Weak Spot and Gap Analysis

of the

Baseline Assessment for the Development of an Integrated Solid Waste Management System in Maseru City

A report prepared by the
Environmental & Process Systems
Engineering Research Group of the
University of Cape Town

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1 Introduction

The purpose of this document is to comment on the gaps and weak spots identified within the baseline study carried out for the waste management sector in Maseru. The proposed document is in line with the deliverable for **Activity 1-A: Baseline Report,** as stated in the Memorandum of Understanding concluded between the United Nations Environment Programme (UNEP) and the University of Cape Town (UCT), Environmental & Process Systems Engineering Research Group.

The approach taken for carrying out the proposed analysis is to answer the following two questions:

- Which data are still needed for assessing the current waste generation and recovery/disposal situation in MCC by sector and types of waste, and which data are necessary for making more accurate projections?
- What is the financial framework within which the MCC acted up to the point of writing regarding its waste management sector, and what budget would be necessary in order to run the current system optimally?

According to the questions formulated here above, the document has been structured into two sections: the first section deals with the data base provided in the baseline study, and investigates its quality and reliability; the second section addresses the budgeting of the waste management sector in Maseru, as it has not been covered in the baseline study, but represents an important issue especially when it comes to the design of an Integrated Waste Management Plan.

2 Data on Waste Management in Maseru

In this Section, the data provided in the baseline study will be analysed regarding two aspects. Firstly, it will be investigated which types of data have been provided by the study. This outcome will be put into relationship to the waste management data available for South African metropolitan municipalities. Secondly, the quality of the data provided will be analysed. The outcome of this analysis is to identify existing gaps and weak spots in the current data basis, and to suggest actions in order to collect necessary information.

An estimated total amount of 105,000 t/a of solid waste is generated in Maseru, stemming from the household, commercial, industrial, administrative, educational and medical sectors. Of these seven sectors, six have been covered by the baseline study in terms of figures. On the other hand the waste recovery and disposal side has only been dealt with in a qualitative way by the baseline study. No waste amounts have been recorded except for the recycling sector.

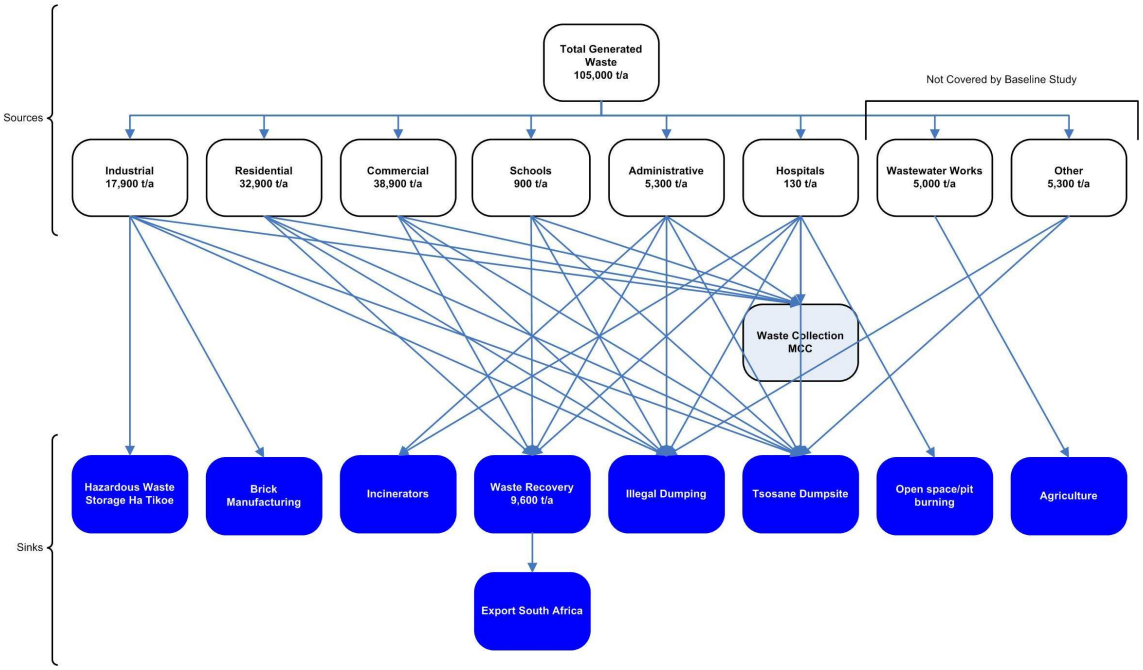


Figure 1: Waste Management Network - Maseru

2.1 Types of Data

Table 1: Types of data available for Maseru City Council in comparison to the six South African metropolitan areas

	Type of Data	IWMP	Waste Generation Quantities	Waste Disposal Quantities	Waste Recycling Quantities	Waste Sources	Waste Fractions	Waste Scenario Projections	Income Group Breakdown
Metropolitan Municipalities									
City of Cape Town (CCT)		X	X	X	X	X	X	X	X
Nelson Mandela Metropolitan Municipality (NMMM)		X	X	X	X	X	X	X	
City of Tshwane Municipality (CTMM)		X	X	X	X	X			
eThekwini Municipality (ETH)				X		X			
Ekurhuleni Metropolitan Municipality (EMM)				X		X			
City of Johannesburg (CoJ)		X	X	X	X	X	X	X	X
Maseru City Council (MCC)			X		X	X	X	X	X

Sources: DST project, baseline study

As can be seen in Table 1, the types of data related to the waste management sector available for the Maseru City Council (MCC) has been compared to the types of data available for the six South African metropolitan municipalities. Whereas it is obvious that the MCC does not have an Integrated Waste Management Plan (IWMP) yet[1], it shall be noted that the only type of data that has not been covered by the baseline study (incl. all precedent work) is waste disposal quantities. From the perspective of data types, Maseru's data base is similar to the ones of Cape Town (CCT) and Johannesburg (CoJ), and possesses an income breakdown which is not available for Port Elisabeth (NMMM) and the remaining three South African metropoles.

One should be careful though to generalise from the availability of data types to the quality of available data. Therefore, the quality of the provided data will be investigated in the next section.

2.2 Quality of Data

The purpose of this Section is to investigate the baseline study regarding the information provided with regards to its quality and representativeness. Each sector will be dealt with separately according to the structure provided by the baseline study, and an analysis of generated wastes by waste types will be carried, as this approach has not systematically been covered by the baseline study.

2.2.1 Domestic Sector

The domestic sector accounts for the second highest share of waste generated with an estimated 33,000 t/a (see Figure 2). Data collected for the household sector are based on estimates of the generated waste volume by the head of the household, and only a limited number of households have been interviewed (220 households of a total of 44,300; 0.5 %). As the interviewees gave estimates on volumes, results are highly subjective, and the error margin important.

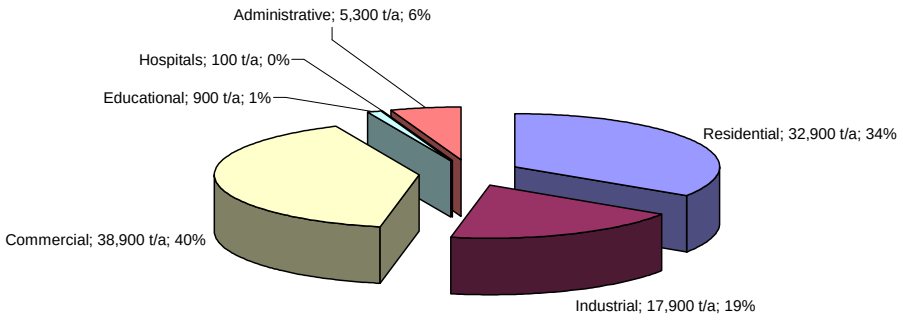


Figure 2: Waste Generation by Sector – Maseru 2006

In the baseline study on p.62, the obtained survey results are validated against a set of empirical samples (weighting truckloads from a sample of 120 households). The conclusions drawn

[1] As this report is part of the process of establishing Maseru's IWMP

from this validation are dubious, as it is stated that the result of 101t/a obtained from the empirical samples of 120 households is lower than the survey results of 32,900 t/a for 44,300 households. By dividing the 101t/a calculated for the empirical sampling by the number of households samples (120), and multiplying the results by the number of total households (44,300), one obtains a total amount of generated household waste of 37,500 t/a, which is higher than the 32,900 t/a obtained from the survey, although being of the same order of magnitude. In contrast to what is stated in the baseline report, the empirical samples seem to validate the survey results.

A breakdown calculation by income level was carried out. The extrapolation carried out for the total household waste generated in Maseru on p. 59 ff. is dubious, as an average value for the per household waste generation was utilised, instead of using the calculated figures per income level. It is argued in the baseline study that the average value was preferred, because some wards have a mixture of low, middle and high income. This however defeats the purpose of calculating waste generation figure per income level. It is therefore suggested to use the waste generation figures per income level, and multiply them with the accurate number of households per income level respectively, in order to obtain a more reliable figure regarding the total waste generation in the household sector. For that purpose, necessary data must be sourced from the Bureau of Statistics.

On page 63, the numbers provided for the different methods used to dispose of waste are interesting. In a next step, it should be established what the waste quantities are that are being disposed of in different ways. This information would help to populate the waste management network as suggested in Figure 1 on the treatment/disposal side.

