

Final Report

**Food Waste Discharge to the Wastewater
Collection System**

**An Evaluation of Current Conditions and
Alternative Management Methods**

**Prepared for:
King County Department of Metropolitan Services**

Prepared by:

E&A Environmental Consultants, Inc.

In Association With:

**Cascadia Consulting Group
Cunningham Environmental Consultants, Inc.**

March 31, 1995

Project 7240



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Primary Project Findings

This evaluation resulted in the following findings and conclusions:

1. Food waste currently discharged to the sewer system represents about 14 percent of the food waste generated in the Metro service area.
2. Food waste discharged to the sewer system is estimated to currently represent about 15 to 18 percent of the organic loading on Metro treatment process units.
3. Food waste is a relatively clean and highly degradable material. Food waste originated material would be expected to digest rapidly with high methane production and would be readily removed in the treatment process.
4. Reducing the discharge of food waste to the sewer system would have the following effects:
 - minimal impact on the quality of biosolids, although metals contents would be expected to increase somewhat.
 - minimal impact on effluent quality requirements, although the 85% removal criteria may result in a somewhat lower effluent BOD concentration requirement at the West Point Treatment Plant (WPTP).
 - An extension of the time before treatment facility expansion is required.
5. Increasing the discharge of food waste to the sewer system would have the following effects:
 - Earlier expansion of treatment facility capacity. A significant diversion of food would have a major impact on treatment plant loading and capacity requirements. The food processing industry in the West Point service area is a potential source of significant unanticipated organic loading.
 - Some dilution of the metals in biosolids.
 - Increased gas production.
 - Higher organic loading on the West Point facility that could potentially raise the facility BOD concentration above 200 mg/L.
6. Management of food grinder usage was not found to be practiced in the United States as a solid waste management method.
7. Estimated costs for non-sewer management options
 - Onsite: \$94 per wet ton
 - Grocery produce waste to yard debris compost facility: \$66 per wet ton
 - Source separated commercial FW collection and composting: \$90 per wet ton
 - Rendering and Reuse of food processing waste: about \$10 per wet ton
 - Collection and Landfilling: \$135 per wet ton

Summary

The objective of this evaluation is to document the current status of food waste management in the Metro service area and the current impact on wastewater treatment facilities, and to develop and compare alternatives for managing food waste in a more cost effective way. The study included analysis of available data on food waste management. Collection and laboratory testing of food waste samples was also included to determine the effect of food waste on wastewater treatment process unit loading.

Policy and Regulation

The utilities in the Metro service area that are responsible for solid waste management are evaluating strategic options for diverting and recycling a portion of the food waste currently disposed of in the garbage. Active programs include backyard "green cone" disposal for residential generators and collection and composting of produce waste from commercial generators. In addition, the City of Seattle and King County have initiated studies of commercial and residential collection and composting as well as on-site composting at commercial businesses. Washington is in the forefront nationally in evaluating food waste management options. Local wastewater agencies have focused on fats, oils and grease, but have done little else to control the discharge of food waste to the sewer system.

Food Waste Grinder Role in Food Waste Management

The food waste grinder is the key instrument for determining how solid food waste is disposed. Solid food waste cannot be washed down the drain on a regular basis without grinding to prevent clogging. Therefore, without external constraints, garbage costs and the cost and convenience of installing and using a food grinder will be the primary factors determining how much food waste goes down the drain and how much goes to garbage collection or on-site use. At this time no significant effort has been made by involved utilities in the Metro service area to encourage or discourage the use of food waste grinders. Several other major metropolitan areas have required or prohibited the installation of food waste grinders.

Only limited data is available on the occurrence and use of food waste grinders in Metro's service area. A study by Seattle Solid Waste Utility provides information on availability and usage by the commercial sector. Information about residential installations and usage is being developed.

Food Waste Quantities

The estimates of food waste generation by source type within the Metro service areas are presented on Table 1.

