COMPOSITION OF WASTE

Swap Study Franz Josef Landfill
22 – 27 January 2004

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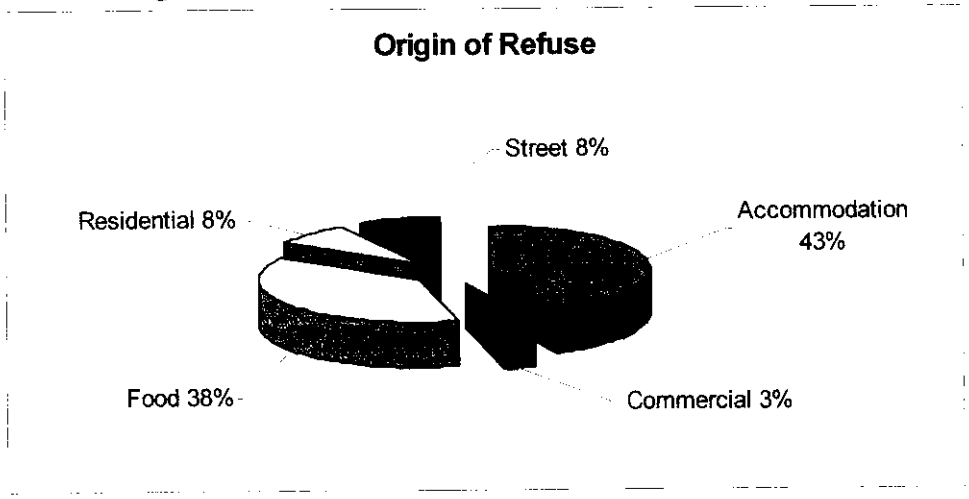
1.0 EXECUTIVE SUMMARY

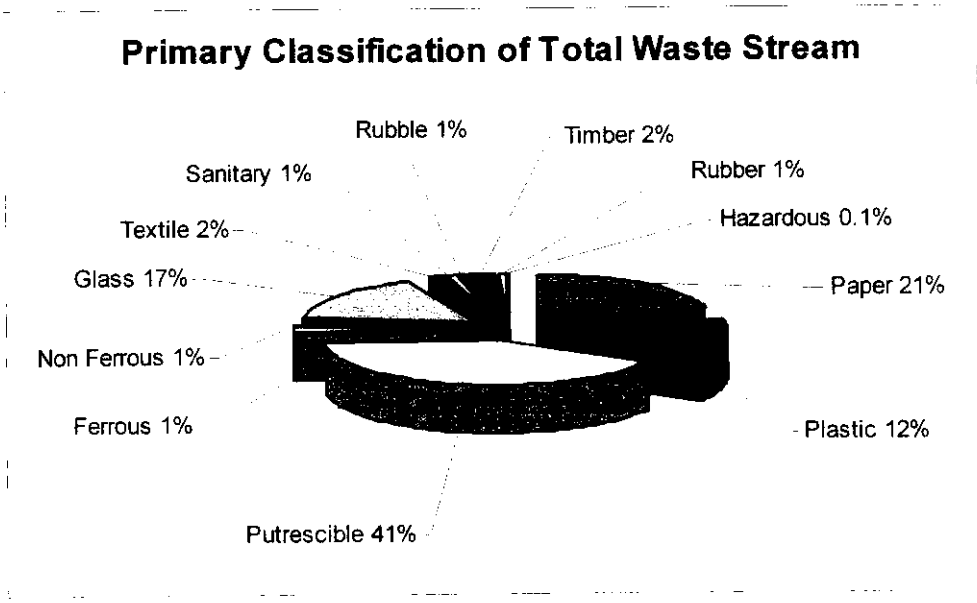
A waste analysis study, to determine the components of the refuse waste stream, was carried out at the Franz Josef landfill between the 22nd and 27th of January 2004.
This study uses the Ministry for the Environment's Solid Waste Analysis Protocol (SWAP) for determining the mix of refuse into twelve primary classifications. This protocol provides a sound method for capturing information which can be used as a tool for the design and management of the waste stream as well as monitoring performance of the landfill and waste strategies. The information provides a base for any future studies and also allows comparison with similar surveys from around New Zealand.
The study included the origin and mode of transport for all loads as these factors can be influential in how the waste is managed in the future.
The origin of refuse is shown in chart 1.

Chart 1 : Origin of Refuse



Patterns in refuse mix, quantities and requirements at this landfill are influenced by two major factors, tourists and seasons. The study was purposely conducted during a peak period for tourist activities in the region which coincides with the likely summer seasonal fluctuation for waste disposal. Over time such influences can be tracked allowing for better design and understanding for future requirements. The aim of the study is to determine, under these influences, the mix of refuse by primary classification. These values are shown in Chart 2.