As biodegradable waste plays an important role on the household level (ca. 40% of total household waste), and that ca. 30% of the surveyed households use composting as one means amongst others for waste disposal (Table 5.24, p. 63 baseline study), it is suggested to further investigate the matter in terms of composting approaches used by the households. The issue of a systematic approach to home composting could be considered as a pilot activity within the frameset of the establishment of the ISWMP for Maseru.

The detailed calculation of generated quantities by waste type and income level for the household sector can be found in Appendix A.

2.2.2 Commercial Sector

Based on the figures given by the baseline study, the commercial sector would account for the highest share of generated waste with 187,701 t/a.

However, major calculation errors were detected in the baseline study on p. 80 and p. 81. In table 5.37 on p.80, the total extrapolated waste volume generated by supermarkets is not 147,752,090 l/a, but 14,775,209 l/a. The total volume of waste generated would therefore change from 179,266,190 l/a to 46,289,309 l/a.

Furthermore, in table 5.28 on p. 81, the mass of waste in kg/d has not been calculated properly. The daily volume of waste given in the second column should have been multiplied by the waste density in kg/l as given in the third column, which has not happened. Therefore, all figures in the fourth and fifth column are erroneous. By correcting these figures, the total quantity of waste generated for the commercial sector in Maseru changes from 187,701 t/a to 38,900 t/a.

The latter error has repercussions on the total waste amount generated for Maseru. On p. 94, the total waste generated from commercial outlets must be changed from 187,701 t/a to

39,000 t/a, the total amount of waste generated in Maseru being 96,000 t/a[2] instead of 255,832 t/a as given by the study. By readjusting these numbers, the commercial sector still accounts for the highest share of generated wastes, but falls from the perspective of an order of magnitude into the same category as household waste.

The detailed calculation of generated quantities by waste type for the commercial sector is given in Appendix B.

It has been identified that from a waste handling perspective, a bailing machine exists at the Shoprite shopping centre.

An important aspect missing in the baseline study is that the commercial sector consists of two distinct types of activities. On the one hand, large commercial activities such as shopping malls and formal shops generate specific types of waste (e.g. paper, cardboard, LD PE plastics) usually collected in formal skips/containers. On the other hand, small commercial activities such as street vendors and vendors at the open fruit and vegetable markets generate waste with a high share of biodegradables, which are collected/dumped in rather informal ways (small containers, burning, spillage, food waste recovered to feed animals).

On p. 82, mechanical workshops have been listed as a special category of commercial establishments. The waste amounts generated have not been included to the total waste volumes for the commercial sector, i.a. because conversion factors for the break-pads, tyres, etc. are not given.

2.2.3 Industrial sector

The industrial sector accounts for the third highest share of waste generated in Maseru with 17,900 t/a (see Figure 2). The main difference of the industrial sector to the other considered sectors is the amount of hazardous wastes generated.

The knitted textile industry produces 3,000 t/a of textile off-cuts that are non-hazardous and are mainly being burned. Due to US trade related issues, it is not possible to release these off-cuts into the local markets for re-use or recycling purposes.

Although figures are given for the textile industries, source documents prepared by the LNDC dealing with the issue had to be consulted in order to clarify hazardous waste classifications.[3] It is state by the LNDC with regards to hazardous waste that *"the waste that remains on site and which is not collected by MCC, generally classified as hazardous waste and generated at the garment factories and mill consists primarily of sludge, blasting sand and pumice stones"*. In Appendix E of the LNDC study submitted in February 2005, a total amount of 11,700 t/a of hazardous waste is given; the baseline study gives a slightly higher number – 13,300 t/a – for 2006, which will be used as a basis for further calculations in the gap analysis and ultimately the ISWMP. However the statement that *"most of the primary residual wastes generated in the textile industry are non-hazardous"* as given by the baseline study is not correct, as 75% of the total industrial waste stream is classified as hazardous.

[2] The total amount of waste generated is 105,000 t/a taking into account assumptions for the sectors not covered by the baseline study.

[3] LNDC, 2005: "Feasibility Study on Waste Management in Lesotho with respect to the Textile Industry in the Thsesane Industrial Estate"
LNDC, 2004: "Determining Lesotho's knitted fabric requirements preparing for the post September 2007 AGOA rules of origin"

It has generally been recognised that the current handling and disposal of hazardous sludge at the Ha Tikoe temporary dumpsite is inadmissible with regards to the threat it poses to the environment and the health of the population, and it appears that action is being taken by the MoLG to prepare the transport of the hazardous sludge to an adequate facility in South Africa (WasteTech/EnviroServe). Confirmation of the arrangements is an important input for the ISWMP project.

Data for the brewery industry are good, whereas no or little data was provided for the flour milling company as well as the TV assembler.

As a step towards the drafting of an ISWMP would be to consider the two industrial areas in Maseru - Maseru Industrial Area and Thetsane Industrial – from a perspective of Cleaner Production and eco-industrial parks.

The detailed calculation of generated quantities by waste type for the industrial sector is given in Appendix C.

2.2.4 Administrative Sector

As already mentioned in the baseline study, the data provided for the administrative sector are scarce, and no breakdown according to waste types is available. It is however assumed to be of a minor issue, as the administrative sector accounts for only 6% of the total waste generated in Maseru (see Figure 2). In order to estimate the waste types generated by the administrative sector, it has been assumed that its constitution is identical to the constitution of the waste generated in the residential sector. See Appendix F for the detailed calculation of waste amounts by type.

It has been observed that a current practice is to burn paper wastes from offices. It might be a way of discarding of confidential data, but should be investigated further.

A figure lacking from the baseline study is the amount of green wastes generated from inner-city forests and parks, which would fall under the responsibility of the administrative sector.

2.2.5 Educational Sector

The educational sector accounts for 1% of the total waste generated in Maseru (see Figure 2). The numbers provided are reliable, and split according to primary, secondary and tertiary institutions.

Source separation of wastes is not practiced at schools in Maseru, although one school runs a composting project for garden waste. It would be useful to investigate the role that schools could play regarding awareness creation and implementation of pilot projects within the framework of an ISWMP.

See Appendix D or the breakdown of waste generated in the educational sector by waste type.

2.2.6 Hospital Sector

The hospital sector accounts for less than 1% of the total waste generated in Maseru (see Figure 2). One particularity is however the amounts of hazardous waste generated. The figures provided by the baseline study are sufficient and reliable, and have been sourced from a study undertaken by the Ministry of Health and Social Welfare (MoHSW).

An ambiguity remains regarding general waste generated by hospitals. The baseline study doesn't clarify whether general waste is collected separately, or is mixed with the health care waste. In case of the latter, source separation would definitely have to be considered. The constitution of the general waste is also missing. For the purpose of calculating generated waste types, it has been assumed that the constitution of general waste from hospitals is similar to the constitution of residential waste. See Appendix E or the detailed breakdown of generated wastes by type.

Moreover, the baseline study does not clarify which amounts of health care wastes are disposed of via which means (dumping, incineration, pit burning).

2.2.7 Other Waste Types

It has been roughly estimated that the waste types which have not been covered by the baseline study, i.e. e-waste, used tyres, builder's rubble, sewage sludge and car batteries, account for a total waste amount of 10,300 t/a.[4] The breakdown for the different waste types is as follows:

Types of waste		2006
e-Waste	1,0%	100,00
Used Tyres	1,0%	100,00
Builder's Rubble	48,5%	5000,00
Sewage Sludge	48,5%	5000,00
Car Batteries	1,0%	100,00

2.2.8 Waste Generation by Type

Based on the assumptions and calculations described for the different sectors as presented here fore, the quantity of wastes generated by waste types has been extrapolated. The assumptions made might not represent the ideal figures, but they provide at least an idea on the order of magnitude regarding the different waste types.

[4] See also Section 2.4

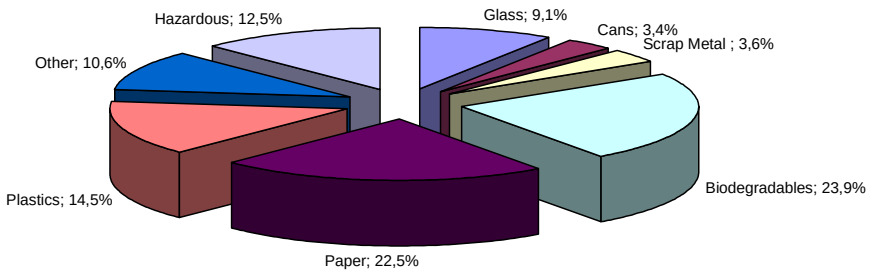


Figure 3: Generated Waste Quantities by Type – Maseru 2006

As can be seen in Figure 3, the waste types paper and biodegradable wastes (kitchen leftovers and garden refuse) represent the highest shares of the wastes types generated with 24% and 22% respectively of the total generated waste volume of approx. 105,000 t/a. Plastics represent 15% of the total generated waste types, and a breakdown of generated amounts by type of plastic (PE, PET, LD PE, PS, PVC, etc.) would be helpful for the investigation of future treatment alternatives. Hazardous wastes account for 12.5%, letting appear the importance of this type of waste in Maseru, requiring immediate action, as it is not handled properly at the moment of writing. Glass and other wastes account for only 9% and 10.5% respectively.

