%	0.7	0.03%	5.9	0.2%
total	2571.6	100.00%	2516.7	100.00%	2544.1	100.0%

6.3 Composition of waste

The composition of general household and commercial waste was determined by collecting waste from premises and conducting a detailed audit on the sample contents. In combination with this, a visual audit of waste entering the landfill was conducted to determine the contribution of larger items and special waste types that do not show up in audits of general waste. Both sources of data were combined to determine the overall generation rate of waste in South Tarawa.

In summary:

- Detailed audits of household and commercial/office premises waste were conducted to find the composition of bagged waste from each of these locations.
- Visual audits of incoming waste to the landfill were conducted for 14 days to determine the composition by source.
- The volumetric data from visual audits was converted to weights using density figures for many categories of waste provided by the US EPA, APWC data from past audits, and the Western Australian Waste Authority.
- Overall weight compositions determined from visual audits were combined with detailed compositions of bagged waste to get an overall waste composition figure for each source of waste
  For households in outlying islands, the total amount of waste generated by the formula outlined earlier in this document was determined as follows:

$$Other\ islands\ household\ generation\ rate = median\ other\ islands\ household\ generation\ rate \frac{mean\ South\ Tarawa\ household\ generation\ rate}{median\ South\ Tarawa\ household\ generation\ rate}$$

6.3.1 Waste generation by material type, weight – Kiribati overall

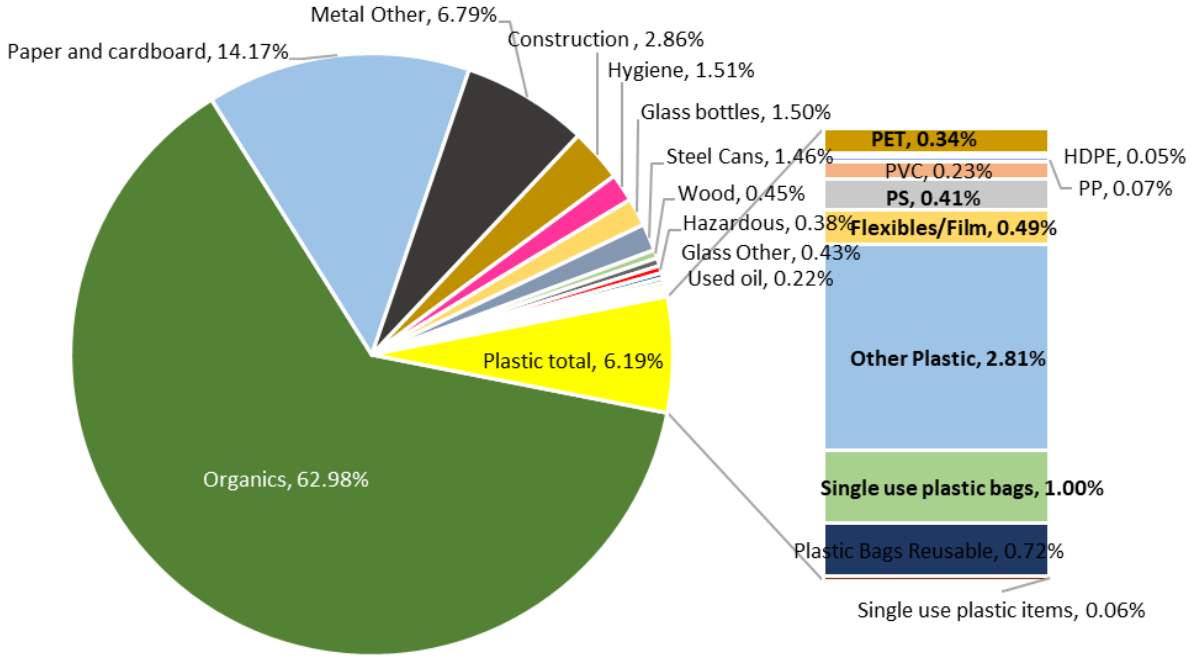


Figure 31: Overall composition of all waste streams in Kiribati

Sixty-three per cent (63%, 10,000 tonnes/per year) of waste deposited at landfills in Kiribati is organic material, followed by paper and cardboard (14%, 2,267 tonnes/per year). This data displays a similar pattern to that found on other islands audited as part of this project (i.e.,Tonga and Samoa). Results suggest that with landfills reaching capacity and the threat of climate change looming, a solution for diverting organic waste from landfill, such as composting will provide the most immediate and long-term success for overall waste management in Kiribati.

Plastics and metals are the other two dominant waste streams, at 6.18% (991 tonnes/per year) and 6.8% (1086 tonnes/per year), respectively. Of note is the amount of plastic arriving at landfill despite a container deposit scheme being in place. However, PET is a small percentage (0.34% of all waste and 5.5% of plastic waste, 55 tonnes per year) of the overall plastic waste stream.

The plastic waste stream in fact dominated by other plastics (450 tonnes per year), which are usually highly non-recyclable.

If all waste that is currently being buried, burnt or otherwise not disposed of using the collection services, the quantities provided above would double.

Table 20: Waste characterization by island, Kiribati

	South Tarawa	Abaiang	Maiana	Other islands
Total plastics	6.18%	6.04%	6.63%	6.20%
Glass bottles	0.85%	2.61%	1.58%	2.09%
Glass other	0.32%	0.53%	0.38%	0.54%
Aluminium cans	0.07%	0.08%	0.07%	0.09%
Steel cans	0.79%	1.95%	2.40%	2.06%
Aluminium other	0.07%	0.26%	0.10%	0.14%

Metal other	5.08%	8.32%	8.34%	8.34%
Hygiene	2.23%	1.50%	0.58%	0.85%
Paper and cardboard	11.65%	17.62%	15.40%	16.46%
E-waste	0.02%	0.00%	0.04%	0.01%
Hazardous	0.29%	0.49%	0.10%	0.48%
Textiles (clothing, fabric)	0.06%	0.10%	0.12%	0.12%
Organics	65.35%	58.90%	62.74%	60.81%
Lithium-ion batteries	0.00%	0.00%	0.00%	0.00%
Other batteries	0.02%	0.44%	0.12%	0.44%
Used lead-acid batteries	0.00%	0.00%	0.00%	0.00%
Used oil	0.47%	0.00%	0.00%	0.00%
Fishing	0.00%	0.00%	0.00%	0.00%
EOL renewable equipment	0.00%	0.00%	0.00%	0.00%
EOL vehicles (inc. heavy machinery)	0.00%	0.00%	0.00%	0.00%
White goods	0.14%	0.18%	0.23%	0.23%
Tyres	0.06%	0.04%	0.05%	0.05%
Wood	0.39%	0.43%	0.50%	0.50%
Construction	5.70%	0.21%	0.27%	0.27%

Previous audits for Tonga and Samoa found outlying islands tended to generate lower quantities of plastic, paper and metal waste in comparison to organics (Tuvalu, PRIF 2019). This pattern was not evident from the audit in Kiribati. Outer islands audited in this audit have better shipping and transport connections to South Tarawa which means that the residents have more readily available access to imported and packaged goods.

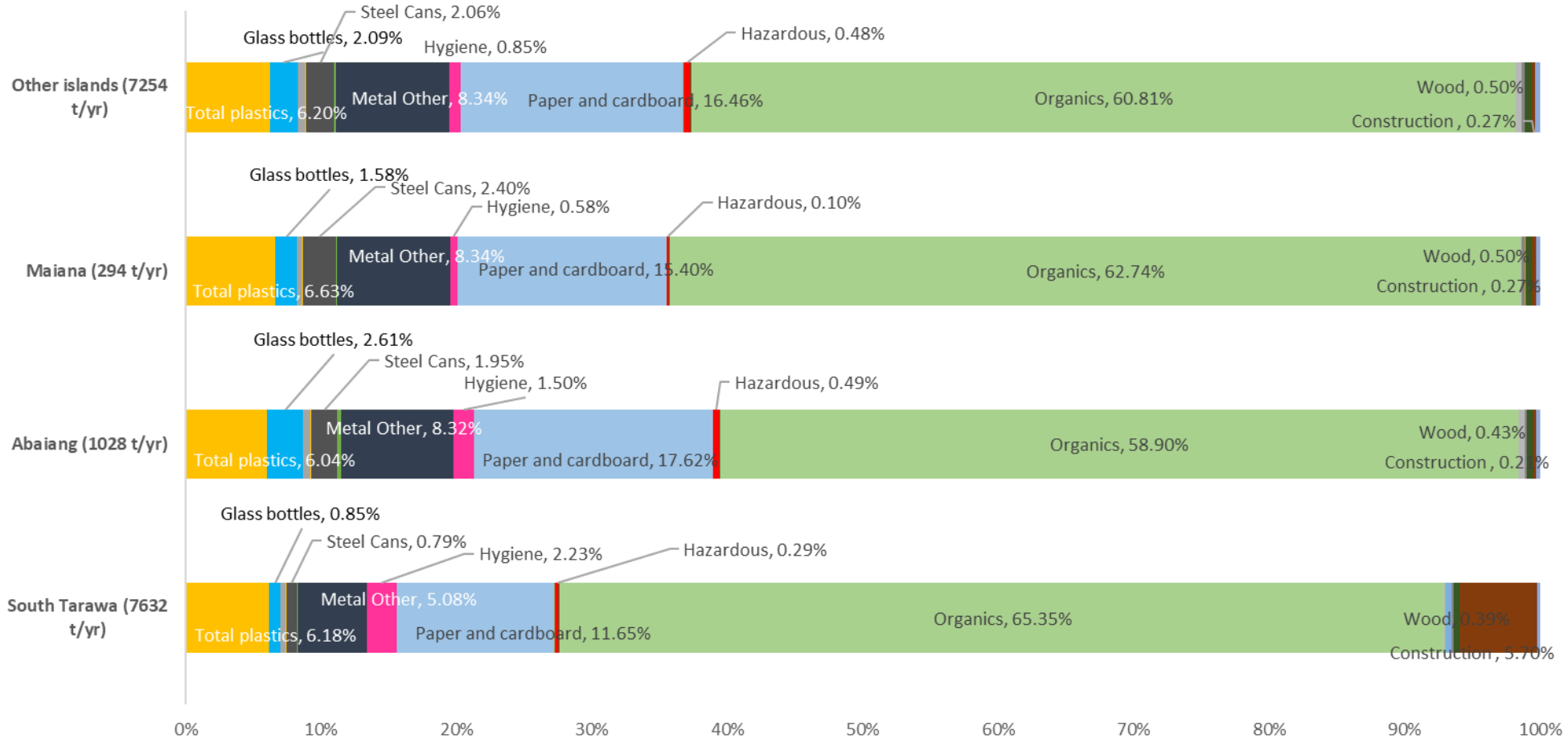


Figure 32: Composition of waste – by island, Kiribati

6.4 Imports, generation and recovery of materials

The quantity of materials recovered was estimated via interviews with recycling facility operators. Customs export figures were not provided by Kiribati.

The quantities imported via customs data were calculated as follows:

- Several hundred HS codes were assigned to around 30 broad categories, representing more than 80% of imports by value
- For each broad category, the proportion of imported material eventually ending up as waste was estimated, including what proportion is consumable (for example, it was estimated that PET water bottles are 99.5 % consumable and 0.5 % PET waste).

A combination of predictive models and educated guesses was used to convert all import records expressed in volumes or units into weights, and to detect outliers in the raw customs data. Even after this, it is believed that some figures were unreliable. In particular, it was found that imports of aluminium cans were far too low and imports of tyres far too high. Import quantities in other categories were believable.

6.4.1 Stockpiles or legacy waste

The study focused on an audit of current stockpiles situated on South Tarawa and Abaiang, which includes the materials found in Table 21 below. The quantities stockpiled were estimated via visual audit and interviews. It was considered important to conduct an analysis of current stockpiles because if measures are implemented to extract recyclable materials of interest as a result of this study, stockpiles represent immediately available material and no additional measures will be required to extract the quantities of materials presented below.

