Honiara Waste Characterization Audit Report 2011







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ACRONYMS

HCC	Honiara City Council
ECD	Environment and Conservation Division
MECDM	Ministry of Environment, Climate Change, Disaster Management and Meteorology
EHD	Environmental Health Division
MHMS	Ministry of Health and Medical Services
J_PRISM	Japanese Technical Cooperation Project for Promotion Regional Initiative on Solid Wastes Management in Pacific Island Countries
JICA	Japan International Cooperate Agency
WD	Works Division
SWM	Solid Waste Management
EEZ	Exclusive Economic Zone
SBD	Solomon Islands Dollar
3R's	Reduce, Reuse, Recycle
HIA	High Income Area
MIA	Middle Income Area
LIA	Low Income Area

ABSTRACT

Solomon Islands amongst other Pacific Island countries are faced with a growing concern of developing an effective solid waste management for the past years. With the drive for economic growth and development, the social, health and environmental aspects are usually threatened or poorly managed.

Solid waste management though might be overlooked by the upper authorities in the Government, is a challenging issue for responsible authorities. These includes; poor landfill management, lack of public awareness and poor attitude of people, lack of waste segregation, increasing population growth, poor contractor collection schedules and improper waste receptacles.

With the current National Solid Waste Management Strategy and Action Plan 2009-2014 in place has ensured that this key issue of waste management can be addressed. Since there are no waste management legislation, different Government Ministries and other partner agencies addresses wastes under different existing legislations. This is a gap that currently needs to be addressed amongst the institutional arrangements.

This report therefore describes the current Honiara waste management practices and waste generation both at the household sector and commercial sector in the Solomon Islands that needs to be improved and addressed.

1.0. INTRODUCTION

1.1. BACKGROUND

This report presents the data results of the waste characterization work carried out in the Honiara City as outlined in the NSWM key priority issues which aims to gather data of the current situation of waste management practices and collection systems in Honiara. Report of these findings also aims to characterize solid waste, evaluate potential options for waste minimization through the development of a 3R implementation plan and to build capacity of key stakeholder agencies.

This report was an outcome of a collaborated effort between the Environmental Health Division in the Honiara City Council and the Environment and Conservation Division in the Ministry of Environment, Climate Change, Disaster Management and Meteorology. The findings of this report are based on the field-work conducted by EHD staff in Honiara from the 8th to 21st August 2011 and co-financed by the Honiara City Council and the Ministry of Environment, Climate Change, Disaster Management and Meteorology.

2.0. OVERVIEW OF SOLID WASTE MANAGEMENT IN SOLOMON ISLANDS

2.1. COUNTRY INFORMATION

Solomon Islands are a chain of scattered islands that lies in the Solomon Sea between 5-12 degrees south and 152-163 degrees east in the South west Pacific, East of Papua New Guinea and North west of Vanuatu. See Map 1. Total land area is approximately 28, 896 square kilometers and surrounded by 1.34 million square kilometers of ocean within its 200 nautical miles EEZ. The land area is widespread across the six major islands of Choiseul, Guadalcanal, New Georgia, Makira, Malaita and Santa Isabel. It comprises of some 986 smallers islands including coral atolls of Lord Howe, Sikaiana and Reef islands amongst others.

Major landscape features include high rugged mountains with the highest at 2400 m elevation, expansive fertile plains, active and dormant volcanoes, fringing coral reefs, atolls, major river system, and dense forest and lagoon systems. The major islands are of volcanic origin with igneous and metamorphic core (Kool et al, 2010: 2).

Solomon Islands climate is humid tropical with an annual average temperature of 27 degrees Celsius constant throughout the year. Seasonal cyclones and monsoonal rains are also experienced during the Southern hemisphere summer months. During summer, winds are mostly west to north-westerly and during winter southeast direction.

The most densely populated urban centre in the Solomon Islands is Honiara with a total of 64,609 populations according to the 2009 census data. Urban growth rate of Honiara based on 2009 census is 2.7 % which indicates an increasingly high rural-urban migration each year. This population pressure in the urban centre often poses concern related to social, health and environment such as on water, sanitation, illegal settlements, housing, employment and wastes.

2.2. INSTITUTIONAL ARRANGEMENT

The institutional arrangement of Solid Waste Management outlined in the National Solid Waste Management Strategy. At the National level, the Environmental Health Division (EHD) in the Ministry of Health and Medical Services (MHMS) is responsible for waste management operations. The Environment and Conservation Division (ECD) in the Ministry of Environment, Climate Change, Disaster Management and Meteorology (MECDM) is responsible for the development and implementation of regulations, strategies and policy issues related to waste. The Honiara City Council (HCC) through the Environment Health Division (EHD) and the Works Division (WD) who the Council deals with the operation and management of solid wastes in terms of waste collection and disposal systems.

3.0. PAST AND PRESENT SITUATION OF RANADI LANDFILL

Ranadi landfill is the biggest dumpsite in the Solomon Islands which accepts all types of wastes and is used to dispose domestic, commercial and industrial wastes in Honiara. Hospital wastes is also being disposed in the Landfill after their incineration facility breaks down. Ranadi Landfill is located on reclaimed

land next to a large area of mangrove swamp which is host to some wetland flora and fauna. The total landfill area is approximately 2 hectares.

3.1. Access

The landfill is partly fenced and has neither gate nor gatehouse at the entrance. As such there are no restrictions and anybody or any vehicle can enter into the landfill site at any time. In addition, there is no collection of tipping fee at the site. Recently, this landfill has been improved with access road for vehicles to tip off wastes at a certain area in the landfill before it is covered with soil. The system used at the landfill is push and cover. There are two landfill supervisors which are posted everyday on the site and their responsibility is to direct vehicles where to tip their wastes as well as to carry out the push and cover of wastes in the landfill.

3.2. Odor and Flies

Currently, there is no bad odor and less flies at the site. This is because of improved management through regular application of soil cover. The improved management of the site was made possible through funding assistance by the New Zealand Commonwealth starting in 2007 -2010. At present JICA provided technical assistance for further rehabilitation of the landfill for a semi-anaerobic system in the near future. Under the Japanese Technical Cooperation Project for Promotion of Regional Initiative on Solid Waste Management in Pacific Island Countries (J_PRISM) 2011-2015.

3.3. Segregation on Site

Ranadi landfill is an open dump-site and there is no proper segregation done at the landfill where all the wastes are accepted. Recent dumpsite management has separated bulky wastes such as car bodies to one location of the site as well as green waste at another location. This allows general household and commercial wastes to be tipped in a particular location where it is later pushed and covered. Also medical wastes are usually burned at a designated location on the site, however, there is no proper incineration system for these medical wastes which is hazardous to the human health especially for the scavengers as well as those living around the area.

3.4. Scavengers

Scavengers are still observed on site and some actually reside in the landfill. These scavengers build their shelter from cardboard boxes, plastics and scraps of roofing iron and old drums. According to observations during site visits, scavengers include children, women, youths and men. The scavengers collect different types of materials at the dump site. A number of women say they come to the site purposely to collect food scraps from restaurants to feed their pigs. Others came to collect recyclable materials such as scrap metal, cardboard boxes, aluminum cans, brass, steel and other items of value.

3.5. Fire and Smoke

Emission of smoke is a severe public health nuisance at the landfill. This increases the chemical and physical risks at hand. This is a common scene at the site every day. Sometimes fire is intentionally started

by the scavengers, however most of the time it started by itself. This is possibly caused by methane gases emitted from the pile of wastes at the site which is becoming an issue that needs to be addressed. Recently, with the technical support provided by J_PRISM Project, a proposed measure against fire or smoke at Ranadi was installed with 7 sets of gas venting facility yet to be installed later.

4.0. COLLECTION AND TRANSPORTATION SYSTEM

Honiara City itself produces a significant amount of waste generated from the households, commercial and industrial sectors which are taken to the Ranadi landfill by assigned contractors, individuals or companies. The Works Division of the Honiara City Council is responsible for the waste collection, transportation and disposal of domestic general wastes and commercial wastes. There used to be twelve (12) Honiara refuse collection zones however; this was reduced to ten (10) refuse collection zones. The Council is responsible for six of the zones while the employed contractors looked after the other four zones within the Honiara City. The list of these Honiara refuse collection zones is as listed below in Table 4.1

Table4.1.: Showing the Honiara Refuse Collection Zones

Zone	Place : From	To
1	White River	West Rove
2	Tasahe	Town Ground
3	Lengakiki road	Honiara City Office
4	Vavaya ridge	Mataniko River mouth
5	Tuvaruhu	Kola ridge
6	Church of Melanesia Quarters	Green House Terrace
7	Fulisago	Naha 4
8	SDA Main Church	Kukum SICHE Field
9	Panatina village	Mbaranaba
10	East Panatina	Gold Club Labourline

According to the Honiara City Council, there are two major separate collection systems in Honiara City. The first major collection system is the household wastes carried out by the contractors employed by the council and Works Division of the Honiara City Council. Currently, only four refuse contractors are collecting residential waste and the rest of the zones are taken care of by the Honiara City Council through the Works Division. Past collection schedules usually was on Mondays, Wednesdays and Fridays each week for 12 days in each month. However, it was observed to be irregular. Normally the contractors use a 3 tonne truck or 4 tonne truck for collection purposes.