Based by number of Collect-a-Can South Africa, it has been calculated that the amount of waste cans generated in Maseru should be approx. 800 t/a, five times smaller than the figure given by the baseline study (ca. 3,600 t/a).[5] Furthermore, the amount of scrap metal is estimated at around 3,800 t/a; this is however the amount of scrap metal being recovered by the recycling companies (see Section 2.2.8). Therefore, it is suggested that these figures need refining and should therefore be recalculated.

By trying to establish the figures for waste quantities generated by type, it became apparent that some important numbers are missing in the baseline study. These gaps have been identified for each waste generation sector separately, and have been summarised in the Table 2.

2.2.9 Collection, Disposal and Recovery

As can be seen in Figure 1, the only waste quantity captured for the collection, disposal and recovery side is that for waste recovery (9,600 t/a), or 9% of the total waste. This figure could however be significantly bigger, as South African recycling companies enter the country ille-

[5] Approx. 3 billion cans are consumed in South Africa each year. Based on a total population of South Africa of 47 million, the weight of an empty can of 40g, and a population of Maseru of 300,000, the total amount of generated empty cans would be approx. 800 t/a.

gally for collecting valuable wastes (illegality here refers to tax evasion and to unlicensed business activities).

Formal waste recovery in Maseru is undertaken by a number of recycling companies as given on p. 46 in the baseline study. It should be noted that Collect-a-Can does no longer operate in Maseru (since 5.7 years), as the terrain has proven to be too difficult for informal waste pickers to collect dumped cans. The highest share of waste being recovered is scrap metal accounting for 38%, followed by paper & cardboard accounting for 39%. On the one hand, it should be investigated what the quantities are that are currently being collected illegally. On the other hand, it should be analysed which barriers exists regarding a higher recycling rate. For that purpose, it would be of interest to source figures from e.g. Collect-a-Can South Africa.

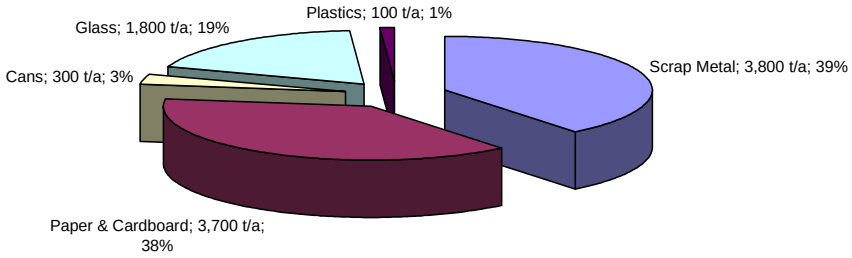


Figure 4: Waste Recovery by Type – Maseru 2006

By subtracting the amount of waste being recovered from the total amount of waste generated (105,000 t/a), it appears that approx. 95,500 t/a of waste must be disposed of at either Tšosane dumpsite, Ha Tikoe temporary dumpsite, on illegal dumpsites, or by some other informal activity. Based on the fact that only 30%-40% of Maseru is being serviced by the City Council – lacking road infrastructure and funds being the main constraints -, it is estimated in a worst case scenario that 70% of the remaining waste is being discarded informally, namely ca. 67,000 t/a. In a best case scenario, one could assume that the recycling rate is actually twice as high as initially assumed (19,200 t/a) and that 40% of the City are being serviced. In this case, only ca. 51,500 t/a of waste are being disposed of informally.

The assumption that 51,500 t/a – 67,000 t/a of waste are disposed of informally lets appear that there exists a large grey zones regarding the destiny of a majority of the waste generated in Maseru.

Currently, waste collection is being undertaken by the MCC, mainly focusing on the CBD. Due to a lack of personnel and financial resources, the waste collection fleet is old and prone to regular breakdowns. Waste collection currently happens sporadically, often only reacting on calls asking to pick up wastes at specific spots. It appears necessary to provide route planning for the waste services in order to be provided properly.

Current collection routes seem to have been influenced by the location of customers paying the collection fees. It is suggested to set up a database system in order to assist in tracking the

payment of waste collection fees by the customers. An interface could then be created to the route planning system allowing to point locations of paying customers.

A tendering process is underway in order to involve private companies in the collection of waste especially in currently not serviced villages. A further challenge that needs to be tackled is the fact that the waste is not transported properly (open trucks, waste flies out) and not disposed of properly i.a. at the Tšosane dumpsite (no lining, no cover material, constant fires, attracts rodents and other animals, health threat to waste pickers as well as local water resources).

As figures for the Tšosane dumpsite as well as all other informal activities have not been covered by the baseline study, it would be of great interest to collect further data regarding these activities.

It would be of paramount importance to get a good guess on what is currently being disposed of at the Tšosane dumpsite, so that the amounts of waste calculated on the generation side could be validated. It has been suggested to carry out a data collection during two weeks at the dumpsite in order to record truckloads of wastes being delivered. As there is no weighbridge available, this task would have to rely on guesses of the data collector, and would therefore bare a high level of subjectivity and uncertainty. At least, a good guess on an order of magnitude would be a realistic outcome.[6]

It is assumed that for the establishment of a sanitary landfill site outside the City boundaries (Tšoeneng Sanitary Landfill), some other data source might have been used for the establishment of the Environmental Impact Assessment (EIA). It would be of importance to get hold of this additional source. Moreover, the new landfill site is to be situated 35 km outside of Maseru centre. A halfway house (transfer station) might be necessary for transporting the waste. It would be of interest to find out what the additional financial burdening would be for the City, and finally the waste service customer base.

[6] Note that it has been risen that waste generation patterns not only vary according to seasonal changes (summer/winter), but also according to the time of month. Whereas consumption and coupled waste generation rises during the days right after end of month paydays, waste generation diminues gradually in the following weeks.

2.3 Projection of Waste Generation Quantities

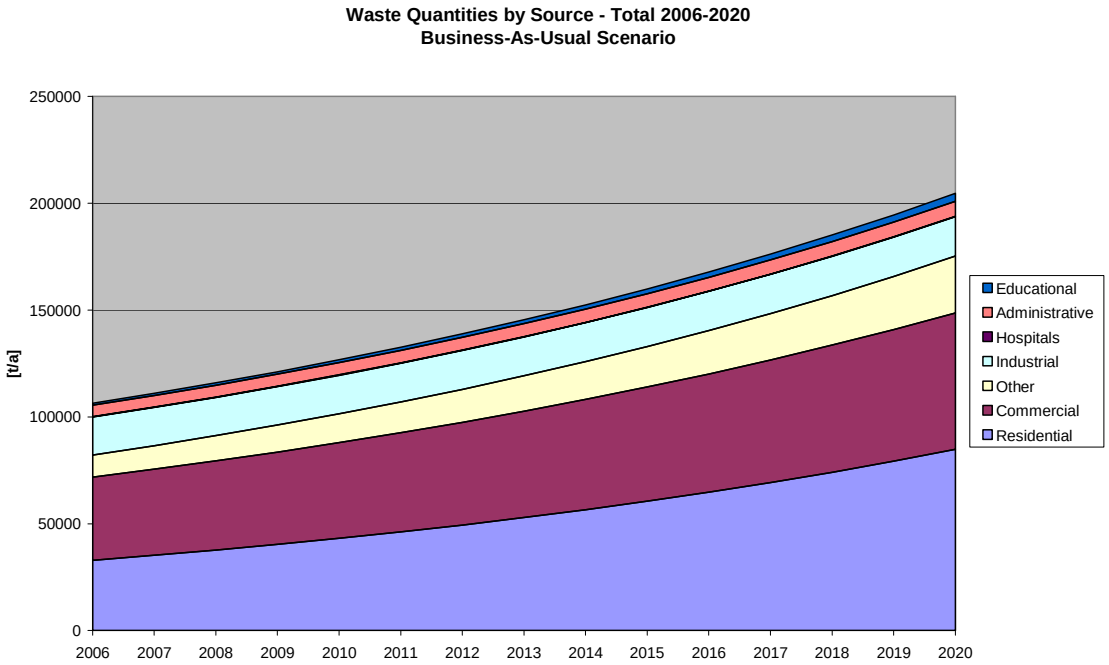


Figure 5: Projected Generated Waste Quantities by Sector – Maseru 2006-2020

The generation of waste quantities by sector has been projected until 2020 in Figure 5 based on the following data:

- baseline study pp. 96-98,
- adjustments made to the commercial sector due to detected calculation errors,
- assumptions for other waste sources, incl. e-waste, used tyres and builder's rubble.

The figures used are based on the worst case assumptions made in the baseline study. It should be noted that in a best case scenario, deviations would have been minimal (ca. 1,500 t/a for 2020). As can be seen in Figure 5, waste generation in 2006 amounts to 105,000 t/a, and reaches ca. 205,000 t/a in 2020. The major causes for the increase in waste amounts during that time period are twofold: on the one hand, an urbanisation rate of 7% has been assumed, letting the residential sector grow substantially; on the other hand, the commercial sector is supposed to grow 3.6% over the considered time interval. The other sectors remain relatively unchanged.

However, the generated waste quantities projected for 2020 were not reproducible for the residential sector, as well as schools and commercial establishments. There is a clear need for clarification, as long-term security of feedstock quantities for potential waste management activities carried out within the ISWMP are crucial with regards to their financial viability.

