OUDTSHOORN

Waste Characterisation Study Oudtshoorn Municipality

Report 2016

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EXECUTIVE SUMMARY

A lack of information regarding waste generation types and volumes was identified as a gap in Oudtshoorn Municipality's Integrated Waste Management Plan. Therefore, Eden District Municipality, together with Oudtshoorn Municipality and the participants of the Youth Jobs in Waste Programme implemented by the National Department of Environmental Affairs conducted a waste characterisation study in September 2016.

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 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 regarding the type of venue, equipment, sampling and sorting methods and data collection were used during the characterisation study.

It was decided that the waste would 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 (18 540) to the graph in Appendix B of the Municipal Waste Characterisation Procedures, EPA, Ireland, it was determined that a sample size of approximately 635 would be adequate in order to ensure a representative sample. It must be noted that the total number of households used to determine the sample size is that portion that receives waste removal services from the municipality.

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

A total number of 562 bags was sampled by Oudtshoorn Municipality with a total mass of 2 707.25 kg (2.70 tons) and a compacted volume of 10.540 m^3 as indicated in Table 3.11 below.

Waste Type	Mass (kg)	Percentage of total Mass (%)	Calculated Volume (m^3)
Soft Plastics	176,32	6,51	1,130
Hard Plastics	182,11	6,73	2,529
Paper	216,42	7,99	0,949
Cardboard	176,43	6,52	1,357
Glass	169,17	6,25	0,412
Metal	75,79	2,80	0,237
Food Waste	611,93	22,60	0,595
Garden	400,78	14,80	0,901
Textiles	103,08	3,81	0,353
Wood	20,72	0,77	0,133
Inert	54,73	2,02	0,052
Nappies	227,08	8,39	1,000
E-Waste	9,37	0,35	0,078
Hazardous	14,89	0,55	0,043
Rest	268,43	9,92	0,771
Total	**2707,25**	**100,00**	**10,540**

Table 3.11: Results for Total Oudtshoorn Municipality (562 samples)

36% of the waste types that were sampled by mass were recyclable materials: Paper (8%), Hard Plastics (7%), Soft Plastics (6%), Cardboard (6%), Glass (6%) and Metal (3%). However, by volume, 63% of the waste types that were sampled were recyclable materials: Hard Plastics (24%), Cardboard (13%), Soft Plastics (11%), Paper (9%), Glass (4%) and Metal (2%).

The results obtained from the different sub areas within Oudtshoorn Municipality illustrated different trends in waste generation. These trends will be significant in identifying and prioritising the type of waste management and 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 36% of the total waste going to Grootkop landfill site on a monthly basis. This amounts to a total of approximately 335.41tons and 2 227.21m^3 of recyclable materials that could potentially be diverted from landfill.

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 Oudtshoorn 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 Oudtshoorn. 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 Oudtshoorn Municipality and the participants of the Youth Jobs in Waste Programme implemented by the National Department of Environmental Affairs conducted a waste characterisation study from 19 September 2016 – 28 September 2016.

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 going to landfill. Any recyclable materials already recovered through the existing at source recycling programme implemented by the local recycling service provider will not form part of this study.

The quantity of recyclable material recovered by the local recycling service provider 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 sample of a total of 562 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 Oudtshoorn 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 the Waste Characterisation Study.

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

2.2 TRAINING

On 15 September 2016 a training session conducted by Eden District Municipality took place at the Oudtshoorn Fire Station Conference Hall and storage facilities. A practical training session was 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 were also discussed at this training session.

The waste is 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	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.

Figure 2.1: Training in data collection

2.3 SAMPLE SIZE & PLANNING

2.3.1 REPRESENTATIVE SAMPLE

The estimated total number of households of 2016 as obtained from Oudtshoorn 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.

When applying the total number of households (18 540) to the graph mentioned above, it was determined that a sample size of approximately 635 would be adequate in order to ensure a representative sample. It must be noted that the total number of households used to determine the sample size is that portion that receives waste removal services from the municipality.

The identified households 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.

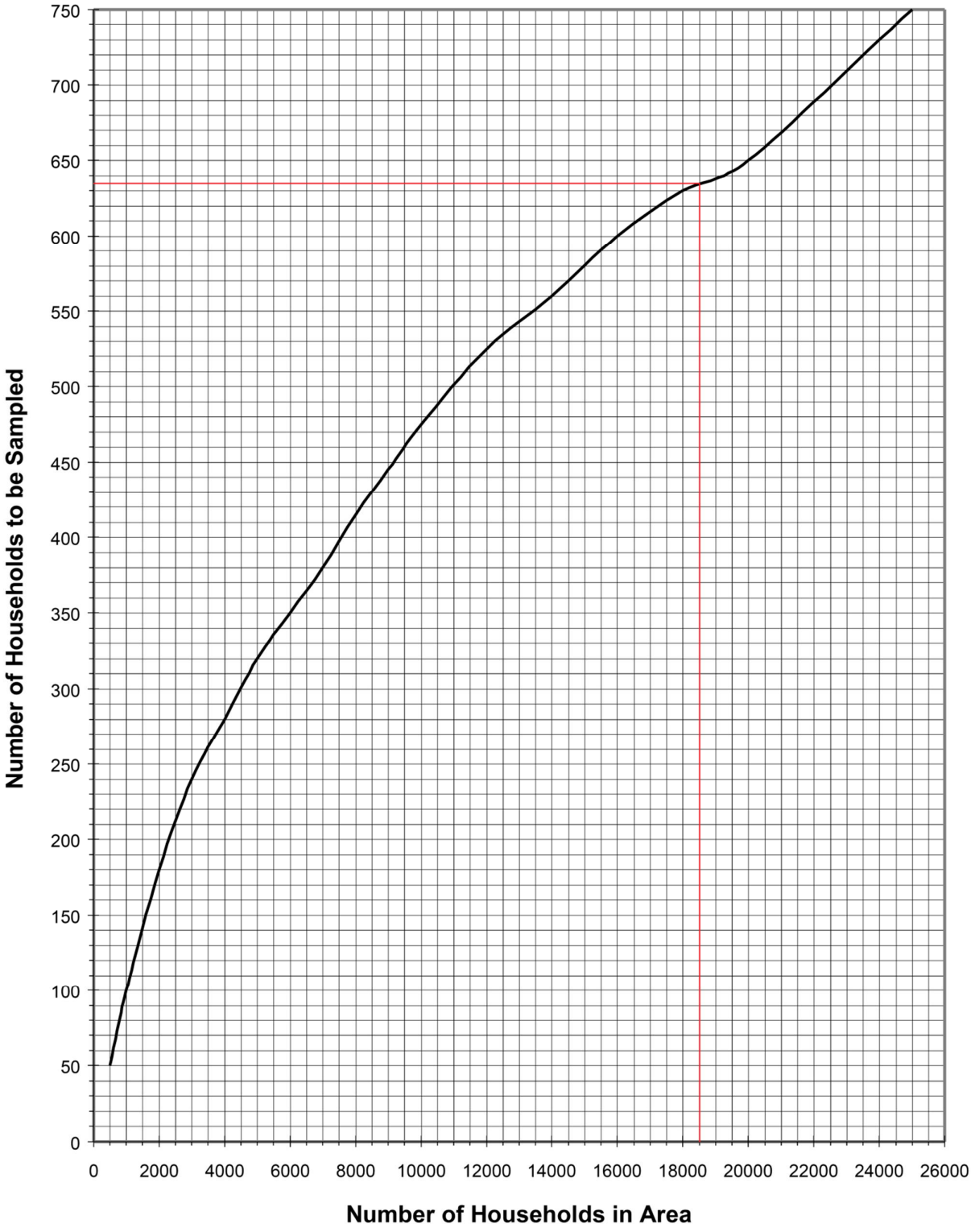


Figure 2.2: Graph determining sample size relative to no. of households

The number of samples per sub area was then calculated relative to the percentage of the total number of households (Table 2.3.2)

