
Final

Waste Composition Study County of Hawai`i

Prepared by



In Association with
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Contents

Section	Page
1 Introduction.....	1-1
1.1 Sources of Disposed Waste	1-1
1.2 Methodology	1-2
1.2.1 Sampling Procedures	1-2
1.2.2 Calculations	1-4
2 Countywide Sampling Results	2-1
2.1 Total County, West Hawai`i, and East Hawai`i Composition	2-1
2.2 Comparison of Hawai`i Composition to U.S. Average	2-2
2.3 Transfer Station, Commercial, and Self-Haul Substreams	2-2
2.4 Explosive and Hard-to-Process Items.....	2-3
3 West Hawai`i Sampling Results	3-1
4 East Hawai`i Sampling Results.....	4-1

Appendices

A	Detailed Sampling Results
B	Detailed West Hawai`i Commercial Substream Results
C	Waste Component Definitions
D	Sampling Methodology and Calculations
E	Field Sampling Forms

Exhibits

1-1	Samples per Day by Substream
1-2	Number of Samples, Total and Average Sample Weight
1-3	Flow Diagram of Composition Calculations
2-1	Composition Estimates by Waste Category: Total County
2-2	Composition Estimates by Waste Category: West Hawai`i
2-3	Composition Estimates by Waste Category: East Hawai`i
2-4	Top Ten Components: Total County
2-5	Top Ten Components: West Hawai`i
2-6	Top Ten Components: East Hawai`i
2-7	Composition and Quantities for West Hawai`i and East Hawai`i Main Categories
2-8	Comparison of Hawai`i County Composition to U.S. Average
2-9	Composition Estimates by Waste Category: Transfer Stations
2-10	Composition Estimates by Waste Category: Commercial
2-11	Composition Estimates by Waste Category: Self-Haul
2-12	Top Ten Components: County Transfer Stations
2-13	Top Ten Components: County Commercial
2-14	Top Ten Components: County Self-Haul

3-1	Composition Estimates by Waste Category: West Hawai`i Transfer Station
3-2	Composition Estimates by Waste Category: West Hawai`i Commercial
3-3	Composition Estimates by Waste Category: West Hawai`i Self-Haul
3-4	Top Ten Components: West Hawai`i Transfer Stations
3-5	Top Ten Components: West Hawai`i Commercial
3-6	Top Ten Components: West Hawai`i Self-Haul
3-7	Composition Estimates: West Hawai`i Individual Transfer Stations
4-1	Composition Estimates by Waste Category: East Hawai`i Transfer Stations
4-2	Composition Estimates by Waste Category: East Hawai`i Commercial
4-3	Composition Estimates by Waste Category: East Hawai`i Self-Haul
4-4	Top Ten Components: East Hawai`i Transfer Stations
4-5	Top Ten Components: East Hawai`i Commercial
4-6	Top Ten Components: East Hawai`i Self-Haul
A-1	Composition Estimates: Total County
A-2	Composition Estimates: West Hawai`i
A-3	Composition Estimates: East Hawai`i
A-4	Composition Estimates: Total County Transfer Stations
A-5	Composition Estimates: Total County Commercial
A-6	Composition Estimates: Total County Self-Haul
A-7	Composition Estimates: West Hawai`i Transfer Stations
A-8	Composition Estimates: West Hawai`i Commercial
A-9	Composition Estimates: West Hawai`i Self-Haul
A-10	Composition Estimates: East Hawai`i Transfer Stations
A-11	Composition Estimates: East Hawai`i Commercial
A-12	Composition Estimates: East Hawai`i Self-Haul
B-1	Composition Estimates: West Hawai`i Commercial Packer Trucks
B-2	Composition Estimates: West Hawai`i Commercial Drop Boxes
B-3	Composition Estimates: West Hawai`i Commercial Other

SECTION 1

Introduction

The County of Hawai`i is updating its Integrated Solid Waste Management Plan. The plan will examine waste management options in the County. To aid in the evaluation of these options, CH2M HILL conducted this waste composition study to provide statistically valid data on the types and quantities of waste currently being disposed of at the West Hawai`i (Pu`uanahulu) Landfill. The field work for this study was performed by Sky Valley Associates.

This report presents the results of the waste composition study, which include composition estimates, both for the overall waste stream and for the transfer station, commercial, and self-haul wastes disposed at the landfill. The results are based on samples taken during May of 2008. A similar study was performed at the South Hilo Landfill in 2001¹. We have used the results of that study to represent the composition of waste that enters the East Hawai`i landfill. The results are combined to provide waste composition estimates for total County disposal.

There are four major sections of this report. Section 1 briefly summarizes the project, including a description of the sources of disposed waste and the project methodology. Sections two through four provide sampling results for the overall waste stream; results for the transfer station, commercial, and self-haul substreams; and substream estimates for West Hawai`i and East Hawai`i.

Following the main body of the report are appendixes that included detailed sampling results (Appendixes A and B), descriptions of waste components (Appendix C), descriptions of the sampling methodology and calculations (Appendix D), and field sampling forms (Appendix E).

1.1 Sources of Disposed Waste

For analysis and planning purposes, landfill disposal quantities can be divided into substreams. A waste substream is defined according to its source of generation, its means of collection and transport to the disposal facility, or both². For the purposes of this study, the waste disposed at the West Hawai`i Landfill was divided into the following three substream categories:

1. Transfer Station – This is waste hauled from one of nine transfer stations on the west side of the Island. It is transported to the West Hawai`i Landfill in transfer station compactor boxes. Transfer station loads are composed primarily of residential waste.

¹ Cascadia Consulting Group, 2001. *Waste Composition Study, South Hilo Landfill, County of Hawai`i*.

² It should be noted that this study estimates the composition of waste disposed, not waste generated. Waste generation is equal to the sum of both the disposed and recycled amounts.

2. Commercial – This is waste hauled by commercial hauling companies. Commercial haulers use a variety of vehicles to transport this waste to the West Hawai`i Landfill, including packer trucks (garbage trucks), roll-offs (primarily open boxes), and other vehicles (e.g. flatbeds, pickups, etc.). This waste is collected both from residences and businesses.
3. Self-Haul – This is waste that residents, contractors, businesses, and public entities haul directly to the West Hawai`i Landfill. These loads are transported either in small vehicles (e.g. autos, pick-ups, etc.) or large vehicles (e.g. dump trucks, flatbeds, etc.). As with waste in the commercial substream, self-haul waste comes from both residences and businesses. Waste from public agencies (such as the County of Hawai`i Parks Department) is also included in this category.

The waste stream was broken down further in the transfer station and commercial substreams as follows:

- During field sampling, samples taken from the transfer station substream were also recorded by station so that information about the waste composition at individual stations could be recorded. Note, however, the relatively few number of samples taken at any individual station make any resulting composition estimates highly uncertain: the results should be viewed accordingly.
- Samples from the commercial substream were divided among the three main vehicle types (packers, rollofs, and other).

Each of the three substreams contributed a portion of the approximately 128,500 total tons of waste disposed at the West Hawai`i Landfill from July 2007-June 2008 (FY 2008). About 32 percent (or about 41,700 tons) of this waste was hauled from transfer stations. Commercial hauling companies disposed of nearly 63 percent (81,000 tons), and the remaining 5,900 tons (approximately 5 percent) were transported to the landfill by self-haulers.

1.2 Methodology

This section presents a summary of the sampling and calculation procedures used in this study. The complete sampling methodology including descriptions of the main calculations can be found in Appendix C. The procedures summarized in this section were used during the recent sampling event at the West Hawai`i Landfill. Sky Valley Associates conducted both the recent sampling event at the West Hawai`i Landfill and the 2001 sampling event at the South Hilo Landfill; the same procedures were used during both events.

1.2.1 Sampling Procedures

A sampling plan was developed to produce statistically valid composition data for the three substreams described above. A total of 100 samples were captured and sorted at the West Hawai`i Landfill on May 15, 16, and 19 through 21, 2008³. The allocation of these samples among the three substreams was determined according to each substream's contribution to the total waste stream, with one exception. There is relatively little mixed self-haul material

³ Because all sampling occurred during May of 2008, these results do not account for any seasonal variation.

delivered to the West Hawai'i Landfill (1,200 of 128,000 tons in FY 2008, or less than 1 percent). Therefore, it was decided that overall sampling accuracy would be improved by using self-haul sampling results from the 2001 study to represent the composition of mixed self-haul loads in West Hawai'i, and assigning samples that would have been obtained from the self-haul stream to the other two substreams. The composition profile of mixed self-haul loads from the 2001 study was used to estimate the mixed self-haul composition for the West Hawai'i Landfill.

In addition to the mixed self-haul loads delivered to the West Hawai'i Landfill, there were about 4,700 tons of pure loads i.e., loads that could be assigned to a single waste component such as confidential documents or tires (or in the case of construction and demolition debris, assigned to a subset of the waste stream). The 2001 composition profile was applied only to the mixed self-haul loads: the pure loads were added to the mixed load profile resulting in a total self-haul profile.

Finally, adjustments were made so that a sufficient number of samples were taken from each substream and vehicle type to assure that sample data are representative of composition. The commercial substream was oversampled to account for the increased variability typically encountered in that substream.

Exhibit 1-1 presents the number of samples taken per day.

EXHIBIT 1-1
Samples per Day by Substream and Vehicle Type

	Number of Samples				Total
	Transfer Station	Commercial Packer	Commercial Rolloff	Commercial Other	
May 15, 2008	6	5	6	3	20
May 16, 2008	6	8	5	1	20
May 19, 2008	6	7	6	1	20
May 20, 2008	6	4	9	1	20
May 21, 2008	6	6	4	4	20
Total	30	30	30	10	100

All loads were systematically selected for sampling⁴. From each selected load, a 200- to 300-pound representative sample was hand-sorted into 58 prescribed component material categories, which were then weighed and recorded. Evidence of explosive or hard-to-process items was noted for each load. A listing and description of the component material categories is included in Appendix C. Exhibit 1-2 summarizes the number of samples and the total and average sample weight.

⁴ Systematic sampling is outlined in more detail in Appendix B. In short, this procedure assures that the correct number of samples is taken randomly and throughout the day by selecting every "nth" vehicle from each substream (i.e. every 4th commercial packer truck).

EXHIBIT 1-2

Number of Samples, Total and Average Sample Weight

	Sample Count	Sample Weights (in pounds)	
		Total for All Samples	Average
Transfer Station	30	6,986	232.9
Commercial Packer	30	6,724	224.1
Commercial Drop Box	30	6,902	230.1
Commercial Other	10	2,376	237.6
Total	100	22,988	231.2

1.2.2 Calculations

A weighted averaging process was used to prepare the waste composition estimates in which composition percentages from substreams were multiplied by FY 2008 tons from that substream. The result is FY 2008 tons for each waste component in each substream.

Exhibit 1-3 presents a flow chart that summarizes the calculation process for the waste composition estimates. For West Hawai`i, composition estimates were calculated for the sample groups, the three substreams, and the overall waste stream using the linked procedure shown. For the transfer station substream, composition percentages were calculated for each of the nine transfer stations. Sample loads that came from each of the nine stations determined these composition percentages. The percentages were weighted according to the tons disposed by each station during FY 2008, and then pooled to produce an overall transfer station composition⁵.

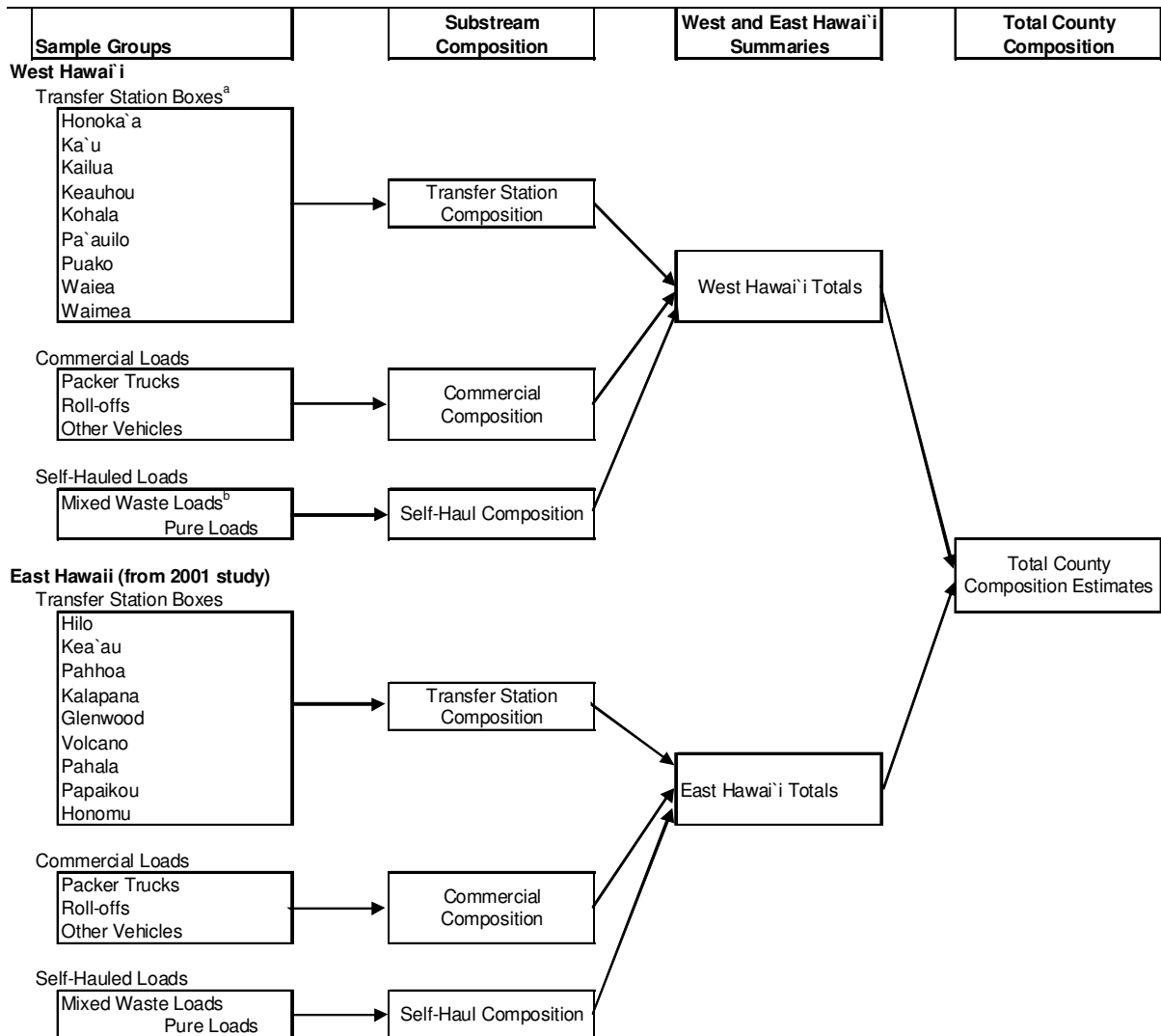
For the commercial haulers, separate composition percentages were calculated for three vehicle types: packer, roll-off, and other vehicles. These percentages were weighted according to the estimated tons disposed by each vehicle type during FY 2008. They were then combined to give composition percentages for the commercial substream.

For waste from East Hawai`i delivered to the South Hilo Landfill, the waste quantities by component were determined by multiplying the 2001 waste composition percentages by FY 2008 deliveries from each substream (transfer stations, commercial loads, and self-haul loads. As described above, pure loads delivered to the South Hilo Landfill were assigned to specific waste components.

The overall waste stream composition for West Hawai`i and East Hawai`i was calculated as an aggregate of the sample group compositions, which were weighted according to their tonnage contribution to the overall waste stream. Finally, a similar process is used to combine results from West Hawai`i and East Hawai`i into a total county waste composition profile.

⁵ Tonnages from the West Hawai`i Landfill and the South Hilo Landfill provided all tonnages used to "weight" each sample group for this study. The weighting process is described in Appendix C.

EXHIBIT 1-3
Flow Diagram of Composition Calculations



^aNot sampled because quantities were small. The 2001 composition was used for these loads.

^bNo waste was sampled from the Laupahoehoe, Miloli'i and Ke'ei stations. Tons from these stations were assigned a waste composition profile from one of the other stations.

For the West Hawai'i substreams, low and high estimates are shown that represent a 90 percent confidence level, meaning that there is a 90 percent certainty that the actual composition is within the calculated range⁶. In exhibits and charts throughout this report, the values graphed represent the mean component percentage, not the range.

⁶ The low and high estimates could not be calculated for any profile that blends information from more than one East Hawai'i substream because the relative quantity of waste delivered to each substream has changed since 2001.

SECTION 2

Countywide Sampling Results

This section presents a summary of countywide composition results for the total waste stream and the three substreams (transfer stations, commercial, and self-haul), and includes data for both West and East Hawai`i. Most of this information is presented in one of the following two formats:

- A bar chart that depicts the composition by nine main waste *categories*: paper, glass, metal, plastic, organics, construction and demolition, household hazardous, special, and mixed.
- An exhibit that lists the ten largest of the 58 waste *components*, by weight.

More comprehensive exhibits that details the full composition results for the 58 component categories are presented in Appendix A (Exhibits A-1 through A-6).