Chart 2 : Total Waste Stream Shown by Primary Classifications



The Franz Josef landfill is a small facility which over the survey period received a total of 48 customers disposing of 13.25 tonne of refuse. At this rate this disposal equates to 690 tonne per year. Caution must be expressed in the use of this value as the results of the survey are representative of the survey period only.
Of all the refuse received during the survey nearly 24% originated from the Fox area.
To gain the necessary information most loads were weighed on entry to the landfill and the proportion of each classification component calculated. The contents of a number of refuse bags were analysed to determine the mix ratio for the various origin categories.
The proportion of material separated for recycling was recorded.
Recycling of cardboard, certain plastics, steel and glass occurs at this site. Recycling is well patronized by local residents but only by commercial operators where material had been separated at point of generation. Much recycling material is lost in unsorted loads.
The accuracy of the results is determined by the frequency of material requiring disposal. The material received from tourist generated activities, because of the constant production, gives a good indication of the total mix whereas infrequently received materials, such as timber from building activities and steel as in car bodies, can drastically sway results in a one off short term survey. These inaccuracies can be lessened by more frequent surveys or inclusion of supporting data.
Moisture content, especially in a high rainfall area, can affect the results. The period of the survey received rain on two days and three nights. Material affected was generally items stored in the open or on vehicles. Bagged refuse from tourist operations was not affected.
During the survey I observed that most of the cardboard was discarded as either being wet or was used as a cover material due to lack of other options to cover the tip face.
In line with the Governments aims for waste reduction to landfill, several waste streams clearly stand out as being suitable for reduction programmes.
Firstly, putrescible wastes, at 41% of the waste stream, can be disposed of in other ways such as a stock food or processed into a compost / fertilizer material. The high volumes of putrescible waste, mainly from commercial kitchens, create problems at the tip face by not being covered.
Further recovery of cardboard and paper is an easy option especially as markets are already established. Currently less than 6% of cardboard is recycled. Likewise a suitable market exists for glass recycling, however this is at a cost and glass is currently stockpiled on site for possible later recovery. Light gauge steel including car bodies should continue to be stockpiled for recovery.
The cost of recovery / recycling is dominated by transport costs of raw materials to markets. This is a problem throughout New Zealand and, in line with government policy on user pays, some means of cost recovery is required especially at this site. With an estimated 75% of waste being tourist generated there are possibilities of targeting this source, however this is only one option and the total user base should be taken into the equation.

2.0 INTRODUCTION

This report presents the results of a waste analysis survey on the composition of the refuse stream recorded at the Franz Josef landfill.
Such surveys, when undertaken over a period of time, can build up a reliable data record on the quantity and type of material being disposed to landfill. The results may become a tool for measuring the changes to waste disposal and for gauging the effects of various waste strategies.
The survey results can also be a tool to assist with the constructive planning and management of the district's waste.
The timing of this survey, 22 to 27 January 2004, is relevant as it falls in the main tourist season when demand on waste facilities is at the greatest.

2.1 Background

Traditionally, rubbish has been dumped and forgotten.
However, growing awareness of environmental effects has increased communities' expectations for enhanced standards of waste disposal. As a result parties responsible for waste management have come under pressure to respond to waste issues. But to enable effective decisions to be made, consistent and reliable data is required.
Therefore, in response to operators' and managers' needs, and the need for information on a national basis, the Ministry for the Environment in 1992 released a strategy for measuring the components of the waste stream. This strategy was known as the "Waste Analysis Protocol" (WAP) which contained a methodology for categorising and collecting data on waste.
The strategy was revised in March 2002 and is now know as the "Solid Waste Analysis Protocol" (SWAP).
It is under the revised protocol that this survey has been conducted.

2.2 Waste Classification

The SWAP protocol provides for two methods of classification, these being:-

Primary Classification
Secondary Classification

The purpose of the two classification systems is to allow quick coverage of the full waste stream and also detailed analysis of any particular component or source of waste.
Primary classification divides the waste into 12 categories with secondary classification further dividing these categories into a total of 47 sub categories.
Secondary classification requires considerable time for detailed analysis and is used more for the analysis of a particular component in the waste stream such as investigating a material for recycling.
This survey is based on primary classification analysis.

2.3 Objectives

The objective of this survey is to gauge the primary classification by weight of the waste stream during the height of the tourist season and for summer seasonal influences.

2.4 The New Zealand Waste Strategy

Reducing New Zealand's waste has become a cornerstone of the Government's commitment to sustainable development.
The Ministry for the Environment released The New Zealand Waste Strategy in March 2002. This document outlines the Government's vision to minimize and manage waste resources as part of an overall goal to form a sustainable society. To achieve the waste reduction aim the New Zealand Waste Strategy has three core goals:

- lowering the social cost and risks of waste
- reducing the damage to the environment from waste generation and disposal
- increasing economic benefit by more efficient use of materials

Through the Ministry for the Environment waste programmes and guidelines, national targets will be set for regions to achieve. Target areas include organic wastes, special wastes, construction and demolition wastes, hazardous wastes, including contaminated sites, organochlorines and trade wastes, and lastly waste disposal.
The results from SWAP studies are one tool that can be used to measure both the performance of a region and the government's achievement towards a sustainable society. On a local level it provides Council with a planning tool and also a measure to chart progress towards its zero waste goal.

2.5 Previous Survey

A waste analysis survey at Franz Josef was conducted in December 2001 by Allan and Scott of the School of Engineering, University of Canterbury.

