

OAHU MUNICIPAL REFUSE DISPOSAL ALTERNATIVES STUDY

GREEN WASTE COLLECTION, PROCESSING, AND MARKETING

AUGUST 1999

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Refuse Division
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EXECUTIVE SUMMARY

This report is an evaluation of options for collection and processing green waste generated in the City & County of Honolulu (City or City & County) from residential and commercial sources, and marketing the compost or mulch produced. Most of the focus of the report is on the residential green waste. The commercially collected materials are expected to go to composting facilities due to the higher costs of disposal at the landfill and at H-POWER.

The report includes a discussion of policies used in mainland settings to encourage the householder to separate the green waste and keep it clean. We provide a summary of the methods used to collect the residential green waste. The discussion of processing identifies the capabilities of the existing facilities in the city. The discussion of marketing covers the effort needed to use all of the possible compost and mulch that could be produced if the entire green waste generation on the island were processed. It also discusses the existing markets for the material.

Green waste is a significant proportion of the solid waste that is currently handled by the disposal system. According to the waste composition study (currently being completed as part of the evaluation of the City's overall program), green waste is 17.9 percent of the total waste stream on the island (147,000 tons of green waste were estimated to be disposed in 1998). The percentage of the residential stream varies by collection district, but averages nearly 30 percent.

The collection alternatives evaluated were

- use of automated collection equipment with 90-gallon containers, similar to those used for rubbish;
- use of manual collection trucks with manual collection of the waste (similar to the existing system); and
- use of a claw attachment on a front loader and manual collection trucks.

The vehicles being used for automated collection of rubbish can also be used for green waste collection. Future purchases of automated vehicles for waste collection need not make special consideration for green waste collection. Using the same vehicles will allow the City to streamline purchase decisions when both rubbish collection and green waste collection are underway.

The advantages of the manual system include the ability of the householder to place larger amounts of material for collection than with the automated system. The odor will be reduced somewhat due to the open air exposure of the waste.

The disadvantages include the cost of manpower and workers' compensation. The current 24,000 pound per day collection limit (we have assumed a limit of 36,000 pounds due to the less material expected at each household) is also a disadvantage to system efficiencies.

The claw is hydraulically controlled by the loader operator and is used to "pinch" piles of green waste. It can typically grasp up to a five cubic foot pile of green waste in one to two passes. The five foot dimension limits the length of the material to ensure the green waste can be loaded into collection vehicle. This method allows the residents to pile their green waste material in the street without the need to containerize or bundle it. There is typically no limit, except for physical space, to the number of piles a resident may place in the street near the curb. However, the piles of waste will interfere with on-street parking, which is very limited in some residential areas.

While this report was being prepared, the City was also evaluating a change from twice-per-week rubbish collection to once-per-week collection and completing the transition to automated collection. With the transition to an automated system and with possible changes to the frequency of waste collection, the City has the opportunity to implement green waste collection for a lower cost. The necessary collection equipment and collection crews should be available, which would reduce the cost of converting to curbside collection of green waste.

The discussions in this section and in the cost analysis assume there will not be any savings by combining the green waste program with further automation and the institution of weekly rubbish collection. The costs provided here assume that the City will implement curbside collection of green waste with new equipment and additional collection personnel.

There are two major green waste processing facilities: Hawaiian Earth Products located in Campbell Industrial Park and Kaleheo Processing Facility located near the Kapaa Transfer Station. There may be an opportunity for a third major, centrally located, processing facility. A facility located in the Sand Island or Middle Street area would reduce the travel time for waste from the West Honolulu area; however, a facility located in this area would not have sufficient land for windrow processing. Since the two major processing facilities have adequate capacity for the additional green waste, composting capacity is not needed. Rather, a size reduction and transfer facility would be appropriate. All equipment, land, processing, and transportation would be provided by a contractor.