2.4 Aspects not Covered by the Baseline Study

Waste categories that have not been covered by the baseline study at least in terms of figures include construction waste (builder's rubble)[7], e-waste, waste tyres, batteries, and sewage

[7] Shortly mentioned on p. 94 and p. 95 of Baseline Study.

sludge. Order of magnitude estimates have been given for these waste types under section 2.2.7.

Builder's rubble is currently disposed of illegally, but could be used as cover material on landfill sites or road construction.

The amount of sewage sludge generated at the wastewater treatment station has also not been recorded in the baseline study. It is known that the sludge is used as fertilizer for agricultural activities. The sludge is picked-up by private people at the wastewater treatment station itself. Additional information might be available from WASA, the national Water and Sewerage Authority.[8]

It would be of interest to come up with a good guess on the amounts of wastes generated for these categories, especially regarding e-waste, used car batteries, and sewage sludge, as they are (potentially) hazardous.

With regards to the establishment of an Integrated Solid Waste Management Plan, it would be of importance to access information of sectors not directly related to the waste management sector. In terms of City planning aspects, it would be of importance to source the Annual Plan and the Progress Report from the Ministry of Local Government. Furthermore, it should be investigated whether there exist a body responsible for air pollution control, and find out which impacts current waste burning practices have on local air quality. Importantly, NES has tried to stop current waste incineration practices, and a shift has taken place to the dumping wastes all along the streets in Maseru. From an energy perspective, it would be of interest to source current amounts of coal consumption in the residential sector (especially during the winter months), the brewery and the textile industry. Here potentials for fuel substitution by specific waste types could be considered.[9]

Social issues related to current practices of waste picking on dumpsites and other places in Maseru should be investigated quantitatively.

3 Budgeting for Waste Management in Maseru

The purpose of this Section is to investigate the financial aspects of the waste management sector in Maseru. This aspect has not been covered by the baseline study. It however represents a major issue in the design of an ISWMP, as it gives the financial boundaries within which such a project has to be carried out, leaving out potential additional funding sources at this stage. Currently, waste services are financed by the National Government and waste collection fees.

[8] It is known that wastewater also goes to sewerage ponds, and is recycled by some industries/factories.
[9] NES also collaborated with Department of Energy to have campaigns for the abolishing of leaded (super) petrol to lead replacement in order to improve local air quality.

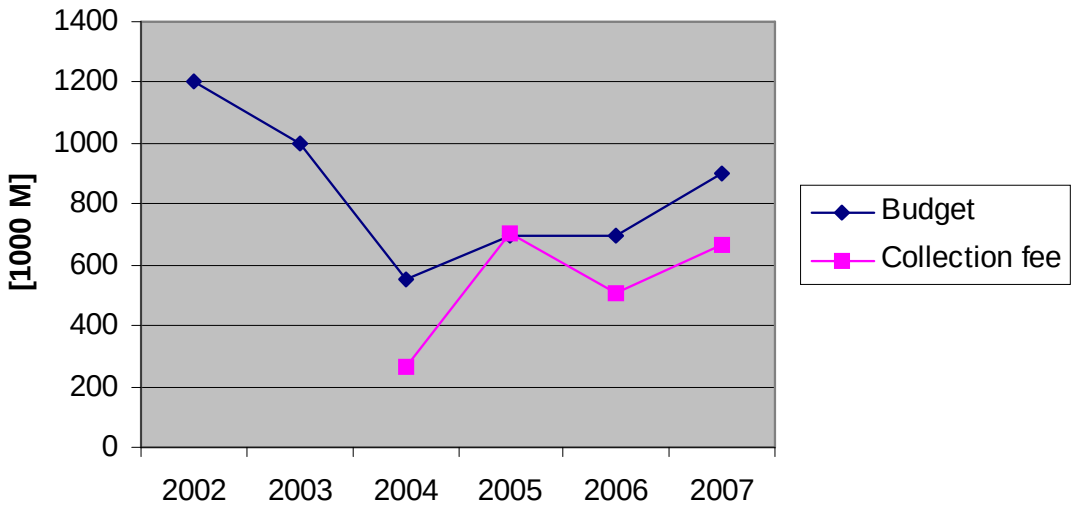


Figure 6: Trend Analysis – Waste Management Budget and Waste Collection Fee Income

Based on figures provided by the MCC Department of Health and Environment, it was possible to carry out a trend analysis regarding the yearly budget available for waste collection in Maseru, as well as the income generated for the City based on waste collection fees.

As can be seen in Figure 6, the budget for refuse collection varies between M1.2 million in 2002, and ca. M550,000 in 2004. A steady increase in the budget is noticeable between 2004 and 2007. On the other hand, the income generated from waste collection fees amounts to ca. M300,000 in 2004, and peaks in 2005 with ca. M700,000. It was only in 2005 that the City broke even regarding the coverage of its expenses regarding waste collection, and fees paid by customers. It is noted that if all customers were to pay the waste collection fees, a total of ca. M1.4 million should be generated as income for the City. However, this is not the case. A reason for this might be that fees are too high for a number of customers, or that the City is not strict enough when it comes to the collection of the fee. Here, further investigation with MCC needs to be done. In conclusion, it is stated that the City of Maseru currently has to subsidise the collection of refuse, to a level of approximately M100,000.

Furthermore, it must be noted that the budget for the whole waste management sector in Maseru is difficult to estimate, as it does not fall under the Department of Health and Environment alone. For instance, the drivers of the waste collection fleet are budgeted under the Department of Administration, whereas fleet maintenance falls under the Department of Works. For the fiscal year 2007/08, the following budgets have been allocated:

- Health and Environment Salaries: M5,197,000
- Refuse Bins: M160,000
- Petrol and Diesel : M1,100,000

The above mentioned figures need clarification with regards to the budget available for refuse collection, and income generated from waste collection fees.

In order to carry out the ISWMP, it would be of interest to consider the following points. Firstly, it should be investigated whether the introduction of a social tariff would enable the City to generate a higher income through waste collection fees, whilst enforcing the payment of the fee. Furthermore, the consideration of waste reduction measures would decrease the burden to be carried by the City. Lastly, further international budgeting sources could be considered in order to carry out an Integrated Solid Waste Management Plan.

An issue becoming apparent from the information given in table 5.27 on p. 66 is that waste collection fees and the cost of refuse bins might not be bearable by an important number of households. Against the background that only 31% of the villages in the Maseru district are being serviced, the need for further subsidisation of the waste services from the MCC is an important aspects.

4 Summary of Identified Gaps

In summary, it can be stated that the baseline study represents a solid piece of work, providing a basic data assessment upon which further research can be carried out. Gaps, weak spots and errors in the baseline study have been identified by analysing the data collected for the different City sectors, as well as the waste service, recovery and disposal side. By extrapolating the numbers provided in order to obtain a breakdown of waste quantities generated by type, a series of assumptions had to be made due to lacking data in the baseline study. The investigation of the financial aspects of the waste management sector in Maseru represents original data collection not provided by the baseline study. In Table 2, the data gaps identified within the baseline study have been summarized. Moreover, required actions have been noted along with their priority.

Table 2: Summary Tableau of Identified Data Gaps

#	Sector	Gap	Action	Priority	Status
1	Residential	Total waste figures by income level	Source data at Bureau of Statistics	Medium	=>ISWMP
2	Residential	Waste quantities for different discarding options	Include in new survey	Medium	done
3	Commercial	Split sector into two two distinct types of activities	On site data collection	Medium	=>ISWMP
4	Commercial	Waste quantities for mechanical workshops	On site data collection/sourcing of conversion fact	Medium	=>ISWMP
5	Industrial	Identify which waste types are hazardous	Source publications from LNDC	High	done
6	Industrial	Data on flour milling industry and TV assembler	On site data collection	Medium	=>ISWMP
7	Administrative	Breakdown according to waste type	On site data collection	Low	pending
8	Administrative	Wastes generated Inner-city forests and parks	On site data collection	Medium	done
9	Hospital	Constitution and source separation of general wast	Source from MoHSW	Medium	done
10	Hospital	Quantities of wastes discarded in which ways	Source from MoHSW	High	done
11	Waste types	Breakdown types of plastics	Source from recyclers	Medium	=>ISWMP
12	Collection, disposal and recovery	Illegally recovered waste quantities	Source from recyclers	Medium	=>ISWMP
13	Collection, disposal and recovery	Hurdles to the achievement of higher recycling rate	Source from recyclers	Medium	=>ISWMP
14	Collection, disposal and recovery	Data Tsosane dumpsite	On site data collection	Medium	=>ISWMP
15	Collection, disposal and recovery	Data on waste disposal	Source EIA on new landfill site	Medium	done
16	Projections	Clarification reg. Calculations	Source from previous consultant team	Low	pending
17	Aspects not Covered	Data on builder's rubble	On site data collection	Medium	=>ISWMP
18	Aspects not Covered	Data on e-waste	On site data collection	Medium	=>ISWMP
19	Aspects not Covered	Data on waste tyres	On site data collection	Medium	done
20	Aspects not Covered	Data on used oil	On site data collection	Medium	done
21	Aspects not Covered	Data on car batteries	On site data collection	Medium	done
22	Aspects not Covered	Data on sewage sludge	Source from WASA	Low	pending
23	Aspects not Covered	Annual Plan and Progress Report	Source from MoLG	Medium	=>ISWMP
24	Aspects not Covered	Data on local air pollution	Source from NES?	Medium	done
25	Aspects not Covered	Data on coal consumption residential and industria	Source from NES?	Medium	done
26	Aspects not Covered	Data on social issues/waste pickers	On site data collection	Medium	=>ISWMP
27	Budgeting	Clarification reg. Figures 2007/08	Source from DoHE	Medium	done
28	Budgeting	Reason for drop in Budgeting for the first two years	Source from DoHE	Medium	done

4.1 Update on Actions Taken

Gap #2:
A second round of surveys has been undertaken by a BSc student on a 1 week field mission in order to collect data amongst other things on waste quantities. It appeared that it is not possible to obtain an accurate estimate on which waste quantities are generated, as this is highly dependant on the subjectivity of individuals interviewed, and infrastructure such as scales for weighting are not readily available. Furthermore, the detail of data looked for has been classified as of lower priority against more imminent issues.