3.0 SURVEY DESIGN and METHODOLOGY

3.1 Design

The survey design is based on the Solid Waste Analysis Protocol (MfE 2002)
In line with the protocol recommendations the data was captured over a one week period during which the landfill was open for six of the seven days. Owing to the relatively low number of vehicle movements during the survey all loads were measured by weight either by use of vehicle scales or by individual weighing of product disposed.
As much refuse is disposed of in bags a number of these were selected at random and the contents analysed, by weight, into primary classifications.
These values were then applied in the final calculation of classifications of loads of bags.
As method of transport to the disposal site is relevant, the survey included the capture of data on the mode of transport to the site.
Vehicles were divided into four categories. These were:-

Trucks
Cars, including station wagons and SUVs
Utility vehicles, including vans
Trailers

The origin of refuse was recorded as one of five categories

Food	This includes restaurants, takeaways and hotel kitchens
Residential	Domestic household and property type wastes
Accommodation	Covers hotels, motels, lodges, backpackers and camping grounds
Commercial	Includes offices, non food shops, and commercial operators
Street	Mainly street litter bins, also other rubbish deposited in streets

3.2 Survey Limitations

Several factors limit the accuracy and use of the final results.
Discussion with local operators indicated there was no unusual event or occurrence that influenced the survey period from what could be termed "normal" for that time of year. There are a few known factors and some minor occurrences observed by the survey team that require noting.
Firstly the results of the survey are indicative of the survey period only. With caution they can be interpreted for a wider period, however to gauge values for an annual basis further information is required such as seasonal and tourist influences. Only by constant monitoring or seasonal surveys can an accurate picture be created.
On site observation indicated moisture content can have a huge effect on results especially with materials that absorb moisture, such as cardboard. The period of the survey received light rain on two days and heavy rain on three nights. Moisture content of incoming material was generally dry, however it was noted that food and kitchen waste contained a high moisture content which may be a consideration if alternative disposal options are sought.
Discussion with patrons indicated the landfill attracts material from outside the region, particularly acting as an over flow from the Fox transfer station. It was also mentioned that commercial refuse operators move material in or out of the area depending on access to various refuse facilities in the region.
Within the waste stream commercial waste was not readily identified with the likelihood that most office waste was thrown out as street refuse. In this category the major items of commercial waste were a load of carpet (textile) from floor replacement and cardboard from a grocery store. The irregular disposal of such items can influence the accuracy of the survey and in particular the component of commercial textile cannot be regarded as indicative of future values in this category. Likewise during the survey no items such as whiteware and little building waste was recorded, however such items were noted in the landfill. The intermittent disposal of such items will influence the accuracy of the survey.

3.3 Methodology

The survey was predetermined for and carried out over the week of 22 to 27 January 2004 on site at the Franz Josef landfill.
Survey forms capturing the required data were developed and used to ensure sufficient information was recorded on site.
A working area was established to one side of the tip face and, in line with Health and Safety requirements, provided a safe working area away from the movement of vehicles.
Most sample analysis and sample weighing was carried out in this area.
Vehicle weighing was conducted on a flat area adjacent to the recycling facilities.
Two staff were involved on site at all times.
A hazards assessment was carried out prior to the event and this, along with general health and safety issues, was discussed with staff on site.
Loads were evaluated as soon as possible after being discharged so to avoid contamination or covering by other loads.
Origin of refuse was recorded as given by the driver.
Samples were removed from loads and analysed on the same day.

4.0 RESULTS

4.1 Primary Classification

4.1.1 Composition of Waste by Primary Classification

A summary of the primary classifications of the total waste stream, for the period of the survey, is shown below in Chart 3 and Table 1.
There are limitations to the accuracy of these values as discussed elsewhere in this report.

