Tuvalu – Waste Audit Report

Including analysis of waste generation and disposal data collected in September 2019

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Executive Summary

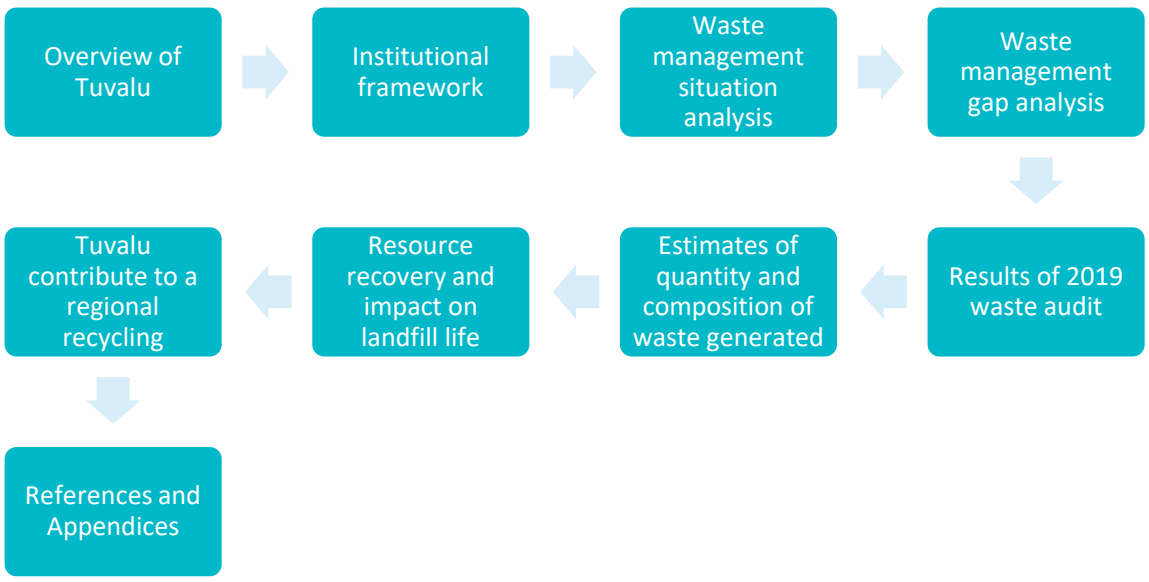
About PRIF

PRIF 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. 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 (US) and the World Bank Group.

About this project

As part of its applied research activities, PRIF has been researching the benefits and challenges of establishing a regional recycling network for the Pacific. Among the benefits considered is a gradual evolution of Pacific Island countries (PICs) from linear economies to more sustainable circular economies. Such circular economies would also foster community engagement, stimulate more responsible behaviour related to environmental impacts, and provide numerous opportunities for public–private partnerships and employment.

In 2019, PRIF engaged consultants Anne Prince, Dr Amardeep Wander, Faafetai Sagapolutele and Geoffrey Thompson to conduct a waste data collection and scoping study to ascertain the potential contribution of materials from Tuvalu towards the feasibility of establishing a recycling network hub in the Eastern Pacific region. The project included undertaking waste audits in Funafuti and Vaitupu. This report presents the findings of the study and includes the following:



Summary of Project results

Summary of Audit activities	• 197 household samples collected and sorted
	• 25 Commercial samples collected and sorted
	• 8 local government staff trained
	• Data collected from two islands – Funafuti and Vaitupu
	• Landfill audit completed over the course of 6 days covering Monday – Saturday
	• Data collected for the following:
	  • Nappies
	  • Green Waste
	  • Food Waste
	  •Stockpiles

Waste generation rates- Funafuti	• Between 6-10m^3 of household waste entering the landfill per day • 750-1000m^3 of non-household entering the landfill per day • Almost 3000kgs of waste generated in Funafuti daily
Stockpiles in Funafuti	• 240 pieces of materials amounting to 1126m^3 and weighing approximately 220 tonnes are currently stockpiled in Funafuti • Data shows that this accounts for 96% of EOL vehicles, 40% of E-waste and 86% of lead acid batteries generated annually. • The E-Waste and lead acid batteries are stockpiled at the TS leading to ease of recovery when transport options are available.
Materials of interest- generation	• Almost 1642 tonnes and 7000m^3 of materials of interest are generated in Tuvalu (all islands) each year. • Please note this is subject to change with more customs data

Reduction in waste going to landfill-bans	The banned single use plastic items represent 6% of the material currently entering the waste stream and approximately 253 to 421 m^3 of material that will not be required to be managed at the landfill.
Recovery of recyclables-levies	If 100% of the levied items are able to be recovered, 14% of the current waste stream will be diverted from landfill for resource recovery. This represents between 781 (at 75% recovery rates) to 1042 m3 of uncompacted materials that Tuvalu will need to store, compact and process before making it available for shipping overseas for recycling.
Recovery of recyclables-potential future projects	Recyclable materials that are not currently being considered through any recycling or recovery scheme account for almost 30% of the waste stream. Future projects involving recovery of cardboard offer the highest savings in landfill space and more than 20% diversion from landfill.
Landfill life	• Given no recovery and a density of 400 kg/m^3, it is estimated that an additional 11,000 m^3 landfill opened in January 2020 would be full by 2025, or 5 years after it opened. • Recovering all identified additional materials not currently covered by legislation extends this life by another 1.5 years, or until mid-2026. • Compaction to 600 kg/m^3 under the existing recovery regime yields a lifespan extension about 0.5 years longer than additional recovery. • At the extreme end, recovering all identified materials and compacting the landfill to 800 kg/m^3 extends the lifespan until around 2032, an extra 7 years.

Two potential projects

- Cardboard recycling/reuse- locally (composting/Briquettes)
- Compostable nappy trial

Challenges for Tuvalu

- Lack of landfill space and
- Inability to move or transport materials to appropriate markets.
- Lack of financial, human resources and capacity to successfully implement activities including enforcement and collection of data
- Lack of proper equipment to deliver new initiatives and high costs of equipment procurement and maintenance.
- Transportation of Recyclable materials from Outer Islands
- No proper storage facility for Hazardous waste

Tuvalu's ability to contribute to recycling network

Based on site visits, meetings with officials, audits and a review of the current legislative framework, the consultants believe that Tuvalu is ready and will be able to contribute fully to the operation of a regional recycling network. The key reasons are as follows:

- A legislative framework is already in place to recover recyclable materials;
- Pressure to undertake recycling activity due to diminishing landfill space;
- Capable staff who are committed to better waste management outcomes and can be trained to participate in recycling network activities; and
- A framework of infrastructure reforms currently underway that will allow for the collection and compaction of materials effectively.

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Acronyms

ACRONYMS	
APWC	Asia Pacific Waste Consultants
CDS	container deposit scheme
DMP	Department of Marine and Ports
DOE	Department of the Environment
DoW	Department of Works
DWM	Department of Waste Management
EU	European Union
EEZ	Exclusive Economic Zone
J-PRISM	Japanese Technical Cooperation Project for Promotion of Regional Initiative on Solid Waste Management
JICA	Japanese International Cooperation Agency
Kaupule	Executive arm of island assembly of elders, similar to a local council
MHARD	Ministry of Home Affairs and Rural Development
MSW	municipal solid waste
NGO	Non-Government Organisation
NZ	New Zealand
PET	Polyethylene terephthalate
PICS	Pacific Island Countries
PRIF	Pacific Region Infrastructure Facility
PV	Photo-voltaic
SAMOA	Small Islands Developing States Accelerated Modalities of Action Pathway
SID	Small Island Developing States
SPREP	Secretariat of the Pacific Regional Environment Programme
SPC	Secretariat of the Pacific Community
DSW	Solid Waste Agency of Tuvalu
SWM	solid waste management
TIWPAP 2017–2026	Tuvalu Integration Waste Policy and Action Plan: Towards Cleaner and Healthier Islands 2017–2026
TLF	top level domain
UNEP	United Nations Environment Program
uPOPs	Unintentional Persistent Organic Pollutants
WMPC	waste management and pollution control

1 Introduction

1.1 Project need

Capacity building within Pacific Island communities (PICs) is a key priority to help deal with the growing problem of waste management and the prevention of land- and marine-based litter. The implications of pollution on marine ecosystems have been widely studied, however the impact on human health remains poorly characterised. Human health impacts are perceived to be an emerging problem, requiring increased scrutiny and attention (Seltenrich, 2015; Ocean Conservancy and International Coastal Cleanup, 2014). There is increasing urgency among industry, government, non-governmental organisations and environmental groups to develop tools and policies to track, capture and recycle waste (particularly plastics) before it reaches the oceans.

PICs face unique and significant obstacles in the development and implementation of sustainable waste management solutions to address and combat litter in terrestrial and marine environments. Organic waste, waste oils and waste from shipping and cruise liners also produce a unique challenge for the area. Globalisation, including increased affluence and consumer-based lifestyles with heavy reliance on imported goods, has had a substantial impact on the amount of waste generated within communities. The waste challenges for island communities are considerable, due in large part to geographic location and physical size coupled with lack of suitable land availability for waste management solutions such as transfer stations, waste treatment and disposal sites, and recycling and reuse facilities. Other obstacles, including the topography and location of some communities, and resourcing and infrastructure limitations, mean that many communities have limited or no access to sustainable waste management, especially those in remote locations. As a result, waste is often dumped, burned or buried, leaving it susceptible to dispersal into the environment.

Recycling on PICs is of great importance. The total available land mass is hugely problematic for PICs, with many countries unable to extend current landfills or dumping sites nor develop new sites owing to lack of space. Immediate improvements in solid waste management systems are crucial to ensuring the health of island residents and the environment. Recycling initiatives in PICs such as Palau and Kiribati have had a positive impact, reducing the waste-to-landfill volume and relieving pressure on the limited end-of-life landfill space. Encouraging the 3Rs plus return (reduce, reuse, recycle and return) prevents and minimises waste generation and pollution.

Additionally, several factors combine to make shipping services to and from PICs relatively expensive, including long distances between ports and low trade volumes, which make it difficult to take advantage of economies of scale. There is a widely variable quality of port facilities, with a general lack of major cargo-handling infrastructure which mandates the use of relatively expensive, geared container vessels (i.e. with on-board cranes). Often extreme trade imbalance exists, with exports far outweighed by imports (Cleaner Pacific 2025), leading to costly container repositioning (Asian Development Bank 2007). These challenges combine to raise the costs of goods and the costs of returning recyclable commodities to foreign recycling facilities. In addition, poor segregation,

especially in outer island communities and an absence of local demand for local recyclable goods, has resulted in lack of market for recyclables in Tuvalu.

As an atoll island with limited land resources, Tuvalu faces several challenges delivering and expanding current waste management systems. In addition to land barriers and space restrictions, there are several complications for a waste management industry in Tuvalu. The private sector is small and has limited capacity in terms of equipment and other resources. Like many of its neighbouring PICs, Tuvalu is at a critical point, with landfill space close to capacity and limited systems in place for recycling and recovery of recyclable materials, especially plastics, glass and bulky waste. Although Tuvalu currently receives funding for waste management initiatives, there is no guarantee that this funding will continue. The government has limited revenue to invest in waste management infrastructure developments. It is anticipated that the introduction of a waste levy to cover beverage containers, some bulky waste such as large appliances and cars and other source-separated recyclables should provide an income stream and create a continuing market for recyclables, reducing dumping of waste and the relieving the pressure on landfill space.

1.2 PRIF regional recycling hub study

PRIF has been researching the benefits and challenges of establishing a regional recycling network for the Pacific with a possible hub located in the region as PICs move from a linear to a circular economy. Opportunities to improve social, environmental and economic outcomes have been identified, however the absence of reliable data is a key constraint to both the design phase and to attracting public-private partnerships.

In 2017–18, PRIF commissioned a research study to identify and quantify the opportunity to improve the resource recovery of 15 primary recyclable commodities present in the solid waste stream in 15 PICs and territories. The recommendations of the project were a pre-feasibility study to determine the viability of establishing a regional network to allow for recovery, consolidation, processing and shipment of recyclables from a network of surrounding islands.

Whereas the PRIF (2018) study focused mostly on the export and import material flows of PICs, more information on standardised country data for solid waste production, collection, treatment, and disposal is required, along with more detailed analysis of institutional readiness and the infrastructure required in each country to make the recycling network viable.

The pre-feasibility study has now been approved, with the first stage of the assignment required to collect and assess the information from detailed waste audits to inform the viability of the broader PRIF's 'Scoping Study for the Regional Recycling Network for the Eastern Pacific Region'.

This pre-feasibility study will establish the viability of the pilot recycling network in the eastern region, using Suva as the regional recycling hub. The pilot recycling network will be planned and implemented

in one region in order to prove viability and sustainability. This would require the establishment of a regional processing, transhipment and recycling hub, suitable urban centre facilities, and scaled outer island storage facilities in each of the PICs associated with the regional hub. Within the context of this proposal, the PRIF report recommends the eastern region, with a Fiji-based regional recycling hub located in Suva. This proposal is based on an assessment of port facilities, capacity, shipping networks and other economic aspects. Under the pilot program, Suva would receive a selected range of recycled waste materials (RWM) from Tonga, Samoa, Tuvalu, Cook Islands, Kiribati, Niue and Vanuatu to supply current/future remanufacturing enterprises and to aggregate and add value to shipments of recyclables to other destinations.

The pilot project will require development partner investment to construct infrastructure and implement regional institutional capacity and economic development programs to support the recycling network. The program will enable a proof of concept to build PIC, private sector and donor confidence. It will aim to transform a linear economy to a circular economy, relying on extensive community engagement and behavioural change, including the development of public-private partnerships.

The overall objective of the study is to scope the establishment of a first node of a regional recycling network in the Pacific and to recommend the infrastructure and policy interventions required. The first phase will collect all information and datasets necessary to propose preliminary arrangements, detail the socio-economic benefits of the hub and the network, and will propose a roadmap of activities that may receive support or funding from PRIF members and stakeholders.

This pilot project seeks to devise a waste audit methodology to capture consistent, reliable, robust data that can subsequently be used to inform future decisions across the region and within Tuvalu. It will aim to increase both recycling and recovery of used materials and reduce the reliance on landfill.

Waste audits of materials delivered to landfill were assessed by weight, count and volume for both household and commercial premises.

1.3 This report

Consultants Anne Prince, Amardeep Wander and Faafetai Sagapolutele were engaged to conduct a scoping study to assess current waste management practices in Tuvalu in order to establish a first ‘hub’ of a regional recycling network in the Pacific. The consultants were also employed to recommend the infrastructure and policy interventions required and to undertake an audit of the materials being generated. Tuvalu is the first of the six South Pacific countries where this programme aims to deliver direct results. The project deliverables were focused in two areas (listed below):

a) Waste audits

Waste audits were required to inform the feasibility of a recycling network, as well as an assessment of the institutional capacity of the PICs to play an effective role in this network. The Tuvalu project is a pilot, where the waste audit methodology developed by the consultants is being used to ascertain if it serves as an appropriate model for all future waste audits across the other PICs and to ensure comparable data. In addition, a data collection system has been employed which incorporates external agency requirements to help facilitate data sharing between all stakeholders and PICs. All data will be uploaded to SPREP's INFORM database.

b) Institutional assessment

An assessment of the capacity both public institutions and the private sector have in establishing a regional recycling network was completed, including a review of the regulatory framework and assessment-ready matrix. This involved undertaking extensive consultations with various government departments and the private sector to determine the appetite for such an initiative. Perspectives on the benefits, risks and challenges of a regional recycling solution were gathered and are included within this report.

This report is the final deliverable under the project. The report starts with a brief literature review summarising the current waste management practices in Tuvalu. It comments on the current infrastructure available and provides an analysis of the waste being generated and disposed of in Tuvalu. The table below lists the various sections of the report and the relevant content to help the reader determine the most relevant section for their pursual.

Table 1: List of sections in this project

Section	Heading	Detail
1 & 2	Introduction and summary	These sections summarise the project need and background as well as provide a country profile for Tuvalu.
3	Institutions, projects and challenges	This section describes the current institutional arrangement in Tuvalu and also lists the projects that are currently underway as well as the potential challenges faced by Tuvalu for waste management
4	Method	This section describes the methodology for data collection in detail
5	Summary	Snapshot of the overall data collected as a result of this audit
6	Results	This section summarises the total generation rate of waste on Tuvalu for both households and commercial premises.
7	Total quantities of materials generated	This section lists the total quantities in tonnes and m^3 that are generated on each island of Tuvalu based on the current consumption trends as well as the audit of the current waste generation habits.
8	Capturing available material	This section summarises the quantities that are able to be captured for recycling based on the current legislative regime and with available

		infrastructure as well as provides some suggestions for future projects that can possibly lead to better resource recovery.
9	Landfill life	How will the quantities of waste that are being currently generated impact on the life of the landfill. The analysis has been performed based on compaction being available and not being available.
10	Potential future projects	Two projects that would lead to a high level of diversion of waste from landfill and can be undertaken independently of the recycling hub study are defined.

The final section of the report uses data and information gathered in-country to ascertain the amount of recyclable materials that can be captured and transported to a regional recycling hub for international markets. Tuvalu's ability to capture and move this material through legislative reform has also been assessed using a readiness matrix. The results section also provides a commentary on the use of the proposed methodology to undertake future waste audits in PICs.

2 Overview of Tuvalu

The consultants were able to draw upon previous work completed by SPREP, the J-PRISM project and EDF 11 projects to understand the current state of waste management for all islands in Tuvalu and the literature review draws heavily on the baseline report for Tuvalu prepared in 2017.

2.1 Background

Formally known as the Ellice Islands or Lagoon Islands, Tuvalu is situated in the Polynesia region of the Western Pacific Ocean, nestled between Fiji, 1,100 kilometres to the north and Kiribati, 250 kilometres to the south. The country spreads across a 676-kilometre arch in the central Pacific and comprises of nine islands (three reef islands and six low-lying atolls). The fourth smallest nation in the world, the total coastline extends 24 kilometres, encompassing a combined total land area of the Tuvalu island group of 25.6 kilometres (Tonkin & Taylor 2005 – Tuvalu Integrated Waste Policy).

Tuvalu means 'eight standing together' (one of the island groups has very little land at sea level). There is currently no point higher than 4.5 metres above sea level across the entire nation. Due to the counties low-lying geography, the effects of climate change pose an ongoing and real risk of submergence, with Tuvalu becoming the world's first nation to be faced with such risk. In 1989, the United Nations (UN) stated the Pacific country was at risk and most likely to disappear beneath the sea in the twenty-first century due to global warming.

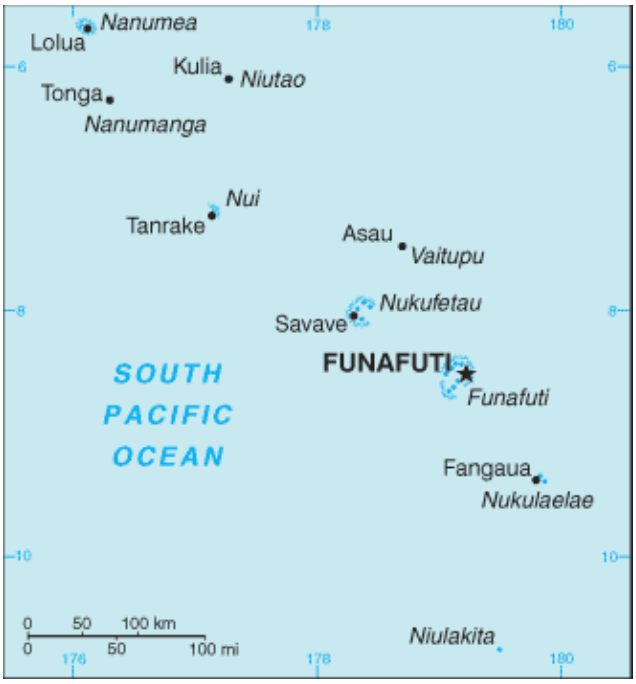


Figure 1: Tuvalu

(Source https://en.wikipedia.org/wiki/Geography_of_Tuvalu#/media/File:Tv-map.png

Tuvalu gained independence on 1 October 1978. The capital, Fongafale Islet, is located on the main islands of Funafuti. The nine islands, from north to south, are:

- Nanumea
- Niutao
- Nanumaga (formerly Nanumanga)
- Nui
- Vaitupu
- Nukufetau
- Funafuti
- Nukulaelae
- Niulakita

The country's exclusive economic zone (EEZ) reaches 259,000 km^2, nearly 200 per cent larger than the land mass.

2.1.1 Climate

The average daytime temperature in Tuvalu ranges between 29°C to 31°C. The country is said to be one of the most fragile and vulnerable environments in the Pacific region. It is at high risk from the effect of cyclones in addition to projected rise in sea level, increased ocean temperature and ocean acidification. In 2015, Cyclone Pam caused significant damage to agricultural land and infrastructure across the country. Flooding affected seven of the nine islands, displacing approximately 10,000 people.

Tuvalu has no streams or rivers, therefore dependence on rainwater is critical. Higher sea levels have threatened the underground water table. A state of emergency was called by the government of Tuvalu in 2011 after a six-month period of no rainfall led to extreme water shortages. After this event, 10,000-litre water tanks were installed to capture rainfall and prevent further water shortages.

2.2 Socio-economic background

The languages spoken include Tuvaluan (a Polynesian language close to Samoan) and English.

According to the latest census conducted in 2012, the total population of Tuvalu is approximately 10,837, with a consistent increase of 0.2% annually. The majority (57.2%) of the population was based on Funafuti. The population density was 423 per km^2.

In 2017, a mini census was conducted and found that national population was 10,507 (excluding 138 visitors or non-residents), a decrease of -1.3%, annual growth rate -0.3% per annum. The population density decreased to 410 per km^2 in 2017.

Table 2: Population of Tuvalu's Islands: 2012 and 2017

Island	Area (km^2)	2012 Population	2017 Population
Nanumea	3.87	1,676	1,603
Nanumaga	2.78	1,217	1,229
Niutao	5.53	1,450	1,402
Nui	2.83	1,054	1,034
Vaitupu	5.6	2,086	1,860
Nukufetau	2.99	1,399	1,322
Funafuti	2.79	1,171	1,340
Nukulaelae	1.82	537	568
Niulakita	0.42	247	31
Other			118
Total	**28.63**	**10,837**	**10,507**

(*Source: Tuvalu census 2012 and mini-census 2017*)

Funafuti Atoll is currently under severe population pressure, with urbanisation increasing significantly over the past 25 years. The population density of the atoll has increased from 1,600 in 2002 to more than 2,220 per km^2 in 2012[1]. Ninety-eight per cent (98%) of the population of Funafuti reside on Fogafale islet; here, the population density rises to 4,225 per km^2.

Two-thirds of the population relies on subsistence farming and traditional fishing. Coconuts, bananas and breadfruit are the main local products. According to government statistics (2017), 26% (or 2,800) people live below the poverty line.