Gap #8:
It has been stated in a personal interview with Mr. Khuto that green wastes generated in inner-city forests and parks are collected by the MCC waste services, and are either brought to the MCC composting facilities, where the obtained end-product (mulch) is being used in the local nurseries, or dumped at the Tšosane site.
It is furthermore suggested that additional information could be obtained from institutions such as prisons and small landscaping companies in Maser, as they usually do the landscaping works.

Gaps #9&10:
A review of the Health Care Waste (HCW) study by the Ministry of Health and Social Welfare revealed that within Lesotho, three different scenarios are prevalent regarding the handling of HCW:

- Hospitals
- Incininerators for Hazardous Waste
- Collection of general waste and ashes from incinerators by municipality for final disposal on dumpsite
- Clinics & Surgeries (Peri-Urban)
- Hazardous waste burned
- General waste collected by municipality
- Clinics in Rural Areas
- Hazardous wastes buried
- Remainder of waste burned and buried

In the study, it has been referred to the situation in the Queen II hospital in Maseru as being representative for the general situation in other hospitals. This situation is summarised as follows:

- Incineration of infectious wastes and sharps
- General wastes go to storage area
- Ash from incinerators and general wastes collected by MCC
- Discarding of wastes within premises and building as not enough waste receptacles (incl. some hazardous!)
- Staff that handles waste not properly trained, and no adequate protective measures
- Additional waste generation due to informal catering activities around hospital premises

As per the National Health Care Waste Management Plan, the Ministry of Health and Social Welfare has already taken steps to implement some of the plans. The plans that are either already in the pipeline or being implemented are as follows:

i. *Purchase of protective clothing for all personnel who handle waste*: this is already in the pipeline
ii. *Refurbishing old incinerators and installation of new incinerators in hospitals and clinics*: funds have already been sourced for this activity, and incinerators that need refurbishing have been identified. However, the Ministry of Health overlooked the need for development of an EIA before undertaking this step, and has been requested to undertake an EIA first. Whether this will happen remains to be seen.
iii. *Use of specialized containers to separate medical waste*: this will involve using the three-bin system at medical centres to sort waste from source. These will soon be ordered.
iv. Training of all healthcare practitioners, and their staff across all cadres, about healthcare waste, and how to handle it.
v. Development of information material in both English and Sesotho (e.g. posters) about general code of practice for healthcare waste. These will be posted in all hospitals and clinics. These are already being developed.
vi. Devise self-assessment tools for hospitals and templates to record minimum data: this is already underway as well.

Gap #15:
An essential element of the ISWMP is the construction of a sanitary landfill site for the City of Maseru. Planning is underway, and an EIA has been carried out by the Genesis consultans for the establishment of Tšoeneng Landfill Site, which has been rejected by NES in its submitted form. Jones & Wagener have been commissioned by NES to amend the EIA.

Upon analysis of the EIA by the UCT team, the following comments have to be made:

- Data base utilised is not well documented
- Assumptions are not clearly founded
- Three scenarios have been developed regarding the waste quantities having to be disposed of (Worst, Intermediate and Best Case)
- Waste quantities in Worst Case Scenario (the highest amount of waste to be disposed of) still lower than calculations in baseline study and subsequent gap analysis
- Growth rate of waste quantities (1.92%) below growth rate for commercial sector (2.0%) and residential sector (7%!).

The level of detail regarding the consideration of alternative sites is good. It has been agreed on the Tšoeneng location as the preferred site for the construction of the sanitary landfill site; it is however the site the furthest away from Maseru, with limited infrastructure in place, i.e. access roads and grid electricity, resulting in additional financial burdening of the City Council, and finally the end customer. Furthermore, a transfer station is planned, as well as an incineration plant.

With total CAPEX of M66 million, OPEX of M8.8 million/a, and after-care costs of M303,000/a, assuming 2005 prices and an overall depreciation of CAPEX over 10 years, costs per households for the new sanitary landfill site account roughly for ca. M415.-/a or M35.-/mo. This does not include costs for new bins or collection services by MCC (or private subcontractors).

It is strongly recommended that waste quantities (and volumes) as well as lifespan calculations are adjusted according to new findings documented in the gap analysis. These adjustments are essential for the realisation of an efficient and long-term integrated waste manage-

ment strategy. It is furthermore suggested that the planning of the sanitary landfill site is aligned with the ISWMP.

Gap #17:
Information might be available from buildings design services (ministry of works).

Gap #19:
It has been estimated that there is a total amount of 15,000-25,000 waste tyres generated in Maseru per year (see Appendix G for detailed calculations).

Gap #20:
According to a private recycling company (Welcome Transport), used oil is being collected and stored on the premises of the collecting company, but no proper disposal takes place up to now.

Gap #21:
It has been estimated based on a lifespan of approx. 5 years that there is a total of 8,450 waste car batteries generated per year (see Appendix H for detailed calculations).

Gaps #24&25:
Based on the report "Environmental Statistics in Lesotho" compiled by the Lesotho Bureau of Statistics, the principal uses of energy types for specific purposes have been represented in Figure 7-9. This information is useful with regards to the potential of fuels substitution by cleaner fuels, and how an integrated waste management system can be supportive of such.

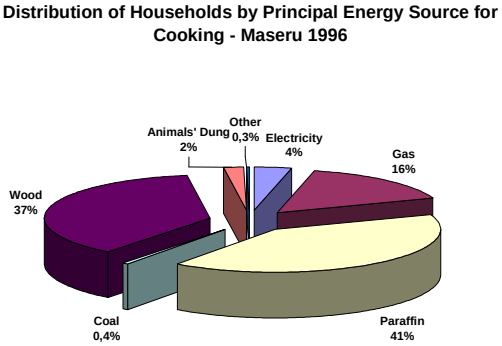


Figure 7: Distribution of Households by Principal Energy Source of Cooking – Maseru 1996

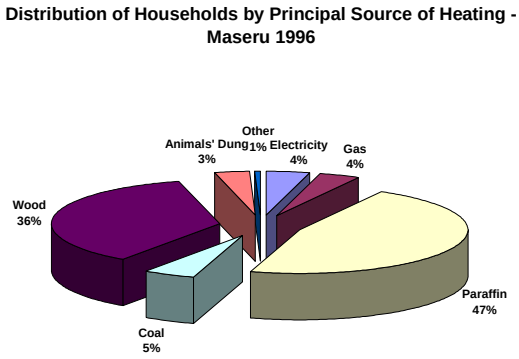


Figure 8: Distribution of Households by Principal Energy Source of Heating – Maseru 1996

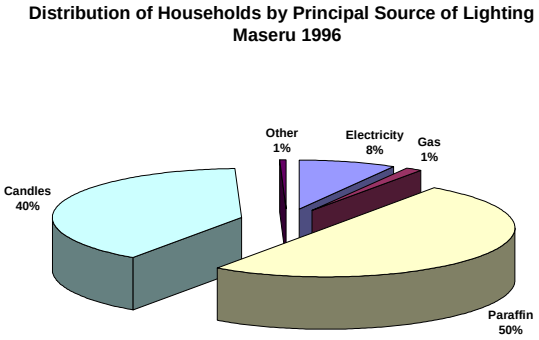


Figure 9: Distribution of Households by Principal Energy Source of Heating – Maseru 1996