Chart 3: Total Waste Stream Shown by Primary Classifications

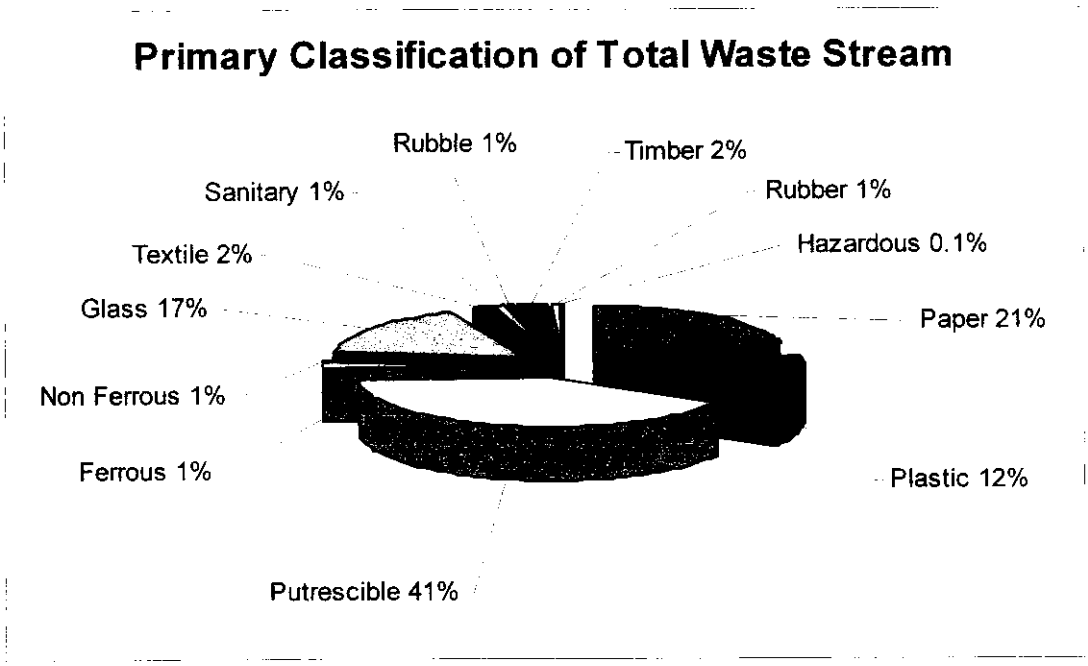


Table 1 : Total Waste Stream Analysis - Primary Classification Values

Classification	Total kgs	% Total
Paper	2815.91	21.25
Plastic	1648.92	12.44
Putrescible	5417.73	40.87
Ferrous	184.06	1.39
Non Ferrous	79.68	0.60
Glass	2263.18	17.08
Textile	227.41	1.72
Sanitary	100.90	0.76
Rubble	77.90	0.59
Timber	321.26	2.42
Rubber	97.48	0.74
Hazardous	18.61	0.14
Total	13253.04	100.00

This survey further identified both the origin of material and the mode of transport to the landfill. The presentation of this data is kept as either the origin or the transport values so to present a clear indication on these properties of the waste stream.
For this landfill the origin of material was divided into five categories and the mode of transport into four.
The results are presented in summary form and under each of these categories. Further details are given in Appendix 1 where the full survey information used to determine the summary values is presented.

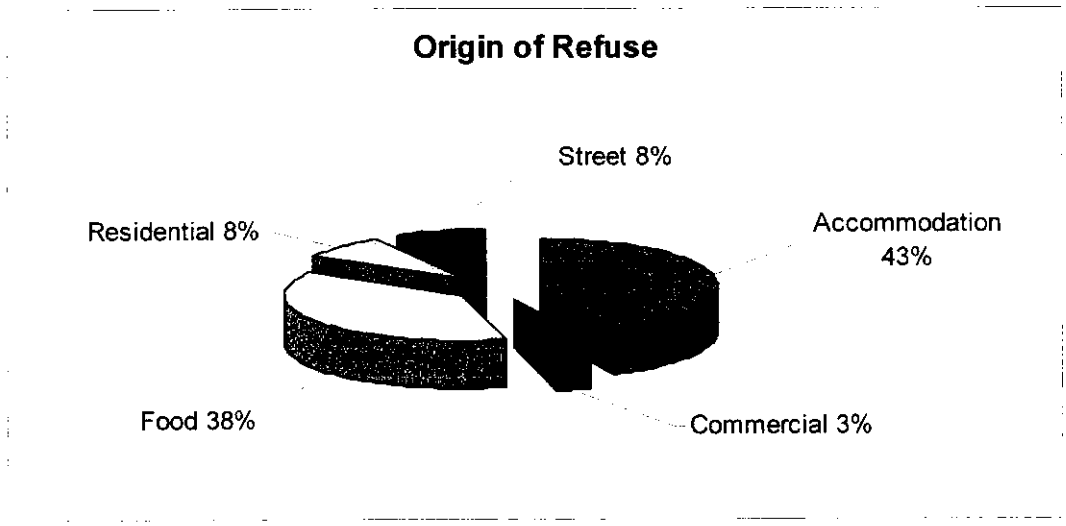
4.2 Origin of Refuse

Knowing the origin of refuse is an important factor in determining activities both targeted at waste reduction and waste management strategies. The breakdown of origin into the five named categories will allow a better understanding of the nature and, through further studies, the trends of each waste source.
Table 2 shows the matrix of the Primary Classifications for the origin of refuse. This information is summarised in Chart 4 and Table 3, with the primary classifications for each of the five origin categories presented in Charts 5 - 9 and Tables 4 – 8.

Table 2 : Waste Stream Primary Classification by Origin (by weight in Kgs)

Classification	Accommodation	Commercial	Food	Residential	Street	Total	% Total
Paper	1515.00	199	772.59	159.59	169.73	2815.91	21.25
Plastic	997.51	0	365.67	113.38	172.36	1648.92	12.44
Putrescible	1891.67	0	2858.68	261.92	405.46	5417.73	40.87
Ferrous	114.80	0	4.82	40.05	24.39	184.06	1.39
Non Ferrous	27.02	0	22.35	17.87	12.44	79.68	0.60
Glass	1031.28	0	885.54	79.68	266.68	2263.18	17.08
Textile	44.38	130	20.07	30.89	2.07	227.41	1.72
Sanitary	42.32	0	0	32.24	26.34	100.90	0.76
Rubble	32.24	0	28.13	0	17.53	77.90	0.59
Timber	0.11	0	8.15	313	0	321.26	2.42
Rubber	1.48	96	0	0	0	97.48	0.74
Hazardous	0.99	0	0	17.62	0	18.61	0.14
						13253.04	**100.0**