Summary Table 1 - Year 2000 Food Waste Generation in the Metro Service Area			
	<i>West Point Wet Tons/yr</i>	<i>East Division Wet Tons/yr</i>	<i>Total Wet Tons/yr</i>
Residential	58,900	37,600	96,500
Food Wholesale/Retail	46,700	21,500	68,200
Food Services	63,400	27,400	90,800
<i>Subtotal</i>	<i>169,000</i>	<i>86,500</i>	<i>255,500</i>
Food Processors	138,000	35,600	173,600
<i>Total</i>	<i>307,000</i>	<i>122,100</i>	<i>429,100</i>

This estimate of food waste generation includes all sources of food waste regardless of the method of management. These estimates are higher than previous estimates developed by solid waste utilities because food waste that is reused or discharged to the sewer system have not been included in the earlier estimates.

Food Waste Discharged to the Sewer System

The quantity of food waste currently being discharged to the sewer system under the current management situation was estimated for this study. These quantities were also projected into the future using the growth rates and procedures from the Metro Wastewater 2020 Plan. The estimates are based on the best available information together with a significant amount of professional judgment by the project team. The estimated sewer system discharges of food waste with no change in food waste management are:

Summary Table 2 - Estimated Food Waste Discharge to the Metro Sewer System (Wet Tons)						
Sector	Year 1990			Year 2000		
	<i>West</i>	<i>East</i>	<i>Total</i>	<i>West</i>	<i>East</i>	<i>Total</i>
Residential	11,400	9,100	20,500	13,100	11,100	24,200
Wholesale/Retail	3,200	1,500	4,700	4,200	1,900	6,100
Food Services	13,500	5,800	16,700	17,100	7,400	24,500
<i>subtotal</i>	<i>28,100</i>	<i>16,400</i>	<i>44,500</i>	<i>34,400</i>	<i>20,400</i>	<i>54,800</i>
Food Processors	4,500	1,200	5,700	4,800	1,200	6,000
<i>Total</i>	<i>32,600</i>	<i>17,600</i>	<i>50,200</i>	<i>39,200</i>	<i>21,600</i>	<i>60,800</i>

These estimates indicate that about 21.5 percent (54,800/255,500) of the food waste generated in the Metro service area in the year 2000 by residences, food services and wholesale / retail businesses would be discharged to the sewer system through grinders. Including the food processing wastes, about 14 percent of the food waste is estimated to be discharged to the sewer system in the year 2000.

Food Waste Impact of Treatment Facility Unit Loading

In addition to reviewing literature estimates of food waste impacts on wastewater treatment facility loadings, a test was conducted to evaluate these effects. Food waste samples collected from volunteers during a two day period and synthesized typical food waste samples were used to model: 1) the effects of travel in the sewer system and 2) how the food waste fractionates to provide loading to the primary clarifiers and secondary aeration basins. Based on these tests the estimated loadings on the critical treatment units under current conditions are given on Table 3. The table shows the treatment facility loading that results from the estimated 1990 food waste generation provided on Table 2 for residential, wholesale/retail and food service generators. Food processors are not included in the Table 3 estimates.

Summary Table 3 - Estimated 1990 Food Waste Loading to Metro Wastewater Treatment Units (Dry Pounds per day)						
	West Point Treatment Plant			East Division Reclamation Plant		
	<i>Primary TS</i>	<i>Primary VS</i>	<i>Secondary BOD</i>	<i>Primary TS</i>	<i>Primary VS</i>	<i>Secondary BOD</i>
Food Waste	22,600	18,700	17,100	13,100	10,600	9,700
Total Load	133,300	110,000	98,800	72,800	59,000	67,000
Percent Food Waste	17%	17%	17%	18%	18%	15%

An important finding is that even though only 14 percent of generated food waste is discharged to the sewer system, it still represents 17 percent of the organic loading on the treatment facility. This indicates that a change in food waste grinder usage has the potential to severely impact the capacity of the existing treatment facilities. Food processing wastes represent a fraction of the food waste stream that is not well understood and has the potential to significantly impact treatment facility capacity, particularly in the West point service area because of the number of food processors in that service area.

