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Solomon Islands – Waste Data report

**Analysis of waste generation and disposal data collected
in November 2018**

Authors: Amardeep Wander, Faafetai Sagapolutele, Amy Foxe, Anne Prince

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Executive Summary

The Commonwealth Litter Programme (CLiP) is an initiative delivered by the Centre for Environment, Fisheries and Aquaculture Science (Cefas) and funded by the United Kingdom's Department for Environment, Food and Rural Affairs. The initiative supports six developing countries across the Commonwealth in advancing national litter action plans focused on preventing plastics entering the oceans.

In 2018, CLiP contracted Asia Pacific Waste Consultants (APWC) to study waste management practices in the Solomon Islands and offer best-practice solutions and training to staff who are engaged in the design and delivery of waste services. This report presents the data, analysis and recommended best practice activities that address gaps in the management of waste within the Solomon Islands.

Waste data collection work was undertaken in November-December 2018. The APWC team was in Solomon Islands for three weeks and assessed waste from eight communities. In total, 218 samples were collected, with 178 rural and 40 urban samples collected from eight different communities. The rural samples were divided between two localities. 81 samples were collected from five villages along Lunga river in Guadalcanal province and the remaining 93 samples were collected from three communities in Malaita province. In addition to the household samples, 46 commercial samples were assessed – 31 premises in Honiara and 15 premises in Auki (Malaita).

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

Interviews were conducted with all households where waste was collected to cross-reference socio-economic and waste behaviour data with the waste disposed. APWC was able to draw upon previous work completed by the JPRISM project (Japanese Technical Co-operation Project for Promotion of Regional Initiative on Solid Waste Management). The comparison of the two studies shows that although the waste collection systems are in place, there is a real need for a number of matters to be urgently addressed to prevent disposal of waste into the environment via waterways, burning and burying.

The audit confirmed that waste generated between urban and rural areas differed. Of interest was the correlation between waste generation and the average grocery bill as opposed to a more complex model incorporating the number of people within the household, household income and a collection service rating in addition to average grocery spends. This simplification on an area, rather than household or regional level, could assist in modelling waste generation rates outside of the sample



areas. It is a finding consistent with research focussing on the variables that influence solid waste generation on a per capita basis within the south-eastern United States (Hockett, Lober and Pilgrim, 2015).

With less than half the waste generated in urban areas being captured through waste management systems currently in place, and the widespread practice of dumping nappies in waterways, there is a range of best practice approaches to improving waste management that can be implemented in urban areas of Solomon Islands. These actions will have a direct positive impact upon the volume of waste that enters waterways.

In rural areas, collection systems are poor, ad hoc or completely absent. As a result, all waste generated in rural areas is being disposed of through burning, burying and dumping, either on land or in nearby waterways. In these areas, beneficial reuse of household organic materials was observed and serves as a positive case study for other areas within the south pacific.

This report outlines a range of best practice actions that range from regulatory to behavioural, with fourteen recommendations that can reduce the volumes of waste entering marine environments in the future, whilst also improving the social and economic prospects of communities in the Solomon Islands.

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Acronyms

ACRONYMS	
ADB	Asia Development Bank
APWC	Asia Pacific Waste Consultants
CCOA	Commonwealth Clean Oceans Alliance
CDL	Container Deposit Legislation
CDS	Container Deposit Scheme
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CLiP	Commonwealth Marine Litter Programme
CHOGM	Commonwealth Heads of Government Meeting
Defra	The UK Department for Environment, Food and Rural Affairs
ED	Environment Division of Department of Environment
EHD	Environmental Health Division of Honiara City Council
EHO	Environment Health Officer
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EU	European Union
FFA/SPC	Pacific Islands Forum Fisheries Agency
GEF	Global Environment Facility
GIS	Geographic Information System
GMP-POPs II	Global Monitoring Plan on Persistent Organic Pollutant Phase II
GPS	Global Positioning System
HCC	Honiara City Council
HDPE	High-density polyethylene
IMO	International Maritime Organisation
IUCN	International Union for the Conservation of Nature
JICA	Japanese International Co-operation Agency
J-PRISM	Japanese Technical Co-operation Project for Promotion of Regional Initiative on Solid Waste Management
J-PRISM II	Japanese Technical Co-operation Project for Promotion of Regional Initiative on Solid Waste Management in Pacific Island Countries Phase II
KG	Kilogram
LEAF	Earning and Ecological Activities Foundation for Children (LEAF) Project
LDN	Least Developed Nation
LDPE	Low-density polyethylene
LGA	Local Government Act
LGNZ	Local Government New Zealand
MARPOL 73/78	The International Convention for the Prevention of Pollution from Ships (Marine Pollution), 1973 as modified by the Protocol of 1978
MEA	Multi-lateral environmental agreements

MECDM	Ministry of Environment, Climate Change, Disaster Management and Meteorology
MID	Ministry of Industry and Development
MGB	Mobile Garbage Bin
MHMS	Ministry of Health and Medical Services
MSW	Municipal Solid Waste
NAPA	National Adaptation Programme of Action
NCCP	National Climate Change Policy
NDS	National Development Strategy
NGO	Non-Government Organisation
NZ	New Zealand
NZMFAT	New Zealand Ministry of Foreign Affairs and Trade
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
PICS	Pacific Island Countries
PRIF	Pacific Region Infrastructure Facility
PV	Photo voltaic
SAMOA	SIDS Accelerated Modalities of Action Pathway
SBD	Solomon Islands Dollar
SI	Solomon Islands
SID	Small Island Developing States
SIMSA	Solomon Islands Maritime Safety Administration
SIPA	Solomon Islands Ports Authority
SIWA	Solomon Islands Water Authority
SPC	Secretariat of Pacific Country
SPREP	Secretariat of the Pacific Regional Environment Programme
SWM	Solid Waste Management
TCPA	Town and Country Planning Act
UNEP	United Nations Environment Program
UNICEF	United Nations International Children's Emergency Fund
USD	United States Dollars
VHF	Very High Frequency
WHO	World Health Organisation
WMAA	Waste Management Association of Australia
WMPC	Waste Management and Pollution Control
WPA	Western Provincial Authority
WRIA	Waste Recycling Industry Association

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 a 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, as well as resourcing and infrastructure limitations, means that many communities, especially those in remote locations, have limited or no access to sustainable waste management. As a result, waste is often dumped, burned or buried, leaving it susceptible to dispersal into the environment.

Transboundary marine litter is another issue facing PICs, with many livelihoods dependent on the continuing health of the ocean. Creating a balance between satisfying the economic aspirations of increasing populations while maintaining healthy marine and terrestrial environments is of major importance in reducing risks to human health, as well as the land- and marine-based life. Major waterways are capable of transporting a substantial amount of waste and litter. Up to 90 per cent of marine litter consists of plastics originating from both land- and sea-based sources (UNEP and GRID-Arendal, 2016). Plastic debris from the land comes primarily from two sources: first, ordinary litter; and second, waste disposed of at open dumps, landfills or illegally dumped waste which then becomes airborne or washes into the ocean from inland waterways and wastewater outflows (Jambeck, J.R. et al., 2015). Marine sources of plastic debris are more nuanced but arise from shipping activities related to transport of goods, services, tourism and fishing.

It is estimated that in the Asia–Pacific region the cost of marine litter to marine industries is a minimum of €1.26 billion per year, including losses from tourism, entangled ship propellers and time lost for fishing (McIlgorm, A., et al., 2008). In the EU, it has been suggested that the cost for coastal and beach cleaning is about €630 million annually (Acoleyen, M., et al., 2013; Werner, S., et al., 2016).

Preventing pollution, especially plastics from entering the environment, requires focused efforts on behaviour change (for example, reducing reliance on single-use plastics), improvements in waste

management and developing a more sustainable life cycle for wastes such plastics. The steps to improve poor systems of waste management or mismanagement of waste rely on quantifying the scale of the problem and the sources of plastics leakage and other wastes into the system. To date, this quantification has not happened. Gaps in local capacity, as well as details of infrastructure and management systems, must be quantified and linked to the leaked waste in order to adequately deal with the issues.

1.2 The Commonwealth Litter Programme (CLiP)

The Commonwealth Litter Programme (CLiP) will support developing countries across the Commonwealth to advance national litter action plans, focusing on preventing litter (including plastics) entering the oceans. The programme is starting in the South Pacific Region, working with Vanuatu and the Solomon Islands, and this project forms a part of the programme.

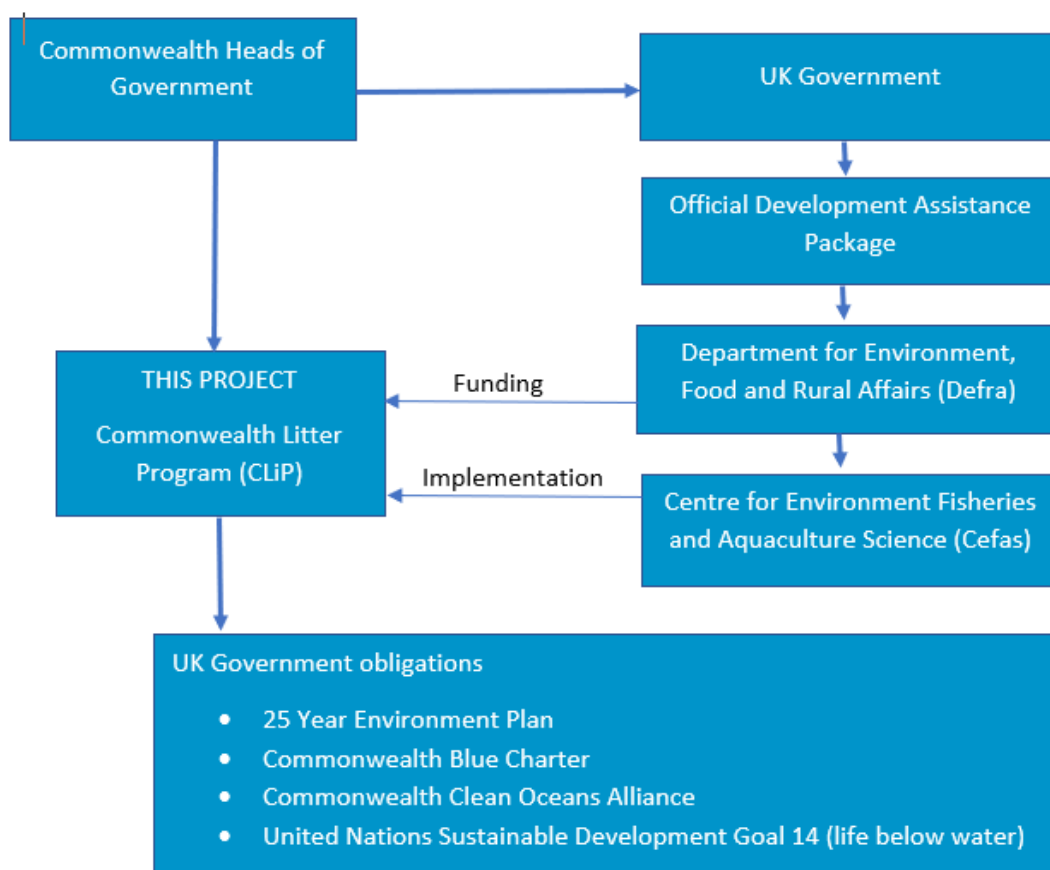


Figure 1: Project delivery organisations

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The programme contributes to the UK meeting its responsibilities under the Commonwealth Blue Charter, which calls for Commonwealth countries to drive action and share expertise on issues affecting the world's oceans, including marine litter. CLiP will contribute delivering the objectives under the UK- and Vanuatu-led Commonwealth Clean Oceans Alliance (CCOA), which calls on other

countries to pledge action on plastics to eliminate avoidable plastic waste. CCOA also promotes actions in line with the United Nations Sustainable Development Goal 14 (life below water) to conserve and sustainably use the oceans.

1.3 This report

Asia Pacific Waste Consultants (APWC) has been engaged by the Centre of Fisheries, Aquaculture and Science (Cefas) to study waste management practices in the Solomon Islands and offer best-practice solutions and training to staff who are engaged in the design and delivery of waste services in the country (including provinces). This is a deliverable under CLiP.

Solomon Islands is the second of the two South Pacific countries where this programme will deliver direct results.

The delivery pathways for the project are listed in Figure 2.

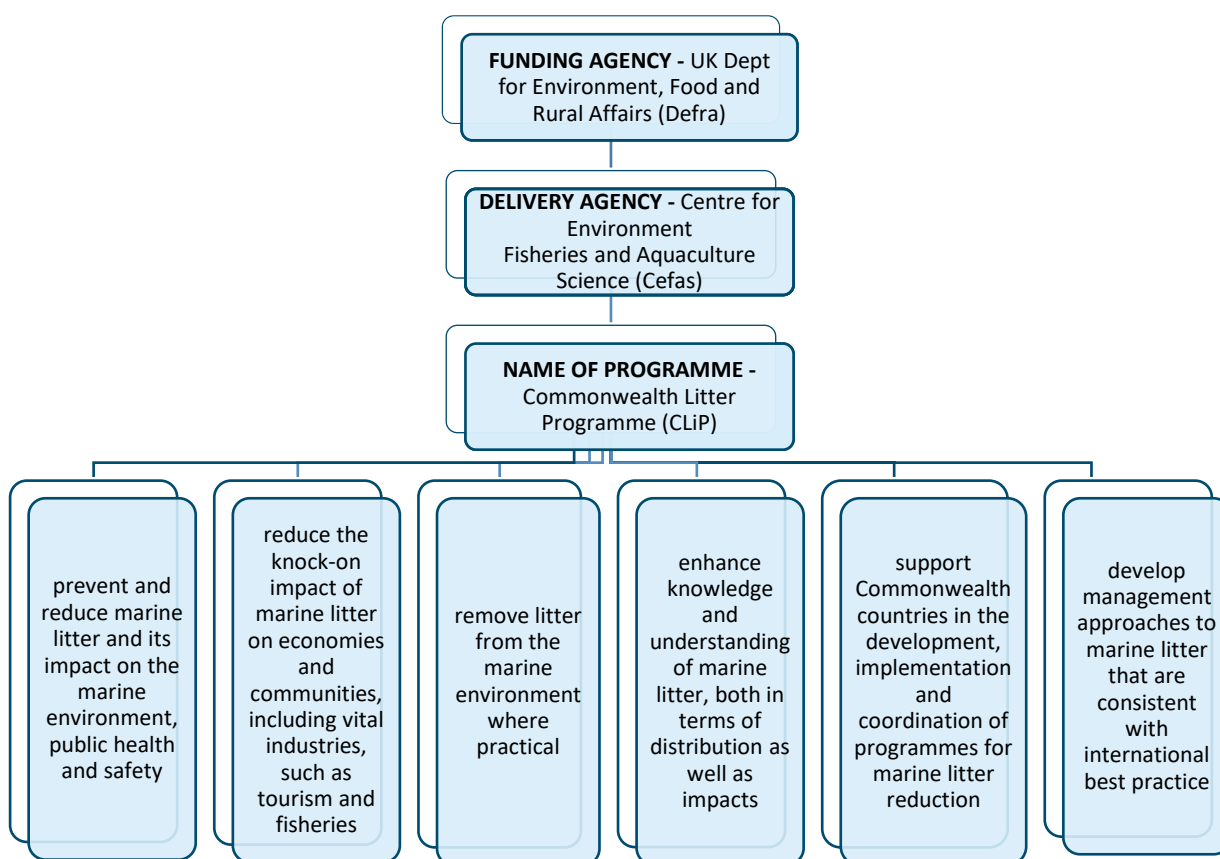


Figure 2: CLiP sponsors and objectives

APWC deliverables have three focus areas, listed below:

- Data collection on waste collection and disposal services, and disposal behaviour
- Best-practice solutions to the current situation
- Provision of training for in-country staff.

This report is the final deliverable under the 'Waste Data' project. The report starts with a brief literature review, summarises the current waste management practices in Solomon Islands, comments on the current infrastructure available and provides an analysis of the waste being generated and disposed of in Solomon Islands.

The final section of the report uses the in-country data and information gathered to suggest potential policy, legislative and infrastructure-based interventions to reduce waste from land-based sources from entering the oceans by employing better management at source and through state-based management systems.

2 Literature Review

2.1 Background

The Solomon Islands (SI) is a group of 986 archipelagic small islands which are distributed within six major island groups (Choiseul, Isabel, Malaita, Makira, New Georgia and Guadalcanal) located in the Melanesia region of the Pacific Ocean, northwest of Vanuatu and east of Papua New Guinea. The country has a total land mass of about 28,896 square kilometres. Solomon Islands was ranked at the highest category 'global outstanding' when it was included in a global rainforest Ecoregion 200 list according to WWF global forest assessment (WWF, 2005). It is uniquely renowned for high species (flora and fauna) biodiversity.

According to a 2009 census, the population Solomon Islands is 515,870 with 80.3% residing in rural areas spread among nine provinces and one council across 900 islands (CLGF, 2018). The nation's capital, Honiara, hosts approximately 64,609 people (2009 census) and is growing rapidly, with 2014 ADB estimates of 35% of residents living in informal settlements on the peri-urban fringe.

Table 1: Population demographics for Solomon Islands

Province	Population	Average no. of households	Average annual pop. growth 1999 2009 (%)	Pop. density (no. of people/km ²)
Solomon Islands	515,870	5.5	2.3	17
Choiseul	26,372	5.5	2.8	7
Western	76,649	5.3	2.0	10
Isabel	26,158	4.9	2.5	6
Central	26,051	5.3	1.9	42
Runnelli-Bellona	3,041	4.4	2.5	5
Guadalcanal	93,613	5.4	4.4	18
Malaita	137,596	5.6	1.2	33
Makira/Ulawa	40,419	5.5	2.6	13
Temotu	21,362	4.9	1.2	25
Honiara City	64,609	7.0	2.7	2.953

Source: 2009 census

Table 2 below shows the estimated population for Honiara City only, based on an average population growth rate of 2.75 per year.

Table 2: Honiara City population growth

Year	Population
2013	76,260
2014	78,346
2015	80,424
2016	82,485
2017	82,485

Note: The only census of Solomon Islands was conducted in 2009. This table lists figures estimated by HCC and JICA experts.

The economy has been described for some time as a dual economy as the result of the earnings emerging from natural resource extraction (first tier) and the traditional, informal economy (second tier). The traditional and informal economy is centred on subsistence agriculture, fishing and collection

of forest products. This economy remains only partially cash based and is central to the lives of the majority of the population in rural areas. It is estimated that this could represent as much as 60% of the formal economy. Its continuation is closely linked with access to land and resources as well as limited provision of state services and poor access to markets.

The UN classifies Solomon Islands as a Least Developed Nation (LDN) with a 2015 GDP (OECD, 2017) of \$1.13 billion USD or \$2,200 USD per capita. Its trade balance was \$210 million USD, with exports at \$648 million USD (+10% annualised) and imports at \$438 million USD (+4.8% since 2010).

Many islands have no roads. On those that have roads, the network is often very limited and in poor condition. Only 34 kilometres of roads (out of a total of 1,360 kilometres) are sealed. Rural areas do not have telephones or other modern communication facilities, resulting in isolation for many Solomon Islands communities, which subjects them to extremely vulnerable conditions in the event of disasters.

The system of government is separated into three tiers: national, provincial, and local. The country consists of nine provincial governments (provincial assemblies), established under the Provincial Government Act (PGA) (1997), and the Honiara City Council (HCC), established under the Honiara City Act (1999), which administers Honiara City as a separate entity from the Guadalcanal Province in which it is situated. The provincial governments play an important developmental role and are the leading agencies in managing waste and pollution at the provincial level. However, their capacity remains weak, with limited staff and each is hugely dependent on the central government. Currently, there are no councils established under the Local Government Act ('LGA') 1996 (Cap. 117) (CLGF, 2018). HCC is headed by a city mayor and executives. The key roles of HCC officials include by-law creation, implementation and amendments, and to ensure that services are both provided and delivered to urban areas in an effective and efficient manner. Waste management is the purview of the Department of Health with waste management staff employed by HCC seconded from the Department of Health.

2.2 Waste management in Solomon Islands

Solomon Islands has faced substantial challenges regarding implementation and development of infrastructure and transport services. Approximately 16% of the population is powered by the electricity grid. The state-owned power utility is almost entirely dependent on diesel generators to supply power to Honiara. The Province of Malaita receives only 2% of the power generation capacity, and many rural areas now use small photo voltaic (PV) panels (The PRIF, 2018).

According to the National Waste and Pollution Control Plan, the overall domestic waste generated in Honiara has tripled in 20 years. A waste characterisation study undertaken for Honiara in 2011 by the HCC showed that the rate of waste generated by the household sector was 0.86 kilograms per person per day. The total amount of waste generated, including both household and commercial waste, is about 80 tonnes a day for Honiara according to the Draft Solid Waste Management Plan for Honiara City being drafted in 2018.

In recent years, a significant degree of support has been provided to improve waste management systems under the first two phases of the Promotion of Regional Initiative Solid Waste Management

project (J-PRISM I: 2011-2016 & JPRISM II: 2017 – 2022). Despite this support, a 2015 study indicated that an estimated 55.8 tonnes of mismanaged plastic waste enters the marine environment daily from either uncontained disposal sites or by direct littering activities throughout the Solomon Islands (The PRIF, 2018; Jenna et al., 2015). Additionally, the significant lack of household collection services and absence of household recycling services, combined with general malpractice of waste dumping results in drains and rivers flooded with masses of waste materials entering the marine environment. This issue is particularly amplified during rainy periods.

A significant portion of daily waste is plastics, PET and HDPE, which are sent to landfill although they are materials eligible for a container deposit scheme (CDS). This was confirmed by the waste assessment undertaken by the APWC team in 2018. The low collection rate of property taxes and the large number of informal settlements not paying council rates remain key issues to be addressed in order to improve solid waste management in Honiara. A prepaid bag system would ensure that waste collection can be funded on an ongoing basis.

Approximately 66% of the total provincial budget is allocated to operations, administration and wages. The remainder available is allocated to the implementation of capital development projects.

2.3 Institutional framework

2.3.1 International agreements

Table 3 below highlights all multi-lateral agreements ratified by Solomon Islands that are relevant to waste management. Solomon Islands has not ratified the Basal Convention.

Table 3: Multi-lateral Environmental Agreements (MEAs) ratified by Solomon Islands

MEAs and Conventions	Status
Stockholm Convention on Persistent Organic Pollutants	Ratified
1995 Waigani Convention	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, and V)	Ratified
London Convention on the Prevention of Marine Pollution by the Dumping of Wastes and Other Matter 1972	Ratified
International Convention on Civil Liability for Oil Pollution Damage 1969 (renewed 1992)	Ratified
Noumea Convention	Ratified
Protocol on Dumping	Ratified
Protocol on Combating Pollution Emergencies	Ratified

Source: SPREP, 2016

2.3.2 National

Solomon Islands has several policies, legislations, strategies and multilateral agreements that address solid waste management and control of pollution, including those listed in table below.