Another collection system in Honiara is the Trade refuse system of which waste is collected from Business or commercial houses by the Works Division of Honiara City Council upon payment of SBD$30 trade refuse fees. However, some business houses and all industries collect their own wastes. The Works division also collects waste on the main street of Honiara City.

Rural settlements and squatters in and around Honiara City are not included in the Honiara refuse collection zones due to issues of poor access road. Due to this fact, generated wastes are not disposed properly and mini-dump sites are obvious.

4.1. IDENTIFIED ISSUES OF EXISTING WASTE COLLECTION SYSTEMS

Solid Waste Management is an obvious problem in Honiara City and the country as a whole. Currently, the existing system for waste collection is limited to three zones within the town boundary. Honiara has ten (10) refuse collection zones. Six (6) zones has been taken over by the council and four (4) zones still done by the private refuse contractors. The council collects from the street and commercial centers. Due to some constraint based on the waste characterization study or review by George Titiulu from the Honiara City Council, the current issues and attitudes of people towards the existing waste collection system is as summarized. The Honiara City Council identified that the following problems are the main factors that influences poor waste collection service provided within the Honiara City:

4.1.1. Collection Vehicles

Honiara City is experiencing low collection coverage due to shortage of collection vehicles. Currently, HCC has a total of 2 collection vehicles servicing six (6) zones out of a total of 10 zones. The other four (4) zones are contracted to private contractors who often use 3 tonne open trucks for collection. This current practice is still insufficient for the increasing demand of the growing population of Honiara City. In addition, using of 3 tonne open trucks for collection purposes by contractors often result in light wastes such as plastics blown out of the trucks during transportation. Furthermore, mechanical breakdown of collection vehicles often lead to disruption of collection schedule which often causes overflowing of waste bins. During mechanical breakdowns vehicle repair procedures is often very slow.

4.1.2. Collection Containers /Storage (Bins, Skip Bins, Bags)

The most common storage container or receptacle used in Honiara is the 44-gallon drums or 200 liter drums. Most of these types of receptacles do not have lids and therefore when it rains water gets into the drum and it often adds weight to it. These are difficult to move and can be very heavy which makes it difficult for waste collectors to manage. It can also lead to health risks for waste collectors. However, some of these type of receptacles although do not have lids but holes are driven at the bottom to allow water to pass through during rain.

Size and type of waste receptacles for storage are not uniform which means there is no standard size bin used in Honiara City. This is possibly due to no proper receptacle supplier in the country. The current suppliers are the hardware shops however the bins are quite expensive. In addition, non-availability of funds by local council to provide uniform receptacles to resident may be another factor. It is important to note that some houses share drums for waste storage. This usually occurs in areas where houses are very close to each other.

Skip bins also used for breakdown of skip bin vehicles storage at some designated zones resulted in waste accumulation sites, but frequent throughout the city. The skip bin storage is not appropriate because skip vehicles are expensive and difficult to maintain. Also note that according to the Litter Ordinance (2009) at the council, it is the responsibility of individual household to have a collection or storage bins.

4.1.3. Distribution of Collection Points

Distribution of collection points is often irregular in Honiara City. It often depends on the location of houses as well as access road to the area. This causes unclear designation of collection routes. As a result, there is often poor collection point of waste from some residential homes such as illegal and squatter settlements. At the moment, there is no refuse collection in the informal settlements. The reasons are, no access, they do not contribute to council service delivery budget through building permit fees and other licenses.

Current road network does not support efficient waste collection as result collection vehicles cannot access collection points in some areas. In addition, because of the poor road access in some areas, collection points are far from houses. Lack of proper planning of roads contributes a lot to the problem of collection point distribution. The council has a formula for zoning of the city. This formula should now be revised since it is obvious that collection zones are too large for the contractor. As a result the contractor often does not provide efficient and timely service to the area it is serving.

4.1.4. Collection Frequency

Collection frequency is a common issue in the city. Irregular collection is often experienced which is often due to a number of reason. For instance, breakdown of collection vehicles, collection vehicle drivers do not follow the schedule of collection designated routes. As a result wastes are overflowing from waste bins.

4.1.5. Collection Time

The time for waste collection is vital in maintaining the frequency and prevent accumulation of the waste been produced. There is no collection time schedule followed by contracted contractors in Honiara. It is also obvious that collection time cannot be followed since collection frequency is already irregular waste collection.

4.2. SUGGESTION FOR IMPROVEMENT

4.2.1. Capacity Building

There is a need to increase capacity in terms of refuse collection vehicles and man power.

4.2.2. Improved refuse collection schedule

Tangible refuse collection schedule needs to be improved for the staff at Works Division and Contractors doing the collection service to maintain.

4.2.3. Awareness

Awareness is one of the important strategies to communicate with the public about issues relating to solid waste management and the different collection systems in Honiara. Over the past years, the Environment

Health Division of the Honiara City Council has been conducting a lot of awareness but to not prevail due to the poor waste discharge manner of some people who dispose waste everywhere due to lack of knowledge or just have bad habits. The time difference between discharge and collection should also be communicated to residents and commercials areas of the expected collection time. This is to avoid delays to collect wastes in other areas not covered during the day.

Some residences that is not aware of collection times or do not have collection containers throw their garbage on illegal mini dump sites for example Bahai area or Kukum seafront. Industries and business sectors do not often practice very little awareness of waste minimization with customers. Public are also ignorant on environmental issues such as this and this may also be due to the ad-hoc awareness programme on solid waste management.

At the dump site, scavengers usually disturb the daily waste inside the landfill looking for valuable items. This group of people needs to be informed of the dangers of residing within the landfill area as well as to train them to manage the site. Overall, the level of environmental education on waste collection for most people is very low.

4.2.4. Enforcement of Litter Ordinance

Existing litter ordinance need to be enforced.

4.2.5. SEGREGATION AND 3R's

All wastes tipped off at the landfill are not segregated. Although some of the households or commercial areas may have done segregation in their workplace, these wastes are tipped off at the landfill where it all gets thrown in one area with other different wastes. This poor or no source segregation of waste is also one of the areas that needs to be addressed in order to reduce the amount of waste disposed at the landfill. Generally all wastes both bulky and electronic goods go to the final disposal site at the landfill without any form of treatment. Moreover, recyclable wastes are not fully recycled due to not enough recycling facilities in the country and less composting is done at source. Therefore, waste segregation is a vital key to waste reduction in Honiara. Past studies showed that organic waste is about 64.4% and other inorganic materials are highly recyclable.

4.2.6. FINANCE

The current Honiara Refuse collection zones are very large areas for the Contractors or the Council to cover and should now be revised as there are not enough collection vehicles to carry out the task or finance to contracted contractors annually. Lack of finance have also resulted in the size and type of waste receptacles for storage are not uniform and some are too big or heavy to be lifted such as the skip bins which requires another vehicle with the machine to do the task. Due to this lack of enough financial support within the various solid waste management unit results in not enough stock of the waste receptacles. Environment Health Division only become supportive through availing waste receptacles for SBD $30.00 during waste storage promotions.

4.2.7. TRAINING

Designated collection route in residential areas are clear but require training and close supervision of crews doing the collection. The definition of waste collection services is not well clarified by the local authority to the residents and the workers. Irregular waste collection schedules and wastes left uncollected for longer period of time are due to lack of training by crews. And this lack of technical training in waste collection and transportation may also be due to lack of financial and political support. Currently, those operating the waste vehicles or trucks and those operating the landfill machines are not provided with sufficient training. If sufficient training involving these people, might change their mindset of solid waste management and build their capacity in such field of work.

4.2.8. POLITICAL

Pre-urban rural dwellers in and around town boundaries waste are not collected because of the location outside of the town boundary. Normally Environmental development does not get support or sometimes really delays activities from related department by the Political interference. Illegal developments by settlers are also not controlled. Non-availability of funds by the local council to provide uniform receptacles to resident is also not fully supported by the Government which often results in different size and types of waste receptacles being used by residences in Honiara.

5.0. INTERMEDIATE TREATMENT AND FINAL WASTE DISPOSAL

5.1. OPEN BURNING

In Honiara and mostly practiced by many Solomon Islanders, the most common method of immediate treatment and final disposal of waste amount whether in the residential and commercial areas is open burning. This open burning can be observed within the city centre and outskirts of the town center as people try to get rid of the amount of waste generated at source. Currently, there is no proper incineration.