Table 21: Type and quantity of materials found in stockpiles around Kiribati*

Waste type	Volume of stockpile (litres)	Number of items in stockpile	State/Island	Detailed location of stockpile
Cars	7.5 million	1,000	South Tarawa	Betio MRF YARD
Cars 2	10,000	150	South Tarawa	Temaiku
Cars 3	30,000	10	Abaiang	Stephen Whitmee High School
Heavy machinery	3,000	6	Maiana	
Heavy machinery 2	10,000	100	South Tarawa	Betio MRF YARD
Heavy machinery 3	7,000	80	South Tarawa	Temaiku
Boats	5,000	1	South Tarawa	Betio MRF YARD
Gas bottles – cooking	1,000	200	South Tarawa	Betio MRF YARD
Containers (20 ft)	1,137,500	36	South Tarawa	Betio MRF YARD
Aluminium cans	31,500	1,080,000	South Tarawa	Betio MRF YARD
PET bottles	560,000	560	South Tarawa	Betio MRF YARD
E-waste	5,600	4605	South Tarawa	Betio MRF YARD

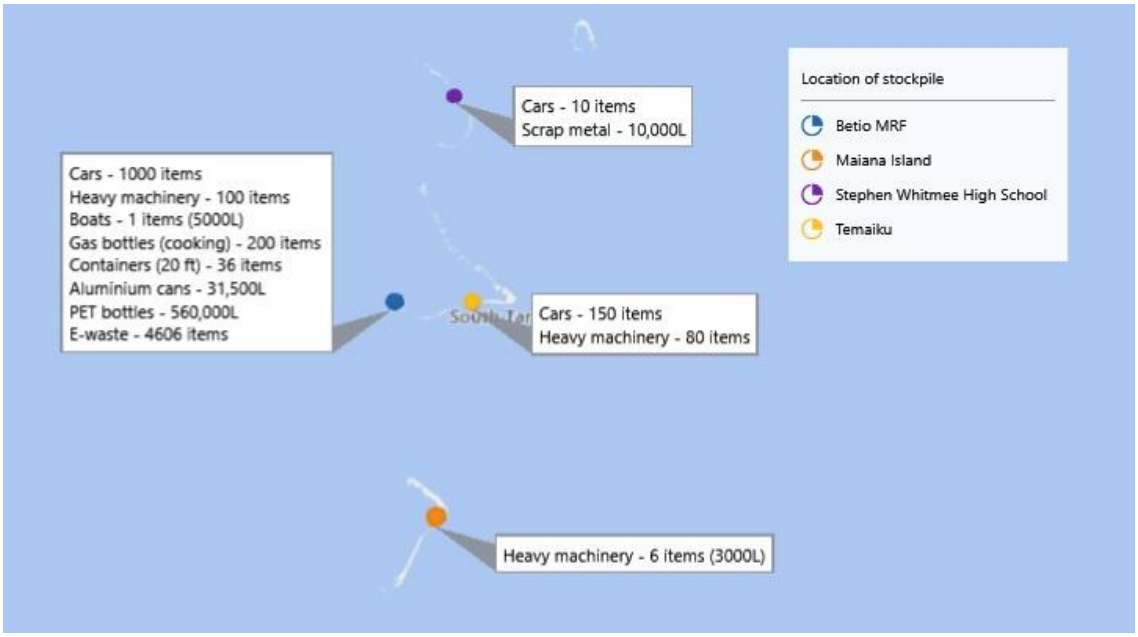


Figure 33: Location of stockpiles in Kiribati

The relative imports, stockpiles, disposal and recycling rates of different materials is presented below.

Table 22: Imports, disposal, stockpiling and recycling of materials in Kiribati

	Customs imports (tonnes per year)	Total waste disposal (t/y)	Stockpile total (tonnes)	Recycle total (t/y)
PET	78.2	54.8	198.8	10.8
HDPE	255.0	7.6		
LDPE	91.9	0.4		
PP	164.7	11.4		
PVC	64.4	37.4		
PS	152.2	65.6		
Other plastic	757.5	449.9		
Glass bottles	239.0	240.0		
Glass other	186.3	69.4		
Aluminium cans	35.7	12.8	4.9	22.7
Steel cans	39.0	233.2		
Aluminium other	89.0	17.1	0.9	
Metal other	1,776.4	1,086.5	1706.3	
Hygiene	436.8	241.3		
Paper and cardboard	1,689.3	2,268.0		
E-waste	281.1	2.5	2.1	0.0
Hazardous	11,682.6	61.6	0.6	0.0
Textiles (clothing, fabric)	1,673.3	14.9		
Organics	9,868.0	10,079.8		
Lithium-ion batteries	2.1	0.0		
Other batteries	18.8	38.4		
Used lead-acid batteries	76.3	0.0	0.0	62.4
Used oil	15.9	35.8		
Fishing	1,307.1			
End-of-life vehicles (inc. some heavy machinery) *	1,184.8	0.0	11290.5	0.0
White goods	111.5	30.0	0.0	0.0
Tyres	97.2	8.5	0.0	0.0

Wood	579.6	71.4	0.0	0.0
Construction (cement, clean fill, plasterboard, rocks, tiles)	4,773.4	457.4	0.0	0.0
Other	107.8	45.3	0.0	0.0

**Import number represents new vehicles not vehicles at the end of life*

6.4.2 Metals

The audit estimates indicate that about 70% of the imported material is disposed of at the various landfills/dumpsites in Kiribati, excluding vehicles. Many imported metals may be used in construction and therefore do not enter the waste stream for many years. As a consequence, large differences between imports and disposal likely reflect that metals have a long lifespan within the economy. However, that there is a considerable stockpile of metals at the MRF facility (1706 tonnes), collected over a number years. Waste disposal figures far outpace material that is being collected at the MRF (see also Table 4), so there is material available for recovery.

6.4.3 End-of-life vehicles (ELVs)

Data indicates that most ELVs in Kiribati are stockpiled, with the stockpile size an estimated 10 years' worth of vehicle imports at 11291 tonnes.

6.4.4 Recovery of e-waste, white goods and batteries

Recyclers reported recycling around 62 tonnes of lead-acid batteries per year, which is 82% of estimated rate of imports (97 tonnes/year). It appears that some of these may be picked up from the landfill (estimated 38 tonnes/year of disposal by this method) and that other batteries are recycled directly. Batteries attract an import levy and are a part of the CDS system, therefore a high (82%) recovery rate is expected.

6.4.5 Recovery of plastics

There is approximately five years' worth of PET imports stockpiled in Kiribati (377 tonnes). However, according to the recycler interviews, only 30% per year (10.8 tonnes/year) is being collected for recycling in 2021. It was estimated that 70% of PET imports (55 tonnes) were disposed of each year (to landfills on South Tarawa or via informal methods on other islands). This indicates there is still a substantial amount of imported PET (55 tonnes/year) being disposed of at the landfill and is therefore available for future recovery. It must be noted that a CDS deposit is only levied on PET beverage bottles and not PET bottles used for packaging other products, such as cleaning supplies. This could be a contributing factor to the amount of PET disposal at landfill. Feedback from Kiribati counterparts suggests that due to the lack of markets post 2019 and substantial stockpiles representing hazardous conditions at the Kaaoki Mange Facility, PET returns were being discouraged at the time of the audit.

6.4.6 Other items

Tyre disposal is very low—only 9% of estimated imports (8.5 tonnes of 97.2 tonnes imported) were disposed of in 2020-21. Approximately 12% and 10% (around 71 tonnes wood and 457 tonnes of construction materials) of imported wood and construction materials were disposed of each year. The lifespan of these materials contributes to a lower rate of disposal each year. There is a history of tyres being upcycled in Kiribati, leading to low disposal rates at landfills.

Key findings – Waste data

- Waste generation rate from all sources for **South Tarawa** is 0.368 kilograms per person per day, of which 50% or 0.164 kilograms per person per day is disposed of at landfills.
- Waste generation rate from all sources for **other islands** is 0.237 kilograms per person per day, with no collection services available.

7 Capturing available material

To ensure the private and public sectors in Kiribati can successfully undertake the activities associated with recycling at a regional level, current challenges must be factored in to decisions, including land barriers, the small private-sector presence and limited technical capacity, and a number of regulatory constraints. Modifications to current infrastructure and implementation of additional appropriate equipment and other resources will also need to be investigated.

The Customs Act introduced an import levy on PET beverage bottles, aluminium cans and batteries. An import ban on plastic bags, ice-block bags and nappies (diapers) came into effect in October 2020.

The CDS is important in the recovery of materials and also crucial for providing a financial basis for material to be moved out of Kiribati for recycling. For the past few years, however, material has not been moved out of Kiribati. This has been further hampered by the COVID-19 pandemic.

This section deals with the amount of material potentially available for compaction, storage and shipping based on the current policy environment.

7.1 Material availability for potential recovery based on situation analysis

7.1.1 Recovered or potentially recoverable materials in Kiribati

PET drink containers, aluminium cans and batteries are being recovered through the CDS system and stockpiled at the Kaoki Maange. Metals, end-of-life vehicles, white goods and e-waste is also collected in an ad-hoc manner and stockpiled at the MRF. There is currently a proposal to move all collected and stockpiled metal overseas for recycling.

The data collected identified a number of recyclable items, such as white goods and e-waste present in the waste stream that are not currently subject to a levy or a recovery scheme. There is an opportunity for these to be considered in the upcoming review of the CDS as well as for resource-recovery initiatives. The list of items presented below outlines current availability in tonnes per year in the waste stream, as well as the potential tonnage available at 100%, 80% and 60% recovery rates.

Table 23: Materials available for recovery (tonnes per year)

	South Tarawa				Other islands			
	100% recovery	80% recovery	60% recovery	Percentage volume savings @ 80% recovery*	100% recovery	80% recovery	60% recovery	Percentage volume savings @ 80% recovery
PET drink bottles	15.2	12.1	9.1	0.2%	27.6	22.1	16.6	0%
PET cleaning products	19.4	15.6	11.7	0.2%	35.4	28.3	21.2	0%
HDPE bottles all types	5.7	4.5	3.4	0.2%	1.9	1.5	1.1	0%
All glass drink bottles	8.5	6.8	5.1	0.4%	22.7	18.2	13.6	0%
Aluminium cans	5.5	4.4	3.3	0.2%	7.3	5.8	4.4	0%
Single-use plastic bag ban, 20% substitution**	49.8	39.8	29.9	0.3%	110.9	88.7	66.5	1%
Nappies (diapers) **	170.4	136.4	102.3	2.7%	70.9	56.7	42.5	1%
Organics	4,987.9	3,990.3	2,992.7	47.7%	5,091.9	4,073.5	3,055.1	42%
E-waste	1.6	1.3	1.0	0.02%	0.9	0.7	0.5	0%
White goods	10.9	8.7	6.6	0.2%	19.1	15.3	11.5	0%
Paper and cardboard	889.5	711.6	533.7	18.3%	1378.5	1102.8	827.1	24%
Aluminium other than cans	5.6	4.5	3.4	0.2%	11.5	9.2	6.9	0%
Ferrous metal	388.1	310.5	232.9	1.2%	698.4	558.7	419.1	2%
Tyres	4.4	3.5	2.6	0.03%	4.1	3.3	2.4	0%
Recover all of the above	**6,562.4**	**5,250.0**	**3,937.5**	**71.7%**	**7,481.1**	**5,984.9**	**4,488.7**	**71%**
Recovery all plastic, glass, metal, tyres	502.1	401.7	301.2	2.9%	919.8	735.8	551.9	4%
Recover all plastic, glass, metal, tyres, organics	5490.0	4392.0	3294.0	50.5%	6011.7	4809.4	3607.0	46%

*0% represents less than 1% reduction in volume.

**Banned in October 2020 but still in use at the time of the audit.

7.1.2 Organics including paper and cardboard

Across all islands included in this audit, organic waste (63%, 10,000 tonnes) and paper and cardboard (14%, 2,268 tonnes) are the most significant waste streams by weight. These materials should be prioritized for future resource-recovery activities. Large quantities of metals, end-of-life vehicles and white goods are separated and stockpiled at the MRF and this partially explains the low proportion of these materials found in the disposal stream. However, the organics waste stream, including paper and cardboard, requires an on-island rather than an overseas (export) solution.

The current commodity value for paper and cardboard is low and finding a market for recycling will be challenging, therefore an in-country solution for the organic waste stream would be highly beneficial. This could include the composting of paper and cardboard along with green waste or potentially the use of paper and cardboard to make briquettes for fuel.

As a ban has been implemented on plastic bags and nappies (diapers) in October 2020, there will be a replacement effect and more compostable/plant based/organic alternatives will enter the waste stream. This makes a future resource-recovery effort for the organics waste stream in Kiribati even more important.

It is highly recommended that a full feasibility study be conducted prior to embarking on any projects in this area.

7.1.3 Plastic bag ban

As noted previously, there is currently a ban in place on plastic shopping bags, ice bags and nappies (diapers). The ban has only recently been introduced, and these items were still in circulation at the time this audit was carried out. Table 24 below provides the quantity of the banned items in the waste stream in Kiribati in quarter 1, 2021. These figures can be used as a baseline to report against the progress of the banned items once the ban has been fully implemented. Subsequent characterization studies of household waste can be used to understand the effectiveness of the ban in the long term. The breakdown of plastics is as follows:

Table 24: Plastics in waste

	South Tarawa		Abaiang		Maiana		Other islands	
	% total waste	% plastics	% total waste	% plastics	% total waste	% plastics	% total waste	% plastics
PET	0.25%	4.12%	0.47%	7.7%	0.32%	4.8%	0.42%	6.8%
HDPE	0.07%	1.20%	0.02%	0.4%	0.01%	0.2%	0.02%	0.4%
LDPE	0.00%	0.03%	0.00%	0.0%	0.00%	0.0%	0.00%	0.04%
PP	0.04%	0.61%	0.13%	2.1%	0.04%	0.6%	0.10%	1.6%
PVC	0.22%	3.52%	0.20%	3.3%	0.24%	3.6%	0.25%	4.0%
PS	0.39%	6.27%	0.42%	6.9%	0.45%	6.7%	0.43%	6.9%
Flexibles/film	0.44%	7.14%	0.58%	9.7%	0.52%	7.7%	0.53%	8.6%
Other plastic	3.64%	58.78%	1.92%	31.8%	2.73%	40.8%	2.06%	33.2%

	South Tarawa		Abaiang		Maiana		Other islands	
	% total waste	% plastics	% total waste	% plastics	% total waste	% plastics	% total waste	% plastics
Single-use plastic bags	0.65%	10.55%	1.24%	20.6%	1.07%	15.9%	1.32%	21.3%
Plastic bags reusable	0.42%	6.86%	0.91%	15.0%	1.26%	18.8%	1.00%	16.1%
Single-use plastic items	0.06%	0.92%	0.15%	2.4%	0.06%	1.0%	0.06%	1.0%
Total plastics	**6.18%**	**100.00%**	**6.04%**	**100.0%**	**6.70%**	**100.0%**	**6.20%**	**100.0%**

7.2 Landfill life

Information provided from in-country contacts suggests that the three landfills on South Tarawa—Betio, Nanikaai and Bikenibeu—each fill at a rate of approximately 800 m^3 per year after compaction. Even under a compaction rate of 1,000 kg/m^3, estimates indicate that closer to 3,000 m^3 of waste is sent to each of these landfills each year.

