THE WASTE AMOUNT & COMPOSITION SURVEY (WACS)

For the Japanese Technical Cooperation Project for Promotion of Regional Initiative on Solid Waste Management in Pacific Island Countries Phase 2

- Final Issue
- May, 2022

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STRATEGIC CONSULTANTS IN PLANNING & ENGINEERING

Kokusai Kogyo Company Limited

WASTE AMOUNT & COMPOSITION SURVEY – SUVA & LAUTOKA

- Final Issue
- MAY 2022

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Key Personnel Involved in the Preparation of The Waste & Composition Survey

- *Table 0-1 WACS Team*

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1. Introduction

1.1. Background & Statement of Need

Kokusai Kogyo Company Limited (KKCL), the client, has engaged SCOPE Pacific (SPL) to conduct the Waste & Composition Survey (WACS) as part of The Japanese Technical Cooperation Project for Promotion of Regional Initiative on Solid Waste Management in Pacific Island Countries Phase 2.

The extent of our investigations included the following:

- pre-survey questionnaire to collect basic household data, concerns and perceived disposal patterns.
- Waste collection, segregation & weighing
- Data analysis

The purpose of the study was to obtain household solid waste data of present amount and composition from participants in the two cities in The Republic of Fiji Islands - Suva and Lautoka. The results of the survey are to be used by the client to understand the waste flows in both Suva and Lautoka; and to use as a nationwide baseline for household solid waste flows.

2. Scope of Works

The scope of work required under this engagement included appropriate selection of 50 households in each city for voluntary participation in establishing a baseline for household solid waste flows – split equally for urban and peri-urban areas. Daily collections of household waste samples were required over a seven (7) consecutive day period, the categorizing and weighing of waste collections, and analysis of recorded data and reporting.

2.1. Methodology

2.1.1. Selection of Households & Pre-Survey

The areas that were part of the study for the baseline survey were selected in consultations with the client and respective city councils. The selected sampling units were administered pre-survey questionnaires to gather basic information about their households and perception on their waste disposal patterns. The households were asked to store daily waste generated for a period of seven days (one week) and the collection days within the scheduled Waste & Composition Survey period were agreed upon with the respondents. The majority of the participating households were acceptable to providing waste bags on a daily basis whilst a few opted for collections every other day. The enumerators requested that should respondents not be in a position to provide a waste bag on any one morning, that a new waste bag be used each morning during the survey so as not to affect the data that was collected to capture waste flows on a daily basis. The pre-survey questionnaire details are annexed as **Appendix A: Household Survey Questionnaire**.

Details of selected areas are provided below:-

- *Table 2-1 List of areas that participated in the Waste Amount & Composition Survey – Suva City*

Suva City		
Survey Area	**Urban / Peri-Urban**	**Total No. of Households**
Central / Flagstaff / Raiwaqa	Urban	6
Nasese	Urban	2
Samabula / Nabua	Urban	13
Tamavua	Urban	4
Tacirua Heights	Peri-Urban	25

Initial surveys for the Suva area were conducted on 6th April 2022 – 7th April 2022 (Wednesday and Thursday) in the areas provided in Table 2-1. Additional households were also included in the survey for both urban and peri-urban areas as a margin for error. The scheduled date to commence collections for the waste survey was Saturday, 9th April 2022. The Garbage Collection Schedules provided by Suva City Council (SCC) were reviewed and households in areas that did not have scheduled collections one day prior to the commencement of the waste collections participated in an initial collection of household solid waste to ensure that collections from Day 1 (9th April 2022) were for a one-day cycle only of household solid wastes.

- *Table 2-2 List of areas that participated in the Waste Amount & Composition Survey – Lautoka City*

Lautoka City		
Survey Area	**Urban / Peri-Urban**	**Total # of Households**
Waiyavi	Urban	6
Simla	Urban	6
Tavakubu	Urban	6
Veitari	Urban	7
Varamoli Settlement	Peri-Urban	4
Tomuka Settlement	Peri-Urban	4
Tavakubu Village	Peri-Urban	2
Field 4 Settlement	Peri-Urban	3
Tavakubu Unsubdivided	Peri-Urban	3
Natabua Settlement	Peri-Urban	3
Koroipita Housing	Peri-Urban	3
Lovu Hart	Peri-Urban	3

Initial surveys for the Lautoka area were conducted on 23rd April 2022 – 24th April 2022 (Saturday and Sunday) in the areas provided in *Table 2-2*. Additional households were also included in the survey for both urban and peri-urban areas as a margin for error. All participating households were requested to use the coded waste bags provided from the morning of 25th April 2022 (Monday) for collections from 26th April 2022 (Tuesday). Participants were also requested to keep separate any prior waste for councils usual collections, as including this would interfere with the data requirements for the study.