Table 4: National policies and legislation pertaining to waste management in Solomon Islands

Laws and legislation	Role and duty
<i>The Environment Act 1998</i>	The Act emphasises environmental management and protection, even at the expense of development projects. The Act tries to address this through the application of environmental impact assessment (EIA) in order to include environmental considerations as a component of any project. There are provisions for industries to be answerable to regarding a sustainable friendly/healthy manner or approach from management, evaluation and control of products and wastes. Section 3 of the Act specifies the objectives of the Act ((a)-(d)). The Act is the most comprehensive legislation that seeks to address waste and pollution at the national level. It defines wastes as liquid, solid, gaseous or radioactive materials, whether toxic or not, which are discharged into the environment or prescribed by regulation to be waste.
<i>The Environmental Health Act 1990</i>	This Act made provisions for securing and maintaining health infrastructures in compliance with sanitary, drainage and sewage specifications. The Act is administered by the Ministry of Health and Medical Services. It provides the backbone for formulation of national health policies, by laws and provincial ordinances. Generally, the Act gives more focus on organisational powers vested on the Ministry than on substantive issues.
<i>The (Public Health Act) 1980 and associated Regulations</i>	This regulation addresses public health issues and how to deal with them when they occur. The regulations empower the Minister and the Under Secretary of the Ministry of Health and Medical Services (MHMS) to take specific measures to prevent the occurrence of a public health disease or where such disease had already occurred, to take measures to contain and prevent the spread of the disease.
<i>Shipping Act 1998</i>	This Act was established for protecting the shipping industry (ensuring safety and health). The Act gives effect to the International Maritime Organisation (IMO) to manage risk, dangers and cleanliness in the marine environment. Part IV mentions the responsibility to respect the safety of all equipment, off and on board the vessel including human beings, which applies to safe disposal of wastes (pollutants) to the ocean that could cause danger or be hazardous to the marine environment and habitat.
<i>Shipping (Marine Pollution) Regulation 2011</i>	This regulation was added to the Shipping Act, which has special emphasis on pollution of the marine environment. The regulation implements international conventions related to marine pollution and shipping such as MARPOL and the IMO standards for safety and security of shipping and prevention of marine pollution by ships. Under this regulation, no pollution and or harmful substances are to be discharged from vessels, platforms or land into the Solomon Islands waters or from a Solomon Islands vessels into any waters. If a person contravenes the provisions and standards, they are liable/guilty to pay a fine or serve imprisonment. The enforcement also includes meeting the immediate cost of restoration, rehabilitation and cleaning up within a set time frame.

<i>Ports Act 1990</i>	Section VI of the Act makes provision for discharge of waste and other pollution of the port. It states that no person shall cause, suffer or permit any refuse, gas, petroleum oil, bilge water, ballast water or other offensive substance whatsoever its nature to be discharged, pumped or cast into or onto any waters or land within the limits of a port without the prior written permission of the Solomon Islands Ports Authority.
<i>Biosecurity Act 2013</i>	The Act provides for preventing the introduction of disease into Solomon Islands through the importation or landing of animals, plants and other risk items; preventing the introduction of pests and undesirable plants; and requiring vessels and aircrafts to give notice of their arrival in Solomon Islands and for connected purposes. This Act grants regulation-making powers to the Minister in respect to the introduction or importation of plants, animals and substances or other material that may be the carrier of plant or animal pests and diseases. The Act further provides for the appointment of inspectors and defines their powers and prescribed list offences.
<i>Safety at Work Act 1982</i>	The legislation codifies the duties of employers to their employees and others responsible for ensuring the safety of workers in various work environments, in particular the safety of workers in dangerous and risky conditions. Part III of the legislation stipulates very specific duties relating to work environments that are dusty or have fumes, pressures and vacuum systems, machinery, electrical installations, fires and explosions, and other hazardous work environments. Part IV provides for the regulation of these conditions and powers given to the commissioner of labour to regulate working conditions, investigate offences and prosecute where there is a breach.
<i>The Town and Country Planning Act 1980</i>	This Act provides for the regulation of planning at national and provincial level. Although it has a national scope, the legislation can only be applied to urban areas. The Act empowered each province to have a Town and Country Planning Board. Their responsibility is to prepare local planning schemes and control development of land within urban areas. The board has no jurisdiction over customary land, which is a significant limitation.
<i>The Mines and Minerals (Amendment) Act 2008</i>	This Act provides the statutory framework for the mining sector. Section 2 states that no mining operations shall take place except in accordance with its provisions. Several types of permits may be granted by the Minister responsible for mines and minerals: reconnaissance permits, prospecting licences, mining leases, alluvial mining, gold dealing and building materials permits. The Act made provisions for formulating an EIS before mining development should occur; Part V 36 (ii) of the Act requires as condition for a mining lease adequate protection of the environment within and outside the mining area. The recent experience with Gold Ridge mining should draw many lessons that will be considered in this strategy.

The Provincial Government Act 1997	<p>Schedule 3 provides a list of activities for which the provinces have responsibility and have the power to pass ordinances:</p> <ul style="list-style-type: none"> • Trade and Industry – Local licensing of professions, trades and businesses, local marketing; • Cultural and Environment Matters – Protection of wild creatures, coastal and lagoon shipping; • Agriculture and Fishing – Protection, improvement and maintenance of freshwater and reef fisheries; • Land and Land Use – Codification and amendment of existing customary law about land. Registration of customary rights in respect of land including customary fishing rights; • Local Matters – Waste disposal; • Rivers and Water – Control and use of river waters, pollution of water; • Corporate or Statutory Bodies – Establishment of corporate or statutory bodies for provincial services including economic activity.
PROVINCIAL LEVEL	
Honiara City Council (HCC Act) 1999	The Act provides the legal framework for the establishment of the Honiara City Council (HCC) and town boundary on Guadalcanal under section 4 of the Honiara City 1999. The function of the HCC council is still determined using other provisions provided for within the Local Government Act, which means that HCC is operated on ordinance to plan, manage and organise Honiara City.
The Honiara (Refuse Disposal) By-law 1994	This by-law is concerned with the management of waste in Honiara and enforcing the management of waste within the city boundary.
Honiara Litter Ordinance 2004	The Litter Ordinance was formulated to keep Honiara clean: local business, houses or individuals have to provide litter receptacles for waste collection, while the council distributes receptacles in the public areas.
HCC Building Ordinance	The Honiara City Council Building Ordinance was created to ensure all buildings built within the Honiara City have to be legally approved considering safe and healthy development for the health of Honiara City. This Ordinance also states the types of materials that are legally approved to use in building constructions.

A number of plans are also in place, all of which have an impact on waste management in the country. These are:

- National Development Strategy (NDS)
- Democratic Coalition for Change Government (DCCG) Policy Statement—The DCCG policy
- National Adaptation Programme of Action (NAPA)
- National Biodiversity Strategic Action Plan (NBSAP)
- National Climate Change Policy (NCCP)
- Solomon Islands National Plan of Action (CTI)
- Solomon Islands National Biosafety Framework 2012
- National Health Strategic Plan 2016–2020
- National Water Resources and Sanitation Policy

2.4 Stakeholder Map

There are various stakeholders responsible for management of waste in Solomon Islands.

These include the following:

1. Ministry of Environment, Climate Change, Disaster Management and Meteorology
2. Ministry of Health and Medical Services
3. Honiara City Council
4. Western Provincial Government
5. Buala Provincial Government
6. Choiseul Provincial Government
7. Malaita Provincial Government

There are a number of recyclers operating in Solomon Islands and the Solomon Islands Recycling and Waste Management Association. It is anticipated that the association will be formed and operational by mid-2019.

2.5 Roles and responsibilities

The Ministry of Environment, Climate Change, Disaster Management and Meteorology (MECDM) has seen a rapid increase in its mandate since its formation as the Ministry of Environment, Conservation and Meteorology (MECM) in December 2007. This initial formation was a merger and upgrading of the Solomon Islands Meteorological Services and the Environment and Conservation Division (ECD) of the Ministry of Forestry. The Ministry has four divisions, each with their own respective directors:

- Meteorology Division
- Climate Change Division
- Disaster Management Division
- Environment and Conservation Division.

The ECD is the key department for waste management and pollution control mandated under *The Environment Act 1998* and regulations 2010. The ECD has also ventured into participating in operational aspects of solid waste management, especially in Honiara.

Although MECDM has been taking a lead role in co-ordinating the activities around waste management and pollution control around the country, the operational management of waste falls under the purview of the Environmental Health Officers (EHO) employed by the Ministry of Health. The staff responsible for management of waste at Honiara City Council as well as at the provincial level are all seconded employees to the council and provinces from the Department of Health. Therefore, MHMS is a player to be considered for future decision making around waste management.

Addressing waste and pollution in the country will require developing the capacity of lead agencies such as MECDM, Honiara City Council, provincial governments, Ministry of Health and also Solomon Islands Maritime Safety Administration (SIMSA). Other government agencies and state-owned enterprises such as Solomon Islands Water Authority (SIWA) have delegated responsibilities to

manage certain types of waste or waste within their jurisdictions and so there is a need for collaboration and for them to proactively take up their mandated responsibilities.

Table 5: Organisational mandate for various departments in Solomon Islands

Organisation	Mandate on waste pollution	Legal provision for waste management	Ongoing work
MECDM	All waste and pollution control issues	<i>Environmental Act 1998</i> part IV	Currently plays the lead co-ordination role
MHMS	Waste and pollution in relation to health through the environmental health division	<i>Environment Health Act 1990</i>	EHOs stationed in every provincial centre are currently the main co-ordinators and managers of waste and pollution control
Provincial governments	All waste and pollution in provincial centres	<i>Provincial Government Act 1997</i> – Devolution of powers for the province to make ordinances on waste and pollution in the environment	Lead agencies and providing funding for waste and pollution in their provinces although much of it is restricted to provincial centres
Solomon Islands Water Authority (SIWA)	Pollution control and prevention	<i>SIWA Act 1992</i> Section 7e to provide, construct, operate, manage and maintain buildings, works, systems and services for the conveyance, treatment and disposal of sewage, trade and industrial waste and other connected purposes	Plans currently in place to build a sewage treatment facility in Honiara
Solomon Islands Port Authority (SIPA)	Waste management and pollution in port jurisdiction	<i>SIPA Act</i> section VI makes provision for discharge of waste, etc. into and other pollution of port. It states that no person shall cause, suffer or permit any refuse, gas, petroleum oil, bilge water, ballast water or other offensive substance whatsoever its nature to be discharged, pumped or cast into or onto any waters or land within the limits of a port without the prior written permission of the SIPA	Ongoing management of ports area by SIPA
Solomon Islands Maritime Safety Authority (SIMSA)	Pollution in the marine environment	<i>Shipping Act 1998</i> – The Act 1998 was purposed for protecting (ensuring safety	The regulation implements the provisions of

		and health) the shipping industry. Shipping (Marine Pollution) Regulation 2011 – was amended into the Shipping Act, which has special emphasis on pollution of the marine environment.	International Conventions (IC) in relation to marine pollution from shipping such as the IC for the Prevention of Pollution from Ships 1973 (MARPOL) and its Protocol 1978
Ministry of Lands	Land-related issue for waste and pollution	Land acquisition under the <i>Lands and Titles Act 1996</i>	N/A
Ministry of Infrastructure	Infrastructure development	<i>Roads Act 1996</i>	N/A

Source: National Waste Management and Pollution Control Strategy 2017–2027

3 Situation analysis: waste management

3.1 APWC scoping visit

In order to fulfil the requirements of this contract, current and up-to-date data was collected in-country, forming the basis of all best-practice recommendations as well as the training schedule for this project. APWC undertook the in-country work from 25 November to 10 December 2018, avoiding the rainy season as well as the holiday period, both of which can heavily affect the outcomes of the waste generation and disposal data. APWC had a five-member team supported by our in-country staff. The team for Solomon Islands is listed in Figure 3.

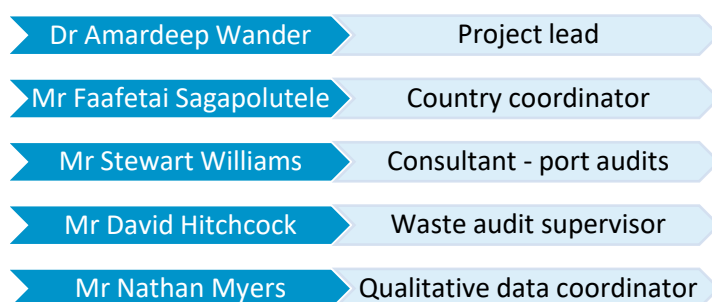


Figure 3: APWC country team for Solomon Islands

The work undertaken by the team includes:



Figure 4: In-country work undertaken

3.2 Waste service provision

3.2.1 Overview

Municipal solid waste on the island of Guadalcanal is under the purview of the Guadalcanal provincial government. Only the city of Honiara is managed by the Honiara City Council (HCC).

With the exception of Honiara, there are no other councils in Solomon Islands. Waste management is the responsibility of Environmental Health Officers (EHOs) employed through the Ministry of Health. It should be noted that waste management is not the primary responsibility of the EHOs under the Act and therefore is often overlooked.



Image 1: A burning pile of rubbish in Auki

The J-PRISM Project has been responsible for identifying the amount of waste generated within Honiara on an ongoing basis. The data obtained during waste characterisation surveys is useful for the organisation's future planning to improve waste management within their respective service areas. Developing technical capacity for provinces and municipalities remains a priority if they are to achieve nationally sustainable waste and pollution management. Most of J-PRISM's efforts in the previous years has been focused on Honiara being an urban centre with poor waste management.

At the time of APWC visit, a waste collection system was in place in the Honiara urban area only. HCC is in the process of developing a waste management plan for adoption in 2019. Malaita did not have a waste collection service nor a waste management plan at the time of the APWC visit. However, a waste management officer has been engaged by the Department of Health in June 2018, with their primary duty being to develop a waste management plan for Malaita, especially for the township of Auki.

3.2.2 Honiara City

J-PRISM II conducted a waste survey and a time and motion study in late 2017 to determine both the waste flows and the collection coverage for the city.

According to this waste-flow modelling, about 80 tonnes of waste is generated by both households and commercial premises in Honiara per day of which approximately 23% is left unmanaged. ADB noted a severe outbreak of dengue fever in 2013 could be directly linked to poor waste management practices.

The overall waste flow for Honiara City is provided in Figure 5 below.

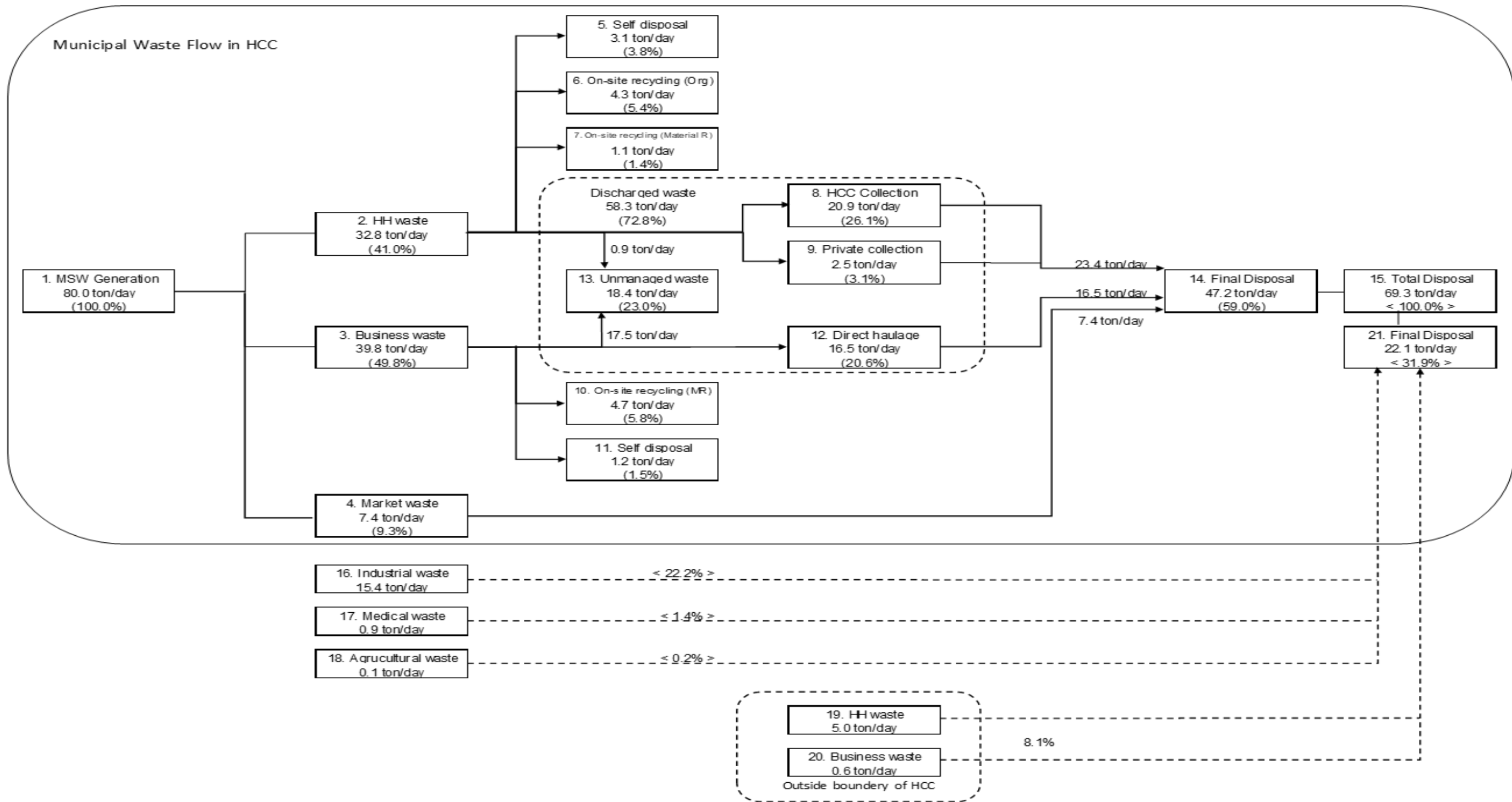


Figure 5: Waste flow for Honiara City Council conducted by J-PRISM II in 2017

Honiara City Council (HCC) – Environment Division (ED) is the governing body responsible for policies and monitoring all aspects of cleaning and waste collection from main roads, central business district (CBD) and commercial waste. This is a combined effort with HCC – Works Division (WD) that is responsible for all cleaning and collection services from the Honiara City area. HCC currently offers a mixture of door-to-door service as well as collection points for households within the city boundary. Residents are required (at their own cost) to use metal drums, plastic bins or a constructed wooden platform for storage of waste. The council then undertakes a waste pickup on a weekly basis.

No source separation is required by residents and, in most cases, the garbage bags and bins are not appropriate for disposal.



Image 2: Plastic rubbish bin in front of a house for rubbish disposal and a skip bin provided for a small shopping centre

Honiara City is divided into 10 zones including the markets, schools and the hospital. Zones 1 to 6 are collected by the waste division of HCC and Zones 7 to 10 are collected by private contractors. The 10 zones represent 12 city wards. The collection service covers between 42% to 60% of the urban area as per consultation with the city officials.

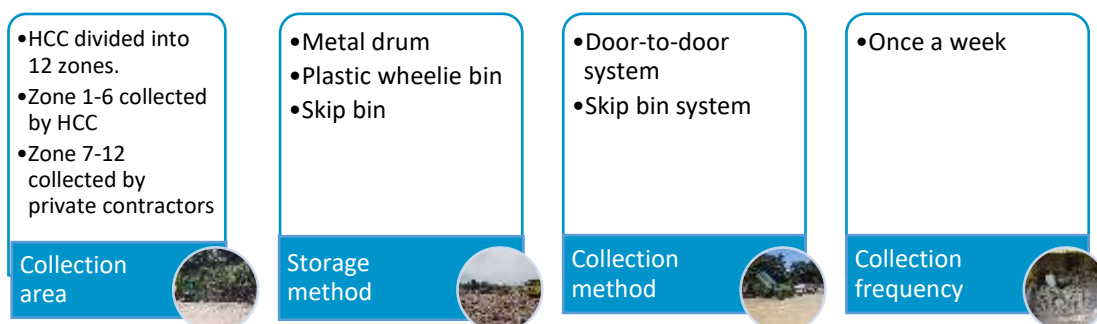


Figure 6: Collection service provided by HCC

In 2018, J-PRISM undertook a time and motion study that generated collection routes for all zones. The study also provided the locations of all skip bins in the HCC area. The information has been shared with APWC and can be provided on request.



Image 3: Map for Zone 5 collection route and collection points

The biggest challenge for the HCC collection vehicles is access to all collection-point locations due to road conditions and the condition of the HCC vehicles. The collection services are notably unreliable and/or unavailable, particularly to regions outside the city of Honiara boundary as these routes and schedules are unpublished (APWC research). HCC works division has introduced GPS tracking and remote VHF monitoring for trucks which is helpful. However, with the current budget, the council cannot afford to pay the recurrent monthly fee for accessing the GIS monitoring system.



Image 4: HCC collection truck





<ul style="list-style-type: none"> • Recurrent budget of 8 million SBD • Capital budget of 5-8 million SBD • Proposed budget for 2019 is 14 million SBD in total 	<ul style="list-style-type: none"> • Total of 58 full time staff in WD • 29 currently work on waste management • Only two staff have some waste training • 8 Drivers & two runners per vehicle + market crew 	<ul style="list-style-type: none"> • 8 rubbish trucks, 4 are working • One provided by JICA, rest are owned by HCC • Average breakdown period is two to four weeks due to lack of trained staff 	<ul style="list-style-type: none"> • Each contractor is paid 8,000 SBD per month. • There was a tender process for the collection contract but HCC wasn't able to agree to the tenderer's terms. • Currently it's a month to month tender
<p>WD budget</p> 	<p>WD staff</p> 	<p>WD vehicles</p> 	<p>Contract Monitoring</p> 

Figure 7: HCC works division

It is estimated that approximately 35% of the population of Solomon Islands resides in informal settlements outside HCC boundary. We understand that less than half receive a waste service. Households that do receive a service are provided with steel drums as collection points that are shared among multiple households. Drums are picked up using compactor trucks by HCC and the contractors use flatbed trucks. However, APWC consultation with households revealed that the service is often monthly to once every three months.

Table 6: Vehicles available to HCC

Vehicle type	Available	Unavailable	Total
Compactor (4 tonne)	3	2	5
Compactor (10 tonne)	1	0	1
Dump truck (tipper)	2 (5 tonne, 4 tonne)	0	2
Container truck (skip)	2 (10 tonne)	1 (4 tonne)	3
Vacuum truck for sludge	1	0	1
Total vehicles	9	3	12

As a result, the open-top steel drums are often so inundated with rubbish that it spills onto the roads or is placed in piles around the drums awaiting collection. Inclement weather, as well as domestic (dogs) and wild animals, tear and burst rubbish bags, perpetuating the leakage into the environment. Drums, although owned by the HCC, are not frequently cleaned or serviced, and waterlogged rubbish presents, among other things, a health challenge for the collection teams. HCC staff and contractors were observed emptying bins without proper PPE, which is a major health hazard.



Image 5: Rubbish being collected in compactor trucks from metal drums

Skip bins are different from the waste drums and are provided to some communities where the trucks are not able to access roads. In such situations, the entire community is provided with a skip bin and allowed to access it as many times as required. APWC community surveys showed a very low level of satisfaction with the skip bins in general. The table below shows the number of skip bins deployed within Honiara boundary.

Table 7: Skip bins deployed in HCC

Skip (tonnes)	Available	Unavailable	Total
*Number of containers (Skip –10t)	10	0	10
*Number of containers (Skip – 4t)	6	4	10

HCC also offers a bulky waste collection but is currently not promoting this service as it does not have the capacity to provide it effectively.

While the Works Division (WD) is responsible for undertaking all collections, the Environmental Health Division (EHD) are responsible for policy and implementation. Currently, there are 20 staff in the EHD, all of whom are seconded employees from the Ministry of Health. Of the 20 staff working at EHD, 12 are fieldworkers responsible for septic waste and sanitation inspections of peri-urban areas. Of the remaining eight, only six are working, with one responsible for overseeing waste management. There is a proposal to employ two full-time staff in Honiara who will work for HCC and carry the responsibility for managing waste for the council in 2019.

EHD is responsible for monitoring the contracts governing the waste collections. The methods of monitoring include:

- Complaints from public
- Sign-off at landfill – explain
- Maintenance of collection schedule in communities.

However, due to the lack of resourcing, there was little monitoring being carried out at the time of the APWC visit.