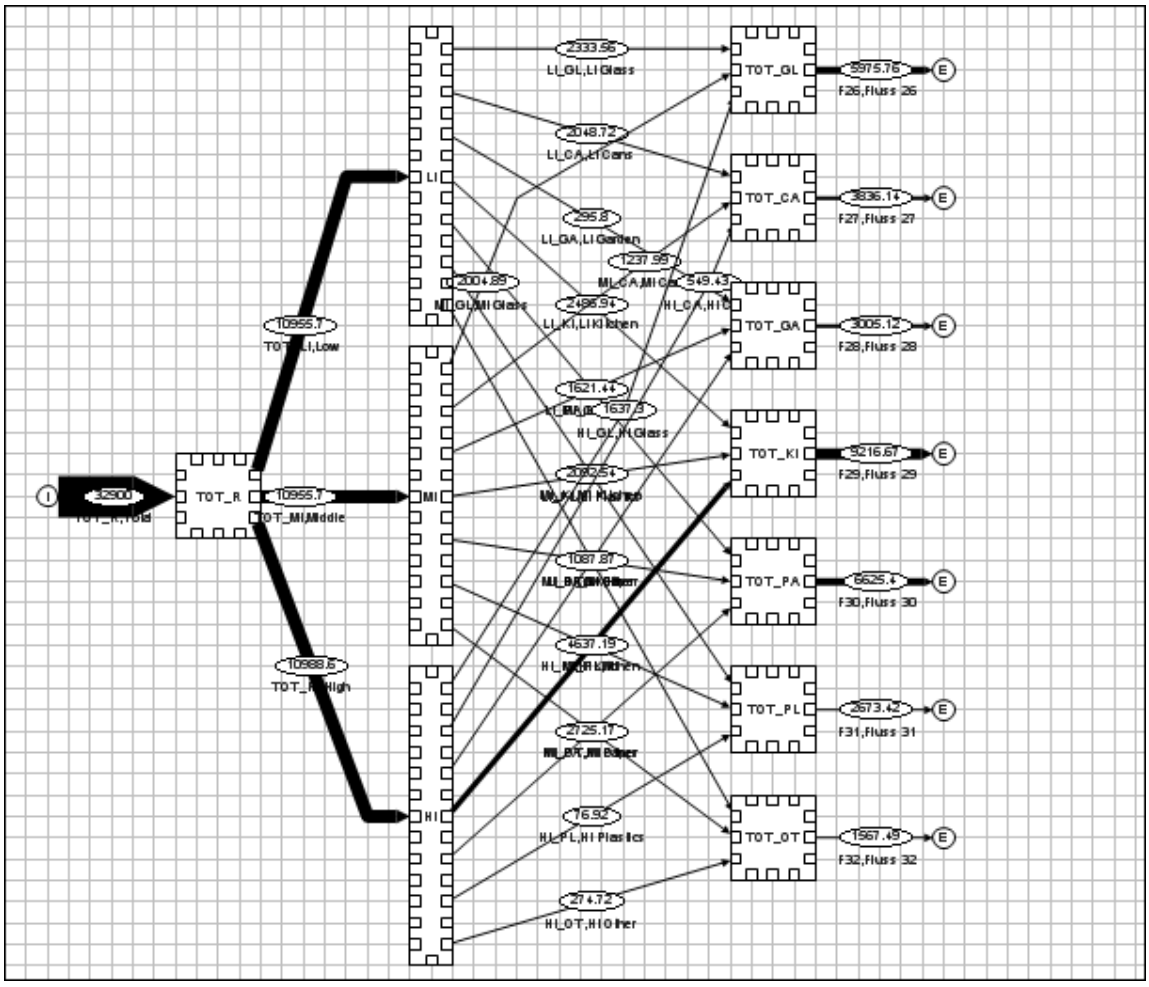
Furthermore, the report "BASELINE DATA ON AMBIENT AIR QUALITY ASSESSMENT IN MASERU AND MAPUTSOE" commissioned by NES states in its conclusion that PM10 concentrations across much of urban Lesotho exceed international standards, and that peaks are more prevalent in residential than in commercial or industrial areas, which might be caused by vehicles travelling on unpaved roads and/or domestic fires. SO2 and NOx levels are generally below international standards.

Although the utilisation of wastes for energy purposes has not been mentioned explicitly in both studies, it might however play an important role, has have shown interviews with local residents.

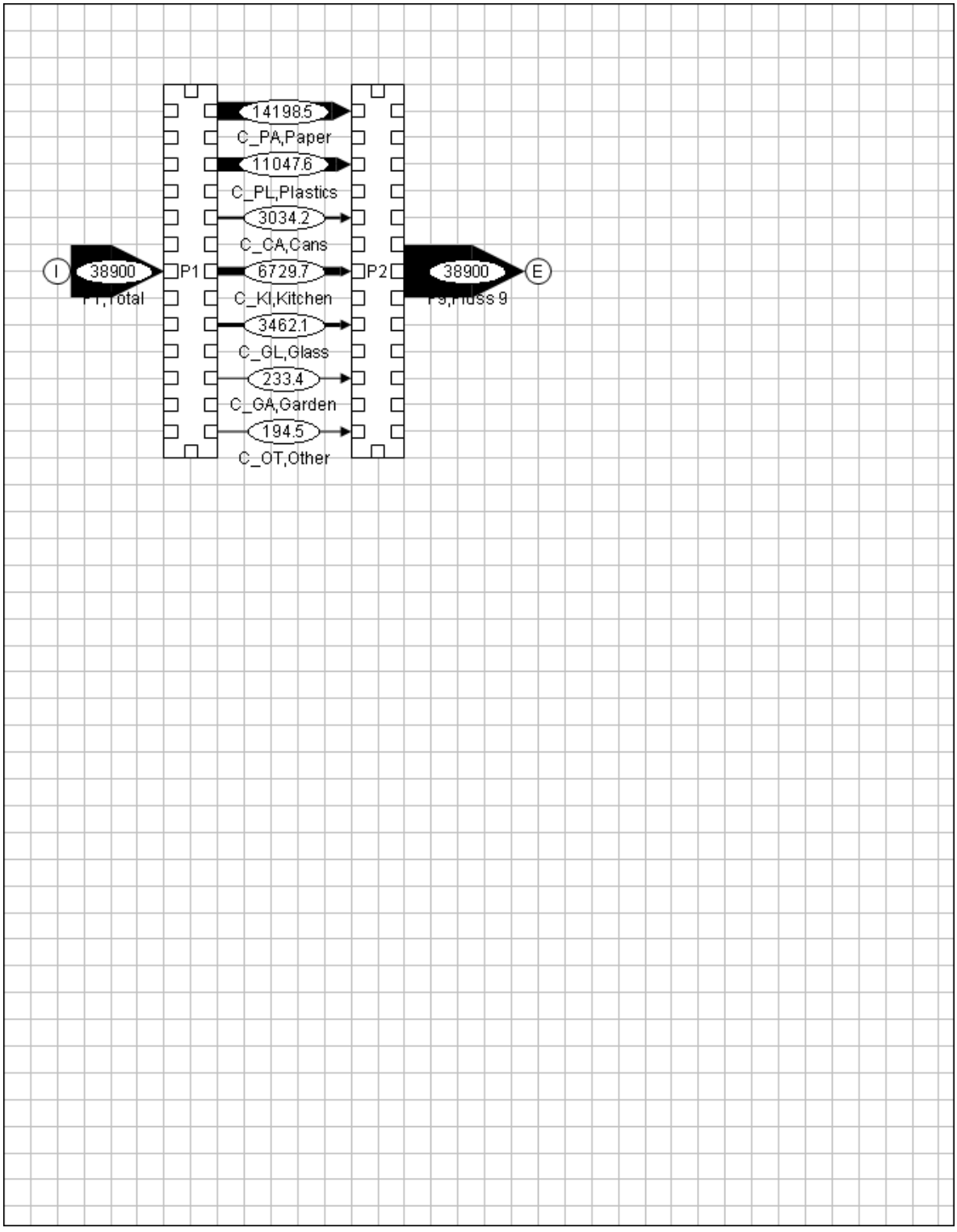
Gaps #27&28:

It became apparent based on numerous personal interviews with representatives of the different institutional bodies that the financing structure of the waste management sector is not clearly defined nor understood. In order to shed light onto this situation, the institutional arrangements and the financing structures of the City of Maseru's waste management sector will be analysed, and a financial strategy will be put in place as an integral part of the ISWMP.