As summarized in the discussion of marketing, the City & County departments with landscaping responsibility (primarily the Parks Department with the City Zoo, Botanical Gardens, and golf courses) have been major bulk users of compost and mulch. It can be difficult to convince other departments and the State to use the material, although those that use it have had good results. Lack of staff and budget and reluctance of some City and State staff have prevented the use of compost and mulch. The City should have a policy directing the use of recycled materials where the price does not exceed a specified amount greater than a non-recycled product. The City should encourage the State to adopt such a policy. A policy requiring the use of compost

produced from material the City collects would be a viable way for the City to support this program.

This report includes recommendation of the following:

- We recommend that the City expand its curbside green waste collection program.
- We recommend that the City issue a Request for Proposals for a processing facility located in the downtown area.
- We recommend that the City establish a policy directing its departments to use compost in applications where it has been shown to have beneficial results on plant life and soil health. The City should encourage the State to adopt a similar policy.

SECTION 1

INTRODUCTION

1.1 PROJECT OVERVIEW

This report was prepared for the City & County of Honolulu (City), Department of Environmental Services, Refuse Division. This evaluation was conducted as part of an overall study addressing six key areas of the City's waste collection and diversion programs. This introduction provides a summary of the solid waste system when the evaluation was conducted.

The evaluations were conducted by R. M. Towill Corporation (RMTC) in association with Solid Waste Associates (SWA), which provided project management support and prepared two evaluations. Other companies that participated in the evaluation are listed below.

The six evaluations were:

- *A Waste Composition Analysis* of the residential, commercial, and self-haul waste streams. This analysis was conducted by Cascadia Consulting Group, Inc., and Sky Valley Associates. They were assisted by SWA.
- *A Study of Managed Competition* in waste collection and transfer services. This study was prepared by HDR Engineering, Inc.
- *An Evaluation of Green Waste Collection, Processing, and Marketing* to address the infrastructure needed for expanded green waste collection. This evaluation was prepared by Total Compliance Management, Inc., in association with SWA.
- *An Evaluation of Curbside Recyclable Collection* from single-family dwellings. This evaluation, conducted by Franklin Associates, was to determine the cost of implementing a curbside program compared to the existing drop-off system.
- *An Evaluation of Emerging Waste Management Technologies* to identify those that might be appropriate for the City to investigate further. This evaluation was prepared by ATG, Inc.
- *An Evaluation of Market Subsidies for Recyclable Materials* prepared by Skumatz Economic Research Associates (SERA).

1.2 EXISTING SYSTEM

1.2.1 General

These reports are based on conditions that existed between January 1998 and September 1998. The data on the waste collection, diversion, and disposal systems were for 1997, the latest full year for which data were available. The waste composition information was taken between April 1998 and September 1998. The waste sampling schedule for the waste composition study was based on 1997 disposal amounts and vehicle counts at the facilities sampled. The 1997 data used to prepare the sampling program were checked against the actual disposal in 1998 to confirm that the 1997 data were representative of the 1998 data.

While the data for 1997 were determined to be adequately representative of the 1998 disposal for waste composition sampling plan purposes, the amount of disposal at the City’s disposal facilities has decreased in 1998. The amount of waste handled at the Waimanalo Gulch Landfill and at H-POWER in the last two fiscal years is shown in **Table 1-1, Changes in Amount of Waste Disposal**. The increase at H-POWER was due to increased availability of the plant, not an increase in waste generation, and would account for part of the decline at Waimanalo Gulch Landfill.

**Table 1-1
Changes in Amount of Waste Disposal
(Tons)**

	H-POWER	Waimanalo Gulch Landfill	Total
FY 96-97	588,939	385,248	974,187
FY 97-98	639,286	278,374	917,660
Difference	9%	-28%	-6%

1.2.2 Collection System

The City & County is divided into seven collection districts. Waste from the districts is either sent through one of three transfer stations or directly to the disposal site, depending on distance from the route to the disposal point.