EHD receives two streams of income, as shown below:

- Ministry of Health (SBD 100,000)
- HCC (SBD approx. 500,000)

The only expenditure on waste is for clean-ups and awareness. These funds are insufficient to effectively train and manage the staff responsible for waste management strategies, plans and policies, setting strategic targets and goals, managing and monitoring contractors' performance and liaising with stakeholders to improve resource recovery and recycling outcomes for the city. APWC notes that at the time of its visit, HCC was relying heavily on J-PRISM support to help develop their waste management strategy and implement some waste data collection and monitoring. The collection is currently paid through the works department budget.

Most staff involved in the managing and monitoring of both waste management and policy are not trained in waste management and are predominantly EHO employees. Waste management is not part of their core training or experience. It is noted that correct practices for rubbish disposal in both public

settings and private residences is poorly followed, with a large proportion of citizens dumping their rubbish in the streets, gutters, bushes and waterways. Ultimately, these practices result in vast amounts of rubbish entering the marine environment, the effect of which is amplified during the rainy season when more rubbish is swept into the oceans.

Waste collection for business houses (commercial premises) is on a request only basis. The business houses are required to sign a Trade Refuse Agreement, which stipulates the following:

- Collection frequency
- Fees paid.

The trade refuse fee for businesses is currently \$30 SBD per bin. Food establishments often have a higher fee and a more regular collection to manage odour.

Waste collection from schools is carried out by contractors three times a week and has the potential to be reduced in frequency as more schools start practising the 3Rs – reduce, reuse, recycle.

The markets are one of the major producers of waste in the Honiara city precinct. It is estimated that about 7.4 tonnes of waste is generated each day at the markets of which approximately 93% is organic in nature. Currently, there are no operational processing facilities for organics in Honiara and all market waste is being dumped at the Ranadi waste disposal site. With limited disposal capacity at Ranadi, processing organic waste separately is a priority for HCC.

HCC also recognises that the use of waste drums for waste disposal poses challenges and risks for collection crews. Council is working with J-PRISM to design new waste disposal receptacles.

Each commercial site in Honiara is required to apply for an operational licence from HCC each year. HCC is engaging with all PET bottle users and exploring opportunities for the development of a waste management plan as part of licensing conditions for all commercial premises.

There are currently no sanitary landfills in Solomon Islands.

3.2.3 Auki (Malaita province)

Auki, the provincial headquarters of Malaita province, serves as the main administrative, education and economic centre for Malaita Province.

The demographics of the town are:

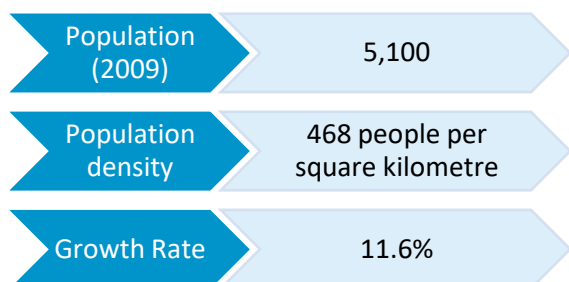


Image 6: Auki

The growth rate of Auki poses a concern for the Malaita Provincial Authority (MPA) due to limited technical and administrative capacity and resources to effectively manage the increasing rapid urban growth and related issues it presents.



Image 7: An informal rubbish pile on a street in Auki and the rubbish dump at Auki currently under dispute

Malaita does not have a town council and there is no waste management system in place. The potential problems arising from this situation will escalate as the population increases, disposable income becomes greater and the township of Auki expands.

The Auki Town Committee (ATC) is responsible for garbage collection and drainage work in the town. Waste collection is sporadic, and sometimes non-existent, due to lack of funds. Solid waste generated from households, offices and shops is dumped on the roadside and left uncollected for weeks and sometimes months, creating public health and road safety risks. Street cleaners, employed through the World Bank's Rapid Employment project, actively clean the streets each day and leave the waste in small open dump sites on the street.

APWC was informed during its visit that a local contractor is collecting waste from Auki town centre, however, since the dump site is not available anymore, there is nowhere to dispose of the waste. Therefore, in November 2018, all waste in Auki was being swept up and left in open dumps on the street. Many of these dumps were located directly next to the ocean.

All villages visited by APWC used pit-latrines (some on the water) and disposed of their waste in the ocean, lagoon or forest.

In the absence of a collection service, the MPA runs a twice-yearly house-to-house education programme focussing on teaching young people the 3Rs. It is a joint programme run by the police and health promotion programme run by the Department of Health and encourages organics composting and sup-sup gardens. It was evident during APWC's site visits that the programme has had an impact on small communities. Furthermore, the project promotes digging disposal points behind individual houses. The provincial council also engaged a waste management officer in June 2018 solely for the purpose of planning for the landfill as well as developing a solid waste management plan for Auki.

3.2.4 Markets at Auki

The market at Auki has about 100 vendors, charged between 10 to 20 SBD per day based on their goods for sale. The market revenue is approximately 1,000 SBD on weekdays and between 3000 to 4,000 SBD on weekends.

All the funds collected from the markets goes to the provincial government, which in turn employs about 17 workers to manage the market, including the market manager. The markets are run by a marketing committee that reports to the provincial government. The committee hires staff, including cleaners.

The market manager's job involves checking all stalls, fielding complaints, as well as managing the market staff, including cleaners. The nine cleaners are required to clean and sort waste that is dumped in a rubbish pile. The cleaning co-



Image 8: A pile of rubbish from the markets in Auki

ordinator makes sure that the waste is sorted into putrescible waste, bottles, tins and green waste. The vendors dump the waste at an open disposal point where the cleaners then sort through the waste and remove any contamination. The clean green waste is placed inside 240-litre mobile garbage bins (MGBs) and then taken to a local farm for composting. The farm organises a truck to pick up the green waste twice a week. The farm truck previously took the bins, emptied them and returned them. Due to negligence by the truck staff, some bins were broken and the practice ceased. The MGBs are now emptied directly into the truck and the bins remain at the market premises. The amount of waste generated is approximately 10 cubic metres (10 m³) or 20 MGBs (240-litre capacity each) twice a week. The contamination is collected by a separate contractor who is paid 300 SBD per load. At the time of APWC's visit, the contractor had not been paid and therefore no waste had been collected. The market manager noted that this issue occurred three or four times per year. The delay in payment was due to the lack of availability of funds when the number of market vendors was low.

In 2015 an attempt was made to promote source separation among vendors. Bins were provided at the end of each aisle for vendors to separate different types of waste. However, a high level of contamination was found and the trial was abandoned. The cleaners have since been responsible for separating contamination from the green waste.

The waste remains at the markets if the contractor fails to pick up the contamination remaining after the farm has picked up the green waste. There is only one contractor in the city for everything including market waste and there are no penalties if the contractor fails to deliver a service.

3.3 Waste infrastructure

3.3.1 Ranadi Dump Site (RDS)

Ranadi Dump Site (RDS), located in a light industrial area approximately 6 kilometres from Honiara City and managed by HCC Environmental Health Division (EHD), is the only waste disposal site in Honiara. It is founded on reclaimed land, 500 metres from the coastline, on a 4-hectare site.

With evidence of dense deposits of rubbish revealed by the eroded coastline and rubbish overflow extending onto neighbouring properties, it is likely that the true nature of the dump is twice the official size (ADB, 2014). The site commenced operation in the 1970s as an open dump site. In 2015, it became a semi-aerobic landfill, with leachate pipes, connected to leachate ponds.



Image 9: Ranadi Dump Site (Honiara City)

Operating hours	Staffing	Gate fees	Equipment
<ul style="list-style-type: none"> • Mon to Fri: 9am to 4pm 	<ul style="list-style-type: none"> • One person at the gate each day • Landfill manager 	<ul style="list-style-type: none"> • None 	<ul style="list-style-type: none"> • N/A

Figure 8: Operating conditions for Ranadi Dump Site, Honiara

Ranadi landfill receives several kinds of waste, including MSW, septic waste, bulk waste, e-waste, hospital (including drugs, hazardous, construction and agriculture waste). Some toxic wastes are temporarily stored on site.

Ranadi landfill is at capacity, with no available space for unloading. The site either requires expansion (which is highly unlikely) or HCC needs to acquire a new parcel of land to ensure waste disposal needs are met for the future.

Waste material from residential, commercial and industrial sectors is dumped into RDS indiscriminately (i.e. general waste, organics and recyclables in the same cell) and any sorting is largely performed by resident waste pickers recovering metals and other valuable recyclables. Access to the RDS is unrestricted and free of charge to households and offices. The landfill receives approximately 80 tonnes of material per day according to the J-PRISM waste-flow study undertaken in 2017. Although the site possesses a small warehouse and baler for storage of PET plastics, the site lacks appropriate equipment to safely dispose of medical wastes and combustibles; these materials are therefore frequently burned in an uncontrolled manner (Mataki, 2011).

As part of the PACWaste project through SPREP, an incinerator was provided to the hospital in Honiara in 2015. However, during the 2018 APWC visit, the incinerator was not being used by the hospital and all medical waste was being dumped at the RDS. Negotiations were ongoing between HCC and the hospital to resolve the matter.

One prominent threat to the longevity of the RDS is the encroachment of the surrounding industries and squatter settlements into land designated for the site (Mataki, 2011).

HCC has received substantial support from the ongoing J-PRISM projects to ensure that the landfill continues to accept waste. In 2012, an environment impact assessment (EIA) was undertaken by J-PRISM and the Ministry of Environment.

Prior to 2013, no environmental hazard reduction tactics were practised, materials were favourably burned, and bulldozers occasionally hired to reduce the volume of excess waste not previously burned.

When the JICA began the Technical Co-operation Project for Promotion of Regional Initiative on Solid Waste Management (J-PRISM) in 2013, the project implemented several installations to improve quality control of the site. These improvements included leachate capture and drainage systems, a small settling/digestion pond, removal of bulky waste into new segregated cells, increasing overall cell space, signage, fencing and installing a gate house (ADB, 2014). Training was provided for the HCC workers on the proposed rehabilitation approaches to improve Ranadi's original conditions.

Rehabilitation and upgrading of the RDS to a semi-aerobic site, implemented by a J-PRISM I Initiative by the JICA, was carried out in 2015 and the plan is provided in Image 10. As part of this project, a training centre was erected, and a guided operations manual was developed for continued onsite use. Regardless of all the efforts, Ranadi has a limited life and alternatives need to be explored for Honiara to have a sustainable waste disposal facility.



Image 10: Ranadi landfill development plan for works undertaken in 2015

3.3.2 Provincial waste dumps

3.3.2.1 Auki, Malaita Province

The town does not have a landfill and the current dump site is no longer accepting waste due to a land dispute. It has been closed as the result of conflict with a proposed tourism facility. The landowner is also disputing the use of the site as a dump site due to it being close to the nearby community where odour is an ongoing issue.

The Malaita Provincial Council is actively looking for a landfill site and this process has been ongoing since 2013. However, during APWC's visit in November 2018, we were informed that an EIS has been prepared for an alternative site and the government is in negotiation with two land owners regarding potential next steps.



Image 11: Open dump site on fire at Auki

3.3.2.2 Gizo, Western Province

Gizo is the provincial centre for Western province and is located approximately 370 kilometres from Honiara. It serves as the main economic link between Honiara and the rural villages in the Western province. Gizo has a population of 7,177 and has been growing rapidly over the recent decades to become the second largest town in the Solomon Islands.

The Western Provincial Authority (WPA) is mandated under the *Provincial Government Act* and the *Town and Country Planning Act*. The terms 'WPA' and 'Gizo authority' are used interchangeably and refer to the provincial executive or government that heads the provincial administration, planning and urban management to the urban and rural population on behalf of the central government. The town lacks proper landfill facilities, and dumping and burning of solid waste on open land is common.

Gizo town suffers from severe littering and a lack of regular rubbish collection. These problems are compounded as the WPA lack the financial resources, proper refuse facilities and skilled human resources. Solid waste management is therefore a critical environmental issue for the WPA. Garbage collection is also of critical importance because Gizo is a popular tourist destination for diving.



Image 12: Waste collection truck in Gizo

The WPA set up the Gizo Town Committee and receives an annual grant of 150,000 SBD to carry out garbage collection in the town. The collection is carried out in an ad hoc manner and rubbish was noticed everywhere in the streets. In 2015, Bank South Pacific (BSP) donated 50 metal drums as waste receptacles to the Gizo Town Council that have been deployed around town.

Gizo Town Committee lacks proper landfill equipment. The use of open spaces for garbage disposal and burning is frequently practised. The main landfill is located on the coast, approximately 3 kilometres from town.



Image 13: Gizo Dump site

Lack of proper refuse facilities, shortage of workers and limited funds continue to affect service collection in Gizo. This has led to residents dumping their garbage in the bush and along the roads, which is an eyesore. Solid waste generated from shops, households and offices is dumped on the roadside and often not collected for weeks, creating public health risks, road safety issues, and loss of amenity, which culminates in degradation of the environment.

3.3.2.3 Noro, Western Province

Noro is a town in the Western Province of Solomon Islands with approximately 5,000 inhabitants. Noro has a major international port and APWC staff visited the landfill as part of the port waste facility audit. The landfill at Noro is an uncontrolled, fenced site with one person manning the site every day.

The landfill charges the Department of Fisheries for disposal of waste to the facility. Fisheries are responsible for providing a waste collection service to the township of Noro and the council pays a fee for the service. However, the service is sporadic and ad hoc and the town struggles with illegal dumping and littering.



Image 14: Dump site at Noro

3.4 Current Financial Mechanisms

There are two main sources for revenue, in accordance with the *Honiara City Act 1999*: grants from the national government and rates stated in the Act. Stipulated rates include head tax (basic rate), property tax (land rate), business tax, gaming and casino tax, vehicle tax, liqueur tax and fees for services rendered by HCC. Environmental Health Division receives two streams of funding:

- Ministry of Health (100,000 SBD)
- HCC (approx. 500,000 SBD)

Only expenditure on waste through the ED is clean-ups and awareness.

The HCC do not currently allocate any specific funding for waste services; the money has been allocated to SWM from grants received from the national government (ADB, 2014).

Under the law, all property owners must pay a 'property rate' to the HCC on the unimproved value of land in Honiara. The property officer issues a property rate notice on the amount to be paid every year. The 2014 rate is set at 0.37% for residential and 0.50% for commercial and industrial of the unimproved value of land in Honiara¹. According to APWC consultation, only approximately 30% of council rates are paid. Therefore, the rates revenue received does not cover the expense of a collection service.

Collection services provided to commercial businesses and market vendors are charged at \$25 SBD for one drum and \$20 SBD for any additional drums. Loose waste from the ground is charged at \$600

¹ <http://honiaracitycouncil.com/index.php/rates/>

SBD, \$1,250 for a 2-cubic metre bin and \$2,000 SBD for a 3-cubic metre bin. These amounts are used to offset the residential collection.

The other nine provincial governments also receive funding from the national government for operation and capital development. Financial support is provided by the Provincial Capacity Development Fund, Rural Development Program, Rural Advancement Micro-projects Program and Rural Constituency Livelihood Fund. However, there are no managed dump sites or an ongoing waste management programme in any of the provinces other than Honiara.

3.5 Recycling in Solomon Islands

Solomon Islands is poised to become the second country in the Pacific to have its own waste and recycling industry association (WRIA) after Samoa. Solomon Islands' WRIA held its inaugural meeting in November 2018 and needs to ratify their constitution and develop a waste management strategy. APWC notes that a JICA senior advisor will be visiting Solomon Islands in March 2019 to help progress these matters for the Association. Currently, the WRIA has only three member recyclers and the current president is not a recycler.

There are several players in the recycling industry in Solomon Islands. The recent downturn in market, however, has had a severe impact. APWC consulted with the major players in the recycling industry and this section summarises the qualitative and quantitative data collected during these meetings.

Aluminium cans are recovered for recycling in Honiara and sell for \$2 to \$3 SBD per kg. Recycling does not currently exist for paper, plastic or e-waste, and recycling of aluminium cans was reported at an average of 50 to 60%. These numbers, although cited in previous reports, could not be confirmed by APWC during our visit in 2018.

APWC's visit to Auki demonstrated that there was no recycling activity for aluminium cans in Auki. There are currently 'no specific policies to support or promote recycling or resource recovery'.

There is one recycling firm in Gizo Western Province that purchases aluminium cans from residents. These are shipped to a recycler in Honiara for export. The PacWaste pilot project collected used lead-acid batteries from household solar systems in the provinces of Malaita, Santa Isabel and Choiseul in the outer islands. The batteries were transported to the Solomon Island Power Warehouse in Honiara for payment and export.

While aluminium cans and ferrous and non-ferrous metals are exported, there are challenges in accessing the international recycling market for a PET bottle collection project in Honiara. This project is now under the responsibility of the HCC.

Three private companies presently operate in Honiara. Of the three, one company recycles only non-ferrous metals due to their high product value. The remaining two focus on all-metal recovery. APWC notes there is potential for the recycling industry to thrive in Solomon Islands. There are established businesses with extensive recycling experience and business acumen ready to meet demand should recycling activity again become profitable.

3.5.1 BJS Recycling

BJS Recycling is based in Honiara and has been active for 20 years. BJS send approximately two 20-foot shipping containers of non-ferrous material overseas every month of which about 80% is cans. On average, a shipping container of metals weighs about 11 to 14 tonnes and a container of plastic weighs 10 to 11 tonnes.

BJS currently has 11 employees.

More recently, BJS took over a granulator for shredded plastic from Ramsey (the peacekeeping force) that can produce 1 tonne per day of granulated PET. However, they have stopped granulating and selling plastic due to poor market conditions.



Image 15: Aluminium baler and stored aluminium cans

BJS own a small aluminium baler that compacts cans to get 11 to 14 tonnes per container. It is looking to make improvements, however, that would allow for greater compaction to achieve payloads of 18 to 20 tonnes per shipping container. BJS pays small recyclers \$2 SBD per kilogram for aluminium cans with 80 to 90% of its aluminium cans collected from Guadalcanal province and the remainder from other provinces. BJS has two vehicles that collect aluminium cans from all over the island. A summary of the BJS business model is below:

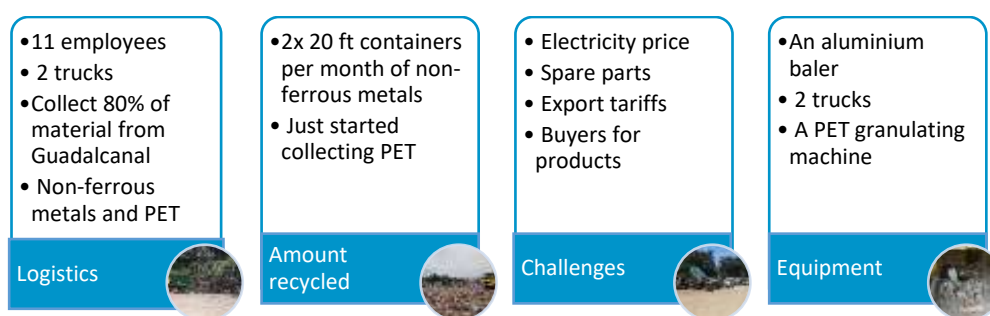


Figure 9: Business details for BJS recycling

BJS's only competitor is Mr Wong, offering a more competitive price of \$3 SBD per kilogram of aluminium cans. Mr Wong is a recent addition to the Honiara recycling business community and could not be contacted during our visit as he was overseas at the time. Neither BJS nor Mr Wong are currently involved with the WRIA. There is an urgent need for all parties in Solomon Islands recycling industry to be involved with the association to ensure its success.

3.5.2 Small-scale recycler of aluminium cans and glass

Patrick, a small-scale recycler based on Honiara, is a member of the Solomon Islands WRIA.

He purchases aluminium cans for \$2 SBD per kilogram from the public and sells it to Mr Wong for \$3 SBD per kilogram. He also deals in Solbrew and Schweppes bottles, buying for 30 cents and selling for 50 cents.



Image 16: Small-scale aluminium can recycling in Honiara

This business collects about 1,000 kilograms of aluminium cans per week and about 200 glass bottles of Solbrew and Schweppes per week. Patrick does not have any equipment or machinery and compacts cans manually. All the material is stored in a small room which fills up within a week. As a consequence, he sells the cans weekly to the buyer. He transports all cans that he collects using a taxi. There is a potential for small-scale businesses such as Patrick's to expand and flourish if there is available support through the WRIA in the form of equipment, truck hire and simple business management techniques.

3.5.3 Small-scale recycler of lead-acid batteries

Michael Mafiti is a small-scale recycler of lead-acid batteries based in Honiara. He pays \$1 SBD per kilogram for batteries brought to him. Michael was able to see the business opportunity to recover used batteries while working in the security sector of a local renewable energy project. He uses his battery-recycling business as top-up income but does not make enough from recycling batteries alone for it to be his primary source of income at this time.

Michael has no equipment and operates from a large, disused ex-MID (Ministry of Industry and Development) shed and office space. He now collects batteries from Guadalcanal province as well as four other surrounding provinces. There is potential for this business to expand, especially if there were capital grants available through the WRIA.

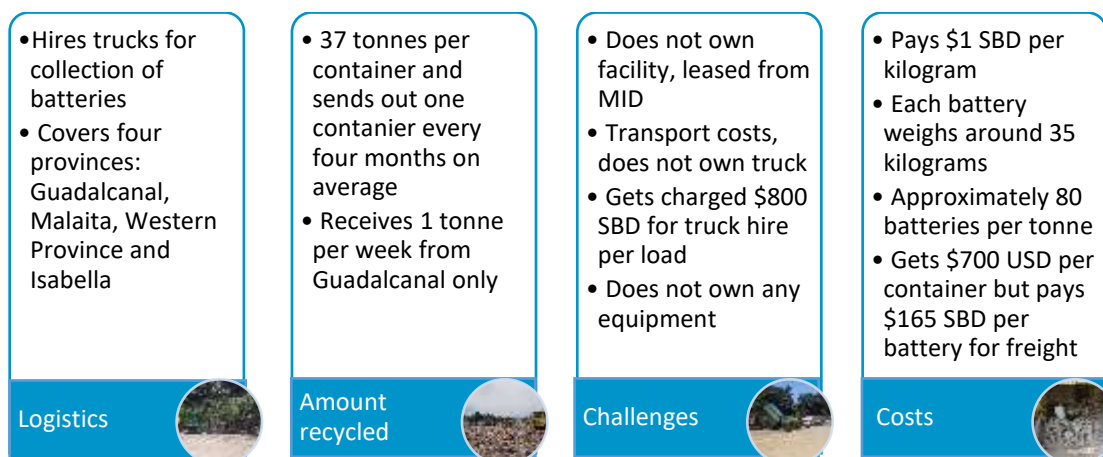


Figure 10: Business model for a small-scale battery recycler in Solomon Islands

3.5.4 Plastics recycler

Lindsey Teobasi is the only plastics recycler in Solomon Islands. A teacher by profession, he is also the vice president of the WRIA. Lindsey is currently working on a project with the New Zealand government to trial the recycling of soft plastics. He pays the waste pickers at the Ranadi dump site \$15 SBD per day to provide him with 3 to 4 kilograms of LDPE. The project involves converting the plastic to fuel and other moulded products using a granulating machine as well as an injector. The project is being trialled with the Mataniko River community and will produce children's toys and other moulded products from waste plastic using 3-D printing techniques.

He is also collecting plastic polymers 1–4 from Woodford School. The PET is then washed, melted, granulated and moulded into other products. The project is currently awaiting some moulds into which the molten plastic can be injected.

There is potential for Lindsey to expand his operation and accept other types of plastics that can simply be compacted and exported for recycling.

3.5.5 Container Deposit Scheme (CDS)

A small Container Deposit Scheme (CDS) is currently in place in Honiara for beer and soft drink bottles. Solomon Brewers Ltd operates a bottle reuse scheme whereby glass bottles are redeemed by retail distributors at 50 cents per bottle. Some tourist accommodation similarly recycles bottles and aluminium cans, ultimately for export.