Currently, 50% of all electricity is derived from renewables in Tuvalu. The country is committed to achieving 100% renewable energy of power generation by 2025.

2.2.1 Imports and exports

Tuvalu has a small and fragile economy and relies on the goodwill and generosity of aid donors.

The Tuvalu currency is the Australian dollar and the Tuvaluan dollar. The OEC reports that during 2017 Tuvalu exported $4.02 million worth of goods to Japan, France, Bonsai and Herzegovina, the United States and Australia.[2] Fifty per cent (50%) of all exports during this period were non-filleted (whole)

[1] GOVERNMENT OF TUVALU (2017).TE KAKEEGA I I I National Strategy for Sustainable Development 2016–2020

[2] OEC.world. (n.d.). OEC - Tuvalu (TUV) Exports, Imports, and Trade Partners. [online] Available at: https://oec.world/en/profile/country/tuv/

frozen fish totalling $2.01 million (99.3% to Japan and 0.66% to Oceania), followed by aqueous paints, polyacetals and laboratory reagents. In the same year, imports amounting to $35.6 million resulted in a negative trade balance of $31.6 million. Imports have decreased during the past five years, from $54.2 million in 2012 to $25.6 million in 2017. The top import origins include China, Fiji, South Korea, Chile and South Africa. Refined petroleum ($8.41 million) is the most popular import, followed by iron structures, fishing ship, gravel and crushed stone.

The GDP in 2017 was $39.7 million, with GDP per capita at $3,920. According to the Tuvalu Government's 2019 national budget, the nation is currently experiencing an unprecedented number on consecutive years of economic growth. It is suggested that this may be a direct result of the large number of infrastructure projects currently funded by the government and co-funded and administered by development partners. The GDP for 2019 is expected to rise from $44.9 million to $46.9 million in 2020 and remain above 4% until 2021 (Minister for Finance and Economic Development, 2018).

The import and export of goods is by air or sea. One shipping company operates services for Tuvalu through Fiji.

3 Institutional framework (Tuvalu)

3.1 National Government

Tuvalu is a parliamentary representative democratic monarchy. Her Majesty Queen Elizabeth II of Great Britain is the head of state and is represented by a governor-general. The prime minister of Tuvalu is the head of government and is elected by parliament. There a no political parties. Fifteen members of parliament are each elected for a four-year term.

The country is divided into seven island councils and one town council, each consisting of six elected members known as the *Falekaupule*, including a president. Customary law continues and has an important role within the institutional framework of Tuvalu. It has effect as law under the *Laws of Tuvalu Act 1987* except where it is inconsistent with an Act of applied law or legislation.

Eight of the nine islands are ruled by a traditional Council of Chiefs. Niutao represents the inhabitants of Niuakiat as the least populated island and 2% of the overall population of Tuvalu. Falekaupule is the traditional assembly in each island and composed with the Aganu (traditional local customs and usages of an island). The Kaupule acts as the executive arm of the Falekaupule on each island. Comprised of six members, the Kaupule performs all the functions conferred on the Falekaupule (Secretariat of the Pacific Regional Environment Programme (SPREP) and EDO NSW, 2018). Meetings are conducted in community meeting houses known as *maneapa*.

The *Tuvalu Integration Waste Policy and Action Plan: Towards Cleaner and Healthier Islands 2017–2026 (TIWPAP 2017–2026)* suggests that for the government to achieve the strategic goals of the

plan, it must ensure the institutional and organisational structure of the waste section is properly set up, and create, amend and update laws, regulations and policies to ensure orderly delivery of waste services (Government of Tuvalu, 2016).

A recent review of TIWPAP 2017–2026 found that a new organisational structure had been agreed and implemented, with 21 new positions identified, confirmed salaries and wages, and recruitment the processes implemented. In addition, the Tuvalu government has recently implemented three new regulations designed to prohibit the import of single-use plastics to address littering and put in place a waste levy deposit regulation.

To further show strengthening of the institutional system aimed to address gaps in waste management, each outer island has either passed or in the process of passing new waste bylaws based on the national waste law. There are several court cases pending relating to illegal dumping and littering. A waste management budget allocation has secured an increase of at least 2.5% per year, and land leases for waste facilities have been successfully achieved.

3.1.1 Establishing new laws and bylaws

Proposed laws or bills may be introduced by any member of parliament. Once introduced, the bill has its first reading at the following session of parliament. The Clerk of Parliament then circulates the bill to the Falekaupule or Kaupule for consideration and comment. However, on the advice of the cabinet, the prime minister can circumvent this process in the case of urgency or if the bill is considered to not be of public importance.

Bills are passed through a majority vote; the speaker has the casting vote. On the presentation to the Head of State, the bill becomes an Act of Parliament, whereby policies, action plans and strategies are written by the relevant government department.

Under the *Faekauple Act 1997*, the Kaupule can make bylaws in relation to any matter and perform the function under section 15(2) of the *Waste Operations and Services Act 2009*. The process for proposing a bylaw is as follows;

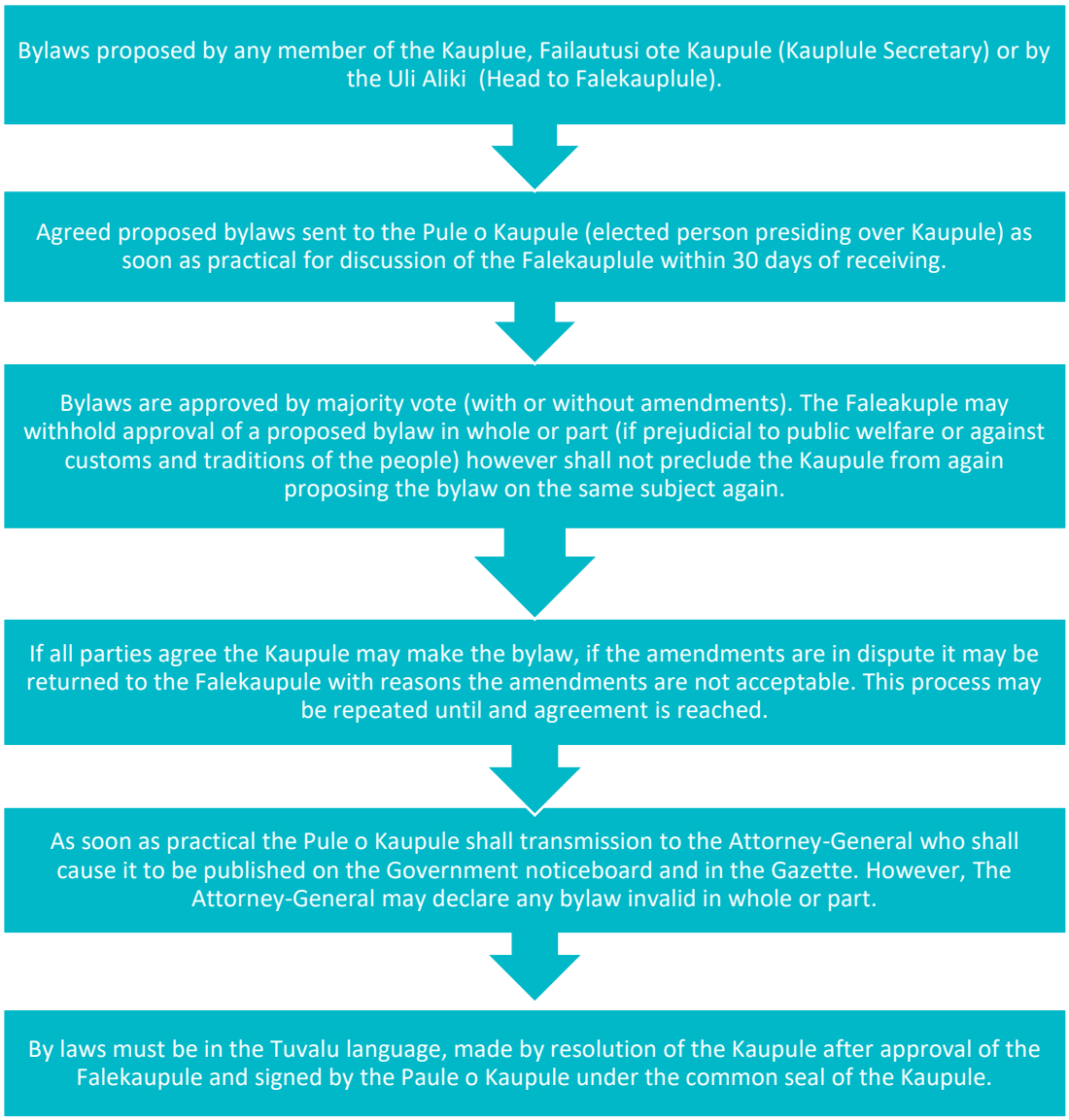


Figure 2: Kaupule bylaw proposal process

3.1.2 International agreements

Tuvalu has ratified numerous environmentally related international and regional commitments and remains in general compliance with the spirt of such commitments. The table below highlights the multilateral agreements significant to waste management in Tuvalu.

Table 3: Multilateral agreements and conventions ratified by Tuvalu

Multilateral agreements and conventions	Status
Stockholm Convention on Persistent Organic Pollutants	Ratified
Convention to Ban the Importation into Forum Island Countries of Hazardous and Radioactive Waste and to Control the Transboundary Movement and Management of Hazardous Waste within the South Pacific Region (Waigani Convention), 1995	Ratified
The Kyoto Protocol to the United Nationals Framework Convention Climate Change	Ratified
Montreal Protocol	Ratified
MARPOL 73/78: International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978 (Annexes I, II, III, IV, V, and VI)	Ratified
Protocol 1973	Ratified
Protocol to the International Convention on Civil Liability for Oil Pollution Damage of 29 November 1969 (1976)	Ratified
International Convention on Civil Liability for Oil Pollution Damage 1969 (renewed 1992)	Ratified
International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (FUND)	Ratified
Protocol on Preparedness, Response and Co-operation to Pollution Incidents by Hazardous and Noxious Substances, 2000 (OPRC/HNS) 2000	Ratified
International Convention on Civil Liability for Bunker Oil Pollution Damage (BUNKER) 2001	Ratified
International Convention on the Control of Harmful Anti-fouling Systems in Ships (AFS Convention) 2001	Ratified
Small Island Developing States Accelerated Modalities of Action (Samoa Pathway)	Ratified
Nairobi International Convention on the Removal of Wrecks 2007	Ratified
Noumea Convention for the Protection of the Natural Resources and Environment of the South Pacific Region (SPREP) (1986) • Protocol converting Cooperation in Combating Pollution Emergencies in the South Pacific Region • Protocol for the Prevention of Pollution the south Pacific Region by Dumping	Ratified
Vienna Convention for the Protection of the Ozone Layer	Ratified

Source: Various

3.1.3 Regional Agreements

In addition to the above, Tuvalu has several strong bilateral and multilateral relationships. It is a member of:

Table 4: Regional agreements and memberships

Regional Agreements	Status
Pacific Islands Forum	Tuvalu hosted August 2019
Secretariat of the Pacific Community (SPC)	Member since 1978
South Pacific Regional Environment Program (SPREP)	Current member
Cleaner Pacific 2025: Pacific Regional Waste and Pollution Management Strategy 2016–2025	Current member
Regional uPOPs Action Plan	Current 2018–2022
National Implementation Plan for the Stockholm Convention on POPs	Current 2008

3.1.4 National regulation and strategy

The Government of Tuvalu (GoT) has recently focused on environmental protection and management of its natural resources, developing and implementing several polices to protect its fragile environment. Two important environmental legislations dealing with waste management include:

- the *Environment Act 2007* and
- *Waste Management and Services Act 2009* and their related regulations.

Most recently, Tuvalu has implemented a waste management Llvy and has banned the import of single-use plastic under the Waste Management (Prohibition on the Importation of Single-Use Plastic) Regulation 2019. These two regulations, in addition to the litter Waste Management (Littering and Disposal) Regulation 2018, are set to significantly change the way Tuvalu manages waste.

The policies, legislations, strategies and multilateral agreements that address solid waste management and control of pollution in Tuvalu are provided in Appendix E.

Figure 3: Plastic items being banned in Tuvalu in 2019

3.2 Stakeholders – roles and responsibility

The table below outlines the roles and responsibilities of each stakeholder managing municipal solid waste in Tuvalu, including decision making, implementation, compliance and monitoring, such as

ongoing data collection. A new government was elected in Tuvalu in September 2019 and there is a possibility that this structure will be reviewed.

Table 5: Stakeholder roles and responsibilities

Stakeholder	Responsibility
Government of Tuvalu	
Ministry of Home Affairs and Rural Development (MHARD)	MHARD is the governing body for waste management. Provides financial support for waste management activities through governments annual budget. Under the Waste Operations and Services Act (2009), the Minister may: 1) Make regulations imposing a special levy on particular goods which have an adverse effect on the environment; 2) Impose additional charges on commercial premises where waste operators maintain a public service ensuing the surrounding areas (streets, parks, etc. are clear of waste and litter); 3) Impose any other type of special levy relating to waste management services for the purpose of recovering costs incurred in the management of wastes.
Ministry of Health (MoH)	MoH is responsible for healthcare waste including collection, treatment and disposal of all medical waste. Monitoring and enforcement of the approved standards of Section 7 (2) of the Public Health Act 2008. The ministry is also responsible for the Island's incinerators.
Subordinated Agencies	
Solid Waste Agency of Tuvalu (DSW)	DSW was established in June 2010. DSW sits under the Ministry of Home Affairs and Rural Development and oversees and manages the overall handling of wastes. DSW is responsible for: 1) Management and operation of waste disposal facilities if needed to provide 'additional technical and operational capacity to ensure the proper processing and disposal of wastes'. This function is exercised by the agency in Funafuti; 2) Handling the collection and disposal of wastes that cannot be managed by Kaupule or designated waste management operators – including the storage and disposal of hazardous and bulky wastes. This function is exercised by this agency in the collection of green wastes, recyclable wastes and hazardous wastes in Funafuti; 2) Ensuring the proper siting, development and management of landfill areas and approved dumping and waste storage sites; 3) Provision of other appropriate waste treatment, storage and disposal facilities; 4) Formulation and implementation of policies, programs and initiatives aimed to reduce the generation of wastes; 5) Public awareness on effective management of wastes to ensure waste reduction and prevention of health and environmental risks; 6) Audit of wastes being generated or disposed of in Tuvalu; and 7) Preparation and issuance of reports and compilation of statistics relevant to management of wastes in Tuvalu. DSW field workers collected and submit data to Waste Operations Officer daily (loads and type of waste including green, scrap metal and nappies).

Department of the Environment (DOE)	The DOE is responsible for ensuring there is proper regulation and control of pollution, littering, wastes (including hazardous wastes), and shall take appropriate measures to minimise the impacts of pollution, litter and wastes on the environment. This includes such tasks as monitoring pollution, licensing polluting industries, regulating the disposal of wastes, and raising public awareness related to waste management. Specifically, in accordance with Part VII of the Environment Protection Act (2008), DOE is responsible for the implementation of international conventions relating to the management of hazardous wastes; and In accordance with section 19(2)(g) of the Environment Protection Act 2008, DOE is responsible for regulatory control over waste dumps and waste disposal sites based on environmental impact assessment procedures.
Department of Waste Management (DWM)	Official designated waste management agencies under waste management act 2017 DWM and Kaupule are the official designated waste management agencies under the Waste Management Act 2017 and consequently have legal obligations to the implementation of the Act and the Policy. The DWM is responsible for overseeing and monitoring the progress of the levy deposit system including; 1) Reconciliation of waste levy deposits, performance of the transfer station and collection point staff, reviewing rates where necessary, 2) Conduct public awareness and consultation to promote participation, 3) Conduct training and prepare monthly reports; and 4) Provide updates on the progress of the system.
Department of Works (DoW)	The DoW provides a collection service for sewage and sludge from septic tanks. It is anticipated that the demand for this service will increase with update building codes requiring proper septic tank construction. DoW also collaborates with DWM and has contributed to clearing bulky wastes along roadside in Funafuti and provided heavy equipment for use at dump sites.
Department of Marine and Ports (DMP)	Responsible for the regulation of waste disposals at sea under the Marine and Pollution Act 1991 together with the DOE which implements the relevant international conventions. Responsible for managing ship generated wastes.
Local Government	
Falekaupule	Traditional assembly on each of the eight inhabited islands. Acts as the local government. Members are appointed by governance customs, only members of the Cultural Falekaupule can vote. Proceedings of the Falekaupule are chaired by the Ulufenua (Head Chief). Functions of the Falekaupule include; 1) Establish, maintain and carry out series for the removal and destruction of, or otherwise dealing with, all kinds of rubbish, refuse or excreta and by bylaws to require householders to contribute to such services. 2) Prohibit bylaws activities detrimental to the sanitary condition of the Falekaupule area. 3) Prevent pollution of any water and prevent access to any polluted source of water. 4) Safeguard and promote public health, prevent and deal with any outbreak or prevalence of any disease. 5) Exterminate and prevent the spread of mosquitoes, rats, bugs and other vermin.

	6) Prepare and implement development plans and programs in consultation with the community government agencies, NGOs and other development partners and coordinate and monitor these programs.
Kaupule	Sits under the Department of Rural Development within the Ministry of Home Affairs and Rural Development. Serves as an executed arm, or secretariat, to the Falekaupule. Kaupule officers are elected by universal suffrage. Local government unit designate as the waste management operator. May make, vary or cancel bylaws at any time under the *Falekaupule Act 1997* relating to any matter. (fines relating to bylaws must not exceed $400- or 6-weeks imprisonment) Specifically, the Kaupule is responsible for community obligations such as the: 1) Management of waste dumps, 2) Provision of compulsory collection services to residential and commercial premises, 3) Cleaning of streets and public areas, 4) Provision of waste receptacles in public areas and other facilities to assist in the reduction of littering and waste in public areas, roads and reserves, 5) Provision of waste management services to aircraft, ships and other vessels, 6) Implementation of litter and waste control measures such as promotion of recycling and other waste minimisation programmes,· Preparation, adoption and enforcement of rules, operating manuals, codes of practices and standards relating to the waste management services, and 7) Preparation of reports and maintenance of statistical records relating to its waste management activities submitted to DSW. Data is collected and submitted daily and is categorized into types of waste and marked as household, community bins or commercial waste. There is a total of 8 Kaupules.
Committees and associations	
Various committees	Waste Management Levy Committee (WMLC) - established to explore potential waste levies for Tuvalu. Committee members include representatives from DWM, Treasury, Customs, Department of Environment etc). Used Lubricating Oil Committee – established as part of a regional project coordinated by SPREP. Committee continues to meet regulatory to discuss all matters associated with used lubricating oil despite the end of the regional initiative. Waste Management Coordinating Committee (WMCC) – overall coordinating committee required under the Policy review and monitoring mechanisms. Developing Coordinating Committee (DCC) – consisting of all government agencies Permanent Secretaries this committee reviews and approves any proposed waste management initiatives including annual reports.
Private Sector	
Waste Recycling Operator	Collection, processing and export of items. Currently undertaken by sole private recycler licensed and contracted by DSW.
Private sector	It is hoped that the private sector will have a greater role following the implementation of the Waste Management Association (as above). Recycling and plant maintenance is usually delegated to the private sector. Reverse logistics (shipping of waste and recyclables after dropping off imported goods).

The figure below from the TIWPAP 2017–2026 outlines the day-to-day operational strucutre of waste management stakeholders in Tuvalu.

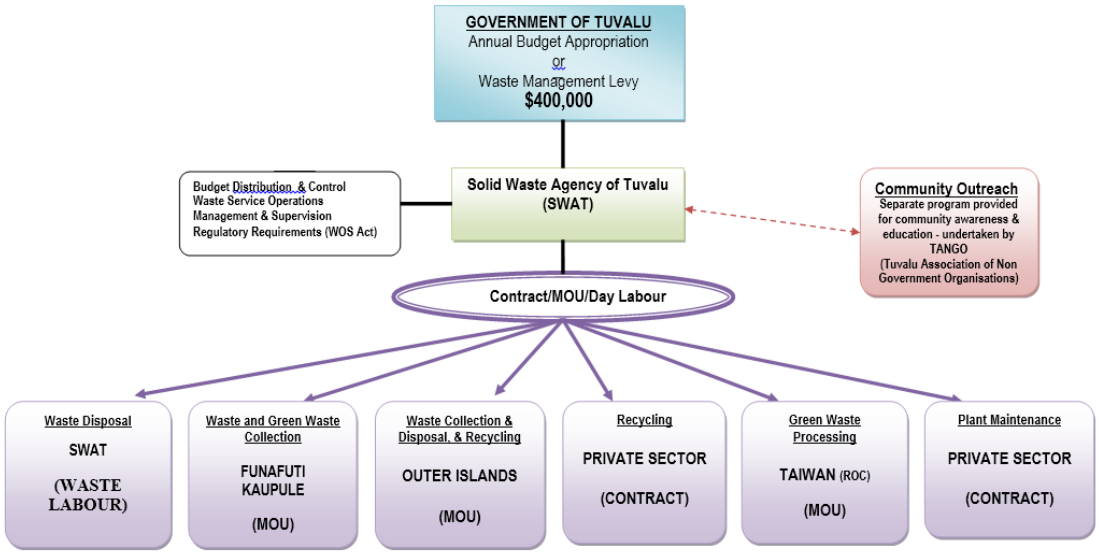


Figure 4: Functional Structure of Waste Management in Tuvalu

(Source: Government of Tuvalu (2016).Tuvalu Integrated Waste Policy and Action Plan: TOWARDS CLEANER AND HEALTHIER ISLANDS 2017 - 2026. pg15)

To date, the private sector has played a very small role in SWM and recycling in Tuvalu. In 2013, JICA stated there would need to be greater future involvement from the private sector for waste management and recycling reverse logistics to work successfully in Tuvalu. It is anticipated with the introduction of the new waste levy there will be opportunities for the private sector to work with the government of Tuvalu and its subordinate departments to deliver successful and profitable recycling programs.

3.2.1 Potential future organisations

Under the coordination and initiative of DWM, a Waste Management and Recyclers association consisting of shops, supermarkets, mechanic workshops, importers and a recycler is currently going through the legal setup process. An Acting Executive Team has been appointed and a draft constitution was developed for the members to finalize. The main objectives of the association are:

- to promote and create opportunities for the private sector`s participation in waste management;
- explore financial support for potential successful initiatives driven by the private sector;
- equip the members with the appropriate skills and knowledge on waste management and
- promote appropriate waste management practices for the management of waste at their businesses activities in line with the Policy.

Tuvalu`s Recyclers and Waste Management Association (TRWMA) would be the 4th association in the Pacific Island Countries following Samoa, Solomon Islands and Vanuatu and will receive similar regional and international benefits to what other associations received on - specialized training

opportunities, exposure to international related waste management meetings and conferences, funding opportunities and future partnership with the government waste management initiatives, programmes, etc.