2.1 Total County, West Hawai`i, and East Hawai`i Composition

Exhibits 2-1, 2-2, and 2-3 are bar charts that show the overall composition results for the nine main waste categories of waste disposed for the entire County, for West Hawai`i, and for East Hawai`i, respectively. When combined, organics and paper comprise more than half of the waste stream. Construction and demolition waste accounts for another 22% by weight. The construction and demolition category includes such components as clean lumber and gypsum scrap. The organics main waste category contains such components as food, textiles, and prunings.

The composition of waste disposed in West Hawai`i is similar to the composition of disposed waste in East Hawai`i. Two differences that merit mention include: there are more organics disposed of in West Hawai`i (35.3%) than in East Hawai`i (29.6%); and more special waste disposed of in East Hawai`i (5.2%) than in West Hawai`i (1.9%). The types of special wastes disposed most often in East Hawai`i include industrial sludge, bulky items, and tires (see Exhibit A-3 in Appendix A).

Exhibits 2-4, 2-5, and 2-6 show the ten largest waste components for the entire County, for West Hawai`i, and for East Hawai`i. In all three areas, the largest three components by weight are food, clean and treated lumber⁷, and cardboard, which combined make up approximately a third of the total waste stream.

Notable differences between West Hawai`i and East Hawai`i include:

- One component in each area appears on the list in one area but not in the other: R/C metal⁸ is in the top ten for West Hawai`i, and film plastic in East Hawai`i.

⁷ Most of the disposed lumber in the waste stream is treated, and is not appropriate for composting.

⁸ The R/C components include waste that is made mostly of one component but contains significant amounts of other components, or waste that is part of a broad waste category but cannot be put into any of its component categories. Examples of R/C organic waste includes carpet and disposable diapers, while materials such as paper towels and coated milk cartons belong to R/C paper.

- Clean and treated lumber accounts for 8.8% by weight in West Hawaii versus 14.3% in East Hawaii.
- Food accounts for 17.7% by weight in West Hawai`i versus 12.8% in East Hawai`i.

Exhibit 2-7 shows a summary comparison of composition and quantities for the nine main waste categories for West Hawai`i and East Hawai`i.

2.2 Comparison of Hawai`i County Composition to U.S. Average

Exhibit 2-8 provides an aggregated comparison of the Hawai`i County disposed waste stream with the U.S. average, as compiled by the US Environmental Protection Agency (EPA). The data are shown in aggregated form because the EPA data is grouped somewhat differently and excludes construction and demolition debris. As shown, Hawaii County's disposed waste stream includes somewhat more paper, metal, and organics and somewhat less plastic and glass than U.S. averages.

2.3 Transfer Station, Commercial, and Self-Haul Substreams

Exhibits 2-9, 2-10, and 2-11 are bar charts that show the overall composition results of waste disposed countywide in the main waste categories for the transfer station, commercial, and self-haul substreams. The composition by category for transfer station and commercial substreams are similar with organics, paper, and construction and demolition waste accounting for 70-80% of the waste disposed. Construction and demolition waste is more pronounced in the commercial substream (24.0% vs. 14.4%) and organics is more pronounced in the transfer station substream (37.6% vs. 31.5%). In comparison, the self-haul substream is quite high in construction and demolition waste (45.6%) and special waste (21.6%). As shown in Appendix A (Exhibit A-6), most of the self-haul special waste consists of industrial sludge.

Exhibits 2-12, 2-13, and 2-14 show the ten largest waste components for the transfer station, commercial, and self-haul substreams. The top ten components make up 69%, 76%, and 87% of the transfer station, commercial, and self-haul substreams, respectively. Food, clean and treated lumber, and cardboard are each in the top 5 components in the transfer station and commercial substreams. The largest self-haul substream components include clean and treated lumber (20.5%), industrial sludge (15.1%), and green waste (11.4%).

It is important to note that many of the top ten components are good candidates for re-use or are potentially recyclable. For example, the estimates indicate that there is over 15,800 tons of cardboard disposed by the transfer station and commercial substreams: cardboard represents 5.9% of the transfer station substream, and 10.0% of the commercial substream.

2.4 Explosive and Hard-to-Process Items

During the process of capturing and sorting samples, the field supervisor noted loads that contained hard-to-process or potentially explosive items. Hard-to-process items include anything that would be difficult or impossible to manually sort, automatically process, or transfer by conveyor belt due to weight or size constraints. Examples of these items are appliances, mattresses, and carpet. Of the 100 loads sampled, 9 contained hard-to-process items: three with mattresses, three with bulky furniture, and one each with large-sized demolition materials, large crates, and large plastic pipe. Five of the hard-to-process items came from the transfer station substream and four came from the commercial substream.

No potentially explosive items were identified during the 2008 and 2001 sampling events.

EXHIBIT 2-1
Composition Estimates by Waste Category: Total County

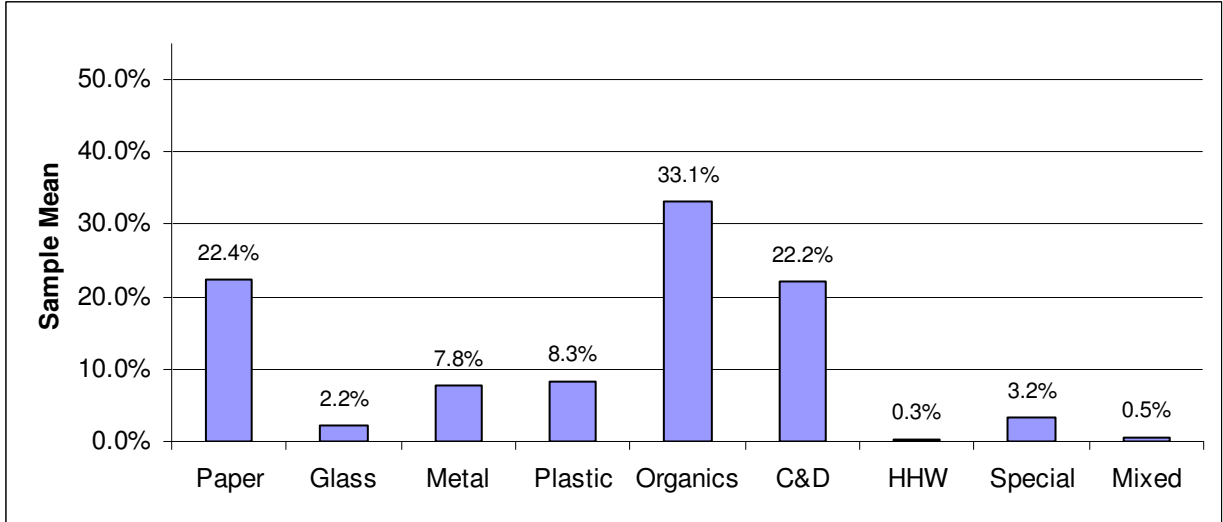


EXHIBIT 2-2
Composition Estimates by Waste Category: West Hawai'i

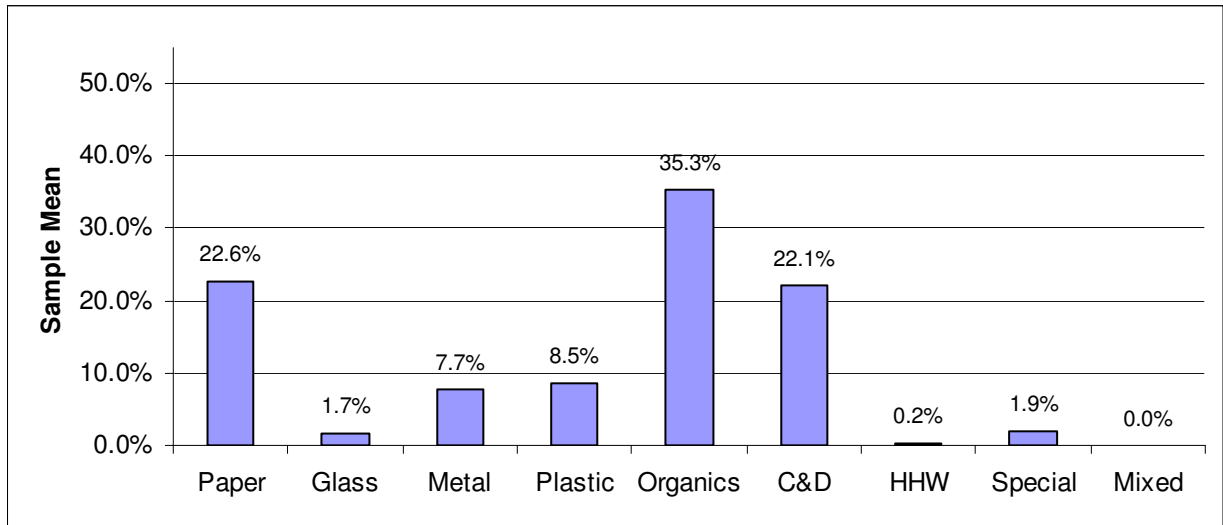


EXHIBIT 2-3
Composition Estimates by Waste Category: East Hawai'i

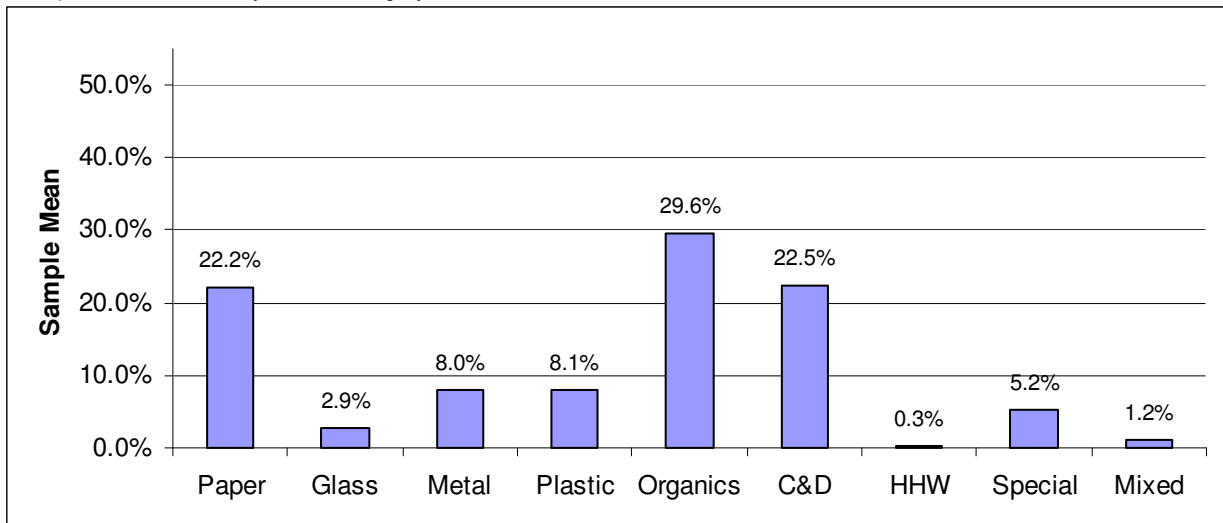


EXHIBIT 2-4

Top Ten Components: Total County

	Tons Disposed	Percent of Total	Cumulative Percent of Total
Food	34,230	16.3%	16.3%
Clean and Treated Lumber	22,984	10.9%	27.2%
Cardboard	16,182	7.7%	34.9%
Green waste	15,858	7.6%	42.5%
R/C Organic	13,875	6.6%	49.1%
R/C Demolition	12,819	6.1%	55.2%
R/C Paper	11,443	5.4%	60.7%
Miscellaneous Paper	8,634	4.1%	64.8%
Ferrous Metal	7,441	3.5%	68.3%
Film Plastic	6,170	2.9%	65.4%

EXHIBIT 2-5

Top Ten Components: West Hawai'i

	Tons Disposed	Percent of Total	Cumulative Percent of Total
Food	22,804	17.7%	17.7%
Clean and Treated Lumber	11,363	8.8%	26.6%
Cardboard	10,211	7.9%	34.5%
Green Waste	10,211	7.9%	42.5%
R/C Demolition	10,172	7.9%	50.4%
R/C Organic	8,573	6.7%	57.1%
R/C Paper	6,400	5.0%	62.0%
Miscellaneous Paper	6,233	4.8%	66.9%
Ferrous Metal	4,417	3.4%	70.3%
R/C Metal	4,169	3.2%	69.0%

EXHIBIT 2-6

Top Ten Components: East Hawai'i

	Tons Disposed	Percent of Total	Cumulative Percent of Total
Clean and Treated Lumber	11,621	14.3%	14.3%
Food	11,426	12.8%	12.8%
Cardboard	5,970	6.8%	33.8%
Green Waste	5,644	6.9%	40.8%
R/C Organic	5,302	6.0%	46.7%
R/C Paper	5,043	4.6%	51.4%
Ferrous Metal	3,025	3.3%	54.7%
R/C Demolition	2,647	3.2%	57.9%
Miscellaneous Paper	2,401	2.5%	60.5%
Film Plastic	2,157	2.3%	62.7%

Note: The abbreviation "R/C" stands for Remainder/Composite. The R/C components include waste that is made mostly of one component but contains significant amounts of other components, or waste that is part of a broad waste category but cannot be put into any of its component categories. Examples of R/C organic waste includes carpet and disposable diapers, while materials such as paper towels and coated milk cartons belong to R/C paper.

Green waste includes leaves and grass, prunings, and stumps.

EXHIBIT 2-7

Composition and Quantities for West Hawai'i and East Hawai'i Main Categories

	Percent of Total		FY 07-08 Tons	
	West Hawai'i	East Hawai'i	West Hawai'i	East Hawai'i
Paper	22.6%	22.2%	29,031	18,099
Glass	1.7%	2.9%	2,234	2,359
Metal	7.7%	8.0%	9,861	6,526
Plastic	8.5%	8.1%	10,895	6,588
Organics	35.3%	29.6%	45,346	24,102
Construction and Demolition	22.1%	22.5%	28,405	18,298
Household Hazardous	0.2%	0.3%	267	260
Special	1.9%	5.2%	2,504	4,259
Mixed Residue	0.0%	1.2%	1	996
	100.0%	100.0%	128,543	81,487

EXHIBIT 2-8

Comparison of Hawai'i County Composition to U.S. Average

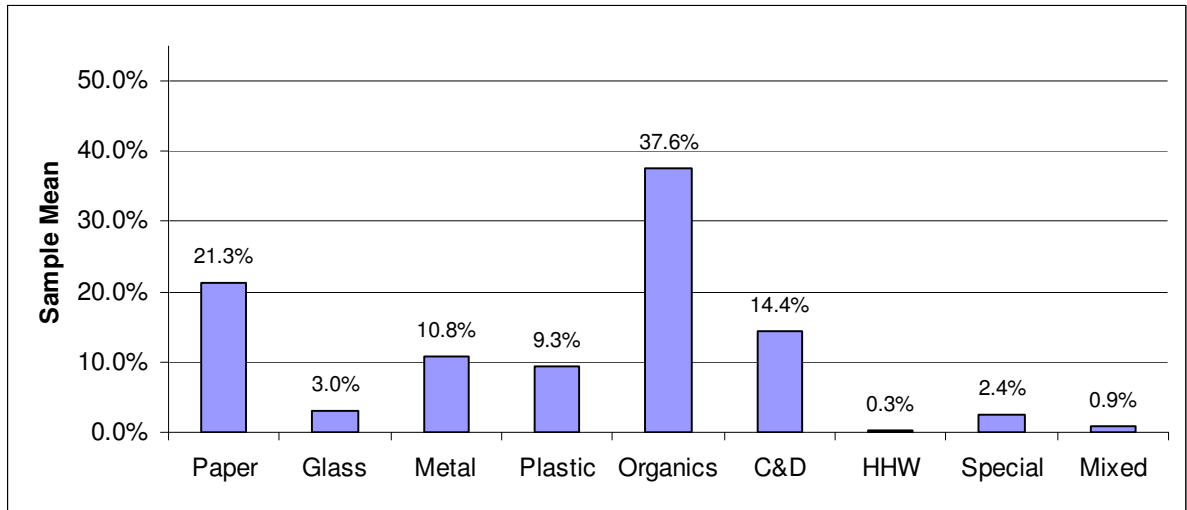
Material Category	Hawaii County	United States ^a	Difference HI - US
Paper	28.9%	26.3%	2.6%
Glass	2.8%	6.6%	-3.8%
Metal	10.0%	7.8%	2.2%
Plastic	10.7%	17.5%	-6.8%
Organics	42.5%	37.3%	5.2%
Other	5.1%	4.5%	0.5%

^aU.S. Environmental Protection Agency, 2006. *Municipal Solid Waste Generation, Recycling, and Disposal in the United States: facts and Figures for 2006*. Accessed at <http://www.epa.gov/epaoswer/non-hw/muncpl/pubs/06data.pdf>

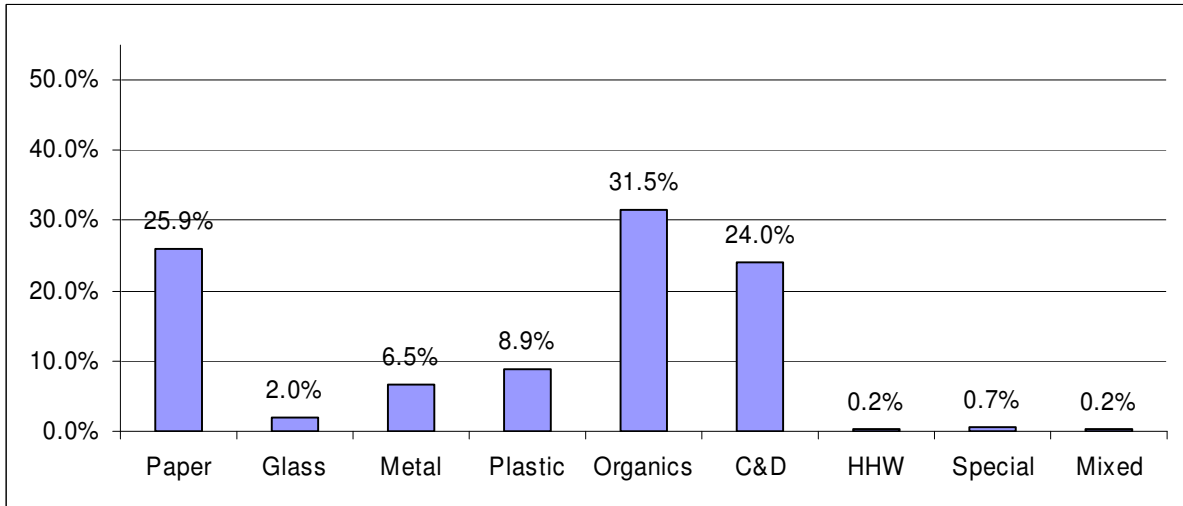
Note: Excludes construction and demolition debris.

