BEFORE THE COUNCIL OF THE
METROPOLITAN SERVICE DISTRICT

FOR THE PURPOSE OF AUTHORIZING ENTRY INTO MEMORANDUM OF UNDERSTANDING NEGOTIATIONS WITH CONTRACTOR OF MASS COMPOSTING AND LIMITED NEGOTIATIONS WITH CONTRACTORS OF MASS INCINERATION AND REFUSE DERIVED FUEL	)	RESOLUTION NO. 87-780 Introduced by the Executive Officer

WHEREAS, The Metropolitan Service District has evaluated five proposals received January 30, 1987, as a result of issuing two Request for Proposals for mass composting, mass incineration and refuse-derived fuel technology systems in November 1986; and

WHEREAS, The Council of the Metropolitan Service District has committed, through Ordinance No. 86-201, to negotiate with selected firm(s) for the procurement of a resource recovery system if Council adopted criteria are met; and

WHEREAS, The evaluation criteria have been met, as evidenced in the attached Resource Recovery Project FINAL EVALUATION REPORT; and

WHEREAS, Riedel/DANO, Schnitzer/Ogden and Fluor/SEI have been recommended by the Resource Recovery Review Committee and the Executive Officer for further consideration; now, therefore,

BE IT RESOLVED,

1. That Metro will proceed to negotiate a Memorandum of Understanding with Riedel/DANO for a mass composting facility capable of processing 160,000 tons per year of solid waste, and also capable of functioning as a transfer station, to be located at N.E. Columbia Boulevard in Portland, Oregon.

2. That Metro will proceed with limited negotiations with Schnitzer/Ogden, Fluor/SEI and Combustion Engineering and staff shall report back to the Council within 60 days with a recommendation on whether to proceed with a memorandum of Understanding.

3. That entering Memorandum of Understanding negotiations indicates Metro's interest in proceeding with procurement of a resource recovery facility or facilities. At the same time, Metro staff is requested to continue to define and refine the projected costs of regional solid waste disposal systems which both exclude and include resource recovery facilities. Staff is also requested to obtain the most reliable information possible on the costs of contracting for Eastern Oregon landfill disposal. The ultimate decision to complete resource recovery procurement will depand on Metro negotiating the lowest cost possible.

ADOPTED by the Council of the Metropolitan Service District this 30th day of June, 1987.

Richard Waker

Richard Waker, Presiding Officer

AMN
7738C/506-2
07/01/87

7801C

BEFORE THE COUNCIL OF THE
METROPOLITAN SERVICE DISTRICT

FOR THE PURPOSE OF AUTHORIZING ENTRY INTO MEMORANDUM OF UNDERSTANDING NEGOTIATIONS WITH ~~SYSTEMS~~ CONTRACTOR~~S~~ OF MASS COMPOSTING AND ~~MASS INCINERATION SYSTEMS~~ limited negotions with contracts of mass incineration and ~~cums~~ RDF burning refuse derived fuel.	)	RESOLUTION NO. 87-780 Introduced by the Executive Officer

WHEREAS, The Metropolitan Service District has evaluated five proposals received January 30, 1987, as a result of issuing two Request for Proposals for mass composting, mass incineration and refuse-derived fuel technology systems in November 1986; and

WHEREAS, This Council of the Metropolitan Service District has committed, through Ordinance No. 86-201, to negotiate with selected firm(s) for the procurement of a resource recovery system if Council adopted criteria are met; and

WHEREAS, The evaluation criteria have been met, as evidenced in the attached Resource Recovery Project FINAL EVALUATION REPORT; and

WHEREAS, Riedel/DANO, Schnitzer/Ogden and Fluor/SEI have been recommended by the Resource Recovery Review Committee and the Executive Officer for further consideration; now, therefore,

BE IT RESOLVED,

1. That Metro will proceed to negotiate a Memorandum of Understanding with Riedel/DANO for a mass composting facility capable of processing 160,000 tons per year of solid waste, and also capable of functioning as a transfer station, to be located at N.E. Columbia Boulevard in Portland, Oregon.

insert #1

2. That Metro will proceed to negotiate a Memorandum of Understanding with Schnitzer/Ogden, as well as with Fluor/SEI for a mass incineration facility capable of processing 350,000 tons per year of solid waste to be located in St. Helens, Oregon.

3. That simultaneous negotiations with Schnitzer/Ogden and Fluor/SEI are intended to yield only one fully executed Memorandum of Understanding between the two.

See insert #2

ADOPTED by the Council of the Metropolitan Service District this ______ day of __________, 1987.

____
Richard Waker, Presiding Officer

AMN/sm
7738C/506
06/29/87

STAFF REPORT

Agenda Item No. 1
Meeting Date June 30, 1987

CONSIDERATION OF A RESOLUTION TO AUTHORIZE ENTRY INTO MEMORANDUM OF UNDERSTANDING NEGOTIATIONS WITH SYSTEMS CONTRACTORS OF MASS COMPOSTING AND MASS INCINERATION SYSTEMS

Date: June 26, 1987 Presented by: Debbie G. Allmeyer

Factual Background and Analysis

Metro received five proposals on January 30, 1987 from systems contractors of mass composting, mass incineration, and refuse derived fuel facilities. The staff project team, as well as the Executive Officer's Review Committee evaluated the proposals, including interviews with each proposer and two sets of questions designed to clarify the written submittals. Previously adopted evaluation criteria were used to assess and compare the merits of the proposals.

The project team prepared a Final Evaluation Report for the Executive Officer which was presented to the Council on June 25, 1987. This report explains the findings of the project team and their evaluation, and transmits the final recommendations of both the Review Committee and the Executive Officer. The recommedation is to proceed with the procurement of a resource recovery system that will include both a mass composting and mass incineration operation.

The mass composting facility is to function as a transfer station, and be capable of processing 160,000 TPY of waste. The facility is to be located on N.E. Columbia Boulevard in Portland.

It is recommended that Metro staff proceed with preliminary negotiations, called Memorandum of Understanding negotiations, with Riedel Environmental Technologies (RET). At the conclusion of these negotiations, staff will report the results to the Council, as well as a recommendation as to whether to proceed into final contract negotiations for a long-term service contract with RET.

The mass incineration facility is to process 350,000 TPY of waste and to be located in St. Helens, Oregon. Simultaneous preliminary negotiations are recommended with Schnitzer/Ogden and Fluor/SEI. At the conclusion of the negotiations, staff will report the results to the Council with a recommendation as to whether to proceed into final contract negotiations for a long-term service contract, and with which of the two firms.

A Resolution is before you to authorize the initiation of these preliminary negotiations.

EXECUTIVE OFFICER RECOMMENDATION

The Executive Officer recommends the Council adopt Resolution No. 87-780.

METRO RESOURCE RECOVERY PROJECT

FINAL EVALUATION REPORT

Prepared By:

METRO
Portland, Oregon

With Assistance From:

Gershman, Brickner, & Bratton, Inc.
Falls Church, Virginia

McEwen, Gisvold, Rankin & Stewart
Portland, Oregon

Government Finance Associates, Inc.
Portland, Oregon

Stoel, Rives, Boley, Jones & Grey
Portland, Oregon

Salomon Brothers, Inc.
New York, New York

Shearson, Lehman Brothers, Inc.
New York, New York

Alex Brown & Sons, Inc.
Baltimore, Maryland

June 19, 1987

METRO RESOURCE RECOVERY PROJECT
FINAL EVALUATION REPORT

TABLE OF CONTENTS

I. Recommendations of the Review Committee

June 16, 1987

To: Rena Cusma, Executive Officer

From: Resource Recovery Review Committee

Subject: Recommendation to Engage in MOU Negotiations for Resource Recovery Projects

The committee has completed its evaluation of available information on the resource recovery technologies and specific project proposals under consideration by Metro. We have concluded that both incineration and composting are technically and economically feasible resource recovery and waste reduction alternatives. It is our unanimous recommendation that Metro pursue MOU negotiations to implement a resource recovery system consisting of: 1) a combined transfer station and composting operation located on NE Columbia Boulevard, and 2) a mass incineration facility located on a site at the Port of St. Helens. We further recommend selection of Riedel Environmental Technologies, Schnitzer/Ogden Martin Systems and Fluor/Southern Electric International to participate in these negotiations subject to the considerations and conditions outlined below.

Riedel

- Size the facility to optimize the equipment and technology offered in the proposal at 160,000 TPY. Continue to require that the facility be fully enclosed.
- Design and operate the facility to serve as a transfer station for the region. Ensure Metro's right to secure the facility for continued use as a transfer station should composting operations cease.
- Fund the project through private sources to minimize Metro financial risk.
- Assure favorable terms for potential future expansion of operations at the primary facility, the incineration facility or the transfer stations.
- Require comprehensive product quality testing and assurance program.

Schnitzer/Ogden Martin and Fluor/SEI

- o Size the facility to provide 350,000 TPY capacity to Metro; modify project scope as required to accommodate Columbia County waste.

- o Assure favorable terms for potential future co-composting at the facility.

- o Maximize material recovery and recycling.

All Proposers

- o Develop neighborhood protection plans which minimize impact and include transportation and traffic aspects.

- o Ensure that tax advantages of the projects are shared with Metro.

- o Maximize local labor content and compliance with applicable labor laws.

- o Clarify and obtain the most advantageous possible parent company guarantees.

The Review Committee has reached these conclusions and recommendations after evaluation of the vendor proposal documents, the results of vendor interviews and responses to questions, testimony received at public hearings, background information provided by staff and consultants and the Final Evaluation Report. We believe we have respected the intent of the Council's evaluation criteria for economic impact, technical feasibility and response to hierarchy.

Incineration has been demonstrated to be a viable technology at a number of locations in the U.S. including Marion County. While there is concern about the environmental impact of air emissions, control technology is considered sound. Siting of the incinerator at the Port of St. Helens would further minimize the impact of operations on non-attainment areas. Although the cost of transporting waste to St. Helens is unquestionably greater than to other proposed sites, the committee feels that these costs are acceptable given the probable costs, including delays, purchase of offsets, and loss of economically productive land, of siting elsewhere. There appears to be broad public support of the project in Columbia County and it is consistent with development goals there.

The committee favors mass incineration over refuse derived fuel primarily on the basis of technical feasibility and risk. Economic analyses performed to date are incomplete and show no clear cost advantage to any single incineration proposal or technology. While we are impressed with the reported potential of an RDF plant for increased material recovery and reduced air emissions, the project as proposed does not demonstrate these features and in fact would generate the largest amount of residue for landfill. RDF technology is the least proven, most complex of the incineration options. Lower flexibility and reliability would be expected due to the single boiler design.

Composting ranks high on the hierarchy, would have relatively low environmental impact and the Riedel proposal is very attractive on a cost basis. Although there is a little domestic experience to support the viability of the technology, low capital costs of the project and the opportunity to combine transfer station operations make the risk to Metro minimal when compared to other options.

This recommendation is not meant to imply that project cost limitations imposed in the Council-established criteria should be ignored. The preliminary system cost data prepared by Metro staff show all proposed projects to be within 10% of the resource recovery system cost goal when averaged over the life of the system. Given the uncertainty of the cost data at this time, we feel that it should be possible to meet cost criteria.

II. Evaluation Process and Criteria

EVALUATION PROCESS

The evaluation of proposals submitted to Metro on January 30, 1987, involved review of proposals and interviews with each firm, by a Review Committee. The Review Committee (RC) has been appointed by the Executive Officer.

All firms which submitted a proposal by January 30, 1987 were interviewed during the period from March 31, 1987 to April 2, 1987. In the interview, the RC sought clarification to any outstanding questions related to the proposal. Information was solicited to clarify or complete a Proposal, but no negotiations occurred during the interviews.

The RC incorporated its findings from the interview into its evaluation forms. Metro and Metro advisors prepared matrices depicting information from the proposals to assist the RC in the evaluation process most of which are included in this report.

Combinations of top rated proposals are being evaluated in order to select the best potential resource recovery "system." This "system" may be composed of one or more facilities, using one or more technologies.

The RC will make recommendations to the Council of the top rated Proposer(s) with whom to negotiate a Memorandum(a) of Understanding (MOU). These preliminary negotiations precede contract negotiations for the long-term service contracts.

EVALUATION CATEGORIES

The evaluation centers around three categories of concern: (1) economic impact, (2) technical feasibility, and (3) responsiveness to the priority given different techniques for waste disposal (the "hierarchy") in Oregon Revised Statutes 459.015(2).

RATING SYSTEM

Each category includes criteria and subscriteria to be rated for thorough evaluation of the category. All criteria and subscriteria are weighted. An overall rating for each firm in each category was established through evaluation of these criteria. Firms were then compared on the basis of overall ratings in each of the three categories.

The ratings are Superior ("S"), Acceptable ("A"), Poor ("P"), and Unacceptable ("U"). A rating of "U" in any category was considered cause for elimination.

WEIGHTING SYSTEM

Asterisks are used to indicate greater or lesser weight given to each criterion within each category. Four asterisks is not intended to indicate that a criterion is four times as important as a criterion with only one asterisk, but rather to convey that it is more important. An example from everyday life that illustrates similar use of such symbols is the critical review of movies symbolized by stars. A movie with four stars is considered a better film than a two-star film, but not necessarily two times as good.

The criteria within each category are as follows:

I. Economic Impact

Cost Proposal	***
Performance Guarantees	***
Contract Proposal	***
Financing Plan	**

II. Technical Feasibility

Technical Proposal	**
Management Proposal	*

III. Hierarchy

Material Recovery	****
Compost	***
RDF/Mass Burn Replacing Conventional Fuel	**
RDF/Mass Burn Yielding Electricity	*

a. A rating of "S" (Superior), "A" (Acceptable), "P" (Poor) or "U" (Unacceptable) was given to each subcriterion.

b. Underlined subcriteria are more important than those not underlined, and were given more emphasis.

c. An overall rating of "S," "A," "P," or "U" was determined for each criterion from ratings given subcriteria.

d. An overall rating of "S," "A," "P," or "U" was given to each category, determined from the ratings given to the criteria.

EVALUATION CRITERIA FOR CATEGORY "ECONOMIC IMPACT"

	S	A	P	U

I. Evaluation of the Cost Proposal

Evaluation of the Cost Proposal on the basis of:

A. Competitiveness of Service Fees relative to other Proposals on a life-cycle cost, and a net present value basis;

B. Impact on total disposal system cost;

C. Revenue-sharing approach between Metro and the Proposer;.

D. Reasonableness of capital and operating cost estimates;

E. Willingness to participate in the financing plan;

F. Proposer's desired return for involvement in the Project, including return on equity; and

G. Demonstrated recognition of potential cost issues with respect to environmental and permitting matters and Facility performance.

II. Evaluation of Performance Guarantees

Evaluation of Performance Guarantees on the basis of:

A. Guarantees offered to Metro;

B. Perceived ability to perform to guarantees offered and respond to the risks assumed by the Proposer;

C. Fiscal capability and financial strength of the Proposer to back offered guarantees and other commitments;

EVALUATION CRITERIA FOR CATEGORY "ECONOMIC IMPACT" (Continued)

	S	A	P	U

D. Competitiveness of offered guarantees relative to the other Recovered Materials Market(s), Proposals;

E. Identified markets for the Energy or Compost;

F. Perceived Viability of Markets;

G. Residue generation and landfill consumption guarantees;

H. Thermal efficiency, electricity, steam and/or RDF production;

I. Recovered Materials Production; and

J. Compost Production.

III. Evaluation of Contract Proposal

Evaluation of the Contract Proposal on the basis of:

A. Exception to risk allocation items shown in Section 4.9; and

B. Financial ability to respond to the risks assumed by the Proposer.

IV. Evaluation of Financing Plan

Evaluation of the Financing Plan on the basis of:

A. The financeability of the project with Metro issued bonds;

B. The financeability of the project with alternative financing (non-Metro bonds;

C. The Contractor's investment banker's acceptance of the relationship to be established with Metro's designated investment banker; and

D. Adequacy of equity contribution.

EVALUATION CRITERIA FOR CATEGORY "TECHNICAL FEASIBILITY"

	S	A	P	U

I. Evaluation of Technical Proposal

Evaluation of the Technical Proposal on the basis of:

A. Site Feasibility;

B. Compliance with, or exceeding all environmental regulations;

C. Process residue: quantity and quality;

D. Overall soundness of the Facility design and integration of separate elements of the Facility (e.g., Residue removal, and Recovered Materials handling);

E. Technical feasibility of equipment and unit processes;

F. Soundness of operations and maintenance plans including feasibility of the system with regard to fluctuations of quantity and composition in the Acceptance Waste stream and contingency capabilities of the system;

G. Reliability/availability of system;

H. Ability to produce Recovered Material and steam, electricity and/or RDF (as applicable) for sale to the appropriate market(s); and

I. Aesthetics of architectural design and Facility Site plan configuration.

Assessment of the requested information on the reference plant relative to:

J. Degree of technical demonstration of the reference facility as compared to the proposed Facility, and Technical feasibility of the Proposal, based on the Proposer's experience with a similar operating system.

	S	A	P	U
II. Evaluation of Management Proposal				
Evaluation of the Management Proposal on the basis of:				
A. Techniques and controls for Project management (i.e., reporting procedures, audits, payment and monitoring responsibilities;				
B. Maintenance philosophy and policies;				
C. Reasonableness of construction schedule and payments;				
D. Safety policies;				
E. Soundness of shakedown and acceptance testing procedures;				
F. Proposed working/operational relationship and procedures with: 1) Metro, 2) the Recovered Materials Markets, and 3) the Energy Market(s);				
G. Parent company and subcontractor staff support;				
H. Willingness to meet the development and implementation schedule; and				
I. Willingness to consider innovative techniques to increase efficiency and maximize Recovered Materials and Energy Production to decrease disposal costs.				

EVALUATION CRITERIA FOR CATEGORY "HIERARCHY"

The hierarchy in ORS 459.015(2) stipulates the order of waste disposal to be reduce, reuse, recycle, recover and landfill so long as each method is economically and technically feasible. This applies to resource recovery technologies as well.

Metro Council has interpreted the statute such that compost is a means of recycling, with preference over incineration technologies as a method to dispose of material that cannot be source separated for recycling, nor recovered through material recovery systems. The technological preference then, is (1) Compost, and (2) Incineration.

Further, where incineration yields steam, thereby replacing a conventional fuel, greater preference is shown over a technique that yields electricity. Incineration to yield electrical power is the least attractive due to the overabundant, local power supply.

Material recovery is categorized as a means of recycling, and proposals incorporating front and/or backend material recovery were given credit for so doing.

TECHNOLOGY

Material Recovery	****
Compost	***
RDF/Mass Burn replacing conventional fuel	**
RDF/Mass Burn yielding electrical power	*

1. Each proposal was reviewed to ascertain percent of waste disposed through any of these technologies. Percent of total throughput, as well as actual tonnage, was noted.

2. Proposals were rated according to quantity of waste, and percent of total throughput managed by technologies high on the hierarchy.

	S	A	P	U
How much material will be processed via Material Recovery?				
Compost?				
RDF/Mass Burn replacing conventional fuels?				
RDF/Mass Burn yielding electricity?				

III. Project Time Schedule

RESOURCE RECOVERY PROJECT TIME SCHEDULE

PROPOSAL EVALUATION
MEMORANDUM OF UNDERSTANDING (MOU) NEGOTIATIONS
FINAL CONTRACT NEGOTIATIONS

April 1987

4-13 Review Committee (RC) tour of Marion County mass incineration facility. 7:45 AM-12 Noon.

4-15 RC evaluation criteria worksession, based on Preliminary Evaluation Report (PER). 11:30-1:30.
*Council Solid Waste Committee (CSWC) invited.

4-16 *RC/CSWC worksession on evaluation criteria, 6:30-8:p.m.

4-17 Proposer answers to "second round of questions" due.

4/20-24 Project team analysis of answers to "second round of questions", preparatory to production of Final Evaluation Report (FER).

4/27-5/5 GBB finalizes FER, including mass compost proposal analysis done by Klaus Feindler of Beaumont Environmental.

4-29 RC public hearing, 7:00-9:00 p.m., in North Portland.
*CSWC invited.

May 1987

5-4 RC public hearing, 7:00-9:00 p.m., in Clackamas County.
*CSWC invited.

5-12 RC meeting to discuss FER, 11:30 am - 1:30 pm.
*CSWC invited.

*Report on FER at meeting of CSWC.

RC public hearing, 7:00-9:00 p.m., in Northeast Portland. *CSWC invited.

5/13-20 Questions of RC and CSWC on FER addressed by staff.

----

*Council Solid Waste Committee invited to attend.

5-14	RC meeting to discuss FER. 12 noon-5:00 pm. *CSWC invited.
5-19	*RC and CSWC invited to presentation by Klaus Feindler of Beaumont Environmental, on viability of mass composting. 4:00 - 5:30 PM, in room #330.
	*Environmental forum on Mass Composting, Hosford Middle School, 2303 SE 28th Place, RC and CSWC invited. 7:00-9:00 pm.
5-20	*RC meeting to finalize review and make preliminary decision, Room 240 from 11:30 to 1:30 . CSWC invited.
	*RC and CSWC invited to public hearing conducted in St. Helens by Columbia County, 6:30 - 10:00 p.m., meet at Metro.
5-25	Draft report due for June 11 Council meeting agenda.
6-1	Final report due for June 11 Council meeting.
6-3	Staff briefing to Executive Officer, 9:00 am. Room 240.
6-4	*Staff briefing to CSWC on FER.
6-4	RC meeting to review system cost data, and "site-free" cost analysis, 4:30 p.m. to 7:00 p.m., Room 330.
6-8	Draft report due for June 25 Council meeting agenda.
6-11	*Council meeting. Staff report on FER.
6/12-15	System cost analysis conducted by Metro.
6-15	Final report due for June 25 Council meeting.
6-16	*RC meeting to review system cost and FER changes; then form recommendations, 11:30 to 1:30, Room 240.
6-23	Special work session for the Council and staff on the Resource Recovery Final Evaluation Report, 3:00 to 7:00 pm in the Council Chambers.
6-25	*Public hearing before the Council. Staff report on System Cost Analysis. Delivery of Review Committee recommendations.
6-30	*Special Council meeting. Authorization requested to begin MOU negotiations.
7-1	Proposers informed of Council decision.

July to September, 1987 will be occupied by MOU negotiations

9-8	Draft report due for Sept. 24 Council meeting agenda.
9-14	Final report due for Sept. 24 Council meeting.
9-24	*Council meeting. Ordinance to proceed to contract negotiations for Resource Recovery Facility(ies).
Oct.-Jan.1988	Negotiation of service agreement(s) Facility(ies) site(s) permitted.
March, 1988	Financing complete, subject to siting of project.

MOU = memorandum of understanding
RC = Resource Recovery Review Committee
CSWC = Council Solid Waste Committee
FER = Final Evaluation Report

Debbie Gorham Allmeyer 6/18/87

IV. Evaluation Summary

A. Summary of Overall Evaluation

SUMMARY OF RESOURCE RECOVERY PROJECT EVALUATION RESULTS

All five proposals are rated according to "S", "A", "P", or "U" in the Evaluation Criteria Form in the Final Evaluation Report. A comment column is provided on this form to describe why a proposal received anything other than an "A", or Acceptable rating. Underlined sub-criteria were weighted more heavily than those not underlined, as they were deemed more critical criteria.

"S" = Superior
"A" = Acceptable
"P" = Poor
"U" = Unacceptable

PROPOSERS

C-E = Combustion - Engineering
Fluor = Fluor/SEI
Reuter = Reuter-Buhler/Miag
Riedel = Riedel/DANO
S/O = Schnitzer/Ogden

ECONOMIC IMPACT CATEGORY

C-E:	2 Superior, 2 weighted 19 Acceptable, 5 weighted
Fluor:	2 Superior 14 Acceptable, 4 weighted 4 Poor, 3 weighted 1 Unacceptable
S/O:	1 Superior 20 Acceptable, 7 weighted
Riedel	2 Superior, 1 weighted 11 Acceptable, 4 weighted 3 Poor, 1 weighted 2 Unacceptable, 1 weighted
Reuter	0 Superior 7 Acceptable, 2 weighted 3 Poor, 1 weighted 7 Unacceptable, 3 weighted

Reuter was eliminated due to overall "Unacceptable" rating in Economic Impact category.

TECHNICAL FEASIBILITY

C-E	1 Superior, 1 weighted 17 Acceptable, 4 weighted 1 Poor
Fluor	3 Superior, 1 weighted 16 Acceptable, 2 weighted
S/O	3 Superior, 1 weighted 16 Acceptable, 4 weighted
Riedel	17 Acceptable, 5 weighted 2 Poor

RESPONSIVENESS TO STATE HIERARCHY

Riedel	Superior
C-E	Acceptable
Fluor	Acceptable
S/O	Poor

OVERALL RANKING

Top ranked=C-E and Schnitzer/Ogden

Second ranked=Fluor/SEI and Riedel/DANO

Debbie Gorham Allmeyer 6-11-87

FINAL EVALUATION
Criteria Categories

Firms	Economic Impact	Technical Feasibility	Responsiveness To State Hierarchy	Overall Rating	Final Ranking
Combustion Engineering	S A P U	S A P U	S A P U	S A P U	1 2 3 4 5
Fluor Engineering	S A P U	S A P U	S A P U	S A P U	1 2 3 4 5
Schnitzer-Ogden	S A P U	S A P U	S A P U	S A P U	1 2 3 4 5
Reuter	S A P U	~~S A P U~~	~~S A P U~~	~~S A P U~~	~~1 2 3 4 5~~
Rejdel Environ. Technology	S A P U	S A P U	S A P U	S A P U	1 2 3 4 5

Ratings: Superior (S), Acceptable (A), Poor (P), Unacceptable (U)

Rankings: 1 2 3 4 5
Highest ________ Lowest

PREFERRED RESOURCE RECOVERY SYSTEM: ________________________________

Dg Altmeyer 6-11-87

B. Evaluation Form Results

EVALUATION FOR "ECONOMIC IMPACT"
Evaluation Weighting System
(Asterisks on criteria headings indicate degree of emphasis; Underlining of sub-criteria indicates greater emphasis.)

	Superior	Acceptable	Poor	Unacceptable	Comments
I. Evaluation of the Cost Proposal***					
Evaluation of the Cost Proposal on the basis of:					
A. <u>Competitiveness of Service Fees relative to other Proposals on a life-cycle cost, and a net present value basis;</u>	Og,Rd	CE	F	Ru	Rd's costs are the lowest. Og's costs are marginally lower than the costs of the other two RFP #1 proposals. RU's costs are significantly greater than those of the others.
B. <u>Impact on total disposal system cost;</u>	Rd	CE,F,Og	--	--	The Riedel proposal would result in a system cost which is less than that of a system without resource recovery facilities.
C. <u>Revenue-sharing approach between Metro and the Proposer;</u>	CE	F,Og,Rd	--	Ru	CE offers 100% to Metro. Ru offers 0% to Metro.
D. Reasonableness of capital and operating cost estimates;	--	CE,F,Og,Rd	--	Ru	Ru did not fill in required forms.
E. Willingness to participate in the financing plan;	--	CE,F,Og,Rd	--	Ru	Ru clarified in the interview that they would prefer not to participate in Metro's financing plan.
F. Proposer's desired return for involvement in the Project, including return on equity; and	--	CE,Og,Rd	F	Ru	Fluor appears to demand high returns, Reuter demands excessive returns. F and Ru's equity contributions are not worthwhile to allow private ownership. Because of CE's willingness to negotiate additional sharing of the tax benefits, CE is marginally better than Ogden.

Legend:
CE = Combustion Engineering
F = Fluor Engineers/Southern Company
Og = Schnitzer/Ogden Martin
Rd = Riedel/Dano
Ru = Reuter/Buhler-Miag

EVALUATION FOR "ECONOMIC IMPACT" (Continued)

	Superior	Acceptable	Poor	Unacceptable	Comments
G. Demonstrated recognition of potential cost issues with respect to environmental and permitting matters and Facility performance.	--	CE,Og,F		--	Riedel and Reuter are weaker in addressing the marketing of compost and the environmental problems associated with contaminants.
II. Evaluation of Performance Guarantees***					
Evaluation of Performance Guarantees on the basis of:					
A. Guarantees offered to Metro;	--	CE,F,Og,Rd,Ru			
B. Perceived ability to perform to guarantees offered and respond to the risks assumed by the Proposer;	--	CE,F,Og	Rd,Ru		Riedel and Reuter's ability to meet guarantees is suspect because of a lack of an exhaustive marketing plan and possible environmental contaminants. CE's operating experience is limited.
C. Fiscal capability and financial strength of the Proposer to back offered guarantees and other commitments;	--	CE,F,Og	--	Rd,Ru	Riedel and Reuter are financially weak firms in relationship to the project requirements.
D. Competitiveness of offered guarantees relative to the other Recovered Materials Market(s), Proposals;	Og,F	CE		--	Ogden guaranteed to never landfill metals; Fluor offered the Shaneway system; for Rd and Ru see II.B.

Legend:
CE = Combustion Engineering
F = Fluor Engineers/Southern Company
Og = Schnitzer/Ogden Martin
Rd = Riedel/Dano
Ru = Reuter/Buhler-Miag

EVALUATION FOR "ECONOMIC IMPACT"
(Continued)

	Superior	Acceptable	Poor	Unacceptable	Comments
II. Evaluation of Performance Guarantees (Cont'd)					
E. Identified markets for the Energy or Compost;	F,Rd,Ri	CE,Og	--	--	Fluor had two markets for energy; Riedel guaranteed never to landfill compost; Reuter will market all compost and RDF.
F. Perceived Viability of Markets;	--	CE,F,Og	Rd,Ru	--	Fluor does not have a long-term contract with Boise Cascade and a short-term agreement is not compatible with a long-term contract with PGE and therefore Fluor probably will go all electric. Riedel and Reuter have taken a different approach to marketing of compost, but neither firm guarantees that a market will truly develop and Metro needs market guarantees for acceptable rating.
G. Residue generation and landfill consumption guarantees;	--	CE,F,Og,Rd,Ru	--	--	
H. Thermal efficiency, electricity, steam and/or RDF production;	--	CE,F,Og	--	--	
I. Recovered Materials Production; and	--	CE,F,Og,Rd,Ru	--	--	
J. Compost Production.	--	Rd,Ru	--	--	

Legend: CE = Combustion Engineering
F = Fluor Engineers/Southern Company
Og = Schnitzer/Ogden Martin
Rd = Riedel/Dano
Ru = Reuter/Buhler-Miag

EVALUATION FOR "ECONOMIC IMPACT"
(Continued)

	Superior	Acceptable	Poor	Unacceptable	Comments
III. Evaluation of Contract Proposal***					
Evaluation of the Contract Proposal on the basis of:					
A. Exception to risk allocation items shown in Section 4.9; and	--	CE,Og,Rd,Ru	F	--	Although Reuter appeared to accept Metro's position in Form N, subsequent discussion and Reuter's response to the second round of questions, that is not true in all cases. CE was the only firm that quoted a price to accept 100% of Metro's risk position. Fluor appears to be unwilling to negotiate accepting any risk other than contractor fault.
B. Financial ability to respond to the risks assumed by the Proposer.	--	Ce,F,Og	Rd,Ru		Riedel and Reuter have very limited financial resources.

Legend:
CE = Combustion Engineering
F = Fluor Engineers/Southern Company
Og = Schnitzer/Ogden Martin
Rd = Riedel/Dano
Ru = Reuter/Buhler-Miag

EVALUATION FOR "ECONOMIC IMPACT"
(Continued)

	Superior	Acceptable	Poor	Unacceptable	Comments
IV. Evaluation of Financing Plan**					
Evaluation of the Financing Plan on the basis of:					
A. <u>The financeability of the project with Metro issued bonds;</u>	--	CE,Og	F	Rd,Ru	Bond ratings expected for the financing: CE (A); F (BBB); Og (BBB). The higher the rating, the lower the interest rate on the bonds. An A rating is higher than a BBB rating. Riedel and Reuter unfinanceable with Metro financing plan due to lack of credit in bond markets.
B. The financeability of the project with alternative financing (non-Metro bonds);	--	CE,F,Og,Rd,Ru	--	--	Riedel and Reuter financeable with private financing from banks or other sources, but will be more expensive.
C. The Contractor's investment banker's acceptance of the relationship to be established with Metro's designated investment banker; and	--	CE,F,Og,Rd,Ru	--	--	Reuter did not accept Metro's position; Riedel did but it does not matter (See IV.A)
D. Adequacy of equity contribution	--	CE,Og,Rd,Ru	--	F	CE, Ogden and Riedel did not offer equity commensurate with tax benefits, Fluor expects a cash return as large as debt service on the same equity contribution. CE has indicated a willingness to negotiate the sharing of the value of tax benefits.

<u>Legend</u>:
CE = Combustion Engineering
F = Fluor Engineers/Southern Company
Og = Schnitzer/Ogden Martin
Rd = Riedel/Dano
Ru = Reuter/Buhler-Miag

EVALUATION FOR "TECHNICAL FEASIBILITY"

	Superior	Acceptable	Poor	Unacceptable	Comments
I. Evaluation of Technical Proposal**					
Evaluation of the Technical Proposal on the basis of:					
A. Site Feasibility;	F	CE,Og,Rd,Ru	--	--	Letters from involved municipal government supplied by Fluor.
B. Compliance with, or exceeding all environmental regulations;	F	CE,Og,Rd,Ru	--	--	Site for Fluor is an attainment area and is not adjacent to non-attainment areas.
C. Process residue: quantity and quality;	--	CE,F,Og,Rd,Ru			
D. Overall soundness of the Facility design and integration of separate elements of the Facility (e.g., Residue removal, and Recovered Materials handling);	--	CE,F,Og,Rd,Ru	--	--	Fluor's design of tipping floor seems inadequate for transfer vehicles. Riedel and Reuter may not have sufficient storage for expected seasonal variation in market demand for compost.
E. Technical feasibility of equipment and unit processes;	--	CE,F,Og,Ru	Rd	--	Riedel's process may have difficulty removing non-compostibles from the Dano tube.
F. Soundness of operations and maintenance plans including feasibility of the system with regard to fluctuations of quantity and composition in the Acceptance Waste stream and contingency capabilities of the system;	--	CE,F,Og,Rd,Ru	--	--	CE's plan is weak due to single boiler design.
G. Reliability/availability of system;	--	F,Og,Rd,Ru	CE	--	CE proposes a single boiler design which varied from Metro's requirement.

Legend:
CE = Combustion Engineering
F = Fluor Engineers/Southern Company
Og = Schnitzer/Ogden Martin
Rd = Riedel/Dano
Ru = Reuter/Buhler-Miag

EVALUATION FOR "TECHNICAL FEASIBILITY"
(Continued)

	Superior	Acceptable	Poor	Unacceptable	Comments
I. Evaluation of Technical Proposal (Cont'd)					
H. Ability to produce Recovered Material and steam, electricity and/or RDF (as applicable) for sale to the appropriate markets.	--	CE,F,Og,Rd	Ru	--	Reuter mass balances did not appear to be correct and did not seem to account for fermentation and evaporative losses.
I. Aesthetics of architectural design and Facility Site plan configuration.	--	CE,F,Og,Rd,Ru			
Assessment of the requested information on the reference plant relative to:					
J. Degree of technical demonstration of the reference facility as compared to the proposed Facility, and Technical feasibility of the Proposal, based on the Proposer's system.			Rd,Ru	--	Ogden's domestic experience is extensive. CE has no reference plant operating of the type offered. Riedel and Reuter have only partially verifiable experience in this area.
II. Evaluation of Management Proposal*					
Evaluation of the Management Proposal on the basis of:					
A. Techniques and controls for management (i.e. reporting procedures, audits, payment and monitoring responsibilities.	CE,F,Og	Rd,Ru	--	--	CE, Fluor and Ogden demonstrated knowledge of the complexity of project and professionalism in dealing with the problem.
B. Maintenance philosophy and policies;	--	CE,F,Og,Rd,Ru			
C. Reasonableness of construction	--	CE,F,Og,Rd,Ru			
D. Safety policies;	Og	CE,F,Rd,Ru	--	--	Ogden offered an exceptional response to the safety issue.

Legend:
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Ru = Reuter/Buhler-Miag

EVALUATION FOR "TECHNICAL FEASIBILITY"
(Continued)

	Superior	Acceptable	Poor	Unacceptable	Comments
I. Evaluation of Technical Proposal (Cont'd)					
E. Soundness of shakedown and acceptance testing procedures.	--	CE,F,Og,Rd,Ru	--	--	
F. Proposed working/operational relationship and procedures with: 1) Metro, 2) the Recovered Materials Markets, and 3) the Energy Market(s);	--	CE,F,Og,Rd,Ru	--	--	
G. Parent company and subcontractor staff support;	--	CE,F,Og,Rd,Ru	--	--	
H. Willingness to meet the development and implementation schedule; and			--	--	
I. Willingness to consider innovative techniques to increase efficiency and maximize Recovered Materials and Energy Production to decrease disposal costs.	--	CE,F,Og,Rd,Ru	--	--	

Legend:
CE = Combustion Engineering
F = Fluor Engineers/Southern Company
Og = Schnitzer/Ogden Martin
Rd = Riedel/Dano
Ru = Reuter/Buhler-Miag

V. Technical Team Evaluation

A. Economic and Technical Analysis

FOREWARD

This report is the result of analyzing the five proposals submitted to Metro on January 30, 1987 by three respondents to the first Request for Proposals (RFP #1) and two respondents to the second Request for Proposals (RFP #2). For purposes of these analyses, the five proposals are the submittals of January 30, 1987 augmented by the answers to the first and second round of questions and the results of the interviews which took place at Metro during the week of March 30 to April 3, 1987.

Sections 1 and 2 are primarily information which was taken directly from the proposals with minimal critique and editorializing on the part of staff and consultants. Sections 3 and 4 are the results of the 20 year life cycle cost analyses for the base case and the sensitivity analyses, respectively. Section 5 is a narrative description of the critical review of each proposal by staff and consultants.

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1. TECHNICAL AND PERFORMANCE OVERVIEW

EVALUATION OF PROPOSALS
METRO, PORTLAND, OREGON

TECHNICAL AND PERFORMANCE OVERVIEW

	Combustion Engineering	Fluor/ SEI	Schnitzer/ Ogden Martin
Technology	Prepared Fuel/Dedicated Boiler	Mass Burn	Mass Burn
Building(s) Related:			
Number of Tipping Positions	N/A	10	12
Tipping Floor Related:			
Enclosed Tipping Floor/Acceptable Waste Storage Area, if applicable, ft^2	21,140	9,950	N/A
Volume of Tipping Area Building, ft^3	808,600	368,000	N/A
Pit Storage Related:			
Storage Pit Area, if applicable, ft^2	N/A	13,124	6,688
Storage Pit Volume - water level, ft^3	N/A	262,500	234,080
Storage Volume - maximum, ft^3	N/A	393,700	412,984
Elevation of Pit Bottom, ft	N/A	-15	-25
Total Square Footage of Building(s), ft^2	104,322	51,600	22,614
Total Volume of Building(s), ft^3	4,966,956	4,395,000	1,964,026
Overhead Cranes:			
Capacity, TPH (each)	N/A	50	75
Quantity	N/A	2	2
Grapple Capacity, Tons	N/A	8.5	8
Ferrous Recovery Systems:	YES	YES	YES
Design Heating Value of Fuel, BTU/lb	4,700 (5,482 RDF)	4,700	5,200
Incinerator/Furnace:			
Number of Units	1	2	2
Rated Capacity of Each Unit (TPD)	1,000 RDF	565 MSW	600 MSW

EVALUATION OF PROPOSALS
METRO, PORTLAND, OREGON

TECHNICAL AND PERFORMANCE OVERVIEW
(Continued)

	Combustion Engineering	Fluor/ SEI	Schnitzer/ Ogden Martin
Grate/Feed System Manufacturer	C-E	Itoh-Takuma	Martin GmbH
Acceptable Waste retention time in furnace, minutes	.3-3.0	60-90	Approx. 15
Steam Generators/Boilers:			
Manufacturer	C-E	Riley Stoker Corp.	Keeler/ Dorr-Oliver or equal
Number of Units Provided	1	2	2
Normal Operating Capacity, lb/hr of Steam	312,000	138,785	150,900
Total Installed Boiler Capacity, lb/hr of Steam	312,000	277,570	301,800
Feedwater Temperature, ^{o}F	350	330	250
Minimum Gross Steaming Rate for reference Fuel, lb Steam/lb Acceptable Waste -(per Spec'd Acceptable Waste)	—	5,895	3.0
Pressure at Superheater (operating), psig	900	650	860
Steam Temperature at Superheater, ^{o}F	830	750	830
Turbine-Generator:			
Quantity	1	1	1
Name Plate Capacity, MW	37.0	31.5	34.8
Throttle Flow at Nameplate Capacity, lb/hr	312,000	302,890	301,800
Controlled Extraction Steam, lb/hr	0	100,000	0
Turbine Exhaust Pressure, inch HgA	2.5	3.0	3.0
Turbine-Generator Heat Rates (Zero Extraction) lb/kwh	9.6	9.83	8.33

TECHNICAL AND PERFORMANCE OVERVIEW
(Continued)

	Combustion Engineering	Fluor/ SEI	Schnitzer/ Ogden Martin
Turbine-Generator Efficiency (Zero Extraction), %	35.9	85.2	97.89
Turbine Condenser:			
Quantity	1	1	1
Inlet Cooling Water Temp., °F	85	77	83
Outlet Cooling Water Temp., °F	114	107	104
Cooling Water Velocity, ft/sec	7	8	8
Number of Passes	2	2	2
Air Pollution Control System:			
Manufacturer	C-E, Inc.	Research Cottrel or equal	Flakt or equal
Number of Units Provided	1	2	2
Particulate gr/dscf at 12% CO_2	0.015	0.015	0.015
Hydrogen Chloride (HCL), PPM	—	50	75
Sulfur Dioxide (SO_2), PPM	—	50	125
Lime Consumption, lb/Ton of Acceptable Waste	35	21	27
Bottom Ash Residue "Dry":			
% By Weight	35*	22	22
% By Volume	—	5.7	10
Carbon Content, % By Dry Weight	2	3	5

* From CE's mass balance diagram.

EVALUATION OF PROPOSALS
METRO, PORTLAND, OREGON

TECHNICAL AND PERFORMANCE OVERVIEW (Continued)

	Combustion Engineering	Fluor/ SEI	Schnitzer/ Ogden Martin
Fly Ash Residue "Dry":			
% By Weight	9.1	1.5	Included Above
% By Volume	—	.6	Included Above
Carbon Content, % By Dry Weight	9	3	Included Above
Stacks:			
Number of Visible Stacks(s)	1	1	1
Number of Flues/Stack	1	2	2
Total Stack Height (ft)	250	250	275
Acceptable Waste Throughput:			
Throughput at Maximum Continuous Rating, TPD of MSW	1,200 @ 4,700 Btu/lb	1,130 @ 5,000 Btu/lb	1,200 @5,200 Btu/lb
Minimum Annual Throughput TPY	350,000	350,000	350,000
Maximum Annual Capacity TPY	350,000	372,300	350,000
Ferrous Recovery:			
Minimum Ferrous Recovery, %	90	70	80
Glass Recovery:			
Minimum Glass Recovery, %	—	N/A	N/A
Aluminum Recovery:			
Minimum Aluminum Recovery, %	—	N/A	N/A
Corrugated Recovery: %	—	N/A	N/A

EVALUATION OF PROPOSALS
METRO, PORTLAND, OREGON

TECHNICAL AND PERFORMANCE OVERVIEW
(Continued)

	Combustion Engineering	Fluor/ SEI	Schnitzer/ Ogden Martin
Newspaper Recovery: %	—	N/A	N/A
Film Plastic Recovery: %	—	N/A	N/A
Construction Period, months	30	35	32
Electric Usage, kWh per Ton of Acceptable Waste	100	70	95 (Not Guaranteed)
Energy Efficiency, kWh per Ton of Acceptable Waste	550 (550 guaranteed)	509/529 (450 guaranteed)	510/580 (470 Guaranteed)
Gross Electrical Production (kWh per Ton of Acceptable Waste) if operating in all-electric mode	650	599	675 (Not Guaranteed)
RDF Output, lb/Ton Waste	—	N/A	N/A
Energy Value of RDF, BTU/lb of Acceptable Waste	—	N/A	N/A

TECHNICAL AND PERFORMANCE OVERVIEW
(Continued)

COMPARATIVE CHARACTERISTICS FOR METRO COMPOSTING

	Dano Process		Buehler Process	
Charactistic	% wt wet	% wt dry	% wt wet	% wt dry
Organic Material	21.2	41.4	26.3	35.0
Ash	30.0	58.6	48.8	65.0
Moisture	48.0	0	25.0	0
Total	100.0	100.0	100.0	100.0
pH	7.2		7.1-7.3	

COMPARISON OF MAJOR DESIGN PARAMETERS FOR THE BUEHLER AND DANO COMPOSTING TECHNOLOGIES

	Dano		Buehler	
Parameters	@100,000 TPY	@200,000 TPY	@100,000 TPY	@200,000 TPY
Electrical Power (kWh/Ton)	39.7	26.7	44.0	29.5
Fuel/Diesel Fuel (1) (gal/Ton)	0.33	0.22	0.20	0.20
Water (gal/Ton)	125	122	150	150
Personnel Productivity (Ton/MY)			1,852	(?)
Mech. Proc. Time	45		36	
Fermentation Time	504		1,008	
Curing Time	504		1,008	
Storage	360		0	
Total Ret. Time (hrs.)	1,413		2,054	
Rejects % wt of input	30.2		39.2	
Recyclables % wt of input	8.9		18.4	
Cured Compost % wt of input	60.0		20.0	

Notes: (1) Gas used for heating purposes is converted to equivalent gallons of fuel.

PROPOSAL RECAP CHART

	Annual Capacity (000 TPY)	Capital Cost ($MM)	Equity	O&M Cost ($MM/Yr.)	Energy (Kwh/Ton MSW)	Compost (Tons/Ton MSW)	Metro Revenue Share	Construction Period
Combustion Engineering (Prepared Fuel with Dedicated Boiler)	250	84.0	20%	10.5	550		100%	
	350	95.0	20%	11.5022	550		100%	30 months
	450	105.7	20%	13.311	550		100%	
Fluor/Southern Electric International (mass burn)	250	79.25	12.2%	7.55	450			
	350	98.392	12.2%	9.1153	450			
	450	117.45	12.2%	10.93	450		100% to 450; 50/50 above 450	35 months
Schnitzer/Ogden (mass burn)	250	87.442	22%	7.318	470			
	350	105.401	22%	8.994	470		90%, 88%, 86%, 84%, 82%, 80%	
	450	120.464	22%	10.649	470		1, 2, 3, 4, 5, 6 yrs	32 months
Reuter/Buhler-Miag (Compost)	100	23.58	20%	2.495035		0.2		
	200	28.77	20%	3.93607		0.2	None	24 months
Riedel/DANO (Compost)	100	10.242837	20%	3.211858		0.6	2/3	
	200	13.0787	20%	4.963246		0.6	2/3	24 months

2. PROPOSAL SUMMARIES

COMBUSTION ENGINEERING

Combustion Engineering (CE) proposes to design, construct, start-up, performance test, operate and maintain a resource recovery facility in the City of Portland, Oregon, on a 20-acre site on the West bank of the Willamette River to be purchased from the Gilmore Steel Corporation. An alternative site at St. Helens was considered by Combustion Engineering. The Facility will employ a "refuse derived fuel" (RDF) technology whereby municipal solid waste (MSW) will be received and processed to recover recyclable materials, including glass and ferrous metals prior to combustion, and to remove other noncombustibles from the waste stream. The result will be a fuel (RDF) that will be burned to produce electricity. The as-fired RDF particle size will be approximately 95% less than 4" and most of the remaining material will be less than 6". Mechanical conveyors will transport the RDF from the fuel preparation area to the boiler house.

The resulting RDF will be burned in a stoker-fired VU-40 boiler, producing steam for conversion to electricity. The boiler design is specific to the fuel characteristics of the RDF produced and considers the corrosive and erosive nature of the RDF. Combustion gases from the boiler will be passed through a dry scrubber, followed by particulate removal in a fabric filter, to meet emission standards.

Characteristics of CE's proposals are:

Capacity:	250,000 TPY	350,000TPY	450,000 TPY
Electrical Production Guarantee (MSW)	550 KWH/Ton	550 KWH/Ton	550 KWH/Ton
Market	PGE	PGE	PGE
Energy Share to Metro	100%	100%	100%
Capital Cost	$84 Million	$95 Million	$105.7 Million
Annual O&M Cost	$10.5 Million	$11.5 Million	$13.3 Million
Construction Period	30 Months	30 Months	30 Months
Equity (as percentage of Capital Cost)	20%	20%	20%
Number of Equipment Trains	1	1	1

Combustion Engineeering will guarantee their 20% equity to the project. Subsequent to the bond financing, Combustion Engineering will put a leveraged lease in place. The leveraged lease is to be totally between Combustion Engineering and its chosen lessor. Combustion Engineering will use Black and Veatch for design and engineering services and Lazard Freres for advice on the financing structure.

As an alternative, Combustion Engineering has agreed to pursue a working relationship with Wastech Inc.'s Oregon Processing and Recovery Center (OPRC) and Reuter Resource Recovery to integrate their recycling and composting operations with Combustion Engineering's resource recovery technology. The three parties have agreed to integrate their three operations to reduce the volume of Metro's waste taken to landfill. A possible scenario for combining the operations of all three technologies is:

- Metro commits 450,000 TPY to resource recovery (composting and power generation) and 200,000 TPY to OPRC for recycling. In total, 650,000 TPY come to an integrated waste management facility (WMF).

- At the WMF, OPRC screens <u>all</u> incoming waste for recyclable materials and removes those materials. All loads or partial loads rejected by OPRC are processed by Combustion Engineering. It is estimated that OPRC will remove approximately 165,000 TPY from the waste stream.

- Combustion Engineering processes about 485,000 TPY to recover 20,000 TPY of ferrous metals and produce 395,000 TPY of prepared fuel. Combustion Engineering's process will separate about 60,000 TPY of organic and noncombustible materials as residue. The residue plus 40,000 TPY of prepared fuel will be delivered to Reuter for composting.

- Combustion Engineering will burn the remaining prepared fuel to generate electricity.

Combustion Engineering's reference plant is in Madison, Wisconsin which has been operating for over ten years. This plant is however, smaller than the RFP specified and is designed to remove less of the combustibles from the waste than the plant proposed for Metro. The prepared fuel that the facility produces is not burned in a dedicated boiler but in a retrofit at a local utility. Combustion Engineering does not have a fully integrated facility yet operating of the type proposed for Metro but does have major projects of the type proposed in Detroit, Michigan; Honolulu, Hawaii; and Hartford, Connecticut.

FLUOR/SOUTHERN ELECTRIC INTERNATIONAL

A joint venture of Fluor Engineers Inc. (Fluor) and Southern Electric International, Inc. (SEI) proposes to develop, design, construct, operate and own a facility to process 1130 tons per day of municipal solid waste (MSW) using Riley Stoker technology and proprietary Takuma grates and combustion controls. The intent is to form a limited partnership (Portland Resource Recovery Ltd. Partnership) between Fluor and SEI to design, build, operate and maintain the facility. They reserve the right to enter into more than one contract with Metro for the Project, each contract covering a discrete scope of work. The proposal is contingent on the facility's qualifying as a co-generation facility, thereby permitting SEI to take an equity position of about 10% of the capital cost under the provisions of the Public Utility Holding Company Act of 1935. In the event the facility cannot qualify as a co-generator, ownership interest in the project will be assigned to a third-party equity participant.

The technology proposed for the Portland project is a mass burn grate process patented by Takuma and licensed in the U.S. by Riley/Takuma. The Riley/Takuma grate consists of a reciprocating, inclined stoker system. The Takuma stoker is integrally engineered into a system consisting of the stoker, the Riley water wall cooled, refractory and cast-block lined furnace and the steam boiler.

The Riley/Takuma technology is characterized by a four-level stoker divided into two lateral, independently operated sections. The four levels are the MSW feeder, drying stoker, burning stoker and final burning stoker. This is designed to achieve maximum agitation of MSW while maintaining a uniform bed to achieve nearly complete combustion. A baghouse scrubber system would provide state-of-the-art flue gas clean-up.

Characteristics of Fluor's proposal is:

Capacity	250,000 TPY	350,000 TPY	450,000TPY
Electrical Production Guarantee	450 KWH/Ton	450 KWH/Ton	450 KWH/Ton
Market	PGE	PGE	PGE
Steam Production	100,000 lbs/hr	100,000 lbs/hr	100,000 lbs/hr
Market	Boise Cascade	Boise Cascade	Boise Cascade
Energy Share to Metro	100 % to 450	KWH/Ton, 50/50	above 450 KWH/Ton
Capital Cost	$78.9 million	$98.4 Million	$122.99 million
Annual O&M Cost	$7.55 million	$9.1 Million	$10.93 million
Construction Period	35 Months	35 Months	35 Months
Equity	10%	10%	10%
Number of Equipment Trains	2	2	2

Materials recovery is not included in the base proposal; however, the joint venture is prepared to offer either front- or back-end recovery (the Shaneway System) after the waste composition is more completely defined by Metro's waste composition analysis.

The proposal is based upon a site situated on the Columbia River at the Port of St. Helens. Two alternative sites, one at Gresham and one near St. Johns, were also considered.

The St. Helens site is owned by the Port Authority, which has agreed in principle to a long-term lease with Fluor/SEI. Fluor claims that the site offers the Project the following:

- A Columbia County commitment of support to Fluor/SEI in a letter with the proposal.

- The Port of St. Helens is interested in this utilization of the site.

- The site is adjacent to a potential steam customer, Boise Cascade.
- Alternative transportation options are available.
- "Air shed" and land use compatibility may positively impact the permitting process.
- The opportunity exists to attract incremental waste from Columbia County and others, with attendant economic advantages to the Project.
- The potential exists for additional contiguous acreage to be acquired during lease negotiations to allow for facility expansion.

The reference plant is located at Osaka City, Japan. It has a capacity of 800 TPD (two trains at 400 TPD each). The contracting parties are Takuma Co., LTD. and the City of Osaka, Japan. Takuma was the turnkey engineer and constructor for the entire facility. Fluor/Southern Electric has no similar system to that proposed for Metro currently in operation. A Riley Takuma facility has begun operation in Minnesota but that facility has no connection to Fluor/Southern Electric.

The Fluor/Southern Electric facility is to be located in St. Helens in proximity to a Boise Cascade pulp and paper mill. The Boise Cascade mill is considered a potential steam customer and the Fluor/Southern Electric price includes an extraction turbine and the steam pipeline to Boise Cascade. Boise Cascade, due to other commitments, would be initially limited to a 5 year steam sales contract.

SCHNITZER/OGDEN MARTIN
RIVERGATE RESOURCE RECOVERY PROJECT

Schnitzer Steel Products Co. (Schnitzer) and Ogden Martin Systems, Inc. (Ogden Martin) propose to design, construct, operate and own a facility to process municipal solid waste (MSW) for Metro. The Rivergate Project (the name Schnitzer/Ogden Martin assigned to the project) will be a privately owned, privately operated energy and materials recovery center. It will be constructed in North Portland on property currently owned by Schnitzer. Ogden Martin owns and operates a waste-to-energy facility in nearby Marion County.

Characteristics of the Schnitzer/Ogden proposals are:

Capacity	250,000 TPY	350,000 TPY	450,000 TPY
Electrical Production Guarantee	470 KWH/Ton	470 KWH/Ton	470 KWH/Ton
Market	PGE	PGE	PGE
Energy Share to Metro	90%, 88%, 86% 84% 82% in years 1, 2, 3, 4, 5 & 80% thereafter		
Capital Cost	$87.4 Million	$105.4 Million	$120.5 Million
Annual O&M Cost	$7.3 Million	$9 Million	$10.6 Million
Construction Period	32 Months	32 Months	32 Months
Equity	22%	22%	22%
Number of Equipment Trains	2	2	2

Schnitzer/Ogden Martin provide in the Rivergate Resource Recovery Project the following:

- Local ownership interests.
- Commitment to the host community.
- Mass burn waste combustion technology.
- Available facility site.

Schnitzer and Ogden Martin propose to take responsibility for the design, construction, ownership and long-term operation and maintenance of the Rivergate Project, through a joint venture, the Rivergate Resource Recovery Company.

Ferrous metals recovered from the combustion residue at the facility have a guaranteed market outlet and will not be returned to Metro's landfill. The facility residue will be less than 10 percent of the volume of the processed waste. The facility will also be able to receive and process the combustible, but nonmarketable, residues of other recycling operations.

Landscaping for the site will include visual and acoustic buffers. Ornamental shrubs and trees will be planted to provide a pleasing environment. Vegetation genus and species will be selected to adapt to local climatic conditions and the environment developed by activities on the site.

The administration/visitors portion of the main building will contain office space, a conference room for fifty people, and facilities for visitors and personnel. It will serve as a visitor area in addition to being the center of plant operations and management.

The Rivergate Project will be located on an approximately 10-acre site in North Portland. The property is owned by Schnitzer and will be made available to the Project by means of a sale or long-term lease arrangement. The site is adjacent to the Rivergate Industrial District and approximately one-half mile from the existing St. Johns landfill.

Portland General Electric Company's St. Johns substation is in direct proximity to the Rivergate site. The interconnection costs between the facility and the substation will be minimized since such costs are directly influenced by distance. Preliminary discussions with PGE have confirmed the acceptability of a tie-in at the St. Johns substation. In addition, the Rivergate Industrial District adjacent to the site represents a potential source of steam purchasers.

Schnitzer's recycling operation is also adjacent to the proposed site. The joint venture intends to remove metals from the ash and then the recovered ferrous metals will be removed from the facility by Schnitzer and returned to commercial use in Schnitzer's other operations. Schnitzer and Ogden are guaranteeing that these metals will never be landfilled. Waste from Schnitzer's other operation will be delivered to the Facility to supplement the energy value of Metro's waste.

REUTER/BUHLER-MIAG

Reuter, Inc., in concert with Buhler-Miag, Inc., proposes two alternatives for the Compost Resource Recovery Project, as follows:

• Processing Capacity	100,000 TPY	200,000 TPY
• Process	Buhler-Miag Static/Dynamic Composting Process with Materials Recovery	
• Owner and Operator	Reuter, Inc.	Reuter, Inc.
• Designer/Supplier/Builder	Buhler-Miag, Inc.	Buhler-Miag, Inc.
• Capital Cost	\$23.6 Million	\$28.8 Million
• Annual O&M Cost	\$2.5 Million	\$3.9 Million
• Tipping Fee	\$58.00	\$40.00
• Source of Financing	(100%) by Reuter	(100%) by Reuter
• Construction Period	24 Months	24 Months
• Processing Lines	2	2
• Revenue Sharing to Metro	None	None

Reuter, Inc. is also proposing a co-venture with Combustion Engineering and Wastech, as discussed in the Combustion Engineering section, designed to convert 650,000 TPY of solid waste and mixed commercial waste paper to power, fuel, compost and other recyclables. The plan will increase materials and energy recovery and minimize residues to a great extent, while increasing recycling.

The preferred site of 42 acres is located at the Clackamas Industrial Park, is immediately available with complete utilities and is zoned I-3.

Secondary sites (all available) are at:

- Valley Industrial Park Site (I-205, south of Foster Road).

- Clackamas Transfer and Recycling Center Site (Alternative 1, only).

- Carver Site (Highway 224).

- St. Johns Riverfront Site (St. Johns Bridge).

The performance of the Reuter/Buhler-Miag Facility would be:

	% (by weight)
• Composting	47
• Energy Recovery	14
• Materials Recovery	26
• Landfill of Residue	13
	100

Proposed products and markets are:

TONS PER YEAR (TPY)

PRODUCTS	ALT 1	ALT 2	LOCAL MARKET
Compost	20,000	40,000	CMI[1]
Fuel	26,000	52,000	Smurfit
Aluminum	500	1,000	Smelters
Ferrous	5,300	10,600	Scrap Dealers
Corrugation	4,800	9,600	Waste Paper Dealers
News	1,200	2,400	Waste Paper Dealers
Plastics	2,200	4,400	Recyclers/Reclaimers
White Goods	500	1,000	Scrap Dealers
Total	60,500	121,000	

1. CMI is a small consulting firm which will develop the market program for the compost.

The compost market is characterized by:

- Market Guarantee - Compost Management, Inc. (CMI).

- Market Price—

  Manufacturer's Price (Reuter) - $5.00/ton

  Wholesaler/Broker's Price (CMI) - $8.00/ton

  Retailer's Price (Landscaper) - $12.00/ton, and up.

- Customers - (Bulk sales only)—

  Level 1 - Landscaping Contractors

  Level 2 - Nurseries and Garden Supply Centers, both Wholesale and Retail.

- Future Markets - Bagged Potting Soil and Custom Planter Mixes.

The fuel market is characterized by:

- Market Guarantee - Smurfit Paper and Combustion Engineering.

- Market Price - $7.50 per ton.

- Fuel Characteristics—

  Bulk Density - 15 to 20 lbs/cu. ft.

  Heat Value - 5,400 to 9,000 Btu/lb

Composition - Plastics, wood, textiles, rubber, etc.

Source - Combustible rejects from mixing drum.

The residues and non-processibles are:

- Rejects from Fines Drum Sieve - 7.5%
  Consists mostly of plastic, glass, stones, etc.

- Rejects from Destoners - 4.4%
  Consists mostly of glass.

- Non-Processibles - 1%
  Consists mostly of bulky items, such as tires, rubber, appliances, mattresses, etc.

- Net Water Evaporation Losses - 27% (Water).

The baseline proposal is for Reuter, Inc. to be considered the Owner and Operator. Wastech, Inc. (formerly GSX) has expressed interest in being the designated owner and operator of the proposed facility, subject to approval by Reuter's Board of Directors and Metro.

Buhler-Miag will design the process, supply all equipment and act as a Turnkey Contractor, at the discretion of Reuter. A local general contractor will be selected through normal bidding procedures for construction.

Reuter, Inc. proposes to finance 100% of the project. Reuter would consider public financing if the assumed 10% interest rate was renegotiated. No site, permitting, zoning or land-use problems or adverse impacts are anticipated. All preferred and optional sites considered are properly zoned and the project would be an acceptable land use in the opinion of Reuter. Reuter is concerned that Metro has not provided valid and verifiable waste composition data, which is the principal criterion for design and making financial projections and firm price proposals for the project. Reuter's firm price is good for 6 months with the exception of any exchange rate adjustments between Swiss francs and the dollar, either upward or downward. This is a fairly significant risk to Metro in that the Swiss franc has appreciated in excess of ten percent from the date of receipt of the proposal. Reuter's market study indicates that volumes and prices for fuel and compost are too low to justify revenue sharing in Reuter's opinion. Reuter has no exclusive arrangements with any of the other proposers and will work with other parties or the winning contractor on any other alternative.

The process, product quality and odor controls are characterized by a fermentation system designed to provide optimum conditions for aerobic fermentation; forced aeration to ensure oxygen supply to control CO_2 concentration in the product; sucking of air through the fresh product and subsequent cleaning of the process air by earthfilters; periodically restoring the homogeneous structure over the complete section of compost heaps by automatic windrow-turning machines to maintain efficiency of forced aeration during the total fermentation period; and computer-aided fermentation control. All turning over of the product is done by the automatic, mobile, self-propelled windrow-turning machine, which can be driven to the vehicle workshop for maintenance.

RIEDEL

Riedel Environmental Technologies, Inc. (RET) proposes to design, build, own and operate a facility to process and dispose of the municipal solid waste (MSW) delivered by Metro.

Characteristics of Riedel's proposals are:

Processing Capacity	100,000 TPY	200,000 TPY
Process	DANO	DANO
Capital Cost	$10.2 Million	$13.1 Million
Annual O&M	3.2 Million	$5 Million
Equity	20%	20%
Processing Lines	2	2
Revenue Sharing to Metro	66 2/3%	66 2/3%

RET will be using the technology developed by DANO, Ltd. The process recovers and recycles usable materials; produces a composted material which may be suitable for use in agricultural, landscaping and nurseries, and reduces the quantity of waste requiring disposal.

The proposal includes hand-picking recycling methods and turning the majority of the remaining product into compost.

Riedel commits to disposing of all the compost generated without cost and risk to Metro, except for transportation costs which are part of the operation and maintenance costs.

The Riedel team consists of:

- Riedel Environmental Technologies;
- Riedel International, Inc. (RII):
- Resource Systems Corporation (RSC);
- Talbott Engineers, Inc.;
- Cogan Sharpe Cogan;
- DANO AG; and

- Motherwell Bridge, Ltd.

RET will assume overall project responsibility and will become the operator of the facility. RII will be the general contractor for the construction of the facility. RSC holds the DANO license for this area and will provide marketing assistance for the compost product. TEI is providing the engineering for the project. CSC is providing planning and permit assistance and a community relations program to facilitate community awareness. DANO AG is the licensor and is providing technical support for the project. Motherwell Bridge, Ltd. will be providing the conceptual design and startup consultants for the project.

RET proposes to construct the DANO composting facility on an 18-acre parcel of land, which is currently under option by Riedel Waste Disposal Systems, Inc. and located at 5437 N.E. Columbia Boulevard, Portland, Oregon. This location is in an industrial area, on a major four-lane highway and approximately halfway between the I-5 and I-205 freeways. RET has already begun the permit application process for the property.

Buildings will be constructed in a manner which will blend into the surrounding industrial community. All structures will be painted in earth tones and the property will be landscaped.

A queuing line of 15 vehicles is available prior to entering the scale area and space for an additional 25 vehicles is provided within the building. The facility will provide a covered recycling area to enable citizens and commercial clients to dispose of source-separated items. A total of 17 dumping stalls will accept incoming waste for the 200,000 ton facility, with two of these sized to accept incoming transfer trucks. The system will operate in this manner: incoming vehicles weigh in at the scales and then proceed to the covered area, where they dump their materials onto the tipping floor, which is approximately 7 feet below ground level. Material deposited on the tipping floor is pushed by a rubber-tire loader onto a walking floor, which is lower by another 2 feet. The refuse is spaced on the walking floor so that it may be examined readily. At this point, large items, or those not readily compostable, such as couches or tires, are transferred to the recycling area or reject areas, depending upon their nature.

The walking floor deposits the waste stream on a conveyor where the waste is transported to a material recovery area. Hand sorting in this area extracts various recyclable materials including paper, cardboard, glass, metals, and other items from the waste stream.

The remaining material enters a DANO drum to begin the composting process. The drum is approximately 12 feet in diameter and 80 feet in length. The drum rotates at about three RPM and quickly and efficiently pulverizes and homogenizes the waste material. Air and water are added to hasten the process and maintain aerobic conditions. After six to eight hours, the waste is removed and screened into fines and oversized material. The latter is returned to the reject area. The fines proceed by conveyor to the compost aeration slab.

The pulverized fines are deposited in windrows or beds in the primary composting area. Air is forced upward through the material from a distribution system underneath the floor that is designed to foster rapid aerobic fermentation. Periodically, the material is turned and mixed by machine to ensure uniform processing. The process is designed so that in approximately three weeks, 90% of the action needed to produce a finished product is completed. The material is then transferred into static piles for final aging and maturing, a process which takes an additional three weeks. The mature compost then receives a final screening to remove extraneous and/or oversize material, is tested to ensure that it meets standards and stored prior to shipment.

The materials screened from the compost at various points within the system are processed further to separate them into their respective components. For example, glass, ferrous and nonferrous metals, and other items may be separated and sold to existing markets. Remaining items without resale value are transferred to the reject area. All rejected materials, including those removed from the walking floor, picking line, oversized particles from the DANO drum and materials from the final screening, are housed in this area and are loaded into transfer trucks daily for transport to a landfill or a mass burn facility. Reject material can go to private facilities for use as hog fuel.

The primary proposal for the Columbia Boulevard property was submitted in response to the Metro RFP design specifications for both 100,000 TPY and 200,000 TPY. In addition to the primary proposal, an alternative design is offered which does not include an indoor composting slab. The reduction in capital costs for the alternative design is approximately 25%.

Three additional alternatives are also offered:

- Alternative One is a 100,000 ton-per-year, two-drum DANO plant on Metro-owned property adjacent to the Clackamas Transfer and Recycling Center (CTRC). All composting operations will take place on this site with the same amount of recycling as of the Columbia Boulevard alternative.

- Alternative Two is a 200,000 ton-per-year, three-drum DANO plant at the CTRC. Because of the limited available space next to the CTRC, RET will install only the recycling and initial stages of the DANO process on this site and will transport the compostable material to property they have identified in the Clackamas industrial area for the 6-week curing cycle.

- Alternative Three is a four-drum plant at the CTRC that will take the entire production of the facility. Again, because of space limitations, RET will transport the compostable material to a property in the Clackamas industrial area for the curing operations.

RET believes that it can distribute the entire production of compost manufactured at its facility, and is willing to make that commitment to Metro. The market strategy is to distribute free compost to a variety of end users for an initial period of time. During this period RET will be testing to demonstrate the value of the product on a cost basis for end users. RET believes that they will be able to charge small amounts for the compost within a short period of time.

RET proposes to divide the revenues from compost sales in this manner: one-third to Metro, one-third to reduce tipping fee requirements, and one-third to Riedel over and above any other income from the project.

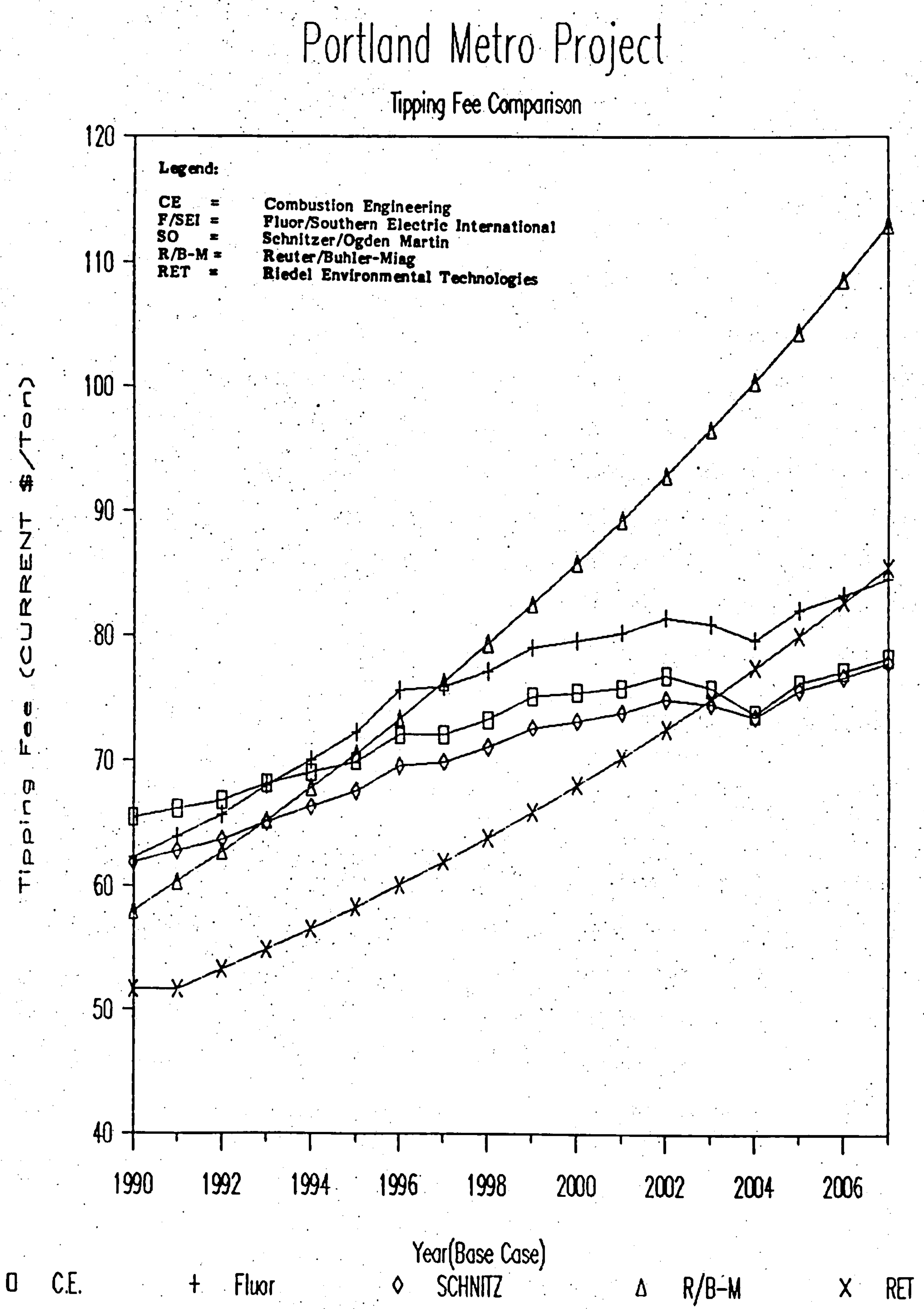
Additionally RET plans to remove recyclable materials from the waste stream. RET anticipates removing at least 5% of the waste stream through recycling and has included costs required to extract that tonnage. For recycling levels above that amount, RET will divide the revenues in the same manner as for compost. RET intends to pursue markets for up to two-thirds of the reject material for use as hog fuel. Any revenues above the costs required to transport reject material marketed as hog fuel would be split three ways as proposed for compost.