Sub Area	No. of Households (18 540)	Percentage of Sample (%)	Sample Size (635)
Bongolethu	3 440	18,55	118
De Rust	782	4,23	27
Dysselsdorp	2 522	13,60	86
Oudtshoorn CBD	342	1,84	12
Bridgeton	4 486	24,19	154
Neppon	402	2,18	14
Oudtshoorn Noord	695	3,76	24
Oudtshoorn Suid	332	1,79	11
Toekomsrus	1 092	5,89	37
Wesbank	4 447	23,97	152
Total	**18 540**	**100**	**635**

Table 2.3: Sample size determination per sub area

A planning session was held on 05 September 2016 together with Eden District Municipality and Oudtshoorn 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 Oudtshoorn 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.

2.3.3 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 collection took place:

- Sub area from which sample was taken
- 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

2.3.4 SAMPLING PLAN

Oudtshoorn 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. It was requested that the samples be 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

Oudtshoorn 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 Fire Station Storage Facility located in Oudtshoorn.

Figure 2.4: Layout of the venue at the Fire Station 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

Oudtshoorn 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.

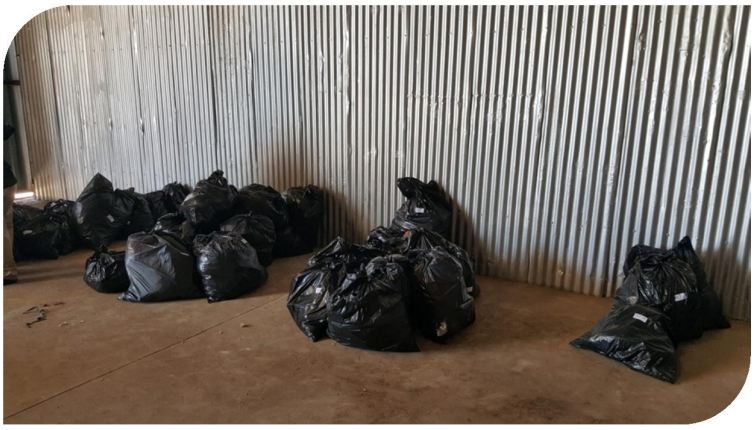


Figure 2.5: Samples stored per sub area

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.

Figure 2.6: Unopened black bag being weighed and mass on label being recorded

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 mass 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 and the data recorded

2.5.4 STEP 4:

All the recyclable waste types / materials were placed into recycling bags (yellow) and the non-recyclable waste was placed into black 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 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.

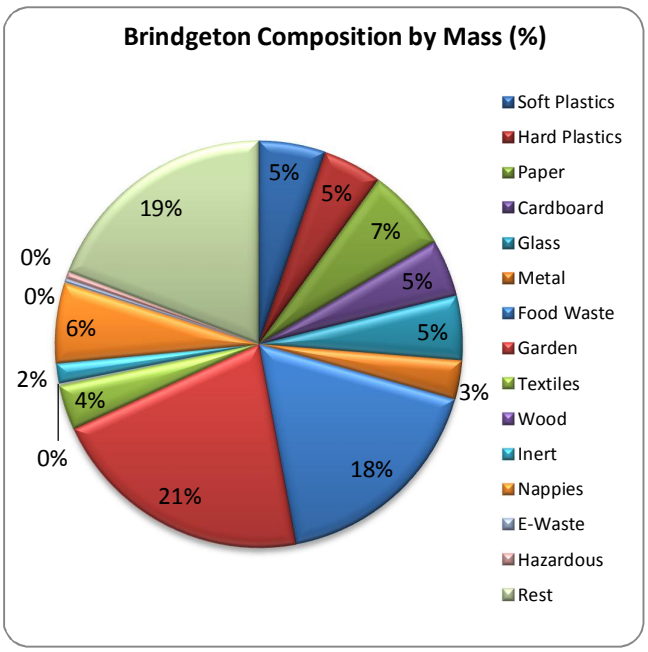
3. RESULTS

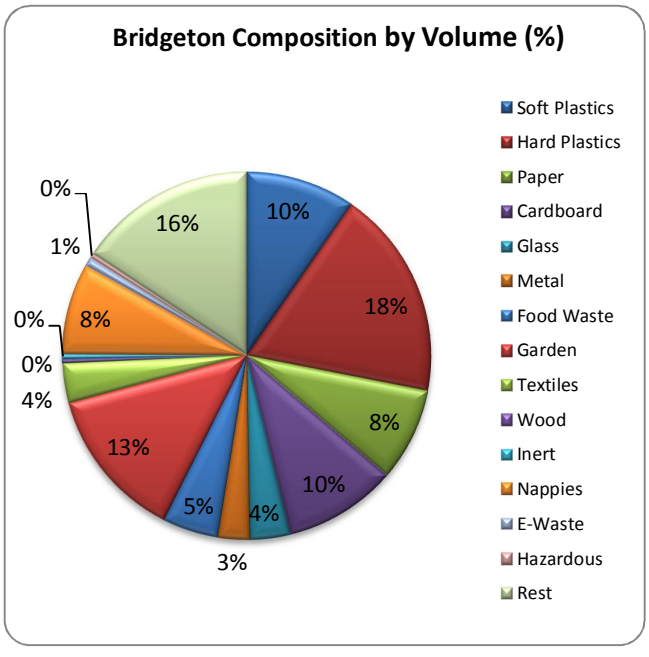
3.1 RESULTS PER SUB AREA

3.1.1 BRIDGETON (73 SAMPLES)

Waste Type	Mass (kg)	Percentage of total	Calculated Volume
Soft Plastics	21.10	5.30	0.135
Hard Plastics	18.65	4.68	0.259
Paper	26.25	6.59	0.115
Cardboard	18.10	4.55	0.139
Glass	20.50	5.15	0.050
Metal	12.40	3.11	0.039
Food Waste	70.50	17.70	0.069
Garden	83.85	21.06	0.188
Textiles	14.25	3.58	0.049
Wood	0.76	0.19	0.005
Inert	6.35	1.59	0.006
Nappies	25.49	6.40	0.112
E-Waste	1.30	0.33	0.011
Hazardous	2.20	0.55	0.006
Rest	76.50	19.21	0.220
Total	**398.20**	**100.00**	**1.403**

Table 3.1: Results for Bridgeton (73 samples)