3.3 Situation analysis: waste management

3.4 Waste service provision

3.4.1 Waste management services overview

Prior to 2015, MSW collections across Tuvalu were charged an annual service fee of AUD$40.00 per household and between A$110 to $410 for commercial collections. Services are now undertaken free of charge. The Kaupule are responsible for collecting municipal solid waste (MSW) from households, schools, government buildings, churches and other institutions and commercial establishments across Funafuti. A memorandum of understanding is in place which addresses the responsibly for waste management between the Kaupule and DSW on the outer islands. There is generally one service that covers the collection of bulky waste, green waste and nappies on the outer islands. Once collected, waste is taken directly to the local dumpsite. There is 100% source separation of food waste, green waste and nappies in Tuvalu.

Figure 5: The only functional equipment at the Funafuti landfill

On Funafuti, household waste is stored in either 80 litre or 120 litre plastic bins for weekly collections. MSW is collected on two flat-tray vehicles and is taken directly to the dumpsite operated by DSW. Commercial and institutional waste is stored in 240 litres of 1,100 litre bins prior to collection. Green waste collections are the responsibility of DSW. Once collected, the green waste is processed through a shredder. DSW also collects bulky waste and scrap metals. A separate collection is carried out for

nappies and these are disposed of within a designated area of the dumpsite. Bulky waste, e-waste, green waste, used oils and so on are collected are stored at the newly constructed transfer station. Healthcare waste is collected by the Department of Health and incinerated. There are collection points for metal can recycling established by the local recycler located in Funafuti, however segregation of other recyclables is not undertaken.

Previously, the reliability of collection services was often interrupted by mechanical issues. The recruitment of a mechanical engineer to maintain equipment has improved services and a regular maintenance schedule is in place across all equipment in Tuvalu.

In 2017, it was reported that some outer island households found the schedules of waste collection services inconvenient, as no one was at the home during service times. It was also found that in Funafuti, most wastes were not properly packed before being placed into the bins for collection. Collection crews would need to handpick through the waste or lift bins, resulting in an occupational health and safety risk (Sagapolutele and Binney, 2017).

The table below summarises the collection services delivered across Tuvalu.

Table 6: Collection services delivered across Tuvalu

Waste Types	F/futi	N/Mea	N/Maga	N/tao	Nui	V/tupu	N/Fetau	N/laelae
Household	✓	✓	✓	✓	✓	✓	✓	✓
Commercial	✓	✓	✓	✓	✓	✓	✓	✓
Institutional	✓	✓	✓	✓	✓	✓	✓	✓
Ships	✓	Ship generated wastes are recovered and disposed of at the bins located at the main wharf in Funafuti. These are transported by DWM and disposed of at the Funafuti dumpsite						
Coastal Litter	The Kaupule arranges some cleaning up with the communities from time to time.							
Bulky	✓	Waste is collected with other wastes under the current available services delivered by the Kaupules in the islands						
Healthcare	Currently collected and disposed of by the Ministry of Health. The ministry is currently understaffed and lacks the appropriate knowledge. It is seeking to work with DWM to create a process that allows for safe disposal of hospital waste in the future.							
Used Lubricating Oil	A programme has been recently introduced to recover and collect used oil from the outer islands. Some of the collected oil containers are shipped to Fiji under a partnership with one of the importers of petrol and oils in the country.							
Electronic and Electrical Waste	✓	All included in the only collection services available in the islands. No special collection service but mixed up in the same service						

(Source: Sagapolutele and Binney, 2017 and PRIF consultants visit 2019)

3.4.2 Collection Schedule

Tuvalu is one of a minority of Pacific nations with waste collection services provided to approximately 90% of the population successfully through support from European Development Fund-EDF10. A recent review of the deliverables of TIWPAP 2017–2020 found that collections on Funafuti had 100% coverage and 80% on the outer islands. In 2016, the Tuvalu Integrated Waste Policy highlighted the waste collection schedule for Funafuti.

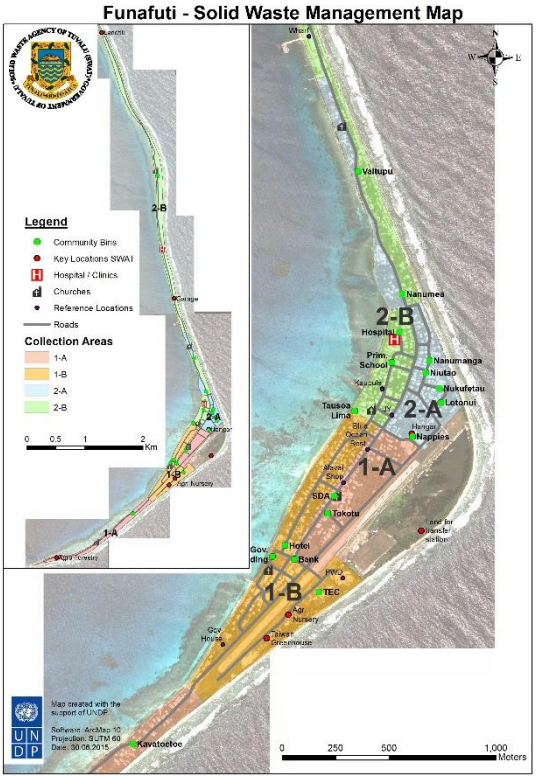


Figure 6: Solid waste collection map Funafuti

The main island of Funafuti has two collection services for the general solid waste, a collection for bulky waste and two special collection for green waste on a weekly basis. The remaining outer islands has two collection services for the general waste. The table below outlines the collection frequency, storage and estimated household coverage across Funafuti and the outer islands.

Table 7: Collection schedule of waste in Funafuti (source: Government of Tuvalu, 2016)

Type of waste	Schedule	Responsible
Household waste	Monday–Friday	Kaupule
Green waste	Monday, Tuesday, Thursday and Friday	DSW
Recycled metals	Wednesday	DSW
Nappies	Monday and Friday	DSW

Table 8: Collection services provided, frequency and coverage

Funafuti Island			
Waste type	**Waste storage at source**	**Weekly collection frequency**	**Estimate household coverage %**
General mixed waste	80L/120L wheelie bins for households 240L/1,100L bins for institutions & businesses, sack &plastic for households without bins & extra waste	Schedule since Jan 2017 Monday & Wednesday – Block 1 & 2 Tuesday & Thursday – Block 3 & 4 Friday – Main road covering Bock 1–4	90–95

Green waste	Sacks & plastic bags for leaves and lawn As loose waste placed along the collection routes	Same as above	45–50
Bulky waste & hazardous waste	As loose waste to be placed along the collection route or approved pick-up points	Friday (8:30am - 12 noon)	30–35
Nappies	Pack in plastic bags or sacks then transport to the central drop-off bins at the hanger. Another bin is located at the hospital for patients which is utilised by hospital staff and nearby families who have 24-hour access to communal bins.	Monday and Friday N.B. Bins are emptied once all are full regardless of what day.	90–95
Outer Islands			
Mixed waste **No special service or segregation for green, bulky or nappy waste.**	Wheelie bins	2–3 times per week	95–100 for Nukuefetau and Nulaelae Islands 75% for Vaitupu 80% for the other islands

(*source: Sagapolutele and Binney, 2017 Confirmed for Funafuti and Vaitupu by PRIF consultants 2019*)

In July 2016, SPREP reported that the 'level of understanding of appropriate waste collection, processing and disposal systems was very low' and 'poor waste practices such as burning, littering and dumping of wastes' were considered socially acceptable in Tuvalu (SPREP 2016). Illegal dumps were scattered alongside roadways, next to the coastline and in bodies of water. During the PRIF consultants visit in September 2019, all illegal dumps were assessed with the location and quantities of dumped material recorded.

In 2019, an evaluation through EDF 11 of the current achievements of the Waste Policy and Action Plan 2016–2026 was found to be working towards a goal to identify the top three bad public behaviours such as burning waste, dumping in waterways, littering and so forth. Under these efforts a list of offenders has been recorded and are now awaiting prosecution. It is anticipated that the

prosecutions shall serve as a warning to other potential offenders in the bid to reduce bad waste management practices.

3.4.2.1 Bulky wastes and scrap metal

According to study completed in August 2014, 85 items of bulky waste were located beside homes, along roadsides and disposal sites in Funafuti. Bulky and hazardous waste is to be placed either along the collection route or at approved pick-up points to await collection. As of 2016, DSW are responsible for the collection of bulky waste and scrap metal across Tuvalu. In November 2017, it was reported that bulky waste collection services cover approximately 35% of the population of Funafuti. Ownership of white goods, vehicles and motorbikes are increasing across Tuvalu; therefore, the generation of bulky waste is also increasing. A dump truck and trailer are used to collect bulky waste, however dumping of waste, particularly of cars, is common practice. The PRIF consultant team (2019) undertook an assessment of all bulky waste and scrap metal dumped in Tuvalu and the records are provided in the results section below.

3.4.2.2 Healthcare waste

The TIWPAP 2017–2026 reports that the amount of healthcare waste generated per occupied bed in Tuvalu is approximately 0.3 kilograms, sitting below the Pacific Island average of 0.8 kilogram per occupied bed (ENVIRON, 2015 in TIWPA).

Figure 7: A small incinerator at the Vaitupu waste dump

In 2017, it was found that stockpiling on Funafuti over several days was not uncommon, allowing for enough waste to be incinerated. Healthcare waste generated on the outer islands is also frequently stockpiled in the incinerators, sometimes weeks before incineration. The incinerator that was viewed by the consultant team on Vaitupu was a basic incinerator with no emission control. These do not comply with the international requirements for incineration of medical waste. Outer islands generate approximately 840 litres monthly whereas Funafuti 100 to 160 kilograms a month.

Healthcare waste falls under the responsibility of the Department of Health. Healthcare waste in Funafuti is managed by the hospital management directly. In the 2018 budget, the Department of Health was allocated $10,000 for the operation of a healthcare incineration facility. A new incinerator was installed near the Princesses Margret Hospital through the EU funded PacWaste Project in 2016.

Hospital staff were trained on proper handling of waste and operation of the incinerator. However, during the PRIF consultants visit in 2019, it was found that the incinerator is not currently operational and the staff that had previously been trained in appropriate disposal of healthcare waste are no longer working at the hospital. There is a need for ongoing collaboration between DSW and the hospital to ensure medical waste is appropriately disposed of in an ongoing manner.

3.4.2.3 Recyclables

Scrap metals and cans

There is one local recycling operator currently collecting scrap metals across Funafuti. The 2019 consultants' visit revealed, however, that the recycling operator has passed away and the business is currently on hold. Scrap metals and cans are collected from drop-off points established by the recycler; however, the capture of recyclable cans is done in an ad hoc manner. Metals are stockpiled at the transfer station awaiting shipment to international buyers. During 2016/2017, no shipment was made due to expensive shipping costs and a low global return rate for metals. Recycling of aluminium cans exists but is not fully addressed as expected. There are many reports of other recyclable metals items, including aluminium cans frequently seen at disposal sites. Since the introduction of the deposit on cans and bottles, the DWM staff have been collecting, washing and storing aluminium cans from specific areas around the island as shown in Figure 7.

Figure 8: Current stockpile of aluminium cans at the transfer station in Funafuti.

Plastics

PET bottles are often reused for homemade drinks, however no formal plastic recycling is or has previously been in place. Larger containers are often reused for gardening and pig food storage before being sent to the dump sites.

The Waste Management (Levy Deposit Regulation 2019) was recently established to provide mechanisms for revenue collection and provide a legal framework that encourages waste avoidance and resource recovery.

Green waste

Figure 9: Green waste ready for collection in rice bags

Numerous studies have identified up to 50% of the total municipal solid waste composition in Tuvalu consists of green waste, mostly made up of pandanus, breadfruit and other trees. In 2016, a study estimated green waste collected totalled 2.5 m^3 per household per annum, or a total for Funafuti of 2,265 m^3 per annum, 788 m^3 of this waste is mulched. Green waste is generally left beside bins for collection and is partially segregated; smaller waste, such as leaf litter in sacks and larger items such as palm fronds are left loose. This is collected by DSW separately to MSW and is deposited at a central location for processing through a shredder at the transfer station. Shredded green waste is deposited into composting units at the Happy Garden facility before being used as bedding for vegetable planting.

In 2017, it was found that the collection and conversion of compostable materials on Funafuti was the only recycling activity undertaken in Tuvalu. In 2019, the composting of green waste is continuing in Funafuti with the Taiwanese farm taking all the mulched material for use as organic fertiliser. It was also noted that informal composting and mulching green waste was occurring organically across approximately 50% of Funafuti and 90% of the outer islands. Some of these composting activities were, however, in fact examples of illegal dumping. Recycling green waste though mulching to control weeds and cool agricultural crops is common across the Islands.

3.4.2.4 Other waste streams

There are several drop-off points on Funafuti for nappy collection and these are well used by the community. The PRIF consultant team inspected and weighed nappies from several bins and can report a 100% source separation of nappies. Nappies are collected twice weekly (Monday and Friday) and deposited at a specific site at the Funafuti landfill.

Figure 10: Nappy bin made available to communities in Tuvalu

E-waste and used oils are collected and stored at the transfer station awaiting processing and shipping from Tuvalu. Waste oil continues to be shipped to Fiji under the ULO Project partnerships with Pacific Energy importer of petrol and oils into Tuvalu. As there are no storage facilities for hazardous waste such as asbestos or chemicals, there are no collections for these wastes.

Ship-generated waste is the only quarantine waste in Tuvalu and falls under the responsibility of the Department of Marine and Ports. The waste is collected in drop-off waste cages at Funafuti wharf and emptied and collected by DWM and taken to the dumpsite.

3.5 Equipment and maintenance

The condition of waste collection equipment is noted to be generally good. In April 2017, a mechanical engineer was employed and had commenced a maintenance programme including a stocktake of spare parts needed to ensure equipment servicing is undertaken in a timely manner and equipment remains well maintained. The below table outlines the equipment currently used to manage MSW across Tuvalu.

Table 9: Waste management equipment

Island	Waste equipment	Designated use	Comments	Donated	
				Year	**Party**
Funafuti	2 Tractors with trailers (8.5 m^3)	General waste collection delivered by Kaupule	In good operational conditions. One of the tractors experienced some problem and was fixed by the mechanical engineer		
	1 tractor with a trailer (no cage). Previously used for the recyclable waste collection	Green waste & bulky waste and nappies	In good operational conditions. Was used to cover for one of the tractors used for the mixed waste collection in June 2017	2013	EU
	1 dyna truck	Assists with the green waste, bulky and nappies collection	Some maintenance works were conducted at the hangar		
	1 pickup	Assists with the green waste, bulky and nappies collection	In operational but deteriorating conditions		

Island	Waste equipment	Designated use	Comments	Donated	
				Year	Party
	New dump truck (6 m^3)	Bulky waste and green waste collection	Good condition and was used for the green waste collection when the tractor for green waste was used for the mixed waste service in June 2017		
	Excavator	Dumpsite maintenance	A spare part was ordered from Fiji and had already been installed		
	Loader	Green waste compound	In good operational condition		
	Forklift	Lifting heavy items including the large bins when unloading the nappies on to the tractors	New		
Namumea	Tractor & trailer	Collection of general waste (mixed waste collection)	In good operational condition. Rust observed	2013	EU
Namumaga	Tractor & trailer	Collection of General Waste (mixed waste collection	In good operational conditions. Front tyres are worn out. Rusting conditions is observed.	2013	EU
Niu	Tractor & trailer	Collection of General Waste (mixed waste collection)	Front end loader mechanism has been broken. Broken Left Front Mirror. Broken front engine protection.	2013	EU
Niutao	Tractor & trailer	Collection of General Waste (mixed waste collection)	The 4WD function of the tractor is not working. Rusting conditions is observed.	2013	EU
Vaitupu	Tractor & trailer	Collection of general waste (mixed waste collection)	Broken down and at the hanger for repair Trailer side cage is loose and need to fix before falling apart Rust observed	2013	EU

Island	Waste equipment	Designated use	Comments	Donated	
				Year	Party
Nukufetau	Tractor & trailer	Collection of general waste (mixed waste collection)	Good operational condition Rust observed	2013	EU
Nukulaelae	Tractor & trailer	Collection of general waste (mixed waste collection)	Tractor in operational condition Roofing is broken Trailer side cage has been removed The volume of the waste is therefore reduced to 1.5 m^3.	2013	EU

(Source Sagapolutele, F. and Binney, J. (2017). TUVALU WASTE BASELINE INFORMATION REPORT)

Most of Tuvalu's waste equipment has been provided through donations or funding via international partners/donors. The estimate to cover the replacement of waste management assets is reported to be approximately $1.26 million.

3.6 Waste data collection and monitoring

The following parties are responsible for ongoing data collection, monitoring, decision making and waste management implementation and compliance.

Data Collection	Decision making	Implementation and compliance
•DSW - Daily data collection and analysis. •Kaupule - Daily data collection template provided by DSW	•MHARD -Overall governing body •WMLC- development of waste levies to support waste management. •Used Lubricating Oil Committee - discuss all matters pertaining to used lubricating oil. •WMCC - Overall coordinating committee •DCCC - Reviews and approves waste management intitatives including annual reports. •Falekaupule -approval of bylaws submitted by Kaupule	•DSW - Implement monitoring and reporting programmes to ensure more informed decisions in the waste sector

A data management system known as Tuvalu Waste Information system (TuWIS) has recently been developed to input, store and process waste information collated by DSW and Kaupule to assist in

monitoring the performance of SWM in Tuvalu. This includes an asset register, waste collection statistics, budget information and enforcement register. For these systems to be successful, data must be collected and recorded daily and is currently done so by field workers. Previously, field workers had issues reporting daily data recordings data due to communication and internet issues. There are provisions for ongoing monitoring and evaluation, which is implemented on an annual basis as part of the annual review required by EU. The last review was implemented in April this year.

3.6.1 DSW staff

According to the 2019 budget, DSW employs 13 staff members to deliver solid waste management services for the government of Tuvalu. The table below outlines the position description of the employees.

Table 10: Solid Waste Agency of Tuvalu (DSW) no of staff 2019

Position	Number of staff in 2019
Director	1
Waste Regulatory Officer	1
Waste Operation Officer	1
Outer Islands Waste Operation Officer	1
Administration Support Officer	1
Equipment/Transport Supervisor and Driver	1
Waste Site Operators	3
Waste Collection Labourers	3
Security Officer	1

(Source: Minister for Finance and Economic Development, 2018)

3.7 Current financial mechanisms

The Tuvalu economy is constrained by several factors, including its remote location and lack of economies of scale. Prior to 2015, SWM collections were charged annually at AUD$40 per household, however collections are now provided free of charge. Commercial collections are charged between AUD$110 and $410. Despite previous collection of SWM fee, the revenue was insufficient to fully cover services provided in Funafuti. Funding is one of the major constraints to sustaining SWM programmes. Since 2019, a levy has been introduced on several materials that are imported into the country, which will possibly provide funding for the management of these materials at the end of life. Since its introduction in August 2019, AUD$5,000 have been collected through the levies.

3.7.1 Department of Waste Management Budget

Waste collection and disposal services for the eight islands are fully funded by the government through the annual budget provisions provided to the Department of Waste Management. The 2019 budget allocated $444,671 to the solid waste management strategic plan for Tuvalu. It is anticipated the budget will increase to approximately $462,636 in 2021The 2019 budget states the following activities are a major priority for the Ministry of Home Affairs and Rural Development:

Figure 11: Ministry of Home Affairs and Rural Development 2019 budget priorities

The table below highlights the Ministry for Home Affairs and Rural Development budget funding allocations for solid waste management in 2019.

Table 11: New funding approved in the 2019 budget

Funding amount	For	Why
$182,750	Department of Waste Management (DWM) Transfer Station Phase	To cater for the segregation of wastes and diversion of green wastes for composting as well as diversion of recyclable and hazardous wastes for recycling
$180,000	To build tractor sheds for outer islands	No proper storage shed for the tractors to avoid exposure to sea spray that will eventually corrode and shorten the tractor lifespan
$141,540	Outer island hazardous waste storage shed	Based on the increasing volume of hazardous wastes Tuvalu, which triggered the construction of the transfer and recycling station to be based on Funafuti and be treated as the main hub for all hazardous wastes collection point for the whole country
$59,678	Dumpsite security sheds (all islands)	To serve as a proper security shed to manage and control all island dump sites
$2.9m (EU Support to Waste Sector)	$198,723 for expenses (dumpsite security houses, hazardous waste shed, etc.) $215,811.20 officer's salary	To successfully implement the operation of this project's equipment

At the time of the budget, the Ministry was seeking development-partner support totalling $62,000 for a transfer and recycling station feasibility study to aid the improvement of recycling programs and the overall waste management systems in relation to recycling.

3.7.2 Development Partners

Tuvalu has several projects, previous and ongoing, that are being developed and funded by various development partners. A full list is provided in Appendix D.

The largest and most current funding is being provided by the EU through the EDF 11. A summary of the activities within EDF 11 is provided below.

The information highlights international and regional projects currently undertaken in Tuvalu with the assistance of international development partners. These projects have provided extensive technical and financial assistance to waste management in Tuvalu.

Table 12: Current development partner assistance provided on waste management in Tuvalu

Project: European Development Fund 11cycle (EDF11)	• **Funding**: €6.8 Million • **Objective**: To reduce waste related environment degradation • **Key activities**: ○ Waste reduction and resource recovery programmes including exporting of recyclables. ○ Improve waste disposal system and infrastructure. ○ Establish public private partnerships. ○ Improve waste collection. ○ Strengthen community awareness and education.

The 2nd Annual Review of the Implementation Status of Tuvalu's National Waste Management Policy and Action Plan 2017–2026 suggested several opportunities for Tuvalu to work with international partners to deliver improved management of challenging wastes.

Assistance from contributing partners would include technical, financial, and capital assistance and would include support through participation in field monitoring and providing advice. The table below outlines the proposed partnerships as discussed within the review.

Table 13: Proposed partnerships for the management of challenging waste

Waste	Responsible agency	Proposed Potential Partnership		
		Area of focus	Contributing partners	Potential assistance
Healthcare waste	DoH	Improving the storage, collection and disposal facilities Training of workers	DWM, DoE	SPREP (PacWaste) plus/ILO
Marine litter	DoM	Improvement of ship waste management/ Marine Litter Management Plan Enforcement of coastal illegal dumping practices	DWM – DoE	SPREP
Asbestos	DWM	Educational materials Training	DoE	SPREP (PacWaste/AFD/GEFPAS)
Expired goods	DoH	Enforcement and awareness	DWM, Customs	Industry
Sewage and sludge	PWD	Development of Management Plan Proper Disposal Facility Plan and development	DWM – DoE – DoH	Donor
Disaster waste	DWM	Development of DWM Contingency Plan Temporary Disposal Site	NDMO – Fire Emergency – PWD PWD – Kauplule	SPREP (PacWaste/AFD)

(*Source: Sagapolutele, 2019, The 2nd Annual Review of the Implementation Status of Tuvalu's National Waste Management Policy and Action Plan 2017 - 2026*)

AFD and PacWaste Plus through SPREP have also some provisions for Tuvalu to use.