The current estimates of landfill utilisation suggest fill rates of closer to 1,500 m^3 per year, or an average density of 2,000 kg/m^3. This density is high given that proper compaction equipment is not available at these landfills.

It has been suggested that landfill fires might contribute to the slower than expected fill rates. The density of ash is between 1,900 and 2,900 kg/m^3, so this is plausible only if fires are converting the majority of landfill contents to ash. Another possible reason could be the separation of green waste, metals and end-of-life vehicles. However, the stockpiled amounts do not allow for the low fill rates.

The dataset accompanying this report presents different landfill life scenarios for the nation to consider.

Materials available for recovery from the waste stream –

- Organics (63%) and paper and cardboard (14%) represent a significant waste stream for potential resource-recovery initiatives.
- Significant quantities of PET bottles for other household uses, HDPE and glass containers are also available in the waste stream for potential recovery.
- Metals, ELVs, white goods and e-waste are already recovered in substantial quantities and stockpiled. These materials remain of interest due to their hazardous nature and difficulty of disposal.

8 Is Kiribati ready to contribute to regional recycling activities?

Onsite visits, meetings with officials, audits and a review of the current legislative framework, suggest that Kiribati has the potential to participate in regional recycling activities with certain limitations, as listed in Table 25 below.

Table 25: Regional recycling activities – Kiribati's readiness to participate

Policy and legislation
Signatory to international treaties allowing movement of waste Kiribati is signatory to the Basel, Rotterdam and Waigani conventions. Kiribati also has a history of being able to move materials collected through the Kaoki Maange system. **Ability to legislate swiftly, if required** For a new bill to pass, it must go through the usual parliamentary process, which may take many months to finalize. However, the ***Customs Act 2019*** has been recently passed and a draft Environment Act 2021 exists. The time it takes for the Environment Act to be legislated should be used as a benchmark for the speed with which legislation might be passed. **Local by-laws and implementation** The enforcement of by-laws and policy around waste disposal is minimal and does nothing to prevent burning and illegal dumping of waste[9]. The draft Environment Act 2021 brings in sweeping changes to the government's ability to manage and police illegal dumping and burning of waste. **EPR schemes** The Kaoki Maange CDS system has been in operation in Kiribati for 10 years despite a number of challenges, including lack of infrastructure (such as collection trucks) and fluctuating market conditions. Reforming or expanding the scheme is a possibility.
Data collection and decision-making
Responsible entities for ongoing data collection Data collection is difficult and there are inadequate systems in place for on-going and appropriate collection of data for decision-making purposes. None of the landfills have weighbridges and the stockpiles of potentially recyclable materials are assessed visually. Accounting of the CDS-levied items versus those returned is carried out in an ad hoc manner. There is, however, technical capacity within the GoK to undertake this activity if personnel are appropriately trained. **Responsible entities for decision-making** Currently, MELAD through ECD is the overall decision-making body, with councils providing collection services. Lines of communication and referral are blurred and the waste management system would benefit from clearer roles and responsibilities.
Economic instruments
Financial instruments for collection of different materials

[9] https://www.lgnz.co.nz/assets/Uploads/Our-work/d7f459a299/Kiribati-Waste-managment-review.pdf

Current CDS is in place for lead-acid batteries, PET beverage containers and aluminium cans. These are collected and stockpiled at the Kaoki Maange.

Bans or phase-outs in place

Since October 2020, a ban is in place for nappies (diapers), plastic shopping bags and ice bags. A substitution effect was not seen at the time of this audit. Alternatives have yet to be approved by GoK.

Collection services

Current availability and effectiveness of waste collection service

Waste collection services are ad hoc and provided only on South Tarawa. The Green Bag scheme promotes source separation but all materials end up at the landfill.

Kiritimati Island has a waste service that is provided to three towns only. Together, the outer islands in Kiribati represent a large proportion of the population and no collection services are currently available to them. These islands practise burning, burying or dumping of waste—a large proportion of which ends up in the oceans.

Ability to diversify to multiple collection types

On South Tarawa, multiple collection types are possible, as there is precedence for it through the MRF and the Kaoki Maange. However, the outer islands require basic collection services.

Recyclers and small-scale players for possible future collections

Collection of recyclables happens in an ad-hoc manner in South Tarawa and can be streamlined. The audit team is unable to comment on the possibility of future collection of recyclables from outer islands as material collections of any type are not available at the time of writing of this report.

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Appendix A: Kiribati solid waste management

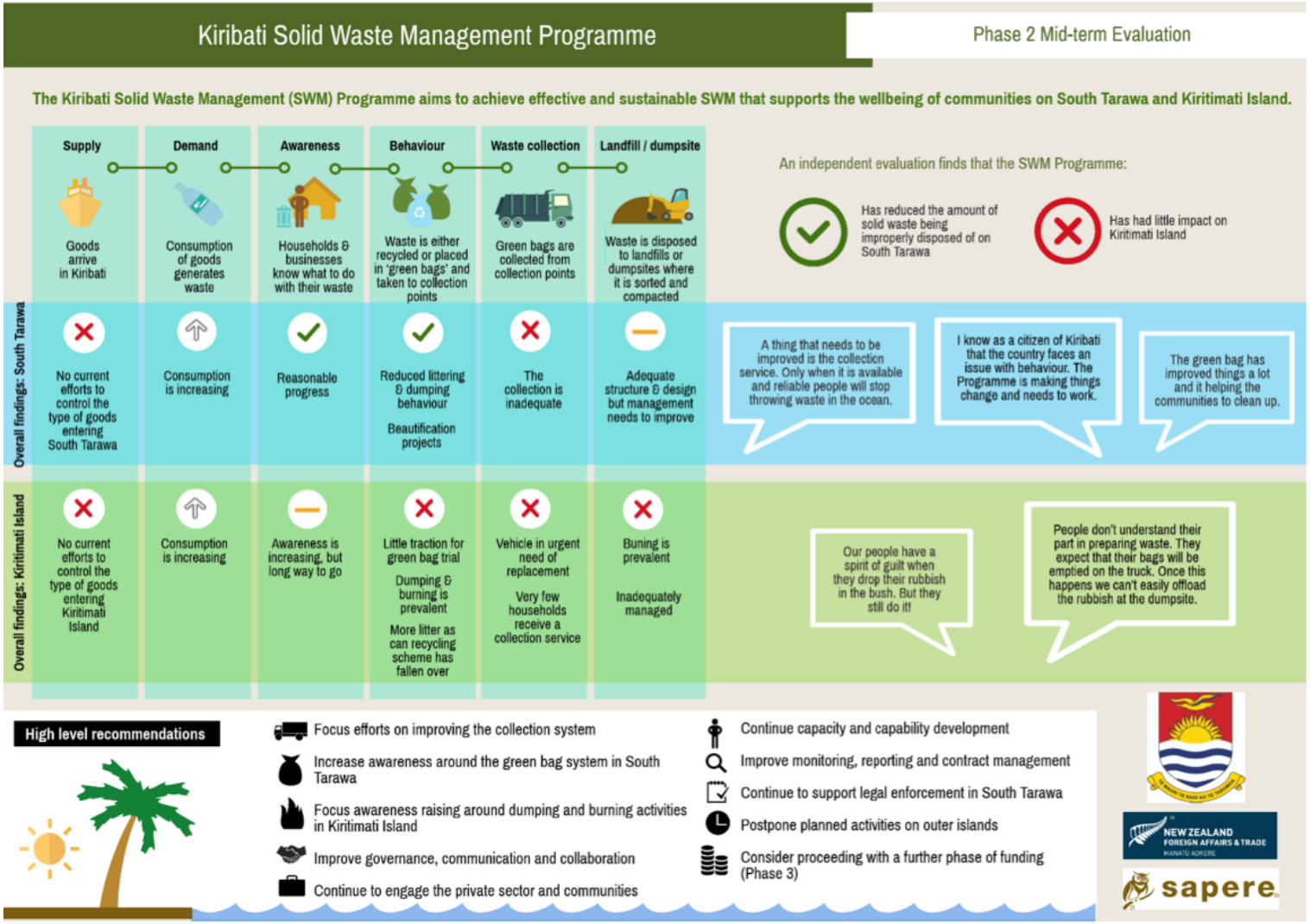


Figure 34: Infographic of Kiribati's solid waste management (Source: MFAT, 2019)

South Tarawa's landfills

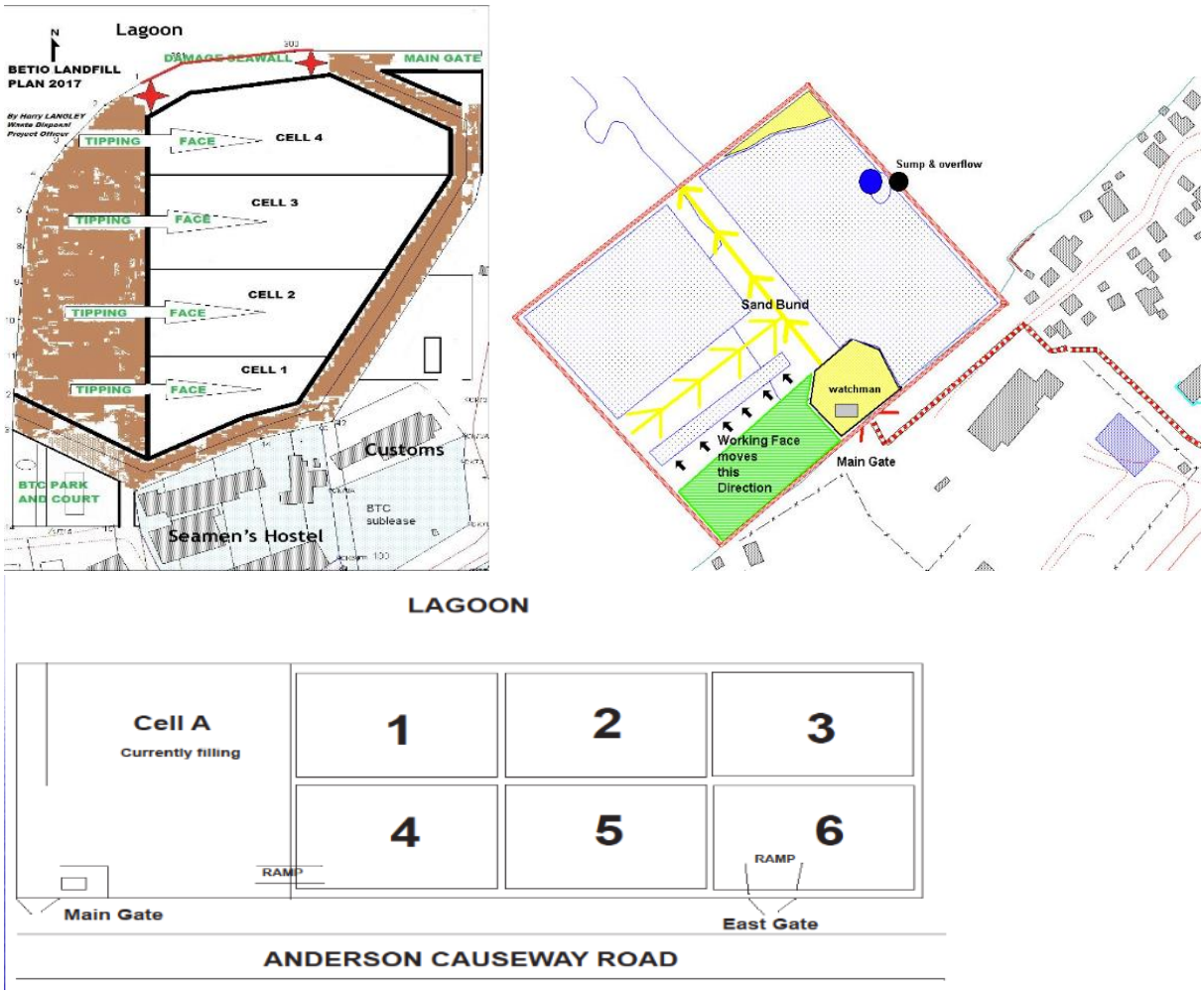


Figure 35: (Top left) Betio Landfill cell plan; (top right) Bikenibeu Landfill cell plan; (bottom) Nanikaai Landfill cell plan

Burning of waste

The World Bank estimates a waste generation rate of 0.86 kg/capita/day for Kiribati. However, according to MELAD's 2019 uPOP report to UNEP, on visiting landfills on South Tarawa and considering estimates provided by the manager of those landfills, SPREP's lower rate of 0.5 kg/capita/day could be used to get an estimate of waste burned per year in Kiribati, as shown in Table 26. According to MELAD, if those householders who prefer to burn their solid waste from time to time also dispose of their solid waste by way of one or more of the six other methods surveyed (roadside collection, ground pit, community pit, beach, sea, other), then an estimate can be made that 50% of the SPREP lower rate may be burned. It is stressed that this is only an estimate based on limited knowledge of the situation (MELAD, 2019a).