3.6 Current Waste Management Initiatives

3.6.1 Government

HCC and the Ministry of Environment work together to deliver waste management education and support to communities, both within Honiara and in other provinces. According to HCC annual report provided to APWC, the following activities were undertaken in 2017:

- Issuance of public nuisance notices following 15 complaints of illegal dumping of waste, followed by compliance-removal of rubbish and purchase of City Council waste storage bins

- Nine schools covered by eco-school programme – waste management and waste segregation. Three best schools awarded with trophies, waste bins and wheel barrows
- Community and house-to-house awareness on waste management, segregation, storage and composting – 60 brochures disseminated, 10 waste bins issued, 15 timber-frame composts constructed, one community with waste action plan developed by youths
- Introduction of private contractor for waste collection from four out of 10 collection zones
- Introduction of two new private contractors for collection of waste from schools and clinic.

APWC understands Gizo delivered a plastics ban on 1 July 2018 but there is no information or legislation available.

3.6.2 NGOs

There are several NGOs working in Honiara and some of their work overlaps with waste management activities. Kastom Gaden Association encourages the community to ‘create small-scale food gardens using organic farming methods’ and promotes small-scale composting activities within this programme.

3.6.3 Waste Pickers

There was extensive scavenging activity at the Ranadi dump site witnessed by the APWC team. The waste pickers range from 10 years to 50 years in age and sometimes include entire families. The pickers are removing scrap metal, plastic bottles, copper, brass, aluminium, glass bottles, paper and cardboard. Some work alone while others work in groups. Metal recyclers mostly come to the landfill to purchase materials that the scavengers have picked from the landfill for recycling. This removes the requirement for pickers to transport their scavenged materials.



Image 17: Waste pickers at Ranadi Dump site

While APWC was on site, parts of the site were on fire and there was constant smoke from burning plastic. The waste pickers are working in highly unsafe conditions with no water or sanitation facilities.

3.6.4 Keep Honiara Healthy campaign (Formally ‘Sup-Sup Garden Project’)

Started in 1986 by HTC under funding support from the Ministry of Health and Medical Services (MHMS), WHO and UNICEF, Keep Honiara Healthy campaign is now implemented by the HCC. The initiative began as the Sup-Sup Garden Project in 1989 with a focus on the home composting of organic wastes. It has since been renamed and evolved to incorporate the linkages between personal hygiene and environmental cleanliness, nutrition, proper yard maintenance and home composting of organic wastes.

As the project evolved, a demonstration gardening and distribution centre was established under the project to educate participating householders (mainly women) on the techniques of vegetable gardening, composting and food preparation through a regular weekly gathering.

It is estimated that over 10% of all households in Honiara are participating in this project. However, since each active participant is also able to share the benefits of the project with two or three neighbours, it is estimated that the actual beneficiaries of the project number considerably more than the direct participants. This initiative has proven itself over decades and continues to benefit the people of Honiara, although it has evolved from its original emphasis on waste management. Several innovative approaches have been successfully tested and adopted, and these experiences would also be of benefit to people in other parts of the Solomon Islands and other Pacific island countries. The impact noted by the APWC team was that most communities visited are using organic waste for sup-sup gardens. The analysis of the household interview data is provided in section 4 of this report.

3.6.5 Eco-School pilot programme

The Eco-School pilot aims to deliver education and awareness programmes to school children in Honiara while enhancing teachers' current knowledge and skills with the outcome of behaviour change and field visits². The waste management component holds a particular focus on waste minimisation and the 3R principle as a pivotal role in the programme as well as litter awareness and field visits to the Ranadi dump site.

3.6.6 Learning and Ecological Activities Foundation for Children (LEAF) Project

Through the initiative of Nishinomiya City, Japan, Learning and Ecological Activities Foundation for Children (LEAF) was established in 1998 as a partnership-based non-profit civic organisation among citizens, businesses and the municipal government. The general scope of activities for LEAF in Honiara is as follows:

- Research projects on community-based education for a sustainable society
- Promotion projects for nature experience activities
- Environmental education projects in liaison with corporate LEAF members
- Global environmental exchange projects for children.

LEAF intends to create a collaborative learning model for the Honiara community through education and engagement activities within the government, communities and the private sector. LEAF has enjoyed initial success in several programmes including helping HCC map its collection routes, writing a draft waste management plan as well as the design of environmental content for school curriculum. An overview of future activities and collaborative projects by LEAF corporate members can be found in Appendix E.

² <http://honiaracitycouncil.com/index.php/health-and-environment/waste-2/eco-school-3rs-pilot-project/>

3.6.7 Mataniko River Clean Up and Rehabilitation Project 2014–2020

This project covers the Honiara and Guadalcanal Province to include the whole catchment of the Mataniko River. The project aims to improve waste management practices to create a cleaner and healthier river by addressing waste collection, storage and disposal. Behavioural change programmes within the community aim to prevent the dumping of waste and litter into the catchment. The project is led by the Ministry of Environment.

The project's main objectives include conducting baseline surveys, creating awareness, conducting education and training, minimising waste in the region using 3R activities (composting, recycling and reuse), removing existing waste via clean-ups and dredging, law enforcement, and sewage and sanitation measures. On 24 June 2015, SPREP and MECDM installed a 60-metre litter boom on the Matinakau River in Honiara. The booms act as a barrier to prevent land-based sources of marine debris, such as litter (particularly plastics) entering the sea. The booms also act as a visual tool to raise awareness of poor waste management (SPREP, 2015). The Ministry had employed three staff who cleaned the boom every day, however, during APWC's visit in November 2018 the booms had been removed due to the lack of funds to pay staff to clean the booms on an ongoing basis. This successful intervention should be continued in Honiara and may be transferable to other coastal communities.

3.6.8 Solomon Islands Ridge to Reef Project

Global Environment Facility (GEF) Pacific Ridge to Reef project (R2R) aims to improve the livelihoods and opportunities of Pacific Islanders through local actions to conserve and rehabilitate their environments. Participants in Ridge to Reef are Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Nauru, Niue, Palau, Papua New Guinea, Republic of the Marshall Islands, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu. Working with a number of stakeholders, the R2R projects intends to develop an environmentally safe waste disposal system. Other outcomes include increased waste management awareness among communities and behavioural change relating to waste disposal practices.

3.6.9 Plasticwise GIZO

This project based in Gizo, the capital of Western Province, began in May 2017. It aims to promote the 3Rs of waste management (reduce, reuse and recycle) by creating purses, garlands, decorations and other items from recycled plastic. The project has also provided education and awareness training to attendees on matters including the negative impacts and health implications of burning plastic waste (SeeChange Magazine, 2018).

3.6.10 International and Regional Projects

Several international and regional projects are being undertaken in the waste management space in the Pacific, and these have the potential to be applied in Solomon Islands. Co-ordination of all work throughout the Pacific region will ensure the best outcomes are achieved for all countries. Please note that the information on current projects has been collated and provided by the Pacific Region Infrastructure Facility (PRIF) secretariat.

Table 8: International and regional waste management projects

Project	Description
J PRISM	<p>JICA funded project of \$15 million USD over five years covering nine PICs. Four focal areas are:</p> <ul style="list-style-type: none"> • Human capacity for solid waste management is strengthened through capacity needs assessment and training • Monitoring and evaluation process well defined • Resource recovery through enhanced recycling processes • Disaster waste management capacity enhanced <p>J-PRISM Project identified the amount and composition of waste generated and found that majority of waste produced domestically was food waste followed by plastics, aluminum and tin containers. The data also suggests that a strong recycling programme focusing on the traditional recyclables (paper, plastics and glass) would be effective in reducing the amount of waste ending up in landfill. Encouraging the separation of kitchen and yard waste at the household level to feed animals or for composting would further reducing waste to landfill. The second phase of the Promotion of Regional Initiative Solid Waste Management (J-PRISM II) project, implemented by JICA in early December 2016, supports capacity-building in waste management. Target initiatives include improved governance and human resource development, focusing on Port Vila, Luganville, and Lenakel.</p>
PacWaste (2014-2017)	<p>A project implemented by Secretariat of the Pacific Regional Environment Programme. Its objectives are to improve the management of e-waste by establishing a pilot project for the safe dismantling and export of e-waste and creating a public awareness campaign (SPREP, 2017). PacWaste is expected to increase the amount of materials recovered as part of PacWaste 2.</p>
GMPII	<p>Global Monitoring Program (GMP) for Persistent Organic Pollutants (POPs) Phase II</p>
Australia	<p>Australian Department of Industry Innovation and Science (DIIS) – participates in the Marine Resources Conservation Working Group of Asia Pacific Economic Co-operation (APEC), which is currently examining waste management infrastructure development experiences in the region. Australia also leads an APEC project, Understanding the Economic Benefits and Costs of Controlling Marine Debris in the APEC Region.</p> <p>Australia is developing a proposal with SPREP for an investment over four years to support co-ordination and implementation of the Pacific Marine Litter Action Plan. The investment aims to reduce the availability of single-use plastics and change the behaviour of industry and consumers to reduce, reuse and recycle. The project would complement existing projects and support SPREP in co-ordinating marine plastic pollution work in a holistic manner, including, for example, enabling linkages with broader waste management programmes and other anti-pollution initiatives.</p>

Project	Description
New Zealand	<p>LGNZ (Local Government New Zealand) is contracted to New Zealand Foreign Affairs and Trade (NZMFAT) to provide technical assistance to Pacific Island countries. This programme provides technical assistance to institutions that are engaged in the same activities as local government hence the name 'PacificTA'. Pacific TA helps local Pacific Island managers to run public services such as environmental management (e.g. water and air quality) infrastructure and asset management, town planning, transport planning, and public health and safety programmes such as dog control and disaster management.</p> <p>Current activities include working with the councils and central government agencies in Kiribati on waste management services (including Betio Town council and Teinainano Urban Council). In Cook Islands, support is provided on landfill management in Rarotonga, including advice on the need for compaction to extend landfill life. Pacific TA also provides support for Port Vila Municipal Council (Vanuatu) on HR, financial management, IT, waterfront maintenance, library support and other institutional support in Kiribati, e.g. HR, financial management, dog control (Kiribati).</p>
EU PacWastePlus	<p>SPREP is the implementing agency for this EU-funded project. \$16.5 million euros funding builds on the work undertaken by PacWaste, to focus on asbestos, healthcare waste, e-waste and other aspects of solid waste management and waste water. PacWaste Plus covers 14 PICS and Timor Leste.</p>
International Union for Conservation of Nature (IUCN)	<p>The IUCN Plastic Waste Free Islands project STOPP Plastics (Source-to-Ocean Plastic Pollution) project.</p> <p>Objective: Driving islands' circular economy and eliminate plastic leakage from islands and small island developing states (SIDS). IUCN is seeking waste data in three countries in the Pacific (from amongst Fiji, Kiribati, Palau, RMI, Samoa, and Vanuatu) for material flow analysis and quantification of leakage. Formal documentation has yet to be signed. Will involve addressing plastics leakage into ecosystems through the waste management, tourism, and fisheries sectors through three prospective PICs. Will co-ordinate with South Pacific Tourism Organisation (SPTO) and the Forum Fisheries Agency (FFA) in the tourism and fisheries sectors.</p>
United Nations Environment Programme (UNEP) and Global Environment Facility (GEF) GEF7 Programme	<p>Planning a regional GEF 7 project with SPREP, expected to commence in 2019. Looking at hazardous waste management, such as used oil, POPs, E-waste and mercury, in the 14 Pacific SIDS.</p> <ul style="list-style-type: none"> The new GEF7 replenishment cycle is expected to help transform SIDS management of chemicals and waste over the next 5 years Funding falls under the Chemicals and Waste focal area Top priority – an integrated (regional) programme on waste management linked to Stockholm and Minamata Conventions in SIDS

Project	Description
	<ul style="list-style-type: none"> \$20 -25 million USD expected to be available to 14 PICs, commencing 2019
Global Green Growth Institute	Francis Mani, who is based at USP, is currently engaged by GGGI on behalf of the Fiji Ministry of Economy (Climate Change Division) to address the Low Emission Development Strategy drafting process for the Waste Sector.

4 Waste data – sample collection methodology

4.1 Samples collected

4.1.1 Household sampling distribution

This section provides the outcomes for waste data collection work undertaken in November–December 2018. Advice was sought from APWC’s 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 9.

Table 9: Households sample to be collected

Confidence level	0.95			0.9		
Error	5%	10%	15%	5%	10%	15%
Sample size	781	196	87	550	138	62

Using the calculations provided above, it was assumed that the minimum number of samples required is 140 and the maximum number is 200. APWC decided to split the sampling based on the population distribution within different communities in Solomon Islands. Honiara City was sampled as representative of an urban population for Solomon Islands. It was aimed to split the rural sampling between a remote island of Ulawa and Auki in Malaita province. However, it was not possible to travel to Ulawa due to adverse weather conditions. Therefore, one half of the rural sampling was undertaken from remote communities around Honiara. The proposed sample split and actual sample distribution achieved is shown in Table 10.

Table 10: Population distribution vs sample distribution

Solomon Islands	Pop	%	No. of households required	Samples achieved
Capital Honiara/Island of Guadalcanal pop: 82,485	82,485	13%	26	40
Noro/New Georgia Islands pop: 3,365	3,365	1%	1	0
Outer Islands 553,568	553,568	87%	173	81+97 = 178

In total, 218 samples were collected, with 178 rural and 40 urban samples collected from eight different communities. The rural samples were divided between two localities, with 81 samples collected from five villages along Lunga river and the remaining 93 samples collected from three communities in Malaita province.

The sample collection from each island was limited by the ease of collection of samples, the ability to transport samples, as well as the presence and absence of collection systems. The APWC team was in Solomon Islands for two and a half weeks and assessed waste from eight communities. The number of samples collected from each site, as well as the collection system available, is listed in Figure 11.

Location	Number of samples	Collection system in place	Collection frequency
Honiara	40	Yes- partial	Once a week
Guadalcanal rural x 5 communiites	81	No	N/A
Kilusakwalo (Malaita)	30	No	N/A
Ambu (Malaita)	31	No	N/A
Arabella (Malaita)	37	No	N/A

Figure 11: Samples collected and collection system in place



Figure 12: Honiara sampling distribution

Note: Blue dots represent urban communities, yellow dots represent commercial samples and green represent rural Guadalcanal communities



Figure 13: Communities assessed in Malaita province

4.1.2 Commercial sampling distribution

In addition to the household samples, 46 commercial samples were assessed – 31 premises in Honiara and 15 premises in Auki (Malaita). Commercial premises were divided into four major categories and the sample number from each is shown in Table 11.

Table 11: Commercial samples collected in Honiara and Auki

Type of business	Honiara	Collection frequency	Auki	Collection frequency
Accommodation and restaurant	9	Once a week	3	Not collected
Administrative and support services	4	Once a week	7	Not collected
Public administration	4	Once a week	-	Not collected
Wholesale and retail trade	14	Once a week	5	Not collected
Total	31		15	

4.2 Sample collection methodology

Domestic waste samples were collected household by household to determine the waste generation and disposal rate per household.

Waste collection methods had to be modified based on the locality being assessed.

4.2.1 Collections from areas with house-to-house collection system

APWC approached the respective collection service provider to assist with the collection of waste just before it was being picked up by the waste trucks. In Honiara, APWC conducted a waste collection prior to the normal collection truck arrival. Each household was approached, and its rubbish bags/bins ready for disposal were requested. APWC did not undertake any sampling in Honiara from collection points. Each collection team comprised the following staff:

- APWC collection supervisor
- APWC collection runner
- Local staff member to ensure smooth running of collections



Image 18: Sample data collection sheet used by APWC staff to collect collection data

Random streets were selected from each ward and a sample was collected from every third to fifth house in each street. No more than five samples were collected from the same street.

APWC collection supervisor collected the following data for each house sampled:

- GPS location
- Number of bags per household
- Interview tag provided
- Photo

The sample collection recording sheet template is provided in Appendix A. At the end of each day, the sample collection sheet was scanned and sent to the APWC office in Sydney for data entry. The methodology remained the same for both households and commercial premises.

The major challenge in collecting waste per household was ensuring that the household or commercial premises could be identified readily by the interviewers later. Different methods were trialed in Vanuatu and the lessons learned were applied in Solomon Islands. A tagging system was employed, whereby a coloured thread or ribbon was attached to each house where a sample was taken. The collection supervisor also had a conversation with the residents to ensure that the house wasn't subdivided and that the correct house was being tagged. The next day, the interviewers arrived at the location using GPS co-ordinates and identified the households using the ribbon/thread tag.

4.2.2 Collections from areas with a collection point

Honiara has some areas that are collection points for waste. People drop off their waste prior to the collection day (or all through the week) at the designated location.

APWC decided not to take samples from areas with collection points. This was another lesson learned from the Vanuatu sampling. It is impossible to ascertain which samples belong to particular households and therefore interviewing specific households becomes difficult. The sample analysis methodology requires collection of household data in order to predict the variables within the waste generation area.

4.2.3 Collections from areas with no collection service

Eight Solomon Island communities were sampled as representative of areas with no collection system. These include five communities along river Lungga in the Guadalcanal province and three communities in Auki. In order to achieve the sampling required in these villages and communities, three separate visits were required to ensure the requisite sample size could be achieved. The method used is as follows:

- a) On day one, APWC staff approached the village chief or pastor (or both) and sought permission to undertake waste data collection in their village. After permission was given, the requirements of the sampling process were explained and advice was sought as to the best day to provide bags for sampling to the community.
- b) APWC returned on the appointed day and provided each household with a bag to use to dispose of their waste from that day onwards. The maximum number of bags provided to a community was 35. Some communities were very small and one community on Lungga River had only seven households. As such, only seven bags were provided. Villagers were told not to dispose of any bulky waste or problem waste that they have been having trouble disposing of into the black bags.
- c) The village chief/pastor was requested to make an announcement at church the next day reinforcing the message regarding disposing of all wastes from that day onwards into the plastic bags being distributed throughout the village.
- d) The APWC team returned after three days to retrieve the bags from each household. As each household brought their waste bag, the bag was labelled and provided to the sorting team.

An interview was conducted with the member of the household depositing the bag. Refreshments were provided to all members of the village during the interview stage.

- e) The tagged bags were brought back to the Ranadi dump site. All sorting took place in Honiara and an abandoned police warehouse in Auki.



Image 19: Seeking permission from the village chief and providing information on how to use the bags to a community.

4.3 Household interviews

Interviews were conducted with all households where waste was collected. The interviews were conducted using the interview sheet provided at Appendix B. As noted in section 4.2, each household location was captured using GPS, a photograph was taken, and a colourful ribbon or piece of string attached to help identify each household.

APWC notes that interviews were challenging because people are at work during the day. Therefore, most of the interviewing was undertaken in the evenings and early mornings or weekends.

The standard APWC procedure is to seek voluntary participation by households in the interview process. The participation rate was high in Solomon Islands and APCW was able to interview all households from which waste was collected. APWC would like to extend our sincere thanks to the interns at HCC who accompanied our collection staff, as well as the interview team that helped translate and gained support for the project.

All interview sheets were translated to pidgin but it was found to be easier to train a local staff member to undertake the interview rather than use the translated interview sheet and notes. All interviews were undertaken in groups of two led by local staff accompanied by an APWC employee. The household interviews were the most time-consuming part of the data collection process, with each interview taking approximately 20 minutes to half an hour. APWC deployed up to four teams with eight staff at times to ensure that all interviews were completed on time.



Image 20: HCC interns assist with the interviews and in the process gained training in interview procedures



Image 21: Household interviews being conducted by APWC staff

4.4 Sample sorting

All waste in Honiara and the rural communities was collected in plastic bags. Once collected, the bags were labelled and brought to the local sorting facility. At all locations, the municipal council provided APWC with a space for sorting of waste upon request. The sorting locations are listed below:

Sample collection location	Sample sorting location
Honiara/Guadalcanal rural	Ranadi Dump Site
Malaita Ambu	Police shed Auki
Malaita Kilusakwalo	Police shed Auki
Malaita Arabella	Arabella community hall

Figure 14: Sorting location for Solomon Island samples

Bag tags were used to identify all sample. Samples were lined up to ensure none were missing. All actual samples were cross-referenced with the collection sheet to ensure consistency between sample collection and sorting.

After checking all samples were present and in order, the collection supervisor scanned the collection sheets and emailed them to APWC headquarters. The physical sheets were handed over to the sorting supervisor to ensure all data was kept at the same place.

Material from each bag was sorted separately into the 49 categories, listed below in Table 12.

Table 12: Household sorting categories

Consolidation	Category	Consolidation	Category
Metal	Aluminium cans	Hygiene	Feminine hygiene
	Aluminium recyclable		Pharmaceutical
	Steel cans		Nappies
	Metal other		Medical waste
Fishing	Fishing/seafood, metal		Other sanitary waste

Consolidation	Category	Consolidation	Category
	Fishing/seafood, plastic	Organics	Food
	Fishing/seafood, wood		Wood/timber
Paper and Cardboard	Cardboard		Other organics
	Cigarette butts	Other	Hazardous
	Liquid Paperboard (LPB)		Textiles
	Paper		White goods
Plastic	PET bottles		Ceramics
	HDPE bottles		Animal faeces
	Expanded polystyrene		Containerised used oil (volume and weight)
	Plastic bags		EOL renewable energy equipment
	Plastic oil containers		End-of-life vehicles
	PolyPropylene (PP)		Tyres
	Flexible/film		Other
	Other plastic	Glass	Glass bottles eligible for CDS
Batteries	Lithium batteries		Glass bottles wine and spirit
	Used lead-acid batteries		Glass fines
	Other batteries		Glass jars
E-waste	Computer equipment		Glass other
	Mobile phones		
	Electrical items and peripherals (including TVs)		
	Toner cartridges		

Typically, the sorting area consisted of a raised table covered with a tarpaulin or plastic sheets. The bagged waste was opened, and the contents sorted into the categories above. Each bag was handled separately and material from only one bag was placed on the table at any one time.

Separated materials were placed in appropriate containers, weighed on a set of electronic scales and the weight recorded. APWC brought its own pre-calibrated electronic scales from Australia to ensure accuracy.



Image 22: Waste sorting at Ranadi dump site

Beverage containers from all general waste samples were labelled to ensure no cross-contamination. They were then stored and counted separately. 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 of bags and all containers were further sorted by size, material type and product type. Cigarette butts, coffee cups and takeaway containers were also segregated. This further sort was undertaken to 294 categories. The sorting sheet is provided at Appendix C. All sorting sheets were scanned and emailed to the APWC headquarters at the end of each day.



Image 23: Waste sorting from commercial samples

4.4.1 Port waste collection and sorting in Honiara

APWC had the opportunity to sample some public-place bins at the Honiara port. It should be noted that these bins did not receive waste from any other facility and were behind locked gates. They are only used by passengers and crew embarking or disembarking vessels. Although these samples do not represent overall waste generated onboard a vessel, which would be impossible to assess without undertaking a detailed ship waste audit, the samples do provide an insight into the types of general waste being generated on vessels visiting the port. The composition of these wastes will be included in the Port Waste Reception Facility and Gap Analysis Report.



Image 24: Ship waste being stored in metal drums at the Honiara port

4.4.2 Work Health and Safety

APWC's parent company has an Integrated Management System covering quality, health, safety and environment (QHSE), which was used during these audits. 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 that APWC staff along with those undertaking training, were 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 them from removing items from the material they sort or from revealing any information they might obtain while sorting or auditing.

Adjustments were made to some standard operating procedures to suit the local conditions while continuing to ensure the safety of all staff, contractors and secondees. APWC's collection and sorting supervisor had full control over local safety requirements to ensure all work was being conducted in a manner that protects health and safety of the staff.

5 Waste data – study limitations

The data for this study was collected and analysed using the best and most accurate methods available within the constraints of available time and budget. This study is a survey, which means that a relatively small amount of data has been collected and then treated as representative of the total. As in any

survey, there are limitations to the accuracy of the data, as described below.