The Refuse Division collects waste from single-family dwellings and from some apartment buildings and small commercial facilities. Waste from most large commercial facilities and apartments is collected by private waste haulers.

Residential waste is collected twice per week. In areas with automated collection services, green waste is collected separately once per month. On-call green waste collection is provided in some automated areas due to the large amount of green waste generated. In areas with manual collection, green waste is collected with the rubbish.

Both automated side-loaders and manual rear-loader trucks are used for waste collection. About 78 percent of the routes are automated. The Refuse Division staff anticipates converting a total of about 90 percent of the routes to automated collection over the next several years. In the automated areas, green waste is collected with manual trucks.

The City operates a system of six convenience centers where householders can drop off waste. The centers have bins designated for recycling, H-POWER, and landfill. The customer places the waste in the proper bin.

1.2.3 Diversion

The waste diversion program includes the following components:

- A drop-off system currently located at schools around the island. Materials collected include paper, plastic, aluminum cans, and glass. The drop-off system is being expanded to additional schools and some commercial facilities, such as grocery stores and supermarkets.
- Green waste processing is done at three locations, two private operations and one operated by the Refuse Division (located at the Kapaa Landfill). The private operations produce both mulch and compost. The finished product from private facilities is marketed in retail stores and in wholesale bulk. The Refuse Division operation produces mulch, which is provided free to the City Parks and Recreation Department and other departments and to the public.
- A statewide advance disposal fee of 1.5 cents that is collected for each glass container entering the state provides an incentive for recycling that material. The processor is paid six cents per pound by the State for recycling glass.
- The Partnership for the Environment is a City-supported organization comprised of businesses that have extensive commercial recycling activities. The Partnership acts as an information source for expanding commercial recycling on Oahu.
- The City requires recycling of glass containers from bars and restaurants. It also requires office buildings greater than 20,000 square feet in size to recycle office paper, newspaper, and cardboard.

- Restaurants and other facilities that generate food waste are required to recycle that material.
- The City has a program to recycle materials from its offices.
- While not City-sponsored, there are commercial programs to recycle construction and demolition waste, tires, and appliances.

1.2.4 Disposal

The City operates two disposal facilities, and a third is privately operated. The City facilities are the Waimanalo Gulch Landfill and H-POWER. H-POWER is a waste-to-energy plant that processes over 620,000 tons of waste per year (about 2,000 tons per day) and generates electricity. The facility is a refuse derived fuel plant that recycles ferrous metals from the front end processing equipment and ferrous and non-ferrous metals from the ash.

The Waimanalo Gulch Landfill accepts non-combustible waste, including the ash from H-POWER, and other materials, mostly from private waste haulers and commercial self-haulers. Householders do not pay for waste disposal. Commercial customers pay \$65.75 per ton, which includes a state tax of \$0.35 per ton. A six-percent City recycling surcharge is added on to each ton disposed. On July 1, 1999, the fee will become \$72.25 per ton and the surcharge will increase to 12 percent.

PVT Land Company operates the private landfill. It accepts construction and demolition materials at a tip fee of \$25 per ton.