Table 26: Estimate of open burning in Kiribati (MELAD, 2019a)

Households that burn domestic waste (2015 Census):	3,568 persons
Average persons per household (2015 Census):	5.78 person per household
Domestic waste kg/day/person for Kiribati (SPREP, 2015):	0.5 kg/capita

(World Bank 2016 rate of waste for Kiribati is 0.86 kg/person/day	
Waste burnt by households per year in Kiribati:	1,888 tonnes/year

Bulky waste (ELV)

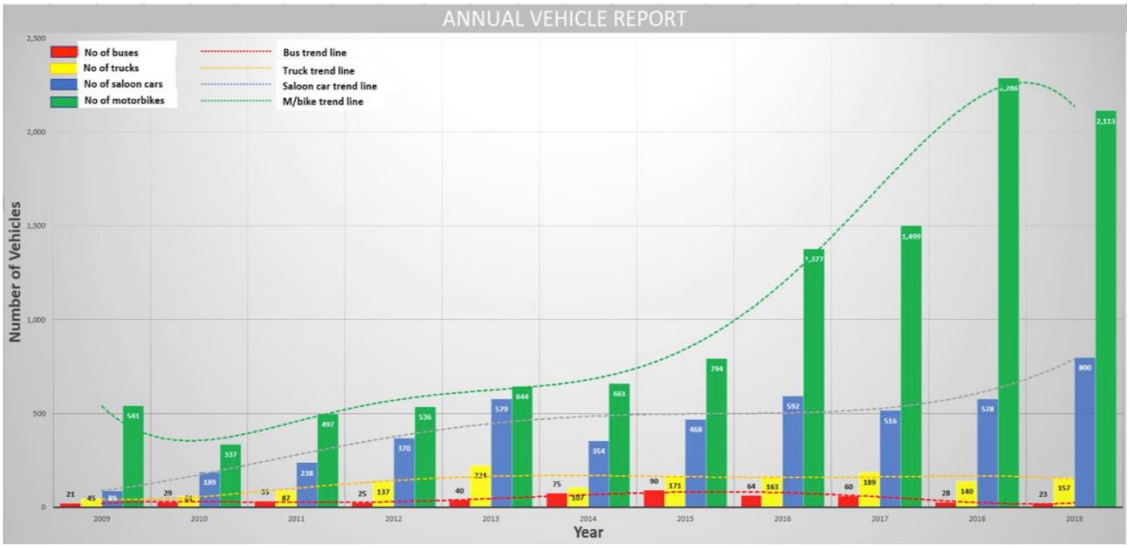
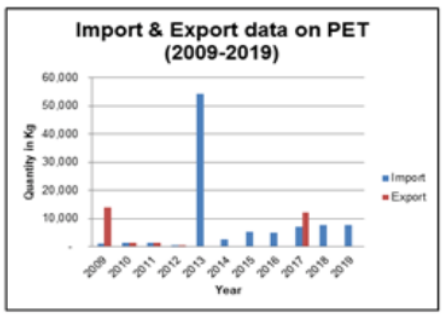
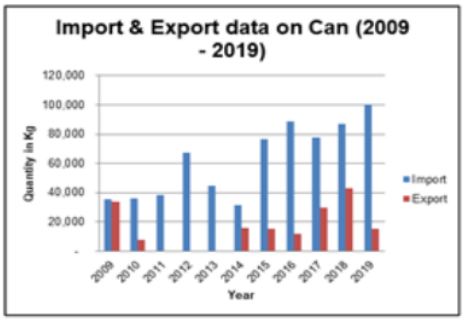


Figure 36: Vehicle import to Kiribati 2009–2019 (source: MELAD, 2020, from *Kiribati Customs Administrative and Enforcement, 2020*)

Lead-acid batteries





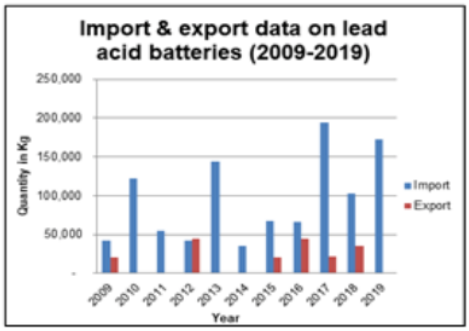


Figure 37: Import and export of recyclable materials under Kiribati's CDS system for 2009–2019 (Source: MELAD, 2020)

Regulation and legislation (Source: SPREP, 2020)

Type of document	Name
Kiribati National Implementation Plan for POPs (2019)	Submitted in fulfilment of Kiribati's obligations as a Stockholm POPs Convention party. Provides an excellent and up-to-date summary of legislation, MEAs and policies.
National Quality Policy 2017–2023	This policy was launched by the Kiribati Government in 2018. It seeks to raise the quality and safety levels of products and services in Kiribati, both locally manufactured and imported, with the aim of protecting consumers, achieving better social and environmental protection, and improving livelihoods. Ministry of Environment, Lands and Agriculture Development is responsible for accelerating implementation of the framework for waste management and recycling.
Kiribati Development Plan 2016–19	The summary of KPA 4: 'Environment' states that 'Significant efforts on solid waste management have been made with donor partner support, upgrading three landfill areas, launching private waste collection, and processing e-waste and bulky waste for export'. Waste management is identified as one of the five key environmental policy areas identified by the government
Kiribati Integrated Environment Policy (2013)	Goal is: To strengthen national capacity to ensure a safe and healthy environment for the people of Kiribati through effective and sound management of chemicals and waste. Kiribati adopts the 'waste hierarchy' approach in its management of waste, starting with avoidance and minimisation first and then looking at the opportunities for reuse, recycling and recovering before finally considering safe disposal.
Kiribati Waste Management Resource Recovery Strategy (KWMRRS 2020–2029)	The ultimate objective of the Strategy is to strengthen national capacity to ensure a safe and healthy environment for the people of Kiribati through effective and sound waste management targeting the priority waste streams. These wastes are plastic waste, end-of-life vehicles, asbestos, used oil, e-waste, recyclables, disaster waste, organic waste, wastewater, laboratory chemical waste and used tire at the national level.
Ninth Regional 3R Forum in Asia and the Pacific (Kiribati Country Report)	This document is a 3R Country Progress Report. It outlines the progress and achievements towards implementation of the Ha Noi 3R Declaration: Sustainable 3R Goals for Asia and the Pacific (2013–2023).
Kaoki Maange Program—Recycling System	This document outlines Kiribati's Kaoki Maange recycling program
National Report Basel Convention 2004	Submitted in fulfilment of Kiribati's obligations as a Basel Convention party.
National Report Basel Convention 2006	Submitted in fulfilment of Kiribati's obligations as a Basel Convention party.

Penalties

Table 27: Penalties for littering offences in Kiribati (Source: (SPREP, 2018a)

Offence	Penalty
Littering and excessive emissions from vehicles	maximum $500 fine and one month's imprisonment
Pollution of waters	maximum $100,000 fine and five years' imprisonment
Dumping in sea or lagoon	maximum $10,000 fine and two years' imprisonment

Appendix B: Collection schedule and cost per month

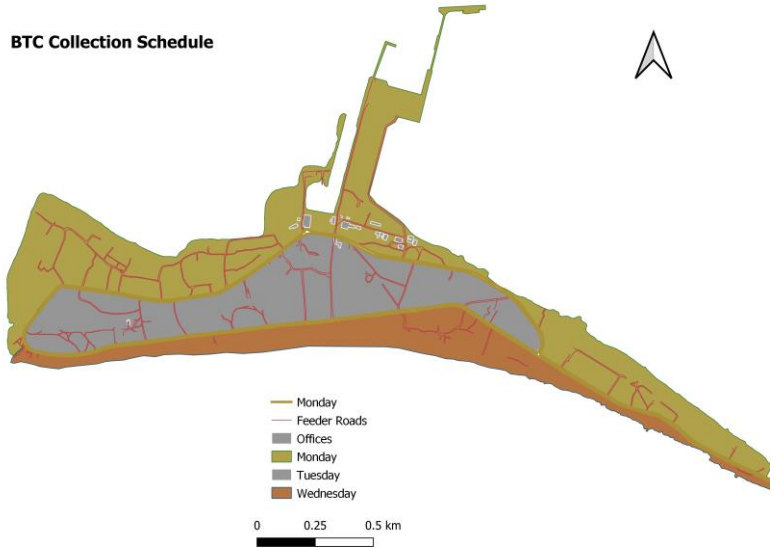


Figure 38: Waste collection service map for Betio Town Council (BTC)
(Source: MNRE, 201N)

TEINAINANO URBAN COUNCIL COLLECTION SCHEDULE 2021

EAST ZONE PLAN WASTE. Week 1 to 5

AREA CODE			
SCHOOL	MONDAY	Red 1	
STORE		Housing 1	Ministry
HOUSING	TUESDAY		
MINISTRY		School	Clinics
CLINICS	WEDNESDAY		Red 2
		Ministry	Store
	THURSDAY	Red 3	
		Housing 3	Clinics
	FRIDAY	Red 4	
		Housing 4	Ministry
	SATURDAY		
		School	Clinics
	SUNDAY	Red 5	
		Housing 5	Store

Monday - Ministry, Red 1:- Kaibangaki to Police line
Tuesday - School and Clinic
Wednesday - Ministry Red 2 :- Man Kaana to FTC ni kawai
Thursday - Housing Red 3 :- Man te Mhelad to Land fill
Friday - Ministry Red 4 :- Man KTC road to te Mackenzie.
Saturday - School and Clinic
Sunday - Store and Housing Red 5:- Labour line

WEST ZONE PLAN WASTE. Week 1 to 5

MONDAY	RED 1	
	Housing 1	Ministry
TUESDAY		
	School	Clinic
WEDNESDAY		Red 2
	Ministry	Store
THURSDAY	Red 3	
	Housing, Red 3	Store
FRIDAY		
	Store	Ministry
SATURDAY		Red 4
	School	Housing
SUNDAY	Red 5	
	Housing 5	

Monday - Ministry, Red 1:- Man TKT store I Bairiki to tennis court
Tuesday - School and Clinic
Wednesday - Ministry Red 2 :- Man te Boruatao Tabonkabauea to Prison
Thursday - Housing Red 3 :- New Building Opp Merry's motel to Police line
Friday - Ministry and Store
Saturday - School Housing Red 4:- Man te Finance office to St Anne Pre sch
Sunday - Housing Red 5:- Man te Bairiki square to super mall.

Figure 39: Collection schedule

Appendix C: Project Plan for Kiribati

ASIA PACIFIC WASTE CONSULTANTS
TH 4/ 28 West Street, North Sydney, NSW 2060
T: 61 2 9907 0994 I E: info@apwc.com.au
www.apwc.com.au

Project Plan – Kiribati – World Bank

APWC contacts

Project Manager	Country Coordinator	In-country Supervisor	Project Delivery
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Kiribati points of contact for the following:

Overall point of contact (World Bank)	Overall point of contact (MELAD)
Ms Akka Rimon Liaison Officer (Kiribati), World Bank/ADB Email: arimon@worldbank.org	Harry Langley Waste Disposal Project Officer (WDPO) Email: h.langley@melad.gov.ki

KEY GOVERNMENT OFFICIALS IN KIRIBATI

Name	Official Designation	Contacts
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2. Mr Taulehia Pulefou	**Program Manager – Waste Management and Pollution Prevention (WMPP)** Environment and Conservation Division (ECD) Ministry of Environment, Lands and Agriculture Development (MELAD)	Phone: (686) 752 28211 Email: t.pulefou@melad.gov.ki
3. Teniti Aro Taam	**Solid Waste Management Officer (SWMO)** Environment and Conservation Division Ministry of Environment, Lands and Agriculture Development (MELAD)	Email: t.taam@melad.gov.ki
4. Dr Farran Redfern	Environment and Conservation Division (ECD) Ministry of Environment, Lands and Agriculture Development (MELAD)	Mobile: (686) 730 58233 Email: f.redfern@melad.gov.ki farranredfern@gmail.com
5. Mr Harry Langley	**Waste Disposal Project Officer (WDPO)**	Mobile: (686) 730 51805 Email: h.langley@melad.gov.ki

	Environment and Conservation Division (ECD) Ministry of Environment, Lands and Agriculture Development (MELAD)	
6. Mr. Teema Biko	Chemical and Hazardous Waste Management Officer	Mobile: (686) 730 27824 Email: t.biko@melad.gov.ki

