Waste Characterisation Study
Bitou Municipality

Final Report
2016

Prepared by:

EXECUTIVE SUMMARY

A lack of information regarding waste generation types and volumes was identified as a gap in Bitou Municipality's Integrated Waste Management Plan. Therefore, Eden District Municipality, together with Bitou Municipality, the Provincial Department of Environmental Affairs and Development Planning (DEADP), as well as the participants of the Youth Jobs in Waste Programme implemented by the National Department of Environmental Affairs conducted a waste characterisation study in August 2015.

The objective of the waste characterisation study was to provide a breakdown of the composition and quantities of household and commercial waste that is being collected from households or commercial outlets in order to ensure proper integrated waste management planning.

As recommended by the DEADP, the Municipal Waste Characterisation Procedures of the Environmental Protection Agency, Ireland, was used as a guideline in determining the sample size for the Waste Characterisation Study.

Recommendations by the DEADP during the training and planning session regarding the type of venue, equipment, sampling and sorting methods and data collection were used during the characterisation study. During the training session it was decided that the waste will be categorised / sorted into fifteen (15) different waste types namely:

No.	Waste Type	Example
1	Soft Plastics	Plastic bags, plastic film.
2	Hard Plastics	Plastic bottles, containers, lids, hard plastic objects.
3	Cardboard	Office paper, newspaper, magazines, books, glossy paper.
4	Paper	Boxes, cardboard packaging.
5	Glass	Glass bottles, jars.
6	Metal	Ferrous and non-ferrous metals, cooldrink cans, tins, metal objects.
7	Food Waste	Any food, vegetable peels.
8	Garden Waste	Grass clippings, leaves, tree branches, flowers.
9	Textiles	Clothes, shoes, blankets, material.
10	Wood	Planks, manufactured wooden products.
11	Inert	Concrete, brick, sand, asphalt, stones.
12	Nappies	Disposable baby and adult nappies.
13	E-Waste	Any electrical or battery operated objects.
14	Hazardous Waste	Paints, resins, glues, fluorescent tubes, batteries, pesticides, asbestos.
15	Rest	All waste that cannot be sorted into abovementioned categories e.g. hair, dust.

When applying the total number of households (17 322) to the graph in Appendix B of the Municipal Waste Characterisation Procedures, EPA, Ireland, it was determined that a sample size of approximately 625 would be adequate, which was rounded off to a sample size of 650 in order to ensure a representative sample.

The number of samples per sub area was then calculated relative to the percentage of the total number of households.

Of the 654 bags that were sampled a total mass of 2 672,67kg (2,67 tons) of waste was recorded, with a compacted volume of 10,537m³ as indicated in Table 3.11 below.

Waste Type	Mass (kg)	Percentage of total Mass (%)	Calculated Volume (m³)
Soft Plastics	191,88	7,18	1,230
Hard Plastics	187,36	7,01	2,602
Paper	244,75	9,16	1,073
Cardboard	226,73	8,48	1,744
Glass	260,36	9,74	0,633
Metal	102,87	3,85	0,321
Food Waste	800,13	29,94	0,777
Garden	131,20	4,91	0,295
Textiles	110,63	4,14	0,379
Wood	9,75	0,36	0,063
Inert	7,15	0,27	0,007
Nappies	125,26	4,69	0,552
E-Waste	13,25	0,50	0,110
Hazardous	9,22	0,34	0,026
Rest	252,13	9,43	0,725
Total	**2672,67**	**100**	**10,537**

Table 3.11: Results for Bitou Municipality (654 samples)

46% of the waste types that were sampled by mass were recyclable materials: Glass (10%), Paper (9%), Cardboard (9%), Hard Plastics (7%), Soft Plastics (7%) and Metal (4%). However, by volume, 72% of the waste types that were sampled were recyclable materials: Hard Plastics (25%), Cardboard (16%), Soft Plastics (12%), Paper (10%), Glass (6%) and Metal (3%).

The results obtained from the different sub areas within Bitou Municipality illustrated different trends in waste generation. These trends will be significant in identifying and prioritising the type of waste minimisation initiatives to be implemented in the various sub-areas. E.g. Home composting initiatives should be implemented in the sub areas where Garden Waste was the prominent component of the waste sampled.

The prediction of uniformity and consistency of waste type occurrence is complex due to the heterogeneous nature and variability of waste. Therefore it is not likely to determine accurate projections of the likelihood of the occurrence of particular waste types in a waste stream.

It is assumed that the recyclable portion (soft plastic, hard plastic, paper, cardboard, glass and metal) comprises of 45% by mass of the total waste transported and landfilled at PetroSA landfill site on a monthly basis. This amounts to a total of approximately 353.53 tons, and 2214,56 m³ of recyclable materials that could potentially be diverted from landfill and could result in a significant transport and disposal cost saving.

CONTENTS

1. INTRODUCTION

Waste stream analysis can be defined as any programme which involves a logical and systematic approach to obtain and analyzing data on one or more waste streams or sub-streams. The analysis also provides an estimate of solid waste quantity and composition, referred to as waste characterisation.

A lack of information regarding waste generation types and volumes was identified as a gap in Bitou Municipality's Integrated Waste Management Plan. Therefore, a waste characterisation study was conducted in order to determine the types and quantities of waste that is being generated in Bitou. The analysis is essential to ensure proper planning in terms of collection, handling, minimisation and disposal of the generated waste.

Eden District Municipality, together with Bitou Municipality, the Provincial Department of Environmental Affairs and Development Planning, as well as the participants of the Youth Jobs in Waste Programme implemented by the National Department of Environmental Affairs conducted a waste characterisation study in August 2015.

The objective of the waste characterisation study was to provide a breakdown of the composition and quantities of household and commercial waste that is being collected from households or commercial outlets in order to ensure proper integrated waste management planning.

This study was also conducted to determine the quantity of recyclable material that still remains in the waste stream transported to landfill. Any recyclable materials already recovered through the existing at source recycling programme implemented by Bitou Municipality will not form part of this study.

The quantity of recyclable material recovered by the recycling service provider appointed by Bitou Municipality is being reported on a monthly basis.

The characterisation study provided the following information:

- The average mass and volume of waste per waste type per household;
- The average mass and volume of waste per waste type per household per socio-economic region;
- The average mass and volume of waste per waste type per business;
- The percentage by mass of each major category in the waste stream;
- The percentage by volume of each major category in the waste stream

A representative sample of a total of 654 bags were collected and sorted into the 15 different major waste types. The number of samples per sub area was determined by the number of households relative to the total number of households in Bitou Municipality.

2. METHODOLOGY

2.1 GENERAL APPROACH

As recommended by the Department of Environmental Affairs and Development Planning (DEADP), the Municipal Waste Characterisation Procedures of the Environmental Protection Agency, Ireland, was used as a guideline in determining the sample size for Waste Characterisation Study.

Recommendations by the DEADP during the training and planning session regarding the type of venue, equipment, sampling and sorting methods and data collection were used during the characterisation study.

2.2 TRAINING

On 16 July 2015 a training session conducted by the DEADP took place at the Piesang Vallley Community Hall in Plettenberg Bay. The training session entailed a formal planning session regarding the type of venue, equipment, sampling and sorting methods and data collection with the Waste Managers and the Eden District Waste Management Section.

A practical training session was then conducted with the Youth Jobs in Waste participants where they were trained in the sorting method, waste types, weighing, volume determination and data collection. Training in the proper use of Personal Protective Equipment, potential hazards and procedures was also discussed at this training session.

During the training session it was decided that the waste will be categorised / sorted into fifteen (15) different waste types namely:

No.	Waste Type	Example
1	Soft Plastics	Plastic bags, plastic film.
2	Hard Plastics	Plastic bottles, containers, lids, hard plastic objects.
3	Cardboard	Office paper, newspaper, magazines, books, glossy paper.
4	Paper	Boxes, cardboard packaging.
5	Glass	Glass bottles, jars.
6	Metal	Ferrous and non-ferrous metals, cooldrink cans, tins, metal objects.
7	Food Waste	Any food, vegetable peels.
8	Garden Waste	Grass clippings, leaves, tree branches, flowers.
9	Textiles	Clothes, shoes, blankets, material.
10	Wood	Treated wood, planks, manufactured wooden products.
11	Rest	Concrete, brick, sand, asphalt, stones.
12	Nappies	Disposable baby and adult nappies.
13	E-Waste	Any electrical or battery operated objects.
14	Hazardous Waste	Paints, resins, glues, fluorescent tubes, batteries, pesticides, asbestos.
15	Inert	All waste that cannot be sorted into abovementioned categories e.g. hair, dust.

Figure 2.1: Training in weighing & data collection

Figure 2.2: Training in waste characterisation & sorting

2.3 SAMPLE SIZE & PLANNING

2.3.1 REPRESENTATIVE SAMPLE

The estimated total number of households of 2013 as obtained from Bitou Municipality's Integrated Waste Management Plan was used to determine a representative sample by using the graph in Appendix B of the Municipal Waste Characterisation Procedures, EPA, Ireland (Figure 2.3).

When applying the total number of households (17 322) to the graph mentioned above, it was determined that a sample size of approximately 625 would be adequate, which was rounded off to a sample size of 650 in order to ensure a representative sample.

The identified households and businesses from which the samples were to be obtained were not informed regarding the study in order to prevent any bias that may result by a temporary change in habits.