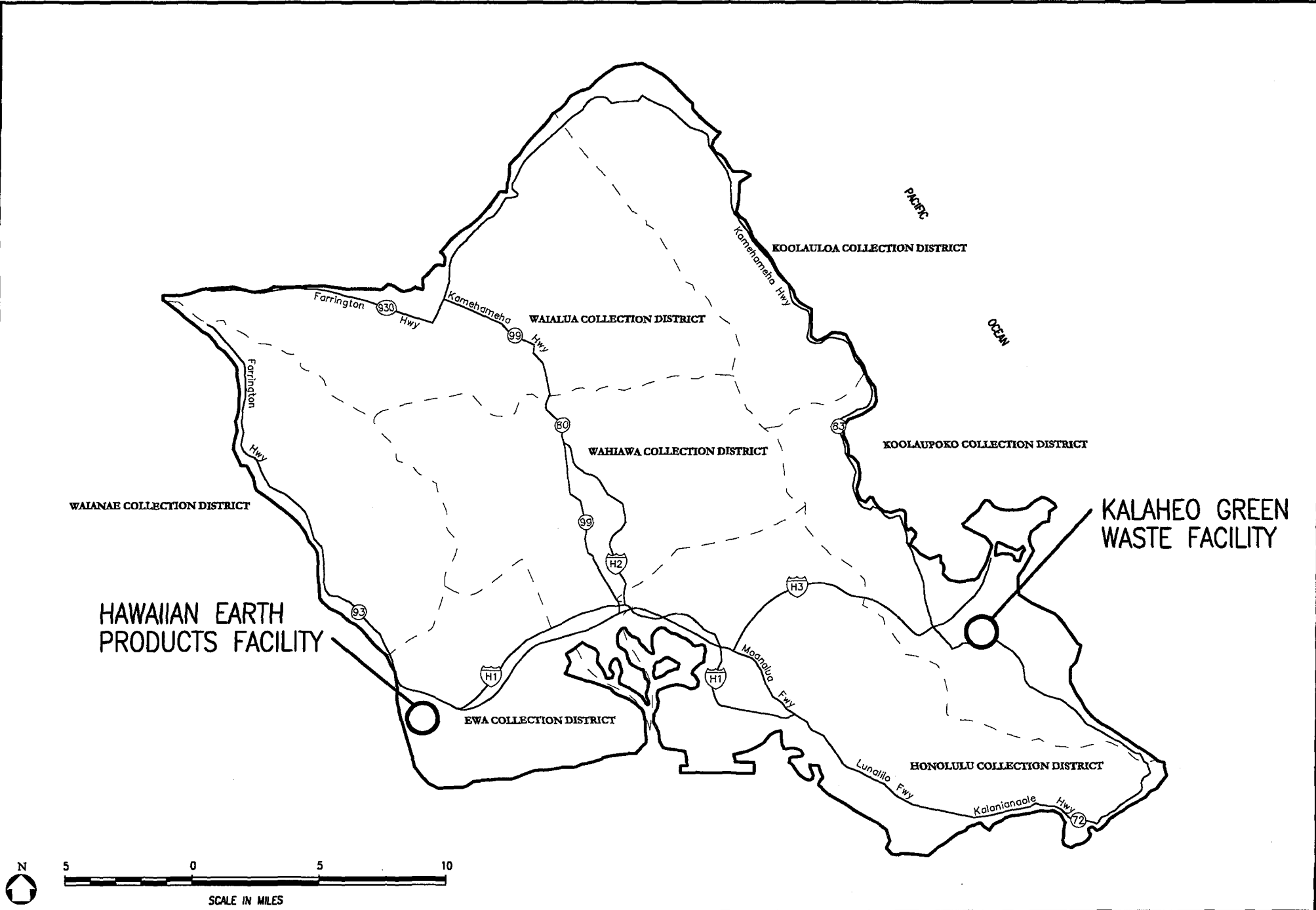
1.2.5 Existing Compost Facilities

Today there are two existing green waste facilities processing approximately 115 tons per day of green material from both commercial and City sources. These existing sites can expand to handle up to 490 tons per day of material. An overview of these facilities is provided in **Table 1-2, Existing Composting Facilities**. **Figure 1-1, Location of Green Waste Processing Facilities**, shows the location of these two composting facilities.

Hawaiian Earth Products is located in the Campbell Industrial Park and has been in operation since 1993. Kalaheo Green Waste Recycling Facility is located on top of the closed Kalaheo Landfill near the Kapaa Quarry and has been in operation since 1996.