Chart 4 : Waste Stream - Origin of Refuse



The numerical values for the Origin of Refuse are shown in Table 3

Table 3 : Origin of Refuse

Origin	Weight kgs	Percentage
Accommodation	5698.80	43.00
Commercial	425.00	3.21
Food	4966.00	37.46
Residential	1066.24	8.04
Street	1097.00	8.28
Total	**13253.04**	**100.00**

4.3 Primary Classification by Origin Category

4.3.1 Accommodation

Chart 5: Primary Classifications of Refuse from Accommodation Origin

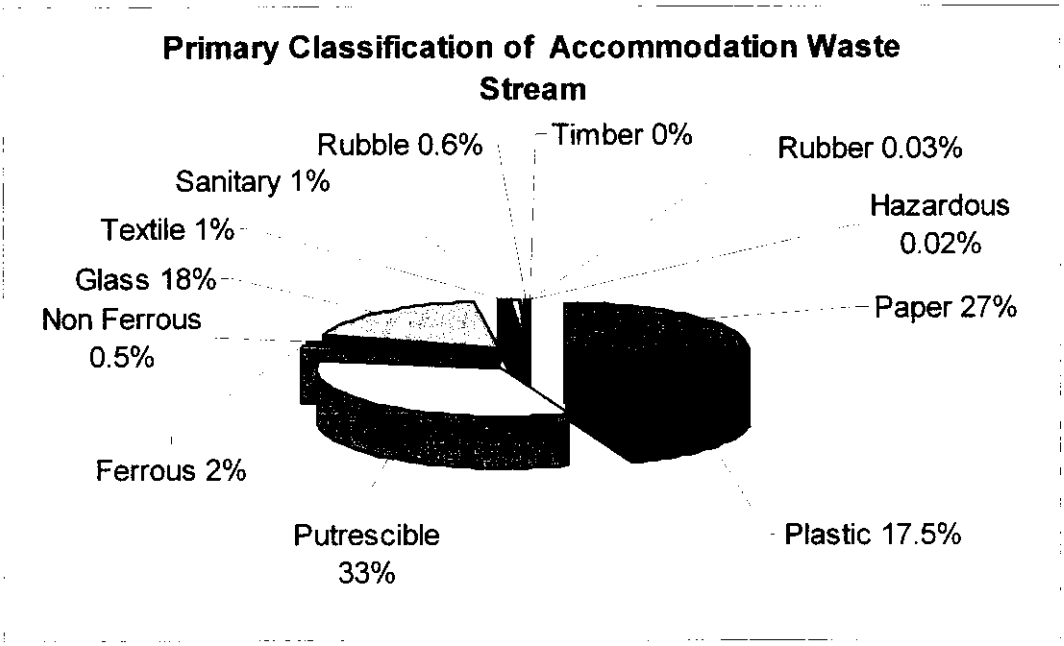


Table 4 Accommodation Waste Stream Primary Classification Values (by weight)

Classification	Total kgs	% Accommodation	% Total Waste
Paper	1515.00	26.58	11.43
Plastic	997.51	17.50	7.53
Putrescible	1891.67	33.19	14.28
Ferrous	114.80	2.01	0.87
Non Ferrous	27.02	0.47	0.20
Glass	1031.28	18.10	7.78
Textile	44.38	0.78	0.33
Sanitary	42.32	0.74	0.32
Rubble	32.24	0.57	0.24
Timber	0.11	0.00	0.00
Rubber	1.48	0.03	0.01
Hazardous	0.99	0.02	0.01
Total	**5698.80**	**100.00**	**43.00**

4.3.2 Commercial

Chart 6: Primary Classifications of Refuse from Commercial Origin

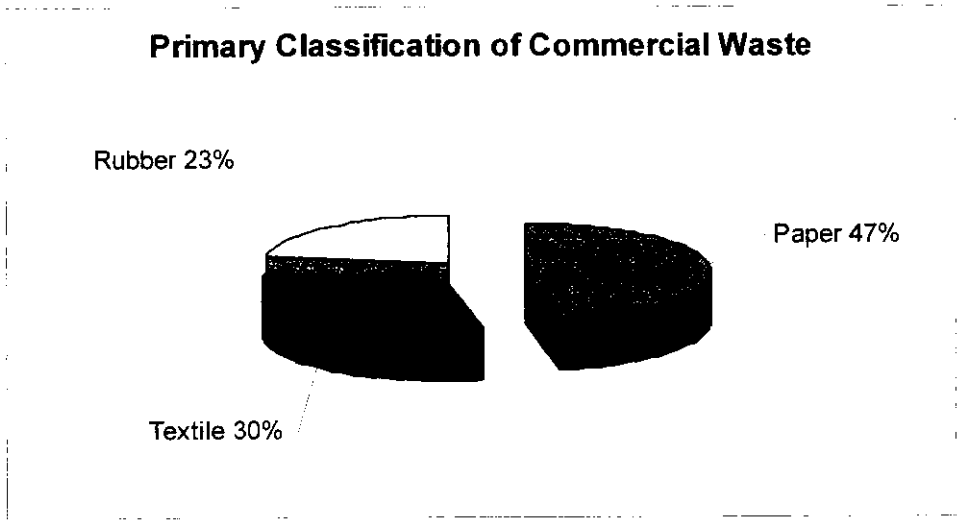


Table 5: Commercial Waste Stream Primary Classification Values (by weight)