5.2. SHREDDING

There is currently no data record of commercial and industrial business sectors practicing shredding. However, it is done at smaller scales in few business offices and government ministries.

5.3. SEPARATION / SEGREGATION

Segregation is done but at smaller scale in some business offices, government ministries, household residences and Non-Governmental Organizations in Honiara and in the provinces.

5.4. COMPOSTING

There are some Non-Governmental Organizations that are encouraging composting. At the household level, most people just throw away organics beside the house on Banana trees suckers while others may

have just throw away the organic wastes in the garbage bins that can contribute to bad odor and attracting flies and rats.

5.5. FINAL WASTE DISPOSAL

All the wastes generated in Honiara are disposed off at the Ranadi Landfill. These wastes are not segregated and every day the amount will have built up if the scavengers at the dump site have not collected some of the cost-benefit items. In a study by Sinclair in 1999, it was discovered that a major component of the waste tipped off at the landfill is organic wastes which contributed to the bad odor had the site not been improved.

6.0. WASTE GENERATION

6.1. EXISTING WASTE GENERATION

A survey which focuses on solid waste stream in households was conducted in Honiara in 1990. From the results of the survey, the waste composition in Honiara at the time of study is as indicated in the given table 6.1.1

Table 6.1.1: Waste Composition in Honiara in respective years

Category of Waste	1990	1999	2009	2009	2011	2011
Vegetables/Putrescibles	64.6	16.7	41.4	94.4	50.43	43.72
Paper/Cardboards	5.8	2.2	6.8	2.3	6.59	28.35
Textiles	1.8	0.1	3.1	0.1	2.86	1.35
Plastics	16.8	3.9	18.5	1.7	11.58	11.81
Grass/leaves	0	0	0	0	1.08	0.57
Leather/Rubber	0	0	2.3	0	0.55	0.32
Metals	6.1	8.2	7.9	1.3	0.13	0
Glass/Ceramic	4.5	1.9	4.6	0	1.1	0.32
Wood	0	0	0	0	0.22	0
Tin	0	0	0	0	6.58	5.54
Bettlenut husk	0	0	0	0	1.12	0.24
PET Bottles	0	0	0	0	7.88	2.31
Aluminum cans	0	0	0.8	0	2.22	2.15
Diapers	0	0	7.7	0	5.71	0
Sanitary pads	0	0		0	1.14	1.03
Electrical equipment/parts	0	0	0.5	0	0.11	0
Shells	0	0	4.4	0	0.44	1.59
Bones	0	0.7	0	0	0	0
Potentially /Hazardous	0.1	0	1	0	0	0.02
Construction/Demolition	0.1	0	1	0	0	0
Miscellaneous /others	0	66.3	0	0.2	0	0.68

Keys: - glass only - papers only - diapers& sanitary pads is 7.7%

-Domestic waste Market waste Commercial waste Battery

Based on Sinclair's study in 1999 of waste collected in the municipal collection system carried out in the landfill from 19th to 24th November 1999. According to this study, the average waste generation rate by the domestic sector was 0.38kg/person/day while the bulk density was a 270 kg/m3. Based on the results from the study in 1999, the waste composition in Honiara was classified into the categories as shown in table 6.1.1.above.

From the data in the table 6.1.1 above, it shows that a majority of the waste composition comes from pieces of organic materials that could be vital for composting. This was also mentioned in the findings by Sinclair in 1999 that organic waste is the major composition of waste tipped off at the Ranadi Dumpsite.

According to Melchior's study in 2009 of market waste and Household waste, indicates that the total waste generated per annum for all households is 3881 tonnes. This finding also shows that the total waste generation rate is 0.87kg/person/day. The waste composition for the household sector is shown in table 6.1.1 above.

In Melchior's study of the Honiara Market waste, it is also found that the total waste generated per annum is 818 tonnes. The composition of Honiara market waste is as shown in table 6.1.2 below.

Table 6.1.2: Market Waste Composition of Honiara

Waste Composition	**Weight in %**
Organics	94.4
Plastics	1.7
Paper	2.3
Metals	1.3
Textiles	0.1
Others	0.2

6.2. CURRENT WASTE GENERATION

Recently, the Honiara City Council carried out a study carried out from the 8th to 21st August 2011 which was co-financed by the Ministry of Environment, Climate Change, Disaster Management and Meteorology and Honiara City Council. Findings from this study shows that, the rate of waste generated by the household sector was 0.86 kg/person/day and by the commercial sector was 0.09 kg/person/day based on Honiara population of 64, 609 people. See Table 6.2.1 and table 6.2.2 below of the waste generation of the different household levels in Honiara and the commercial sectors. The bulk density for the domestic sector was 447.73 kg/m³ and for the commercial sector were 284.63 kg/m³. There are no data generated for industrial and medical wastes but this is another key area for future waste characterization study.

Table 6.2.1 Waste Generation at Different Household Income levels in Honiara, 2011

HH .No	Low-Income		Middle-Income		High-Income		Total
	Family size	Weight(kg)	Fam.Size	Wgt(kg)	Fam.size	Wgt(kg)	wgt in kg
1	13	26	6	17.4	16	64.5	107.9
2	5	50	7	29.5	2	21.5	101
3	5	51	5	22	5	84	157
4	5	37	9	19	2	78	134
5	8	31	6	31	0	61.5	123.5
6	10	49.5	9	19	9	49	117.5
7	27	75	7	19.9	2	36	130.9
8	11	41	10	49	1	26	116
9	5	35.5	6	20	4	21.9	77.4
10	9	33	5	17	3	23	73
11	4	29	10	55	4	46	130
12	9	50	13	60	0	36	146
13	2	48.5	9	64	0	68	180.5
14	4	21.5	3	18	15	48.5	88
15	4	23.5	6	19.4	6	23.5	66.4
16	7	55.5	13	36	6	28.5	120
17	9	105	6	31	20	50.5	186.5
18	7	41	11	84	2	14	139
19	0	66	6	29	2	19.5	114.5
20	19	50	0	19	4	38	107
21					4	7	11
Total in kg	163	919	147	659.2	107	844.9	2427.1
Total in %		37.86		27.16		34.81	

Table 6.2.2 Waste Generation at Different Commercial Areas in Honiara, 2011

Office	Floor	No.Employees				Days					Total
No	area (m^2)	/Guests/Tabl	1	2	3	4	5	6	7	8	
1	874.04	???	200	36	35	17	11	9	0	10	318
2	290.4	25	13	15	10	4	26	8	9	7	92
3	279.52	yees/35 tbles	0	28	65	29	33.5	5	30	0	190.5
4	192.92	23	0	13	9	4	6	1.5	1	1.5	36
5	906.5	11	24	51	13.5	8	24	16	27	36	199.5
6	470.12	12	0	15	12	5	8	2	4	4	50
7	243.1	882	14	11	2.5	2	7	9	0	3	48.5
TOTAL	2350.1										934.5

The waste composition of the domestic sector and commercial sector based on the results of the findings is indicated in the tables 6.2.3 and 6.2.4 below. Additionally, based on findings in table 15.4 and table 16.8; the rate of total daily waste disposed by the domestic sector is 65.10 kg/day while the total daily waste disposed by the commercial sector is 89.76kg/day.

Table 6.2.3: Domestic Sector Waste Composition

Categories	Weight in %
Vegetables/Putrescibles (organics)	50.43
Paper/Cardboards	6.59
Textiles	2.86
Plastics	11.58
Grass/Leaves	1.08
Leather Rubber	0.55
Metals	0.13
Glass/Ceramic	1.1
Wood	0.22
Tin	6.85
Betel-nut husk	1.12
Pet Bottles	7.88
Aluminium cans	2.22
Diapers	5.71
Used Sanitary pads	1.14
Electrical fittings	0.11
Shells	0.44

Table 6.2.4. Commercial Waste Composition

Categories	Weight in %
Vegetables/Putrescibles	43.72
Paper/Cardboard	28.35
Textiles	1.35
Plastics	11.81
Grass/Leaves	0.57
Leather Rubber	0.32
Glass/Ceramic	0.32
Tin	5.54
Betel-nut husk	0.24
Pet Bottles	2.31
Aluminum cans	2.15
Used Sanitary pads	1.03
Shells	1.59
Battery	0.02
Miscellaneous	0.68

6.2.1. WASTE FLOW IN HONIARA

See Annex 1.

7.0. EDUCATION AND AWARENESS

The Honiara City Council over the years has been carrying out awareness to keep Honiara Clean. However, the people's attitudes towards this issue have still not changed. These are some of the challenging issues that need to be addressed as early as in the primary school curriculums so they may be taught at an early stage.

8.0. (a) EXISTING LEGISLATIONS AND POLICIES

8.1. National Solid Waste Management Strategy 2009-2014

The National Solid Waste Management Strategy is the outcome of the long time attempts to develop an effective solid waste management concerns for the Solomon Islands raised by various stakeholders in

Honiara and in the provinces. This strategy identifies focal major priorities that describes the situation of waste management practices in the Solomon Islands and thus, is a way forward for future plan of actions.