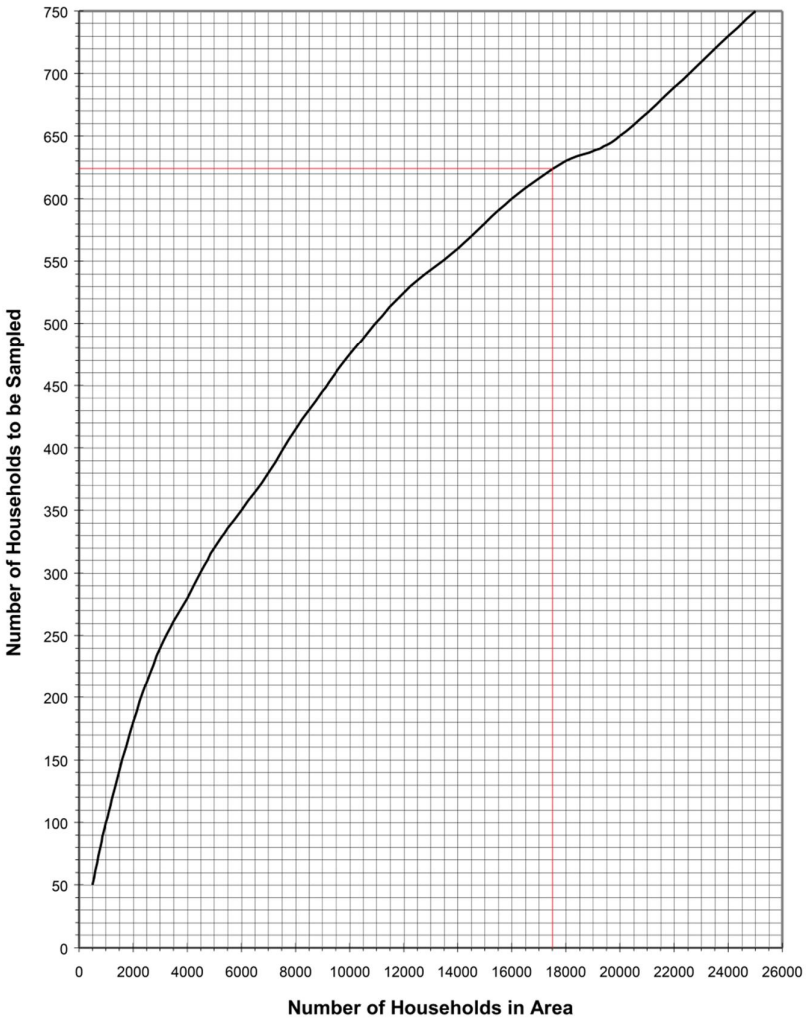


Figure 2.3: Graph determining sample size relative to no. of households

The number of samples per sub area was then calculated relative to the percentage of the total number of households. (Table 2.4)

Sub Area	No. of Households (17322)	Percentage of Sample (%)	Sample size (650)
Bloukrans State Forest	46	0.3	2
Harkerville State Forest	121	0.7	5
Keurboomsrivier	123	0.7	5
Keurboomstrand	40	0.2	2
Klien Palmietrivier State Forest	7	0.04	2
Kranshoek	873	5	33
Kurland Estate	1328	8	52
Kwanokuthula	4931	28	182
Natures Valley	125	0.7	5
New Horizons - Bossies Gif	1036	6	39

New Horizons - Weldon	518	3	20
Plettenberg Bay	3051	18	117
Plettenberg Bay – New Horizons	2084	12	78
Wittedrift	652	4	26
Plettenberg Bay - Knysna Rural	50	0.2	2
Plettenberg Bay - Plett Rural	2337	13	85

Table 2.4: Sample size determination per sub area

A planning session was held on 28 July 2015 together with officials from Eden District Municipality and Bitou Municipality. Maps of each sub area were provided, and specific households were identified from which to sample. These identified households were evenly distributed in order to ensure a representative sample of that specific sub area.

The local knowledge of the Bitou Municipality officials were relied upon in order to identify businesses in each sub area which was included in the sample size of that specific sub area.

It was decided that should no bags be available for sampling from the specified household that a sample be taken from a household in the near proximity of the specified household.

2.3.2 LABELLING OF SAMPLES

In order to identify the sub area from which the sample was taken as well as to ensure the capturing of other relevant information, it was essential that the samples were properly labelled when collected. The following details were recorded on the labels when the collection of samples took place:

- Date on which sample was taken
- The address from which the sample was taken
- Household or Business
- Total number of bags from which the sample was taken e.g. 1 of 3

2.3.3 SAMPLING PLAN

Bitou Municipality was responsible for the sampling of bags. A sampling team collected and labelled the samples from the identified households prior to the waste collection on that specific day of the week. The samples were then stored in the secure storage area prior to sorting. Samples were taken the day before the intended sorting in order to ensure that the Youth Jobs in Waste participants could commence with the sorting at the start of the working day.

2.4 VENUE & EQUIPMENT

2.4.1 VENUE

Bitou Municipality was responsible for acquiring a venue with the following requirements:

- Under cover
- Ablution facilities
- Running water
- Electricity
- Proper ventilation

- Secure / no unauthorized access

The venue which was acquired was the Bitou Municipality's Parks and Recreation Storage Facilities.

Figure 2.5: Bitou Municipality Parks & Recreation Storage Facility

2.4.2 EQUIPMENT

The following equipment was required in order to conduct the Characterisation Study, which was purchased and provided by Eden District Municipality:

- 4 x 150kg electronic platform scales
- 80 x 46cm plastic basins
- 6 x yard brooms
- 20 x vapour & organic respirator masks incl. replacement filters
- Plastic aprons
- Safety glasses
- Red PVC gloves
- Surface disinfectant
- Hand sanitizer
- Cleaning Rags
- Disposable towels with stands
- Data sheets
- Stationery
- Labels
- Permanent markers and pens

Bitou Municipality was responsible for the provision of the sorting tables, recycling and refuse bags as well as a hosepipe for the cleaning of the sorting basins during and after each working day.

2.5 CHARACTERISATION, WEIGHING & DATA COLLECTION

The samples were stored per sub area in order to ensure that the data collection was done per sub area which eases the analysis of the data and ensures that the analysis is done per sub area.

Figure 2.6: Samples stored per sub area

2.5.1 STEP 1:

The unopened black bag (sample) was weighed and the mass and the particulars of the label recorded on the data sheets.

2.5.2 STEP 2:

The contents of the sample was then categorised into the fifteen different waste types using the 46cm plastic basins.

Figure 2.7: Waste being sorted into different waste types

2.5.3 STEP 3:

Each categorised waste type was then weighed individually. The Scales were tarred before weighing and therefore only the contents of the basin were recorded. The volumes of the waste types in the basins were estimated as recommended by the DEADP. The mass and volumes of each waste type from that specific sample was recorded. The individual masses of the waste types should add up to the total mass of the unopened bag.

Figure 2.8: Basin with sorted waste type being weighed

2.5.4 STEP 4:

All the recyclable waste types / materials were placed into recycling bags (yellow) and the non-recyclable waste were placed into blue bags. It was decided at the planning session to recover all the recyclable materials during the study. The local recycler was contacted at the end of each working day to collect the recovered recyclable materials.

Figure 2.9: Recovered recyclable material in yellow bags

2.5.5 DATA CAPTURING

Eden District Municipality was responsible for the data capturing of the raw data to an electronic format (spreadsheets) in order to simplify the data analysis.

2.6 VOLUME DETERMINATION

It was recommended by DEADP to determine the volume of waste by estimating the volume percentage occupied by the sorted waste types per basin. However, each waste type occupies a different volume when compacted which is determined by the density of each waste type. The volume was therefore determined by obtaining the general compacted densities of each waste type and converting the mass to volume in cubic metres (m^3).

It is imperative to determine the volume of the waste as this determines the lifespan of a landfill site as well as transport costs as the waste is compacted and then transported to the landfill site. The general compacted densities were sourced from the Environmental Protection Authority, Victoria, Australia.

The general compacted densities of the different waste types are indicated in Table 2.10 below.

Waste Type	Density (Compacted)
Soft Plastics	156 kg/m³
Hard Plastics	72 kg/m³
Paper	228 kg/m³
Cardboard	130 kg/m³
Glass	411 kg/m³
Metal	320 kg/m³
Food Waste	1029 kg/m³
Garden	445 kg/m³
Textiles	292 kg/m³
Wood	156 kg/m³
Inert	1060 kg/m³
Nappies	227 kg/m³
E-Waste	120 kg/m³
Hazardous	348 kg/m³
Rest	348 kg/m³

Table 2.10: General densities of the various compacted waste types

It should be noted that the calculated volumes are representative of the specific waste types should they be compacted separately.