Food Waste Impact on Treatment Facility Operations and Cost

Removal of food wastes from the influent stream may result in more stringent treatment requirements at West Point Treatment Plant (WPTP). Approximately 17% of WPTP capacity and 8% of East Division Reclamation Plant (EDRP) capacity was dedicated to treating food wastes in 1990. Operational and maintenance costs for Metro to treat and reuse this waste stream are estimated at \$2.4 million in 1990 and projected to increase to \$3.4 million by 2010. Food waste appears to have minimal impact on the quality of biosolids.

Potential for Food Waste Diversion

Based on a range of alternative control strategies the maximum diversion of food waste to and away from the sewer system have been estimated. These estimates (Table 4) are based on reasonable extremes of anticipated participation by generators. Based on these estimates up to 27,000 and 14,000 tons per year of food waste could be diverted from WPTP and EDRP respectively.

Summary Table 4 - Estimated 1990 Range of Discharge of Food Waste to the Sewer System (Wet Tons)			
<i>Management Strategy</i>	<i>West</i>	<i>East</i>	<i>Total</i>
Current Practice	32,700	17,600	50,300
Maximum to Sewers	75,900	37,300	113,200
Minimum to Sewers	5,800	2,900	8,700

Note that a change in disposal economics could result in much greater food processing waste discharge to the sewer system than indicated on this table.

Alternative Food Waste Management Strategies

The objective of the alternative evaluation is to compare the economic and environmental cost of managing food waste through food grinders and wastewater treatment in comparison to other management methods. To accomplish this, alternatives were compared that consider the impact of major food waste management programs on the distribution of food waste among the primary processing options. The alternative considered include:

1. *Current Practice* - No change from current management of food grinder use.
2. *Source Separation* - Discharge to the sewer is discouraged through formation of a food waste separation, collection and processing system to recycle a major portion of the food waste. Variations considered include (A) collection of only commercial waste and (B) collection of commercial and residential waste. The separated food waste would be processed by either composting or anaerobic digestion.
3. *Minimum Food Waste to Sewers* - Discharge to the sewer system is discouraged and no viable options to landfilling are made available.
4. *Maximum Food Waste to Sewers* - Discharge to the sewer system is encouraged.
5. *Minimum Food Waste to WPTP* - The goal of this alternative is to reduce the loading on the West Point Treatment Plant. A source separation program is

established to recycle food waste by composting or digestion, and the use of food grinders is discouraged.