RET is not of sufficient size to provide Metro with a Baa bond rating. RET believes it can accomplish the same result by credit enhancements, such as letter-of-credit guarantees. RET is also willing and prepared to pursue alternate financing, either through conventional sources or nonconventional sources, such as convertible subordinated debentures or additional equity offerings.

RET is proposing to participate on an equity basis in the amount of 20% of the construction costs and is willing to finance the balance through any of the above.

The reference plant is a compilation of two plants: Salford, Manchester, England, 672 ton per day, municipally owned and operated; and Fredericksund, Copenhagen, Denmark, 280 ton per day, municipally owned and operated.

3. ECONOMIC (REVENUE AND EXPENSE) FORECASTS



Portland Metro Project
Tipping Fee Comparison
Legend:
CE = Combustion Engineering
F/SEI = Fluor/Southern Electric International
SO = Schnitzer/Ogden Martin
R/B-M = Reuter/Buhler-Miag
RET = Riedel Environmental Technologies
Tipping Fee (CURRENT $/Ton)
120
110
100
90
80
70
60
50
40
1990
1992
1994
1996
1998
2000
2002
2004
2006
Year(Base Case)
C.E.
Fluor
SCHNITZ
R/B-M
RET

COMBUSTION ENGINEERING
BASE CASE

Technology:	Prepared Fuel with Dedicated Boiler
Size:	350,000 tons per year
Capital:	$95,000,000
Annual O&M Cost:	$11,502,200
Energy Production:	550 kilowatt hours per ton
Site Location:	Gilmore Steel
Interest Rate on Tax Exempt Debt:	9-1/4% per annum
Term of Tax Exempt Debt:	23 years
Interest Rate on Taxable Debt:	10-1/4% per annum
First Year Tipping Fee (1991):	$66.13
First Year (1991) Net Present Value of Tipping Fee ($ 1987):	$56.53
Average Present Value of Tipping Fees in $ 1987:	$44.25

SPECIAL COMMENTS:

1. Metro to receive 100% of energy revenues.
2. Leveraged lease with Combustion Engineering acting as owner of last resort.
3. Non-escalating return on equity of $893,000 per annum.
4. No management fee.
5. Added two months to construction schedule for acceptance testing.
6. $4,000,000 added to above capital cost to account for additional site development costs.

PORTLAND METRO PROJECT - PAGE ONE
COMBUSTION ENGINEERING, INC.
350,000 TPY REFUSE DERIVED FUEL FACILITY PROPOSAL-BASE

PORTLAND METRO RESOURCE RECOVERY PROJECT - BASE CASE REVENUE AND EXPENSE FORECAST
($000, Except Where Otherwise Specified)

ASSUMPTIONS:	OPERATING PERIOD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1986 Dollars	YEAR	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
	FACILITY OPERATING ANALYSIS																	
350,000 Tons	Accept. Waste Received (Tons)	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000
0.00 Percent	Bypass Waste (Tons)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Accept. Waste Processed (Tons)	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000
32 Percent	Residue to Landfill (Tons)	113,050	113,050	113,050	113,050	113,050	113,050	113,050	113,050	113,050	113,050	113,050	113,050	113,050	113,050	113,050	113,050	113,050
550 kWh/Ton	Electricity Produced (mWh/Year)	192,500	192,500	192,500	192,500	192,500	192,500	192,500	192,500	192,500	192,500	192,500	192,500	192,500	192,500	192,500	192,500	192,500
0 Pounds	Steam Produced (Pounds/Year)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4 Percent	Materials Recovered (Tons)	14,700	14,700	14,700	14,700	14,700	14,700	14,700	14,700	14,700	14,700	14,700	14,700	14,700	14,700	14,700	14,700	14,700
0 Percent	RDF Produced (Tons)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0 Percent	Compost Produced (Tons)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.04 esc. rate	REVENUES																	
	Electricity Value ($/mWh)	31.30	33.30	34.30	36.30	38.30	38.30	42.30	44.30	45.30	49.30	53.30	56.30	63.30	72.30	73.30	77.30	81.30
	Total Electricity Revenue	6,025	6,410	6,603	6,988	7,373	7,373	8,143	8,528	8,720	9,490	10,260	10,838	12,185	13,918	14,110	14,880	15,650
2.39 $/1,000	Steam Value ($/1,000 Pounds)	2.91	3.02	3.15	3.27	3.40	3.54	3.68	3.83	3.98	4.14	4.30	4.48	4.66	4.84	5.04	5.24	5.45
	Total Steam Revenue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.00 $/Ton	Recovered Materials Value ($/Ton)	5.52	5.63	5.74	5.86	5.98	6.09	6.22	6.34	6.47	6.60	6.73	6.86	7.00	7.14	7.28	7.43	7.58
1.02 esc. rate	Total Materials Revenue	81	83	84	86	88	90	91	93	95	97	99	101	103	105	107	109	111
7.50 $/Ton	RDF Value ($/Ton)	9.12	9.49	9.87	10.26	10.67	11.10	11.55	12.01	12.49	12.99	13.51	14.05	14.61	15.19	15.80	16.43	17.09
	Total RDF Revenue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 $/Ton	Compost Value ($/Ton)	3.65	3.80	3.95	4.11	4.27	4.44	4.62	4.80	5.00	5.20	5.40	5.62	5.84	6.08	6.32	6.57	6.84
	Total Compost Revenue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total Revenues	6,106	6,493	6,687	7,074	7,461	7,462	8,234	8,621	8,815	9,587	10,359	10,939	12,288	14,023	14,217	14,989	15,762
	REVENUE CREDITS TO METRO																	
100 Percent	Percent Electricity Credit	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	Dollar Electricity Credit	6,025	6,410	6,603	6,988	7,373	7,373	8,143	8,528	8,720	9,490	10,260	10,838	12,185	13,918	14,110	14,880	15,650
0 Percent	Percent Steam Credit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dollar Steam Credit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90 Percent	Percent Rec. Materials Credit	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00
	Dollar Rec. Materials Credit	73	74	76	78	79	81	82	84	86	87	89	91	93	94	96	98	100
0 Percent	Percent RDF Credit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dollar RDF Credit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0 Percent	Percent Compost Credit	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Dollar Compost Credit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Revenue Credits To Metro	6,098	6,485	6,679	7,065	7,452	7,453	8,225	8,612	8,806	9,578	10,349	10,929	12,278	14,012	14,207	14,979	15,751
	TOTAL CREDITS/NET REVENUE TO METRO																	
	Subtotal - Revenue Credits	6,098	6,485	6,679	7,065	7,452	7,453	8,225	8,612	8,806	9,578	10,349	10,929	12,278	14,012	14,207	14,979	15,751
991,025 $/Year	Interest Income on Funds (1)	991	991	991	991	991	991	991	991	991	991	991	991	991	991	991	991	991
	Total Credits/Net Revenues	7,089	7,476	7,670	8,056	8,443	8,444	9,216	9,603	9,797	10,569	11,340	11,920	13,269	15,003	15,198	15,970	16,742
	Dollars Per Ton ($)	20.26	21.36	21.91	23.02	24.12	24.13	26.33	27.44	27.99	30.20	32.40	34.06	37.91	42.87	43.42	45.63	47.83

1. Based on a Debt Service Reserve Fund of $11.91 million, plus a $2 million Reserve and Contingency Fund, both at a 7 percent interest rate, compounded semi-annually.
SOURCE: GERSHMAN, BRICKNER & BRATTON, INC. $ Portland Metro Project: CB622-B $ Programmer:JVLK $ 19-Jun-87

PORTLAND METRO PROJECT - PAGE TWO
COMBUSTION ENGINEERING, INC.
350,000 TPY REFUSE DERIVED FUEL FACILITY PROPOSAL-BASE

PORTLAND METRO RESOURCE RECOVERY PROJECT - BASE CASE REVENUE AND EXPENSE FORECAST
($000, Except Where Otherwise Specified)

		OPERATING PERIOD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	1986 Dollars	YEAR	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
		COSTS																	
		Debt Service On Bonds	13,285	13,285	13,285	13,285	13,285	13,285	13,285	13,285	13,285	13,285	13,285	13,285	13,285	13,285	13,285	13,285	13,285
	1.04 Inflation	OPERATING & MAINTENANCE COST																	
	2,756,000 1986$	Personnel	3,353	3,487	3,627	3,772	3,923	4,080	4,243	4,412	4,589	4,773	4,963	5,162	5,368	5,583	5,806	6,039	6,280
	285,800 1986$	Utilities (Natural Gas/Other)	348	362	376	391	407	423	440	458	476	495	515	535	557	579	602	626	651
	781,300 1986$	Facility Maintenance	951	989	1,028	1,069	1,112	1,157	1,203	1,251	1,301	1,353	1,407	1,463	1,522	1,583	1,646	1,712	1,780
	1,474,700 1986$	Processing Equipt. Maintenance	1,794	1,866	1,941	2,018	2,099	2,183	2,270	2,361	2,455	2,554	2,656	2,762	2,873	2,987	3,107	3,231	3,360
	0 1986$	Building Maintenance	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	888,600 1986$	Contract Services	1,081	1,125	1,170	1,216	1,265	1,316	1,368	1,423	1,480	1,539	1,601	1,665	1,731	1,801	1,873	1,947	2,025
	0 1986$	Equipment Rental	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1,293,600 1986$	Equipment Replacement Fund	1,574	1,637	1,702	1,770	1,841	1,915	1,991	2,071	2,154	2,240	2,330	2,423	2,520	2,621	2,725	2,834	2,948
		Total O & M Costs	9,101	9,465	9,843	10,237	10,647	11,073	11,515	11,976	12,455	12,953	13,471	14,010	14,571	15,154	15,760	16,390	17,046
		PASS THROUGH COSTS TO METRO																	
	1,430,976 1986$	Property Tax	1,741	1,811	1,883	1,958	2,037	2,118	2,203	2,291	2,383	2,478	2,577	2,680	2,787	2,899	3,015	3,135	3,261
	401,300 1986$	Raw Materials	488	508	528	549	571	594	618	642	668	695	723	752	782	813	845	879	914
	350,000 1986$	Insurance Premium	426	443	461	479	498	518	539	560	583	606	630	656	682	709	737	767	798
	100,000 1986$	Site Lease	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	513,100 1986$	Electricity/Water/Sewer	624	649	675	702	730	760	790	821	854	889	924	961	999	1,039	1,081	1,124	1,169
	0 1986$	District Assessment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0 1986$	Trustees Fees	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0 1986$	Metro Administration Fees	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0 1986$	Office Supplies	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Residue/RDF/Compost Costs																	
10	0.60 $/Ton	Residue Hauling (10 miles)	825	858	893	928	965	1,004	1,044	1,086	1,129	1,175	1,222	1,270	1,321	1,374	1,429	1,486	1,546
Miles	20.00 $/Ton	Residue Disposal	2,751	2,861	2,975	3,094	3,218	3,347	3,481	3,620	3,765	3,915	4,072	4,235	4,404	4,580	4,764	4,954	5,152
	4.00 $/Ton	RDF Transportation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	3.75 $/Ton	Compost Transportation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Total Pass Through Costs	6,955	7,230	7,515	7,811	8,120	8,441	8,774	9,121	9,482	9,857	10,248	10,654	11,076	11,515	11,971	12,446	12,940
		INDIRECT OPERATING COSTS																	
	0 1986$	Management Fee	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	893,000 1986$	Return On Equity	893	893	893	893	893	893	893	893	893	893	893	893	893	893	893	893	893
	0 Percent	Revenue Sharing To Contractor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Total Indirect Operating Costs	893	893	893	893	893	893	893	893	893	893	893	893	893	893	893	893	893
		TOTAL COSTS																	
		Facility Operating Costs (F.O.C.)	16,949	17,588	18,251	18,942	19,660	20,406	21,183	21,990	22,830	23,704	24,612	25,557	26,539	27,561	28,624	29,729	30,879
		Dollars Per Ton Accepted	48.43	50.25	52.15	54.12	56.17	58.30	60.52	62.83	65.23	67.72	70.32	73.02	75.83	78.75	81.78	84.94	88.23
		Debt Service And F.O.C. Costs	30,234	30,873	31,536	32,227	32,945	33,691	34,468	35,275	36,115	36,989	37,897	38,842	39,824	40,846	41,909	43,014	44,164
		Dollars Per Ton Accepted	86.38	88.21	90.10	92.08	94.13	96.26	98.48	100.79	103.19	105.68	108.28	110.98	113.78	116.70	119.74	122.90	126.18
		SERVICE FEE TO METRO																	
		Gross Service Fee Dollars	23,145	23,397	23,867	24,170	24,502	25,247	25,252	25,673	26,318	26,420	26,557	26,922	26,556	25,843	26,711	27,045	27,422
350,000	410 kWh/Ton	Plus Metro Shortfall Payments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Net Service Fee Dollars	23,145	23,397	23,867	24,170	24,502	25,247	25,252	25,673	26,318	26,420	26,557	26,922	26,556	25,843	26,711	27,045	27,422
		Net Dollars Per Ton ($)	66.13	66.85	68.19	69.06	70.00	72.13	72.15	73.35	75.20	75.49	75.88	76.92	75.87	73.84	76.32	77.27	78.35
	1.04 Disc. Rate	Net Present Value/Ton (1987$)	56.53	54.94	53.89	52.48	51.15	50.68	48.74	47.65	46.97	45.34	43.82	42.71	40.51	37.91	37.67	36.68	35.76
		Avg. Present Value/Ton (1987$)	44.25																

SOURCE: GERSHMAN, BRICKNER & BRATTON, INC. $ Portland Metro Project: CB622-B $ Programmer: JVLK $19-Jun-87

FLUOR ENGINEERS/SOUTHERN ELECTRIC
BASE CASE

Technology:	Mass Burn
Size:	350,000 tons per year
Capital:	$98,392,000
Annual O&M Cost:	$9,115,300
Energy Production:	450 kilowatt hours per ton
Site Location:	St. Helens
Interest Rate on Tax Exempt Debt:	9-1/2% per annum
Term of Tax Exempt Debt:	23 years
Interest Rate on Taxable Debt:	10-1/2% per annum
First Year Tipping Fee (1991):	$63.93
First Year (1991) Net Present Value of Tipping Fee ($ 1987):	$54.65
Average Present Value of Tipping Fees in $ 1987:	$46.26

SPECIAL COMMENTS:

1. Reduction in residue due to Shaneway System.
2. Property tax holiday of 100% in first year of operation, 80% in second, 60% in third, 40% in fourth and 20% in fifth.
3. Transportation cost to St. Helens of $5.51 per ton in 1987 dollars.
4. Metro to receive 100% of energy revenues up to 450 kilowatt hours per ton; 50/50 split above 450 kilowatt hours per ton.
5. Return on equity of $1,100,000 per annum in 1986 dollars escalated with CPI.
6. $200,000 per annum escalating management fee.
7. Residue haul included in guaranteed O & M cost up to ten miles.
8. Added $350,000 for lime to normalize to other proposals.

PORTLAND METRO PROJECT - PAGE ONE
FLUOR/SOUTHERN ELECTRIC INTERNATIONAL/RILEY/TAKUMA
350,000 TPY MASS BURN FACILITY PROPOSAL-BASE

PORTLAND METRO RESOURCE RECOVERY PROJECT - BASE CASE REVENUE AND EXPENSE FORECAST
($000, Except Where Otherwise Specified)

ASSUMPTIONS:	OPERATING PERIOD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1986 Dollars	YEAR	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
	FACILITY OPERATING ANALYSIS																	
350,000 Tons	Accept. Waste Received (Tons)	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000
0.00 Percent	Bypass Waste (Tons)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Accept. Waste Processed (Tons)	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000
23 Percent	Residue to Landfill (Tons)	79,050	79,050	79,050	79,050	79,050	79,050	79,050	79,050	79,050	79,050	79,050	79,050	79,050	79,050	79,050	79,050	79,050
450 kWh/Ton	Electricity Produced (mWh/Year)	157,500	157,500	157,500	157,500	157,500	157,500	157,500	157,500	157,500	157,500	157,500	157,500	157,500	157,500	157,500	157,500	157,500
0.00 Pounds/Lb	Steam Produced (Mlbs/Year)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4 Percent	Materials Recovered (Tons)	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000
0 Percent	RDF Produced (Tons)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0 Percent	Compost Produced (Tons)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.04 esc. rate	REVENUES																	
	Electricity Value ($/mWh)	31.30	33.30	34.30	36.30	38.30	38.30	42.30	44.30	45.30	49.30	53.30	56.30	63.30	72.30	73.30	77.30	81.30
	Total Electricity Revenue	4,930	5,245	5,402	5,717	6,032	6,032	6,662	6,977	7,135	7,765	8,395	8,867	9,970	11,387	11,545	12,175	12,805
2.39 $/1,000#	Steam Value ($/1,000 Pounds)	2.91	3.02	3.14	3.27	3.40	3.54	3.68	3.82	3.98	4.14	4.30	4.47	4.65	4.84	5.03	5.23	5.44
	Total Steam Revenue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.00 $/Ton	Recovered Materials Value ($/Ton)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.02 esc. rate	Total Materials Revenue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.50 $/Ton	RDF Value ($/Ton)	9.12	9.49	9.87	10.26	10.67	11.10	11.55	12.01	12.49	12.99	13.51	14.05	14.61	15.19	15.80	16.43	17.09
	Total RDF Revenue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 $/Ton	Compost Value ($/Ton)	3.65	3.80	3.95	4.11	4.27	4.44	4.62	4.80	5.00	5.20	5.40	5.62	5.84	6.08	6.32	6.57	6.84
	Total Compost Revenue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total Revenues	4,930	5,245	5,402	5,717	6,032	6,032	6,662	6,977	7,135	7,765	8,395	8,867	9,970	11,387	11,545	12,175	12,805
	REVENUE CREDITS TO METRO																	
100 Percent	Percent Electricity Credit	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	Dollar Electricity Credit	4,930	5,245	5,402	5,717	6,032	6,032	6,662	6,977	7,135	7,765	8,395	8,867	9,970	11,387	11,545	12,175	12,805
0 Percent	Percent Steam Credit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dollar Steam Credit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100 Percent	Percent Rec. Materials Credit	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
	Dollar Rec. Materials Credit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0 Percent	Percent RDF Credit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dollar RDF Credit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0 Percent	Percent Compost Credit	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Dollar Compost Credit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Revenue Credits To Metro	4,930	5,245	5,402	5,717	6,032	6,032	6,662	6,977	7,135	7,765	8,395	8,867	9,970	11,387	11,545	12,175	12,805
	TOTAL CREDITS/NET REVENUE TO METRO																	
	Subtotal - Revenue Credits	4,930	5,245	5,402	5,717	6,032	6,032	6,662	6,977	7,135	7,765	8,395	8,867	9,970	11,387	11,545	12,175	12,805
1,037,891 $/Year	Interest Income on Funds (1)	1,038	1,038	1,038	1,038	1,038	1,038	1,038	1,038	1,038	1,038	1,038	1,038	1,038	1,038	1,038	1,038	1,038
	Total Credits/Net Revenues	5,968	6,283	6,440	6,755	7,070	7,070	7,700	8,015	8,173	8,803	9,433	9,905	11,008	12,425	12,583	13,213	13,843
	Dollars Per Ton ($)	17.05	17.95	18.40	19.30	20.20	20.20	22.00	22.90	23.35	25.15	26.95	28.30	31.45	35.50	35.95	37.75	39.55

1. Based on a $12.57 million Debt Service Reserve Fund, and a $2 million Reserve and Contingency Fund, both at a 7 percent interest rate, compounded semi-annually.
SOURCE: GERSHMAN, BRICKNER & BRATTON, INC. $ Portland Metro Project: CB622-B $ Programmer:JVLK $ 19-Jun-87

PORTLAND METRO PROJECT - PAGE TWO
FLUOR/SOUTHERN ELECTRIC INTERNATIONAL/RILEY/TAKUMA
350,000 TPY MASS BURN FACILITY PROPOSAL-BASE

PORTLAND METRO RESOURCE RECOVERY PROJECT - BASE CASE REVENUE AND EXPENSE FORECAST
($000, Except Where Otherwise Specified)

	1986 Dollars	OPERATING PERIOD / YEAR	1 1991	2 1992	3 1993	4 1994	5 1995	6 1996	7 1997	8 1998	9 1999	10 2000	11 2001	12 2002	13 2003	14 2004	15 2005	16 2006	17 2007
		COSTS																	
		Debt Service On Bonds	15,097	15,097	15,097	15,097	15,097	15,097	15,097	15,097	15,097	15,097	15,097	15,097	15,097	15,097	15,097	15,097	15,097
	1.04 Inflation	OPERATING & MAINTENANCE COST																	
	1,660,000 1986$	Personnel	2,020	2,100	2,184	2,272	2,363	2,457	2,555	2,658	2,764	2,875	2,990	3,109	3,234	3,363	3,497	3,637	3,783
	240,000 1986$	Utilities	292	304	316	328	342	355	369	384	400	416	432	450	467	486	506	526	547
	896,000 1986$	Facility Maintenance	1,090	1,134	1,179	1,226	1,275	1,326	1,379	1,435	1,492	1,552	1,614	1,678	1,745	1,815	1,888	1,963	2,042
	298,000 1986$	Processing Equipt. Maintenance	363	377	392	408	424	441	459	477	496	516	537	558	580	604	628	653	679
	25,000 1986$	Building Maintenance	30	32	33	34	36	37	38	40	42	43	45	47	49	51	53	55	57
	697,000 1986$	Raw Materials	848	882	917	954	992	1,032	1,073	1,116	1,161	1,207	1,255	1,305	1,358	1,412	1,468	1,527	1,588
	300,000 1986$	Contract Services	365	380	395	411	427	444	462	480	500	520	540	562	584	608	632	657	684
	85,000 1986$	Equipment Rental	103	108	112	116	121	126	131	136	142	147	153	159	166	172	179	186	194
	1,085,000 1986$	Equipment Replacement Fund	1,320	1,373	1,428	1,485	1,544	1,606	1,670	1,737	1,807	1,879	1,954	2,032	2,113	2,198	2,286	2,377	2,472
	0 1986$	Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Total O & M Costs	6,431	6,688	6,956	7,234	7,524	7,825	8,138	8,463	8,802	9,154	9,520	9,901	10,297	10,708	11,137	11,582	12,046
		PASS THROUGH COSTS TO METRO																	
	1,578,728 1986$	Property Tax	0	400	831	1,296	1,798	2,337	2,430	2,528	2,629	2,734	2,843	2,957	3,075	3,198	3,326	3,459	3,598
	33,000 1986$	Site Lease	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
	239,000 1986$	Water/Sewer	291	302	315	327	340	354	368	383	398	414	430	448	466	484	504	524	545
	600000 1986$	Insurance Premium	730	759	790	821	854	888	924	961	999	1,039	1,081	1,124	1,169	1,215	1,264	1,315	1,367
	0 1986$	Trustees Fees	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0 1986$	Metro Administration Fees	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0 1986$	Office Supplies	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Residue/RDF/Compost Costs																	
0	0.60 $/Ton	Residue Hauling (10 miles)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Miles	20.00 $/Ton	Residue Disposal	1,924	2,000	2,080	2,164	2,250	2,340	2,434	2,531	2,632	2,738	2,847	2,961	3,080	3,203	3,331	3,464	3,603
	4.00 $/Ton	RDF Transportation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	5.30 $/Ton	MSW Transport. To Facility	2,257	2,347	2,441	2,539	2,640	2,746	2,856	2,970	3,089	3,212	3,341	3,474	3,613	3,758	3,908	4,065	4,227
		Total Pass Through Costs	5,234	5,842	6,490	7,180	7,915	8,698	9,045	9,405	9,780	10,170	10,575	10,997	11,435	11,892	12,366	12,859	13,372
		INDIRECT OPERATING COSTS																	
	200,000 Dollars	Management Fee	243	253	263	274	285	296	308	320	333	346	360	375	390	405	421	438	456
	1,100,000 Dollars	Return On Equity	1,338	1,392	1,448	1,505	1,566	1,628	1,693	1,761	1,832	1,905	1,981	2,060	2,143	2,228	2,318	2,410	2,507
	0 Dollars	Revenue Sharing To Contractor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Total Indirect Operating Costs	1,582	1,645	1,711	1,779	1,850	1,924	2,001	2,081	2,165	2,251	2,341	2,435	2,532	2,634	2,739	2,848	2,962
		TOTAL COSTS																	
		Facility Operating Costs (F.O.C.)	13,247	14,175	15,156	16,193	17,289	18,447	19,183	19,949	20,746	21,575	22,436	23,332	24,264	25,234	26,242	27,290	28,380
		Dollars Per Ton Accepted	37.85	40.50	43.30	46.27	49.40	52.71	54.81	57.00	59.27	61.64	64.10	66.66	69.33	72.10	74.98	77.97	81.09
		Debt Service And F.O.C. Costs	28,344	29,272	30,253	31,290	32,386	33,544	34,280	35,046	35,843	36,672	37,533	38,429	39,361	40,331	41,339	42,387	43,477
		Dollars Per Ton Accepted	80.98	83.63	86.44	89.40	92.53	95.84	97.94	100.13	102.41	104.78	107.24	109.80	112.46	115.23	118.11	121.11	124.22
		SERVICE FEE TO METRO																	
		Gross Service Fee Dollars	22,376	22,990	23,813	24,535	25,316	26,474	26,580	27,031	27,670	27,869	28,101	28,524	28,354	27,905	28,756	29,174	29,635
350,000	410 kWh/Ton	Plus Metro Shortfall Payments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Net Service Fee Dollars	22,376	22,990	23,813	24,535	25,316	26,474	26,580	27,031	27,670	27,869	28,101	28,524	28,354	27,905	28,756	29,174	29,635
		Net Dollars Per Ton ($)	63.93	65.68	68.04	70.10	72.33	75.64	75.94	77.23	79.06	79.63	80.29	81.50	81.01	79.73	82.16	83.36	84.67
	1.04 Disc. Rate	Net Present Value/Ton (1987$)	54.65	53.99	53.77	53.27	52.85	53.14	51.30	50.17	49.38	47.82	46.36	45.25	43.25	40.93	40.56	39.56	38.64
		Avg. Present Value/Ton (1987$)	46.26																

SOURCE: GERSHMAN, BRICKNER & BRATTON, INC. \| Portland Metro Project: CB622-B \| Programmer: JVLK \|19-Jun-87

SCHNITZER/OGDEN
BASE CASE

Technology:	Mass Burn
Size:	350,000 tons per year
Capital:	$105,401,000
Annual O&M Cost:	$8,994,000
Energy Production:	470 kilowatt hours per ton
Site Location:	Schnitzer Steel
Interest Rate on Tax Exempt Debt:	9-1/2% per annum
Term of Tax Exempt Debt:	23 years
Interest Rate on Taxable Debt:	10-1/2% per annum
First Year Tipping Fee (1991):	$62.77
First Year (1991) Net Present Value of Tipping Fee ($ 1987):	$53.65
Average Present Value of Tipping Fees in $ 1987:	$43.10

SPECIAL COMMENTS:

1. Energy share to Metro is 90% in first year of operation, 88% in second, 86% in third, 84% in fourth, 82% in fifth, and 80% in sixth year and thereafter.
2. Site owned by Schnitzer, one of the joint venture partners.
3. No management fee.

PORTLAND METRO PROJECT - PAGE ONE
SCHNITZER STEEL PRODUCTS COMPANY/OGDEN MARTIN SYSTEMS, INC.
350,000 TPY MASS BURN FACILITY PROPOSAL-BASE

PORTLAND METRO RESOURCE RECOVERY PROJECT - BASE CASE REVENUE AND EXPENSE FORECAST
($000, Except Where Otherwise Specified)

ASSUMPTIONS:	OPERATING PERIOD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1986 Dollars	YEAR	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
	FACILITY OPERATING ANALYSIS																	
350,000 Tons	Accept. Waste Received (Tons)	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000
0.00 Percent	Bypass Waste (Tons)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Accept. Waste Processed (Tons)	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000
21 Percent	Residue to Landfill (Tons)	73,500	73,500	73,500	73,500	73,500	73,500	73,500	73,500	73,500	73,500	73,500	73,500	73,500	73,500	73,500	73,500	73,500
470 kWh/Ton	Electricity Produced (mWh/Year)	164,500	164,500	164,500	164,500	164,500	164,500	164,500	164,500	164,500	164,500	164,500	164,500	164,500	164,500	164,500	164,500	164,500
0 Pounds	Steam Produced (Pounds/Year)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4 Percent	Materials Recovered (Tons)	14,700	14,700	14,700	14,700	14,700	14,700	14,700	14,700	14,700	14,700	14,700	14,700	14,700	14,700	14,700	14,700	14,700
0 Percent	RDF Produced (Tons)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0 Percent	Compost Produced (Tons)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.04 esc. rate	REVENUES																	
	Electricity Value ($/mWh)	31.30	33.30	34.30	36.30	38.30	38.30	42.30	44.30	45.30	49.30	53.30	56.30	63.30	72.30	73.30	77.30	81.30
	Total Electricity Revenue	5,149	5,478	5,642	5,971	6,300	6,300	6,958	7,287	7,452	8,110	8,768	9,261	10,413	11,893	12,058	12,716	13,374
2.39 $/1,000#	Steam Value ($/1,000 Pounds)	2.91	3.02	3.15	3.27	3.40	3.54	3.68	3.83	3.98	4.14	4.30	4.48	4.66	4.84	5.04	5.24	5.45
	Total Steam Revenue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.00 $/Ton	Recovered Materials Value ($/Ton)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.02 esc. rate	Total Materials Revenue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.50 $/Ton	RDF Value ($/Ton)	9.12	9.49	9.87	10.26	10.67	11.10	11.55	12.01	12.49	12.99	13.51	14.05	14.61	15.19	15.80	16.43	17.09
	Total RDF Revenue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 $/Ton	Compost Value ($/Ton)	3.65	3.80	3.95	4.11	4.27	4.44	4.62	4.80	5.00	5.20	5.40	5.62	5.84	6.08	6.32	6.57	6.84
	Total Compost Revenue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total Revenues	5,149	5,478	5,642	5,971	6,300	6,300	6,958	7,287	7,452	8,110	8,768	9,261	10,413	11,893	12,058	12,716	13,374
	REVENUE CREDITS TO METRO																	
90 Percent	Percent Electricity Credit	90	88	86	84	82	80	80	80	80	80	80	80	80	80	80	80	80
In 1991	Dollar Electricity Credit	4,634	4,821	4,852	5,016	5,166	5,040	5,567	5,830	5,961	6,488	7,014	7,409	8,330	9,515	9,646	10,173	10,699
0 Percent	Percent Steam Credit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dollar Steam Credit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0 Percent	Percent Rec. Materials Credit	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Dollar Rec. Materials Credit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0 Percent	Percent RDF Credit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dollar RDF Credit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0 Percent	Percent Compost Credit	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Dollar Compost Credit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Revenue Credits To Metro	4,634	4,821	4,852	5,016	5,166	5,040	5,567	5,830	5,961	6,488	7,014	7,409	8,330	9,515	9,646	10,173	10,699
	TOTAL CREDITS/NET REVENUE TO METRO																	
	Subtotal - Revenue Credits	4,634	4,821	4,852	5,016	5,166	5,040	5,567	5,830	5,961	6,488	7,014	7,409	8,330	9,515	9,646	10,173	10,699
1,043,000 $/Year	Interest Income on Funds (1)	1,043	1,043	1,043	1,043	1,043	1,043	1,043	1,043	1,043	1,043	1,043	1,043	1,043	1,043	1,043	1,043	1,043
	Total Credits/Net Revenues	5,677	5,864	5,895	6,059	6,209	6,083	6,610	6,873	7,004	7,531	8,057	8,452	9,373	10,558	10,689	11,216	11,742
	Dollars Per Ton ($)	16.22	16.75	16.84	17.31	17.74	17.38	18.88	19.64	20.01	21.52	23.02	24.15	26.78	30.16	30.54	32.04	33.55

1. Based on a $12.64 million Debt Service Reserve Fund, and a $2 million Reserve and Contingency Fund, both at a 7 percent interest rate, compounded semi-annually.
SOURCE: GERSHMAN, BRICKNER & BRATTON, INC. • Portland Metro Project: C8622-B • Programmer:JVLK • 13-May-87

PORTLAND METRO PROJECT - PAGE TWO
SCHNITZER STEEL PRODUCTS COMPANY/OGDEN MARTIN SYSTEMS, INC.
350,000 TPY MASS BURN FACILITY PROPOSAL-BASE

PORTLAND METRO RESOURCE RECOVERY PROJECT - BASE CASE REVENUE AND EXPENSE FORECAST
($000, Except Where Otherwise Specified)

1987 ASSUMPTIONS:		OPERATING PERIOD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	1986 Dollars	YEAR	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
		COSTS																	
		Debt Service On Bonds	14,498	14,498	14,498	14,498	14,498	14,498	14,498	14,498	14,498	14,498	14,498	14,498	14,498	14,498	14,498	14,498	14,498
	1.04 Inflation	OPERATING & MAINTENANCE COST																	
	1,635,000 1986$	Personnel	1,989	2,069	2,152	2,238	2,327	2,420	2,517	2,618	2,722	2,831	2,945	3,062	3,185	3,312	3,445	3,582	3,726
	660,000 1986$	Utilities	803	835	869	903	939	977	1,016	1,057	1,099	1,143	1,189	1,236	1,286	1,337	1,391	1,446	1,504
	1,548,000 1986$	Facility Maintenance	1,883	1,959	2,037	2,119	2,203	2,291	2,383	2,478	2,578	2,681	2,788	2,899	3,015	3,136	3,261	3,392	3,528
	439,000 1986$	Processing Equipt. Maintenance	534	555	578	601	625	650	676	703	731	760	791	822	855	889	925	962	1,000
	91,000 1986$	Building Maintenance	111	115	120	125	130	135	140	146	152	158	164	170	177	184	192	199	207
	947,000 1986$	Raw Materials	1,152	1,198	1,246	1,296	1,348	1,402	1,458	1,516	1,577	1,640	1,705	1,774	1,845	1,918	1,995	2,075	2,158
	409,000 1986$	Contract Services	498	518	538	560	582	605	630	655	681	708	737	766	797	829	862	896	932
	19,000 1986$	Equipment Rental	23	24	25	26	27	28	29	30	32	33	34	36	37	38	40	42	43
	625,000 1986$	Equipment Replacement Fund	760	791	822	855	890	925	962	1,001	1,041	1,082	1,126	1,171	1,217	1,266	1,317	1,369	1,424
	385,000 1986$	Insurance Premium	468	487	507	527	548	570	593	616	641	667	693	721	750	780	811	844	877
		Total O & M Costs	8,222	8,551	8,893	9,249	9,619	10,003	10,404	10,820	11,253	11,703	12,171	12,658	13,164	13,690	14,238	14,808	15,400
		PASS THROUGH COSTS TO METRO																	
	2,111,460 1986$	Property Tax	2,569	2,672	2,779	2,890	3,005	3,125	3,250	3,381	3,516	3,656	3,803	3,955	4,113	4,277	4,449	4,626	4,812
	100,000 1986$	Site Lease	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	0 1986$	District Assessment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0 1986$	Trustees Fees	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0 1986$	Metro Administration Fees	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0 1986$	Office Supplies	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1986$	Residue/RDF/Compost Costs																	
10	0.60 $/Ton	Residue Hauling (10 miles)	537	558	580	604	628	653	679	706	734	764	794	826	859	893	929	966	1,005
Miles	20.00 $/Ton	Residue Disposal	1,720	1,788	1,860	1,934	2,012	2,092	2,176	2,263	2,354	2,448	2,546	2,647	2,753	2,863	2,978	3,097	3,221
	4.00 $/Ton	RDF Transportation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	3.75 $/Ton	Compost Transportation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Total Pass Through Costs	4,925	5,118	5,319	5,528	5,745	5,971	6,205	6,450	6,704	6,968	7,242	7,528	7,825	8,134	8,456	8,790	9,137
		INDIRECT OPERATING COSTS																	
	0 Dollars	Management Fee	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0 Dollars	Return On Equity	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0 Percent	Revenue Sharing To Contractor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Total Indirect Operating Costs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		TOTAL COSTS																	
		Facility Operating Costs (F.O.C.)	13,147	13,669	14,212	14,776	15,363	15,974	16,609	17,269	17,956	18,670	19,413	20,186	20,989	21,825	22,694	23,597	24,537
		Dollars Per Ton Accepted	37.56	39.05	40.61	42.22	43.90	45.64	47.45	49.34	51.30	53.34	55.47	57.67	59.97	62.36	64.84	67.42	70.11
		Debt Service And F.O.C. Costs	27,645	28,167	28,710	29,274	29,861	30,472	31,107	31,767	32,454	33,168	33,911	34,683	35,487	36,322	37,191	38,095	39,035
		Dollars Per Ton Accepted	78.99	80.48	82.03	83.64	85.32	87.06	88.88	90.76	92.73	94.77	96.89	99.10	101.39	103.78	106.26	108.84	111.53
		SERVICE FEE TO METRO																	
		Gross Service Fee Dollars	21,968	22,303	22,814	23,215	23,652	24,388	24,497	24,894	25,449	25,637	25,854	26,231	26,114	25,765	26,502	26,880	27,293
350,000	410 kWh/Ton	Plus Metro Shortfall Payments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Net Service Fee Dollars	21,968	22,303	22,814	23,215	23,652	24,388	24,497	24,894	25,449	25,637	25,854	26,231	26,114	25,765	26,502	26,880	27,293
		Net Dollars Per Ton ($)	62.77	63.72	65.18	66.33	67.58	69.68	69.99	71.13	72.71	73.25	73.87	74.95	74.61	73.61	75.72	76.80	77.98
	1.04 Disc. Rate	Net Present Value/Ton (1987$)	53.65	52.38	51.52	50.40	49.38	48.96	47.28	46.20	45.42	43.99	42.66	41.62	39.84	37.79	37.38	36.45	35.59
		Avg. Present Value/Ton (1987$)	43.10																

SOURCE: GERSHMAN, BRICKNER & BRATTON, INC. * Portland Metro Project: C8622-B * Programmer: JVLK *13-May-87

REUTER/BUHLER-MIAG
BASE CASE (SMALL)

Technology:	Compost
Size:	100,000 tons per year
Capital:	$23,580,000
Annual O&M Cost:	$2,495,035
Compost Production:	20,000 tons per year
Site Location:	Clackamas Industrial Park
Interest Rate on Tax Exempt Debt:	9-1/4% per annum
Term of Tax Exempt Debt:	23 years
Interest Rate on Taxable Debt:	10-1/4% per annum
First Year Tipping Fee (1991):	$58.00
First Year (1991) Net Present Value of Tipping Fee ($ 1987):	$51.56
Average Present Value of Tipping Fees in $ 1987:	$51.56

SPECIAL COMMENTS:

$58.00 per ton tipping fee in first year of operation escalating with CPI.

PORTLAND METRO PROJECT - PAGE ONE
REUTER, INC. AND BUHLER-MIAG
100,000 TPY COMPOSTING FACILITY PROPOSAL

PORTLAND METRO RESOURCE RECOVERY PROJECT - BASE CASE REVENUE AND EXPENSE FORECAST
($000, Except Where Otherwise Specified)

ASSUMPTIONS:	OPERATING PERIOD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1986 Dollars	YEAR	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
	FACILITY OPERATING ANALYSIS																	
100,000 Tons	Accept. Waste Received (Tons)	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
0 Percent	Bypass Waste (Tons)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Accept. Waste Processed (Tons)	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
13 Percent	Residue to Landfill (Tons)	12,710	12,710	12,710	12,710	12,710	12,710	12,710	12,710	12,710	12,710	12,710	12,710	12,710	12,710	12,710	12,710	12,710
0 mWh	Electricity Produced (mWh/Year)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0 Pounds	Steam Produced (Pounds/Year)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14 Percent	Materials Recovered (Tons)	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000
26 Percent	RDF Produced (Tons)	26,000	26,000	26,000	26,000	26,000	26,000	26,000	26,000	26,000	26,000	26,000	26,000	26,000	26,000	26,000	26,000	26,000
20 Percent	Compost Produced (Tons)	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000
1.04 esc. rate	REVENUES																	
$/mWh	Electricity Value ($/mWh)	31.30	33.30	34.30	36.30	38.30	38.30	42.30	44.30	45.30	49.30	53.30	56.30	63.30	72.30	73.30	77.30	81.30
	Total Electricity Revenue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.39 $/1,000#	Steam Value ($/1,000 Pounds)	2.80	2.91	3.02	3.15	3.27	3.40	3.54	3.68	3.83	3.98	4.14	4.30	4.48	4.66	4.84	5.04	5.24
	Total Steam Revenue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5 $/Ton	Recovered Materials Value ($/Ton)	5.85	5.97	6.09	6.21	6.33	6.46	6.59	6.72	6.85	6.99	7.13	7.27	7.42	7.57	7.72	7.87	8.03
1.02 esc. rate	Total Materials Revenue	82	84	85	87	89	90	92	94	96	98	100	102	104	106	108	110	112
7.5 $/Ton	RDF Value ($/Ton)	8.77	9.12	9.49	9.87	10.26	10.67	11.10	11.55	12.01	12.49	12.99	13.51	14.05	14.61	15.19	15.80	16.43
	Total RDF Revenue	228	237	247	257	267	278	289	300	312	325	338	351	365	380	395	411	427
5 $/Ton	Compost Value ($/Ton)	5.85	6.08	6.33	6.58	6.84	7.12	7.40	7.70	8.01	8.33	8.66	9.00	9.36	9.74	10.13	10.53	10.96
	Total Compost Revenue	117	122	127	132	137	142	148	154	160	167	173	180	187	195	203	211	219
	Total Revenues	427	442	458	475	492	510	529	548	568	589	611	633	656	681	706	732	759
	REVENUE CREDITS TO METRO																	
0 Percent	Percent Electricity Credit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dollar Electricity Credit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0 Percent	Percent Steam Credit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dollar Steam Credit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.00 Percent	Percent Rec. Materials Credit	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Dollar Rec. Materials Credit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0 Percent	Percent RDF Credit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dollar RDF Credit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.00 Percent	Percent Compost Credit	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Dollar Compost Credit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Revenue Credits To Metro	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL CREDITS/NET REVENUE TO METRO																	
	Subtotal - Revenue Credits	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
192,300 $/Year	Interest Income on Funds (1)	192	192	192	192	192	192	192	192	192	192	192	192	192	192	192	192	192
	Total Credits/Net Revenues	192	192	192	192	192	192	192	192	192	192	192	192	192	192	192	192	192
	Dollars Per Ton ($)	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92

1. Based on a $2.7 million Debt Service Reserve Fund, at a 7 percent interest rate, compounded semi-annually.
SOURCE: GERSHMAN, BRICKNER & BRATTON, INC. • Portland Metro Project: CB622-B • Programmer:JVLK • 11-May-87

PORTLAND METRO PROJECT - PAGE TWO
REUTER, INC. AND BUHLER-MIAG
100,000 TPY COMPOSTING FACILITY PROPOSAL

PORTLAND METRO RESOURCE RECOVERY PROJECT - BASE CASE REVENUE AND EXPENSE FORECAST
($000, Except Where Otherwise Specified)

		OPERATING PERIOD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	1986 Dollars	YEAR	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
		COSTS																	
		Debt Service On Bonds	3013	3,010	3,009	3,012	3,010	3,013	3,014	3,008	3,015	3,008	3,013	3,008	3,013	3,010	3,015	3,011	3,007
	1.04 Inflation	OPERATING & MAINTENANCE COST																	
	1,061,000 1986$	Personnel	1,241	1,291	1,343	1,396	1,452	1,510	1,571	1,633	1,699	1,767	1,837	1,911	1,987	2,067	2,149	2,235	2,325
	406,720 1986$	Utilities	476	495	515	535	557	579	602	626	651	677	704	732	762	792	824	857	891
	0 1986$	Facility Maintenance	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	217,000 1986$	Processing Equipt. Maintenance	254	264	275	286	297	309	321	334	347	361	376	391	406	423	440	457	475
	0 1986$	Building Maintenance	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0 1986$	Raw Materials	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0 1986$	Contract Services	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0 1986$	Equipment Rental	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0 1986$	Equipment Replacement Fund	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	238,080 1986$	Insurance Premium	279	290	301	313	326	339	352	367	381	396	412	429	446	464	482	502	522
		Total O & M Costs	2,249	2,339	2,433	2,530	2,631	2,737	2,846	2,960	3,078	3,202	3,330	3,463	3,601	3,745	3,895	4,051	4,213
		PASS THROUGH COSTS TO METRO																	
	413,362 1986$	Property Tax	484	503	523	544	566	588	612	636	662	688	716	744	774	805	837	871	906
	0 1986$	Site Lease	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0 1986$	District Assessment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0 1986$	Trustees Fees	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0 1986$	Metro Administration Fees	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0 1986$	Office Supplies	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Residue/RDF/Compost Costs																	
10	0.60 $/Ton	Residue Hauling (10 miles)	89	93	96	100	104	109	113	117	122	127	132	137	143	149	154	161	167
Miles	20.00 $/Ton	Residue Disposal	297	309	322	335	348	362	376	391	407	423	440	458	476	495	515	536	557
	4.00 $/Ton	RDF Transportation	122	127	132	137	142	148	154	160	167	173	180	187	195	203	211	219	228
	3.75 $/Ton	Compost Transportation	88	91	95	99	103	107	111	116	120	125	130	135	141	146	152	158	164
		Total Pass Through Costs	1,080	1,123	1,168	1,214	1,263	1,314	1,366	1,421	1,478	1,537	1,598	1,662	1,729	1,798	1,870	1,944	2,022
		INDIRECT OPERATING COSTS																	
	142,265 Dollars	Management Fee	166	173	180	187	195	202	211	219	228	237	246	256	266	277	288	300	312
	0 Dollars	Return On Equity	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0 Percent	Revenue Sharing To Contractor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Total Indirect Operating Costs	166	173	180	187	195	202	211	219	228	237	246	256	266	277	288	300	312
		TOTAL COSTS																	
		Facility Operating Costs (F.O.C.)	3,495	3,635	3,781	3,932	4,089	4,253	4,423	4,600	4,784	4,975	5,174	5,381	5,596	5,820	6,053	6,295	6,547
		Dollars Per Ton Accepted	34.95	36.35	37.81	39.32	40.89	42.53	44.23	46.00	47.84	49.75	51.74	53.81	55.96	58.20	60.53	62.95	65.47
		Debt Service And F.O.C. Costs	6,505	6,644	6,793	6,942	7,102	7,267	7,431	7,615	7,792	7,988	8,182	8,394	8,606	8,835	9,064	9,302	9,559
		Dollars Per Ton Accepted	65.05	66.44	67.93	69.42	71.02	72.67	74.31	76.15	77.92	79.88	81.82	83.94	86.06	88.35	90.64	93.02	95.59
		SERVICE FEE TO METRO																	
		Gross Service Fee Dollars	5,800	6,032	6,273	6,524	6,785	7,057	7,339	7,632	7,938	8,255	8,585	8,929	9,286	9,657	10,044	10,445	10,863
100000	410 kWh/Ton	Plus Metro Shortfall Payments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Net Service Fee Dollars	5,800	6,032	6,273	6,524	6,785	7,057	7,339	7,632	7,938	8,255	8,585	8,929	9,286	9,657	10,044	10,445	10,863
		Net Dollars Per Ton ($)	58.00	60.32	62.73	65.24	67.85	70.57	73.39	76.32	79.38	82.55	85.85	89.29	92.86	96.57	100.44	104.45	108.63
	1.04 Disc. Rate	Net Present Value/Ton (1987$)	51.56	51.56	51.56	51.56	51.56	51.56	51.56	51.56	51.56	51.56	51.56	51.56	51.56	51.56	51.56	51.56	51.56
		Avg. Present Value/Ton (1987$)	51.56																

SOURCE: GERSHMAN, BRICKNER & BRATTON, INC. * Portland Metro Project: C8622-B * Programmer: JVLK *11-May-87

RIEDEL/DANO
BASE CASE (SMALL)

Technology:	Compost
Size:	100,000 tons per year
Capital:	$10,242,837
Annual O&M Cost:	$3,211,858
Compost Production:	60,000 tons per year
Site Location:	Clackamas Transfer and Recycling Center
Interest Rate on Tax Exempt Debt:	9-1/4% per annum
Term of Tax Exempt Debt:	23 years
Interest Rate on Taxable Debt:	10-1/4% per annum
First Year Tipping Fee (1991):	$51.62
First Year (1991) Net Present Value of Tipping Fee ($ 1987):	$45.89
Average Present Value of Tipping Fees in $ 1987:	$27.52

PORTLAND METRO PROJECT - PAGE ONE
RIEDEL ENVIRONMENTAL TECHNOLOGIES, INC.
100,000 TPY COMPOSTING FACILITY PROPOSAL-BASE

PORTLAND METRO RESOURCE RECOVERY PROJECT - BASE CASE REVENUE AND EXPENSE FORECAST
($000, Except Where Otherwise Specified)

ASSUMPTIONS:	OPERATING PERIOD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1986 Dollars	YEAR	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
	FACILITY OPERATING ANALYSIS																	
100,000 Tons	Accept. Waste Received (Tons)	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
33 Percent	Bypass Waste (Tons)	33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000
	Accept. Waste Processed (Tons)	67,000	67,000	67,000	67,000	67,000	67,000	67,000	67,000	67,000	67,000	67,000	67,000	67,000	67,000	67,000	67,000	67,000
45 Percent	Residue to Landfill (Tons)	30,150	30,150	30,150	30,150	30,150	30,150	30,150	30,150	30,150	30,150	30,150	30,150	30,150	30,150	30,150	30,150	30,150
0 mWh	Electricity Produced (mWh/Year)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0 Pounds	Steam Produced (Pounds/Year)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10 Percent	Materials Recovered (Tons)	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
0 Percent	RDF Produced (Tons)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60 Percent	Compost Produced (Tons)	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000
10 Percent	Recovered Waste (Hog Fuel) (Tons)	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
1.04 esc. rate	REVENUES																	
$/mWh	Electricity Value ($/mWh)	31.30	33.30	34.30	36.30	38.30	38.30	42.30	44.30	45.30	49.30	53.30	56.30	63.30	72.30	73.30	77.30	81.30
	Total Electricity Revenue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.39 $/1,000#	Steam Value ($/1,000 Pounds)	2.80	2.91	3.02	3.15	3.27	3.40	3.54	3.68	3.83	3.98	4.14	4.30	4.48	4.66	4.84	5.04	5.24
	Total Steam Revenue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5 $/Ton	Recovered Materials Value ($/Ton)	5.85	5.97	6.09	6.21	6.33	6.46	6.59	6.72	6.85	6.99	7.13	7.27	7.42	7.57	7.72	7.87	8.03
1.02 esc. rate	Gross Materials Revenue	58	60	61	62	63	65	66	67	69	70	71	73	74	76	77	79	80
7.5 $/Ton	RDF Value ($/Ton)	8.77	9.12	9.49	9.87	10.26	10.67	11.10	11.55	12.01	12.49	12.99	13.51	14.05	14.61	15.19	15.80	16.43
	Total RDF Revenue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 $/Ton	Compost Value ($/Ton)	3.51	3.65	3.80	3.95	4.11	4.27	4.44	4.62	4.80	5.00	5.20	5.40	5.62	5.84	6.08	6.32	6.57
	Total Compost Revenue	0	219	228	237	246	256	266	277	288	300	312	324	337	351	365	379	394
	Total Revenues	58	279	289	299	310	321	332	344	357	370	383	397	411	426	442	458	475
	REVENUE CREDITS TO METRO																	
0 Percent	Percent Electricity Credit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dollar Electricity Credit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0 Percent	Percent Steam Credit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dollar Steam Credit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66.60 Percent	Percent Rec. Materials Credit	66.60	66.60	66.60	66.60	66.60	66.60	66.60	66.60	66.60	66.60	66.60	66.60	66.60	66.60	66.60	66.60	66.60
	Dollar Rec. Materials Credit	39	40	41	41	42	43	44	45	46	47	47	48	49	50	51	52	53
0 Percent	Percent RDF Credit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dollar RDF Credit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66.60 Percent	Percent Compost Credit	66.60	66.60	66.60	66.60	66.60	66.60	66.60	66.60	66.60	66.60	66.60	66.60	66.60	66.60	66.60	66.60	66.60
	Dollar Compost Credit	0	146	152	158	164	171	177	185	192	200	208	216	225	234	243	253	263
	Revenue Credits To Metro	39	186	192	199	206	214	221	229	238	246	255	264	274	284	294	305	316
	TOTAL CREDITS/NET REVENUE TO METRO																	
	Subtotal - Revenue Credits	39	186	192	199	206	214	221	229	238	246	255	264	274	284	294	305	316
89,700 $/Year	Interest Income on Funds	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90
	Total Credits/Net Revenues	129	275	282	289	296	303	311	319	327	336	345	354	364	374	384	395	406
	Dollars Per Ton ($)	1.29	2.75	2.82	2.89	2.96	3.03	3.11	3.19	3.27	3.36	3.45	3.54	3.64	3.74	3.84	3.95	4.06

1. Based on a $1.26 million Debt Service Reserve Fund, at a 7 percent interest rate, compounded semi-annually.
SOURCE: GERSHMAN, BRICKNER & BRATTON, INC. • Portland Metro Project: C8622-8 • Programmer:JVLK • 13-May-87

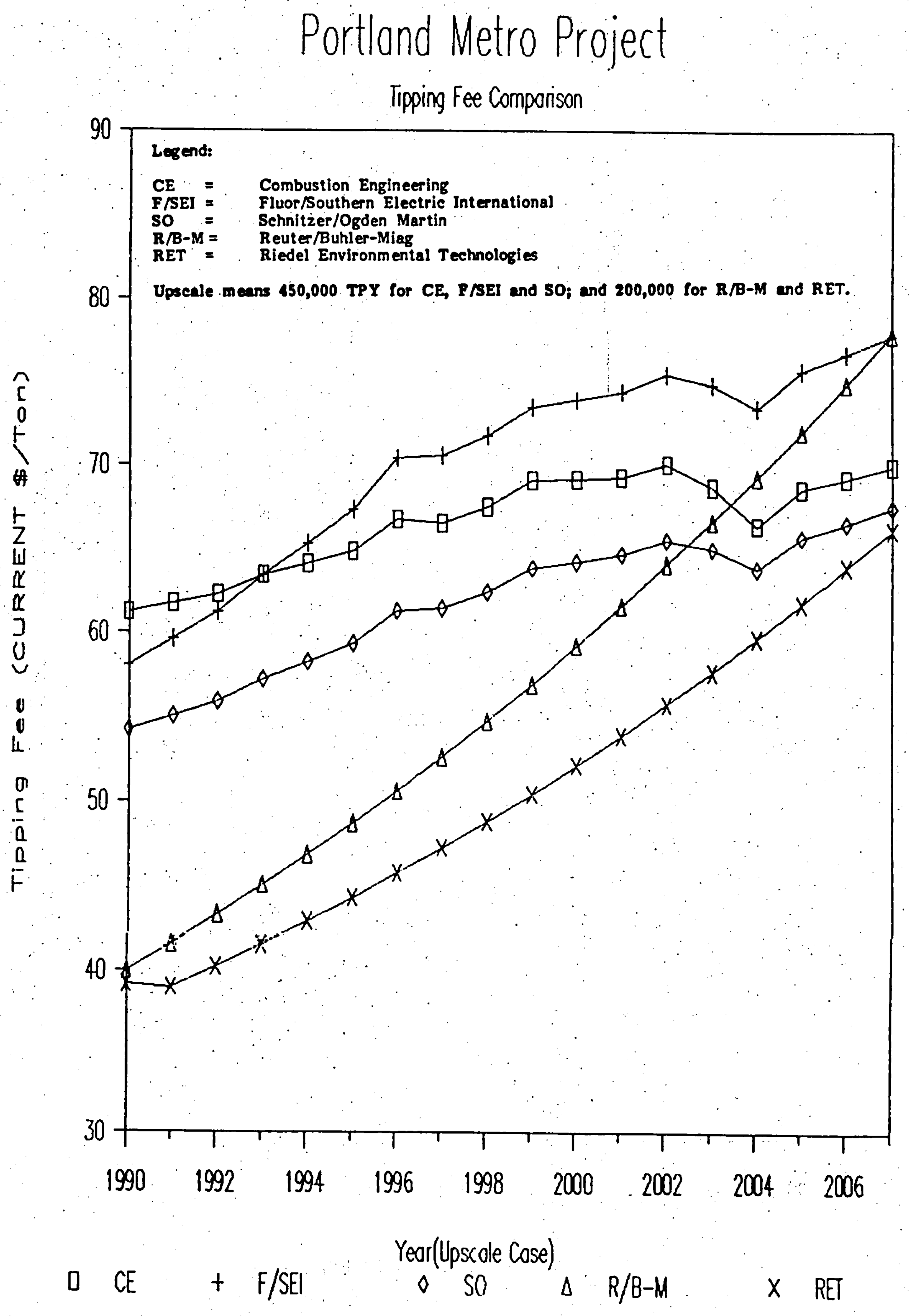
PORTLAND METRO PROJECT - PAGE TWO
RIEDEL ENVIRONMENTAL TECHNOLOGIES, INC.
100,000 TPY COMPOSTING FACILITY PROPOSAL-BASE

PORTLAND METRO RESOURCE RECOVERY PROJECT - BASE CASE REVENUE AND EXPENSE FORECAST
($000, Except Where Otherwise Specified)

		OPERATING PERIOD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	1986 Dollars	YEAR	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
		COSTS																	
		Debt Service On Bonds	1,402	1,402	1,402	1,402	1,402	1,402	1,402	1,402	1,402	1,402	1,402	1,402	1,402	1,402	1,402	1,402	1,402
	1.04 Inflation	OPERATING & MAINTENANCE COST																	
	447,302 1986$	Personnel	523	544	566	589	612	637	662	689	716	745	775	806	838	871	906	942	980
	222,500 1986$	Utilities	260	271	282	293	305	317	329	343	356	370	385	401	417	433	451	469	488
	10,000 1986$	Facility Maintenance	12	12	13	13	14	14	15	15	16	17	17	18	19	19	20	21	22
	60,000 1986$	Processing Equipt. Maintenance	70	73	76	79	82	85	89	92	96	100	104	108	112	117	122	126	131
	30,000 1986$	Building Maintenance	35	36	38	39	41	43	44	46	48	50	52	54	56	58	61	63	66
	0 1986$	Raw Materials	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	111,000 1986$	Contract Services	130	135	140	146	152	158	164	171	178	185	192	200	208	216	225	234	243
	0 1986$	Equipment Rental	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	50,000 1986$	Equipment Replacement Fund	58	61	63	66	68	71	74	77	80	83	87	90	94	97	101	105	110
	273,600 1986$	Insurance Premium	320	333	346	360	374	389	405	421	438	456	474	493	512	533	554	576	599
		Total O & M Costs	1,409	1,465	1,524	1,585	1,648	1,714	1,783	1,854	1,928	2,005	2,086	2,169	2,256	2,346	2,440	2,537	2,639
		PASS THROUGH COSTS TO METRO																	
	174,000 1986$	Property Tax	204	212	220	229	238	248	258	268	279	290	301	313	326	339	352	367	381
	0 1986$	Site Lease	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0 1986$	District Assessment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2,000 1986$	Trustees Fees	2	2	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4
	0 1986$	Metro Administration Fees	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	15,000 1986$	Office Supplies	18	18	19	20	21	21	22	23	24	25	26	27	28	29	30	32	33
		Residue/RDF/Compost Costs																	
10	0.60 $/Ton	Residue Hauling (10 miles)	212	220	229	238	248	257	268	278	290	301	313	326	339	352	366	381	396
Miles	20.00 $/Ton	Residue Disposal	705	734	763	794	825	858	893	928	965	1,004	1,044	1,086	1,129	1,175	1,222	1,270	1,321
	4.00 $/Ton	RDF Transportation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	3.75 $/Ton	Compost Transportation	263	274	285	296	308	321	333	347	361	375	390	406	422	439	456	474	493
		Total Pass Through Costs	1,404	1,460	1,519	1,579	1,642	1,708	1,776	1,847	1,921	1,998	2,078	2,161	2,248	2,338	2,431	2,528	2,630
		INDIRECT OPERATING COSTS																	
	500,000 Dollars	Management Fee	585	608	633	658	684	712	740	770	801	833	866	900	936	974	1,013	1,053	1,096
	368,742 Dollars	Return On Equity	431	449	467	485	505	525	546	568	590	614	639	664	691	718	747	777	808
	0 Percent	Revenue Sharing To Contractor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	50,000 Dollars	Dano Royalty	58	61	63	66	68	71	74	77	80	83	87	90	94	97	101	105	110
		Total Indirect Operating Costs	1,075	1,118	1,163	1,209	1,257	1,308	1,360	1,414	1,471	1,530	1,591	1,655	1,721	1,790	1,861	1,936	2,013
		TOTAL COSTS																	
		Facility Operating Costs (F.O.C.)	3,888	4,043	4,205	4,373	4,548	4,730	4,919	5,116	5,321	5,533	5,755	5,985	6,224	6,473	6,732	7,002	7,282
		Dollars Per Ton Accepted	38.88	40.43	42.05	43.73	45.48	47.30	49.19	51.16	53.21	55.33	57.55	59.85	62.24	64.73	67.32	70.02	72.82
		Debt Service And F.O.C. Costs	5,290	5,446	5,607	5,776	5,951	6,132	6,322	6,518	6,723	6,936	7,157	7,387	7,627	7,876	8,135	8,404	8,684
		Dollars Per Ton Accepted	52.90	54.46	56.07	57.76	59.51	61.32	63.22	65.18	67.23	69.36	71.57	73.87	76.27	78.76	81.35	84.04	86.84
		SERVICE FEE TO METRO																	
		Gross Service Fee Dollars	5,162	5,170	5,325	5,487	5,655	5,829	6,011	6,199	6,396	6,600	6,812	7,033	7,263	7,502	7,751	8,009	8,278
100000	410 kWh/Ton	Plus Metro Shortfall Payments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Net Service Fee Dollars	5,162	5,170	5,325	5,487	5,655	5,829	6,011	6,199	6,396	6,600	6,812	7,033	7,263	7,502	7,751	8,009	8,278
		Net Dollars Per Ton ($)	51.62	51.70	53.25	54.87	56.55	58.29	60.11	61.99	63.96	66.00	68.12	70.33	72.63	75.02	77.51	80.09	82.78
	1.04 Disc. Rate	Net Present Value/Ton (1987$)	45.89	44.20	43.77	43.36	42.97	42.59	42.23	41.88	41.55	41.22	40.91	40.62	40.33	40.05	39.79	39.54	39.29
		Avg. Present Value/Ton (1987$)	27.52																

SOURCE: GERSHMAN, BRICKNER & BRATTON, INC. * Portland Metro Project: C8622-B * Programmer: JVLK *13-May-87

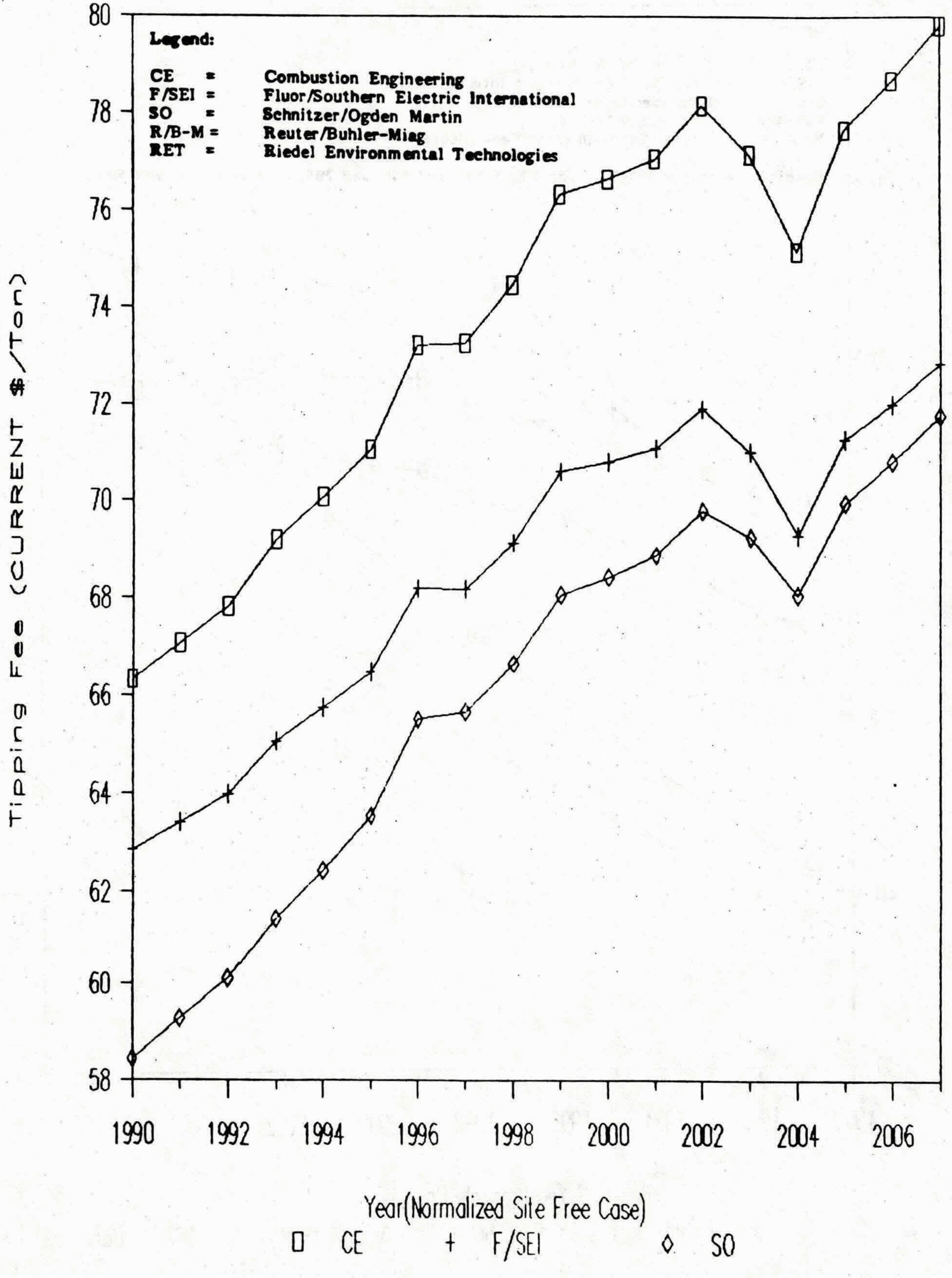
4. GRAPHED RESULTS OF SENSITIVITY ANALYSES

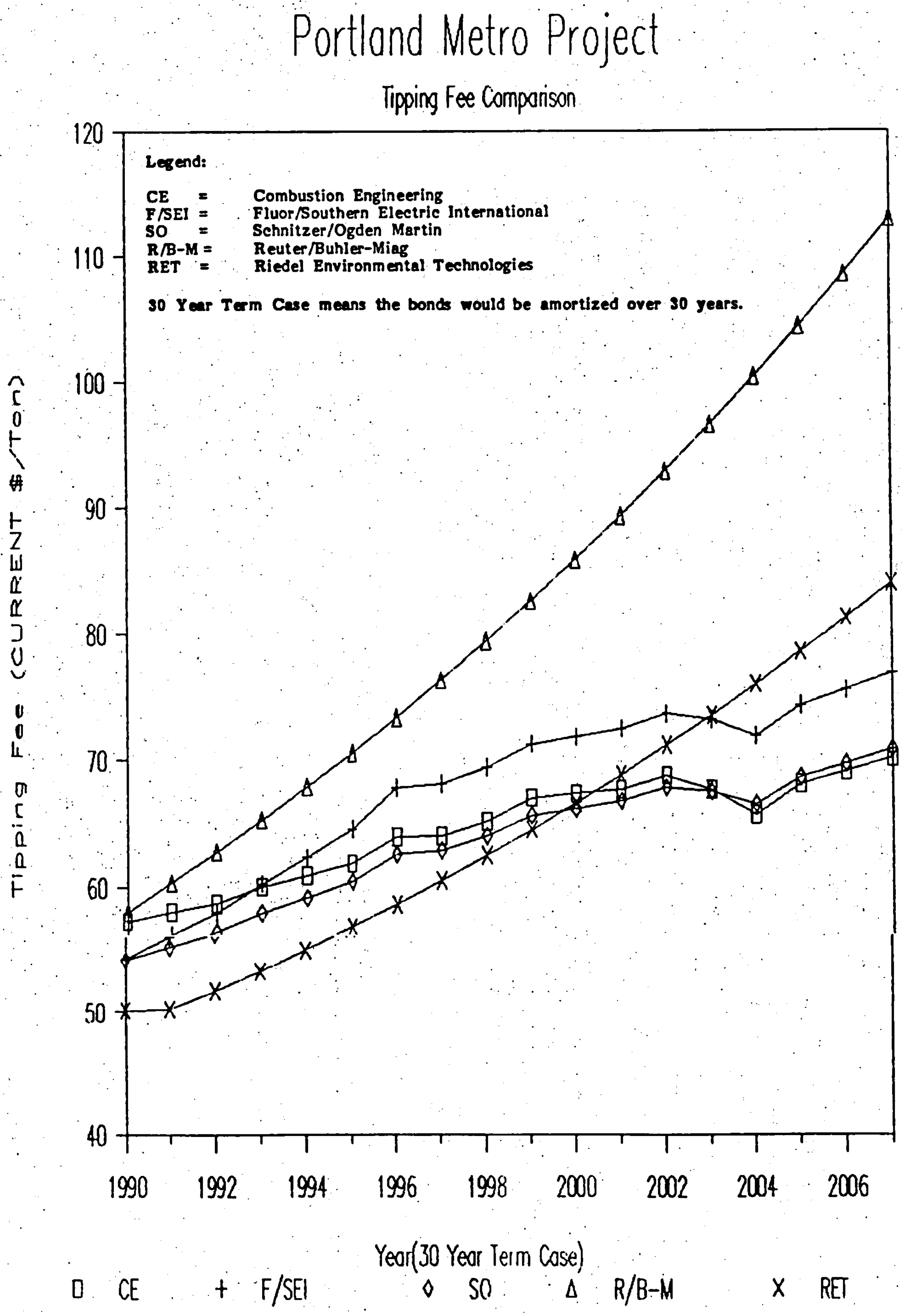


Portland Metro Project
Tipping Fee Comparison
Legend:
CE = Combustion Engineering
F/SEI = Fluor/Southern Electric International
SO = Schnitzer/Ogden Martin
R/B-M = Reuter/Buhler-Miag
RET = Riedel Environmental Technologies
Upscale means 450,000 TPY for CE, F/SEI and SO; and 200,000 for R/B-M and RET.
Tipping Fee (CURRENT $/Ton)
90
80
70
60
50
40
30
1990
1992
1994
1996
1998
2000
2002
2004
2006
Year(Upscale Case)
CE
F/SEI
SO
R/B-M
RET