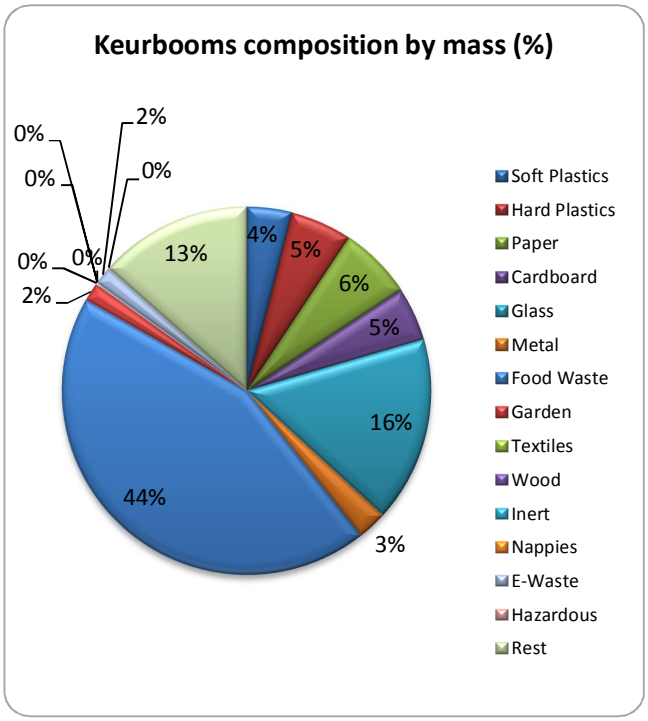
3. RESULTS

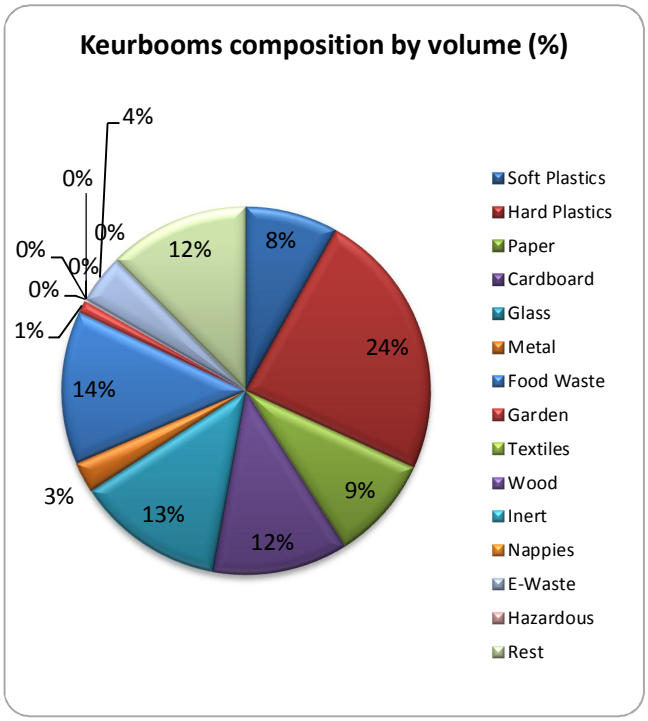
3.1 RESULTS PER SUB AREA

3.1.1 KEURBOOMS (10 SAMPLES)

Waste Type	Mass (kg)	Percentage of total Mass (%)	Calculated Volume (m^3)
Soft Plastics	2,36	3,96	0,015
Hard Plastics	3,20	5,37	0,044
Paper	3,85	6,46	0,017
Cardboard	2,80	4,70	0,022
Glass	9,71	16,29	0,024
Metal	1,55	2,60	0,005
Food Waste	26,10	43,80	0,025
Garden	0,96	1,61	0,002
Textiles	0,10	0,17	0,0003
Wood	0,00	0,00	0,00
Inert	0,00	0,00	0,00
Nappies	0,00	0,00	0,00
E-Waste	0,95	1,59	0,008
Hazardous	0,00	0,00	0,00
Rest	8,01	13,44	0,023
Total	**59,59**	**100**	**0,1853**

Table 3.1: Results of Keurbooms (10 samples)

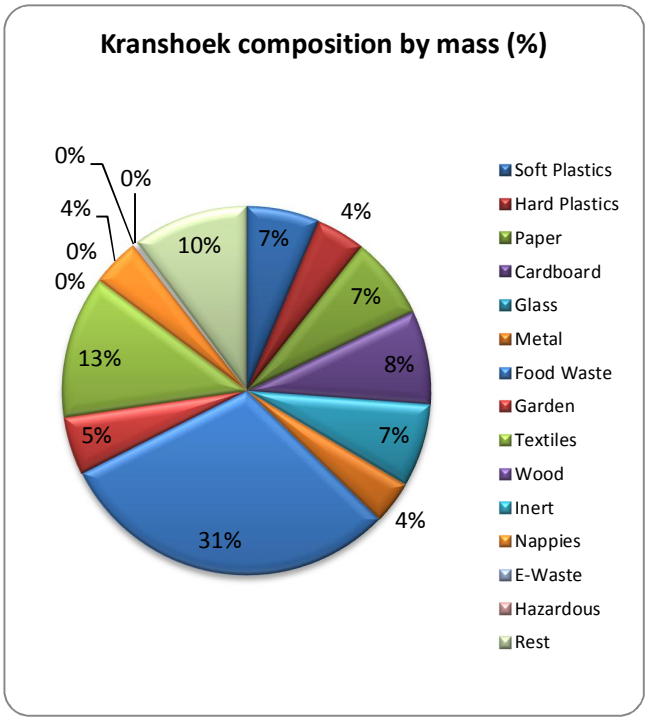


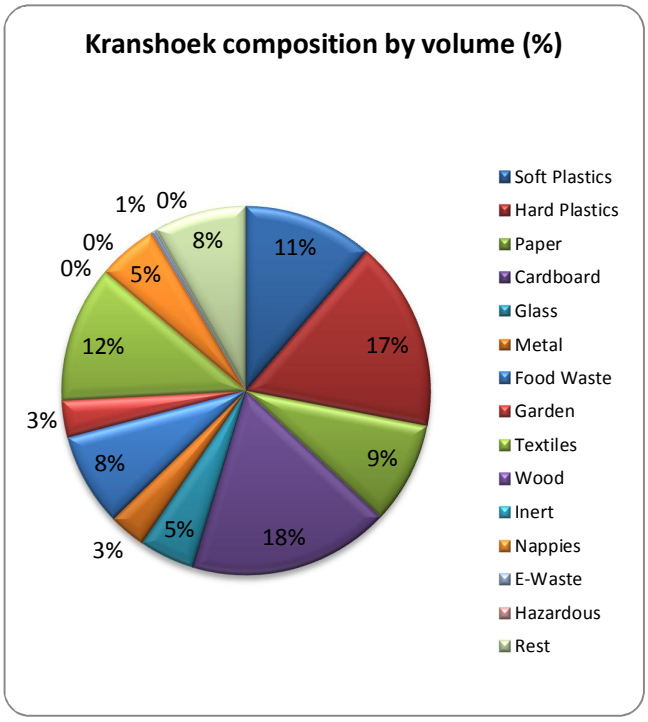


3.1.2 KRANSHOEK (32 SAMPLES)

Waste Type	Mass (kg)	Percentage of total Mass (%)	Calculated Volume (m^3)
Soft Plastics	8,72	6,36	0,056
Hard Plastics	5,91	4,31	0,082
Paper	9,97	7,27	0,044
Cardboard	11,30	8,24	0,087
Glass	10,01	7,30	0,024
Metal	5,17	3,77	0,016
Food Waste	41,66	30,38	0,040
Garden	6,96	5,08	0,016
Textiles	17,18	12,53	0,059
Wood	0,00	0,00	0,00
Inert	0,00	0,00	0,00
Nappies	5,80	4,23	0,026
E-Waste	0,20	0,15	0,002
Hazardous	0,31	0,23	0,0001
Rest	13,93	10,16	0,040
Total	**137,12**	**100**	**0,4921**

Table 3.2: Results of Kranshoek (32 samples)