3.7.3 Waste Levy

In 2019, the Waste Management (Levy Deposit) regulation was introduced to support Tuvalu's recycling program. From 1 August 2019, all aluminium cans, PET bottles, vehicles, nappies, white goods, vehicles, and construction equipment, will be levied when imported into the country. It is anticipated the generated deposits will support a recycling programme for the levied waste items and support in-country appropriate treatments and disposal if/where the goods are unable to be exported overseas. Levy ranges from 0.5 cents per nappy to $2,000 for heavy construction equipment more than 10 tonnes. A complete list of all products and goods to be levied, including the deposit amount, refund amount, recycling operations subsidy and administration and management support for each item can be found in Appendix B. The levy also explicitly states the set minimum number of waste items allowed for PET bottles from water, sweetened drinks and cooking oils, aluminium cans from sweetened drinks and alcohols, glass bottles from sweetened drinks, alcohols and cooking and other waste items. It also importantly outlines that any wastes which are old buried cans, PET and glass bottles either imported or collected prior to the levy deposit system commencing shall not be accepted.

Finally, the levy establishes that there:

Shall be a transfer station on Funafuti and recycling collection point on

Nanumea

Nanumaga

Niutao

Nui

Vaitupu

Nukufetau and

Nukalaelae

Every island shall consist of one (1) recycling collection point except for Funafuti Island which shall be divided into the following blocks:

(a) Block 1: Kavatoetoe;

(b) Block 2: Vaiaku;

(c) Block 3: Funafuti;

(d) Block 4: Fakaifou; and

(e) Block 5: Lofeagai

A study in 2017 indicated that there was full (100%) support for the introduction of a container deposit levy for recycling purposes and willingness to fully participate if such initiative was introduced (Sagapoulutele & Binney, 2017). The introduction of the levy provides an opportunity for private business to participate in recycling on a larger scale than is currently undertaken.

3.7.4 User-pay options

User-pay options such as prepaid bags have successfully been introduced in other Pacific countries such as Vanuatu and Kiribati. These options have previously been examined and recommended to the government of Tuvalu as an efficient waste management method in addition to establishing an income stream. In 2017, it was reported there was significant support from all eight islands to support the use of a prepaid rubbish bag for collection services where the cost of a bag is below 50 cents (Sagapoulutele & Binney, 2017). The 2019 survey for PRIF indicates that 99% of the community on Funafuti and 85% in Vaitupu support the introduction of a prepaid bag system. People willing to pay 5c per bag in Funafuti and 15c per bag in Vaitupu.

Tipping fees have also been discussed as another income initiative. However, due to the recent national initiatives implemented by the government such as the Waste Management Levy and plastics ban, the Department of Environment has decided to hold any decision until these programs are sufficiently implemented.

3.8 Waste management infrastructure

Waste dumps are located on each of the Islands of Tuvalu. There is little to no control relating to the types of waste dumped. They are non-engineered and have no pollution control measures in place. On the main island group of Funafuti, there is currently only one dump site located at the northern end of Funafuti. DSW is responsible for managing the site.

In addition to a lack of available land for moving/establishing/expanding dumpsites, land lease issues are proving problematic. The previous government was in negotiations with the Native Land Board

and landowners to secure land for waste disposal development. A lease rate has been approved by cabinet of $3,000–$3,500, however landowners were yet to agree on the new rate and negotiations were at a standstill. Recent changes in the government may renew negotiations. The new the government, headed by a Funafuti prime minister and ministers may consider higher funds. The Funafuti people have proposed a land lease rate at $5,000, which had also been previously proposed.

In April 2017 an assessment at the Funafuti disposal site reported that there was approximately eight months for the site to remain operational (Sagapolutele and Binney, 2017). According to DWM records, monthly incoming waste is 262 m^3, 50% of which is low-density wastes such as plastics, paper and cardboard, ferrous and non-ferrous cans, textiles, nappies and white goods.

TIWPAP 2016–2025 aims to rehabilitate the national landfill sites. The consultant team (2019) found that this is partly achieved. However, construction had been put on hold at the time of the review due to equipment breakdown, and was set to continue once new equipment was received on procurement from overseas. Improvements to the dump sites located on the outer islands are also underway, including fencing works.

Storage for hazardous waste was located at the transfer station awaiting transportation to a disposal facility in another country.

Table 14: Waste disposal sites across Tuvalu

ITEM	Ffuti	Vtupu	Nmea	Nmaga	Ntao	Niu	Nfetau	Nlaelae
Status								
Area	------	2.8acr	0.5ac	0.5acr	0.24ac	0.49ac	0.46ac	0.50ac
Type	OD/WSM	OD/WSM	OD	OD	OD	OD	OD	OD
D-status	PTR	AR	PTR	PTR	PTR	PTR	PTR	PTR
Suitability for waste disposal								
Less than 50 m from coastline	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Less than 5 m soil profile depth (m)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Soil conditions	Sandy – porous	Sandy – porous	Sandy – porous	Sandy – porous	Sandy – porous	Sandy – porous	Sandy – porous	Sandy – porous

OP – Open Dumping (meaning no soil cover); WSM – with some maintenance; PTR – plan to rehabilitate

(*Source: Tuvalu Waste Baseline Information Report 2017*)

An integral component of the Waste Management (Levy Deposit) Regulation 2019 is the development and implementation of a transfer station for Funafuti and recycling collection points on the outer islands. The transfer station is in the final stages of construction with the supporting office for waste management staff to be completed in 2020. It will act as a recycling collection point and operate on the last five working days of the year to receive levied recyclable items. The transfer station was partially operational at the time of the consultants' visit. The supporting office is to be

located next to the transfer station. This is where the payment of 5c deposit will be processed once the National Recycling Programme commences sometime in early 2020 once the construction of the office is completed. The materials for the building are currently being procured from Fiji. The challenges now are to get the staff and workers trained with the basic skills and knowledge required. The Transfer Station Supervisor spent a week with the Samoa Scrap Metals operators in October 2019, who are dismantling and shipping e-waste overseas. During this visit, they were also able to observe the daily operations involved in the processing of incoming scrap metals, dismantling and baling, as well as packing and loading to containers.

3.9 Challenges delivering waste management services

Tuvalu, as an atoll island with limited land resources, faces several challenges delivering and expanding current waste management systems. Many challenges exist for a waste management industry to operate in Tuvalu. Challenges are summarised below.

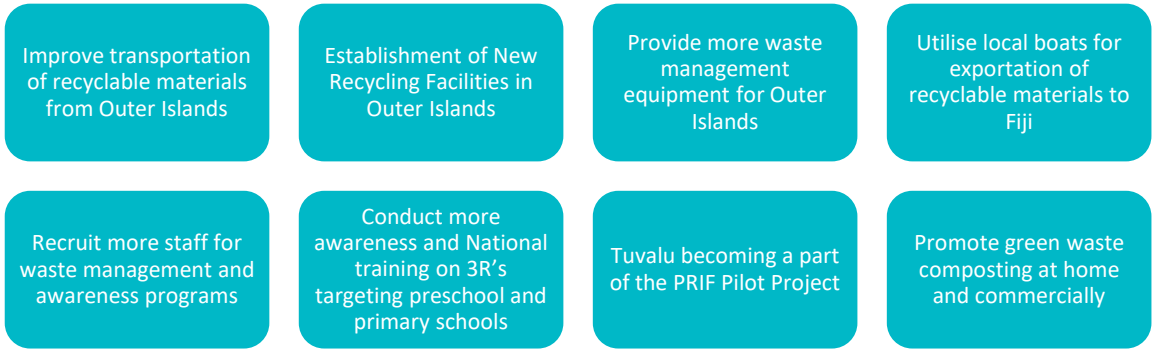
3.10 Initiatives and opportunities

Tuvalu is in the process of signing and ratifying the Basel Convention on the Transboundary Movement of Waste. The Waigani Convention allows Tuvalu to ship items to Fiji.

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

Tuvalu's plastics ban follows several other PICs that have banned single-use plastics including Vanuatu, Samoa and the Marshall Islands. In addition to the recent ban, Tuvalu recently achieved the following:

In addition to the achievements above, Tuvalu has some major plans and projects for the future of waste management including:



4 Waste audits: details of method

4.1 Waste sampling distribution

4.1.1 Households

This section provides information on how the waste data collection works were undertaken in September 2019 in Tuvalu (Funafuti and Vaitupu). Advice was sought from the APWC statistician to determine the sample size required to provide reliable and robust data. The minimum and maximum number of household samples required are shown in Table 16.

Table 15: Households sample to be collected

Scheme	Error at 80% Confidence	Error at 90% Confidence
90 houses Funafuti, 60 houses Vaitupu (or other)	20%	25%
140 houses Funafuti, 60 houses Vaitupu (or other)*	17%	21%
90 houses Funafuti, 60 houses Vaitupu, 50 houses other	15%	19%

**Target scheme aiming for a sample size of 200*

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 136 samples were collected from Funafuti and 59 samples from Vaitupu. Therefore, the total sample size in Tuvalu was 197, bringing the number to an acceptable level of confidence needed for decision-making purposes.

Funafuti has around 57% of Tuvalu's population as it also accommodates people from the outer islands who migrate to Funafuti for employment, businesses, healthcare and educational purposes. Vaitupu is next to Funafuti with 14.4% of the population.

The remainder of the population (28.5%) resides on the other remote outer islands. Funafuti and Vaitupu islands were selected for this waste assessment as more appropriate and representative of the Tuvalu population.

Table 16: Tuvalu household sampling distribution

Tuvalu Islands	Population	Percent	Samples required	Samples collected	Collection systems	Collection frequency
Funafuti	6.152	57.1	140	136	Yes – door to door/ wheelie bins	1/wk – General 1/wk– bulky 2/wk – green Nappies as required
Vaitupu	1,555	14.4	60	59	Yes – door to door/ wheelie bins	Twice a week
Total	**7,707**	**71.5**	**220**	**197**		

4.1.2 Commercial premises

Commercial samples were required to be distributed as follows:

Table 17: Tuvalu commercial samples required

Sample type	Minimum	Desired
Admin/office	7	10
Food Outlet	9	13
Retail	9	12
Hotel	9	12
Supermarket	9	13
Manufacturing	7	10
	This would yield a (very crudely) estimated error of 1.0 kg/business/day or 17% at 80% CI.	This would yield a (very crudely) estimated error of 0.87 kg/business/day or 15% at 80% CI.
Total	**50**	**70**

However, Funafuti did not have a total of 50 commercial premises that could be sampled. Therefore, the team collected as many samples as possible based on the commercial activity on the island.

A total of 25 commercial premises were sampled simultaneously with households in Funafuti. From the collected samples, there were 10 shops, six restaurants and five offices. The offices and small shops, including restaurants in Funafuti and Vaitupu, are collected twice a week. The supermarkets and wholesalers in Funafuti provide their own collection services and disposal services.

Table 18: Commercial sample and collection systems in place

Type of commercial premises	No. of samples	Waste pickup frequency	Destination
Administration offices	5	Twice per week	Waste disposal site
Schools	4		
Hotel/Motel and accommodation	6		
Supermarkets/Wholesalers	10	Self-haul	

4.1.3 Landfill samples

The landfill at Funafuti is open from Monday to Saturday, 9am to 5pm. Given the consulting team was in Funafuti for almost three weeks, it was agreed with the DWM staff that a full week's sampling would be conducted. Therefore, all trucks entering the landfill over the course of a week were assessed for their contents.

4.1.4 Other data

The following organisations were contacted to provide further data in order to get a complete understanding of the waste generation rates:

a) Tuvalu Electrical Corporation (TEC) – To gather data for the number of EOL renewable energy equipment. Tuvalu started installing solar panels in 2008. Consultants were able to collect data for all solar panels/batteries installed since 2008.
b) Department of Customs – Direct contact was made with staff from the customs department and a request for data was made while in the country (next time we suggest requesting this data earlier).
c) DSW, Department of Environment and Kaupule – Staff directly engaged with providing waste management services were asked to confirm the consultants' observations before proceeding to finalise data collected. This included assessments on infrastructure and collection systems.
d) All stockpiles for metals, used oil, batteries and e-waste were assessed independently by assessors.

4.2 Sample collection

The consultant team created a project plan (See Appendix F) and then discussed and planned the collection of the samples with the Department of Waste Management and the island Kaupule as the responsible agencies for waste management in Tuvalu to ensure the smooth implementation of the waste audit operations. The two islands selected for waste sample collection were:

- Funafuti
- Vaitupu

Both islands have collection systems in place, therefore all samples were collected as per the collection methodology below.

4.2.1 Households Waste Samples

Households samples were collected from Funafuti island (140) and Vaitupu island (60) based on the required samples. The methodology requires collection of household samples across the low-, medium- and high-income streams. Due to the small size of the islands, the 140 domestic samples in Funafuti were collected randomly from both sides of the main road that stretches 13 kilometres from the northern end to the southern end of Funafuti island. The sampling covered the entire stretch of the island.

Figure 12: The consultant team collecting household waste samples with support from local staff

The 60 samples for Vaitupu island were collected from the main community settlement area that had a collection day three days prior to the arrival of the team on the island. The location of the households where samples were collected in Funafuti and Vaitupu were marked using the GPS coordinates for follow-up assessments. 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 spread of samples is shown below.

The collection team members consisted of the three key members with separate functions. These tasks can be performed by two people but three or more is recommended for efficient performance of the following tasks. The consultant team engaged up to three waste management staff kindly provided by DWM and Kaupule to support this project. Having local people in the team, especially the workers and staff involved with the collection service, proved to be extremely helpful. They knew the area well

Figure 13: Household samples collected in Vaitupu and Funafuti

and were able to answer any questions locals posed regarding the consultant team collecting waste from their household bins instead of the council. The consultant team used an online tool to collect all data as the samples were collected. A collection sheet is provided in Appendix G. Collections were carried out in the following way:

- A collection supervisor and recorder marked the location of a sample using the GPS coordinates and at the same time taking photos of 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, how much was left, types of waste, etc.).
- The second member(s) of the team assessed the nature of the waste and provided information to the recorder as well as collecting the samples using the garbage bags by emptying the contents of the bins into these bags and placing them in the truck for transportation to the sorting area at the landfill.
- The third member marked the households or commercial premises using ribbons (as tags) tied to a nearby tree, property fence or gate for easier identification later during follow-up interviews. The household numbers recorded by the recorder must be the same as the numbers written on the garbage bags and the ribbons (tags). This task can be done by a local staff or worker.

Figure 14: Household being tagged for interview at a later stage and sample collection in Vaitupu

During the fieldwork, the recorder entered the required information, the photos of the premises and the filled-out sheets into a tablet device. The information is stored and sent at the end of each day to APWC statistician for analysis. In situ electronic recording of information in the field was an improvement from the standard manual filling and scanning of the completed survey sheets, which then requires data entry off site.

Figure 15: Samples being transported to the sorting facility

In Vaitupu, all samples were collected in the same manner but collected samples were loaded on to a boat and brought back to Funafuti for sorting.

4.2.2 Commercial Samples

The smaller commercial samples from small shops, offices and businesses were collected along with the household samples. The methodology remained the same for both households and commercial premises.

The survey team did not collect for the larger commercial sources such as supermarkets, wholesalers and hotels. An assessment was conducted at the waste disposal site when these waste streams entered the site. These audits became a part of the landfill audits.

Data collected - summary

- 197 household samples collected and sorted
- 25 Commercial samples collected and sorted
- 8 local government staff trained
- Data collected from two islands – Funafuti and Vaitupu
- Landfill audit completed over the course of 6 days covering Monday – Saturday
- Data collected for the following:
  - Nappies
  - Green Waste
  - Food Waste

4.3 Interviews (Households and Businesses)

The interviews were conducted by the consultants with assistance from staff of DWM and two local workers hired to provide some translation when needed. An e-copy of the survey questionnaire was used to record the responses from households and businesses using tablets, laptops or phones. All the filled questionnaires were automatically stored remotely (in the cloud) and sent later at the end of the day to APWC office in Sydney for analysis.

The interviews were the most time-consuming task of the fieldwork conducted in Tuvalu, with an average of

20 to 30 minutes per household. In order to mitigate this, two to three survey teams were used to expedite the interview process.

The interviews covered the following master list of questions. Further questions were added or deleted based on local assessment by the consultants:

The interviews cover the following:

- 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. It has been our experience that it is better to have the questionnaire in English and undertake the interviews with the help of interpreters. In cases where we tried to have the questionnaire translated, we found that the language can be misleading, and the answers might not reflect the questions asked.

4.4 Sample sorting

All the collected samples from Funafuti and Vaitupu were transported to the Funafuti waste disposal site for sorting. The building is the property of DWM, and was approved for the use of the consultant team for sorting of the samples. 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.

It is general practice for the consultant team to purchase the tubs and baskets required for sorting. However, in Tuvalu an inspection of the landfill site revealed the presence of many buckets and tubs that had been disposed of at the landfill. The team decided to salvage materials from the landfill to construct the sorting table and to use the tubs and baskets for sorting.

Figure 16: site set up in Tuvalu using salvaged materials from the landfill. Tubs and buckets also procured from the landfill

The sorting area consisted of a raised platform (rather than on ground level) to facilitate ease and speed of sorting. Each waste bag was opened and the contents were carefully spread and sorted into different waste items. Waste containers recovered and collected from the waste disposal site were used for easier sorting of the different waste items.

Separated materials were placed in different containers, weighed using an electronic scale and the weight measurement recorded using the electronic forms. In maintaining the high level of accuracy, APWC brought its own pre-calibrated electronic scales from Australia.

Figure 17: Samples ready for sorting

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).

Further, 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 H.

Figure 18: Sorted waste sample

4.5 Landfill audit

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. Since January 2019, the Department of Waste Management (DWM) records all vehicles coming into the landfill, therefore data is available for the total amount of waste coming into the landfill over time. The consultants 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 material coming in to determine the content.

We therefore requested the data from the landfill gatekeeper, which indicated that on average four to 15 vehicles arrive at the landfill each day. We also noticed that some members of the community drive up to the landfill with household garbage, which was not noted in the gatekeeper notes.

Due to the small number of vehicles entering the landfill each day and because the sort site was co-located at the landfill, the consulting team decided to undertake a landfill audit for each day of the week.

Therefore, the audit was conducted over six days and 67 vehicles were audited in the process.

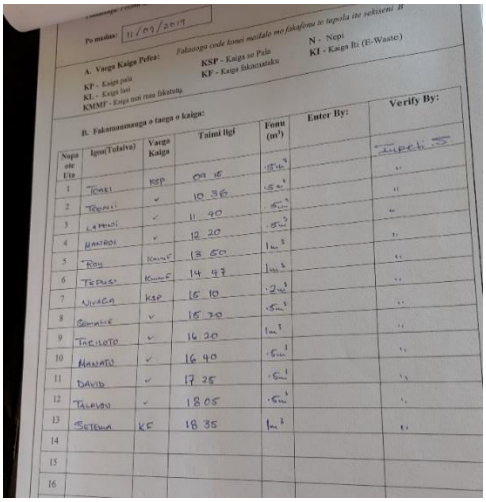


Figure 19: Record of vehicles entering the landfill for a day at the Tuvalu landfill site

The waste audit supervisor, Geoff Thompson, was in attendance from opening to closing time each audit day at each site. Every effort was made to record every load, however, the audit staff noticed that some vehicles entered from sites other than the main landfill entrance gate. We also believe that a few vehicles may have been missed during staff amenity breaks. Due to the lack of weighbridge, the exact number could not be recorded but we believe that more than 90% of all vehicles entering the landfill were audited.

Auditors were equipped with mobile phones, high-visibility safety vests, sunscreen, wet weather gear and safety boots (with steel base to prevent any penetration). Data sheets were loaded on tablets in weatherproof cases and all data was entered directly onto the tablet to be assessed by the statistician. The categories and information recorded for each vehicle is provided at Appendix J.

All data was recorded in a consistent manner in litres on a standard data sheet. Space was provided on the form so that if significant quantities of any other items were found they could be appropriate recorded. Sheets were pre-numbered to ensure all recording sheets are accounted for after the audit. The consulting team used an online system to record data, circumventing the need to use paper recording sheets.

All auditors recorded the following information:

- Date and time of the vehicle arrival
- Registration number
- Vehicle type
- Vehicle volume
- Composition of the load
- Degree of compaction
- Photographs of specific loads of interest taken by the assessors.

Figure 20: Commercial premises self-hauling waste and a mixed construction load

4.6 Work Health and Safety

The consulting team at APWC has an integrated management system used during audits, which 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).

We are very proud of our excellent work, health and safety record and our commitment to quality, environmental protection and sustainability. Therefore, the following steps were undertaken to ensure APWC staff, as well as those being trained to undertake the work, are always safe.

- Site-specific safe work method statements (SWMS) were developed
- A pre- and post-work commencement risk assessment was undertaken
- APWC collection and sorting supervisor undertook QHSE inductions for project staff
- All staff were trained in the waste audit code of conduct developed by APWC, 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 the safety of staff based on local conditions. APWC's collection and sorting supervisor had full control over local safety requirements to ensure all work was being conducted in a manner to protect the health and safety of the staff.

4.7 Staff training

The consultant team trained staff from the DWM and Kaupule in the process of undertaking the audits. We believe that the staff in Tuvalu would be able to replicate this audit if required. The list of staff trained and the training undertaken is provided in the table below.

Table 19: List of staff trained from Tuvalu

	Waste characterisation	Data entry	Interviews
Siliaco Letueti (Waste Education Officer)	✓	✓	
Saluu Tilaima	✓		
Jonah	✓		
Salusalu Vaguna	✓		
Kitasi Sioni	✓		
Khan Tel Bruce			✓
Epu Felenga			✓
Mataliki Lesaa (Vaitupu)	✓	✓	✓

Although the staff have been trained to undertake the audits, currently accurate scales are not available for the local staff to undertake their own audits. This is something that could possibly be covered through a donor fund.

All measurements are done by weight and a volume to weight conversion calculator can then be used to convert these weights to volumes and vice versa.

5 Summary of data collected

During the three-week mission to Tuvalu in September 2019, the consultants were able to collect a wide range of data, as summarised in Table 20 . Further data from customs is still being requested.

Table 20: Data collected for Tuvalu audit

Sample type	Number of samples from Funafuti	Number of samples from Vaitupu	
Household samples	136	59	
Commercial samples	25	2	
Landfill samples	6 days (67 samples)	Visual audit only – dumpsite	
Litter samples	5 sites on Funafuti (twice, one week apart)	N/A 1 litter audit number 6 on one of the conservation islet – **Sualopa** Litter audit 7: On the litter audit submission	Same five sites, sampled one week apart. Pins for sites 3, 4, 5 dropped during the first sampling. Pins for site 1, 2 dropped during the second sampling
Nappies	10 x 15L buckets were weighed and nappy numbers counted Household interviews to determine number of nappies per household per week		

Green waste	Estimate of stockpile at the Transfer Station and 9 months data of green waste generated through DWM
Batteries **E-waste** **Aluminium cans (separate entries for compacted and non-compacted)** **Engine oil** **Old machinery**	Stockpile at the Transfer Station
All island stockpiles	All stockpiles of metal, electronic goods and white goods on the island

6 Results of 2019 waste audit

6.1 Household and commercial audit results

The aim of the waste audit is 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, including the disposal data available, to determine what our data revealed about waste generation characteristics and how it varies 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
- Whether or not there is a collection service in the house 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.