Portland Metro Project

Tipping Fee Comparison

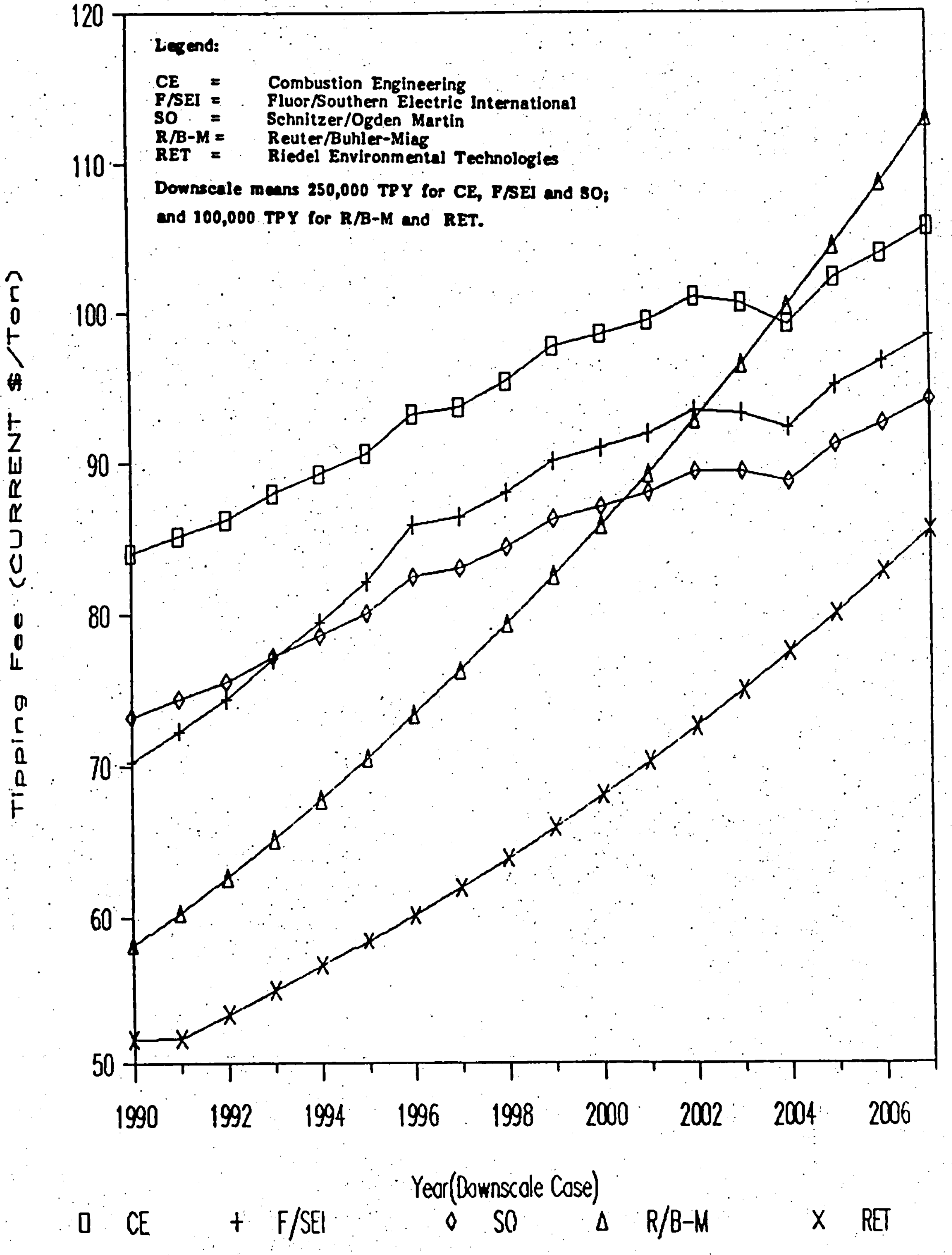




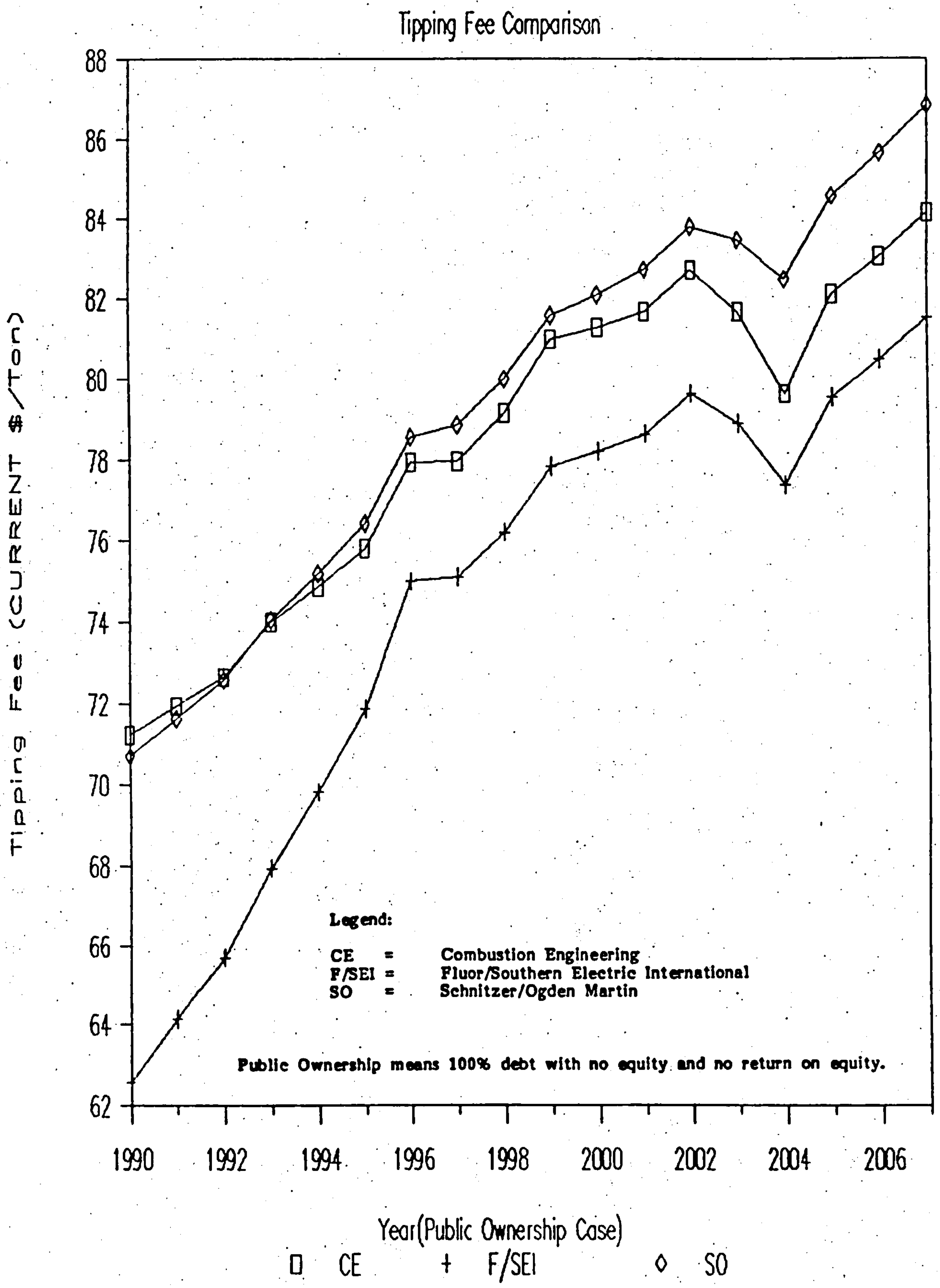
Portland Metro Project
Tipping Fee Comparison
Legend:
CE = Combustion Engineering
F/SEI = Fluor/Southern Electric International
SO = Schnitzer/Ogden Martin
R/B-M = Reuter/Buhler-Miag
RET = Riedel Environmental Technologies
30 Year Term Case means the bonds would be amortized over 30 years.
Tipping Fee (CURRENT $/Ton)
120
110
100
90
80
70
60
50
40
1990
1992
1994
1996
1998
2000
2002
2004
2006
Year(30 Year Term Case)
□ CE
+ F/SEI
◊ SO
Δ R/B-M
X RET

Portland Metro Project

Tipping Fee Comparison

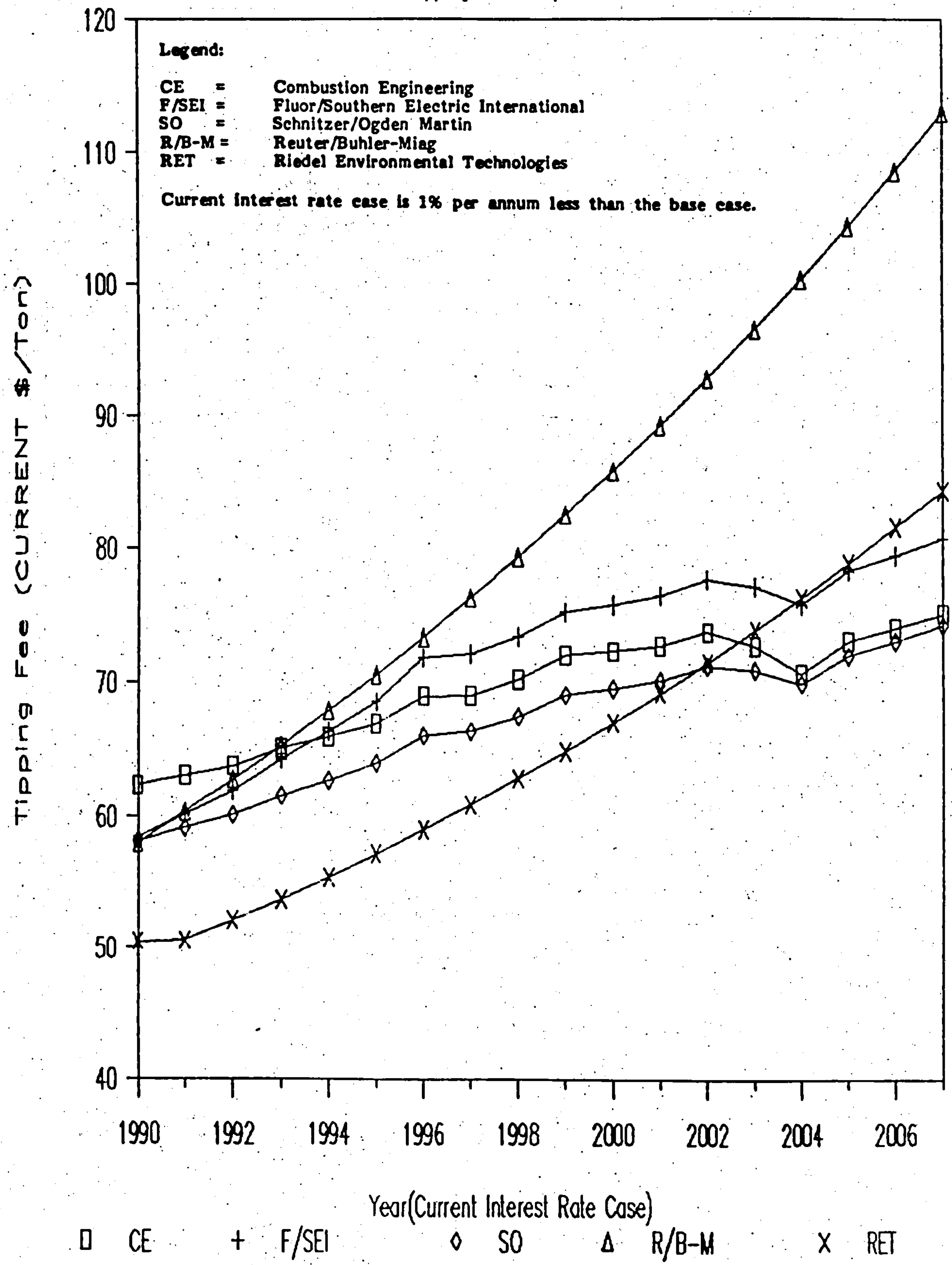


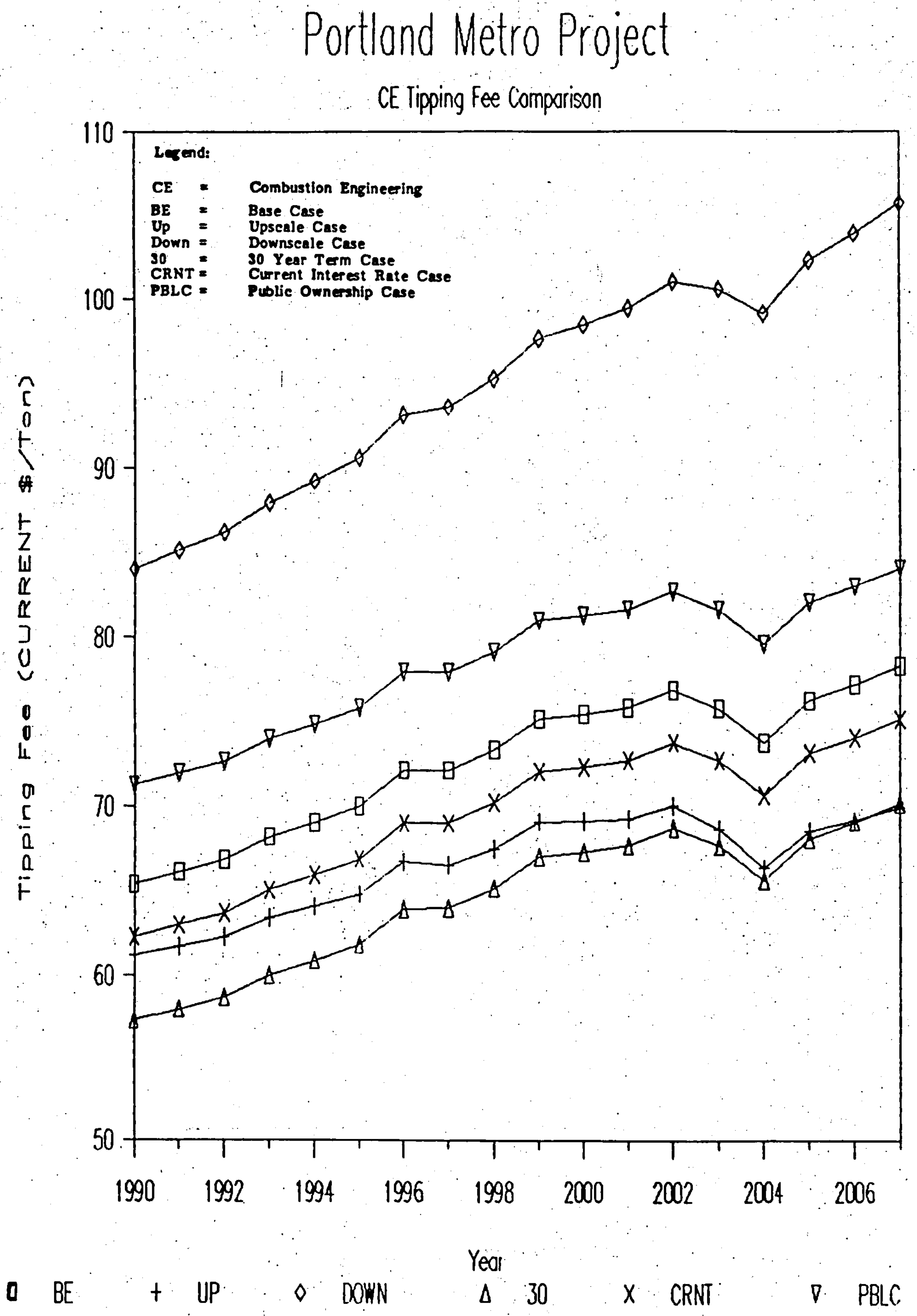
Portland Metro Project

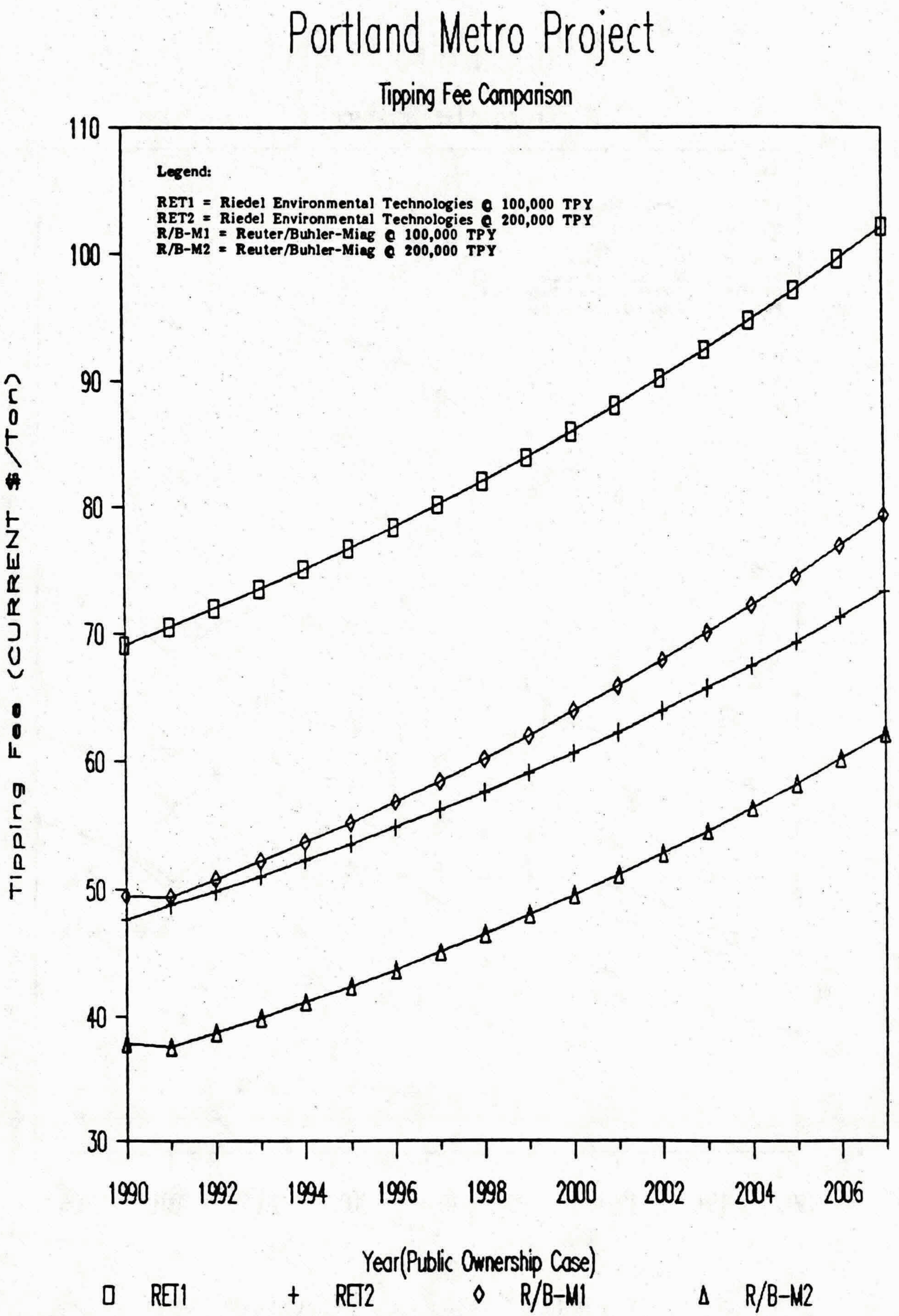


Portland Metro Project

Tipping Fee Comparison

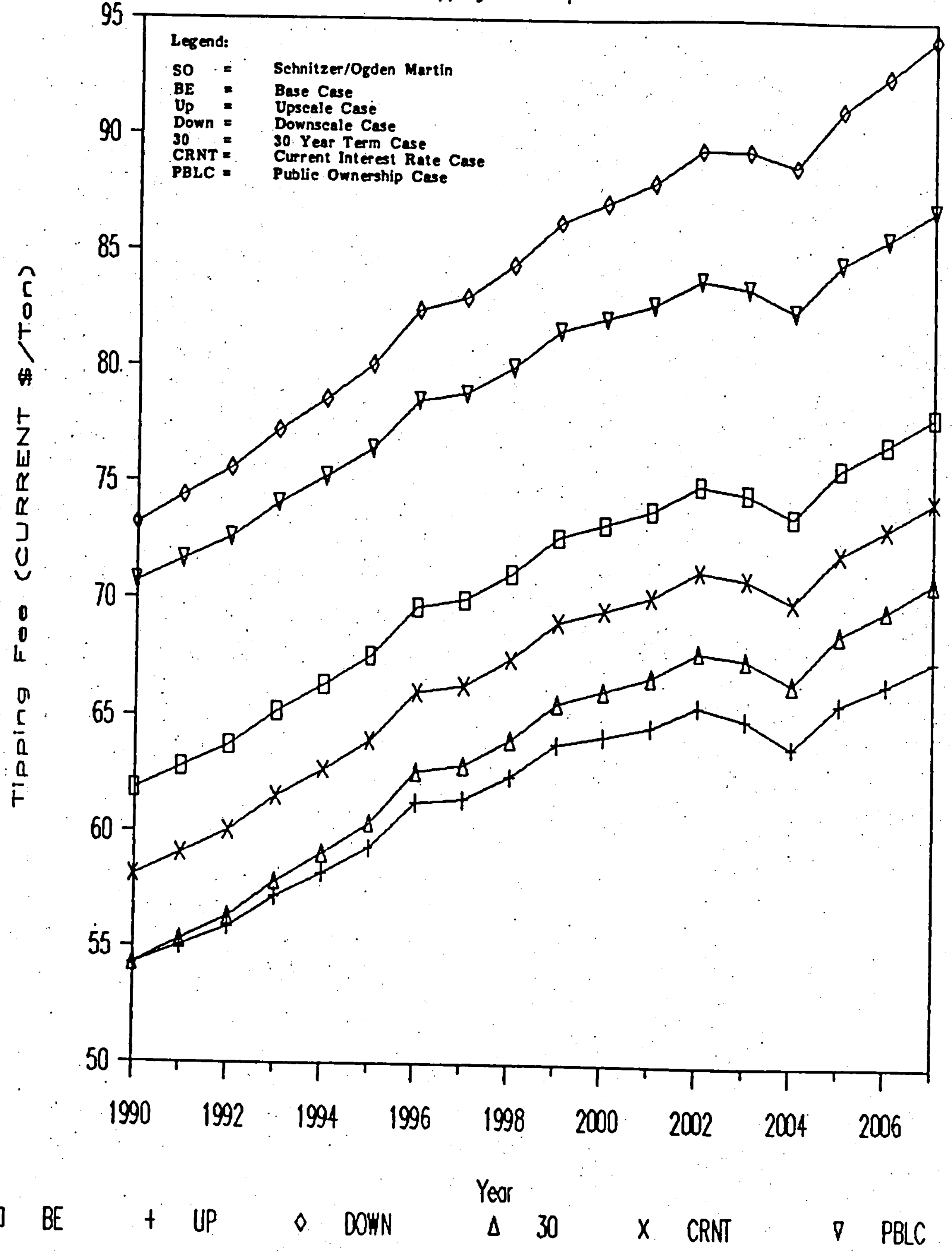


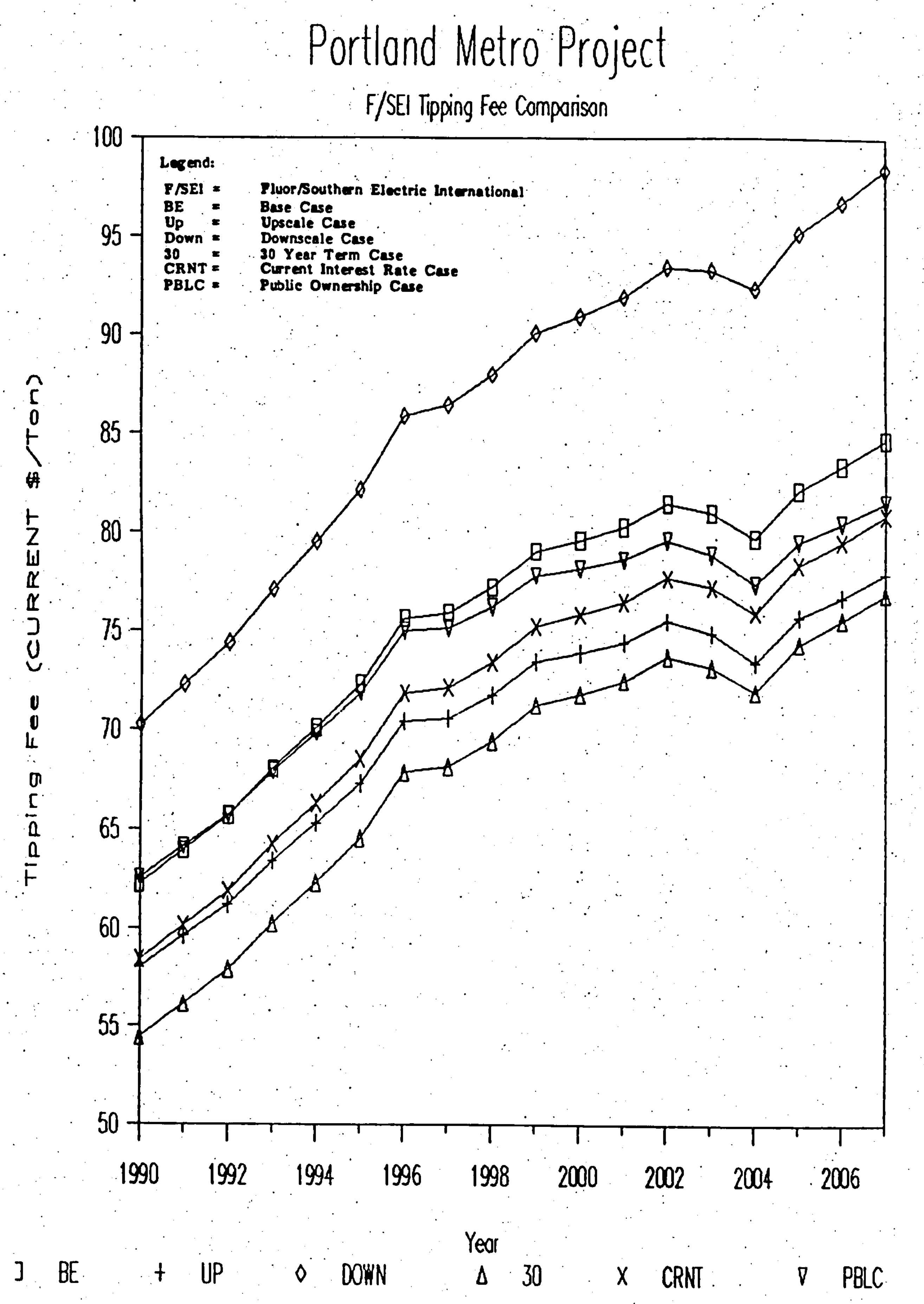

Portland Metro Project
CE Tipping Fee Comparison
Legend:
CE = Combustion Engineering
BE = Base Case
Up = Upscale Case
Down = Downscale Case
30 = 30 Year Term Case
CRNT = Current Interest Rate Case
PBLC = Public Ownership Case
Tipping Fee (CURRENT $/Ton)
110
100
90
80
70
60
50
1990
1992
1994
1996
1998
2000
2002
2004
2006
Year
BE
UP
DOWN
30
CRNT
PBLC


Portland Metro Project
Tipping Fee Comparison
Legend:
RET1 = Riedel Environmental Technologies @ 100,000 TPY
RET2 = Riedel Environmental Technologies @ 200,000 TPY
R/B-M1 = Reuter/Buhler-Miag @ 100,000 TPY
R/B-M2 = Reuter/Buhler-Miag @ 200,000 TPY
Tipping Fee (CURRENT $/Ton)
110
100
90
80
70
60
50
40
30
1990
1992
1994
1996
1998
2000
2002
2004
2006
Year(Public Ownership Case)
RET1
RET2
R/B-M1
R/B-M2

Portland Metro Project

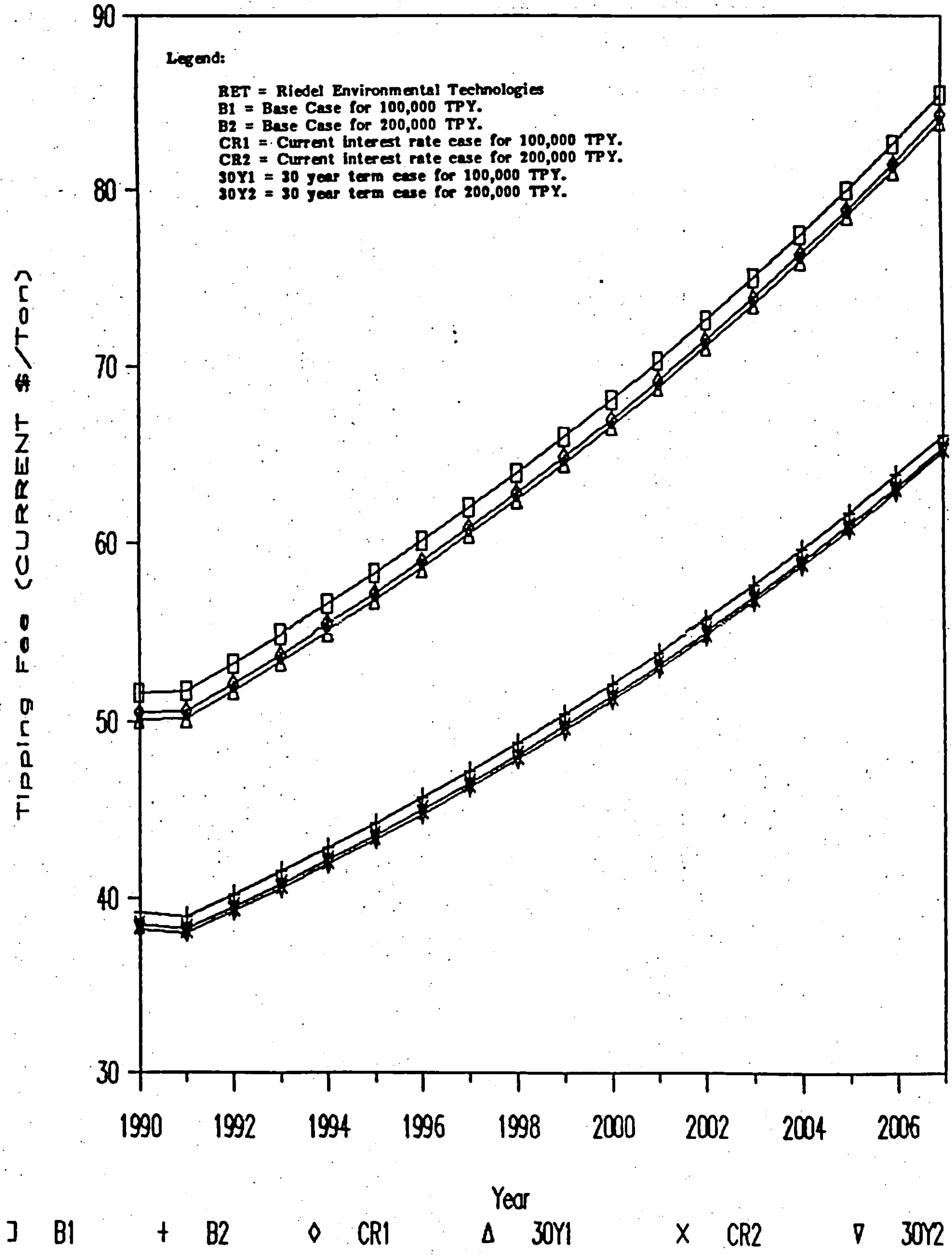
SO Tipping Fee Comparison

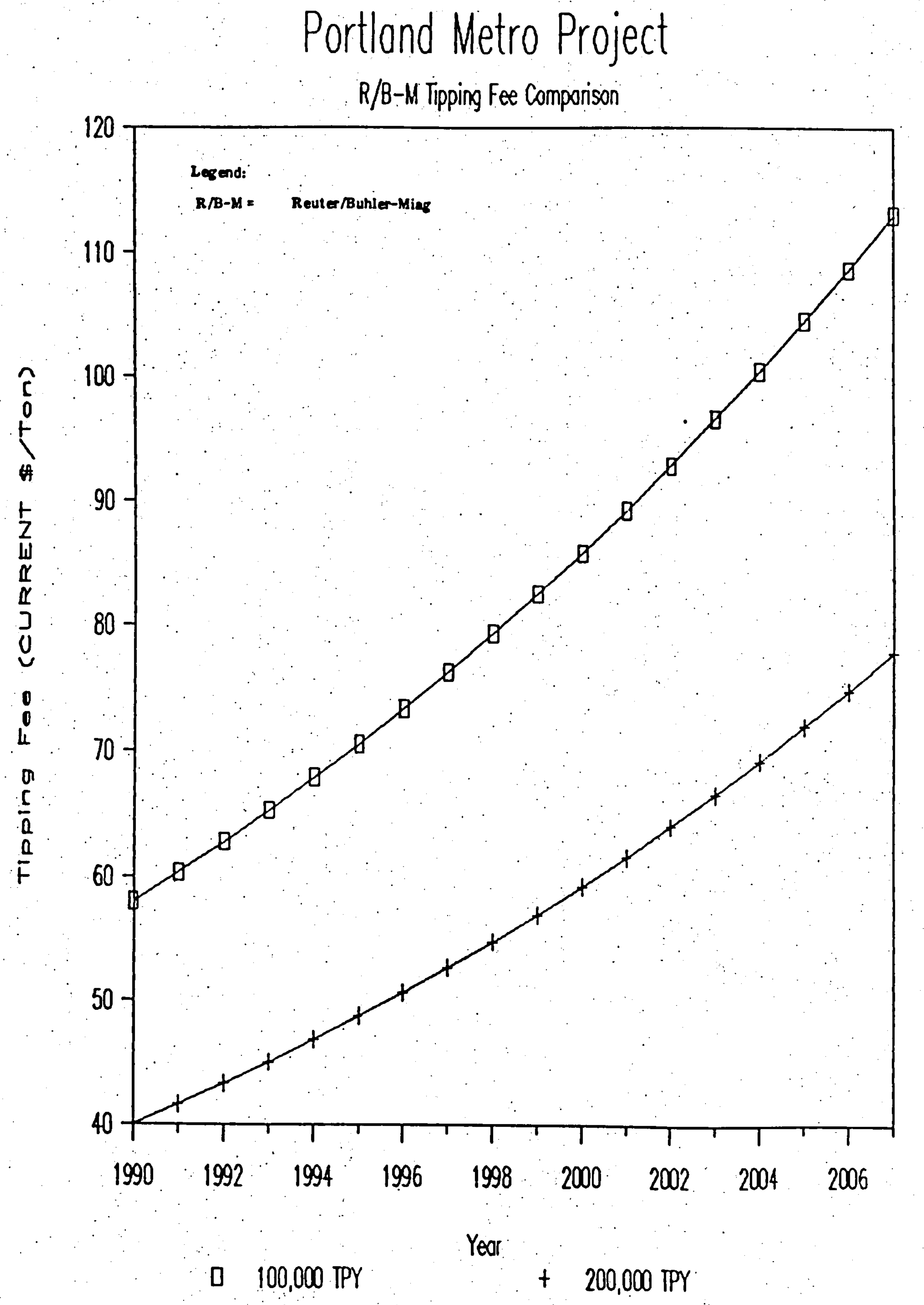



Portland Metro Project
F/SEI Tipping Fee Comparison
Legend:
F/SEI = Fluor/Southern Electric International
BE = Base Case
Up = Upscale Case
Down = Downscale Case
30 = 30 Year Term Case
CRNT = Current Interest Rate Case
PBLC = Public Ownership Case
Tipping Fee (CURRENT $/Ton)
100
95
90
85
80
75
70
65
60
55
50
1990
1992
1994
1996
1998
2000
2002
2004
2006
Year
BE
UP
DOWN
30
CRNT
PBLC

Portland Metro Project

RET Tipping Fee Comparison




Portland Metro Project
R/B-M Tipping Fee Comparison
Legend:
R/B-M = Reuter/Buhler-Miag
Tipping Fee (CURRENT $/Ton)
120
110
100
90
80
70
60
50
40
1990
1992
1994
1996
1998
2000
2002
2004
2006
Year
100,000 TPY
200,000 TPY

5. FINDINGS ON RISK, BUSINESS AND TECHNICAL POSITIONS

CE has committed to putting $24 million of equity into the project. However, they've offered Metro the opportunity to share in any additional profit if the lease can be executed for a lower yield than what their proposal assumes. An analysis of the CE proposal shows that they assume approximately a 14 percent after tax yield in executing the lease. As to the adequacy of the equity contribution, CE should be rated as acceptable since the contribution represents the value of the tax benefits of the project.

As to the financeability of the proposed financing plan, CE should be rated acceptable. CE is able to provide Metro with a financeable investment grade project. As to the bond rating expected by the consultants for the financing, CE should be rated acceptable since they bring to the project the ability to obtain an investment grade rating. The credit rating adequate to make the project financeable is acceptable since the credit rating of the corporate guarantor for the CE proposal is A. As to the financial resources of the Contractor, CE is acceptable; CE has sufficient financial resources to support their construction and operation guarantees.

Technical Rating

CE proposes to utilize a prepared fuel technology which produces "refuse derived fuel" or "RDF". With this technology the refuse, by means of a series of mechanical reduction and classification processes, is reduced to prepared fuel, the RDF, that contains a large portion of the burnable portions of the refuse and eliminates most of the unburnables producing a more homogenous material than the input refuse.. This fuel, generally four inches or less in size, is then burned in a stoker fired traveling grate boiler of the type commonly used to burn chunk coal. CE would use the steam produced by the boiler in a turbine-generator to produce electricity for sale to Portland General Electric.

CE has proposed a plant of a very high efficiency anticipating to recover approximately 80% of the refuse as fuel with that fuel containing 95% of the original refuse heat content. The CE guarantee of 550 kwhr of electricity to be produced from a ton of refuse is the highest of the proposers. While CE has offered Metro 100% of electrical revenues, it is not anticipated the guarantee will be exceeded or that the projected disposal fee based on that guarantee will be reduced.

COMBUSTION ENGINEERING (CE)

Risk Rating

As the only proposer that, in its response to the second round of questions, gave Metro a fixed bid for accepting 100 percent of Metro's risk position, CE deserves a plus, maybe even a superior rating. None of the other bidders gave Metro a dollar figure because they were not prepared, apparently for any price, to accept 100 percent of the risk allocation proposed by Metro. CE's proposal accepted the risk allocation "in principle as a satisfactory basis for commencing negotiation", except as identified in Form N and the accompanying discussion. The accompanying footnotes and narrative suggest that CE will be responsible for problems caused by contractor fault, Metro would be responsible for problems caused by Metro fault and CE would be willing to negotiate an agreement to share the risk associated with uncontrollable circumstances. How much risk is CE willing to take for uncontrollable circumstances? The proposal and the responses to questions do not specifically answer that question. However, one of the footnotes in the CE's proposal, footnote 12, indicates that CE may not be willing to take very much of that risk:

> "12. Paragraph 4.9.6 (A) requires the Contractor to bear up to one-half of the financial consequences for a Change in Law or Uncontrollable Circumstance event. CE does not believe this is an equitable sharing of risk for events over which the Contractor has no control. CE believes an alternative risk sharing arrangement is required here, under which <u>Metro bears a greater share of risk</u> for Change of Law or Uncontrollable Circumstances." (Emphasis added)

Accordingly, CE should be given an <u>acceptable</u> rating. However, CE's position is similar to Ogden/Schnitzer, but clearly better than Fluor.

Business and Financial Rating

CE's equity contribution is rated acceptable but their leveraged lease proposal warrants some special attention by Metro. A leveraged lease is the most efficient manner of contributing equity into the project. It has the potential of maximizing the value of the tax benefits and minimizing the cash return required by the investors.

FLUOR/SEI (FLUOR)

Risk Rating

Although softened somewhat by the interview and the responses to the second round of questions, the Fluor position on risk allocation is definitely the most rigid of the three incineration proposals. In almost all risk categories, Fluor's position is that it has no responsibility for events or actions beyond the reasonable control of contractor. Put another way, Fluor is responsible only for contractor fault. When asked if Fluor would put a price on assuming Metro's risk allocation, they said, in effect, that Fluor cannot accept Metro's risk allocation at any price. Therefore, Fluor's position on risk allocation is rated poor.

Business and Financial Rating

As to the desired return on the equity contribution, Fluor's proposal is poor because it states that they are proposing an equity contribution which would be limited to 10 percent of their capital cost price up to a maximum of $12 million on the 350,000 TPY facility. This reflects a rather conservative estimate of the value of the project's tax benefits; all one needs to do is to examine what CE and Ogden offered in equity to compare how conservative Fluor's offer is. In addition, Fluor requires a $1.1 million return on their equity in the first year escalating in accordance with inflation. As to the adequacy of Fluor's proposed equity contribution, Fluor should be rated as unacceptable. Fluor's contribution does not adequately represent the value of the tax benefits of the project.

As to the financeability and bond rating of the proposed financing plan, Fluor is rated acceptable. Fluor is able to provide Metro with a financeable investment grade rating for the project. Fluor's credit rating is adequate to make the project financeable and should be rated acceptable since the credit rating of the corporate guarantors for the Fluor/Southern Company is A. As to the financial resources of the contractor, Fluor is superior because of the considerable financial strength of SEI's parent. They have sufficient financial resources to support their construction and operation guarantees.

Whether CE will be able to achieve the high level of performance guaranteed, particularly in consideration of the single boiler design can not be assured — but it is guaranteed.

In comparison to the mass burn technology proposed by Schnitzer/Ogden and Fluor/Southern Electric, CE's RDF process offers the potential for a greater recovery of recyclables from the waste stream. That is, during the preparation of the RDF there is the potential for removal of recyclables before the materials are burned. It is understood, however, CE now intends to recover only ferrous metals.

On the negative side, the RDF process, largely U.S. in origin, has not had a good track record. Several RDF facilities have been failures and virtually all have had problems. One significant problem associated with the RDF process is that of explosions. In the mechanical processing of the refuse into RDF, the highly flammable materials such as gasoline that often get into the refuse stream can and have exploded — often causing considerable damage. While CE has taken steps to mitigate this risk, it is not eliminated.

Further RDF is a difficult material to handle and store, and many plants have had difficulties with supplying and feeding RDF boilers.

CE believes they have successfully solved the historic problems with RDF, but they have yet to place into operation a fully integrated plant such as proposed for Metro to demonstrate this belief.

only recently begun operations. Further, the Olmsted facility is County operated and neither Fluor nor its partner had any part in its design or construction.

Technical Rating

The Takuma technology, which originated in Japan and is proposed by Fluor and Southern Electric International, is of the mass burn type wherein the untreated and unsorted refuse is introduced into a boiler equipped with a special feed system and grate for burning refuse. Steam from this boiler would flow to a turbine generator for both the production of electricity and the extraction of lower pressure steam.

Fluor proposes to be the designer and constructor of the facility and Southern Electric, which operates a number of electric utility plants in the South, to act as the long term facility operator.

While the mass burn technology has the definite advantage of simplicity it does not lend itself well to the recovery of recyclables in the waste stream with recovery of ferrous metals after combustion the only practical possibility.

Fluor would locate their facility in St. Helens adjacent to the Boise Cascade Pulp and Paper Mill, and they propose to sell the electricity produced to Portland General Electric and the extraction steam to Boise Cascade. While under PURPA, PGE is obligated to purchase the electricity at their "avoided cost", the steam sale may not be economically viable. Boise Cascade can not commit to a contract of over five years which is insufficient to support the financing, and the price is limited to 75% of Boise's cost of generation. Furthermore, if the sale of steam was committed for the short term and Boise failed to renew the contract the project would lose the revenues that would otherwise have been obtained from PGE for capacity avoidance.

The Fluor guarantee of 450 kwhr to be produced per ton of garbage processed, and on which the projected service fee is based, is not particularly high, and in view of the actual overall plant efficiency anticipated, this guarantee level is expected to be exceeded. To the extent that it is exceeded Metro's 50% share of the additional revenue generated will reduce refuse disposal costs to Metro.

The Takuma technology proposed by Fluor has a good track record in Japan but the Japanese plants tend to be smaller than that proposed for Metro with only one plant of a comparable size and that running at less than capacity. There is one Takuma facility operating in the U.S. at Olmsted, Minnesota but although operating well has the contractors, SO is acceptable; they have sufficient financial resources to support their construction and operation guarantees.

As to the adequacy of the equity contribution, SO should be rated as acceptable since the equity contribution nearly represents the value of the federal tax benefits of the project.

Technical Rating

The Martin technology as proposed by Schnitzer and Ogden Martin is of the mass burn type wherein the untreated and unsorted refuse is introduced into a boiler equipped with a special feed system and grate for burning refuse. Steam from this boiler would flow to a turbine generator for the production of electricity for sale to Portland General Electric. While the Schnitzer facility would be located in an industrial area and a potential steam customer was noted, no specific sale of steam was proposed.

While the mass burn technology has the definite advantage of simplicity it does not lend itself well to the recovery of recyclables in the waste stream with the recovery of ferrous metals after combustion now the only practical possibility.

The Ogden guarantee of 470 kwhr to be produced per ton of garbage processed, on which the projected service fee is based, is not particularly high, and in view of the actual overall plant efficiency anticpated this guarantee level is expected to be exceeded. To the extent that it is exceeded Metro's 90% down to 80% share of the additional revenue generated wil reduce refuse disposal costs to Metro.

Of the technologies offered to Metro, the Martin technology has by far the best track record of performance in the U.S., the most notable example being the Ogden facility operating in Marion County, Oregon.

The issue has been rasied as to Ogden's ability to effectively manage all the facilities they now have in development, construction, startup, and operation. Ogden's response has been, they believe through their system of project management — using a number of different consultants and builders with only a core group from Ogden — that they can and will perform in accordance with their representations.

OGDEN MARTIN/SCHNITZER

Risk Rating

On the risk criterion, Schnitzer/Ogden (SO) should receive an acceptable rating. Their proposal is reasonably specific: SO will be responsible for problems caused by contractor fault, and Metro should be responsible for problems caused by Metro fault and Uncontrollable Circumstances. There is not much evidence in the proposal that SO is willing to negotiate a sharing of the risks and problems caused by Uncontrollable Circumstances. However, SO is willing to accept Metro's concept of Uncontrollable Circumstances, i.e., a limited list of events rather than any event beyond the reasonable control of the contractor. But it would add additional events to the list. On the other hand, SO does have a better response with respect to indemnifying contractor for changes in tax law. Whereas CE desires to negotiate some form of indemnity for Uncontrollable Circumstances, SO appears to take full responsibility for changes in tax law after the Contract Date. Finally, what moves SO from a possible poor to an acceptable rating is an apparent softening of their initial position. In its response to the first round of questions, SO states its position regarding the risk allocation:

> "We have modified the risk-sharing arrangement described in Section 4.9 of the RFP to reflect the Company being responsible for those risks it can control, and Metro being responsible for those risks it can control, and the remaining risks being insured, shared or assumed by Metro as the entity charged ultimately with public responsibility for the disposal of solid waste" (emphasis added).

Business and Financial Rating

As to the desired return on the equity contribution, SO should be rated Acceptable. SO offers an acceptable equity contribution. SO equity is $23 million, one-half to come from Ogden, and one-half from Schnitzer. The guarantee to provide the equity would be a several obligation of the two companies. Therefore, the Ogden Corporation guarantee would not support the Schnitzer half of the equity contribution and vice versa.

As to the financeability and the bond rating of the proposed financing plan, SO should be rated acceptable, since SO is able to provide Metro with a financeable investment grade project. As to the credit rating adequate to make the project financeable, SO is acceptable since the credit rating of the corporate guarantor for SO is BBB assuming Ogden is the Corporate Guarantor. As to the financial resources of expensive but would eliminate the financial exposure to Metro in the event of company default.

As to the financial resources of the contractor, Reuter is poor because the financial strength of the company would not enable it to support the damage payments in the event of default on the construction and operation guarantees.

REUTER RESOURCE RECOVERY, INC.

Risk Rating

From the proposal and the responses, it appears that Reuter, of all the proposers, accepts more of the risk allocation as proposed in the RFP. There is however some doubt as to whether Reuter, in fact, intended to accept RFP Section 4.9 in as broad some fashion as they appear to have done. Relative to the other proposers, a superior rating may have been warranted. However, in their answers to questions dated April 15, 1987, their response regarding pass through costs where they noted that if their compost was rendered Prohibited or Unacceptable Waste under state or federal law, Metro would have to pay for disposal causes concern. That is a significant risk which Reuter appears to push 100 percent on Metro, even after saying in the original proposal that marketing the compost (and disposing of it if it could not be sold) was their sole responsibility. Because much of their response is from Form N without the benefit of clarification, the rating of superior may be suspect. It may be that Reuter's higher price is a direct result of the amount of risk they believe they are assuming but may ultimately attempt to mitigate if they have the opportunity to negotiate with Metro. Given the lack of clarification and the above concerns, an acceptable rating is appropriate.

Business and Financial Rating

As to the desired return on the equity contribution, Reuter should be rated Acceptable, since Reuter offers an acceptable equity contribution, however, Reuter's overall return on the project as shown in their pro forma income statements should be rated unacceptable since the return appears to approximate $20 per ton. As to the adequacy of the equity contribution, Reuter should be rated as acceptable since the equity contribution adequately represents the value of the tax benefits of the project.

As to the financeability of the proposed financing plan, Reuter should be rated unacceptable, since a tax-exempt financing complying with Metro's business arrangement would not be financeable under the Reuter proposal. As to the bond rating and the credit rating expected for the financing, Reuter is unacceptable since the company is not investment grade and does not have the capacity to obtain an investment grade rating. However, they have offered to Metro a private financing which would be more

As to the financial resources of the contractor, Riedel is poor because the financial strength of the company would not enable it to support damage payments in the event of default of the construction and operation guarantees.

RIEDEL

Risk Rating

In Form N Riedel accepts about one third of the items and proposes to modify the remaining ones. Review of the narrative section of the proposal and Riedel's responses to the varous questions suggests that Riedel's modifications would focus on several things. First, Riedel would seek to expand the definition of uncontrollable circumstances. Second, Riedel would seek to specify the liability of Metro for contractor's damages in those sections of 4.9 where Metro either is at fault or initiated a change to the facility. Third, Riedel would have Metro assume responsibility for composition and quality of acceptable waste. Fourth, Riedel wants protection from Metro for loss of anticipated tax benefits resulting solely from unilateral actions by Metro. The changes requested in these areas are similar to the ones requested by other proposers and certainly not out of line.

In summary, Riedel's response to the contract proposal and risk allocation items should be rated acceptable.

Business and Financial Rating

As to the desired return on equity contribution, Riedel should be rated Acceptable since Riedel offers an acceptable equity contribution. As to the adequacy of the equity contribution, Riedel should be rated as acceptable since Riedel's contribution adequately represents the value of the federal tax benefits of the project.

As to the financeability of the proposed financing plan, Riedel should be rated unacceptable since a tax-exempt financing complying with Metro's business arrangement would not be financeable under the Riedel proposal. The bond rating and the credit rating expected for the financing would not be acceptable since the company is not investment grade. However, the company has offered Metro a private financing which would be more expensive but would eliminate the financial exposure to Metro in the event of company default.

TIP FEE COMPARISON

METRO RESOURCE RECOVERY PROJECTS
COST COMPARISON - ALL CASES FOR ONE VENDOR

22-Jun-87
TIP FEE

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TIP FEE
****

		BASE CASE 350,000 TPY	30 YEAR CASE 350,000 TPY	CURRENT RATES 350,000 TPY	UPSCALE 450,000 TPY	DOWNSCALE 250,000 TPY	PUBLIC OWNS 350,000 TPY
FLUOR	Net Dollars per Ton (1991)	63.93	56.13	60.14	59.61	72.28	64.13
	Avg. PV/Ton (PV at 4%)	46.26	37.36	43.97	42.87	52.99	45.42
OGDEN	Net Dollars per Ton (1991)	62.77	55.31	59.11	55.06	74.37	71.64
	Avg. PV/Ton (PV at 4%)	43.10	34.73	40.89	37.64	51.44	48.46
CE	Net Dollars per Ton (1991)	66.13	57.96	63.00	61.72	85.11	71.94
	Avg. PV/Ton (PV at 4%)	44.25	34.82	42.36	40.44	58.13	47.76
REIDEL 0,000 TPY	Net Dollars per Ton (1991)	39.84	39.05	39.14			
	Avg. PV/Ton (PV at 4%)	32.22	30.94	31.78			
ASSUMES METRO PLEDGE OF SYSTEM REVENUES							
REIDEL 100,000 TPY	Net Dollars per Ton (1991)	51.62	50.11	50.48			
	Avg. PV/Ton (PV at 4%)	41.28	39.08	40.57			
ASSUMES METRO PLEDGE OF SYSTEM REVENUES							
REUTER 200,000 TPY	Net Dollars per Ton (1991)	40.00					
	Avg. PV/Ton (PV at 4%)	35.56					
REUTER 100,000 TPY	Net Dollars per Ton (1991)	58.00					
	Avg. PV/Ton (PV at 4%)	51.56					

COST COMPARISONS

ALL CASES FOR ONE VENDOR

METRO RESOURCE RECOVERY PROJECTS 23-Jun-87
COST COMPARISON - ALL CASES FOR ONE VENDOR FLUOR

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FLUOR
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	ASSUMPTIONS	BASE CASE 350,000 TPY	30 YEAR CASE 350,000 TPY	CURRENT RATES 350,000 TPY	UPSCALE 450,000 TPY	DOWNSCALE 250,000 TPY	PUBLIC OWNS 350,000 TPY
ONE-TIME COSTS							
BONDS							
Tax Exempt	CE 9.25%; Og & Fl. 9.50%	$125,715,000	$125,715,000	$123,125,000	$149,470,000	$100,950,000	$124,470,000
Taxable	CE 10.25%; Og & Fl 10.50%	7,190,000	7,190,000	6,870,000	11,000,000	3,040,000	22,645,000
	Term of bonds: 23 Years						
TOTAL		132,905,000	132,905,000	129,995,000	160,470,000	103,990,000	147,115,000
CONSTRUCTION	1/1/88 THRU 10/1/1990	100,459,000	100,459,000	100,459,000	119,458,000	80,659,000	100,465,775
TOTAL PROJECT COST	Tax-exempt and taxable and all reserves, costs, etc.	157,417,113	157,597,116	152,511,131	187,804,956	126,079,586	160,996,791
ANNUAL COSTS							
DEBT SERVICE	Est. Average Annual						
Tax Exempt		15,095,000	13,535,000	13,750,000	18,295,000	11,805,000	16,495,000
ANNUAL O&M COST		9,115,300	9,115,300	9,115,300	10,930,000	7,550,000	9,115,300
TIP FEE (1987$)							
Tip Fee $	In 1991	22,376,000	19,647,000	21,048,000	26,826,000	18,070,000	22,447,000
Net $ per Ton	In 1991	63.93	56.13	60.14	59.61	72.28	64.13
Avg. PV/Ton	Discount Rate 4%	46.26	37.36	43.97	42.87	52.99	45.42
VENDOR CONTRIBUTIONS							
EQUITY		12,000,000	12,000,000	12,000,000	12,000,000	10,000,000	0
REVENUE CREDITS TO METRO							
Total	In 1991	5,968,000	7,138,000	5,949,000	7,545,000	4,383,000	5,959,000
Dollars/Ton	In 1991	17.05	20.39	17.00	16.77	17.53	17.02

METRO RESOURCE RECOVERY PROJECTS 23-Jun-87
COST COMPARISON BETWEEN VENDORS OGDEN

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OGDEN
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	ASSUMPTIONS	BASE CASE 350,000 TPY	30 YEAR CASE 350,000 TPY	CURRENT RATES 350,000 TPY	UPSCALE 450,000 TPY	DOWNSCALE 250,000 TPY	PUBLIC OWNS 350,000 TPY
ONE-TIME COSTS							
BONDS							
Tax Exempt	CE 9.25%; Og & Fl. 9.50%	126,445,000	126,445,000	123,830,000	144,510,000	104,925,000	125,195,000
Taxable	CE 10.25%; Og & Fl 10.50%	1,280,000	1,275,000	1,035,000	715,000	1,260,000	31,365,000
	Term of bonds: 23 Years						
TOTAL		127,725,000	127,720,000	124,865,000	145,225,000	106,185,000	156,560,000
CONSTRUCTION	1/1/88 THRU 10/1/1990	107,565,650	107,565,650	107,565,650	122,938,000	89,238,000	107,565,650
TOTAL PROJECT COST	Tax-exempt and taxable and all reserves, costs, etc.	163,090,591	163,085,415	158,170,965	185,855,822	135,729,678	171,170,629
ANNUAL COSTS							
DEBT SERVICE	Est. Average Annual						
Tax Exempt	From 1995-2011	14,495,000	12,990,000	13,195,000	16,480,000	12,050,000	17,600,000
ANNUAL O&M COST		8,994,000	8,994,000	8,994,000	10,649,000	7,318,000	8,994,000
TIP FEE (1987$)							
Tip Fee $	In 1991	21,968,000	19,360,000	20,688,000	24,777,000	18,592,000	25,074
Net $ per Ton	In 1991	62.77	55.31	59.11	55.06	74.37	71.64
Avg. PV/Ton	Discount Rate 4%	43.10	34.73	40.89	37.64	51.44	48.46
VENDOR CONTRIBUTIONS							
EQUITY		20,000,000	20,000,000	19,000,000	22,500,000	16,000,000	0
REVENUE CREDITS TO METRO							
Total	In 1991	5,668,000	6,777,000	5,677,000	7,130,000	4,200,000	5,658,000
Dollars/Ton	In 1991	16.20	19.36	16.22	15.84	16.80	16.17

METRO RESOURCE RECOVERY PROJECTS
COST COMPARISON BETWEEN VENDORS

23-Jun-87
CE

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CE
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	ASSUMPTIONS	BASE CASE 350,000 TPY	30 YEAR CASE 350,000 TPY	CURRENT RATES 350,000 TPY	UPSCALE 450,000 TPY	DOWNSCALE 250,000 TPY	PUBLIC OWNS 350,000 TPY
ONE-TIME COSTS							
BONDS							
Tax Exempt	CE 9.25%; Og & Fl. 9.50%	119,135,000	119,135,000	116,375,000	155,290,000	106,155,000	127,370,000
Taxable	CE 10.25%; Og & Fl 10.50%	24,431,000	24,431,000	24,431,000	26,700,000	21,221,000	17,955,000
	Term of bonds: 23 Years						
TOTAL							
CONSTRUCTION	1/1/88 THRU 10/1/1990	100,951,000	100,951,000	100,951,000	128,010,000	89,262,000	100,951,000
TOTAL PROJECT COST	Tax-exempt bonds and all reserves, costs, etc.	151,179,840	151,179,841	146,668,414	192,873,740	134,238,071	159,750,794
ANNUAL COSTS							
DEBT SERVICE							
	Est. Average Annual	13,285,000	11,855,000	12,075,000	17,315,000	11,835,000	16,270,000
ANNUAL O&M COST		11,502,200	11,502,200	11,502,200	13,311,000	10,500,200	11,502,000
TIP FEE (1987$)							
Tip Fee $	In 1991	23,145,000	20,285,000	22,052,000	27,774,000	21,277,000	25,179,000
Net $ per Ton	In 1991	66.13	57.96	63.00	61.72	85.11	71.94
Avg. PV/Ton	Discount Rate 4%	44.25	34.82	42.36	40.44	58.13	47.76
VENDOR CONTRIBUTIONS							
EQUITY		18,533,444	18,533,444	19,011,924	20,254,715	16,098,326	0
REVENUE CREDITS TO METRO							
Total	In 1991	7,089,000	8,520,000	7,070,000	9,089,000	5,254,000	7,148,000
Dollars/Ton	In 1991	20.26	24.34	20.20	20.20	21.02	20.42

METRO RESOURCE RECOVERY PROJECTS
COST COMPARISON BETWEEN VENDORS

23-Jun-87
REIDEL

****
REIDEL
****

	ASSUMPTIONS	*****BASE CASE***********		*********30 YEAR CASE********		*********CURRENT RATES********		******PUBLIC OWNERSHIP******	
		200,000 TPY	100,000 TPY	200,000 TPY	100,000 TPY	200,000 TPY	100,000 TPY	200,000 TPY	100,000 TP
ONE-TIME COSTS									
BONDS - ASSUMES TAX EXEMPT BONDS SOLD WITH METRO PLEDGE OF SYSTEM REVENUES									
Tax Exempt	Interest Rate 9.25%	15,600,000	12,600,000	15,600,000	12,600,000	15,395,000	12,425,000	17,250,000	13,590,00
Taxable								1,635,000	1,565,00
	Term of bonds: 23 YR								
TOTAL		15,600,000	12,600,000	15,600,000	12,600,000	15,395,000	12,425,000	18,885,000	15,155,00
CONSTRUCTION	From 1/1/88-2/1/90	13,186,000	10,327,000	13,186,000	10,327,000	13,186,000	10,327,000	13,186,000	10,327,00
TOTAL PROJECT COST		19,665,815	15,753,133	19,665,815	15,753,133	19,232,544	15,402,490	20,654,511	16,494,76
ANNUAL COSTS									
DEBT SERVICE									
	Est. Average Annual	1,740,000	1,405,000	1,740,000	1,255,000	1,600,000	1,290,000	2,110,000	1,695,00
ANNUAL O&M COST		4,963,246	3,211,858	4,963,246	3,211,858	4,963,246	3,211,858	4,963,246	3,211,83
TIP FEE (1987$)									
Tip Fee $	In 1991	7,969,000	5,162,000	7,810,000	5,011,000	7,828,000	5,048,000	7,577,000	4,944,00
Net $ per Ton	In 1991	39.84	51.62	39.05	50.11	39.14	50.48	37.88	49.4
Avg. PV/Ton	Discount Rate 4%	32.22	41.28	30.94	39.08	31.78	40.57	30.00	25.86
VENDOR CONTRIBUTIONS									
EQUITY		2,615,740	2,048,567	2,615,740	2,048,567	2,615,740	2,048,567		
REVENUE CREDITS TO METRO									
Total	In 1991	189,000	129,000	189,000	129,000	187,000	127,000	272,000	207,000
Dollars/Ton	In 1991	0.95	1.29	0.95	1.29	0.94	1.27	1.36	2.07

COMPARISON BETWEEN

VENDORS

INCINERATION PROJECTS

	********INCINERATION PROJECTS***************			
	ASSUMPTIONS	FLUOR	OGDEN	CE
	**************************** BASE CASE: 350,000 TPY ****************************			
ONE-TIME COSTS				
BONDS				
Tax Exempt	CE 9.25%; Og & Fl 9.50%	$125,715,000	126,445,000	119,135,000
Taxable	CE 10.25%; Og & Fl 10.50%	7,190,000	1,280,000	24,431,000
	Term of bonds: 23 Years			
TOTAL		132,905,000	127,725,000	
CONSTRUCTION	1/1/88 THRU 10/1/1990	100,459,000	107,565,650	100,951,000
TOTAL PROJECT COST	Tax-exempt and taxable and all reserves, costs, etc.	157,417,113	163,090,591	151,179,840
ANNUAL COSTS				
DEBT SERVICE	Est. Average Annual			
Tax Exempt and Taxable wrapped		15,095,000	14,495,000	13,285,000
ANNUAL O&M COST		9,115,300	8,994,000	11,502,200
TIP FEE (1987$)				
Tip Fee $	In 1991	22,376,000	21,968,000	23,145,000
Net $ per Ton	In 1991	63.93	62.77	66.13
Avg. PV/Ton	Discount Rate 4%	46.26	43.10	44.25
VENDOR CONTRIBUTIONS				
EQUITY		12,000,000	20,000,000	18,533,444
REVENUE CREDITS TO METRO				
Total	In 1991	5,968,000	5,668,000	7,089,000
Dollars/Ton	In 1991	17.05	16.20	20.26

********INCINERATION PROJECTS****************

	ASSUMPTIONS	FLUOR	OGDEN	CE
	**************************** 30 YEAR CASE - 350,000 TPY ****************************			
ONE-TIME COSTS				
BONDS				
Tax Exempt	CE 9.25%; Og & Fl 9.50%	$125,715,000	126,445,000	119,135,000
Taxable	CE 10.25%; Og & Fl 10.50%	7,190,000	1,275,000	24,431,000
	Term of bonds: 33 Years			
TOTAL		132,905,000	127,720,000	
CONSTRUCTION	1/1/88 THRU 10/1/1990	100,459,000	107,565,650	100,951,000
TOTAL PROJECT COST	Tax-exempt and taxable and all reserves, costs, etc.	157,597,116	163,085,415	151,179,841
ANNUAL COSTS				
DEBT SERVICE	Est. Average Annual			
Tax Exempt and Taxable wrapped		13,535,000	12,990,000	11,855,000
ANNUAL O&M COST		9,115,300	8,994,000	11,502,200
TIP FEE (1987$)				
Tip Fee $	In 1991	19,647,000	19,360,000	20,285,000
Net $ per Ton	In 1991	56.13	55.31	57.96
Avg. PV/Ton	Discount Rate 4% 1991 through 2007	37.36	34.73	34.82
VENDOR CONTRIBUTIONS				
EQUITY		12,000,000	20,000,000	18,533,444
REVENUE CREDITS TO METRO				
Total	In 1991	7,138,000	6,777,000	8,520,000
Dollars/Ton	In 1991	20.39	19.36	24.34

METRO RESOURCE RECOVERY PROJECTS — 23-Jun-87
COST COMPARISON BETWEEN VENDORS — COSTS

********INCINERATION PROJECTS***************

	ASSUMPTIONS	FLUOR	OGDEN	CE
	CURRENT RATES - 350,000 TPY			
ONE-TIME COSTS				
BONDS				
Tax Exempt	CE 8.25%; Og & Fl 8.50%	$123,125,000	123,830,000	116,375,000
Taxable	CE 9.25%; Og & Fl 9.50%	6,870,000	1,035,000	24,431,000
	Term of bonds: 23 Years			
TOTAL		129,995,000	124,865,000	
CONSTRUCTION	1/1/88 THRU 10/1/1990	100,459,000	107,565,650	100,951,000
TOTAL PROJECT COST	Tax-exempt and taxable and all reserves, costs, etc.	152,511,131	158,170,965	146,668,414
ANNUAL COSTS				
DEBT SERVICE	Est. Average Annual			
Tax Exempt and Taxable wrapped		13,750,000	13,195,000	12,075,000
ANNUAL O&M COST		9,115,300	8,994,000	11,502,200
TIP FEE (1987$)				
Tip Fee $	In 1991	21,048,000	20,688,000	22,052,000
Net $ per Ton	In 1991	60.14	59.11	63.00
Avg. PV/Ton	Discount Rate 4% 1991 through 2007	43.97	40.89	42.36
VENDOR CONTRIBUTIONS				
EQUITY		12,000,000	19,000,000	19,011,924
REVENUE CREDITS TO METRO				
Total	In 1991	5,949,000	5,677,000	7,070,000
Dollars/Ton	In 1991	17.00	16.22	20.20

METRO RESOURCE RECOVERY PROJECTS 23-Jun-87
COST COMPARISON BETWEEN VENDORS COSTS

********INCINERATION PROJECTS***************

ASSUMPTIONS		FLUOR	OGDEN	CE
	UPSCALE CASE - 450,000 TPY			
ONE-TIME COSTS				
BONDS				
Tax Exempt	CE 9.25%; Og & Fl 9.50%	$149,470,000	144,510,000	155,290,000
Taxable	CE 10.25%; Og & Fl 10.50%	11,000,000	715,000	26,700,000
	Term of bonds: 23 Years			
TOTAL		160,470,000	145,225,000	
CONSTRUCTION	1/1/88 THRU 10/1/1990	119,458,000	122,938,000	128,010,000
TOTAL PROJECT COST	Tax-exempt and taxable and all reserves, costs, etc.	187,804,956	185,855,822	192,873,740
ANNUAL COSTS				
DEBT SERVICE	Est. Average Annual			
Tax Exempt and Taxable wrapped		18,295,000	16,480,000	17,315,000
ANNUAL O&M COST		10,930,000	10,649,000	13,311,000
TIP FEE (1987$)				
Tip Fee $	In 1991	26,826,000	24,777,000	27,774,000
Net $ per Ton	In 1991	59.61	55.06	61.72
Avg. PV/Ton	Discount Rate 4% 1991 through 2007	42.87	37.64	40.44
VENDOR CONTRIBUTIONS				
EQUITY		12,000,000	22,500,000	20,254,715
REVENUE CREDITS TO METRO				
Total	In 1991	7,545,000	7,130,000	9,089,000
Dollars/Ton	In 1991	16.77	15.84	20.20

METRO RESOURCE RECOVERY PROJECTS 23-Jun-87
COST COMPARISON BETWEEN VENDORS COSTS

	ASSUMPTIONS	FLUOR	OGDEN	CE
	********INCINERATION PROJECTS***************			
	DOWNSCALE CASE - 250,000 TPY			
ONE-TIME COSTS				
BONDS				
Tax Exempt	CE 9.25%; Og & Fl 9.50%	$100,950,000	104,925,000	106,155,000
Taxable	CE 10.25%; Og & Fl 10.50%	3,040,000	1,260,000	21,221,000
	Term of bonds: 23 Years			
TOTAL		103,990,000	106,185,000	
CONSTRUCTION	1/1/88 THRU 10/1/1990	80,659,000	89,238,000	89,262,000
TOTAL PROJECT COST	Tax-exempt and taxable and all reserves, costs, etc.	126,079,586	135,729,678	134,238,071
ANNUAL COSTS				
DEBT SERVICE	Est. Average Annual			
Tax Exempt and Taxable wrapped		11,805,000	12,050,000	11,835,000
ANNUAL O&M COST		7,550,000	7,318,000	10,500,200
TIP FEE (1987$)				
Tip Fee $	In 1991	18,070,000	18,592,000	21,277,000
Net $ per Ton	In 1991	72.28	74.37	85.11
Avg. PV/Ton	Discount Rate 4% 1991 through 2007	52.99	51.44	58.13
VENDOR CONTRIBUTIONS				
EQUITY		10,000,000	16,000,000	16,098,326
REVENUE CREDITS TO METRO				
Total	In 1991	4,383,000	4,200,000	5,254,000
Dollars/Ton	In 1991	17.53	16.80	21.02

********INCINERATION PROJECTS***************

	ASSUMPTIONS	FLUOR	OGDEN	CE
	**************************** PUBLIC OWNERSHIP CASE - 350,000 TPY ****************************			
ONE-TIME COSTS				
BONDS				
Tax Exempt	CE 9.25%; Og & Fl 9.50%	$124,470,000	125,195,000	127,370,000
Taxable	CE 10.25%; Og & Fl 10.50%	22,645,000	31,365,000	17,955,000
	Term of bonds: 23 Years			
TOTAL		147,115,000	156,560,000	
CONSTRUCTION	1/1/88 THRU 10/1/1990	100,465,775	107,565,650	100,951,000
TOTAL PROJECT COST	Tax-exempt and taxable and all reserves, costs, etc.	160,996,791	171,170,629	159,750,794
ANNUAL COSTS				
DEBT SERVICE	Est. Average Annual			
Tax Exempt and Taxable wrapped		16,495,000	17,600,000	16,270,000
ANNUAL O&M COST		9,115,300	8,994,000	11,502,000
TIP FEE (1987$)				
Tip Fee $	In 1991	22,447,000	25,074,000	25,179,000
Net $ per Ton	In 1991	64.13	71.64	71.94
Avg. PV/Ton	Discount Rate 4% 1991 through 2007	45.42	48.46	47.76
VENDOR CONTRIBUTIONS				
EQUITY		0	0	0
REVENUE CREDITS TO METRO				
Total	In 1991	5,959,000	5,658,000	7,148,000
Dollars/Ton	In 1991	17.02	16.17	20.42

COMPARISON BETWEEN

VENDORS

COMPOST PROJECTS

***********************************COMPOST PROJECTS*************************

	ASSUMPTIONS	***********Reuter 200,000 TPY	******************* 100,000 TPY	REIDEL 200,000	********** 100,000
	BASE CASE				
ONE-TIME COSTS					
BONDS	REIDEL: ASSUMES METRO PLEDGES SYSTEM REVENUES TO BONDS				
Tax Exempt	Interest Rate 9.25%	32,525,000	27,005,000	15,600,000	12,600,000
Taxable					
	Term of bonds: 23 Years				
TOTAL		32,525,000	27,005,000	15,600,000	12,600,000
CONSTRUCTION	From 1/1/88-2/1/90	29,008,000	23,775,000	13,186,000	10,327,000
TOTAL PROJECT COST		41,422,316	34,254,237	19,665,815	15,753,133
ANNUAL COSTS					
DEBT SERVICE	Est. Average Annual From 1995-2011	3,630,000	3,010,000	1,740,000	1,405,000
Tax Exempt and					
ANNUAL O&M COST		3,936,070	2,495,035	4,963,246	3,211,858
TIP FEE (1987$)					
Tip Fee $	In 1991	8,000,000	5,800,000	7,969,000	5,162,000
Net $ per Ton	In 1991	40.00	58.00	39.84	51.62
Avg. PV/Ton	Discount Rate 4%	35.56	51.56	32.22	41.28
VENDOR CONTRIBUTION					
EQUITY		5,770,000	4,780,000	2,615,740	2,048,567
REVENUE CREDITS TO METRO					
Total	In 1991	232,000	192,000	189,000	129,000
Dollars/Ton	In 1991	1.16	1.92	0.95	1.29

		COMPOST PROJECTS			
		Reuter		***REIDEL***	
	ASSUMPTIONS	200,000 TPY	100,000 TPY	200,000	100,000
	30 YEAR CASE				
ONE-TIME COSTS					
BONDS	REIDEL: ASSUMES METRO PLEDGES SYSTEM REVENUES TO BONDS				
Tax Exempt	Interest Rate 9.25%			15,600,000	12,600,000
Taxable					
	Term of bonds: 33 Years				
TOTAL				15,600,000	12,600,000
CONSTRUCTION	From 1/1/88-2/1/90			13,186,000	10,327,000
TOTAL PROJECT COST				19,665,815	15,753,133
ANNUAL COSTS					
DEBT SERVICE	Est. Average Annual From 1995-2011			1,740,000	1,255,000
Tax Exempt and					
ANNUAL O&M COST				4,963,246	3,211,858
TIP FEE (1987$)					
Tip Fee $	In 1991			7,810,000	5,011,000
Net $ per Ton	In 1991			39.05	50.11
Avg. PV/Ton	Discount Rate 4%			30.94	39.08
VENDOR CONTRIBUTION					
EQUITY				2,615,740	2,048,567
REVENUE CREDITS TO METRO					
Total	In 1991			189,000	129,000
Dollars/Ton	In 1991			0.95	1.29

		************Reuter************		*******REIDEL**********	
	ASSUMPTIONS	200,000 TPY	100,000 TPY	200,000	100,000
	CURRENT RATES				
ONE-TIME COSTS					
BONDS	REIDEL: ASSUMES METRO PLEDGES SYSTEM REVENUES TO BONDS				
Tax Exempt	Interest Rate 8.25%			15,395,000	12,425,000
Taxable					
	Term of bonds: 23 Years				
TOTAL				15,395,000	12,425,000
CONSTRUCTION	From 1/1/88-2/1/90			13,186,000	10,327,000
TOTAL PROJECT COST				19,232,544	15,402,490
ANNUAL COSTS					
DEBT SERVICE	Est. Average Annual From 1995-2011			1,600,000	1,290,000
Tax Exempt and					
ANNUAL O&M COST				4,963,246	3,211,858
TIP FEE (1987$)					
Tip Fee $	In 1991			7,828,000	5,048,000
Net $ per Ton	In 1991			39.14	50.48
Avg. PV/Ton	Discount Rate 4%			31.78	40.57
VENDOR CONTRIBUTION					
EQUITY				2,615,740	2,048,567
REVENUE CREDITS TO METRO					
Total	In 1991			187,000	127,000
Dollars/Ton	In 1991			0.94	1.27

************************************COMPOST PROJECTS*************************

	ASSUMPTIONS	***********Reuter*** 200,000 TPY	100,000 TPY	***REIDEL*** 200,000	100,000
	************************ PUBLIC OWNERSHIP ************************				
ONE-TIME COSTS					
BONDS	REIDEL: ASSUMES METRO PLEDGES SYSTEM REVENUES TO BONDS				
Tax Exempt	Interest Rate 8.25%	37,945,000	31,280,000	17,250,000	13,590,000
Taxable		2,040,000	1,910,000	1,635,000	1,565,000
	Term of bonds: 23 Years				
TOTAL		39,985,000	33,190,000	18,885,000	15,155,000
CONSTRUCTION	From 1/1/88-2/1/90	29,008,000	23,775,000	13,186,000	10,327,000
TOTAL PROJECT COST		43,843,154	36,236,682	20,654,511	16,494,766
ANNUAL COSTS					
DEBT SERVICE					
Tax Exempt and	Est. Average Annual	4,465,000	3,705,000	2,110,000	1,695,000
ANNUAL O&M COST		3,936,070	2,495,035	4,963,246	3,211,837
TIP FEE (1987$)					
Tip Fee $	In 1991	9,527,000	6,906,000	7,577,000	4,944,000
Net $ per Ton	In 1991	47.64	69.06	37.88	49.44
Avg. PV/Ton	Discount Rate 4%	36.98	51.72	30.00	25.86
VENDOR CONTRIBUTION					
EQUITY					
REVENUE CREDITS TO METRO					
Total	In 1991	342,000	294,000	272,000	207,000
Dollars/Ton	In 1991	1.71	2.94	1.36	2.07

B. Hierarchy Analysis

RESOURCE RECOVERY HIERARCHY ANALYSIS

The following is a discussion of the hierarchy analysis and the results. The hierarchy for solid waste disposal described in the RFP is shown below with the first being the most desireable way of dealing with solid waste:

- I Material Recovery
- II Compost Production
- III Refuse Derived Fuel (RDF) or Steam production as supplements to existing fuel markets.
- IV Electricity Generation through mass incineration or RDF incineration.