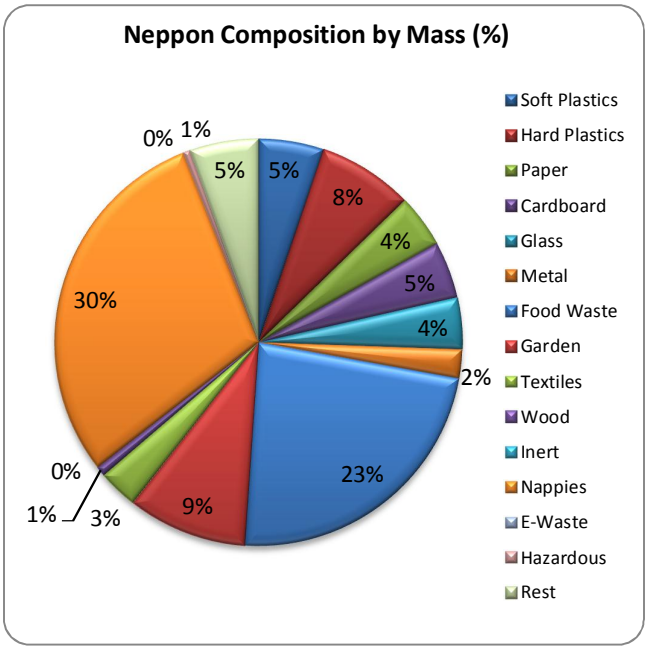


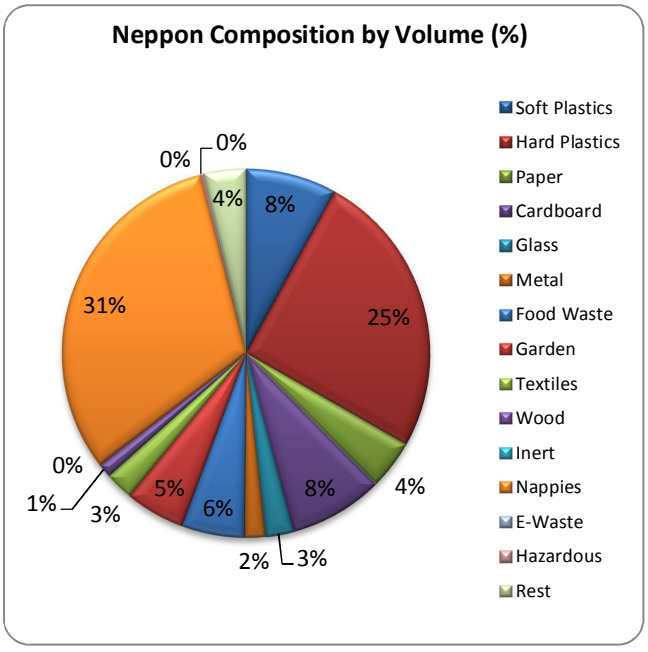


3.1.2 NEPPON (13 SAMPLES)

Waste Type	Mass (kg)	Percentage of total	Calculated Volume
Soft Plastics	4.05	5.19	0.026
Hard Plastics	5.90	7.55	0.082
Paper	3.30	4.23	0.014
Cardboard	3.50	4.48	0.027
Glass	3.20	4.10	0.008
Metal	1.80	2.30	0.006
Food Waste	18.15	23.24	0.018
Garden	7.40	9.48	0.017
Textiles	2.45	3.14	0.008
Wood	0.60	0.77	0.004
Inert	0.00	0.00	0.000
Nappies	23.05	29.51	0.102
E-Waste	0.00	0.00	0.000
Hazardous	0.45	0.58	0.001
Rest	4.25	5.44	0.012
Total	**78.10**	**100.00**	**0.324**

Table 3.2: Results for Neppon (13 samples)

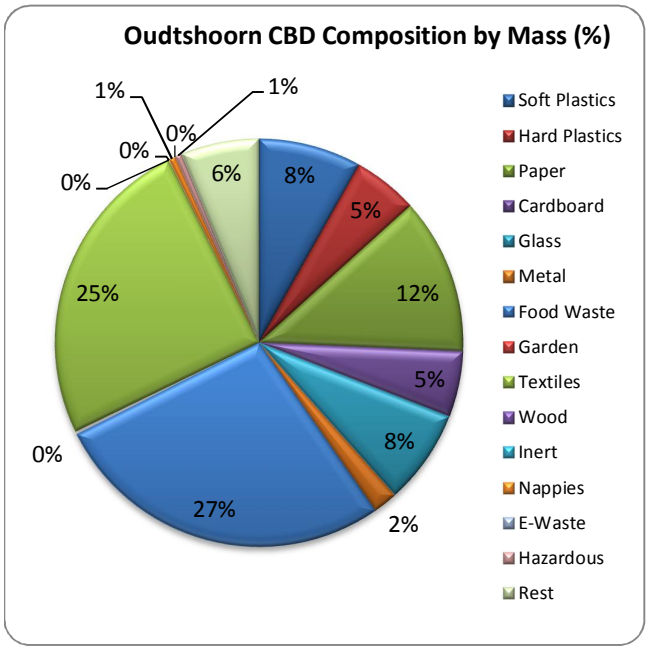


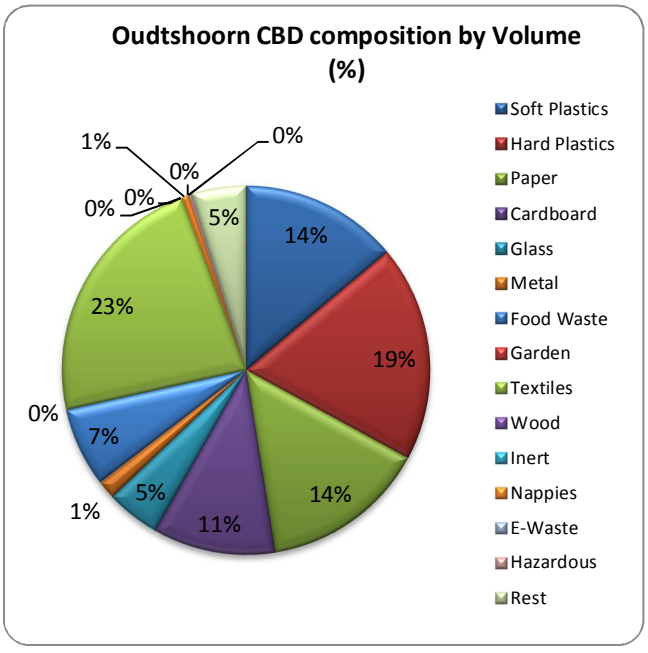


3.1.3 OUDTSHOORN CBD (20 SAMPLES)

Waste Type	Mass (kg)	Percentage of total	Calculated Volume
Soft Plastics	6.88	8.14	0.044
Hard Plastics	4.35	5.15	0.060
Paper	10.47	12.39	0.046
Cardboard	4.40	5.21	0.034
Glass	6.35	7.51	0.015
Metal	1.65	1.95	0.005
Food Waste	23.00	27.22	0.022
Garden	0.20	0.24	0.000
Textiles	21.00	24.85	0.072
Wood	0.05	0.06	0.000
Inert	0.00	0.00	0.000
Nappies	0.45	0.53	0.002
E-Waste	0.00	0.00	0.000
Hazardous	0.45	0.53	0.001
Rest	5.25	6.21	0.015
Total	**84.50**	**100.00**	**0.318**

Table 3.3: Results for Oudtshoorn (20 samples)