8.2. Environment Act 1998

An ACT passed by the National Parliament "to make provision for the protection and conservation of the Environment; the establishment of the Environment and Conservation Division and the Environment Advisory Committee and for matters connected therewith or incidental thereto"

8.3. Pure Food Act 1996 and Pure Food Regulation 2010(formerly Environmental Health Act 1996)

An ACT "to make provision for securing and maintaining environmental health and for matters connected therewith or incidental thereto".

8.4. Agriculture Quarantine Order 1995

An ACT " to provide for preventing the introduction of disease into Solomon Islands through the importation or landing of animals, plants and other things and preventing the introduction of pests and undesirable plants; for requiring vessels and aircrafts to give notice of their arrival in Solomon Islands; and for connected purposes".

8.5. Ports Act 1990

An ACT " to provide for the establishment of a corporation to be known as the Solomon islands ports authority, for the transfer to the authority of certain of the port and harbour undertakings of the Government, for the functions of the authority and for purposes connected with the matters aforesaid".

8.6. Shipping Act 1998

An ACT "to Consolidate and Amend the law relating to shipping and seaman and to control the registration, safety and manning of ships, and to give effect to certain international maritime conventions, and for other purposes connected therewith".

8.0. (b) LOCAL GOVERNMENT/PROVINCIAL GOVERNMENT LEGISLATION

8.7. Honiara City Council (Litter) Ordinance 2009 (formerly known as Honiara Litter By-Law 1994/ Honiara Refuse Disposal By-Law 1994)

This legislation was supposing to prevent littering in public areas and offenders to pay a certain amount of fine. However it was not enforced. It was also supposing to promote the use of standard and acceptable receptacles that are approved by the responsible authority which is the Honiara City Council. Due to lack of enforcement it has not been imposed in past years and in recent years.

8.8. Provincial Ordinances

Isabel and Western Province are the only two Province in the Country that have litter ordinance. But due to lack of management, it has not been enforced which is a gap that needs to be addressed in the Provincial level.

9.0. 3R INITIATIVES

9.1. Recycling

a. BJS group of companies

BJS group of companies has been operating in the Solomon Islands for over 40 years and initially was an exporter of Solomon Islands Handicraft. This is a family–owned business by the Managing Director, Bruce Saunders with a long-term commitment to Solomon Islands and community. The company is involved in purchasing of scrap metals which are non-ferrous metals. These metals includes; aluminum cans, all types of aluminum that are non-ferrous/ free of ferrous material, used batteries (wet cell), radiators, copper, brass. The sellers are people in Honiara whether individuals or business. Some are their contacts in town when they are doing their cleaning up, they sell the materials to BJS. The scrap metals are brought in from sellers in Honiara to BJS from Monday to Saturday. The aluminum cans are usually crashed into blocks using a crasher machine and then packed into a container with volumes ranging from 10 tonnes-30 tonnes. Scrap metals are usually exported to Australia usually once a month and sometimes twice a month. The importers of the scrap metals are Smorgon Steel. There are currently two vehicles and there are two drivers with 1 or 2 assistants helping out. Currently, the company does not go out to the provinces outside of Honiara to buy scrap metals due to the expensive cost of freight and shipping and it is not economically viable. However, sometimes people from the provinces do bring in their scrap metals for sale in Honiara. The prices charged for each of the scrap metals is as listed below:

- Aluminum cans (all types uncrushed- $ 3/kg) (crashed - $2.50/kg)
- Stainless steel- $1.25/kg
- Radiator- $3.50/kg
- Brass (ferrous free- $ 10) (with some ferrous material- $ 4)
- Copper (ferrous free- $10) (with some iron particles- $ 4)
- Battery (whole body parts- $ 0.60/kg) (cleaned battery parts- $ 1.80/kg)

b. Toner Refiling Services

The Toner Refiling Services is a company that is a recent initiative for recycling of empty toner cartridges so as not to damage the environment. All types of toners are refilled at this company for various price ranges. The Company was established in 2004 by a local Solomon Islands Couple. Mr and Mrs Galo. The company mainly deals with refilling of empty toners of all brands that is: hp invent, Fuji Xerox, brother, NEC, canon, Konica Minolta, Lexmark, Samsung, sharp, Epson and others. It is the only company operating in the Solomon Islands that is operating in this area. Although it does not buy empty cartridge for export overseas but it enables individuals, business offices to be able to refill their empty cartridge at a lower price than buying for a new cartridge. The price range for the entire printer cartridges differ according to the printer types that is between SBD$400 to $800. During time of refilling, the company puts a mark on

the cartridge to show that it has been used for refilling. These marked printer cartridges are only refillied twice and the main customers includes private home users and business companies.

c. Solomon Breweries Ltd

Solomon Breweries Limited is the only company to have involved in reusing or returnable bottle system especially beer bottles and soft drink bottles.

d. Leksme Metal trading

A company that involves in scrap metals for recycling that have just started its operation in recent years. The company has been exporting scrap metals (ferrous, non-ferrous) to Asia for the past 3 years. There are more than 200 containers .The main market for export is asia. Main products exported: copper, brass, aluminium, stainless steel, radiators, motors, compressors, batteries.

e. Other recycling opportunities

Although there are no waste paper and cardboard recycling business in Honiara, some people have involved in purchasing cardboard from scavengers at the dumpsite to package corals for export. As well as, some business organizations and Ministries in the Government uses shredding machines to shred paper but not for export. These are some gaps which the Government needs to provide support and prioritize by giving incentives to these companies to encourage more recycling in the Country.

9.2. Composting

a. Zai na tina

The 'kastom garden' was founded by the late Joeni Tutuo and later on started organic farming. At the farm encourages organic composting to be used on the farm. The type of compost being used includes rotten coconut husk which is grated, chicken manure, biomass and soil. Joini Tutua from Choiseul Province was the founder of Organic farming in the Solomon Islands. Late Joini Tutua was also the co-founder of Kastom Garden Association (KGA). In 1991, Zai Na Tina organic demonstration Farm at Burns creek was started.

b. Solomon Environment Beautification

This is an organization that addresses waste and helps to beautify Honiara City streets with flower beds and tree planting. This is done by improving unattractive sites in and around Honiara with beautiful trees as an initiative creating an environment that will not cause people to litter in public areas.

10.0. METHODOLOGY

10.1.Equipments/Materials

- Plastic bags (8 days x number of households being sampled)
- Weighing scale: at least 1 to measure the waste
- Buckets: (a). To measure the volume of waste
  (b). Container for weighing
- Plastic sheets(tarpaulin) : to spread waste for sorting out
- Gloves : to protect workers handling the waste
- Water bottles: to drink
- Hat /cap: for sun protection

10.2. What you need

- Transportation: to move the waste from the respective location to the dumpsite
- Workers
  - 1 driver
  - 1 or 2 collection workers to load waste on the vehicle
  - 2 or 3 workers at dumpsite to sort and measure the weight and volume of waste
  - A supervisor to oversee the characterisation and record the data

10.3. Before Actual study day

- Check that pre-required materials/ facilities are organized
- Letters to the respective study sites
- Fuel
- Vehicle
- Manpower arranged- composition
-

10.4. Step Undertaken

1. Issue plastic bags to Households and commercial areas
2. Pre-test before actual activity
3. Debrief Honiara City Council Clerk on project background and activities
4. Execution plan of operation
5. Collection of bags in vehicle
6. Waste Characterisation at Ranadi landfill site

10.5. Methodology for Waste Characterization at Household

Preparation

1. Select the Households, shops/offices to be sampled and assign an identification number to each one
2. Label each plastic bag with the appropriate identification numbers
3. Prepare the data sheets for recording
4. Record the number of persons in each household, and the floor area of each shop/office
5. Distribute plastic bags (8 each) and a leaflet explaining the study

- when collecting rubbish give another plastic bag
- weigh all the 20 samples at the collection point and place a mark on it

Procedures

1. Collect the plastic bags from each Household in the sample area and transport them to the sorting area
2. Weigh each plastic bag and record the weight corresponding to the ID number
3. Randomly select 5 plastic bags from those 20 collected in each area to be sorted and segregate by putting first inside a bucket to measure the volume
4. Open these bags and empty contents into a bucket until it is full
5. Empty the bucket and spread contents over the plastic sheet
6. Count how many bucket full
7. Start weighing on scale of segregated waste.