The weighting and scoring system described below is being proposed as a way to develop a comparison between proposers responses to the waste reduction and disposal hierarchy. It does not suggest a policy valuation but is a way of showing relative efforts by proposers in addressing the hierarchy. The manner in which the various components of the proposers processes respond to the hierarchy is preserved with this weighting and comparison system.

I MATERIALS RECOVERY

Material recovery was evaluated by calculating the percentage of the dedicated waste stream a proposing contractor would reclaim for resale, such as ferrous metals or aluminum. The percentage was multiplied by a weighting factor of four in the overall evaluation.

The organization of this analysis is according to the hierarchy, dedicated waste stream and the proposers. The dedicated waste stream described in the RFP are; composting: 100,000 TPY and 200,000 TPY and incineration: 250,000 TPY, 350,000 TPY and 450,000 TPY.

I MATERIALS RECOVERY COMPUTATIONS

Waste Composition (From the Waste Reduction Plan: Appendix I)

Ferrous Metals	6.6%
Aluminum	0.5%
Non-Ferrous Metals	2.0%
Corrugated Paper	4.6%
Newspaper	2.1%
Glass	4.9%

I MATERIALS RECOVERY COMPUTATIONS (Continued)

Dedicated Waste: 100,000 TPY (Tons Per Year)

Riedel	Ferrous	.7* (.066(100,000))=	4,620 TPY
	Aluminum	.5(.005(100,000))=	250 TPY
	Corrugated	.4(.046(100,000))=	1,840 TPY
	Newspaper	.4(.021(100,000))=	840 TPY
	Glass	.3(.049(100,000))=	1,470 TPY
			9,020 TPY

9,020/100,000 = **9.0%**

Reuter	Ferrous	.5(.066(100,000))=	3,300 TPY
	Aluminum	.75(.005(100,000))=	375 TPY
	Corrugated	.8(.046(100,000))=	3,680 TPY
			7,355 TPY

7,355/100,000 = **7.4%**

Dedicated Waste: 200,000 TPY (Tons Per Year)

Riedel	Ferrous	.7(.066(200,000))=	9,240 TPY
	Aluminum	.5(.005(200,000))=	500 TPY
	Corrugated	.2(.046(200,000))=	1,840 TPY
	Newspaper	.1(.021(200,000))=	420 TPY
	Glass	.3(.049(200,000))=	2,940 TPY
			14,940 TPY

14,940/200,000 = **7.5%**

Reuter	Ferrous	.5(.066(200,000))=	6,600 TPY
	Aluminum	.75(.005(200,000))=	750 TPY
	Corrugated	.8(.046(200,000))=	7,360 TPY
			14,710 TPY

14,710/200,000 = **7.4%**

I MATERIALS RECOVERY COMPUTATIONS (Continued)

Dedicated Waste: 250,000 TPY

Flour	Ferrous	.78(.066(250,000))=	12,870 TPY
	Non-Ferrous (including aluminum)	.31(.025(250,000))=	1,938 TPY
			14,808 TPY

14,808/250,000 = **5.9%**

Dedicated Waste: 250,000 TPY

Combustion Engineering	Ferrous	.9(.066(250,000))=	14,850 TPY

14,850/250,000 = **5.9%**

Schnitzer Ogden/Martin	Ferrous	.8(.066(250,000))=	13,200 TPY

13,200/250,000 = **5.3%**

* This is the recovery factor supplied in the contractors proposal for a specific material.

Dedicated Waste: 350,000 TPY *

Fluor	.059(350,000) =	20,650 TPY
Combustion Engineering	.059(350,000) =	20,650 TPY
Schnitzer/Ogden/Martin	.053(350,000) =	18,550 TPY

Dedicated Waste: 450,000 TPY *

Fluor	.059(450,000) =	26,550 TPY
Combustion Engineering	.059(450,000) =	26,550 TPY
Schnitzer/Ogden/Martin	.053(450,000) =	23,850 TPY

*Note: Proposals submitted by these vendors indicate that the percentage recovery of specific materials is not expected to change with the amount of waste dedicated.

II COMPOST PRODUCTION

Annual compost production was evaluated by calculating the amount of compost produced as a percentage of the dedicated waste stream. The percentage was multiplied by a weighting factor of three in the overall evaluation.

II COMPOST PRODUCTION COMPUTATIONS

Dedicated Waste: 100,000 TPY

Riedel	(60,000 TPY)/(100,000 TPY) = 60.0%
Reuter	(20,000 TPY)/(100,000 TPY) = 20.0%

Dedicated Waste: 200,000 TPY

Riedel	(120,000 TPY)/(200,000 TPY) = 60.0%
Reuter	(40,000 TPY)/(200,000 TPY) = 20.0%

III REFUSE DERIVED FUEL (RDF) AND STEAM PRODUCTION FOR FUEL MARKETS

The amount of RDF produced for sale to existing fuel markets was calculated as a percentage of the dedicated waste stream. This was multiplied by a factor of two in the overall evaluation.

The Riedel Proposal suggested that two thirds of the residue produced in their facility could be sold as hog fuel (RDF). Although they did not include this in their business proposal it was calculated separately for comparison in this evaluation.

The amount of the dedicated waste stream used for the production of steam that is sold to an independent user was calculated as a percentage. The Fluor proposal for the St. Helens site is the only proposal that quantified this so that it could be evaluated. This percentage was multiplied by a weighting factor of two in the overall evaluation. Also the steam sold by Fluor will not replace hog fuel.

III RDF/MASS BURN REPLACING CONVENTIONAL FUEL COMPUTATIONS (INCLUDING STEAM)

Dedicated Waste: 100,000 TPY

Reuter(RDF)	(26,000 TPY)/(100,000 TPY)	= 26.0%
Riedel(RDF suggested	2/3(.302(100,000 TPY))	= 20,100 TPY
but not proposed)	20,100/100,000	= 20.1%

III RDF/MASS BURN REPLACING CONVENTIONAL FUEL COMPUTATIONS (INCLUDING STEAM) (Continued)

Dedicated Waste: 200,000 TPY

Reuter(RDF)	(52,000 TPY)/(200,000 TPY)	= **26.0%**
Riedel(RDF suggested but not proposed)	2/3(.302(200,000 TPY)) = 40,200 TPY 40,200/200,000	= **20.1%**

Dedicated Waste: 250,000 TPY

Fluor	(173,450 TPY)/(250,000 TPY)	= **69.4%**

Dedicated Waste: 350,000 TPY

Fluor	(173,450 TPY)/(350,000 TPY)	= **49.6%**

Dedicated Waste: 450,000 TPY

Fluor	(173,450 TPY)/(450,000 TPY)	= **38.5%**

IV ELECTRICITY PRODUCTION

The amount of the dedicated waste stream not used for "III" that is used for the generation of electricity is calculated as a percentage of the total dedicated waste stream. A weighting factor takes into account the facilities' electrical generation efficiency for 4700 BTU/lb waste as shown in the following formula; 1 + KWH/# . This weighting factor is multiplied by the percentage of dedicated wasted in the overall evaluation.

IV RDF/MASS BURN YIELDING ELECTRICITY COMPUTATIONS

Dedicated Waste: 250,000 TPY

Fluor	(76,550 TPY)/(250,000 TPY)	= **30.6%**
Combustion Engineering		= **100%**
Schnitzer/Ogden/Martin		= **100%**

Dedicated Waste: 350,000 TPY

Fluor	(176,550 TPY)/(350,000 TPY)	= **50.4%**
Combustion Engineering		= **100%**
Schnitzer/Ogden/Martin		= **100%**

Dedicated Waste: 450,000 TPY

Fluor	(276,550 TPY)/(450,000 TPY)	= 61.5%
Combustion Engineering		= 100%
Schnitzer/Ogden/Martin		= 100%

IV RDF/MASS BURN YIELDING ELECTRICITY COMPUTATIONS (Continued)

Electricity Generation Efficiency

Combustion Engineering	550 KWH/2,000 = .275 KWH/Pound
Fluor	450 KWH/2,000 = .225 KWH/Pound
Schnitzer/Ogden/Martin	470 KWH/2,000 = .235 KWH/Pound

Electricity Generation Efficiency Weighting Factor

Combustion Engineering	= 1.275
Fluor	= 1.225
Schnitzer/Ogden/Martin	= 1.235

The following computations and tables were used to derive the summary table at the end of this paper.

HIERARCHY EVALUATION COMPUTATIONS

Dedicated Waste: 100,000 TPY

Riedel	I	4(9.0)	= 36
	II	3(60.0)	= 180
			216
Riedel(RDF)	I	4(9.0)	= 36
	II	3(60.0)	= 180
	III	2(20.1)	= 40.2
			256.2
Reuter	I	4(7.4)	= 29.6
	II	3(20.0)	= 60
	III	2(26.0)	= 52
			141.6

HIERARCHY EVALUATION COMPUTATIONS (Continued)

Dedicated Waste: 200,000 TPY

Riedel	I	4(7.5)	= 30
	II	3(60.0)	= 180
			210
Riedel(RDF)	I	4(7.5)	= 30
	II	3(60.0)	= 180
	III	2(20.1)	= 40.2
			250.2
Reuter	I	4(7.4)	= 29.6
	II	3(20.0)	= 60
	III	2(26.0)	= 52
			141.6

Dedicated Waste: 250,000 TPY

Combustion Engineering	I	4(5.9)	= 23.6
	IV	1.275(100)	= 127.5
			151.1
Fluor	I	4(5.9)	= 23.6
	III	2(69.4)	= 138.8
	IV	1.225(30.6)	= 38.4
			199.9
Schnitzer/Ogden/Martin	I	4(5.3)	= 21.2
	IV	1.235(100)	= 123.5
			144.7

HIERARCHY EVALUATION COMPUTATIONS (Continued)

Dedicated Waste: 350,000 TPY

Combustion Engineering	I	4(5.9) =	23.6
	IV	1.275(100) =	127.5
			151.1
Fluor	I	4(5.9) =	23.6
	III	2(49.6) =	99.2
	IV	1.225(50.4) =	61.7
			184.5
Schnitzer/Ogden/Martin	I	4(5.3) =	21.2
	IV	1.235(100) =	123.5
			144.7

Dedicated Waste: 450,000 TPY

Combustion Engineering	I	4(5.9) =	23.6
	IV	1.275(100) =	127.5
			151.1
Fluor	I	4(5.9) =	23.6
	III	2(38.5) =	77.0
	IV	1.225(61.5) =	73.3
			175.9
Schnitzer/Ogden/Martin	I	4(5.3) =	21.2
	IV	1.235(100) =	123.5
			144.7

The following table is a summary of the totals for each proposing contractor and the five potential annual dedicated waste amounts. The higher the number the better the effort to meet the hierarchy. The highest possible score of 400 would indicate that 100 percent of the dedicated waste stream was processed as a recovered material. The lowest score of 100(multiplied by a boiler efficiency coefficient) indicates that all of the dedicated waste is incinerated to generate electricity with no materials recovery.

SUMMARY HIERARCHY EVALUATION TABLE

	Dedicated Waste (Tons Per Year)				
Contractor	100,000	200,000	250,000	350,000	450,000
Combustion Engineering			151.1	151.1	151.1
Fluor			199.9	184.5	175.9
Riedel	216.0	210.0			
Riedel & RDF	256.2	250.2			
Reuter	141.6	141.6			
Schnitzer/Ogden/Martin			144.7	144.7	144.7

A score above 200 earns a proposal a "Superior" ranking, a score above 150 earns a proposal an "Acceptable" ranking, a score above 120 earns a proposal a "Poor" ranking and a score below 120 is "Unacceptable".

Based on the scoring above; the cumulative hierarchy ratings to be used in the final evaluation report are as follows:

Combustion Engineering	Acceptable	
Fluor	Acceptable	
Riedel Environmental	Superior	More than 200
Reuter/Buhler-Miag	Poor	Less than 150
Schnitzer/Ogden/Martin	Poor	Less than 150

Closing Comments:

The main difference in the composting proposals was due to the fact that Riedel plans to produce 60,000 tons of compost for every 100,000 tons of dedicated waste and Reuter proposes to produce only 20,000 tons. This assumes that all compost is environmentally acceptable. Please refer to the technical evaluations for reference to the proposers experience and the proposals technical feasibility to produce environmentally sound compost consistently. The 26,000 tons of RDF that Reuter plans to produce is weighted less in the hierarchy evaluation system than compost.

Fluor's hierarchy advantage over the incineration proposers is due to the steam customer they have for their St. Helens site.

C. Site Descriptions

Evaluation Form For Site Feasibility Analysis

A. Site Description
<u>Site Name</u>: Carver

<u>Vendor</u>: Reuter/Buhler-Miag

Primary or Alternative Site Status: alternative site

<u>Type of Technology</u>: composting

Site Ownership: Frances/Rollin Lumber Co.

Site Location: just outside Carver on east side of Highway 224

Site Size: 23 acres

Access to Utilities: outside Urban Growth Boundary: on-site utilities necessary

Surrounding Uses: north: side of hill, south: gravel pit and mobile home park, east: lumber mill and community center, west: commercial and vacant land.

Sensitive Receptors: community center

Buffering: site is on a bluff which serves as natural buffering

B. Land Use Considerations

Land Use Zone: rural industrial

<u>Permit Process</u>: conditional use

<u>Description of permit process</u>: hearing before Hearings Officer. no local appeal process. conditional use process for river conservation designation

Special Considerations: river conservation designation. Such a designation requires minimum setback of structures and maintenance of existing vegetation along river bank.

Future Land Use: industrial

<u>C. Air Quality Issues</u> N/A for composting project
Non Attainment or Attainment area:

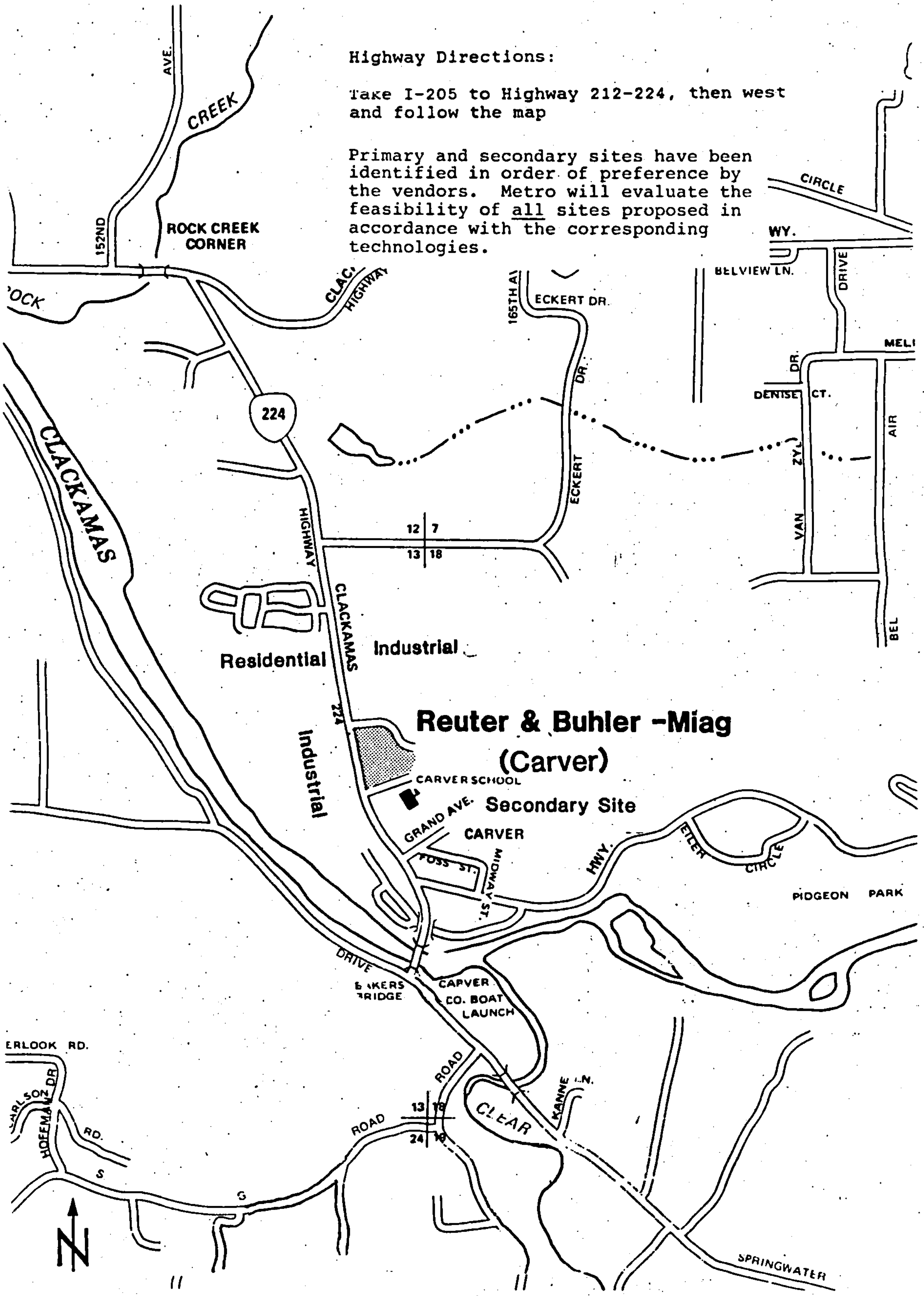
Description of Permit Process:

<u>D. Identified Neighborhood Opposition</u>
river conservation groups

Highway Directions:

Take I-205 to Highway 212-224, then west and follow the map

Primary and secondary sites have been identified in order of preference by the vendors. Metro will evaluate the feasibility of all sites proposed in accordance with the corresponding technologies.



Evaluation Form For Site Feasibility Analysis

A.Site Description
Site Name: Clackamas Transfer and Recycling Center

Vendor: Reuter/Buhler-Miag and Riedel Environmental Tech.

Primary or Alternative Site Status: alternative sites for both vendors

Type of Technology: composting

Site Ownership: Metro

Site Location: I-205 and Washington Street 16101 S.E. 82

Site Size: 9 acres

Access to Utilities: all utilities available

Surrounding Uses: north:industry, south:industry, east: closed landfill, west: I-205.

Sensitive Receptors: none

Buffering: develop as part of site plan. no natural buffering

B.Land Use Considerations
Land Use Zone: Manufacturing 2 (heavy industrial)

Permit Process: conditional use

Description of permit process: review by planning commission. appeal to city council. city makes final decision.

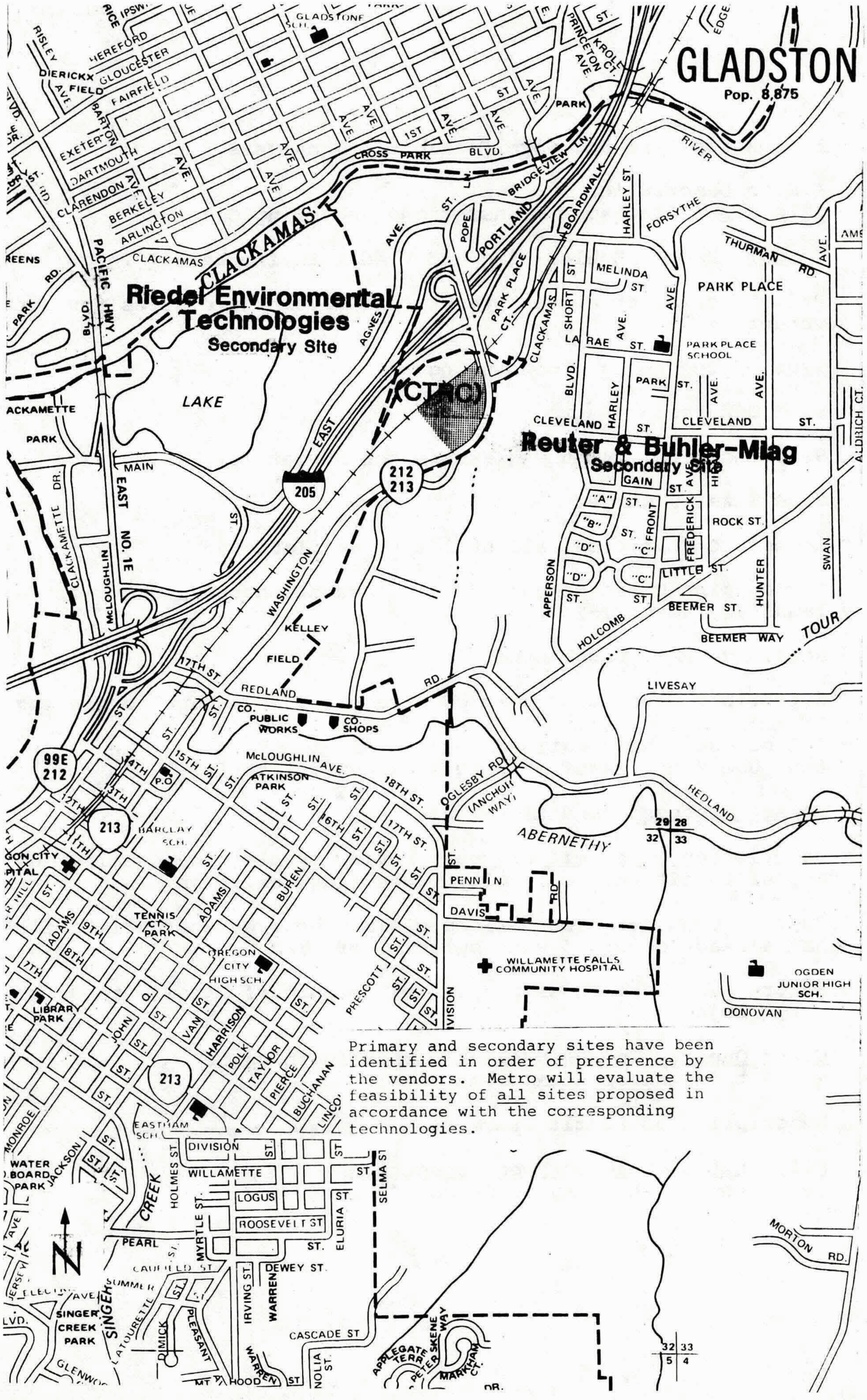
Special Considerations: flood plain - however appropriate fill has already occurred with building of CTRC.

Future Land Use: industrial. area is part of Gateway to Oregon City Project

C.Air Quality Issues N/A for composting project
Non Attainment or Attainment area:

Description of Permit Process:

D.Identified Neighborhood Opposition
residents of the City of Oregon City



Primary and secondary sites have been identified in order of preference by the vendors. Metro will evaluate the feasibility of <u>all</u> sites proposed in accordance with the corresponding technologies.

Evaluation Form For Site Feasibility Analysis

A.Site Description
Site Name: Valley Industrial park

Vendor: Reuter/Buhler-Miag

Primary or Alternative Site Status: alternative

Type of Technology: composting

Site Ownership: Publisher's Paper

Site Location: I-205 south of Foster

Site Size: 120 acres

Access to Utilities: all utilities available

Surrounding Uses: north:residential, south: residential, east:industrial, west: I-205.

Sensitive Receptors: none

Buffering: develop as part of site work. no natural buffering

B.Land Use Considerations
Land Use Zone: Manufacturing 1/ manufacturing 2

Permit Process: composting is not a listed use. zoning interpretation required

Description of permit process: not known at this time

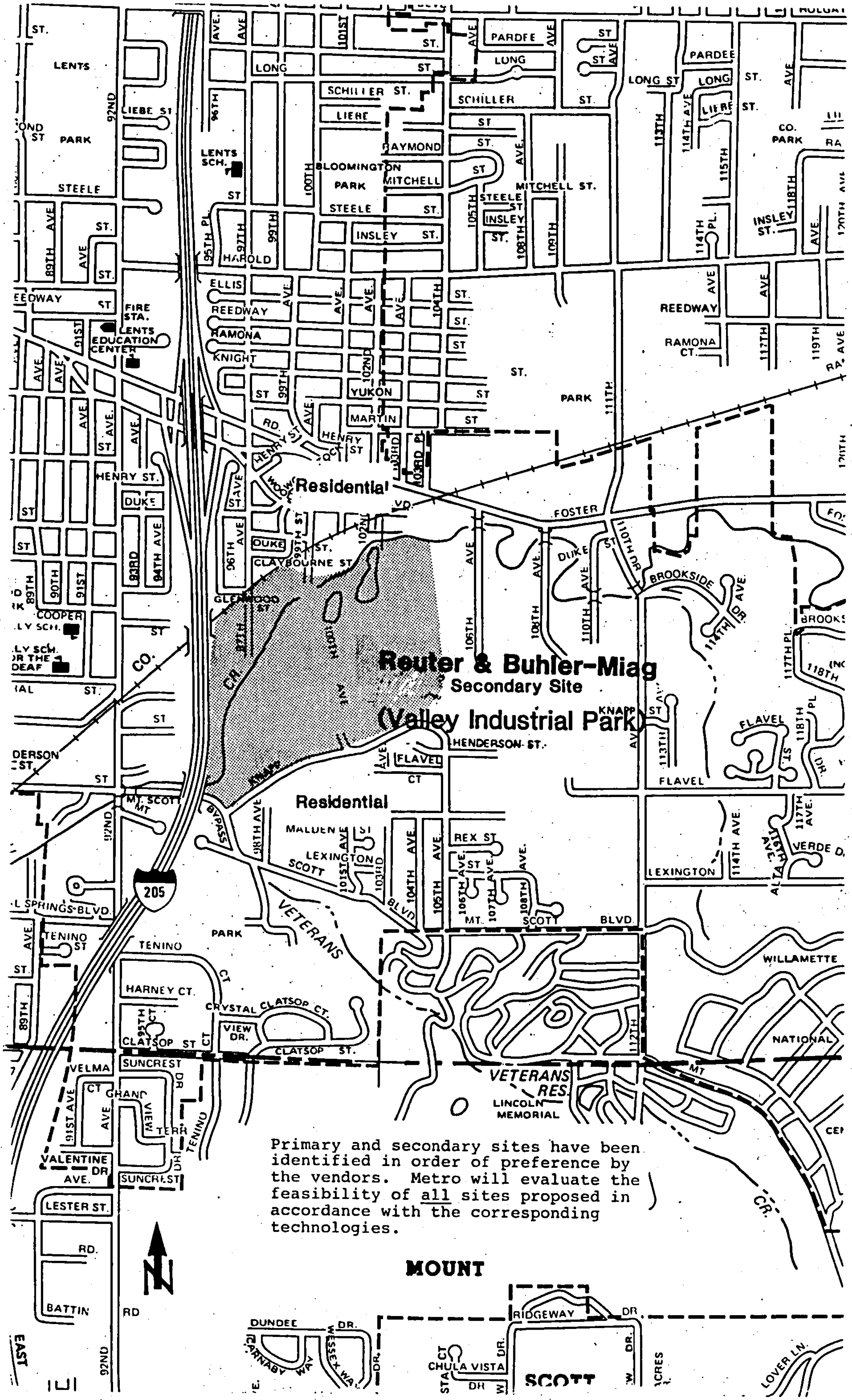
Special Considerations: flood plain, Recreation Trail designation Structures must be above flood plain and measures taken to protect other surrounding properties. There are no standards for recreation trail development

Future Land Use: industrial

C.Air Quality Issues N/A for composting project
Non Attainment or Attainment area:

Description of Permit Process:

D.Identified Neighborhood Opposition
Planning staff stated there is an existing conflict between residents and operating industry in the same area.



Primary and secondary sites have been identified in order of preference by the vendors. Metro will evaluate the feasibility of all sites proposed in accordance with the corresponding technologies.

Evaluation Form For Site Feasibility Analysis

A.Site Description
Site Name: Columbia Blvd.

Vendor: Riedel Environmental Technologies, Inc.

Primary or Alternative Site Status: Primary site

Type of Technology: composting

Current Ownership: Calcagno

Site Location: 5437 N .E. Columbia Blvd. (7 tax lots)

Site Size: 18 acres

Access to Utilities: all utilities available

Surrounding Uses: north:slough, south: industry/residential, east: industry, west: industrial

Sensitive Receptors: school

Buffering: develop as part of site work, no natural buffering

B.Land Use Considerations
Land Use Zone: General Manufacturing

Permit Process: composting is not a listed use

Description of permit process: not known at this time

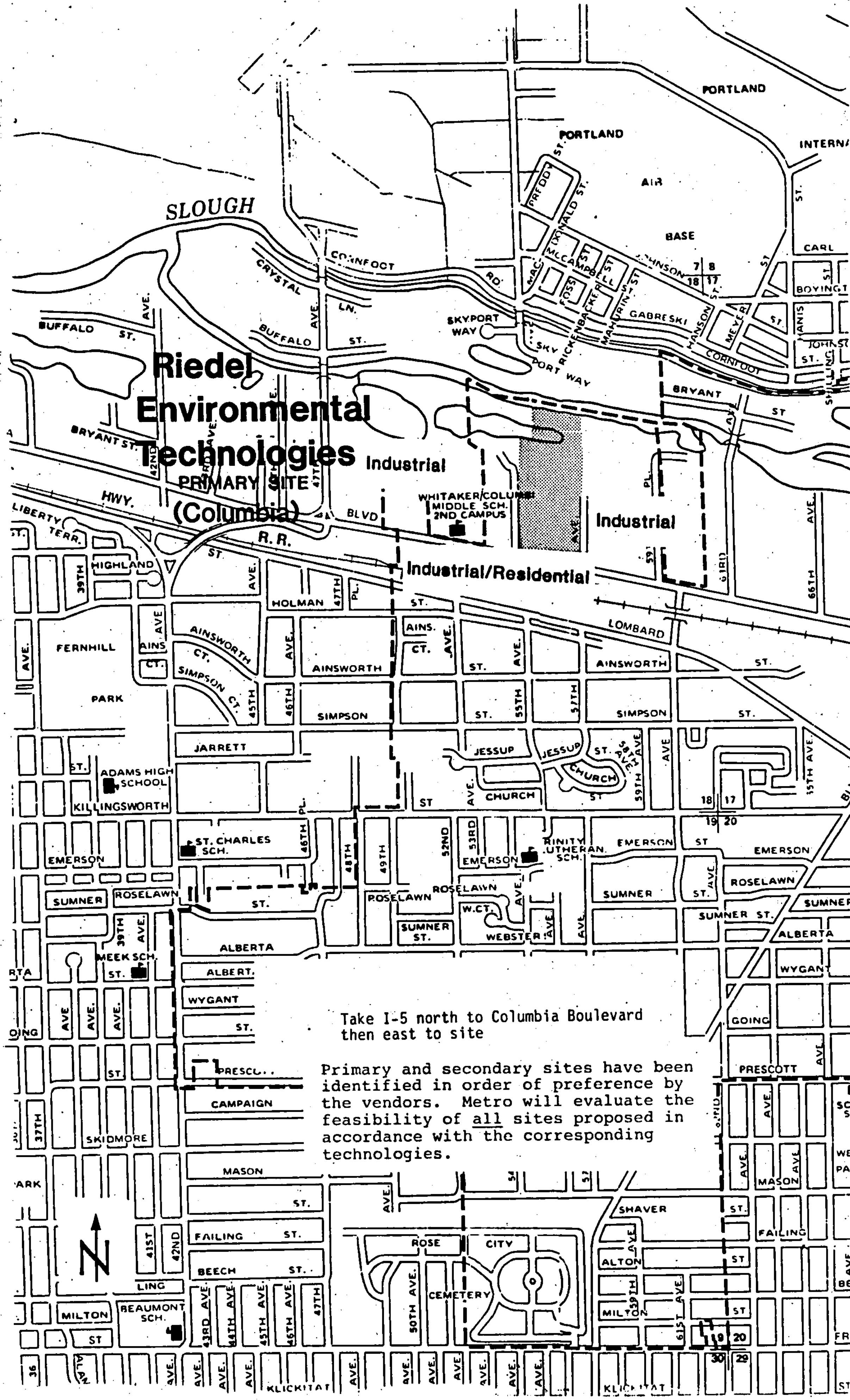
Special Considerations: flood fringe on back part of property Uses are allowed in this designation with conditions related to changes in water surface elevation and construction techniques that resist flood damage

Future Land Use:industrial

C.Air Quality Issues N/A to composting facility
Non Attainment or Attainment area:

Description of Permit Process:

D.Identified Neighborhood Opposition



Take I-5 north to Columbia Boulevard then east to site

Primary and secondary sites have been identified in order of preference by the vendors. Metro will evaluate the feasibility of all sites proposed in accordance with the corresponding technologies.

Evaluation Form For Site Feasibility Analysis

A.Site Description
Site Name: Rivergate Facility

Vendor: Schnitzer Steel products/Ogden Martin Systems, Inc.

Primary or Alternative Site Status: Primary Site

Type of Technology: mass burn

Current Ownership: Schnitzer Steel

Site Location: west of St. John's Substation on private road north of intersection of Lombard and Burgard.

Site Size: 10 acres

Access to Utilities: all utilities available

Surrounding Uses: heavy industry in all directions

Sensitive Receptors: none

Buffering: develop through design of facility. no natural buffering

B.Land Use Considerations
Land Use Zone: Manufacturing 1

Permit Process: conditional use

Description of permit process: planning commission review with public hearings. can be appealed to city council. city council makes final decision.

Special Considerations: flood plain. Structures must be above flood plain and meet standards to reduce impact to surrounding properties.

Future Land Use: industrial

C. Air Quality Issues
Non Attainment or Attainment area: attainment area for particulate

Description of Permit Process: prepare modelling and plant design for review by DEQ. Public hearings scheduled and issues responded to by DEQ. DEQ will determine if significant impact occurs in area and impact to surrounding non-attainment area. If non-attainment area is impacted "offsets" must be sought. Process anticipated to take one year. Vendor has met with DEQ and completed substantial amount of modelling work.

D.Identified Neighborhood Opposition

St. John's N. Portland Neighborhood
Port of Portland has expressed concern about potential economic impacts to Rivergate area.

Evaluation Form For Site Feasibility Analysis

A. Site Description
Site Name: St. John's Site

Vendor: Fluor/Southern Electric International

Primary or Alternative Site Status: alternative site

Type of Technology: mass burn

Site Ownership: Gilmore Steel

Site Location: Columbia Blvd. and Burgard Road

Site Size: 20 acres

Access to Utilities: all utilities available

Surrounding Uses: industry in all directions

Sensitive Receptors: none

Buffering: develop as part of site work. no natural buffering

B. Land Use Considerations
Land Use Zone: Manufacturing 1

Permit Process: conditional use

Description of permit process: review by planning commission. appeal to city council. city council makes final decision.

Special Considerations: none

Future Land Use: industrial

C. Air Quality Issues
Non Attainment or Attainment area: attainment area

Description of Permit Process: prepare modelling results and plant design for review by DEQ. Public hearings scheduled and issues responded to by DEQ. DEQ determines if significant impact occurs in area and if nearby non-attainment area is impacted. Process is anticipated to take one year. Vendor has discussed preliminary permit requirements with DEQ.

D. Identified Neighborhood Opposition
St. John's North Portland Neighborhood
Port of Portland has expressed concern about potential economic impacts to Rivergate area.

Evaluation Form For Site Feasibility Analysis

A. Site Description
Site Name: Gilmore Steel

Vendor: Combustion Engineering

Primary or Alternative Site Status: primary site

Type of Technology: refuse derived fuel

Site Ownership: Gilmore Steel

Site Location: 14400 N. Rivergate

Site Size: 20 acres

Access to Utilities: all utilities available

Surrounding Uses: north:industry, south:industry, east: industry, west:river

Sensitive Receptors: none

Buffering: develop as part of site work. no natural buffering

B. Land Use Considerations
Land Use Zone: Manufacturing 1

Permit Process: permitted use if privately owned. Conditional use if publicly owned because development would be considered a community service.

Description of permit process: allowed use if privately owned through administrative decision which can be appealed to Board of County Commissioners. Board of County Commissioners makes final decision. Conditional use process reviewed before planning commission and can be appealed to Board of County Commissioners. Board of County Commissioners makes final decision. Decision on ownership must be made prior to submittal of application.

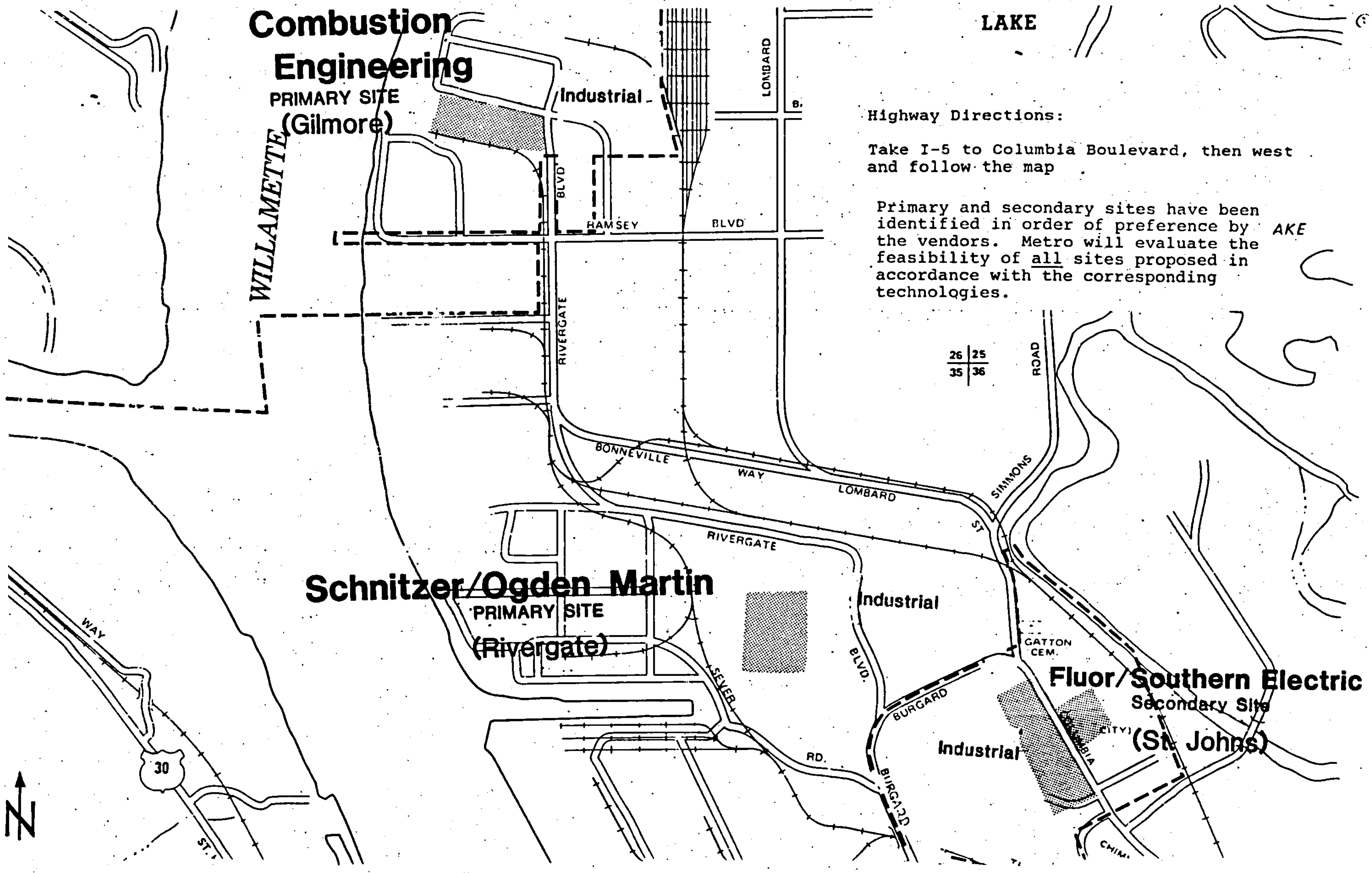
Special Considerations: there is no existing Willamette Greenway designation on tax map. County staff believes that the designation was lost when the parcel was deannexed from the City of Portland. However the entire site lies within the set back used by the City of Portland to designate area for the Willamette Greenway. The County would more than likely require Willamette Greenway considerations. Such a designation requires extensive landscaping, public access to the river and protective measures for fish and wildlife. Port of Portland will review project based on covenents and deed restrictions.

Future Land Use: industrial

C. Air Quality Issues
Non Attainment or Attainment area: attainment area for particulate

Description of Permit Process: Prepare review modelling and plant design for review by DEQ. DEQ will schedule public hearings and respond to issues raised at public hearings. DEQ will determine if significant impact occurs in area and impact to surrounding non-attainment area. If non-attainment area is impacted "offsets" must be sought. Process is anticipated to take one year. Vendor has discussed preliminary permit requirements with DEQ.

D. Identified Neighborhood Opposition
St. John's North Portland Neighborhood
Port of Portland has expressed concern about potential economic impacts to Rivergate area.



Highway Directions:

Take I-5 to Columbia Boulevard, then west and follow the map.

Primary and secondary sites have been identified in order of preference by the vendors. Metro will evaluate the feasibility of <u>all</u> sites proposed in accordance with the corresponding technologies.

Evaluation Form For Site Feasibility Analysis

A.Site Description
Site Name: UDAG

Vendor: Reuter/Buhler-Miag

Primary or Alternative Site Status: alternative site

Type of Technology: composting

Site Ownership: Portland Development Commission

Site Location: land along the Willamette River from the St. John's bridge south to the railroad bridge

Site Size: 46.5

Access to Utilities: all utilities available

Surrounding Uses: north:industrial/residential, south: industrial/residential, east:industrial/residential, west: river

Sensitive Receptor: none

Buffering: develop as part of site plan. no natural buffering

B.Land Use Considerations
Land Use Zone: manufacturing 2

Permit Process: composting is not a listed use

Description of permit process: not known at this time

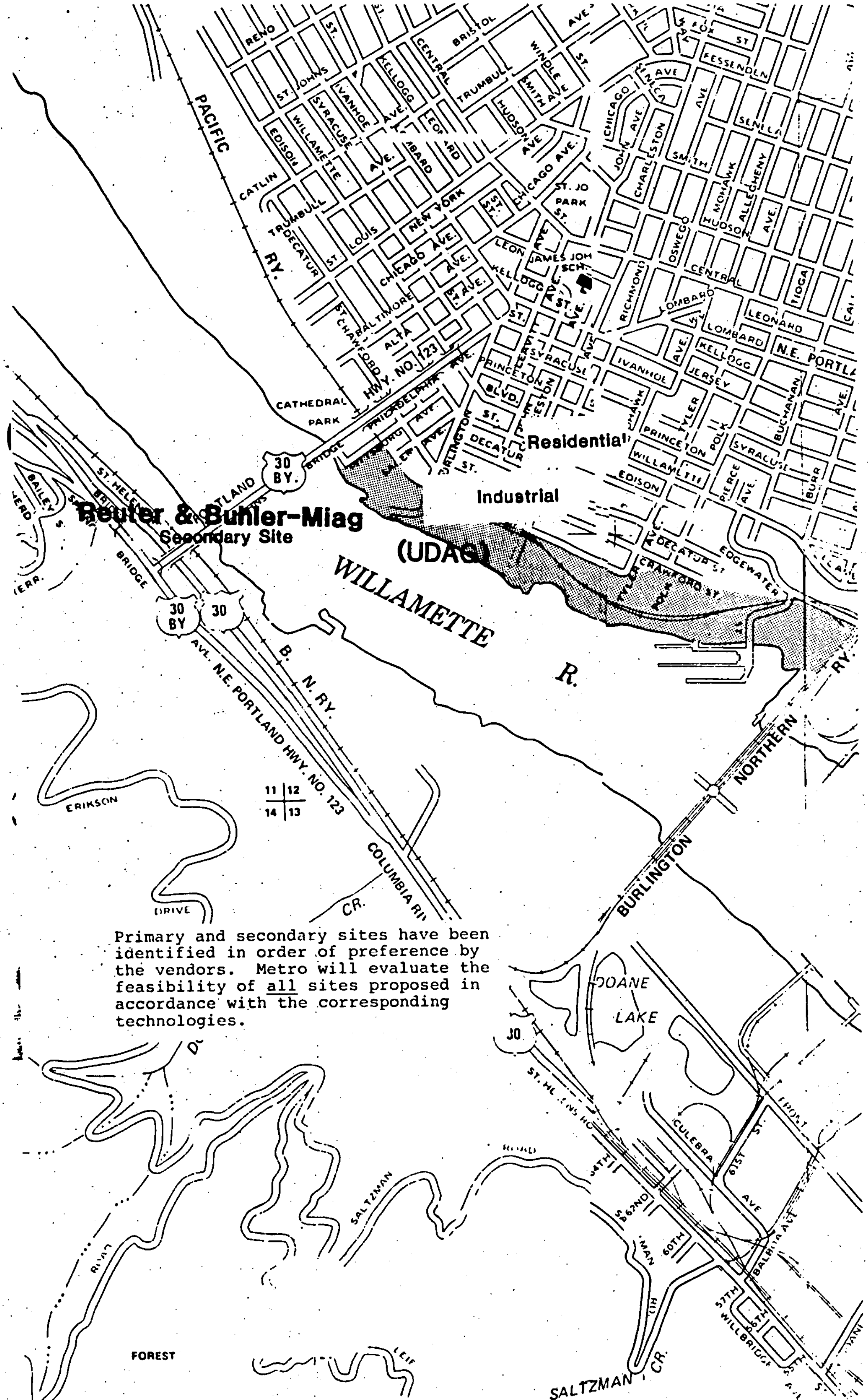
Special Considerations: Willamette River Scenic Development Zone Recreational Trail Designation. Willamette River Scenic Development involves a set-back for non-water dependent uses and landscaping, architecture and project development consistent with scenic qualities of the Willamette River. There are no standards for recreational trail development.

Future Land Use: questionable. was anticipated at one time for riverfront residential. may be considered for office/commercial area.

C.Air Quality Issues N/A for composting project
Non Attainment or Attainment area:

Description of Permit Process:

D.Identified Neighborhood Opposition
St. John's North Portland Neighborhood



Primary and secondary sites have been identified in order of preference by the vendors. Metro will evaluate the feasibility of all sites proposed in accordance with the corresponding technologies.

Evaluation Form For Site Feasibility Analysis

A.Site Description
<u>Site Name</u>: Port of St. Helen's

<u>Vendor</u>: Fluor/Southern Electric and Combustion Engineering

Primary or Alternative Site Status: primary/alternative

<u>Type of Technology</u>: mass burn/refuse derived fuel

Site Ownership: Port of St. Helen's

Site Location: Railroad Rd. off Rt. 30, adjacent to Willamette River

Site Size: 10 acres

Access to Utilities: all utilities available

Surrounding Uses:north:industry, south:industry, east: forested land, west:river.

Sensitive Receptors: none

Buffering: good natural buffering from City of St. Helen's. no natural buffering from Willamette river

B.Land Use Considerations
Land Use Zone:heavy industrial

<u>Permit Process</u>: permitted use/conditional use

<u>Description of permit process</u>: there is some confusion at the local level whether this use is a permitted or conditional use process. In a letter from the administrator from Columbia County it is stated that the use is a conditional use. When meeting with planning staffs from both the city of St. Helen's and Columbia County it was stated that the use is a permitted use. The question centers around how hazardous the use is and whether the use exhibits hazardous characteristics stated in the St. Helen's zoning code. It will be up to the vendor to address the list of hazardous characteristics.

Special Considerations: flood plain, Willamette Greenway designation. Flood plain considerations require structure to be above the flood plain and not to significantly effect water level in flood plain. Willamette Greenway designation requires additional landscaping and a building setback from the river.

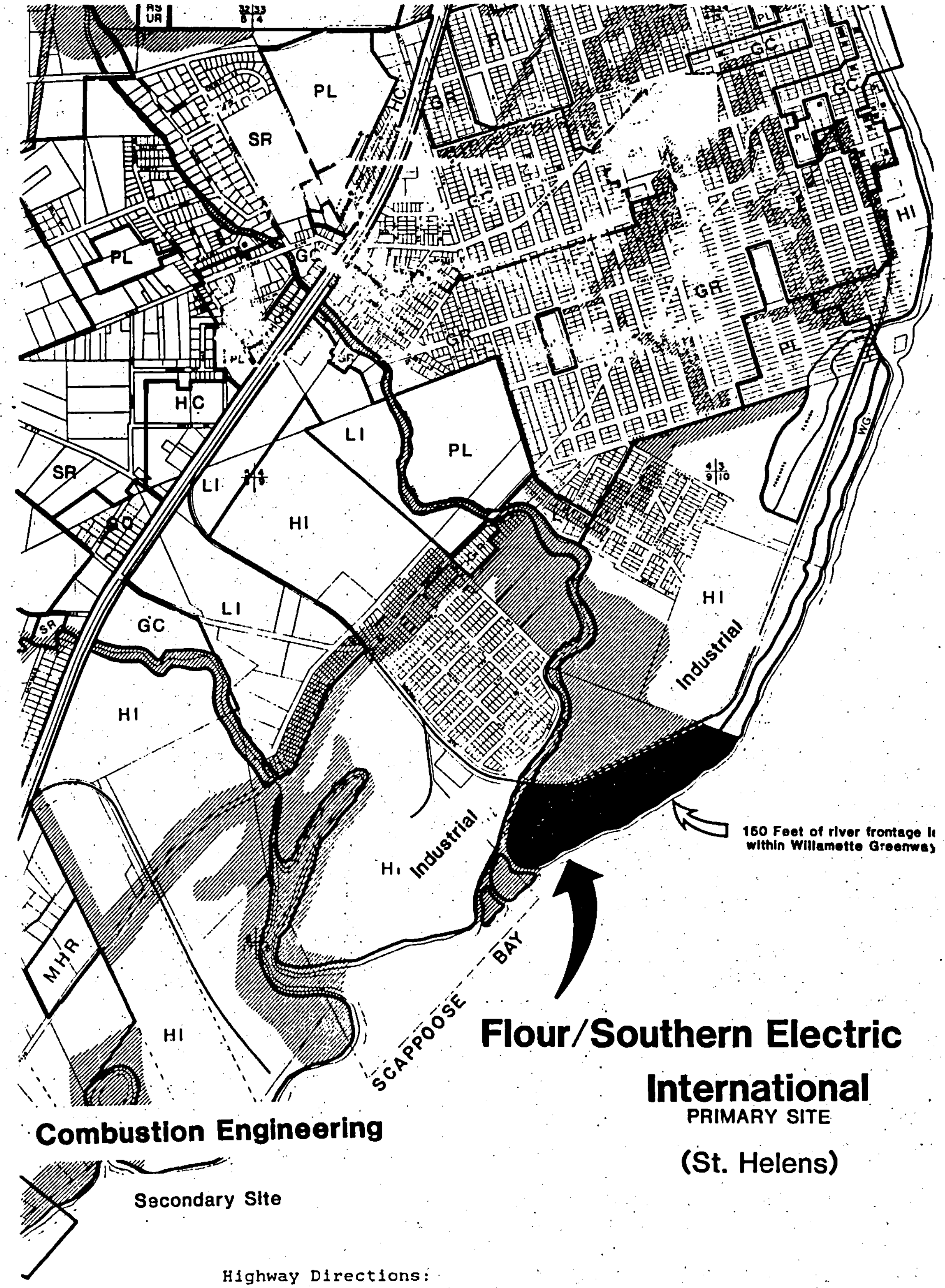
Future Land Use: industrial

<u>C.Air Quality Issues</u>
Non Attainment or Attainment area: attainment for particulate

Description of Permit Process: prepare modelling results and plant design for review by DEQ. DEQ schedules public hearings and responds to issues raised. DEQ will determine if significant impact occurs. No concern about impact to non-attainment area. Vendor has discussed preliminary permit requirement with DEQ.

D. Identified Neighborhood Opposition

a referendum was defeated banning out-of-county waste from Columbia Co. Community favors locating a resource recovery facility in the area. Community would oppose trucking of waste and prefer barging of waste.



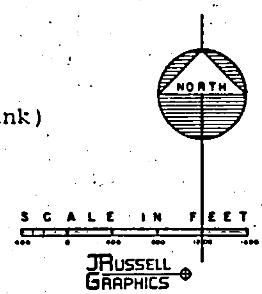
Flour/Southern Electric International
PRIMARY SITE
(St. Helens)

Combustion Engineering
Secondary Site

Highway Directions:

Take Highway 30 to St. Helens
Turn right on old Portland Road
Turn right on Railroad Avenue
Proceed to pole yard (along the river bank)

Primary and secondary sites have been identified in order of preference by the vendors. Metro will evaluate the feasibility of all sites proposed in accordance with the corresponding technologies.



Evaluation Form For Site Feasibility Analysis

A. Site Description
Site Name: Clackamas Industrial Park

Vendor: Reuter/Buhler-Miag

Primary or Alternative Site Status: primary site

Type of Technology: composting

Site Ownership: Santa Fe Realty company

Site Location: along Highway 212 near I-205 off Capps Road

Site Size: 156.31 acres acres available in parcels from 1.76 up to 42.23 acres

Access to Utilities: all utilities available

Surrounding Uses: north: industrial; south: large lot rural residential, east: industrial, west: gravel pit

Sensitive Receptors: none

Buffering: develop through design of facility. no existing buffering

B. Land Use Considerations
Land Use Zone: Industrial 3 (heaviest industrial zone)

Permit Process: conditional use

Description of permit process: hearing before Hearings Officer. no local appeal. conditional use process for river conservation area.

Special Considerations: river conservation designation. Such a designation requires minimum setback of structures and maintenance of existing vegetation along river bank.

Future Land Use: high-tech industries

C. Air Quality Issues N/A for composting project
Non Attainment or Attainment area:

D. Identified Neighborhood Opposition
Economic Development Groups-- County staff related that this area is being marketed for high-tech industries and a general upgrading of the aesthetics of the area is being considered

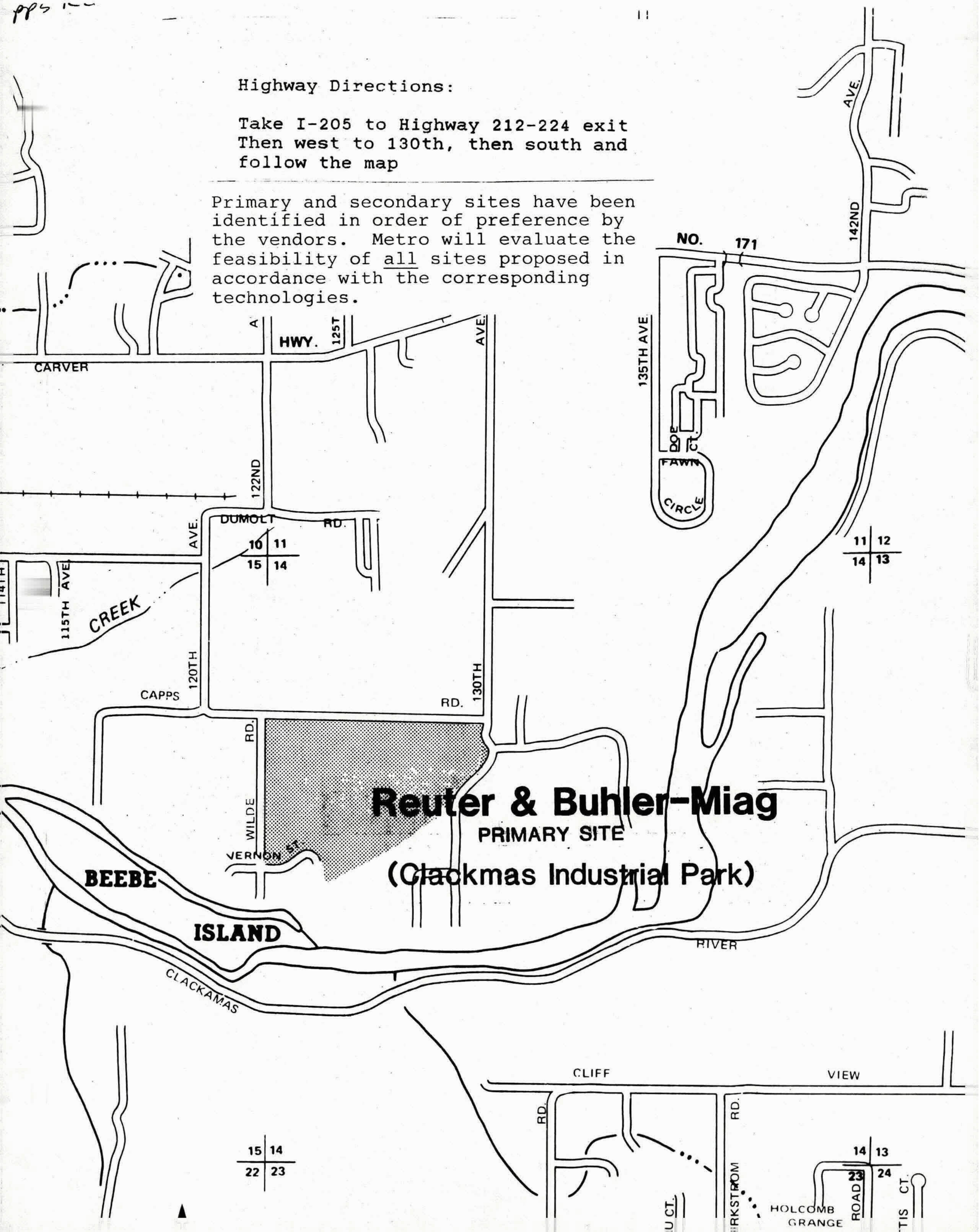
River Conservation Groups--County staff related that any perceived impacts from development of land in close proximity to rivers raises concerns from this group.

pps

Highway Directions:

Take I-205 to Highway 212-224 exit
Then west to 130th, then south and
follow the map

Primary and secondary sites have been identified in order of preference by the vendors. Metro will evaluate the feasibility of <u>all</u> sites proposed in accordance with the corresponding technologies.



D. Additional Compost Evaluations

Perhaps the largest operation involving municipal solid waste composting is in Wilmington, Delaware, where sewage sludge and solid waste are composted and blended together. This facility has been plagued by operational problems and marketing of finished compost has been difficult and expensive.

Compost Marketing

In Europe, the presence of numerous composting plants attests to the general success of the technique in handling refuse. In Belgium, Austria and Sweden, for example, different types of compost have apparently found ready markets at prices which significantly reduce operation costs. In Italy, the Cecchini process turns out a very high quality compost which has a variety of applications: animal feed, soil amendment, etc.

However, most mass composting is government-supported in Europe, so some marketing success appears to be due to community subisidies. Also, other plants in those same countries and in other parts of Europe have experienced serious marketing difficulties. In England and Germany several important solid waste composting operations have closed entirely due to marketing limitations, while in other places the operation is used only for volume reduction and stabilization prior to landfilling. As a general rule it appears that solid waste composting is of limited value, even in Europe, where landfill space is scarce.

In the United States there is very little experience with compost. Marketing of sewage sludge and yard debris composts has met with some success in the East and Midwest; however, these operations are usually municipal and it appears that a subsidy of one kind or another is necessary to achieve effective dissemination of the material.

By order of importance, several reasons appear to account for marketing limitations in Europe as well as in the United States:

- contaminants in the waste stream result in high processing costs and prevent widespread use of the material;

- beyond ordinary market sensitivity, the growth of environmentalism on both continents has resulted in lower market demand for compost due to uncertainty about future government regulation and possible long term effects of even trace amounts of heavy metals and other possible contaminates.

- even without environmental concerns there is limited demand for soil amendments; chemical fertilizers are conveniently available.

MARKETING PROPOSALS FOR MASS COMPOSTING

The purpose of this report is to review the history of mass composting in terms of its effectiveness in handling municipal solid waste. This report also summarizes portions of a larger study done recently by Metro as an evaluation of the Reuter/Buhler-Miag and Riedel/DANO resource recovery compost marketing proposals.

General History of Solid Waste Composting

Large scale composting of municipal solid waste arose with post-war affluence in Europe as a means to avoid landfilling or incineration. Mechanical composting usually included the extraction of metals and removal of minor contaminates. However, the increasing proportion of plastics, metals and other non-compostables in the waste stream tends to reduce the quality of compost and increase production costs, thus limiting the potential success of the overall science. Plant construction appeared to peak during the 1970s, and few new plants are now under construction in Europe.

At the present time more than 300 municipal solid waste composting facilities are in operation around the world. The majority of these are found in Europe, where affluence and lack of space combine to encourage a wide variety of waste management technologies. Although there are a variety of composting technologies in Europe, the majority are simple mechanical devices for processing the waste, after which composting takes place in open windrows.

Municipal waste composting was first tried in the United States during the 1960s, but was not successful due to a combination of financing, management and general economic problems. Primarily, the presence of inexpensive, loosely regulated landfill space prevented the growth of composting during that era. Only since the 1980s has interest in mass composting arisen again.

At present, composting of municipal solid waste and sewage sludge together occurs in several municipalities, while purely municipal solid waste composting is planned or underway only in Minnesota, California and in experimental projects primarily associated with universities. In fact, several hundred commercial/municipal composting facilities are planned or operational in North America, but fewer than 20 are intended primarily for municipal solid waste. The majority are for sewage sludge, yard debris, other materials or combinations of several types of wastes.

Sources:

1. "Refuse Refinement in the Netherlands: A Technically Proven Matter," Andre Westerhuis, from Recycling International, Vol.II, Karl J. Thome-Kozmiensky, Editor, EF Verlag fur Energie und Unweltechnik, GmbH, 1984.

2. Klaus Feindler, President, Beaumont Environmental Inc., sub-consultant to GBB on composting issues, P.O. Box 530 Wheatley Heights, New York, 11798: telephone conversation, April 27, 1987.

3. "Methods for Examination and Quality Control of Waste Compost - the Austrian Standard (S2023), Bernhard Raninger, from Recycling International (cited in footnote (1)), pp. 382-87).

4. Bernd Franke, telephone interview of April 27, 1987 and related material from him; Institue for Energy and Environmental Research, 6935 Laurel Avenue, Takoma Park, MD 20912.

Also, Norman Daykin, Sales Director, Municipal Composting Plant, Leicester, England, telephone conversation, April 30, 1987.

5. Experience and Conclusions from Swedish Waste Treatment Plants, Results from the DRAV Project, Gunnar Bergvall, from Recycling International (cited in footnote (1)), pp. 57-66.

6. HDR Techserv, Inc., Solid Waste Management/Resource Recovery, consultants to Clark County, Washington resource recovery project, 8404 Indian Hills Drive, Omaha, Nebraska, 68114, pp. 1-6, 2-17 to 2-21. The report cited the lack of longterm markets for compost and the discovery of PCB contamination in compost as major reasons for decline of compost plants in the United States.

7. "The Composting of Garden Refuse in the Landkreis Erlangen-Hochstadt by Local Collection and Processing at a Central Point, U. Wustmann, from Recycling International, cited in footnote (1), pp. 848-853.

8. "Heavy Metal Concentration and Amount in Highly Mechanized Plants to Produce Compost and RDF," Peter Kraub, from Recycling International (cited in footnote (1)), pp.

9. "Assessing Risk of Solid Waste Compost," Jeffrey M. Dyer and Aga S. Razvi, University of Wisconsin, Stevens Point, cited in Biocycle, Journal of Waste Recycling, March, 1987, pp. 31-36.

10. David Adams, Extension Agent, Multnomah County OSU Extension, letter to Tor Lyshaug, Acting Portland Metro Solid Waste Director, March 28, 1987.

11. Ernie Schmidt, Oregon DEQ, telephone interview, April 28, 1987.

Specific Environmental Concerns

Few industry or governmental regulations or guidelines exist for compost use. In Europe, various nations have promulgated rules limiting the heavy metal loading of soils through compost application, but there is little concensus of policy or established procedure. In the United States EPA and state-level rules exist for water quality, sewage sludge applications and other environmental categories but not for municipal waste compost.

As a general rule, the 'EP tox' test (extraction procedure for toxicity) is used to measure the presence of heavy metals and other contaminates. Unfortunately, this test and the corresponding EPA standards for metals and other contaminates in drinking water do not provide effective insight into environmental hazards: soil conditions, plant types and other factors strongly alter the amount of contaminants which are available for plant uptake and migration into sensitive situations.

The lack of consensus and common regulation of compost use do not indicate lack of concern, however. In fact, uncertainty about evolving public sentiment and potential environmental effects and regulations are probably limiting factors themselves. Until the long term effects and potential liabilities of soil contamination are better known, compost use will continue to be avoided in many applications.

In spite of general concern about contamination, European and domestic research indicate that metals are not likely to be found in food products grown in compost. Tests of wine produced in European compost-treated vineyards and sensitive vegetable tissue tests performed in the United States demonstrate that even worst-case land application loadings of compost result in relatively little plant up-take of metals, even though EPA drinking water standards for metals were exceeded in sample compost leachate.

Recent European experiments with source separation and front-end separation of vegetable, fruit and garden waste have resulted in improved compost quality; however, high processing cost and limited public interest in segregating their waste prevent expansion of this method.

Conclusion

Composting of solid waste is a well known, technically proven science. However, product marketing is complicated by the potential for soil contamination. Careful market development and knowledge about the effects of specific soil applications is needed to assure marketing success.

2. Technical Aspects

PRELIMINARY TECHNICAL EVALUATION OF THE RIEDEL COMPOSTING PROPOSALS

A. BACKGROUND AND INTRODUCTION

This report was prepared by Metro from original work done for Metro by Beaumont Environmental, Inc., (BEI) a subcontractor to GBB, which is the prime consultant on the Resource Recovery Project. The conclusions of this report are preliminary, pending Metro's decision to invite either proposer to further consideration.

The Metropolitan Service District (Metro) has been working for years towards a solution to handle waste disposal problems of the region. Metro has pursued a two-prong approach: promote waste reduction by materials recycling and develop resource recovery projects.

What makes Portland different from some other places is a popular sentiment towards organic approaches, i.e. the return of nutrients to the soil. As a result, Metro decided to implement more than one resource recovery project and the idea was born of allocating one part of the waste stream to a combustion type of project and the other part to a composting type of project.

In response to the RFP to mass composting technology vendors, Riedel Environmental Technologies, Inc., based upon DANO technology, and Reuter/Buhler-Miag (Buhler-Miag technology) submitted proposals. Both technologies originated in Europe where there are more than 100 mechanical refuse composting plants in operation today.

Through its principal and founder, BEI has been involved with the transfer of European resource recovery technologies for 15 years. BEI has visited numerous reference plants for the purpose of data collection, including those of Buhler and DANO. Therefore, BEI is qualified to assist with the technical evaluations for Portland.

The purpose of this report is to provide Metro decision makers with preliminary conclusions and recommendations as to which, if either, technology and vendor ought to be chosen for use by Metro in the Resource Recovery project.

This report summarizes BEI study of the following topics:

- A general review of the technical proposals, looking for obvious problems;

- Check of the mass and energy balances prepared by the vendors;

- Examination of the process flow sheets for their functional adequacy;

- Comment on the biochemical process descriptions;

- An attempt to corroborate the claims made for the performance of reference plants;

- Evaluation of the capacity and prediction of the reliability of the facility designs and quality control aspects.

Subsequent to the initiation of this project Reuter/Buhler-Miag apparently withdrew its proposal for this Resource Recovery project. Therefore, the bulk of this analysis deals with the Riedel proposal.

B. WASTE STREAM DEFINITION

Detailed knowledge of the quantity and quality of available processable waste is important for designing the processing system which is the backbone of any resource recovery facility.

There are many similarities between the phenomena which govern the oxidation process in incinerators and in composting plants. For both types of facilities one needs to know the amount of organics in the waste stream. This is the basic fuel for both processes except for one significant difference: what is combustible may not necessarily be biodegradable.

For example, a high concentration of certain types of paper and wood tends to increase the lignin content. The latter is resistive to rapid biodegradation. Conversely, a high concentration of certain types of food wastes is suitable for rapid biodegradation.

Unfortunately, unlike other solid fuels, municipal solid waste compost (msw) is heterogeneous. Its nature varies by the day and by the load brought into the facility. Yet it is necessary, for design purposes, to define a range of values one can expect during the course of a typical operating year and to estimate approximate averages.

Metro is well aware of this problem and has commissioned several programs for sampling and analysis. In Table I-1a, the results of an earlier study in 1979 are compared with those of a more recent study in 1986.

Inspection of this table suggests that the composition of Portland's waste has changed: plastics and paper up, glass,

Table I-1a: COMPOSITION OF PORTLAND MSW BASED ON FIELD SAMPLING
(Mixed Residential and Commercial)

Component	Previously Estimated Composition(1)(2) % Wt	Fall 86 (3)(4) Assessment Composition in % Wt		
		Range	Median	Adjusted Median
PAPER				
OCC/Kraft	4.6%	7.7% - 10.0%	8.85	8.57
Newspaper	2.1%	3.7% - 4.8%	4.25	4.12
Office paper	4.4%	3.9% - 6.3%	5.10	4.94
Other	12.2%	13.8% - 17.0%	15.40	14.92
Subtotal	23.3%			32.55
GLASS(5)	4.9%	2.7% - 3.6%	3.15	3.05
METALS				
Ferrous	6.6%	4.9% - 7.7%	6.30	6.10
Aluminum	0.5%	0.9% - 1.6%	1.25	1.21
Non-Ferrous(6)	2.0%	N.A.		N.A.
Subtotal	9.1%			7.31
PLASTICS	4.0%	5.7% - 7.3%	6.50	6.30
FOOD WASTE	19.5%	8.0% - 11.2%	13.10	12.69
YARD DEBRIS	13.4%	11.1% - 18.2%	14.65	14.19
MISC. ORGANICS(7)	13.0%	13.1% - 20.7%	16.60	16.08
MISC. INORGANICS(8)	12.8%	6.1% - 10.1%	8.10	7.85
TOTAL	100.0%	81.6% -118.5%	103.25	100.00

Table I-1a

Notes:

(1) Presumably based on survey conducted by SCS Engineers in 1979, using 110 samples in the "as received" condition. Reportedly, this survey included both residential and commercial collections and was conducted at the Rossman's and St. John's landfills.

(2) The original survey report nor the method used for fitting this data were available to us. In fact, we could not find these values in the Compost RFP.

(3) Samples were taken at the Clackamas Transfer Recycling Center, at St. John's Landfill and Killingsworth Landfill. Both, residential and commercial collections were involved. Approximately, 180 original samples were sorted during fall 1986.

(4) Statistical parameters were developed at the 80% confidence level.