EXHIBIT 2-9

Composition Estimates by Waste Category: Transfer Stations

**EXHIBIT 2-10**

Composition Estimates by Waste Category: Commercial

**EXHIBIT 2-11**

Composition Estimates by Waste Category: Self-Haul

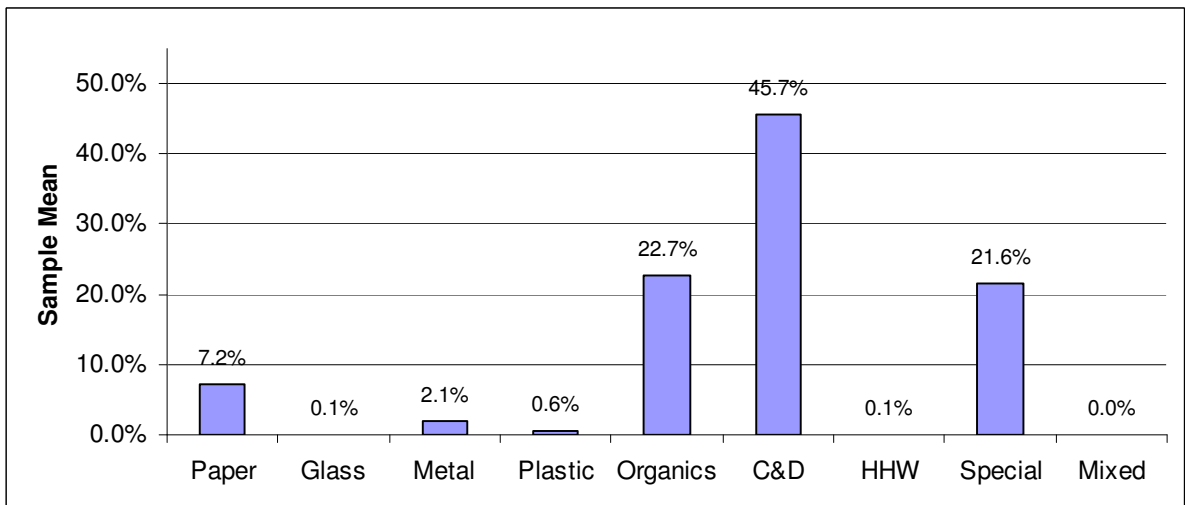


EXHIBIT 2-12

Top Ten Components: County Transfer Stations

	Tons Disposed	Percent of Total	Cumulative Percent of Total
Food	10,944	13.5%	13.5%
Green Waste	9,839	12.1%	25.6%
R/C Organic	6,711	8.3%	33.8%
Clean and Treated Lumber	5,570	6.9%	40.7%
Cardboard	4,822	5.9%	46.6%
R/C Demolition	4,014	4.9%	51.6%
Miscellaneous Paper	3,834	4.7%	56.3%
R/C Paper	3,730	4.6%	60.9%
Ferrous Metal	3,574	4.4%	65.3%
R/C Metal	3,102	3.8%	69.1%

EXHIBIT 2-13

Top Ten Components: County Commercial

	Tons Disposed	Percent of Total	Cumulative Percent of Total
Food	22,760	20.7%	20.7%
Clean and Treated Lumber	13,576	12.3%	33.0%
Cardboard	11,011	10.0%	43.0%
R/C Demo	7,422	6.7%	49.7%
R/C Paper	6,826	6.2%	55.9%
R/C Organic	5,586	5.1%	61.0%
Miscellaneous	4,764	4.3%	65.3%
Green Waste	3,886	3.5%	68.9%
Film	3,845	3.5%	72.4%
Concrete	3,696	3.4%	75.7%

EXHIBIT 2-14

Top Ten Components: County Self-Haul

	Tons Disposed	Percent of Total	Cumulative Percent of Total
Clean and Treated Lumber	3,839	20.5%	20.5%
Industrial Sludge	2,826	15.1%	35.6%
Green Waste	2,129	11.4%	47.0%
R/C Organic	1,578	8.4%	55.5%
R/C Demolition	1,383	7.4%	62.9%
Concrete	923	4.9%	67.8%
Rocks and Soil	921	4.9%	72.7%
Asphalt Paving	897	4.8%	77.5%
R/C Paper	888	4.7%	82.3%
Treated Lumber	878	4.7%	87.0%

Notes: The abbreviation "R/C" stands for Remainder/Composite. The R/C components include waste that is made mostly of one component but contains significant amounts of other components, or waste that is part of a broad waste category but cannot be put into any of its component categories. Examples of R/C organic waste includes carpet and disposable diapers, while materials such as paper towels and coated milk cartons belong to R/C paper.

Green waste includes leaves and grass, prunings, and stumps.

SECTION 3

West Hawai`i Sampling Results

This section presents summary composition results for the West Hawai`i transfer station, commercial, and self-haul substreams. The information is presented using the same formats used in Section 2. More comprehensive exhibits that detail the full composition results for the 58 component categories are presented in Appendix A (Exhibits A-7, A-8, and A-9).

Exhibits 3-1, 3-2, and 3-3 show the overall composition results for waste disposed of in West Hawai`i via the three substreams. Organics, paper, and construction and demolition debris account for 77% and 83% of the transfer station and commercial substreams, respectively. More than 90% of the self-haul substream consists of three waste categories: special waste (mainly industrial sludge), construction and demolition debris, and organics.

Exhibits 3-4, 3-5, and 3-6 show the ten largest waste components in West Hawai`i for the three main substreams. Cardboard is a significant component in all three substreams: 5.1% for transfer stations, 9.8% for commercial, and 2.4% for self-haul. Other components that appear in all three substreams include food, green waste, clean and treated lumber, and R/C organic.

Green waste (14.4%) is the largest component of the West Hawai`i transfer station substream, and food (21.3%) is the largest component of the West Hawai`i commercial substream. Food, clean and treated lumber and R/C demolition are in the top 5 of both the transfer station and commercial substreams. Some components that appear in the top 10 of only one of the transfer station or commercial substreams include R/C metal, ferrous metal, and textiles, which are in the top 10 in the transfer station substream, and R/C paper, concrete, and film plastic which are in the top 10 in the commercial substream.

The self-haul substream composition differs from the transfer station and commercial substreams. The top three components of the self-haul substream are industrial sludge, clean and treated lumber, and rocks and soil.

Exhibit 3-7 shows FY 2008 tons, the number of samples taken, and composition results by category for West Hawai`i transfer stations. As discussed in Section 1, the small number of samples taken from individual stations means that there is considerable uncertainty associated with these estimates.

EXHIBIT 3-1
Composition Estimates by Waste Category: West Hawai'i Transfer Station

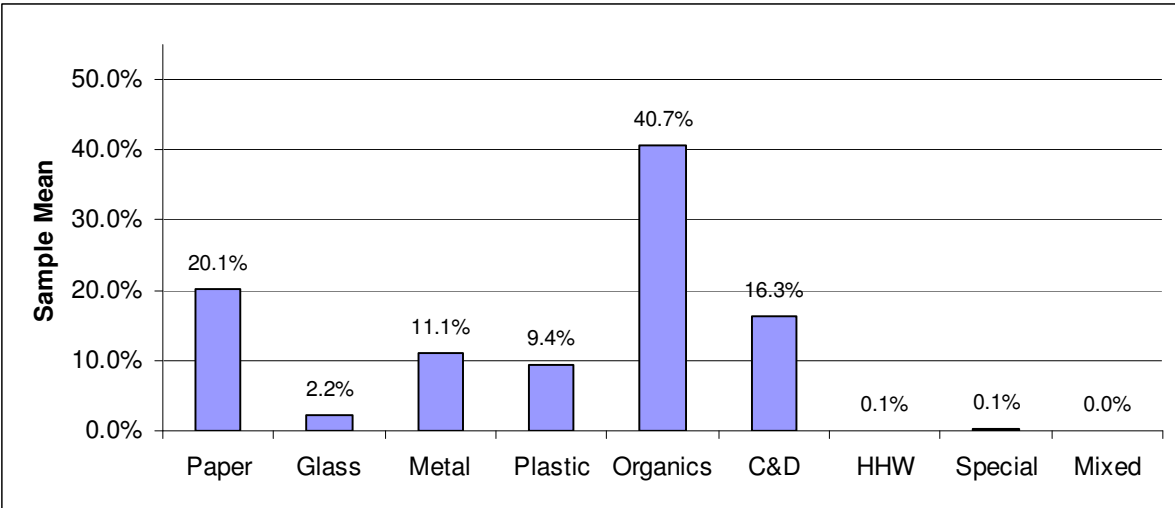


EXHIBIT 3-2
Composition Estimates by Waste Category: West Hawai'i Commercial

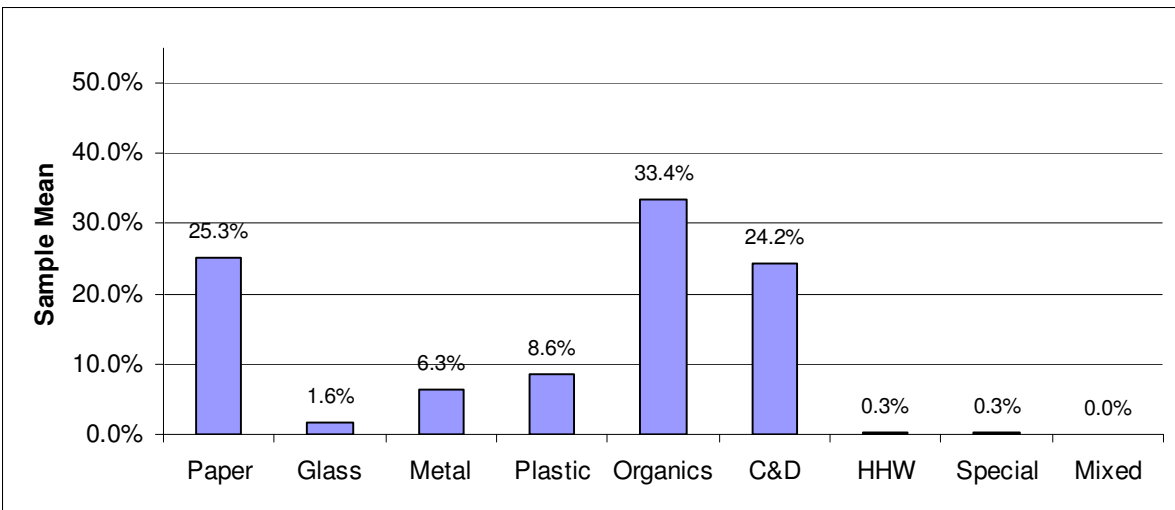


EXHIBIT 3-3
Composition Estimates by Waste Category: West Hawai'i Self-Haul

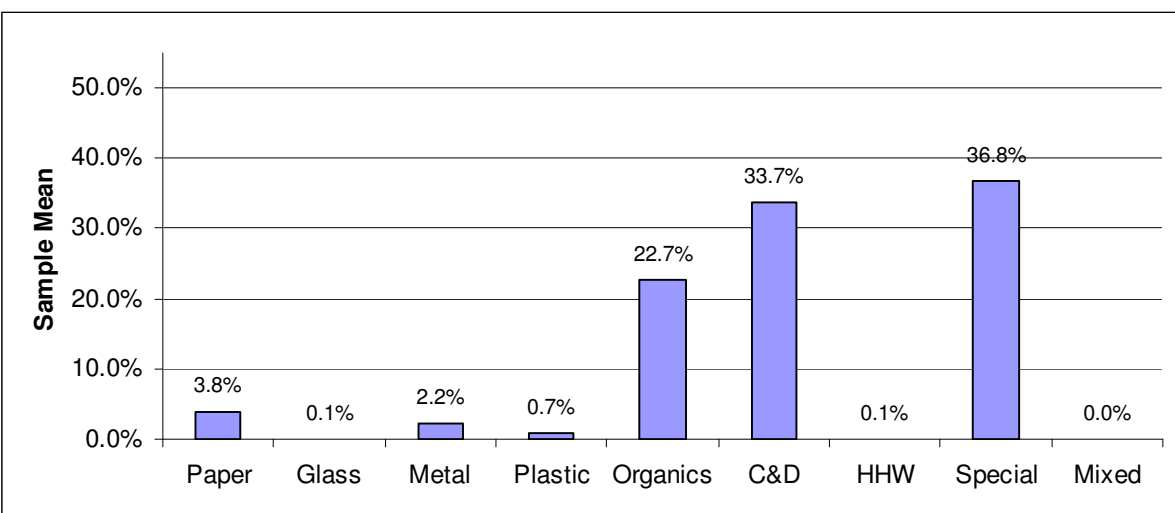


EXHIBIT 3-4

Top Ten Components: West Hawai'i Transfer Stations

	Tons Disposed	Percent of Total	Cumulative Percent of Total
Green Waste	6,007	14.4%	14.4%
Food	5,311	12.7%	27.2%
R/C Organic	3,721	8.9%	36.1%
Clean and Treated Lumber	3,334	8.0%	44.1%
R/C Demolition	2,859	6.9%	51.0%
Miscellaneous Paper	2,333	5.6%	56.6%
R/C Metal	2,230	5.4%	61.9%
Cardboard	2,125	5.1%	67.0%
Ferrous Metal	1,911	4.6%	71.6%
Textiles	1,903	4.6%	76.2%

EXHIBIT 3-5

Top Ten Components: West Hawai'i Commercial

	Tons Disposed	Percent of Total	Cumulative Percent of Total
Food	17,280	21.3%	21.3%
Cardboard	7,945	9.8%	31.1%
Clean and Treated Lumber	7,586	9.4%	40.5%
R/C Demolition	6,835	8.4%	49.0%
R/C Paper	4,936	6.1%	55.1%
R/C Organic	4,468	5.5%	60.6%
Miscellaneous	3,885	4.8%	65.4%
Concrete	3,693	4.6%	69.9%
Green Waste	3,467	4.3%	74.2%
Film Plastic	2,774	3.4%	77.6%

EXHIBIT 3-6

Top Ten Components: West Hawai'i Self-Haul

	Tons Disposed	Percent of Total	Cumulative Percent of Total
Industrial Sludge	1,585	26.8%	26.8%
Clean and Treated Lumber	921	14.5%	41.3%
Rocks and Soil	792	13.4%	54.7%
Green Waste	737	12.5%	67.2%
R/C Demolition	478	8.1%	75.3%
R/C Organic	384	6.5%	81.8%
R/C Special Waste	299	5.1%	86.9%
Food	212	3.6%	90.5%
Cardboard	141	2.4%	92.8%
Tires	116	2.0%	94.8%

Note: The abbreviation "R/C" stands for Remainder/Composite. The R/C components include waste that is made mostly of one component but contains significant amounts of other components, or waste that is part of a broad waste category but cannot be put into any of its component categories. Examples of R/C organic waste includes carpet and disposable diapers, while materials such as paper towels and coated milk cartons belong to R/C paper.

Green waste includes leaves and grass, prunings, and stumps.

EXHIBIT 3-7

Composition Estimates: West Hawai‘i Individual Transfer Stations

	Honoka‘a	Ka‘u	Kailua	Keauhou	Kohala	Pa‘auilo	Puako	Waiea	Waimea	Laupa- hoehoe	Miloli‘i	Ke‘ei
Tons 06-07	3,459	3,447	7,860	5,017	4,145	1,922	2,681	2,968	6,376	1,547	207	2,025
No. of Samples	2	3	6	5	4	1	2	2	5			
Station used as a proxy when calculating total transfer station waste composition										Pa‘auilo	Waiea	Kohala
Percent of Total												
Paper	21.9%	24.1%	23.6%	21.9%	17.2%	21.1%	6.3%	14.4%	20.5%	Not Sampled		
Glass	0.7%	3.3%	2.2%	4.9%	0.5%	1.7%	0.1%	2.1%	1.7%			
Metal	11.3%	14.6%	7.4%	10.2%	7.9%	23.0%	16.9%	11.4%	7.7%			
Plastic	10.3%	6.9%	15.1%	10.4%	5.2%	11.3%	4.8%	5.4%	7.6%			
Organics	33.3%	40.9%	36.5%	41.0%	42.6%	25.3%	70.8%	41.8%	43.2%			
Construction and Demolition	21.8%	10.1%	15.1%	11.5%	26.5%	17.6%	1.1%	24.8%	18.3%			
Household Hazardous	0.7%	0.2%	0.0%	0.1%	0.2%	0.0%	0.0%	0.0%	0.1%			
Special	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.9%			
Mixed Residue	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%			

SECTION 4

East Hawai`i Sampling Results

This section presents summary composition results for the East Hawai`i transfer station, commercial, and self-haul substreams. More comprehensive exhibits that detail the full composition results for the 58 component categories are presented in Appendix A (Exhibits A-10, A-11, and A-12). As noted in Section 1, the composition percentages for the East Hawai`i substreams were taken from the results of the 2001 study. The tons for waste components were calculated by multiplying FY 2008 tons for each substream by the 2001 study's composition percentages.