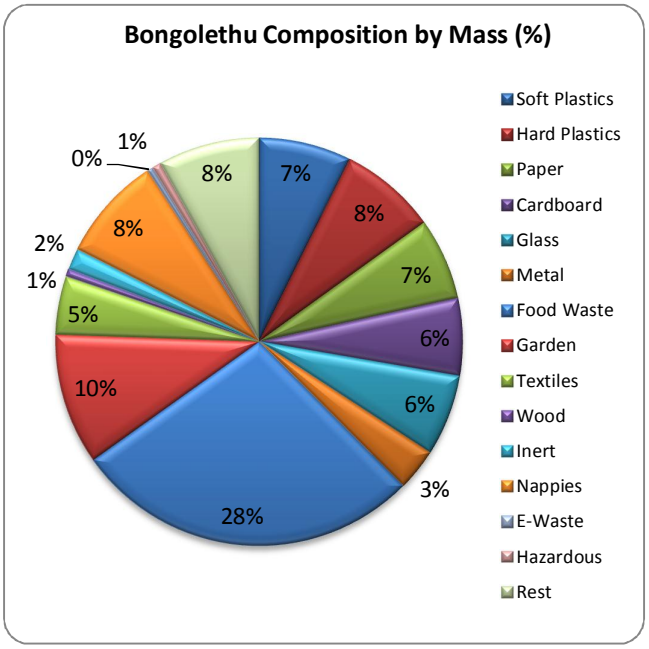


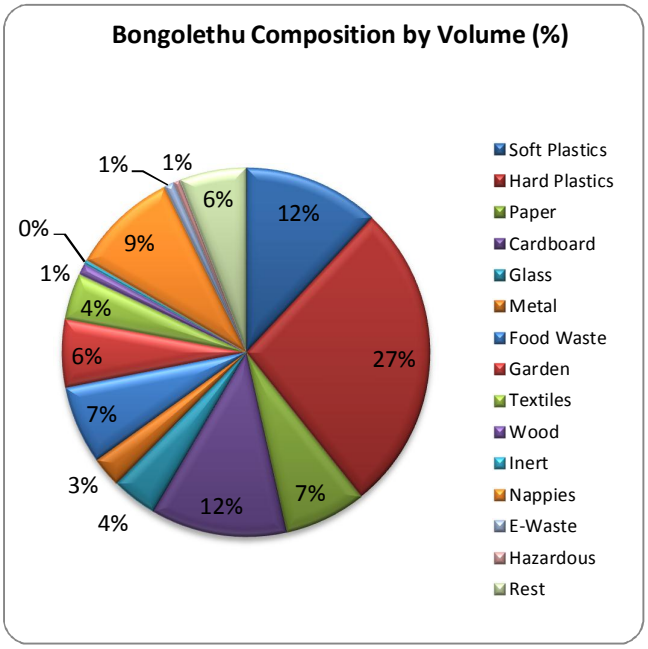


3.1.4 BONGOLETHU (108 SAMPLES)

Waste Type	Mass (kg)	Percentage of total	Calculated Volume
Soft Plastics	38.60	7.35	0.247
Hard Plastics	40.54	7.72	0.563
Paper	34.05	6.49	0.149
Cardboard	32.17	6.13	0.247
Glass	33.75	6.43	0.082
Metal	17.63	3.36	0.055
Food Waste	145.33	27.68	0.141
Garden	54.55	10.39	0.123
Textiles	24.25	4.62	0.083
Wood	3.20	0.61	0.021
Inert	8.80	1.68	0.008
Nappies	43.79	8.34	0.193
E-Waste	2.27	0.43	0.019
Hazardous	3.79	0.72	0.011
Rest	42.26	8.05	0.121
Total	**524.98**	**100.00**	**2.064**

Table 3.4: Results for Bongolethu (108 samples)

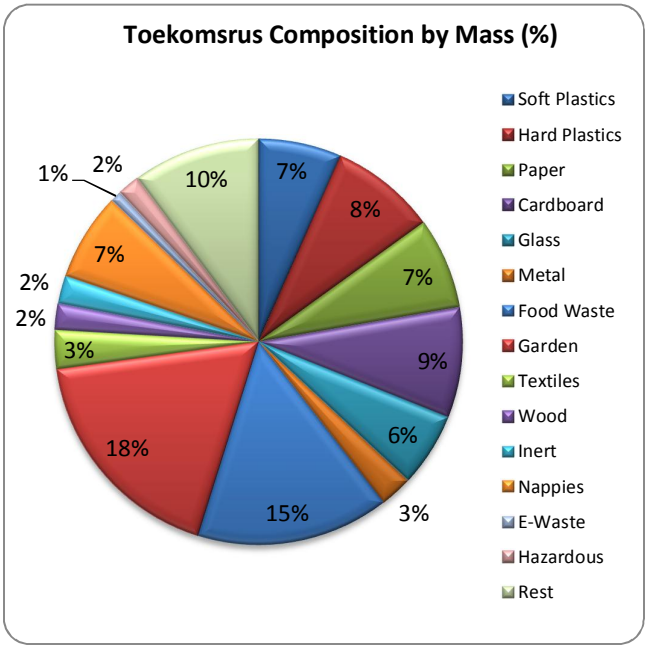


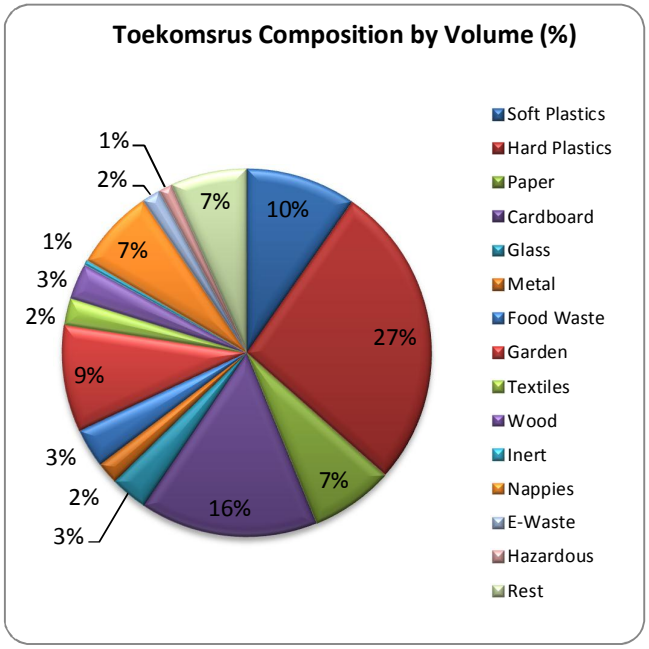


3.1.5 TOEKOMSRUS (35 SAMPLES)

Waste Type	Mass (kg)	Percentage of total	Calculated Volume
Soft Plastics	10.20	6.59	0.065
Hard Plastics	13.05	8.43	0.181
Paper	11.20	7.24	0.049
Cardboard	13.60	8.79	0.105
Glass	9.10	5.88	0.022
Metal	4.00	2.58	0.013
Food Waste	23.70	15.32	0.023
Garden	27.85	18.00	0.063
Textiles	4.80	3.10	0.016
Wood	3.20	2.07	0.021
Inert	3.45	2.23	0.003
Nappies	10.85	7.01	0.048
E-Waste	1.35	0.87	0.011
Hazardous	2.75	1.78	0.008
Rest	15.65	10.11	0.045
Total	**154.75**	**100.00**	**0.673**

Table 3.5: Results for Toekomsrus (35 samples)