(5) The glass category in the Waste Characterization Study only includes recyclable glass. Other non-recyclable glass is included in the Miscellaneous Inorganics category.

(6) Non-Ferrous metals were included in the Miscellaneous Inorganics during the fall assessment.

(7) For this table the Wood, Textiles, Diapers and Fines categories from the fall assessment were added to the Miscellaneous Organics category of the fall assessment.

(8) For this table the Returnables, Hazardous and Other categories from the fall assessment were added to the Miscellaneous Inorganics category of the fall assessment.

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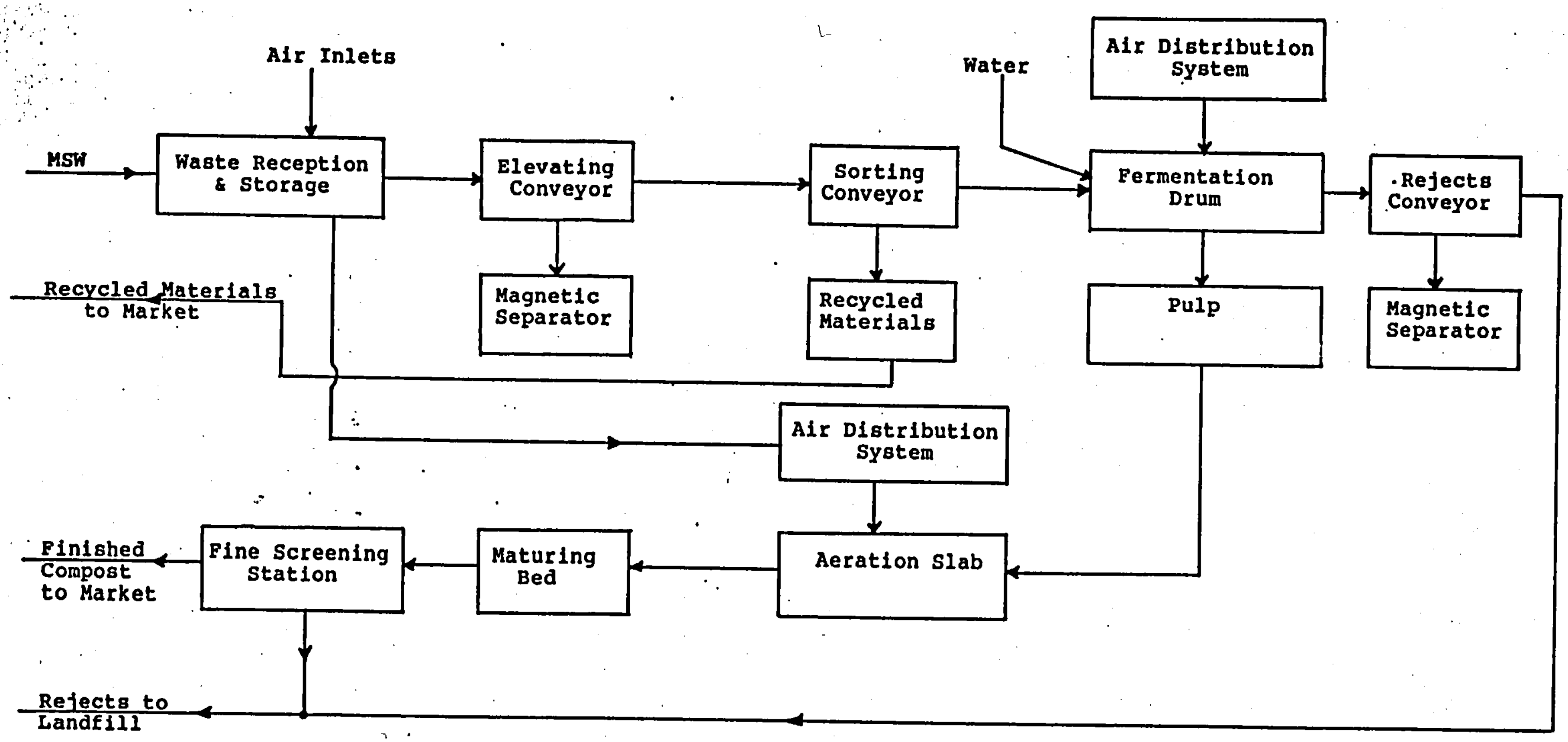

Figure II-1: PROCESS FLOW SCHEMATIC FOR DANO COMPOSTING SYSTEM metals and food wastes are down. The latter observation is of significance for the design of composting systems.

Another type of analysis is performed in laboratories set up for routine fuel analysis applying standard methods espoused by the ASME and the ASTM.

The trend towards higher amounts of combustibles is clearly discernible. This development resulted in relatively high heating values. In this connection, it is important to distinguish between the higher heating value (HHV) and the lower heating value (LHV). the difference between the two represents heat losses due to free water received with the waste and chemical water made during oxidation.

Because little if any latent heat of vaporization can be recovered, the LHV is the more important for projecting process efficiencies. This holds true for incineration and composting alike.

C. DANO (REIDEL) PROCESS & TECHNOLOGY DESCRIPTION

The basic Dano composting processing has been available on a commercial scale since 1960. There are upwards of 90 plants operating in 20 counties around the world today. Numerous Dano composting plants have been build especially in Great Britain and Italy.

During the last 15 years we had the opportunity to inspect a number of these plants to convince ourselves of the successful commercial status attained by this technology. Several of these plants fall within the size range proposed for Portland (274-548 $STPD_7$ or 320-640 $STPD_6$*)

Some of the Dano plants are technology hybrids, i.e. they combine composting with incineration. The ultimate objective of such hybrids is to minimize landfill requirements. Examples of our site visits included Pinneberg FRG, Rome I and Wanlip, B.B. The first of these includes incineration of rejects and bulky wastes, while the last features co-composting of sewage sludge with refuse.

Not all composting plants have been successful. This statement holds true especially for plants which are exclusively dedicated to refuse compsoting. In its supplemental sumbittal on March 23, 1987, under "Previous Experience", RET indicates that

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*$STPD_6$ means short tons per day on a 6-day a week input basis

*$STPD_7$ means short tons per day on a 7-day a week input basis

"... at least 80 other plants are not included because their status is unknown. Many are undoubtedly still operating, but others may have ceased operations..."

The current U.S. West Coast licensee for DANO is Recovery Systems of Portland, Oregon which in turn has sublicensed Riedel Environmental Technologies (RET) for the Metro project. Since the technology is the same for both plants, i.e. the smaller and the larger one, we intend to keep our discussion in a generic format.

Figure II-1 presents the basic flow schematic. Unlike some other composting plants (including several of those based on the Dano system), RET does not believe in the necessity of primary shredding. Consequently, there is no size reduction and mixing prior to the Dano stabilizer drum. The latter is the heart of the system where, in the presence of air and water, the biological fermentation process starts. Because of the relatively short retention time (i.e. approximately 8 hours), only a limited amount of organic decomposition occurs here.

In the older, more traditional Dano systems a longer retention time of a typically 36 hours was necessary. In addition, the warm exhaust air from the fermenting process inside the drum was drawn out through the feed hopper. The purpose of this ducting arrangement was - at least in part - to preheat the colder incoming refuse. During this preheating some of the water vapor in the exhaust air would condense thus helping to moisten the incoming refuse. In theory this approach would lower the need for water addition up front and drying air at the back end of the system.

The limitations of time and available resources did not permit an in-depth investigation of these phenomena at this time. Figure II-2 shows the average temperature profile for fermentation in a Dano stabilizer drum. The temperature measurements came from an older Dano plant operating in the FRG. Apparently refuse of a lower BTU value and different compositional analysis than the one expected in Portland were involved.

Unfortunately the RET proposal did not contain similar projections for Portland. Therefore, the adequacy of the shorter retention time could not be checked. The German example certainly shows the need of a 3-days in order to get up to the desired optimal fermentation temperature of about 130°F.

A thorough understanding of the biochemistry involved is the

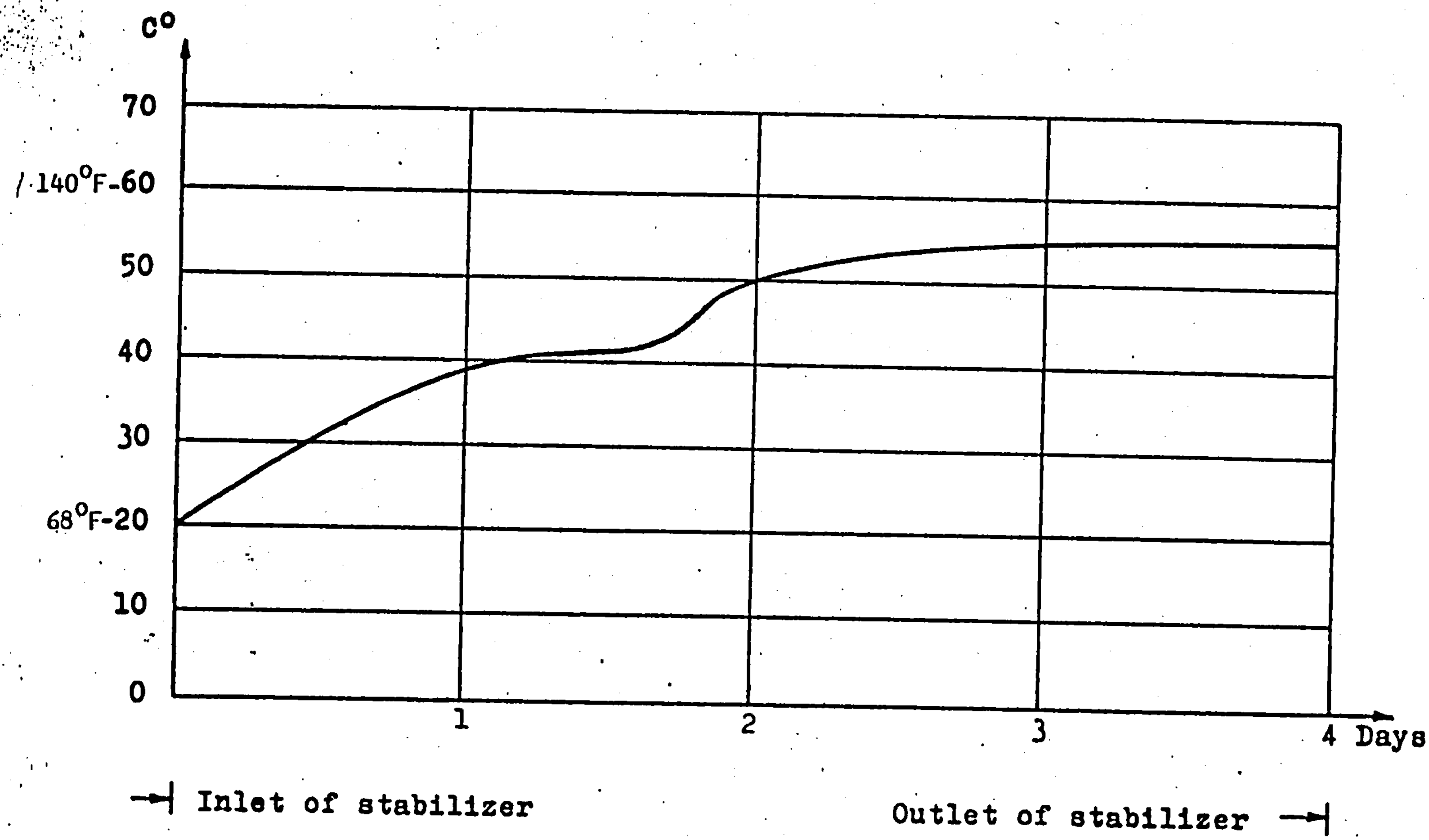


Figure II-2: AVERAGE TEMPERATURE PROFILE FOR FERMENTATION IN A DANO STABILIZER DRUM key to designing an efficient mechanical composting system. Dano's German licensee, VKW has furnished a brief but excellent description of the basic process if action in the drum itself is to be maximized.

With the drum in rotation, there is some natural mixing and size reduction because of shearing forces. At the back end, the drum is equipped with a screen which allows the undersized material, i.e. the pulp, to exit while the oversized material continues on the out to the rejects conveyor. These rejects will be taken either to a landfill or to a waste-to-energy facility as a fuel, possibly as a low quality RDF (refuse derived fuel).

The pulp is placed in windrows on a aeration slab, where exhaust air form the waste receiving and processing buildings is used for forced aeration. A compost turning machine, which can be used to break up and reset these windrows, is also furnished. With approximately 504 hours of retention time, the bulk of the biochemical decomposition process takes place here.

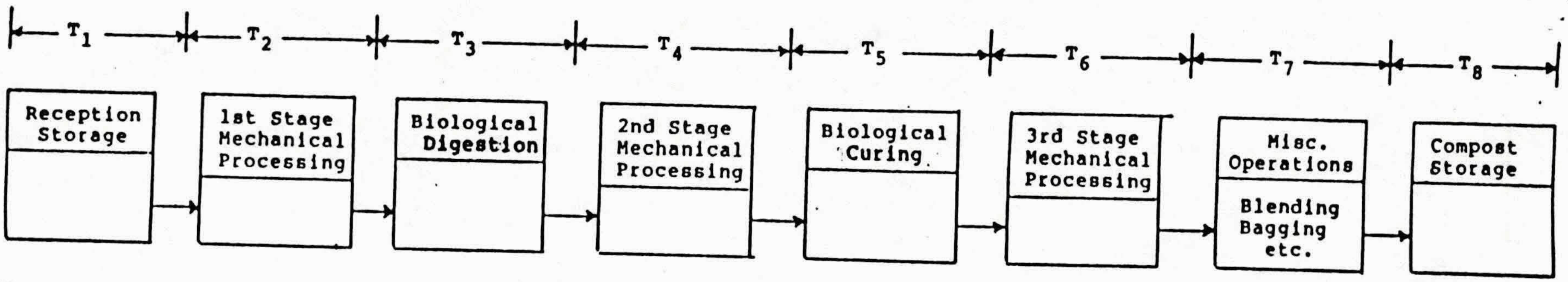
Once decomposition is about 95% complete, the compost is transferred by front loaders to the maturing beds, where it will remain for approximately 504 hours.

As a final step, the compost is conveyed to a fine screening station from whence the product can go to market in bulk form. A bagging capability is not initially planned on.

In Figure II-3, the total retention time of an average waste particle through the system is described. It totals 1,413 hours, which is less than that used in some other operational plants. However, RET feels confident that this is sufficient for Portland waste. In the event that more retention time is needed, either the aeration and/or the maturing pad can be extended at a future date. Only 11 acres out of the 18 acre site chosen by RET will be immediately developed.

Retention time in the drum can be varied by switching on and off hydraulic pump motors. For higher speed more of the modular pumps will operate. Conversely, for low speed fewer will operate. A speed of about 3-4 RPM is anticipated.

Certain design details were not furnished with the technical proposal because of their proprietary nature. However, both are important to proper performance of the biostabilizer. One involves the discharge gate which is mounted inside the drum ahead of the discharge screen. It is intended to run the drum continuously, even during those hours when waste is not charged. During such off-shift hours, the discharge gate will remain closed in order to retain some material tumbling around inside. This method is expected to prevent the build up of material which may turn anaerobic.



Total Retention Time $T = T_1 + T_2 + T_3 + T_4 + T_5 + T_6 + T_7 + T_8$

$T = \underline{36} + \underline{8} + \underline{504} + \underline{0} + \underline{504} + \underline{1} + \underline{0} + \underline{360}$ [hours] 1413 hrs

Note: For T_1 assume 36 hours average
For T_8 assume 360 hours average

* 36 hours is excessive. The waste will be processed promptly upon receipt. Two hours would be a generous time allowance.

** T8 is unneeded. Compost may be moved out promptly after final screening.

Figure II-3: <u>TIME FLOW SCHEMATIC FOR AVERAGE COMPOST PARTICLE RETENTION TIME IN DANO (RIEDEL) SYSTEM</u>

Another proprietary feature concerns the air flow control scheme for the drum. The older Dano drums had an air blower-manifolding arrangement which would create suction at both ends. Adjustable air inlets were positioned along the perimeter to control the amount and direction of the air flow.

Temperature was measured in a number of locations by means of a thermometers which were also mounted on the perimeter. This is easy to do and temperature is considered to be a valid indicator of treatment progress.

For Portland, the drum design has reportedly been changed, because slip rings will send electrical power directly to the drum in order to feed power to centrifugal blowers. The latter will be attached directly to the drum. Temperature will be the major process variable which will be monitored throughout. It is much easier to do than O_2 monitoring (which would be helpful, too). After completion of biological digestion, the average compost temperature tends to approach abient conditions.

On the other hand, RET in its Portland proposal has shifted more of the fermentation burden to the aeration slab on which the raw compost or pulp coming off the drum is to be placed.

A typical time-temperature profile is illustrated in Figure II-6 for Dano compost sitting in windrows. The individual temperatures were determined by inserting portable thermometers into the windrows. The sharp drops suggest that the windrows were turned by a machine initially at 7-day intervals and thereafter at 14-day intervals. Consequently, some type of a stirring effect seems to be visible.

For Portland, a different approach has been chosen in that an aeration slab will be built which consists of special concrete blocks spaced 8" on center. In between blocks, there will be air gaps 1/8" wide and 3-1/2" long which will allow for continuous admission of forced air coming off a blower manifold. The aforementioned turning-machine will only be used sparingly, if at all.

While the forced aeration approach is expected to greatly reduce the need for retention time, important technical details were not furnished. Therefore, an independent variation could not be made.

Besides maturity, the final product may also be judged according to glass, metal and plastic particles which may be found in it. In order to reduce such fragments, many composting plants in Europe provide additional treatment steps beyond the fine screen proposed by RET. Secondary shredders, air classifiers and ballistic separators are examples of such

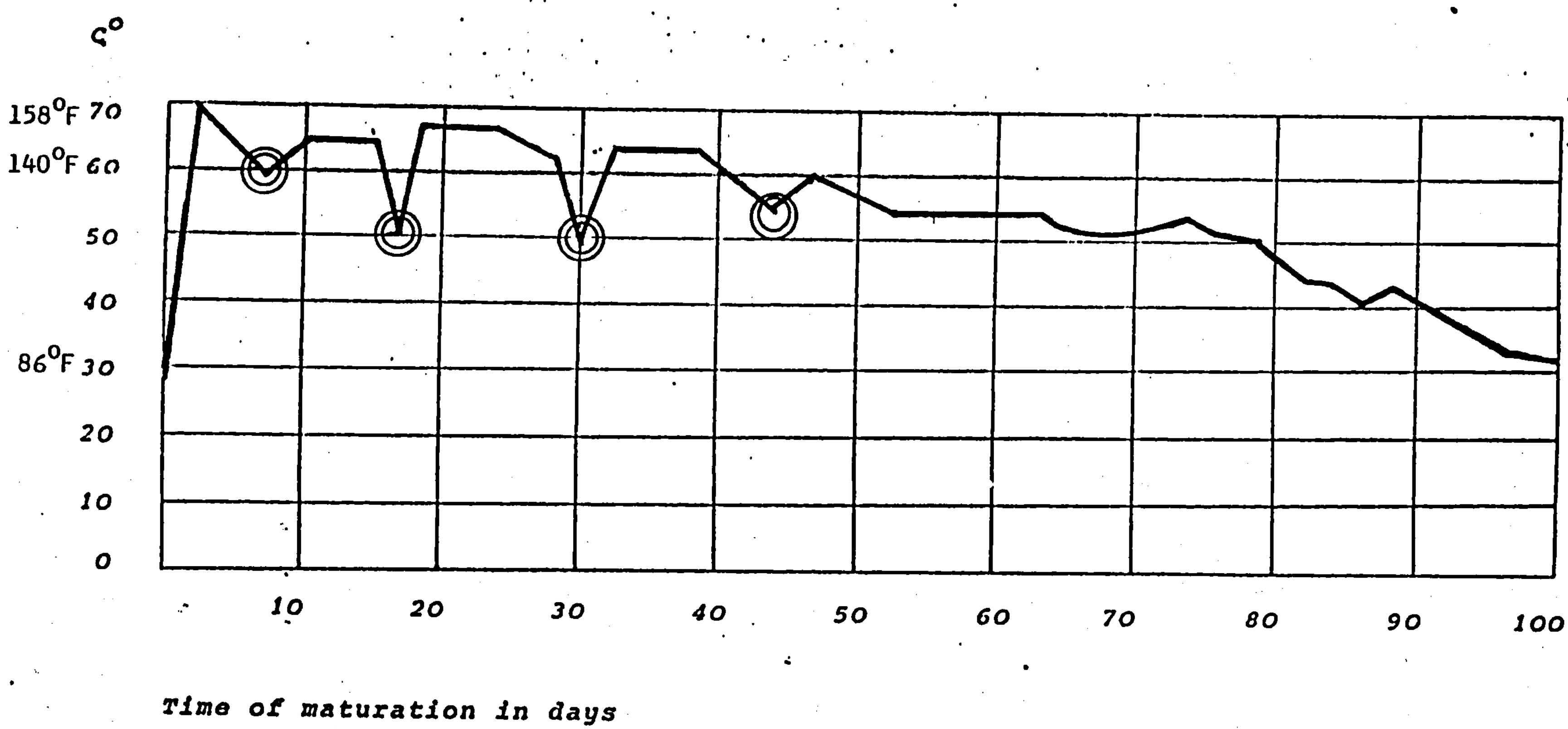


Figure II-6: TYPICAL TIME-TEMPERATURE PROFILE FOR MATURING OF DANO-COMPOST IN WINDROWS

Note: ◎ Incidents when composting machine was used to turn windrows.

equipment.

Based on its preliminary local marketing efforts RET believes that no such equipment is needed. However, RET contends that a retrofit could easily be made at a future date if the market should demand it.

Along the sorting conveyor, there will be some 6 to 12 picking stations for the manual recovery of certain materials for the recycle market depending on the size of the plant. Typically, glass, plastics, paper, cardboard, aluminum and non-ferrous metals are recovered.

The idea of manual recovery is not new. There are several full-scale plants in Europe, including Dano plants, which practice this method. It has several advantages in that it provides jobs and holds down capital costs. In addition, it has great flexibility to respond to changes in waste composition and the scrap market.

On the downside, it has the potential of exposing the pickers to personal injury. The operator will mandate that suits, masks and gloves be worn. However, not everyone is certain that all such rules are always enforceable. It is conceivable that contaminated syringes may be discarded by intravenous drug users, together with their household garbage. At this time, it is not known whether gloves will offer guaranteed protection against puncture and injury from injury from syringes.

In the alternative, there are fully mechanized and automated sorting systems which operate in Europe in combination with composting systems. However, they are expensive to build and to maintain. As a result, they increase the economic risk affiliated with materials recovery. It is more difficult to reassign an idle machine than a worker to new duties during a downturn in the scrap market.

With regard to environmental protection, there has been a great deal of discussion as to whether or not the entire biological process should be enclosed.

In the RFP, a rather protective stance was taken in that enclosed buildings were requested. One of the reasons behind this request was the concern about the intensive rainfalls which Portland experiences from time to time. It was suggested that high intensity rain fall might block void spaces in parts of the windows and increase channeling of ventilation air. Anaerobic pockets might then form with concomitant production of odiferous gases. Later on, these pockets might open up again, allowing these gases to escape without any means of control.

RET, on the other hand, argued that enclosing the buildings would not only add to construction costs, but it might also cause condensation during periods of high humidity. This, in turn, would increase maintenance costs.

Although there are many plants in Europe with outdoor piles, there are also those with roofing over them in order to keep rain and snow out. With the sides being open, cross ventilation should abe facilitated. The important part to enclose is the fermentation part. The maturing part is more forgiving, because most of the process is already complete.

The Dano drums are of one standard size and, beyond rotational speed, the only other issue to be discussed deals with the number of units or processing lines to be installed. In the RFP, several conditions were set which constrain plant design:

(a) Minimum number of lines to be furnished must be 2.
(b) Annual processing capacity either 100,000 or 200,000 STPY

The first stipulation originated from the desire to eliminate the complete plant shut down which would be the result of equipment failure in a single-line plant.

On the other hand, the annual processing capacity choices were only planning numbers which can and should be changed if processing costs can be lowered.

It has been estimated that a standard Dano drum can process Portland waste at a rate of 300 STPD, based on charging 16 hours per day. Generally, there would be no charging during the third shift and on Sundays thus reserving ample time for heavy maintenance.

If a plant capacity factor, or PCF of 0.85 were to be applied in order to allow for some variations in the processing rate due to waste compositional changes, to delivery problems or to minor operating problems, then the annual plant capacity would be fixed at

$$0.85 \times 2 \times 300 \times 52 \times 6 = \underline{160{,}000 \text{ STPY}}$$

In this case, insisting that the plant be run at only 100,000 STPY, would mean under utilization of equipment and people and might jeopardize operating economics. Therefore it appears appropriate to consider an annual throughput of 160,000 STPY as the lower plant threshold.

A similar case can be made for the larger plant, which would require the installation of three Danos to begin with. However, a tonnage of 0.85 x 3 x 300 x 52 x 6 = 240,000 STPY should be allocated in that case for the most economical mode of operation.

With regard to potential operating problems, it needs to be pointed out that RET does not wish to use a primary shredder between the elevating conveyor and the drum. Once again, European plants have been build either way, with or without primary shredders.

A primary shredder has the following advantages:
(1) Plastic bags do not remain intact.
(2) Stringy material such as wire coils and plastic film are torn up.
(3) Particles are limited in size.

A primary shredder has the following disadvantages:
(1) High energy use.
(2) High wear and maintenance.
(3) Potential explosion hazard.

RET is aware of the possibility that without the primary shredder, stringy material may form a "sausage" inside the drum from time to time. This problem is common in European plants of this type. It usually requires a brief shutdown in order to allow workers to go inside the drum and remove the stringy mass.

D. PROCESS ANALYSIS - DANO

The analysis of any composting process follows several steps:

(1) Characterization of the waste to be oxidized and formulation of the basic biochemical reaction.
(2) Mass balance, i.e. the inputs must equal the outputs in all three phases, solid, liquid and gaseous. Water which is chemically made as the result of oxidation must be included.
(3) Energy balance, i.e. the inputs must equal the outputs, taking recognition of the fact that the oxidation of organic material produces the energy necessary to drive the process.
(4) Thermodynamic equilibrium, i.e. the amounts of energy and air must be checked in order to determine if there is enough or too much air for cooling and drying.

With regard to step one, it is usually assumed that carbohydrates predominate over the organic waste component which is biodegradable. It is then convenient to use aerobic glycolysis as the biochemical reaction model.

Dano supplied some of the information needed but not enough by a long shot. The mass balance illustrated in Figure IV-1 should not be relied on for correctness, because more time and work plus Dano input will be required to complete and/or revise it.

E. <u>CONCLUSIONS (PRELIMINARY)</u>

1. Both technologies have been widely used in Europe for a long time.

2. Both technologies are considered to be proven on the scale of operations proposed for Portland.

3. Hardware is readily available "off-the-shelf" for either project.

4. Buhler (through Reuter) has the advantage of having already designed and constructed its first full-scale American plant (Eden Prairie in Minnesota). Thus the Americanization of its technology may be somewhat further ahead.

5. The Dano process, in terms of equipment selections and plant configuration, appears to be simpler and less costly.

6. The Buhler process results in a more highly processed product which ultimately may command a higher price, depending on market acceptance.

7. Dano uses a shorter retention time, which may not necessarily be detrimental. However, Dano has not yet furnished enough hard technical data to back this contention.

8. Dano products more compost per ton of refuse processed. Also, Dano generally produces a moister compost, which may be quite acceptable to certain customers (agriculture) but may be objectionable to other customers (horticulture and gardening outlets).

9. In terms of consumables, i.e. electricity, fuel and water, both technologies are nearly equal.

10. With regard to staffing, Dano accomplishes a higher throughput with fewer people.

11. Both proposers have put considerable effort into their technical proposals, although Dano has been more forthcoming during the technical discussions.

12. The earlier failures of Dano plants in the U.S. should not be viewed as a deterrent to a successful Portland project. There are design refinements, changes in waste composition, increased environmental concerns and improved economics to be considered.

13. The minimum tonnage of 100,000 STPY allocated for composting is not the optimum for either technology.

15. In the RFP, neither proposer has furnished as requested the detailed operating data which describe the results obtained in the reference plants cited. As a result, an in-depth evaluation was not possible, and areas of high risk remain. Lacking data on efficiency, reliability and product quality in particular impeded progress with the evaluation.

F. <u>RECOMMENDATIONS</u>

1. Funding should be secured in order to perform the in-depth technical evaluation previously proposed by BEI.

2. A "truth squad" should be assembled and funded to go to Europe to spend sufficient time with the designers and operators of the following Dano reference plants: Federickssund, Duisburg and Oberpullendorf in order to gain more confidence.

3. An independent marketing consultant should be hired to verify that the Portland market for refuse-based compost does exist, that there are firm commitments and the compost quality as proposed is satisfactory.

4. The proposer should be required to set aside sufficient land to expand the aeration and curing slabs in case the proposed retention times are inadequate.

5. In view of the technical discussions which followed the original submittal, the demand for enclosed aeration or fermentation buildings can be dropped. However, the requirement for roofing and positive drainage provisions should be retained.

6. The proposer should be required to make the use of the windrow-turning machine part of his regular operating schedule.

7. Metro should change the allocated tonnages in order to make better use of existing drum designs and staffing patterns.

   Go from 100,000 STPY to 160,000 STPY

   or

   Go from 200,000 STPY to 240,000 STPY

   These changes should result in increased efficiencies and economics without a loss of reliability.

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Figure IV-1: SIMPLIFIED MASS BALANCE FOR DANO COMPOSTING PROCESS(1)

Acceptable Waste

Solids:	750,000
Water:	250,000
Total:	1,000,000

Process Water

Solids:	0
Water:	500,000
Total:	500,000

Process Air Intake

CO_2	5,494 Lb
N_2	9,217,951 Lb
O_2	2,832,536 Lb
H_2O	80,581 Lb
A	162,382 Lb
Total:	12,298,944 Lb

Biological Digestion Process

1. Aeration Drum
2. Aeration Slab
3. Curing Pile

Solids Loss: 79,800

Rejects

Solids:	224,930
Water:	76,570
Total:	301,500

Gaseous Effluent (2)

CO_2	122,534 Lb
N_2	9,217,951 Lb
O_2	2,747,416 Lb
H_2O	557,961 Lb
A	162,382 Lb
Total:	12,808,244 Lb

Recovered Materials(3)

Solids:	85,270
Water:	3,930
Total:	89,200

Cured Compost

Solids:	360,000
Water:	240,000
	(40.0% RH)
Total:	600,000

Notes: (1) Basis 1,000,000 Lb of acceptable waste input.
(2) Free water from liquid and solid inputs, to be removed during processing: = 429,500 Lb
(3) Includes glass and rocks

E. Reference Checks

Reference Plant Checks
(General Narrative)

DANO Technology

Few, applicable reference plants exist with which to compare the Riedel proposal for Portland Metro. In fact, of the many DANO-type plants in existence, some are now closed, or operate in altered manner, sometimes using the DANO tubes for merly reducing the volume of waste prior to the landfilling. In fact, no DANO plant has been identified for this report which produces a fully mature compost for which there is any actual market application, other than landfilling or land reclamation.

The apparent lack of fully comparable reference plants is not due to the inappropriateness of the technology: waste disposal priorities, general marketing environment, environmental regulations and general public sentiment are all crucial factors which vary from place to place. Language barriers have also prevented Metro staff from contacting all of the potential reference plants in Europe which may, in fact, be operating in an environment at least roughly comparable to Metro.

Two DANO facilities in England employ DANO tubes to partially compost the material for the purpose of preparing the material for landfilling the material so that no cover material is needed, or to stabilize the waste so that it can be used for filling low, marshy ground. It is almost certain that some European or South American plants make marketable land application of compost as a soil amendment; however, no contact has been made with these plants.

In fairness to the proposal it is clear from the general literature and contacts with people having knowledge of European composting that the DANO technology is competent and effective for producing a general compost of reasonable quality. However, successful marketing of the compost on a long term basis, as a true soil amendment, will be a difficult task and represents substantial risk on the part of both Metro and the proposer.

Buhler-Miag Technology

Like Riedel, Reuter has no comparable, operating domestic reference plant using Buhler-Miag technology. Attempts to contact applicable European plants have been limited primarily by language barriers. However, information about three European composting plants has been supplied by Buhler and indicates that MSW compost is actively sold in Sweden and Holland(21). The material is apparently sold at more than $5.00 per ton and none of the material is landfilled for lack of a market. More detailed information will not be forthcoming since this proposer has apparantely dropped out of the review process due to its failure to meet Metro economic evaluation criteria.

Reference Plant Checks

For Riedel Environmental Technologies, Inc. (DANO Technology):

Greater Manchester, England.

Contact people: Alec Davidson, Refuse Disposal Officer

Facility Type: Six drum DANO facility, with modifications. Capacity of approximately 1,000 tons per day.

Production Schedule: Plant is no longer in normal operation; production varies. Operation is now intended to produce material suitable for landfilling or land reclamation.

DANO process is used for volume reduction, possible contaminate removal and sufficient composting to preclude the need for landfill soil cover over fill material.

Marketing Program: Compost is no longer being marketed as a soil amendment. All material is now landfilled or otherwise disposed of as fill material, with the exception of limited amounts being applied to roadway shoulders, golf courses and other grassy areas.

Leicester, England

Contact People: Norman Daykin, Sales Director

Facility Type: Four drum DANO, with modifications, including addition of more recent French SILODA silo-type composting unit.

Production Schedule: DANO operation now primarily closed; SILODA operation continues as a simple compost turning mechanism for accelerated fermentation (8 to 10 days, then maturation for 60 days).

Marketing Program: None at present; compost is no longer marketed due to general lack of public interest in this type of soil amendment and due to high product promotion and distribution costs. Environmental issues also reduce market interest. Material is now landfilled, generally, with some material being applied to non-agricultural uses, e.g. park lands, etc. Some material is sold at 10 pounds (English) per ton, although sales price is believed to be below production cost. Project philosophy is to achieve disposal of material with no direct intention of achieving beneficial use.

PROPOSER REFERENCE CHECKS

OGDEN MARTIN--MARION COUNTY, OREGON

CONTACT PEOPLE: Bob Hanson, Public Works Director
Bob Cannon, County Attorney

FACILITY TYPE: mass burn using Martin technology; 550 ton-per-day, currently producing electricity and may produce steam in the future, privately owned, and operating since May 1986. Tip fee is $26. Price for sale of energy 6.5 cents per kw/hour.

RISK ISSUES: County is providing a fixed amount of garbage within a Btu "envelope" of 43-4700 Btu. If Ogden tests show Btu content is higher or lower, Marion County hires an independent engineer to determine Btu content. If County and Ogden do not agree, three panel arbitration decides the issue.

County asked Ogden to purchase insurance for risks such as earthquakes (uncontrollable circumstances). If insurance doesn't pay, Ogden pays. Contracts described as perform or pay contracts.

NEGOTIATION STRATEGY
Descriptors: business like, sophisticated, slick, aggressive, truthful,and straightforward.
Negotiations completed in 2 and a half weeks full time after Ogden purchased the contracts from TransEnergy (original vendor).

OPERATIONS
A few minor problems which could be characterized by growing pains that occur while developing a relationship with a new contractor. Nothing has stopped Marion Co. waste from being processed at the facility. Relationship is characterized as good. Only comment was that flexibility and compromise is slow. Ogden holds strictly to contract, little flexibility in day to day operational problems.

CONSTRUCTION
Construction was completed a year early. There was a fixed price contract for construction. The contract conditions were met. There are no pending legal issues following construction.

ASH DISPOSAL
Ash is currently disposed of at the Woodburn landfill. The ash is treated as a special waste. A specially designed monofill is being used. A monofill is clay lined and has a leachate collection system. Fly ash and bottom ash are currently being mixed for disposal. Ash has been tested and County is working with federal EPA. Testing method is under question and Lead and Cadmium may be close to threshold levels for hazardous waste.

For Reuter and Buhler-Miag Technology

Falkenburg, Sweden

Facility Type: Buhler-Miag, capacity of 200 tons per day

Production Schedule: 100 tons per day, limited by available waste. Compost and RDF are major products. Plant operates at half capacity with unscheduled downtime averaging 8 percent.

Marketing Program: Daily production of 35 tons of compost are all sold at equivalent of $10/ton to the public. Daily RDF production of 40 tons is provided free to municipal incinerator, at $17/ton to other incinerator. No market is available for recovered ferrous metals.

Stenungsund, Sweden

Facility Type: Buhler-Miag, capacity of 200 tons per day

Production Schedule: 160 tons per day; scheduled and unscheduled downtime are equal, at seven percent each.

Marketing Program: All of compost production at 56 tons per day is sold to the public at $1.50/ton. All of RDF at 64 tons/day is sold to a local incinerator at $ .70/ton.

Idelux, Belgium.

Facility Type: Buhler-Miag, capacity of 325 tons per day.

Production Schedule: Current production at full capacity: 115 tons of compost, 100 tons of RDF. Downtime totals about 15 percent, scheduled and unscheduled.

Marketing Program: All of compost is sold at $50/ton; RDF is sold to local incinerators. Ferrous metals are sold at $45/ton.

Note: due to the lack of English-speaking operators at these plants, no telephone contact was possible; however, Urs Maire, Group Manager of Buhler-Miag, Inc., quartered in Minneapolis, Minnesota, provided essential data on these plants and will provide translation of Metro reference check questions and responses to plant operators in the near future.

COMBUSTION ENGINEERING--CONN. RESOURCE RECOVERY AUTHORITY, HARTFORD CONN.

CONTACT PEOPLE: MARION CHERTOW
THOMAS LENEKAN

FACILITY TYPE: Refuse derived fuel with dedicated boiler, 2000 ton per day, will produce electricity, publicly owned, performance testing to begin in July 1987. Tip fee will be $25 in 1987 dollars. Price for sale of energy is 8.0 cents per kw/hour. City has required CE to clean metals to increase value for resale.

RISK ISSUES: because facility is publicly owned, the city of Hartford is taking most of the risk including change in law, operations, and uncontrollable circumstances

NEGOTIATIONS STRATEGY
Descriptors: contact people did not participate in negotiations

OPERATIONS
Facility is not yet operating.

CONSTRUCTION
A good working relationship has been established during the construction phase. The relationship is characterized as cooperative, professional, with willingness and ability to work problems out.

COMBUSTION ENGINEERING--GREATER DETROIT RESOURCE RECOVERY AUTHORITY

CONTACT PEOPLE: MIKE BRINKER

FACILITY TYPE: mass burn facility, 4,000 ton per day, will produce steam and electricity, publicly owned, construction complete May 1989. Tip fee will be $35-40 in 1989 dollars.

RISK ISSUES: because facility is publicly owned, Authority has responsibility of change in law and uncontrollable circumstances. CE owns building and indebtedness during 36 months of construction.

NEGOTIATIONS STRATEGY
Descriptors: disgustingly honest, forthright, don't hide or conceal, identify problem and develop innovative, creative solutions.

OPERATIONS
Facility is not yet operating.

CONSTRUCTION
Presently at one-third anniversary time. Slightly ahead of schedule and project is meeting budget. There are no pending legal issues.

OGDEN MARTIN--BABYLON N.Y.

CONTACT PEOPLE: Lenny Shore

FACILITY TYPE: mass burn using Martin technology; 750 ton-per-day, will produce electricity in the future, privately owned, will begin operating April 1989. Tip fee is $45-$47 in 1989 dollars. Price for sale of energy is 6.0 cents per kw/hour.

RISK ISSUES: This project is described as risk free to the community. The town's only responsibility is to deliver waste and ensure that the waste does not contain hazardous wastes. Damage to the plant due to waste delivered is the responsibility of the town. Contracts are written to provide Ogden with incentive to fix plant while the town must find another disposal option. Uncontrollable risks are the responsibility of Ogden. To reach this risk posture, the tip fee increased $11. This figure is included in the $45-$47 opening tip fee. Ogden purchased insurance for risks and is also self-insured.

NEGOTIATION STRATEGY
descriptors: very knowledgeable, bright, tough, know what the big dollar items are, easy to work with, up front.
Contract negotiations took four months for major issues. Some of the smaller details dragged out and should not have taken as long as they did. This problem is not attributed solely to Ogden.

OPERATIONS
The facility is not yet operating.

CONSTRUCTION
Currently at about the 50% complete mark. No existing construction litigation. Both parties will make good faith issues to tackle any issues that arise to avoid arbitration

ASH DISPOSAL
On May 5 1987, the New York State Department of Environmental Conservation issued a memo stating that ash from incinerators is not a hazardous waste. Ash from this incinerator will go to an existing landfill.

FLUOR ENGINEERS/RILEY STOKER--Olmstead County, Minn.

CONTACT PEOPLE: CHUCK MICHEAL

FACILITY TYPE: mass burn facility using Takuma technology; 200 tons per day, will produce steam and electricity, publicly owned, just starting acceptance testing process. Tip fee will be $37 in 1987 dollars. Facility is a twin to plant in Jackson Co. Michigan. Price for sale of energy is 6.4 cents per kw/hour.

RISK ISSUES: County is self insured and is accepting most risks. The County chose this position for the following reasons: the facility is considered a small facility, the County is responsible for disposal, the County has experience operating power plants, and the County desired to maintain control of the disposal system.

NEGOTIATIONS STRATEGY
Municipality did not negotiate with Fluor. Fluor is not involved with this project.

OPERATIONS
Facility is not yet fully operational.

CONSTRUCTION
Fluor is not involved in the construction of this facility.

COMBUSTION ENGINEERING--CITY AND COUNTY OF HONOLULU

CONTACT PEOPLE: ROY TAKARA
BOB DOYLE

FACILITY TYPE: refuse derived fuel with dedicated boiler; 1800 ton-per-day, will produce electricity, publically owned, currently under construction. Tip fee approximately $28 in 1988 dollars. Price for sale of energy 7 cents per kw/hour.

RISK ISSUES: Since the facility is publically owned the city is taking responsibility for most of the risks. For uncontrollable circumstances, CE purchased insurance. If such an occurrence happens and the insurance is insufficient to cover the damages, CE is responsible for remaining costs. Changes in law before July 1, 1985 CE responsibility. Changes in law after this date is the responsibility of the city.

NEGOTIATION STRATEGY
Descriptors: professional, very conservative company, want to cover all risks including those with only a million and one chance of occurring, good negotiators. Negotiations took one and a half years on first site and two years on second site. The long time period was partially attributed to IDB financing issues. City received alot of pressure to not select RDF technology. Because of this, city required CE to add a clause to a contract that stated CE would build a mass burn facility if the RDF plant failed. CE complied with the requirement.

OPERATIONS
Facility is not yet operating.

CONSTRUCTION
All parts of the facility not connected to air quality control equipment are almost complete. No litigation pending on completed construction work. Air quality permit is holding up completion of construction. The issue is whether or not scrubbers should be included as air quality control technology.

ASH DISPOSAL
Presently thinking ash will go to a city sanitary landfill.

FLUOR ENGINEERS--SPRINGFIELD, MASS.

CONTACT PEOPLE: Joe Superneau
Mike Sinn

FACILITY TYPE: mass burn using Intercon technology; 360 ton-per-day with expansion capacity to 480 ton-per-day, will produce steam (for waste water treatment plant) and electricity, privately owned, and will be operational in August 1988. Tip fee will be $20/ton in 1987 dollars. Price for sale of energy during first year is 9 cents a kw/hour and then will fluctuate between 4-6 cents.

RISK ISSUES
City guarantees waste stream for Btu content. If city Btu content changes significantly the city pays for changes. The burden of proof of the change is on Fluor. If there is a disagreement, litigation will resolve the issue. Uncontrollable circumstances is shared 60%-40% with the town's share being 60% Change in law risks are the responsibility of the town.

NEGOTIATION STRATEGY
Descriptors: top-shelf professional organization, up front, will get the job done, very good, hard negotiators, and ultimately resolved every issue. Unusual circumstances existed in this case.
Fluor teamed up with an existing vendor, Vicon, who had originally bid with a local utility. The local utility and Vicon had negotiated the bulk of the contracts and then the utility pulled out. Fluor came in and re-examined the contracts. Fluor accepted most of the provisions in the existing contracts despite being uncomfortable with some of the provisions. Fluor agreed to accept the contracts and has stuck by them.

OPERATIONS
Facility is not yet operating.

CONSTRUCTION
Currently the project is on time and on budget. Contracts provide incentives to finish ahead of schedule.

ASH DISPOSAL
Ash from the facility will be disposed of at an existing sanitary landfill. Ash will be disposed of in a dedicated section of the landfill which has a double liner and leachate collection system.

UPDATE ON SPOKANE WASHINGTON RESOURCE RECOVERY PROCESS

CONTACT PERSON: DAVE BIRKS, PROJECT MANAGER

On May 7, the Spokane Resource Recovery Section publically announced their recommendation of a resource recovery vendor. Signal Environmental was selected from a field a four proposers. The other proposers included Combustion Engineering, Ogden Martin, and Fluor Engineers.

According to the project manager, Signal Environmental had the best proposal based on lowest capital cost, lowest operation and maintenance costs, highest guarantee of net electricity produced, best revenue sharing proposal, most experience, and ability and guarantee to meet environmental compliance issues of the RFP. The relevant numbers are as follows:

CAPITAL COSTS:	Signal--$88,556 million CE --$93,900 million other two proposers were not even close
O/M COSTS:	Signal--$4.9 million CE --$5.3 million other two proposers were much higher
NET ELECTRICITY GUARANTEE:	Signal--540 CE --475
REVENUE SHARE:	Signal--90% of revenues CE --100% up to certain amount and then nothing
OPERATING HOURS:	Signal-- 200,000 hours operating CE -- no similar experience
ENVIRONMENTAL COMPLIANCE:	Signal--guarantee reduce emission equal to or below performance standards stated in RFP. RFP standards are stricter than state standards. CE--guarantee to meet state standards, not standards stated in RFP.
Conclusion:	Signal Environmental was the clear choice

TECHNOLOGY REFERENCE CHECKS

COMBUSTION ENGINEERING--MADISON, WISCONSIN

CONTACT PEOPLE: George Oshgard

FACILITY TYPE: refuse derived fuel without a dedicated boiler, pellets are sold to customers, planning to install dedicated boiler in future, currently not producing steam or electricity at facility, publically owned, and operating since 1979. Tip fee is $14.75 in 1987 dollars. This plant exhibits the same technology as CE's proposal. Technology has been dependable since operation.

SHANEWAY PROCESS--COLUMBUS OHIO

CONTACT PEOPLE: Scott Summers

PROCESS TYPE: additional processes to mass burn facility that recovers ferrous and non-ferrous material. Shaneway pays City for recovery of materials (approximately $5 ton). City sends less ash to landfill. Process working very well.

SHANEWAY PROCESS--BALTIMORE MD.

CONTACT PEOPLE: George Hudnett

PROCESS TYPE: shaneway process is part of mass burn facility. It will begin start-up about June 1 1987. Negotiated separate contracts with Shaneway. Very good, tough negotiators, with good integrity. Shaneway takes responsibility for marketing recovered material. City does not have to pay if market slumps. City knows nothing about markets. Must sign secrecy agreement.

F. Public Hearing Testimony

MAJOR THEMES FROM MAY 4, 1987 PUBLIC HEARING

Hearing held at Clackamas High School in Milwaukee
Approximately 30 people attended

Sierra Club reiterated its position as stated at the April 29 meeting regarding Resource Recovery technologies.

<u>Uncertainties of Composting technology</u>
--no markets
--unknown effects of technology
--Dano project in Sacramento went broke

<u>Environmental Impacts of Composting</u>
--litter problems
--odor problems
--visual impacts
--sites to close to river
--impacts to tourism and scenic river qualities
--traffic problems
--water quality impacts

<u>Site Characteristics of Potential Composting Sites</u>
--to close to residential areas
--facility belongs in industrial area
--to close to river
--proposing facility in the only industrial park in Clackamas Co.

<u>Clackamas Co. should not be the region's dumping ground</u>
--Metro already over the tonnage limit at CTRC
--only one site for R. R. on west side of river

MAJOR THEMES FROM APRIL 29, 1987 PUBLIC HEARING

Hearing held at St. John's Community Center in St. John's Neighborhood
Approximately 70 people attended

<u>St. John's has done its share for garbage</u>
--already have sewage treatment plant
--already have landfill
--some other communities turn
--need fair share garbage plan
--disperse solutions through out region
--garbage plants affect livability

<u>Economic Impacts are Negative from Garbage facilities</u>
--property values already depressed in St. John's
--need economic development from Port and Ramsey Lake

<u>Environmental Concerns</u>
--health and safety issues
--Brooks facility exceeds NOx emissions of permit
--dioxin, lead, cadmium, chromium, mercury air pollutants
--what about food chain exposure by dioxin
--increased truck traffic
--smell from burners
--air already polluted
--ash is hazardous

<u>Costs</u>
--burning is most expensive option
--can ship to eastern Oregon for less cost
--look at all costs, not just construction costs
--don't be swayed by contractors' promises

<u>Small Scale Solutions</u>
--don't pick one grand place
--disperse solutions
--why mega solutions

<u>Oppose Burners</u> (Sierra Club)
--lacks flexibility
--garbage should be a resource
--lots of environmental concerns (air emissions/ash)
--endorse composting
--health and safety concerns

MAJOR THEMES FROM MAY 12, 1987 PUBLIC HEARING

Hearing held at Presbyterian Church in NE. Portland
Approximately 50 people attended

<u>Composting facility at Valley Industria Park not acceptable</u>
--in floodplain of Johnson Creek
--to close to residential area both north and west --MT. Scott residential area
--odors and noise will drift to Mt. Scott
--not really an industrial park
--would rather have businesses or shopping center
--traffic concerns
--lower property values

<u>Composting facility at Columbia Blvd not acceptable</u>
--to close to residential area
--already have limited purpose landfill
--more garbage more problems

<u>Environmental issues</u>
--ash disposal; a hazardous waste, both WA and CA declared fly ash as hazardous waste
--Marion County exceeding NOx emissions
--dioxin emissions, particulate, toxic metals
--air shed already polluted

<u>Support from Columbia County</u>
--problem is not going away
--trucking wastes outside our County
--compost as much as possible but still waste left over for burner
--looking at burners cause better than Wildwood
--burners create jobs, energy contract keep Boise Cascade in town

<u>Sierra Club</u> reiterated its position as stated at the April 29 hearing regarding Resource Recovery Technologies

<u>More Information</u>
--Review Committee should know whether N. Portland sites will require emission offsets, how much they cost and what future businesses might be displaced.
--all new landfill proposals should be evaluated by Review Committee

G. Technical Reports
on Incineration

HAULING OF WASTE FOR RESOURCE RECOVERY FACILITIES (RRFs)

Hauling Cost of Dedicated Waste

A waste generation/demographic analysis has determined the quantity of waste generated within a 20 minute travel time contour of the proposed sites for the RRF (see Table Four). It shows that for a 350,000 ton per year facility, four out of the ten sites would need supplemental waste.

The four sites are: St Helens(A); Gilmore(B); Rivergate(C); and St. Johns(D). The incineration technologies are proposed for these sites. The three sites in North Portland would have to import 36% of dedicated waste for a 350,000 ton per year facility. However, there is enough waste generated within a 25 minute travel time contour, around the North Portland sites, to allow direct hauling to the three sites by the commercial trucks. The St. Helens' site (A) would have to import 100% of the dedicated waste (i.e. 350,000 tons per year).

Sources of supplemental waste for the four sites could be the existing Clackamas Transfer and Recycling Center (CTRC) and the proposed West Transfer and Recycling Center (WTRC). The following sections of the report describe two modes of transporting the waste--Trucking and Barging.

Transfer Truck Haul Cost:

Travel time is the major factor controlling hauling and disposal costs. Table 1 describes the cost components of hauling waste and converts the costs to dollars per minute. (All costs in the tables are based on current 1987 prices).

Of the four sites that would need supplemental waste the St. Helens' site proposed by Fluor is the only one that is outside Metro's waste management boundary.

TABLE 1

HAULING COSTS: TRANSFER TRUCKS
FIXED AND VARIABLE COSTS

TRUCK:

ITEMS	2,580* ANNUAL COSTS:work hrs
Depreciation of Trailer and Tractor 5 yrs. @ 21% discount rate Capital Cost: Trailer= $40,000 Tractor= $75,000	$21,930
Insurance	$12,500
Licence	$120
Federal Highway-Use Tax	$550
Public Utility Commission Plate @ 11.5 cents per mile	$11,040
Garage/Service Facility @ $150/month	$1,800
Tires @ 3 cents per minute per set/truck	$77
Maintainance: Labor @ $500/month	$6,000
Parts @ $1,000/month	$12,000
Office Overhead @ $160/month	$1,920
Fuel @ 10 gallons per Hour (at $0.70/gallon)	$18,060
TOTAL	$85,997

LABOR:

Union Labor Wage plus all Fringe Benefits $22/Hour

TOTAL TRUCKING/HAULING COSTS

ITEM	$/HOUR	$/MINUTE
TRUCK	$36.25	$0.60
LABOR	$22.00	$0.37
NET	$58.25	$0.97
PROFIT(20%)	$11.65	$0.19
TOTAL	$69.90	$1.16

*2,580 Hrs/yr = 10 hrs/day

However, a hauling analysis shows that the cost of hauling waste from CTRC to the St. Helens site would be lower than the cost of hauling waste to the proposed Bacona Road landfill (see Table 2).

TABLE 2

Waste Source	Disposal Site	Quantity of Waste	Hauling Cost
CTRC	Bacona Rd.	900 TPD	$7,011/day (@ $7.79/ton)
CTRC	St. Helens	900 TPD	$6,678/day (@ $7.42/ton)
WTRC	Bacona Rd.	900 TPD	$4,194/day (@ $4.66/ton)
WTRC	St. Helens	900 TPD	$5,832/day (@ $6.48/ton)

Since the amount of waste generated at CTRC (900 TPD) would not meet the daily waste demand at the proposed St. Helens facility it is expected that the proposed WTRC would supply the balance of the supplemental waste. The costs associated with hauling different proportions of waste from each Transfer station to the St. Helens site is shown in Table 3.

TABLE 3

Waste Source	Disposal Site	Quantity of Waste	Hauling Cost
CTRC	St. Helens	900 TPD	$6,678/day
WTRC	"	300 TPY	$1,944/day
			$8,622/day
WTRC	"	900 TPD	$5,832/day
CTRC	"	300 TPY	$2,226/day
			$8,058/day

Table 4, on the following page, shows the amount of supplemental waste required at each proposed site and the cost of hauling the waste to the sites.

TABLE 4

SOURCE AND COST OF SUPPLEMENTAL WASTE FOR RESOURCE RECOVERY FACILITIES

VENDOR	SITE	WASTE DEDICATED (TON/YEAR)	WASTE GENERATED WITHIN 20 MIN OF SITE (TON/YEAR)	SUPPLEMENTAL WASTE TON/YEAR	HAULING COST FROM (20 TON TRUCK) ($/TON) CTRC	WTRC	TOTAL HAULING COST ($/YEAR) CTRC	WTRC
COMBUSTION	B	250,000	224,799	25,201	4.42	3.62	$111,388	$91,227
	Gilmore	350,000	•	125,201	•	•	$553,388	$453,227
		450,000	•	225,201	•	•	$995,388	$615,227
FLUOR/SOUTHERN	A	250,000	-	250,000	7.42	6.48	$618,271	$1,079,892
	St. Helen						83,325 TPY*	166,650 TPY*
		350,000		350,000	•	•	$865,580	$1,511,849
							116,655 TPY*	233,310 TPY*
		450,000	-	450,000	•	•	$1,112,889	$1,943,805
							149,985 TPY*	299,979 TPY*
	D	250,000	224,799	25,201	4.12	3.32	$103,828	$83,667
	St. Johns	350,000	•	125,201	•	•	$515,828	$415,667
		450,000	•	225,201	•	•	$927,828	$747,667
	C	250,000	224,799	25,201	4.30	3.49	$108,364	$87,951
SCHNITZER/OGDEN	Rivergate	350,000	•	125,201	•	•	$538,364	$436,951
		450,000	•	225,201	•	•	$958,364	$785,951
REUTER	E	100,000	224,799	0	-	-	-	-
	UDAG(St.Johns)	200,000	•	0	-	-	-	-
	H	100,000	484,054	0	-	-	-	-
	Valley Ind.Park	200,000	•	0	-	-	-	-
	Foster							
	I	100,000	466,836	0	-	-	-	-
	Carver	200,000	•	0	-	-	-	-
	J							
	Clackamas	100,000	466,836	0	-	-	-	-
		200,000	•	0	-	-	-	-
	K							
	CTRC	100,000	318,260	0	-	-	-	-
		200,000	•	0	-	-	-	-
RIEDEL	K	100,000	318,260	0	-	-	-	-
	CTRC	200,000	•	0	-	-	-	-
	F	100,000	494,337	0	-	-	-	-
	Columbia	200,000	•	0	-	-	-	-

* The hauling and cost analysis show 1) that CTRC would not be able to meet the waste demand at the St. Helens' facility, and 2) Metro would save money if WTRC and CTRC supplied 66.6% and 33.3% respectively of the facility's waste demand.

Barging Cost:

The barging companies[1] indicate a long term committment is required to offset high initial capital costs. This would result in a small savings in transportation costs to the St. Helens site. (Long term is 20 years)

The cost of transporting waste by barge varies according to the system and geography of the route. There are three types of barging systems: 1) Bin Barge; 2) Container Barge; and 3) Roll-on Roll-off Barge. All the systems would require special interchange facilities at the loading and unloading points. Tractors and trailers will be needed to move the waste from the transfer station to the loading dock and from the unloading dock to the RRF.

The Bin Barge system would require a hopper and conveyor belt to feed the waste into the bin barge, and a "pico crane" to unload the waste at the St. Helens dock.

The Container Barge systems would require an adjustable pad and forklifts for loading and unloading. A compactor-loader may be needed to load waste into the containers so as to maximize load economies.

The Roll-on Roll-off system would need an adjustable ramp with transition lip at the loading and unloading docks. In addition 120 trailers and 4 tractors would be needed. A compactor-loader may also be needed to load waste into the containers so as to maximize load economies.

Each of the three system described above would involve an estimated initial capital cost in the range of $7 to $12 million, and operation and maintainance costs of approximatelly $4 million annually as shown in Table 5 in the following page.

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1. Barging cost estimates were based on figures submitted by Foss Launch & Tug, Co., & Sowsear-Knoppton Inc..

TABLE 5

BARGING SYSTEMS COSTS

Description	Systems & Costs (in million $)	
	Bin Barge	Roll-On/ Roll-Off
Capital*:		
Land to Barge Interchange	$4.0 m	$4.0 m
Hopper and Conveyor Belt	$1.75 m	--
Trailers	$0.16 m(4)	$4.8 m(120
Tractors	$0.30 m(4)	$0.30 m(4)
Compacting Equipment (Optional)	--	$0.50
Barges (1000 ton capacity ea.) (50'*180'/50'*220')	$1.3 m(4)	$2.4 m(4)
Operating Expenses (Annually):		
Interchange Labor	$0.2 m	$0.2 m
Towing	$0.94 m	$0.94 m
Unloading Labor	$0.2 m	$0.2 m
Maintainance, Taxes, & Ins.	$1.0 m	$1.0 m
Debt Service--Capital (@ 12%)	$0.90 m	$1.44 m
Administrative & ROI (Annually):		
ROI & Replacement (5 yrs.)	$0.91 m	$0.91 m
Salaries	$0.4 m	$0.4 m
TOTAL	$12.06 m	$17.09 m

NOTE: "m" = One Million Dollars

Annualized Costs and Cost Per Ton:

To compute an annual cost for the barging systems the following amortization assumptions were employed:

-Land	20 yrs. @ 9%
-Hopper & Conveyor	5 yrs. @ 9%
-Trailers	5 yrs. @ 9%
-Tractors	5 yrs. @ 9%
-Compactor	5 yrs. @ 9%
-Barges	40 yrs @ 9%

As shown in Table 6 the estimated annual cost of the Roll-On Roll-Off system is about 22% more than that of the Bin Barge system.

TABLE 6

Description		Systems & Costs (in million $)	
		Bin Barge	Roll-On/ Roll-Off
Capital		$1.34 m	$2.50 m
Operating Expenditure		$3.24 m	$3.78 m
Administration		$1.31 m	$1.31 m
	TOTAL =	$5.89 m	$7.59 m
WASTE HAULED		350,000 tons	350,000 tons
COST PER TON		$17.09	$21.69

NOTE: "m" = One Million Dollars

SUMMARY

Hauling Cost of Dedicated Waste by Systems

A hauling cost comparison of the **trucking** and **barging** systems show an estimated annual cost difference of over $5.0 million (see Table 7 below), and a per ton cost difference of $15 approximately.

TABLE 7

System	Cost Per Ton	Annual Cost
Transfer Truck Haul	$6.72*	$2.4 million*
	$7.19**	$2.5 million**
Barging	$22	$7.6 million

* assuming WTRC and CTRC supply 66% and 33% of the supplemental waste respectively.

** assuming CTRC and WTRC supply 66% and 33% of the supplemental waste respectively.

HAULING AND DISPOSAL COST OF RESIDUE FROM INCINERATION

With more than 300,000 tons of solid waste to be incinerated annually, over 80,000 tons of residue would be generated. If Metro decides to choose a composting vendor about 12 % of the 100,000 tons of accepted waste would have to be landfilled.

Historically ash has been disposed in landfills and in some cases as landfill cover. Environmental concerns over the composition of this ash residue and its potential impact on surface runoff and ground water has prompted further research.

Currently the residue from the facility in Marion County is being stockpiled at the Woodburn landfill. The residue from the proposals currently under consideration by Metro should differ from most other facilities because of the new air pollution technologies that will be included. Attached to this report are two documents that will shed some light on the national status of residue disposal.

The Oregon Department of Environmental Quality (DEQ) and the National Environmental Protection Agency (NEPA) are currently studying the residue from the mass incineration facility in Marion County to determine the proper methods of handling and disposing of the process residue.

There are generally three constituents to incineration process residue: bottom ash , fly ash and for refuse derived fuel (RDF) plants, processing residue. The environmental studies that are underway will determine the proper method of disposing residue from incineration.

The following disposal scenarios bracket the expected range of options:

1) disposal in general purpose landfills

2) disposal of the fly ash component in a hazardous waste landfill and the bottom ash in a general purpose landfill

3) disposal of the fly ash and the bottom ash in a hazardous waste landfill.

This report will estimate the costs for each of the disposal scenarios above. This will provide the economic parameters necessary to evaluate the range of residue disposal options.

Generation of Incineration Process Residue:

The proportion of bottom ash to fly ash vary from one proposal to another. As shown in the Table 1 fly ash will make up 60% and 31% of total ash residue generated by Combustion Engineering and Fluor respectively. The Schnitzer/Ogden proposal did not show separate amounts of bottom ash and fly ash that would be generated.

Schnitzer/Ogden's technology generates the least amount of incineration residue (26% of dedicated waste) for a 350,000 TPY facility. Combustion Engineering's technology generates the greatest amount of residue (33% of dedicated waste).

TABLE 1

Description	Vendor		
	Combustion Engineering	Fluor /SEI	Schnitzer /Ogden
Received Waste	350,000 TPY	350,000 TPY	350,000 TPY
RDF Process Residue	49,735 TPY	----	----
Bottom Ash Residue (weight)	26,544 TPY	61,774 TPY	89,389 TPY*
Fly Ash Residue	39,816 TPY	27,830 TPY	
TOTAL RESIDUE TO LANDFILL	116,095 TPY	89,604 TPY	89,389 TPY

* Schnitzer/Ogden's proposal did not show the proportions of each type of ash generated.

DISPOSAL COST FOR BOTTOM ASH AND FLY ASH (AS REGULAR) RESIDUE

The disposal of residue as regular waste will occur at one of the two sites being considered by DEQ for the new Regional Landfill. Since the site is not known, two different costs hauling and disposal of residue have been computed. According to DEQ the estimated costs of disposal at Bacona Road and Ramsey Lake sites are $25 and $45 per ton respectively.

1) Disposal of Incineration Residue at Proposed Bacona Rd. Site

Flour's proposed site (St. Helens) offers the least annual hauling and disposal cost (see Table 2). The second site proposed by Fluor (St. Johns) offers the second least cost of hauling and disposal. The Gilmore site proposed by Combustion Engineering offers the highest combined cost of hauling and disposal as shown in the Table 2.

TABLE 2

ANNUAL HAULING AND DISPOSAL COST--BACONA RD.

Vendor	Site	Residue Ton/Year	Hauling & Disposal Cost ($/Year)
Combustion/ Engineering	Gilmore	116,095	$3,753,000
Fluor/ Southern	St. Helens	89,604	$2,831,000
	St. Johns	89,604	$2,870,000
Schnitzer/ Ogden	Rivergate	89,389	$2,878,000

2) Disposal of Incineration Residue at Proposed Ramsey Lake Site

If DEQ decides that the new Regional Landfill will be built at the Ramsey Lake site some changes would be expected in the ranking of the sites that offer the least and most expensive annual hauling and disposal costs. The Rivergate site proposed by Schnitzer/Ogden offers the least annual hauling and disposal cost (see Table 3). One of the two sites proposed by Flour (St. Johns) offers the next lower hauling and disposal cost.

TABLE 3

ANNUAL HAULING AND DISPOSAL COST--RAMSEY LAKE

Vendor	Site	Residue Ton/Year	Hauling & Disposal Cost ($/Year)
Combustion/ Engineering	Gilmore	116,095	$5,251,000
Flour/ Southern	St. Helen	89,604	$4,437,000
	St. John	89,604	$4,047,000
Schnitzer/ Ogden	Rivergate	89,389	$4,037,000

DISPOSAL OF FLY ASH AND BOTTOM ASH AS HAZARDOUS MATERIALS

Cost estimates from CHEM Security show that material handling, transportation, and disposal of fly ash is approximately $640 per 20 Ton Truck or $32 per ton. There is also a $10 per ton Oregon State DEQ Hazardous Waste Tax.

Based on the above data the costs of hauling and disposing of fly ash (generated by proposers) in a hazardous waste landfill are as shown in Table 4.

TABLE 4

Disposal cost for Fly Ash as Hazardous Waste
($/YEAR)

Description	Vendor		
	Combustion Engineering	Fluor/ SEI	Schnitzer /Ogden
Quantity	39,816 TPY	27,830 TPY	27,711 TPY*
Disposal Cost	$1,274,112	$890,560	$886,752
State DEQ Tax	$398,160	$278,300	$277,110
TOTAL COST	$1,672,272	$1,168,860	$1,163,862

* The Fluor/SEI and Schnitzer/Ogden proposals utilize the same technology, therefore this report will assume that they will generate the same proportion of fly ash (31%) to total residue.

Below in Table 5 are the costs of hauling and disposing of fly ash and bottom ash as hazardous material and regular waste respectively.

TABLE 5

Description	Vendor		
	Combustion	Fluor	Schnitzer
Fly Ash	39,816 TPY	27,830 TPY	27,711 TPY
" Disposal (as Hazardous)	$1,672,272	$1,168,860	$1,163,862
Bottom Ash	26,544 TPY*	61,774 TPY*	61,678 TPY*
" Disposal (as regular)	$858,168	$1,951,440	$1,982,035
RDF Process Residue	49,735 TPY*	N/A**	N/A**
" Disposal	$1,607,933	N/A**	N/A**
TOTAL COST	$4,138,373	$3,120,300	$3,145,897

* The report assumes that both bottom ash and RDF process residue would be disposed of at the proposed Bacona Road regional landfill.

** Not Applicable

Table 6 below summarizes the costs associated with the last disposal scenario--disposal of the fly ash and bottom ash in a hazardous waste landfill.

TABLE 6

<u>Disposal Cost for Bottom Ash and Fly Ash as Hazardous Waste</u> ($/YEAR)

Description	Vendor		
	Combustion Engineering	Fluor /SEI	Schnitzer /Ogden
Quantity	66,360 TPY	89,604 TPY	89,389 TPY
Disposal Cost	$2,123,520	$2,867,320	$2,860,448
State DEQ Tax	$663,600	$896,040	$893,890
RDF Process Residue	$1,607,933*	N/A**	N/A**
TOTAL COST	$4,395,053	$3,763,360	$3,754,338

* The report assumes RDF process residue is disposed of at the proposed Bacona Road landfill.

** Not Applicable

The impact on the overall costs are as follows:

Combustion Engineering	$12.56 per ton of dedicated waste
Fluor/SEI	$10.75 per ton of dedicated waste
Schnitzer/Ogden	$10.73 per ton of dedicated waste

If the residue is disposed of in a general purpose landfill the cost impacts are as follows:

BACONA ROAD

Combustion Engineering	\$10.73 per ton of dedicated waste
Fluor/SEI	\$8.09 per ton of dedicated waste
Schnitzer/Ogden	\$8.22 per ton of dedicated waste

RAMSEY LAKE

Combustion Engineering	\$15.25 per ton of dedicated waste
Fluor/SEI	\$12.68 per ton of dedicated waste
Schnitzer/Ogden	\$11.53 per ton of dedicated waste

VOLUME REDUCTION COMPARISON

This report will discuss the expected volume reductions associated with the three incineration Resource Recovery proposals that Metro is currently considering.

The average density of municipal solid waste (MSW), as delivered by waste hauling vehicles, is about 600 pounds per cubic yard. The compaction process at the landfill increases this to approximately 1200 pounds per cubic yard. This results in about 50% reduction in volume. The residue left after incinerating MSW has a density of 1400* pounds per cubic yard. This density change is not directly proportional to the change in volume because mass leaves the incinerator, not only in the form of ash residue, but also in the form of flue gases. Volume reductions of as much as 90% can be expected through incineration of MSW.

The following table shows the reduction of MSW, in weight and volume, that can be achieved by the proposed processes.

PHYSICAL CHANGES TO MSW THROUGH PROPOSED PROCESSES

DESCRIPTION	LANDFILLED	COM.ENGR.	FLOUR	S/O-M
As Delivered				
Weight (tons)	350,000	350,000	350,000	350,000
Volume (cu.yd.)	1,166,667	1,166,667	1,166,667	1,166,667
Density(lb/yd^3)	600	600	600	600
After Processing				
Weight (tons)	350,000	118,545	102,830	87,500
Volume (cu.yd.)	583,334	295,848	105,706	92,593
Density(lb/yd^3)	1,200	801	1,946	1,890
Percent Change in Volume	50%	75%	91%	92%

* 1400 lbs/cuyd is from national averages.

Volume Reduction Computations

The information provided on form C of the bid proposals was used to calculate the weight and volume of residue remaining after incineration (as shown above).

Combustion Engineering

Combustion Engineering has reported that 14.21% of the infeed will be removed from the process prior to combustion. This waste will be landfilled and its density will be 1200lbs/cuyd. The bottom ash (wet) from the burner will be 7.56%, by weight, of the infeed (350,000tons), and will have a density of 45lbs/cuft (1215lbs/cuyd). The fly ash (wet)* will be 12.1%, by weight, of the infeed, and have a density of 18.5lbs/cuft (500lbs/cuyd). The following equations illustrate how the total amount of residue to be landfilled was calculated.

Bottom Ash: 7.56% * 350,000 = 26,460 tons or 52,920,000 lbs
52,920,000 / 1,215 = 43,556 cuyd

Fly Ash: 12.1% * 350,000 = 42,350 tons or 84,700,000 lbs
84,700,000 / 500 = 169,400 cuyd

Preburn Residue: 14.21% * 350,000 = 49,735 tons or 99,470,000 lbs
99,470,000 / 1,200 = 82,892 cuyd

Total to Landfill: 118,545 tons or 295,848 cuyd
Density : 118,545 * 2,000 / 295,848 = 801 lbs/cuyd

Flour/SEI

Flour/SEI has reported that their process will produce 27.5%, by weight, as wet bottom ash at 74lbs/cuft (1998lbs/cuyd), and 1.88%, by weight, of the infeed as wet* fly ash at 52.07lbs/cuft (1406lbs/cuyd). The total residue to be landfilled is calculated below.

Bottom Ash: 27.5% * 350,000 = 96,250 tons or 192,500,000 lbs
192,500,000 / 1,998 = 96,346 cuyd

Fly Ash: 1.88% * 350,000 = 6,580 tons or 13,160,000 lbs
13,160,000 / 1,406 = 9,360 cuyd

Total to Landfill: 102,830 tons or 105,706 cuyd
Density: 102,830 * 2,000 / 105,706 = 1,946 lbs/cuyd

Schnitzer/Ogden-Martin

Schnitzer/Ogden-Martin has reported that 25%, by weight, of the infeed will exit the facility as residue to be landfilled. This is their bottom ash and their fly ash combined (wet). The density of this residue is 70lbs/cuft (1890lbs/cuyd).

Total to Landfill: 25% * 350,000 = 87,500 tons or 175,000,000 lbs
175,000,000 / 1,890 = 92,593 cuyd

* Fly ash was only reported as dry fly ash. The values reported by the vendors were changed to reflect the same moisture content in the fly ash as was reported to be in the bottom ash.

CONCLUSION

The volume reduction achieved by mass incineration has been shown above to be slightly higher than 90%. This is a 40% greater reduction over landfilling of unprocessed waste. The volume reduction achieved by RDF processing followed by incineration is shown to be 75%. This is about a 25% greater reduction over landfilling of unprocessed waste.