Classification	Total kgs	% Commercial	% Total Waste
Paper	199	46.82	1.50
Plastic	0		
Putrescible	0		
Ferrous	0		
Non Ferrous	0		
Glass	0		
Textile	130	30.59	0.98
Sanitary	0		
Rubble	0		
Timber	0		
Rubber	96	22.59	0.73
Hazardous	0		
Total	**425**	**100**	**3.21**

4.3.3 Food Premises

Chart 7: Primary Classifications of Refuse from Food Premises Origin

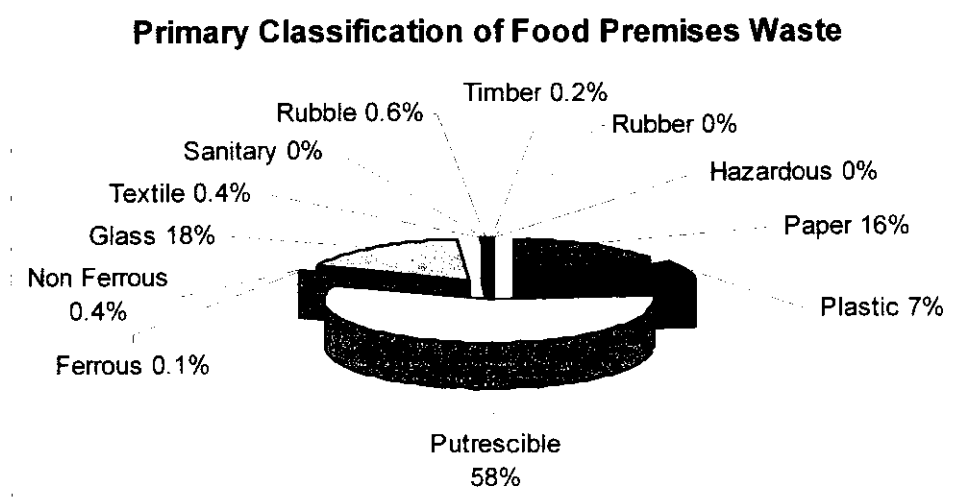


Table 6: Food Premises Waste Stream Primary Classification Values (by weight)

Classification	Total kgs	% Food Premises	% Total Waste
Paper	772.59	15.56	5.83
Plastic	365.67	7.36	2.76
Putrescible	2858.68	57.57	21.57
Ferrous	4.82	0.10	0.04
Non Ferrous	22.35	0.45	0.17
Glass	885.54	17.83	6.68
Textile	20.07	0.40	0.15
Sanitary	0.00	0.00	0.00
Rubble	28.13	0.57	0.21
Timber	8.15	0.16	0.06
Rubber	0.00	0.00	0.00
Hazardous	0.00	0.00	0.00
Total	**4966.00**	**100.0**	**37.47**

4.3.4 Residential

Chart 8: Primary Classifications of Refuse from Residential Origin

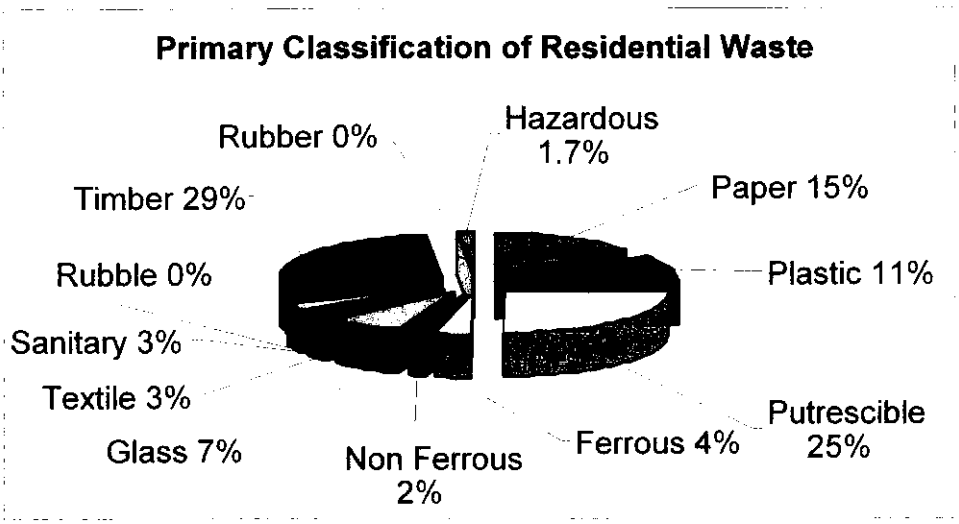


Table 7: Residential Waste Stream Primary Classification Values (by weight)

Classification	Total kgs	% Residential	% Total Waste
Paper	159.59	14.97	1.20
Plastic	113.38	10.63	0.86
Putrescible	261.92	24.56	1.98
Ferrous	40.05	3.76	0.30
Non Ferrous	17.87	1.68	0.14
Glass	79.68	7.47	0.60
Textile	30.89	2.90	0.23
Sanitary	32.24	3.02	0.24
Rubble	0.00	0.00	0.00
Timber	313.00	29.36	2.36
Rubber	0.00	0.00	0.00
Hazardous	17.62	1.65	0.13
Total	**1066.24**	**100.00**	**8.04**