Figure 2-1 Household WACS Participant during pre-survey & waste bag distribution

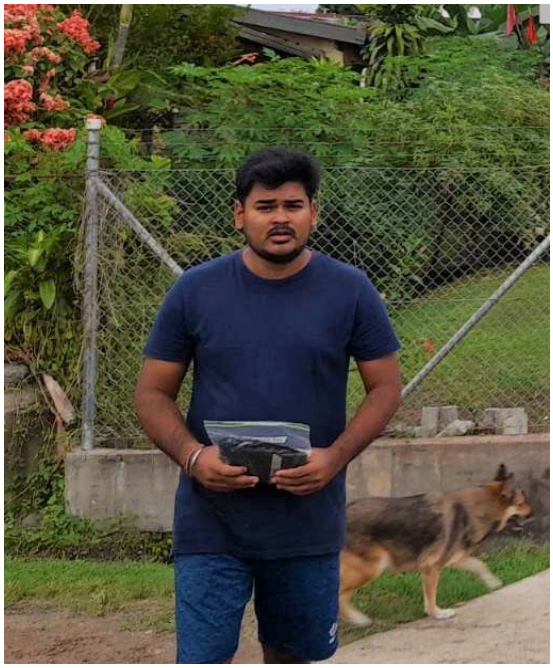
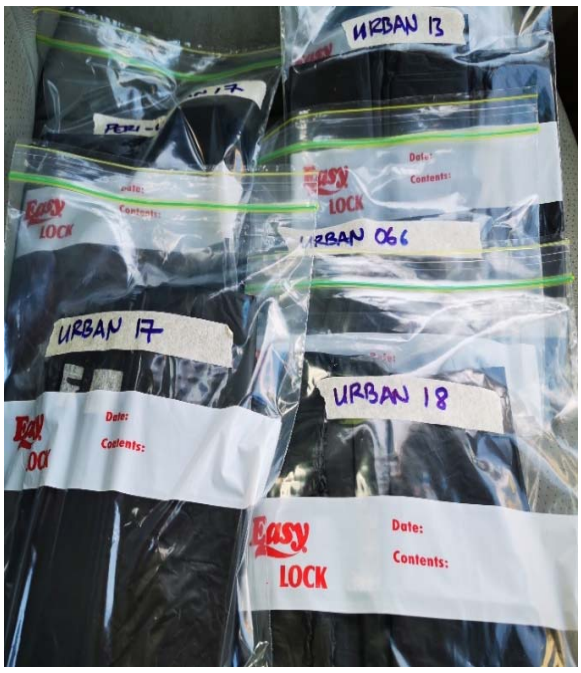


Figure 2-2 Coded Waste Bags Distributed to Participants



2.1.2. Waste Collection

Waste collections in each city were conducted over 7 consecutive days with pick up points for coded waste bags being arranged during pre-survey.

The Suva waste collections were conducted from 9th April 2022 – 15th April 2022. Two teams were dispatched for collections to cover the urban area and peri-urban area respectively prior to peak traffic and council collections. The collections were conducted between 6am and 7am each morning. The final day of waste collections coincided with the National Holiday – Good Friday (15th April 2022). Given that collections were conducted early in the morning of the National Holiday, little to no significant change in waste generation was envisaged for the final day of collections. See **Appendix B: Locality Maps for Suva Urban Survey** and **Appendix C: Locality Maps for Suva Peri-Urban Survey**

The Lautoka waste collections were conducted from 26th April 2022 – 2nd May 2022. Two teams were dispatched for collections to cover the urban area and peri-urban areas respectively. Peri-Urban collections commenced from 6am and continued to 8.30am whilst Urban collections were from 8am to 9.30 am for the convenience and at the request of participating households. See **Appendix D: Locality Maps for Lautoka Urban Survey** and **Appendix E: Locality Maps for Lautoka Peri-Urban Survey**