The best results were obtained using only a single predictor: the town population. The models that best fit the generation data are different, based on the variability of waste generated versus the characteristics measured. Therefore, the model that fits the data will be different for each country but can be easily determined by modelling the data collected versus the potential predictors of generation. The generation rates thus generated are then checked against actual disposal rate data made available through the landfill/dumpsite audits.

Household generation rates in Vaitupu and Funafuti were in line with a broader pattern we have observed across other developing countries audited by APWC. Settlement population is highly predictive of household generation rates across countries. We have found that household generation rates are well approximated by the formula:

$$HH\ Generation\ \left(\frac{kg}{hh \cdot day}\right) = 0.4 \ln(population) - 2$$

This formula gives the following results for Funafuti and Vaitupu:

Table 21: Waste generation rates

	Predicted Generation (kg/hh/day)	Measured Generation (kg/hh/day)
Funafuti	1.51	1.34
Vaitupu	0.80	0.51

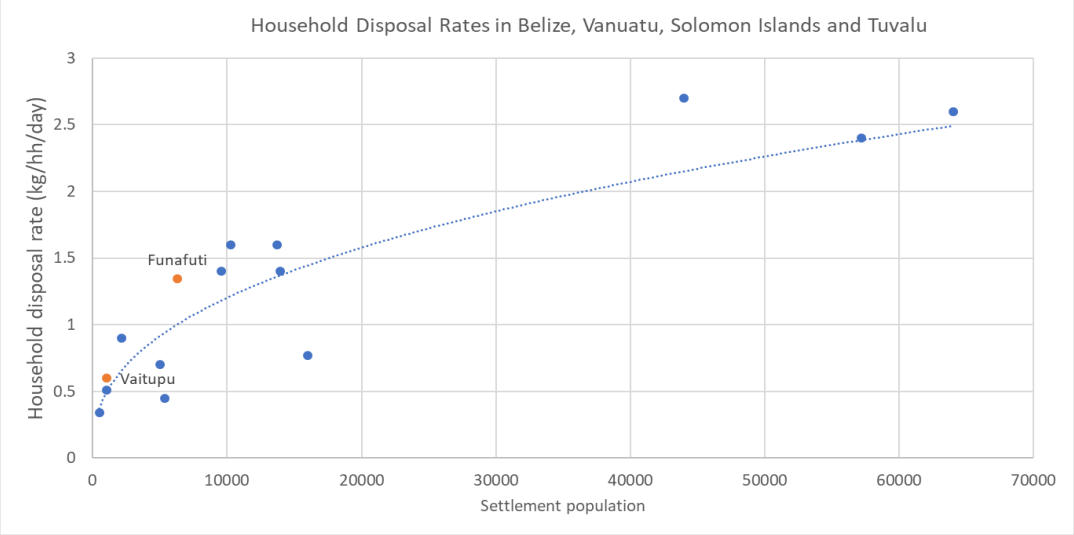


Figure 21: Household disposal rates compared across countries

However, the predictive model was not used because actual sampling was undertaken for these two islands. The model is useful for future predictions if decisions around ongoing material generation are to be made. The model can be applied to understand the potential generation rate of these materials.

6.1.1 Estimating household and commercial waste generation: Funafuti and Vaitupu

6.1.1.1 Funafuti

Extrapolating generation rates from household audits, we estimated 1,144 kg/day (1.1 tonnes) of waste generated by the whole of Funafuti. This is based on waste generated by households only.

From January 2019, the Department of Waste Management (DWM) started recording incoming waste volumes at the landfill. The data provided by DWM shows that an average of 5.5 m^3 per day household waste entered the landfill since January 2019. This corresponds to a density of 208 kg/m^3. The consultant team observed a very low compaction rate (with no equipment available for compaction) at the landfill and 208 kg/m^3 corresponds to that observation.

The analysis also attempted to compare the household waste generation rates with the amount of waste being offloaded at the landfill from the household waste collection trucks. The collected waste is subject to some compaction, whereas the unsorted waste is not. The landfill audit recorded 9.7 m^3 per day of household waste over a 10-day period, which corresponds to a density of 117 kg/m^3. Both figures are broadly compatible with densities for mixed, uncompacted waste, and we used the DWM data to determine volumes as they had a much longer sampling period.

Daily waste generation rates for Funafuti

- Between 6-10m^3 of household waste entering the landfill per day
- 750-1000m^3 of non-household entering the landfill per day
- Almost 3000kgs of waste generated in Funafuti daily

Further, the data was used to estimate the contribution of other sources. For commercial samples, a per-employee generation rate was derived, then extrapolated based on the estimated number of workers in Funafuti. This yielded a non-household generation rate of 935 kg/day, compared with 744 kg/day estimated from trucks arriving at landfills using the same density figure of 120 kg/m^3. The figure from the landfill is deflated because only the larger commercial premises undertake their own waste disposal and the smaller shops and offices are collected through the DWM. In cases where landfill audits are not possible, the commercial sampling strategy provides a high level of accuracy for prediction of waste generation.

Table 22: Waste generation rate for Tuvalu in September 2019

Household generation rate	Non-household generation rate	Overall generation rate
1,144 kg/day	1,760 kg/day	2,904kg/day

The overall generation rates of 2,904 kg/day is higher than found in the 2017 Tuvalu waste survey (Sagapolutele & Binney, 2017), which provided an estimate of 2,478 kg/day. However, we believe that this represents a genuine increase in the total amount of waste generated, as our data corresponds with that collected over nine months by DWM.

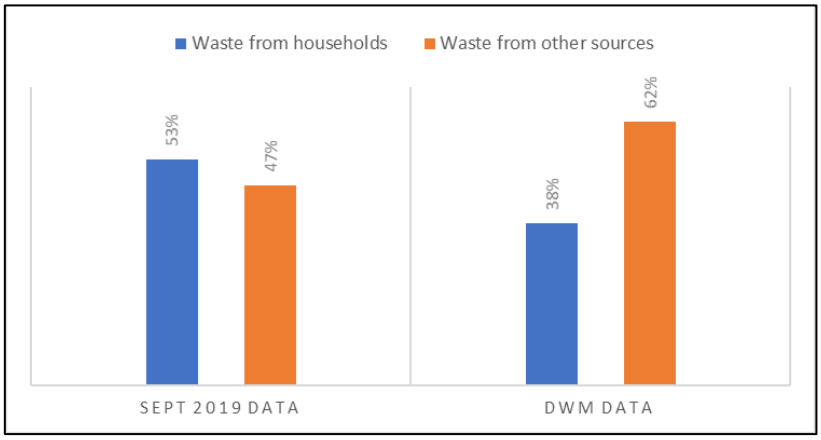


Figure 22: Sources of incoming waste

Both this 2019 survey and the 2017 waste survey found only small quantities of food among waste products, as this was overwhelmingly fed to pigs.

By volume from DWM data, 38% of incoming waste is from households and 62% from other sources, including green waste. Our landfill sample, gained over 6 days featured much less construction waste than DWM data, given the shorter timeframe and put the ratio at 53% household and 47% other sources. We believe that the DWM data was highly affected by construction work in preparation for the PIF's meeting. However, the importance of the impact of events on the waste generation cannot be discounted and any future waste management decisions should endeavour to include the increased rate of waste generation from activities arising from events and natural disasters..

The standard error of the total sample weight for household surveys was 107 kg/day, corresponding to an 80% confidence interval of 1,007–1,280 kg/day total household generation. The median standard error for individual materials was 20%.

6.1.1.2 Vaitupu

In Vaitupu, only a household and commercial premises audit was conducted. We estimate that households in Vaitupu generate 100 kg/day of waste, not including green waste as it is placed separately in sacks or bundles for collection. Assuming other sources of waste, including commercial waste, account for 40% of incoming waste, the overall waste generation rate on Vaitupu is 157 kg/day.

This is far below the estimate from the 2017 Tuvalu waste survey estimate of 704 kg/day. If we consider packaging materials, we find that our figures, while lower, are closer to those of the waste survey in 2017.

Table 23: Waste generation rate in Vaitupu 2019 vs 2017

	APWC (kg/day)	2017 Tuvalu waste survey (kg/day)
Plastics	35.3	21.2
Glass	20.0	21.2
Metal	14.7	21.2
Paper and cardboard	21.4	14.1
Green waste	48.5	535

This difference is expected because during the consultant survey of 2019, the green waste was not picked up for analysis due to operational constraints. For subsequent analysis, instead of our figure we used a figure 0.32 kg/person/day of green waste generation for the outlying islands. This represented the average from (Sagapolutele & Binney, 2017) for the outlying islands.

Standard error for total sample weight was 15 kg/day, giving an 80% confidence interval for household generation of 81–119 kg/day, or 135–199 kg/day for total generation. The median standard error for individual materials was 20%.

6.2 Stockpile audit results

APWC conducted an audit of stockpiles situated on Funafuti. Several bulky items not found in other waste streams were found in significant quantities in stockpiles including shipping containers, end-of-life vehicles, fuel drums and lead-acid batteries. We were unable to estimate generation rates from stockpiles, but we could compare the stockpiles found with the estimated annual generation rates.

We found close to one year's worth of vehicles in various stockpiles around the island, and an additional stockpile holding about one year's worth of lead-acid batteries. Around three months' worth of e-waste and green waste were found in stockpiles, and around one month's worth of aluminium cans was found. These figures could be helpful if they were combined with estimates of the rates of outflow from stockpiles, as they could give some indication of recovery rates from landfill as well as accumulation rates. We are still gathering the requisite information from customs to determine whether it is possible to get the outflow information. The second (and more likely scenario) is that the materials that are not in the stockpile are not being recovered and are therefore ending up in the landfill.

Apart from green waste, by far the most prevalent material in stockpiles was ferrous metal – this includes the categories EOL vehicles, metal drums, metal ferrous and shipping containers. In total, we found 680 m^3 of ferrous materials in stockpiles, weighing 113 tonnes. This represents by volume around 6% of annual Tuvalu waste generation and 8% of annual waste generation by weight.

Table 24: Type and quantity of materials found in stockpiles around Tuvalu

	Count	*Volume (m^3)*	*Weight (T)*	*Annual generation Funafuti (m^3)*	*Percent of annual generation found in stockpile*
Aluminium boats	2	6	0.6	-	-
Aluminium cans	-	15.25	2.2875	102.1758	14.9%
E-waste	1	30.25	4.5375	72.96996	41.5%
EOL vehicles	35	160.28	80.14	167	96.0%
Fiberglass boats	3	9	0.9	-	-
Glass	-	0.5	0.1125	181.1662	0.3%

Green waste	-	360	72	872.5501	41.3%
Lead-acid batteries	-	5.5	20.9	6.4	85.9%
Metal drums	140	24.164	3.26214	-	-
Metal ferrous	10	1.33	0.266	-	-
Plastic water tanks	16	11	1.65	-	-
Shipping containers	13	495	29.19231	-	-
Used oil	-	2.4	2.4	28	8.6%
White goods	20	5.06	0.5566	104.3904	4.8%

Stockpiles in Funafuti

- 240 pieces of materials amounting to 1126m^3 and weighing approximately 220 tonnes are currently stockpiled in Funafuti
- Data shows that this accounts for 96% of EOL vehicles, 40% of E-waste and 86% of lead acid batteries generated annually.
- The E-Waste and lead acid batteries are stockpiled at the TS leading to ease of recovery when transport options are available.

7 Materials available in Tuvalu

Compiling the household and commercial waste data was only the first step in estimating the total amount of material being generated in various parts of each country so that the quantities of materials to be collected, compacted and moved can be projected as accurately as possible. A number of other sources of data were used to generate the quantities of materials available, and currently being landfilled or stockpiled on the various islands in Tuvalu.

7.1 Total quantities of materials available in Tuvalu

The waste generation rates for household and commercial premises, stockpile data and data collected directly from other sources such as the TEC and customs department allows us to estimate annual waste generation per island in tonnes per year and cubic metres (m$^{3)}$ per year.

7.2 How the estimates were developed

7.2.1 Sources of data:

APWC data from September 2019 waste audits	Other sources of data
• Household audit results • Commercial audit results • Landfill audit results • Litter audit results • Nappies audit and interview results • Transfer station stockpile audit results • Other island stockpile audit results	• 9 months' data available from DWM for green waste, nappies, overall household waste, household clean-up and household and commercial collection in m3 • Import data: bulky and long-lived waste • Solar panel installation records. Note: awaiting updated figures. • Note: engine oil data has been requested from the supplier.

7.2.2 Estimating bulky and long-lived items

To estimate waste generation of long-lived, bulky or hazardous items found in stockpiles rather than at the landfill, we took the average of imports from 2010 to 2018 and postulated that this rate is constant over approximately 10 years, and that items have a lifetime of approximately 10 years, thus licensing us to use the average rate of imports as an average rate of waste generation. Note that World Bank (2018) estimates Tuvalu's GDP growth at 4.9% p.a. since 1990, so a degree of growth in imports might be expected. However, the customs data obtained by the consultants was quite variable and gave no reliable reading on the rate of growth in imports. A dataset tracking at least 20 items for the entire 2010–2018 period might be able to provide a useful estimate in the rate of growth from period. We have requested this dataset from the customs department and are expecting to receive it within the next few weeks, at which point this dataset will be updated.

Table 25: The average import quantities for bulky and long-lived items*

	Average imports	Unit	Period
Cars (used and new)	24	Units	2010–2017
Motorcycles	531	Units	2016–2017
Cans, soft drink and beer	296,402	litres	2018–2019
Soft drink bottles	115,643	Litres	2018–2019
Water	226,305	Litres	2016–2019
Beer bottles	3, the674	Litres	2018–2019
Refrigerators	247	Units	2010–2016
Washing machines	202	Units	2010–2016
Car tyres	236	Units	2016–2017
Motorcycle tyres	2,934	Units	2016–2017
Motorcycle tubes	2,745	Units	2016–2017
Lead acid batteries	4,116	Units	2016–2019
Lithium ion batteries	6	Units	2016–2019
Lubricating oil	21,416	Litres	2016–2019

**Please note: some data is not up to date. The consultants are currently acquiring this data from the Tuvalu customs department.*

7.2.3 Estimating waste from renewable energy installations

Data obtained by the consultant team indicates a project or plans for the installation of 3,557 kW of solar power in Tuvalu between 2008 and 2019. This is combined with 14,762 kWh of battery storage systems and 3,722 kVa of generator capacity. Solar panels are rated with a typical lifespan of 25 years (Lombardo, 2014). Thus, we might expect to see renewable energy equipment from these installations beginning retirement by 2033.

The weight of 10 kWh of battery storage can be between 60 and 600 kg and a volume of 60 to 500 litres (https://www.solarquotes.com.au/battery-storage/comparison-table/). A solar panel of 6 kW typically has a volume of around 80 litres and weighs 18 kilograms (https://news.energysage.com/average-solar-panel-size-weight/). A 100 kVa diesel generator has a volume of 3.5 cubic metres and weighs 1730 kg (https://www.bluedm.com.au/denyo-100kva-diesel-generator-3-phase-dca-100esi/).

Putting these figures together (choosing the middle of the range for battery systems) yields the following table for installation rates of renewable energy systems.

Table 26: Annual solar panels installed in Tuvalu*

	Installation (kg/year)	Installation (m^3/year)
Solar panels	970	4.3
Storage systems[3]	44,300 (6,500–80,000)	36 (6.5–65)
Generators	5,800	12
Total		

*Consultants are confident in receiving an update on the exact number of solar panels installed from TEC, at which point this table will be updated.

7.2.4 Applying estimates to other islands

We assumed the outer islands shared the waste generation rate and composition of Vaitupu.

Funafuti's average share of waste, excluding organics, was 77% and across a wide variety of materials Funafuti's estimated share was close to this figure. 'Metal other' was the only exception, which was minimally present on Vaitupu (the largest source of this type of waste on Funafuti was commercial and industrial waste arriving at the landfill). We assumed for bulky items not found in household audits, such as white goods and vehicles, that Funafuti's share of the waste was again 77%. This figure informed the estimated generation rates across the various islands of Tuvalu. The resulting share of waste generation across the islands shown in Figure 23.

Materials of interest – generation rate

- Almost 1642 tonnes and 7000m^3 of materials of interest are generated in Tuvalu (all islands) each year.

[3] We believe this figure is likely to be captured by import data for sealed lead-acid batteries, and does not count it separately

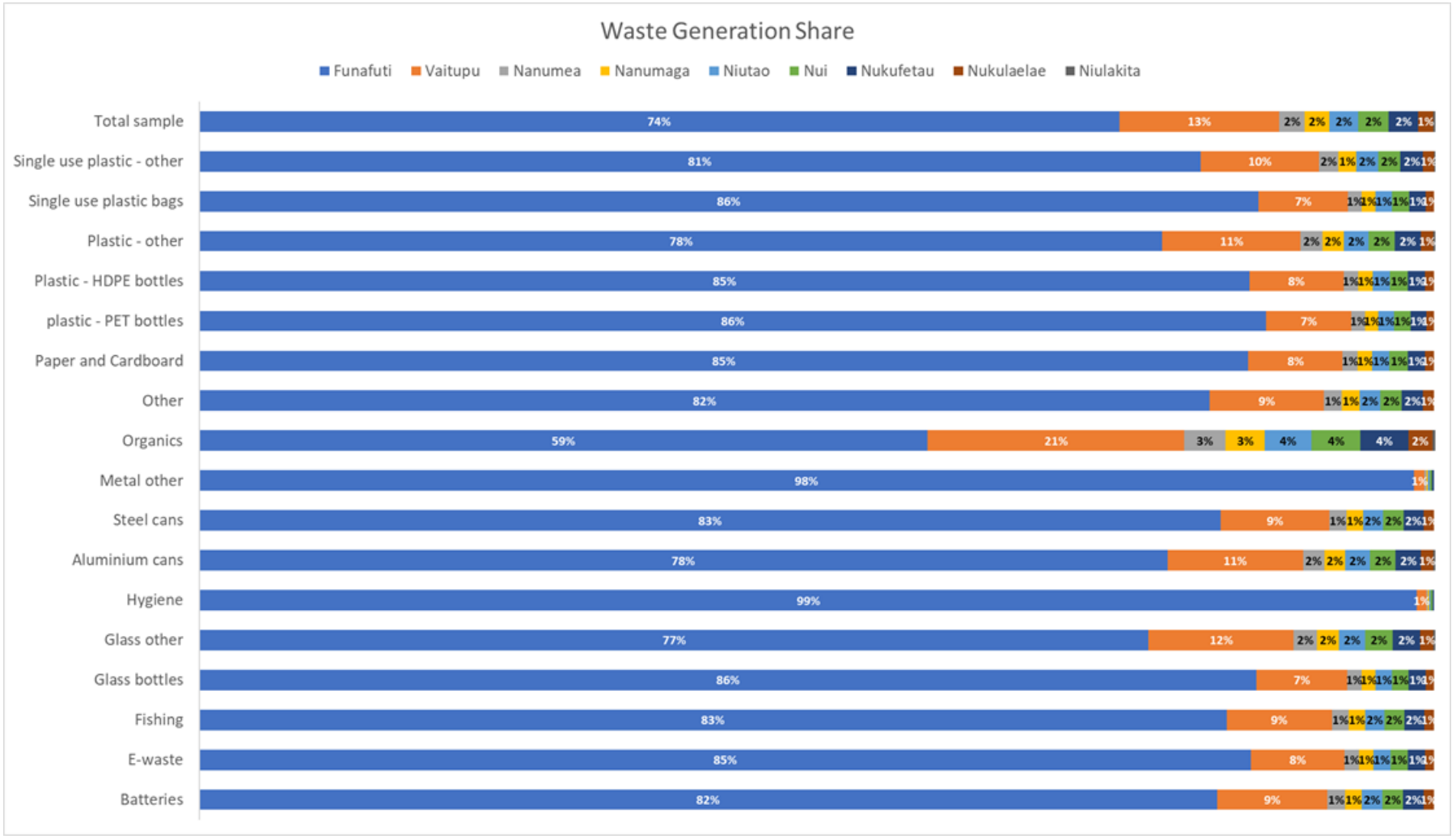


Figure 23: Share of waste for each island of Tuvalu

7.3 Quantities of materials available in Funafuti and islands of Tuvalu

Using the data from household audits, commercial audits, landfill audits, customs department and stockpiles and applying the assumptions and calculations noted in section 9.2; we were able to estimate the amount of material of each type being generated on each island.

Our estimates of the generation of waste on the islands of Tuvalu are shown in Table 27 (by weight) and Table 28 (by volume). These figures provide the basis for the data required for undertaking the next stages of analysis for the pre-feasibility study, as required by the terms of reference of this project.

Please note that this data presents the total quantities of materials being generated and does not include the actual ability of the material to be recovered depending on operational on-ground realities like household behaviour, collection infrastructure, transport, equipment, shipping etc. The next section provides estimates on potential recovery rates for some materials.