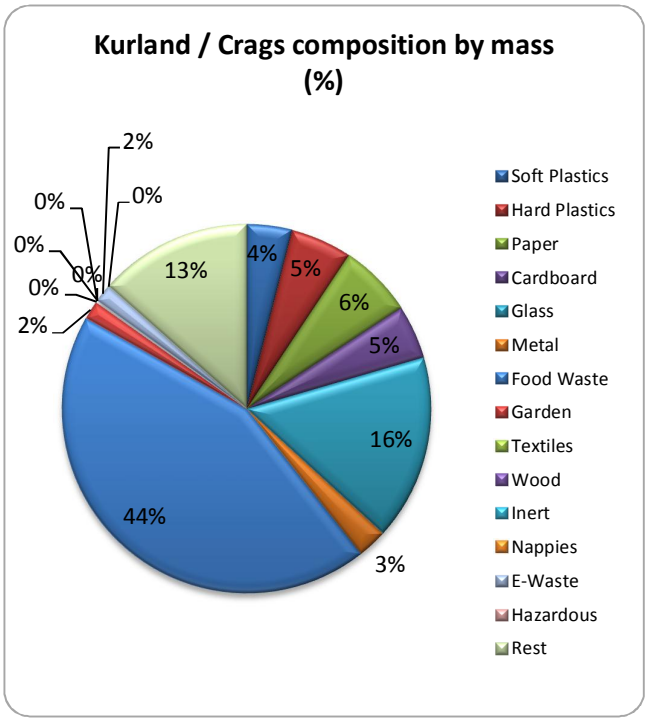


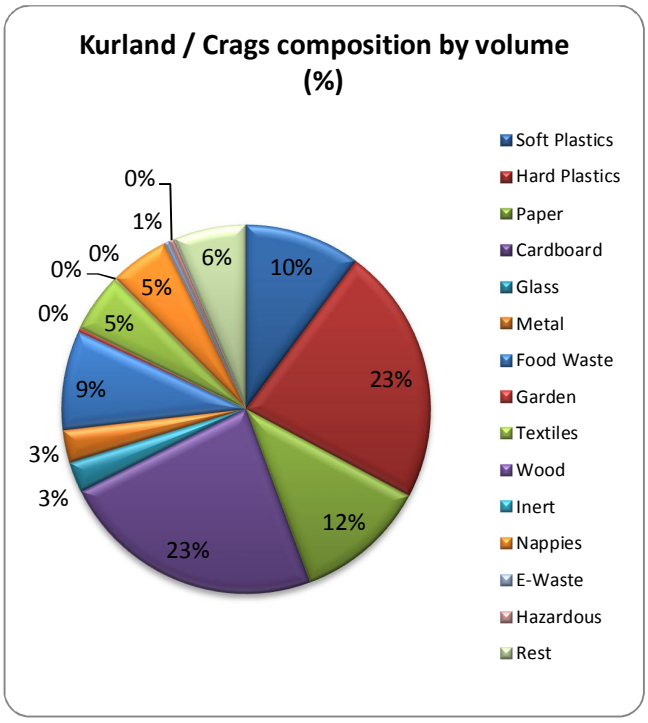


3.1.3 KURLAND / THE CRAGS (52 SAMPLES)

Waste Type	Mass (kg)	Percentage of total Mass (%)	Calculated Volume (m^3)
Soft Plastics	9,90	6,22	0,064
Hard Plastics	10,27	6,45	0,143
Paper	16,69	10,48	0,073
Cardboard	19,11	12,00	0,147
Glass	6,80	4,27	0,017
Metal	5,82	3,66	0,018
Food Waste	57,03	35,82	0,055
Garden	0,85	0,53	0,002
Textiles	9,70	6,09	0,033
Wood	0,05	0,03	0,0003
Inert	0,00	0,00	0,00
Nappies	7,45	4,68	0,033
E-Waste	0,35	0,22	0,003
Hazardous	1,15	0,72	0,003
Rest	14,05	8,82	0,040
Total	**159,22**	**100**	**0,6313**

Table 3.3: Results of Kurland / The Crags (52 samples)

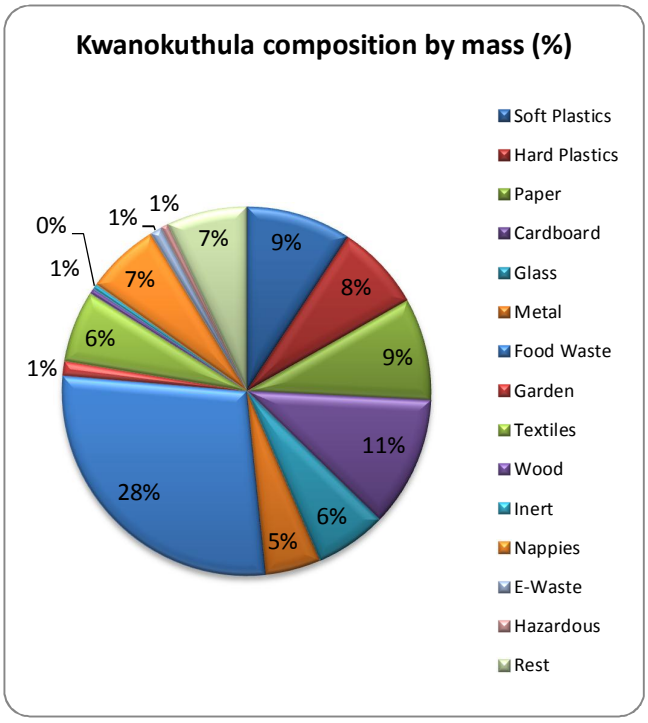


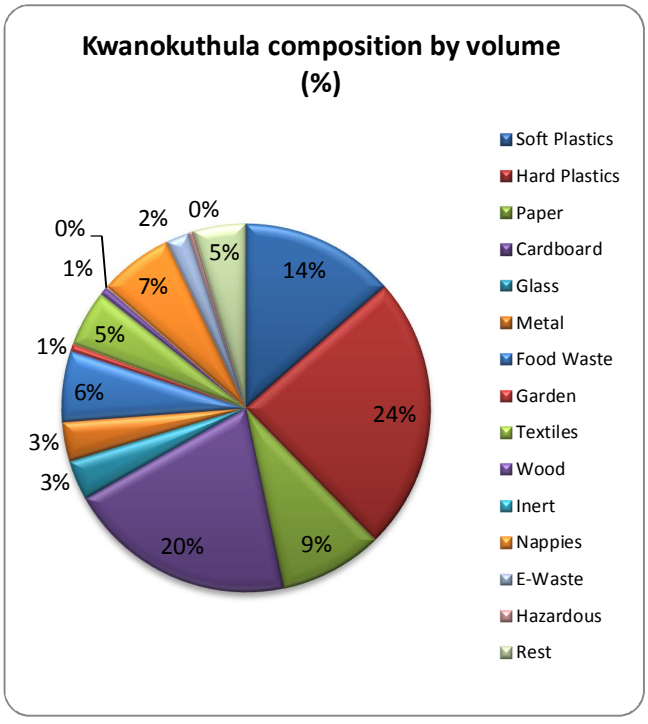


3.1.4 KWANOKUTHULA (131 SAMPLES)

Waste Type	Mass (kg)	Percentage of total Mass (%)	Calculated Volume (m^3)
Soft Plastics	60,40	9,22	0,387
Hard Plastics	49,68	7,59	0,690
Paper	58,81	8,98	0,258
Cardboard	74,89	11,43	0,576
Glass	41,15	6,28	0,100
Metal	31,74	4,85	0,099
Food Waste	183,34	27,99	0,178
Garden	8,30	1,27	0,018
Textiles	41,10	6,28	0,141
Wood	3,15	0,48	0,021
Inert	2,95	0,45	0,003
Nappies	42,25	6,45	0,186
E-Waste	6,90	1,05	0,058
Hazardous	4,25	0,65	0,012
Rest	46,01	7,03	0,132
Total	**654,92**	**100**	**2,859**

Table 3.4: Results of Kwanokuthula (131 samples)

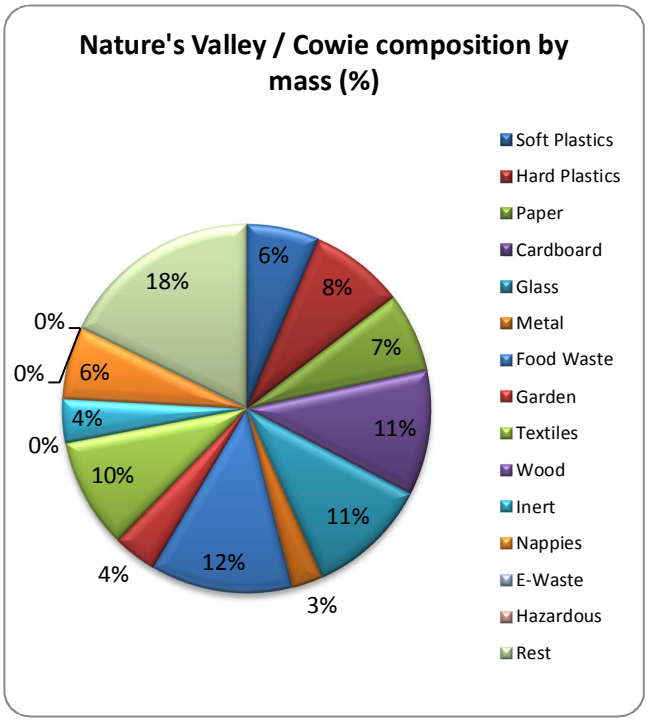


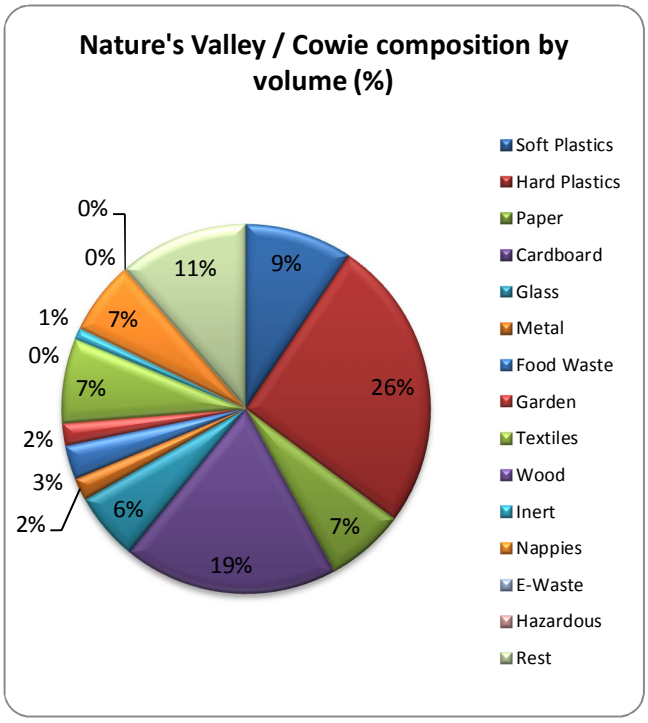


3.1.5 NATURES VALLEY / COWIE (11 SAMPLES)

Waste Type	Mass (kg)	Percentage of total Mass (%)	Calculated Volume (m^3)
Soft Plastics	2,90	6,36	0,019
Hard Plastics	3,77	8,27	0,052
Paper	3,20	7,02	0,014
Cardboard	5,00	10,97	0,038
Glass	4,85	10,64	0,012
Metal	1,25	2,74	0,004
Food Waste	5,70	12,51	0,006
Garden	1,75	3,84	0,004
Textiles	4,40	9,66	0,015
Wood	0,00	0,00	0,00
Inert	1,75	3,84	0,002
Nappies	2,90	6,36	0,013
E-Waste	0,00	0,00	0,00
Hazardous	0,00	0,00	0,00
Rest	8,10	17,77	0,023
Total	**45,57**	**100**	**0,202**