STAKEHOLDERS FOR APPOINTMENTS

Agency	Contact person	Contacts
1. Teinainano Urban Council (TUC)	Ms. Alice K Teabo Mr. Tiabere Itinibwara	tucclerk@internalaffairs.gov.ki
2. Betio Town Council (BTC)	Mr. Maraki Bokai Ms. Bwaaree Taorobwa	btcclerk@internalaffairs.gov.ki pwrtiito2016@gmail.com
3. New Zealand High Commission (NZHC)	HE Mr Paul Wallis Ms Marni Gilbert Mr Ross Craven Ms Lailai Takfai	 Marni.Gilbert@mfat.govt.nz Ross.Craven@mfat.govt.nz Lailai.TakFai@mfat.gov.nz
4. Kiribati Customs, Administration and Enforcement (KCAE)	Mr Tooua Bateriki Ms. Metioteraka Nita	tooua.bateriki@kiribaticustoms.gov.ki metioteraka@kiribaticustoms.gov.ki
5. Ministry of Health and Medical Services (MHMS)	Ms. Ereti Timeon Mr. Aritu	dph@mhms.gov.ki aritu2012@gmail.com
6. Kaoki Maange/MRF	Mr Derek Andrewartha	onestop.tarawa@gmail.com
7. Moel Trading	Mr. Tangtang Kaureata Mr. Teiti Iona	kaureatat@moeltrading.com teiti@moeltrading.com
8. Kiribati Red Cross Society (KRCS)	Mr. Depweh Kanono Ms Maria Taua, Mr Ioteba Tokanikai	depwehkanono@gmail.com mtauatobwai@gmail.com itokanikai@gmail.com
9. Clerk for Maiana island **Clerk for Abaiang island**	Ms. Miire Terakunene Ms. Arii Bareta	Phone: 73058011 Phone: 73075742
10. Ministry of Infrastructure and Sustainable Energy (MISE)	Ms. Saitofi Mika Mr. Arobati Brectefield Mr. Teteki Taoaba	secretary@mise.gov.ki depsec@mise.gov.ki taoabateteki@mise.gov.ki

SAMPLING PLAN – DATA REQUIRED TO BE COLLECTED IN KIRIBATI

Households (collect and sort waste – conduct same number of interviews)

Scheme	Error at 80% Confidence	Error at 90% confidence
120 houses Tarawa, 30 houses other	19%	24%
90 houses Tarawa, 30 houses Kiritimati or Abaiang, 30 houses other	17%	22%
115 houses Tarawa, 50 houses Abaiang, 35 houses Maiana	15%	19%
105 houses Tarawa, 45 houses Kiritimati or Abaiang, 25 houses on two other islands	14%	18%
120 houses Tarawa, 30 houses other	19%	24%

Note: grey-shaded is the chosen sample split

Businesses (collect and sort waste – conduct requested interviews)

	Samples	Interviews
Admin/office - MISE (Betio) - KOIL (Betio) - KCDL (Betio) - OB (Bairiki) - BPA (Bairiki) - MFED (Bairiki) - KOES (Ambo) - MELAD (Bikenibeu) - MoE (Bikenibeu) - MHMS (Bikenibeu)	10	10
Food outlet - Capital Chinese Restaurant (Betio) - Betio Lodge Restaurant (Betio) - The George Restaurant (Betio) - CPPL Restaurant (Bairiki) - Mary's Restaurant (Bairiki) - Elizabeth Restaurant (Teao) - Pacific Chinese Restaurant (Banraeaba) - Bikenibeu Chinese Restaurant (Bikenibeu) - Paradise Restaurant (Bikenibeu) - Nei Kaitibo's fast food (Bonriki)	10	10
Supermarket - MOEL (Betio) - Wishing Star (Betio) - LEE's Store (Betio) - Punjas (Betio) - Slim Price (Bai) - Taotin HQ (Teao) - Fair Price (Teao) - LMTA Supermarket (Antebuka) - Coral Ace (Abarao) - I-Mart (Bik)	10	10
Hotel - The George Hotel - Betio Lodge - Mary's Motel - The George Bungalow - Fema Lodge - Utirerei Hotel - Dreamer's Guest House - Tobaraoi Travel Guest House - TAD's Lodge - Eniita's Motel	10	10
Retail	10	10

- Tateraka's store - Bonteman's store - Auribwa's store - Teuamori's store - Rakentai's store (opp. USP) - Ataia's store (Green double-story) - Teimi's store - Bweman's store - Bikenibeu Soccer field store - Causeway store		
Public Bar - Seaman - Marina - Tiktok - Freddy's - Fab Ace - The George Bungalow - Ambo Lagoon - Tekeraoi public bar - Slim price - Kaitibo's bar	10	10

Landfill (collect and sort waste, conduct requested interviews) – as many landfills as possible

Understandable	7 days – Betio
Desirable	14 days – Nanikaai

Bottling companies – local manufacture of plastic (gather data around plastics manufacturing – use data sheet provided)

List of bottling/water refill companies in Kiribati

No water bottling companies in Kiribati, but two producers on Tarawa Island:

- *Kiribati Coconut Development Company (KCDL)*
- *Kiribati Fish Limited (KFL)*

Recyclers (gather data around materials recycled currently and current recycling markets – use data sheet provided)

1) Kaoki Maange

Contact:

Lydia J Langley, Cashier
73029650
rjamira1104@gmail.com
One Stop Shop, Betio Tarawa

Customs (request data around import and export of materials)

Data was received from the Customs department in February 2020

Municipal services provision sheet (request data around current legislation, collection and disposal services)

Mr Harry Langley completed interviews with:

- Councils (TUC and BTC)
- Private sectors (Green Bag – MOEL)

COLLECTION OF WASTE AND SORTING ARRANGEMENTS

Sort site

Bikenibeu Landfill (in front gate)

Contact: Harry Langley and Kiribati Waste Field Team

APWC Work Health and Safety Training

TASKS	Completed in country	Signed off by PM
APWC waste audit code of conduct	✓	✓
APWC COVID response safety plan	✓	✓
Electronic copies of SWMS/JSEA*	✓	✓
Training for staff and hard copy of training module	✓	✓

Equipment required in country

ITEM	Purchased/organized in country	Receipts provided to PM
Safety boots	Angiriin Hardware/Betio Hardware	✓
Tables	Rental from Easy Way Services	✓
Marquee (if necessary)	Rental from Easy Way Services	✓
2 x electronic scales	GoodLife Enterprise	✓
iPad and tablet	Taotin Electronics	✓
Inner gloves	Nei Akoako Store	✓
Outer gloves	Betio Hardware	✓
Masking tape and permanent markers	KOES	✓
Garbage bags	Retail Store	✓
Masks/face shields	Retail Store	✓
Disposable overalls	Uncle Bill	✓
Sorting tubs/aluminium trays	Wishing Star	✓
First Aid kits	Uncle Bill	✓
Soap and hand sanitizer	Wishing Star Super Market	✓
Pickup truck for collections	Rental (sedan and pickup truck)	✓
Polyethylene sheet	TTT Enterprise	✓
Water	Wishing Star	✓

Work schedule

	February 2021					
Sun	**Mon**	**Tue**	**Wed**	**Thu**	**Fri**	**Sat**
	1	**2**	**3**	**4**	**5**	6
7	**8**	**9** **Waste Audit in-house training (Intro and Collection and Sorting Form)**	**10** **Waste Audit in-house training (Plastics Game)**	**11** **Waste Audit in-house training** **(OHS training and Code of Conduct – Commercial form toolbox, project planning)**	**12** **Waste Audit in-house training** **(Litter audit, project planning)**	**13**
14	**15** **Day 1 – Practical** **Collect 6 samples from HI, MI, LI HHs. Sorting waste and entering data.**	**16** **Day 2 – Practical** **Landfill audit and interview**	**17** **Virtual update meeting with team and Erin based on data via messenger** **-press release and media outreach (waste audit training and starting date on fieldwork) to the public**	**18** **Logistics and budgets** **-Trial data discussion with APWC** **-final prep**	**19** **Logistics and budgets** **Trial data discussion with APWC** **-Final prep**	**20**
21	**22** **Day 1 – Field work; HHs collection.** **Landfill Audit 1**	**23** **Day 2 – Field work, HHs collection** **.** **Landfill Audit 2**	**24** **Day 3 – Field work; Sorting waste and data entering** **Landfill Audit 3**	**25** **Day 4 – field work; Sorting and data entering** **Landfill Audit 4**	**26** **Day 5 – field work; sorting and data entering.** **Landfill Audit 5**	**27** **HHs Interview** **Landfill Audit 6**
28 **Landfill Audit 7**						

	March 2021					
Sun	**Mon**	**Tue**	**Wed**	**Thu**	**Fri**	**Sat**
	1 **Day 6 – Commercial collection** **Landfill Audit 8**	**2** **Day 7 – commercial collection** **Sorting and data entering** **Landfill Audit 9**	**3** **Day 8 – sorting and data entering** **Landfill Audit 10**	**4** **Day 9 – sorting and data entering** **Landfill Audit 11**	**5** **Day 10 – sorting and data entering** **Landfill Audit 12**	6 **Commercial Interview** **Landfill Audit 13**
7 Logistics for Outer Island Teams prep. & back up. **Landfill Audit 14**	**8** **OUTER ISLAND FIELD WORK:** **Maiana & Abaiang** **Day 11 – Team arrived Maiana & Abaiang (Move to Hotel & rest)** **Landfill Audit Betio 1**	**9** **Day 12 – island Protocol (Courtesy call) followed with the filed arrangement work with island council Clerk** **Landfill Audit Betio 2**	**10** **Day 13 – HHs collection & sorting and data entering, interview** **Landfill Audit Betio 3**	**11** **Day 14 – HHs collection & sorting and data entering** **Landfill Audit Betio 4**	**12** **Day 15 – HHs collection sorting and data entering** **Landfill Audit Betio 5**	**13** Day 16 – HHs collection sorting and data entering **Landfill Audit Betio 6**
14 **Day 17 – Team return back to Tarawa** **Landfill Audit Betio 7**	**15** **Day 1/14 - Landfill audit**	**16** **Day 2/14 - Landfill audit**	**17** **Day 3/14 - Landfill audit**	**18** **Day 4/14 - Landfill audit**	**19** **Day 5/14 - Landfill audit**	**20** **Day 6/14 - Landfill audit**
21 **Day 7/14 - Landfill audit**	**22** **Day 8/14 - Landfill audit**	**23** **Day 9/14 - Landfill audit**	**24** **Day 10/14 - Landfill audit**	**25** **Day 11/14 - Landfill audit**	**26** **Day 12/14 - Landfill audit**	**27** **Day 13/14 - Landfill audit**
28 **Day 14/14 - Landfill audit**	**29** **Process reviewing Team & Erin**	**30** **Process reviewing & wrap up Team & Erin**	**31** **Conclusion of the Kiribati Waste Audit Project**			

WORK HEALTH AND SAFETY

Safety while travelling and working in Kiribati:

a) **PRE-MISSION BRIEFING:** In-country project team members to be provided with a copy of the mission brief, all documents and safety while travelling/working, briefing and audit training. Team also briefed of all in-country requirements, safety, local conditions and data to be collected. In-country briefing to include details on accommodation, transport, money and timekeeping. Team will be provided with a copy of an attendance sheet that must be signed confirming that all training, briefing and safety documents have been read and understood. A copy of this document must be sent to the Project Manager. BRIEF AND SIGNED COPY OF ATTENDANCE SAVED IN PROJECT DROPBOX. Once this has been completed, please fill out the table below. Copy of attendance, briefing and safety sheets in Appendix B.

	Date/signed by in-country team	Received and saved by PM
Mission brief	✓	✓
Work, Health and Safety	✓	✓
Audit training	✓	✓

B) **POST-MISSION BRIEFING**: After completion of in-country mission, review of all processes and learnings. All learnings to be recorded by PM and reflected in future project planning. A COPY OF THE REVIEW PROCESS TO BE SAVED IN PROJECT DROPBOX.

Project team	
Collections	
Mr. Eneri Inatoa	eneriinatoa0809@gmail.com
Mr. Tootiketa Areke	tootiketa.areke@gmail.com
Mr. Areieta Temwanne	areetdanny@gmail.com
Sorting team	
Mr. Tetabea Terubentau	tetabea.akura@gmail.com
Mr. Teangaubwa Tekinene	teangaubwatknn2@gmail.com
Mr. Harry Langley	h.langley@melad.gov.ki
Mr. Teema Biko	t.biko@melad.gov.ki
Interview team	
Ms. Kathelyn Aneli	k.aneli@melad.gov.ki
Ms. Teniti Taam	t.taam@melad.gov.ki

Emergency contacts

MEDICAL:
Paramedic Ambulance: Tungaru Central Hospital (TCH Nawerewere) (686) 194 Free Toll
Betio Hospital (686) 195 Free Toll
Search and Rescue: + (686) 1050 and (686) 188 Free Toll

EMERGENCY DENTAL – (686) 194 Free Toll

ELECTRICAL FAULTS – (686) 1130 Free Toll

FIRE – (686) 192 and (686) 193

MEDICAL EMERGENCIES – Tungaru Central Hospital (TCH Nawerewere) (686) 194 Free Toll
Betio Hospital (686) 195 Free Toll

POLICE – (686) 192 and (686) 188 Free Toll or (686) 740 26187

OFFICE OF DISASTER PREPAREDNESS – (686) 1055 Free Toll

Appendix D: Project methodology

Impact of COVID-19

Due to a pause on all international travel arising from the COVID-19 pandemic, a remote methodology was applied to the training and supervision of the in-country team recruited by MELAD.

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Air travel to Kiribati's outer islands was also challenging. As a result, the outer islands chosen for the audit were close to South Tarawa and accessible by a 30-minute boat trip to lower the risk of the team getting stranded if travel restrictions were introduced on flights.