Table 27: Type and quantity of materials produced on islands of Tuvalu (T/yr)

	Funafuti (T/year)	*Vaitupu (T/year)*	*Nanumea (T/year)*	*Nanumaga (T/year)*	*Niutao (T/year)*	*Nui (T/year)*	*Nukufetau (T/year)*	*Nukulaelae (T/year)*	*Niulakita (T/year)*	*Total (T/year)*
Used lead-acid batteries[4]	23.6	3.1	0.5	0.5	0.6	0.6	0.6	0.3	0.0	29.7
Lithium-ion batteries[4]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other batteries	1.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2
E-waste	21.9	1.9	0.3	0.3	0.4	0.4	0.4	0.2	0.0	25.7
Fishing	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Glass bottles	31.5	2.7	0.4	0.4	0.5	0.5	0.5	0.3	0.0	36.8
Glass other	50.0	7.6	1.2	1.2	1.4	1.5	1.4	0.7	0.1	65.1
Hazardous	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8
Hygiene	44.7	0.3	0.1	0.1	0.1	0.1	0.1	0.0	0.0	45.4
Aluminium cans	8.2	1.1	0.2	0.2	0.2	0.2	0.2	0.1	0.0	10.4
Steel cans	52.5	5.6	0.9	0.9	1.0	1.1	1.0	0.5	0.1	63.5

[4] Data from Tuvalu customs

Other metal	93.5	0.8	0.1	0.1	0.1	0.2	0.2	0.1	0.0	95.2
Organics	349.0	123.2	19.7	18.9	22.4	23.4	22.9	11.5	1.3	592.3
End-of-life vehicles[5]	98.0	17.0	2.7	2.6	3.1	3.2	3.2	1.6	0.2	131.6
EOL renewable equipment[6]	5.0	0.9	0.1	0.1	0.2	0.2	0.2	0.1	0.0	6.8
White goods	13.8	1.6	0.3	0.2	0.3	0.3	0.3	0.1	0.0	16.9
Other	101.8	11.5	1.8	1.8	2.1	2.2	2.1	1.1	0.1	124.5
Paper and cardboard	122.0	11.0	1.8	1.7	2.0	2.1	2.1	1.0	0.1	143.8
PET bottles	35.7	2.9	0.5	0.4	0.5	0.5	0.5	0.3	0.0	41.3
HDPE bottles	8.3	0.7	0.1	0.1	0.1	0.1	0.1	0.1	0.0	9.8
Other plastic	96.8	11.9	1.9	1.8	2.2	2.3	2.2	1.1	0.1	120.3
Single-use plastic bags	23.4	2.0	0.3	0.3	0.4	0.4	0.4	0.2	0.0	27.3
Other single-use plastic	6.0	0.7	0.1	0.1	0.1	0.1	0.1	0.1	0.0	7.4
Tyres[4]	12.6	2.2	0.3	0.3	0.4	0.4	0.4	0.2	0.0	16.9
Used oil[4]	20.0	3.5	0.6	0.5	0.6	0.7	0.6	0.3	0.0	26.9
Total	1223.0	212.4	33.9	32.5	38.6	40.4	39.6	19.9	2.3	1642.6

Table 28: Type and quantity of materials produced on islands of Tuvalu (m^3/yr)

	Funafuti (m^3/y)	*Vaitupu (m^3/y)*	*Nanumea (m^3/y)*	*Nanumaga (m^3/y)*	*Niutao (m^3/y)*	*Nui (m^3/y)*	*Nukufetau (m^3/y))*	*Nukulaelae (m^3/y)*	*Niulakita (m^3/y)*	*Total (m^3/y)*
Used lead-acid batteries[4]	5.5	0.8	0.1	0.1	0.2	0.2	0.2	0.1	0.0	7.1
Lithium-ion batteries[4]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other batteries	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
E-waste	73.0	6.5	1.0	1.0	1.2	1.2	1.2	0.6	0.1	85.7
Fishing	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6

[5] Includes cars and motorcycles; data from Tuvalu customs

Glass bottles	70.1	6.0	1.0	0.9	1.1	1.1	1.1	0.6	0.1	81.9
Glass other	111.1	17.0	2.7	2.6	3.1	3.2	3.2	1.6	0.2	144.6
Hazardous	12.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.7
Hygiene	149.1	1.1	0.2	0.2	0.2	0.2	0.2	0.1	0.0	151.3
Aluminium cans	102.2	14.3	2.3	2.2	2.6	2.7	2.7	1.3	0.2	130.4
Steel cans	350.1	37.2	5.9	5.7	6.8	7.1	6.9	3.5	0.4	423.6
Other metal	389.8	3.4	0.5	0.5	0.6	0.7	0.6	0.3	0.0	396.5
Organics	872.6	307.9	49.2	47.2	55.9	58.6	57.4	28.8	3.3	1480.8
End-of-life vehicles[5]	124.8	21.7	3.5	3.3	3.9	4.1	4.0	2.0	0.2	167.6
EOL renewable energy equipment[6]	38.9	6.8	1.1	1.0	1.2	1.3	1.3	0.6	0.1	52.3
White goods[7]	104.4	14.5	2.3	2.2	2.6	2.8	2.7	1.4	0.2	133.1
Other	339.4	38.3	6.1	5.9	7.0	7.3	7.1	3.6	0.4	415.1
Paper and cardboard	1109.5	100.2	16.0	15.3	18.2	19.1	18.7	9.4	1.1	1307.4
PET bottles	357.0	28.6	4.6	4.4	5.2	5.4	5.3	2.7	0.3	413.5
HDPE bottles	44.6	4.0	0.6	0.6	0.7	0.8	0.7	0.4	0.0	52.5
Other plastic	754.6	108.1	17.3	16.6	19.6	20.6	20.1	10.1	1.1	968.2
Single-use plastic bags	271.6	23.0	3.7	3.5	4.2	4.4	4.3	2.2	0.2	317.0
Other single-use plastic	59.7	7.1	1.1	1.1	1.3	1.3	1.3	0.7	0.1	73.7
Tyres[4]	111.7	19.4	3.1	3.0	3.5	3.7	3.6	1.8	0.2	150.0
Used oil[4]	20.8	3.6	0.6	0.6	0.7	0.7	0.7	0.3	0.0	28.0
Total	5473.7	769.4	122.9	117.9	139.7	146.5	143.3	72.0	8.2	6993.7

[6] The renewable energy equipment considered in the data is expected to begin decommissioning around 2033 and includes solar panels and supporting diesel generators; data from solar installation plans 2008–2019

[7] Includes refrigerators and wahing machines; data from Tuvalu customs

8 Capturing available material

For both the private and public sector to undertake the activities required for the successful movement of material to be accepted at a proposed recycling hub, difficulties include land barriers, a small private sector and limited technical capacity and infrastructure including appropriate equipment and other resources.

Tuvalu has recently implemented several bans and levies. When implemented, these mechanisms will aid in the recovery of materials while providing a financial basis for the movement of material out of Tuvalu for recycling. This section discusses the impact of these levies and bans on the amount of material available for recovery from Tuvalu and the potential materials that Tuvalu can target for increased resource recovery.

This section deals with the amount of material that can potentially be available for compaction, storage and shipping based on the current:

- Levies
- Available infrastructure
- Deposit scheme

Once collected, the materials will need to be consolidated for shipping for recycling. Shipping is a major issue since there is only one shipping company serving Tuvalu through Fiji. As a result, there is no competition for securing better shipping or handling costs. At present, freight is AUD$2,000+ for a 20-foot container. There is limited knowledge on the proper dismantling of e-waste and a visit to Samoa and Fiji was undertaken to improve the knowledge and skills on the basic scrap-metal processing and preparation.

The potential recycling network and hub would therefore provide a much needed outlet for the materials that will start accumulating at the Transfer Station from 2020 onwards with aggregation with other PICs recyclables to gain access to either export markets or to create economies of scale for local value added solutions.

8.1 Waste reduction through bans

Tuvalu has implemented bans on the import of several items as listed in Table 29. These bans came into force on 1 August, 2019. The ban allows for the existing stockpiles of materials to be utilised while there is an active ban on the import of new materials. The waste audits were conducted between 19 and 27 September 2019 and the bans are therefore likely to have had some impact on behaviour, but the full impact is unknown. This audit is very timely and can act as

Waste reduction - bans

- The banned single use plastic items represent 6% of the material currently entering the waste stream and approximately 253 to 421 m^3 of material that will not be required to be managed at the landfill.

a baseline to measure and determine how the waste stream changes over time as the bans and levies are implemented. The banned items will not enter the waste stream and will therefore not be available for recovery in the future.

Banned items are often substituted for other items at some rate. In Australia, the ACT Commissioner for Sustainability and the Environment (2018) suggests that plastic shopping bags are substituted at a 5:1 ratio for heavier bags. As the heavier bags are typically twice the weight, this suggests that a shopping bag ban may overall reduce plastic bag waste by about 60%.

We consider two levels of reduction to waste due to banned items:

- a 60% reduction (with 40% substitution); and
- a full reduction (with no substitution).

The 'no substitution' estimate may be particularly relevant for plastic bottles less than 1.5 litres, as larger bottles are subject to a levy and are likely to be recovered from the waste stream at high rates. We also believe that Tuvalu has a much higher ability to control the flow of substitutes into the country and can therefore restrict the use of the thicker bags thus controlling household behaviour. The following identifications were made between consultant sort categories and banned items:

Table 29: List of newly banned items currently found in the waste stream

APWC sort categories	Banned item
Single-use plastic bags – lightweight	*Shopping bags, wholly or predominantly made of or lined with plastic or plastic blend and designed to be given out to consumers*
Single-use plastic beverage containers, PET drink pouches	*Plastic water pouches and plastic bags used to produce ice blocks*
Single-use plastic straws	*Straws which are made, in whole or in part, of plastic*
Single-use plastic takeaway containers, single-use polystyrene takeaway containers, single-use plastic takeaway container lids, single-use plastic coffee cups	*Single-use plastic and polystyrene plates, cups and takeaway container*
PET containers water, juice, flavoured milk or soft drink, <1500 ml, HDPE containers water, juice or soft drink <1500 ml, LPB containers flavoured milk, juice or soft drink <1500 ml	*Plastic water bottles less than 1.5 litres and plastic beverage bottles less than 1.5 litres*

The table below estimates that of the total waste generated on Funafuti annually, 421 m3 will avoided if there is no substitution of bags and bottles occurs.

Data in the table below shows that the banned items represent 6% of the material currently entering the waste stream and approximately 253 to 421 m^3 of material that will not be required to be managed at the landfill. The ban will have a beneficial impact on the availability of landfill space in Tuvalu as the current landfill is at full capacity.

Table 30: Estimated annual saving in waste arising from the bans

Banned item	Estimated annual saving in plastic waste with 40% substitution (m^3)	Estimated annual saving in plastic waste with no substitution (m^3)	Percentage of total waste volume represented by items in the category
All single-use plastic bans	168	280	4%
Plastic bottles less than 1.5 litres	85	141	2%
Total	**253**	**421**	**6%**

8.2 Material recovery through levies

Several items are subject to levies which will be applied upon point of entry into the country into a fund administering the implementation and recycling of these items. As a result of refundable deposits, there is more than 90% recovery of these selected materials in Palau. The following items are subject to levies supporting recovery and (if applicable) recycling operations:

Recover of recyclables with the current levies in place

If 100% of the levied items are able to be recovered, 14% of the current waste stream will be diverted from landfill for resource recovery. This represents between 781 (at 75% recovery rates) to 1042 m^3 of uncompacted materials that Tuvalu will need to store, compact and process before making it available for shipping overseas for recycling.

Table 31: Items in the waste stream subject to levies

APWC Category	Levied item
PET carbonated water, soft drink, fruit juice, vegetable oil – all sizes	Mineral water, sweetened drinks and cooking oils in PET bottles
Aluminium alcoholic sodas, mixers, beer, cider, soft drink – all sizes	Sweetened drinks and alcohols in aluminium cans
Glass beer, fruit juice, spirits, wine – all sizes	Sweetened drinks, alcohols and cooking oil in glass bottles
Containerised used oil	Lubricating oil
Hygiene – nappies	Nappies
White goods	Large white goods, medium white goods, small white goods

End-of-life vehicles	Construction heavy, medium, small equipment
End-of-life vehicles	Office and family vehicles
End-of-life vehicles	Motorbikes
Batteries, lead-acid	Batteries – motorbike, vehicle/equipment, solar panel

The following table shows the amount of material available for recovery if 75% or 100% of levied items can be recovered.

When estimating the contribution to the waste stream of these items, we discount the contributions from the excluded categories above. As mentioned previously, levies on larger beverage containers may reduce the effective rate of substitution for plastic bottles less than 1.5 litres.

At the time of writing this report we only obtained customs data for refrigerators and washing machines, which represents a subset of all whitegoods imported to Tuvalu, so the true quantity of whitegoods recovered is likely to be higher.

Table 32: Potential materials available for recycling due to levies

Levied item	Annual saving if recovered at 75%, m^3	Annual saving with full recovery (m^3)	Percentage of total waste volume represented by items in this category
PET beverage and oil containers greater than or equal to 1.5 litres	268	357	5%
Glass beverage containers	37	49	0.7%
Aluminium beverage containers	132	176	2.5%
White goods	80	107	1.5%
End of life vehicles	125	167	2%
Hygiene – nappies	113	151	2%
Batteries, lead-acid	5.6	7.5	0.1%
Used lubricating oil	21	28	0.4%
Total	781	1042	14%

Data presented in the table above shows that if 100% of the levied items are able to be recovered, 14% of the current waste stream will be diverted from landfill for resource recovery. This represents between 781 (at 75% recovery rates) to 1042 m3 of uncompacted materials that Tuvalu will not landfill but will need to be stored, compacted and processed prior to export to the proposed recycling hub or directly to overseas markets for recycling.

Recover of recyclables through further projects/expanding the levy scheme:

Recyclable materials that are not currently being considered through any recycling or recovery scheme account for almost 30% of the waste stream. Future projects involving recovery of cardboard offer the highest savings in landfill space and more than 20% diversion from landfill.

8.3 Future options for increased resource recovery

The data collected also shows that there are a number of recyclable items that are present in the waste stream that are not currently subject to a levy or a recovery scheme. The items considered recyclable and not subject to a levy currently are listed below:

Table 33: List of potential recyclable items that could be targeted for recovery

Current category	
PET cleaning products – all sizes	Glass water carbonated or non-carbonated
HDPE personal care, cleaning – all sizes	Steel cans
Polypropylene	Cardboard
PVC	Paper and LPB
Aluminium, human food – all sizes	E-waste
Aluminium, recyclable	

Cardboard is the most significant item (in terms of volume) that may be targeted for a future resource recovery program or project, followed by paper and liquid paperboard (LPB). Steel cans, glass bottles and e-waste are also substantial categories. Recyclable aluminium includes aluminium foil, food containers and deodorant cans. PET cleaning product bottles, polypropylene packages and HDPE personal care and cleaning bottles offer some savings, while PVC bottles were quite rare in Tuvalu waste.

Table 34: Potential recovery of additional recyclable materials

Recyclable item	Annual saving if recovered at 75%, m^3	Annual saving with full recovery, m^3	Percentage of total waste volume represented by items in this category
Glass water bottles	2.6	3.5	0.05%
Glass jars, fines, other	89	119	1.7%
Steel cans	317	423	6%

Aluminium recyclable	55	73	1%
PET cleaning products	26	35	0.5%
HDPE bottles	32	43	0.6%
Polypropylene	28	37	0.5%
PVC bottles	0.1	0.14	-
Cardboard	711	949	14%
Paper and LPB	268	358	5%
E-waste	64	85	1%
Total	**1,593**	**2,126**	**30.4%**

Data shows that cardboard, paper and LPB account for almost 20% of the current waste stream and should therefore be considered for a future project. There are a number of examples in PICs of successful recovery of cardboard to make briquettes or use as weed cover and in composting. The next most populous category is steel cans which can possibly be included in a future expansion of the bans/levies. However, steel cans are difficult to recycle and therefore have low market value. Any project for recovery of these materials must consider all options carefully.

Please note that the above estimates do not include ferrous metals (iron and steel) that are recyclable, and we found substantial quantities in stockpiles in the form of shipping containers, end of lifer cars and fuel drums. These items appear to head directly to stockpiles, and therefore are not represented in waste delivered to the landfill. We do not have a reliable estimate for the rate at which these items enter stockpiles due to lack of customs data but given that the stockpiles represent 6% of Tuvalu's annual waste generation, the quantity is potentially substantial.

9 Landfill life

A range of policy options has been discussed in section 8 and all of them will have an impact on the lifespan of the landfill. The current landfill is at capacity. All calculations in this figure assume that the additional 1,100m3 of landfill space will be made available from January 2020.

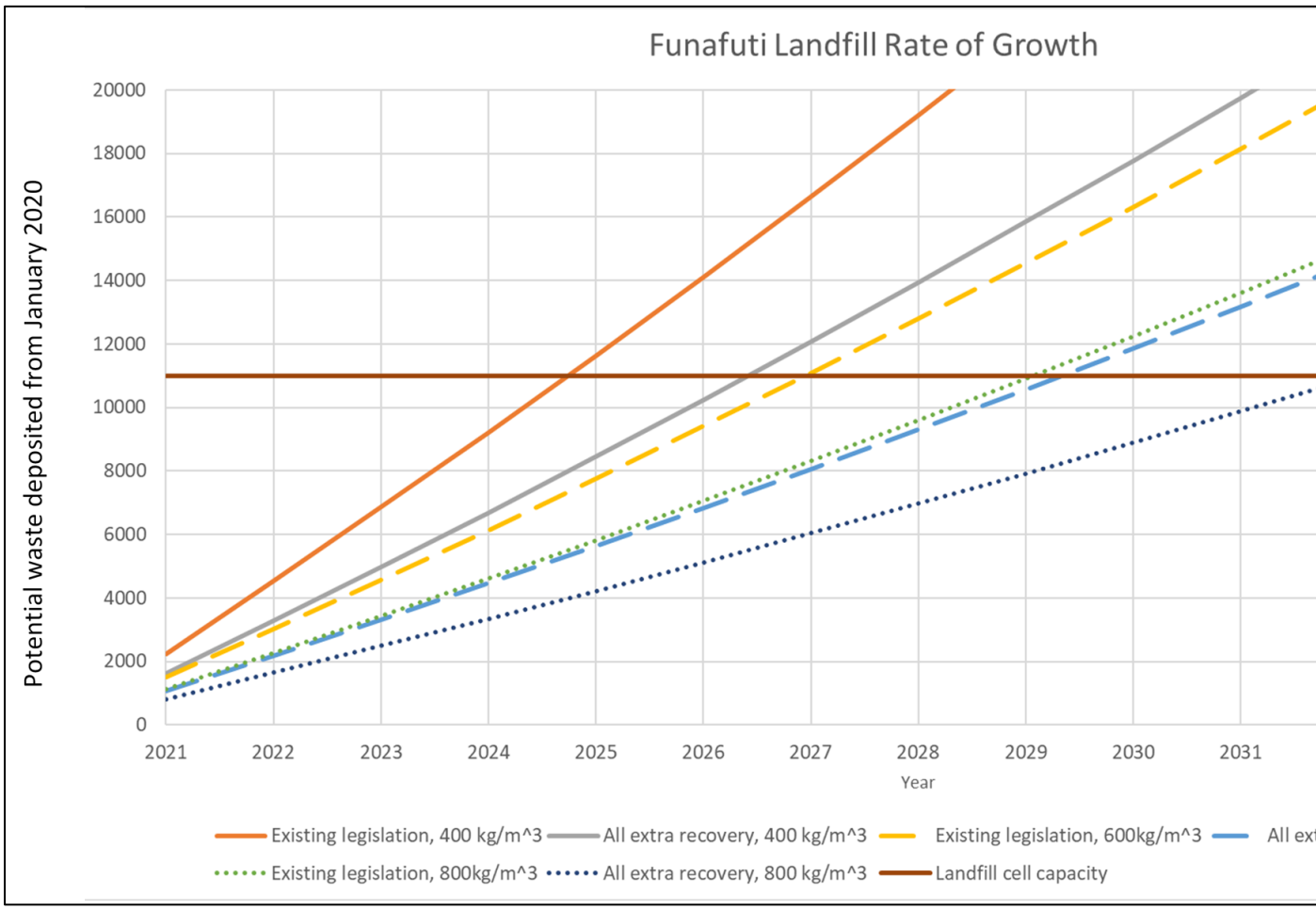


Figure 24 shows the rate of growth of the Funafuti landfill under different policies and compaction rates. Compaction rates have been chosen as a criterion because it can have a huge impact on the lifespan of a landfill, especially one as small as the one in Tuvalu.

Waste is currently delivered to the Tuvalu landfill uncompacted, and according to our audit sample we estimated a density of 208 kg/m^3. This density is likely to increase in the landfill even without compaction due to settling, though exactly how much the density rises is not known. In addition, the Funafuti landfill is currently being compacted with a 6–8-tonne excavator without proper compaction wheels. In this report, we have provided an estimate of the average weight deposited at the landfill each day. Monitoring the rate of growth in landfill volume could then provide an estimate of the density achieved in the landfill. Such an estimate may be valuable in determining how much compaction is possible with proper equipment.

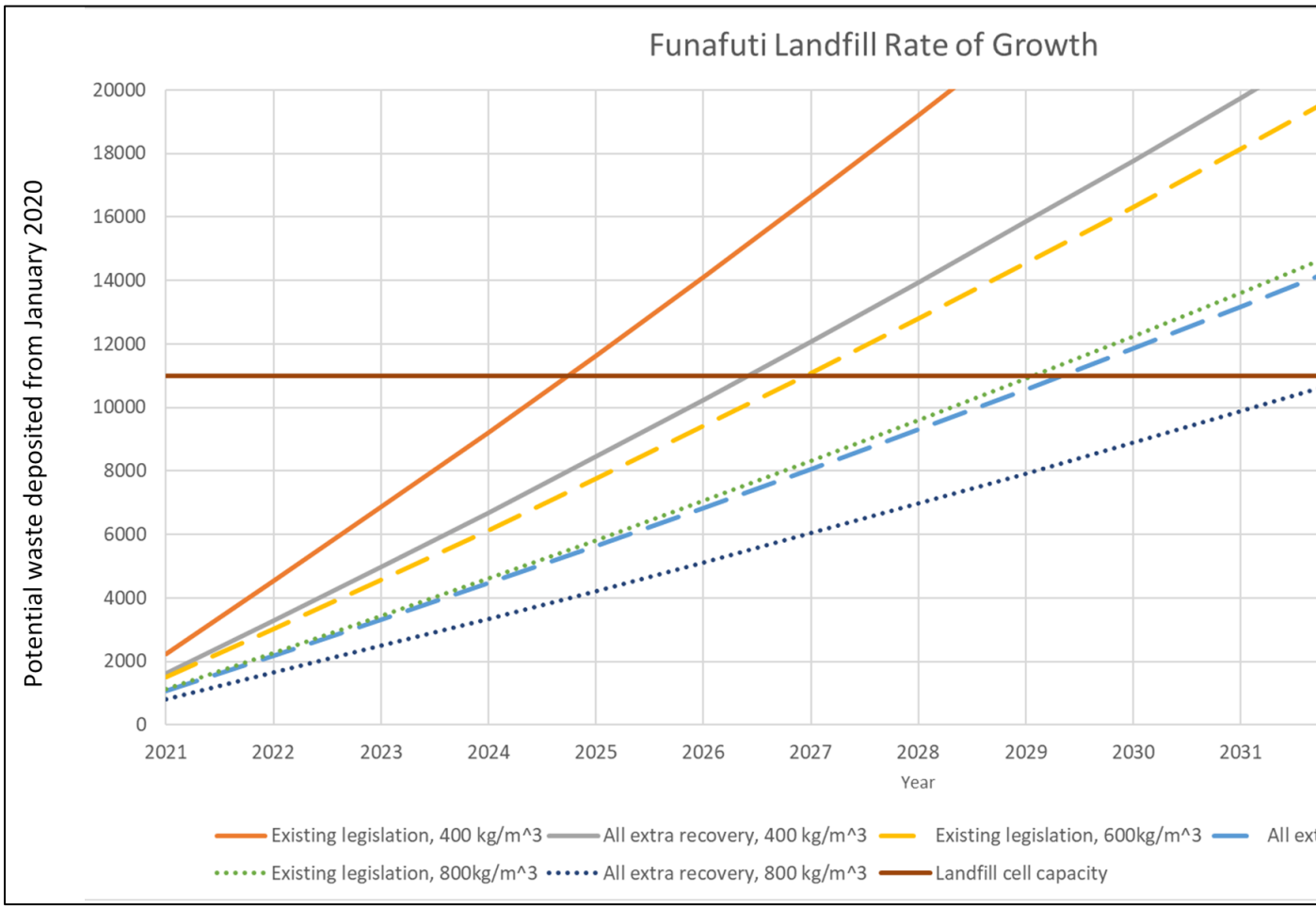
Table 35: Waste compaction possibilities with different equipment

Waste and compaction type	Density
Delivered to Funafuti landfill	208 kg/m^3
Commingled waste compacted in rear-end loader truck	400 kg/m^3

Landfill compacted with steel tooth drums[8]	800–1,100 kg/m^3

Given the different waste policies and bans coming into effect and with the potential new equipment being made available, the landfill lifespan can be extended. The following four scenarios have been explored

- No recovery and a density of 400 kg/m^3, it is estimated that an additional 11,000 m^3 landfill opened in January 2020 would be full by 2025, or 5 years after it opened.
- Recovering all identified additional materials not currently covered by legislation extends this life by another 1.5 years, or until mid-2026.
- Compaction to 600 kg/m^3 under the existing recovery regime yields a lifespan extension about 0.5 years longer than additional recovery.
- Recovering all identified materials and compacting the landfill to 800 kg/m^3 extends the lifespan until around 2032, an extra 7 years.