H. System Cost Analysis

MEMORANDUM

DATE: June 23, 1987

TO: Members of the Metro Council

FROM: Rena Cusma, Executive Officer

REGARDING: Recommendation on best resource recovery system and firms selected for negotiation of Memoranda of Understanding

This document, Metro's Resource Recovery Project Final Evaluation Report, has been prepared to enable decision-making on Metro's Resource Recovery Project. The project was undertaken to procure a resource recovery system composed of one or more mass composting, refuse-derived fuel, and mass incineration facilities. The completion of the evaluation process, leading up to Council authorization to proceed into the first stage of negotiations, marks the conclusion of the "procurement planning" phase of the Resource Recovery Project, and prepares the way to enter the "procurement" phase.

Background

In pursuit of a balanced, technically feasible, economically sound solid waste disposal system, Metro issued requests for proposals in the Fall of 1986 to mass incineration, mass composting, and refuse-derived fuel systems contractors. Proposals were received January 30, 1987. Previously established evaluation criteria were then used to assess the relative merits of each proposal. A Review Committee was appointed by the Executive Officer to make a recommendation as to which firm(s) is top ranked for entry into preliminary negotiations.

The Final Evaluation Report

The Final Evaluation Report presents the evaluation instrument and findings of Metro's Resource Recovery Project Team. The Metro Solid Waste Department staff was assisted by management and technical consultants Gershman, Brickner, and Bratton, Inc., legal advisor McEwen, Gisvold, Rankin and Stewart, bond counsel Stoel, Rives, Boley, Jones and Grey, financial advisor Government Finance Associates, Inc., and investment bankers Salomon Brothers, Shearson Lehman Brothers, and Alex. Brown and Sons, Inc. Three major categories, "Economic Impact", "Technical Feasibility", and "Responsiveness to State Hierarchy" are evaluated in the report.

Economic forecasts, which show tip fee ranges, have been performed for each proposal. Every effort has been made to "normalize" the forecasts, in order to make an "apples to apples" comparison. In addition, sensitivities were done to show the upscale and downscale (different volume size) scenarios, as well as public ownership, 30 year term, and current interest rate (100 basis points less than base case) variations.

The Reuter/Buhler-Miag proposal was eliminated from further consideration after receiving an "Unacceptable" rating in the Economic Impact category. The four remaining proposals were considered extremely competitive by the project team. Based on the evaluation instrument, the Schnitzer/Ogden and Combustion Engineering proposals were top ranked, and the Riedel/DANO and Fluor/SEI proposals a close second.

The Combustion Engineering proposal, though top ranked, is not recommended for further consideration due to the lack of redundancy in their technical proposal, which represents a greater risk to Metro than a two line system would. Additionally, the experience, or "track record" of both the Riley-Takuma and Ogden-Martin technologies exceeds that of the Combustion Engineering refuse derived fuel technology.

A System Cost Analysis is part of the <u>Final Evaluation Report</u> and was performed to determine if the projected resource recovery project system cost is within 20% of the projected landfill only system cost. The results of this analysis indicate that several resource recovery system options meet this important criterion. It is important to note that the analysis averages system costs over a 17 year time period. The life of resource recovery facilities can extend beyond 25 or 30 years. A different analysis plotting and averaging costs over a longer time period would result in projected system costs <u>well within</u> 20% of landfill only system cost.

The Review Committee recommendations are included in the report, and represent many hours of concentrated effort by the six people who volunteered to serve on the Committee. In order to render their decision the committee read reports, listened to four days of proposer interviews, heard public testimony in three public hearings, attended environmental impact forums sponsored by Metro, and studied numerous evaluation documents prepared by staff.

Executive Officer Recommendation

The Executive Officer recommends procurement of a resource recovery system which includes a 160,000 TPY mass composting facility and a 350,000 TPY mass incineration facility. Both technologies are recommended to assure a balanced system; not a composting facility without an incineration facility. Simultaneous negotiations are recommended to yield a Memorandum of Understanding (MOU) with both mass composting and mass incineration proposers.

The Riedel/DANO project is recommended for MOU negotiations. The facility is to be sized to process 160,000 TPY and to function as a regional transfer station, located on their primary site on N.E. Columbia Boulevard, in Portland. MOU negotiations are also recommended with both Fluor/SEI and Schnitzer/Ogden for a 350,000 TPY mass incineration facility to be located in St. Helens, Oregon.

The combination of mass composting and mass incineration is believed to be the most prudent, cost effective means of extending the life of the regional landfill(s), in accord with Metro waste disposal policy, as well as Federal and State law.

The selection process, or "procurement planning" for a resource recovery system began with a symposium on the subject, in August of 1985. It has been a comprehensive, rigorous, and equitable process. The proposals Metro received are of the highest caliber. The recommendation has been difficult to reach due to the competitiveness of the proposals. But the project team, review committee and executive officer concur that this is the best recommendation on how to proceed to procure the best resource recovery system for this metropolitan area.

System Cost

METRO RESOURCE RECOVERY PROJECT

FINAL EVALUATION REPORT

Prepared By:

METRO
Portland, Oregon

With Assistance From:

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New York, New York

Alex Brown & Sons, Inc.
Baltimore, Maryland

June 19, 1987

EXECUTIVE SUMMARY

SYSTEM COST ANALYSIS
FOR THE
METRO RESOURCE RECOVERY PROJECT
FINAL EVALUATION REPORT

The system cost evaluation was developed -- based on key assumptions -- to help the Metro Council consider total system cost impacts of the various resource recovery proposals. If resource recovery facilities were implemented it was anticipated that savings might occur elsewhere in the system. The Council indicated a willingness to proceed with alternative technology options if proposals were cost-effective for the system (approximately within 20% of landfill-based systems).

Four resource recovery proposals (3 incineration and 1 composting facility) were evaluated. Each was scaled to various sizes and considered both singly and in combination; all included landfilling of some portion of the total wastestream. Nineteen different systems -- including the base case with no resource recovery -- were developed and studied. (Systems A-O as described in Table 1)

Percentages comparing each system to the base case (with no resource recovery) ranged between -4.4% and +33.3% below or above this base system cost. (See Table 3) The negative percentage means the system being evaluated costs less than the base system. This only occurred when composting alone was considered as a resource recovery component. (Systems E and I).

A simple rating system -- based on these percentages --ranks each system as Superior (S), Acceptable (A), or Poor (P). Acceptable was considered to be 15% to 25%. Percentages less than 15% were rated Superior and percentages above 25% were rated Poor. Because of the complexity of the interrelated analyses that make up each system evaluation, variations in assumptions result in changes in the percentage comparisons. Proposals within five percentage points of twenty percent will be above or below the twenty percent line depending upon changes in the assumption parameters. Therefore proposals with comparison percentages between 15% and 25% are being considered "acceptable".

Superior ranked systems are E and I, and range from -4.4% (I) to -2.2% (E). Systems with an Acceptable ranking include B, C, D, F, H, J, L, M, N, and O. These systems range from 17.8% (B) to 24.4% (C, H, M, and N). Systems ranked as Poor include CC, G, GG, K, KK and NN. The Poor systems range from 26.7% (CC and K) to 33.3% (GG).

In addition to each system's costs (relative to the base system), the evaluation also includes the number of years landfill life will be extended (see Figure 1). On the two extremes are Systems GG and I. System GG is the most expensive (ranked poor); however it extends landfill life 14 years. Note, however, that Systems G and H, at a lower cost, also extend the landfill the same 14 years. System I, in contrast, is the least expensive (ranked superior), yet it extends landfill life only two years. System E also costs less than the base system; however, it extends landfill life by 4 years.

Although each system will carry other merits and drawbacks, a combination of landfill life extension and its related costs will be a key factors in determining the adoption of a system that includes resource recovery components.

SYSTEM COST ANALYSIS

FOR THE

METRO RESOURCE RECOVERY PROJECT

FINAL EVALUATION REPORT

I. Introduction

This chapter of the Metro Resource Recovery Project Final Evaluation Report provides an analysis of how the proposals, or a mix of the proposals under consideration, might affect the total system cost in future years. The analysis is a theoretical or academic one and does not necessarily represent a "tip fee" projection for future years. We have used the variables that we are able to identify and quantify but realize that there will be variables in the future that we can not anticipate with the information available.

Projected tip fees for individual proposals have been presented elsewhere in the Final Evaluation Report for a number of operational scenarios. The purpose in conducting a system cost analysis is to learn what impacts there might be on the "total system" if a resource recovery facility or facilities were implemented. In order to make meaningful comparisons between resource recovery projects, it is helpful to know how landfilling, transportation, and transfer cost components of the system are affected by particular projects. This system cost analysis attempts to provide for this comparison through the application of a reasonable set of uniform system assumptions to the proposals which are evaluated.

In its criteria for implementing resource recovery projects, the Metro Council agreed to proceed with resource recovery if the project(s) --

> "Will not increase the disposal system cost more than 20 percent over a landfill-based disposal system. (The disposal system costs described in this section include costs associated with operating transfer stations, resource recovery facilities and landfills; it does not include collection costs. Determination of whether a proposal(s) meets this criteria will be based on disposal system cost figures available from Metro at the time of evaluation.) (Metro Council Resolution No. 86-201)"

Other criteria for proceeding with a project were also indicated. In addition it was stated that --

> "Metro <u>may</u> proceed with a resource recovery project(s) that increases the disposal system cost more than 20 percent over a landfill-based system if the project(s) meets (other criteria) and the Council determines that the project(s) provides a reasonable cost-effective method to achieve the goals of Section 3 (technically and economically feasible waste reduction to extend landfill life and to conserve open space and natural resources as well as reducing reliance on landfilling as the sole waste disposal method for non-recyclable material)."

The findings of this analysis provides a basis for evaluating proposals under the "system cost" criteria and also demonstrate how the different proposals might impact system expenditures for the transferring, transporting and landfilling of wastes. The results of this analysis should be considered as only one component in the overall economic impact evaluation of proposals. Because of the broad range of alternative assumptions which might have been used and the potential for vast differences in findings, the results should also be viewed as indications of general cost impacts and not as definitive estimates of future costs. It should also be noted that energy prices or other key assumptions used in the analysis could change in the future, thus making certain resource recovery systems more or less beneficial than perceived at present.

Methodology

In general, the methodology applied to analyze system costs was to :

1) Identify the systems to be analyzed (along with the tonnage distributions to each system component);
2) Obtain unit costs (or a range of unit costs for various waste tonnages) for each system component, and;
3) Calculate total annual expenditures for the components of each system over time.

Table 1 describes the 19 systems for which a system cost analysis has been developed.

TABLE 1

SYSTEM DESCRIPTION

System A	The Base Case or landfill-based system
Systems B - E	Single resource recovery facilities for Combustion Engineering, Fluor/SEI, Schnitzer/Ogden-Martin at 350,000 TPY and Riedel at 200,000 TPY. (system cost analyses were not developed for the Reuter/Buhler-Miag proposal because it was dropped from the evaluation process before the system costing was initiated).
Systems F - H	Combinations of the Riedel compost plant at 200,000 TPY and either a mass burn or RDF plant at 350,000 TPY.
System I	Down-scaled Riedel compost plant at 100,000 TPY.
Systems J - L	Up-scaled single mass-burn or RDF plants at 450,000 TPY.
Systems M - O	Combinations of down-scaled mass-burn or RDF plants at 250,000 TPY with the Riedel compost plant at 200,000 TPY.
Systems CC,GG,KK,NN	Provide for the same Flour/SEI systems indicated above except that the barging of waste to St. Helens replaces the trucking costs.

Although many other systems could have been evaluated, those indicated have been chosen as representative of probable implementation scenarios. Appendix A contains schematic drawings that graphically illustrate the waste delivery and distribution assumptions for each of the 19 systems.

Results are expressed as dollars per year for each system component and as dollars per ton in the years for which each of the systems is analyzed. (See Appendix B) Dollar per ton figures are based on the total annual volume of waste projected at all facilities within the system (this represents a uniform rate approach).

In addition to the landfill, resource recovery, transfer station and transportation cost components, a user fee component of $3.00 per ton has been included in all system cost analyses to make the results more meaningful in comparison with current tipping fees which include a $3.20 per ton user fee to pay for Metro solid waste administration, planning and waste reduction programs.

The unit costs for landfilling wastes were developed on the basis of the cost estimates prepared for the Department of Environmental Quality by CH2M Hill in evaluating the Bacona Road landfill site. (See Appendix C) Both capital and operating expenditures for this site are greater than the current costs for the St. Johns landfill. DEQ landfilling expenditure estimates were modified to include the costs of project financing. They were then calibrated for various annual waste volumes on the basis of periodic cell development requirements and economies of scale; these are expected in operation costs with higher waste volumes.

Costs for the resource recovery components of the various systems were prepared by Gershman, Brickner and Bratton, Inc. using the same models and information used to develop tipping fees presented elsewhere in the Final Evaluation Report. (See Appendix D) Costs for transporting and landfilling residual wastes from the resource recovery facilities have been deleted from the resource recovery costs and are included in other components in this analysis.

Capital and operating costs for transfer stations were developed on the basis of current experience with the Clackamas Transfer and Recycling Center and the estimated construction cost of the West Transfer and Recycling Center. Costs for managing and operating each transfer station were assumed to be constant and independent of waste volumes transferred. (See Appendix E)

Costs for transporting wastes and residues within the systems were based on current experience with truck and walking floor trailer operations and on estimated barging costs. Travel times between sites as well as loading and unloading times at sites have been incorporated in the per ton transportation costs which were developed. (See Appendix F)

Key assumptions which were made in the development of system component costs and in the calculation of total costs for each of the systems are described below. Certain assumptions which have been discussed above are reiterated below so that they may be easily accessed. Supporting information for these assumptions and a tabulation of the detailed component cost analysis are provided in the attached appendices.

Key Assumptions

General Assumptions and Givens

- In 1985 the Oregon State Legislature directed Metro to develop a Solid Waste Reduction program (1985 Or Laws ch 679).

- Metro Ordinance No. 86-201 states that up to 52% of the wastestream is potentially available for reduce, reuse and recycling, and that up to 48% is available for alternative technology / resource recovery projects.

- It has been assumed that the analysis covers an 18-year period from 1990 to 2007 and is based on 1990 costs (17 years for the incineration proposals since they can not begin until 1991).

- Costs are presented on an annual basis in constant 1990 dollars.

- Waste volumes are based upon the historic per capita waste generation information and population data that the DEQ used in their landfill analysis (the annual projected increase in tonnage averages 2 to 3 % per year). This generation data takes into account the current recycling rate and assumes that the materials currently being recovered will continue to be recovered over the period of this analysis.

  It has been further assumed that new recycling or other waste reduction or diversion will reduce the volume of available waste by an additional 15% below this level and that this will remain constant throughout the 18-year period (i.e. the "system waste" is 85% of the generated waste estimates used for the DEQ landfill analysis).

- It has been assumed that Metro will own CTRC, WTRC, and possibly a third transfer station (ETRC - in some cases) as well as the Bacona Road Landfill.

- Annual inflation has been assumed to be 5% for adjusting current or future costs to 1990 dollars.

- The Metro user fee charge has been assumed to remain constant ($3.00) over time and is applied equally to all systems.

- It has been assumed that the annual tonnages dedicated to specified resource recovery facilities in each system do not change over the period of the analysis (for example - it was assumed in System E that the Riedel compost plant would process 200,000 tons per year during each of the 18 years, even though total tonnages managed in the system are expected to increase throughout the period and the facility could possibly handle additional volumes).

- It has been assumed that all systems take mixed municipal solid waste and do not depend on a subdivision of the waste stream by composition.

- It has been assumed that a compost facility could be in operation in 1990, but that incineration facilities could not begin operation until 1991.

- It has been assumed that the useful life of resource recovery facilities in the various systems is not a factor for the system analysis except as it relates to financing assumptions which are explained elsewhere.

Resource Recovery Component Assumptions

- Gershman, Brickner and Bratton, Inc. (GBB) provided the analysis for each of the project proposals based on the models which are presented for the tipping fee evaluations. Models were revised to exclude those portions of the project costs, such as transport and disposal of residuals, which are dealt with elsewhere in the system components.

Landfill Component Assumptions

- It has been assumed that all waste requiring landfilling will be sent to the Bacona Road Landfill and that residual or ash wastes will not require special handling or different expenditures for disposal than mixed municipal solid wastes.

  It has been assumed that the costs associated with the Bacona Road landfill will exceed the current costs to utilize the St. Johns landfill. The development and construction costs are substantially different than those associated with St. Johns and are detailed in the feasibility study published by the DEQ. The operation costs will differ due to increased neighborhood protection programs and a daily operation plan which requires that all waste be compacted and covered by 10:00 PM each evening. These costs and others are detailed in the DEQ feasibility study.

  Because of the many differences with existing operational costs and the complexity of the landfill feasibility report, the major DEQ costing assumptions were utilized as they had been provided, except as noted below:

  - It has been assumed that pre-development costs, capital costs, first purchases of heavy equipment, and the costs of the first cell preparation will be capitalized with long-term bonds. It has been assumed that financing can be obtained at 4% interest in constant dollars (9% interest in inflated dollars).

- Longterm financing assumes a 25-year payback period, to be repaid during the final 23 years (in the first 2 years only interest will be paid). Although the landfill's lifetime will exceed the 25 years, little would be gained by extending the period of the bonds.

- It has been assumed that this borrowed money is invested at 2% interest in constant dollars (7% interest in inflated dollars) until it is needed.

- It has been assumed that annual landfill costs will include debt service, operations, maintenance and funding of reserve accounts. Reserve accounts are necessary to purchase subsequent heavy equipment, to pay for subsequent cell preparation, all cell closures, final closure and post-closure.

- As indicated in the feasibility report, the Bacona Road Landfill has a capacity of 44,540,000 tons over its life. Therefore is has been assumed that periodic landfill development can be divided into ten equal-sized cells (each with a capacity of 4,454,000 tons). Annual contributions to reserve accounts have been based on this schedule of development. The schematic diagrams in Appendix A indicate the expected life of the Bacona Road site for each of the systems which have been evaluated.

Transfer Component Assumptions

- It has been assumed that WTRC and ETRC can be operational by 1990. It has been assumed that a third transfer station will not be needed or that it can be scaled down waste can be hauled directly to a resource recovery facility.

- Waste transport costs (between transfer stations and facilities) are excluded from "transfer station system costs" and they are considered separately as "system transportation costs."

- Development and construction costs for new transfer stations have been assumed to be similar to present cost estimates. (Full scale: $8 million, i.e. WTRC; smaller scale: $5 million, i.e. ETRC in some systems)

- It has been assumed that the interest rate on the debt service for the capital cost is 4% in constant dollars (or 9% in inflated dollars). A repayment period on the bonds of

25 years has been assumed.

- Annual expenditures for transfer include facility operation and maintenance costs as well as debt service.

- It has been assumed that certain facility maintenance or improvements will be required and scheduled during the analysis period.

- The Riedel proposal provides for a transfer station as part of the resource recovery facility design. The development cost component of this transfer station is shown in the "resource recovery system cost." It has been assumed that Metro would enter into an operation contract with Riedel in which Riedel would be paid $6.24/ton, in 1990 dollars, for waste transfer and operations at the transfer station. (i.e. In 1991 Systems E, G, and GG would allocate 200,000 tons to the production of compost and an additional 288,400 tons would be transferred through the Riedel facility. Although these tonnage amounts vary with some of the different systems, this example illustrates the use of the Riedel facility as a transfer station as has been assumed in the analysis.)

Transportation Component Assumptions

- It has been assumed that walking floor trucks will be used to haul waste from the transfer stations to all facilities. They carry 20 tons as opposed to the 26 tons per load that the transfer trucks in current use carry. It is uncertain if resource recovery facilities or the new landfill will be equipped with a tipper that is required to empty the transfer trailers currently used.

- Trucking costs per ton are based on travel times during off-peak hours of the day. (Travel times were available from Metro's Transportation Dept. for 1983 and 2005 and were interpolated for 1990.) Each trip was based on twice the travel time (to and from the facility) plus 30 minutes for loading/unloading.

Consumer Impact of System Cost

As has been mentioned previously, the dollar per ton figures which are presented in this analysis for the various systems do not represent projected tipping fees. The analysis does indicate that, even with just a landfill based system, costs of disposal are expected to more than double in the next four years over the current costs of Metro solid waste services. It may be possible to minimize the adverse effects of dramatic rate increases by spreading them over several years or by structuring bond repayment schedules so that debt service expenditures are reduced in the early years.

The Metro transfer and disposal system accounts for just one part of the fee which residents or businesses pay for collection service. As the system cost increases it will account for an even larger portion of collection billings. It should also be recognized that collection efficiencies may increase as a result of improved transfer service to allow for savings in some areas of the region. Table 2 shows how consumer charges for collection service might be effected by anticipated "base system" cost increases and by the implementation of a resource recovery component which would add an additional 20 percent to the total system cost.

TABLE 2

ESTIMATED CONSUMER IMPACTS OF PROJECTED SYSTEM COST INCREASES

	Metro Charges	Residential Service Cost	Commercial Service Cost	Dropbox Service Cost
1987 Average Fees	$18.20/T.	$8.00/mo.	$65/mo.	$110/20yds
System A (landfill) Average Cost 1990 dollars	$47.00/T.	$11.25/mo.	$104/mo.	$192/20yds
20% Above System A	$56.40/T.	$11.95/mo.	$114/mo.	$216/20yds
Percent increase in service fee resulting from 20% cost of resource recovery over System A	20%	6%	10%	12.5%

Results and Discussion

Results of the system cost analysis are shown in Table 3 and the graphs that follow. The graphs illustrate system costs and landfill life over time.

Table 4 compares the average costs, over the analysis period, for the systems as a percentage of System A average cost (the base case system where all waste is landfilled). (This is the evaluation that addresses the 20 percent criteria in Metro Council Ordinance 86-201.) Table 4 also shows the landfill life that can be expected with each system.

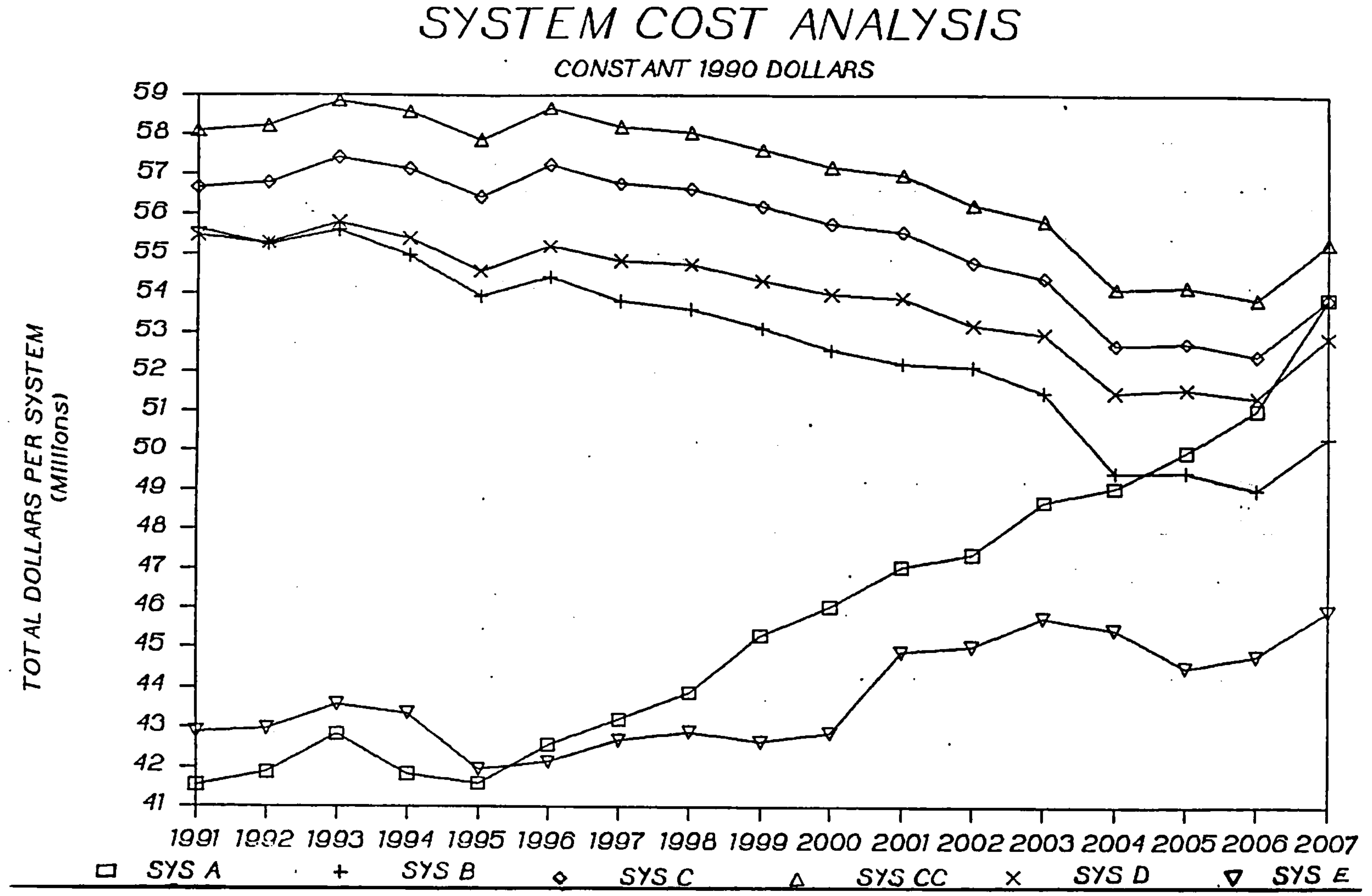
The systems that include a Fluor\SEI facility at St. Helens reflect an added cost of transportation.(A line item quantity for the transportation costs can be found in Appendix B) The systems with the highest percentages generally result in the longest landfill life. A resource recovery system can extend the life of the Bacona Road Landfill between 2 and 14 years or between 5 and 36 percent.

TABLE 3

AVERAGE TOTAL COSTS OF SYSTEMS SCENARIOS

SYSTEMS SCENARIOS		AVERAGE COST/TON	AVERAGE TOTAL COSTS
A)	BACONA ROAD LANDFILL 3 FULL SIZE TRANSFER STATIONS	$45	$45,751,000
B)	BACONA ROAD LANDFILL 2 FULL SIZE TRANSFER STATIONS 1 HALF SIZE TRANSFER STATION COMBUSTION ENGINEERING FACILITY IN RIVERGATE (processing 350,000 TPY)	$53	$52,760,000
C)	BACONA ROAD LANDFILL 3 FULL SIZE TRANSFER STATIONS FLUOR/SEI FACILITY IN ST. HELENS (processing 350,000 TPY)	$56	$55,495,000
CC)	BACONA ROAD LANDFILL 3 FULL SIZE TRANSFER STATIONS FLUOR/SEI FACILITY IN ST. HELENS (processing 350,000 TPY by barge)	$57	$56,926,000
D)	BACONA ROAD LANDFILL 2 FULL SIZE TRANSFER STATIONS 1 DOWN SIZE TRANSFER STATION SCHNITZER/OGDEN-MARTIN FACILITY IN RIVERGATE (processing 350,000 TPY)	$54	$53,934,000
E)	BACONA ROAD LANDFILL 2 FULL SIZE TRANSFER STATIONS RIEDEL FACILITY ON NORTH EAST COLUMBIA BLVD. (processing 200,000 TPY)	$44	$43,789,000

* Costs are in constant 1990 dollars
** Riedel Facility includes a Transfer Station


SYSTEM COST ANALYSIS
CONSTANT 1990 DOLLARS
TOTAL DOLLARS PER SYSTEM (Millions)
59
58
57
56
55
54
53
52
51
50
49
48
47
46
45
44
43
42
41
1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007
SYS A
SYS B
SYS C
SYS CC
SYS D
SYS E

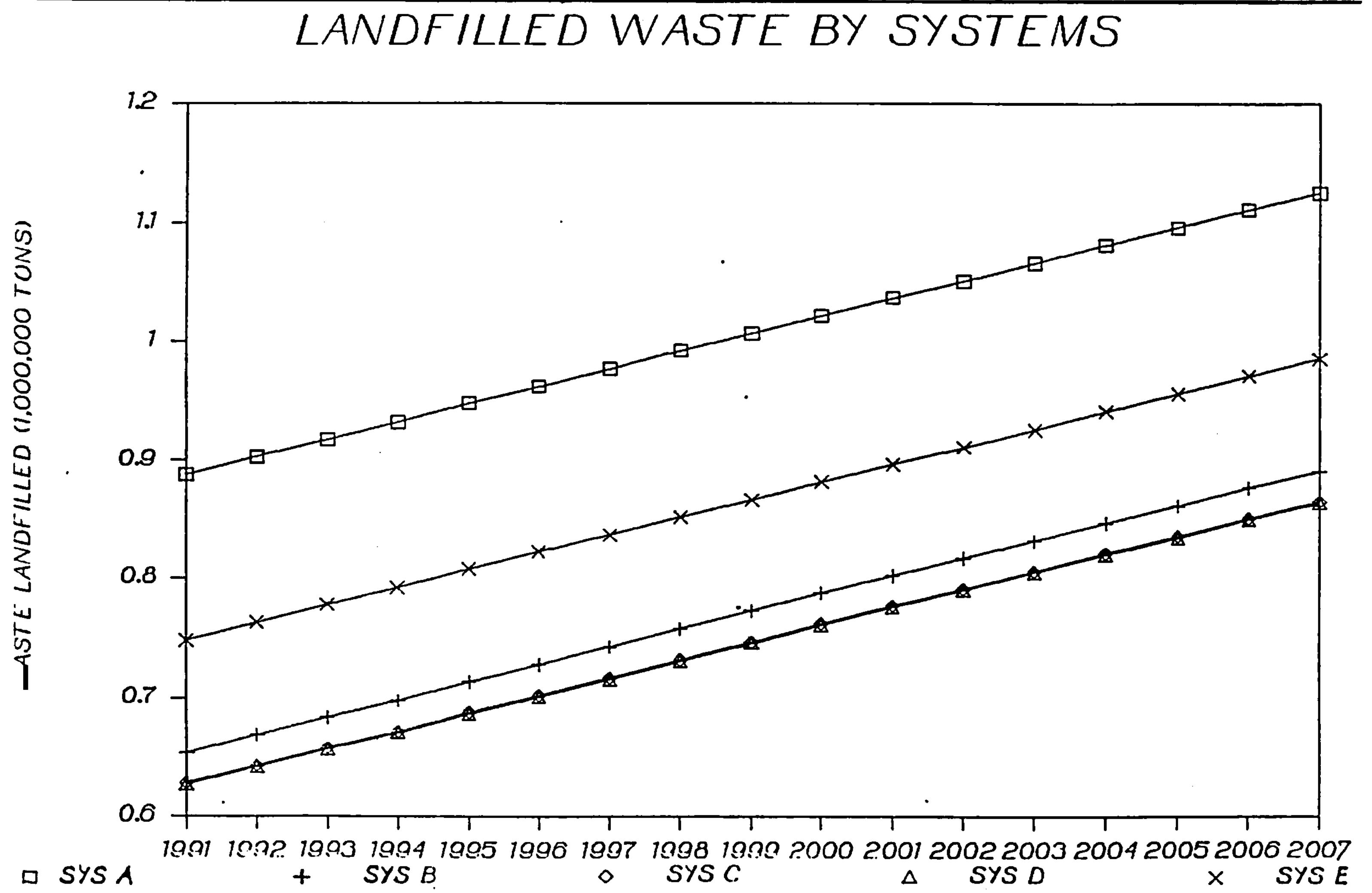

LANDFILLED WASTE BY SYSTEMS
ASTE LANDFILLED (1,000,000 TONS)
1.2
1.1
1
0.9
0.8
0.7
0.6
1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007
SYS A
SYS B
SYS C
SYS D
SYS E

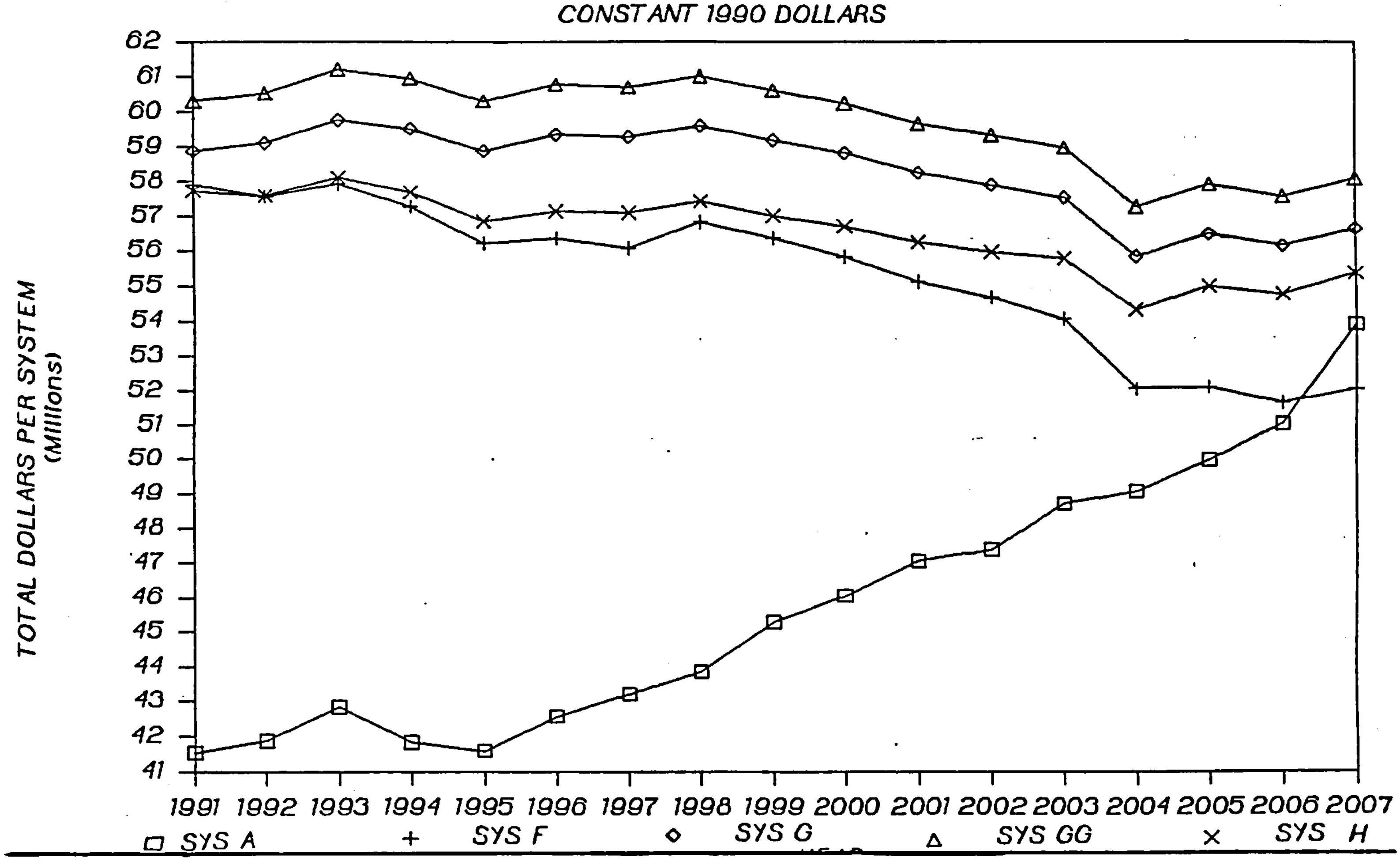
TABLE 3

AVERAGE TOTAL COSTS OF SYSTEMS SCENARIOS

SYSTEMS SCENARIOS		AVERAGE COST/TON	AVERAGE TOTAL COSTS
A)	BACONA ROAD LANDFILL 3 FULL SIZE TRANSFER STATIONS	$45	$45,751,000
F)	BACONA ROAD LANDFILL 2 FULL SIZE TRANSFER STATIONS RIEDEL FACILITY ON NORTH EAST COLUMBIA BLVD. (processing 200,000 TPY) COMBUSTION ENGINEERING FACILITY IN RIVERGATE (processing 350,000 TPY)	$55	$55,280,000
G)	BACONA ROAD LANDFILL 2 FULL SIZE TRANSFER STATIONS RIEDEL FACILITY ON NORTH EAST COLUMBIA BLVD. (processing 200,000 TPY) FLUOR/SEI FACILITY IN ST. HELENS (processing 350,000 TPY)	$58	$58,284,000
GG)	BACONA ROAD LANDFILL 2 FULL SIZE TRANSFER STATIONS RIEDEL FACILITY ON NORTH EAST COLUMBIA BLVD. (processing 200,000 TPY) FLUOR/SEI FACILITY IN ST. HELENS (processing 350,000 TPY by barge)	$60	$59,715,000
H)	BACONA ROAD LANDFILL 2 FULL SIZE TRANSFER STATIONS RIEDEL FACILITY ON NORTH EAST COLUMBIA BLVD. (processing 200,000 TPY) SCHNITZER/OGDEN-MARTIN FACILITY IN RIVERGATE (processing 350,000 TPY)	$56	$56,497,000

* Costs are in constant 1990 dollars
** Riedel Facility includes a Transfer Station

SYSTEM COST ANALYSIS –Combined Systems



LANDFILLED WASTE – COMBINED SYSTEMS

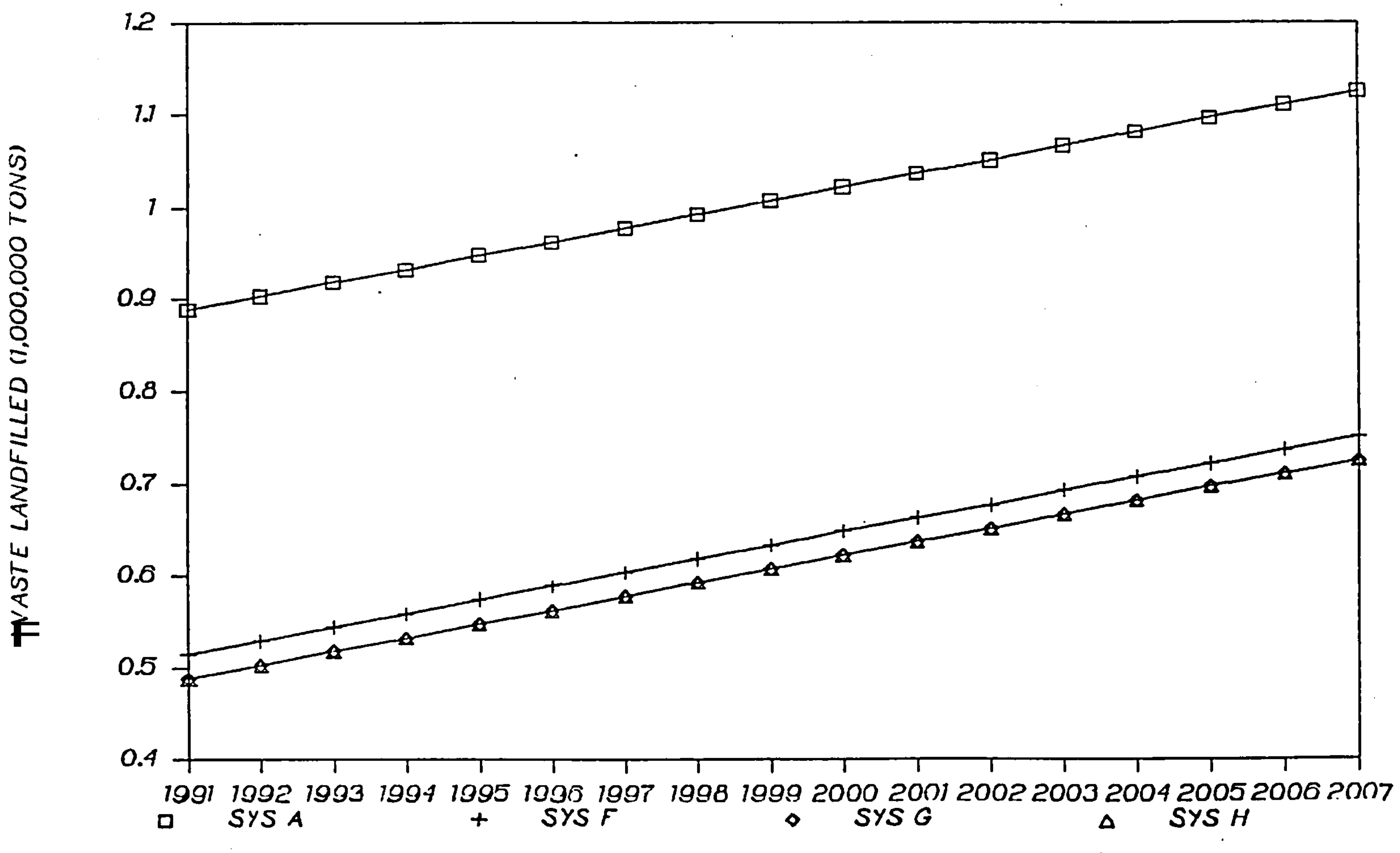


TABLE 3

AVERAGE TOTAL COSTS OF SYSTEMS SCENARIOS

SYSTEMS SCENARIOS		AVERAGE COST/TON	AVERAGE TOTAL COSTS
I)	BACONA ROAD LANDFILL 2 FULL SIZE TRANSFER STATIONS RIEDEL FACILITY ON NORTH EAST COLUMBIA BLVD. (processing 100,000 TPY)	$43	$42,805,000
J)	BACONA ROAD LANDFILL 2 FULL SIZE TRANSFER STATIONS 1 DOWN SIZE TRANSFER STATION COMBUSTION ENGINEERING FACILITY IN RIVERGATE (processing 450,000 TPY)	$54	$53,510,000
K)	BACONA ROAD LANDFILL 3 FULL SIZE TRANSFER STATIONS FLUOR/SEI FACILITY IN ST. HELENS (processing 450,000 TPY)	$57	$57,426,000
KK)	BACONA ROAD LANDFILL 3 FULL SIZE TRANSFER STATIONS FLUOR/SEI FACILITY IN ST. HELENS (processing 450,000 TPY by barge)	$59	$59,240,000
L)	BACONA ROAD LANDFILL 2 FULL SIZE TRANSFER STATIONS 1 DOWN SIZE TRANSFER STATION SCHNITZER/OGDEN MARTIN FACILITY IN RIVERGATE (processing 450,000 TPY)	$54	$53,593,000
M)	BACONA ROAD LANDFILL 2 FULL SIZE TRANSFER STATIONS 1 DOWN SIZE TRANSFER STATION RIEDEL FACILITY ON NORTH EAST COLUMBIA BLVD. (processing 200,000 TPY) COMBUSTION ENGINEERING FACILTY IN RIVERGATE (processing 250,000 TPY)	$56	$55,506,000

* Costs are in constant 1990 dollars
** Riedel Facility includes a Transfer Station

TABLE 3

AVERAGE TOTAL COSTS OF SYSTEMS SCENARIOS

SYSTEMS SCENARIOS		AVERAGE COST/TON	AVERAGE TOTAL COSTS
N)	BACONA ROAD LANDFILL 2 FULL SIZE TRANSFER STATIONS 1 DOWN SIZE TRANSFER STATION RIEDEL FACILITY ON NORTH EAST COLUMBIA BLVD. (processing 200,000 TPY) FLUOR FACILITY IN ST. HELENS (processing 250,000 TPY)	$56	$55,814,000
NN)	BACONA ROAD LANDFILL 2 FULL SIZE TRANSFER STATIONS 1 DOWN SIZE TRANSFER STATION RIEDEL FACILITY ON NORTH EAST COLUMBIA BLVD. (processing 200,000 TPY) FLUOR FACILITY IN ST. HELENS (processing 250,000 TPY by barge)	$57	$56,822,00
O)	BACONA ROAD LANDFILL 2 FULL SIZE TRANSFER STATIONS 1 DOWN SIZE TRANSFER STATION RIEDEL FACILITY ON NORTH EAST COLUMBIA BLVD. (processing 200,000 TPY) SCHNITZER/OGDEN MARTIN FACILITY IN RIVERGATE (processing 250,000 TPY)	$55	$54,710,00

* Costs are in constant 1990 dollars
** Riedel Facility includes a Transfer Station

TABLE 4

	SYSTEM DESCRIPTION	AVERAGE COST % ABOVE (A)	LANDFILL LIFE (YEARS)
SYSTEM A	BACONA ROAD LANDFILL ONLY		39
SYSTEM B	C-E @ 350,000 TPY	17.8%	46
SYSTEM C	FLUOR/SEI @ 350,000 TPY	24.4%	47
SYSTEM CC	FLUOR/SEI @ 350,000 TPY (Barge)	26.7%	47
SYSTEM D	SCHNITZER\OGDEN @ 350,000 TPY	20.0%	47
SYSTEM E	RIEDEL @ 200,000 TPY	-2.2%	43
SYSTEM F	C-E @ 350,000 TPY RIEDEL @ 200,000 TPY	22.2%	52
SYSTEM G	FLUOR\SEI @ 350,000 TPY RIEDEL @ 200,000 TPY	28.9%	53
SYSTEM GG	FLUOR\SEI @ 350,000 TPY(Barge) RIEDEL @ 200,000 TPY	33.3%	53
SYSTEM H	SCHNITZER\OGDEN @ 350,000 TPY RIEDEL @ 200,000 TPY	24.4%	53
SYSTEM I	RIEDEL @ 100,000 TPY	-4.4%	41
SYSTEM J	C-E @ 450,000 TPY	20.0%	49
SYSTEM K	FLUOR\SEI @ 450,000 TPY	26.7%	50
SYSTEM KK	FLUOR\SEI @ 450,000 TPY(Barge)	31.1%	50
SYSTEM L	SCHNITZER\OGDEN @ 450,000 TPY	20.0%	50
SYSTEM M	C-E @ 250,000 TPY RIEDEL @ 200,000 TPY	24.4%	49
SYSTEM N	FLUOR\SEI @ 250,000 TPY RIEDEL @ 200,000 TPY	24.4%	50
SYSTEM NN	FLUOR\SEI @ 250,000 TPY(Barge) RIEDEL @ 200,000 TPY	26.7%	50
SYSTEM O	SCHNITZER\OGDEN @ 250,000 TPY RIEDEL @ 200,000 TPY	22.2%	50

In order to comply with the evaluation process it is necessary to grade each of the proposals (S) for superior, (A) for acceptable, (P) for poor, or (U) for unacceptable. Acceptable was considered to be 15% to 25%. Percentages less than 15% were rated Superior and percentages above 25% were rated Poor. Because of the complexity of the interrelated analyses that make up each system evaluation, variations in assumptions result in changes in the percentage comparisons. Proposals within five percentage points of twenty percent will be above or below the twenty percent line depending upon changes in the assumption parameters. Therefore proposals with comparison percentages between 15% and 25% are being considered "acceptable".

Using the base case proposals for each proposal the following ratings appear justified:

		Rating	% from Table 3
System B	C-E	A	17.8%
System C	Fluor\SEI	A	24.4%
System D	Schnitzer\Ogden	A	20.0%
System I	Riedel	S	-2.2%

This is an extremely simplistic grading and does not do justice to the complexity of the information available with the systems cost analysis.

Premium Cost of Diversion Analysis

This analysis is developed to provide additional insight into the costs associated with the primary goal of resource recovery -- diversion of waste from landfills. By assessing the total system cost of resource recovery and comparing it to the cost of a landfill only system (System A) the incremental cost associated with each ton of waste that is diverted from the landfill can be determined. Table 5 presents the average premium cost for each system as well as the landfill life and the percentages for the main system cost comparison.

TABLE 5

	SYSTEM DESCRIPTION	AVERAGE COST % ABOVE (A)	LANDFILL LIFE (YEARS)	AVERAGE PREMIUM COST
SYSTEM A	BACONA ROAD LANDFILL ONLY		39	
SYSTEM B	C-E @ 350,000 TPY	17.8%	46	$30
SYSTEM C	FLUOR/SEI @ 350,000 TPY	24.4%	47	$37
SYSTEM CC	FLUOR/SEI @ 350,000 TPY (Barge)	26.7%	47	$43
SYSTEM D	SCHNITZER\OGDEN @ 350,000 TPY	20.0%	47	$31
SYSTEM E	RIEDEL @ 200,000 TPY	-2.2%	43	- $14
SYSTEM F	C-E @ 350,000 TPY RIEDEL @ 200,000 TPY	22.2%	52	$26
SYSTEM G	FLUOR\SEI @ 350,000 TPY RIEDEL @ 200,000 TPY	28.9%	53	$31
SYSTEM GG	FLUOR\SEI @ 350,000 TPY(Barge) RIEDEL @ 200,000 TPY	33.3%	53	$35
SYSTEM H	SCHNITZER\OGDEN @ 350,000 TPY RIEDEL @ 200,000 TPY	24.4%	53	$27
SYSTEM I	RIEDEL @ 100,000 TPY	-4.4%	41	- $42
SYSTEM J	C-E @ 450,000 TPY	20.0%	49	$26
SYSTEM K	FLUOR\SEI @ 450,000 TPY	26.7%	50	$35
SYSTEM KK	FLUOR\SEI @ 450,000 TPY(Barge)	31.1%	50	$40
SYSTEM L	SCHNITZER\OGDEN @ 450,000 TPY	20.0%	50	$23
SYSTEM M	C-E @ 250,000 TPY RIEDEL @ 200,000 TPY	24.4%	49	$32
SYSTEM N	FLUOR\SEI @ 250,000 TPY RIEDEL @ 200,000 TPY	24.4%	50	$31
SYSTEM NN	FLUOR\SEI @ 250,000 TPY(Barge) RIEDEL @ 200,000 TPY	26.7%	50	$34
SYSTEM O	SCHNITZER\OGDEN @ 250,000 TPY RIEDEL @ 200,000 TPY	22.2%	50	$27

The premium costs tell us several things when aligned with landfill life and the percentage comparison. First, systems F, G, GG, and H process 550,000 TPY with lower average premium costs and longer landfill life than Systems M, N, NN, and O which process 450,000 TPY. Second, the Riedel proposal appears to be a worthwhile risk as substantial system benefits can be realized although the gains in landfill life are not as substantial as the combination systems. Also, the premium cost of a facility in St. Helens is between six and eleven dollars per ton when averaged over 17 years. (See Appendix G)

<u>Summary</u>

The System Cost Analysis and Premium Cost Analysis provide a useful tool in the process of evaluating proposals, indicating the relative merits of one system when compared with another. It is important that both cost and the extension of landfill life be considered. Systems F, H, G and GG accomplish this best but result in some of the poorest percentage criteria comparisons. This raises the issue of how much should be invested today for long term gains. Systems E and I reflect very well in the cost comparisons but fare poorly if you consider their return in providing additional landfill life.

The remaining systems analyzed present cost and landfill life increments that fit within the range indicated by System I and System GG above (i.e. extend landfill life 2-14 years over the landfill based system with a cost differential of between -4% and

31%). (See Figure 1 at the bottom of this page for a graphic presentation of the system costs compared to landfill life.)

This system cost analysis should be used to evaluate the economic issues associated with considering a resource recovery facility at St. Helens as well as the cost impacts and how they relate to landfill life.

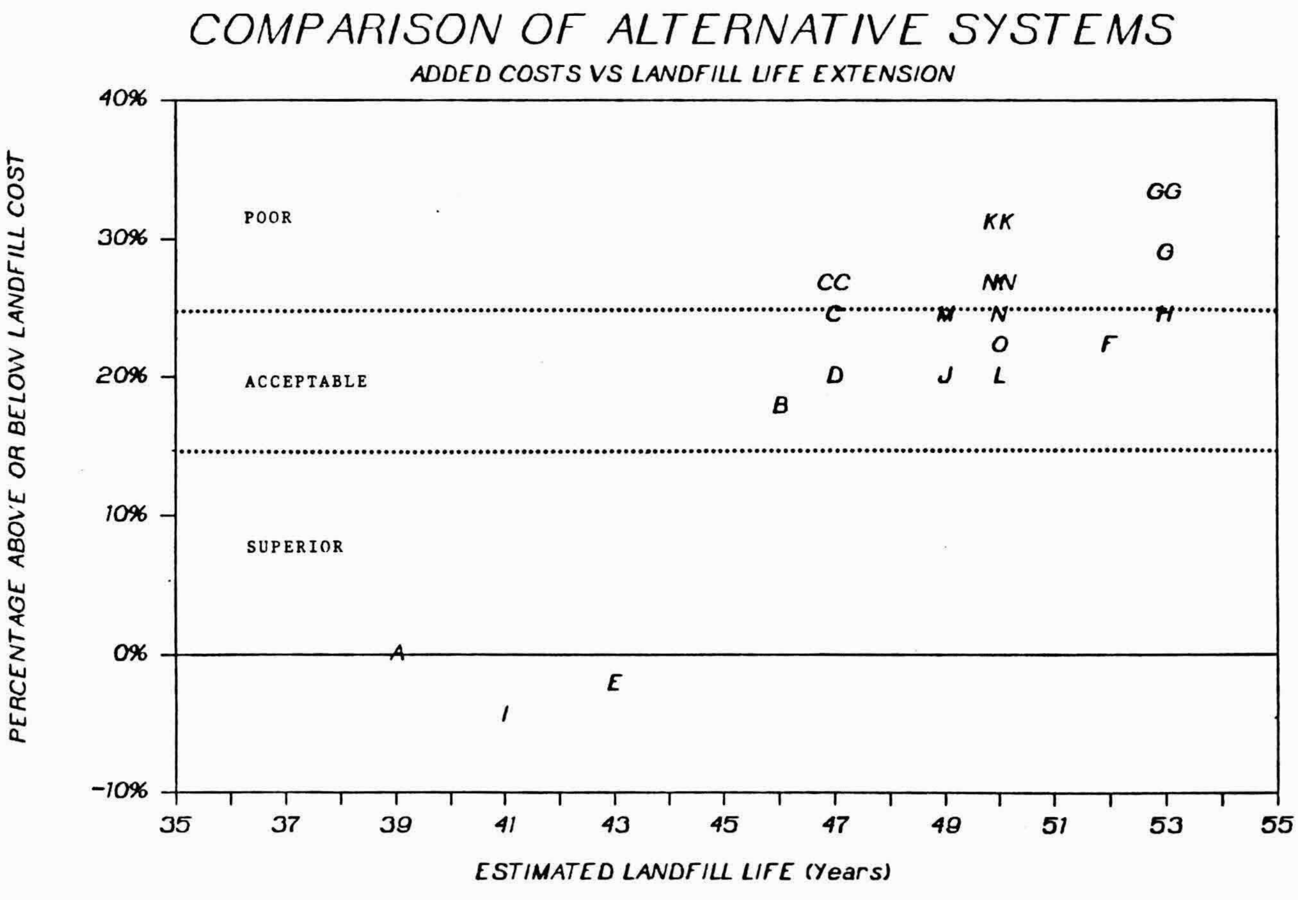


FIGURE 1

APPENDICES

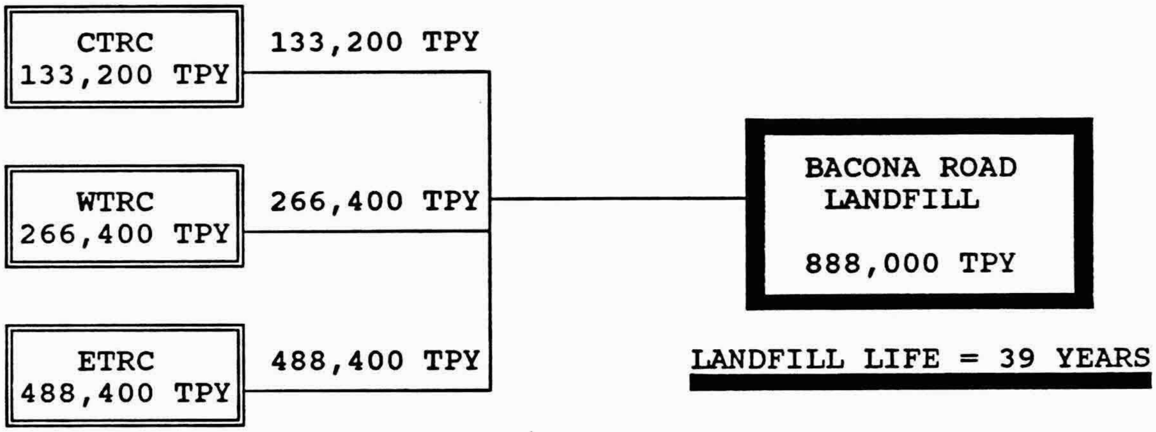
APPENDIX A	SYSTEM SCHEMATICS FOR 1991 WASTE FLOWS
APPENDIX B	TOTAL SYSTEM COSTS
APPENDIX C	LANDFILL COSTS
APPENDIX D	RESOURCE RECOVERY COSTS
APPENDIX E	TRANSFER STATION COSTS
APPENDIX F	TRANSPORTATION COSTS (INCLUDING BARGE COSTS)
APPENDIX G	DIVERSION PREMIUM COSTS

APPENDIX A

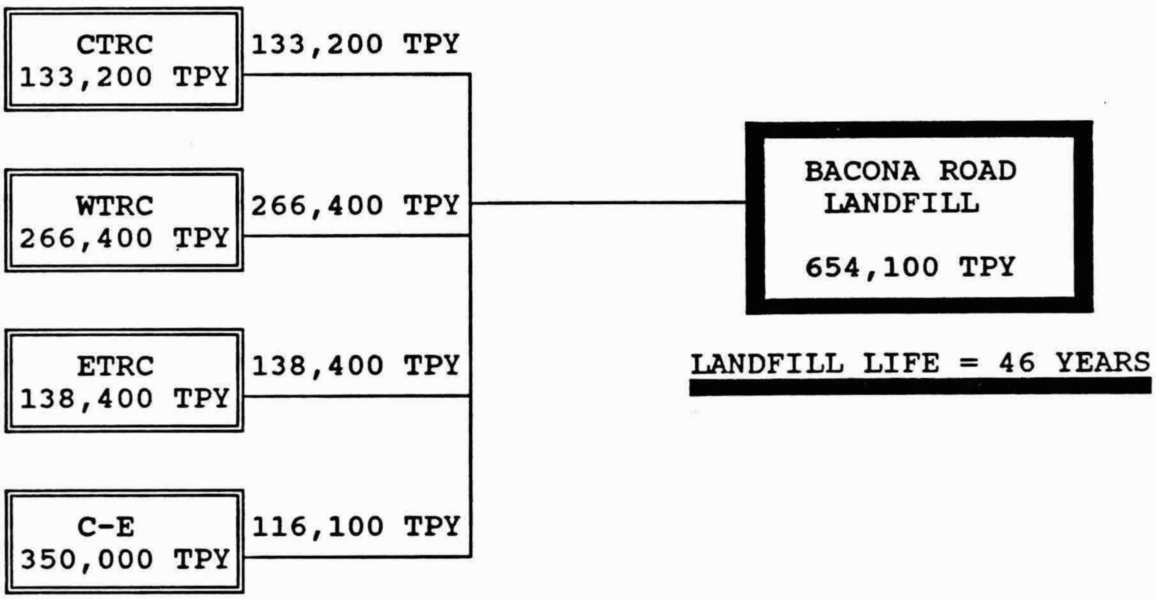
SYSTEM SCHEMATICS FOR 1991 WASTE FLOWS

1991 WASTE FLOWS

<u>SYSTEM A:</u> One Landfill
Three full size Transfer Stations



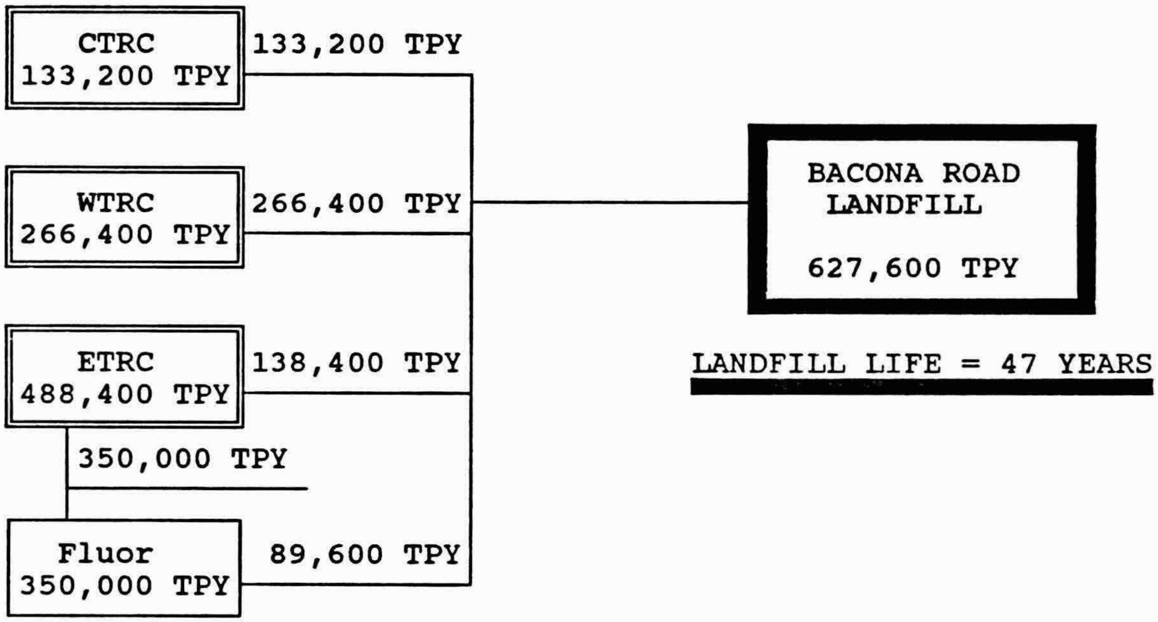
<u>SYSTEM B</u>: One landfill
Two Full Size Transfer Stations
One Down Size Transfer Station
Combustion Engineering RDF facility in Rivergate
(processing 350,000 TPY)



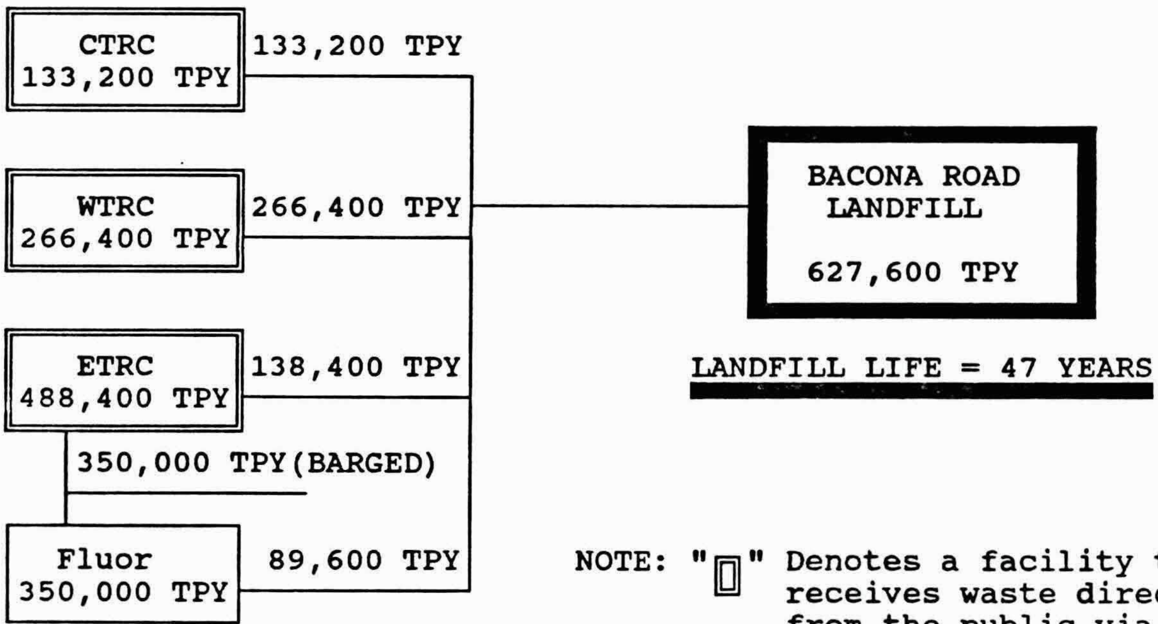
NOTE: "□" Denotes a facility that receives waste directly from the public via self or commercial haulers.

1991 WASTE FLOWS

SYSTEM C: One landfill
Three Full Size Transfer Stations
A Fluor Incineration facility in St. Helens
(processing 350,000 TPY)



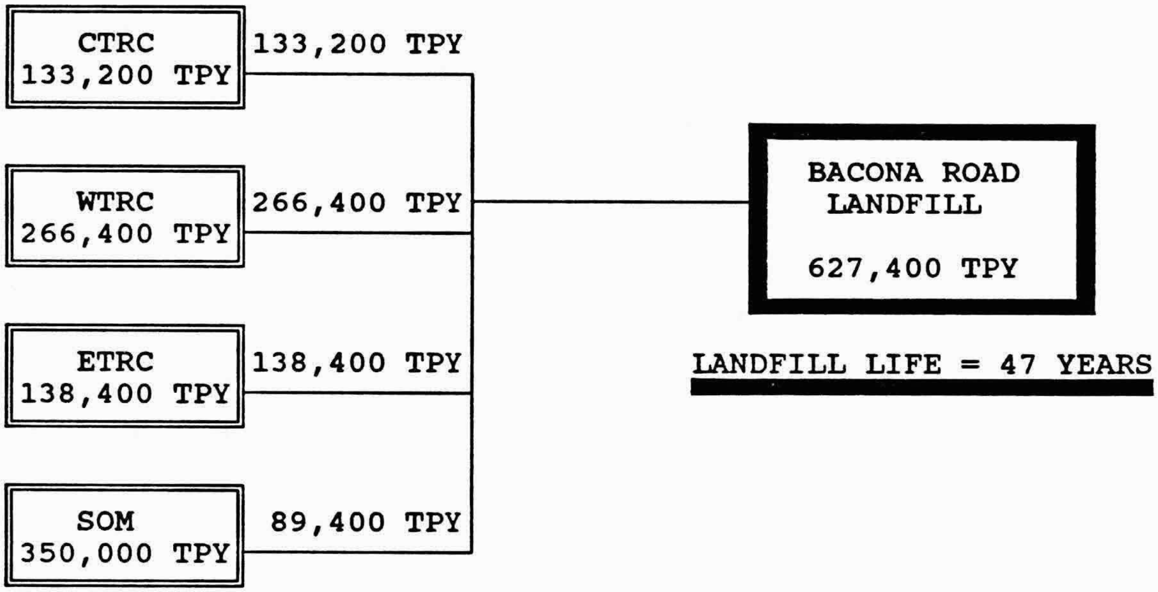
SYSTEM CC: (w/barging) One landfill
Three full size transfer stations
A Fluor Incineration facility in St. Helens



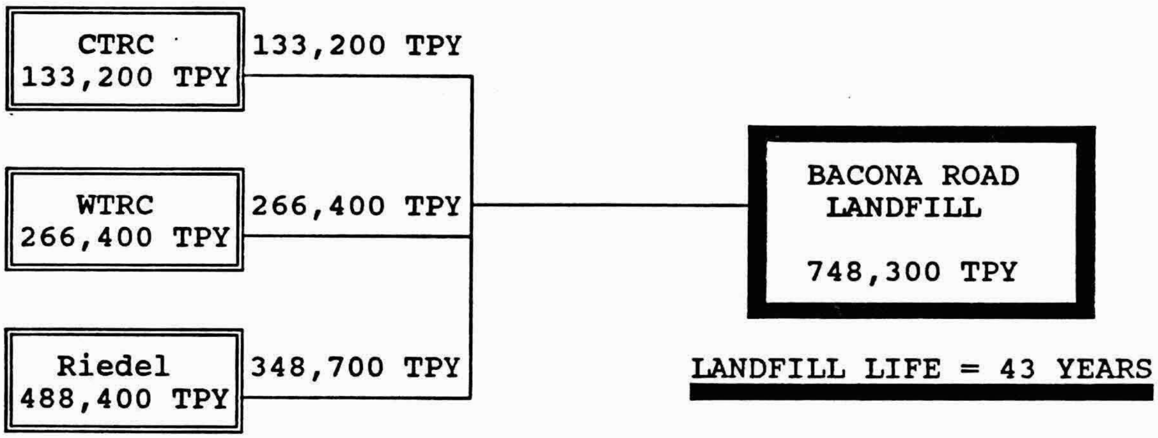
NOTE: "▯" Denotes a facility that receives waste directly from the public via self or commercial haulers.

1991 WASTE FLOWS

SYSTEM D: One landfill
Two full size Transfer Stations
One down size Transfer Station
A Schnitzer/Ogden-Martin facility in Rivergate
(processing 350,000 TPY)



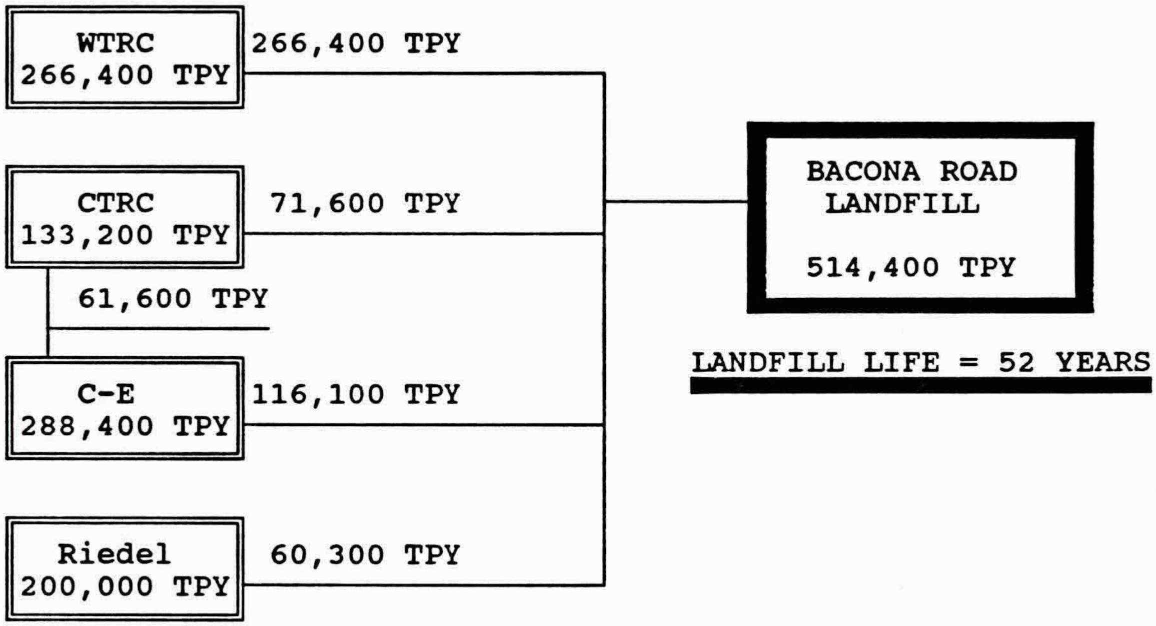
SYSTEM E: One landfill
Two full size transfer stations
A Riedel Compost and Transfer facility on Columbia
(processing 200,000 TPY)



NOTE: "☐" Denotes a facility that recieves waste directly from the public via self or commercial haulers.

1991 WASTE FLOWS

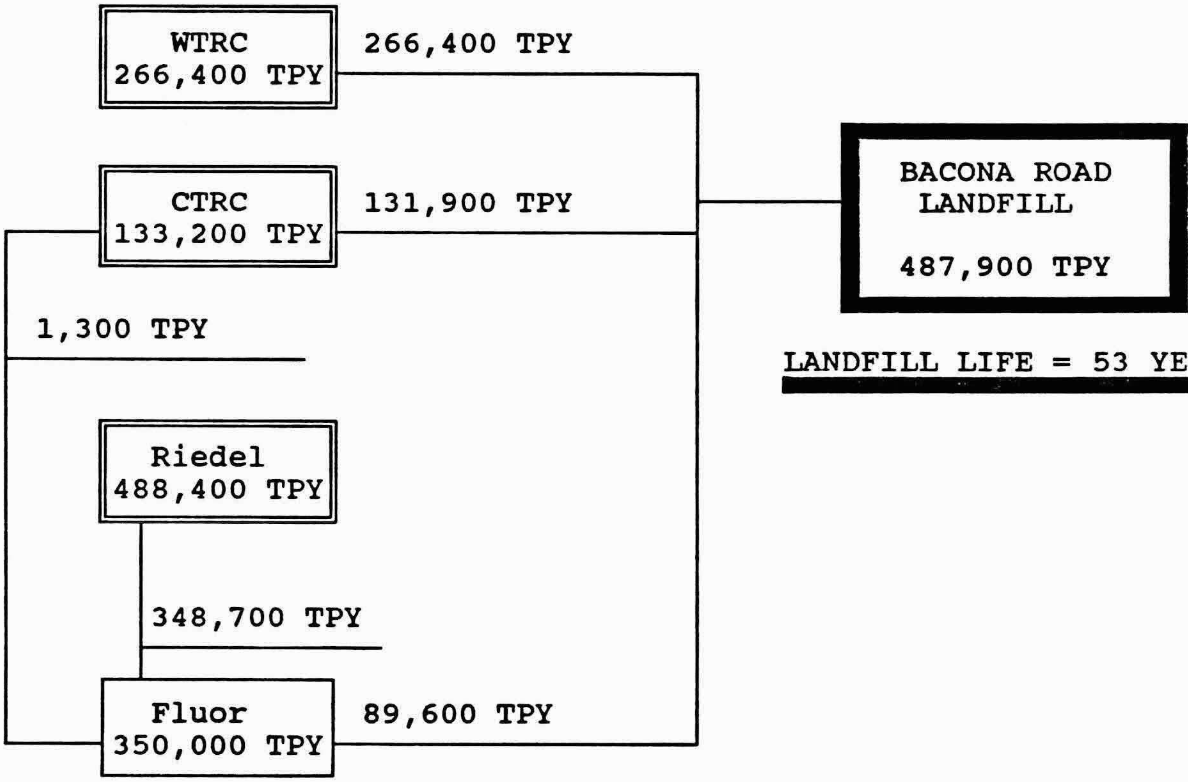
<u>SYSTEM F</u>: One landfill
Two full size Transfer Stations
A Riedel Composting and Transfer facility on Columbia
(processing 200,000 TPY)
A Combustion Engineering RDF facility in Rivergate
(processing 350,000 TPY)



NOTE: "" Denotes a facility that recieves waste directly from the public via self or commercial haulers.