4.3.5 Street

Chart 9: Primary Classifications of Refuse from Street Origin

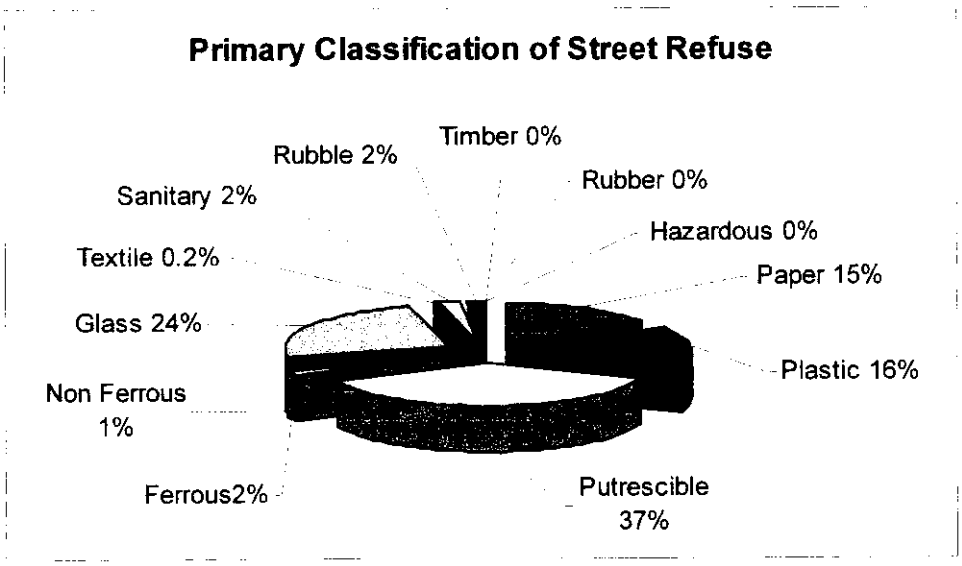


Table 8: Street Waste Stream Primary Classification Values (by weight)

Classification	Total kgs	% Street	% Total Waste
Paper	169.73	15.47	1.28
Plastic	172.36	15.71	1.30
Putrescible	405.46	36.96	3.06
Ferrous	24.39	2.22	0.19
Non Ferrous	12.44	1.13	0.09
Glass	266.68	24.31	2.01
Textile	2.07	0.19	0.02
Sanitary	26.34	2.40	0.20
Rubble	17.53	1.60	0.13
Timber	0.00	0.00	0.00
Rubber	0.00	0.00	0.00
Hazardous	0.00	0.00	0.00
Total	**1097.00**	**100.0**	**8.28**

4.4 Transport of Refuse

Both commercial and private vehicles access the landfill. Whereas the survey recorded the origin of loads and category of vehicle, from which the commercial and residential values can be determined, the thrust of the transport information has been the determination on the size and configuration of vehicles. This information is more likely to be required for future development and access issues. By monitoring the changes in the four categories of vehicle type the success and efficiencies in changes to the refuse services can be determined.
Table 9 presents a summary of the transport category values.

Chart 10: Refuse Weight by Transport Category

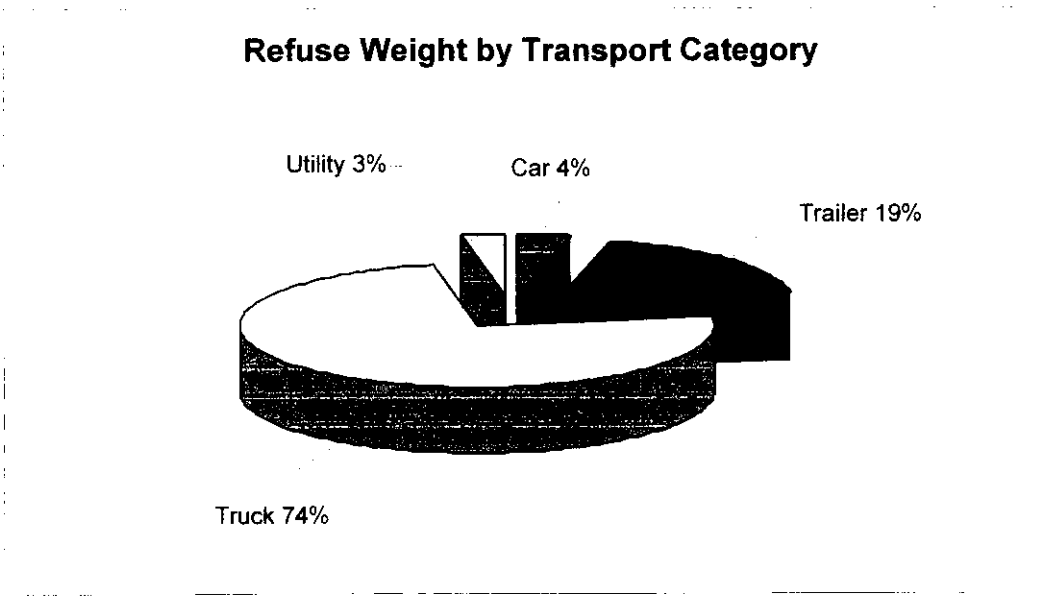


Table 9 : Refuse Weight by Transport Category

Category of vehicle	Weight kgs	Percentage
Car	462.90	3.49
Trailer	2570.00	19.39
Truck	9819.94	74.10
Utility	400.20	3.02
Total	**13151.04**	**100**