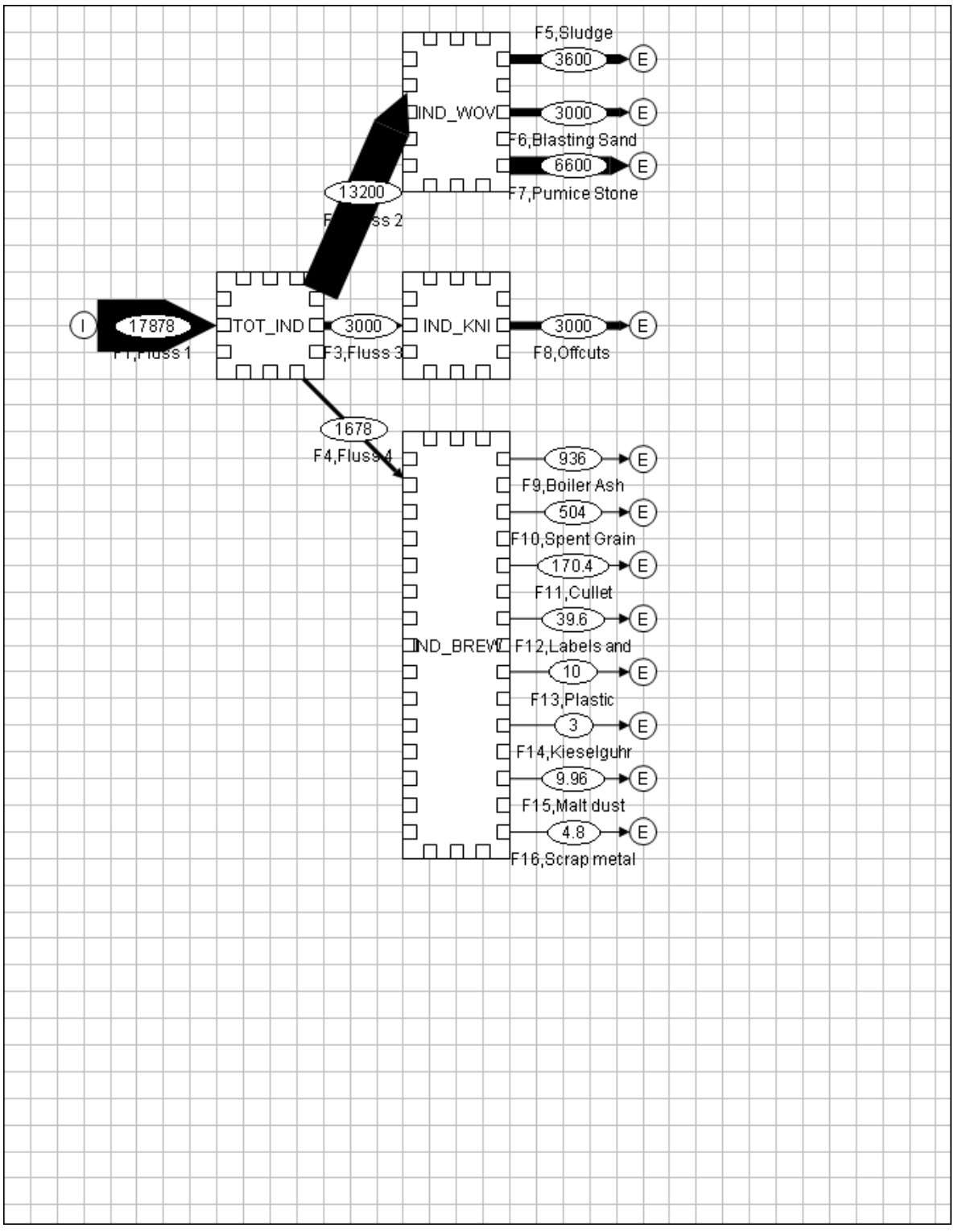
Appendix A – Waste Generation Breakdown, Residential Sector



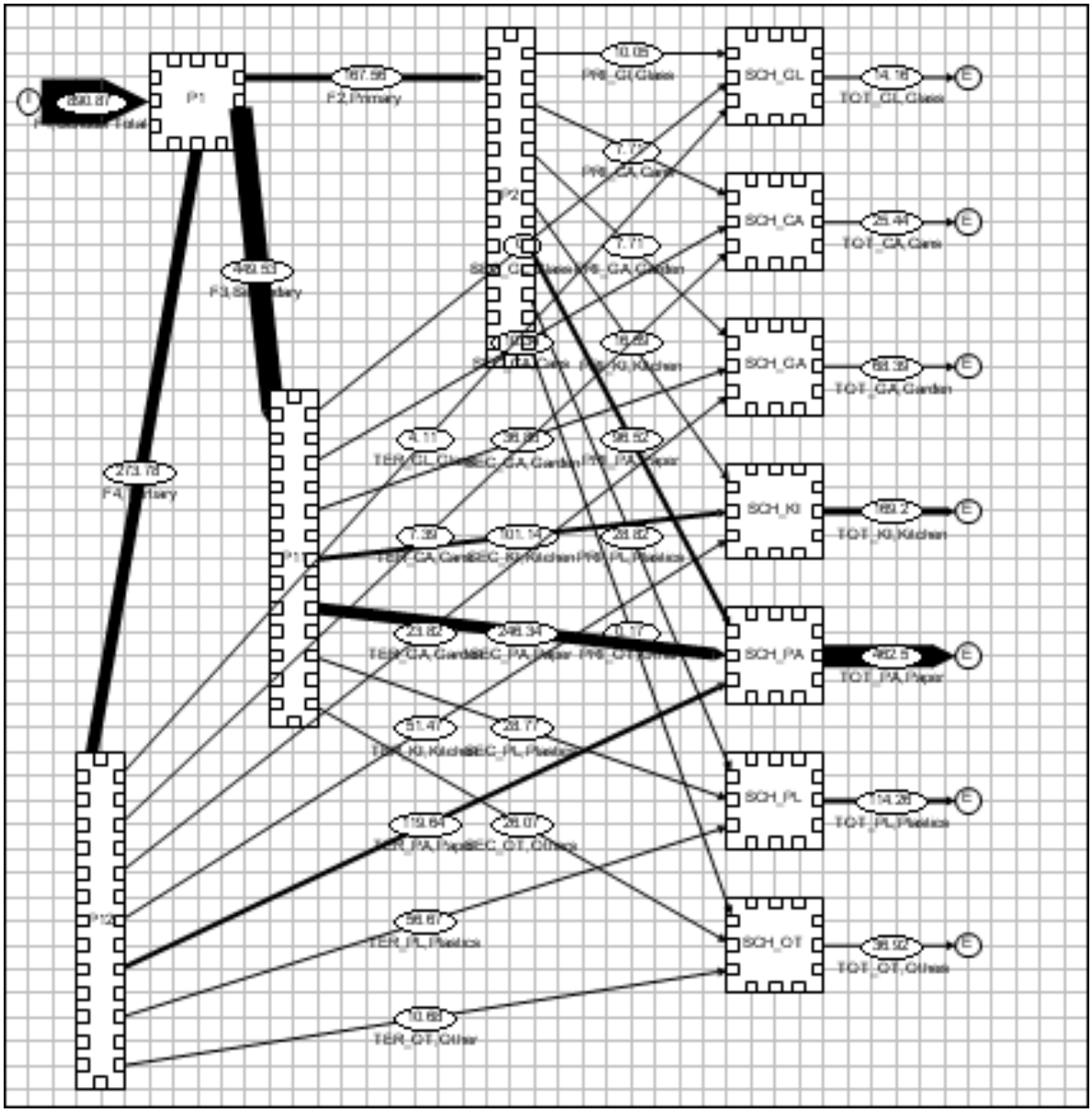
Appendix B – Waste Generation Breakdown, Commercial Sector



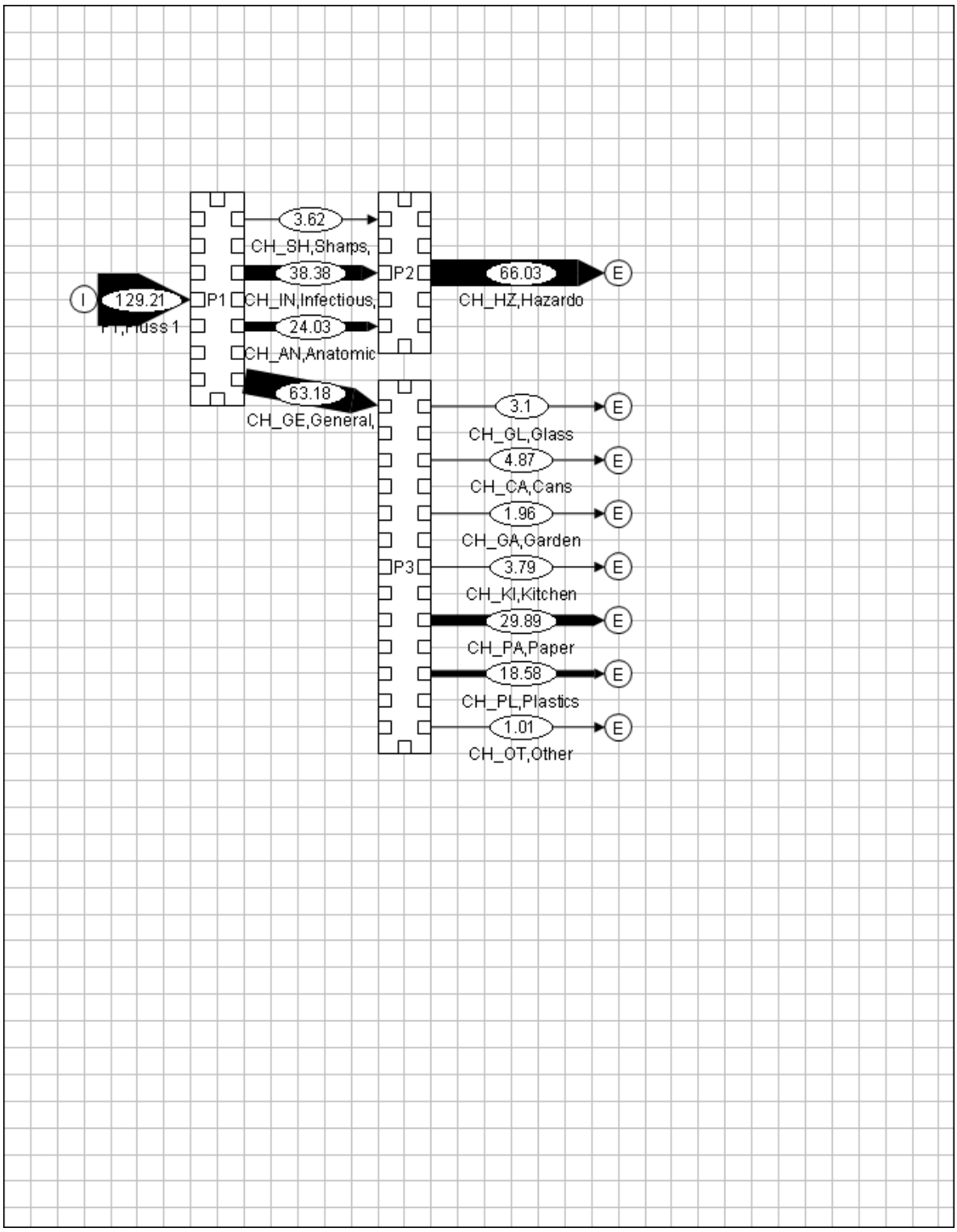
Appendix C – Waste Generation Breakdown, Industrial Sector