1991 WASTE FLOWS

<u>SYSTEM G</u>: One Landfill
Two full size Transfer Stations
A Riedel Composting and Transfer facility on Columbia (processing 200,000 TPY)
A Fluor Incineration facility in St. Helens (processing 350,000 TPY)



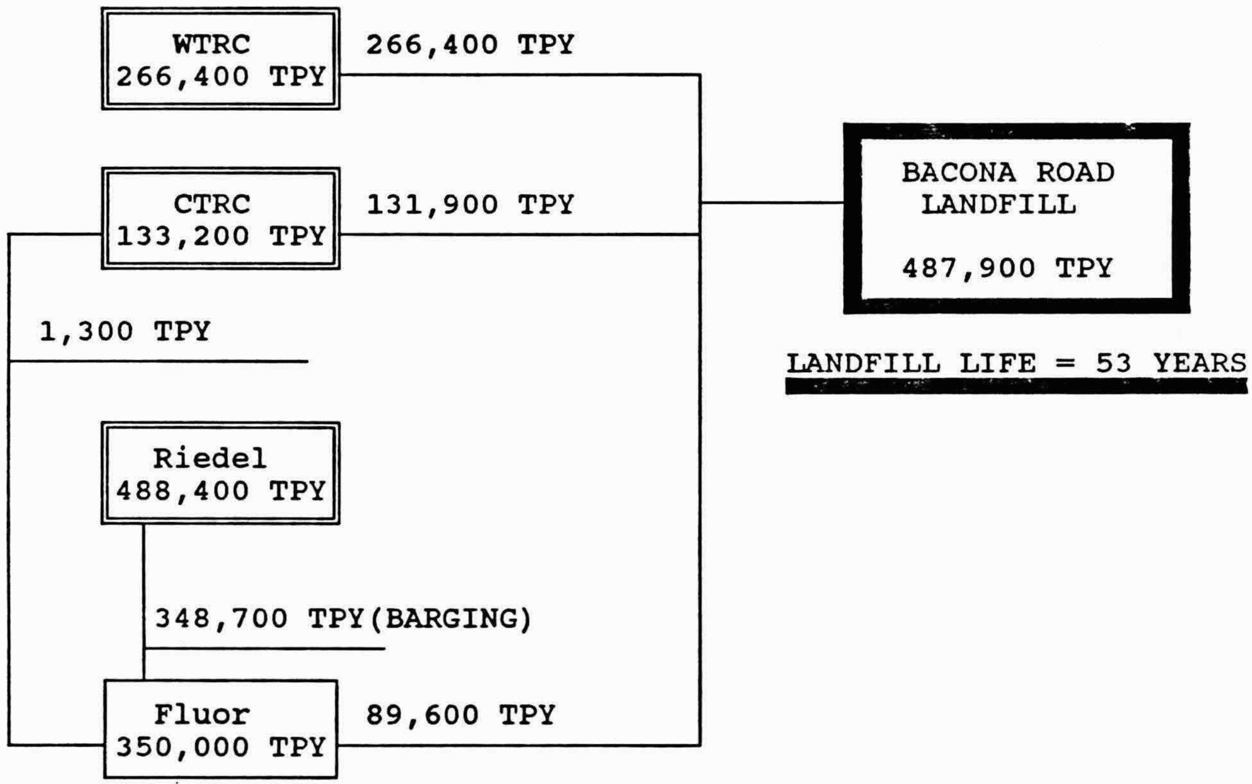
LANDFILL LIFE = 53 YEARS

NOTE: "□" Denotes a facility that recieves waste directly from the public via self or commercial haulers.

1991 WASTE FLOWS

<u>SYSTEM GG</u>: (w/barging)

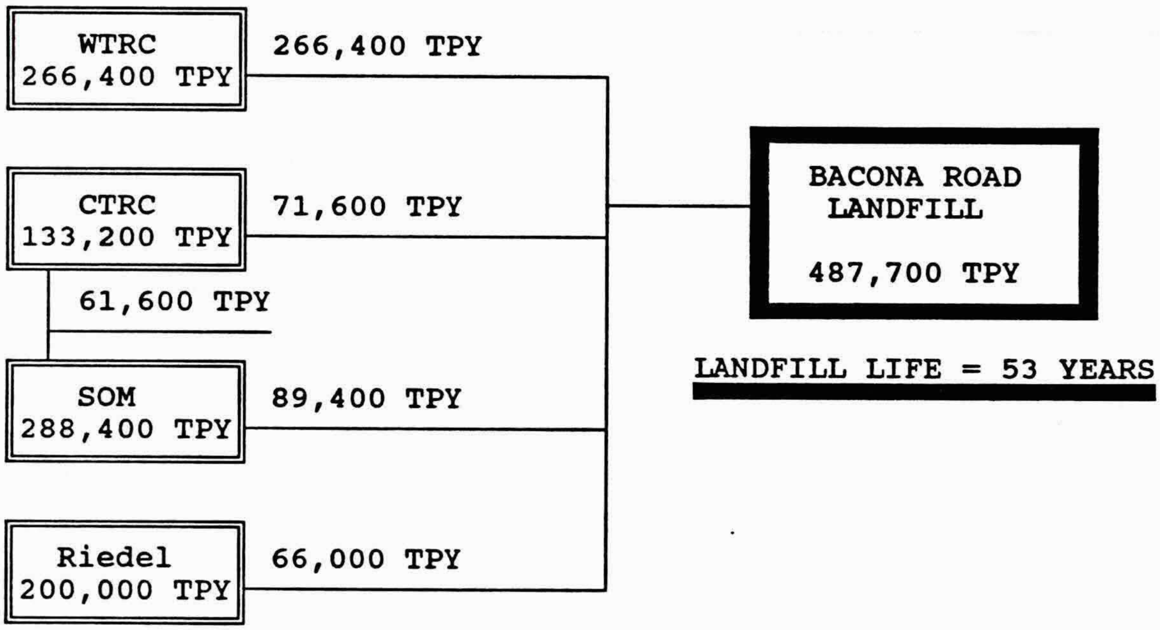
One landfill
Two full size Transfer Stations
A Riedel Composting and Transfer facility on Columbia (processing 200,000 TPY)
A Fluor Incineration facility in St. Helens (processing 350,000 TPY)



NOTE: "□" Denotes a facility that recieves waste directly from the public via self or commercial haulers.

1991 WASTE FLOWS

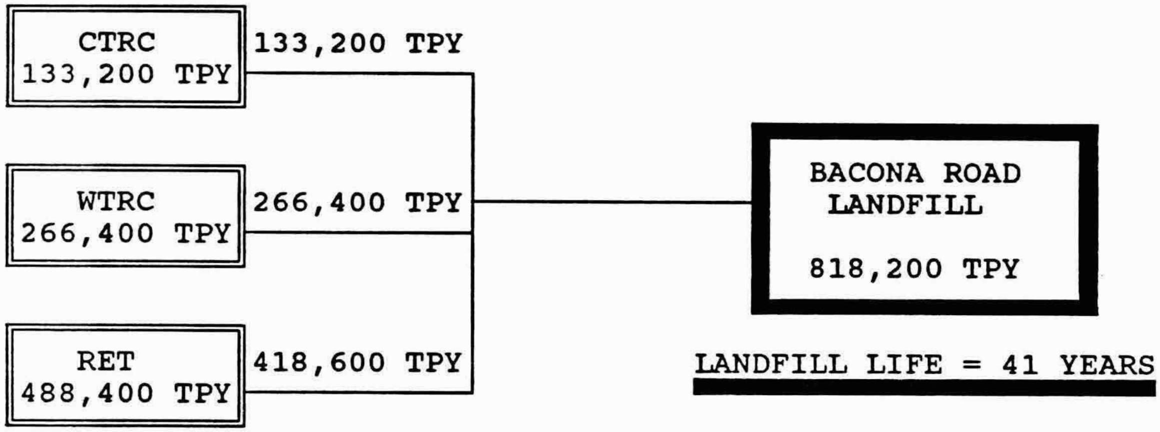
<u>**SYSTEM H**</u>: One landfill
Two full size Transfer Stations
A Riedel Composting and Transfer facility on Columbia (processing 200,000 TPY)
A Schnitzer/Ogden-Martin Incineration facility in Rivergate. (processing 350,000 TPY)



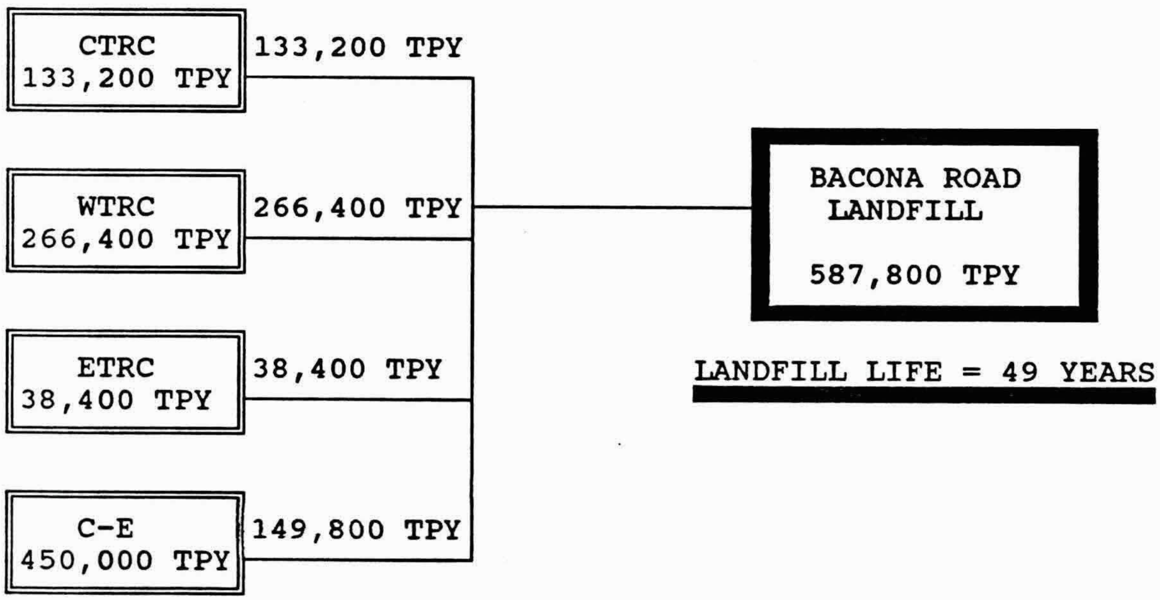
NOTE: "□" Denotes a facility that recieves waste directly from the public via self or commercial haulers.

1991 WASTE FLOWS

<u>SYSTEM I:</u> One Landfill
Two Full Size Transfer Stations
A Riedel Conpost and Transfer facility on Columbia



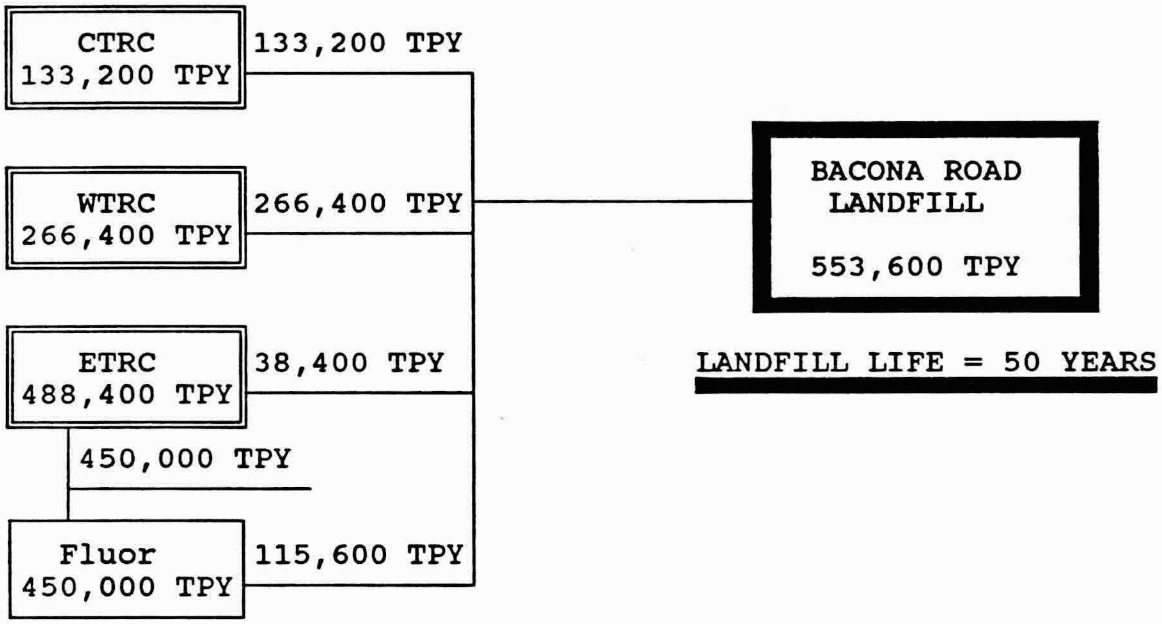
<u>SYSTEM J:</u> One landfill
Two Full Size Transfer Stations
One Down Size Transfer Station
Combustion Engineering RDF facility in Rivergate
(processing 450,000 TPY)



NOTE: "▭" Denotes a facility that receives waste directly from the public via self or commercial haulers.

1991 WASTE FLOWS

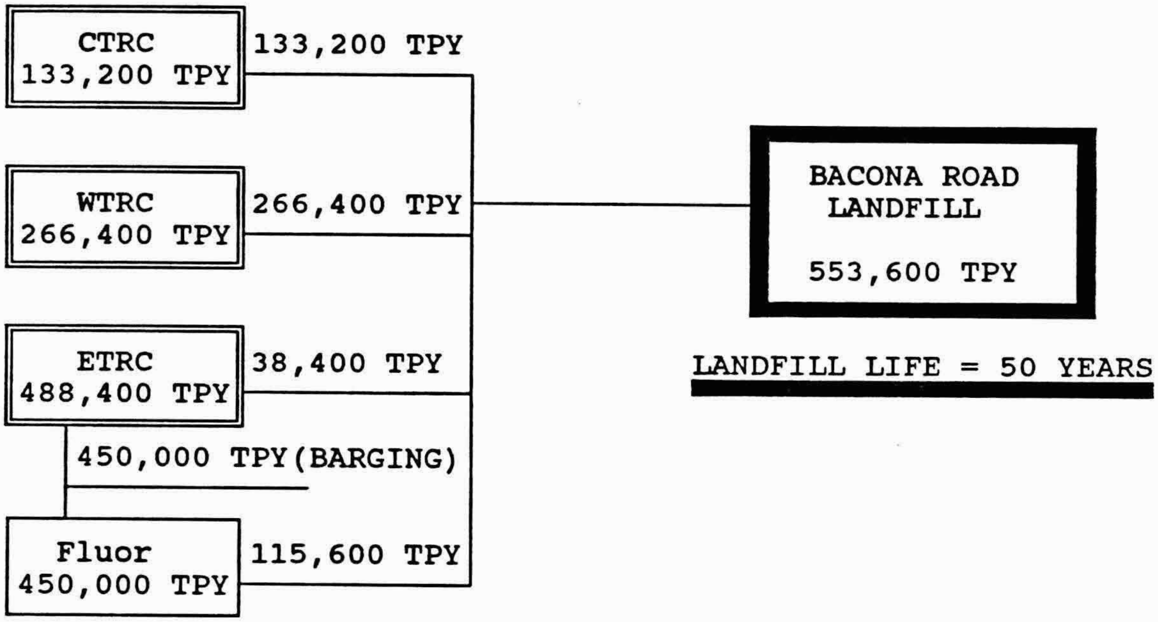
SYSTEM K: One landfill
Three Full Size Transfer Stations
A Fluor Incineration facility in St. Helens
(processing 450,000 TPY)



NOTE: "▭" Denotes a facility that receives waste directly from the public via self or commercial haulers.

1991 WASTE FLOWS

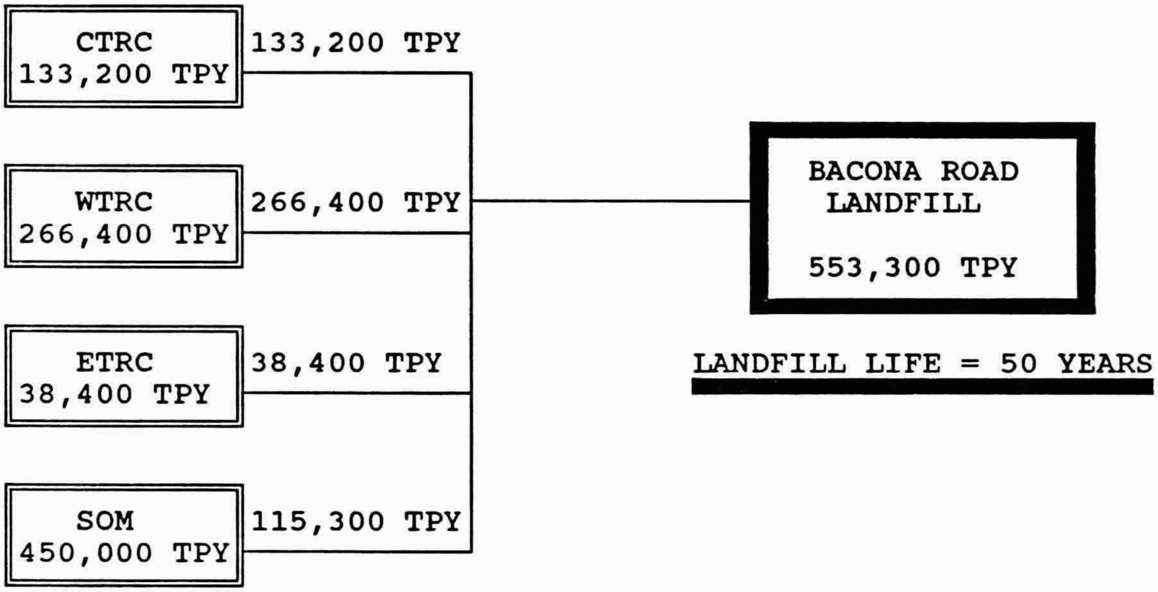
SYSTEM KK: One landfill
(w/barging) Three Full Size Transfer Stations
A Fluor Incineration facility in St. Helens
(processing 450,000 TPY)



NOTE: "□" Denotes a facility that receives waste directly from the public via self or commercial haulers.

1991 WASTE FLOWS

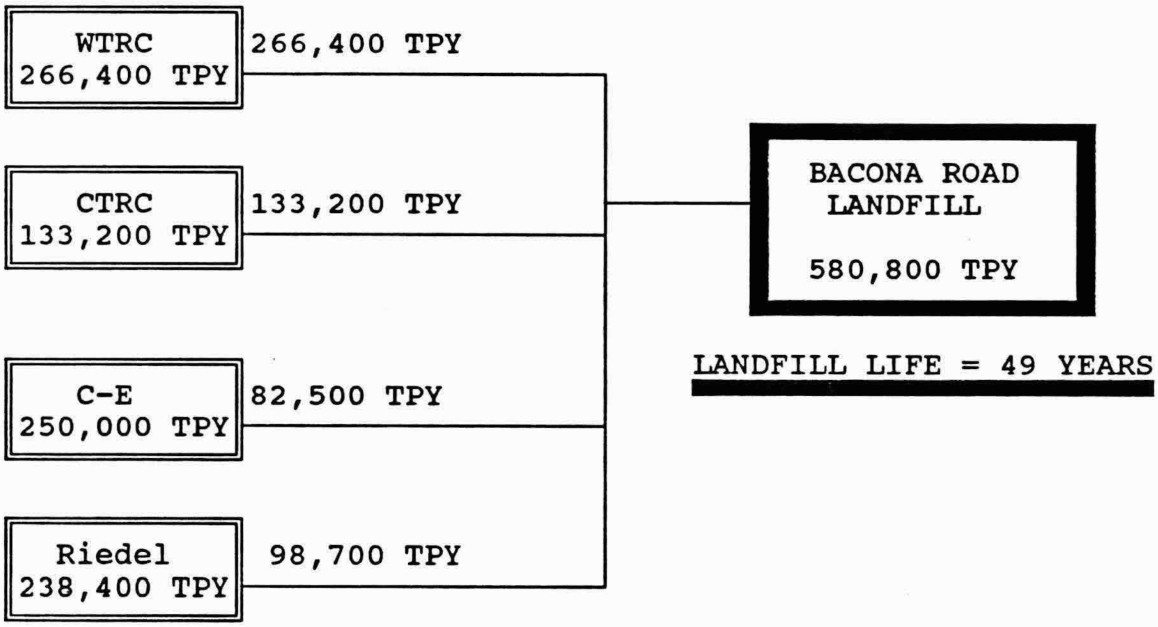
SYSTEM L: One landfill
Two full size Transfer Stations
One down size Transfer Station
A Schnitzer/Ogden-Martin facility in Rivergate
(processing 450,000 TPY)



NOTE: "□" Denotes a facility that recieves waste directly from the public via self or commercial haulers.

1991 WASTE FLOWS

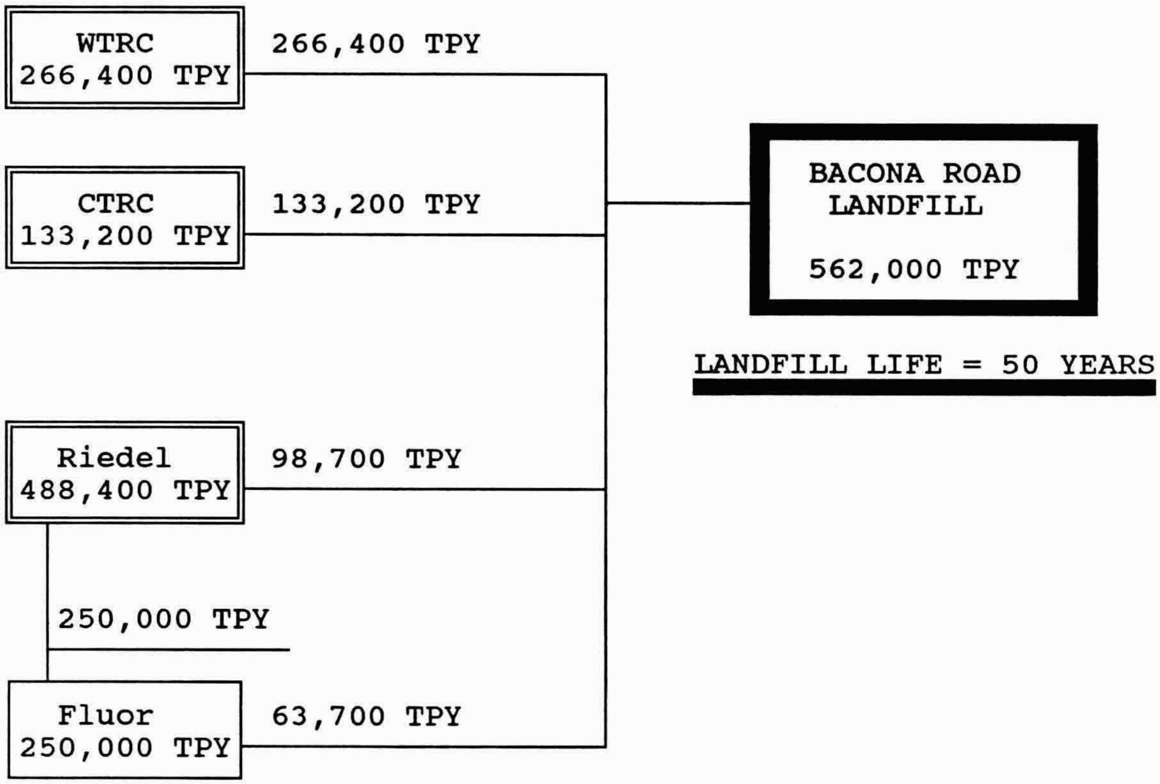
SYSTEM M: One landfill
Two Full Size Transfer Stations
One Down Size Transfer Station
Riedel Composting and Transfer Facility on Columbia
(processing 200,000 TPY)
Combustion Engineering RDF facility in Rivergate
(processing 250,000 TPY)



NOTE: " " Denotes a facility that receives waste directly from the public via self or commercial haulers.

1991 WASTE FLOWS

SYSTEM N: One Landfill
Two full size Transfer Stations
A Riedel Composting and Transfer facility on Columbia
(processing 200,000 TPY)
A Fluor Incineration facility in St. Helens
(processing 250,000 TPY)

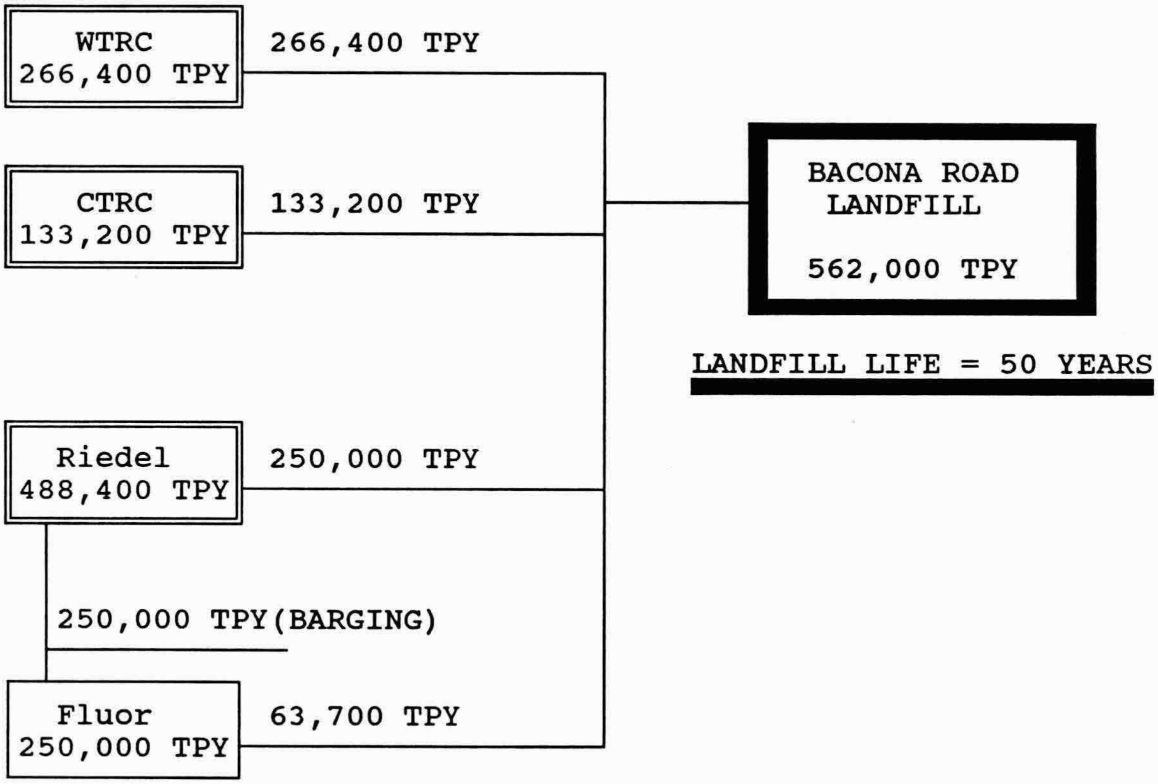


NOTE: "□" Denotes a facility that recieves waste directly from the public via self or commercial haulers.

1991 WASTE FLOWS

SYSTEM NN: (w/barging)

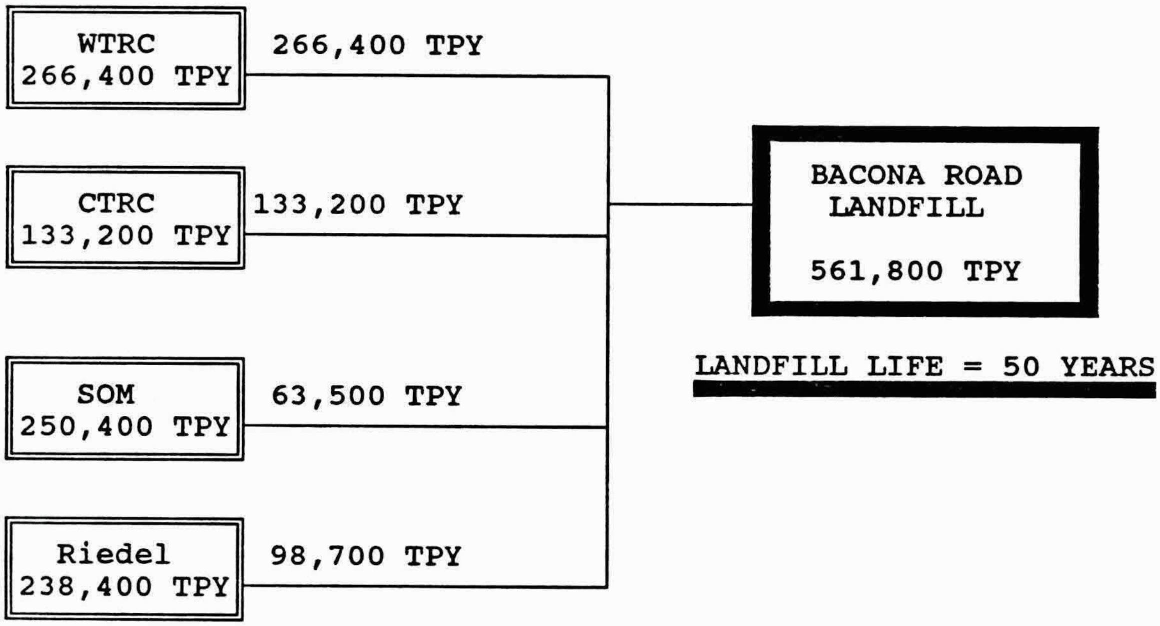
One Landfill
Two full size Transfer Stations
A Riedel Composting and Transfer facility on Columbia (processing 200,000 TPY)
A Fluor Incineration facility in St. Helens (processing 250,000 TPY)



NOTE: "▭" Denotes a facility that recieves waste directly from the public via self or commercial haulers.

1991 WASTE FLOWS

<u>SYSTEM O</u>: One landfill
Two full size Transfer Stations
A Riedel Composting and Transfer facility on Columbia (processing 200,000 TPY)
A Schnitzer/Ogden-Martin Incineration facility in Rivergate. (processing 250,000 TPY)



NOTE: "☐" Denotes a facility that recieves waste directly from the public via self or commercial haulers.

APPENDIX B

TOTAL SYSTEM COSTS

METRO SOLID WASTE SYSTEM COSTS
CONSTANT DOLLARS ANALYSIS
(Dollars per ton)

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
	YEAR	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
	WASTE FLOW	874,000	888,000	903,000	918,000	932,000	948,000	962,000	977,000	992,000	1,007,000	1,022,000	1,037,000	1,051,000
COST FOR SYSTEM A	TRANSP.	$8,190,000	$8,321,000	$8,462,000	$8,602,000	$8,734,000	$8,884,000	$9,015,000	$9,155,000	$9,296,000	$9,436,000	$9,577,000	$9,718,000	$9,849,000
	TRANSF.	$10,081,000	$9,963,000	$9,761,000	$10,154,000	$9,760,000	$9,746,000	$10,088,000	$10,054,000	$10,023,000	$9,698,000	$9,695,000	$9,931,000	$9,464,000
	LANDFILL	$20,245,000	$20,589,000	$20,951,000	$21,332,000	$20,544,000	$20,116,000	$20,579,000	$21,064,000	$21,574,000	$23,148,000	$23,709,000	$24,298,000	$24,915,000
	USER	$2,622,000	$2,664,000	$2,709,000	$2,754,000	$2,796,000	$2,844,000	$2,886,000	$2,931,000	$2,976,000	$3,021,000	$3,066,000	$3,111,000	$3,153,000
	TOTAL	$41,138,000	$41,537,000	$41,863,000	$42,842,000	$41,834,000	$41,590,000	$42,568,000	$43,204,000	$43,869,000	$45,303,000	$46,047,000	$47,058,000	$47,381,000
	PER TON	$47.07	$46.78	$46.38	$46.67	$44.89	$43.87	$44.25	$44.22	$44.22	$44.99	$45.06	$45.38	$45.08
COST FOR SYSTEM B	TRANSP.		$6,077,000	$6,218,000	$6,358,000	$6,489,000	$6,639,000	$6,771,000	$6,911,000	$7,052,000	$7,192,000	$7,333,000	$7,473,000	$7,605,000
	CE		$19,535,000	$19,161,000	$18,962,000	$18,571,000	$18,181,000	$18,174,000	$17,402,000	$17,013,000	$16,817,000	$16,047,000	$15,279,000	$14,702,000
	TRANSF.		$9,657,000	$9,456,000	$9,848,000	$9,454,000	$9,441,000	$9,764,000	$9,749,000	$9,718,000	$9,393,000	$9,389,000	$9,626,000	$9,159,000
	LANDFILL		$17,708,000	$17,706,000	$17,688,000	$17,667,000	$16,819,000	$16,818,000	$16,821,000	$16,838,000	$16,692,000	$16,709,000	$16,711,000	$17,501,000
	USER		$2,664,000	$2,709,000	$2,754,000	$2,796,000	$2,844,000	$2,886,000	$2,931,000	$2,976,000	$3,021,000	$3,066,000	$3,111,000	$3,153,000
	TOTAL		$55,641,000	$55,250,000	$55,610,000	$54,977,000	$53,924,000	$54,413,000	$53,814,000	$53,597,000	$53,115,000	$52,544,000	$52,200,000	$52,120,000
	PER TON		$62.66	$61.18	$60.58	$58.99	$56.88	$56.56	$55.08	$54.03	$52.75	$51.41	$50.34	$49.59
COST FOR SYSTEM C	TRANSP.		$8,725,000	$8,865,000	$9,006,000	$9,137,000	$9,287,000	$9,418,000	$9,559,000	$9,699,000	$9,840,000	$9,980,000	$10,121,000	$10,252,000
	FLUOR		$17,625,000	$17,754,000	$17,826,000	$17,784,000	$17,753,000	$18,041,000	$17,418,000	$17,107,000	$16,950,000	$16,323,000	$15,696,000	$15,226,000
	TRANSF.		$9,963,000	$9,761,000	$10,154,000	$9,760,000	$9,746,000	$10,088,000	$10,054,000	$10,023,000	$9,698,000	$9,695,000	$9,931,000	$9,464,000
	LANDFILL		$17,695,000	$17,693,000	$17,675,000	$17,654,000	$16,806,000	$16,805,000	$16,808,000	$16,824,000	$16,679,000	$16,695,000	$16,698,000	$16,698,000
	USER		$2,664,000	$2,709,000	$2,754,000	$2,796,000	$2,844,000	$2,886,000	$2,931,000	$2,976,000	$3,021,000	$3,066,000	$3,111,000	$3,153,000
	TOTAL		$56,672,000	$56,782,000	$57,415,000	$57,131,000	$56,436,000	$57,238,000	$56,770,000	$56,629,000	$56,188,000	$55,759,000	$55,557,000	$54,793,000
	PER TON		$63.82	$62.88	$62.54	$61.30	$59.53	$59.50	$58.11	$57.09	$55.80	$54.56	$53.57	$52.13
COST FOR SYSTEM CC W/BARGING	TRANSP.		$10,156,000	$10,297,000	$10,437,000	$10,568,000	$10,718,000	$10,850,000	$10,990,000	$11,131,000	$11,271,000	$11,412,000	$11,552,000	$11,684,000
	FLUOR		$17,625,000	$17,754,000	$17,826,000	$17,784,000	$17,753,000	$18,041,000	$17,418,000	$17,107,000	$16,950,000	$16,323,000	$15,696,000	$15,226,000
	TRANSF.		$9,963,000	$9,761,000	$10,154,000	$9,760,000	$9,746,000	$10,088,000	$10,054,000	$10,023,000	$9,698,000	$9,695,000	$9,931,000	$9,464,000
	LANDFILL		$17,695,000	$17,693,000	$17,675,000	$17,654,000	$16,806,000	$16,805,000	$16,808,000	$16,824,000	$16,679,000	$16,695,000	$16,698,000	$16,698,000
	USER		$2,664,000	$2,709,000	$2,754,000	$2,796,000	$2,844,000	$2,886,000	$2,931,000	$2,976,000	$3,021,000	$3,066,000	$3,111,000	$3,153,000
	TOTAL		$58,103,000	$58,214,000	$58,846,000	$58,562,000	$57,867,000	$58,670,000	$58,201,000	$58,061,000	$57,619,000	$57,191,000	$56,988,000	$56,225,000
	PER TON		$65.43	$64.47	$64.10	$62.83	$61.04	$60.99	$59.57	$58.53	$57.22	$55.96	$54.95	$53.50
COST FOR SYSTEM D	TRANSP.		$5,781,000	$5,922,000	$6,062,000	$6,194,000	$6,343,000	$6,475,000	$6,615,000	$6,756,000	$6,896,000	$7,037,000	$7,177,000	$7,309,000
	S/OM		$19,635,000	$19,504,000	$19,466,000	$19,298,000	$19,141,000	$19,262,000	$18,732,000	$18,464,000	$18,328,000	$17,800,000	$17,271,000	$16,875,000
	TRANSF.		$9,657,000	$9,456,000	$9,848,000	$9,454,000	$9,441,000	$9,764,000	$9,749,000	$9,718,000	$9,393,000	$9,389,000	$9,626,000	$9,159,000
	LANDFILL		$17,695,000	$17,693,000	$17,675,000	$17,654,000	$16,806,000	$16,805,000	$16,807,000	$16,824,000	$16,679,000	$16,695,000	$16,698,000	$16,698,000
	USER		$2,664,000	$2,709,000	$2,754,000	$2,796,000	$2,844,000	$2,886,000	$2,931,000	$2,976,000	$3,021,000	$3,066,000	$3,111,000	$3,153,000
	TOTAL		$55,432,000	$55,284,000	$55,805,000	$55,396,000	$54,575,000	$55,192,000	$54,834,000	$54,738,000	$54,317,000	$53,987,000	$53,883,000	$53,194,000
	PER TON		$62.48	$61.22	$60.79	$59.44	$57.57	$57.37	$56.12	$55.18	$53.94	$52.82	$51.96	$50.61

	YEAR	2003	2004	2005	2006	2007	AVERAGE
	WASTE FLOW	1,066,000	1,081,000	1,096,000	1,111,000	1,125,000	COSTS
COST FOR	TRANSP.	$9,989,000	$10,130,000	$10,270,000	$10,411,000	$10,542,000	$9,434,765
SYSTEM A	TRANSF.	$9,956,000	$9,456,000	$9,456,000	$9,580,000	$11,456,000	$9,896,529
	LANDFILL	$25,564,000	$26,244,000	$26,958,000	$27,707,000	$28,493,000	$23,399,118
	USER	$3,198,000	$3,243,000	$3,288,000	$3,333,000	$3,375,000	$3,020,471
	TOTAL	$48,707,000	$49,073,000	$49,972,000	$51,031,000	$53,866,000	$45,750,882
	PER TON	$45.69	$45.40	$45.59	$45.93	$47.88	$45
COST FOR	TRANSP.	$7,745,000	$7,886,000	$8,026,000	$8,167,000	$8,298,000	$7,190,588
SYSTEM B	CE	$13,366,000	$11,654,000	$11,462,000	$10,704,000	$9,947,000	$15,704,529
	TRANSF.	$9,651,000	$9,151,000	$9,151,000	$9,275,000	$11,151,000	$9,590,176
	LANDFILL	$17,517,000	$17,520,000	$17,536,000	$17,539,000	$17,539,000	$17,254,647
	USER	$3,198,000	$3,243,000	$3,288,000	$3,333,000	$3,375,000	$3,020,471
	TOTAL	$51,477,000	$49,454,000	$49,463,000	$49,018,000	$50,310,000	$52,760,412
	PER TON	$48.29	$45.75	$45.13	$44.12	$44.72	$53
COST FOR	TRANSP.	$10,393,000	$10,533,000	$10,674,000	$10,814,000	$10,945,000	$9,838,118
SYSTEM C	FLUOR	$14,131,000	$12,727,000	$12,571,000	$11,948,000	$11,327,000	$15,776,882
	TRANSF.	$9,956,000	$9,456,000	$9,456,000	$9,580,000	$11,456,000	$9,896,529
	LANDFILL	$16,714,000	$16,717,000	$16,733,000	$16,736,000	$16,736,000	$16,962,706
	USER	$3,198,000	$3,243,000	$3,288,000	$3,333,000	$3,375,000	$3,020,471
	TOTAL	$54,392,000	$52,676,000	$52,722,000	$52,411,000	$53,839,000	$55,494,706
	PER TON	$51.02	$48.73	$48.10	$47.17	$47.86	$56
COST FOR	TRANSP.	$11,824,000	$11,965,000	$12,105,000	$12,246,000	$12,377,000	$11,269,588
SYSTEM CC	FLUOR	$14,131,000	$12,727,000	$12,571,000	$11,948,000	$11,327,000	$15,776,882
W/BARGING	TRANSF.	$9,956,000	$9,456,000	$9,456,000	$9,580,000	$11,456,000	$9,896,529
	LANDFILL	$16,714,000	$16,717,000	$16,733,000	$16,736,000	$16,736,000	$16,962,706
	USER	$3,198,000	$3,243,000	$3,288,000	$3,333,000	$3,375,000	$3,020,471
	TOTAL	$55,823,000	$54,108,000	$54,153,000	$53,843,000	$55,271,000	$56,926,176
	PER TON	$52.37	$50.05	$49.41	$48.46	$49.13	$57
COST FOR	TRANSP.	$7,449,000	$7,590,000	$7,730,000	$7,871,000	$8,002,000	$6,894,647
SYSTEM D	S/OM	$15,955,000	$14,778,000	$14,644,000	$14,121,000	$13,599,000	$17,466,059
	TRANSF.	$9,651,000	$9,151,000	$9,151,000	$9,275,000	$11,151,000	$9,590,176
	LANDFILL	$16,714,000	$16,717,000	$16,732,000	$16,735,000	$16,736,000	$16,962,529
	USER	$3,198,000	$3,243,000	$3,288,000	$3,333,000	$3,375,000	$3,020,471
	TOTAL	$52,967,000	$51,479,000	$51,545,000	$51,335,000	$52,863,000	$53,933,882
	PER TON	$49.69	$47.62	$47.03	$46.21	$46.99	$54

METRO SOLID WASTE SYSTEM COSTS
CONSTANT DOLLARS ANALYSIS
(Dollars per ton)

	YEAR	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
	WASTE FLOW	874,000	888,000	903,000	918,000	932,000	948,000	962,000	977,000	992,000	1,007,000	1,022,000	1,037,000	1,051,000
COST FOR	TRANSP.	$6,804,000	$6,936,000	$7,076,000	$7,217,000	$7,348,000	$7,498,000	$7,629,000	$7,770,000	$7,910,000	$8,051,000	$8,191,000	$8,332,000	$8,463,000
SYSTEM E	RET	$6,181,000	$5,790,000	$5,777,000	$5,763,000	$5,749,000	$5,734,000	$5,718,000	$5,702,000	$5,686,000	$5,669,000	$5,651,000	$5,632,000	$5,613,000
	TRANSF.	$8,965,000	$8,895,000	$8,814,000	$9,258,000	$8,912,000	$8,953,000	$8,991,000	$9,361,000	$9,381,000	$9,108,000	$9,156,000	$9,046,000	$9,025,000
	LANDFILL	$15,356,000	$18,595,000	$18,594,000	$18,576,000	$18,554,000	$16,916,000	$16,916,000	$16,918,000	$16,935,000	$16,789,000	$16,806,000	$18,783,000	$18,783,000
	USER	$2,622,000	$2,664,000	$2,709,000	$2,754,000	$2,796,000	$2,844,000	$2,886,000	$2,931,000	$2,976,000	$3,021,000	$3,066,000	$3,111,000	$3,153,000
	TOTAL	$39,928,000	$42,880,000	$42,970,000	$43,568,000	$43,359,000	$41,945,000	$42,140,000	$42,682,000	$42,888,000	$42,638,000	$42,870,000	$44,904,000	$45,037,000
	PER TON	$45.68	$48.29	$47.59	$47.46	$46.52	$44.25	$43.80	$43.69	$43.23	$42.34	$41.95	$43.30	$42.85
COST FOR	TRANSP.		$5,063,000	$5,153,000	$5,244,000	$5,329,000	$5,426,000	$5,511,000	$5,602,000	$5,693,000	$5,807,000	$5,947,000	$6,088,000	$6,219,000
SYSTEM F	RET		$5,790,000	$5,777,000	$5,763,000	$5,749,000	$5,734,000	$5,718,000	$5,702,000	$5,686,000	$5,669,000	$5,651,000	$5,632,000	$5,613,000
	CE		$19,535,000	$19,161,000	$18,962,000	$18,571,000	$18,181,000	$18,174,000	$17,402,000	$17,013,000	$16,817,000	$16,047,000	$15,279,000	$14,702,000
	TRANSF.		$8,271,000	$8,190,000	$8,634,000	$8,288,000	$8,329,000	$8,367,000	$8,737,000	$8,757,000	$8,484,000	$8,532,000	$8,422,000	$8,401,000
	LANDFILL		$16,576,000	$16,574,000	$16,556,000	$16,535,000	$15,686,000	$15,686,000	$15,689,000	$16,693,000	$16,548,000	$16,564,000	$16,567,000	$16,567,000
	USER		$2,664,000	$2,709,000	$2,754,000	$2,796,000	$2,844,000	$2,886,000	$2,931,000	$2,976,000	$3,021,000	$3,066,000	$3,111,000	$3,153,000
	TOTAL		$57,899,000	$57,564,000	$57,913,000	$57,268,000	$56,200,000	$56,342,000	$56,063,000	$56,818,000	$56,346,000	$55,807,000	$55,099,000	$54,655,000
	PER TON		$65.20	$63.75	$63.09	$61.45	$59.28	$58.57	$57.38	$57.28	$55.95	$54.61	$53.13	$52.00
COST FOR	TRANSP.		$7,340,000	$7,479,000	$7,620,000	$7,751,000	$7,901,000	$8,032,000	$8,173,000	$8,313,000	$8,454,000	$8,595,000	$8,735,000	$8,866,000
SYSTEM G	RET		$5,790,000	$5,777,000	$5,763,000	$5,749,000	$5,734,000	$5,718,000	$5,702,000	$5,686,000	$5,669,000	$5,651,000	$5,632,000	$5,613,000
	FLUOR		$17,625,000	$17,754,000	$17,826,000	$17,784,000	$17,753,000	$18,041,000	$17,418,000	$17,107,000	$16,950,000	$16,323,000	$15,696,000	$15,226,000
	TRANSF.		$8,895,000	$8,814,000	$9,258,000	$8,912,000	$8,953,000	$8,991,000	$9,361,000	$9,381,000	$9,108,000	$9,156,000	$9,046,000	$9,025,000
	LANDFILL		$16,562,000	$16,560,000	$16,542,000	$16,521,000	$15,672,000	$15,672,000	$15,675,000	$16,114,000	$15,969,000	$15,985,000	$15,988,000	$15,988,000
	USER		$2,664,000	$2,709,000	$2,754,000	$2,796,000	$2,844,000	$2,886,000	$2,931,000	$2,976,000	$3,021,000	$3,066,000	$3,111,000	$3,153,000
	TOTAL		$58,876,000	$59,093,000	$59,763,000	$59,513,000	$58,857,000	$59,340,000	$59,260,000	$59,577,000	$59,171,000	$58,776,000	$58,208,000	$57,871,000
	PER TON		$66.30	$65.44	$65.10	$63.86	$62.09	$61.68	$60.66	$60.06	$58.76	$57.51	$56.13	$55.06
COST FOR	TRANSP.		$8,771,000	$8,911,000	$9,052,000	$9,183,000	$9,333,000	$9,464,000	$9,605,000	$9,745,000	$9,886,000	$10,026,000	$10,167,000	$10,298,000
SYSTEM GG	RET		$5,790,000	$5,777,000	$5,763,000	$5,749,000	$5,734,000	$5,718,000	$5,702,000	$5,686,000	$5,669,000	$5,651,000	$5,632,000	$5,613,000
	FLUOR		$17,625,000	$17,754,000	$17,826,000	$17,784,000	$17,753,000	$18,041,000	$17,418,000	$17,107,000	$16,950,000	$16,323,000	$15,696,000	$15,226,000
W/BARGING	TRANSF.		$8,895,000	$8,814,000	$9,258,000	$8,912,000	$8,953,000	$8,991,000	$9,361,000	$9,381,000	$9,108,000	$9,156,000	$9,046,000	$9,025,000
	LANDFILL		$16,562,000	$16,560,000	$16,542,000	$16,521,000	$15,672,000	$15,672,000	$15,675,000	$16,114,000	$15,969,000	$15,985,000	$15,988,000	$15,988,000
	USER		$2,664,000	$2,709,000	$2,754,000	$2,796,000	$2,844,000	$2,886,000	$2,931,000	$2,976,000	$3,021,000	$3,066,000	$3,111,000	$3,153,000
	TOTAL		$60,307,000	$60,525,000	$61,195,000	$60,945,000	$60,289,000	$60,772,000	$60,692,000	$61,009,000	$60,603,000	$60,207,000	$59,640,000	$59,303,000
	PER TON		$67.91	$67.03	$66.66	$65.39	$63.60	$63.17	$62.12	$61.50	$60.18	$58.91	$57.51	$56.43

	YEAR WASTE FLOW	2003 1,066,000	2004 1,081,000	2005 1,096,000	2006 1,111,000	2007 1,125,000	AVERAGE COSTS
COST FOR SYSTEM E	TRANSP.	$8,604,000	$8,744,000	$8,885,000	$9,025,000	$9,157,000	$8,049,176
	RET	$5,593,000	$5,572,000	$5,551,000	$5,529,000	$5,506,000	$5,660,882
	TRANSF.	$9,568,000	$9,120,000	$9,171,000	$9,285,000	$10,271,000	$9,195,000
	LANDFILL	$18,800,000	$18,802,000	$17,633,000	$17,636,000	$17,636,000	$17,863,059
	USER	$3,198,000	$3,243,000	$3,288,000	$3,333,000	$3,375,000	$3,020,471
	TOTAL	$45,763,000	$45,481,000	$44,528,000	$44,808,000	$45,945,000	$43,788,588
	PER TON	$42.93	$42.07	$40.63	$40.33	$40.84	$44
COST FOR SYSTEM F	TRANSP.	$6,360,000	$6,500,000	$6,641,000	$6,781,000	$6,912,000	$5,898,588
	RET	$5,593,000	$5,572,000	$5,551,000	$5,529,000	$5,506,000	$5,660,882
	CE	$13,366,000	$11,654,000	$11,462,000	$10,704,000	$9,947,000	$15,704,529
	TRANSF.	$8,944,000	$8,496,000	$8,547,000	$8,661,000	$9,647,000	$8,571,000
	LANDFILL	$16,583,000	$16,586,000	$16,601,000	$16,605,000	$16,605,000	$16,424,765
	USER	$3,198,000	$3,243,000	$3,288,000	$3,333,000	$3,375,000	$3,020,471
	TOTAL	$54,044,000	$52,051,000	$52,090,000	$51,613,000	$51,992,000	$55,280,235
	PER TON	$50.70	$48.15	$47.53	$46.46	$46.22	$55
COST FOR SYSTEM G	TRANSP.	$9,007,000	$9,147,000	$9,288,000	$9,429,000	$9,560,000	$8,452,353
	RET	$5,593,000	$5,572,000	$5,551,000	$5,529,000	$5,506,000	$5,660,882
	FLUOR	$14,131,000	$12,727,000	$12,571,000	$11,948,000	$11,327,000	$15,776,882
	TRANSF.	$9,568,000	$9,120,000	$9,171,000	$9,285,000	$10,271,000	$9,195,000
	LANDFILL	$16,004,000	$16,007,000	$16,587,000	$16,591,000	$16,591,000	$16,178,118
	USER	$3,198,000	$3,243,000	$3,288,000	$3,333,000	$3,375,000	$3,020,471
	TOTAL	$57,501,000	$55,816,000	$56,456,000	$56,115,000	$56,630,000	$58,283,706
	PER TON	$53.94	$51.63	$51.51	$50.51	$50.34	$58
COST FOR SYSTEM GG	TRANSP.	$10,439,000	$10,579,000	$10,720,000	$10,860,000	$10,991,000	$9,884,118
	RET	$5,593,000	$5,572,000	$5,551,000	$5,529,000	$5,506,000	$5,660,882
	FLUOR	$14,131,000	$12,727,000	$12,571,000	$11,948,000	$11,327,000	$15,776,882
W/BARGING	TRANSF.	$9,568,000	$9,120,000	$9,171,000	$9,285,000	$10,271,000	$9,195,000
	LANDFILL	$16,004,000	$16,007,000	$16,587,000	$16,591,000	$16,591,000	$16,178,118
	USER	$3,198,000	$3,243,000	$3,288,000	$3,333,000	$3,375,000	$3,020,471
	TOTAL	$58,933,000	$57,248,000	$57,888,000	$57,546,000	$58,061,000	$59,715,471
	PER TON	$55.28	$52.96	$52.82	$51.80	$51.61	$60

	YEAR	2003	2004	2005	2006	2007	AVERAGE
	WASTE FLOW	1,066,000	1,081,000	1,096,000	1,111,000	1,125,000	COSTS
COST FOR SYSTEM H	TRANSP.	$6,064,000	$6,204,000	$6,345,000	$6,485,000	$6,616,000	$5,600,412
	RET	$5,593,000	$5,572,000	$5,551,000	$5,529,000	$5,506,000	$5,660,882
	S/OM	$15,955,000	$14,778,000	$14,644,000	$14,121,000	$13,599,000	$17,466,059
	TRANSF.	$8,944,000	$8,496,000	$8,547,000	$8,661,000	$9,647,000	$8,571,000
	LANDFILL	$16,004,000	$16,007,000	$16,587,000	$16,591,000	$16,591,000	$16,178,118
	USER	$3,198,000	$3,243,000	$3,288,000	$3,333,000	$3,375,000	$3,020,471
	TOTAL	$55,758,000	$54,300,000	$54,962,000	$54,720,000	$55,334,000	$56,496,941
	PER TON	$52.31	$50.23	$50.15	$49.25	$49.19	$56
COST FOR SYSTEM I	TRANSP.	$9,297,000	$9,438,000	$9,578,000	$9,719,000	$9,850,000	$8,742,471
	RET	$4,067,000	$4,057,000	$4,046,000	$4,035,000	$0	$3,864,118
	TRANSF.	$9,568,000	$9,120,000	$9,171,000	$9,285,000	$10,271,000	$9,195,000
	LANDFILL	$18,873,000	$17,691,000	$17,707,000	$17,709,000	$17,710,000	$17,982,941
	USER	$3,198,000	$3,243,000	$3,288,000	$3,333,000	$3,375,000	$3,020,471
	TOTAL	$45,003,000	$43,549,000	$43,790,000	$44,081,000	$41,206,000	$42,805,000
	PER TON	$42.22	$40.29	$39.95	$39.68	$36.63	$43
COST FOR SYSTEM J	TRANSP.	$7,010,000	$7,149,000	$7,290,000	$7,429,000	$7,567,000	$6,459,176
	CE	$14,988,000	$12,819,000	$12,580,000	$11,621,000	$10,673,000	$17,937,706
	TRANSF.	$9,515,000	$9,024,000	$9,025,000	$9,149,000	$11,012,000	$9,448,765
	LANDFILL	$17,201,000	$17,207,000	$17,226,000	$17,232,000	$17,251,000	$16,688,294
	USER	$3,153,000	$3,198,000	$3,243,000	$3,288,000	$3,333,000	$2,976,176
	TOTAL	$51,867,000	$49,397,000	$49,364,000	$48,719,000	$49,836,000	$53,510,118
	PER TON	$48.66	$45.70	$45.04	$43.85	$44.30	$54
COST FOR SYSTEM K	TRANSP.	$10,364,000	$10,504,000	$10,645,000	$10,785,000	$10,927,000	$9,811,118
	FLUOR	$16,432,000	$14,658,000	$14,464,000	$13,680,000	$12,908,000	$18,506,706
	TRANSF.	$9,816,000	$9,325,000	$9,327,000	$9,451,000	$11,313,000	$9,750,765
	LANDFILL	$15,833,000	$17,175,000	$17,194,000	$17,200,000	$17,219,000	$16,381,588
	USER	$3,153,000	$3,198,000	$3,243,000	$3,288,000	$3,333,000	$2,976,176
	TOTAL	$55,598,000	$54,860,000	$54,873,000	$54,404,000	$55,700,000	$57,426,353
	PER TON	$52.16	$50.75	$50.07	$48.97	$49.51	$57
COST FOR SYSTEM KK W/BARGING	TRANSP.	$12,178,000	$12,320,000	$12,460,000	$12,602,000	$12,744,000	$11,624,529
	FLUOR	$16,432,000	$14,658,000	$14,464,000	$13,680,000	$12,908,000	$18,506,706
	TRANSF.	$9,816,000	$9,325,000	$9,327,000	$9,451,000	$11,313,000	$9,750,765
	LANDFILL	$15,833,000	$17,175,000	$17,194,000	$17,200,000	$17,219,000	$16,381,588
	USER	$3,153,000	$3,198,000	$3,243,000	$3,288,000	$3,333,000	$2,976,176
	TOTAL	$57,412,000	$56,676,000	$56,688,000	$56,221,000	$57,517,000	$59,239,765
	PER TON	$53.86	$52.43	$51.72	$50.60	$51.13	$59

METRO SOLID WASTE SYSTEM COSTS
CONSTANT DOLLARS ANALYSIS
(Dollars per ton)

	YEAR	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
	WASTE FLOW	874,000	888,000	903,000	918,000	932,000	948,000	962,000	977,000	992,000	1,007,000	1,022,000	1,037,000	1,051,000
COST FOR	TRANSP.		$4,979,000	$5,114,000	$5,253,000	$5,390,000	$5,526,000	$5,669,000	$5,803,000	$5,943,000	$6,082,000	$6,222,000	$6,362,000	$6,499,000
SYSTEM L	S/O-M		$21,500,000	$21,253,000	$21,212,000	$21,028,000	$20,555,000	$20,996,000	$20,309,000	$19,975,000	$19,809,000	$19,144,000	$18,482,000	$18,001,000
	TRANSF.		$9,505,000	$9,299,000	$9,687,000	$9,312,000	$9,281,000	$9,622,000	$9,599,000	$9,571,000	$9,253,000	$9,251,000	$9,487,000	$9,037,000
	LANDFILL		$16,771,000	$16,754,000	$16,741,000	$16,743,000	$15,877,000	$15,915,000	$15,904,000	$15,924,000	$15,785,000	$15,804,000	$15,810,000	$15,829,000
	USER		$2,622,000	$2,664,000	$2,709,000	$2,754,000	$2,796,000	$2,844,000	$2,886,000	$2,931,000	$2,976,000	$3,021,000	$3,066,000	$3,111,000
	TOTAL		$55,377,000	$55,084,000	$55,602,000	$55,227,000	$54,035,000	$55,046,000	$54,501,000	$54,344,000	$53,905,000	$53,442,000	$53,207,000	$52,477,000
	PER TON		$62.36	$61.00	$60.57	$59.26	$57.00	$57.22	$55.78	$54.78	$53.53	$52.29	$51.31	$49.93
COST FOR	TRANSP.		$5,244,000	$5,378,000	$5,517,000	$5,654,000	$5,791,000	$5,934,000	$6,067,000	$6,208,000	$6,347,000	$6,487,000	$6,627,000	$6,765,000
SYSTEM M	RET		$5,699,000	$5,681,000	$5,669,000	$5,663,000	$5,637,000	$5,635,000	$5,614,000	$5,600,000	$5,585,000	$5,568,000	$5,551,000	$5,538,000
	CE		$18,399,000	$18,120,000	$17,984,000	$17,732,000	$17,423,000	$17,458,000	$16,898,000	$16,628,000	$16,491,000	$15,951,000	$15,412,000	$15,021,000
	TRANSF.		$8,141,000	$8,034,000	$8,493,000	$8,164,000	$8,189,000	$8,245,000	$8,603,000	$8,625,000	$8,358,000	$8,407,000	$8,301,000	$8,289,000
	LANDFILL		$16,797,000	$16,781,000	$16,768,000	$16,770,000	$15,904,000	$15,941,000	$16,487,000	$16,507,000	$16,368,000	$16,388,000	$16,394,000	$16,413,000
	USER		$2,622,000	$2,664,000	$2,709,000	$2,754,000	$2,796,000	$2,844,000	$2,886,000	$2,931,000	$2,976,000	$3,021,000	$3,066,000	$3,111,000
	TOTAL		$56,902,000	$56,678,000	$57,140,000	$56,737,000	$55,740,000	$56,057,000	$56,555,000	$56,499,000	$56,125,000	$55,822,000	$55,351,000	$55,137,000
	PER TON		$64.08	$62.77	$62.24	$60.88	$58.80	$58.27	$57.89	$56.95	$55.73	$54.62	$53.38	$52.46
COST FOR	TRANSP.		$7,107,000	$7,239,000	$7,379,000	$7,518,000	$7,652,000	$7,799,000	$7,931,000	$8,071,000	$8,212,000	$8,352,000	$8,492,000	$8,631,000
SYSTEM N	RET		$5,699,000	$5,681,000	$5,669,000	$5,663,000	$5,637,000	$5,635,000	$5,614,000	$5,600,000	$5,585,000	$5,568,000	$5,551,000	$5,538,000
	FLUOR		$14,750,000	$14,765,000	$14,892,000	$14,923,000	$14,908,000	$15,176,000	$14,729,000	$14,516,000	$14,411,000	$13,975,000	$13,537,000	$13,222,000
	TRANSF.		$8,755,000	$8,668,000	$9,107,000	$8,778,000	$8,802,000	$8,860,000	$9,217,000	$9,239,000	$8,972,000	$9,021,000	$8,916,000	$8,905,000
	LANDFILL		$16,777,000	$16,761,000	$16,748,000	$16,750,000	$15,884,000	$15,921,000	$16,467,000	$16,487,000	$16,348,000	$16,367,000	$16,374,000	$16,393,000
	USER		$2,622,000	$2,664,000	$2,709,000	$2,754,000	$2,796,000	$2,844,000	$2,886,000	$2,931,000	$2,976,000	$3,021,000	$3,066,000	$3,111,000
	TOTAL		$55,710,000	$55,778,000	$56,504,000	$56,386,000	$55,679,000	$56,235,000	$56,844,000	$56,844,000	$56,504,000	$56,304,000	$55,936,000	$55,800,000
	PER TON		$62.74	$61.77	$61.55	$60.50	$58.73	$58.46	$58.18	$57.30	$56.11	$55.09	$53.94	$53.09
COST FOR	TRANSP.		$8,113,000	$8,245,000	$8,385,000	$8,526,000	$8,657,000	$8,807,000	$8,938,000	$9,079,000	$9,219,000	$9,360,000	$9,501,000	$9,641,000
SYSTEM NN	RET		$5,699,000	$5,681,000	$5,669,000	$5,663,000	$5,637,000	$5,635,000	$5,614,000	$5,600,000	$5,585,000	$5,568,000	$5,551,000	$5,538,000
	FLUOR		$14,750,000	$14,765,000	$14,892,000	$14,923,000	$14,908,000	$15,176,000	$14,729,000	$14,516,000	$14,411,000	$13,975,000	$13,537,000	$13,222,000
W/BARGING	TRANSF.		$8,755,000	$8,668,000	$9,107,000	$8,778,000	$8,802,000	$8,860,000	$9,217,000	$9,239,000	$8,972,000	$9,021,000	$8,916,000	$8,905,000
	LANDFILL		$16,777,000	$16,761,000	$16,748,000	$16,750,000	$15,884,000	$15,921,000	$16,467,000	$16,487,000	$16,348,000	$16,367,000	$16,374,000	$16,393,000
	USER		$2,622,000	$2,664,000	$2,709,000	$2,754,000	$2,796,000	$2,844,000	$2,886,000	$2,931,000	$2,976,000	$3,021,000	$3,066,000	$3,111,000
	TOTAL		$56,716,000	$56,784,000	$57,510,000	$57,394,000	$56,684,000	$57,243,000	$57,851,000	$57,852,000	$57,511,000	$57,312,000	$56,945,000	$56,810,000
	PER TON		$63.87	$62.88	$62.65	$61.58	$59.79	$59.50	$59.21	$58.32	$57.11	$56.08	$54.91	$54.05

	YEAR	2003	2004	2005	2006	2007	AVERAGE
	WASTE FLOW	1,066,000	1,081,000	1,096,000	1,111,000	1,125,000	COSTS
COST FOR SYSTEM L	TRANSP.	$6,632,000	$6,773,000	$6,912,000	$7,052,000	$7,189,000	$6,082,353
	S/O-M	$16,825,000	$15,337,000	$15,173,000	$14,514,000	$13,868,000	$18,704,765
	TRANSF.	$9,515,000	$9,024,000	$9,025,000	$9,149,000	$11,012,000	$9,448,765
	LANDFILL	$15,832,000	$17,175,000	$17,194,000	$17,200,000	$17,218,000	$16,380,941
	USER	$3,153,000	$3,198,000	$3,243,000	$3,288,000	$3,333,000	$2,976,176
	TOTAL	$51,957,000	$51,507,000	$51,547,000	$51,203,000	$52,620,000	$53,593,000
	PER TON	$48.74	$47.65	$47.03	$46.09	$46.77	$54
COST FOR SYSTEM M	TRANSP.	$6,898,000	$7,038,000	$7,177,000	$7,318,000	$7,455,000	$6,347,353
	RET	$5,514,000	$5,495,000	$5,475,000	$5,454,000	$5,437,000	$5,577,353
	CE	$14,065,000	$12,856,000	$12,723,000	$12,187,000	$11,662,000	$15,706,471
	TRANSF.	$8,818,000	$8,378,000	$8,430,000	$8,544,000	$9,527,000	$8,445,059
	LANDFILL	$16,416,000	$16,422,000	$16,441,000	$16,447,000	$16,465,000	$16,453,471
	USER	$3,153,000	$3,198,000	$3,243,000	$3,288,000	$3,333,000	$2,976,176
	TOTAL	$54,864,000	$53,387,000	$53,489,000	$53,238,000	$53,879,000	$55,505,882
	PER TON	$51.47	$49.39	$48.80	$47.92	$47.89	$56
COST FOR SYSTEM N	TRANSP.	$8,764,000	$8,904,000	$9,044,000	$9,184,000	$9,324,000	$8,211,941
	RET	$5,514,000	$5,495,000	$5,475,000	$5,454,000	$5,437,000	$5,577,353
	FLUOR	$12,441,000	$11,454,000	$11,347,000	$10,910,000	$10,484,000	$13,555,294
	TRANSF.	$9,434,000	$8,993,000	$9,046,000	$9,159,000	$10,143,000	$9,059,706
	LANDFILL	$16,396,000	$16,402,000	$16,421,000	$16,427,000	$16,445,000	$16,433,412
	USER	$3,153,000	$3,198,000	$3,243,000	$3,288,000	$3,333,000	$2,976,176
	TOTAL	$55,702,000	$54,446,000	$54,576,000	$54,422,000	$55,166,000	$55,813,882
	PER TON	$52.25	$50.37	$49.80	$48.98	$49.04	$56
COST FOR SYSTEM NN	TRANSP.	$9,772,000	$9,913,000	$10,053,000	$10,193,000	$10,334,000	$9,219,765
	RET	$5,514,000	$5,495,000	$5,475,000	$5,454,000	$5,437,000	$5,577,353
	FLUOR	$12,441,000	$11,454,000	$11,347,000	$10,910,000	$10,484,000	$13,555,294
W/BARGING	TRANSF.	$9,434,000	$8,993,000	$9,046,000	$9,159,000	$10,143,000	$9,059,706
	LANDFILL	$16,396,000	$16,402,000	$16,421,000	$16,427,000	$16,445,000	$16,433,412
	USER	$3,153,000	$3,198,000	$3,243,000	$3,288,000	$3,333,000	$2,976,176
	TOTAL	$56,710,000	$55,455,000	$55,585,000	$55,431,000	$56,176,000	$56,821,706
	PER TON	$53.20	$51.30	$50.72	$49.89	$49.93	$57

METRO SOLID WASTE SYSTEM COSTS
CONSTANT DOLLARS ANALYSIS
(Dollars per ton)

	YEAR	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
	WASTE FLOW	874,000	888,000	903,000	918,000	932,000	948,000	962,000	977,000	992,000	1,007,000	1,022,000	1,037,000	1,051,000
COST FOR SYSTEM D	TRANSP.		$5,037,000	$5,171,000	$5,311,000	$5,447,000	$5,584,000	$5,726,000	$5,861,000	$6,000,000	$6,140,000	$6,279,000	$6,420,000	$6,556,000
	RET		$5,699,000	$5,681,000	$5,669,000	$5,663,000	$5,637,000	$5,635,000	$5,614,000	$5,600,000	$5,585,000	$5,568,000	$5,551,000	$5,538,000
	S/O-M		$16,691,000	$16,549,000	$16,526,000	$16,430,000	$16,288,000	$16,410,000	$16,023,000	$15,838,000	$15,745,000	$15,375,000	$15,006,000	$14,742,000
	TRANSF.		$8,141,000	$8,054,000	$8,493,000	$8,164,000	$8,189,000	$8,245,000	$8,603,000	$8,625,000	$8,358,000	$8,407,000	$8,301,000	$8,289,000
	LANDFILL		$16,777,000	$16,761,000	$16,748,000	$16,750,000	$15,884,000	$15,921,000	$16,467,000	$16,487,000	$16,348,000	$16,367,000	$16,374,000	$16,393,000
	USER		$2,622,000	$2,664,000	$2,709,000	$2,754,000	$2,796,000	$2,844,000	$2,886,000	$2,931,000	$2,976,000	$3,021,000	$3,066,000	$3,111,000
	TOTAL		$54,967,000	$54,880,000	$55,456,000	$55,208,000	$54,378,000	$54,781,000	$55,454,000	$55,481,000	$55,152,000	$55,017,000	$54,718,000	$54,629,000
	PER TON		$61.90	$60.78	$60.41	$59.24	$57.36	$56.94	$56.76	$55.93	$54.77	$53.83	$52.77	$51.98

	YEAR	2003	2004	2005	2006	2007	AVERAGE
	WASTE FLOW	1,066,000	1,081,000	1,096,000	1,111,000	1,125,000	COSTS
COST FOR SYSTEM D	TRANSP.	$6,691,000	$6,830,000	$6,970,000	$7,110,000	$7,247,000	$6,140,000
	RET	$5,514,000	$5,495,000	$5,475,000	$5,454,000	$5,437,000	$5,577,353
	S/O-M	$14,083,000	$13,254,000	$13,162,000	$12,794,000	$12,438,000	$15,138,471
	TRANSF.	$8,818,000	$8,378,000	$8,430,000	$8,544,000	$9,527,000	$8,445,059
	LANDFILL	$16,396,000	$16,402,000	$16,421,000	$16,427,000	$16,445,000	$16,433,412
	USER	$3,153,000	$3,198,000	$3,243,000	$3,288,000	$3,333,000	$2,976,176
	TOTAL	$54,655,000	$53,557,000	$53,701,000	$53,617,000	$54,427,000	$54,710,471
	PER TON	$51.27	$49.54	$49.00	$48.26	$48.38	$55

METRO SOLID WASTE SYSTEM COSTS
CONSTANT DOLLARS ANALYSIS
(Dollars per ton)

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
	YEAR	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
	WASTE FLOW	874,000	888,000	903,000	918,000	932,000	948,000	962,000	977,000	992,000	1,007,000	1,022,000	1,037,000	1,051,000
COST FOR SYSTEM H	TRANSP.		$4,758,000	$4,850,000	$4,942,000	$5,028,000	$5,126,000	$5,212,000	$5,304,000	$5,396,000	$5,511,000	$5,651,000	$5,792,000	$5,923,000
	RET		$5,790,000	$5,777,000	$5,763,000	$5,749,000	$5,734,000	$5,718,000	$5,702,000	$5,686,000	$5,669,000	$5,651,000	$5,632,000	$5,613,000
	S/ON		$19,685,000	$19,504,000	$19,466,000	$19,298,000	$19,141,000	$19,262,000	$18,732,000	$18,464,000	$18,328,000	$17,800,000	$17,271,000	$16,875,000
	TRANSF.		$8,271,000	$8,190,000	$8,634,000	$8,288,000	$8,329,000	$8,367,000	$8,737,000	$8,757,000	$8,484,000	$8,532,000	$8,422,000	$8,401,000
	LANDFILL		$16,562,000	$16,560,000	$16,542,000	$16,521,000	$15,672,000	$15,672,000	$15,675,000	$16,114,000	$15,969,000	$15,985,000	$15,988,000	$15,988,000
	USER		$2,664,000	$2,709,000	$2,754,000	$2,796,000	$2,844,000	$2,886,000	$2,931,000	$2,976,000	$3,021,000	$3,066,000	$3,111,000	$3,153,000
	TOTAL		$57,730,000	$57,590,000	$58,101,000	$57,680,000	$56,846,000	$57,117,000	$57,081,000	$57,393,000	$56,982,000	$56,685,000	$56,216,000	$55,953,000
	PER TON		$65.01	$63.78	$63.29	$61.89	$59.96	$59.37	$58.42	$57.86	$56.59	$55.46	$54.21	$53.24
COST FOR SYSTEM I	TRANSP.	$7,498,000	$7,629,000	$7,770,000	$7,910,000	$8,041,000	$8,191,000	$8,322,000	$8,463,000	$8,604,000	$8,744,000	$8,885,000	$9,025,000	$9,156,000
	RET	$4,361,000	$4,165,000	$4,159,000	$4,152,000	$4,145,000	$4,137,000	$4,129,000	$4,122,000	$4,113,000	$4,105,000	$4,096,000	$4,085,000	$4,077,000
	TRANSF.	$8,965,000	$8,895,000	$8,814,000	$9,258,000	$8,912,000	$8,953,000	$8,991,000	$9,361,000	$9,381,000	$9,108,000	$9,156,000	$9,046,000	$9,025,000
	LANDFILL	$15,429,000	$18,668,000	$18,667,000	$18,649,000	$18,627,000	$16,990,000	$16,989,000	$16,991,000	$17,008,000	$16,863,000	$18,855,000	$18,857,000	$18,856,000
	USER	$2,622,000	$2,664,000	$2,709,000	$2,754,000	$2,796,000	$2,844,000	$2,886,000	$2,931,000	$2,976,000	$3,021,000	$3,066,000	$3,111,000	$3,153,000
	TOTAL	$38,875,000	$42,021,000	$42,119,000	$42,723,000	$42,521,000	$41,115,000	$41,317,000	$41,868,000	$42,082,000	$41,841,000	$44,058,000	$44,124,000	$44,267,000
	PER TON	$44.48	$47.32	$46.64	$46.54	$45.62	$43.37	$42.95	$42.85	$42.42	$41.55	$43.11	$42.55	$42.12
COST FOR SYSTEM J	TRANSP.		$5,356,000	$5,489,000	$5,629,000	$5,766,000	$5,903,000	$6,046,000	$6,180,000	$6,319,000	$6,459,000	$6,599,000	$6,739,000	$6,876,000
	CE		$22,771,000	$22,279,000	$22,032,000	$21,567,000	$21,034,000	$21,076,000	$20,080,000	$19,593,000	$19,348,000	$18,377,000	$17,407,000	$16,696,000
	TRANSF.		$9,505,000	$9,299,000	$9,687,000	$9,312,000	$9,281,000	$9,622,000	$9,599,000	$9,571,000	$9,253,000	$9,251,000	$9,487,000	$9,037,000
	LANDFILL		$16,803,000	$16,786,000	$16,773,000	$16,776,000	$15,910,000	$15,947,000	$16,493,000	$16,513,000	$16,373,000	$16,393,000	$16,399,000	$16,418,000
	USER		$2,622,000	$2,664,000	$2,709,000	$2,754,000	$2,796,000	$2,844,000	$2,886,000	$2,931,000	$2,976,000	$3,021,000	$3,066,000	$3,111,000
	TOTAL		$57,057,000	$56,517,000	$56,830,000	$56,175,000	$54,924,000	$55,535,000	$55,238,000	$54,927,000	$54,409,000	$53,641,000	$53,098,000	$52,138,000
	PER TON		$64.25	$62.59	$61.91	$60.27	$57.94	$57.73	$56.54	$55.37	$54.03	$52.49	$51.20	$49.61
COST FOR SYSTEM K	TRANSP.		$8,705,000	$8,835,000	$8,976,000	$9,117,000	$9,247,000	$9,398,000	$9,529,000	$9,670,000	$9,811,000	$9,951,000	$10,092,000	$10,233,000
	FLUOR		$20,971,000	$20,927,000	$21,077,000	$21,053,000	$20,961,000	$21,356,000	$20,555,000	$20,169,000	$19,978,000	$19,191,000	$18,403,000	$17,831,000
	TRANSF.		$9,805,000	$9,599,000	$9,988,000	$9,613,000	$9,582,000	$9,941,000	$9,900,000	$9,871,000	$9,554,000	$9,552,000	$9,788,000	$9,338,000
	LANDFILL		$16,771,000	$16,755,000	$16,742,000	$16,744,000	$15,878,000	$15,915,000	$15,905,000	$15,925,000	$15,785,000	$15,805,000	$15,811,000	$15,830,000
	USER		$2,622,000	$2,664,000	$2,709,000	$2,754,000	$2,796,000	$2,844,000	$2,886,000	$2,931,000	$2,976,000	$3,021,000	$3,066,000	$3,111,000
	TOTAL		$58,874,000	$58,780,000	$59,492,000	$59,281,000	$58,464,000	$59,454,000	$58,775,000	$58,566,000	$58,104,000	$57,520,000	$57,160,000	$56,343,000
	PER TON		$66.30	$65.09	$64.81	$63.61	$61.67	$61.80	$60.16	$59.04	$57.70	$56.28	$55.12	$53.61
COST FOR SYSTEM KK W/BARGING	TRANSP.		$10,516,000	$10,645,000	$10,786,000	$10,930,000	$11,057,000	$11,212,000	$11,341,000	$11,483,000	$11,623,000	$11,765,000	$11,906,000	$12,049,000
	FLUOR		$20,971,000	$20,927,000	$21,077,000	$21,053,000	$20,961,000	$21,356,000	$20,555,000	$20,169,000	$19,978,000	$19,191,000	$18,403,000	$17,831,000
	TRANSF.		$9,805,000	$9,599,000	$9,988,000	$9,613,000	$9,582,000	$9,941,000	$9,900,000	$9,871,000	$9,554,000	$9,552,000	$9,788,000	$9,338,000
	LANDFILL		$16,771,000	$16,755,000	$16,742,000	$16,744,000	$15,878,000	$15,915,000	$15,905,000	$15,925,000	$15,785,000	$15,805,000	$15,811,000	$15,830,000
	USER		$2,622,000	$2,664,000	$2,709,000	$2,754,000	$2,796,000	$2,844,000	$2,886,000	$2,931,000	$2,976,000	$3,021,000	$3,066,000	$3,111,000
	TOTAL		$60,685,000	$60,590,000	$61,302,000	$61,094,000	$60,274,000	$61,268,000	$60,587,000	$60,379,000	$59,916,000	$59,334,000	$58,974,000	$58,159,000
	PER TON		$68.34	$67.10	$66.78	$65.55	$63.58	$63.69	$62.01	$60.87	$59.50	$58.06	$56.87	$55.34

APPENDIX C

LANDFILL COSTS

Final Feasibility Study Report

BACONA ROAD POTENTIAL LANDFILL SITE

Prepared for
Oregon Department of Environmental Quality

REGISTERED PROFESSIONAL ENGINEER
8480
OREGON
August 22, 1975
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May 1987

Section 5
COST ESTIMATE

APPROACH

An order-of-magnitude level cost estimate has been prepared for each of the the conceptual site development plans. This estimate includes projected capital and operational costs. These costs have been input to a computer model that predicts the true social cost of disposing solid waste at the Bacona Road site. The cost model uses economic analyses to make expenditures in future years comparable in today's dollars.

