



SPREP
Secretariat of the Pacific Regional
Environment Programme



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Waste Audit Report

VANUATU

October 2020



Supported by the Australian Government
through the Pacific Ocean Litter Project



The information and data gathered from these waste audits will be used by countries in the Pacific to support the development and monitoring of waste and resource recovery projects and recommend the infrastructure and policy interventions required. The regional dataset will also be used to identify and evaluate potential regional projects that would improve waste management in the region.

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Acknowledgement: SPREP, through the PacWastePlus programme engaged Tonkin & Taylor International Limited (T+TI) to undertake a waste audit in five Pacific Island countries. This report presents the findings of the waste audit undertaken, under a sub-contract by the Asia Pacific Waste Consultants, in Vanuatu. The methodology applied for this waste audit was as per the Waste Audit Methodology – a step-by-step manual to conduct comprehensive waste audits in SIDs, produced by the Pacific Regional Infrastructure Facility (PRIF).

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Our vision: A resilient Pacific environment sustaining our livelihoods and natural heritage in harmony with our cultures.

As part of SPREP's commitment to the environment, this item is printed on paper made from 100% recycled postconsumer waste.

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Acronyms

APWC	Asia Pacific Waste Consultants
CDS	Container Deposit Scheme
DEPC	Department of Environmental Protection and Conservation
EU	European Union
GEF	Global Environment Facility
HDPE	High Density Polyethylene
JICA	Japanese International Co-operation Agency
JPRISM	Japanese Technical Cooperation Project for Promotion of Regional Initiative on Solid Waste Management in Island Countries
LMC	Luganville Municipal Council
MGB	Mobile Garbage Bin
PET	Polyethylene Terephthalate
PRIF	Pacific Regional Infrastructure Facility
PVC	Polyvinyl Chloride
PVMC	Port Vila Municipal Council
SPC	Shefa Provincial Council
SPREP	Secretariat of the Pacific Regional Environment Programme
UNEP	United Nations Environment Programme
VUV	Vatu



Executive Summary

Summary of Audit Activities

- Data collected on two islands - Efate and Espiritu Santo.
- 5 stockpile assessments - RecycleCorp yard PV & LUG - other informal stockpiles in rural areas on Efate found.
- 272 vehicles audited at Bouffa Landfill over a period of 14 days.
- 58 vehicles audited at Luganville Dumpsite over a period of 5 days.

Recovery of Recyclables

- RecycleCorp is the sole material aggregator and recycler in Vanuatu.
- No material recycling occurs in country, all material is exported for recycling.
- RecycleCorp has a two sites, their main site is in Port Vila on Efate Island and their secondary site is in Luganville on Espiritu Santo Island.

Stockpiles in Vanuatu

- Stockpiles are located at RecycleCorp Yards in Port Vila and Luganville awaiting sufficient volumes and suitable markets for export.
- Informal stockpiles can be found in rural areas.

Bouffa Landfill Composition

- | | |
|------------------------------|-----------------------|
| • 25.9% paper & cardboard | 25.4% organics |
| • 12% plastics | 3% hygiene |
| • 15.8% metals | 4.6% single use items |
| • 6.7% glass | 2% textiles |
| • 3.1% e-waste & white goods | 0.3% batteries |
| • 0.1% hazardous | 0.6% wood |
| • 0.5% biodegradable | 0.2% ash |
| • 2% rubber | 2.5% construction |

Luganville Landfill Composition

- 14% paper & cardboard
- 6% plastics
- 9% metals
- 5% glass
- 4% e-waste & white goods
- 0% hazardous
- 0% biodegradable
- 2% rubber
- 46% organics
- 3% hygiene
- 3% textiles
- 3% wood
- 0% ash
- 4% construction

PacWastePlus Programme

The Pacific – European Union (EU) Waste Management Programme, PacWastePlus, is a 72-month programme funded by the EU and implemented by the Secretariat of the Pacific Regional Environment Programme (SPREP) to improve regional management of waste and pollution sustainably and cost-effectively.

About PacWastePlus

The impact of waste and pollution is taking its toll on the health of communities, degrading natural ecosystems, threatening food security, impeding resilience to climate change, and adversely impacting social and economic development of countries in the region. The PacWastePlus programme will generate improved economic, social, health, and environmental benefits by enhancing existing activities and building capacity and sustainability into waste management practices for all participating countries.

Countries participating in the PacWastePlus programme are: *Cook Islands, Democratic Republic of Timor-Leste, Federated States of Micronesia, Fiji, Kiribati, Nauru, Niue, Palau, Papua New Guinea, Republic of Marshall Islands, Samoa, Solomon Islands, Tonga, Tuvalu, Vanuatu.*

KEY OBJECTIVES

Outcomes & Key Result Areas

The overall objective of PacWastePlus is “to generate improved economic, social, health and environmental benefits arising from stronger regional economic integration and the sustainable management of natural resources and the environment”.

The specific objective is “to ensure the safe and sustainable management of waste with due regard for the conservation of biodiversity, health and wellbeing of Pacific Island communities and climate change mitigation and adaptation requirements”.

Key Result Areas

- **Improved data collection, information sharing, and education awareness**
- **Policy & Regulation** - Policies and regulatory frameworks developed and implemented.
- **Best Practices** - Enhanced private sector engagement and infrastructure development implemented
- **Human Capacity** - Enhanced human capacity

Learn more about the PacWastePlus programme by visiting



<https://pacwasteplus.org/>

Introduction

The Secretariat of the Pacific Regional Environment Programme (SPREP) engaged Asia Pacific Waste Consultants (APWC) subcontracted through Tonkin & Taylor International Limited (T+TI) to undertake a landfill audit in Vanuatu complementing the household audit undertaken by APWC for Cefas. This report presents the findings of the landfill audit undertaken for Vanuatu. The methodology applied for this landfill audit was as per the Waste Audit Methodology – a step-by-step manual to conduct comprehensive waste audits in SIDs, produced by PRIF¹. The waste audit was undertaken with support from Port Vila Municipal Council and Luganville Municipal Council in close collaboration with APWC (remotely) supporting the delivery of the waste audit and other key stakeholders. The audit took place from 9 to 30 October 2020 and the results are presented in this report.

The results from the Vanuatu landfill audit are part of a Pacific-wide audit activity being implemented by a range of agencies. This audit is funded by SPREP through the EU-funded PacWaste Plus programme and with support from the Australian-funded Pacific Ocean Litter Project. Other audits in the region are funded by the United Nations Environment Programme (UNEP), the World Bank and the Pacific Regional Infrastructure Facility (PRIF).

The information and data gathered from the waste audits will be used by countries in the Pacific to support the development and monitoring of waste and resource recovery projects and recommend the infrastructure and policy interventions required. The regional dataset will also be used to identify and evaluate potential regional projects that would improve waste management in the region.

Landfills in Vanuatu

Once collected, solid waste is taken to a landfill or a controlled disposal site. There are three waste disposal sites in Vanuatu, Bouffa landfill (Port Vila City Council), Luganville dumpsite (Luganville Municipal Council) and Lenakel dumpsite (Lenakel Town Municipal Council). In other Provincial centres, waste is disposed of openly at an assigned area. Besides the formal disposal, backyard disposal is also still in practice in most homes throughout Vanuatu (DEPC, 2016)². Backyard waste is either buried or burnt. Bouffa landfill on Efate is the only managed landfill in Vanuatu. There is an unmanaged dumpsite on Espiritu Santo with a collection service (the site has a caretaker, but access is not controlled). On the remaining 81 islands – all less populated than Efate and Espiritu Santo – waste management is performed via informal dumpsites, burning, burying, and littering. Most of the other areas do not have a proper and organized collection and disposal waste management services. As part of the Waste Management Plans for Councils and Provinces developed under the technical support of JPRISM II and DEPC, some areas like Lenakel Municipal Council and in Malampa Province have commenced some small collection and disposal services.

¹ <https://www.sprep.org/sites/default/files/documents/publications/waste-audit-methodology-common-approach.pdf>

² DEPC, 2016. National Waste Management, Pollution Control Strategy and Implementation Plan 2016-2020. Republic of Vanuatu.