Figure 2-3 Waste Surveyor (Ueteri) with Household WACS Participant during Waste Collections

2.1.3. Segregation & Weighing

Following each daily collection of coded waste bags which were unique to each participating household - The segregation and weighing exercises were conducted at compost yards at the Participants respective cities. Given that the results of this survey are to be used to understand the waste flows in the two cities and to contribute to baseline data for Fiji, the waste separation and weighing for this study was conducted at household level at daily intervals. This was to allow for further analysis by the client if necessary into the relationship between factors such as household size and general make up, and demographic factors that could affect the waste output. The sixteen major categories that waste was segregated to are as follows:

- *Table 2-3 Waste Categories for Segregation and Weighing*

WASTE CATEGORIES	Green	Plastic Bags	Glass	Other metal
	Food Scrap	PET Bottles	Ceramic	Textile
	Paper	Plastic Containers	Steel	Rubber
	Cardboard	Diaper	Aluminium	Others

Prior to the onset of weighing of segregated waste at household level, each container was weighed and the same was recorded. The segregated waste for each coded waste bag was placed in appropriately sized containers and weighed. The result was entered with the known weight of the container subtracted from each record entry. The digital scale was configured to measure data in grams, initial record entries were completed in grams as well, and later converted to kilograms for further analysis. See **Appendix F: Digital Scale Specifications**

Figure 2-4 Waste Surveyor (Gerrald) categorizing waste bag contents at Household Level

Figure 2-5 Lami Town Council Rep – Using the Digital Scale to weigh categorized waste

2.1.4. Disposal

Following the segregation and weighing exercise - Waste was rebagged and disposed of for council collection. In Suva, the team disposed of the waste at a nearby skip bin location. For the Lautoka survey, the team contacted the Lautoka City Council (LCC) Land Field Surveyor to arrange garbage collections. For both surveys, disposal of surveyed waste was arranged each day immediately after the exercise was completed.

2.2. Waste Composition Analysis

The results of the pre-survey provide us with some understanding on the participants perception on methods of diverted waste flows, waste management behavioral patterns and existing issues with current disposal systems.

Pre-survey results reveal that all **Suva** participants dispose of general collections through council scheduled collections. Households disposed of compostable materials (greens) through mixed habits of composting and council collections. Only 8% of respondents confirmed that greens are also burned, this would generally refer to garden waste / trimmings. The majority of respondents confirmed that recyclables are generally disposed of with council collections (94%) with only about a third of participants (34%) also confirming that some recyclable materials are also re-used but are eventually disposed of through council collections. Generally, recyclable

materials that are reused would include a mixture of bags, bottles, containers & jars, aluminium trays and cardboard boxes. The majority of recyclable material generally wears out over time and is disposed of by the participants at a later date. The perceived waste management patterns of the 50 Participants for the Suva study are tabulated below:

- *Table 2-4 Summary Features of Participants Waste Disposal Habits - Perceived Waste Management Patterns (%) - SUVA*

	Waste Disposal Method						
Category	**Council Collection**	**Compost**	**Re-use**	**Burn**	**Bury**	**Other Collection**	**Animal Feed / Others**
General	100%	0%	0%	0%	0%	0%	0%
Greens	62%	62%	0%	8%	0%	0%	0%
Recyclables	94%	0%	34%	0%	0%	0%	0%
Others	96%	0%	0%	0%	0%	8%	14%

The majority of surveyed Households (94%) in the **Lautoka** area confirmed that all forms of waste were disposed of through council arranged collections. Only 6% of respondents confirmed not having access to council collections at all but had access to disposing waste through a structured community organized waste disposal system. A further 4% also confirmed burying general waste products. Whilst council collections under each category are high, majority of the participants also confirmed that composting (90%) and re-using (94%) recyclable materials were a general habit. Also revealed during the survey was that 40% of respondents also used other methods of waste collections – in reference to Bottle Collections (for locally packaged alcoholic beverages in glass bottles). This is common with households in communities with generally low to mid-range standards of living in the country.