**Table 1-2
Existing Composting Facilities**

	Hawaiian Earth Products	Kalaheo Green Waste Recycling Facility
Existing Throughput	75 tons per day	40 tons per day
Potential Capacity	250 tons per day	240 tons per day
Feedstock	Commercial green waste Residential green waste Compost manures	Commercial green waste
Size	10 acres plus a 7-acre expansion	10 acres on top of the landfill
Equipment	Available on-site to reach capacity	Will need to purchase additional equipment
Site Challenges	Water supply Dust control Fire control	Site maintenance Fire control



1.2.6 Mulch/Compost Production

In this report, we are considering mulch to be green waste that has been mechanically reduced in size, but has not undergone a time-and-temperature process to qualify as a compost product. Mulch may or may not have undergone the full compost process to achieve the desired levels of pathogen reduction and weed seed kill. The amount of mulch produced at a compost facility may equal the amount of compost produced. Mulch is used as a top dressing to retain moisture, to control erosion, and to discourage weed growth.

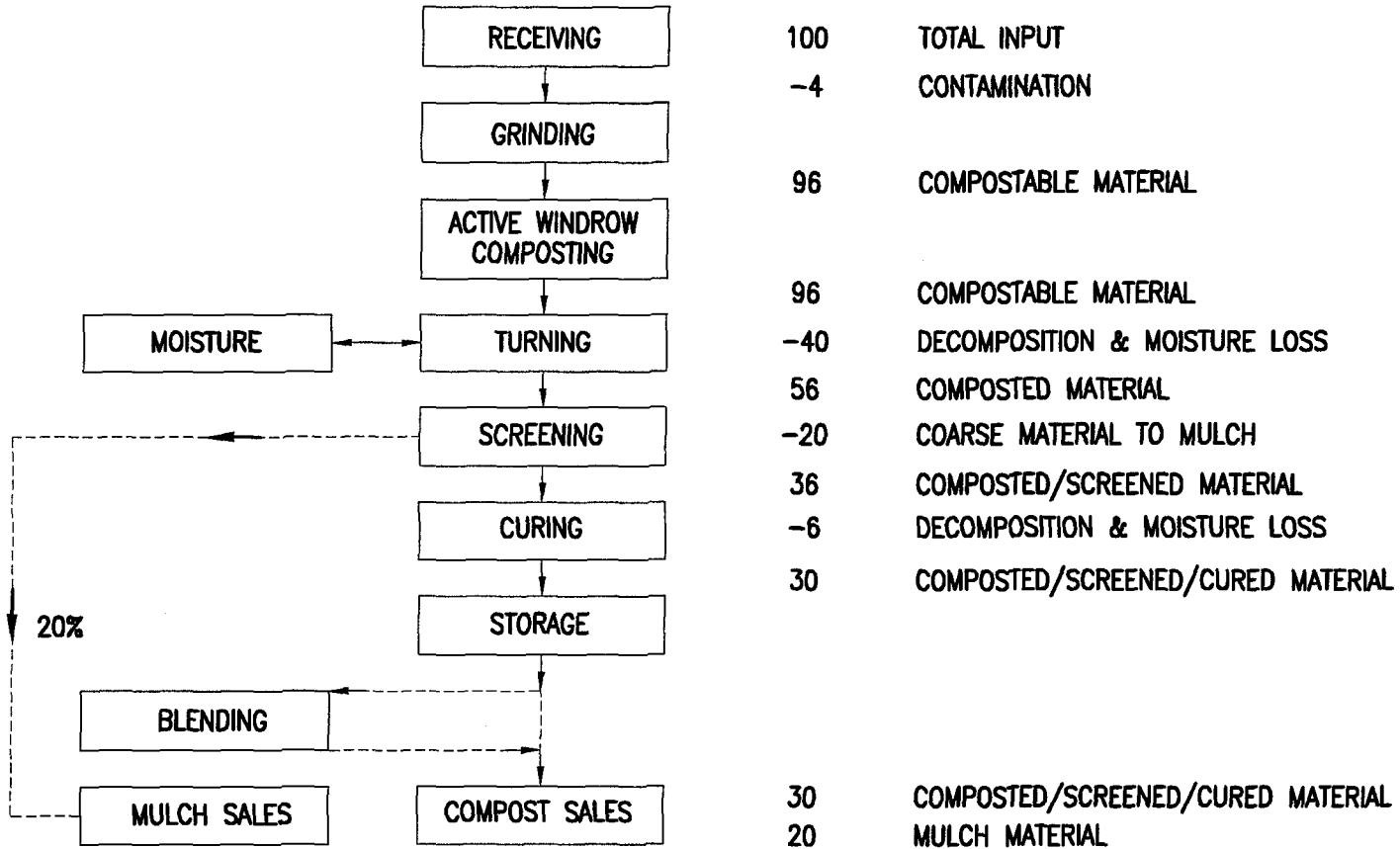
Compost is the product resulting from the controlled biological decomposition of organic wastes. It has been adequately sanitized and stabilized so it is potentially beneficial to plant growth when used as a soil amendment. Feedstocks commonly include green waste, animal wastes, and food waste. Sewage sludge can also be a feedstock, but can restrict the marketability of the product. The types of organic products produced consist of finished compost and a mulch product. The composting process includes a pathogen reduction phase as well as a weed seed kill. Those attributes of the compost process provide its users with confidence in the material.