Data collection

Waste samples

Household samples

This section provides information on the waste data collection works over the period March to April 2021 in Kiribati. The minimum and maximum number of household samples required is shown in Table 28.

Table 28: Household samples to be collected

Scheme	Error at 80% confidence	Error at 90% confidence
120 houses Tarawa, 30 houses other	19%	24%
90 houses Tarawa, 30 houses Kiritimati or Abaiang, 30 houses other	17%	22%
115 houses Tarawa, 50 houses Abaiang, 35 houses Maiana	15%	19%
105 houses Tarawa, 45 houses Kiritimati or Abaiang, 25 houses on two other islands	14%	18%
120 houses Tarawa, 30 houses other	19%	24%

(* Schemes highlighted in orange represent the targeted samples prior to commencing the audit.)

Using the calculations provided above, it was assumed that the minimum number of samples required is 150 and the maximum number is 200. A total of 119 urban samples was collected in South Tarawa, 52 were collected on Abaiang and 37 on Maiana. Therefore, the total sample size in Kiribati was 208, bringing the number to an acceptable level of confidence needed for decision-making purposes.

Table 29: Kiribati household sampling distribution

Urban/ Rural		Income category	Samples required	Samples collected	Total	Collection systems	Collection frequency
Urban	South Tarawa	Low	39	37	119	Yes – door-to-door at set collection points	Twice a week
		Middle	39	42			
		High	37	37			
Rural	Abaiang island	Low	50	21	89	No collection service	Not applicable
		Middle		21			

		High		9			
	Maiana island	Low	35	21			
		Middle		15			

Table 30: Household samples collected

Income category	Urban	Rural	Total
Low income	37	42	79
Middle income	42	36	78
High income	37	9	46
Total	119	89	208

A project plan template was provided to the in-country team following the online training provided by the Project Manager (See Appendix G). The plan was discussed by the in-country team and the Project Manager during the online training to ensure the smooth implementation of the waste audit operations. Samples were collected on Tarawa, Abaiang and Maiana islands, of which only Tarawa has a collection system in place. All samples were therefore collected as per the collection methodology below.

Household waste samples were collected from Tarawa, Abaiang and Maiana islands based on the required samples. The methodology requires collection of household samples across the low-, medium- and high-income streams.

The location of the households where samples were collected were marked using the GPS coordinates. On Tarawa Island, the sample collection team arrived prior to the arrival of the waste collection truck on the day of the collection and procured the sample before the truck could visit the households. The team had to use a slightly different methodology for collecting samples on both Abaiang and Maiana islands, as neither has a collection service. On Abaiang Island, the distance travelled between households was significant and the team had limited transport options, therefore the team collected a single bag of rubbish from each household visited and assumed that it had been there for more than two weeks. On Maiana Island, the team distributed bags to households at the beginning of the day and returned later in the afternoon to collect the sample.

The collection team consisted of the three key members with separate functions. The World Bank consultant team engaged and trained up to eight waste management staff, kindly provided by the MELAD, to undertake the in-country work for this project. The in-country team used their local knowledge and experience in the waste industry to develop the collection routes on each of the islands. Knowing the areas well, the team were able to answer questions posed by locals regarding the purpose of collecting waste from their household bins instead of the regular contractor. The in-country team used an online tool to capture all data as the samples were collected. A collection sheet is provided in Appendix J.

Collections were carried out in the following way:

- A collection supervisor and recorder marked the location of a sample using the GPS coordinates, photographed the premises for follow-up interviews and inserted notes on the

nature of the collected samples (e.g. bin fullness, how much waste collected for sampling, contents description, types of waste, etc.).

- The second member(s) of the team assessed the types of waste presented and provided information to the recorder. Samples were collected by emptying the contents of the bins into the tagged garbage bags and placing them in the truck for transportation to the sorting area at the landfill.
- The third member of the team conducted the interview with the resident of the household. If the resident was not home, a note was made of the address and the corresponding sample number collected for easier identification later during follow-up interviews. The household numbers recorded by the recorder must correspond to numbers written on the garbage bags.

Commercial premises

Commercial samples were required to be distributed as follows:

Table 31: Commercial samples collected

Sample type	Samples required	Samples collected	Interviews	Waste pickup frequency	Destination
Food outlet	10	8	8	Once a week	Waste disposal site
Admin/office	10	10	10		
Supermarket	10	11	11		
Hotel	10	6	6		
Retail	10	10	10		
Public bars	10	8	8		
TOTAL	**60**	**53**	**53**		

A total of 53 commercial premises was sampled simultaneously with households in South Tarawa. All commercial premises have a waste collection once a week.

The business name and location of each of the commercial premises sampled are presented in Appendix R for food outlets, administration/offices, supermarkets, hotels, retailers and public bars.

The commercial samples from small shops, offices, businesses and hotels were collected at the same time as the household samples. A team member was required to speak directly to the person in charge of waste management at the premises in order to collect a sample, therefore the interview was completed at the same time rather than the team returning at a later date.

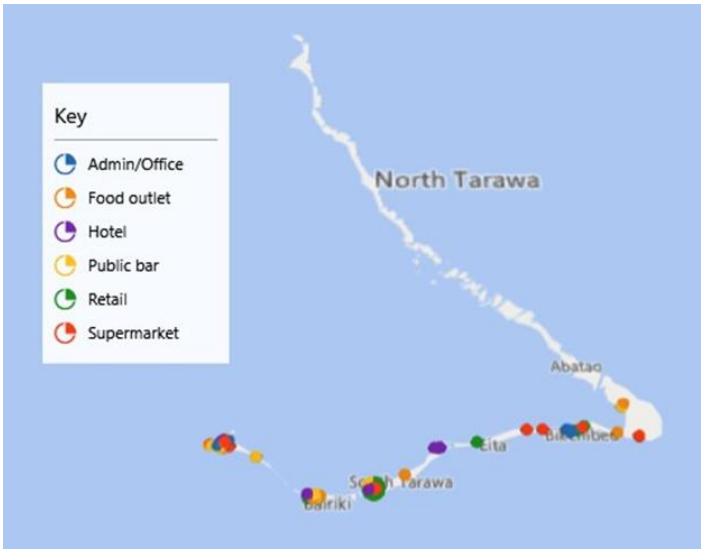

Figure 40: Map of commercial samples collected on South Tarawa Island

Landfill samples

Two of the three landfills on Tarawa Island—Nanikaai and Betio—were assessed during the audit period in March 2021. Nanikaai Landfill was chosen as the site to be audited for 14 days as it is located along a main stretch of road and caters to both households and business, and thereby receives the most traffic. Betio Landfill is located in the commercial centre and accommodates predominantly commercial disposal. Both Nanikaai and Betio landfills have opening hours of Monday to Sunday from 6 a.m. to 6 p.m.

Table 32: Landfill audit statistics

	Statistics	
Landfill visual audit	Nanikaai Landfill	Betio Landfill
Number of days of visual audit	14 consecutive days	7 consecutive days
Number of vehicles audited	299	251

The in-country team needed to undertake a snapshot audit so that the composition of the different types of materials can be understood. This composition can then be applied to the overall volume of incoming material to determine the content.

Auditors were equipped with mobile phones, high-visibility safety vests, gloves, protective glasses, sunscreen, wet-weather gear and safety boots (with steel base to prevent any penetration). Paper data sheets were used at the landfill instead of tablets, as multiple entries often had to be made at once. These sheets were then scanned and sent to the data-entry staff based in Australia to be entered into KoboToolbox. The categories and information recorded for each vehicle is provided at Appendix O.

All data was recorded in a consistent manner (in litres) on a standard data sheet. Space was provided on the form to allow for appropriate recording of significant quantities of any other items. Sheets were pre-numbered to ensure all recording sheets were accounted for after the audit.

The following information was recorded on each load:

- Date and time of vehicle arrival
- Registration number
- Vehicle type
- Volume of vehicles load in litres
- Composition and volume of load in litres
- Degree of compaction
- Photographs of specific loads of interest.

Interviews

Household and commercial

The methodology assesses the amount of waste requiring immediate management, that is, the general municipal waste being placed in bags. It also assesses self-reported household behaviours based on interviews in order to understand what happens to uncollected waste or why certain waste is not placed in bags, including the reason for these behaviours.

All interviews were conducted by the in-country team. The team conducted the interviews for both households and commercial premises at the same time as sample collection. As the team often had to meet with the business owner in order to collect a waste sample for commercial premises, interviews were conducted immediately in order to precisely match samples. If residents were not home when undertaking the household collections/interviews, the team took note of the address and a sample ID, and returned at another time.
The interviews cover the following areas:

- Demographic information
- Income levels
- Disposal behaviour by material type
- Willingness to pay for collection/disposal systems
- Current recycling behaviours including further source separation
- Level of awareness about the current waste service
- Type of premises
- Access to amenities (electricity, sanitation, stormwater infrastructure, etc.)
- Consumption habits.

The questionnaires are designed specifically for each country and are based on the local conditions, language and culture (if they cover the above criteria). The questionnaires were in English and interpreters were used when required. The use of interpreters was chosen over local language translation because it had been previously demonstrated that translated questionnaires can be misleading and answers may not reflect the questions asked.

Producer interviews

There are only two producers on Tarawa Island (Table 33) as most goods are imported. The in-country team interviewed both of these companies to obtain a more accurate understanding of their production and generation of waste that included recyclable materials.

Table 33: List of producers on Tarawa Island

Producers
Kiribati Coconut Development Company (KCDL)
Kiribati Fish Limited (KFL)

As well as collecting data from the producers, an interview was also conducted with the one recycler that is currently operating in Kiribati to determine the amount of recyclable material collected. The in-country team also conducted an audit of all current stockpiled material. The size and location of each stockpile was audited, and the data was recorded for analysis.

Sample sorting

All the Tarawa Island samples were transported to an area at the entrance to Bikenibeu Landfill where the team set up a marquee and area for sorting. All Maiana Island samples were sorted in the village of Tebanga where the team set up a sorting site at Kiebu Station Lagoon. The only transport available on Abaiang Island are bikes. The team members chose to carry the necessary equipment required for sorting with them, as the distances travelled between households were large. Samples were sorted at the time of collection.

On Tarawa and Maiana islands, the bags tags were used to identify all samples to avoid misidentification. The collected samples were lined up to ensure none were missing. All samples were cross-referenced with the collection sheet to ensure consistency between sample collection and sorting. As samples were collected, sorted and householders/business owners interviewed at the same time on Abaiang Island and therefore the tags were not necessary.

Each waste sample was opened and the individual materials within each bag sorted into different trays according to the pre-defined categories. Separated materials were weighed using an electronic scale and the weight measurement recorded in a sorting sheet on KoBoToolbox using digital tablets/smart phones. Due to the global COVID-19 pandemic, the pre-calibrated electronic scales from Australia were unavailable therefore the team sourced their own calibrated scales on Tarawa Island.

A separate count of beverage containers for all general waste samples was also undertaken. Beverage containers from the samples were stored and counted separately. Containers were stored and labelled to ensure no cross-contamination took place. Containers were sorted by size, material (e.g. plastic, aluminium) and product type (e.g. milk, juice).

All plastic bags were sorted into different types and all containers were further sorted by size, material type and product type. Cigarette butts, coffee cups and takeaway containers were also segregated. All sort data was added to the sorting form on the tablet using the categories listed in Appendix F.

Work Health and Safety

The study has an integrated management system used during audits that covers quality, health, safety and environment (QHSE). The system has been developed to be consistent with the requirements of the international standards ISO9001 (Quality), ISO14001 (Environment) and AS4801 (Occupational Health and Safety).

The following steps were undertaken to ensure the safety of personnel:

- Site-specific safe work method statements (SWMS) were developed
- A pre- and post-work commencement risk assessment was undertaken
- Collection and sorting supervisor undertook QHSE inductions for project staff
- All staff were trained in the Waste Audit Code of Conduct developed by the project team, which includes a requirement to sign a confidentiality agreement prohibiting staff from removing anything from the material they sort or from revealing any information they might obtain while sorting or auditing
- Adjustments were made to ensure safety of staff based on local conditions. Collection and sorting supervisor had full control over local safety requirements to ensure all work was being conducted in a manner protecting the health and safety of the staff.

To comply with best-practice COVID health and safety requirements, wearing masks was mandatory when completing collections and sorting. The teams were required to abide by the nationally implemented social-distancing rules and to be vigilant about their personal health as well as that of the public. The in-country consultant responsible for supervising the fieldwork was given an extra briefing on safety and hygiene during a pandemic by the APWC project manager before commencing work. This message was shared to the whole team by the in-country consultant.

9.1 Staff training

As much as possible during the project, training was provided to local university student volunteers in collecting waste samples, conducting waste characterisations, conducting interviews, and in landfill assessments, as outlined below in Table 35.

Table 34: Training received by MELAD staff in Kiribati

Staff name	Training received
Mr Harry Langley	Landfill and stockpile assessments, interviews, collection and sorting: • Waste audits • Material identification and classification • Plastic resin and product identification • Household interviewing skills • Data-entry skills
Ms Teniti Aro Teem	
Mr Eneri Inatoa	
Mr Teangaubwa Tekinene	
Mr Areieta Temwanne	
Mr Tetabea Akura	
Mr Tootiketa Areke	
Ms Kathelyn Aneli	
Ms Rokonimaeu Eritaia	

Due to the COVID-19 international travel restrictions, a remote training method was developed to instruct local volunteers and staff via a series of Zoom video meetings to MELAD staff members.