- *Table 2-5 Summary Features of Participants Waste Disposal - Perceived Waste Management Patterns (%) - LAUTOKA*

	Waste Disposal Method						
Category	**Council Collection**	**Compost**	**Re-use**	**Burn**	**Bury**	**Other Collection**	**Animal Feed / Others**
General	94%	0%	0%	0%	4%	6%	0%
Greens	94%	90%	0%	32%	0%	0%	0%
Recyclables	94%	0%	94%	8%	0%	0%	0%
Others	94%	0%	0%	0%	0%	40%	12%

Below is a table presenting the Typical Components of Discharged Waste per Category as identified during the Waste & Composition Survey in both cities. The waste descriptions provided are generalized and does not constitute as an inventory of all waste products that were sorted or weighed during this assignment.

- *Table 2-6 Typical Components of Discharged Waste per Category in Suva & Lautoka*

Category	Description
Green	Vegetables, fruits, vegetable and fruit peelings / shells / husk, plants, trimmings / garden waste, and other cut offs from plant-based foods and medicine
Food Scrap	Food waste, bones, egg shells, expired products (removed from packaging)

Paper	Books, paper sheets, stickers & labels, small sachets, paperbags, newsprint
Cardboard	Boxes, cigarette packets, used toilet paper / paper towel rolls, milk & other food and beverage cartons, shoe boxes
Plastic Bags	Plastic bags, plastic sheets
PET Bottles	Bottles of mineral water, soft drinks, bottle caps
Plastic Containers	Plastic cups, Food / Beverage plastic containers, broken basins / buckets, syringe
Diaper	Disposable baby / adult diapers, sanitary pads
Glass	Used liqour & soft drink, used / damaged glass jars and containers
Ceramic	Broken dishes, ornaments
Steel	Damaged kitchen utensil
Aluminium	Foil Tray, Foil, drink cans (typically for soft drinks / alchohol)
Other metal	Tinned food containers, other metals
Textile	Old clothes, socks, rags, cloth shopping bags
Rubber	Shoe sole, stationery
Others	Light bulbs, used lighters, spray cans, batteries, wood scrap and miscellaneous items

The **Suva** Survey featured 343 waste bag samples over the 7-day period, with 7 instances over the sampling week whereby random households did not generate disposable solid waste for collections in a one-day cycle. Of the 50 participating households, a total occupancy between the urban and peri-urban areas were 232 with waste disposal of 797.63 kg over the week. Based on the data collected, the Waste Generation Rate for Suva study is 3.9 kilograms weekly or 557 grams per day (*per individual*). The study also revealed that a large part of these wastes fall into two major categories – Greens & Food Scrap, making up 58% of total disposed waste. Over 21% was attributed specifically to greens or compostable material. Several of the waste categories may identify as potentially recyclable material – *Paper, Cardboard, Plastic Bags, PET Bottles, Plastic Containers, Glass, Ceramic, Steel, Aluminium & Other Metals*. Potentially Recyclable Materials as identified above contributed to just over 30% of the solid waste disposal during the study at a rate of 170 grams per person / day. The highest total waste outputs were found on Monday morning (156kg) & Saturday morning (148kg) well above the weeks daily average of 113 kilograms.