[8] (Owusu-Nimo, Oduro-Kwarteng, Hellen, Farida, & Mohammed, 2019)

Figure 24 shows the rate of growth of the Funafuti landfill under the different scenarios above . Compaction rates have been chosen as a criterion because it can have a huge impact on the lifespan of a landfill, especially one as small as the one in Tuvalu.

Waste generation rates are also likely to increase over time. We plotted this figure with a conservative estimate of a 2% per year increase – this is around double the population growth rate of Tuvalu, which has been 1% per year since around 1980. The lifespan of a small extension to the landfill, which we estimate is 12 years at most, is not particularly sensitive to the rate of growth. The increase is likely to be significant over a period of two decades or more.

Landfill life:

- *Given no recovery and a density of 400 kg/m^3, it is estimated that an additional 11,000 m^3 landfill opened in January 2020 would be full by 2025, or 5 years after it opened.*
- *Recovering all identified additional materials not currently covered by legislation extends this life by another 1.5 years, or until mid-2026.*
- *Compaction to 600 kg/m^3 under the existing recovery regime yields a lifespan extension about 0.5 years longer than additional recovery.*
- *At the extreme end, recovering all identified materials and compacting the landfill to 800 kg/m3 extends the lifespan until around 2032, an extra 7 years.*

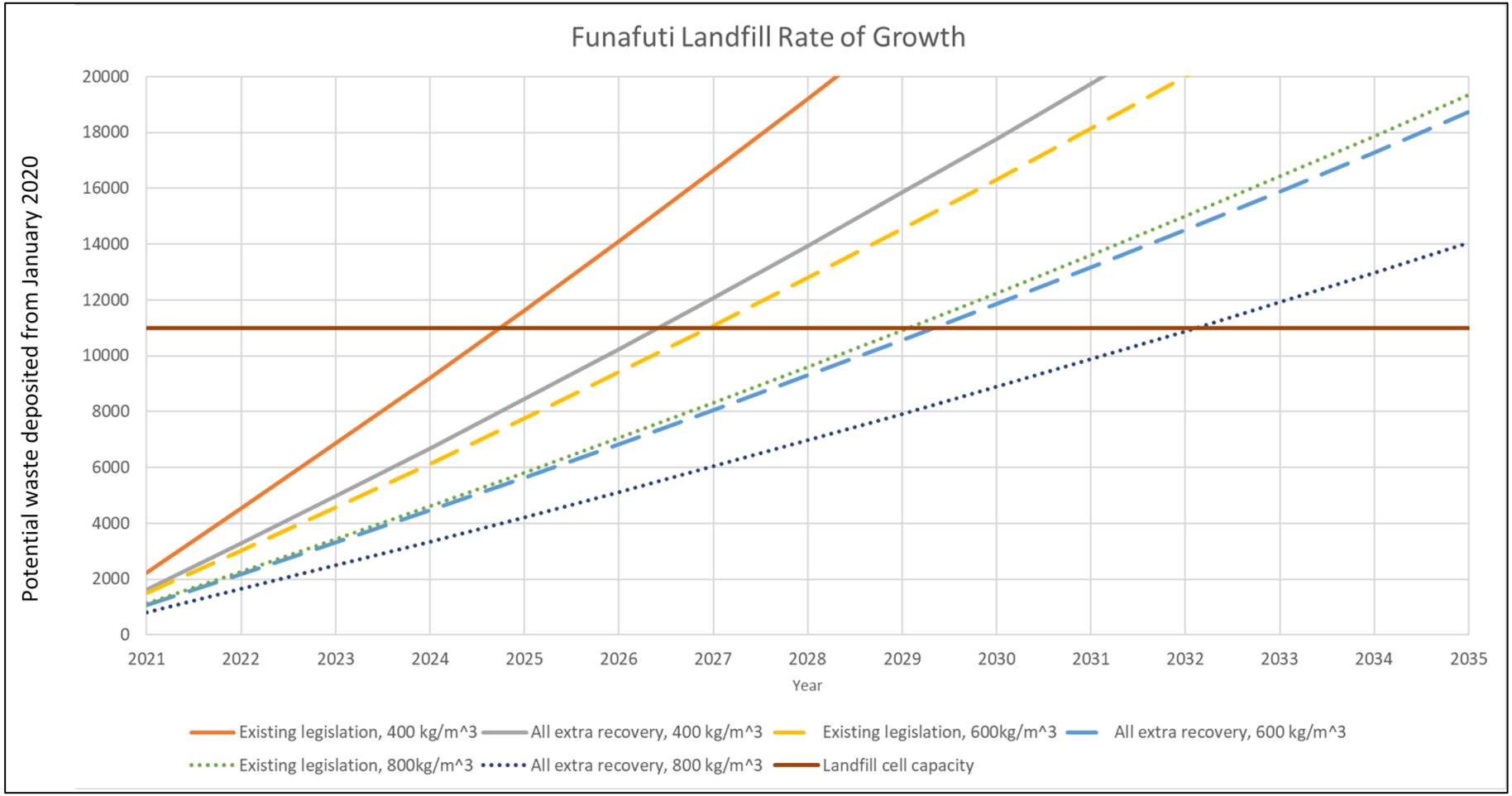


Figure 24: Landfill life vs rate of waste generation in Tuvalu

10 Potential projects for increased recovery for Tuvalu

There are several options for Tuvalu to consider for increased resource recovery. However, there are two that present the biggest value for money proposition. These are presented below:

10.1 Recovery of paper and cardboard

Data shows that Cardboard, paper and LPB account for almost 20% of the current waste stream and should therefore be considered for a future project. This is not surprising given all materials arrive in Tuvalu via sea or air freight and are almost always packaged in cardboard boxes.

There are several examples in PICs of successful recovery of cardboard to make briquettes or use as weed cover and in composting. We believe that cardboard and paper should be considered for future source separation projects with local small scale, low tech solutions.

Given that the green waste is currently being successfully composted and used by the local vegetable farm, we believe that there is potential for the cardboard to be considered as part of the composting process. However, there will be a number of options that should be considered as using cardboard as a substrate for composting may not always work.

We therefore think that a short feasibility study with practical options for the local reuse and recycling of cardboard and paper should be considered.

10.2 Nappies

Nappies are being source separated in Tuvalu for a number of years now. There is 100% source separation for nappies and the new legislation that came into force in August 2019, puts a 5c levy on each nappy.

We hope that this will allow for alternatives like completely compostable nappies more competitive in terms of cost as well as furnishing the DWM with funds to undertake a trial that requires the use of compostable nappies.

For any trial to be successful, the biggest challenge is source separation and education. Tuvalu is well ahead in this instance and therefore has the opportunity to serve as a case study and a success story in this space.

Two potential projects for increased resource recovery:

a) *Cardboard recycling/reuse- locally (composting/Briquettes)*
b) *Compostable nappy trial*

11 Is Tuvalu ready to contribute to a regional recycling facility?

11.1 Readiness for participation

Based on site visits, meetings with officials, audits and a review of the current legislative framework, the consultants believe that Tuvalu is ready and will be able to contribute fully to the operation of a regional recycling network. The key reasons are as follows:

a) A legislative framework is already in place to recover recyclable materials
b) Pressure to undertake recycling activity due to diminishing landfill space
c) Capable staff who are committed to better waste management outcomes and can be trained to participate in recycling network activities
d) A framework of infrastructure reforms currently underway that will allow for the collection and compaction of materials effectively.

Table 36: Regional hub: Tuvalu readiness assessment

Theme	Requirement	Tuvalu's readiness assessment
Policy/legislation	Signatory to international treaties allowing movement of waste	Tuvalu already signed the Waigani Convention to allow to ship waste to Fiji, which will potentially be the regional hub location. The process for signing the Basel Convention has commenced and should be completed by mid-2020.
	In-country deposit legislation and the extent	Tuvalu has recently endorsed (on 1 August 2019) its Waste Management Levy Deposit, which is a combination of CDL and disposal fee systems. It covers beverage containers usually covered under CDL, vehicles, motorbikes, white goods, car batteries, engine oil, nappies, etc. The first year of enforcement covers beverage containers, the second year covers others. Refer to the Regulation e-copy.
	Ability to legislate swiftly if required	Compared with Samoa and other PICs, Tuvalu's legislative framework is less complex and processes to introduce regulations are not as involved.
	Local bylaws and implementation	Six out of eight islands have waste bylaws. However, there is little progress with the implementation because of the capacity of local councils (Kaupule) to enforce. Part of the visit to Samoa by Tuvalu waste management staff in October 2019 is to look at how villages chiefs deal with littering and illegal dumping in the Samoa communities without bylaws. This helps Samoa to maintain cleanliness in rural communities. The proposal from the outer islands to

Theme	Requirement	Tuvalu's readiness assessment
		have transfer stations is being considered by the Department of Waste as the beginning of future on going collaboration in recovering recyclable wastes.
	Responsibilities and power of implementation and compliance	The responsibilities on waste management is shared between the Department of Waste & Islands Kaupule. The Island Kaupule has more authority to enforce compliance at the island level. This is the issue as the capacity at the local councils is weak and the Department of Waste is now recruiting waste staff to be based at the councils to be directly responsible for waste management. Vaitupu and Funafuti now have their waste management staff at the councils.
	EPR schemes	There is a waste oil collection and return shipment implemented by the Pacific Energy from Fiji.
Data collection and decision making	Responsible entities for ongoing data collection	Department of Waste
	Responsible entities for decision making	Department of Waste at the national level Kaupule authorities at the island level Island chiefs at the community level
	Responsible entities for implementation and compliance	Department of Waste at the national level Kaupule authorities at the island level Island chiefs at the community level
Economic instruments	Financial instruments for collection of different materials	Tuvalu has enforced the Waste Management Levy Deposit covering beverage containers including plastic bottles, vehicles, motor bikes, heavy machinery, white goods and electronics, care batteries, nappies, etc. The revenue generated will support the recovery, processing and shipment of recovered waste items covered.
	Local laws supporting/inhibiting import/export of materials	The ban of plastics regulation, which covers more plastic items, helps to control the entry of plastic

Theme	Requirement	Tuvalu's readiness assessment
		items. The waste levy deposit supports the export of potential recyclable items and shipment of low-value items overseas.
	Bans or phase outs in place	Current bans on single-use plastic items as well as a control on importing of white goods with CFC to control ozone-depleting substances. Without the approval, any imported refrigerator without the appropriate document cannot enter.
Collection services	Current availability and effectiveness of waste collection service	The collection service covers all the eight islands. Funafuti as the main island has a very good collection system for the general waste, bulky waste, green waste and nappies. There are separate collection services for these items. The general waste collection is provided twice a week, twice a week for the green waste, once for the bulky waste and the nappies. Communal bins are accessible to all households 24 hours to drop off their nappies.
	Ability to diversify to multiple collection types Ability to expand	With the current separate collection systems available and the waste recycling programme to be supported by the waste levy deposit, Tuvalu can diversify its collection system and expand
	Recyclers and small-scale players for possible future collections	This is in the pipeline, with the recent establishment of the Waste Recyclers and Management Association. The plan for the implementation of the Recycling Programme supported by the Waste Levy is for the Department of Waste to establish and implement the recycling processes initially 2 years) until the private sector is ready to take over.

12 Continuous improvement

The audits conducted in Tuvalu were a trial of the methodology proposed by the consulting team. As a result, this report not only presents data but also presents commentary on the modifications to the methodology that could potentially be made for future audits. A quick summary is provided below:

a) **Support from local government is crucial**: The audits cannot be undertaken successfully without the full support of the local government. The Department of Waste management in Tuvalu, as well as the Kaupule, was instrumental in ensuring data was collected within the tight timeframes of the consultant visit. The DWM supported the audit process though the provision of equipment, staff and transport. DWM also acted as a liaison with all other government departments and helped collect data after the consultants had left the country.

b) **Customs data is important but time consuming**: As raised in the inception report by the consultant team, customs data is crucial in developing the overall material flow for individual materials. Although the customs department has been highly supportive in providing the data, the extraction of data is a tedious, time-consuming process. We have been slowly receiving this information, but we suggest contacting the customs department at the time of contacting the country for mission clearance. The analysis in this report is incomplete because we are still receiving information from customs.

c) **Categories review**: Based on the analysis performed so far, one of the most important improvements that could be made to the methodology is in the 'single-use plastics' category. During analysis, it was found that the categories into which the material was sorted were not always an exact match to the categories in which the material was imported. Given the bans and levies on single-use plastic items are being implemented at the point of entry into the country, it would be most beneficial to match the single-use plastic categories to the categories in the HS system for imports.

d) **Practical suggestions**: The consultants have made a range of practical suggestions throughout the report around the collection and sorting of materials as well as for data recording for the consideration of the technical committee.

e) **Timeline:** This report was produced within 13 days of arriving back to base from country. We believe that this is not enough time to undertake all required work and produce a good quality report. We therefore recommend at-least two weeks post fieldwork for data checking and entry, two weeks for analysis and another two weeks for report writing.

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Waste Management (Levy Deposit) Regulation 2019.Made under Section 10 (1) in the Waste Management Act 2017.

Waste Management (Prohibition on the Importation of Single-Use Plastic) Regulation 2019.

Waste Management (Litter and Waste Control) Regulation 2018.Made under Section 11 of the Waste Management Act 2017.

Environment Protection Act 2008 Revised Edition.CAP. 30.25 Arrangement of Sections.

Waste Operations and Services Act 2009

Appendix A: *Waste Management (Litter and Waste Control) Regulation 2018* Schedule 2

Waste Management (Litter and Waste Control) Regulation 2018 **Schedule 2 – Table of Penalty Notice Offences**

Penalty Notice Offences	**Penalty to be paid**
Regulation 3 - Littering	$20
Regulation 5 - Dumping Waste	$100
Regulation 6(1) Dumping waste which cause pollution	$250
Regulation 7(1) - Unlawful use of public waste bins	$50
Regulation 7(2) - Stealing, damaging or burning a public waste bin	$250
Regulation 8 - Burning litter and wastes	$50
Regulation 9 - Burning hazardous or noxious wastes (including plastics, rubber, oils and poly-foam)	$500
Regulation 10 - Use of banned waste for land filling (except at dumpsites)	$500
Regulation 11 - Unlawful fire at dumpsites	$1,000
Regulation 12(2)(a) - Failure to disclose hazardous wastes when taking to dumpsites	$250
Regulation 12(2)(b) - Providing false information about hazardous wastes when taking to dumpsites	$250
Regulation 12(2)(c) - Unlawful storage or disposal of hazardous wastes	$500
Regulation 14(2) - Failure to comply with clean-up notice	$200

Appendix B: Waste Management (Levy Deposit) Regulation 2019

Waste Management (Levy Deposit) Regulation 2019 Schedule 2 – Set Levy Amounts per Good and Committed Purposes

Table 37: Levy Amounts per Good and Committed Purposes

Item	Good or Product	For the Management of the Resulting Waste			
		Deposit amount	Refund amount	Recycling operations subsidy	Administration and management support
1	Mineral water, sweetened drinks and cooking oils come in PET bottles	10 cents per container	5 cents	0. 25 cent	0.25 cent
2	Sweetened drinks and alcohol come in aluminium cans	10 cents per container	5 cents	0. 25 cent	0.25 cent
3	Sweetened drinks, alcohol and cooking oil come in glass bottles	10 cents per container	5 cents	0. 25 cent	0. 25 cent
4	Lubricating oil	40 cents per litre	Nil	Nil	40 cents
5	Nappy	5 cents per unit	Nil	Nil	5 cents
6	Large white goods – refrigerators, freezers, washing machines, electric ovens (over $2m^3$ size)	$100 per unit	$50	$25	$25
7	Medium white goods – refrigerators, washing machines, electric ovens (between $1m^3$ and $2m^3$ sizes)	$60 per item	$30	$15	$15
8	Small white goods – microwaves, refrigerators, washing machines, etc. (smaller than $1m^3$ size)	$30 per item	$15	$7.50	$7.50
9	Construction heavy equipment – excavator, loader, trucks (more than 10 tonnes)	$2,000 per unit	$1000	$500	$500

10	Construction medium equipment – excavator, loader, truck (between 5–10 tonnes)	$1,000 per unit	$500	$250	$250
11	Construction small equipment – excavator, loader, truck (less than 5 tonnes)	$500 per unit	$250	$125	$125
12	Office and family vehicles	$400 per unit	$200	$100	$100
13	Motorbikes	$200 per unit	$100	$50	$50
14	Batteries				
	Motorbike	$10 per unit	$5	$2.50	$2.50
	Vehicle/equipment –	$30 per unit	$15	$7.50	$7.50
	Solar panel	$60 per unit	$30	$15	$15

Waste Management (Levy Deposit) Regulation 2019 Schedule 3 – Set Minimum Number of waste Items Allowed

Table 38: Set Minimum Number of waste Items Allowed

Item	Good or Product	At the waste materials transfer station		At the collection agents	
		Set minimum number of items	Equivalent refund amount	Set minimum number of items	Equivalent refund amount
1	PET bottles from water, sweetened drinks and cooking oils	20	$1	1	5 cents
2	Aluminium cans from sweetened drinks and alcohols	20	$1	1	5 cents
3	Glass bottles from sweetened drinks, alcohol and cooking	20	$1	1	5 cents
4	Other waste items	No Limit		Not Accepted	

Appendix C: Assets register – equipment used by DSW to deliver waste services

Asset description	Year acquired	How acquired
Truck (Mitsubishi)	2009	
Pick Up Mini Truck		donated by AusAid
600XL CHIPPER (VERMEER)	2014	donated by NAPA
600XL CHIPPER (VERMEER)	2010	
600XL CHIPPER (VERMEER)		
VEGETATION CHIPPER (HANSA C30)	2013	donated by EU
ALERT CAN & METAL BALER	2013	donated by EU
LOADER (CAT)	2013	donated by EU
EXCAVATOR (CAT)	2013	donated by EU
LOADER (KOMATSU)		donated by EU
KUBOTA 4X4	2013	donated by EU
DAELIM 250CC	2010	
TRACTOR & TRAILER (FUN KP)	2013	donated by EU
TRACTOR & TRAILER (FUN KP)	2013	donated by EU
TRACTOR & TRAILER (RECYCLER)	2013	donated by EU
TRACTOR & TRAILER (NNMEA)	2013	donated by EU
TRACTOR & TRAILER (NMGA)	2013	donated by EU
TRACTOR & TRAILER (NTO)	2013	donated by EU
TRACTOR & TRAILER (NUI)	2013	donated by EU
TRACTOR & TRAILER (VTP)	2013	donated by EU
TRACTOR & TRAILER (NKFT)	2013	donated by EU
TRACTOR & TRAILER (NKL)	2013	donated by EU

(Source: Government of Tuvalu (2016). Tuvalu Integrated Waste Policy and Action Plan: TOWARDS CLEANER AND HEALTHIER ISLANDS 2017 - 2026.)

Appendix D: List of projects in Tuvalu funded by various development partners

The table below highlights Tuvalu has been a recipient of several international financial aid opportunities to develop and maintain waste management infrastructure in Tuvalu.

Table 39: Development partners and associated projects

Development partner	Year	Outcome	Areas of assistance provided
AusAID	1999–2002	Introduction of municipal-scale waste management system through the Tuvalu Waste Management Project	Under the Tuvalu Waste Management Project, in partnership with the Tuvalu government, the following achievements were made: 1) Setting up of a Waste Management Unit under the Department of Environment to manage the project waste activities. 2) A collection service was implemented to cover the rest of the Funafuti island, which was not included under the Kaupule collection service. The Kaupule collection at the time only covered the central area adjacent to the airport runway with an estimate of 300 households. 3) All households were provided with wheelie bins to store their waste at source. Large communal wheelie bins (1,100 litres) were located throughout the island for the public to dispose of their waste. 4) A dumpsite was prepared to dispose of the collected waste.

Development partner	Year	Outcome	Areas of assistance provided
8th & 9th EDF	2000–2006	• Drafting of the *Waste Operations and Services Act 2009* • Provision of financial support for the initial operation of DSW • Solid waste survey of Nanumaga island • Provision of equipment and household bins to improve delivery of waste services • Capacity building to DSW • Support to enhance awareness in the waste sector, through TANGO	Financial support of the new waste management unit operations 1) Development of the *Waste Operations and Services Act 2009* which provided the legal framework for the management of waste. This has been replaced with the *Waste Management Act 2017*. 2) Support of the establishment of a Solid Waste Agency of Tuvalu (DSW) in 2010 3) Waste characterisation study on Nanumaga island
	2007–2010	Extended to the outer islands	
10th EDF	2013		**Provision of waste equipment:** 1) Collection equipment – all tractors & trailers for the outer islands 2) Wheelie bins for the outer islands 3) Excavator for the Funafuti dumpsite 4) Loader for the composting/mulching project 5) Green waste shredders
European Development Fund 11	2017–2020	Bilateral funding	The Sustainable Waste Action Programme (SWAP) has been put in place with a funding of 6.8 million euros for the period 2017–2020. This supports the implementation of Tuvalu's Integrated Waste Management Policy 2017–2026 and its Medium Integrated Waste Action Plan 2017–2020.