Bouffa Landfill

Bouffa landfill is located on the island of Efate, 8.5 kilometres from Port Vila (Figure 7). First opened as a dumpsite in 1995 to serve the largest population centre in Vanuatu, it was subsequently upgraded into a semi-aerobic landfill in 2006. Bouffa landfill is a disposal point for domestic, commercial, and industrial waste collected by the municipal council, as well as waste brought in by the public. Bouffa landfill is used for the disposal of Port Vila Municipal Council (PVMC) and Shefa Provincial Council (SPC). Shefa Provincial Council does not have its landfill, so all collected waste from both PVMC and SPC goes to the Bouffa landfill. Each trip costs around 2000 VUV to the contractor. Shefa government pays the landfill tipping fees to the PVMC and are currently considering starting their landfill site.

Luganville Waste Disposal Site

Luganville dumpsite is a controlled disposal site³. It is located approximately 6 kilometres from the town centre and close to Pekoia airport. The site has been operational since the end of World War 2 when the site was initially opened as a limestone quarry, and it was reported that burning waste was the primary waste management tool. In 2017, the dumpsite was extended, and the site is now approximately 4.2 hectares with the capacity to last an additional 20 years (APWC, 2019). The ownership of the areas covered by the disposal site is shared by 9 owners and this affects the needed developments of the site such as fencing and construction of other facilities which require the support of the owners.

The Luganville Municipal Council (LMC) has been struggling to provide ongoing maintenance of the site by hiring heavy equipment every 3 to 4 months. The recent donation by JICA in December 2020 of a new bulldozer with a rubbish truck is now allowing LMC to provide regular maintenance. There are more improvements needed to the site to function properly such as a weighing bridge with a gated office, some supporting workers on site and the implementation of regular soil cover.

Lenakel Dump, Tafea Province

This site is included here because it is the de-facto location for the disposal of waste in Tafea Province. It is currently used for waste disposal, but not yet legally endorsed by the Department of Environment Protection and Conservation. There are no facilities available on site and lots of improvements are needed in the future to upgrade the area.

Lakatoro Dumpsite, Malampa Province

The site is included here because it is the de-facto location for the disposal of waste in Malampa Province. It is also under customary ownership and yet to be legally endorsed for waste disposal purposes. There are no facilities on-site and requires lots of improvement in the future to upgrade the area. Some fencing and a temporary gate had been installed to demarcate the area.

³ DEPC, 2016. National Waste Management, Pollution Control Strategy and Implementation Plan 2016-2020. Republic of Vanuatu.

Landfill Infrastructure

Bouffa Landfill

Inputs to Landfill

Operating Hours	Staffing	Gate Fees	Equipment
<ul style="list-style-type: none"> • Mon to Fri: 7:30am -11:30am and 1:30pm -4:00pm • Saturday: 7:30am - 11am 	<ul style="list-style-type: none"> • one person at the gate each day 	<ul style="list-style-type: none"> • camion: 1,800VUV • ute: 1,200 VUV • car: 600VUV • bags excluding yellow bags: 60VUV each • Yellow bags: free 	<ul style="list-style-type: none"> • 2 excavators. Only one was working at the time fo the visit • 1 bulldozer funded by JICA in 1998 during the building of the cell. It is now not working • 1 bulldozer funded by JICA in Decemember 2020

Image 1: Operating conditions at Bouffa landfill

Landfill infrastructure

In 2000, the site was approximately 48 hectares in size which included 5 hectares of existing disposal area and facilities and 43 hectares of available volume. The site contains 1 cell which is almost at capacity at 200,000m³. Plans for two additional cells, cell 2 and cell 3 were developed in the year 2000.



Image 2: Tip face Bouffa landfill

Image 3: Sloping back face of Bouffa landfill

In the last 5 years, many donor-funded works have been undertaken at the Bouffa landfill.

Rehabilitation of the site funded by PacWaste Project in November 2016

PacWaste was an EU-funded initiative between 2014-18. PacWaste’s activities consisted of repairing the underground main leachate pipe, replacing damaged vertical gas facilities, clearance of waste along with the main access, creating new access on the disposed waste for direct entry to the available space at the back, and building a disposal cell for asbestos.



Image 4: Tyres and other bulky waste at Bouffa Landfill

During APWC’s visit to the landfill in September 2020, the auditors noted that the access road is still available, the leachate pipes and vertical gas facilities were operational, however, the audit confirmed the leachate control was not operational as the water pump was damaged.

In 2018 the active face of the landfill was piled high because of the lack of availability of an excavator to push the waste back, however, a new bulldozer was donated by JICA in Dec 2020 to replace a non-operational old bulldozer (also donated by JICA). Adjoining sewage and sludge open lagoons flank the site, and new residential areas are situated at the front boundary of the landfill, in addition, other surround areas include vacant customary lands under crop cultivation.

Infrastructure on-site includes a storage building, garage building for parking machinery, a small gate office, wastewater (leachate) collection, storage and treatment facilities, and drainage.

Waste Acceptance

General waste, green waste, metal, paper and cardboard, glass, plastics, tyres, batteries, and aluminium cans are all accepted at Bouffa Landfill. There is no limit to the incoming waste loads during operational times.

Both healthcare waste and asbestos are accepted at the landfill. No healthcare waste was observed at the Bouffa Waste Landfill during the assessment. The Landfill Supervisor confirmed that the Healthcare Waste Incinerator located at the National Hospital site in Port Vila is operational and receiving healthcare waste.

A landfill is an option only when the incinerator is not working. In addition, an area is designated at Bouffa waste disposal sites for the safe burial of incoming asbestos.

Luganville waste disposal site

Inputs to Landfill

Operating hours	Staffing	Gate fees	Equipment
<ul style="list-style-type: none"> • Mon to Sat: 7.30am- 4pm • Sunday closed 	<ul style="list-style-type: none"> • one person at the gate each day 	<ul style="list-style-type: none"> • Flatbed truck 1800VUV • Pickup truck 1200 VUV • Small load 600 VUV 	<ul style="list-style-type: none"> • Bulldozer donated by JICA in Dec 2020, LMC no longer have to hire equipment

Image 6: Operating conditions at Luganville Municipal landfill



Image 5: Signage at the landfill gatekeeper's hut



Image 7: Left - Sign at the entrance of Luganville landfill and Right - signage at Luganville landfill (Source: APWC, 2018)

Landfill Infrastructure

There is no weighbridge on site. Before December 2020 Luganville Municipal Council (LMC) hired a local contractor to push up waste, burn and cover the active face every four to five months. In December 2020, the LMC was gifted a bulldozer from JICA as part of the same assistance which supported both Port Vila City Council and Luganville Municipal Council. The audit was conducted in October 2020, therefore any improvements in tip-face management were not recorded.

Waste Acceptance

No limit to the incoming waste loads during the opening days. All wastes are accepted at the landfill except liquids (e.g. waste oil and chemicals).



Image 8: Tip face of LMC landfill (Source: APWC, 2018)

For healthcare waste, the Incinerator Facility in Luganville is not working. An excavated hole is prepared for the disposal of incoming healthcare waste at the waste disposal site. In addition, an area is designated at the Luganville waste disposal site for the safe burial of incoming asbestos.

Disposal at Landfills, Dumpsites and Littering

Waste Quantity

Bouffa landfill on Efate is the only managed landfill in Vanuatu. There is an unmanaged dumpsite on Espiritu Santo with a collection service (the site has a caretaker, but access is not controlled). On the remaining 81 islands – all less populated than Efate and Espiritu Santo – waste management is performed via informal dumpsites, burning, burying, and littering. Most of the other areas do not have a proper and organized collection and disposal waste management services. As part of the Waste Management Plans for Councils and Provinces developed under the technical support of JPRISM II and DEPC, some areas like Lenakel Municipal Council and in Malampa Province have commenced some small collection and disposal services. The estimate of waste disposed at other islands is based on the assumption that the per-capita rate of waste disposal at other islands is 50% of the per-capita rate at Luganville. This is in line with our 2018 audit results on Lelepa, noting that several islands are substantially more populous than Lelepa. This figure represents how much waste would be collected if a collection service were set up. This is in line with the 2018 audit methodology. It is *not* an estimate of total waste generation.

Table 1: Waste generation by source, 2020. Individual sources are not identified for other islands in Vanuatu as we don't have direct data and they are likely to be significantly different from the more populated islands.