Calculation

- 10.2kg/ 22people= 0.46kg/person/day
- Thus can tell a particular zone area x multiply total population
- For % say example paper 1/10.2 = 0.1 which is 10%

Volume

- V= 14 litre (bucket size)
- Total 10.2 kg/14L bucket = 0.72kg/litre

For Hotels

- Guest no
- Offices- floor area

11.0. LIMITATIONS AND RECOMMENDATIONS

i. Political Support

The need for political support is one of the backbones to the success of any implementing agencies or project activities. Likewise, the J_PRISM project requires the National Government to recognize its activities and for implementing agencies to collaborate with the Government in institutional strengthening and capacity development.

ii.Public Awareness and Attitude

The Environmental Health Division under the Honiara City Council and the Ministry of Health and Medical Services have been conducting awareness on waste management over the years. Despite the effort to change the mindset of people in the Community for a positive attitude towards waste management, it is still a challenging issue to combat. However, there are few of the population in Honiara that are beginning to see the significance of waste management in the society and are contributing towards a sustainable and clean environment in the Honiara City. Nevertheless, more awareness and education on waste management needs to be implemented at the early childhood curriculum so that children know about this issue and this can also change their mindset about waste.

iii. Financial Support

A major setback in implementing the activities of the J_PRISM project is finance to undertake the various activities as stipulated in the plan of operation required activities. All partners agencies to this project need to include in their annual budget waste management as one of the priority activities. Due to non inclusion of waste management in budget for this year (2011) some of the required activities for the current year were delayed and thus, cross-cut with other administrative activities of the agency. Moreover, due to lack of financial capacity, some of the required activities for this year were put forward for next year 2012. Lack of equipments and machines necessary for carrying out the required activities is also a huge hindrance to the J_PRISM Project implementation for this year.

vi. 3R Initiatives

One of the major activities that were supposing to be done in 2011 is the 3R activities which were moved to be conducted in 2012. The 3R's activities are significant in that, it will provide data and information on the status of recycling materials in the country. With this information, recycling companies will show an interest to operate in the country, which will in turn boost the economic growth of the Solomon Islands as well. A proposed draft concept note from the Dr.Shane Tutua of the Secretariat of the Pacific Community on the establishment of a pilot vertical composting unit in Honiara which is a vital step in managing the organic wastes generated from the markets and households into nutrient rich composts. This method is currently seen to be successfully used in countries such as New Zealand and Australia amongst others , thus it could be tested in the Solomon Islands.

v. Enforcement of existing legislations

Another major setback to the management of waste in Honiara and in the Solomon Islands is due to the lack of enforcement of the existing legislations such as the Honiara Litter By- law 1994 or Honiara Refuse Disposal By- Law 1994. These two legislations were supposed to provide the use of regular waste receptacles approved by the Honiara City Council and to prevent citizens from littering in the public areas within the town boundary. The consequence for offenders of these significant By-Laws is fines to be incurred by the offenders. However, at present it was not enforced and thus requires the responsible authorities to re-enforce them once again with support from the Police Department in order for these legislations to be taken seriously by the public.

vi. Provincial Ordinances

Isabel and Western Province are the only two provinces that litter ordinances, however, there is no proper management in their Provincial Government and so these litter ordinances are not enforced. This is a gap which requires to be improved through National Government and Provincial Government consultations with the relevant implementing agencies dealing with waste management in the Country. By doing so, officers could be deployed to all the provinces and existing legislations could then be enforced.

viii. Capacity Building and Development

Officers and any person involve in Waste management activities need to well inform of the issues and challenges with regards to implementation of the activities and the legislations guiding each implementing partner organizations. Training of staff and workers including those responsible for collection of waste, management of landfill operation and those dealing with the administrative matters of waste management activities in the Government sectors. This can enable staff to have more capacity and development on their existing skills.

xi. Collection Improvement

Wastes collection is one of the most important tasks related to management of waste in any area. However, it is also the most expensive or costly process of management of solid waste in any country. In Honiara City, this problem of waste collection is related to the lack of cooperation of employed contractors, vehicle drivers, breakdown of vehicles, and lack of training and irregular collection time schedule.

x. Landfill Rehabilitation

With the current scenario at the Ranadi Landfill, there is a need for rehabilitation and improvement to control the amount of waste tipped off at the site as well as to collect data of the incoming waste vehicles into the landfill compound and scavengers.

12.0. CONCLUSION

In conclusion, the problem of Solid waste management is obviously a challenging issue in the past, present and for the future which will have a dramatic impact to the socio-economic and environmental aspects of Solomon Islands. Despite, the challenges and gaps relating to Solid Waste Management issues in Solomon Islands and particularly in Honiara, all the responsible agencies are trying to fill in the gaps and to meet the key indicators as outlined in the National Solid Waste Management Strategy 2009-2014.By addressing these key indicators taking into account the suggested recommendations will facilitate in solving some of the challenging issues of this growing problem.

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Annex 1- DATA RESULTS:

13.0 Honiara Waste Audit (Daily Generation Rate)

Table 13.1. Daily Generation rate: Low-Income Area-Kukum Labourline

HH.no	Fam.size			Days						Total wgt
		1	2	3	4	5	6	7	8	(kg)
1	13	7	3	1	7	2	1	2	3	20
2	5	15	4	8	8	5	5	3	2	50
3	5	14	4	10	7	6	4	4	2	51
4	5	6	5	5	6	6	5	1	3	37
5	8	7	4	1	6	7	2	3	1	31
6	10	14	3	5	7	12	6	1	1.5	49.5
7	27	44	7	3	5	8	2	2	4	75
8	11	9	5	3	8	7	4	3	2	41
9	5	8	1	4.5	5	10	5	1	1	35.5
10	9	10	4	2	5	6	3	2	1	33
11	4	6	4	2	5	1	4	4	3	29
12	9	11	3	14	10	6	2	1	3	50
13	2	19	1	9	6	5	2	1	5.5	48.5
14	4		4	4	3		4	2	4.5	21.5
15	4		6	2	5		5	4	1.5	23.5
16	7	13	9	5	5	7	3	11	2.5	55.5
17	9	38	11	8	19	9	3	6	11	105
18	7	11	2	3	8	6	3	5	3	41
19			4	39	7	5	4	3	4	66
20	19	12	1	8	8	7	1	5	8	50
TOTAL	163									913

Computation:
(mean) daily generation rate = (913)/(163)/7 (kg/person/day)
= 0.805434
= **0.81 kg/person/day**

Table 13.1.1. Data Sheet for Volume (Density)

Day	**1**	**2**	**3**	**4**	**5**	**6**	**7**	8	**Total vol. (in liters)**
Number of Bucketfull loads *		7	8.5	6.5	9	5.25	7.25	7.12	49.62
Daily total volume		98	119	91	126	73.5	101.5	99.68	708.68

*Volume of the bucket used is 14 L.

TABLE 13.2: Daily Generation Rate. Middle-Income Area: Naha 1

HH.no	Fam.size			Days						Total wgt
		1	2	3	4	5	6	7	8	(kg)
1	6	5	2	1.5	5		1	0.9	2	17.4
2	7	5	4	2.5	5	2	1	7	3	29.5
3	5	7	2	1	3	3	4		2	22
4	9	3	1	2	3	1	3	2	4	19
5	6	9	3	3	5	3	4	2	2	31
6	9	6	3	1	2	1	1	1	4	19
7	7	4	3	1.5	3.5	2	2	0.9	3	19.9
8	10	3	10	4	4	11	8	1	8	49
9	6		12	1	2	2	1	1	1	20
10	5	4	3	1	4	1	1	1	2	17
11	10	7	20	5	9	10	1	2	1	55
12	13	18	2	5	3	20	4	5	3	60
13	9	9	13	5	12	10	7	5	3	64
14	3	4	2	2	3	2	1	1	1	18
15	6	5	5	2.5	2	1	1	0.9	2	19.4
16	13	17	4	1	4	3	5	1	1	36
17	6	11	4	3	2	1	5	3	2	31
18	11	46	4	5	3	11	6	5	4	84
19	6	6	3	1	3	7	7	1	1	29
20			3	1	4	2	3	3	3	19
TOTAL	147									659.2

Computation:

(mean) daily generation rate = (659.2)/ (147)/7 (kg/person/day)
= 0.640622
= **0.64 kg/person/day**

Table 13.2.1. Data Sheet for Volume (Density)

Day	**1**	**2**	**3**	**4**	**5**	**6**	**7**	8	**Total vol. (in liters)**
Number of Bucketfull loads		7	8.86	4.25	8	5.75	3.75	7.25	44.86
Daily total volume		98	124	59.5	112	80.5	52.5	101.5	628.04

*Volume of bucket used is 14L.