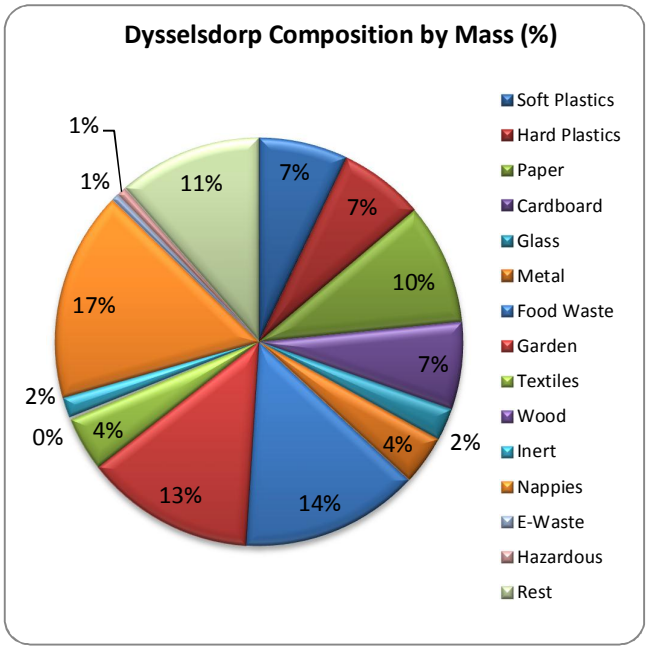


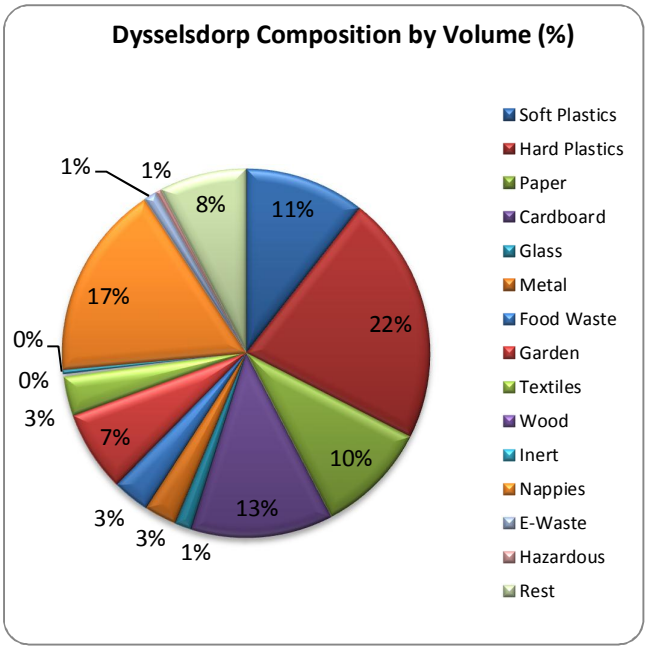


3.1.6 DYSSELSDORP (82 SAMPLES)

Waste Type	Mass (kg)	Percentage of total	Calculated Volume
Soft Plastics	26.97	7.06	0.173
Hard Plastics	25.74	6.74	0.358
Paper	36.70	9.61	0.161
Cardboard	26.50	6.94	0.204
Glass	9.85	2.58	0.024
Metal	15.00	3.93	0.047
Food Waste	54.15	14.17	0.053
Garden	51.45	13.47	0.116
Textiles	16.43	4.30	0.056
Wood	0.70	0.18	0.004
Inert	6.17	1.61	0.006
Nappies	63.65	16.66	0.280
E-Waste	2.25	0.59	0.019
Hazardous	2.85	0.75	0.008
Rest	43.65	11.42	0.125
Total	**382.06**	**100.00**	**1.634**

Table 3.6 Results for Dysselsdorp (82 samples)

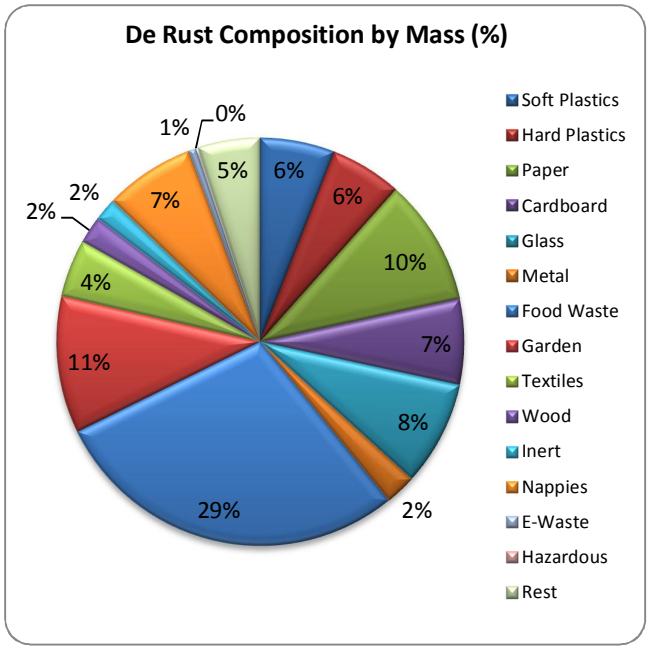


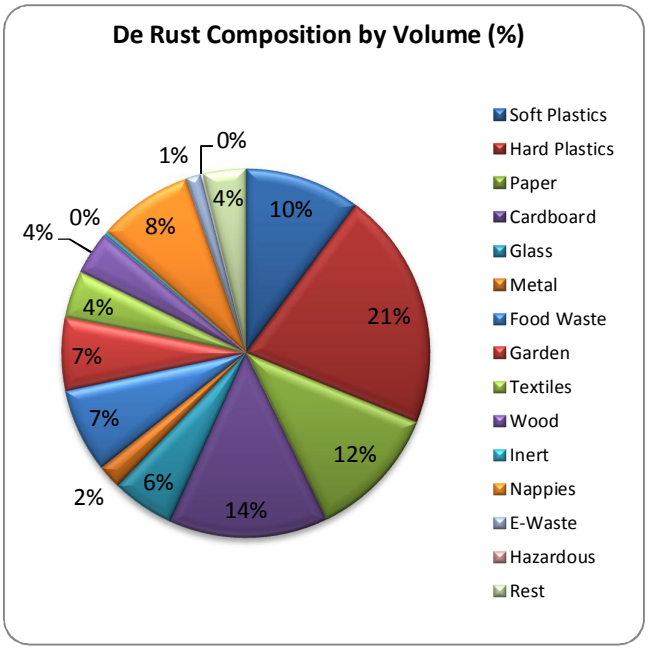


3.1.7 DE RUST (30 SAMPLES)

Waste Type	Mass (kg)	Percentage of total	Calculated Volume
Soft Plastics	8.36	5.92	0.054
Hard Plastics	8.00	5.66	0.111
Paper	14.15	10.02	0.062
Cardboard	9.60	6.80	0.074
Glass	11.75	8.32	0.029
Metal	3.45	2.44	0.011
Food Waste	40.35	28.57	0.039
Garden	15.35	10.87	0.034
Textiles	6.45	4.57	0.022
Wood	3.05	2.16	0.020
Inert	2.55	1.81	0.002
Nappies	10.10	7.15	0.044
E-Waste	0.85	0.60	0.007
Hazardous	0.20	0.14	0.001
Rest	7.01	4.96	0.020
Total	**141.22**	**100.00**	**0.530**

Table 3.7 Results for De Rust (30 samples)