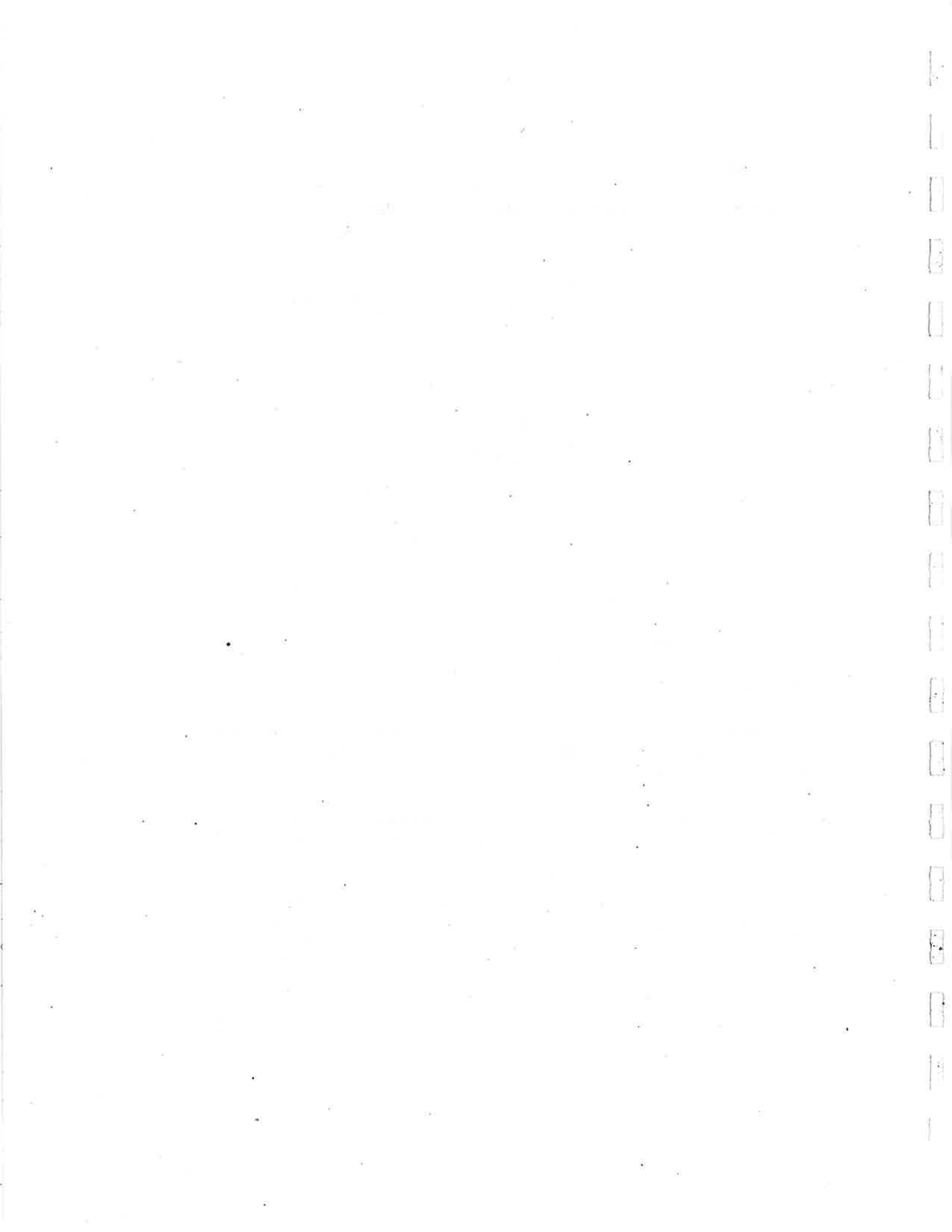
The alternatives were compared considering quantity discharged to the sewer system and potential operational savings. The results are given on the following table.

Summary Table 5 - Alternative Comparison (Year 2000 Conditions)		
	<i>Wet Tons / Yr Food Waste to Sewer</i>	<i>Preliminary Wastewater Treatment Operational Cost (10⁶/yr)</i>
Current	51,800	\$2.8
Source Separation		
Commercial Only		
Composting	44,500	\$2.4
Digestion	44,500	\$2.4
Resid & Commer.		
Composting	36,500	\$2.0
Digestion	36,500	\$2.0
Minimum to Sewer	8,200	\$0.4
Maximum to Sewer System	135,000	\$5.5
Minimum to West Point	24,600	\$1.1

Implementation Recommendations

The intent of this evaluation was to identify potentially viable management methods and additional issues that need to be resolved. Based on the analysis the following implementation recommendations are provided:

1. Consider reducing the discharge of food waste to the West Point service area by implementing education programs. Consider prohibiting the use of food waste grinders within the West Point service area.
2. Investigate the most attractive source separation and processing options in cooperation with the City of Seattle and King County Solid Waste Division.
3. Gather better information of the use of residential food waste grinders.
4. Determine the current disposal practices of food processors and the potential for future wastewater treatment capacity impacts due to changes in practice.
5. Evaluate the effect of current management method fixed costs on the economics of diversion of food wastes to other processing methods.