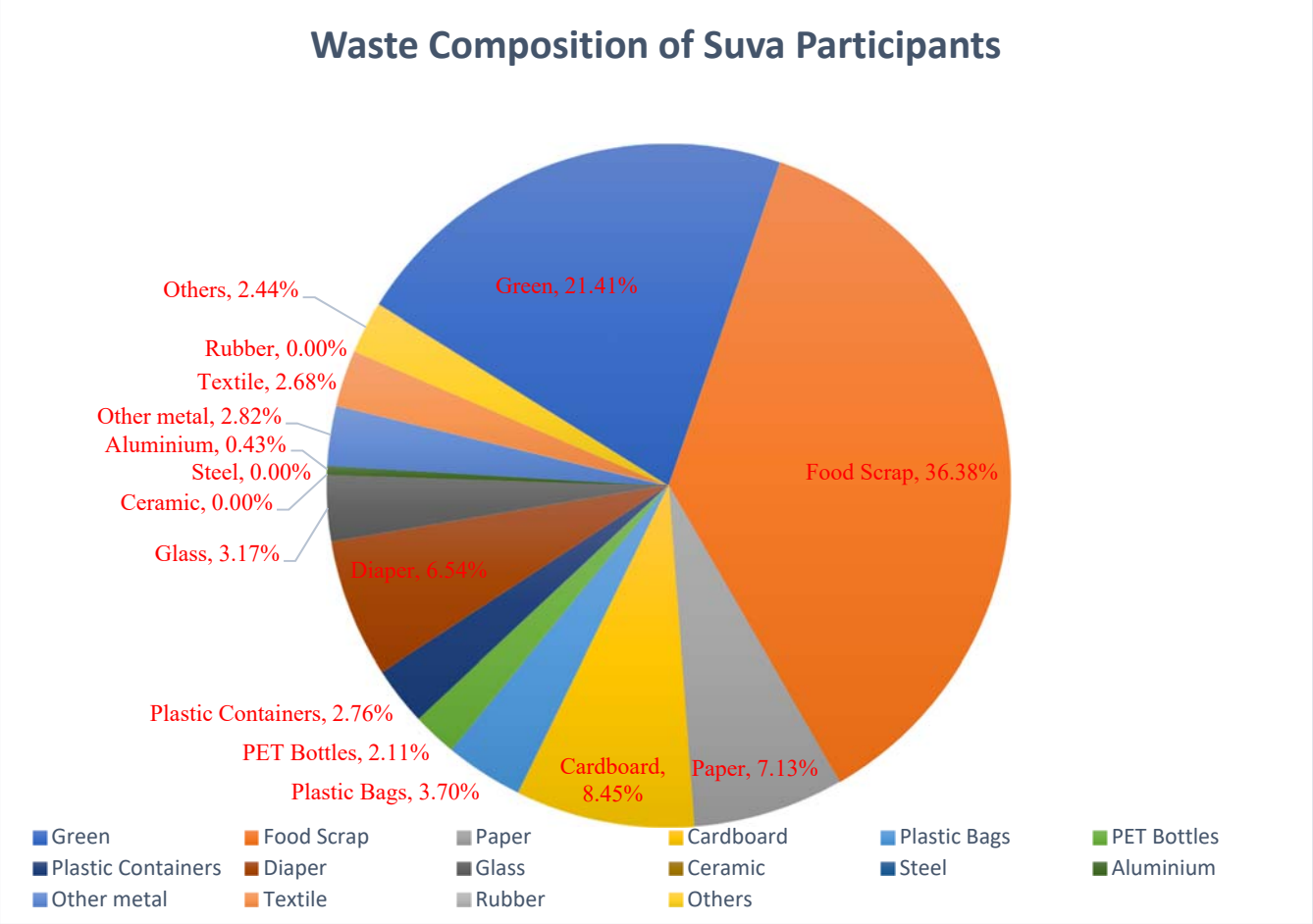
- *Table 2-7 Discharged Waste Amount & Composition of Suva Survey Participants*

Waste Categories	Saturday Day 1	Sunday Day 2	Monday Day 3	Tuesday Day 4	Wednesday Day 5	Thursday Day 6	Friday Day 7	Total Sum (Kg)
Green	28.75	8.41	26.79	29.16	33.95	19.93	23.74	170.74
Food Scrap	41.43	38.15	83.66	35.26	33.02	29.40	29.26	290.16
Paper	13.19	5.43	8.90	9.08	6.66	9.09	4.53	56.87
Cardboard	10.53	9.47	10.27	10.02	9.31	10.18	7.61	67.38
Plastic Bags	4.18	4.33	3.59	4.47	4.72	5.12	3.06	29.48
PET Bottles	4.31	2.97	1.90	1.77	3.06	1.50	1.31	16.82

Plastic Containers	6.78	2.85	2.55	3.11	3.08	2.62	1.01	21.99
Diaper	9.96	5.59	6.37	7.96	7.29	7.03	7.96	52.15
Glass	6.08	3.35	4.04	2.88	4.02	2.64	2.27	25.28
Ceramic	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Steel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aluminium	1.84	0.48	0.10	0.12	0.09	0.07	0.75	3.44
Other metal	4.62	2.97	2.15	4.54	5.29	0.00	2.95	22.52
Textile	5.83	3.70	4.16	2.24	2.24	2.34	0.84	21.35
Rubber	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Others	10.58	0.96	1.36	1.20	1.70	2.47	1.17	19.43
Total	**148.08**	**88.64**	**155.83**	**111.80**	**114.43**	**92.38**	**86.46**	**797.63**

It was further observed during the Suva Survey that there was a general behaviour of uncontrolled waste dumping in a few categories. Some examples include food and green wastage (not specifically scrap) to a larger scale, and on the lesser note - textile and plastic products such as clothing, and shopping bags that were not intended for single-use.