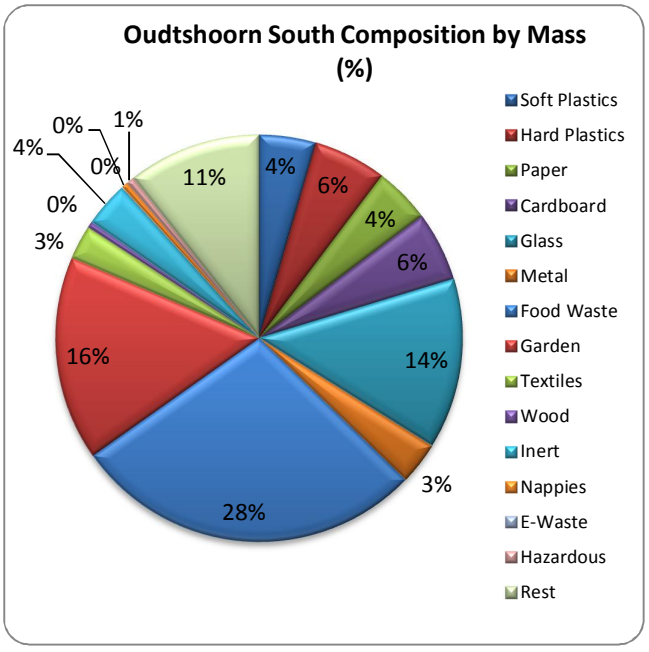


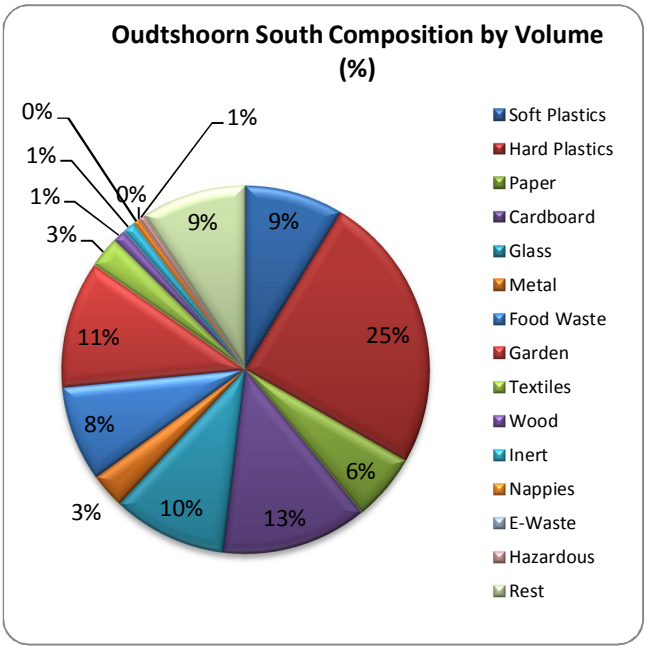


3.1.8 OUDTSHOORN SOUTH (22 SAMPLES)

Waste Type	Mass (kg)	Percentage of total	Calculated Volume
Soft Plastics	4.90	4.51	0.031
Hard Plastics	6.30	5.80	0.088
Paper	4.85	4.46	0.021
Cardboard	6.01	5.53	0.046
Glass	14.75	13.57	0.036
Metal	3.65	3.36	0.011
Food Waste	30.45	28.01	0.030
Garden	17.65	16.24	0.040
Textiles	2.95	2.71	0.010
Wood	0.55	0.51	0.004
Inert	3.90	3.59	0.004
Nappies	0.55	0.51	0.002
E-Waste	0.00	0.00	0.000
Hazardous	0.70	0.64	0.002
Rest	11.50	10.58	0.033
Total	**108.71**	**100.00**	**0.358**

Table 3.8: Results for Oudtshoorn South (22 samples)

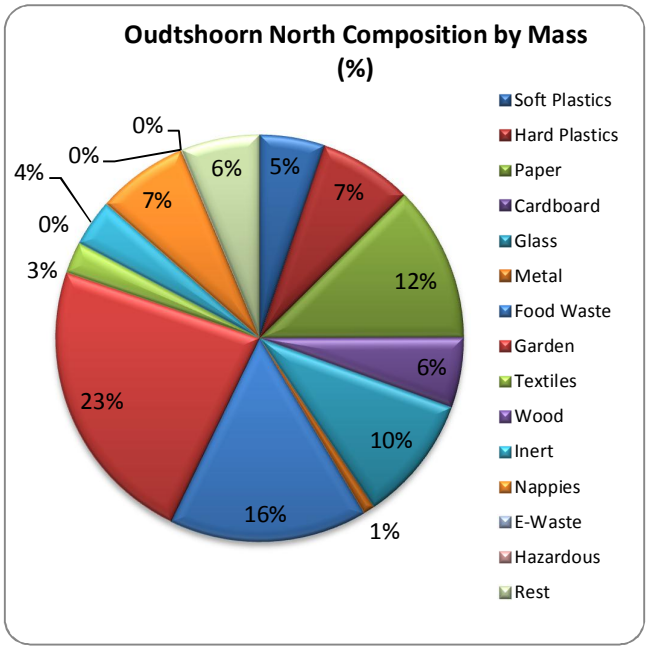


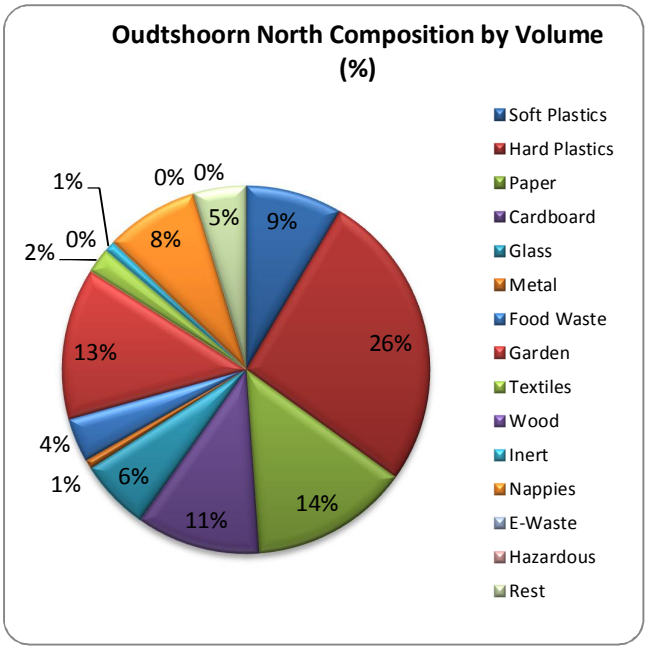


3.1.9 OUDTSHOORN NORTH (34 SAMPLES)

Waste Type	Mass (kg)	Percentage of total	Calculated Volume
Soft Plastics	8.25	5.16	0.053
Hard Plastics	11.85	7.41	0.165
Paper	19.80	12.38	0.087
Cardboard	8.90	5.56	0.068
Glass	16.05	10.03	0.039
Metal	1.45	0.91	0.005
Food Waste	25.10	15.69	0.024
Garden	36.90	23.07	0.083
Textiles	4.00	2.50	0.014
Wood	0.05	0.03	0.000
Inert	5.95	3.72	0.006
Nappies	11.55	7.22	0.051
E-Waste	0.05	0.03	0.000
Hazardous	0.10	0.06	0.000
Rest	9.95	6.22	0.029
Total	**159.95**	**100.00**	**0.623**

Table 3.9: Results for Oudtshoorn North (34 samples)