Section 1

Existing Conditions

1.1 Define Existing Policies and Regulations

The purpose of this section is to describe current activities and anticipated trends regarding food waste disposal within Metro's wastewater treatment service area. A recent study addressing food waste disposal in King County indicates approximately 60 percent of the commercial food waste generated is disposed either in the solid waste stream (landfilled) or through food waste disposals into the liquid waste stream (the remainder is recycled, primarily by renders). Likewise, the majority of residential food waste generated is apparently disposed through the solid waste disposal or wastewater treatment systems. Consequently, the ensuing discussion considers the activities of agencies involved with both solid waste management and wastewater collection and treatment.

At this time, most government agencies have not developed and implemented policies and regulations regarding food waste disposal. However, given the statewide recycling goal of 50 percent by 1998, solid waste agencies are considering alternatives to the landfill disposal of food waste. Prior to this evaluation, agencies responsible for wastewater collection and treatment have not placed much emphasis on the impacts of food waste disposal on wastewater conveyance and treatment systems.

1.1.1 Solid Waste Food Disposal

The City of Seattle and King County both have ambitious goals of reducing the amount of solid waste that is landfilled. Recycling has significantly reduce the amount of solid waste being landfilled. Seattle has a recycling goal of 60 percent by 1998. King County's recycling goal is 65 percent by 2000. In achieving these goals, the City and County have identified food waste as a potential for recycling. Food wastes comprise 12 and 15 percent of the entire solid waste stream in Seattle and King County respectively. In their planning efforts the City and County divide food waste into two categories, residential and commercial. The definition of commercial food waste is broad and essentially includes all food waste that is not from a residential source. The various programs being conducted by Seattle and King County are described as follows.

1.1.1.1 City of Seattle

The Seattle Solid Waste Utility (Utility) currently has several food waste composting programs in the planning stage, as well as a backyard food waste composting program currently being implemented.

Commercial Food Waste Composting

A comprehensive project to examine the feasibility of collecting and composting food waste generated by the commercial sector was recently completed. This project was funded by the Washington State Department of Ecology and was conducted in cooperation with the King County Solid Waste Division. The project included the following main components.

- *Generator Survey* - estimated commercial food waste generation and determined the level of interest and concerns businesses and institutions had regarding the separation of food waste.
- *Collection and Composting Demonstration* - determined technical feasibility of commercial food waste collection and composting, develop facility basis of design information.
- *Product Testing* - examined compost feedstocks and products for a comprehensive suite of product quality and environmental contaminant parameters.
- *Collection and Facility Cost Model* - developed detailed cost estimation models for commercial food waste collection and facility capital, operating and maintenance costs.

The feasibility study results demonstrated that commercial food waste composting was technically feasible. In addition, several of the collection and composting scenarios developed, indicated commercial food waste composting were economically feasible. The Utility is encouraged by these results and is considering internally how a commercial food waste composting facility could be developed. The Utility has essentially ruled out a City owned and operated facility and is internally examining methods for promoting the private development and operation of a commercial food waste composting facility.

Residential Food Waste Composting

The Utility is currently examining the feasibility of providing residential customer curbside collection service of separated food waste. Diverting residential food waste from the disposed waste stream is expected to contribute approximately two percent towards the 60 percent waste reduction and recycling goal. The Utility is conducting a pilot curbside collection study of 900 households during a nine week period lasting from October 24 to December 23, 1994. The projects goals are presented as follows.

- Measure diversion potential of all food waste and food soiled paper versus uncooked vegetative food waste
- Evaluate participants' ability to sort correctly according to these categories
- Assess participants' attitudes towards food waste separation after completing involvement in the collection project

- Collect participant feedback on various types of bags and containers which could be used for future food waste collection pilots and programs
- Identify incentives which may be needed to gain public participation in a curbside food waste collection program.