Figure 2-6 Visual Representation of Discharged Waste Amount (%) & Composition of Suva Survey Participants



Concerns raised by Suva participants regarding council collections were that the number of collections per week were not reasonable for the waste discharge in the area, particularly in Tacirua Heights (Peri-Urban centre). This would result in spillage in overloaded common garbage trays. There were also concerns raised with the collection of white goods whereby no publicly issued schedule is being provided, collection times being either too early (resulting in garbage not being taken out in time by households). Or too late, causing a foul-smell along the road side. These concerns with the overall schedule were revealed by 26% of the respondents. Eight percent (8%) of complainants were not happy with the council not collecting loose bottles, garbage stored in cartons and the use of property frontage as a collection & pick-up point for the garbage in the area. Another comment raised by 10% of Suva participants was that there was no option available for waste if segregated. Poor handling of bins by collectors and animals tearing garbage bags were also raised during the survey.

The **Lautoka** survey consisted of 347 waste samples provided over the 7 day survey period with 3 instances of no solid waste disposal over a one day cycle amongst the 50 participating households. The total generated waste was over 583.34 kilograms for a population of 296 individuals residing in the participating homes. The waste generation rate for Lautoka is 326 grams per person per day. The largest contributor for waste in Lautoka were Greens which was approximately 39% of the total waste disposal. Several of the waste categories may identify as potentially recyclable material – *Paper, Cardboard, Plastic Bags, PET Bottles, Plastic Containers, Glass, Ceramic, Steel,*

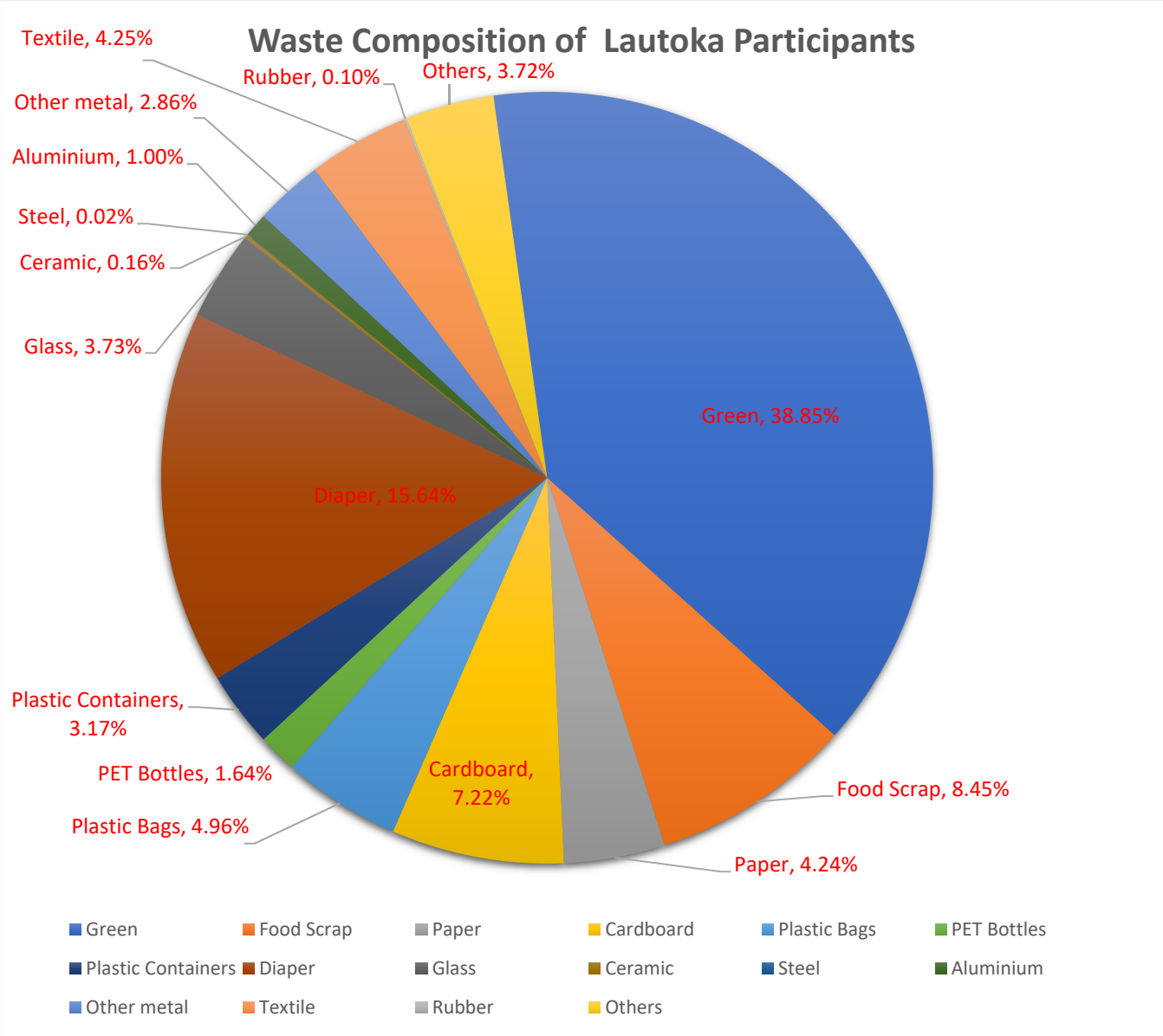
Aluminium & Other Metals. Potentially Recyclable Materials as identified above contributed to just over 29% of the solid waste disposal during the study at a rate of 96 grams per person / day.