Waste Source	Waste Disposed at Bouffa Landfill, 2020 (T)	Waste Disposed at Luganville Dumpsite, 2020 (T)	Waste Disposed of, islands apart from Efate and Espiritu Santo, 2020 (T, estimate)
Household Municipal Solid Waste	3063	1831	2381
Household Self Haul	4827	702	913
Construction and Demolition	0.0	0.0	0.0
Private Waste Contractor	697	974	1267
Office	315	192	249
Commercial and Industrial	2145	1364	1774
Hospitals and Veterinary Clinics	562	0.0	0.0
Ship	0.0	0.0	0.0
Resorts, Hotels and Apartments	1273	934	1214
Charity/Church	265	0	0
Other*	843	0	0
Total	13101	5997	7797

**Other items include end of life vehicles and end of life renewable energy equipment*

**No healthcare waste was observed during the audit period, refer to Section 1.2.3 for comments on healthcare waste management in Luganville.*

Waste Disposal by Material Type and Weight

The composition of waste entering the landfill was determined through visual audits of trucks arriving at a landfill in October 2020 and detailed audits of the contents of bagged waste from an audit of household and commercial waste conducted 2018 as shown in **Table 1**. The quantity was estimated from the visual audits of trucks arriving at the landfill. Note that this estimate is only possible to do with the 2020 audit data, so the annual disposal figures are categorised according to the 2020 audit:

- Detailed audits of household and commercial/office premises waste were conducted to find the composition of bagged waste from each of these locations (from the 2018 audit).
- Visual audits were conducted of incoming waste to the landfill for 14 days to determine the composition and quantity of waste entering the landfill by source.
- The volumetric data from visual audits was converted to weights using density figures for many categories of waste provided by the US EPA, and data from past audits and the Western Australian Waste Authority.
- Overall weight compositions determined from visual audits were combined with detailed compositions of bagged waste to get an overall waste quantity for each source of waste and material type.

Data captured during the visual audit at Bouffa Landfill in September 2020 has been used to estimate the total waste disposed at the landfill. The compositions in **Figure 1** are derived from the visual audit at Bouffa landfill in 2020 and includes all types of disposed waste, both household garbage bags and bulk/self-haul to tip face:

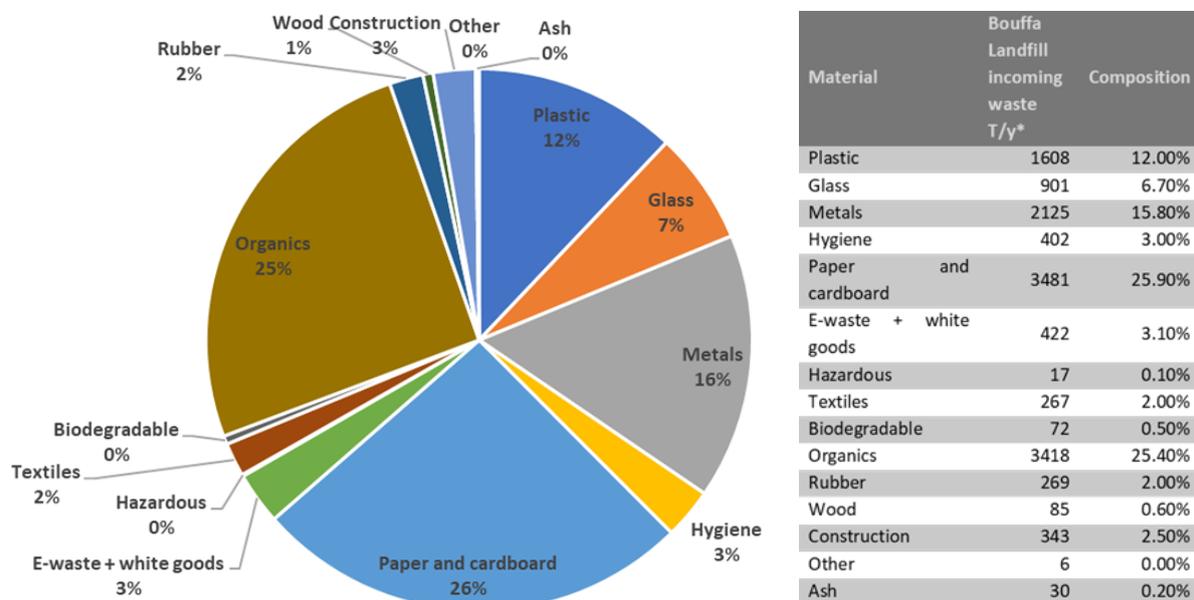


Figure 1: Estimated volume of solid waste deposited into Bouffa Landfill 2020

*Detailed data suggests a high amount of metal arriving from some construction and demolition activity happening during the 2020 audit.

Data captured during the visual audit at Luganville Landfill in September 2020 has been used to estimate the total waste disposed at the landfill. The compositions in **Figure 2** are derived from the visual audit at Luganville Landfill in 2020 and includes all types of disposed waste, both household garbage bags and bulk/self-haul to tip face:

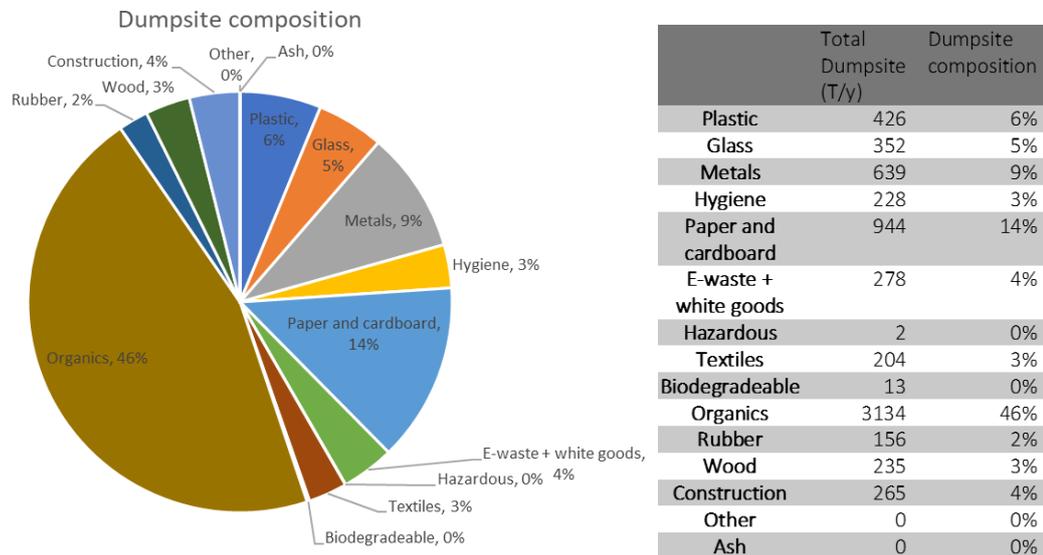


Figure 2: Estimated volume of solid waste deposited into Luganville Landfill 2020

“Waste disposal” is tricky to calculate for other islands. If they have dumpsites, the data on how much waste, or waste composition entering the sites was not provided.. Two rural areas were audited in 2018: Rural Shefa is relatively close to Vanuatu’s largest city of Port Vila. Lelepa, on the other hand, is an isolated island with just 500 residents.

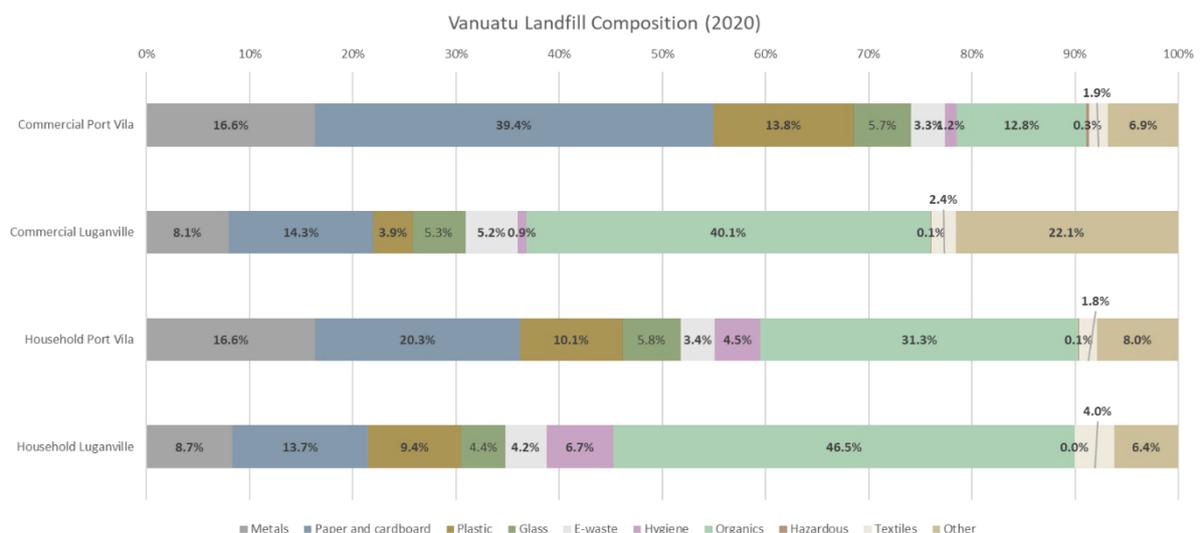


Figure 3: Landfill Composition Vanuatu 2020

Stockpiles

Audits of stockpiles located on Efate and Espiritu Santo were conducted in September and November 2020. The scope included:

- Waste awaiting processing, recycling or reuse.
- Informal stockpiles/illegal dumping
- Stockpiling for sale to RecycleCorp

Formal Stockpiles - RecycleCorp

Recycling in Vanuatu is currently undertaken by a private company, RecycleCorp. RecycleCorp is active in collecting aluminium cans, glass, scrap metal and batteries and even some e-waste for recycling.



Image 9: RecycleCorp yard in Port Vila

The audit team consulted with local stakeholders to identify known stockpile locations on the islands of Vanuatu. A majority of stockpiles are located at the RecycleCorp yards in Port Vila on Efate Island and Luganville on Espiritu Santo Island. The most commonly stockpiled materials at these yards are end of life vehicles (ELV), used lead-acid batteries (ULAB), roofing materials/scrap metals, copper from e-waste and aluminium.

RecycleCorp collects directly from pickers at the landfill and provides 240-litre mobile garbage bins (MGBs) to commercial premises (for a cost) in Port Vila. An example of stockpiles found at RecycleCorp is shown in **Image 10**.

The quantity of material held in stockpiles was considered commercially sensitive and therefore not provided to the audit team.



Image 10: Stockpiles located in RecycleCorp yard in Port Vila (APWC: 2020)

Table 2 highlights the value of some products currently recycled. However, RecycleCorp has faced challenges in the last few years in its ability to export its consolidated recycled materials.

Table 2: Price of collected recyclable materials

Name of recycling company	Recycling item	Value (Vatu)* 2015	Value (Vatu)* 2018
RecycleCorp Vanuatu	Copper	200 VUV/kg	
	Brass	120 VUV/kg	
	Aluminum (Al)	40 VUV/kg	2 VUV/kg
	Gear Box	10 VUV/kg	
	Lead-acid batteries	10 VUV/kg	
	Stainless steel	40 VUV/kg	5 VUV/kg
	Compressors	10 VUV/kg	
	Brass radiators	120 VUV/kg	
	Aluminum radiators	100 VUV/kg	
	Electric motors	10 VUV/kg	
Kava bars/markets/	PET bottles		10–20 VUV/bottle

Source: Department of Environmental Protection and Conservation, 2016

*Stakeholder consultation in November 2018. Please note collection of certain items is limited due to the crash in the international export market for recycled goods.

Illegal Dumping

The audit team located a number of illegal dumps of recyclable material in rural areas on Efate Island. These included work yards stockpiling used batteries and broken machinery, household personal stockpiles of aluminium cans, and stockpiles consisting of mixed materials such as white goods, e-waste and so on.

These stockpiles would fit more comfortably in the category of illegal dumping and **Table 3** below provide visual examples. Please note that these are only examples identified during the audit and do not encompass all illegal dumping in Efate. The location of these illegally dumped items is provided in the table as well.

Table 3: Examples of Illegal dumping in Efate

Dumped material	Photograph	Location
End of Life Vehicle		Bladiniere
End of Life Vehicle		Bladiniere
White Goods/E-Waste		Beverly Hills
White Goods		Bladiniere
Mixed materials		Stella Mari

Dumped material	Photograph	Location
Mixed materials		Stella Mari
Aluminium cans		Bladiniere
		No 2 Lagoon
Old machinery		No 2 Lagoon

Dumped material	Photograph	Location
Tyres, ULAB		No 2 Lagoon

Landfill Stockpiles

Stockpiles of aluminium cans and scrap metals can also be found at both Bouffa Landfill and Luganville Dumpsite. These piles are created by waste pickers and then sold to and collected by RecycleCorp for export.



Image 11: Stockpiles of segregated recyclable waste items by waste pickers (APWC, 2020)

Bouffa Landfill

The audit team witnessed extensive scavenging activity at the Bouffa landfill. The waste pickers range in age from six to 60 years and sometimes include entire families. The pickers are removing everything from food scraps for their animals to scrap metal, plastic bottles, copper, brass, aluminium, glass bottles, paper, and cardboard.

Some work by themselves while others work in groups. Each scavenger interviewed picks about one to two 240-litre MGBs (Mobile Garbage Bins) full of materials each day. The materials (mostly scrap metal and aluminium cans) are stored in bulk bags stashed all over the landfill for collection by RecycleCorp.

Luganville Dumpsite

The council informally collects cardboard from the businesses every Friday. There is a separate area dedicated to the disposal of cardboard. However, it is an open-air space with no shelter from the elements. A fire was recently reported in the segregated cardboard area. The cardboard is not currently being recycled.

Luganville Municipal Council (LMC) is trying to segregate waste as much as possible. In July 2018, signs were commissioned to direct customers to where they should unload their waste. Only some of the signs had been installed at the time of the visit in November 2018.

The waste pickers operate at the dumpsite and are most interested in PET bottles as they can sell them for 10 to 20 VUV at kava bars and market vendors. Waste pickers collecting aluminium cans to be on-sold to recycling companies were present daily

The next most popular item is beer bottles that can also be returned for 10 VUV. Pickers were not interested in scrap steel at this time but were actively looking for brass and copper as they can sell those to some auto-repair shops and electrical businesses in town.

Almost all pickers have other jobs and were using the scavenging activity as an additional source of income. This was not the case for children, however.

It is estimated by council staff that there are between 20 to 50 scavengers that frequent the landfill and pick from streets.

Between 5 – 10, waste pickers extract metals to be sold to RecycleCorp since the establishment of the RecycleCorp branch in Luganville. Some come to the site only when family members who work at local stores or supermarkets inform them to expect loads of expired goods to be sent to the disposal site.

Imports, Generation, and Recovery of Materials

The quantity of materials recovered was estimated via interviews with Recyclecorp and waste pickers. In addition, the customs export figures were examined separately, however, customs exports do not differentiate between exports of recyclables and exports of goods, so this is not a very good measure of the number of recyclables exported. RecycleCorp has not provided information on materials they export as they consider this commercial in confidence.

The quantities imported via customs data were calculated as follows and is presented in **Table 4**:

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

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

Most stockpiles found were very small compared to the quantities that were reported to have been recovered and the quantities calculated as imported. The exception to this was used oil, which appears to have around four years' worth stockpiled.

For all material types except for lead-acid batteries and aluminium cans, imported quantities were much larger than the reported recovery rates. The imported number for aluminium cans appears to be around one-tenth of the annual generation rate of aluminium can waste, however, it is expected that there are also substantial numbers of aluminium cans that are not recovered.

Table 4 outlines the disposal, recycling, and stockpile rate in addition to the customs import and export for material in Vanuatu.

Table 4: Waste disposal, exports, imports, recycling, and estimated quantity of recoverable material in tonnes per the year 2020.