Food waste setouts will be weighed weekly by the haulers to quantify the amount of food waste disposed by a typical household. A visual assessment of inert contamination levels (plastic, glass and metal refuse) will be conducted. At the conclusion of the pilot, all 900 participants will be contacted by phone to obtain feedback on how difficult it was to separate food waste, problems encountered, and whether they continued to use their food grinders. In addition, the Utility will conduct two focus groups in January involving about 24 participants to obtain more detailed feedback about containers and bags which could be used in future food waste collection pilots and programs, and identify incentives for separating food waste for curbside collection or backyard composting. In a related matter, a random telephone survey of 600 Seattle residents will be conducted at the end of 1994 on practices and attitudes towards yard and food waste disposal.

Backyard Food Waste Composting

This project was undertaken by the Utility to assess the feasibility of backyard composting as an alternative to divert food wastes from being landfilled. In 1994, the Utility distributed "green cones" to 2,000 Seattle residents for backyard food waste composting. The public was introduced to the food waste composters, or green cones, through several workshops conducted throughout the city. A green cone consists of a double-walled cone-shaped section with a lid on top which sits above ground and a laundry basket section that is buried two feet into the ground. At the workshops participants are provided instructions on how to assemble, install and use the green cone, as well as harvest the final product. Trainers also discuss food waste composting as an alternative to using food waste grinders. A telephone survey of green cone users will be conducted in the spring of 1995 to obtain feedback on the ease of using the unit and level of satisfaction.

The backyard food waste composting program is an outgrowth of the residential yard waste composting program, which has been conducted by the city since 1989. In 1992, the Utility conducted a pilot food waste composting project involving 250 volunteer households who were given one of four units to be tested. The participants were asked to weigh all food waste composted in the unit as well as all other food waste generated. The results of the pilot showed that the average household generated about 370 pounds of food waste per year, and that 81% (300 pounds) of the food waste can be composted.

1.1.1.2 King County

The King County Solid Waste Division is currently conducting several planning activities that address food waste composting. These activities are described as follows.

Commercial Food Waste Composting

The King County Solid Waste Division (County) was a co-manager of the commercial food waste composting project described above. The County is currently reviewing the findings from this study and considering the full scale implementation of commercial food waste composting.

The County is also currently conducting a project to examine the feasibility of on-site commercial food waste composting. On-site composting is of interest as it can eliminate food waste collection and hauling costs. Furthermore, an on-site composting system does not require a costly solid waste handling permit. Project results to date indicate there is some interest at the commercial level regarding on-site food waste composting. However, capital and operating costs are of concern. Accordingly, this project will develop capital and operating costs at five locations in order to address economic feasibility. Based on the results of the feasibility study, the County may choose to conduct a pilot scale on-site composting demonstration project.

King County Residential Food Waste Composting

The King County Solid Waste Division (KCSWD) is planning a pilot project to test the effectiveness of food waste composting in the residential sector. The project is currently in the planning stages and the KCSWD has not decided on details of the pilot project. The KCSWD's preference is to evaluate a curbside food waste collection program, but is also considering a backyard program. The KCSWD has sponsored a residential backyard compost bin distribution program for the last five years to divert yard waste from the disposed waste stream. Participants have been instructed to not add food waste to the yard waste composters which are not rodent-proof. The food waste pilot is seen as the next step towards further diversion. Food waste generated by the residential sector of King County has been estimated to comprise six percent of the total disposed solid waste stream.

1.1.1.3 Other Activities

Several other activities related to food waste composting are occurring within Metro's service area. These activities are described as follows.

Organic Grocery Debris Composting

Three composting facilities within Metro's service area are permitted by the King County - Seattle Health Department to compost pre-consumer, vegetative food wastes. These composting services are primarily provided for use by grocery stores. In addition to food waste, other compostable, non-recyclable materials generated by grocery stores, such as wax coated cardboard, soiled paper and wooden vegetable crates are also being composted.

Use of these services is becoming more common as participating grocery stores are saving approximately 25 percent on their refuse disposal costs. Some food processors, wholesale