Time frame	<ul style="list-style-type: none"> • These audits were carried out to cover one week's waste from selected areas. The data was then extrapolated using mathematical models to obtain the generation rate for the whole of Solomon Islands. • Seasonal trends (e.g. warmer weather leading to increased consumption of beverages; Easter, Christmas) and weather events (e.g. high rainfall leading to grass growth) may change waste generation over time. • The results of this audit should be treated with caution when comparing the results with reports based on data taken at different times of year.
Representative sample	<ul style="list-style-type: none"> • The sample for this audit is necessarily small due to the high per-capita cost and resource-intensive nature of waste auditing. • There is always a small probability of inadvertently collecting waste from atypical households, resulting in non-representative data. • APWC audits are carried out using strict random sampling, stratified by geographic area, to minimise the chance of this situation occurring. • We found substantial variation between disposal rates between rural and different urban areas even after accounting for factors like income and consumption. This adds additional uncertainty when using the data we collected to estimate disposal rates for regions we were unable to cover.
Sample size limitations	<ul style="list-style-type: none"> • All surveys carry an element of sampling error, which is the mathematical error associated with using a sample to represent a total population. • Sampling error can be reduced by taking larger samples. The sampling error involved in waste audits is usually small and can be tabulated by producing estimates augmented by upper and lower confidence intervals. • For household disposal rates within a particular region, sampling uncertainty was around 20% of the household disposal rate • For commercial disposal rates within a particular region, sampling uncertainty was around 40% of the business disposal rate
Weight based analysis	<ul style="list-style-type: none"> • The collection of data for this audit was recorded by weight. • This type of collection may cause some materials to appear to be present in quite small proportions due to their comparatively low densities (e.g. plastic beverage containers). They can, however, consume large amounts of volume. • Weight-based analysis has been used in this audit because it is a standard procedure and is the most accurate way to collect data on a number of different types of materials.
Collection methodology	<ul style="list-style-type: none"> • For areas with collection services, a household's regular rubbish load was picked up. If households were disposing of any rubbish via other means, this was not picked up in the survey. The numbers collected may be a reasonable estimate of waste going to landfill, but are unlikely to be a reasonable estimate of waste generation rates. • For areas without collection services, the households were given a bag into which to put rubbish and were collected after three days. Some households may have taken this opportunity have disposed of extra rubbish, with nappies being a particular concern. • We noticed a general trend of waste quantities in this sample being lower than in previous samples of sites with disposal services. This could be due to the methodology that covers disposal rates rather than generation rates
Model Assumptions	<ul style="list-style-type: none"> • While we did not assume we knew the disposal rates for sites we did not sample, we assumed that they displayed a similar pattern of variation to sites we did sample • Relationships between variables were assumed to be linear. This reduces the chance that the model fits

Figure 15: Waste data study limitations

6 Waste Data – results

All data in this section is weight-based unless otherwise stated. Some percentages have been rounded to the nearest whole number and therefore some figures and descriptions may not add up to 100%.

APWC team sorted 1,010 kilograms of rubbish over two weeks to gather waste generation, behaviour and disposal data. This section presents the results based on this data.

6.1 Waste generation, household management and disposal rates

In Australia and around the world, the waste generation rate and waste disposal rate are often used interchangeably. However, the results presented below represent the *waste disposal rates only* for Solomon Islands. We make this distinction as the result of data available to us from previous JICA audits as well as the interviews conducted as part of the data collection process.

Table 13: Waste disposal rate for Solomon Islands

Country	Area	Average waste disposal (grams/capita/day)	95% Confidence Interval (grams/capita/day)	Average number of people in a household
Solomon Islands	Honiara	310	296–324	8.2
	Rural Guadalcanal	299	253–345	5.2
	Rural Auki	87	64–110	6.2

Note: The number of people per household is based on the data collected from household interviews and is not the average number of households overall as reported by the Bureau of Statistics

The waste disposal rate for Honiara falls within that previously estimated for the East Asian and Pacific region according to the World Bank published data (2012). World Bank global review states that, 'The annual waste generation in East Asia and the Pacific Region is approximately 270 million tonnes per year. This quantity is mainly influenced by waste generation in China, which makes up 70% of the regional total. Per capita waste generation ranges from 440 to 4,300 grams per person per day within the region, with an average of 950 g/capita/day (Hoornweg et al. 2005).' In this case, the mean includes the waste generation rate in China, which is one of the greatest in the region.

However, previous studies done using the JICA methodology estimate a much higher waste generation rate (see Table 14 below). It is important to make a distinction between the generation rate and disposal rate because of the methodology used by the two studies.

Table 14: Comparison of disposal and generation rates, Solomon Islands

Area	Present Disposal Estimate	Previous Generation Estimate
Honiara	315 grams/capita/day	860 grams/capita/day*

** Source: JICA Honiara Waste Characterization Report, 2011*

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

The JICA methodology allows for all waste to be placed in specially provided bags, which are then assessed for content over a period of time, usually a week to ten days. Therefore, JICA studies are estimating the total amount of waste generated at source rather than the amount people are willing to place in a bag.

The comparison of the two studies shows that although the waste collection systems are in place, there is a real need for a number of matters to be urgently addressed to prevent disposal of waste into the environment via waterways, burning and burying.

In APWC's opinion, the most interesting outcomes of the waste generation rates are the differences in the amount of waste generated between urban and rural areas. This is addressed in detail in section 6.3 and 6.4 and modelling suggests that waste generation is linked to the average grocery bill for an area.

6.2 Waste burning, burying and dumping in waterways

The graphs (Figure 16, Figure 17, Figure 18 and Figure 19) present data from the household interviews undertaken for the same households from which waste was collected. Comparative data from JICA and APWC shows that only 37 to 45% of waste generated is being captured through the waste management systems currently in place in the urban areas. In the rural areas, all waste generated is being disposed of through burning, burying and dumping, either on land or in nearby waterways.

Figure 16 shows that waste burning is the most common means of disposing of waste that has not been placed in bags for Honiara. Of the waste burned in Honiara, the most common is green waste. This can be confirmed anecdotally, based on the observed burn piles.

Honiara also reported dumping of nappies in waterways. The practice of dumping on land or at sea, and burning instead of burying stems from the fact that most people live in smaller homes with no adjoining land. They have no space to bury their waste.

Although both rural Guadalcanal and rural Auki are without collection systems, people behave quite differently. In Auki, all bulky waste and recyclables are weighed down with rocks and dumped in the ocean, whereas people prefer to burn their waste or bury it in rural Guadalcanal rather than dump it in the ocean. APWC believes this is due to the level of awareness among communities. As Guadalcanal is near Honiara, and is popular with tourists, residents understand the importance of not polluting the waterways. This, however, does not stop a proportion of the population from dumping waste in the water.

The education programmes in Auki are centered around sup-sup gardens or household organic gardens. This is reflected in no green waste being buried, dumped or disposed of in waterways. However, residents do use dry green waste to start fires for their community garbage disposal sites.

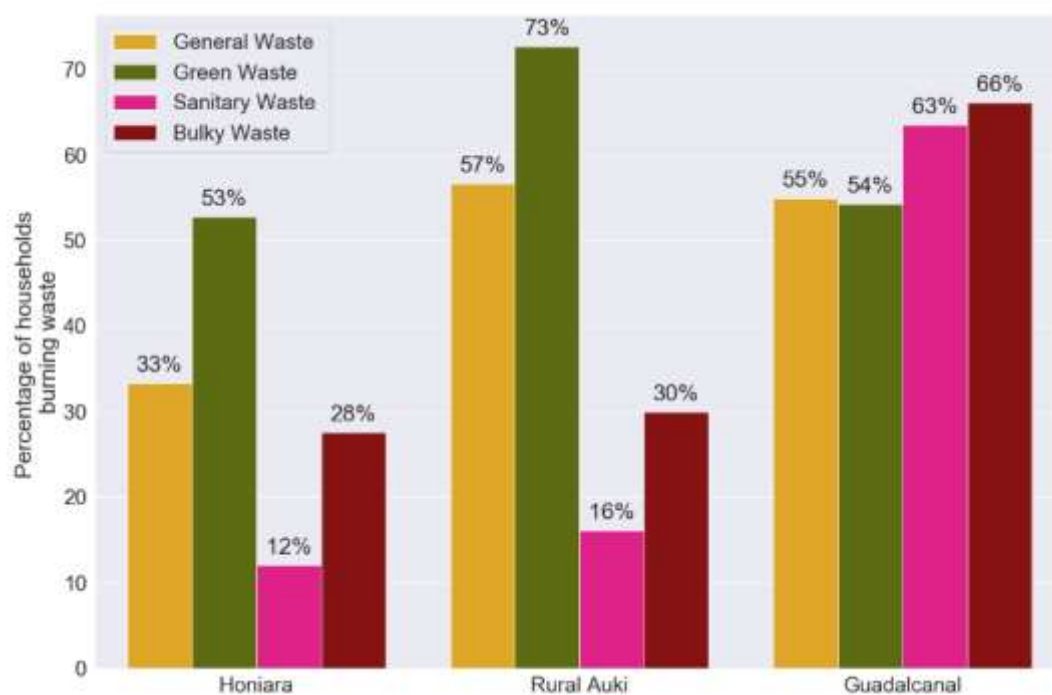


Figure 17: Waste burning rates in Solomon Islands

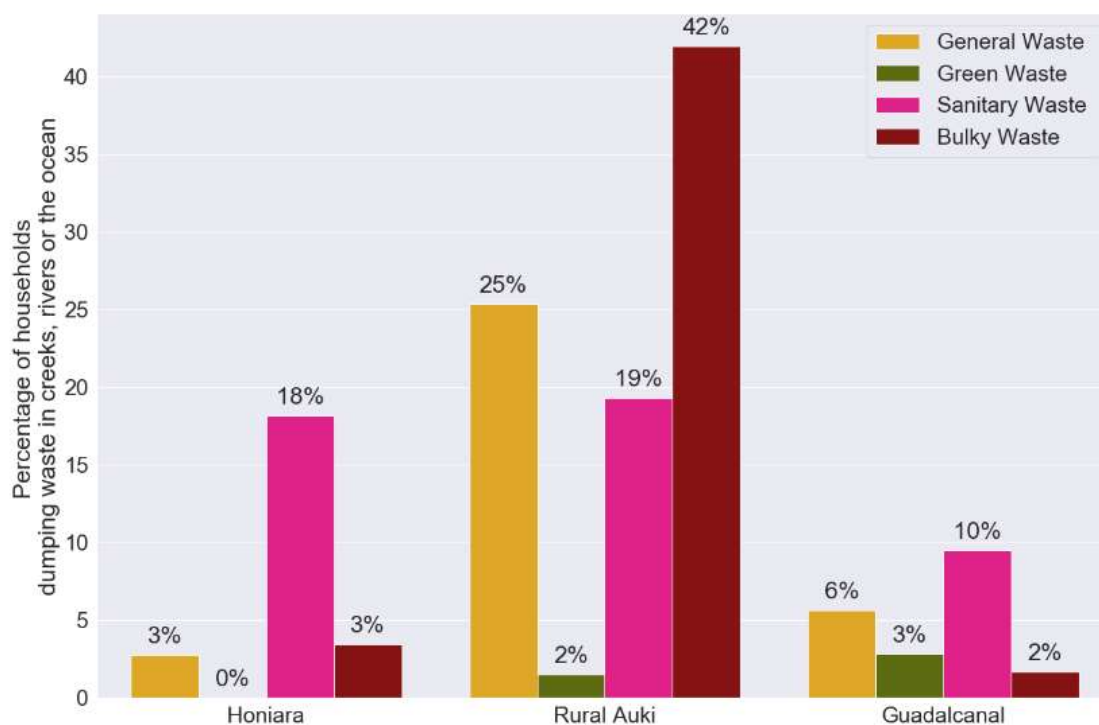


Figure 16: Waste dumping in water in Solomon Islands

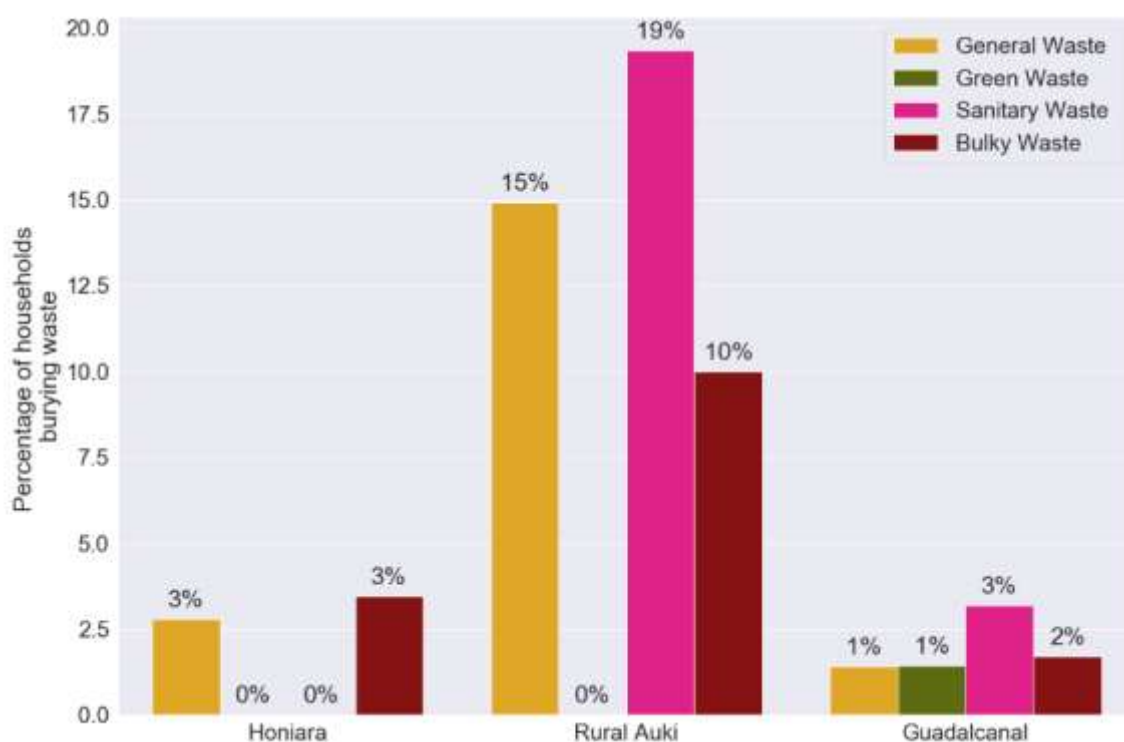


Figure 18: Waste burying rates in Solomon Islands

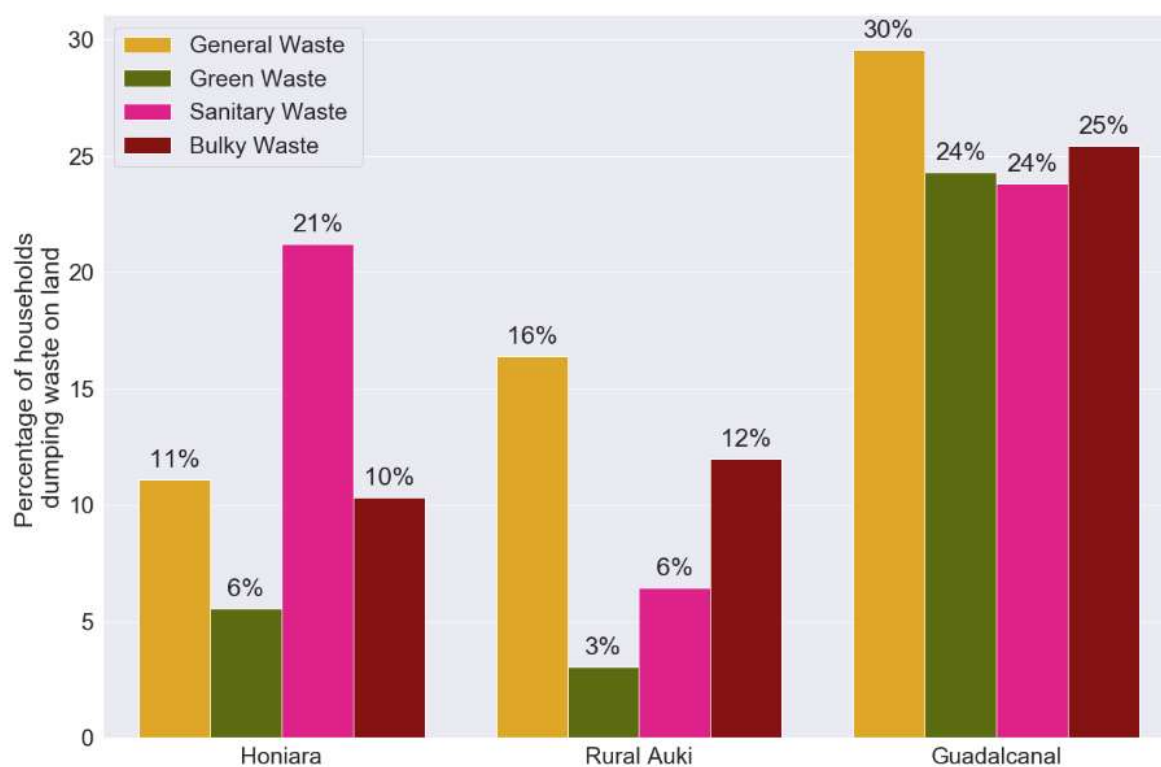


Figure 19: Waste dumping on the land in Solomon Islands

Based on the disposal data, we draw the following conclusions:

- Burning is the most common way of disposing of waste in areas that don't have collection systems.
- Although the collections in Honiara are unreliable and do not cover the entire city, there is a significant change in disposal behavior in comparison to localities without a system in place.
- The provision of a collection service would be a good first step for areas beyond Honiara. In Honiara, the collection service needs to improve in terms of regularity and consistency.

6.3 National Waste Disposal Rate – households only

Households were given surveys covering several factors that might be associated with the household waste disposal rate. Initially, the household disposal rate was modelled as being determined by the following:

- number of people in the house
- the household income
- the household grocery spending
- the collection service rating (which we theorised might be related to how often the house makes use of the collection service).

Because the disposal rates varied by region even after accounting for these factors, we also modelled the site disposal rate for each area (e.g. Honiara, Auki) as being determined by that area's:

- average collection service rating
- its distance from an urban centre
- its average grocery spending
- its average income.

The household disposal rate was then determined by the site disposal rate and the factors previously mentioned. This model is shown in Figure 20.

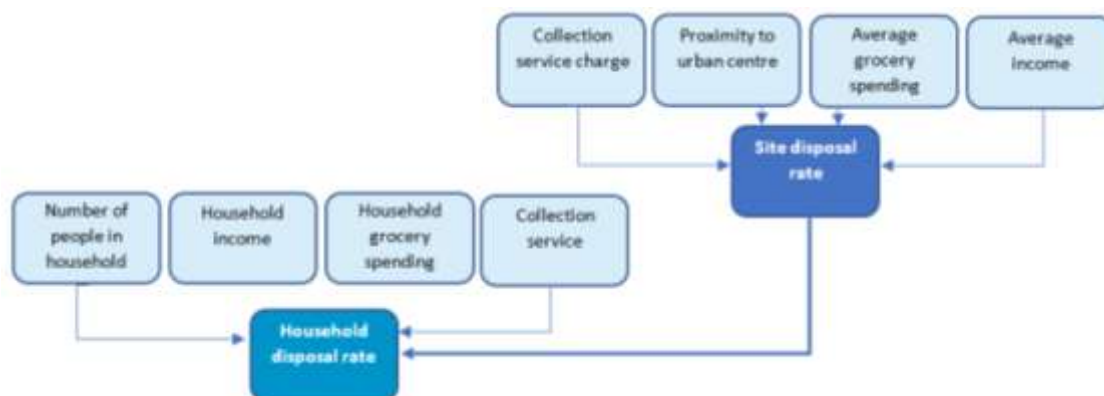


Figure 20: Initial model for disposal rate

We ultimately found that a simpler model fits the data more robustly (Figure 21). This model incorporated only the effect of the average grocery spending on the site disposal rate, and the household disposal rate was determined by the site disposal rate and the number of people in the household.

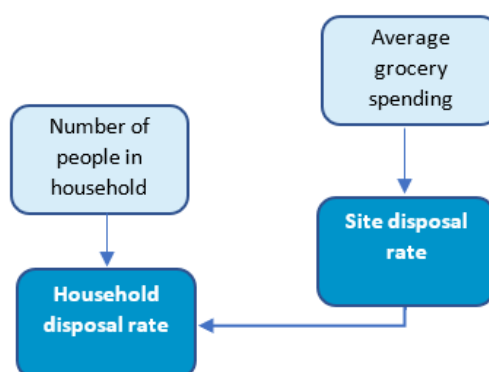


Figure 21: Final model for disposal rate

Previous work on municipal waste generation in the United States found that average retail spending is a better predictor of waste generation than household income (Hockett, Lober and Pilgrim, 1995). It is interesting that even in the very different cultural and socio-economic context of the Solomon Islands, we find what appears to be a similar pattern.

Using this model, we could estimate disposal rates in areas that were not directly sampled. Modelled disposal rates are more uncertain than measured disposal rates, but the model also provided an estimate of this uncertainty. This allowed us to estimate a range of plausible waste disposal rates nationally. The 95% Bayesian Credible Interval (BCI) is the range in which 95% of the samples from the model fell.

Table 15: Solomon Islands national disposal rate*

Estimated disposal rate (g/capita/day)	Estimated overall disposal (tonnes/day)
170 (95% BCI 110–230)	104 (95% BCI 67–140)

*Please note that these calculations are only for the household waste. Based on this model, we further tried to estimate how much of this overall waste disposed of, is contributed from the urban and rural areas.

6.4 Urban and rural waste disposal rate – households only

Estimated urban and rural contributions of waste for Solomon Islands are given in Table 16. Percentages are of the median total estimate of 104 tonnes/day of household waste for all of Solomon Islands. The model allowed a range of waste disposal rates to be estimated for each area. In order to assess how much waste came from urban areas compared with rural areas, three scenarios were considered:

- First, when the waste volumes from both areas came from the middle of the range.
- Second, we considered a scenario when the waste from the rural areas was at the upper end of the range while the waste for the urban areas was at the lower end. This gives an estimate of the upper bound on the proportion of waste from rural areas.
- Finally, we considered a scenario where the urban waste was at the high end of the range and the rural waste was at the low end. This gives an estimate of the lower bound on the proportion of waste from rural areas.

The data were sampled from a hierarchical Bayesian model, so there may be slight variation to other estimates of household waste generation.

Table 16: Overall waste contributions – urban and rural Solomon Islands

	Best estimate (tonnes/day)	High rural waste scenario (tonnes/day)	High urban waste scenario (tonnes/day)
Honiara	27.5 (25%)	22.9 (15%)	30.7 (35%)
All rural areas	82.8 (75%)	126.5 (85%)	58.1 (65%)

Please note that the last population census for Solomon Islands (2009) put Honiara's population at 64,609. This analysis has used the latest estimates of population (84,520) provided by HCC because the difference is too significant to ignore and potentially has a large impact on the generation rates. Also, we are comparing the waste generation rates with the incoming landfill tonnes per day at the Ranadi dump site (RDS) in late 2017.

The J-PRISM HCC draft WMS states that the total amount of waste from households arriving at RDS is 32 tonnes per day (2016–2017). This is significantly similar to the high urban waste scenario modelled above, which puts the Honiara household waste generated at almost 31 tonnes per day. If this data model was to be used for the estimation of amounts of material generated by urban versus rural Solomon Islands, cross-referencing with available data on landfill disposal rates would appear to be

the most logical way to ensure data integrity. We therefore propose that the rapid assessment method in the field followed by using the proposed model allows for a reasonable estimation of the scale of waste generated in country.

The waste disposal to landfill amounts were reported by J-PRISM II (2017) and note that of the overall waste being disposed of at RDS, 41% (or 32 tonnes/day) is household waste, 49.8% is from commercial sources and 9.3% is market waste. This is the equivalent of 7.4 tonnes of green waste arriving at the RDS each day from markets.

6.5 Income and purchasing habits

While average grocery expenses for a region were found to be correlated with disposal rates, neither income nor grocery expenses for a particular household were found to have a significant relationship.