The online training was organized across three sessions with the whole team. In preparation for these sessions, one-on-one virtual meetings were conducted between the country coordinator and the project manager (PM). During these meetings, the PM provided an overview of the project activities, methodology used, and the different processes involved in the audit work. The PM and the country coordinator worked through any existing queries prior to the training sessions with the whole team.

The full-team training sessions were approximately three to four hours long and took place over three consecutive days via zoom in one of the conference rooms at the World Bank Office in South Tarawa. The first session gave an overview of the project, which consisted of instruction on the different sorting categories used during the audit process, with specific attention paid to understanding the detailed plastic categories. The PM used interactive games and memory-oriented techniques to help the team members familiarize themselves with the categories to instil more confidence when sorting. At the end of the session, the team was taken through a step-by-step process of downloading and installing the different KoboToolbox forms on their devices for data collection.

The second session began with the team reviewing the sorting and plastics categories from the previous day and working through any questions that may have arisen. A more practical approach was taken for the remainder of the session in order to familiarize the team with how to use the KoboToolbox platform. The team split into groups of two to practise interviewing each other, entering the responses into KoboToolbox and submitting the forms upon completion. The team also went through the landfill entry and tip-face sheets, in preparation for the visual audit that would be undertaken.

The third session allowed the team members to familiarize themselves with the remaining audit processes for the landfill and stockpiles components of the project, along with all the health and safety protocols required, including those specific to the COVID-19 pandemic.

Following the three-day training, the team undertook a practical training session in order to practise the collection and sorting process—from waste characterisation, using the scales and the input of data into the KoboToolbox form. The team completed several days of this practical training, contacting the PM with any queries or concerns throughout the process to ensure all challenges were addressed prior to commencing the actual audit work.

Appendix E: Collection sheet

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	Date [10]	Auditor		Weather			
	Sample number	GPS location recorded?	Photo?	Interview sheet provided?	Interview sheet returned?	Bags provided?	Comments
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							

[10] Please note that the consultant team used an online tool but collected the information below

Appendix F: Sorting categories

Material categories, definition and source of data

C	Category	Description	EOL Source	Incoming
Metal	Aluminium cans	Alcoholic sodas and spirit-based mixers, beer and soft drink, food cans, pet food cans, aerosols, industrial cans	H, C, L	Cu, D
	Aluminium recyclable	Steel packaging	H, C, L	Cu, D
	Steel containers	Alcoholic sodas and spirit-based mixers, beer, soft drink, food cans, pet food cans, aerosols, industrial cans, clean/empty paint cans	H, C, L	Cu, D
	Metal other	100% ferrous items that are not cans/tins/packaging materials, any other steel, beer bottle tops, jar lids, composite ferrous items for which the weight of the ferrous metal is estimated to be greater than the other material items, foils, 100% aluminium items that are not cans/tins/or packaging materials, any other aluminium	H, C, L	Cu, D
Fishing	Fishing/seafood, metal		H, C, L	
	Fishing/seafood, plastic		H, C, L	
	Fishing/seafood, wood		H, C, L	
Paper and cardboard	Cardboard	Cardboard without corrugation (glossy and non-glossy), cereal boxes, business cards	H, C, L	
	LPB	Soy milk cartons, some fruit juice cartons, UHT/long-life milk	H, C, L	
	Composite	Composite paper items for which the weight of the paper is estimated to be greater than the weight of the other materials	H, C, L	
	Paper	Office paper, writing pads, letters, envelopes, books, newspapers, newspaper-like pamphlets, paper, magazines, brochures, wrapping paper, labels, paper packaging (no plastic or wax coating)	H, C, L	
Plastic	PET containers	(Polyethylene) – soft drink, flavoured water, fruit juice, sports drinks, plain water (carbonated/non-carb), food containers, mouthwash containers, detergent bottles	H, C, L	Cu, D
	HDPE containers	(High-density polyethylene) milk and flavoured milk bottles, bleach bottles, oil containers, food containers	H, C, L	Cu, D
	LDPE containers	(Low-density polyethylene) squeeze bottles	H, C, L	Cu, D
	PVC containers	(Polyvinyl chloride) clear cordial and juice bottles, detergent bottles	H, C, L	Cu, D
	PP	Bottles and containers	H, C, L	Cu, D
	EPS	Yoghurt and dairy containers, vending cups, clam shells	H, C, L	Cu, D
	PS	Meat and poultry trays, vending cups, fragile-item packaging	H, C, L	Cu, D
	PP	Bottles and containers	H, C, L	Cu, D
	Flexibles/film	No shopping bags, just chip packets and other MLM packaging	H, C, L	Cu, D
	Other plastic		H, C, L	Cu, D
Single-use plastic items	Beverage containers	Total count from the beverage container sort	H, C, L	Cu, D
	Cigarette butts		H, C, L	Cu, D
	Cigarette packets		H, C, L	Cu, D

C	Category	Description	EOL Source	Incoming
	Straws		H, C, L	Cu, D
	Coffee cups		H, C, L	Cu, D
	Bags – heavy, glossy typically branded carry bags		H, C, L	Cu, D
	Bags – supermarket-type light-weight carry bags		H, C, L	Cu, D
	Takeaway containers plastic other than EPS		H, C, L	Cu, D
	Takeaway containers styrofoam		H, C, L	Cu, D
	Takeaway containers paper		H, C, L	Cu, D
	Takeaway container lids		H, C, L	Cu, D
	Bottle lids		H, C, L	
Batteries	Non-rechargeable batteries	Common batteries, AAA, AA, etc. single-use	H, C, L	
	Rechargeable Batteries	Common batteries (rechargeable), AAA, AA, etc. rechargeable	H, C, L	
	Lead-acid batteries	Large batteries used in vehicles or other machinery	H, C, L	Cu, D
	Mobile phone batteries	Batteries used in mobile phones	H, C, L	Cu, D
	Power tool batteries	Batteries used in power tools	H, C, L	
	Lithium batteries	Small lithium batteries	H, C, L	
	Lithium ion batteries	Batteries used in electric cars	H, C, L	Cu, D
	Other batteries	All other battery types	H, C, L	Cu, D
E-Waste	Computer equipment	Keyboard, monitor, hard drives, printers, etc.	H, C, L	Cu, D
	TVs	TVs	H, C, L	Cu, D
	Mobile phones	Mobile phones, phones, pads, charges, car kits, Bluetooth	H, C, L	Cu, D
	Electrical items and peripherals	Radio, iPod, Gameboys, stereos, speakers, VCR, DVD players, power tools, wiring and cables, small electrical items (toaster, blender, etc.), computer discs, cassettes, DVDs, CDs	H, C, L	Cu, D
	Toner cartridges	Printer and toner cartridges	H, C, L	Cu, D
Glass	Glass bottles	Recyclable (all colours) – beer bottles, wine bottles, spirit cider/fruit-based, flavoured water, fruit juice, sports drinks, plain water	H, C, L	Cu, D
	Glass jars	Non-beverage containers (all colours) – sauce bottles, jam jars, vegetable oils, other food containers	H, C, L	Cu, D
	Glass fines	Mixed glass or glass fines < 4.75 mm	H, C, L	Cu, D
	Glass other	Plate glass (window and windscreen), Pyrex, mirror glass, Corning ware, light globes, laboratory and medical glass, white opaque glass (e.g. Malibu alcohol bottles)	H, C, L	Cu, D
Hygiene	Feminine hygiene	Used disposable feminine hygiene products	H, C, L	
	Pharmaceutical		H, C, L	
	Nappies (diapers)	Used disposable nappies/diapers	H, C, L	

C	Category	Description	EOL Source	Incoming
	Medical waste	Sharps, human tissue, bulk bodily fluids and blood, any blood-stained disposable material or equipment	H, C, L	
	Other sanitary waste		H, C, L	
Organics	Food	Vegetable/fruit/meat scraps	H, C, L	
	Wood/timber		H, C, L	
	Garden organics	Grass clippings, tree trimmings/prunings, flowers, tree wood (< 20 mm diameter)	H, C, L	
	Other organics	Animal excrement, mixed compostable items, cellophane, kitty litter	H, C, L	
Hazardous	Paint	Containers containing paint (dry or wet)	H, C, L	
	Fluorescent tubes	Fluorescent tubes; compact fluorescent lamps (CFLs)	H, C, L	
	Household chemicals	Containers containing bleach, cleaning products, unused medical pills	H, C, L	
	Asbestos	Asbestos and asbestos-containing products or building materials	H, C, L	
	Clinical (medical)	Sharps, human tissue, bulk bodily fluids and blood, any blood-stained disposable material or equipment	H, C, L	
	Gas bottles	Gas bottles	H, C, L	
	Mercury	Mercury used in medical applications	H, C, L	Ministry of Health, hospitals
	Hazardous other	Any other hazardous material	H, C, L	
	Textiles	Wool, cotton and natural fibre materials	H, C, L	
	White goods		H, C, L	Cu, D
	Ceramics		H, C, L	
	Containerized used oil		H, C, L	Cu, Retail
	EOL renewable energy equip	Includes EOL solar panels	H, C, L	Cu, Power company, installers
	End-of-life vehicles		H, C, L	Cu
	Tyres		H, C, L	Cu
	Please describe			

Codes used:

H = Household audit

C = Commercial audit

L = Landfill audit

Cu = Customs

D = Distributors

Appendix G: High-level sorting sheet

APWC: HOUSEHOLD_____ Collection date: _____Sorting Date: _____

		Material Type	Grams	Volume	Count (where possible)
Metals	Aluminium cans				
		Aluminium recyclable			
		Steel containers			
		Metal other			
		Fishing/seafood metal			
		Fishing/seafood plastic			
		Fishing/seafood wood			
		Paper			
		Cardboard			
		Composite (mostly paper)			
		Liquid paperboard			
		PET containers			
		HDPE containers			
		LDPE containers			
		PVC containers			
		PP			
		EPS			
		PS			
		PP			
		Flexibles/Film			
		Other plastic			
		Beverage containers			
		Cigarette butts			
		Cigarette packets			
		Straws			
		Coffee cups			
		Bags – heavy glossy typically branded carry bags			
		Single-use plastic items			
		Bags – supermarket light weight carry bags			
		Takeaway containers plastic other than EPS			
		Takeaway containers paper			
		Takeaway container lids			
		Bottle lids			
		Glass			
		Glass bottles			
		Glass jars			
		Glass fines			
		Glass other			
		Hygiene			
		Feminine hygiene			
		Pharmaceutical			
		Nappies (diapers)			
		Medical waste			
		Other sanitary waste			
		Organics			
		Food			
		Wood/timber			
		Garden organics			
		Other organics			
		Textiles			
		Ceramics			
		Hazardous			

		Paint			
		Fluorescent tubes			
		Household chemicals			
		Asbestos			
		Clinical (medical)			
		Gas bottles			
		Hazardous other	specify		
		Batteries			
		Non-rechargeable batteries			
		Rechargeable batteries			
		Lead acid batteries			
		Mobile phone batteries			
		Power tool batteries			
		Lithium batteries			
		Lithium ion batteries			
		Other batteries			
		E-waste			
		Computer equipment			
		TVs			
		Mobile phones			
		Electrical items and peripherals			
		Toner cartridges			
		Other (specify)	specify		

Appendix H: Detailed list of container categories

BEVERAGE CONTAINER ONLY FURTHER SORT			
	<500	500-1500	>1500
Alumimium			
Alcoholic sodas & spirit-based mixers			
Beer/cider			
Water			
flav water/soft drink (carbonated)			
flav water/soft drink (non-carb)			
Food (human)			
Food (dog and cat)			
Other			
Steel			
Alcoholic sodas & spirit-based mixers			
Beer			
cider/fruit based etc			
flav water/soft drink (carbonated)			
flav water/soft drink (non-carb)			
Other			
LPB			
milk			
flavoured milk			
fruit juice (>90% fruit &/or Veg juice)			
fruit drink			
flav water/sports drink, non-carb			
Beauty and personal care			
Home care (including cleaning)			
Other			
PET			
milk			
drink pouches			
flav. Milk			
flav water/ sports drink etc (non-carb)			
flav water/soft drink (carbonated)			
plain water (carbonated or non-carb)			
fruit juice (>90% fruit &/or Veg juice)			
fruit drink			
Beauty and personal care			
Home care (including cleaning)			
Other			
HDPE			
milk			
drink pouches			
flav. Milk			
flav water/ sports drink etc (non-carb)			
flav water/soft drink (carbonated)			
plain water (carbonated or non-carb)			
fruit juice (>90% fruit &/or Veg juice)			
fruit drink			
Beauty and personal care			
Home care (including cleaning)			
Other			
Other Plastic			
milk			
drink pouches			
flav. Milk			
flav water/ sports drink etc (non-carb)			
flav water/soft drink (carbonated)			
plain water (carbonated or non-carb)			
fruit juice (>90% fruit &/or Veg juice)			
fruit drink			
wine bladders			
Beauty and personal care			
Home care (including cleaning)			
Other			
Glass			
Alcoholic sodas/spirit-based mixers			
Beer			
Cider/fruit based etc			
Flav water/soft drink (carbonated)			
Plain water (carbonated or non-carb)			
fruit juice (>90% fruit &/or Veg juice)			
fruit drink			
Wine (glass only)			
Wine cooler			
Spirit			
Beauty and personal care			
Home care (including cleaning)			
Other			