- *Table 2-8 Discharged Waste Amount & Composition of Lautoka Survey Participants*

Waste Categories	Tuesday Day 1	Wednesday Day 2	Thursday Day 3	Friday Day 4	Saturday Day 5	Sunday Day 6	Monday Day 7	Total Sum (Kg)
Green	49.19	28.97	28.55	26.12	24.53	29.93	39.76	227.04
Food Scrap	12.61	12.30	6.26	4.05	6.98	4.10	3.05	49.35
Paper	3.07	4.59	2.87	5.20	1.95	4.86	2.21	24.75
Cardboard	7.64	8.61	3.95	6.63	5.38	5.95	4.06	41.20
Plastic Bags	6.62	5.27	4.65	4.11	3.07	2.83	2.46	29.01
PET Bottles	2.02	1.05	1.26	1.63	1.33	1.13	1.15	9.57
Plastic Containers	2.95	2.30	2.11	1.75	2.16	3.38	3.88	18.53
Diaper	17.01	16.60	12.67	10.22	10.08	16.27	8.54	91.39
Glass	1.96	4.23	3.53	1.54	1.33	5.95	3.27	21.80
Ceramic	0.00	0.00	0.78	0.00	0.12	0.06	0.00	0.96
Steel	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10
Aluminium	0.83	1.92	1.12	0.21	0.33	0.41	1.03	5.84
Other metal	2.23	2.95	2.25	2.39	1.62	3.87	1.39	16.70
Textile	6.86	4.82	3.56	3.24	2.71	1.87	1.77	24.83
Rubber	0.00	0.49	0.00	0.00	0.00	0.00	0.07	0.56
Others	2.34	1.92	4.42	8.73	0.80	2.19	1.31	21.72
Total	**115.33**	**96.03**	**77.97**	**75.81**	**62.40**	**82.78**	**74.04**	**584.36**

It was observed during the study that most of the areas for which households were selected for survey in Lautoka were characterized by generally lower living standards in Villages, Informal Settlements and communities available only to vulnerable families. Evidently, organic or plant-based foods such as root crop peelings, coconut shells and taro stems were more prominent. Medicinal plants also contributed to the waste disposed and categorized as greens. Other contributing factors such as lesser access to waste generating goods through consumer spending, an average occupancy of about 5 residents per household with an employment rate of only 31% could further substantiate high green waste discharge (39%) as opposed to general food scrap which only contributed to < 9% of total waste.