Table 3.5: Results of Natures Valley / Cowie (11 samples)

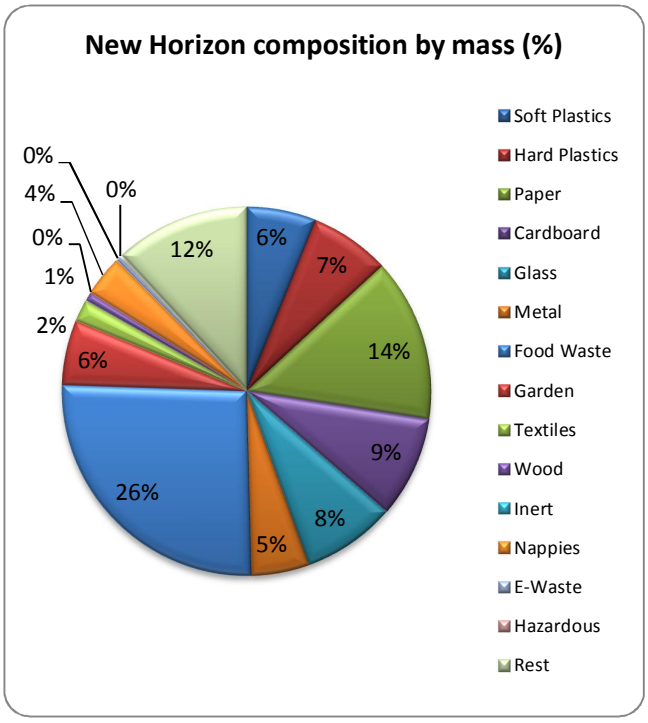


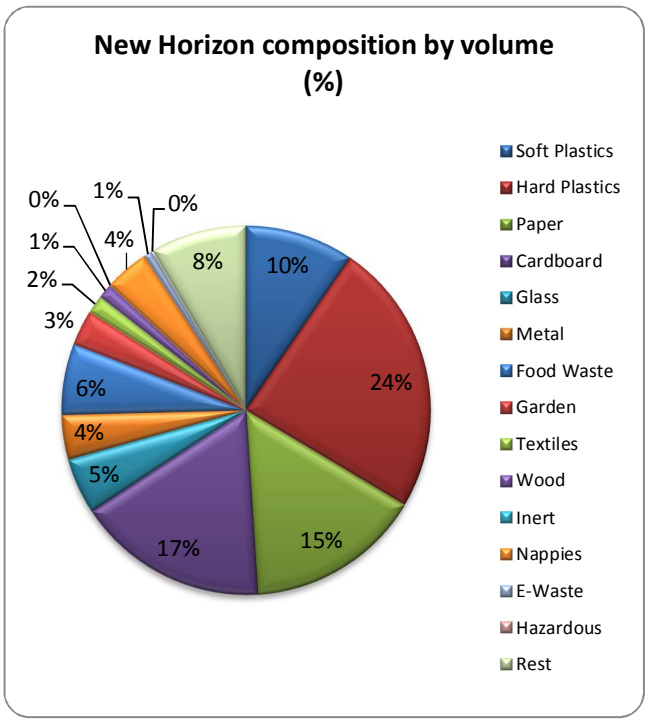


3.1.6 NEW HORIZON (109 SAMPLES)

Waste Type	Mass (kg)	Percentage of total Mass (%)	Calculated Volume (m^3)
Soft Plastics	20,64	6,08	0,132
Hard Plastics	23,93	7,05	0,332
Paper	48,60	14,31	0,213
Cardboard	30,15	8,88	0,232
Glass	27,85	8,20	0,068
Metal	17,29	5,09	0,054
Food Waste	88,00	25,92	0,086
Garden	19,35	5,70	0,043
Textiles	6,55	1,93	0,022
Wood	2,75	0,81	0,018
Inert	0,00	0,00	0,00
Nappies	12,20	3,59	0,054
E-Waste	1,20	0,35	0,010
Hazardous	0,85	0,25	0,002
Rest	40,21	11,84	0,116
Total	**339,57**	**100**	**1,382**

Table 3.6: Results of New Horizon (109 samples)

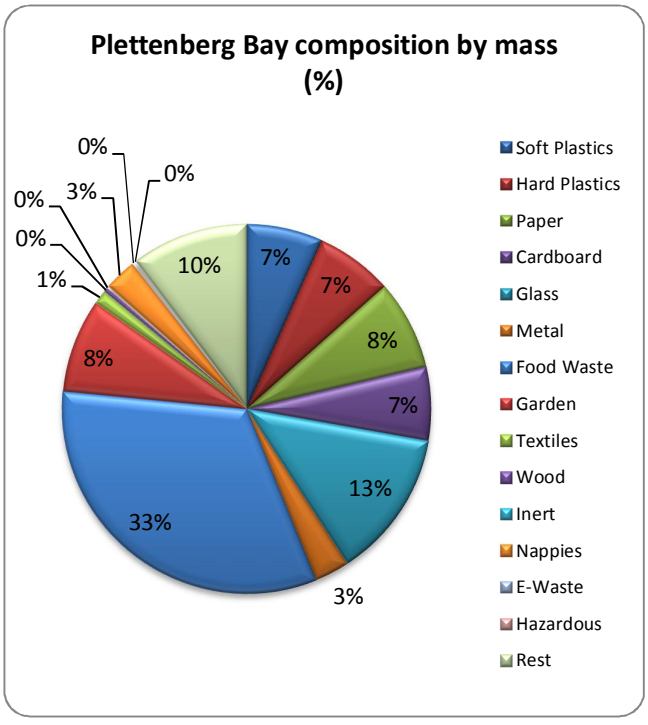


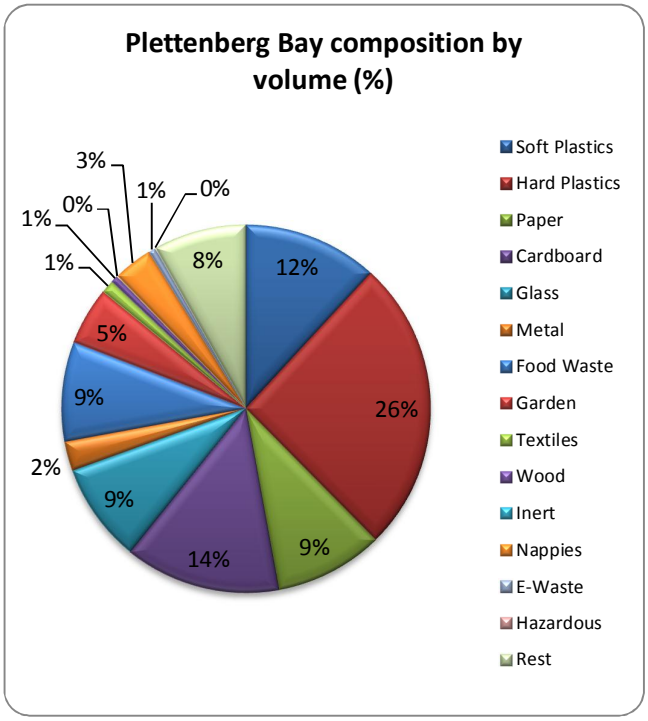


3.1.7 PLETTENBERG BAY (236 SAMPLES)

Waste Type	Mass (kg)	Percentage of total Mass (%)	Calculated Volume (m^3)
Soft Plastics	64,51	6,69	0,414
Hard Plastics	65,18	6,76	0,905
Paper	76,01	7,88	0,333
Cardboard	62,23	6,45	0,479
Glass	125,88	13,05	0,306
Metal	29,22	3,03	0,091
Food Waste	314,90	32,66	0,306
Garden	79,31	8,22	0,178
Textiles	11,80	1,22	0,040
Wood	3,50	0,36	0,022
Inert	1,95	0,20	0,002
Nappies	27,25	2,83	0,120
E-Waste	2,55	0,26	0,021
Hazardous	0,96	0,10	0,003
Rest	99,01	10,27	0,285
Total	**964,26**	**100**	**3,505**

Table 3.7: Results of Plettenberg Bay (236 samples)