Income and spending figures found in the household surveys were mostly smaller than those detailed in the 2012 Solomon Islands Household Income and Expenditure Survey (HIES). Reported Honiara incomes were 33% lower, while in rural Auki reported incomes were 30% lower. However, in rural Guadalcanal, reported incomes were 58% higher than in the 2012 HIES. This could suggest that the sample of households in Guadalcanal was not representative of the area as a whole. However, there is no previous data available for waste generation rates in Guadalcanal making it impossible to make a reliable comparison.

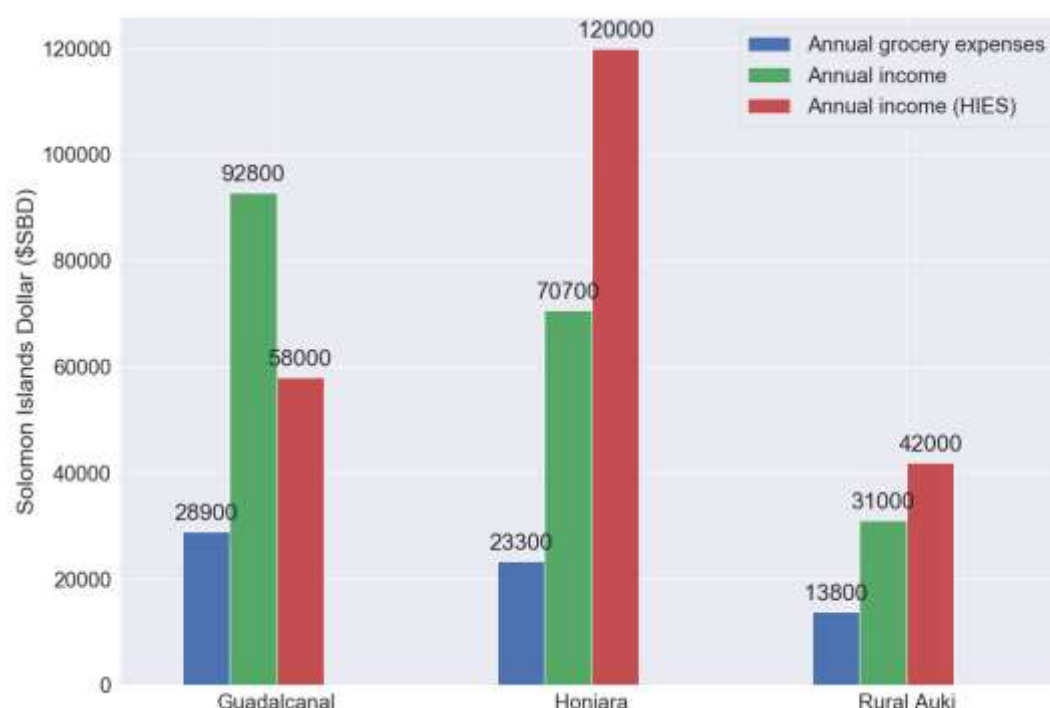


Figure 22: Solomon Islands income and grocery expenses

Based on the interview process followed in Solomon Islands, we note that getting an estimate of income from households is difficult and the noted discrepancies between the reported income and

that found in this survey are all too real. We experienced that given many people rely on subsistence farming and fishing, they don't consider selling their vegetables at the market as a source of income. One lesson learned from this process is to be specific about the questions asked to estimate household income. We had more success with expenditure on groceries because the survey guidelines that we developed listed the various types of things that a grocery expense includes. We also propose to try and replicate the HIES methodology to gather comparable data.

6.6 Waste composition

Organics not only made up the largest overall category of household waste at 47% to 77%, it was also the most prevalent item in waste samples from Solomon Islands.

Interestingly, the more rural an area, the higher the organics composition. This is what we would expect based on our on-ground observations around the availability of materials for consumption. For example, the three rural communities in Auki all had a small kiosk that sold a limited variety of goods. Otherwise, everything in the villages was locally made or bartered with surrounding communities. It is also of note that all three communities mentioned seasonal income based on what they were growing in their market gardens. Many participants noted that they go to the shops, drink beverages other than water and buy confectionary only when they can afford it.

It is entirely possible that an audit conducted at a time when communities had access to some disposable income would result in a different waste profile. Data also show that following green waste, recyclable items such as aluminium cans and plastic containers are the next most common item.

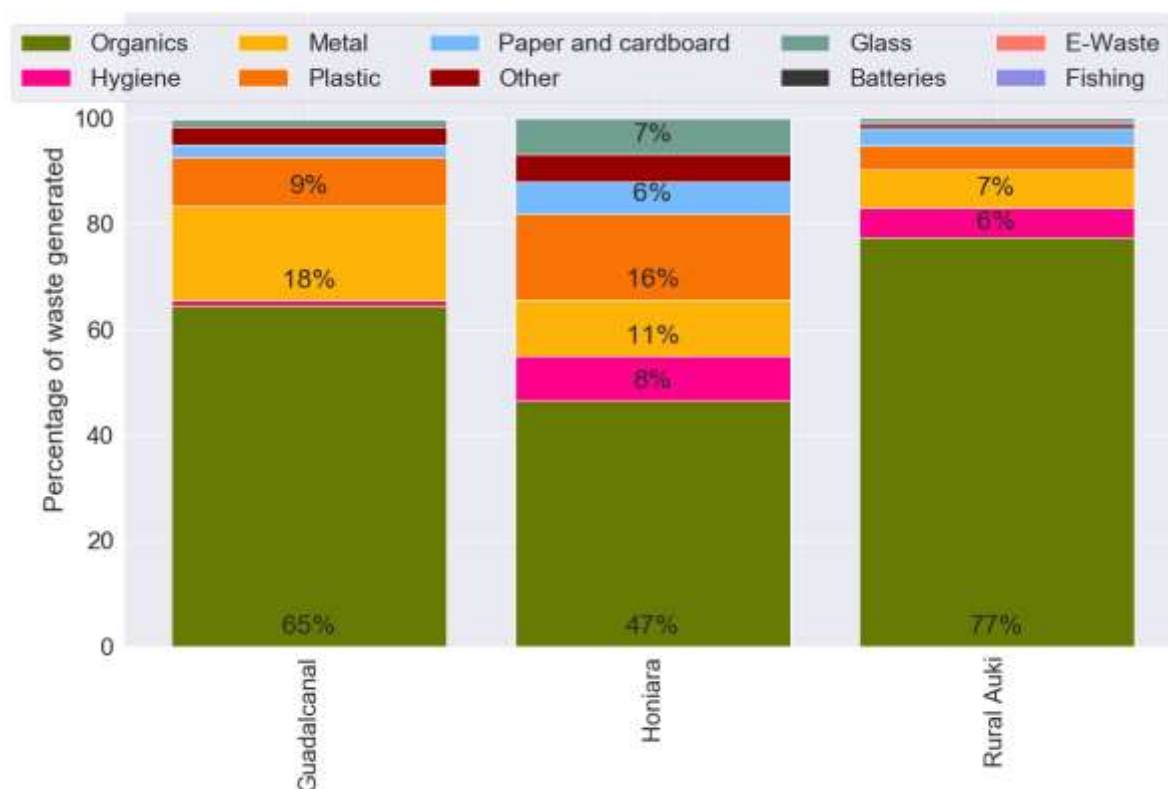


Figure 23: Breakdown of waste types compared between sites, Solomon Islands

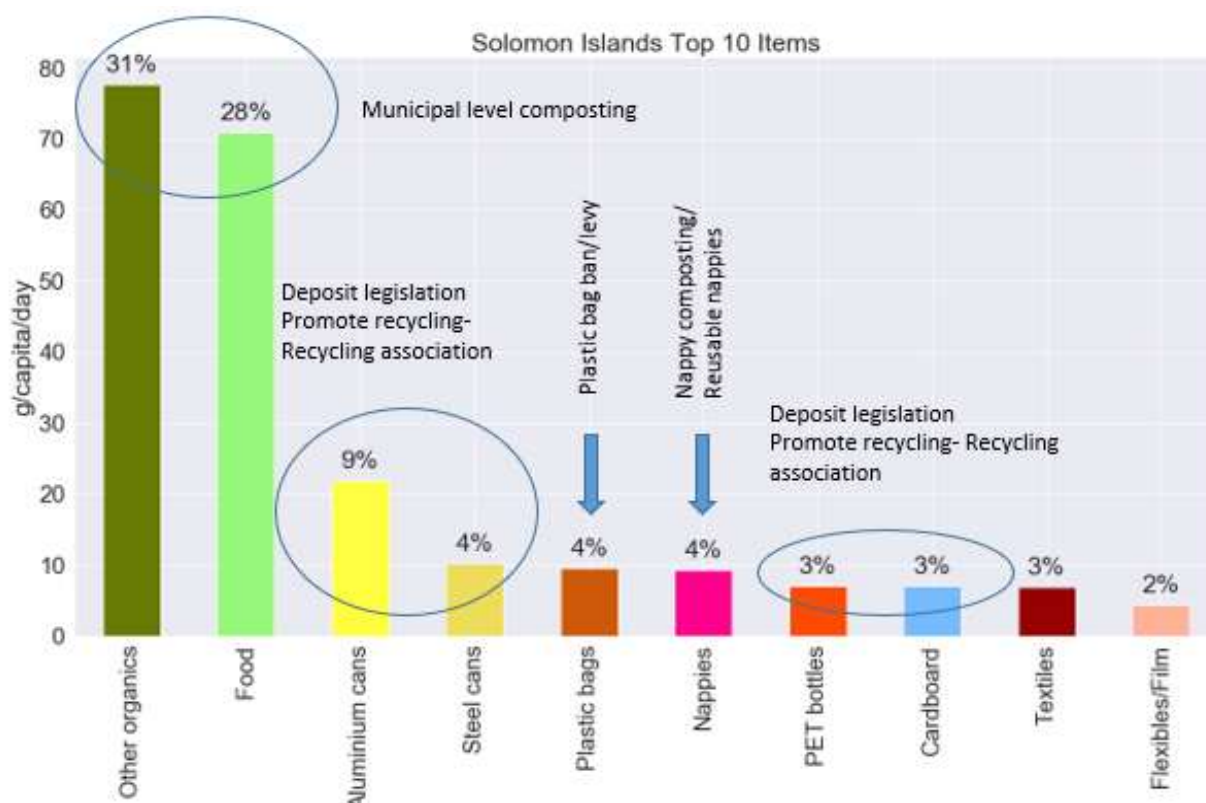


Figure 24: Solomon Islands top 10 waste items and proposed solutions

Best-practice actions are proposed based on both qualitative and quantitative data in section 6.9. Given the desperate need for Solomon Islands provinces and Honiara to extend or find land for landfilling, separation of organics and composting seems the obvious first step to recoup some more space in the landfills that are nearing capacity.

6.7 Commercial waste – generation rate

The average commercial disposal rate for Honiara was 16.3 kg/business/day (95% CI 10–22.5 kg/business/day). A 2017 survey counted 312 businesses sending waste to landfill, which at the average rate corresponds to an estimate of 5,085 kg/day disposed of by businesses (95% CI 3,120–7,020 kg/day). This compares with an estimated 20,619 kg/day disposed of by households (95% CI 17,287–23,951 kg/day), and puts commercial waste at an estimated 20% of household and commercial waste disposal. For Auki, the average disposal rate was 2.1 (95% CI 1.5–2.7 kg/business/day), and an estimated count of businesses was not available.

Due to the small number of commercial businesses audited, it is not possible to accurately extrapolate overall generation rates for businesses. The data has been used to predict the composition or the types of wastes being generated by different types of businesses.

Comparatively, accommodation providers were the largest contributors to the waste stream in Honiara. Restaurants were the largest contributors in Auki, and the second largest in Honiara (see Figure 25 and Figure 26).

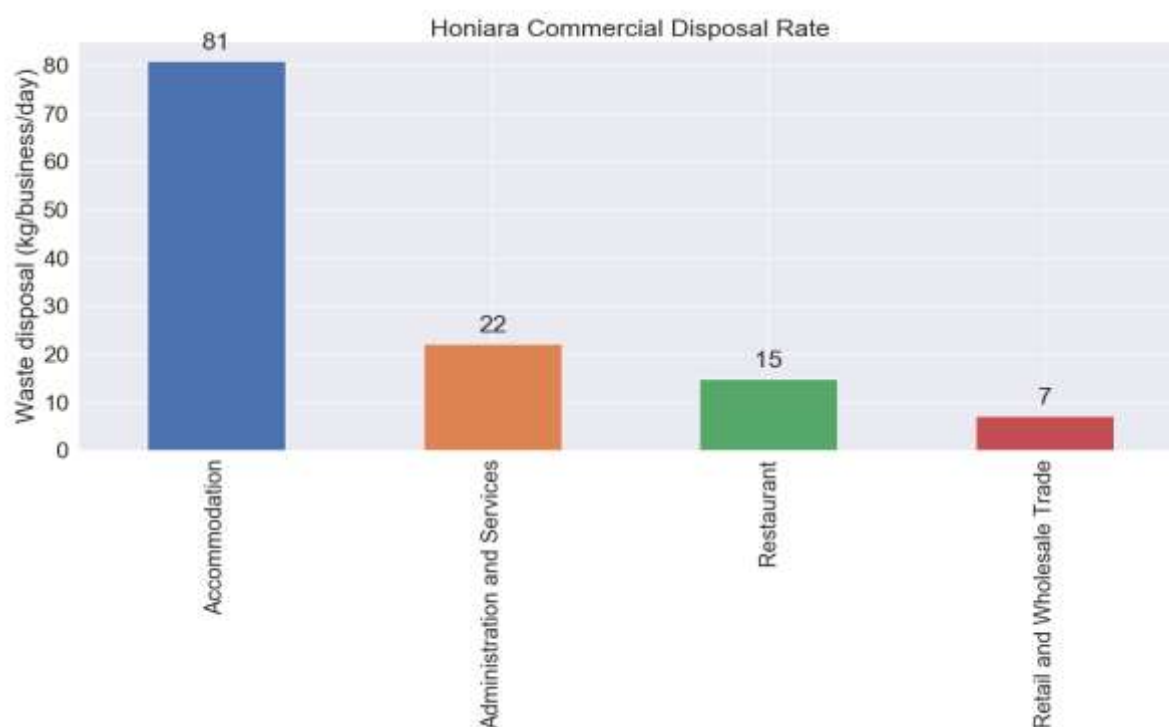


Figure 25: Honiara commercial disposal rate

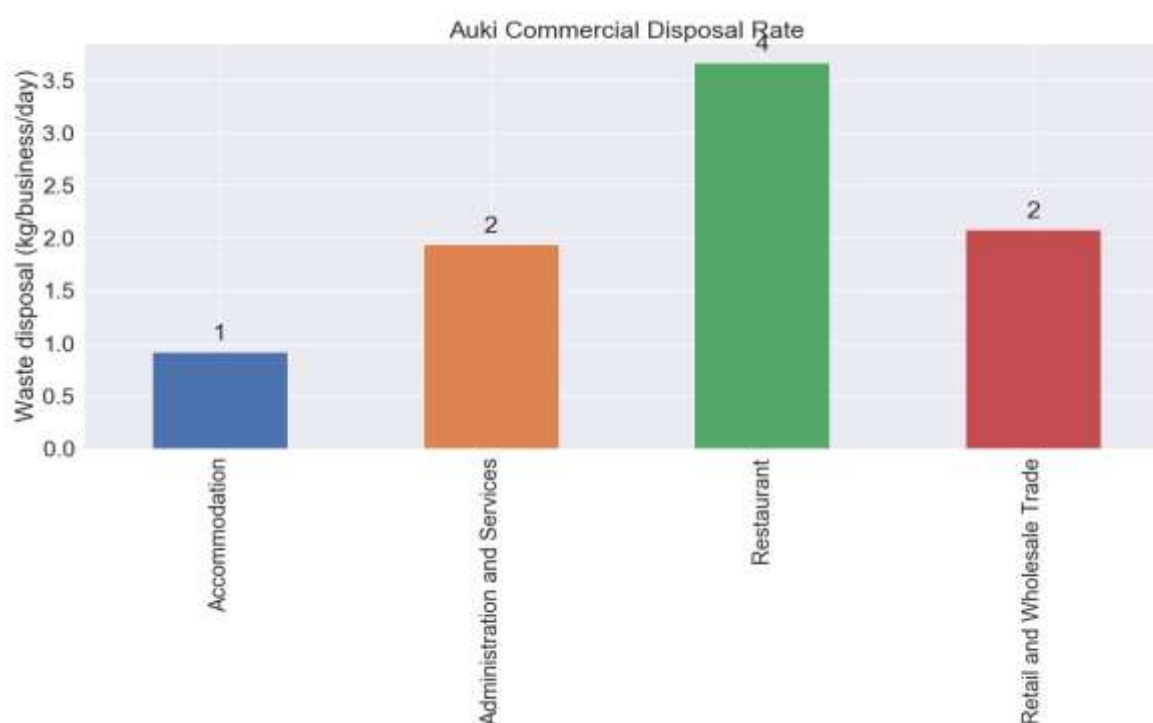


Figure 26: Auki commercial disposal rate

Commercial sources had comparatively more paper and e-waste and less hygiene and metal waste than household sources. Both had similar quantities of organic waste. Somewhat expectedly, retail trade and administrative services produce a much larger amount of paper and cardboard waste as

compared to accommodation and restaurants. All types of commercial premises produced large quantities of recyclable plastic and metal whereas administration offices generated a substantial quantity of e-waste.

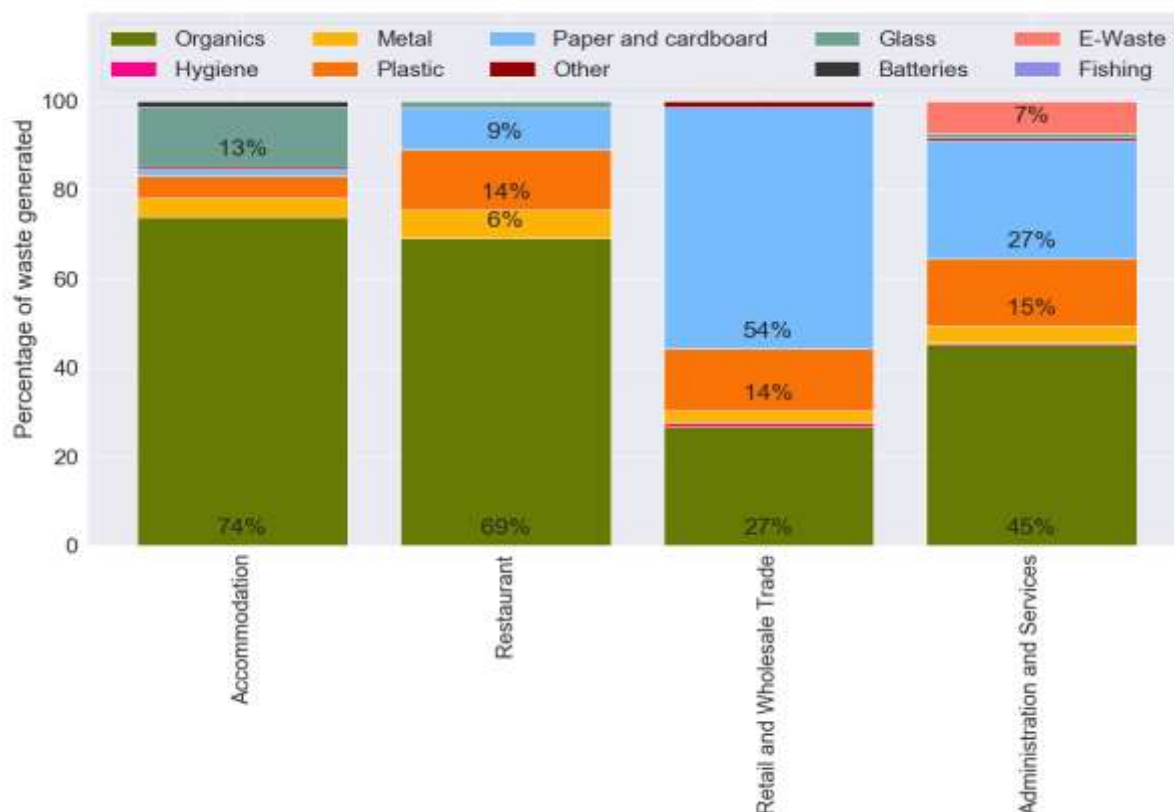


Figure 27: Solomon Islands waste composition by business type

The best-practice actions proposed below also include the wastes generated in commercial premises. Town councils and provincial governments might be able to exercise a greater degree of control over commercial premises through licence conditions. This could lend itself to quicker reform for the sector as compared to household waste.

7 Gaps

The following gaps have been identified in the provision of waste management services. Please note that this list is based on stakeholder consultation and initial observation only.

Table 17: Gaps in overall waste management in Solomon Islands

Theme	Gaps
Policy/legislation	<ul style="list-style-type: none"> There is confusion as to where ultimate responsibility for waste management lies. Although the Environment Health Officers are responsible for delivery and implementation of waste management projects in Honiara and around the country, the Ministry of Environment has taken the lead in developing a National Solid Waste Management Plan.

Theme	Gaps
	<ul style="list-style-type: none"> Although the Ministry of Environment developed the NSWMP, no resources have been allocated to the implementation of the plan. The plan also does not identify how it will use the Ministry of Health resources to implement the actions. The plan also lacks tangible targets or goals. There are no current solid waste management plans at the provincial or local level for the country. The only ordinance empowering HCC to implement waste management is the litter ordinance with its 7-metre rule (HCC litter ordinance) There is no law making it compulsory for HCC to collect a payment for dumping material at the dump site. There are no robust financial mechanisms that allow for HCC or provincial governments to fund their waste management activities.
Data collection and decision making	<ul style="list-style-type: none"> All waste data is collected with the help of JICA volunteers. There is no internal capacity within local council or provincial staff to use data for decision-making processes. No litter data collection is undertaken in a systematic process to understand, what, why and where. Data for incoming waste not collected at the Ranadi dump site. Landfills do not charge a fee for dumping. Most provinces don't have landfills or even managed dumping spaces. Most islands don't have any waste disposal facilities or any accounting for what is happening with their waste.
Economic instruments	<ul style="list-style-type: none"> There is no income from waste management activities currently coming into HCC or any other province. The business houses are charged a small levy. All income/expenditure for waste management is not clearly accounted for. The budget for solid waste management is limited. Although provinces are thinking about having financial mechanisms in place, it is not currently the case. None of the landfills/dumps charge a fee for disposal. There are no financial incentives in place in the form of export tax breaks for recycling activities and shipping of recyclable materials overseas.
Collection services	<ul style="list-style-type: none"> Domestic collection services are provided by HCC only. The collection services in HCC are also limited to the urban areas only but an expanding population and expansion to the peri-urban areas will require services and substantial support. The services in provinces are ad hoc and basic.
Equipment and maintenance	<ul style="list-style-type: none"> Collection vehicle breakdown time due to lack of spare parts is a significant issue. There is limited stock of spare parts. Maintenance and mechanical capacity is limited. There were broken-down collection trucks in each of the municipal councils visited. HCC needs more collection trucks with access to spare parts.