Incoming waste is typically reduced by 50 percent in weight to evaporation during the composting process. This concept is extremely important to understand when designing an organic market development plan for the processed material.

Figure 1–2, Compost Flow Diagram and Mass Balance, illustrates a typical windrow composting operation. As shown on the figure, four percent of the total input is contaminants. The remaining 96 percent is ground and placed in windrows. During the compost process, the material is turned and moisture is added to replace the moisture lost due to evaporation. The material is composted for a 60-day to 90-day period during which up to 40 percent of the total input is lost as decomposition and moisture. After screening, 20 percent of the total input is overs and is used as mulch (overs can be recomposted). During curing, another six percent of the total input is lost as moisture. With 30 percent of the total input available for compost sales and 20 percent for mulch sales, a total of 50 percent of the input material is available for sale.

These numbers are only used for planning purposes. The numbers will vary based upon the feedstock, climatic variations, and processing techniques.

COMPOST MASS BALANCE



SECTION 2

BACKGROUND

This report is an evaluation of options for collection, processing, and marketing the compost or mulch produced by the green waste generated in the city from residential and commercial sources. Most of the focus of the report is on the residential generation of green waste. The commercially collected materials are expected to go to composting facilities due to the higher costs of disposal at the landfill and at H-POWER. The report includes a discussion of methods used in mainland settings for encouraging the collection of clean, source separated green waste. We provide a summary of the methods used to collect residential green waste. The discussion of processing identifies the capabilities of the existing facilities in the city using data taken from public records. Given the competitive nature of this business, it is likely that the existing processing capabilities are different than those we suggest. The discussions of collection and processing are based on realistic estimates of the material that could be collected. The discussion of marketing covers the effort necessary to use all of the potential compost and mulch produced if the entire green waste generation on the island were processed. It also discusses existing markets for the material.

It is important to recognize in reviewing the collection options that the City collects residential waste and a small amount of commercial waste. It can directly affect the collection of only the residential waste. It can influence the collection of green waste by commercial waste haulers through its bans on disposal and the tip fee charged at disposal facilities. The commercial haulers are responsible for collecting waste from businesses, offices, most multi-family dwellings, the hospitality industry and others. Our discussion of the marketing of green waste includes the amount of material that is collected by the commercial haulers. Our discussion of collection options includes only City collections.

2.1 SETTING

This evaluation is being conducted as the City is in process of evaluating several changes to its solid waste management system. One of the changes expected is expansion of the automated routes to 90 percent of the households. Currently, about 78 percent of the 150,186 residential units are serviced by automated collection vehicles, which the City has used since 1992. Those householders that have automated collection also receive twice-a-month green waste collection.