Figure 2-7 Visual Representation of Discharged Waste Amount (%) & Composition of Lautoka Survey Participants



The key concerns highlighted by participating households during the Lautoka survey regarding the existing waste disposal system included a general dissatisfaction with the schedule for council collections (42%). The majority of those raising this concern suggested that the council collections were inconsistent with collection times which were ranging anywhere between early morning and mid-afternoon. Other comments on schedule included none to low weekly council arranged collections and additional charges for white good collections just prior to a popular festive period. Other concerns raised were to do with poor handling of bins resulting in damage to personal property; and animals tearing garbage bags. It is noted that 54% of respondents confirmed that they do not have proper waste

storage such as bins or garbage trays for council collections, but use either garbage bags or cardboard boxes as main modes of storage for collections.

3. Conclusions

This Waste Amount & Composition Survey (WACS) report presents the results of a baseline study conducted in Suva and Lautoka presenting weight and category of disposed waste based on data collected over 7 consecutive days in each city with 50 households each – split equally between the urban and peri-urban center. An analysis of the data was conducted and will be used by the client to prepare a baseline for nation-wide solid waste flows and the promotion of a regional initiative on solid waste management in Pacific Island Countries.

Summarized below in **Table 3-1** are details acquired during the survey from which the waste generation rate was determined and outlined in **Section 2.2**. The Suva Total Waste Disposal was higher regardless of the total surveyed population being relatively lower then Lautoka. Suva households generally having more urbanized living standard as opposed to Lautoka is a contributing factor towards waste disposal habits. The average daily waste generation for the survey in the two cities was 197kg for the 100 participating households. The Waste Generation Rate for the study was calculated at 429 grams per person per day. Adjustments to total population in terms of waste generation were made to take into account age groups less then 10 years and greater then 70 years old. These age ranges were calculated at 50% (of person) for the purpose of determining the daily Waste Generation Rate per person.

- *Table 3-1 Comparable Statistics between Suva & Lautoka for Waste Generation*

WASTE GENERATION RATE	SUVA	LAUTOKA	TOTAL
Collected Amount per week	798 kg	584 kg	1,382 kg
Average per day	114 kg	83 kg	197 kg
Number of Participated Households	50	50	100
Number of People Participated	*232*	*296*	*528*
Number of People Participated regards to waste generation *	204.5	256.0	460.5
Waste Generation Rate per day (g/person/day)	**557**	**326**	**429**

** To determine waste generation, it is assumed that age ranges <10 & > 70 are 0.5 of person*

The Waste Composition Rate Findings between Suva and Lautoka are presented below. It can be concluded that the majority of waste generated between the two cities is attributed to food consumption (>50%) in the categories of Greens and Food Scrap, with the balance being spread amongst the other 14 categories.

- *Table 3-2 Comparable Findings between Suva & Lautoka for Waste Composition*

WASTE COMPOSITION RATE	SUVA	LAUTOKA	TOTAL
GREEN	21%	39%	**29%**
FOOD SCRAP	36%	8%	**25%**
PAPER	7%	4%	**6%**
CARDBOARD	8%	7%	**8%**
PLASTIC BAGS	4%	5%	**4%**
PET BOTTLES	2%	2%	**2%**
PLASTIC CONTAINERS	3%	3%	**3%**
DIAPER	7%	16%	**10%**
GLASS	3%	4%	**3%**
CERAMIC	0%	0%	**0%**
STEEL	0%	0%	**0%**
ALUMINIUM	0%	1%	**1%**
OTHER METAL	3%	3%	**3%**
TEXTILE	3%	4%	**3%**
RUBBER	0%	0%	**0%**
OTHERS	2%	4%	**3%**
TOTAL	100%	100%	**100%**

In concluding, it is envisaged that educational programs could assist in better management of solid waste habits at household level – to further improve organic waste diversion and to promote a reduction in food wastage. Solid Waste Planners can use these results and data sets to better target the materials or categories in demographic areas that could contribute to the highest potential for meaningful diversion. Behavior change and participation of the public is key to a well functioning waste management system.