Development partner	Year	Outcome	Areas of assistance provided
ADB	2004 –2005	Development of the Integrated Solid Waste Plan 2005	Technical assistance through the Tuvalu Effective Waste Management and Recycling Project
Republic of China (Taiwan)	2009 2011–2014 2015–2020	Support for green waste processing by buying the mulch and converting to compost product for gardens	**Assistance Provided through a Volunteer** Supply of wheelie bins to households, businesses and institutions. **Under the Horticulture Project** Production of more than 470 tonnes of compost a year for gardening purposes, which has been utilising DSW-generated mulch. Setting up of a compost fund about AUD$1 million Continuing the purchasing of DSW's generated mulch to produce the Horticulture Expansion Project's targeted production of 600 tonnes of compost (100 tonnes per annum) for the Funafuti Farm Production of 600 tons of compost for the Elise Farm in Vaitupu. The process absorbs the generated green waste in Vaitupu.
World Bank	2010	Solid waste inventory for Funafuti and Nanumaga, and feasibility studies on the options for exportation of wastes	Waste surveys in Funafuti and Namumaga to explore options on recyclable waste and their feasibility. Provision of the metal baler equipment

Development partner	Year	Outcome	Areas of assistance provided
JICA	2013 2017–2018	Provision of one training for Kaupule, through the J-PRISM project. Promotion of Regional Initiative Solid Waste Management project aimed to build capacity and improve solid waste management.	Reverse logistics for recyclable waste shipping. Tuvalu was one of the countries included in the assessment. 1) Provision of a new dump truck (6 m^3). 2) Training opportunity in Japan for one DSW staff on waste management. 3) Waste landfill training in March 2018 4) Endorsement of the Waste Management (Litter and Waste Disposal) Regulation 2017 5) Endorsement of the *Waste Management Act 2017* 6) Changing of DSW to DWM (Department of Waste Management)
NAPA Project	2014		Provision of green waste shredder equipment for Funafuti and all the outer islands to convert the generated green waste to compostable materials for gardening
New Zealand – MFAT	2015	Closure of borrow pits and improvement of the Funafuti dumpsite	Rehabilitation of open pits in Funafuti and the Funafuti dumpsite

Development partner	Year	Outcome	Areas of assistance provided
SPREP (Regional Projects supported by Development Partners – EU, JICA, etc.)	2010–2016	• Provision of waste management training • Assistance to the development of the Tuvalu Integrated Waste Policy and Action Plan • Management of healthcare wastes, asbestos, and e-wastes through the EU-SPREP PacWaste Project • Management of chemicals through the GEFPAS Project	GEFPAS Used Lubricant Oil (ULO) Project, which has promoted the proper management of ULO by funding public awareness and educational materials, including meetings and workshops. The project has not, however, provided the funding needed for the purchasing and installation of storage containers. Under the PacWaste project, an assessment was conducted to study the generated healthcare waste 1) As a follow-up to the assessment work, a new incineration facility was installed at the Funafuti Hospital for the incineration of the generated healthcare waste. This was officially opened in 2016. 2) Under the PacWaste project, an assessment was conducted to investigate asbestos in the country. 3) Conducting a cost-benefit analysis study and report for Green Waste Management in Funafuti in 2016 4) Development of the Tuvalu Integrated Waste Policy 2017–2026 and Integrated Waste Plan 2017–2020 5) Under the PacWaste Project, this assessment was initiated and commenced to investigate the status of waste Management in Tuvalu (as the basis of this status report). 1) Under the J-PRISM project, some staff of DSW have been receiving waste management training.
UNDP		Preparation of the waste/debris component of the TC Pam Recovery and Vulnerability Reduction Plan	Assistance in Funafuti to remove cyclone debris and backlog of one month's worth of uncollected municipal waste as part of Waste Management and Livelihood Recovery Initiative.

Appendix E: Tuvalu solid waste regulations and policies

Falekauplule Act 1997 This Act provides for the establishment of Falekaupule and Kaupule, its purposes to ensure each island is appointed a Falekaupule and Kaupule forming the local government structure.	
Part V	prescribes functions for powers of public officers and enforcement functions
Schedule 3	prescribes functions of the Falekaupule exercised through their Kaupule and offices relating to environment management matters
53	states the Kaupules may make bylaws in relation to their functions
122	requires each Falekauple to prepare a Local Development Plan setting out programmes and priorities for social and economic developments
129	states the Minister may make regulations applying to all or a particular Falekauple area, after consultation, to better facilitate the provisions of the Act
Environment Protection Act 2008 revised edition The Environment Protection Act 2008 makes provision for the responsibility for managing the Tuvaluan environment. The Act has numerous objectives which include, coordinate the role of government in relation to environmental protection and sustainable development; • provide a mechanism for the development of environmental policy and law; • promote a clean and healthy environment for all Tuvaluans; • prevent, control, monitor and respond to pollution; • promote public awareness and involvement in environmental issues and the preservation of Iloga as it relates to the environment; • facilitate the compliance and implementation of obligations under any regional and international agreements or conventions; • facilitate sustainable development with respect to the management of the environment and natural resources; • facilitate the assessment and regulation of environmental impacts of certain activities; • promote conservation and sustainable use of biological diversity and the protection and conservation of natural resources, on the land, air and sea; and • reduce the production of wastes, and at the same time, promoting the environmentally sound management and disposal of all wastes.	
5	sets administrative responsibilities with the Minister, who is responsible for the proper administration of the Act
7	sets responsibilities of the Director of Environment, which includes proper administration and implementation of the Act as delegated from the Minister, subject to the direction of the Permanent Secretary of the Ministry
Part III	outlines the powers of enforcement
11	Confers powers to environmental officers in order to facilitate the fulfilment of their functions.
14	Establishes a National Environment Forum and Council
16	Enables a Kaupule to establish Island Environment Committees whom may identify priorityy areas of environmental concern, participate in programmes, recommend regulations and provide representatives to the National Environment Forum
Part VI	addresses pollution control and waste management outlining roles of the department in relation to pollution and wastes including, regulations dealing with pollution control, waste management and hazardous wastes and substances

Part VII	addresses international and regional environmental obligations
Part X	Provides provisions for addressing offences and sets penalties for any person who fails to comply license, permit or approval granted under the Act.
Waste Operations and Services Act 2009 The Waste Operations and Services Act 2009 defines the roles and responsibilities for waste management in Tuvalu and makes provision for the management of solid waste and environmental protection relating to the collection, recycling and disposal of waste and other wastes related operations and services in designated areas of Tuvalu. It sets a detailed legal framework for waste operations and it regulates the entire sector.	
2	Identifies and defines bulk waste, hazardous waste and solid waste.
Part II	Outlines the responsibilities for waste management in Tuvalu including the regulation of waste, waste management operations, waste management planning, environmental and public health standards and auditing of waste generation and disposal.
Part III	Delegates general powers in relation to wastes.
Part IV	Outlines waste management operations including the designation of waste service areas, waste management operators and their functions, outlines the powers of waste management operators and their performance of community obligations. It also outlines the ability to impose fees and charges for waste management services, provides provisions to ensure waste management operators prepare and submit reports to any aspect of waste management and immediately notify relevant Ministries of adverse effects to human health or the environment. In addition, it specifies control measures relating to recycling of wastes.
Part V	States controls over certain wastes, offences against designated waste management operators, enforcement provisions, prosecutions under the Act and the jurisdiction of the courts to try offences.
The Environment Protection (Environmental Impact Assessment) Regulations 2014 This act provides regulation relating to the environmental impact assessment process. It provides forms of assessment, administrative responsibilities, the application process for development, and the establishment of an environmental task force for environmental assessment.	
Part VI	Outlines pollution control and waste management including roles of the department in relation to pollution and wastes, regulations dealing with pollution control, waste management and hazardous waste and substances.
X	Offences and penalties stipulate general penalty for conviction where a person fails, refuses or neglects to remove or stop any waste or pollution of the environment.
XI	Outlines the Ministers jurisdiction to make regulations relating to the control of pollution and regulation of wastes and the regulation and prohibition of the importation of goods where contributing to an increase in waste.
Waste Management (Littering & Waste Control) Regulation 2018 The Waste Management (Littering & Disposal) Regulation outlines litter control measures and waste related measures. It also provides litter and waste compliance notices; penalty notice offences form of penalty notices.	
Part II	Outlines litter control measures, stating that it is an offence to litter in a public place or on land belonging to another person and that every owner and occupier of land or premise must keep it free from litter or waste that may become litter.

Part III	States waste related offences and associated fines for individuals and corporation where convictions are made. Including 1) Offence to dump waste 2) Offence to dump hazardous waste 3) Dumping waste which cause pollution 4)Offences relating to community waste bins 5)Restrictions on burning off and other activates 6) Offence to burn noxious waste 7) Offence to burn hazardous waste 8) Wastes not to be used for landfilling or reclamation 9) Prescribes hazardous waste
Part IV	Provides ability for Enforcement Officers to service notice to cease certain activities concerning waste in addition to outlining remedial action and cost recovery
Part VI	States Island Counts may hear prosecutions under the regulations.
Waste Management (Levy Deposit) Regulation 2019 The purpose of the Waste Management (Levy Deposit) Regulation is to – (a) State the principles and rules to support the recovery, processing, treatment and shipment of incoming goods at the end of their operation conditions; (b) Provide mechanism for revenue collection and administration; and (c) Provide legal framework that encourages waste avoidance and resource recovery behaviour	
10	states every officer, producer and consumer must work collaboratively to reduce and dispose of the goods and products
13	Prescribes scheme for the movement of the specified goods and products
14	Provides facility for exemptions
Part III	Outlines the administration of the system including obligation of importers, obligation of custom officers, obligation of consumers, function of designated waste operators and outlines the functions of the Department of Waste Management.
PART IV	States the number of operational days the transfer stations will be opened, and the state and quantity of wastes deposited will be accepted.
Part V	Outlines the financial arrangement stating the purpose of the Levy Fund is to generate revenue for the government, support operations of the system and finance educational and marking needs of the Act. Fifty percent refund payments to collectors, twenty-five percent to operators of transfer station and twenty-five percent to the Department of Waste Management for treatment of waste to be disposed in Tuvalu, public awareness and monitoring, reporting and other administration aspects.
Part VI	Outlines offences and illegal practices and associated fines. Also states it is an offence to litter and dump waste and directs to the Waste Management (Litter and Waste Control) Regulations 2018.
Schedule 1	Provides a list of goods and products to be levied
Schedule 2	Sets levy amounts per good and committed purposes.
Schedule 3	Sets the minimum number of waste items allowed.

Waste Management (Prohibition on the Importation of Single-Use Plastic) Regulation 2019 The Waste Management (Prohibition on the Importation of Single-Use Plastic) regulation 2019 came into force on 1 August 2019. The purpose of the regulation is to prohibit the importation, manufacture, sale or distribution of certain single-use plastic.	
5	Specifies prohibited items which include: • Shopping bags, wholly or predominantly made of or lined with plastic or plastic blend and designed to be given out to consumers; • Plastic water bottles less than 1.5 litres and plastic beverage bottles less than 1.5 litres; • Plastic water pouches and plastic bags used to produce ice blocks; • Straws which are made, in whole or in part, of plastic or a plastic blend and designed for one-time use (not including straws attached to packaging.); • Single-use plastic and polystyrene plates, cups and take-away container, including cups and plates with a plastic coating or lining; • Single-use plastic cutlery; • Plastic sheet or cling film glad warp used for food wrapping; • Plastic sheet used for spreading on dining table; and • Plastic flags In addition, the regulation notifies fines for individuals up to $5,000 for a first offence, for offences committed more than once a fine of up to $5,000, or imprisonment of 2 months or both apply. For a body corporate a fine up to $10,000 may apply. If an offence is committed on more than once, fines up to $10,000 or 3-months imprisonment or both may apply.
Marine Pollution Act 1992 The Marine Pollution Act 1992 is a comprehensive law providing provisions for preventing and dealing with marine pollution and the dumping and incineration of waste at sea. The Act outlines requirements for the disposal of wastes including oil, pollutant reside, garbage and sewerage from ships at port reception facilities and the environmental liability in relation to the prevention and remediation of environmental damage caused by oil, sewage, garbage and other pollutants. In addition, also incorporates the following international conventions; • the International Convention for the Prevention of Pollution from Ships 1973, as supplemented by the Protocol thereto of 1978; • the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972; and • the Convention for the Protection of the Natural Resources and Environment of the South Pacific Region 1986.	
Te Kakeega III: National Strategy for Sustainable Development 2016–2020 This document identifies the national strategic plans attuned with sustainable development goals for Tuvalu for 2016–2020. The management of solid waste and is covered in Strategic Area 5.7 and identifies a number of challenges for the solid waste sector In Tuvalu, including: • A lack of proper Funafuti dumpsite management and oversight; • Dedicated and managed land space for solid waste disposal in the outer islands; • Lack of equipment for sorting and incinerating waste;	

• Lack of public awareness about waste disposal and a litter-free environment; • Lack of waste management expertise of DSW staff. The document outlines that DSW will commission a new technical assistance study to investigate: • alternative ways to improve waste disposal, including waste-to-energy systems; • staff capacity building; identifying new equipment needs for waste collection, disposal and processing; • expanding and improving organic, green waste operations; • relocating the Funafuti dumpsite; and • waste disposal on the outer islands, building on the lessons learned on Funafuti over the last 15-16 months
Tuvalu Integrated Waste Policy and Action Plan 2017–2026 This policy strives towards cleaner and healthier islands and provides a roadmap that sets a clear direction for Tuvalu to improve waste management. Six strategic goals were established via sectoral and wider stakeholder consultations: Goal 1: Strengthened institutional systems to address gaps in waste management Goal 2: The stakeholders fully understand the merits of proper waste management and co-share the responsibility of managing wastes. Goal 3: Established strong partnerships between the public and the private sector in the delivery of waste services Goal 4: Delivered waste services following best practice and cost-effective approach tailored to local conditions with continuous improvement Goal 5: Enhanced capacity of waste practitioners Goal 6: Waste activity outcomes are reported and disseminated to relevant stakeholders

Appendix F: Project Plan for Tuvalu

FIELD CONTACTS

Project Delivery Recycling specialist	Country Co-ordinator	Waste Audit Specialist
Amardeep Wander amardeep@apwc.com.au WhatsApp: +6143351167	Faafetai Sagapolutele faafetais2018@gmail.com	Geoff Thompson Geoff@apwc.com.au

GOVERNMENT POINTS OF CONTACT

Overall point of contact	Collections and Disposal Services
Mr Walter Pulogo Department of Waste Management Ministry of Home Affairs and Rural Development, Government Building. Funafuti, Tuvalu. WPulogo@gov.tv	Ms Miriama Uluiviti Funafuti Waste Collection & Disposal Operations Department of Waste Management Ministry of Home Affairs and Rural Development Government Building, Funafuti, Tuvalu MUluiviti@gov.tv

KEY STAKEHOLDERS

Organisation name	Name of stakeholder/s	Email
1. Ministry of Home Affairs and Rural Development (MHARD)	• Mr Lete Avanitele, Permanent Secretary • Mr Walter Pulogo, Acting Director, Department Waste Management • Mr Taualo Penivao, Secretary, Island Kaupule of Funafuti • Mr Ionatana Peia Secretary, Vaitupu Island Kaupule	lAvanitele@gov.tv WPulogo@gov.tv tpenivao@gmail.com tana.peia55@gmail.com
2. Ministry of Foreign Affairs	• Mr Fakavae Taomia, Permanent Secretary • Mr Soseala Tinilau, Director, Department of Environment	ftaomia@gmail.com butchersn@gmail.com
3. Ministry of Finance	• Mr Niuatui Niuatui, Acting Permanent Secretary • Mr Tuilagi Teii, Director, Department of Custom	NNuiatui@gov.tv Tteii@gov.tv
4. Ministry of Health	• Mr. Faivatala Lee Moresi, Permanent Secretary • Dr Tuese Falesa, Acting Director, Department of Health	aceinc337@yahoo.com jiushiwo0906@gmail.com
5. Department of Works	• Mr Avafoa Irata, Permanent Secretary • Mr Malofou Sopoaga, Acting Director, Department of Works	avafoa@gmail.com msopoaga@gmail.com

6. Department of Marine	• Mr Tapugao Falefou, Permanent Secretary • Mr Taasi Pitoi, Director, Marine Department	tfalefou@gmail.com taasi.pitoi@gmail.com
7. Tuvalu Recyclers and Waste Management Association	• Mr Timuani Selu, President	
8. Pacific Direct Line (PDL)	• Mr Apisai Kilima, General Manager, PDL Shipping Agent	Apisai166@gmail.com

ACTIVITY	OPERATION	12/9	13/9	14/9	15/9	16/9	17/9	18/9	19/9	20/9	21/9	22/9	23/9	24/9	25/9	26/9	27/9	28/9	29/9	30/9	1/10	2/10	3/10
1. Briefing Meetings & Interview	• DWM&Waste Collection Crew																						
	• Department of Environment																						
	• Department of Customs																						
	• Waste Management Committee																						
	• Recyclers and Waste Association																						
	• Local Importers and Suppliers																						
	• Department of Health																						
	• Public Works																						
	• Marine Department																						
	• Shipping Company																						
	• Kaupule Authorities																						
2. Waste Audit Tasks	• Identify – high-, mid- and low-income areas																						
	• Select samples – high-, mid- and low-income areas																						
	• Distribute rubbish bags to domestic and commercial																						
	• Collect and analyse the samples in Funafuti																						
	• Move to Vaitupu Island																						
	• Distribute bags to families and businesses																						
	• Collect and analyse the samples in Vaitupu and dumpsite audit																						
	• Return to Funafuti																						
	Landfill audit in Funafuti																						

WASTE AUDIT COMPONENT

SAMPLING SCHEDULE FOR TUVALU

The following schedule has been provided by the statistician based on the criteria noted in the audit methodology.

Percentage errors will be higher in places where overall generation rates are lower (0.24 kg/household error is about 20% error in Tuvalu, where we estimate 1.2 kg/household/day generation but only 10% in South Africa where we estimate 2.4 kg/hh/day). Higher rural populations have lower generation rates.

Tuvalu

Scheme	Error at 80% Confidence	Error at 90% Confidence
90 houses Funafuti, 60 houses Vaitupu (or other)	20%	25%
140 houses Funafuti, 60 houses Vaitupu (or other)	17%	21%
90 houses Funafuti, 60 houses Vaitupu, 50 houses other	15%	19%

COMMERCIAL SAMPLE SPLIT

Sample type	Minimum	Desired
Admin/office	7	10
Food Outlet	9	13
Retail	9	12
Hotel	9	12
Supermarket	9	13
Manufacturing	7	10
	This would yield a (very crudely) estimated error of 1.0 kg/business/day or 17% at 80% CI.	This would yield a (very crudely) estimated error of 0.87 kg/business/day or 15% at 80% CI.
Total	**50**	**70**

PRE-PROJECT PLANNING

1. **Transportation**:
    - Boat for Vaitupu waste audit and cost for hire – by Thursday 12th
    - Rental car for the team transportation in Funafuti and Vaitupu – by Thursday 12th. N.B. Rental vehicle belongs to the Hotel (where the team will stay).
    - Vehicles arrangement and support for the collection of samples – by Thursday 12th. N.B. Use of the Department of Waste Management's small truck for the collection of the rubbish bags – arranged and TBC with Mr Walter Pulogo (Director of DWM). The small truck of DWM may carry half of the load of the ute truck used by the team in Solomon and Vanuatu during the CEFAs waste audit.
    - Will confirm the use of a private truck and backup support from DWM available trucks and tractors if available on some days – TBC by Walter Pulogo.

2. Accommodation

- Funafuti – already confirmed
- Vaitupu – TBC by Fri 13th

3. Meetings

- Meeting with the Waste Management Committee on Friday 13th before and after the mission. Waste Management Committee – by Wed 11th. N.B. The Waste Management Committee has all representatives of the key government agencies and other stakeholders. Use to confirm appointments for the proposed meetings later with the individual stakeholders.
- Meeting with the DWM Collection Crews on Friday 13th or Sat 14th to discuss the survey for their information – by Thurs 11th
- Meeting with the Tuvalu Recyclers and Waste Management Association – by Fri 13th
- Confirmation of all appointments for the listed stakeholders on Thursday 12th.

4. Collection and Sorting Preparations

- Visit the proposed sorting areas – DWM Hanger or DWM new recycling station & DWM Disposal Site Storage Facility – on Friday 13th.
- Drive around the island to observe the collection routes
- Get the Collection Map with indicated collection routes
- Identify and select the sampling areas – by Friday 13th or Sat 14th during the meeting with DWM collection crew.

5. **Audit items**

- Printouts of high-level sort sheets
- Printouts of CDS sort sheets
- Waste audit code of conduct
- Printed copies of safe work method statements (SWMS)
- Notepad with all sorting and collection sheets loaded on them
- First aid kits
- Scales
- PPE sorting baskets and tarps available locally
- Sorting tents are available at Tuvalu shops
- Disposable facial masks and gloves confirmed

Appendix G: Collection sheet

Please note that the consultant team used an online tool but collected the below information.

	Date	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							

Appendix H: 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
	Straws		H, C, L	Cu, D
	Coffee cups		H, C, L	Cu, D

C	Category	Description	EOL Source	Incoming
	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 & 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	Used disposable nappies/diapers	H, C, L	
	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	

C	Category	Description	EOL Source	Incoming
	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	
	Containerised 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 I: 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 J: Landfill audit sheet

Location		**Date: _____**		**Auditor**
Sample Number				
Entry time				
Vehicle registration number				
Type of vehicle				
Maximum capacity (m^3)				
Compaction (Circle)		H M L	H M L	H M L
Tipping point				
Source (C&I / C&D / Council / SH / MSW)				
Sector (M S H O X C T L E U G)				
Bagged waste	**Bagged waste**			

Metals	Aluminium cans			
	Aluminium recyclable			
	Steel containers			
	Metal other			
Fishing	Fishing/seafood metal			
	Fishing/seafood plastic			
	Fishing/seafood wood			
Paper Cardboard	Cardboard			
	LPB			
	Composite			
	Paper			
Plastic	PET containers			
	HDPE containers			
	LDPE containers			
	PVC containers			
	PP			
	EPS			
	PS			
	PP			
	Flexibles/Film			
	Other plastic			
Single-use plastic items	Beverage containers			
	Cigarette butts			
	Cigarette packets			
	Straws			
	Coffee cups			

	Bags – heavy, glossy branded carry bags			
	Bags – supermarket light-weight carry bags			
	Takeaway containers plastic not EPS			
	Takeaway containers Styrofoam			
	Takeaway containers paper			
	Takeaway container lids			
	Bottle lids			
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 & peripherals			
	Toner Cartridges			
Glass	Glass bottles			
	Glass jars			
	Glass fines			
	Glass other			
Hygiene	Feminine hygiene			
	Pharmaceutical			
	Nappies			
	Medical waste			
	Other sanitary waste			
Organics	Food			
	Wood/timber			
	Garden organics			
	Other organics			
Hazardous	Paint			
	Fluorescent tubes			
	Household chemicals			
	Asbestos			
	Clinical (medical)			
	Gas bottles			
	Mercury			
	Hazardous other			
Other	Textiles			
	White goods vol/ count	/	/	/
	Ceramics			
	Containerised used oil (vol /weight)	/	/	/
	EOL renewable energy equip vol/count	/	/	/

	End of life Vehicles vol/ count	/	/	/
	Tyres vol/ count	/	/	/
	Please describe			