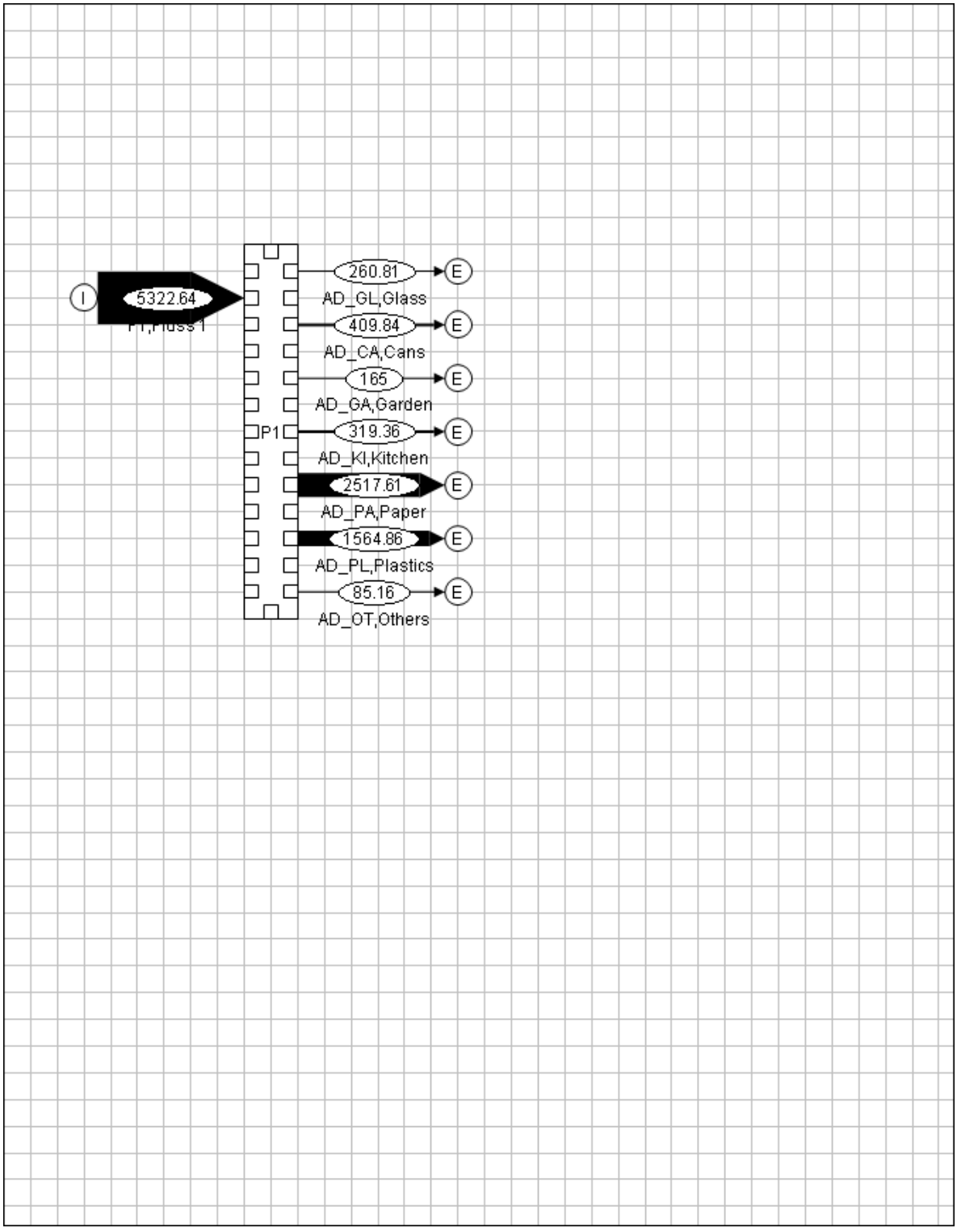
Appendix D – Waste Generation Breakdown, School Sector



Appendix E – Waste Generation Breakdown, Hospital Sector



Appendix F – Waste Generation Breakdown, Administrative Sector



Appendix G – Calculations reg. Amount of Waste Tyres

Number of cars:

The population of Maseru city is about 300,000 (Lesotho revenue report, 2006). It would be a good estimate to assume that one in every 20 people has a car so that would lead us to a figure of 15,000 cars in the Maseru city.

Number of trucks and buses:

There are about 40 industrial establishments in the city of Maseru (32 textile + one flour mill + one brewery + one brick making factory + few TV, plastic, paper cartons and soap making industries).
If we make a conservative estimate and assume that each of these industries would have at least two trucks of their own for delivery and raw material collection purposes, we would come to a number of about 80 trucks. We add in that a few trucks owned by MCC and 16 other waste collectors (mentioned in the Maseru Baseline study, ISWM Section 4) taking the figure to approximately 100. Plus I learn that there are not many buses in the city of Maseru and people use taxis for commuting within the city. So, it should be a good estimate to assumer that there are at least 100 buses plying in and out of Maseru and whose tyres would be a part of the waste stream of Maseru city.

Estimate of number of waste tyres produced per year

According to a waste tyre management report published by the NEWMOA (Northeast Waste Management Official's Association) number of waste tyres produced in a state in a year is roughly equal to its population. But we have to keep in mind the fact that the North-eastern states of the Unites States have more cars per capita than Maseru, roughly say one in every two people has a car compared with one in every 20 people in Maseru.

Number of waste tyres per year → number of cars **x** life of a tyre **x** kilometres clocked in an year

=> Number of waste tyres per year → number of cars/person **x** population **x** life of a tyre **x** kilometres clocked in an year

For North-eastern states of the U.S.:-
Number of waste tyres per year = population

- ⇨ Population = k **x** 0.5 (cars/person) **x** population **x** 50,000 (km/tyre) **x** C (km/ car/year)
- ⇨ k = 1/(0.5 **x** 50,000 **x** C)

For Maseru (assuming k and C to be constants irrespective of geographic location)

- ⇨ Number of waste tyres per year = k **x** 1/20 (cars/person) **x** 300,000 **x** 25,000 (km/tyre) **x** C
- ⇨ Number of waste tyres per year = 1/(0.5 **x** 50,000 **x** C) **x** 1/20 **x** 300,000 **x** 25,000 **x** C

Number of waste tyres per year in Maseru = **15,000**

Another way of estimating the number of waste tyres produced per year

For cars:

Let us assume that the number of kilometres a car travels per day to be roughly around 15. Meaning that in a year a car would travel approximately 6000 km. Assuming the lifetime of a tyre to be around 25,000 km. for the back tyres in a front wheel driven car and half of that meaning 12,000 km for the front tyres. This would imply that in 4 years one car would produce approximately 2+2+2 = 6 waste tyres meaning 1.5 waste tyres a year per car so that takes the figure of waste tyres produced per year by cars in the city of Maseru to 1.5*15,000 = **22,500**.

For trucks:

Average travel per day: 50 km
Number of kilometres clocked in a year (250 days) = 13,000 km
Assuming the same life time for truck tires, in 2 years we would have 2+4+4 = 10 waste tyres because trucks are rear wheel driven and they have 4 rear wheels.
This implies 5 waste tyres per truck per year.
Total number of waste tyres produced per year from 100 trucks = **500**

For buses:

Average travel per day: 50 km
Number of kilometres clocked in a year (250 days) = 13,000 km
Assuming the same life time for bus tires, in 2 years we would have 2+2+2 = 6 waste tyres.
This implies 3 waste tyres per bus per year.
Total number of waste tyres produced per year from 100 buses = **300**.

Total number of waste tyres = 22,500+500+300 = 23,300.

So approximate number of waste tyres produced in Maseru could be a figure of **20,000-25,000** per year.

Assuming the weight of a car tyre to be an average of 5 kg and that of a truck or a bus to be an average of 15 kg, we have:
Amount of rubber that can be potentially recycled from waste tyres is approximately 22500*5 + (500+300)*15 = **124,500 kg/year** = **341 kg/day**.
Assuming that the shredding machine works for 8 hours a day, the throughput required from the shredding machine is 341(kg/day)/8(hours/day) = **43 kg/hour**.

Appendix H - Calculations reg. Amount of Waste Car Batteries

Presently, the population of Maseru is approx. 300,000. 15,000 cars are currently registered in Maseru, implying one car in every 20 people. This ratio is estimated to rise to one car in every 5 people by the end of 2020.
It is furthermore assumed that the population in Maresu will grow at a rate of 7%, and that a normal car battery has a lifespan of approx. 5 years. Based on the calculations represented in the graph below, it is estimated that approx. 8,450 waste car batteries have been generated by the year 2006.