Exhibits 4-1, 4-1, and 4-3 show the overall composition results of waste disposed of in East Hawai`i via the three main substreams. Organics, paper, and construction and demolition debris account for 69%, 77% and 83% of the transfer station, commercial, and self-haul substreams, respectively. Other waste types that comprise large percentages of individual substreams include metal and plastic in the transfer station substream (10.5% and 9.2%, respectively), plastic in the commercial substream (10.0%), and special waste (14.6%) in the self-haul substream.

Exhibits 4-4, 4-5, and 4-6 show the ten largest waste components in East Hawai`i for the three main substreams. Three of the top five components are the same for the transfer station and commercial substreams (food, cardboard, and R/C paper). Cardboard comprises 6.8% of the transfer stations substream and 10.5% of the commercial substream. Several waste components appear in the top 10 of only one substream, including green waste, bulky items, and R/C plastic, which are in the top 10 in the transfer station substream, and film plastic, durable plastic, and newspaper which are in the top 10 in the commercial substream.

The self-haul substream composition differs from the transfer station and commercial substreams. The top three self-haul substream components are clean and treated lumber, green waste, and industrial sludge. The only top 10 self-haul components that are also in the top 10 in one or both of the other substreams include green waste, R/C organic, R/C paper, and clean and treated lumber.

EXHIBIT 4-1

Composition Estimates by Waste Category: East Hawai'i Transfer Stations

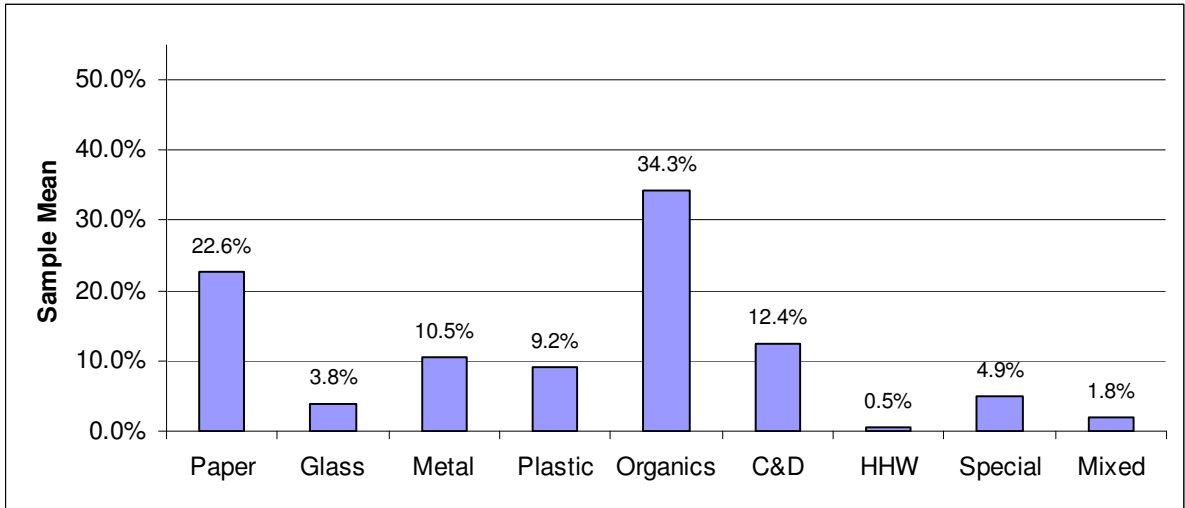


EXHIBIT 4-2

Composition Estimates by Waste Category: East Hawai'i Commercial

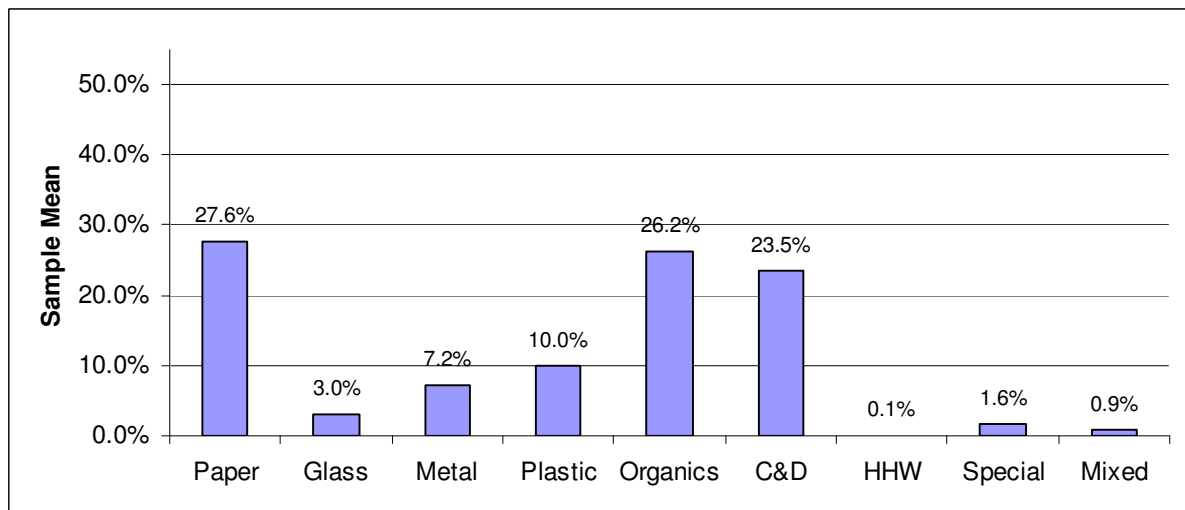


EXHIBIT 4-3

Composition Estimates by Waste Category: East Hawai'i Self-Haul

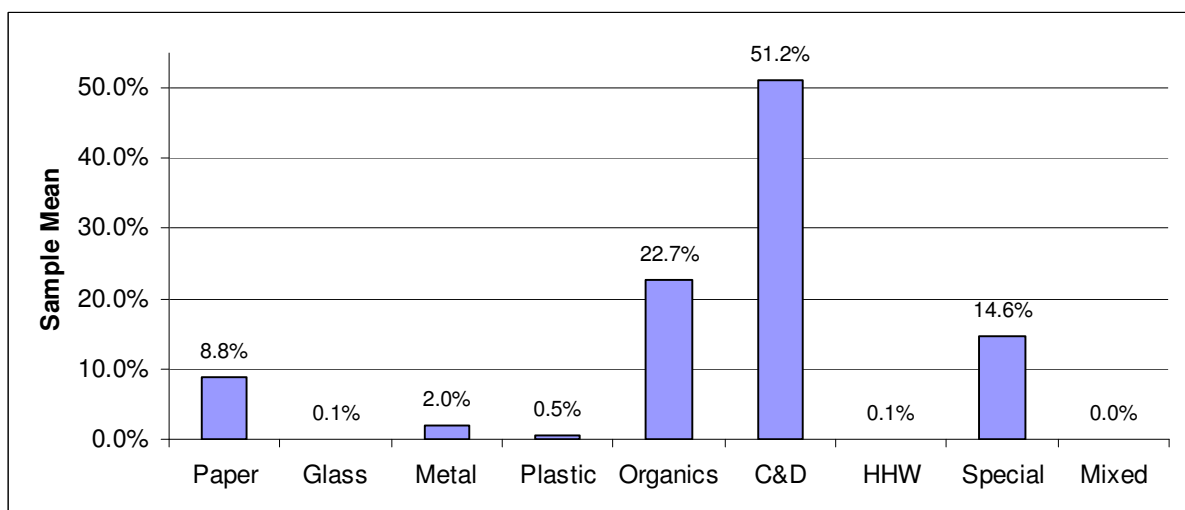


EXHIBIT 4-4

Top Ten Components: East Hawai'i Transfer Stations

	Tons Disposed	Percent of Total	Cumulative Percent of Total
Food	5,633	14.2%	14.2%
Green Waste	3,832	9.7%	23.9%
R/C Organic	2,990	7.6%	31.5%
Cardboard	2,696	6.8%	38.3%
R/C Paper	2,303	5.8%	44.1%
Clean and Treated Lumber	2,235	5.6%	49.8%
Ferrous Metal	1,663	4.2%	54.0%
Bulky Items	1,642	4.1%	58.1%
Miscellaneous Paper	1,501	3.8%	61.9%
R/C Plastic	1,291	3.3%	65.2%

EXHIBIT 4-5

Top Ten Components: East Hawai'i Commercial

	Tons Disposed	Percent of Total	Cumulative Percent of Total
Clean and Treated Lumber	5,990	20.6%	20.6%
Food	5,479	18.8%	39.4%
Cardboard	3,066	10.5%	49.9%
R/C Paper	1,889	6.5%	56.4%
Ferrous Metal	1,207	4.1%	60.5%
R/C Organic	1,118	3.8%	64.4%
Film Plastic	1,072	3.7%	68.1%
Miscellaneous Paper	879	3.0%	71.1%
Durable Plastic	815	2.8%	73.9%
Newspaper	734	2.5%	76.4%

EXHIBIT 4-6

Top Ten Components: East Hawai'i Self-Haul

	Tons Disposed	Percent of Total	Cumulative Percent of Total
Clean and Treated Lumber	1,194	18.8%	18.8%
Green Waste	1,392	10.9%	29.7%
Industrial Sludge	1,241	9.7%	39.4%
R/C Organic	1,194	9.3%	48.7%
R/C Demolition	905	7.1%	55.8%
R/C Paper	850	6.6%	62.4%
Concrete	816	6.4%	68.8%
Asphalt Paving	793	6.2%	75.0%
Tires	514	4.0%	79.0%
Gypsum Board	509	4.0%	83.0%

Note: The abbreviation "R/C" stands for Remainder/Composite. The R/C components include waste that is made mostly of one component but contains significant amounts of other components, or waste that is part of a broad waste category but cannot be put into any of its component categories. Examples of R/C organic waste includes carpet and disposable diapers, while materials such as paper towels and coated milk cartons belong to R/C paper.

Green waste includes leaves and grass, prunings, and stumps.

APPENDIX A

Detailed Sampling Results

EXHIBIT A-1

Composition Estimates: Total County

	Tons Disposed	Percent of Total		Tons Disposed	Percent of Total
Paper	47,130	22.4%	Construction and Demolition	46,702	22.2%
Cardboard	16,182	7.7%	Concrete	5,128	2.4%
Bags	723	0.3%	Asphalt Paving	2,212	1.1%
Newspaper	4,193	2.0%	Asphalt Roofing	381	0.2%
White Ledger	1,540	0.7%	Clean and Treated Lumber	22,984	10.9%
Colored Ledger	280	0.1%	Gypsum Board	1,471	0.7%
Computer	92	0.0%	Rocks and Soil	1,707	0.8%
Office	1,510	0.7%	R/C Demo	12,819	6.1%
Magazines	2,424	1.2%	Household Hazardous	527	0.3%
Directories	109	0.1%	Paint	171	0.1%
Miscellaneous	8,634	4.1%	Vehicle Fluids	20	0.0%
R/C Paper	11,443	5.4%	Oil	54	0.0%
Glass	4,592	2.2%	Batteries	117	0.1%
Clear Containers	1,476	0.7%	R/C Hazardous	165	0.1%
Green Containers	1,296	0.6%	Special	6,762	3.2%
Brown Containers	1,024	0.5%	Ash	93	0.0%
Other Containers	307	0.1%	Sewage Sludge	0	0.0%
Flat Glass	160	0.1%	Industrial Sludge	2,826	1.3%
R/C Glass	329	0.2%	Treated Medical	139	0.1%
Metal	16,388	7.8%	Bulky Items	2,177	1.0%
Aluminum Cans	565	0.3%	Tires	1,124	0.5%
Tin Cans	1,525	0.7%	R/C Special	404	0.2%
Ferrous	7,441	3.5%	Mixed	997	0.5%
Nonferrous	504	0.2%	Mixed Residue	997	0.5%
White Goods	742	0.4%			
R/C Metal	5,611	2.7%			
Plastic	17,482	8.3%			
#1 Containers	1,067	0.5%			
#2 Containers	882	0.4%			
Other Containers	818	0.4%			
Film	6,170	2.9%			
Durable	4,002	1.9%			
R/C Plastic	4,543	2.2%			
Organics	69,448	33.1%			
Food	34,230	16.3%			
Textiles	5,485	2.6%			
Leaves and Grass	6,160	2.9%			
Prunings	7,057	3.4%			
Stumps	2,637	1.3%			
Crop Residue	3	0.0%			
Manure	0	0.0%			
R/C Organic	13,875	6.6%			
Total Tons	210,030				
Sample Count	100				

EXHIBIT A-2

Composition Estimates: Total West Hawai'i

	Tons Disposed	Percent Total		Tons Disposed	Percent of Total
Paper	29,031	22.6%	Construction and Demolition	28,405	22.1%
Cardboard	10,211	7.9%	Concrete	3,800	3.0%
Bags	360	0.3%	Asphalt Paving	616	0.5%
Newspaper	2,313	1.8%	Asphalt Roofing	165	0.1%
White Ledger	726	0.6%	Clean and Treated Lumber	11,363	8.8%
Colored Ledger	190	0.1%	Gypsum Board	829	0.6%
Computer	62	0.0%	Rocks and Soil	1,460	1.1%
Office	1,090	0.8%	R/C Demo	10,172	7.9%
Magazines	1,410	1.1%	Household Hazardous	267	0.2%
Directories	36	0.0%	Paint	117	0.1%
Miscellaneous	6,233	4.8%	Vehicle Fluids	2	0.0%
R/C Paper	6,400	5.0%	Oil	54	0.0%
Glass	2,234	1.7%	Batteries	29	0.0%
Clear Containers	590	0.5%	R/C Hazardous	65	0.1%
Green Containers	615	0.5%	Special	2,504	1.9%
Brown Containers	401	0.3%	Ash	93	0.1%
Other Containers	294	0.2%	Sewage Sludge	0	0.0%
Flat Glass	98	0.1%	Industrial Sludge	1,585	1.2%
R/C Glass	236	0.2%	Treated Medical	20	0.0%
Metal	9,861	7.7%	Bulky Items	392	0.3%
Aluminum Cans	224	0.2%	Tires	116	0.1%
Tin Cans	800	0.6%	R/C Special	299	0.2%
Ferrous	4,417	3.4%	Mixed	1	0.0%
Nonferrous	250	0.2%	Mixed Residue	1	0.0%
White Goods	1	0.0%			
R/C Metal	4,169	3.2%			
Plastic	10,895	8.5%			
#1 Containers	580	0.5%			
#2 Containers	483	0.4%			
Other Containers	566	0.4%			
Film	4,013	3.1%			
Durable	2,632	2.0%			
R/C Plastic	2,621	2.0%			
Organics	45,346	35.3%			
Food	22,804	17.7%			
Textiles	3,755	2.9%			
Leaves and Grass	4,833	3.8%			
Prunings	4,085	3.2%			
Stumps	1,293	1.0%			
Crop Residue	3	0.0%			
Manure	0	0.0%			
R/C Organic	8,573	6.7%			
Total Tons	128,543				
Sample Count	100				

EXHIBIT A-3

Composition Estimates: Total East Hawai'i

	Tons Disposed	Percent of Total		Tons Disposed	Percent of Total
Paper	18,099	22.2%	Construction and Demolition	18,298	22.5%
Cardboard	5,970	7.3%	Concrete	1,328	1.6%
Bags	362	0.4%	Asphalt Paving	1,597	2.0%
Newspaper	1,880	2.3%	Asphalt Roofing	216	0.3%
White Ledger	814	1.0%	Clean and Treated Lumber	11,621	14.3%
Colored Ledger	90	0.1%	Gypsum Board	642	0.8%
Computer	31	0.0%	Rocks and Soil	247	0.3%
Office	420	0.5%	R/C Demo	2,647	3.2%
Magazines	1,014	1.2%	Household Hazardous	260	0.3%
Directories	74	0.1%	Paint	53	0.1%
Miscellaneous	2,401	2.9%	Vehicle Fluids	18	0.0%
R/C Paper	5,043	6.2%	Oil	0	0.0%
Glass	2,359	2.9%	Batteries	89	0.1%
Clear Containers	886	1.1%	R/C Hazardous	100	0.1%
Green Containers	682	0.8%	Special	4,259	5.2%
Brown Containers	623	0.8%	Ash	0	0.0%
Other Containers	13	0.0%	Sewage Sludge	0	0.0%
Flat Glass	62	0.1%	Industrial Sludge	1,241	1.5%
R/C Glass	92	0.1%	Treated Medical	119	0.1%
Metal	6,526	8.0%	Bulky Items	1,785	2.2%
Aluminum Cans	341	0.4%	Tires	1,008	1.2%
Tin Cans	725	0.9%	R/C Special	105	0.1%
Ferrous	3,025	3.7%	Mixed	996	1.2%
Nonferrous	254	0.3%	Mixed Residue	996	1.2%
White Goods	741	0.9%			
R/C Metal	1,442	1.8%			
Plastic	6,588	8.1%			
#1 Containers	487	0.6%			
#2 Containers	399	0.5%			
Other Containers	252	0.3%			
Film	2,157	2.6%			
Durable	1,370	1.7%			
R/C Plastic	1,923	2.4%			
Organics	24,102	29.6%			
Food	11,426	14.0%			
Textiles	1,730	2.1%			
Leaves and Grass	1,327	1.6%			
Prunings	2,972	3.6%			
Stumps	1,344	1.6%			
Crop Residue	0	0.0%			
Manure	0	0.0%			
R/C Organic	5,302	6.5%			
Total Tons	81,487				
Sample Count (2001 study)	100				