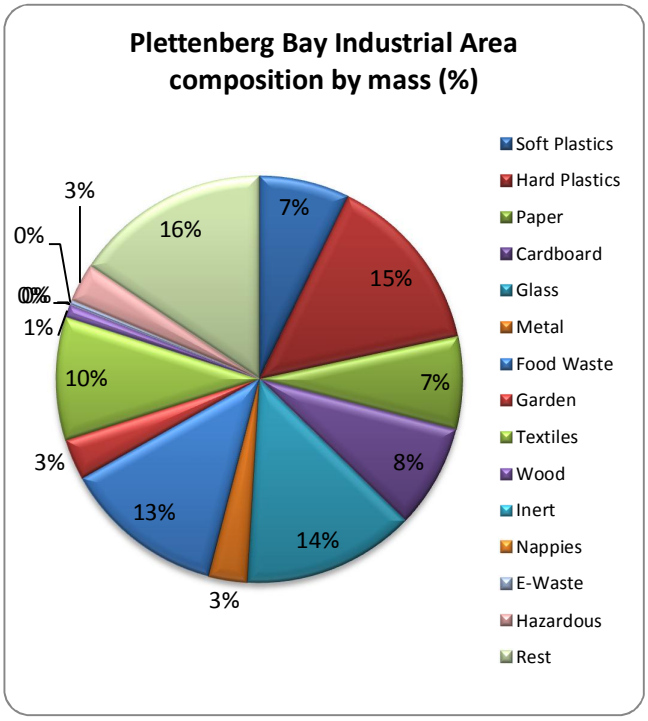


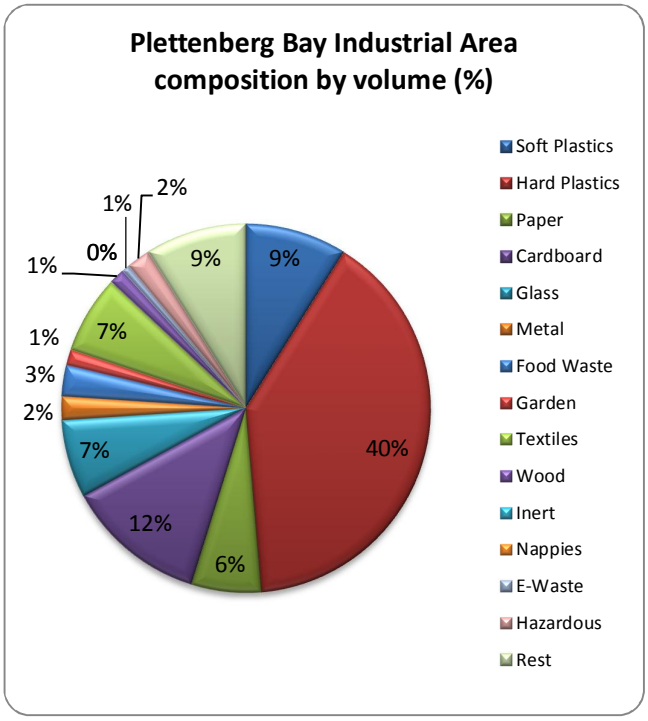


3.1.8 PLETTENBERG BAY INDUSTRIAL AREA (6 SAMPLES)

Waste Type	Mass (kg)	Percentage of total Mass (%)	Calculated Volume (m^3)
Soft Plastics	2,10	7,20	0,013
Hard Plastics	4,20	14,41	0,058
Paper	2,15	7,38	0,009
Cardboard	2,40	8,23	0,018
Glass	4,00	13,72	0,010
Metal	0,90	3,09	0,003
Food Waste	3,75	12,86	0,004
Garden	0,95	3,26	0,002
Textiles	2,85	9,78	0,010
Wood	0,30	1,03	0,002
Inert	0,00	0,00	0,00
Nappies	0,00	0,00	0,00
E-Waste	0,10	0,34	0,001
Hazardous	0,90	3,09	0,003
Rest	4,55	15,61	0,013
Total	**29,15**	**100**	**0,146**

Table 3.8: Results of Plettenberg Bay Industrial Area (6 samples)

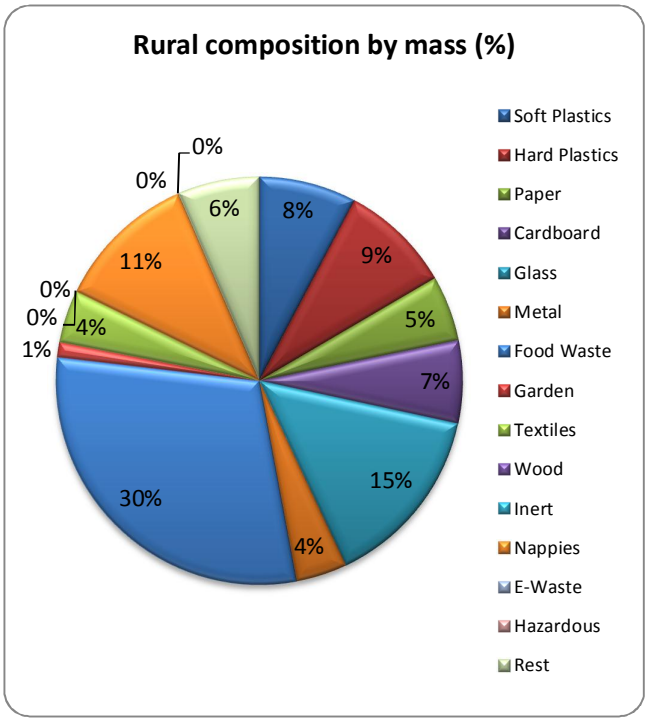


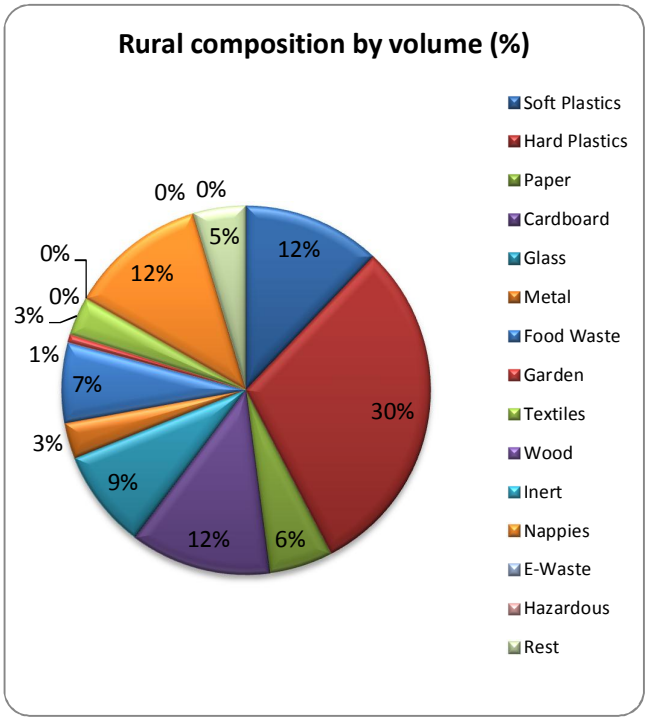


3.1.9 RURAL (21 SAMPLES)

Waste Type	Mass (kg)	Percentage of total Mass (%)	Calculated Volume (m^3)
Soft Plastics	7,85	7,76	0,050
Hard Plastics	8,97	8,86	0,125
Paper	5,25	5,19	0,023
Cardboard	6,65	6,57	0,051
Glass	14,80	14,62	0,036
Metal	4,11	4,06	0,013
Food Waste	30,15	29,79	0,029
Garden	1,20	1,19	0,003
Textiles	4,22	4,17	0,014
Wood	0,00	0,00	0,00
Inert	0,00	0,00	0,00
Nappies	11,41	11,27	0,050
E-Waste	0,00	0,00	0,00
Hazardous	0,05	0,05	0,0001
Rest	6,56	6,48	0,019
Total	**101,22**	**100**	**0,4131**

Table 3.9: Results of Rural (21 samples)