TABLE 13.3. Daily Generation Rate: High-Income Area: Nggossi

HH.no	Fam.size			Days						Total wgt
		1	2	3	4	5	6	7	8	(kg)
1	16	19	15	5	4	6.5	2	5	8	64.5
2	2	3	1	2		4.5	3	7	1	21.5
3	5	19		18	20	3	1	22	1	84
4	2	19	14	2	2	17	22		2	78
5			30	11	10		10.5			61.5
6	9		5	8	9	9	10	-1	9	49
7	2	5	5	4	3		4	8	7	36
8	1	2			5	11	5		3	26
9	4	7	3	2	1	4.9			4	21.9
10	3	6		2	9			3	3	23
11	4	11	8	6	2		10	3	6	46
12		17			7	8	1		3	36
13			9	14	9		21	11	4	68
14	15	9	9	5	1	17	2.5	4	1	48.5
15	6	7	1	3	2	3.5	1	3	3	23.5
16	6	7	3	1	3	6	2.5	4	2	28.5
17	20	8	7	5	17	5.5	2	3	3	50.5
18	2	4	2	1	1	3		1	2	14
19	2	5	3	1	4	3	0.5		3	19.5
20	4	7		3	2	11	9	3	3	38
21	4	7								7
TOTAL	107									844.9

Computation:

(mean) daily generation rate = (844.9)/ (107)/7 (kg/person/day)

= 1.128037

= 1.13 kg/person/day

Table 13.3.1. Data Sheet for Volume (Density)

Day	**1**	**2**	**3**	**4**	**5**	**6**	**7**	8	**Total**
Number of Bucketfull loads		20	13.4	11.5	7.75	10	6.43	7.36	76.44
Daily total volume		280	188	161	109	140	90.02	103.04	1070.16

*Volume of bucket used is 14L.

Domestic Sector

Total (mean) daily generation rate
= (0.81 + 0.64 + 1.13)/3 (kg/person/day)
= **0.86 kg/person/day**

COMMERCIAL SECTOR

Table 13.4. Daily Generation Rate: Commercial Areas

Office	Floor	No.Employees				Days					Total
No	area (m^2)	/Guests/Tables	1	2	3	4	5	6	7	8	
1	874.04	???	200	36	35	17	11	9	0	10	318
2	290.4	25	13	15	10	4	26	8	9	7	92
3	279.52	31 emplyees/35 tbles	0	28	65	29	33.5	5	30	0	190.5
4	192.92	23	0	13	9	4	6	1.5	1	1.5	36
5	906.5	11	24	51	13.5	8	24	16	27	36	199.5
6	470.12	12	0	15	12	5	8	2	4	4	50
7	243.1	882	14	11	2.5	2	7	9	0	3	48.5
TOTAL	2350.1										934.5

- Measurements taken from Google earth ???- still

Computation:

Hotel (mean) daily generation rate = (308)/ (874.04)/7(kg/m²/day)
= 0.050341
= **0.05 kg/m²/day**

Motel (mean) daily generation rate = (190.5)/ (290.4)/7 (kg/m²/day)
= 0.093713
= **0.09 kg/m²/day**

Restaurant (mean) daily generation rate= (190.5)/ (279.52)/7(kg/m²/day)
= 0.097361
= **0.10kg/m²/day**

Office (mean) daily generation rate = (36)/ (192.92)/7(kg/m²/day)
= 0.026658
= **0.03 kg/m²/day**

Supermarket (mean) daily generation rate = (199.5)/ (906.5)/7(kg/m²/day)
= 0.3144
= **0.31 kg/m²/day**

Retail/wholesale shop (mean) daily generation rate = (50)/ (470.12)/7(kg/m²/day)
= 0.015194
= **0.02 kg/m²/day**

School (mean) daily generation rate = (48.5)/ (243.1)/7(kg/m²/day)
= 0.028501
= **0.03 kg/m²/day**

Commercial Sector

Total (mean) daily generation rate

= (0.05 + 0.09 + 0.10 + 0.03 + 0.31 + 0.02 + 0.03) /7 (kg/m²/day)

= **0.09 kg/m²/day**

Table 13.4.1. Data Sheet for Volume (Density); Motel

Day	1	2	3	4	5	6	7	8	Total vol. (in liters)
Number of Bucketfull loads		10.75	3.75	2.75	7.3	5.25	4.5	2.93	37.18
Daily total volume		150.5	52.5	38.5	102	73.5	63	41.02	520.52

Table 13.4.2. Data Sheet for Volume (Density): School

Day	1	2	3	4	5	6	7	8	Total vol. (in liters)
Number of Bucketfull loads		10.75	3.75	2.75	7.3	5.25	4.5	2.93	37.18
Daily total volume		150.5	52.5	38.5	102	73.5	63	41.02	520.52

Table 13.4.3. Data Sheet for Volume (Density): Supermarket

Day	1	2	3	4	5	6	7	8	Total vol. (in liters)
Number of Bucketfull loads		18	5.11	4	10	18.75	9.5	14.75	80.36
Daily total volume		252	71.54	56	144	262.5	133	206.5	1125.04

Table 13.4.4. Data Sheet for Volume (Density): Hotel

Day	1	2	3	4	5	6	7	8	Total
Number of Bucketfull loads		5	7.75	4	3.25	3.25	0	3.92	27.17
Daily total vol.		70	108.5	56	45.5	45.5	0	54.88	380.38

Table 13.4.5. Data Sheet for Volume (Density): Shop

Day	1	2	3	4	5	6	7	8	Total vol. (in liters)
Number of Bucketfull loads		3.5	5.75	7.25	0	4.5	5	3	29
Daily total volume		49	80.5	102	0	63	70	42	406

Table 13.4.6. Data Sheet for Volume (Density): Restaurant

Day	1	2	3	4	5	6	7	8	Total vol. (in liters)
Number of Bucketfull loads		5.75	13.25	6	7	3.08	6.75	0	41.83
Daily total volume		80.5	185.5	84	98	43.12	94.5	0	585.62

Table 13.4.7. Data Sheet for Volume (Density): Office

Day	1	2	3	4	5	6	7	8	Total vol. (in liters)
Number of Bucketfull loads		0	2.25	2.75	3.8	2.75	1.75	1.62	13.87
Daily total volume		0	31.5	38.5	46	38.5	17.5	22.68	194.18

14.1. RECORDING OF CORRESPONDING WEIGHTS (SAMPLES TAKEN): DOMESTIC SECTOR

Table 14.1.1: Record of corresponding weights in Low-income area

Low -Income Area

1		2		3		4		5		6		7		8		Total
H # **	Wgt *	H #	Wgt	H#	Wgt	H#	Wgt	H #	Wgt	H#	Wgt	H #	Wgt	H #	Wgt	
1	7	1	3	1	1	1	7	1	2	1	1	1	2	1	3	26
2	15	2	4	2	8	2	8	2	5	2	5	2	3	2	2	50
3	14	3	4	3	10	3	7	3	6	3	4	3	4	3	2	51
4	6	4	5	4	5	4	6	4	6	4	5	4	1	4	3	37
5	7	5	4	5	1	5	6	5	7	5	2	5	3	5	1	31
6	14	6	3	6	5	6	7	6	12	6	6	6	1	6	1.5	49.5
7	44	7	7	7	3	7	5	7	8	7	2	7	2	7	4	75
8	9	8	5	8	3	8	8	8	7	8	4	8	3	8	2	41
9	8	9	1	9	4.5	9	5	9	10	9	5	9	1	9	1	35.5
10	10	10	4	10	2	10	5	10	6	10	3	10	2	10	1	33
11	6	11	4	11	2	11	5	11	1	11	4	11	4	11	3	29
12	11	12	3	12	14	12	10	12	6	12	2	12	1	12	3	50
13	19	13	1	13	9	13	6	13	5	13	2	13	1	13	5.5	48.5
14	0	14	4	14	4	14	3	14	0	14	4	14	2	14	4.5	21.5
15	0	15	6	15	2	15	5	15	0	15	5	15	4	15	1.5	23.5
16	13	16	9	16	5	16	5	16	7	16	3	16	11	16	2.5	55.5
17	38	17	11	17	8	17	19	17	9	17	3	17	6	17	11	105
18	11	18	2	18	3	18	8	18	6	18	3	18	5	18	3	41
19	0	19	4	19	39	19	7	19	5	19	4	19	3	19	4	66
20	12	20	1	20	8	20	8	20	7	20	1	20	5	20	8	50
Total	244		85		137		140		115		68		64		66.5	919

*Weight in kg.
**House number.