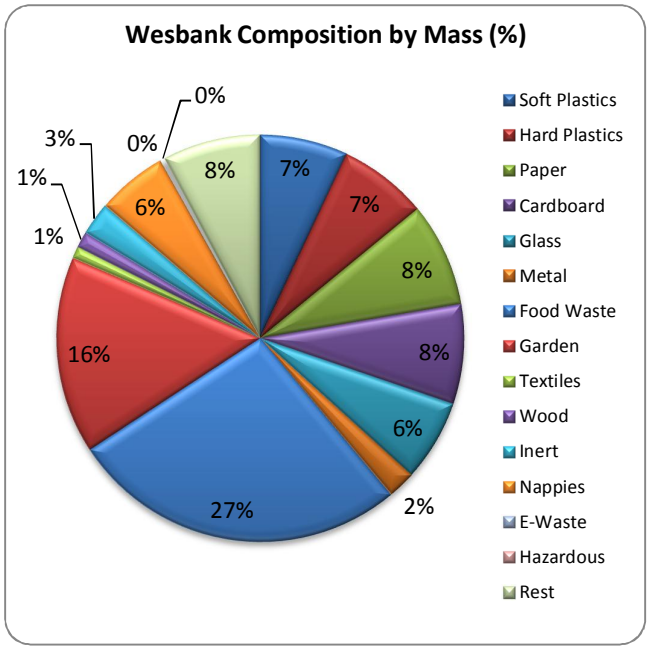


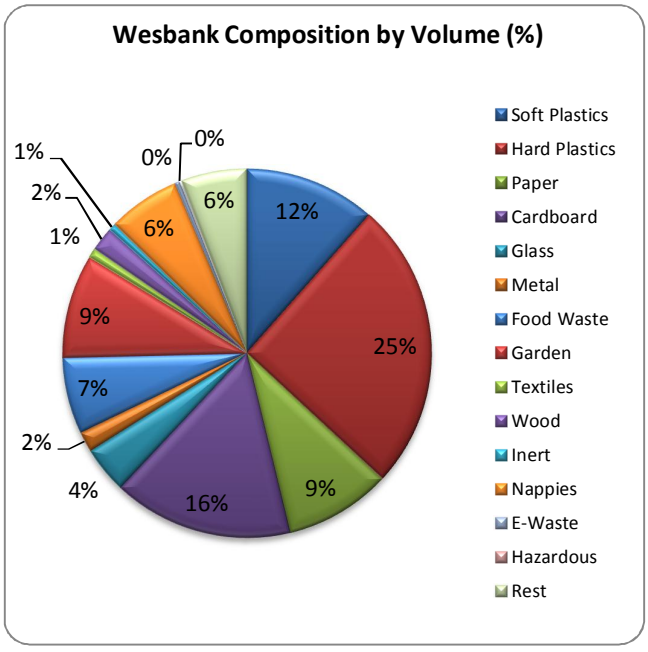


3.1.10 WESBANK (145 SAMPLES)

Waste Type	Mass (kg)	Percentage of total	Calculated Volume
Soft Plastics	47.01	6.97	0.301
Hard Plastics	47.73	7.07	0.663
Paper	55.65	8.25	0.244
Cardboard	53.65	7.95	0.413
Glass	43.87	6.50	0.107
Metal	14.76	2.19	0.046
Food Waste	181.20	26.85	0.176
Garden	105.58	15.65	0.237
Textiles	6.50	0.96	0.022
Wood	8.56	1.27	0.055
Inert	17.56	2.60	0.017
Nappies	37.60	5.57	0.166
E-Waste	1.30	0.19	0.011
Hazardous	1.40	0.21	0.004
Rest	52.41	7.77	0.151
Total	**674.78**	**100.00**	**2.612**

Table 3.10: Results for Wesbank (145 samples)

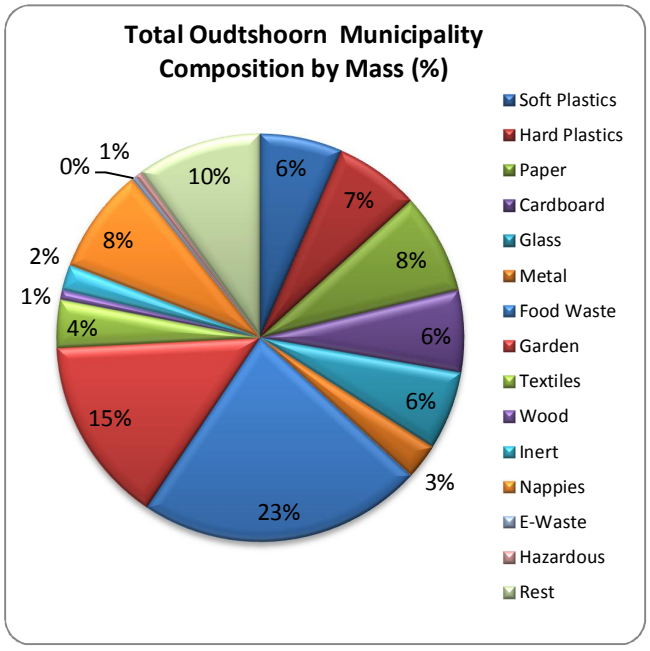


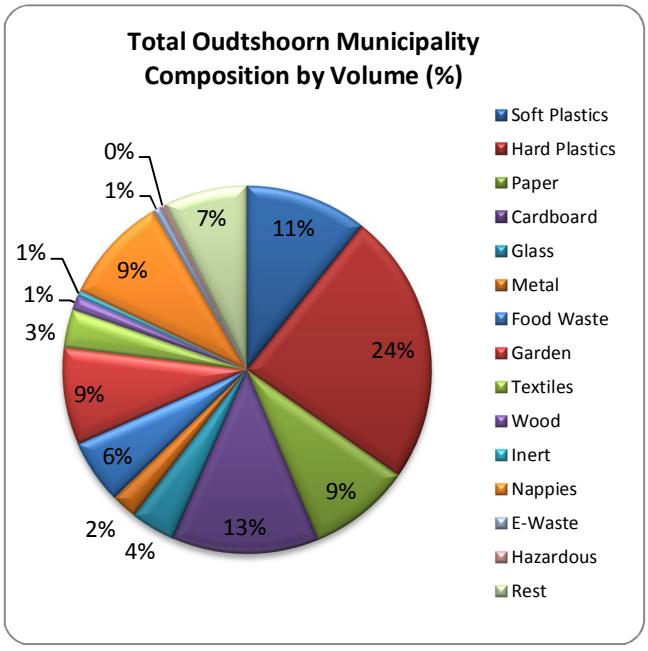


3.1.11 TOTAL OUDTSHOORN MUNICIPALITY (562 SAMPLES)

Waste Type	Mass (kg)	Percentage of total	Calculated Volume
Soft Plastics	176,32	6,51	1,130
Hard Plastics	182,11	6,73	2,529
Paper	216,42	7,99	0,949
Cardboard	176,43	6,52	1,357
Glass	169,17	6,25	0,412
Metal	75,79	2,80	0,237
Food Waste	611,93	22,60	0,595
Garden	400,78	14,80	0,901
Textiles	103,08	3,81	0,353
Wood	20,72	0,77	0,133
Inert	54,73	2,02	0,052
Nappies	227,08	8,39	1,000
E-Waste	9,37	0,35	0,078
Hazardous	14,89	0,55	0,043
Rest	268,43	9,92	0,771
Total	**2707,25**	**100,00**	**10,540**

Table 3.11: Results for Total Oudtshoorn Municipality (562 samples)





4. CONCLUSIONS

Of the 562 bags that were sampled a total mass of 2 707.25kg (2.70 tons) of waste was recorded, with a compacted volume of 10.540 m^3.

Food Waste was the most prominent component by mass (23%) of the waste types that were sampled, however only makes up 6% of the total waste by volume. Hard Plastics was the most prominent component by volume (24%) of the waste types that were sampled.