EXHIBIT A-4

Composition Estimates: Total County Transfer Stations

	Tons Disposed	Percent of Total		Tons Disposed	Percent of Total
Paper	17,309	21.3%	Construction and Demolition	11,699	14.4%
Cardboard	4,822	5.9%	Concrete	509	0.6%
Bags	232	0.3%	Asphalt Paving	803	1.0%
Newspaper	2,109	2.6%	Asphalt Roofing	102	0.1%
White Ledger	503	0.6%	Clean and Treated Lumber	5,570	6.9%
Colored Ledger	69	0.1%	Gypsum Board	249	0.3%
Computer	24	0.0%	Rocks and Soil	452	0.6%
Office	826	1.0%	R/C Demo	4,014	4.9%
Magazines	1,136	1.4%	Household Hazardous	258	0.3%
Directories	26	0.0%	Paint	46	0.1%
Miscellaneous	3,834	4.7%	Vehicle Fluids	16	0.0%
R/C Paper	3,730	4.6%	Oil	19	0.0%
Glass	2,407	3.0%	Batteries	84	0.1%
Clear Containers	830	1.0%	R/C Hazardous	94	0.1%
Green Containers	666	0.8%	Special	1,981	2.4%
Brown Containers	563	0.7%	Ash	0	0.0%
Other Containers	155	0.2%	Sewage Sludge	0	0.0%
Flat Glass	43	0.1%	Industrial Sludge	0	0.0%
R/C Glass	150	0.2%	Treated Medical	0	0.0%
Metal	8,802	10.8%	Bulky Items	1,699	2.1%
Aluminum Cans	277	0.3%	Tires	221	0.3%
Tin Cans	790	1.0%	R/C Special	60	0.1%
Ferrous	3,574	4.4%	Mixed	732	0.9%
Nonferrous	320	0.4%	Mixed Residue	732	0.9%
White Goods	739	0.9%			
R/C Metal	3,102	3.8%			
Plastic	7,530	9.3%			
#1 Containers	481	0.6%			
#2 Containers	472	0.6%			
Other Containers	368	0.5%			
Film	2,301	2.8%			
Durable	1,752	2.2%			
R/C Plastic	2,156	2.7%			
Organics	30,511	37.6%			
Food	10,944	13.5%			
Textiles	3,017	3.7%			
Leaves and Grass	5,133	6.3%			
Prunings	4,243	5.2%			
Stumps	462	0.6%			
Crop Residue	0	0.0%			
Manure	0	0.0%			
R/C Organic	6,711	8.3%			
Total Tons	81,230				
Sample Count	70				

EXHIBIT A-5

Composition Estimates: Total County Commercial

	Tons Disposed	Percent of Total		Tons Disposed	Percent of Total
Paper	28,471	25.9%	Construction and Demolition	26,466	24.0%
Cardboard	11,011	10.0%	Concrete	3,696	3.4%
Bags	484	0.4%	Asphalt Paving	512	0.5%
Newspaper	2,019	1.8%	Asphalt Roofing	279	0.3%
White Ledger	1,034	0.9%	Clean and Treated Lumber	13,576	12.3%
Colored Ledger	210	0.2%	Gypsum Board	646	0.6%
Computer	69	0.1%	Rocks and Soil	335	0.3%
Office	684	0.6%	R/C Demo	7,422	6.7%
Magazines	1,286	1.2%	Household Hazardous	253	0.2%
Directories	84	0.1%	Paint	117	0.1%
Miscellaneous	4,764	4.3%	Vehicle Fluids	0	0.0%
R/C Paper	6,826	6.2%	Oil	33	0.0%
Glass	2,173	2.0%	Batteries	32	0.0%
Clear Containers	642	0.6%	R/C Hazardous	71	0.1%
Green Containers	630	0.6%	Special	738	0.7%
Brown Containers	459	0.4%	Ash	0	0.0%
Other Containers	152	0.1%	Sewage Sludge	0	0.0%
Flat Glass	117	0.1%	Industrial Sludge	0	0.0%
R/C Glass	173	0.2%	Treated Medical	91	0.1%
Metal	7,202	6.5%	Bulky Items	330	0.3%
Aluminum Cans	283	0.3%	Tires	273	0.2%
Tin Cans	735	0.7%	R/C Special	45	0.0%
Ferrous	3,654	3.3%	Mixed	262	0.2%
Nonferrous	181	0.2%	Mixed Residue	262	0.2%
White Goods	0	0.0%			
R/C Metal	2,348	2.1%			
Plastic	9,844	8.9%			
#1 Containers	583	0.5%			
#2 Containers	407	0.4%			
Other Containers	447	0.4%			
Film	3,845	3.5%			
Durable	2,242	2.0%			
R/C Plastic	2,319	2.1%			
Organics	34,691	31.5%			
Food	22,760	20.7%			
Textiles	2,460	2.2%			
Leaves and Grass	985	0.9%			
Prunings	2,790	2.5%			
Stumps	112	0.1%			
Crop Residue	0	0.0%			
Manure	0	0.0%			
R/C Organic	5,586	5.1%			
Total Tons	110,101				
Sample Count	66				

EXHIBIT A-6

Composition Estimates: Total County Self-Haul

	Tons Disposed	Percent of Total		Tons Disposed	Percent of Total
Paper	1,350	7.2%	Construction and Demolition	8,537	45.7%
Cardboard	349	1.9%	Concrete	923	4.9%
Bags	6	0.0%	Asphalt Paving	897	4.8%
Newspaper	65	0.3%	Asphalt Roofing	0	0.0%
White Ledger	2	0.0%	Clean and Treated Lumber	3,839	20.5%
Colored Ledger	0	0.0%	Gypsum Board	575	3.1%
Computer	0	0.0%	Rocks and Soil	921	4.9%
Office	1	0.0%	R/C Demo	1,383	7.4%
Magazines	2	0.0%	Household Hazardous	15	0.1%
Directories	0	0.0%	Paint	7	0.0%
Miscellaneous	36	0.2%	Vehicle Fluids	4	0.0%
R/C Paper	888	4.7%	Oil	2	0.0%
Glass	13	0.1%	Batteries	1	0.0%
Clear Containers	5	0.0%	R/C Hazardous	0	0.0%
Green Containers	1	0.0%	Special	4,043	21.6%
Brown Containers	2	0.0%	Ash	93	0.5%
Other Containers	0	0.0%	Sewage Sludge	0	0.0%
Flat Glass	0	0.0%	Industrial Sludge	2,826	15.1%
R/C Glass	5	0.0%	Treated Medical	48	0.3%
Metal	384	2.1%	Bulky Items	148	0.8%
Aluminum Cans	5	0.0%	Tires	630	3.4%
Tin Cans	0	0.0%	R/C Special	299	1.6%
Ferrous	213	1.1%	Mixed	3	0.0%
Nonferrous	2	0.0%	Mixed Residue	3	0.0%
White Goods	3	0.0%			
R/C Metal	161	0.9%			
Plastic	108	0.6%			
#1 Containers	2	0.0%			
#2 Containers	3	0.0%			
Other Containers	2	0.0%			
Film	23	0.1%			
Durable	8	0.0%			
R/C Plastic	69	0.4%			
Organics	4,245	22.7%			
Food	526	2.8%			
Textiles	9	0.0%			
Leaves and Grass	42	0.2%			
Prunings	24	0.1%			
Stumps	2,063	11.0%			
Crop Residue	3	0.0%			
Manure	0	0.0%			
R/C Organic	1,578	8.4%			
Total Tons	18,699				
Sample Count	24				

EXHIBIT A-7

Composition Estimates: West Hawai'i Transfer Stations

	Tons Disposed	Percent of Total	Low	High		Tons Disposed	Percent of Total	Low	High
Paper	8,359	20.1%			Construction and Demolition	6,794	16.3%		
Cardboard	2,125	5.1%	4.1%	6.1%	Concrete	0	0.0%	0.0%	0.0%
Bags	47	0.1%	0.0%	0.2%	Asphalt Paving	0	0.0%	0.0%	0.0%
Newspaper	1,001	2.4%	1.5%	3.3%	Asphalt Roofing	102	0.2%	0.0%	0.7%
White Ledger	195	0.5%	0.3%	0.7%	Clean and Treated Lumber	3,334	8.0%	5.0%	11.0%
Colored Ledger	31	0.1%	0.0%	0.1%	Gypsum Board	165	0.4%	0.0%	0.9%
Computer	21	0.1%	0.0%	0.1%	Rocks and Soil	333	0.8%	0.3%	1.3%
Office	532	1.3%	0.6%	2.0%	R/C Demo	2,859	6.9%	3.5%	10.2%
Magazines	632	1.5%	0.9%	2.1%	Household Hazardous	48	0.1%		
Directories	15	0.0%	0.0%	0.1%	Paint	0	0.0%	0.0%	0.0%
Miscellaneous	2,333	5.6%	4.2%	7.0%	Vehicle Fluids	0	0.0%	0.0%	0.0%
R/C Paper	1,427	3.4%	2.7%	4.1%	Oil	19	0.0%	0.0%	0.1%
Glass	918	2.2%			Batteries	15	0.0%	0.0%	0.1%
Clear Containers	309	0.7%	0.2%	1.2%	R/C Hazardous	14	0.0%	0.0%	0.1%
Green Containers	235	0.6%	0.3%	0.9%	Special	58	0.1%		
Brown Containers	130	0.3%	0.1%	0.5%	Ash	0	0.0%	0.0%	0.0%
Other Containers	142	0.3%	0.2%	0.5%	Sewage Sludge	0	0.0%	0.0%	0.0%
Flat Glass	14	0.0%	0.0%	0.1%	Industrial Sludge	0	0.0%	0.0%	0.0%
R/C Glass	87	0.2%	0.1%	0.3%	Treated Medical	0	0.0%	0.0%	0.0%
Metal	4,630	11.1%			Bulky Items	58	0.1%	0.0%	0.4%
Aluminum Cans	75	0.2%	0.1%	0.2%	Tires	0	0.0%	0.0%	0.0%
Tin Cans	268	0.6%	0.5%	0.8%	R/C Special	0	0.0%	0.0%	0.0%
Ferrous	1,911	4.6%	3.1%	6.0%	Mixed	0	0.0%		
Nonferrous	147	0.4%	0.0%	0.7%	Mixed Residue	0	0.0%	0.0%	0.0%
White Goods	0	0.0%	0.0%	0.0%					
R/C Metal	2,230	5.4%	3.1%	7.6%					
Plastic	3,907	9.4%							
#1 Containers	173	0.4%	0.3%	0.5%					
#2 Containers	222	0.5%	0.4%	0.7%					
Other Containers	217	0.5%	0.4%	0.6%					
Film	1,229	3.0%	2.5%	3.4%					
Durable	1,202	2.9%	1.6%	4.2%					
R/C Plastic	865	2.1%	1.6%	2.5%					
Organics	16,941	40.7%							
Food	5,311	12.7%	10.5%	15.0%					
Textiles	1,903	4.6%	2.5%	6.6%					
Leaves and Grass	4,016	9.6%	5.3%	14.0%					
Prunings	1,529	3.7%	1.0%	6.3%					
Stumps	462	1.1%	0.0%	2.3%					
Crop Residue	0	0.0%	0.0%	0.0%					
Manure	0	0.0%	0.0%	0.0%					
R/C Organic	3,721	8.9%	7.2%	10.7%					
Total Tons	41,655								
Sample Count	30								

Low and High are calculated at a 90% confidence interval

EXHIBIT A-8

Composition Estimates: West Hawai'i Commercial

	Tons		Percent			Tons		Percent	
	Disposed	of Total	Low	High		Disposed	of Total	Low	High
Paper	20,448	25.3%			Construction and Demolition	19,622	24.2%		
Cardboard	7,945	9.8%	6.6%	13.0%	Concrete	3,693	4.6%	1.4%	7.7%
Bags	311	0.4%	0.1%	0.7%	Asphalt Paving	512	0.6%	0.0%	1.6%
Newspaper	1,286	1.6%	0.6%	2.6%	Asphalt Roofing	63	0.1%	0.0%	0.2%
White Ledger	530	0.7%	0.2%	1.1%	Clean and Treated Lumber	7,586	9.4%	4.8%	14.0%
Colored Ledger	158	0.2%	0.0%	0.4%	Gypsum Board	598	0.7%	0.0%	1.6%
Computer	40	0.0%	0.0%	0.1%	Rocks and Soil	335	0.4%	0.0%	1.0%
Office	558	0.7%	0.3%	1.1%	R/C Demo	6,835	8.4%	3.2%	13.7%
Magazines	777	1.0%	0.3%	1.6%	Household Hazardous	214	0.3%		
Directories	21	0.0%	0.0%	0.1%	Paint	117	0.1%	0.0%	0.3%
Miscellaneous	3,885	4.8%	3.4%	6.2%	Vehicle Fluids	0	0.0%	0.0%	0.0%
R/C Paper	4,936	6.1%	4.1%	8.1%	Oil	33	0.0%	0.0%	0.1%
Glass	1,311	1.6%			Batteries	13	0.0%	0.0%	0.0%
Clear Containers	279	0.3%	0.1%	0.6%	R/C Hazardous	51	0.1%	0.0%	0.2%
Green Containers	379	0.5%	0.2%	0.7%	Special	274	0.3%		
Brown Containers	270	0.3%	0.1%	0.5%	Ash	0	0.0%	0.0%	0.0%
Other Containers	152	0.2%	0.1%	0.3%	Sewage Sludge	0	0.0%	0.0%	0.0%
Flat Glass	84	0.1%	0.0%	0.3%	Industrial Sludge	0	0.0%	0.0%	0.0%
R/C Glass	147	0.2%	0.0%	0.4%	Treated Medical	0	0.0%	0.0%	0.0%
Metal	5,103	6.3%			Bulky Items	274	0.3%	0.0%	0.9%
Aluminum Cans	147	0.2%	0.1%	0.2%	Tires	0	0.0%	0.0%	0.0%
Tin Cans	533	0.7%	0.2%	1.1%	R/C Special	0	0.0%	0.0%	0.0%
Ferrous	2,447	3.0%	0.7%	5.3%	Mixed	0	0.0%		
Nonferrous	102	0.1%	0.1%	0.2%	Mixed Residue	0	0.0%	0.0%	0.0%
White Goods	0	0.0%	0.0%	0.0%					
R/C Metal	1,874	2.3%	0.6%	4.1%					
Plastic	6,944	8.6%							
#1 Containers	406	0.5%	0.4%	0.6%					
#2 Containers	261	0.3%	0.2%	0.4%					
Other Containers	348	0.4%	0.3%	0.6%					
Film	2,774	3.4%	2.3%	4.6%					
Durable	1,427	1.8%	0.5%	3.0%					
R/C Plastic	1,728	2.1%	1.2%	3.0%					
Organics	27,064	33.4%							
Food	17,280	21.3%	15.1%	27.5%					
Textiles	1,849	2.3%	1.3%	3.3%					
Leaves and Grass	809	1.0%	0.0%	2.1%					
Prunings	2,546	3.1%	0.0%	6.6%					
Stumps	112	0.1%	0.0%	0.3%					
Crop Residue	0	0.0%	0.0%	0.0%					
Manure	0	0.0%	0.0%	0.0%					
R/C Organic	4,468	5.5%	2.6%	8.5%					
Total Tons	80,981								
Sample Count	30								

EXHIBIT A-9

Composition Estimates: West Hawai'i Self-Haul

	Tons Disposed	Percent of Total		Tons Disposed	Percent of Total
Paper	224	3.8%	Construction and Demolition	1,989	33.7%
Cardboard	141	2.4%	Concrete	106	1.8%
Bags	3	0.0%	Asphalt Paving	103	1.8%
Newspaper	26	0.4%	Asphalt Roofing	0	0.0%
White Ledger	1	0.0%	Clean and Treated Lumber	443	7.5%
Colored Ledger	0	0.0%	Gypsum Board	66	1.1%
Computer	0	0.0%	Rocks and Soil	792	13.4%
Office	0	0.0%	R/C Demo	478	8.1%
Magazines	1	0.0%	Household Hazardous	5	0.1%
Directories	0	0.0%	Paint	0	0.0%
Miscellaneous	14	0.2%	Vehicle Fluids	2	0.0%
R/C Paper	37	0.6%	Oil	2	0.0%
Glass	5	0.1%	Batteries	1	0.0%
Clear Containers	2	0.0%	R/C Hazardous	0	0.0%
Green Containers	0	0.0%	Special	2,172	36.8%
Brown Containers	1	0.0%	Ash	93	1.6%
Other Containers	0	0.0%	Sewage Sludge	0	0.0%
Flat Glass	0	0.0%	Industrial Sludge	1,585	26.8%
R/C Glass	2	0.0%	Treated Medical	20	0.3%
Metal	128	2.2%	Bulky Items	60	1.0%
Aluminum Cans	2	0.0%	Tires	116	2.0%
Tin Cans	0	0.0%	R/C Special	299	5.1%
Ferrous	59	1.0%	Mixed	1	0.0%
Nonferrous	1	0.0%	Mixed Residue	1	0.0%
White Goods	1	0.0%			
R/C Metal	65	1.1%			
Plastic	44	0.7%			
#1 Containers	1	0.0%			
#2 Containers	1	0.0%			
Other Containers	1	0.0%			
Film	9	0.2%			
Durable	3	0.1%			
R/C Plastic	28	0.5%			
Organics	1,341	22.7%			
Food	212	3.6%			
Textiles	3	0.1%			
Leaves and Grass	9	0.1%			
Prunings	10	0.2%			
Stumps	719	12.2%			
Crop Residue	3	0.1%			
Manure	0	0.0%			
R/C Organic	384	6.5%			
Total Tons	5,907				
Sample Count	0				

Notes:

Waste composition percent for mixed loads from 2001 study at South Hilo Landfill.