Appendix I: Landfill gate entry sheet

Date							
Time	**Type of vehicle**	**Waste type**	**Company**	**Premises type**	**Location**	**Size**	**Plate#**
	F / P / V / C / S / O	Tr / W /M /Mat/Ty/WG/Gr/B/O		Hhl/Shop/Acc/C&D/Of/Caf/PWC/Ch/E/M	1 / 2 /3		
	F / P / V / C / S / O	Tr / W /M /Mat/Ty/WG/Gr/B/O		Hhl/Shop/Acc/C&D/Of/Caf/PWC/Ch/E/M	1 / 2 /3		
	F / P / V / C / S / O	Tr / W /M /Mat/Ty/WG/Gr/B/O		Hhl/Shop/Acc/C&D/Of/Caf/PWC/Ch/E/M	1 / 2 /3		
	F / P / V / C / S / O	Tr / W /M /Mat/Ty/WG/Gr/B/O		Hhl/Shop/Acc/C&D/Of/Caf/PWC/Ch/E/M	1 / 2 /3		
	F / P / V / C / S / O	Tr / W /M /Mat/Ty/WG/Gr/B/O		Hhl/Shop/Acc/C&D/Of/Caf/PWC/Ch/E/M	1 / 2 /3		
	F / P / V / C / S / O	Tr / W /M /Mat/Ty/WG/Gr/B/O		Hhl/Shop/Acc/C&D/Of/Caf/PWC/Ch/E/M	1 / 2 /3		
	F / P / V / C / S / O	Tr / W /M /Mat/Ty/WG/Gr/B/O		Hhl/Shop/Acc/C&D/Of/Caf/PWC/Ch/E/M	1 / 2 /3		
	F / P / V / C / S / O	Tr / W /M /Mat/Ty/WG/Gr/B/O		Hhl/Shop/Acc/C&D/Of/Caf/PWC/Ch/E/M	1 / 2 /3		
	F / P / V / C / S / O	Tr / W /M /Mat/Ty/WG/Gr/B/O		Hhl/Shop/Acc/C&D/Of/Caf/PWC/Ch/E/M	1 / 2 /3		
	F / P / V / C / S / O	Tr / W /M /Mat/Ty/WG/Gr/B/O		Hhl/Shop/Acc/C&D/Of/Caf/PWC/Ch/E/M	1 / 2 /3		
	F / P / V / C / S / O	Tr / W /M /Mat/Ty/WG/Gr/B/O		Hhl/Shop/Acc/C&D/Of/Caf/PWC/Ch/E/M	1 / 2 /3		
	F / P / V / C / S / O	Tr / W /M /Mat/Ty/WG/Gr/B/O		Hhl/Shop/Acc/C&D/Of/Caf/PWC/Ch/E/M	1 / 2 /3		
	F / P / V / C / S / O	Tr / W /M /Mat/Ty/WG/Gr/B/O		Hhl/Shop/Acc/C&D/Of/Caf/PWC/Ch/E/M	1 / 2 /3		
	F / P / V / C / S / O	Tr / W /M /Mat/Ty/WG/Gr/B/O		Hhl/Shop/Acc/C&D/Of/Caf/PWC/Ch/E/M	1 / 2 /3		
	F / P / V / C / S / O	Tr / W /M /Mat/Ty/WG/Gr/B/O		Hhl/Shop/Acc/C&D/Of/Caf/PWC/Ch/E/M	1 / 2 /3		
	F / P / V / C / S / O	Tr / W /M /Mat/Ty/WG/Gr/B/O		Hhl/Shop/Acc/C&D/Of/Caf/PWC/Ch/E/M	1 / 2 /3		

F = flatbed/ **P** = pickup / **V** = van / **C** = compactor (dump truck) / **S** = sedan / **O** = other

Hhl=household self-haul/**Shop** = any commercial including shopping centre/**Acc** = resort, hotel, apartments/**C&D**/**Of** = office/**Caf** = food outlet/**PWC** = private waste collector/ **Ch** = charity / **E** = educational institution/ **M** = municipal waste

Tr = trash / **W** = wood/**M** = metal/**Mat** = mattresses/ **Ty** = tyres/**Gr** = green waste/**WG** = white goods/**B** = batteries/**O** = other

Appendix J: Landfill audit sheet

Date	Time	Location		
Time				
Plate number				
Type of vehicle	F / P / V / C / S / O	F / P / V / C / S / O	F / P / V / C / S / O	F / P / V / C / S / O
Size of load				
Source	Hhl/Shop/Acc/C&D/ Of/Caf/PWC/Ch/E/M	Hhl/Shop/Acc/C&D/ Of/Caf/PWC/Ch/E/M	Hhl/Shop/Acc/C&D/ Of/Caf/PWC/Ch/E/M	Hhl/Shop/Acc/C&D/ Of/Caf/PWC/Ch/E/M
Compaction (Circle)	H M L	H M L	H M L	H M L
Green bags of rubbish				
Other bags of rubbish				
Paper - recyclable				
Paper - non-recyclable				
Cardboard				
Food / kitchen				
Nappies (diapers)				
Dead animals				
Vegetation/garden				
Stumps, logs (10 cm diameter +)				
Wood – furniture, painted wood				
Wood – chipboard, MDF				
Wood – pallets				
Wood – board/pole, untreated				
Wood – board/pole, treated				
Covered furniture				
Carpet and underlay				
Textiles – clothing / cloth				
Textiles – composite (shoes, bags)				
Mattresses - spring				
Rubber – tyres				
Rubber/foam				
Glass – containers recyclable				
Glass – plate/other				
Plastic – containers recyclable				
Plastic – plastic bags and film				
Plastic – polystyrene foam				
Plastic – other				
Metals – recyclable containers				
Metals – ferrous (steel)				
Metals – non-ferrous				
Concrete/cement				
Bricks				
Tiles				
Plasterboard				

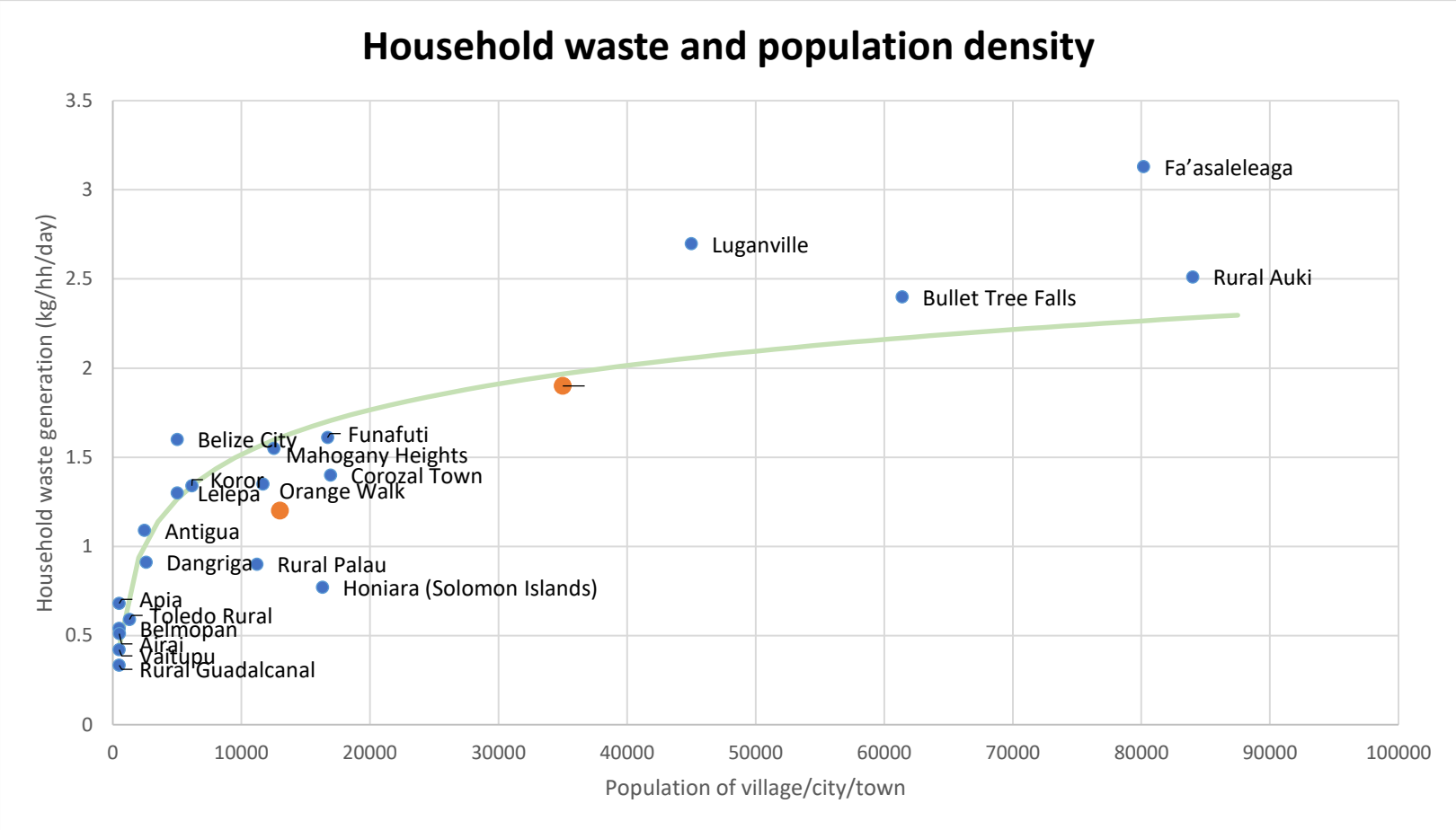
Clean fill				
Rock/dirt/soil/sand				
Asphalt				
Sludge				
Toner cartridges vol				
Electrical large, i.e. white goods				
Electrical medium, i.e. televisions				
Electrical small, i.e. blender				
Insulation				
End-of-life vehicles				
EOL renewable energy equip.				
Paint				
Gas bottles				
Containerized used oil				
Other – organic				

Appendix K: Stockpile assessment sheet

Date
Location of stockpile
Photo taken

Material type	☐ Cars ☐ Heavy machinery ☐ Solar Panels ☐ Boats ☐ Gas bottles – acetylene ☐ Gas bottles – oxygen ☐ Gas bottles – cooking ☐ 44 gallon drums ☐ Containers (20 ft) ☐ Containers (40 ft) ☐ Used oil ☐ Iron roofing material ☐ Aluminium cans ☐ Plastic water tanks
Volume of stockpile	
Number of items in stockpile	
Weight of one item (if possible)	
Comments	

Appendix L: Household waste and population density at APWC-audited cities and townships



Appendix M: Name and location commercial premises sampled

Table 35: Food outlets sampled on Tarawa

Business name	Location
Capital Chinese Restaurant	Betio, Tarawa
Betio Lodge Restaurant	Betio, Tarawa
The George Restaurant	Betio, Tarawa
CPPL Restaurant	Bairiki, Tarawa
Mary's Restaurant	Bairiki, Tarawa
Elizabeth Restaurant	Teao, Tarawa
Pacific Chinese Restaurant	Banraeba, Tarawa
Bikenibeu Chinese Restaurant	Bikenibeu, Tarawa
Paradise Restaurant	Bikenibeu, Tarawa
Nei Kaitibo's fast food	Bonriki, Tarawa

Table 36: Admin/office outlets sampled

Business name	Location
MISE	Betio, Tarawa
KOIL	Betio, Tarawa
KCDL	Betio, Tarawa
OB	Bairiki, Tarawa
BPA	Bairiki, Tarawa
MFED	Bairiki, Tarawa
KOES	Ambo, Tarawa
MELAD	Bikenibeu, Tarawa
MoE	Bikenibeu, Tarawa
MHMS	Bikenibeu, Tarawa

Table 37: Supermarkets sampled

Business name	Location
MOEL	Betio, Tarawa
Wishing Star	Betio, Tarawa
LEE's Store	Betio, Tarawa
Punjas	Betio, Tarawa
Slim Price	Bairiki, Tarawa
Taotin HQ	Teao, Tarawa
Fair Price	Teao, Tarawa
LMTA supermarket	Antebuka, Tarawa
Coral Ace	Abarao, Tarawa
I-Mart	Bikenibeu, Tarawa

Table 38: Hotels sampled in Tarawa

Business name
The George Hotel
Betio Lodge
Mary's Motel
The George Bungalow
Fema Lodge

Utirerei Hotel
Dreamer's Guest House
Tobaraoi Travel Guest House
TAD's Lodge
Eniita's Motel

Table 39: Retail outlets sampled in Tarawa

Business name
Tateraka's store
Bonteman's store
Auribwa's store
Teuamori's store
Rakentai's store (opp USP)
Ataia's store (Green double story)
Teimi's store
Bweman's store
Bikenibeu Soccer field store
Causeway store

Table 40 Public Bars sampled in Tarawa

Business name
Seaman
Marina
Tiktok
Freddy's
Fab Ace
The George Bungalow
Ambo Lagoon
Tekeraoi public bar
Slim Price
Kaitibo's bar