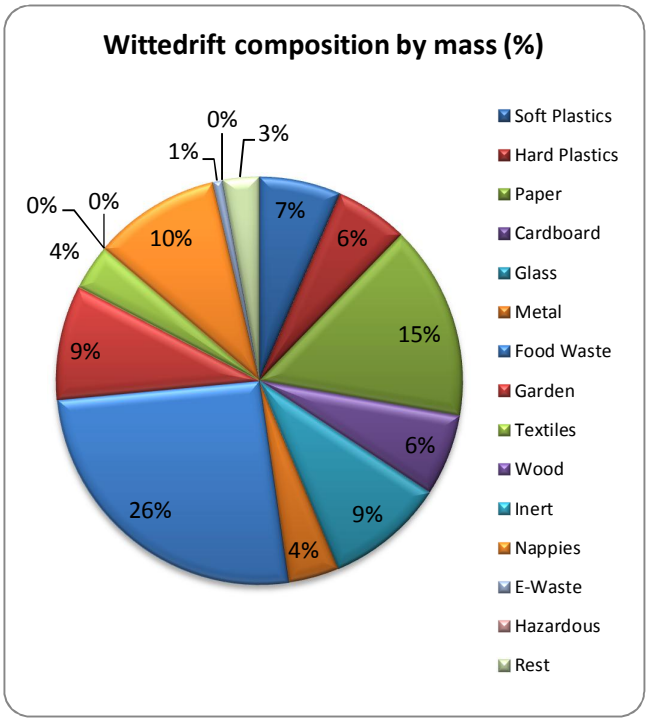


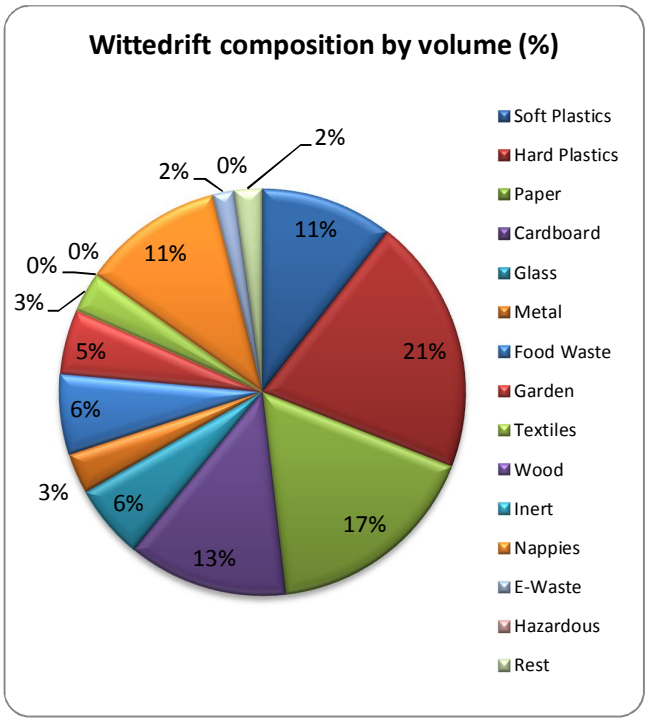


3.1.10 WITTEDRIFT (26 SAMPLES)

Waste Type	Mass (kg)	Percentage of total Mass (%)	Calculated Volume (m^3)
Soft Plastics	6,75	6,50	0,043
Hard Plastics	6,00	5,78	0,083
Paper	16,07	15,48	0,070
Cardboard	6,73	6,48	0,052
Glass	9,80	9,44	0,024
Metal	4,17	4,02	0,013
Food Waste	26,80	25,81	0,026
Garden	9,42	9,07	0,021
Textiles	3,77	3,63	0,013
Wood	0,00	0,00	0,00
Inert	0,00	0,00	0,00
Nappies	10,50	10,11	0,046
E-Waste	0,80	0,77	0,007
Hazardous	0,00	0,00	0,00
Rest	3,02	2,91	0,009
Total	**103,83**	**100**	**0,407**

Table 3.10: Results of Wittedrift (26 samples)

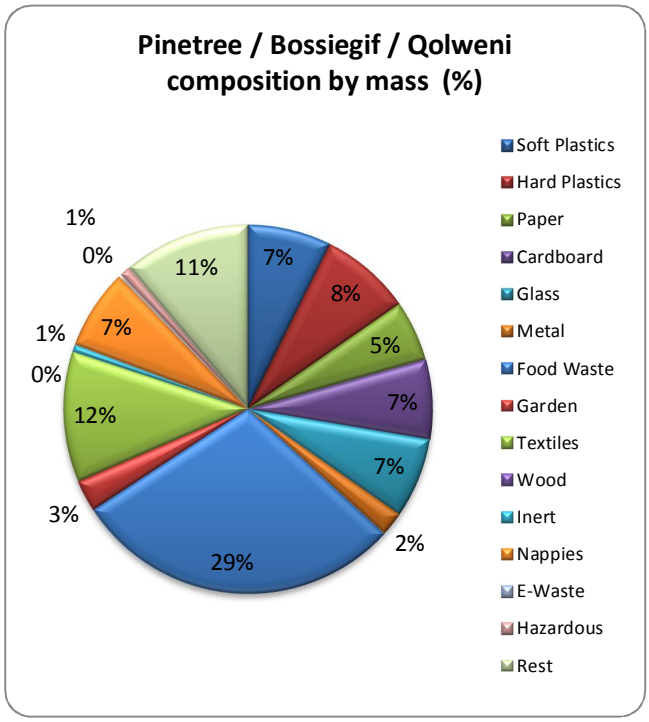


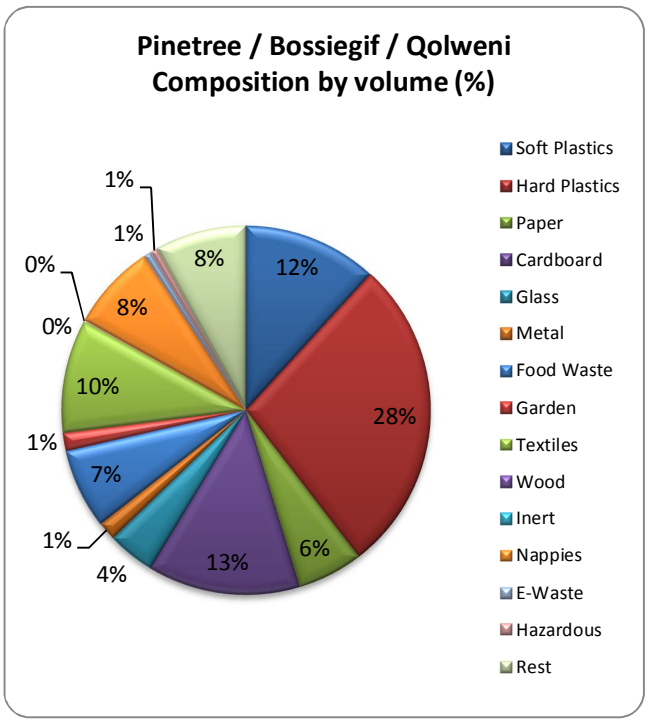


3.1.11 PINTREE / BOSSIEGIF / QOLWENI (20 SAMPLES)

Waste Type	Mass (kg)	Percentage of total Mass (%)	Calculated Volume (m^3)
Soft Plastics	5,75	7,35	0,037
Hard Plastics	6,25	7,99	0,087
Paper	4,15	5,31	0,018
Cardboard	5,47	6,99	0,042
Glass	5,51	7,04	0,013
Metal	1,65	2,11	0,005
Food Waste	22,70	29,02	0,022
Garden	2,15	2,75	0,005
Textiles	8,96	11,45	0,031
Wood	0,00	0,00	0,00
Inert	0,50	0,64	0,0005
Nappies	5,50	7,03	0,024
E-Waste	0,20	0,26	0,002
Hazardous	0,75	0,96	0,002
Rest	8,68	11,10	0,025
Total	**78,22**	**100**	**0,3135**

Table 3.11: Results of Pinetree,/ Bossiegi / Qolweni (20 samples)

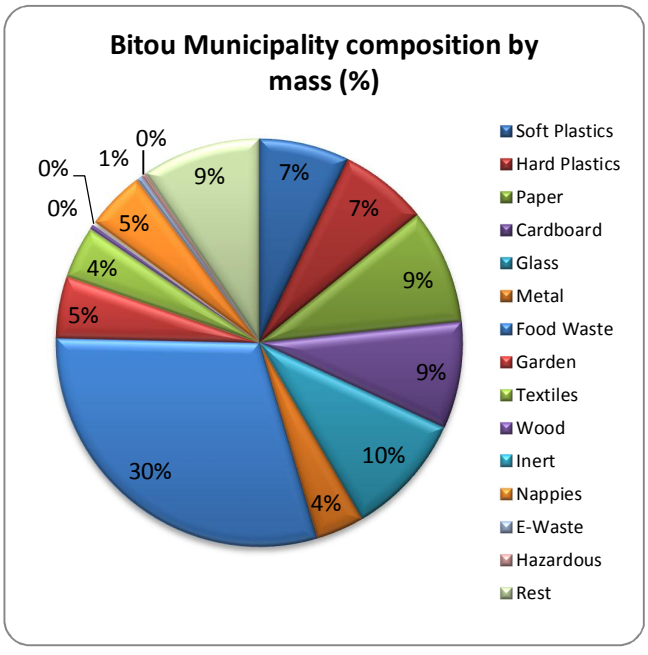


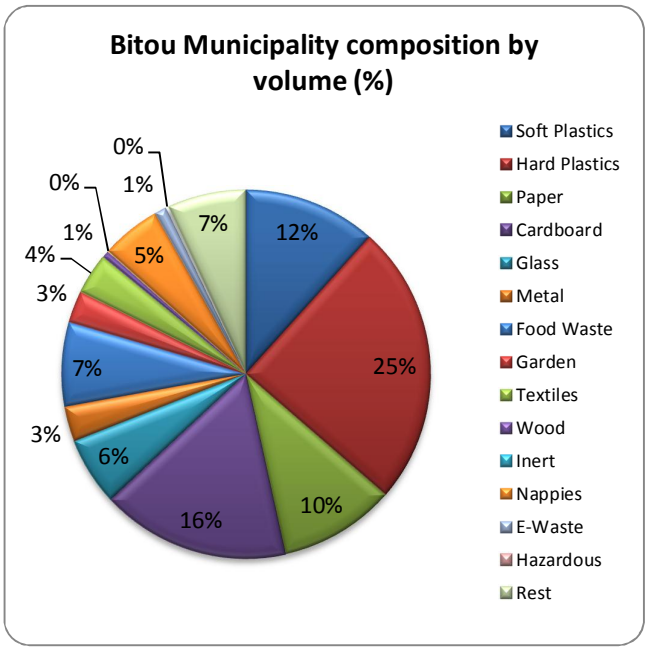


3.2 TOTAL BITOU MUNICIPALITY (654 SAMPLES)

Waste Type	Mass (kg)	Percentage of total Mass (%)	Calculated Volume (m^3)
Soft Plastics	191,88	7,18	1,230
Hard Plastics	187,36	7,01	2,602
Paper	244,75	9,16	1,073
Cardboard	226,73	8,48	1,744
Glass	260,36	9,74	0,633
Metal	102,87	3,85	0,321
Food Waste	800,13	29,94	0,777
Garden	131,20	4,91	0,295
Textiles	110,63	4,14	0,379
Wood	9,75	0,36	0,063
Inert	7,15	0,27	0,007
Nappies	125,26	4,69	0,552
E-Waste	13,25	0,50	0,110
Hazardous	9,22	0,34	0,026
Rest	252,13	9,43	0,725
Total	**2672,67**	**100**	**10,537**

Table 3.12: Results for Bitou Municipality (654 samples)





4. CONCLUSIONS

Of the 654 bags that were sampled a total mass of 2 672,67kg (2.67 tons) of waste was recorded, with a compacted volume of 10,537m³.