4.5 Refuse Volume and Weights

4.5.1 Annual Volume and Weight of Refuse

This survey determined values for a summer and a high tourist influx period. As the region experiences high seasonal and tourist variations the values obtained are applicable only for the survey period and extrapolation of results from these values may not be reliable. However as refuse is often expressed as terms of an annual values the results from the survey have been extrapolated to this format. No adjustments or correction factors have been applied so these values should be used for indicative purposes only. The values are shown in Table 10 below.

Table 10: Estimated Annual Volume and Weight Values

	Survey Period	Estimated Annual Value
Weight kgs	13,253 kgs	690 tonne
Volume (loose)	98m3	5100 m3

4.5.2 Density of Refuse

The density of refuse was calculated from the measuring of 14 bulk loads both in size and weight. As shown in table 11 the mean value for loose refuse equated to 135kg /m3. This value has been applied for calculating the volumes in Table 10 above.

Table 11: Average Density of Refuse During Survey Period

Total weight kgs	5090
Total volume m3	37.7
Average Density	**135 kg/m3**

4.5.3 Values for Individual Components of Refuse.

To assist with estimating the weight of common containers of refuse a number of samples of particular items were taken and unit rates derived. These are summarised in Table 12

Table 12: Volume, Weight and Density of Product in Common Containers

Classification	Item	Container	kg/ container	kg/m3
Glass	Bottles	120 L wheelie bin	31	258
Putrescible	food	120 L wheelie bin	90	750
Putrescible	food	20 L bucket	11.5	575
Paper	Cardboard	Wool bale 0.9 x 0.9 x 1.0	58	71.6
Plastic	PET bottles	Wool bale 0.9 x 0.8 x 1.0	12	16.7

4.6 Refuse Bag Analysis

As much refuse arrived at the landfill in bags, this survey included the analysis of bag contents to determine the mix ratio for primary classifications.
These results were recorded by origin and from the summary of each origin a mean value calculated. The mean values were then applied to determine the classification values for other bags in this survey.

Table 13 presents a summary of the classification values for bags from four of the five origins. Where no individual bags were identified as from commercial origin it is likely that these were included in the street collection.

Table 13: Refuse Bag Analysis

Classification	% value by weight			
	Accommodation	Food	Residential	Street
Paper	27.67	18.32	18.79	16.37
Plastic	18.04	11.39	17.08	16.62
Putrescible	37.76	62.12	37.67	39.10
Ferrous	1.92	0.20	3.53	2.35
Non Ferrous	0.36	0.74	0.43	1.20
Glass	11.84	5.25	8.54	19.93
Textile	0.87	0.48	2.63	0.20
Sanitary	0.86	0.00	11.33	2.54
Rubble	0.65	1.17	0.00	1.69
Timber	0.00	0.34	0.00	0.00
Rubber	0.03	0.00	0.00	0.00
Hazardous	0.02	0.00	0.00	0.00

4.6.1 Sample Size and Accuracy of Bag Analysis

The number of samples analysed was determined by the availability of suitable bags. The contents from a total of 46 bags were analysed.

Based on information from similar surveys a sample size in the order of 40 bags is required to give an acceptable order of accuracy on components greater than 15% of the refuse.
Generally, for this survey, paper, plastics, and putrescibles achieve a precision level of ± 20% or greater at a 95% confidence level.
Glass, except for street bags, falls below this level and the remaining classifications achieve a very low order of accuracy. However the contents of bags were generally consistent and no items out of the ordinary were encountered.

4.7 Recycling Values

Recycling occurs for several of the components of the waste stream, in particular plastics types 1 & 2, cardboard, glass, aluminium cans (non ferrous) and steel (ferrous).
Only items in the first four categories were recycled during the survey period. No car bodies or large steel items for recycling were received.
Table 14 shows, for each classification of material recycled, the total weight collected during the survey, the total weight recorded as recycled and the recycled value expressed as a percentage of the total weight of that classification.

Table 14: Values of Recycled Material

Material	Total Weight kgs	Recycled Weight kgs	% of Total Weight
Paper	2815.91	157.04	5.58%
Plastic	1648.92	96.96	5.88%
Non Ferrous	79.68	9	11.30%
Glass	2263.18	1206.28	53.30%

4.8 Fox Transfer Station Refuse

The Franz Josef Landfill generally receives material both from local activities and the wider community. In particular it acts as an overflow for the Fox Transfer Station which is serviced on a weekly basis.
During the survey nearly 24% of the waste stream originated from the Fox area. Of this 775kg (5.8%) came directly from overflow at the Fox Transfer Station and a further 2358kg was brought in from commercial refuse operations in the Fox area.
The contractor who manages both the Fox and Franz Josef facilities transported the refuse from the Fox Transfer Station.