Pure loads at the West Hawaii Landfill added to the mixed load composition.

EXHIBIT A-10

Composition Estimates: East Hawai'i Transfer Stations

	Tons Disposed	Percent of Total	Low	High		Tons Disposed	Percent of Total	Low	High
Paper	8,950	22.6%			Construction and Demolition	4,905	12.4%		
Cardboard	2,696	6.8%	5.5%	8.2%	Concrete	509	1.3%	0.3%	2.3%
Bags	185	0.5%	0.3%	0.6%	Asphalt Paving	803	2.0%	0.0%	5.2%
Newspaper	1,108	2.8%	0.2%	3.6%	Asphalt Roofing	0	0.0%	0.0%	0.0%
White Ledger	308	0.8%	0.5%	1.0%	Clean and Treated Lumber	2,235	5.6%	3.7%	7.5%
Colored Ledger	37	0.1%	0.1%	0.1%	Gypsum Board	85	0.2%	0.0%	0.4%
Computer	2	0.0%	0.0%	0.0%	Rocks and Soil	119	0.3%	0.0%	0.7%
Office	294	0.7%	0.1%	1.3%	R/C Demo	1,154	2.9%	0.3%	5.6%
Magazines	503	1.3%	0.8%	1.7%	Household Hazardous	210	0.5%		
Directories	11	0.0%	0.0%	0.1%	Paint	46	0.1%	0.0%	0.3%
Miscellaneous	1,501	3.8%	3.0%	4.6%	Vehicle Fluids	16	0.0%	0.0%	0.1%
R/C Paper	2,303	5.8%	4.5%	7.1%	Oil	0	0.0%	0.0%	0.0%
Glass	1,489	3.8%			Batteries	69	0.2%	0.1%	0.3%
Clear Containers	520	1.3%	0.9%	1.7%	R/C Hazardous	80	0.2%	0.0%	0.4%
Green Containers	431	1.1%	0.8%	1.4%	Special	1,923	4.9%		
Brown Containers	433	1.1%	0.7%	1.5%	Ash	0	0.0%	0.0%	0.0%
Other Containers	13	0.0%	0.0%	0.1%	Sewage Sludge	0	0.0%	0.0%	0.0%
Flat Glass	29	0.1%	0.0%	0.2%	Industrial Sludge	0	0.0%	0.0%	0.0%
R/C Glass	63	0.2%	0.1%	0.2%	Treated Medical	0	0.0%	0.0%	0.0%
Metal	4,172	10.5%			Bulky Items	1,642	4.1%	1.5%	6.8%
Aluminum Cans	202	0.5%	0.4%	0.6%	Tires	221	0.6%	0.0%	1.1%
Tin Cans	523	1.3%	1.0%	1.7%	R/C Special	60	0.2%	0.0%	0.4%
Ferrous	1,663	4.2%	2.2%	6.2%	Mixed	732	1.8%		
Nonferrous	173	0.4%	0.3%	0.6%	Mixed Residue	732	1.8%	0.9%	2.8%
White Goods	739	1.9%	0.0%	4.7%					
R/C Metal	872	2.2%	0.8%	3.6%					
Plastic	3,623	9.2%							
#1 Containers	308	0.8%	0.5%	1.0%					
#2 Containers	250	0.6%	0.5%	0.8%					
Other Containers	151	0.4%	0.3%	0.5%					
Film	1,072	2.7%	2.2%	3.2%					
Durable	550	1.4%	0.9%	1.9%					
R/C Plastic	1,291	3.3%	2.4%	4.2%					
Organics	13,570	34.3%							
Food	5,633	14.2%	11.2%	17.3%					
Textiles	1,114	2.8%	1.9%	3.8%					
Leaves and Grass	1,118	2.8%	1.2%	4.4%					
Prunings	2,714	6.9%	3.4%	10.3%					
Stumps	0	0.0%	0.0%	0.0%					
Crop Residue	0	0.0%	0.0%	0.0%					
Manure	0	0.0%	0.0%	0.0%					
R/C Organic	2,990	7.6%	4.3%	10.8%					
Total Tons	39,575								
Sample Count (2001 study)	40								

Low and High are calculated at a 90% confidence interval

EXHIBIT A-11

Composition Estimates: East Hawai'i Commercial

	Tons Disposed	Percent of Total	Low	High		Tons Disposed	Percent of Total	Low	High
Paper	8,023	27.6%			Construction and Demolition	6,844	23.5%		
Cardboard	3,066	10.5%	7.4%	13.7%	Concrete	2	0.0%	0.0%	0.0%
Bags	174	0.6%	0.4%	0.8%	Asphalt Paving	0	0.0%	0.0%	0.0%
Newspaper	734	2.5%	1.5%	3.5%	Asphalt Roofing	216	0.7%	0.0%	2.0%
White Ledger	504	1.7%	0.9%	2.6%	Clean and Treated Lumber	5,990	20.6%	12.5%	28.7%
Colored Ledger	52	0.2%	0.1%	0.2%	Gypsum Board	48	0.2%	0.0%	0.4%
Computer	28	0.1%	0.0%	0.2%	Rocks and Soil	0	0.0%	0.0%	0.0%
Office	125	0.4%	0.3%	0.6%	R/C Demo	587	2.0%	0.0%	4.6%
Magazines	509	1.7%	0.8%	2.7%	Household Hazardous	39	0.1%		
Directories	63	0.2%	0.0%	0.5%	Paint	0	0.0%	0.0%	0.0%
Miscellaneous	879	3.0%	2.4%	3.7%	Vehicle Fluids	0	0.0%	0.0%	0.0%
R/C Paper	1,889	6.5%	4.5%	8.5%	Oil	0	0.0%	0.0%	0.0%
Glass	861	3.0%			Batteries	19	0.1%	0.0%	0.2%
Clear Containers	363	1.2%	0.8%	1.7%	R/C Hazardous	20	0.1%	0.0%	0.2%
Green Containers	250	0.9%	0.4%	1.3%	Special	464	1.6%		
Brown Containers	189	0.6%	0.3%	1.0%	Ash	0	0.0%	0.0%	0.0%
Other Containers	0	0.0%	0.0%	0.0%	Sewage Sludge	0	0.0%	0.0%	0.0%
Flat Glass	33	0.1%	0.0%	0.3%	Industrial Sludge	0	0.0%	0.0%	0.0%
R/C Glass	26	0.1%	0.0%	0.2%	Treated Medical	91	0.3%	0.0%	0.7%
Metal	2,098	7.2%			Bulky Items	56	0.2%	0.0%	0.5%
Aluminum Cans	136	0.5%	0.3%	0.6%	Tires	273	0.9%	0.0%	2.1%
Tin Cans	202	0.7%	0.5%	0.9%	R/C Special	45	0.2%	0.0%	0.3%
Ferrous	1,207	4.1%	0.3%	8.0%	Mixed	262	0.9%		
Nonferrous	79	0.3%	0.1%	0.4%	Mixed Residue	262	0.9%	0.5%	1.3%
White Goods	0	0.0%	0.0%	0.0%					
R/C Metal	474	1.6%	0.4%	2.9%					
Plastic	2,900	10.0%							
#1 Containers	177	0.6%	0.3%	0.9%					
#2 Containers	146	0.5%	0.3%	0.7%					
Other Containers	99	0.3%	0.2%	0.4%					
Film	1,072	3.7%	2.8%	4.5%					
Durable	815	2.8%	0.3%	5.2%					
R/C Plastic	591	2.0%	1.0%	3.0%					
Organics	7,627	26.2%							
Food	5,479	18.8%	13.7%	24.0%					
Textiles	611	2.1%	0.4%	3.8%					
Leaves and Grass	176	0.6%	0.2%	1.1%					
Prunings	243	0.8%	0.3%	1.4%					
Stumps	0	0.0%	0.0%	0.0%					
Crop Residue	0	0.0%	0.0%	0.0%					
Manure	0	0.0%	0.0%	0.0%					
R/C Organic	1,118	3.8%	1.5%	6.1%					
Total Tons	29,119								
Sample Count (2001 study)	36								

Low and High are calculated at a 90% confidence interval

EXHIBIT A-12

Composition Estimates: East Hawai'i Self-Haul

	Tons Disposed	Percent of Total		Tons Disposed	Percent of Total
Paper	1,126	8.8%	Construction and Demolition	6,549	51.2%
Cardboard	208	1.6%	Concrete	816	6.4%
Bags	4	0.0%	Asphalt Paving	793	6.2%
Newspaper	39	0.3%	Asphalt Roofing	0	0.0%
White Ledger	1	0.0%	Clean and Treated Lumber	2,619	20.5%
Colored Ledger	0	0.0%	Treated Lumber	776	6.1%
Computer	0	0.0%	Gypsum Board	509	4.0%
Office	1	0.0%	Rocks and Soil	129	1.0%
Magazines	1	0.0%	R/C Demo	905	7.1%
Directories	0	0.0%	Household Hazardous	11	0.1%
Miscellaneous	21	0.2%	Paint	7	0.1%
R/C Paper	850	6.6%	Vehicle Fluids	3	0.0%
Glass	8	0.1%	Oil	0	0.0%
Clear Containers	3	0.0%	Batteries	1	0.0%
Green Containers	1	0.0%	R/C Hazardous	0	0.0%
Brown Containers	1	0.0%	Special	1,871	14.6%
Other Containers	0	0.0%	Ash	0	0.0%
Flat Glass	0	0.0%	Sewage Sludge	0	0.0%
R/C Glass	4	0.0%	Industrial Sludge	1,241	9.7%
Metal	256	2.0%	Treated Medical	28	0.2%
Aluminum Cans	3	0.0%	Bulky Items	88	0.7%
Tin Cans	0	0.0%	Tires	514	4.0%
Ferrous	154	1.2%	R/C Special	0	0.0%
Nonferrous	1	0.0%	Mixed	2	0.0%
White Goods	2	0.0%	Mixed Residue	2	0.0%
R/C Metal	96	0.7%			
Plastic	65	0.5%			
#1 Containers	1	0.0%			
#2 Containers	2	0.0%			
Other Containers	1	0.0%			
Film	14	0.1%			
Durable	5	0.0%			
R/C Plastic	41	0.3%			
Organics	2,905	22.7%			
Food	314	2.5%			
Textiles	5	0.0%			
Leaves and Grass	33	0.3%			
Prunings	15	0.1%			
Stumps	1,344	10.5%			
Crop Residue	0	0.0%			
Manure	0	0.0%			
R/C Organic	1,194	9.3%			
Total Tons	12,792				
Sample Count (2001 study)	24				

APPENDIX B

Detailed West Hawai`i Commercial Substream Results

EXHIBIT B-1

Composition Estimates: West Hawai'i Commercial Packer Trucks

bb	Tons				Tons				
	Disposed	Percent of Total	Low	High	Disposed	Percent of Total	Low	High	
Paper	12,382	31.5%			Construction and Demolition	2,904	7.4%		
Cardboard	3,260	8.3%	6.8%	9.8%	Concrete	0	0.0%	0.0%	0.0%
Bags	146	0.4%	0.2%	0.6%	Asphalt Paving	512	1.3%	0.0%	3.4%
Newspaper	765	1.9%	1.3%	2.5%	Asphalt Roofing	0	0.0%	0.0%	0.0%
White Ledger	466	1.2%	0.3%	2.0%	Clean and Treated Lumber	713	1.8%	1.3%	2.3%
Colored Ledger	153	0.4%	0.0%	0.8%	Gypsum Board	112	0.3%	0.0%	0.7%
Computer	5	0.0%	0.0%	0.0%	Rocks and Soil	94	0.2%	0.0%	0.6%
Office	540	1.4%	0.6%	2.2%	R/C Demo	1,473	3.7%	1.2%	6.3%
Magazines	605	1.5%	0.5%	2.6%	Household Hazardous	97	0.2%		
Directories	21	0.1%	0.0%	0.1%	Paint	0	0.0%	0.0%	0.0%
Miscellaneous	3,148	8.0%	6.1%	9.9%	Vehicle Fluids	0	0.0%	0.0%	0.0%
R/C Paper	3,274	8.3%	6.3%	10.4%	Oil	33	0.1%	0.0%	0.2%
Glass	712	1.8%			Batteries	13	0.0%	0.0%	0.1%
Clear Containers	144	0.4%	0.2%	0.5%	R/C Hazardous	51	0.1%	0.0%	0.3%
Green Containers	274	0.7%	0.4%	1.0%	Special	274	0.7%		
Brown Containers	170	0.4%	0.2%	0.7%	Ash	0	0.0%	0.0%	0.0%
Other Containers	111	0.3%	0.2%	0.4%	Sewage Sludge	0	0.0%	0.0%	0.0%
Flat Glass	0	0.0%	0.0%	0.0%	Industrial Sludge	0	0.0%	0.0%	0.0%
R/C Glass	12	0.0%	0.0%	0.1%	Treated Medical	0	0.0%	0.0%	0.0%
Metal	2,400	6.1%			Bulky Items	274	0.7%	0.0%	1.8%
Aluminum Cans	114	0.3%	0.2%	0.4%	Tires	0	0.0%	0.0%	0.0%
Tin Cans	253	0.6%	0.5%	0.8%	R/C Special	0	0.0%	0.0%	0.0%
Ferrous	907	2.3%	0.3%	4.3%	Mixed	0	0.0%		
Nonferrous	97	0.2%	0.2%	0.3%	Mixed Residue	0	0.0%	0.0%	0.0%
White Goods	0	0.0%	0.0%	0.0%					
R/C Metal	1,029	2.6%	1.3%	4.0%					
Plastic	3,941	10.0%							
#1 Containers	312	0.8%	0.6%	1.0%					
#2 Containers	204	0.5%	0.4%	0.7%					
Other Containers	254	0.6%	0.5%	0.8%					
Film	1,803	4.6%	3.8%	5.4%					
Durable	372	0.9%	0.6%	1.3%					
R/C Plastic	996	2.5%	2.0%	3.1%					
Organics	16,599	42.2%							
Food	10,880	27.7%	22.6%	32.7%					
Textiles	1,677	4.3%	2.5%	6.0%					
Leaves and Grass	699	1.8%	0.0%	3.7%					
Prunings	807	2.1%	0.6%	3.5%					
Stumps	0	0.0%	0.0%	0.0%					
Crop Residue	0	0.0%	0.0%	0.0%					
Manure	0	0.0%	0.0%	0.0%					
R/C Organic	2,537	6.5%	4.3%	8.6%					
Total Tons	39,309								
Sample Count	30								