Theme	Gaps
Contracts and tenders	<ul style="list-style-type: none"> Private contractors are being used by HCC in some areas and this option should be explored further by HCC and provincial governments. Tender and contract management capacity is limited in the assessed council and the provincial governments.
Landfill design and management	<ul style="list-style-type: none"> Current landfill capacity is extremely limited for Ranadi. There is an urgent need to find an alternative suitable landfill site. None of the dumping sites in the provincial areas are controlled, sanitary or safe. No landfill cover was seen on any of the dump sites visited. Heavy equipment for compaction is not available or is very limited. HCC and provincial governments are dependent on hired heavy plant and equipment to manage landfill, which also has a propensity to break down. All landfills have waste pickers of all ages and genders working in very unsanitary conditions. At landfills, waste picker activity is not regulated or formalised
Education and engagement	<ul style="list-style-type: none"> There is one awareness activity being undertaken by both HCC and provincial government aimed at educating youth about the 3Rs. Waste education/awareness is missing/limited in provinces and outer islands There is no co-ordination between the myriad of national and international projects being undertaken in the waste space. There is no staff capacity within either the Department of Environment or within council to undertake this co-ordination. There are no staff currently undertaking or responsible for waste education or awareness activities.
Recycling	<ul style="list-style-type: none"> There is recycling of aluminium cans currently taking place in the Guadalcanal province which can be strengthened through a CDS scheme or similar with a proper economic incentive. Currently \$2–3 SBD per kilogram is insufficient to motivate the broader community. Organics are not being composted or even source separated at a large scale. Market waste is currently going to the landfill at HCC. This is not the case in Auki. There is some education for source separation and composting, most of which is well practised where implemented. There is a large number of communities that have received no education or awareness. Recycling capacity in Solomon Islands is limited by the lack of awareness of markets for sale of recyclables, prohibitive shipping costs and lack of availability of simple, bespoke recycling infrastructure.
Monitoring	<ul style="list-style-type: none"> There is no monitoring and evaluation being undertaken for the NWMPCS or for the local solid waste management plans. There is no internal capacity within either the department or councils or provincial government to do so.
Training	<ul style="list-style-type: none"> Some staff have had extensive training under the JICA, EU and other regional projects whereas others have had none. There is a disparity

Theme	Gaps
	between waste management capacity between HCC in the urban areas and staff in provinces.

8 Suggested best-practice actions

8.1 Improved policy/plan structure and delineation of roles and financial mechanisms

Solomon Islands has a national waste management strategy that sits within the Department of Environment. The strategy clearly states the issues that require attention around waste management and offers several possible solutions. However, the strategy can be strengthened through the addition of an outcomes-based action plan. The action plan should include the following:

- Clear targets to be achieved based on the problem priority materials of concern that need to be managed.
- Articulated actions that will help achieve each of the targets
- List of the resourcing requirements for each action
- Defined roles within each stakeholder organisation responsible for ensuring these goals or targets can be achieved
- Defined roles within each stakeholder organisation responsible for collecting data and measuring progress against each goal
- Define a clear monitoring and evaluation matrix for each activity identified in the action plan
- Help each province write a waste management action plan with all activities clearly contributing to the achievement of the targets mentioned in the national waste management strategy.
- All town councils and provinces need to establish financial mechanisms that would allow them to fund their collection and disposal activities in a sustainable manner. This includes prepaid bag systems, container deposit legislation, environmental levies, fees for disposal at landfills as well as a separate accounting system for money collected for waste management.

8.2 Management of organics

Any future policy or plan for Solomon Islands, even in provinces and regional Guadalcanal, must consider a proposal to manage organic waste. With landfill space running out or non-existent, the removal of organics from the incoming waste stream to landfill not only solves an environmental issue, it has the potential to reduce the requirement for landfill space and therefore a substantial cost to government and council. The following table outlines the potential landfill savings in Honiara City only, based on the data collected by APWC in 2018 and using the J-PRISM II incoming waste to landfill survey of 2017.

Table 18: Potential savings in landfill space based on source separation of organics

Source of waste	Daily tonnes to landfill	Potential recovery modelled*	Potential tonnages diverted from landfill (yearly)	Potential landfill space saved (m ³ per year)
Household	47% of 32.8	60%	2,886	4,645
Commercial	45% of 39.8	80%	4,470	7,195
Markets	7.9	90%	2,218	3,571
Total	41.226	2.3	9,574	15,411

*Potential recovery means the ability to source separate and recover material if a system was put in place

Based on a 47% organic content in Honiara's household waste and a 60% recovery rate, composting would lead to a saving of 4,886 tonnes of organics going to landfill, saving 4,645 cubic metres of space. (Conversion factors as per waste densities listed by Sustainability Victoria, Australia³). J-PRISM data contained within the 2017 HCC waste management strategy shows that 7.9 tonnes of market waste enters the landfill each day, of which 93% is organic in nature and 7% is contamination. Assuming 90% of this waste is able to be segregated for composting, it would save an additional 3600 cubic metres of space in the landfill. Similarly, commercial waste contributes about 7,195 cubic metres of organic waste per year.

Overall a minimum of 15,000 cubic metres of space per year can be saved at the Ranadi dump site if organics can be separated and composted separately in Honiara.

With a large amount of organic waste being generated a market study will have to be performed to ensure that any organic product generated as a result can be sold back to the community.

However, any future business plan should consider the segregation of organic matter, composting it and using it merely as landfill cover. None of the landfill sites visited during the APWC visit were using a landfill cover. Using a volume reduced and composted organic product reduces requirement of landfill space, reduces greenhouse gas emission and methane production and improves landfill management through the availability of cover material.

APWC understands that acquisition of land is a challenge, and even for a composting trial, land will have to be acquired as there is not enough land available at the Ranadi dump site.

8.3 Container deposit legislation and support for recycling association

Container Deposit Schemes (CDS) encourage community recycling while reducing litter and the number of containers going to landfill. Under such schemes, eligible empty containers can be returned at return points for a refund. The best schemes have different refund amounts for different containers or materials depending on the value of the recyclable material.

A small CDS is currently in place in Honiara for beer and soft drink bottles. Solomon Brewers Ltd operates a bottle reuse scheme whereby glass bottles are redeemed by retail distributors at \$0.50

³https://www.epa.vic.gov.au/business-and-industry/lower-your-impact/~/_media/Files/bus/EREP/docs/wastematerials-densities-data.pdf

SBD a bottle. Some tourist accommodations similarly recycle bottles and aluminium cans, ultimately for export. Some small-scale recyclers were also observed to be making use of the scheme.

As part of the APWC audit, all containers (plastic, aluminum, steel, LPB and glass) were sorted by size, material type and product type. Data show that each household on average produces nine (9) containers per day in Solomon Islands and almost 100% of these containers could be recycled if an appropriate deposit scheme was in place. Figure 28 show the counts of the most common containers.

There were some common consumption trends – aluminium soft drink cans (150–500 ml) were common everywhere, but particularly in rural Guadalcanal. In fact, a higher number of alcoholic beverage containers were observed in all communities in Guadalcanal, i.e. aluminium or glass beer containers, when compared to other areas.

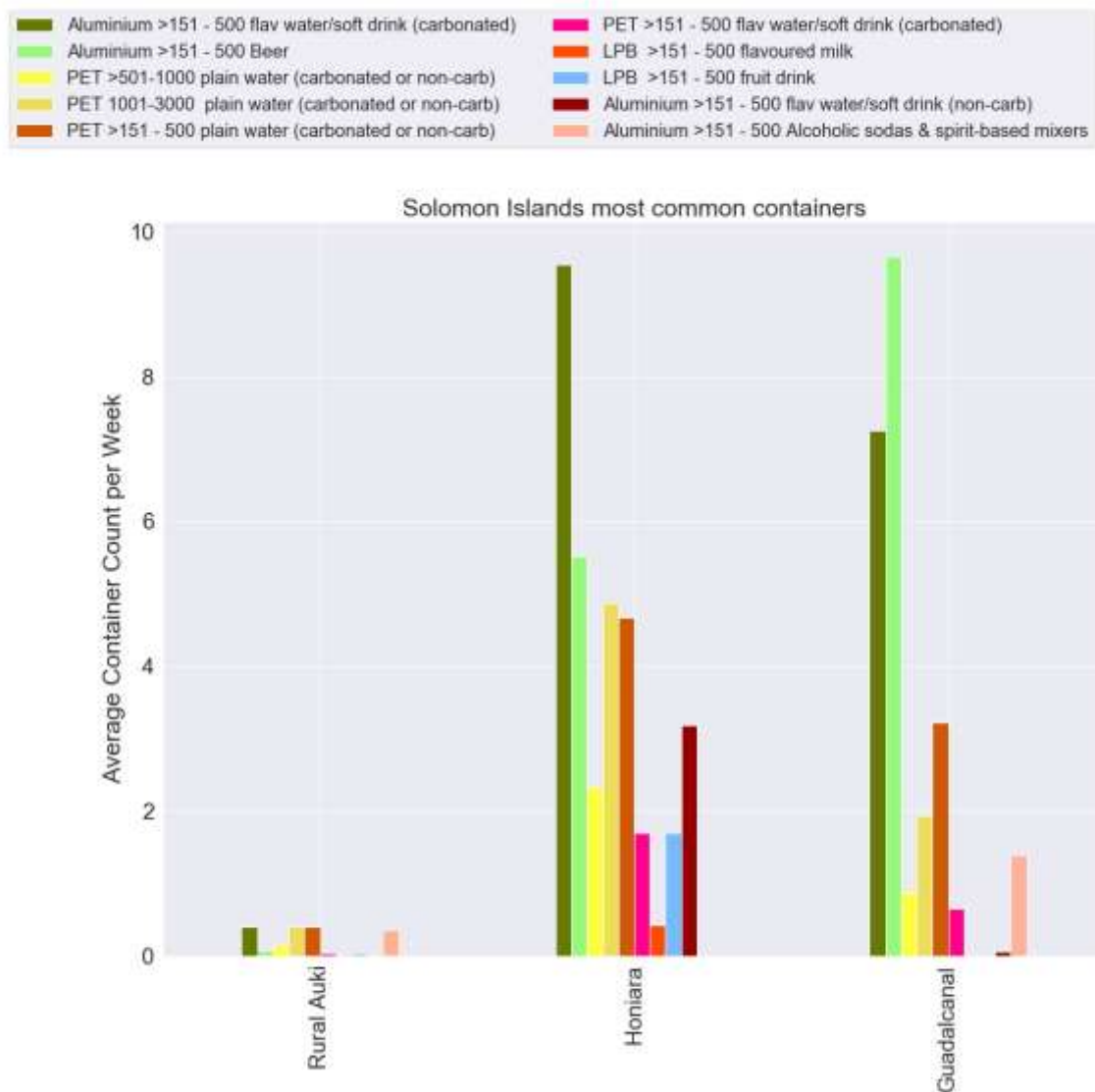


Figure 28: Most common beverage containers – Solomon Islands

The most common containers in Auki were PET bottles (water) and aluminium carbonated drink containers. Honiara returned a more even distribution of the types of containers found, with larger PET water bottles (one to three litres), liquid paperboard fruit juice containers and aluminium cans being the most common containers.

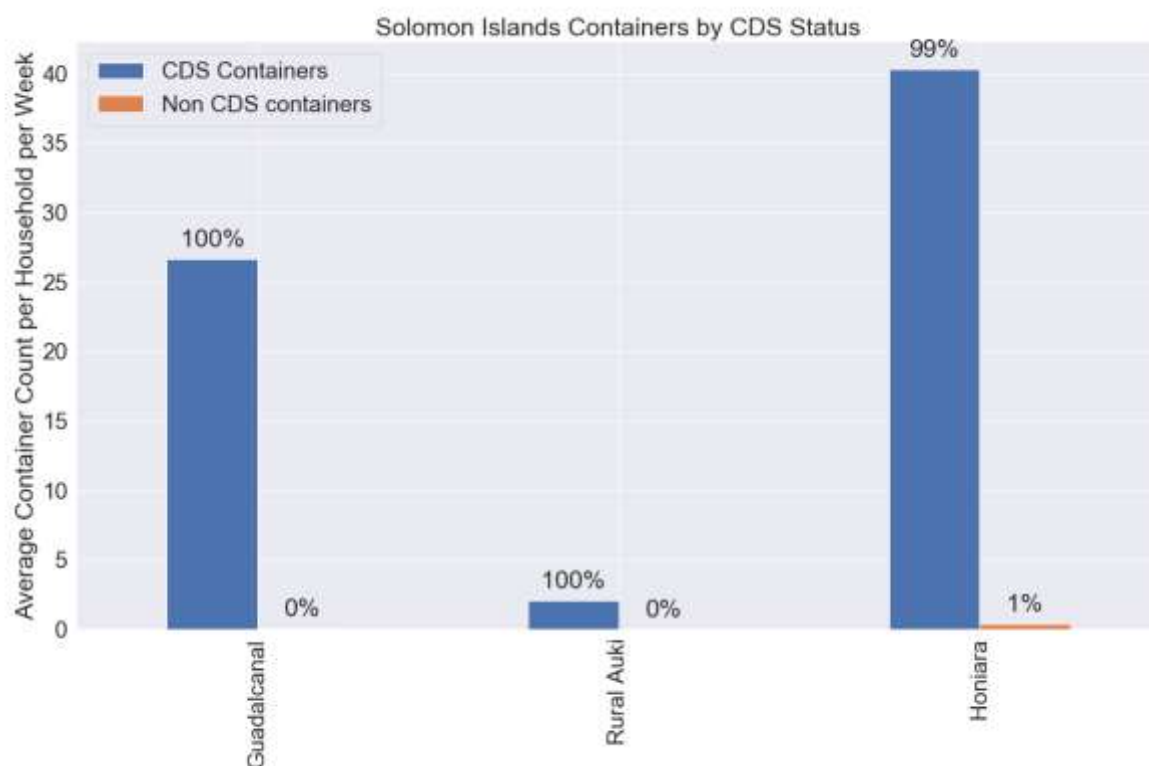


Figure 29: Containers by CDS status – Solomon Islands

Based on an extensive number of deposit legislations, APWC modelled the eligibility criteria for container legislation to be most effective in Solomon Islands. The analysis is based on the inclusions and exclusions listed at Appendix D. These inclusions and exclusions are only proposed based on the data available to us and would encompass more than 95% of the containers in the waste stream for most communities. This would allow for any Pacific country to become an extension of the CDS working in Australia thereby reducing the amount of new research required to be conducted.

Many bottles and cans are also currently under circulation within the communities as these are re-used for water and fuel. These containers often end up buried, burnt or in the environment once they cannot be reused. If a deposit is put on these containers, it would increase the likelihood of them being returned at the end of their life.

Traditionally, the biggest challenges for Solomon Islands, as articulated during APWC stakeholder consultation, are the following:

- Lack of knowledge and exposure to export markets for recycled materials
- The cost of shipping materials from Solomon Islands to market is prohibitively high compared with the relatively small amount of material being generated in the country

- The cost of shipping materials from outer islands to the main islands also must be borne by the recycler
- Sending a container of recyclables out of the country incurs a tax. There have been consistent demands by the recycling sector to have this tax rebated, reduced or removed.

Although the Moana Taka partnership currently exists for the movement of materials within the Pacific, it is restricted to materials of no commercial value. The proposed Pacific Regional Recycling Hub currently under investigation led by the Pacific Regional Infrastructure Facility (PRIF) with the support of all donors and SPEP is on the horizon. It will allow Pacific countries to ship recycling to a hub for consolidation and local value-adding. The feasibility study to undertake a pilot project in Fiji is proposed to be carried out in 2019–2020. Used beverage containers, paper and cardboard, scrap metal, batteries, e-waste and end-of-life renewables are also included in the scope for the PRIF regional recycling hub.

APWC proposes that a strong Solomon Islands WRIA, led by a local recycler, would be well placed to communicate the need for more support for recyclers in the country. Although the association has been formed, it needs to finalise its constitution, write an action plan and articulate its most pressing needs. Data shows that there is enough recyclable material currently in circulation to help the current number of recyclers thrive. According to APWC estimates, there is about 1.5 tonnes of aluminium cans available for recycling every day in Solomon Islands from households only. This does not include cans generated by businesses such as restaurants or resorts.

8.4 Management of nappies

Nappies as a separate product have not been counted in any of the previous audits conducted in Solomon Islands, making it difficult to determine the scale of the problem prior to this visit. However, clearly, the residents of Solomon Islands find it hard to find appropriate disposal methods for nappies.

In communities where there are no collection systems in place, nappies are being buried, burnt or dumped in water. Given that this applies to most of Solomon Islands, the rate at which nappies are accumulating in the environment is only rivalled by PET bottles and plastic bags.

APWC believe the solution to the growing problem of nappy disposal is the introduction of small, community-scale nappy composting system, especially on islands where there are no collections available. The same system could be scaled up to compost nappies at a municipal scale in a place such as Honiara where little community land is available for the introduction of a communal nappy composting site.

For such systems to be viable, compostable nappies have to be made available to the community at an affordable price point and at a competitive cost with the traditional plastic-containing nappies. This would involve researching the current tariff on nappies with plastic versus compostable nappies.

The introduction of nappy composting should be aligned with a community-level education campaign focused on reusable nappies and the benefits of such a scheme.

8.5 Plastic bag ban

Approximately 4.4% of the overall waste collected from households in Solomon Islands is plastic bags. Interestingly, this percentage increases to 6.6% in urban areas and drops down to 2.6% in rural areas (see Figure 30: Breakdown of waste in urban Solomon Islands).

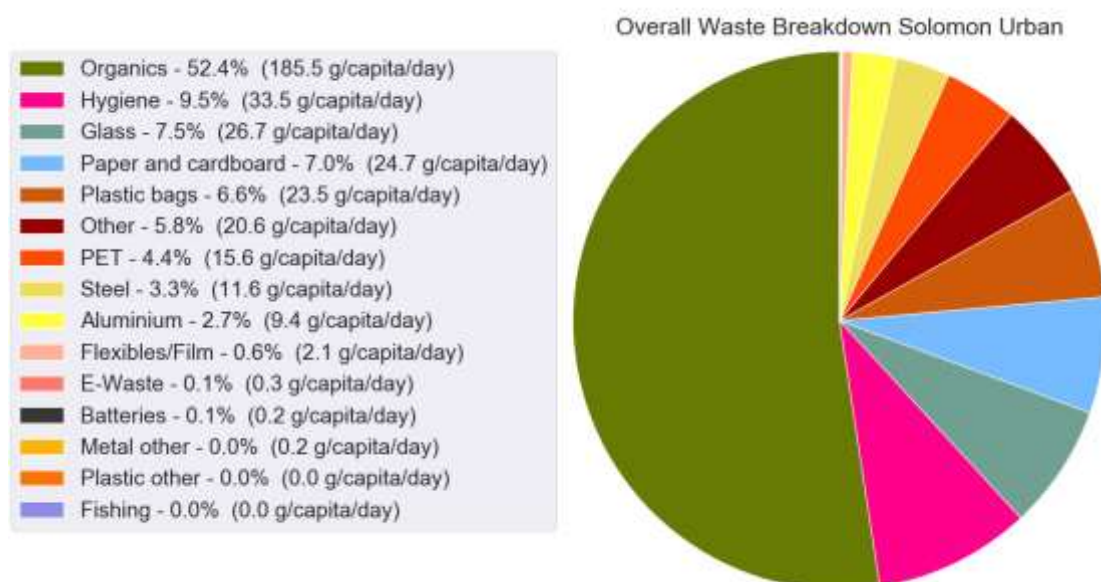


Figure 31: Breakdown of waste in urban Solomon Islands

After recyclable aluminium and PET, plastic bags were the most common item found in the household waste audit conducted by APWC in 2018. For Honiara alone, that amounts to 1.3 tonnes of plastic bags generated per day by households (based on 32.8 tonnes per day going to landfill as per J-PRISM II data).

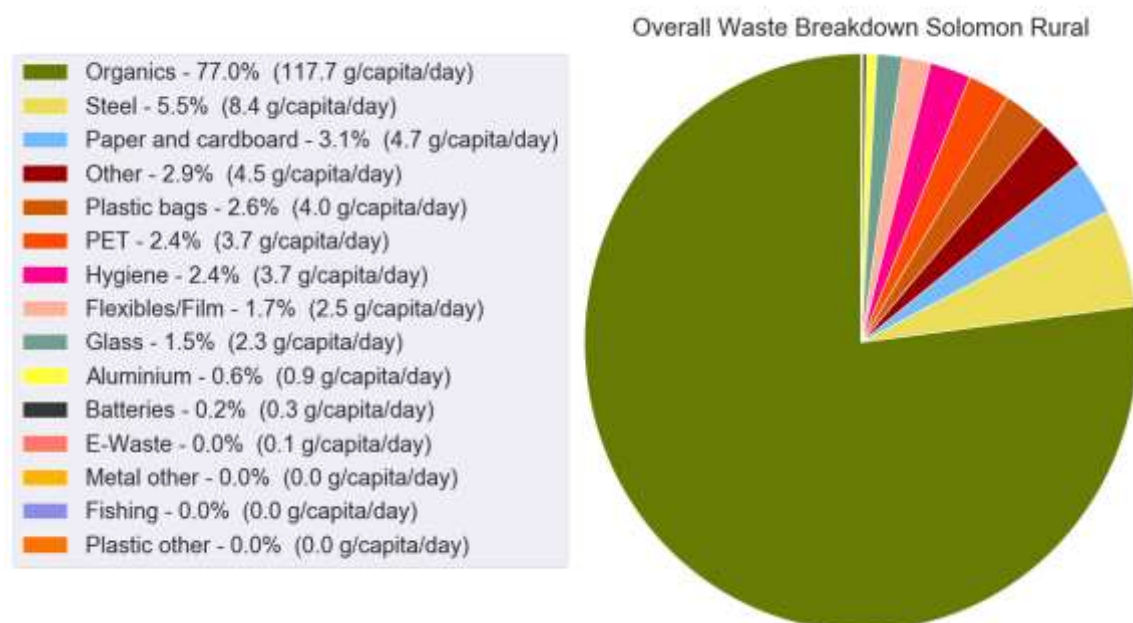


Figure 32: Breakdown of waste in rural Solomon Islands

Further analysis was performed to understand the types of bags generated in Solomon Islands. Data shows that almost 100% of the bags found in household waste were shopping bag less than 300 gsm.

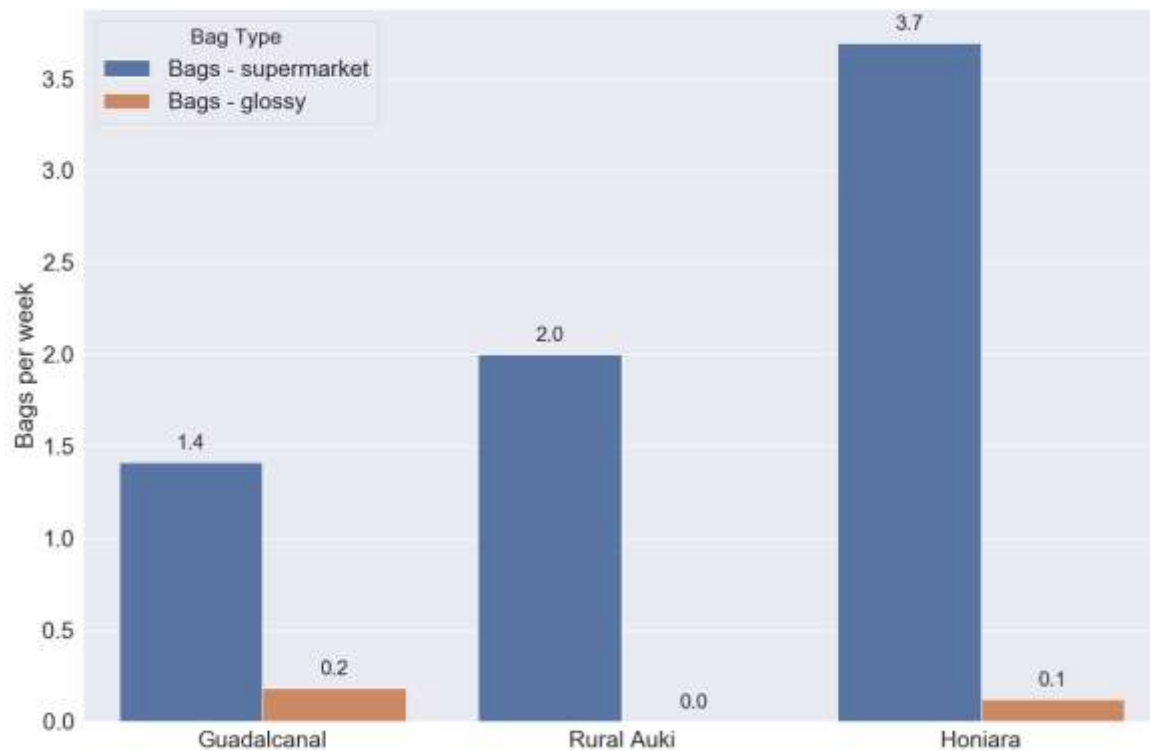


Figure 33: Supermarket vs glossy bags found in household rubbish

This implies that a plastic bag ban, similar in nature to Vanuatu's, covering shopping bags only, should help remove almost 99% of plastic bags from the household waste stream. However, there are lessons to be learned from the implementation of Vanuatu's ban and Solomon Islands staff would benefit from an ongoing collaboration with their colleagues in Vanuatu to implement such a scheme.