Food Waste was the most prominent component by mass (30%) of the waste types that were sampled, however only makes up 7% of the total waste by volume. Hard Plastics was the most prominent component by volume (25%) of the waste types that were sampled.

46% of the waste types that were sampled by mass were recyclable materials: Glass (10%), Paper (9%), Cardboard (9%), Hard Plastics (7%), Soft Plastics (7%) and Metal (4%). However, by volume, 72% of the waste types that were sampled were recyclable materials: Hard Plastics (25%), Cardboard (16%), Soft Plastics (12%), Paper (10%), Glass (6%) and Metal (3%).

Garden waste constituted 5% of the total waste sampled by mass and 3% by volume. It must be noted that a separate tariff is charged by Bitou Municipality for the collection of garden waste. Generally garden waste is disposed of directly at the Robberg Garden Waste Site by the public. Therefore the portion of the garden waste sampled in this study was improperly disposed of in the bags intended for household refuse.

E-waste constituted a mere 0,5% of the total waste sampled by mass and 1% by volume. E-waste is however classified as hazardous waste and contains recyclable materials that can be recovered. The remaining hazardous components of the E-waste should be disposed of at an appropriate facility.

Hazardous Waste constituted a mere 0,34% of the total waste sampled by mass and 0,25% by volume. Although minimal, hazardous waste should not be disposed with household general waste.

The remaining 19% of the waste types by mass and 18% by volume was Nappies, Textiles, Wood, Inert and Rest. These waste types cannot be recycled and there is no or limited (unaffordable) alternative waste technologies available in South Africa. Therefore this is considered the portion that will be necessary to dispose of at a landfill site.

The results obtained from the different sub areas within Bitou Municipality illustrated different trends in waste generation. These trends will be significant in identifying and prioritising the type of waste minimisation initiatives to be implemented in the various sub-areas. E.g. Home composting initiatives should be implemented in the sub areas where Garden Waste was the prominent component of the waste sampled.

It was generally considered that the participation rate in the two-bag recycling system was prominent in the higher income areas. However the study indicated approximately 72% (by volume) of the waste generated in the higher income areas are recyclable materials.

The prediction of uniformity and consistency of waste type occurrence is complex due to the heterogeneous nature and variability of waste. Therefore it is not likely to determine accurate projections of the likelihood of the occurrence of particular waste types in a waste stream.

5. ASSUMPTIONS

Based on the figures provided by Bitou Municipality for the tonnages of household waste disposed of for the period July 2014 – June 2016 (two financial years), an estimated 778.35 tons of waste is transported to the PetroSA landfill site in Mossel Bay on a monthly basis. It must be noted that during the summer holiday season there is a spike in the amount of waste generated, and has therefore increased the monthly average.

When applying the results of the characterisation study to the monthly average, the following tonnages per waste type transported and landfilled can be assumed:

Waste Type	Mass (Tons)	Percentage of total Mass (%)	Calculated Volume (m^3)
Soft Plastics	55,89	7,18	358,26
Hard Plastics	54,56	7,01	757,78
Paper	71,30	9,16	312,72
Cardboard	66,00	8,48	507,69
Glass	75,81	9,74	184,45
Metal	29,97	3,85	93,66
Food Waste	233,04	29,94	226,47
Garden	38,22	4,91	85,89
Textiles	32,22	4,14	110,34
Wood	2,80	0,36	17,95
Inert	2,10	0,27	1,98
Nappies	36,50	4,69	160,79
E-Waste	3,89	0,50	32,42
Hazardous	2,65	0,34	7,61
Rest	73,40	9,43	210,92
Total	**778,35**	**100**	**3068,93**

Table 5.1: Assumed tonnages per waste type per month

When referring to Table 5.1 above, the recyclable portion (soft plastic, hard plastic, paper, cardboard, glass and metal) comprises of 45% of the total waste transported and landfilled at PetroSA landfill site on a monthly basis. This amounts to a total of approximately 353.53 tons, and 2214,56 m^3 of recyclable materials that could potentially be diverted from landfill and could result in a significant transport and disposal cost saving.

It is assumed that approximately 233.04 tons (226,47m^3) of food waste and 38.22 tons (85,89m^3) of garden waste is being transported and landfilled on a monthly basis.

It is alarming to note that approximately 3.89 tons of E-waste and 2.65 tons of Hazardous Waste is assumed to be disposed of on a monthly basis.

The remaining waste types (Textiles, Wood, Inert, Nappies and Rest) amounts to approximately 147.02 tons (501,98m^3) and is considered the portion that has no alternative than landfill.

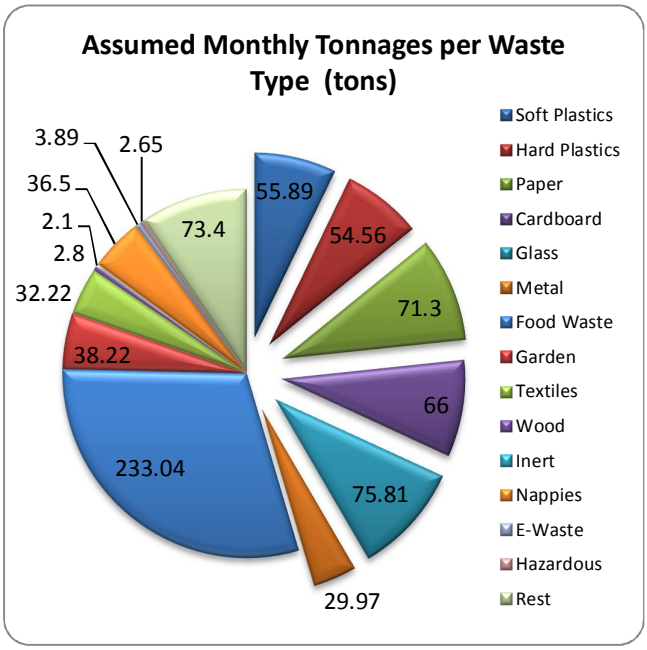


Figure 5.2: Pie Chart indicating assumed portion of recyclable materials in tons

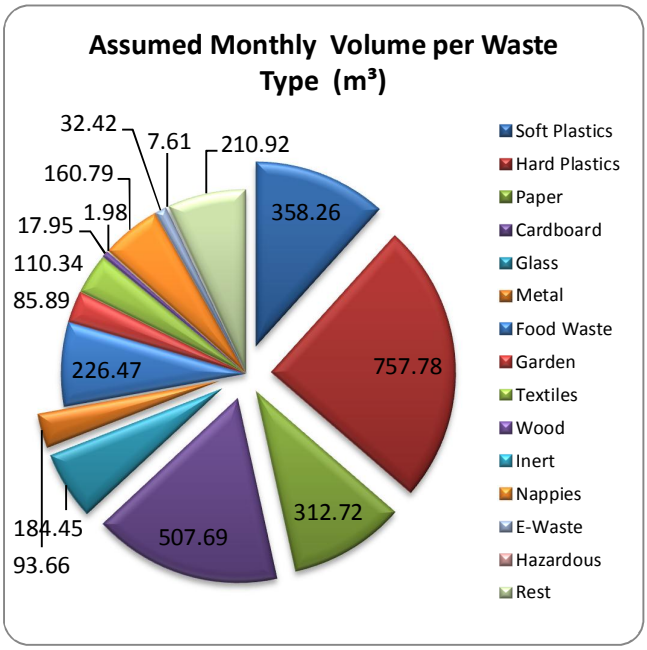


Figure 5.3: Pie chart indicating assumed portion of recyclable materials in m³

6. CHALLENGES

6.1 WHEELIE BINS

Some sub areas of Bitou Municipality make use of wheelie bins for waste storage and collection. This made the sampling of the waste more labour intensive and time consuming. This also made the determination of the total number of bags more complex as it needed to be estimated.

6.2 DATA CAPTURING

The capturing of data from the raw data sheets to an electronic format (spreadsheets) was time consuming and may have resulted in possible human error. The data sheets were scrutinised on a number of occasions in order to ensure that human error was eliminated.

6.3 LACK OF SUPERVISION

The lack of supervision of the Youth Jobs in Waste participants resulted in longer lunch breaks and absenteeism causing the characterisation study to proceed for longer than anticipated. The lack of supervision also resulted in the theft of certain equipment used for the study.

7. RECOMMENDATIONS

7.1 As indicated in the results of the study, a large portion of recyclable material is being transported and disposed of at landfill. It is therefore recommended that recycling initiatives be significantly intensified in Bitou Municipality.

7.2 This report should be used as a guideline to prioritise waste minimisation initiatives per sub area. E.g. Composting initiatives should be implemented in areas where garden and food waste generation is prominent.

7.3 Waste generation is affected by seasonal variation and therefore it would be recommended that waste characterisation studies be conducted at three month intervals. However, due to personnel and financial constraints, it is acceptable to carry out a minimum of two surveys six months apart.

7.4 Categorise the waste into a bigger variety of waste types i.e. break up waste types more specifically e.g. Categorise plastics into different polymer groups.