Computation:

LIA Total weight = 919 kg

bulk density of **waste**= 919 / 708.68 (kg/L) x 1000

= 1296.78 kg/m³

Table 14.1.2: Record of corresponding weights to Middle-income areas

Middle -Income Area

1		2		3		4		5		6		7		8		Total
H # **	Wgt *	H #	Wgt	H#	Wgt	H#	Wgt	H #	Wgt	H#	Wgt	H #	Wgt	H #	Wgt	
1	5	1	2	1	1.5	1	5	1	0	1	1	1	0.9	1	2	17.4
2	5	2	4	2	2.5	2	5	2	2	2	1	2	7	2	3	29.5
3	7	3	2	3	1	3	3	3	3	3	4	3	0	3	2	22
4	3	4	1	4	2	4	3	4	1	4	3	4	2	4	4	19
5	9	5	3	5	3	5	5	5	3	5	4	5	2	5	2	31
6	6	6	3	6	1	6	2	6	1	6	1	6	1	6	4	19
7	4	7	3	7	1.5	7	3.5	7	2	7	2	7	0.9	7	3	19.9
8	3	8	10	8	4	8	4	8	11	8	8	8	1	8	8	49
9	0	9	12	9	1	9	2	9	2	9	1	9	1	9	1	20
10	4	10	3	10	1	10	4	10	1	10	1	10	1	10	2	17
11	7	11	20	11	5	11	9	11	10	11	1	11	2	11	1	55
12	18	12	2	12	5	12	3	12	20	12	4	12	5	12	3	60
13	9	13	13	13	5	13	12	13	10	13	7	13	5	13	3	64
14	4	14	2	14	2	14	3	14	2	14	1	14	1	14	1	16
15	5	15	5	15	2.5	15	2	15	1	15	1	15	0.9	15	2	19.4
16	17	16	4	16	1	16	4	16	3	16	5	16	1	16	1	36
17	11	17	4	17	3	17	2	17	1	17	5	17	3	17	2	31
18	46	18	4	18	5	18	3	18	11	18	6	18	5	18	4	84
19	6	19	3	19	1	19	3	19	7	19	7	19	1	19	1	29
20	0	20	3	20	1	20	4	20	2	20	3	20	3	20	3	19
Total	169		103		49		81.5		93		66		43.7		52	657.2

*Weight in kg.
**House number.

Computation:

MIA Total weight = 657.2 kg

bulk density of **waste** = 657.2/ 628.04(kg/L) x 1000
= 1.046430164
= 1046.43 kg/m³

Table 14.1.3: Record of corresponding weights to High-income areas

High -Income Area

1		2		3		4		5		6		7		8		Total
H # **	Wgt *	H #	Wgt	H#	Wgt	H#	Wgt	H #	Wgt	H#	Wgt	H #	Wgt	H #	Wgt	
1	19		15		5		4		6.5		2		5		8	64.5
2	3		1		2		0		4.5		3		7		1	21.5
3	19		0		18		20		3		1		22		1	84
4	19		14		2		2		17		22		0		2	78
5	0		30		11		10		0		11		0		0	62
6	0		5		8		9		9		10		-1		9	49
7	5		5		4		3		0		4		8		7	36
8	2		0		0		5		11		5		0		3	26
9	7		3		2		1		4.9		0		0		4	21.9
10	6		0		2		9		0		0		3		3	23
11	11		8		6		2		0		10		3		6	46
12	17		0		0		7		8		1		0		3	36
13	0		9		14		9		0		21		11		4	68
14	9		9		5		1		17		2.5		4		1	49.5
15	7		1		3		2		3.5		1		3		3	23.5
16	7		3		1		3		6		2.5		4		2	28.5
17	8		7		5		17		5.5		2		3		3	50.5
18	4		2		1		1		3		0		1		2	14
19	5		3		1		4		3		0.5		0		3	19.5
20	7		0		3		2		11		9		3		3	38
21	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
Total	162		115		93		111		113		108		76		68	846.4

* Weight in kg.
** House number.

Computation:
HIA total weight = 846.4 kg
bulk density of waste = 846.4/ 1070.16 (kg/L) x 1000
= **790.91 kg/m³**

Domestic Grand total weight= 919+ 657.2 +846.4 (kg)

= **2422.6 kg**

Domestic (mean) bulk density of waste = (790.91+ 1046.43+1296.78)/ 7(kg/m³)

= 3134.12/7

= 447.73 kg/m³

14.2. RECORDING OF CORRESPONDING WEIGHTS (SAMPLES TAKEN): COMMERCIAL SECTOR

Office.no	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Total
	Wgt *	Wgt	Wgt	Wgt	Wgt	Wgt	Wgt	Wgt	
1	200	36	35	17	11	9	0	10	318
2	13	15	10	4	26	8	9	7	92
3	0	28	65	29	33.5	5	30	0	190.5
4	0	13	9	4	6	1.5	1	1.5	36
5	24	51	13.5	8	24	16	27	36	199.5
6	0	15	12	5	8	2	4	4	50
7	14	11	2.5	2	7	9	0	3	48.5
TOTAL									934.5

*All weight measured in kg.

Computation:

Commercial Grand total weight = 318+ 92+190.5+36+180.5+50+48.5 (kg)

= 934.5 kg

Hotel (mean) bulk density = (318/ 520.52) kg/L x 1000
= **610.93 kg/m³**

Motel (mean) bulk density = (92/ 316.12) kg/L x 1000
= **291.03 kg/m³**

Restaurant (mean) bulk density = (190.5 / 1125.04) kg/L x 1000
= **169.33 kg/m³**

Office (mean) bulk density = (36 / 380.38) kg/L x 1000
= **94.62 kg/m³**

Supermarket (mean) bulk density = (199.5/ 406) kg/L x 1000
= **491.38 kg/m³**

Shop (mean) bulk density = (50 / 585.6) kg/L x 1000
= **85.38 kg/m³**

School (mean) bulk density = (48.5 / 194.18) kg/L x 1000
= **249.77 kg/m³**

Therefore, **Commercial (mean) bulk density** = (610.93 + 291.03+ 169.33+ 94.62+ 491.38+ 85.38+ 249.77)/7 (kg/L)
= 284.63 kg/m³

Table 15.1. Waste Composition for Low-Income Areas: Kukum-Labourline Area

Category				Days					Total Wgt	Wgt in %
	1	2	3	4	5	6	7	8	(in kg)	
Vegetables/Putrescibles		18	11	13	11	6	8	6	73	47.99
Paper		6	0.1	1	1	1	0.5	0.1	9.7	6.38
Textiles		0	0.1	1	1	0	0	0	2.1	1.38
Plastics		7	2	6	2	1	3	2	23	15.12
Grass/leaves		0	0	0	0	0	1	0.9	1.9	1.25
Tin		7	0.5	2	1	1	1	1	13.5	8.88
Betel-nut Husks		0	0	0	2	0	1	0	3	1.97
Bottle		6	0.1	0.1	1	1	0.5	0	8.7	5.72
Aluminium cans		0	0	0.1	1	0	0	0.1	1.2	0.79
Diapers		7	1	0	1	2	1	1	13	8.55
Used Sanitary pads		0	1	0	0	2	0	0	3	1.97
Total									152.1	100

Table 15.2. Waste Composition for Middle-Income Areas: Naha 1

Category				Days					Total Wgt	Wgt in %
	1	2	3	4	5	6	7	8	(in kg)	
Vegetables/Putrescibles		7	10.2	4	11	10	6	2	50.2	50.6
Paper		1	0.2	1	1	0.5	0.1	1	4.8	4.84
Textiles		1	1	0	1	1	1	1	6	6.05
Plastics		1	2	1	2	1	1	2.9	10.9	10.99
Grass/leaves		0	0	0	0	2	0	0	2	2.02
Leather Rubber		0	0	0	1	0	0	1	2	2.02
Wood		0	0	0	1	0	0	0	1	1.01
Tin		1	0.2	0.5	3	1	1	1	7.7	7.76
Betel-nut Husks		0	0	0	2	0	0	0	2	2.02
Bottle		1	0.2	0	1	0	0	1	3.2	3.23
Aluminium cans		1	0.2	1	0	1	0.1	0	3.3	3.33
Diapers		1	0	0	0	0	1	0	2	2.02
Used Sanitary pads		2	0.1	0	0	0	0	0	2.1	2.12
Shells						2			2	2.02
Total									**99.2**	100

Table 15.3. Waste Composition for High-Income Areas: Nggossi

Category				Days					Total Wgt	Wgt in %
	1	2	3	4	5	6	7	8	(in kg)	
Vegetables/Putrescible		34.1	13.5	11	14	13	9	12	106.6	52.2
Paper		3	2	1	2.5	1	2	4	15.5	7.59
Textiles		3	0.3	0.5	1.1	0	0	0	4.9	2.4
Plastics		0	4	1.8	3	5	2	3	18.8	9.21
Grass/leaves		0	0	0	0	1	0	0	1	0.5
Leather Rubber		0	0.5	0	0	0	0	0	0.5	0.24
Metals		0	0.1	0.5	0	0	0	0	0.6	0.3
Glass/Ceramic		0	0	0	3	2	0	0	5	2.45
Tin		2	3	1	2	1	1	2	10	4.9
Betel-nut Husks		0	0	0	0	0	0	0.1	0.1	0.05
Bottle		2	5	5	5	2	4	1	24	11.75
Aluminium cans		2	0.5	0.5	0	0.1	0.5	2	5.6	2.74
Diapers		1	2	0	3	1	2	2	11	5.39
Used Sanitary pads		0.1	0	0	0	0	0	0	0.1	0.05
Electrical Fittings		0	0	0.5	0	0	0	0	0.5	0.24
Total									204.2	100

Table 15.4. Waste Composition for Domestic Sector in Honiara.