Low and High are calculated at a 90% confidence interval

EXHIBIT B-2

Composition Estimates: West Hawai'i Commercial Drop Boxes

	Tons Disposed	Percent of Total	Low	High		Tons Disposed	Percent of Total	Low	High
Paper	7,737	21.1%			Construction and Demolition	13,562	37.0%		
Cardboard	4,443	12.1%	7.3%	16.9%	Concrete	3,652	10.0%	3.2%	16.7%
Bags	135	0.4%	0.0%	0.7%	Asphalt Paving	0	0.0%	0.0%	0.0%
Newspaper	514	1.4%	0.0%	2.9%	Asphalt Roofing	4	0.0%	0.0%	0.0%
White Ledger	57	0.2%	0.1%	0.3%	Clean and Treated Lumber	5,818	15.9%	8.3%	23.4%
Colored Ledger	6	0.0%	0.0%	0.0%	Gypsum Board	371	1.0%	0.0%	2.1%
Computer	36	0.1%	0.0%	0.3%	Rocks and Soil	0	0.0%	0.0%	0.0%
Office	16	0.0%	0.0%	0.1%	R/C Demo	3,718	10.1%	3.5%	16.7%
Magazines	167	0.5%	0.1%	0.8%	Household Hazardous	117	0.3%		
Directories	0	0.0%	0.0%	0.0%	Paint	117	0.3%	0.0%	0.7%
Miscellaneous	715	2.0%	1.0%	2.9%	Vehicle Fluids	0	0.0%	0.0%	0.0%
R/C Paper	1,648	4.5%	2.2%	6.8%	Oil	0	0.0%	0.0%	0.0%
Glass	587	1.6%			Batteries	0	0.0%	0.0%	0.0%
Clear Containers	134	0.4%	0.0%	0.7%	R/C Hazardous	0	0.0%	0.0%	0.0%
Green Containers	98	0.3%	0.1%	0.5%	Special	0	0.0%		
Brown Containers	100	0.3%	0.1%	0.5%	Ash	0	0.0%	0.0%	0.0%
Other Containers	40	0.1%	0.0%	0.2%	Sewage Sludge	0	0.0%	0.0%	0.0%
Flat Glass	84	0.2%	0.0%	0.6%	Industrial Sludge	0	0.0%	0.0%	0.0%
R/C Glass	131	0.4%	0.0%	0.8%	Treated Medical	0	0.0%	0.0%	0.0%
Metal	2,422	6.6%			Bulky Items	0	0.0%	0.0%	0.0%
Aluminum Cans	32	0.1%	0.0%	0.1%	Tires	0	0.0%	0.0%	0.0%
Tin Cans	142	0.4%	0.2%	0.6%	R/C Special	0	0.0%	0.0%	0.0%
Ferrous	1,495	4.1%	1.3%	6.9%	Mixed	0	0.0%		
Nonferrous	4	0.0%	0.0%	0.0%	Mixed Residue	0	0.0%	0.0%	0.0%
White Goods	0	0.0%	0.0%	0.0%					
R/C Metal	749	2.0%	0.0%	4.3%					
Plastic	2,857	7.8%							
#1 Containers	92	0.3%	0.1%	0.4%					
#2 Containers	56	0.2%	0.1%	0.3%					
Other Containers	94	0.3%	0.1%	0.4%					
Film	886	2.4%	0.9%	3.9%					
Durable	1,048	2.9%	0.5%	5.2%					
R/C Plastic	681	1.9%	0.6%	3.1%					
Organics	9,389	25.6%							
Food	6,380	17.4%	9.2%	25.6%					
Textiles	164	0.4%	0.2%	0.7%					
Leaves and Grass	29	0.1%	0.0%	0.2%					
Prunings	962	2.6%	0.0%	6.5%					
Stumps	0	0.0%	0.0%	0.0%					
Crop Residue	0	0.0%	0.0%	0.0%					
Manure	0	0.0%	0.0%	0.0%					
R/C Organic	1,854	5.1%	1.2%	8.9%					
Total Tons	36,671								
Sample Count	30								

Low and High are calculated at a 90% confidence interval

EXHIBIT B-3

Composition Estimates: West Hawai'i Commercial Other

	Tons		Percent			Tons		Percent	
	Disposed	of Total	Low	High		Disposed	of Total	Low	High
Paper	330	6.6%			Construction and Demolition	3,156	63.1%		
Cardboard	242	4.8%	0.6%	9.1%	Concrete	42	0.8%	0.0%	1.8%
Bags	29	0.6%	0.0%	1.3%	Asphalt Paving	0	0.0%	0.0%	0.0%
Newspaper	7	0.1%	0.0%	0.4%	Asphalt Roofing	59	1.2%	0.0%	3.0%
White Ledger	7	0.1%	0.0%	0.3%	Clean and Treated Lumber	1,055	21.1%	9.2%	33.0%
Colored Ledger	0	0.0%	0.0%	0.0%	Gypsum Board	115	2.3%	0.4%	4.2%
Computer	0	0.0%	0.0%	0.0%	Rocks and Soil	241	4.8%	0.0%	11.7%
Office	2	0.0%	0.0%	0.1%	R/C Demo	1,644	32.9%	16.3%	49.5%
Magazines	6	0.1%	0.0%	0.3%	Household Hazardous	0	0.0%		
Directories	0	0.0%	0.0%	0.0%	Paint	0	0.0%	0.0%	0.0%
Miscellaneous	22	0.4%	0.0%	1.0%	Vehicle Fluids	0	0.0%	0.0%	0.0%
R/C Paper	15	0.3%	0.0%	0.6%	Oil	0	0.0%	0.0%	0.0%
Glass	13	0.3%			Batteries	0	0.0%	0.0%	0.0%
Clear Containers	0	0.0%	0.0%	0.0%	R/C Hazardous	0	0.0%	0.0%	0.0%
Green Containers	7	0.1%	0.0%	0.4%	Special	0	0.0%		
Brown Containers	0	0.0%	0.0%	0.0%	Ash	0	0.0%	0.0%	0.0%
Other Containers	1	0.0%	0.0%	0.0%	Sewage Sludge	0	0.0%	0.0%	0.0%
Flat Glass	0	0.0%	0.0%	0.0%	Industrial Sludge	0	0.0%	0.0%	0.0%
R/C Glass	4	0.1%	0.0%	0.2%	Treated Medical	0	0.0%	0.0%	0.0%
Metal	281	5.6%			Bulky Items	0	0.0%	0.0%	0.0%
Aluminum Cans	2	0.0%	0.0%	0.1%	Tires	0	0.0%	0.0%	0.0%
Tin Cans	138	2.8%	0.0%	6.9%	R/C Special	0	0.0%	0.0%	0.0%
Ferrous	45	0.9%	0.2%	1.6%	Mixed	0	0.0%		
Nonferrous	0	0.0%	0.0%	0.0%	Mixed Residue	0	0.0%	0.0%	0.0%
White Goods	0	0.0%	0.0%	0.0%					
R/C Metal	96	1.9%	0.4%	3.4%					
Plastic	145	2.9%							
#1 Containers	1	0.0%	0.0%	0.1%					
#2 Containers	1	0.0%	0.0%	0.0%					
Other Containers	0	0.0%	0.0%	0.0%					
Film	85	1.7%	0.2%	3.2%					
Durable	7	0.1%	0.0%	0.3%					
R/C Plastic	51	1.0%	0.0%	2.2%					
Organics	1,076	21.5%							
Food	20	0.4%	0.0%	1.1%					
Textiles	8	0.2%	0.0%	0.4%					
Leaves and Grass	81	1.6%	0.0%	3.3%					
Prunings	777	15.5%	0.0%	31.7%					
Stumps	112	2.2%	0.0%	5.3%					
Crop Residue	0	0.0%	0.0%	0.0%					
Manure	0	0.0%	0.0%	0.0%					
R/C Organic	77	1.5%	0.0%	3.9%					
Total Tons	5,000								
Sample Count	10								

Low and High are calculated at a 90% confidence interval

APPENDIX C

Waste Component Definitions

Waste Component Definitions

The list and definitions of the Standard Material Categories were drawn from the California Integrated Waste Management Board's Uniform Waste Disposal Characterization Method. The component category "treated lumber" was added during the design of this study. Definitions of the component materials used in this report follow.

Paper

(1) **Uncoated Corrugated Cardboard** usually has three layers. The center wavy layer is sandwiched between the two outer layers. It does not have any wax coating on the inside or outside. Examples: This component includes entire cardboard containers, such as shipping and moving boxes, computer packaging cartons, and sheets and pieces of boxes and cartons. This component does not include chipboard.

(2) **Paper Bags** means bags and sheets made from kraft paper. Examples: This component includes paper grocery bags, fast food bags, department store bags, and heavyweight sheets of kraft packing paper.

(3) **Newspaper** means paper used in newspapers. Examples: This component includes newspaper and glossy inserts, and all items made from newsprint, such as free advertising guides, election guides, and tax instruction booklets.

(4) **White Ledger** means uncolored bond, rag, or stationary grade paper. It may have colored ink on it. When the paper is torn, the fibers are white. Examples: This component includes white photocopy, white laser print, and letter paper.

(5) **Colored Ledger** means colored bond, rag, or stationery grade paper. When the paper is torn, the fibers are colored throughout. Examples: This component includes colored photocopy and letter paper. This component does not include fluorescent dyed paper or deep-tone dyed paper such as goldenrod colored paper.

(6) **Computer Paper** means paper used for computer printouts. This component usually has a strip of form feed holes along two edges. If there are no holes, then the edges show tear marks. This component can be white or striped. Examples: This component includes computer paper and printouts from continuous feed printers. This component does not include "white ledger" used in laser or impact printers, nor computer paper containing groundwood.

(7) **Other Office Paper** means other kinds of paper used in offices. Examples: This component includes manila folders, manila envelopes, index cards, white envelopes, white window envelopes, notebook paper, and carbonless forms. This component does not include "white ledger," "colored ledger," or "computer paper".

(8) **Magazines and Catalogs** means items made of glossy coated paper. This paper is usually slick, smooth to the touch, and reflects light. Examples: This component includes glossy magazines, catalogs, brochures and pamphlets.

(9) **Phone Books and Directories** means thin paper between coated covers. These items are bound along the spine with glue. Examples: This component includes whole or damaged telephone books, "yellow pages," real estate listings, and some non-glossy mail order catalogs.

(10) **Other Miscellaneous Paper** means items made mostly of paper that do not fit into any of the above components. Paper may be combined with minor amounts of other materials such as wax or glues. This component includes items made of chipboard, groundwood paper, and deep-toned or fluorescent dyed paper. Examples: This component includes cereal and cracker boxes, unused paper plates and cups, goldenrod colored paper, and hardcover and softcover books.

(11) **Remainder/Composite Paper** means items made mostly of paper but combined with large amounts of other materials such as wax, plastic, glues, foil, food, and moisture. Examples: This component includes waxed corrugated cardboard, aseptic packages, wax coated milk cartons, waxed paper, tissue, paper towels, blueprints, sepia, onionskin, fast food wrappers, carbon paper, self-adhesive notes, and photographs.

Glass

(12) **Clear Glass Bottles and Containers** means clear glass beverage and food containers with or without a CRV label. Examples: This component includes whole or broken clear soda and beer bottles, fruit juice bottles, peanut butter jars, and mayonnaise jars.

(13) **Green Glass Bottles and Containers** means green-colored glass containers with or without a CRV label. Examples: This component includes whole or broken green soda and beer bottles, and whole or broken green wine bottles.

(14) **Brown Glass Bottles and Containers** means brown-colored glass containers with or without a CRV label. Examples: This component includes whole or broken brown soda and beer bottles, and whole or broken brown wine bottles.

(15) **Other Colored Glass Bottles and Containers** means colored glass containers and bottles other than green or brown with or without a CRV label. Examples: This component includes whole or broken blue or other colored bottles and containers.

(16) **Flat Glass** means clear or tinted glass that is flat. Examples: This component includes glass windowpanes, doors, and tabletops, flat automotive window glass (side windows), safety glass, and architectural glass. This component does not include windshields, laminated glass, or any curved glass.

(17) **Remainder/Composite Glass** means glass that cannot be put in any other component category. It includes items made mostly of glass but combined with other materials. Examples: This component includes Pyrex, Corningware, crystal and other glass tableware, mirrors, and auto windshields.

Metal

(18) **Tin/Steel Cans** means rigid containers made mainly of steel. These items will stick to a magnet and may be tin-coated. This component is used to store food, beverages, paint, and a variety of other household and consumer products. Examples: This component includes canned food and beverage containers, empty metal paint cans, empty spray paint and other aerosol containers, and bimetal containers with steel sides and aluminum ends.

(19) **Major Appliances** means discarded major appliances of any color. These items are often enamel-coated. Examples: This component includes washing machines, clothes dryers, hot water heaters, stoves, and refrigerators. This component does not include electronics, such as televisions and stereos.

(20) **Other Ferrous** means any iron or steel that is magnetic or any stainless steel item. This component does not include "tin/steel cans". Examples: This component includes structural steel beams, metal clothes hangers, metal pipes, stainless steel cookware, security bars, and scrap ferrous items.

(21) **Aluminum Cans** means any food or beverage container made mainly of aluminum. Examples: This component includes aluminum soda or beer cans, and some pet food cans. This component does not include bimetal containers with steel sides and aluminum ends.

(22) **Other Non-Ferrous** means any metal item, other than aluminum cans, that is not stainless steel and that is not magnetic. These items may be made of aluminum, copper, brass, bronze, lead, zinc, or other metals. Examples: This component includes aluminum window frames, aluminum siding, copper wire, shell casings, brass pipe, and aluminum foil.

(23) **Remainder/Composite Metal** means metal that cannot be put in any other component category. This component includes items made mostly of metal but combined with other materials and items made of both ferrous metals and non-ferrous metal combined. Examples: This component includes brown goods (electronics and other small appliances), computers, televisions, radios, and electronic parts.

Plastic

(24) **HDPE Containers** means natural and colored HDPE containers. This plastic is usually either cloudy white, allowing light to pass through it (natural) or a solid color, preventing light from passing through it (colored). When marked for identification, it bears the number "2" in the triangular recycling symbol. Examples: This component includes milk jugs, water jugs, detergent bottles, some haircare bottles, empty motor oil, empty antifreeze, and other empty vehicle and equipment fluid containers.

(25) **PETE Containers** means clear or colored PETE containers. When marked for identification, it bears the number "1" in the center of the triangular recycling symbol and may also bear the letters "PETE" or "PET". The color is usually transparent green or clear. A PETE container usually has a small dot left from the manufacturing process, not a seam. It does not turn white when bent. Examples: This component includes soft drink and water bottles, some liquor bottles, cooking oil containers, and aspirin bottles.

(26) **Miscellaneous Plastic Containers** means plastic containers made of types of plastic other than HDPE or PETE. Items may be made of PVC, PP, or PS. When marked for identification, these items may bear the number "3," "4," "5," "6," or "7" in the triangular recycling symbol. Examples: This component includes food containers such as bottles for salad dressings and vegetable oils, flexible and brittle yogurt cups and lids, syrup bottles, margarine tubs, microwave food trays, and clamshell-shaped fast food containers. This component also includes some shampoo containers and vitamin bottles.

(27) **Film Plastic** means flexible plastic sheeting. It is made from a variety of plastic resins including HDPE and LDPE. It can be easily contoured around an object by hand pressure. Examples: This component includes plastic garbage bags, food bags, dry cleaning bags, grocery store bags, packaging wrap, and food wrap. This component does not include rigid bubble packaging.

(28) **Durable Plastic Items** means plastic objects other than containers and film plastic. This component also includes plastic objects other than containers or film that bear the numbers "1" through "7" in the triangular recycling symbol. These items are usually made to last for more than one use. Examples: This component includes plastic outdoor furniture, plastic toys and sporting goods, and plastic housewares, such as mop buckets, dishes, cups, and cutlery. This component also includes building materials such as house siding, window sashes and frames, housings for electronics such as computers, televisions and stereos, and plastic pipes and fittings.

(29) **Remainder and Composite Plastic** means plastic that cannot be put in any other component category. This component includes items made mostly of plastic but combined with other materials. Examples: This component includes auto parts made of plastic attached to metal, plastic bubble packaging, drinking straws, foam drinking cups, produce trays, egg cartons, foam packing blocks, packing peanuts, and cookie and muffin trays.

Other Organic

(30) **Food** means food material resulting from the processing, storage, preparation, cooking, handling or consumption of food. This component includes material from industrial, commercial or residential sources. Examples: This component includes discarded meat scraps, dairy products, eggshells, fruit or vegetable peels, and other food items from homes, stores, and restaurants. This component includes grape pomace and other processed residues or material from canneries, wineries, or other industrial sources.

(31) **Leaves and Grass** means plant material, except woody material, from any public or private landscapes. Examples: This component includes leaves, grass clippings, and plants. This component does not include woody material or material from agricultural sources.

(32) **Prunings and Trimmings** means woody plant material up to 4 inches in diameter from any public or private landscape. Examples: This component includes prunings, shrubs, and small branches with branch diameters that do not exceed 4 inches. This component does not include stumps, tree trunks, or branches exceeding 4 inches in diameter. This component does not include material from agricultural sources.

(33) **Branches and Stumps** means woody plant material, branches and stumps that exceed 4 inches in diameter from any public or private landscape.

(34) **Agricultural Crop Residues** means plant material from agricultural sources. Examples: This component includes orchard and vineyard prunings, vegetable by-products from farming, residual fruits, vegetables, and other crop remains after usable crop is harvested. This component does not include processed residues from canneries, wineries, or other industrial sources.

(35) **Manures** means manure and soiled bedding materials from domestic, farm, or ranch animals. Examples: This component includes manure and soiled bedding from animal production operations, racetracks, riding stables, animal hospitals, and other sources.

(36) **Textiles** means items made of thread, yarn, fabric, or cloth. Examples: This component includes clothes, fabric trimmings, draperies, and all natural and synthetic cloth fibers. This component does not include cloth-covered furniture, mattresses, leather shoes, leather bags, or leather belts.

(37) **Remainder/Composite Organic** means organic material that cannot be put in any other component category. This component includes items made mostly of organic materials but combined with other materials. Examples: This component includes leather items, carpets, disposable diapers, cork, hemp rope, garden hoses, rubber items, hair, and carpet padding.

Construction and Demolition

(38) **Concrete** means a hard material made from sand, gravel, aggregate, cement mix and water. Examples: This component includes pieces of building foundations, concrete paving, and cinder blocks.

(39) **Asphalt Paving** means a black or brown, tar-like material mixed with aggregate used as a paving material.

(40) **Asphalt Roofing** means composite shingles and other roofing material made with asphalt. Examples: This component includes asphalt shingles and attached roofing tar and tarpaper.