36% of the waste types that were sampled by mass were recyclable materials: Paper (8%), Hard Plastics (7%), Soft Plastics (6%), Cardboard (6%), Glass (6%) and Metal (3%). However, by volume, 63% of the waste types that were sampled were recyclable materials: Hard Plastics (24%), Cardboard (13%), Soft Plastics (11%), Paper (9%), Glass (4%) and Metal (2%).

Garden waste constituted 15% of the total waste sampled by mass and 9% by volume.

E-waste constituted a mere 0.35% of the total waste sampled by mass and 0.74% 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 0.55% of the total waste sampled by mass and 0.41% by volume. Although minimal, hazardous waste is not permitted to be disposed with household general waste.

The remaining 25% of the waste types by mass and 22% 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 Oudtshoorn Municipality illustrated different trends in waste generation. These trends will be significant in identifying and prioritising the type of waste minimisation and management 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.

5. ASSUMPTIONS

Currently, there is no record of waste tonnages that is being disposed of at the Grootkop landfill site. Based on the figures calculated from the results of the waste characterisation study, the following assumptions can be made:

- The average household generates 2,55 refuse bags per week.
- The average mass per refuse bag can be assumed to be 4,82kg.
- The number of households with access to refuse removal services is approximately 18 540.
- Oudtshoorn Municipality's IDP indicates the total number of households to be 23 878 and access to refuse removal services being at 78.2%. Therefore, the estimation of 18 540 households with access to refuse removal can be considered moderately accurate at 77.6% (compared to the IDP's 78.2%).

Based on the above, it can be assumed that approximately 911.5 tons of waste is collected and disposed of at Grootkop landfill site on a monthly basis. However, it should be noted that waste generation is affected by seasonal variation, and this figure increasing during the months of the KKNK and festive holiday season is probable.

When applying the results of the characterisation study to the assumed monthly average of 911.5tons, the following tonnages per waste type being landfilled can be assumed:

Waste Type	Mass (Tons)	Percentage of total Mass (%)	Calculated Volume (m^3)
Soft Plastics	59,34	6,51	380,38
Hard Plastics	61,34	6,73	851,94
Paper	72,83	7,99	319,43
Cardboard	59,43	6,52	457,15
Glass	56,95	6,25	138,56
Metal	25,52	2,80	79,75
Food Waste	206,00	22,60	200,19
Garden	134,90	14,80	303,15
Textiles	34,71	3,81	118,86
Wood	7,02	0,77	45,00
Inert	18,41	2,02	17,37
Nappies	76,47	8,39	341,38
E-Waste	3,17	0,35	26,42
Hazardous	5,01	0,55	14,40
Rest	90,40	9,92	259,77
Total	**911,50**	**100**	**3553,75**

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 36% of the total waste going to Grootkop landfill site on a monthly basis. This amounts to a total of approximately 335.41tons and 2 227.21m^3 of recyclable materials that could potentially be diverted from landfill.

There are currently informal waste pickers removing the recyclable materials from the waste at Grootkop landfill site as it is received. However, a large portion of the recyclable material will be of a poor quality as it is contaminated by organic waste.

It is assumed that approximately 206.00 tons (200.19 m^3) of food waste and 134.90 tons (303.15 m^3) of garden waste is being landfilled on a monthly basis. This is a portion that can be significantly reduced should home composting initiatives be implemented.

It is alarming to note that approximately 3.17 tons of E-waste (recyclable and hazardous components) and 5.01 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 227.01 tons (782.38 m^3) and is considered the portion that has no alternative than landfill.

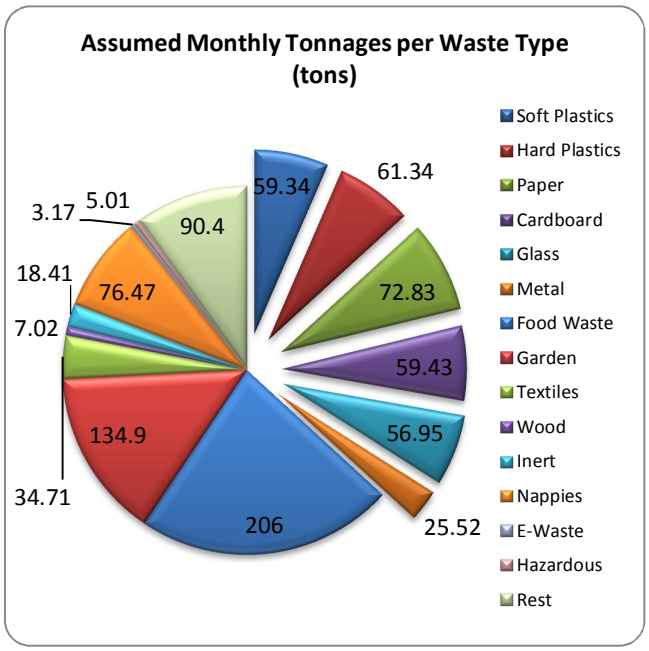


Figure 5.2: Pie Chart indicating assumed portion of recyclable materials in tons

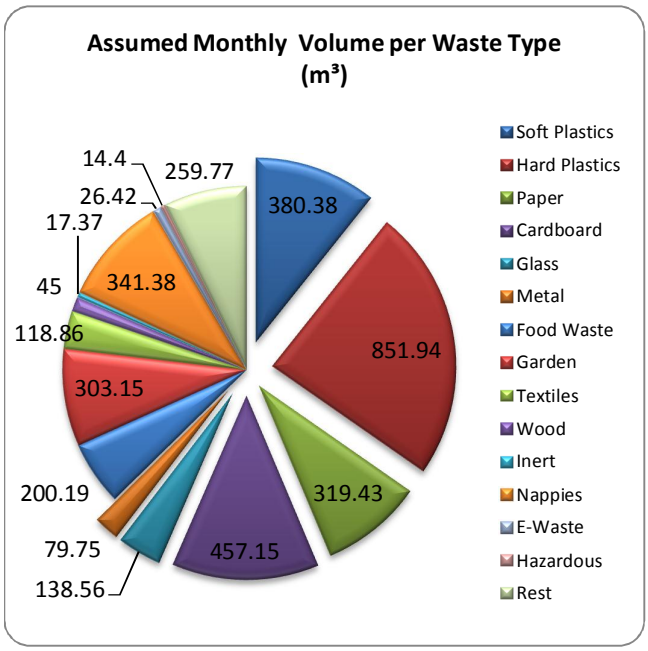


Figure 5.3: Pie chart indicating assumed portion of recyclable materials in m^3

6. CHALLENGES

6.1 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.

6.2 INSUFFICIENT SAMPLING PLAN

The lack of a sufficient sampling plan resulted in a shortage of a representative sample. A sample size of 635 was determined in order to ensure a representative sample, however, only a total of 562 samples were collected. The sample size of 562 was deemed to be sufficient in order to represent an indication of waste generation trends.

The lack of a sufficient sampling plan also resulted in time constraints as the samples that were to be sorted on the specified days were only collected on the morning of that day. This resulted in extensive time periods where no sorting or work could be conducted until such time that the samples were dropped off. This resulted in the study being extended for an additional two days.

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.

7. RECOMMENDATIONS

7.1 As indicated in the results of the study, a large portion of recyclable material is being disposed of at landfill. It is therefore recommended that recycling initiatives (formal) be significantly intensified in Oudtshoorn 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.