Material Type	Total Recycled per year, survey (T/y)	Stockpiles for Recycling found (T/y)	Waste Disposal (T/y)	Exports, Customs Data (T/y)	Imports, Customs Data (T/y)	Estimated Recoverable (survey, T/y)
PET (1)	0	0	583	4.99	859	8.5*
HDPE (2)	0	0	277	3.11	745	
LDPE (4)	0	0	844	0.64	672	
PP (5)	0	0	190	0.01	440	
PVC (3)	0	0	69	0.02	144	
PS (6)	0	0	262	0.01	453	
Other (7)	0	0	282	3.43	1,385	
Aluminium	13	13	272	5.89	1,365	
Ferrous metals	440	155	3,178	928	18,237	1,500
Copper	0.112	0				
Nonferrous metals	100	0	135	39.6	157	
Glass	50	0	1,672	0.95	1,483	
Hygiene	0	0	902	83.7	1,846	
Paper and cardboard	0	0	5,408	8.44	2,866	
LPB	0	0	180	0.16	740	
e-waste	10	0	350	19.92	1,738	
Toner cartridges	0	0		0.2	22	
Used lead-acid batteries	3.1	0	21		250	
Lithium ion batteries	0	0		0.1	74	
Used oil	0	0		0.01	18	
Hazardous**	0	0	0	8.85	2635	
Textiles	0	0	730	0.7	3430	
Biodegradable	0	0	54	0		
Organics	0	0	10,561	2,632.48	19,927	
End of life vehicles	40*	46		110.09	6661	460
End of life renewable energy equipment (PV cells)	0	0	0	0		
White goods	0**	0	713	0.74	863	
Rubber	0	0	628	5.85	1362	
Wood	0	0	626	4,286.46	1,4204	
Construction	0	0	953	8.46	12,410	
Other	0	0	0	0.02	1,482	
Ash	0	0	30	0	0	

Blank cells indicate no data. * Interview reported 850 000 bottles recoverable annually.

** asbestos, clinical medical, fluorescent tubes, gas bottles

Stockpiles Awaiting Export

Currently, there is no formal material recycling performed in Vanuatu, therefore, all formal stockpiles managed by RecycleCorp are exported for recycling. All materials must have a buy price of USD 4000-5000 per container before being exported to Asian markets. RecycleCorp uses 20ft containers to export their materials and will send approximately 2-3 containers of recyclable material to Asia markets per month.

Metals

At 18,394 tonnes per year, there are vastly more metals imported than found in the waste stream (3,313 t/y). which, in turn, is much larger than the quantity reported to be recovered (540 t/y) (see **Table 4**). Many imported metals may be being used in constructions lasting many decades, and so may not be entering the waste stream yet, so the large differences between imports and disposal are likely to reflect the fact that metals have a long lifetime circulating within the economy. However, even waste disposal figures far outpace recovery (see **Table 4**), so there is substantial material available for recovery.

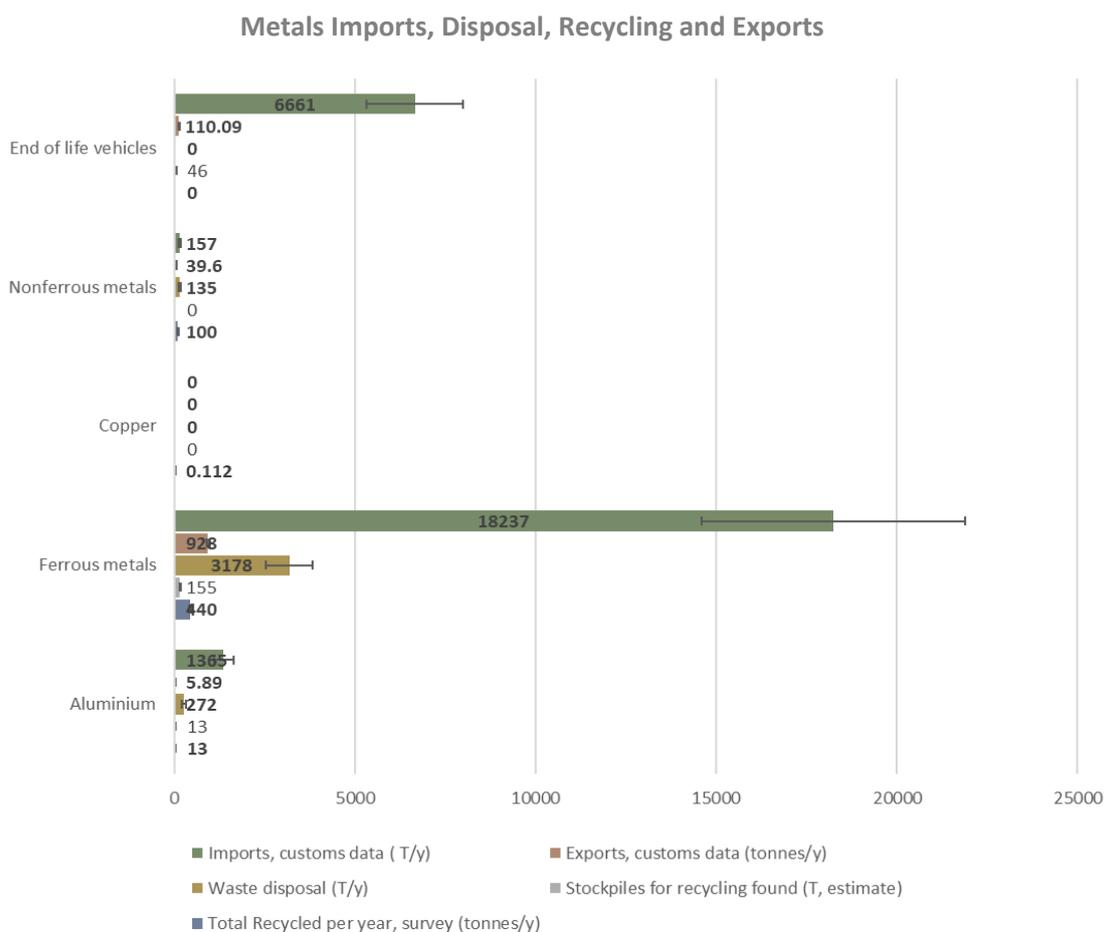


Figure 4: Metal imports, stockpiles, recovery, and disposal. *

*Error bars on imports and exports reflect educated judgements about uncertainty in assumptions made to derive numbers. Error bars on waste generation reflect uncertainty from sampling and volume to weight conversion; both are 80% credible intervals. Corresponding data in Table 4.

E-waste, White Goods and Batteries

For most categories of e-waste, white goods, and batteries; the audit noted large quantities imported and comparatively small amounts disposed of, recovered or stockpiled. The only batteries collected are the ULAB in areas surrounding Port Vila and Luganville. There is no collection for these in other areas of the country.

Electrical items tend to have shorter lifespans than metals used for construction but may remain in circulation for decades before disposal. While some battery collection (3.1 t/y) is reported, many more batteries are imported (324 t/y) and disposed of (21 t/y) (See **Table 5**). While whiteware like refrigerators and air conditions were highlighted by Recyclecorp for recovery of the copper metals and other valuable non-ferrous metals embedded, no information is available on the quantities collected.

Electronics and Batteries Imports, Disposal, Recycling and Exports

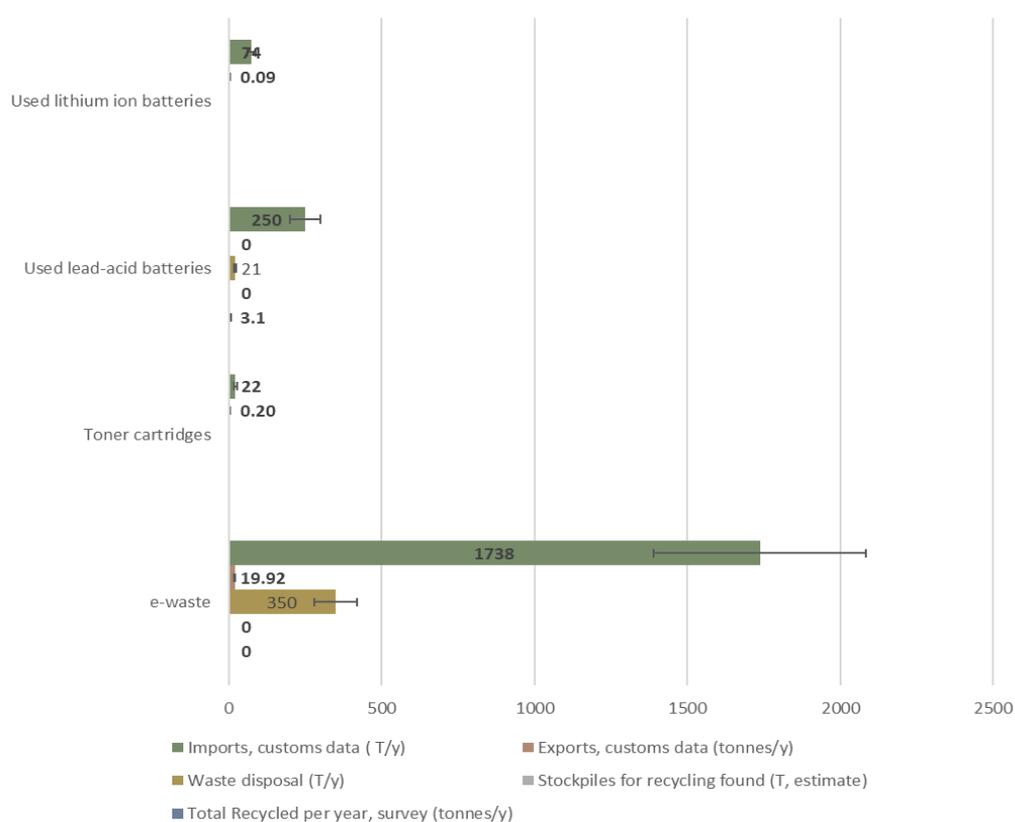


Figure 5: Electronics and batteries imports, disposal, recycling, and exports*

All information provided is based on the import data (See **Table 4**). The recycler is reluctant to share any information apart from what is presented.