(41) **Clean Lumber** means processed wood for building, manufacturing, landscaping, packaging, and processed wood from demolition. Examples: This component includes untreated dimensional lumber, lumber cutoffs, engineered wood such as plywood and particleboard, wood scraps, pallets, wood fencing, wood shake roofing, and wood siding. Note that County of Hawai'i building codes require the use of treated lumber for home construction, thus there is relatively little clean lumber in the waste stream.

(42) **Treated Lumber** means new and used lumber that has been treated with any chemical preservative. Examples: This component includes railroad ties, marine timbers and pilings, some landscape timbers, and telephone poles.

(43) **Gypsum Board** means interior wall covering made of a sheet of gypsum sandwiched between paper layers. Examples: This component includes used or unused, broken or whole

sheets of sheetrock, drywall, gypsum board, plasterboard, gypboard, gyproc, and wallboard.

(44) **Rock, Soil and Fines** means rock pieces of any size and soil, dirt, and other matter. Examples: This component includes rock, stones, and sand, clay, soil and other fines. This component also includes non-hazardous contaminated soil.

(45) **Remainder/Composite Construction and Demolition** means construction and demolition material that cannot be put in any other component category. This component may include items from different components combined, which would be very hard to separate. Examples: This component includes brick, ceramics, tiles, toilets, sinks, and fiberglass insulation. This component may also include demolition debris that is a mixture of items such as plate glass, wood, tiles, gypsum board, and aluminum scrap.

Household Hazardous Waste

(46) **Paint** means containers with paint in them. Examples: This component includes latex paint, oil-based paint, and tubes of pigment or fine art paint. This component does not include dried paint, empty paint cans, or empty aerosol containers.

(47) **Vehicle and Equipment Fluids** means containers with fluids used in vehicles or engines, except used oil. Examples: This component includes used antifreeze and brake fluid. This component does not include empty vehicle and equipment fluid containers.

(48) **Used Oil** means the same as defined in Health and Safety Code section 25250.1(a). Examples: This component includes spent lubricating oil such as crankcase and transmission oil, gear oil, and hydraulic oil.

(49) **Batteries** means any type of battery including both dry cell and lead acid. Examples: This component includes car, flashlight, small appliance, watch and hearing aid batteries.

(50) **Remainder/Composite Household Hazardous** means household hazardous material that cannot be put in the "Paint", "Automotive Fluids", "Used Oil", or "Batteries" component categories. This component also includes household hazardous material that is mixed. Examples: This component includes household hazardous waste which if improperly put in the solid waste stream may present handling problems or other hazards.

Special Waste

(51) **Ash** means a residue from the combustion of any solid or liquid material. Examples: This component includes ash from fireplaces, incinerators, biomass facilities, waste-to-energy facilities, and barbecues. This component also includes ash and burned debris from structure fires.

(52) **Sewage Solids** means residual solids and semi-solids from the treatment of domestic wastewater or sewage. Examples: This component includes biosolids, sludge, grit, screenings, and septage. This component does not include sewage or waste water discharged from the sewage treatment process.

(53) **Industrial Sludge** means sludge from factories, manufacturing facilities, and refineries. Examples: This component includes paper pulp sludge, and water treatment filter cake sludge.

(54) **Treated Medical Waste** has the same meaning as treated medical waste in Section 25023.5 of the Health and Safety Code.

(55) **Bulky Items** means large, hard-to-handle items that are not defined separately, including furniture, mattresses, and other large items. Examples: This component includes all sizes and types of furniture, mattresses, box springs, and base components.

(56) **Tires** means vehicle tires. Examples: This component includes tires from trucks, automobiles, motorcycles, heavy equipments, and bicycles.

(57) **Remainder/Composite Special Waste** means special waste that cannot be put in any other component category. Examples: This component includes asbestos-containing materials, such as certain types of pipe insulation and floor tiles, auto fluff, auto-bodies, trucks, trailers, truck cabs, and artificial fireplace logs.

Mixed Residue

(58) **Mixed Residue** means material that cannot be put in any other component categories. This component includes mixed residue that cannot be further sorted. Examples: This component includes residual material from a materials recovery facility or other sorting process that cannot be put in any of the previous remainder/composite component categories.

APPENDIX D

Sampling Methodology and Calculations

Sampling Methodology and Calculations

Sampling Methodology

Objective

This study was intended to produce statistically valid data on the types and quantities of waste disposed at the West Hawai`i Landfill during FY 2008. The results of this study were combined with the results of the 2001 study conducted at the South Hilo Landfill resulting in a waste composition profile for the entire County.

Substream Definition

The waste hauled to the West Hawai`i Landfill can be divided into the following three categories (called **substreams**):

1. **Transfer Station** – is composed of waste hauled from nine transfer stations on the west side of the island. It is transported to the West Hawai`i Landfill in transfer station compactor boxes. Transfer station loads are made up primarily of residential waste.
2. **Commercial** – is composed of waste hauled by commercial hauling companies. Commercial haulers use a variety of vehicles to transport this waste to the West Hawai`i Landfill, including: packer trucks (garbage trucks), roll-offs (primarily open boxes), and other vehicles (e.g. flatbeds, pickups, etc.). This waste is collected from both residences and businesses. Commercial samples were allocated to each of these three vehicle types.
3. **Self-Haul** – is composed of waste that residents, contractors, businesses, and public entities haul directly to the West Hawai`i Landfill. These loads are transported either in small vehicles (e.g. autos, pick-ups, etc.) or large vehicles (e.g. dump trucks, flatbeds, etc). As with waste in the commercial substream, self-haul waste comes from both residences and businesses.

Sample Allocation

The total number of samples allocated to each substream and sampled on each day of the study is provided in Exhibit D-1. Note that no samples were allocated to the self-haul substream. There is relatively little mixed self-haul material delivered to the West Hawai`i Landfill (1,200 of 128,000 tons in FY 2008, or less than 1 percent). Therefore, it was decided that overall sampling accuracy would be improved by using self-haul sampling results from the 2001 study to represent the composition of mixed self-haul loads in West Hawai`i, and assigning samples that would have been obtained from the self-haul stream to the other two substreams. The composition profile of mixed self-haul loads from the 2001 study was used to estimate the mixed self-haul composition for the West Hawai`i Landfill.

The project budget allowed for a total of 100 total loads to be sampled. The allocation of samples between the substreams was determined according to each substream's

EXHIBIT D-1

Samples per Day by Substream

	Number of Samples				Total
	Transfer Station	Commercial Packer	Commercial Rolloff	Commercial Other	
May 15, 2008	6	5	6	3	20
May 16, 2008	6	8	5	1	20
May 19, 2008	6	7	6	1	20
May 20, 2008	6	4	9	1	20
May 21, 2008	6	6	4	4	20
Total	30	30	30	10	100

contribution to the total waste stream. Adjustments were made so that a sufficient number of samples were taken from each substream to ensure a representative composition. Thus, the commercial substream was slightly over sampled, and the transfer station substream was slightly under sampled.

Vehicle Selection

Sampling intervals for each substream and vehicle type were determined by dividing the day's expected number of arriving loads by the number of samples needed on that day. For example, if 20 commercial packer trucks were expected to arrive at the West Hawai'i Landfill on a sampling day, and a total of 5 samples were needed, every 4th commercial packer truck would be selected for sampling. Prior to each sampling day, the Field Supervisor was given a sheet outlining specific sampling intervals per substream and vehicle type. Appendix E contains an example of the vehicle selection sheet used in this study.

Field Procedures

On each sampling day, the Field Supervisor identified sample loads as they arrived at the West Hawai'i Landfill. The Supervisor assigned each selected load a unique sample identification number. Then, the Supervisor surveyed the driver of each vehicle to obtain "header information" which was recorded on that sample's waste sort sheet. The following information was collected for each sample load:

1. Load type

- a. Commercially hauled loads only - the hauler name
- b. Transfer station loads only - name of transfer station the load came from

2. Generator type

- a. Commercially hauled loads only
 - i. Loads that were 80% or more residential waste were recorded as “residential”
 - ii. Loads that were 80% or more commercial waste were recorded as “commercial”
 - iii. Otherwise, the generator type was recorded as “mixed”
- b. Transfer station loads only - always marked as “mixed”

3. Vehicle type

- a. Commercially hauled loads only - recorded as “packer,” “roll-off,” or “other vehicle” (e.g. flatbeds, dump trucks, pickups).
- b. Transfer station loads only - were always recorded as “transfer station box.”

As the load was emptied at the West Hawai'i Landfill, the Field Supervisor observed the load for evidence of hard-to-process or potentially explosive items. Details regarding these items were noted on the sample's waste sort sheet. Hard-to-process items included anything that would be difficult or impossible to manually sort, automatically process, or transfer by conveyor belt due to weight or size, such as: appliances, mattresses, cabinets, carpet, asphalt or concrete, and large pieces of scrap metal or lumber.

Next, the selected load was visually divided into an imaginary 16-cell grid. The supervisor then identified the randomly selected cell and approximately 200 to 300 pounds of waste was removed from that cell with a loader and placed on a tarpaulin. Samples were then tagged with a sample identifier labeled with their unique sample number and the date.

Once the total weight of a sample was recorded, the material was sorted by hand into the 58 prescribed components, placed in plastic laundry baskets, weighed, and recorded. (See Appendix C for a list and definitions of the components.)

Each sample was sorted by hand to the greatest reasonable level of detail, until no more than a small amount of homogeneous fines (less than 1 square inch) remained. The goal was to sort each sample completely into component categories. However, if fines did remain after sorting, they were weighed and the Supervisor classified them as “mixed residue.”

As the final step in collecting field data, the Supervisor reviewed, completed and organized the forms from each day's sampling activity. The Supervisor also prepared data summary sheets and sampling checklists at the end of each day. Completed data forms were then transmitted to the Project Manager at CH2M HILL for review and quality control prior to data entry.

Waste Composition Calculations

The composition estimates represent the **ratio of the components' weight to the total waste** for each noted substream. They are derived by summing each component's weight across all of the selected records and dividing by the sum of the total weight of waste, as shown in the following equation:

$$r_j = \frac{\sum_i c_{ij}}{\sum_i w_i}$$

where:

c = weight of particular component

w = sum of all component weights

for i 1 to n

where n = number of selected samples

for j 1 to m

where m = number of components

The low and high, or confidence interval, for this estimate is derived from a nonparametric statistical technique called the Bootstrap (Efron, B. 1982. *The Jackknife, the Bootstrap, and other Resampling Plans*. Society for Industrial and Applied Mathematics). Standard methods of calculating sample statistics are generally not applicable to waste composition results because each substream consists of multiple waste components that must sum to one for each substream. The distribution of these components is a multinomial with unknown properties. As such, sample statistics other than the sample mean proportions cannot be calculated using standard parametric techniques without making unappealing assumptions that would invalidate the results.

The Bootstrap method is a simulation technique that allows the calculation of the variance and other statistics of a parameter with unknown distributional properties. In this study, the Bootstrap method was used to calculate the square root of the Bootstrap variance estimates of each sample mean (henceforth referred to as the standard error). The mean and standard error were then used to calculate confidence intervals about sample mean estimates.

The upper and lower confidence limits provide the boundaries of an interval within which we are 90 percent confident that the true mean proportion of a waste type will lie. They represent the high and low estimates shown in this study.

Upper and lower confidence limits were calculated as follows:

$$CI_u = \overline{SM}_g + (1.645 * SE_g)$$

$$CI_l = \overline{SM}_g - (1.645 * SE_g)$$

where: CI_u = upper confidence limit

CI_l = lower confidence limit

\overline{SM}_g = sample mean proportion for waste component g

1.645 = standard normal deviate (two-tailed) at a 0.05 level

SE_g = standard error for waste component g

The overall waste composition estimates were calculated by performing a weighted average across the relevant sampling groups. For the transfer station substream, the estimates were calculated by performing a weighted average based on the tonnage disposed by each transfer station. For the commercial substream, the estimates were calculated by performing a weighted average based on the tonnage hauled by each vehicle type. For the self-haul substream, the estimates were calculated by multiplying total self-haul mixed loads by the waste component percentages from mixed loads from the 2001 sampling study. To that was added the tonnages disposed by 18 pure loads. Component percentages were then calculated based on the tons of mixed material and pure loads for each component.

The weighting percentages that were used to perform the composition calculations are listed in Exhibit D-2. This information was obtained from scale records at the West Hawai`i Landfill for FY 2008. The composition estimates for both the overall waste stream and each substream were applied to the relevant tonnages to estimate the amount of waste disposed for each component category.

The **weighted average for an overall composition estimate** is performed as follows:

$$O_j = (p_1 * r_{j1}) + (p_2 * r_{j2}) + (p_3 * r_{j3}) +$$

where:

O_j = overall composition estimate for component j

p = the production of tonnage contributed by the noted sample group

r = ratio of component weight to total waste weight in the noted sample group

for j = 1 to m

where m = number of components

EXHIBIT D-2
Weighting Percentages

Transfer Stations	Tons Disposed	Percent of Total
Kailua	7,860	6.1%
Keauhou	5,017	3.9%
Keei / Napoopoo	2,025	1.6%
Waiea	2,968	2.3%
Milolii	207	0.2%
Waiohinu / Ka'u	3,447	2.7%
Waimea	6,376	5.0%
Puako	2,681	2.1%
Kohala	4,145	3.2%
Honoka'a	3,459	2.7%
Pa'auilo	1,922	1.5%
Laupahoehoe	1,547	1.2%
Commercial		
Packers	39,309	30.6%
Rolloff	36,671	28.5%
Other Commercial	5,000	3.9%
Self-Haul		
Ash	93	0.1%
Crop residue	3	0.0%
Industrial Sludge	1,585	1.2%
Oil	2	0.0%
R/C Demo	765	0.6%
R/C Organic	294	0.2%
R/C Paper	2	0.0%
R/C Special	299	0.2%
Rocks and Soil	786	0.6%
Stumps	719	0.6%
Tires	116	0.1%
Treated Medical	20	0.0%
Mixed waste Loads	1,224	1.0%
Total	128,543	100.0%

Waste was not sampled from the Laupahoehoe, Miloli'i, and Ke`ei transfer stations. When calculating composite results for the transfer station substream, the tons from those stations were assumed to have the composition profile of the following stations: Pa'auilo, Waiea, and Kohala, respectively.

APPENDIX E

Field Sampling Forms

APPENDIX E

Field Sampling Forms

Two sampling forms were used in the field during the sampling event:

- Vehicle Selection Sheet
- Waste Sort Sheet

Examples of those forms follow.

COUNTY OF HAWAII WASTE CHARACTERIZATION STUDY

Vehicle Selection Form

Site: Pu`uanahulu Landfill

Date: Thursday, May 15, 2008

Cross off one number for each type of vehicle entering the landfill.

Continue for each block, beginning at #1, on the next line until the required number of vehicles is sampled.

TRANSFER STATION BOXES:		NEED <u>6</u> TOTAL – SAMPLE EVERY <u>2nd</u> VEHICLE
1	2	
1	2	
1	2	
1	2	
1	2	
1	2	

COMMERCIAL PACKERS:			NEED <u>5</u> TOTAL – SAMPLE EVERY <u>3rd</u> VEHICLE
1	2	3	
1	2	3	
1	2	3	
1	2	3	
1	2	3	

COMMERCIAL ROLL-OFFS:					NEED <u>6</u> TOTAL – SAMPLE EVERY <u>5th</u> VEHICLE
1	2	3	4	5	
1	2	3	4	5	
1	2	3	4	5	
1	2	3	4	5	
1	2	3	4	5	

NEED <u>3</u> TOTAL – SAMPLE FIRST VEHICLE AFTER TIME INDICATED	
After 9:00 am	
After 11:00 am	
After 2:00 pm	

Pu`uanahulu Landfill Sampling Form

Sample ID: _____

Load Type: TS Com

(Commercial Loads Only)

Hauler: _____

Date: _____

Route: _____

Generator: Res Com Mix R/C Const GW

(TS Boxes Only)

Vehicle Type: Packer Roll Off Other Com TS Box

Site/Origin: _____

PAPER	Cardboard			
	Bags			
	Newspaper			
	White Ledger			
	Colored Ledger			
	Computer			
	Office			
	Magazines			
	Directories			
	Miscellaneous			
	R/C Paper			

GLASS	Clear Containers			
	Green Containers			
	Brown Containers			
	Other Containers			
	Flat Glass			
R/C Glass				

METAL	Aluminum Cans			
	Tin Cans			
	Ferrous			
	Nonferrous			
	White Goods			
	R/C Metal			

SPECIAL	Ash			
	Sewage Sludge			
	Industrial Sludge			
	Treated Medical			
	Bulky Items			
	Tires			
	R/C Special			

Mixed Residue			
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ORGANIC	Food			
	Textiles			
	Leaves and Grass			
	Prunings			
	Stumps			
	Crop Residue			
	Manure			
	R/C Organic			

PLASTIC	#1 Containers			
	#2 Containers			
	Other Containers			
	Film			
	Durable			
R/C Plastic				

C & D	Concrete			
	Asphalt Paving			
	Asphalt Roofing			
	Clean Lumber			
	Treated Lumber			
	Gypsum Board			
	Rocks and Soil			
	R/C Demo			

HHW	Paint			
	Vehicle Fluids			
	Oil			
	Batteries			
	R/C Hazardous			

Evidence of Explosive/Hard-to-Process Items in Load:

Yes No

Explosives:
(e.g., propane tanks) _____

Hard-to-Process Items: _____