Category	HIA	MIA	LIA	Total wgt in kg	Weight in %
Vegetables/Putrescible	106.6	50.2	73	229.8	50.43
Paper/Cardboard	15.5	4.84	9.7	30.04	6.59
Textiles	4.9	6.05	2.1	13.05	2.86
Plastics	18.8	10.99	23	52.79	11.58
Grass/Leaves	1	2.02	1.9	4.92	1.08
Leather Rubber	0.5	2.02	0	2.52	0.55
Metals	0.6	0	0	0.6	0.13
Glass/Ceramic	5	0	0	5	1.1
Wood	0	1	0	1	0.22
Tin	10	7.7	13.5	31.2	6.85
Betel-nut husk	0.1	2	3	5.1	1.12
Pet Bottles	24	3.2	8.7	35.9	7.88
Aluminium cans	5.6	3.3	1.2	10.1	2.22
Diapers	11	2	13	26	5.71
Used Sanitary pads	0.1	2.1	3	5.2	1.14
Electrical fittings	0.5	0	0	0.5	0.11
Shells	0	2	0	2	0.44
Miscellaneous	0	0	0	0	0
Total	204.2	99.42	152.1	455.72	100

Total daily waste disposed (Domestic)
= 455.72 / 7 (kg/day)
= **65.10 kg/day**

16.0. COMMERCIAL WASTE COMPOSITION

Table 16.1. Waste Composition for Bulaia Backpackers (Motel)

Category				Days					Total Wgt	Wgt in %
	1	2	3	4	5	6	7	8	(in kg)	
Vegetables/Putrescible		10	7	4	10	4	3	3	41	36.19
Paper		14	0.1	1	1	2	1	0.1	19.2	16.95
Textiles		0	0	0	0.5	1	0	2.5	4	3.53
Plastics		4	2	3	1	0.2	2	0	12.2	10.77
Tin		7	1	1	0.5	1	1	0.5	12	10.59
Betel-nut Husks		0	0	0	0.5	1	0	0	1.5	1.32
Bottle		1	0	1	0	1	0	0.2	3.2	2.82
Aluminium cans		0.1	0	1	0.5	1	0.5	0.5	3.6	3.18
Used Sanitary pads		6	0	0	0	0	0	0.5	6.5	5.74
Miscellaneous		0.1	0	0	0	0	0	0	0.1	0.09
Shells		0	0	0	10	0	0	0	10	8.83
Total									113.3	100

Table 16.2. Waste Composition for Coronation School (School)

Category				Days					Total Wgt	Wgt in %
	1	2	3	4	5	6	7	8	(in kg)	
Vegetables/Putrescible		2	0	0	1	0	0	4	7	15.77
Paper		2	1	1	2	0.1	0	4	6.1	13.74
Textiles		0	1	0	0	0	0		1	2.25
Plastics		2	0	1.1	1	3	0	7	14.1	31.76
Grass/leaves		0	0	0	0	3	0	0	3	6.76
Leather Rubber		0	0	0	1	0	0	0	1	2.25
Tin		0	0	0.1	0	0	0	3	3.1	6.98
Aluminium cans		0	0	1	0	0.1	0	0	1.1	2.48
Miscellaneous		0	1	0	0	3	0	0	4	9.01
Total									44.4	100

Table 16.3. Waste Composition for Wings Supermarket (Supermarket)

Category				Days					Total Wgt	Wgt in %
	1	2	3	4	5	6	7	8	(in kg)	
Vegetables/Putrescible		20	1	0	10	1	6	5	43	24.32
Paper		19	4	6	12	24	16	22	103	58.26
Textiles		0	0	0	0.5	0	0	0	0.5	0.28
Plastics		2	0.1	4	2	2	2	0.5	12.6	7.13
Grass/leaves		0	0	0	0	0	0.1	0	0.1	0.28
Glass/Ceramic		0	0	0	0	1	0	0	1	0.57
Tin		1	0.1	0	3	1	0	3	8.1	4.58
Bottle		0	0	0	0	0	0	2	2	1.13
Aluminium cans		1	0	0	3	0.5	1	1	6.5	3.68
Total									**176.8**	**100**

Table 16.4. Waste Composition for Honiara Hotel (Hotel)

Category				Days					Total Wgt	Wgt in %
	1	2	3	4	5	6	7	8	(in kg)	
Vegetables/Putrescible		14	19	14	1	5	0	9	62	
Paper		5	5	1	1	1	0	0.5	13.5	
Textiles		2	0	0	0	0	0	0	2	
Plastics		1	2	2	1	1	0	2	9	
Glass/Ceramic		0	0	1	0	0	0	0	1	
Tin		0.1	0.2	1	0	1	0	0	2.3	
Bottle		0	5	0	0	0	0	0.5	5.5	
Aluminium cans		0	1	0	0.5	0	0	0.5	2	
Miscellaneous		0.1	0	0	0	0	0	0	0.1	
Total									**97.4**	

Table 16.5. Waste Composition for Low Price Enterprises (Retail /Wholesale Shop)

Category				Days					Total Wgt	Wgt in %
	1	2	3	4	5	6	7	8	(in kg)	
Paper/cardboard		1	3	6	0	2	4	2	18	72
Plastics		0.1	0	4	0	1	1	0.5	6.6	26.4
Aluminium cans		0	0	0.1	0	0.1	0	0	0.2	0.8
Miscellaneous		0	0	0	0	0.1	0	0	0.1	0.4
Battery		0	0.1	0	0	0	0	0	0.1	0.4
Total									**25**	**100**

Table 16.6. Waste Composition for Sea King Restaurant (Restaurant)

Category				Days					Total Wgt	Wgt in %
	1	2	3	4	5	6	7	8	(in kg)	
Vegetables/Putrescible		14	47	20	16	7	17	0	121	73.65
Paper		2	6.3	2	2	1	5	0	18.3	11.14
Plastics		1	6	3	0.5	1	3	0	13.5	8.22
Grass/leaves		0	0	0	0	0	0.5	0	0.5	0.3
Tin		1	1.1	1	1	0.1	3	0	7.2	4.38
Bottle		0.1	0.1	2	0.5	0.1	1	0	3.8	2.31
Total									**164.3**	**100**

Table 16.7. Waste Composition for Honiara City Council Health Office (Office)

Category				Days					Total Wgt	Wgt in %
	1	2	3	4	5	6	7	8	(in kg)	
Vegetables/Putrescible		0	0	0.1	0	0.1	0	0.5	0.7	4.09
Paper/cardboard		0	2	1	1	1	0.5	0.5	6	35.09
Textiles		0	0	1	0	0	0	0	1	5.85
Plastics		0	1	1	3	0.2	0.5	0.5	6.2	36.26
Leather Rubber		0	0	0	0	1	0	0	1	5.85
Tin		0	0.1	0	2	0	0	0	2.1	12.28
Aluminium cans		0	0	0.1	0	0	0	0	0.1	0.58
Total									**17.1**	**100**

Table 16.8. Waste Composition for Commercial Sectors

Category				Commercial areas				Total Wgt	Total
	1	2	3	4	5	6	7	in kg	in %
Vegetables/Putrescible	41	7	43	62	0	121	0.7	274.7	43.72
Paper/Cardboard	19.2	6.1	103	13.5	18	18.3	6	178.1	28.35
Textiles	4	1	0.5	2	0	0	1	8.5	1.35
Plastics	12.2	14.1	12.6	9	6.6	13.5	6.2	74.2	11.81
Grass/Leaves	0	3	0.1	0	0	0.5	0	3.6	0.57
Leather Rubber	0	1	0	0	0	0	1	2	0.32
Glass/Ceramic	0	0	1	1	0	0	0	2	0.32
Tin	12	3.1	8.1	2.3	0	7.2	2.1	34.8	5.54
Betel-nut husk	1.5	0	0	0	0	0	0	1.5	0.24
Pet Bottles	3.2	0	2	5.5	0	3.8	0	14.5	2.31
Aluminium cans	3.6	1.1	6.5	2	0.2	0	0.1	13.5	2.15
Used Sanitary pads	6.5	0	0	0	0	0	0	6.5	1.03
Shells	10	0	0	0	0	0	0	10	1.59
Battery	0	0	0	0	0.1	0	0	0.1	0.02
Miscellaneous	0.1	4	0	0.1	0.1	0	0	4.3	0.68
Total								**628.3**	**100**

Total daily waste disposed (Commercial areas)

= 628.3/7 (kg/day)

= **89.76 kg /day**

Therefore,
Total daily waste disposed in Honiara (Domestic + Commercial)
= Domestic + Commercial
= 65.10 kg + 89.76 kg
= **154.86 kg**