*Error bars on imports and exports reflect educated judgements about uncertainty in assumptions made to derive numbers. Error bars on waste generation reflect uncertainty from sampling and volume to weight conversion; both are 80% credible intervals. Corresponding data in Table 4.

Plastics

Very little plastic is currently collected for recycling in Vanuatu. All plastic collected is brought to the RecycleCorp facility for compaction and future export. The facility sent their first shipment of plastics to Australia in July 2021.

Some Kava bars purchase PET bottles for use, but bottles ultimately end up at the landfill.

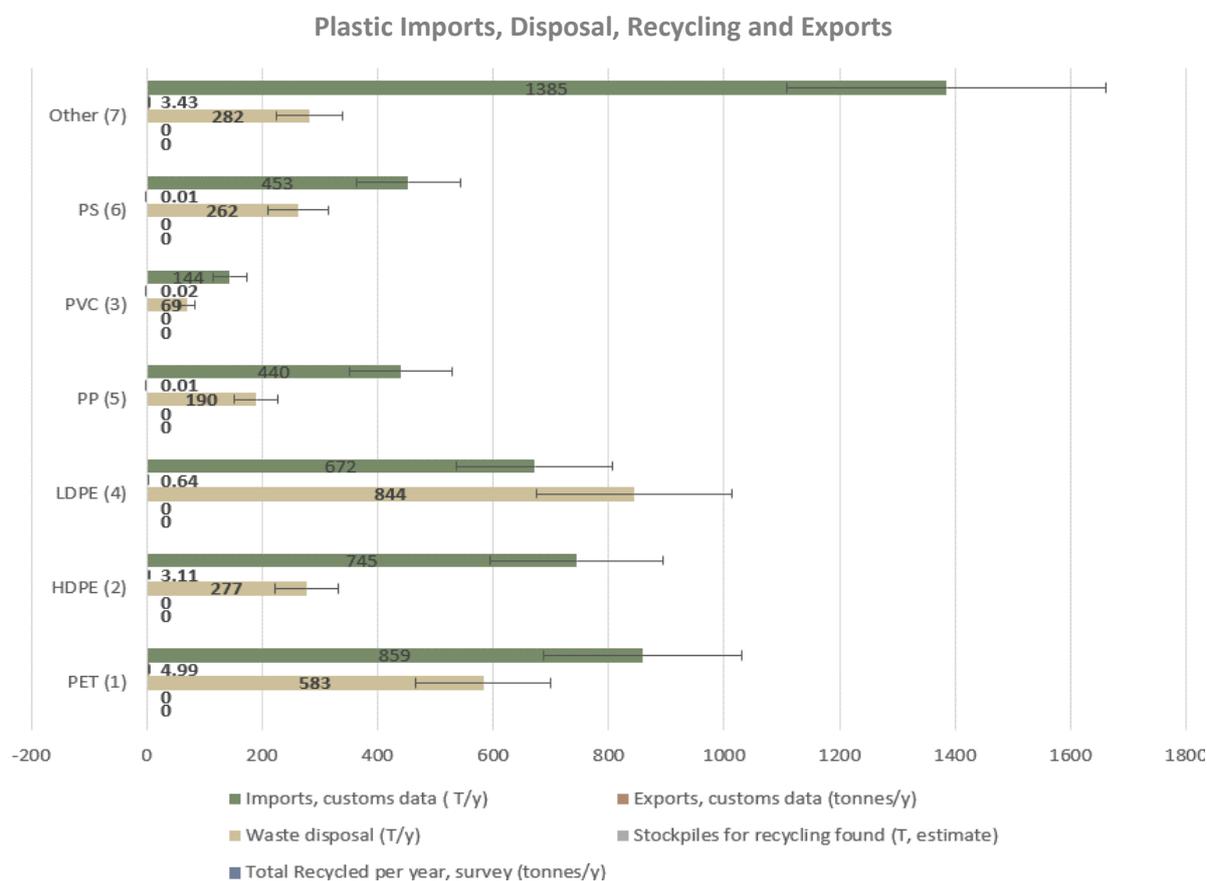


Figure 6: Plastics imports, disposal, recycling, and exports*

*Error bars on imports and exports reflect educated judgements about uncertainty in assumptions made to derive numbers. Error bars on waste generation reflect uncertainty from sampling and volume to weight conversion; both are 80% credible intervals. Corresponding data in Table 4.

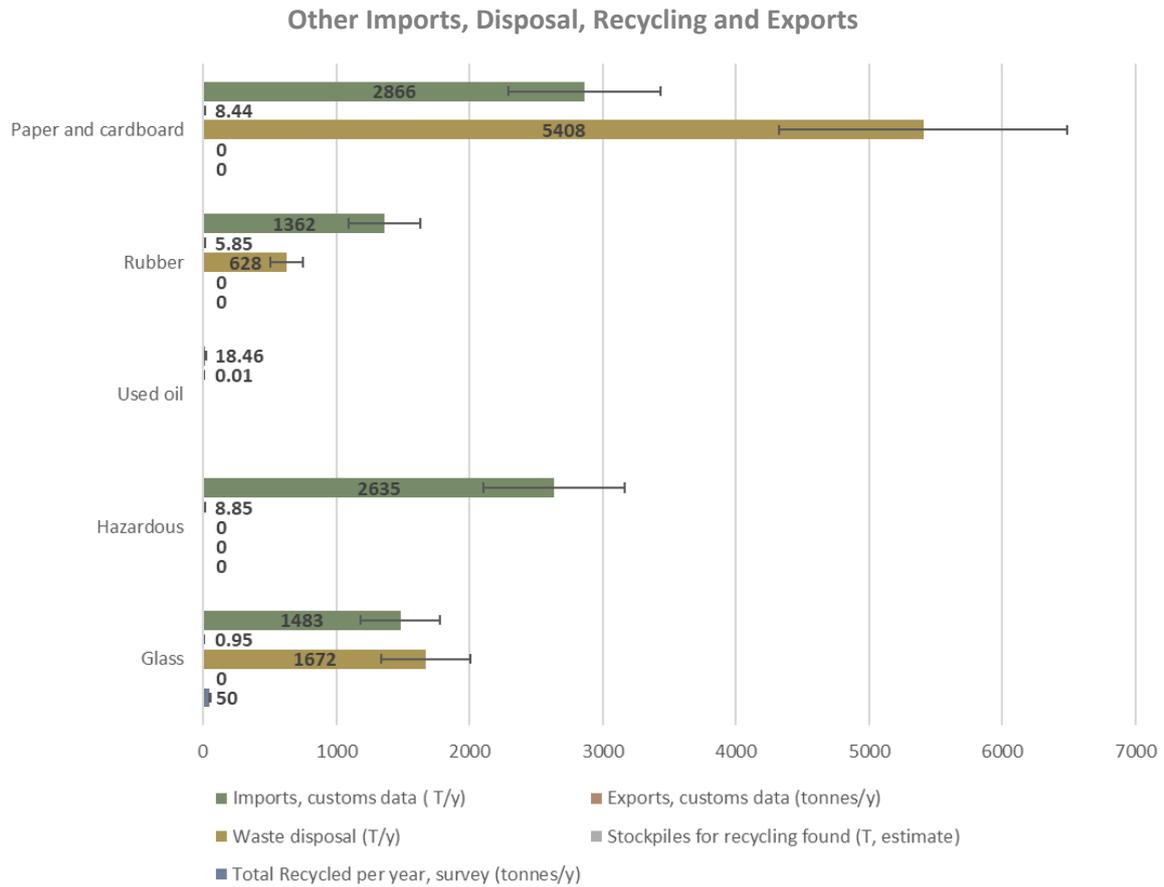
Other Items

Paper and cardboard were found in waste disposal at rates *greater* than the estimated amount imported. The model for estimating quantities imported is particularly inaccurate for cardboard, because cardboard packaging is ubiquitous, and it is very difficult to estimate how much packaging an item comes in simply by the description of the item. Thus, the estimate for cardboard imports substantially understates the actual amount of cardboard imported each year.