Additional changes are expected in expanded green waste collection and consideration of curbside recyclable collection. It is possible that additional bans on materials at the disposal sites or other significant changes to the collection system may be implemented. These changes will make resources available to the City for re-direction to other programs. For example, as the manual collection routes are converted to automated, vehicles and collection crews may become available for green waste collection. We have indicated where these system efficiencies may be possible.

It is in this time of major changes to the system that this green waste report is being prepared. Green waste is a significant proportion of the solid waste that is currently handled by the disposal system. According to the waste composition study (currently being completed as part of the evaluation of the City's overall program), green waste is 17.9 percent of the total waste stream on the island (or 147,000 tons of green waste disposed in 1998). The percentage of the residential stream varies by collection district, but averages nearly 30 percent.

This study analyzes several collection options, suggests several policy options to increase source separated collection of green waste, discusses the processing of the material, and identifies options for increasing the use of the compost produced through the City's marketing efforts. The study authors acknowledge that the City is continuing its efforts to address the green waste stream. We have endeavored to reflect the changing collection system in the recommendations for increasing the beneficial use of green waste.

2.2 ALTERNATIVES BEING EVALUATED

The major alternatives evaluated are for collection and additional processing facilities. We have also evaluated and made recommendations on several policy options and on marketing approaches. The collection alternatives evaluated were

- use of automated collection equipment with 90-gallon containers, similar to those used for rubbish;
- use of manual collection trucks with manual collection of the waste (similar to the existing system); and
- use of a claw attachment on a front loader and manual collection trucks.

The processing options reviewed are the addition of a third processing site and use of satellite processing sites.

2.3 QUANTITIES OF MATERIALS

The quantity of green waste to be collected and processed is indicated in Table 2-1, Green Waste Quantities. That table shows the green waste collected by City crews and by the commercial haulers. The quantity of material reflects only the green waste that is disposed. The percentage composition was provided by the waste composition study and the total 1998 tonnage was estimated from the tonnage for part of calendar year 1998.

Table 2-1
Green Waste Quantities

RESIDENTIAL				
Collection District	Percentage Composition*		Estimated Disposal Tons/Yr	
	Mean	+/-	Mean	+/-
Honolulu	29.5	4.6	36,657	5,719
East Honolulu	28.9	5.0	23,356	4,045
West Honolulu	30.6	3.9	13,250	1,561
Ewa	23.8	3.5	16,291	2,396
Koolaupoko	35.7	3.9	17,538	1,916
Wahiawa	24.3	3.7	5,406	823
Waianae	27.3	3.2	4,368	512
Combined Residential**	28.7	1.9	90,728	6,086
COMMERCIAL				
Disposal Location	Percentage Composition*		Estimated Disposal Tons/Yr	
	Mean	+/-	Mean	+/-
H-POWER	12.8	3.3	43,720	11,272
Waimanalo Gulch	6.0	3.4	8,172	4,631
Combined Commercial**	10.9	3.3	51,892	15,903
*Calculated at 90 percent confidence interval.				
**Totals may not sum due to rounding				
NOTE: Waialua and Koolauloa Collection Districts are not included.				

The collection district with the largest amount of green waste was the Honolulu District, as would be expected considering the population density. For the waste composition study the Honolulu collection district was divided into East and West subareas. The East Honolulu area generates the most residential green waste in the city. Of the collection districts studied (sampled), the Ewa and Koolaupoko areas have the largest amounts of green waste. The waste composition analysis did not include the Koolauloa or Waialua collection districts because they generate much less waste than the others.

The commercial tonnage going to H-POWER is also an important source of green waste. The distribution of this waste by collection district was not available. The City's ban of more than 10 percent green waste in commercial loads going to H-POWER should encourage diversion of this material to the processing sites.