9 Recommendations

Based on APWC's assessment of the current situation, a set of recommendations and future actions has been prepared. Areas for Cefas collaboration with other projects in the region have also been identified.

Table 19: Draft key recommendations for Solomon Islands waste management

Theme	Aspect	Recommendation	Potential Cefas collaboration
Institutional arrangements and support	Support staff	<p>In the absence of sustainable budget support to employ permanent staff to support waste management in Solomon Islands, all effort must be made to secure volunteers from the available donor-supported programmes to provide the human resources needs through the:</p> <ul style="list-style-type: none"> • JICA Volunteer Programme (Senior and Junior Volunteer provisions) • Australia, New Zealand and USA volunteer programmes • Others 	Facilitate and conduct a Donors Dialogue (meeting) to bring together the donors (USA, New Zealand, Australia and Japan) for discussion of their existing volunteer programmes. This meeting shall be attended by representatives from the provinces and municipalities to give them the chance to directly inform the donors of their human resources needs.
	Waste management financing	To introduce applicable waste financing mechanisms to generate sustainable funding support for the provision of waste services	<ul style="list-style-type: none"> • Collaborate with donors and other projects in the promotion and implementation of the prepaid rubbish bag system in <ul style="list-style-type: none"> ▪ Honiara City Council ▪ Gizo ▪ Auki (if landfill area is confirmed) • Introduce tipping fee at the Ranadi and Gizo disposal sites • Ensure accounting systems are set up so that waste revenue goes to waste management activities • Introduce and implement Waste Levy (CDS, ARF, etc.) in Solomon Islands. This will require the following:

			<ul style="list-style-type: none"> Conduct a Preliminary Assessment in Solomon Islands. A pre-feasibility has already been proposed under J-PRISM II (2019) Conduct Detailed Feasibility Study (Could be supported by Cefas in the future) Legislation / regulation Development for implementation at potential locations and islands.
Capacity building	<p>To support training for existing staff supporting waste management activities at national, provincial and council levels.</p> <ul style="list-style-type: none"> Priority must be given to staff and workers that have not yet attended training under the on-going JICA training programmes in Japan, e.g. Auki, Gizo and Noro staff A city-to-city sister training programme can be established for staff from Vanuatu and Solomon Islands to receive training in other countries (Australia, New Zealand, Fiji, Palau, Kiribati, Samoa, etc. within the Pacific region with appropriate and applicable systems to their situation. The Melanesian Countries (Fiji, Vanuatu, Solomon Islands and PNG) have some similar systems which can be followed to promote South-to-South collaboration. 	<p>Organizing and financing of any training / collaboration programme for staff and workers to be trained in Australia or Vanuatu and Solomon Islands on heavy to medium sizes equipment for landfill and collection services operations and maintenance. This includes the securing of spare parts given the close location to Vanuatu and Solomon Islands compared to NZ, Japan and Asian and Europe countries.</p>	
	<p>To promote the transfer of skills from current trained and experienced staff to new staff and workers. Use of current HCC staff and workers to provide technical assistance and training to other areas of Vanuatu and Solomon Islands on different aspects of waste management, e.g. Joe Kelesi of HCC on Waste Landfill Construction and Operation. Rosemary, Wendi and</p>	<p>Supporting and financing a number of in-country workshops to bring together all the staff involved in waste management in the provinces and councils in Solomon Islands for waste management staff in the Ministry of Environment and HCC to train in different areas of waste management.</p> <ul style="list-style-type: none"> Waste assessment methodologies How the information is used to develop waste management plans at the provincial level Assisting the provinces in the development of their waste management plans 	

	George of Solomon Islands for Waste Audits, waste strategy development, etc.	
Co-ordination	<p>To strengthen the national co-ordination capacity of the responsible agencies in Solomon Islands for the co-ordination of waste management activities throughout Solomon Islands.</p> <p>This includes management of ship waste.</p>	<ul style="list-style-type: none"> • In collaboration with JICA, support the establishment of a national waste management committee (similar to JCC for J-PRISM II), which includes representatives of all provinces in Solomon Islands. • Support could be provided through financing of meetings from 2019–2021. • This can also be the platform in the future to promote better co-ordination of the National Waste Management Strategy throughout the country. • Such co-ordination mechanism is required to promote and help other provinces in the improvement of their waste management and ensure that there is no overlap between various donor funded activities.
Waste management plans	The development of a waste management plan at the provincial and council levels is a requirement under the current National Waste Management Strategies of Vanuatu and Solomon Islands. The provinces and councils are ill-equipped to develop such waste plans on their own and through the co-ordination mechanism at 1.4.1, this shall promote the development of waste plans if the actual situations are discussed during the National Waste Management Committee meetings.	To support the development of waste management plans in other provinces. (Collaborate with existing projects such as PAC Waste, J-PRISM etc.)
Legislation	Bylaws must be developed at the provincial, council or community level for enforcement of existing waste management laws relating to littering, illegal dumping, burning, etc.	Support the development of the waste bylaws for the provinces

Infrastructure	Litter control	Installation of river booms at key rivers	<ul style="list-style-type: none"> • Financing of the purchase of river booms and a pilot project in collaboration with existing provinces and councils for the removal and disposal of the captured litter from the booms. Setting up of a number of booms along some of the key rivers in Honiara can confirm the main areas for ongoing support required in the form of awareness programmes and measures to contain the generated wastes. • Financing of a waste management pilot for communal bins to be stationed within the communities along the river banks in collaboration with the responsible provinces and councils to control litter input to the river and sea. • Financing composting projects for nappies, green wastes and recyclable waste collection in collaboration with existing waste recyclers.
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	Collection service	<p>Improve the collection system by increasing the areas covered under the HCC existing collection services and promote the participation of private contractors</p> <p>Improvement of collection service in rural and outer areas, including remote islands using the prepaid bag system.</p>	<ul style="list-style-type: none"> • Support a preliminary assessment and a pilot collection service in Honiara (areas out of HCC coverage), Gizo and Auki using a special prepaid bag. • Provision of medium open dump trucks to support the pilot project at the above areas outside of HCC (Honiara, Solomon Islands). Proper rubbish compactors are expensive and difficult to maintain in the long run. Open dump trucks can be converted to rubbish trucks by installing cages at the sides (similar to some of the trucks used by PVMC). • Conduct public awareness activities to promote the use of the prepaid bags in the proposed areas in Solomon Islands. For gaining maximum attention, awareness and support from the targeted communities, the trucks can have the name of the Cefas project painted on the truck sides with phone numbers of the responsible provincial offices (Gizo and Auki). • It is important for such an initiative to have a good launch and beginning for active participation from the communities. The trucks can collect the proposed prepaid bags for the beginning of the programme and provide services in collaboration with existing private contractors. Discussions can be made with existing contractors for their awareness and input to this initiative for successful implementation. These can all be assessed during a preliminary assessment proposed above.
	Disposal	<p>Improvement of waste disposal site operations in Honiara and Port Vila (Ranadi, Gizo and Bouffa) – under J-PRISM II 2017–2021 with no plan for capital investment on heavy equipment</p>	<ul style="list-style-type: none"> • Providing heavy equipment support to Solomon Islands' existing main waste landfills • 20-tonne excavator for Ranadi dump site to assist the maintenance operations provided by the existing D7 bulldozer. This will also help with the proposed on-site composting activities for the large influx of green waste. • 15-tonne excavator for Gizo disposal site. This is adequate enough to provide the needed daily maintenance. • As part of any supply of heavy equipment, it should cover training for operators, spare parts and on-going contact information for future communication, e.g. NZ or Australia supplier, which are closer to Solomon Islands and Vanuatu. • Providing manual weighing bridge (available in Australia) to assist with data collection at the current main waste landfills in Vanuatu and Solomon

			<p>Islands because of the difficulty in the installation of electronic weighing bridge.</p> <ul style="list-style-type: none"> Any deal for the supply of these weighing bridges must include some training programme for the waste/landfill staff and operators including securing of spare parts and establishment of contacts for future communication.
	Recycling	To support the Recyclers' Association in Solomon Islands by providing some equipment and facilities to improve and promote their recycling operations	<ul style="list-style-type: none"> Funding of a 10-tonne flat deck truck with a hiab lifter for collection and movement of recyclable waste materials in Honiara area. This truck can be leased by the Association to its members at a lower rate compared with the rental daily rates. This will help with the recyclers' individual operations while simultaneously generating some revenues for the Association through the daily rental fees. This can reduce the existing piles of scrap metals at Bouffa and Ranadi waste landfills. The available bulky wastes can be recycled but the removal and transportation to the existing recycling operators is an issue. This will also benefit the waste pickers at these waste landfills for the removal of their wastes. Assist in the setting up of some waste recycling operations within or close to the existing waste landfills, especially at Bouffa, to promote the collaboration between the recycling operators and the waste pickers
Education and public awareness	Education materials	To support the development of educational materials in both English and the local languages for public awareness programmes and activities to promote awareness on the impacts of poor waste management and how to address it.	<ul style="list-style-type: none"> Financing the production of videos, posters and calendars with photos showing plastics in stomachs of fish, turtles, whales, etc. Financing the production of the following educational materials for awareness programmes in the communities: <ul style="list-style-type: none"> How to dispose of green wastes using the sup-sup garden methodology How to set up simple composts at the base of your agriculture crops or fruit trees How to set up a compost unit using an empty steel or plastic drum Nappy compost method How to dispose of other waste streams using backyard ditches or holes

	School programmes	In collaboration with the LEAF project to support educational activities through schools	LEAF project is currently active and has extensive networks within the country. Their networks could be leveraged for future work to be conducted for community education.
Other	Waste pickers	To improve the working conditions of waste pickers at the main Solomon Islands Ranadi dump site.	<ul style="list-style-type: none"> • To set up registration and recording system for waste picking operations at Ranadi landfill. Such system should enforce the following conditions, which are vital in the management of the waste landfills (this could be done in collaboration with existing projects). <ul style="list-style-type: none"> ▪ All waste pickers must become a member of the waste pickers group (can be a formal organisation later for access to funding to improve their operations and working conditions through available funding schemes for civil and society funding). ▪ Must wear personal protection equipment before entering the site (Cefas can help in the provision of PPE). ▪ Must wear an ID card (issued by the councils and management of the waste landfills). • Assist in the setting up of shelters for waste pickers to use on a daily basis for their activities. The centre must have a toilet and water supply in line with occupational, health and safety aspects. The office is an open house with a toilet and shower block and a block for storage of equipment to be used by the waste pickers. This equipment can be kept by the waste landfill offices and leased to the waste pickers at a lower price to help them with their daily tasks. Examples of equipment are: <ul style="list-style-type: none"> ▪ Wire strippers ▪ Wheel barrows ▪ Metals cutters • Provision of training for waste pickers to improve their operations and safety. This can promote the image of waste picking operations as a professional but not as the last hope. • Waste pickers proposed developments can fit well with the proposed recycling developments at Ranadi. With the availability of some recycling facilities within or close to the waste landfill area, it can improve the

			recovery and capture of waste materials from the landfill for recycling purposes.
Implementation	Cefas project continuity	<ul style="list-style-type: none"> • To continue the current momentum of waste management developments in Solomon Islands, the role of the Ministry of Environment and Ministry of Health is vital with support from the same stakeholders under the established co-ordination Committee. The Ministry of Health has the national network, which the project and the Ministry of Environment can use to promote waste-related developments throughout the countries as highlighted above. Currently Dr Matakai heads the co-ordination committee. • The project must use the proposed co-ordinating mechanism highlighted above for a National Waste Committee to consist of all provinces to ensure the promotion of the project nationwide. • The same co-ordinating mechanism can be used as a platform to monitor the progress of the project through annual meetings. • There is a potential for continuity if all waste projects are channelled through the same co-ordinating mechanism in the future to ensure the continuation of this national co-ordination effort as well as to expand the initiatives to other provinces. This will also prevent any duplication of efforts and resources in the future from future waste-related programmes and projects. 	

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Appendix A: Household sample collection sheet

Household collection sheet

	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							
14							
15							

Appendix B: Household interview sheet

Area or Island Name: Date:..... Sample number (H1 to H200).....

Weather(Sunny/Windy/Raining)

1. CONTACT INFORMATION

Household name/number	
Total number of people in the household	
No. of adults in the household	
No. of children in the household	
Location	
House type	
House ownership	

2. NATURE OF THE WASTE GENERATED

Daily Diet:

Preference 1P or Buy

Preference 2.....P or Buy

Preference 3.....P or Buy

Weekly number of soft drink cans consumed

Weekly number of water bottle consumed

Weekly Expense on Groceries: **Vt.**.....**Per**..... **OR**..... (Total)

Weekly Expense on Transportation: **Vt.**.....**Per**..... **OR**..... (Total)

Weekly Expense on Electricity: **Vt.**.....**Per**..... **OR**.....(Total)

3. MEASURE OF INCOME

Source of income	
No of people employed in the family	
Estimated monthly income	

4. WASTE MANAGEMENT

No. of bins in the house	
What is the waste level in your house when the collection comes?	
Do you burn any waste?	
Choose one. Do you	
• Take your bin out to a collection point	
• Throw it along the road/creek/ocean	
• Bin gets collected from your house	
• Other (describe how you dispose of your waste and where)	
How do you dispose of the following:	
• Green waste	

• General waste	
• Bulky waste	
• Nappies	

5 AWARENESS LEVEL

Are you aware of the waste collection/recycling services available? (Y/N) if yes, how many?	
Did you get any information about the collection services	
How did you get this information or where did you hear about it?	
Do you have a radio?	

6. APPRECIATION OF THE COLLECTION SERVICE

Rate your collection service from 1 to 10. 1 is really bad.	
What's the reason for the score?	
Do you have any suggestions for improvement?	

7. WILLINGNESS TO PAY FOR THE SERVICE

How much you are willing to pay if the waste collection is charged monthly?	
Do you support an idea of introducing a rubbish bag for people to put in their waste like in NZ, Australia, Kiribati and Vanuatu?	
These rubbish bags cost between 20 cents to \$1. How much you can afford if we sell the rubbish bag?	

8. CDL & RECYCLING

In order for cans, plastic bottles, and bulky waste to be recycled and send overseas, we need to support the cost by introducing a waste levy like other countries, e.g. 10 cent for soft drinks, \$100 for import cars, \$50 for washing machines and refrigerators. Do you support this plan?

Appendix C: Further sort sheet

Beverage containers	Cigarette Butts	Cigarette Packets	Straws	Coffee Cups	
Bags - heavy glossy typically branded carry bags	Bags - supermarket type light weight carry bags	Takeaway containers (plastic and paper)	Takeaway container lids		
BEVERAGE CONTAINER ONLY FURTHER SORT					
	<150	>151 - 500	>501-1000	1001-3000	>3001
Aluminium					
Alcoholic sodas & spirit-based mixers					
Beer					
cider/fruit based etc					
flav water/soft drink (carbonated)					
flav water/soft drink (non-carb)					
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					
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					
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					
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					
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					
Other					

Appendix D: Inclusions and exclusions in CDL

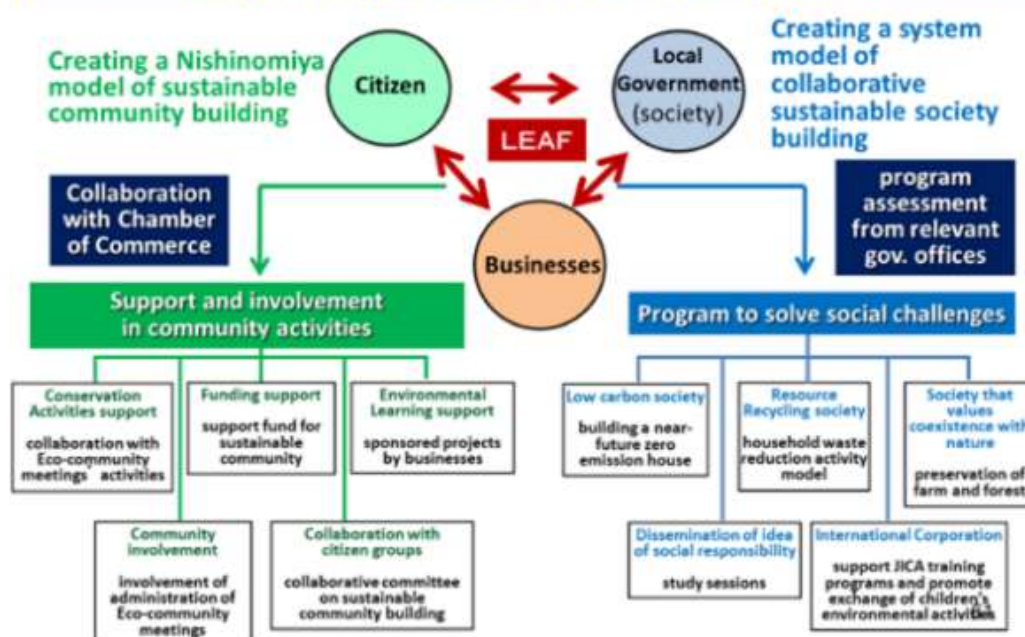
MATERIAL CATEGORY	0 - 150ml	>150 - 500ml	>500ml - 1lt	>1L - 1.5lt	>1.5lt - 2lt	>2 - 2.5lt	>2.5lt - 3lt	>3L
Aluminium	EXCL							EXCL
Alcoholic sodas & spirit-based mixers	EXCL							EXCL
Beer	EXCL							EXCL
cider/fruit based etc	EXCL							EXCL
flav water/soft drink (carbonated)	EXCL							EXCL
flav water/soft drink (non-carb)	EXCL							EXCL
Other	EXCL							EXCL
Steel	EXCL							EXCL
Alcoholic sodas & spirit-based mixers	EXCL							EXCL
Beer	EXCL							EXCL
cider/fruit based etc	EXCL							EXCL
flav water/soft drink (carbonated)	EXCL							EXCL
flav water/soft drink (non-carb)	EXCL							EXCL
Other	EXCL							EXCL
LPB	EXCL							EXCL
milk	EXCL	EXCL	EXCL	EXCL	EXCL	EXCL	EXCL	EXCL
flavoured milk	EXCL			EXCL	EXCL	EXCL	EXCL	EXCL
fruit juice (>90% fruit &/or Veg juice)	EXCL			EXCL	EXCL	EXCL	EXCL	EXCL
fruit drink	EXCL							EXCL
flav water/sports drink, non-carb	EXCL							EXCL
Other	EXCL							EXCL
HDPE	EXCL							EXCL
milk	EXCL	EXCL	EXCL	EXCL	EXCL	EXCL	EXCL	EXCL
drink pouches	EXCL							EXCL
flav. Milk	EXCL			EXCL	EXCL	EXCL	EXCL	EXCL
flav water/ sports drink etc (non-carb)	EXCL							EXCL
flav water/soft drink (carbonated)	EXCL							EXCL
plain water (carbonated or non-carb)	EXCL							EXCL
fruit juice (>90% fruit &/or Veg juice)	EXCL			EXCL	EXCL	EXCL	EXCL	EXCL
fruit drink	EXCL							EXCL
Other	EXCL							EXCL
PET	EXCL							EXCL
milk	EXCL	EXCL	EXCL	EXCL	EXCL	EXCL	EXCL	EXCL
drink pouches	EXCL							EXCL
flav. Milk	EXCL			EXCL	EXCL	EXCL	EXCL	EXCL
flav water/ sports drink etc (non-carb)	EXCL							EXCL
flav water/soft drink (carbonated)	EXCL							EXCL
plain water (carbonated or non-carb)	EXCL							EXCL
fruit juice (>90% fruit &/or Veg juice)	EXCL			EXCL	EXCL	EXCL	EXCL	EXCL
fruit drink	EXCL							EXCL
Other	EXCL							EXCL
plastic other	EXCL							EXCL
milk	EXCL	EXCL	EXCL	EXCL	EXCL	EXCL	EXCL	EXCL
drink pouches	EXCL							EXCL
flav. Milk	EXCL			EXCL	EXCL	EXCL	EXCL	EXCL
flav water/ sports drink etc (non-carb)	EXCL							EXCL
flav water/soft drink (carbonated)	EXCL							EXCL
plain water (carbonated or non-carb)	EXCL							EXCL
fruit juice (>90% fruit &/or Veg juice)	EXCL			EXCL	EXCL	EXCL	EXCL	EXCL
fruit drink	EXCL							EXCL
wine bladders	EXCL			EXCL	EXCL	EXCL	EXCL	EXCL
Other	EXCL							EXCL
Glass	EXCL							EXCL
Alcoholic sodas/spirit-based mixers	EXCL							EXCL
Beer	EXCL							EXCL
Cider/fruit based etc	EXCL							EXCL
Flav water/soft drink (carbonated)	EXCL							EXCL
Plain water (carbonated or non-carb)	EXCL							EXCL
fruit juice (>90% fruit &/or Veg juice)	EXCL			EXCL	EXCL	EXCL	EXCL	EXCL
fruit drink	EXCL							EXCL
Wine	EXCL	EXCL	EXCL	EXCL	EXCL	EXCL	EXCL	EXCL
Wine cooler	EXCL							EXCL
Spirit	EXCL	EXCL	EXCL	EXCL	EXCL	EXCL	EXCL	EXCL
Other	EXCL							EXCL

Appendix E: LEAF organisational structure and future collaborative activities

Organization of LEAF



Overview of future activities of collaborative project by LEAF corporate members





About us

The Centre for Environment, Fisheries and Aquaculture Science is the UK's leading and most diverse centre for applied marine and freshwater science.

We advise UK government and private sector customers on the environmental impact of their policies, programmes and activities through our scientific evidence and impartial expert advice.

Our environmental monitoring and assessment programmes are fundamental to the sustainable development of marine and freshwater industries.

Through the application of our science and technology, we play a major role in growing the marine and freshwater economy, creating jobs, and safeguarding public health and the health of our seas and aquatic resources

Head office

Centre for Environment, Fisheries & Aquaculture
Science
Pakefield Road
Lowestoft
Suffolk
NR33 0HT
Tel: +44 (0) 1502 56 2244
Fax: +44 (0) 1502 51 3865

Weymouth office
Barrack Road
The Nothe
Weymouth
DT4 8UB

Tel: +44 (0) 1305 206600
Fax: +44 (0) 1305 206601

academia, non-governmental organisations (NGOs), at home and internationally.

We work with:

- a wide range of UK Government departments and agencies, including Department for the Environment Food and Rural Affairs (Defra) and Department for Energy and Climate Change (DECC), Natural Resources Wales, Scotland, Northern Ireland and governments overseas.
- industries across a range of sectors including offshore renewable energy, oil and gas emergency response, marine surveying, fishing and aquaculture.
- other scientists from research councils, universities and EU research programmes.
- NGOs interested in marine and freshwater.
- local communities and voluntary groups, active in protecting the coastal, marine and freshwater environments.



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We offer a range of multidisciplinary bespoke scientific programmes covering a range of sectors, both public and private. Our broad capability covers shelf sea dynamics, climate effects on the aquatic environment, ecosystems and food security. We are growing our business in overseas markets, with a particular emphasis on Kuwait and the Middle East.

Our customer base and partnerships are broad, spanning Government, public and private sectors,