Disposal exceeding imports suggests that there is a lot of cardboard packaging coming in and ‘counted’ against other materials e.g., electronic items or whiteware will be accompanied by cardboard packaging.

Glass bottles were disposed of in similar quantities to the estimated import quantity. Glass bottles are like PET plastics in that almost all glass and PET is packaging a single item type – drinks – and most glass and PET will enter the waste stream within one year of import. Note, however, that uncertainties associated with both estimates allow for substantial glass leakage.

Oil, tyres, and hazardous items are found to be imported in quantities much greater than disposed of, and the audit did not find any evidence that these were collected for any type of recycling.



*Figure 7: Other imports, disposal, recycling, and exports**

*Error bars on imports and exports reflect educated judgements about uncertainty in assumptions made to derive numbers. Error bars on waste generation reflect uncertainty from sampling and volume to weight conversion; both are 80% credible intervals. Corresponding data in **Table 4**.

Recovered or Potentially Recoverable Materials in Vanuatu

Across all categories, it is estimated that most potentially recoverable materials are not currently being recovered in Vanuatu. **Table 5** provide examples of the amount of material potentially recoverable at a 60%, 80% and 100% recovery rate.

Paper and Cardboard

There is no indication of paper and cardboard recycling in Vanuatu, however, there is a separate collection service for commercial premises in LMC that occurs on Fridays, where businesses separate their paper and cardboard from their general waste to be collected and stockpiled at the landfill. Paper and cardboard are the single largest contributor to landfill disposal, taking up an estimated 39% of the space available.

Contaminated cardboard has a low value and finding a viable market for it is likely to be a challenge. Nonetheless, if a market or alternative use can be found then recovery will save substantial landfill space.

Composting

Around 20% of survey respondents already report composting or mulching their green waste. The remaining organics make up around 25% of the volume of material sent to landfills.



Table 5: Potentially recoverable material * Assumed that recovered aluminium was all in the form of drink cans

	60% Recovery (T/y)	80% Recovery (T/y)	100% Recovery (T/y)	Already Recovered (T/y)	60% (m ³ /y)	80% (m ³ /y)	100% Recovery (m ³ /y)	Percentage of Landfill Space
PET bottles (drink + home care + beauty)	200	266	333	0	3994	5326	6657	10.1%
HDPE bottles (drink + home care + beauty)	19	25	31	0	373	497	621	0.9%
Glass bottles	377	503	628	50	2384	3178	3973	6.0%
Nappies	241	322	402	0	1609	2146	2682	4.1%
Organics	2051	2734	3418	0	9765	13021	16276	24.7%
E-waste	103	138	172	10	985	1313	1641	2.5%
White goods	150	200	250	0	1430	1906	2383	3.6%
Paper and cardboard	2032	2709	3386	0	15632	20842	26053	39.5%
Aluminium drink cans*	42	56	70	13	469	625	782	1.2%
Used oil	11	14	18	0	12	16	20	0.0%
Single use plastic bags (20% substitution)	14	19	24	NA	97	129	161	0.2%
Hazardous	10	14	17	0	30	40	49	0.1%
Ferrous metal (scrap)	1154	1539	1923	440	1282	1710	2137	3.2%
Aluminium other than cans*	31	41	51	0	340	453	566	0.9%
Tyres	161	215	269	0	403	538	672	1.0%

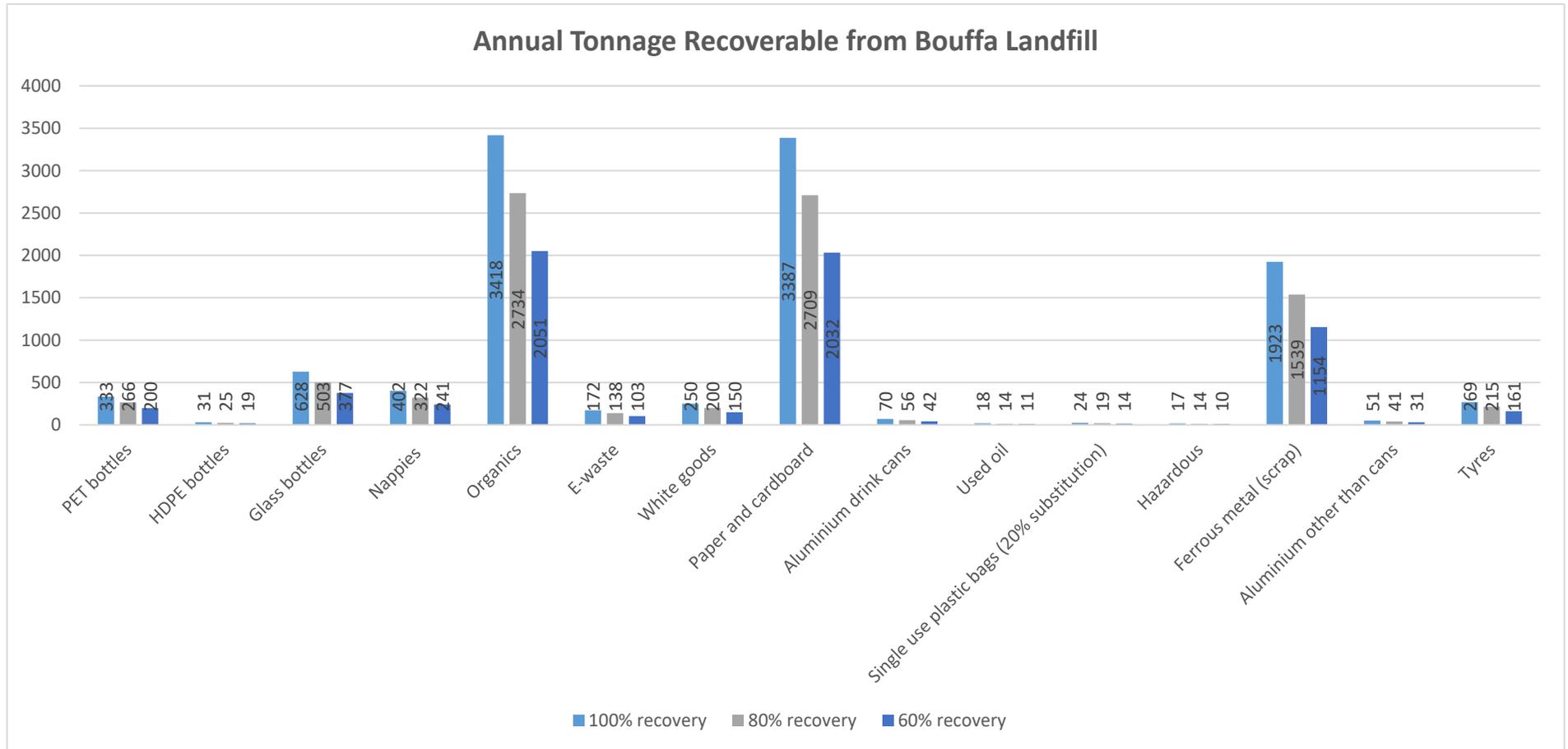


Figure 8: Potentially recoverable material from Bouffa Landfill

Landfill Life Analysis

The footprint of the Bouffa landfill is 48 hectares, but detailed information on the capacity is not available. Based on the limited information available the landfill has significant remaining capacity subject to developing additional filling areas and appropriate management.

Suppose that each cell of the landfill can be filled to a depth of 10m, and the entire 48-hectare footprint can be filled in this manner. These assumptions yield a landfill volume of 4 800 000 m³ volume. The landfill has much more space than this, but it is unclear how much of it can be utilised.

Implementing higher recovery scenarios will extend the life of each stage of the landfill development reducing capital requirements and the need for planning and design for future stages. *Figure 8* above outlines possible airspace reductions at Bouffa landfill based on modelling that assumes recyclable materials are removed from landfill disposal.

These assumptions do not consider other landfill operations matters such as the impact of the use of a cover on available airspace or consolidation over time to improve airspace utilisation.

Assuming Port Vila waste disposal grows by 2% each year on average and is compacted to 600 kg/m³, 530 000 m³ will be occupied already, and with no change to waste management practices 1 000 000 m³ will be occupied by 2036. Based on the modelling assumptions, removing recyclable materials such as paper and cardboard from disposal at the site will reduce landfill utilisation by 39.5%, organic material a further 24.7% and plastic PET materials such as drink, homecare and beauty produce a further 10.1%.

Implementing a CDL scheme that captures plastic (PET and HDPE), glass and metal materials (aluminium cans, other aluminium materials and ferrous metals) could increase the overall landfill utilisation by 22.3%.

Finally, Vanuatu has been seeking alternatives options for the use of single-use nappies, based on the model above removing single-use nappies from landfills will reduce landfill space by 4.1% overall.

Appendix A: Material Categories

	Category	Description	EOL Source	Incoming
Organics	Food	Vegetable/fruit/meat scraps	H, C, L	
	Wood/timber		H, C, L	
	Garden organics	Grass clippings, tree trimmings/pruning, flowers, tree wood (< 20 mm diameter)	H, C, L	
	Other organics	Animal excrement, mixed compostable items, cellophane, kitty litter	H, C, L	
Paper and Cardboard	Cardboard	Cardboard without corrugation (glossy and non-glossy), cereal boxes, business cards	H, C, L	
	LPB	Soy milk cartons, some fruit juice cartons, UHT/long-life milk	H, C, L	
	Composite	Composite paper items for which the weight of the paper is estimated to be greater than the weight of the other materials	H, C, L	
	Paper	Office paper, writing pads, letters, envelopes, books, newspapers, newspaper-like pamphlets, paper, magazines, brochures, wrapping paper, labels, paper packaging (no plastic or wax coating)	H, C, L	
	Soiled paper/cardboard	Dirty paper, paper towel, tissues	H, C, L	
Glass	Glass bottles	Recyclable (all colours) – beer bottles, wine bottles, spirit cider/fruit-based, flavoured water, fruit juice, sports drinks, plain water	H, C, L	Cu, D
	Glass jars	non-beverage containers (all colours) – sauce bottles, jam jars, vegetable oils, other food containers	H, C, L	Cu, D
	Glass fines	Mixed glass or glass fines < 4.75 mm	H, C, L	Cu, D
	Glass other	Plate glass (window and windscreen), Pyrex, mirror glass, Corning ware, light globes, laboratory and medical glass, white opaque glass (e.g. Malibu alcohol bottles)	H, C, L	Cu, D
Metal	Aluminium cans	Alcoholic sodas and spirit-based mixers, beer and soft drink, food cans, pet food cans, aerosols, industrial cans	H, C, L	Cu, D
	Aluminium recyclable	Steel packaging	H, C, L	Cu, D
	Steel containers	Alcoholic sodas and spirit-based mixers, beer, soft drink, food cans, pet food cans, aerosols, industrial cans, clean/empty paint cans	H, C, L	Cu, D
	Metal other	100% ferrous items that do not can/tins/packaging materials, any other steel, beer bottle tops, jar lids, composite ferrous items for which the weight of the ferrous metal is estimated to be greater than the other material items, foils, 100% aluminium items that are not cans/tins/or packaging materials, any other aluminium	H, C, L	Cu, D
Plastic	PET	(Polyethylene) – soft drink, flavoured water, fruit juice, sports drinks, plain water (carbonated/non-carb), food containers, mouthwash containers, detergent bottles	H, C, L	Cu, D
	HDPE	(High-density polyethylene) milk and flavoured milk bottles, bleach bottles, oil containers, food containers	H, C, L	Cu, D
	PVC	(Polyvinyl chloride) clear cordial and juice bottles, detergent bottles	H, C, L	Cu, D
	LDPE	(Low-density polyethylene) squeeze bottles	H, C, L	Cu, D
	PP	Bottles and containers	H, C, L	Cu, D
	EPS	Yoghurt and dairy containers, vending cups, clam shells	H, C, L	Cu, D
	PS	Meat and poultry trays, vending cups, fragile-item packaging	H, C, L	Cu, D
	Other plastic		H, C, L	Cu, D

	Category	Description	EOL Source	Incoming
Single-use plastic items	Flexibles/film	No shopping bags, just chip packets and other MLM packaging	H, C, L	Cu, D
	Cigarette butts		H, C, L	Cu, D
	Cigarette packets		H, C, L	Cu, D
	Straws		H, C, L	Cu, D
	Cutlery			
	Coffee cups		H, C, L	Cu, D
	Bags – heavy, glossy typically branded carry bags		H, C, L	Cu, D
	Bags – supermarket-type light-weight carry bags		H, C, L	Cu, D
	Takeaway containers plastic other than EPS		H, C, L	Cu, D
	Takeaway containers styrofoam		H, C, L	Cu, D
	Takeaway containers paper		H, C, L	Cu, D
	Takeaway container lids		H, C, L	Cu, D
	Bottle lids		H, C, L	
Hygiene	Feminine hygiene	Used disposable feminine hygiene products	H, C, L	
	Pharmaceutical		H, C, L	
	Nappies	Used disposable nappies/diapers	H, C, L	
	Other sanitary waste		H, C, L	
Hazardous	Paint	Containers containing paint (dry or wet)	H, C, L	
	Fluorescent tubes	Fluorescent tubes; compact fluorescent lamps (CFLs)	H, C, L	
	Household chemicals	Containers containing bleach, cleaning products, unused medical pills	H, C, L	
	Asbestos	Asbestos and asbestos-containing products or building materials	H, C, L	
	Clinical (medical)	Sharps, human tissue, bulk bodily fluids and blood, any blood-stained disposable material or equipment	H, C, L	
	Gas bottles	Gas bottles	H, C, L	
	Mercury	Mercury used in medical applications	H, C, L	Ministry of Health, hospitals
	Hazardous other	Any other hazardous material	H, C, L	
E-Waste	Computer equipment	Keyboard, monitor, hard drives, printers, etc.	H, C, L	Cu, D
	TVs	TVs	H, C, L	Cu, D
	Mobile phones	Mobile phones, phones, pads, charges, car kits, Bluetooth	H, C, L	Cu, D
	Electrical items & peripherals	Radio, iPod, Gameboys, stereos, speakers, VCR, DVD players, power tools, wiring and cables, small electrical items (toaster, blender, etc.), computer discs, cassettes, DVDs, CDs	H, C, L	Cu, D
	Toner cartridges	Printer and toner cartridges	H, C, L	Cu, D
Batteries	Non-rechargeable batteries	Common batteries, AAA, AA, etc. single-use	H, C, L	
	Rechargeable Batteries	Common batteries (rechargeable), AAA, AA, etc. rechargeable	H, C, L	
	Lead-acid batteries	Large batteries used in vehicles or other machinery	H, C, L	Cu, D

Category	Description	EOL Source	Incoming	
	Mobile phone batteries	Batteries used in mobile phones	H, C, L	Cu, D
	Power tool batteries	Batteries used in power tools	H, C, L	
	Lithium batteries	Small lithium batteries	H, C, L	
	Lithium ion batteries	Batteries used in electric cars	H, C, L	Cu, D
	Other batteries	All other battery types	H, C, L	Cu, D
Fishing	Fishing/seafood, metal	Fishing equipment made of metal	H, C, L	
	Fishing/seafood, plastic	Fishing equipment made of plastic	H, C, L	
	Fishing/seafood, wood	Fishing equipment made of wood	H, C, L	
Other	Textiles	Wool, cotton and natural fibre materials	H, C, L	
	White goods		H, C, L	Cu, D
	Ceramics		H, C, L	
	Faeces			
	Containerised used oil		H, C, L	Cu, Retail
	EOL renewable energy equip	Includes EOL solar panels	H, C, L	Cu, Power company, installers
	End-of-life vehicles		H, C, L	Cu
	Tyres		H, C, L	Cu
	Other			