The site selection process followed by DEQ, as outlined in the October 1986 report, Selection of Sites for Feasibility Analysis, has used detailed technical, environmental, and land use criteria to identify sites with physical features that offer superior natural environmental protection. In previous work on potential sites, indirect measures of costs were used to evaluate sites. The detailed conceptual site plans and Neighborhood Protection Plan in this Final Feasibility Study Report allow a more direct comparison of site costs. This section focuses on the cost of development, operation, closure, and post-closure care of the Bacona Road site.

This cost estimate is based on the proposed conceptual site plan and Neighborhood Protection Plan presented in this
* report. Changes made to the conceptual plan and the Neighborhood Protection Plan after the Draft Feasibility Study Report was prepared have resulted in changes to estimated costs.

COST ESTIMATING PHILOSOPHY

Fiscal impacts on agencies and individuals is an important consideration in decision-making. Because of the relative importance of costs, a rigorous and structured approach to estimating costs has been developed. This approach is outlined in a statement titled, "Expected Accuracy of Estimates," from The Cost Engineer's Notebook published by the American Association of Cost Engineers.

Even for a scientific approach to cost estimating, however, the results will remain somewhat inexact. It is not possible to estimate costs exactly because of factors beyond the control of the estimator. These include market factors, construction conditions, material availability, labor relations, and other unforeseeable future impacts. Because of these unforeseeable factors in cost estimating, costs are developed within defined ranges of accuracy. A range provides upper and lower cost limits to account for differences between actual and estimated costs due to various factors. These factors include the level of detail of the information supplied with the proposal, regional factors, and the cost estimator's own professional opinion of the likely degree of impact of unforeseeable factors.

The cost estimate presented in this study for the Bacona Road landfill is an order-of-magnitude level cost estimate. This means that costs presented can be expected to be accurate within +50 percent or -30 percent of the indicated value. This level of estimate is routinely used for comparison of alternatives at the feasibility study level. The methodology used in developing all costs is the same, resulting in costs that can be the basis for sound decisions.

BACONA ROAD LANDFILL COST FACTORS

The equipment and operating procedures for a sanitary landfill vary with the type and quantity of refuse accepted for disposal and with unique site conditions. Accordingly, the associated costs for different landfills that accept the same type of refuse will be different. At the Bacona Road site, the costs of construction, operation, and closure are influenced by the following factors:

- Abundant supplies of cover material onsite, lowering costs
- * Construction of about 4 miles of new two-lane, paved site access road, and widening Highway 47, increasing costs
- Large site capacity, lowering unit costs
- * Requirement to pump treated leachate to the Hillsboro POTW, increasing costs

Site development costs for modern sanitary landfill facilities have increased as a result of advances in technology and more stringent regulations. Modern landfills require careful site preparation prior to construction. Sites requiring extensive site preparation will generally result in a greater net unit operating cost than more straightforward sites.

A major item in sanitary landfill operations costs is the purchase, transport, and placement of earth cover material. The cost for this item over the entire site life can be the single most expensive item in a sanitary landfill. Therefore, sites that have an adequate amount of cover material onsite, such as the Bacona Road site, can generally be operated for a lower net unit operating cost.

Total capital costs for the Bacona Road landfill site were separated into site work, utilities, buildings, roads, surface water control, landfill area construction, leachate collection system, leachate control system, environmental monitoring systems, berms and landscaping, Neighborhood Protection Plan features, and ancillary features. Capital costs listed are total capital expenditures over the life of the site.

Total estimated operation and maintenance costs assume payments to a contract operator to cover his labor; equipment O&M, including annual environmental control maintenance; operation reserve funds to cover recurring maintenance costs to fixed facilities and utilities; leachate treatment, erosion control and landscaping; and costs for Neighborhood Protection Plan features. Operation and maintenance costs listed are total O&M costs over the life of the site.

Estimated landfill closure costs include final cover system, erosion control, and landscaping. Post-closure costs include leachate pretreatment costs, pump station O&M, gas system O&M, final cover maintenance, groundwater and other site monitoring, and general site maintenance for the 30-year post-closure period. All costs are estimated based on current regulations and technology. Future changes in either regulations or technology will change these estimated costs.

Consistent with the analyses performed in this feasibility study, two waste flow options have been evaluated. The first option envisions that waste reduction through an alternative technology facility will be constructed. Under this option, the Bacona Road site would have a site life of approximately 60 years. The second option assumes that waste reduction through an alternative technology will not be constructed. This option results in an anticipated site life of about 47 years.

CAPITAL COSTS

Table 5-1 summarizes the order-of-magnitude estimate of capital costs, by cost category, for the Bacona Road site. The capital costs listed are for capital assets over the life of the site, even though some of these costs, such as for bottom lining, will be spent incrementally. Land purchase costs are included. The total estimated capital cost, in spring 1987 dollars, is about $226.1 million.

The difference of $119.6 million between the capital cost estimated in this Final Feasibility Study Report and the

*

Table 5-1
ESTIMATED CAPITAL COSTS
BACONA ROAD SITE

Description	Estimated Total Cost
Site preparation	$ 171,000
Highway 47 widening	3,300,000
Main access road	4,446,000
Local road improvements	743,600
Excavation and embankment	2,400,000
Bottom lining system	53,720,000
Final cover system	24,480,000
Underdrain collection pipe	600,000
Leachate collection pipe system	1,400,000
Leachate pump stations	75,000
Leachate transmission pipeline system	2,295,200
Offsite treatment hookup fee	100,000
Underdrain pump stations	150,000
Onsite surface water ditch	96,000
Onsite access and haul roads	300,000
Perimeter surface water ditch	405,000
Fire control ponds	150,000
Sedimentation control ponds	450,000
Perimeter fence	420,000
Perimeter road	255,000
Screening and landscaping	550,000
Landfill equipment	44,820,000
Office	135,000
Maintenance shop	225,000
Groundwater monitoring wells	52,000
Gas monitoring wells	68,000
Gas collection and control system	2,190,000
Leachate pretreatment system	3,190,000
Electric service	300,000
Subtotal	$147,486,800
Engineering, legal, and administrative (20%)	$ 29,497,400
Construction contingency (30%)	$ 44,246,000
Subtotal	$221,230,200
Land acquisition	
Site purchase	$ 3,850,000
Offsite wetlands mitigation	$ 986,000
Total	$226,066,200

capital cost estimated in the Draft Feasibility Study Report is due primarily to addition of the cost of widening Highway 47, minor changes to the bottom lining system, and moving the final cover cost and landfill equipment cost from O&M to capital cost.

OPERATING COSTS

* Table 5-2 summarizes the estimated total operating costs for the Bacona Road site, in 1987 dollars. The estimated total * operating cost, in 1987 dollars, is $373.0 million under the * waste flow option with alternative technology and $325.4 million under the waste flow option without alternative technology. The operating cost includes costs for landfill closure. The site will be operated using a close-as-you-fill philosophy. Top caps and final cover will be placed on the fill at the earliest possible time.

* Table 5-2
OPERATING COST SUMMARY
BACONA ROAD SITE

Description	Estimated Total Cost ($) Alternative Technology	Unprocessed Refuse
Site preparation and excavation	$ 58,311,000	$ 58,311,000
Road maintenance	12,000,000	12,000,000
Labor	39,600,000	31,000,000
Fuel and maintenance	15,000,000	11,750,000
Daily cover	28,260,000	28,260,000
Interim access roads	1,920,000	1,920,000
Surface water control	1,540,000	1,540,000
Utilities	4,500,000	3,520,000
Leachate control	81,600,000	63,900,000
Groundwater control	600,000	470,000
Environmental monitoring	4,800,000	3,760,000
Erosion control	510,000	510,000
Subtotal	248,641,000	216,941,000
Engineering, legal, and administrative (20%)	49,728,000	43,388,000
Contingency (30%)	74,592,000	65,082,000
Total	$372,961,000	$325,411,000

POST-CLOSURE COST ESTIMATE

The estimated 30-year, post-closure cost for the Bacona Road landfill, in 1987 dollars, is about $35.7 million, as itemized in Table 5-3.

*

*

Table 5-3
ESTIMATED POST-CLOSURE COSTS
BACONA ROAD SITE

Description	Estimated Total Cost
Leachate pump station operation and maintenance	$ 1,500,000
Leachate treatment costs	13,500,000
Gas system operation and maintenance	1,800,000
Final cover maintenance	3,060,000
Operation and maintenance supervisor	1,350,000
Landfill site monitoring program	2,250,000
Subtotal	23,460,000
Engineering, legal, and administration (20%)	4,692,000
Operation and maintenance contingency (30%)	7,507,200
Total 30-year cost	$35,659,200

SANITARY LANDFILL COST MODEL

DEQ has used a computer model to predict the true social cost of disposing of municipal solid waste at the Bacona Road site. The cost analyses follow the methodology detailed in "An Evaluation of the True Costs of Sanitary Landfills for the Disposal of Municipal Solid Waste in the Portland Metropolitan Area," prepared by ECO Northwest and dated
* April 1986. An explanation of the application of benefit-cost analysis to sanitary landfills, from the ECO Northwest report, is included in Appendix G.

The cost model accounts for all costs that would affect residents in the metropolitan area. These costs include the usual construction and operation costs, as well as the costs of planning, public involvement, and implementation of Neighborhood Protection Plan features. The costs input to the
* model have been taken from Tables 5-1 through 5-3. Notes explaining how the costs in Tables 5-1 through 5-3 are distributed into the cost model are included in Appendix G. The cost model does not calculate a "tipping fee" or

disposal rate. It can be used only to compare relative costs of two or more sites.

Because the current value of money decreases over time, the costs in Tables 5-1 through 5-3 have been discounted in the cost model at a 3 percent social discount rate to make expenditures in future years comparable. This real annual discount rate does not include inflation, as all costs are assumed to rise or fall at an equal rate. The cost model is not a solid waste rate model and the cost figures should not be interpreted as tipping fees for the disposal of solid waste.

Many of the estimated capital costs, such as bottom lining and gas collection pipes, will occur over time, as new fill areas are developed. These costs have been separately calculated in the cost model in order to account for the 3 percent annual discount on the value of money. They are considered periodic costs and are included under Periodic Equipment, Periodic Cell Development, and Periodic Cell Closure in the cost model.

* A number of revisions were made to the Bacona Road cost model from the Draft Feasibility Study Report. The major changes include:

- A revision of the cost-per-minute of transport from $.90 per minute to $1.16 per minute. Both of these estimates were developed for DEQ by Metro.

- Inclusion of approximately $2 million toward noise mitigation expenses for potentially affected properties.

- Addition of about $3.3 million for widening of Highway 47 along the entire route to the site.

- Assumed heavy equipment life of 4.7 years, instead of the 7.5 years assumed in the Draft Feasibility Study Report.

* Additional, less significant changes were made to the acreage total, final cover costs, liner costs, surface water control, and equipment salvage value.

In comparing the total cost-per-ton of the Ramsey Lake and Bacona Road sites, a distinction is made between fixed costs (those not dependent on total site life) and variable costs (those dependent on total site life).

Variable costs include the periodic costs listed above, operation and maintenance costs, and transportation costs. For these cost categories, a common time frame was used to compare the two sites. The life span of the shortest lived landfill site (Ramsey Lake) has been used as the time frame in calculating these variable costs.

Fixed costs include predevelopment, land acquisition, one-time construction and equipment, final closure, and post-closure costs. These costs are not dependent on the total amount of waste or the site life, and were therefore calculated for the entire life of the landfill. Final closure costs are limited because closure will be conducted on a close-as-you-fill basis. Transport costs were calculated assuming three transfer stations and using a weighted average for the driving time required for all transfer vehicles driving to the site.

Table 5-4 presents the cost model analysis of the Bacona Road site assuming alternative technology is implemented in
* the Portland region. The projected unit cost is $20.42 per ton.

*

Table 5-4
COST MODEL ANALYSIS--WITH ALTERNATIVE TECHNOLOGY
BACONA ROAD SITE

Item	Total Cost (Thousand Dollars)	Unit Cost (Dollars per ton)
Predevelopment costs	$ 4,010	$ 0.09
Capital costs		
Land	6,038	0.13
One-time construction and equipment	27,975	0.60
Periodic equipment	11,918	0.97
Periodic cell development	54,415	4.44
Periodic cell closure	5,047	0.41
Total capital costs	$105,393	$ 6.55
Operation and maintenance costs	86,741	7.07
Final closure costs	25	0.00
Post-closure costs	4,231	0.09
Other environmental impacts	0	0.00
Transportation costs	81,084	6.61
Total costs	$281,483	$20.42

Table 5-5 presents the cost model analysis of the Bacona Road site assuming alternative technology is not implemented
* in the Portland region. The projected unit cost is $20.99 per ton.

*

Table 5-5
COST MODEL ANALYSIS--NO ALTERNATIVE TECHNOLOGY
BACONA ROAD SITE

Item	Total Cost (Thousand Dollars)	Unit Cost (Dollars per ton)
Predevelopment costs	$ 4,010	$ 0.09
Capital costs		
Land	6,038	0.14
One-time construction and equipment	27,975	0.63
Periodic equipment	8,492	0.74
Periodic cell development	49,852	4.35
Periodic cell closure	4,488	0.39
Total capital costs	$ 96,844	$ 6.24
Operation and maintenance costs	73,146	6.38
Final closure costs	37	0.00
Post-closure costs	6,168	0.14
Other environmental impacts	0	0.00
Transportation costs	93,261	8.14
Total costs	$273,465	$20.99

* Sensitivity Analysis

Several variations were run on the Bacona Road cost model, assuming unprocessed refuse, to test the cost sensitivity to changes in input values. Many of these changes were suggested as part of the public testimony. The following sensitivity analyses were conducted:

1. Addition of an overpass at Highway 47 intersection with Highway 26. This addition raises the per-ton cost by $.01.

2. Assuming much higher (100 percent) increases in the price of gasoline. A doubling of fuel prices, over and above normal inflation, raises the per-ton cost by $.98.

3. Assuming longer travel time. Testimony suggested travel time may be 181 minutes, rather than 156 minutes per transfer trip. This increase raises the per-ton cost by $1.30.

4. Assuming reduced capacity. If, because of the need to avoid local landslide areas, the site life were cut from 47 to 37 years, this would raise the per-ton cost by $2.05.

5. Cumulative worst-case impacts. Assuming all of the cost increases from the previous four analyses, the total cumulative impact would raise the per-ton cost by $4.51.

* FINANCIAL ANALYSIS

A financial analysis of the Bacona Road site operation has been prepared by DEQ and Metro. The financial analysis more closely estimates the actual cost of the landfill portion of the tipping fee by including inflation effects and finance costs.

THE FINANCIAL ANALYSIS WAS NOT COMPLETED IN TIME FOR PRINTING AND WILL BE DISTRIBUTED SEPARATELY TO ALL DOCUMENT HOLDERS.

Bacona Rd., no rr - Sys A 1990 $ (000)
DEQ model (1986 $ converted to 1987 $; western mid-size city CPI: 1.7% (1986 to 1987; source: US Dept of Labor) Assumed inflation 1987 to 1990: 5%
DEQ model pre-dev & cap costs adjusted

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Pre-dev	1,103	1,470	1,470	368													
Cap. Costs		23,633	14,622														
Periodic Costs																	
Heavy eq.				3,465					3,465				3,465				
(Salvage)									(519)				(519)				
Cell prep.				20,637				20,637					20,637				20,637
Cell closure								2,903					2,903				2,903
O & M				7,136	7,136	7,136	7,136	7,136	7,136	7,136	7,136	7,136	7,136	7,136	7,136	7,136	7,136
Final Closure																	
Post Closure																	
Total	1,103	25,103	16,093	31,605	7,136	7,136	7,136	30,676	10,081	7,136	7,136	7,136	33,621	7,136	7,136	7,136	30,676

Bacona Rd., no rr - Sys A
Nominal $ (000) DEQ model Assumed inflation rate after 1987: 5%

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Pre-dev	953	1,334	1,400	368	0	0	0	0	0	0	0	0	0	0	0	0	0
Cap. Costs	0	21,435	13,926	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Periodic Costs																	
Heavy eq.	0	0	0	3,465	0	0	0	0	4,422	0	0	0	5,375	0	0	0	0
(Salvage)	0	0	0	0	0	0	0	0	(663)	0	0	0	(805)	0	0	0	0
Cell prep.	0	0	0	20,637	0	0	0	25,084	0	0	0	0	32,015	0	0	0	38,914
Cell closure	0	0	0	0	0	0	0	3,529	0	0	0	0	4,504	0	0	0	5,474
O & M	0	0	0	7,136	7,492	7,867	8,260	8,673	9,107	9,562	10,041	10,543	11,070	11,623	12,204	12,815	13,455
Final Closure	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Post Closure	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	953	22,769	15,326	31,605	7,492	7,867	8,260	37,287	12,867	9,562	10,041	10,543	52,158	11,623	12,204	12,815	57,844

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Waste volume	1,028,000	1,045,000	1,062,000	1,080,000	1,097,000	1,115,000	1,132,000	1,150,000	1,167,000	1,185,000	1,202,000	1,220,000	1,237,000	1,254,000
Recycle vol. above pres.(15%))	154,000	157,000	159,000	162,000	165,000	167,000	170,000	173,000	175,000	178,000	180,000	183,000	186,000	188,000
Landfill volume	874,000	888,000	903,000	918,000	932,000	948,000	962,000	977,000	992,000	1,007,000	1,022,000	1,037,000	1,051,000	1,066,000
Accumulated total	874,000	1,762,000	2,665,000	3,583,000	4,515,000	5,463,000	6,425,000	7,402,000	8,394,000	9,401,000	10,423,000	11,460,000	12,511,000	13,577,000

Bacona Rd., no rr - Sys A

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Pre-dev																	
Cap. Costs																	
Periodic Costs																	
Heavy eq.	3,465					3,465				3,465					3,465		
(Salvage)	(519)					(519)				(519)					(519)		
Cell prep.				20,637				20,637				20,637			20,637		
Cell closure				2,903				2,903				2,903			2,903		
O & M	7,136	7,136	7,136	7,136	7,136	7,136	7,136	7,136	7,136	7,136	7,136	7,136	7,136	7,136	7,136	7,136	7,136
Final Closure																	
Post Closure																	
Total	10,081	7,136	7,136	30,676	7,136	10,081	7,136	30,676	7,136	10,081	7,136	30,676	7,136	7,136	33,621	7,136	7,136

Bacona Rd., no rr - Sys A
Nominal $ (000)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Pre-dev	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cap. Costs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Periodic Costs																	
Heavy eq.	6,860	0	0	0	0	8,755	0	0	0	10,642	0	0	0	0	13,582	0	0
(Salvage)	(1,028)	0	0	0	0	(1,312)	0	0	0	(1,595)	0	0	0	0	(2,035)	0	0
Cell prep.	0	0	0	47,300	0	0	0	57,494	0	0	0	69,884	0	0	80,900	0	0
Cell closure	0	0	0	6,654	0	0	0	8,088	0	0	0	9,831	0	0	11,381	0	0
O & M	14,129	14,834	15,576	16,355	17,173	18,031	18,933	19,880	20,874	21,917	23,013	24,164	25,372	26,641	27,973	29,371	30,840
Final Closure	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Post Closure	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	19,960	14,834	15,576	70,310	17,173	25,475	18,933	85,462	20,874	30,965	23,013	103,879	25,372	26,641	131,800	29,371	30,840
Waste volume	1,272,000	1,289,000	1,307,000	1,324,000	1,342,000	1,359,000	1,377,000	1,394,000	1,412,000	1,429,000	1,446,000	1,464,000	1,481,000	1,499,000	1,516,000	1,534,000	1,551,000
Recycle vol. above pres.(15%)	191,000	193,000	196,000	199,000	201,000	204,000	207,000	209,000	212,000	214,000	217,000	220,000	222,000	225,000	227,000	230,000	233,000
Landfill volume	1,081,000	1,096,000	1,111,000	1,125,000	1,141,000	1,155,000	1,170,000	1,185,000	1,200,000	1,215,000	1,229,000	1,244,000	1,259,000	1,274,000	1,289,000	1,304,000	1,318,000
Accumulated total	14,658,000	15,754,000	16,865,000	17,990,000	19,131,000	20,286,000	21,456,000	22,641,000	23,841,000	25,056,000	26,285,000	27,529,000	28,788,000	30,062,000	31,351,000	32,655,000	33,973,000

Bacona Rd., no rr - Sys A

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Pre-dev																	
Cap. Costs																	
Periodic Costs																	
Heavy eq.			3,465														
(Salvage)			(519)					(519)									
Cell prep.		20,637			20,637												
Cell closure		2,903			2,903			2,903									
O & M	7,136	7,136	7,136	7,136	7,136	7,136	7,136	4,578									
Final Closure								63	113								
Post Closure									541	1,509	1,509	1,509	1,509	1,509	1,509	1,509	1,509
Total	7,136	30,676	10,081	7,136	30,676	7,136	7,136	7,026	654	1,509	1,509	1,509	1,509	1,509	1,509	1,509	19,754

Bacona Rd., no rr - Sys A
Nominal $ (000)

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Pre-dev	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cap. Costs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Periodic Costs																	
Heavy eq.	0	0	17,335	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Salvage)	0	0	(2,598)	0	0	0	0	(3,315)	0	0	0	0	0	0	0	0	0
Cell prep.	0	98,334	0	0	113,834	0	0	0	0	0	0	0	0	0	0	0	0
Cell closure	0	13,834	0	0	16,014	0	0	18,539	0	0	0	0	0	0	0	0	0
O & M	32,382	34,001	35,701	37,486	39,360	41,328	43,395	29,236	0	0	0	0	0	0	0	0	0
Final Closure	0	0	0	0	0	0	0	404	760	0	0	0	0	0	0	0	0
Post Closure	0	0	0	0	0	0	0	0	3,627	10,625	11,157	11,715	12,300	12,915	13,561	14,239	14,951
Total	32,362	146,169	50,438	37,486	169,208	41,328	43,395	44,863	4,386	10,625	11,157	11,715	12,300	12,915	13,561	14,239	14,951
Waste volume	1,569,000	1,586,000	1,603,000	1,621,000	1,638,000	1,656,000	1,673,000	1,085,000									
Recycle vol. above pres.(15%)	235,000	238,000	240,000	243,000	246,000	248,000	251,000	163,000									
Landfill volume	1,334,000	1,348,000	1,363,000	1,378,000	1,392,000	1,408,000	1,422,000	922,000									
Accumulated total	35,307,000	36,655,000	38,018,000	39,396,000	40,788,000	42,196,000	43,618,000	44,540,000									

Bacona Rd., no rr - Sys A

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	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054
Pre-dev																	
Cap. Costs																	
Periodic Costs																	
Heavy eq.																	
(Salvage)																	
Cell prep.																	
Cell closure																	
O & M																	
Final Closure																	
Post Closure	1,509	1,509	1,509	1,509	1,509	1,509	1,509	1,509	1,509	1,509	1,509	1,509	1,509	1,509	1,509	1,509	1,509
Total	14,238	1,509	1,509	1,509	1,509	1,509	1,509	1,509	1,509	1,509	1,509	1,509	1,509	1,509	1,509	1,509	1,509

Bacona Rd., no rr - Sys A
Nominal $ (000)

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	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054
Pre-dev	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cap. Costs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Periodic Costs																	
Heavy eq.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Salvage)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cell prep.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cell closure	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
O & M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Closure	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Post Closure	15,699	16,484	17,308	18,173	19,082	20,036	21,038	22,090	23,194	24,354	25,572	26,850	28,193	29,602	31,082	32,636	34,268
Total	15,699	16,484	17,308	18,173	19,082	20,036	21,038	22,090	23,194	24,354	25,572	26,850	28,193	29,602	31,082	32,636	34,268

Waste volume
Recycle vol. above pres.(15%)
Landfill volume
Accumulated total

Bacona Rd., no rr - Sys A

===========================

	2055	2056	2057	2058	2059
Pre-dev					
Cap. Costs					
Periodic Costs					
Heavy eq.					
(Salvage)					
Cell prep.					
Cell closure					
O & M					
Final Closure					
Post Closure	1,509	1,509	1,509	1,509	968
Total	1,509	1,509	1,509	1,509	968

Bacona Rd., no rr - Sys A
Nominal $ (000)

===========================

	2055	2056	2057	2058	2059
Pre-dev	0	0	0	0	0
Cap. Costs	0	0	0	0	0
Periodic Costs					
Heavy eq.	0	0	0	0	0
(Salvage)	0	0	0	0	0
Cell prep.	0	0	0	0	0
Cell closure	0	0	0	0	0
O & M	0	0	0	0	0
Final Closure	0	0	0	0	0
Post Closure	35,982	37,781	39,670	41,653	28,062
Total	35,982	37,781	39,670	41,653	28,062

Waste volume
Recycle vol. above pres.(15%)
Landfill volume
Accumulated total

BACONA ROAD - WITHOUT RESOURCE RECOVERY
ANNUAL INFLATION RATE 0.00%

23-Jun-87
IBACNRR

ANNUAL REQUIREMENTS TO BE FUNDED BY TIP FEES

*****ALL FIGURES IN THOUSANDS*****

CALENDAR YEAR		1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
PRE-DEVELOPMENT AND CAPITAL BONDS		1,469	2,938.8	6,201.4	6,201.4	6,201.4	6,201.4	6,201.4	6,201.4	6,201.4	6,201.4	6,201.4	6,201.4	6,201.4	6,201.4
Tip fee revenue amounts here fund the debt service requirement PLUS the coverage requirement on the bonds.															
The coverage amount is then used to fund the debt service reserve and to offset the periodic cost reserve requirement.															
Present Value	4.00%	1,412.9	2,717.0	5,513.0	5,301.0	5,097.1	4,901.1	4,712.6	4,531.3	4,357.0	4,189.5	4,028.3	3,873.4	3,724.4	3,581.2
PERIODIC COSTS (financed by reserve collections)															
Heavy Equipment				566.0	566.0	566.0	566.0	566.0	714.0	714.0	714.0	714.0	566.0	566.0	566.0
Cell preparation and closure				5,711.0	5,711.0	5,711.0	5,711.0	4,523.0	4,523.0	4,523.0	4,523.0	4,523.0	5,711.0	5,711.0	5,711.0
Final Closure				3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Post Closure				429.0	429.0	429.0	429.0	429.0	429.0	429.0	429.0	429.0	429.0	429.0	429.0
LESS Surplus from coverage				(238.6)	(238.6)	(238.6)	(238.6)	(238.6)	(1,236.3)	(1,236.3)	(1,236.3)	(1,236.3)	(1,236.3)	(1,236.3)	(1,236.3)
LESS Earnings on debt reserve				0.0	(19.8)	(39.6)	(59.3)	(79.1)	(98.9)	(98.9)	(98.9)	(98.9)	(98.9)	(98.9)	(98.9)
TOTAL PERIODIC COSTS				6,470.5	6,450.7	6,430.9	6,411.1	5,203.4	4,333.8	4,333.8	4,333.8	4,333.8	5,373.8	5,373.8	5,373.8
TOTAL BONDS AND PERIODIC COSTS		1,469.4	2,938.8	12,671.9	12,652.1	12,632.3	12,612.5	11,404.8	10,535.3	10,535.3	10,535.3	10,535.3	11,575.3	11,575.3	11,575.3
OPERATIONS AND MAINTENANCE	0	0	0	7,573	7,936	8,319	8,719	9,139	9,581	10,043	10,529	11,039	11,573	12,134	12,723
TOTAL LANDFILL COSTS		1,469.4	2,938.8	20,244.5	20,538.5	20,950.9	21,331.9	20,544.2	20,116.3	20,578.7	21,064.3	21,573.9	23,148.5	23,709.5	24,298.1
WASTE PROJECTIONS				874	888	903	918	932	948	962	977	992	1,007	1,022	1,037
UNIT COST -NOMINAL LANDFILLING COMPONENT				23.16	23.19	23.20	23.24	22.04	21.22	21.39	21.56	21.75	22.99	23.20	23.43

NOTE: LAST YEAR DEBT SERVICE IS PAID BY DEBT RESERVE

BALONA ROAD - WITHOUT RESOURCE RECOVERY
ANNUAL INFLATION RATE 0.0%

ANNUAL REQUIREMENTS TO BE FUNDED BY TIP FEES

CALENDAR YEAR		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
PRE-DEVELOPMENT AND CAPITAL BONDS		6,201.4	6,201.4	6,201.4	6,201.4	6,201.4	6,201.4	6,201.4	6,201.4	6,201.4	6,201.4	6,201.4	0.0	0.0	0.0
Tip fee revenue amounts here fund the debt serv													from DSR		
The coverage amount is then used to fund the ce															
Present Value	4.00%	3,443.4	3,311.0	3,183.6	3,061.2	2,943.5	2,830.2	2,721.4	2,616.7	2,516.1	2,419.3	2,326.3	0.0	0.0	0.0
PERIODIC COSTS (financed by reserve collections)															
Heavy Equipment		566.0	566.0	566.0	565.0	566.0	566.0	566.0	566.0	566.0	566.0	566.0	566.0	714.0	714.0
Cell preparation and closure		5,711.0	5,711.0	5,711.0	5,711.0	5,711.0	5,711.0	5,711.0	5,711.0	5,711.0	5,711.0	5,711.0	5,711.0	5,711.0	7,691.0
Final Closure		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Post Closure		429.0	429.0	429.0	429.0	429.0	429.0	429.0	429.0	429.0	429.0	429.0	429.0	429.0	429.0
LESS Surplus from coverage		(1,236.3)	(1,236.3)	(1,236.3)	(1,236.3)	(1,236.3)	(1,236.3)	(1,236.3)	(1,236.3)	(1,236.3)	(1,236.3)	(1,236.3)	0.0	0.0	0.0
LESS Earnings on debt reserve		(98.9)	(98.9)	(98.9)	(98.9)	(98.9)	(98.9)	(98.9)	(98.9)	(98.9)	(98.9)	(98.9)	0.0	0.0	0.0
TOTAL PERIODIC COSTS		5,373.8	5,373.8	5,373.8	5,373.8	5,373.8	5,373.8	5,373.8	5,373.8	5,373.8	5,373.8	5,373.8	6,709.0	6,857.0	8,837.0
TOTAL BONDS AND PERIODIC COSTS		11,575.3	11,575.3	11,575.3	11,575.3	11,575.3	11,575.3	11,575.3	11,575.3	11,575.3	11,575.3	11,575.3	6,709.0	6,857.0	8,837.0
OPERATIONS AND MAINTENANCE	0	13,340	13,988	14,669	15,382	16,132	16,918	17,743	18,609	19,518	20,472	21,474	22,525	23,628	24,786
TOTAL LANDFILL COSTS		24,915.3	25,563.6	26,243.8	26,957.7	27,707.0	28,492.8	29,318.5	30,184.2	31,093.2	32,047.4	33,048.9	29,233.8	30,484.7	33,622.9
WASTE PROJECTIONS		1,051	1,066	1,081	1,096	1,111	1,125	1,141	1,155	1,170	1,185	1,200	1,215	1,229	1,244
UNIT COST - NOMINAL		23.71	23.98	24.28	24.60	24.94	25.33	25.70	26.13	26.58	27.04	27.54	24.06	24.80	27.03
LANDFILLING COMPONENT															

NOTE: LAST YEAR DEBT SERVICE IS PAID BY DEBT RESERVE

BACONA ROAD - WITHOUT RESOURCE RECOVERY
ANNUAL INFLATION RATE 0.00%

ANNUAL REQUIREMENTS TO BE FUNDED BY TIP FEES

CALENDAR YEAR		2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
PRE-DEVELOPMENT AND CAPITAL BONDS		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tip fee revenue amounts here fund the debt serv														
The coverage amount is then used to fund the de														
Present Value	4.00%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PERIODIC COSTS (financed by reserve collections)														
Heavy Equipment		714.0	714.0	566.0	566.0	566.0	566.0	566.0	0.0	0.0	0.0	0.0	0.0	0.0
Cell preparation and closure		7,691.0	7,691.0	5,711.0	5,711.0	5,711.0	5,711.0	7,691.0	7,691.0	7,691.0	3,693.0	3,693.0	3,693.0	2,363.5
Final Closure		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	1.9
Post Closure		429.0	429.0	429.0	429.0	429.0	429.0	429.0	429.0	429.0	429.0	429.0	429.0	274.6
LESS Surplus from coverage		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LESS Earnings on debt reserve		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL PERIODIC COSTS		8,837.0	8,837.0	6,709.0	6,709.0	6,709.0	6,709.0	8,689.0	8,123.0	8,123.0	4,125.0	4,125.0	4,125.0	2,640.0
TOTAL BONDS AND PERIODIC COSTS		8,837.0	8,837.0	6,709.0	6,709.0	6,709.0	6,709.0	8,689.0	8,123.0	8,123.0	4,125.0	4,125.0	4,125.0	2,640.0
OPERATIONS AND MAINTENANCE	0	26,002	27,278	28,617	30,023	31,499	33,049	34,675	36,382	38,175	40,056	42,032	44,106	29,697
TOTAL LANDFILL COSTS		34,838.[illegible]	36,114.6	35,326.2	36,732.3	38,207.9	39,757.9	43,364.0	44,505.5	46,298.0	44,181.3	46,157.4	48,230.8	32,337.0
WASTE PROJECTIONS		1,259	1,274	1,289	1,304	1,318	1,334	1,348	1,363	1,378	1,392	1,408	1,422	922
UNIT COST -NOMINAL LANDFILLING COMPONENT		27.67	28.35	27.41	28.17	28.99	29.80	32.17	32.65	33.60	31.74	32.78	33.92	35.07

NOTE: LAST YEAR DEBT SERVICE IS PAID BY DEBT RESERVE

APPENDIX D

RESOURCE RECOVERY COSTS

Tabulation of Resource Recovery Costs over time based on phone info provided to Dave L. 6/12/87 by GBB
Total annual cost to the system is shown for each vendor - under both 0% and 5% inflation assumptions
Per per ton figures (in 1990 dollars) reflect distribution of costs over the entire Metro system. RDM

1 RESOURCE RECOVERY COST RIEDEL-200,000 tons

Year	Tons to Metro	GROSS SERV. FEE IN 1990 DOLLARS	$/ton (1990)	GROSS SERV. INFL. DOLLAR	$/ton INFL.
1990	873,000	$6,180	$7.07	$6,180	$7.07
1991	888,000	$5,790	$6.52	$6,078	$6.89
1992	903,000	$5,777	$6.40	$6,348	$7.03
1993	918,000	$5,763	$6.28	$6,589	$7.18
1994	932,000	$5,749	$6.17	$6,843	$7.34
1995	948,000	$5,734	$6.05	$7,110	$7.50
1996	962,000	$5,718	$5.94	$7,390	$7.68
1997	977,000	$5,702	$5.84	$7,684	$7.86
1998	992,000	$5,686	$5.73	$7,993	$8.06
1999	1,007,000	$5,669	$5.63	$8,318	$8.26
2000	1,022,000	$5,651	$5.53	$8,659	$8.47
2001	1,037,000	$5,632	$5.43	$9,017	$8.70
2002	1,051,000	$5,613	$5.34	$9,394	$8.94
2003	1,066,000	$5,593	$5.25	$9,790	$9.18
2004	1,081,000	$5,572	$5.15	$10,205	$9.44
2005	1,096,000	$5,551	$5.06	$10,640	$9.71
2006	1,111,000	$5,529	$4.98	$11,101	$9.99
2007	1,125,000	$5,506	$4.89	$11,583	$10.30

2 RESOURCE RECOVERY COST CE-350,000 tons

Year	Tons to Metro	GROSS SERV. FEE IN 1991 DOLLARS	GROSS SERV. IN 1990 DOL	$/ton (1990)	GROSS SERV. INFL. DOLLAR	$/ton INFL.
1991	888,000	$20,176	$19,535	$22.00	$20,176	$22.72
1992	903,000	$19,789	$19,161	$21.22	$20,438	$22.63
1993	918,000	$19,595	$18,960	$20.65	$20,926	$22.80
1994	932,000	$19,209	$18,571	$19.93	$21,255	$22.81
1995	948,000	$18,822	$18,181	$19.18	$21,621	$22.81
1996	962,000	$18,820	$18,174	$18.89	$22,409	$23.29
1997	977,000	$18,349	$17,402	$17.81	$22,456	$22.99
1998	992,000	$17,662	$17,013	$17.15	$22,949	$23.13
1999	1,007,000	$17,483	$16,817	$16.70	$22,659	$22.50
2000	1,022,000	$16,696	$16,047	$15.70	$23,856	$23.34
2001	1,037,000	$15,925	$15,279	$14.73	$24,092	$23.23
2002	1,051,000	$15,345	$14,702	$13.99	$24,573	$23.38
2003	1,066,000	$13,996	$13,366	$12.54	$24,332	$22.83
2004	1,081,000	$12,262	$11,654	$10.78	$23,753	$21.98
2005	1,096,000	$12,067	$11,462	$10.46	$24,694	$22.52
2006	1,111,000	$11,295	$10,704	$9.63	$25,307	$22.78
2007	1,125,000	$10,523	$9,947	$8.84	$25,885	$23.01

3 RESOURCE RECOVERY COST — FLUOR-350,000 tons

Year	Tons to Metro	GROSS SERV. FEE IN 1991 DOLLARS	GROSS SERV. IN 1990 DOL	$/ton (1990)	GROSS SERV. INFL. DOLLAR	$/ton INFL.
1991	888,000	$18,033	$17,625	$19.85	$18,033	$20.31
1992	903,000	$18,165	$17,754	$19.66	$18,585	$20.58
1993	918,000	$18,323	$17,826	$19.42	$19,359	$21.09
1994	932,000	$18,324	$17,784	$19.08	$20,044	$21.51
1995	948,000	$18,325	$17,753	$18.73	$20,802	$21.94
1996	962,000	$18,641	$18,041	$18.75	$21,953	$22.82
1997	977,000	$18,011	$17,418	$17.83	$22,019	$22.54
1998	992,000	$17,696	$17,107	$17.24	$22,432	$22.61
1999	1,007,000	$17,538	$16,950	$16.83	$23,041	$22.88
2000	1,022,000	$16,993	$16,323	$15.97	$23,215	$22.72
2001	1,037,000	$16,278	$15,696	$15.14	$23,429	$22.59
2002	1,051,000	$15,806	$15,226	$14.49	$23,844	$22.69
2003	1,066,000	$14,703	$14,131	$13.25	$23,672	$22.21
2004	1,081,000	$13,285	$12,727	$11.77	$23,232	$21.49
2005	1,096,000	$13,128	$12,571	$11.47	$24,101	$21.99
2006	1,111,000	$12,498	$11,948	$10.75	$24,548	$22.10
2007	1,125,000	$11,863	$11,327	$10.07	$25,050	$22.27

4 RESOURCE RECOVERY COST — SCM-350,000 tons

Year	Tons to Metro	GROSS SERV. FEE IN 1991 DOLLARS	GROSS SERV. IN 1990 DOL	$/ton (1990)	GROSS SERV. INFL. DOLLAR	$/ton INFL.
1991	888,000	$20,241	$19,665	$22.17	$20,241	$22.79
1992	903,000	$20,054	$19,504	$21.60	$20,920	$22.93
1993	918,000	$20,022	$19,466	$21.20	$21,183	$23.08
1994	932,000	$19,959	$19,298	$20.71	$21,643	$23.22
1995	948,000	$19,708	$19,141	$20.19	$22,143	$23.36
1996	962,000	$19,934	$19,262	$20.02	$22,962	$23.87
1997	977,000	$19,308	$18,732	$19.17	$23,158	$23.70
1998	992,000	$19,045	$18,464	$18.61	$23,653	$23.84
1999	1,007,000	$18,913	$18,328	$18.20	$24,318	$24.15
2000	1,022,000	$18,387	$17,803	$17.42	$24,625	$24.10
2001	1,037,000	$17,850	$17,271	$16.65	$24,979	$24.09
2002	1,051,000	$17,456	$16,875	$16.05	$25,507	$24.27
2003	1,066,000	$16,544	$15,955	$14.97	$25,553	$23.97
2004	1,081,000	$15,350	$14,775	$13.67	$25,335	$23.43
2005	1,096,000	$15,228	$14,644	$13.36	$26,321	$24.02
2006	1,111,000	$14,702	$14,121	$12.71	$26,975	$24.23
2007	1,125,000	$14,176	$13,599	$12.09	$27,556	$24.50

5 RESOURCE RECOVERY COST — RIEDEL-100,000 tons

Year	Tons to Metro	GROSS SERV. FEE IN 1990 DOLLARS	$/ton (1990)	GROSS SERV. INFL. DOLLAR	$/ton INFL.
1990	873,000	$4,360	$4.99	$4,360	$4.99
1991	888,000	$4,165	$4.69	$4,368	$4.92
1992	903,000	$4,159	$4.61	$4,523	$5.01
1993	918,000	$4,152	$4.52	$4,687	$5.11
1994	932,000	$4,145	$4.45	$4,858	$5.21
1995	948,000	$4,137	$4.36	$5,038	$5.31
1996	962,000	$4,129	$4.29	$5,223	$5.43
1997	977,000	$4,122	$4.22	$5,427	$5.55
1998	992,000	$4,113	$4.15	$5,635	$5.68
1999	1,007,000	$4,105	$4.08	$5,855	$5.81
2000	1,022,000	$4,095	$4.01	$6,085	$5.95
2001	1,037,000	$4,085	$3.94	$6,328	$6.10
2002	1,051,000	$4,077	$3.88	$6,582	$6.26
2003	1,066,000	$4,067	$3.82	$6,849	$6.42
2004	1,081,000	$4,057	$3.75	$7,130	$6.60
2005	1,096,000	$4,045	$3.69	$7,425	$6.77
2006	1,111,000	$4,035	$3.63	$7,734	$6.96
2007	1,125,000				

6 RESOURCE RECOVERY COST — OE-450,000 tons

Year	Tons to Metro	GROSS SERV. FEE IN 1991 DOLLARS	GROSS SERV. IN 1990 DOL	$/ton (1990)	GROSS SERV. INFL. DOLLAR	$/ton INFL.
1990	873,000					
1991	888,000	$23,855	$23,135	$26.05	$23,855	$26.86
1992	903,000	$23,359	$22,655	$25.09	$24,085	$26.67
1993	918,000	$23,109	$22,393	$24.40	$24,599	$26.80
1994	932,000	$22,612	$21,896	$23.49	$24,903	$26.72
1995	948,000	$22,115	$21,395	$22.57	$25,247	$26.63
1996	962,000	$22,113	$21,387	$22.23	$26,129	$27.16
1997	977,000	$21,121	$20,394	$20.87	$26,064	$26.68
1998	992,000	$20,624	$19,894	$20.05	$26,541	$26.76
1999	1,007,000	$20,374	$19,641	$19.50	$27,313	$27.12
2000	1,022,000	$19,382	$18,651	$18.25	$27,395	$26.81
2001	1,037,000	$18,390	$17,663	$17.03	$27,530	$26.55
2002	1,051,000	$17,645	$16,921	$16.10	$27,959	$26.61
2003	1,066,000	$15,910	$15,202	$14.26	$27,477	$25.78
2004	1,081,000	$13,680	$13,000	$12.03	$26,552	$24.56
2005	1,096,000	$13,430	$12,754	$11.64	$27,672	$25.25
2006	1,111,000	$12,438	$11,780	$10.60	$28,119	$25.31
2007	1,125,000	$11,445	$10,807	$9.61	$28,637	$25.45

7 RESOURCE RECOVERY COST — FLUCR-450,000 tons

Year	Tons to Metro	GROSS SERV. FEE IN 1991 DOLLARS	GROSS SERV. IN 1990 DOL	$/ton (1990)	GROSS SERV. INFL. DOLLAR	$/ton INFL.
1990	873,000					
1991	888,000	$21,977	$21,307	$23.99	$21,977	$24.75
1992	903,000	$21,949	$21,280	$23.57	$22,539	$25.07
1993	918,000	$22,123	$21,427	$23.34	$23,583	$25.69
1994	932,000	$22,095	$21,374	$22.93	$24,408	$26.19
1995	948,000	$22,067	$21,321	$22.49	$25,323	$26.71
1996	962,000	$22,444	$21,672	$22.53	$25,739	$27.79
1997	977,000	$21,634	$20,876	$21.37	$26,799	$27.43
1998	992,000	$21,229	$20,479	$20.64	$27,309	$27.53
1999	1,007,000	$21,026	$20,230	$20.14	$28,068	$27.87
2000	1,022,000	$20,216	$19,477	$19.06	$28,256	$27.65
2001	1,037,000	$19,406	$18,573	$18.01	$28,516	$27.50
2002	1,051,000	$18,799	$18,071	$17.19	$29,021	$27.61
2003	1,066,000	$17,331	$16,565	$15.53	$28,771	$26.99
2004	1,081,000	$15,559	$14,864	$13.75	$28,175	$26.06
2005	1,096,000	$15,356	$14,565	$13.33	$29,250	$26.70
2006	1,111,000	$14,545	$13,857	$12.48	$29,802	$26.82
2007	1,125,000	$13,736	$13,070	$11.62	$30,412	$27.03

8 RESOURCE RECOVERY COST — S/C-M 450,000 tons

Year	Tons to Metro	GROSS SERV. FEE IN 1991 DOLLARS	GROSS SERV. IN 1990 DOL	$/ton (1990)	GROSS SERV. INFL. DOLLAR	$/ton INFL.
1990	874,000					
1991	888,000	$22,485	$21,345	$24.30	$22,485	$25.32
1992	903,000	$22,245	$21,612	$23.93	$22,837	$25.36
1993	918,000	$22,204	$21,565	$23.49	$23,540	$25.64
1994	932,000	$21,994	$21,349	$22.91	$24,049	$25.80
1995	948,000	$21,601	$20,908	$22.05	$24,610	$25.96
1996	962,000	$21,963	$21,305	$22.15	$25,565	$26.57
1997	977,000	$21,236	$20,625	$21.11	$25,720	$26.33
1998	992,000	$20,947	$20,282	$20.45	$26,255	$26.47
1999	1,007,000	$20,776	$20,108	$19.97	$27,003	$26.82
2000	1,022,000	$20,101	$19,460	$19.01	$27,290	$26.70
2001	1,037,000	$19,425	$18,753	$18.08	$27,524	$26.54
2002	1,051,000	$18,917	$18,244	$17.35	$28,178	$26.81
2003	1,066,000	$17,733	$17,065	$16.01	$28,109	$26.37
2004	1,081,000	$16,210	$15,553	$14.39	$27,757	$25.68
2005	1,096,000	$16,041	$15,354	$14.04	$28,817	$26.29
2006	1,111,000	$15,354	$14,712	$13.24	$29,431	$26.49
2007	1,125,000	$14,587	$14,043	$12.48	$30,109	$26.75

9 RESOURCE RECOVERY COST — CE-250,000 tons

Year	Tons to Metro	GROSS SERV. FEE IN 1991 DOLLARS	GROSS SERV. IN 1990 DOL	$/ton (1990)	GROSS SERV. INFL. DOLLAR	$/ton INFL.
1990	974,000					
1991	988,000	$19,274	$18,693	$21.05	$19,274	$21.70
1992	903,000	$18,998	$18,426	$20.41	$19,526	$21.69
1993	918,000	$18,850	$18,283	$19.92	$20,070	$21.86
1994	932,000	$18,584	$18,002	$19.32	$20,444	$21.94
1995	948,000	$18,308	$17,722	$18.69	$20,851	$21.99
1996	962,000	$18,305	$17,715	$18.42	$21,568	$22.42
1997	977,000	$17,755	$17,162	$17.57	$21,770	$22.28
1998	992,000	$17,479	$16,883	$17.02	$22,284	$22.46
1999	1,007,000	$17,340	$16,741	$16.62	$22,975	$22.82
2000	1,022,000	$16,789	$16,189	$15.84	$23,297	$22.80
2001	1,037,000	$16,238	$15,633	$15.08	$23,561	$22.62
2002	1,051,000	$15,824	$15,224	$14.49	$24,209	$23.03
2003	1,066,000	$14,860	$14,265	$13.38	$24,254	$22.75
2004	1,081,000	$13,621	$13,037	$12.06	$24,075	$22.27
2005	1,096,000	$13,480	$12,899	$11.77	$25,050	$22.86
2006	1,111,000	$12,931	$12,353	$11.12	$25,667	$23.10
2007	1,125,000	$12,380	$11,809	$10.50	$26,342	$23.42

10 RESOURCE RECOVERY COST — FLUOR-250,000 tons

Year	Tons to Metro	GROSS SERV. FEE IN 1991 DOLLARS	GROSS SERV. IN 1990 DOL	$/ton (1990)	GROSS SERV. INFL. DOLLAR	$/ton INFL.
1990	974,000					
1991	988,000	$15,453	$14,967	$16.38	$15,453	$17.41
1992	903,000	$15,437	$15,015	$16.63	$15,974	$17.69
1993	918,000	$15,629	$15,139	$16.49	$16,556	$18.04
1994	932,000	$15,556	$15,151	$16.26	$17,294	$18.55
1995	948,000	$15,633	$15,164	$16.00	$17,973	$18.96
1996	962,000	$15,942	$15,400	$16.01	$18,952	$19.70
1997	977,000	$15,492	$14,959	$15.31	$19,117	$19.57
1998	992,000	$15,267	$14,739	$14.86	$19,535	$19.69
1999	1,007,000	$15,155	$14,629	$14.53	$20,101	$19.96
2000	1,022,000	$14,705	$14,193	$13.88	$20,362	$19.92
2001	1,037,000	$14,255	$13,735	$13.25	$20,559	$19.92
2002	1,051,000	$13,917	$13,400	$12.75	$21,105	$20.08
2003	1,066,000	$13,130	$12,619	$11.84	$21,141	$19.83
2004	1,081,000	$12,117	$11,615	$10.75	$20,992	$19.42
2005	1,096,000	$12,005	$11,505	$10.50	$21,787	$19.88
2006	1,111,000	$11,555	$11,060	$9.95	$22,290	$20.06
2007	1,125,000	$11,105	$10,616	$9.44	$22,340	$20.30

11 RESOURCE RECOVERY COST S/OM-250,000 tons

Year	Tons to Metro	GROSS SERV. FEE IN 1991 DOLLARS	GROSS SERV. IN 1990 DOL	$/ton (1990)	GROSS SERV. INFL. DOLLAR	$/ton INFL.
1990	874,000					
1991	888,000	$17,423	$16,958	$19.10	$17,423	$19.62
1992	903,000	$17,230	$16,829	$18.64	$17,764	$19.67
1993	918,000	$17,267	$16,801	$18.30	$18,239	$19.87
1994	932,000	$17,151	$16,680	$17.90	$18,644	$20.00
1995	943,000	$17,043	$16,568	$17.48	$19,055	$20.13
1996	962,000	$17,133	$16,653	$17.31	$19,751	$20.53
1997	977,000	$16,757	$16,273	$16.66	$19,980	$20.45
1998	992,000	$16,569	$16,081	$16.21	$20,426	$20.59
1999	1,007,000	$16,475	$15,983	$15.87	$20,999	$20.85
2000	1,022,000	$16,099	$15,604	$15.27	$21,323	$20.86
2001	1,037,000	$15,723	$15,226	$14.68	$21,632	$20.91
2002	1,051,000	$15,441	$14,941	$14.22	$22,172	$21.10
2003	1,066,000	$14,783	$14,284	$13.40	$22,324	$20.94
2004	1,081,000	$13,937	$13,441	$12.43	$22,329	$20.66
2005	1,096,000	$13,843	$13,345	$12.18	$23,128	$21.10
2006	1,111,000	$13,457	$12,959	$11.67	$23,690	$21.32
2007	1,125,000	$13,091	$12,595	$11.20	$24,299	$21.60

APPENDIX E

TRANSFER STATION COSTS

17 YEAR PROJECTION OF TRANSFER STATION COSTS (ALL COSTS ARE IN CONSTANT DOLLARS; BASE YEAR IS 1990)
****

KEY ASSUMPTIONS
****

-New Landfill in Operation in 1991
-WTRC and ETRC in Operation in 1991
-Riedel Compost Facility includes a Transfer Station
-Unit Price in the Contract Rebid would increase Annually at a
. Constant Inflation Rate of Five Percent
-$8,000,000 Development Cost of Full Scale Transfer Station
-$5,000,000 Development Cost of Down Scale Transfer Station
-9% Interest Rate on Debt Service (on Development Cost)
(for constant dollar projection inflation rate (5%) is deducted)
-Annual Increase in Regional Waste Flow is approximately Two to Three Percent
-Waste Transfer costs excluded from the costs of Materials & Services

ANNUAL NOTES
****

1991	A	Assumes high Capital Outlay due to new Office Equipment for WTRC &ETRC
1993	A	Assumes increase in Capital Fund Transfer due to scheduled repairs (pitfloor, clam shell, and compactor) at CTRC
1996	A	Assumes increase in Capital Fund Transfer due to scheduled major repairs (pitfloor and clam shell) at WTRC and ETRC
	B	Assumes slight increase in Capital Outlay due to replacement of Office Equipment at WTRC and ETRC
1998	A	Assumes increase in Capital Fund Transfer due to sceduled repairs (pitfloor and clam shell) at CTRC
2001	A	Assumes increase in Capital Fund Transfer due to sheduled repairs (compactor and calm shell) at WTRC and ETRC
	B	Assumes increase in Capital Outlay due to Office needs at WTRC and ETRC
2003	A	Assume major increase in Capital Fund Transfer due to scheduled repairs (compactor, reroofing, clam snell, and pitfloor) at CTRC
2006	A	Assumes increase in Capital Outlay due to Office needs at WTRC and ETRC
2007	A	Assumes major increase in Capital Fund Trnasfer due to scheduled repairs (reroffing, clam shell, and compactor) at WTRC and ETRC

17 YEAR TRANSFER STATION COSTS AT CONSTANT 1990 PRICES

5B)

TRANSFER SYSTEM/ITEMS	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
CTRC										
Personal Services	$171,153	$171,153	$171,153	$171,153	$171,153	$171,153	$171,153	$171,153	$171,153	$171,153
Materials and Services	$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956
Capital Outlay	$21,763	$21,763	$21,763	$21,763	$21,763	$21,763	$21,763	$21,763	$21,763	$21,763
Debt Service	$369,799	$369,799	$305,267	$297,731	$303,962	$290,124	$279,740	$264,844	$256,984	$242,421
Gen, Bldg, & Insur. Transfer	$218,125	$218,125	$218,125	$218,125	$218,125	$218,125	$218,125	$218,125	$218,125	$218,125
Capital Fund Transfer	$115,763			$400,000					$310,000	
Contingency	$273,403	$273,403	$273,403	$273,403	$273,403	$273,403	$273,403	$273,403	$273,403	$273,403
TOTAL	$3,096,962	$2,981,199	$2,916,667	$3,309,131	$2,915,362	$2,901,524	$2,891,140	$2,876,244	$3,178,384	$2,853,821
WASTE TO METRO FACILITIES (TPY)	873,800	888,000	903,000	918,000	932,000	948,000	962,000	977,000	992,000	1,007,000
AVERAGE BASE RATE ($/TON)	$3.54	$3.36	$3.23	$3.60	$3.13	$3.06	$3.01	$2.94	$3.20	$2.83

| $$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$|
| $8,000,000 = Principal Amount |(---- DEBT (MTRC & ETRC Development Cost)
| 9%= Interest Rate | ASSUME FULL SIZE
| 25 = Repayment Period|
| $$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$|

MTRC	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Personal Services	$171,153	$171,153	$171,153	$171,153	$171,153	$171,153	$171,153	$171,153	$171,153	$171,153
Materials and Services	$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956
Capital Outlay	$86,591	$86,591	$18,191	$18,191	$18,191	$18,191	$51,670	$18,191	$18,191	$18,191
Debt Service	$814,450	$814,450	$814,450	$814,450	$814,450	$814,450	$814,450	$814,450	$814,450	$814,450
Gen, Bldg, & Insur. Transfer	$218,125	$218,125	$218,125	$218,125	$218,125	$218,125	$218,125	$218,125	$218,125	$218,125
Capital Fund Transfer							$300,000			
Contingency	$273,403	$273,403	$273,403	$273,403	$273,403	$273,403	$273,403	$273,403	$273,403	$273,403
TOTAL	$3,490,678	$3,490,678	$3,422,278	$3,422,278	$3,422,278	$3,422,278	$3,422,278	$3,755,757	$3,422,278	$3,422,278
TOTAL COST (CTRC & MTRC)	$6,587,640	$6,471,877	$6,338,945	$6,731,409	$6,337,640	$6,323,802	$6,313,418	$6,632,001	$6,600,662	$6,276,099
WATSE TO METRO FACILITIES (TPY)	873,800	888,000	903,000	918,000	932,000	948,000	962,000	977,000	992,000	1,007,000
AVERAGE BASE RATE ($/TON)	$7.54	$7.29	$7.02	$7.33	$6.80	$6.67	$6.56	$6.79	$6.65	$6.23

2000	2001	2002	2003	2004	2005	2006	2007	
$171,153	$171,153	$171,153	$171,153	$171,153	$171,153	$171,153	$171,153	
$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956	
$21,763	$21,763	$21,763	$21,763	$21,763	$21,763	$21,763	$21,763	
$238,637	$77,742	$8,079	$0	$0	$0	$0	$0	based on current and future debts
$218,125	$218,125	$218,125	$218,125	$218,125	$218,125	$218,125	$218,125	
			$500,000					
$273,403	$273,403	$273,403	$273,403	$273,403	$273,403	$273,403	$273,403	assume 8% of personal services, materials & services and capital outlay
$2,850,037	$2,689,142	$2,619,479	$3,111,400	$2,611,400	$2,611,400	$2,611,400	$2,611,400	
1,022,000	1,037,000	1,051,000	1,066,000	1,081,000	1,096,000	1,111,000	1,125,000	waste flow based on capacity of Metro's facilities
$2.79	$2.59	$2.49	$2.92	$2.42	$2.38	$2.35	$2.32	$/TON-- ONE FULL SIZE TRANSFER STATION

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2000	2001	2002	2003	2004	2005	2006	2007	
$171,153	$171,153	$171,153	$171,153	$171,153	$171,153	$171,153	$171,153	
$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956	
$18,191	$65,970	$18,191	$18,191	$18,191	$18,191	$80,220	$18,191	
$814,450	$814,450	$814,450	$814,450	$814,450	$814,450	$814,450	$814,450	
$218,125	$218,125	$218,125	$218,125	$218,125	$218,125	$218,125	$218,125	
							$1,000,000	
$273,403	$273,403	$273,403	$273,403	$273,403	$273,403	$273,403	$273,403	assume 8% of personal services, materials & services and capital outlay
$3,422,278	$3,422,278	$3,422,278	$3,422,278	$3,422,278	$3,422,278	$3,484,307	$4,422,278	
$6,272,315	$6,111,420	$6,041,757	$6,533,678	$6,033,678	$6,033,678	$6,095,707	$7,033,678	
1,022,000	1,037,000	1,051,000	1,066,000	1,081,000	1,096,000	1,111,000	1,125,000	waste flow based on capacity of Metro's facilities
$6.14	$5.89	$5.75	$6.13	$5.58	$5.51	$5.49	$6.25	$/TON--TWO FULL SIZE TRANSFER STATIONS

ETRC (FULL SIZE)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Personal Services	$171,153	$171,153	$171,153	$171,153	$171,153	$171,153	$171,153	$171,153	$171,153	$171,153
Materials and Services	$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956
Capital Outlay	$86,591	$86,591	$18,191	$18,191	$18,191	$18,191	$70,771	$18,191	$18,191	$18,191
Debt Service	$814,450	$814,450	$814,450	$814,450	$814,450	$814,450	$814,450	$814,450	$814,450	$814,450
Gen, Bldg, & Insur. Transfer	$218,125	$218,125	$218,125	$218,125	$218,125	$218,125	$218,125	$218,125	$218,125	$218,125
Capital Fund Transfer							$300,000			
Contingency	$273,403	$273,403	$273,403	$273,403	$273,403	$273,403	$273,403	$273,403	$273,403	$273,403
TOTAL (ETRC- FULL SIZE-ONLY)	$3,490,678	$3,490,678	$3,422,278	$3,422,278	$3,422,278	$3,422,278	$3,774,858	$3,422,278	$3,422,278	$3,422,278
TOTAL COST (CTRC, WTRC & ETRC)	$10,078,318	$9,962,555	$9,761,223	$10,153,687	$9,759,918	$9,746,080	$10,088,276	$10,054,279	$10,022,940	$9,698,377
WASTE TO METRO FACILITIES (TPY)	873,800	888,000	903,000	918,000	932,000	948,000	962,000	977,000	992,000	1,007,000
AVERAGE BASE RATE ($/TON)	$11.53	$11.22	$10.81	$11.06	$10.47	$10.28	$10.49	$10.29	$10.10	$9.63

| $$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$ |
| $3,000,000 = Principal Amount |(---- DEBT (ETRC Development Cost)
| 9% = Interest Rate | ASSUME DOWN SCALE
| 25 = Repayment Period |
| $$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$ |

ETRC (DOWN SIZE)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Personal Services	$171,153	$171,153	$171,153	$171,153	$171,153	$171,153	$171,153	$171,153	$171,153	$171,153
Materials and Services	$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956
Capital Outlay	$86,591	$86,591	$18,191	$18,191	$18,191	$18,191	$51,670	$18,191	$18,191	$18,191
Debt Service	$509,031	$509,031	$509,031	$509,031	$509,031	$509,031	$509,031	$509,031	$509,031	$509,031
Gen, Bldg, & Insur. Transfer	$218,125	$218,125	$218,125	$218,125	$218,125	$218,125	$218,125	$218,125	$218,125	$218,125
Capital Fund Transfer							$300,000			
Contingency	$273,403	$273,403	$273,403	$273,403	$273,403	$273,403	$273,403	$273,403	$273,403	$273,403
TOTAL (ETRC- DOWN SIZE-ONLY)	$3,185,259	$3,185,259	$3,116,859	$3,116,859	$3,116,859	$3,116,859	$3,450,338	$3,116,859	$3,116,859	$3,116,859
TOTAL COST (CTRC, WTRC & ETRC)	$9,772,899	$9,657,136	$9,455,804	$9,848,263	$9,454,499	$9,440,661	$9,763,756	$9,748,860	$9,717,521	$9,392,958
WASTE TO METRO FACILITIES (TPY)	873,800	888,000	903,000	918,000	932,000	948,000	962,000	977,000	992,000	1,007,000
AVERAGE BASE RATE ($/TON)	$11.18	$10.88	$10.47	$10.73	$10.14	$9.96	$10.15	$9.98	$9.80	$9.33

0.55
200000
6.24

UPSCALE										
RET FACILITY TRANSFER STATION (Facility Process 200,000 TPY)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
OPERATION CONTRACT @ $6.24/TON 0.55 6.24	$1,750,882	$1,799,616	$1,851,096	$1,902,576	$1,950,624	$2,005,536	$2,053,584	$2,105,064	$2,156,544	$2,208,024
WASTE TO METRO FACILITY (TPY)	873,800	888,000	903,000	918,000	932,000	948,000	962,000	977,000	992,000	1,007,000
AVERAGE BASE RATE ($/TON)	$2.00	$2.03	$2.05	$2.07	$2.09	$2.12	$2.13	$2.15	$2.17	$2.19

0.55
100000
6.24

DOWNSCALE										
RET FACILITY TRANSFER STATION (Facility Process 100,000 TPY)										
OPERATION CONTRACT @ $6.24/TON	$2,374,882	$2,423,616	$2,475,096	$2,526,576	$2,574,624	$2,629,536	$2,677,584	$2,729,064	$2,780,544	$2,832,024
AVERAGE BASE RATE ($/TON)	$2.72	$2.73	$2.74	$2.75	$2.76	$2.77	$2.78	$2.79	$2.80	$2.81

H-E.6

CONSTANT DOLLARS

SYSTEM COSTS SCENARIO-- $/TON ##############################	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
SYSTEM:										
A -3 FULL SIZE TRANSFER STATIONS	$11.53	$11.22	$10.81	$11.06	$10.47	$10.28	$10.49	$10.29	$10.10	$9.63
B -2 FULL SIZE TRANSFER STATIONS & 1 DOWN SIZE TRANSFER STATION	$11.18	$10.88	$10.47	$10.73	$10.14	$9.96	$10.15	$9.98	$9.80	$9.33
C -3 FULL SIZE TRANSFER STATIONS	$11.53	$11.22	$10.81	$11.06	$10.47	$10.28	$10.49	$10.29	$10.10	$9.63
D -2 FULL SIZE TRANSFER STATIONS & 1 DOWN SIZE TRANSFER STATION	$11.18	$10.88	$10.47	$10.73	$10.14	$9.96	$10.15	$9.98	$9.80	$9.33
E -2 FULL SIZE TRANSFER STATIONS & RET TRANSFER STATION	$9.[illegible]4	$9.31	$9.07	$9.41	$8.89	$8.79	$8.70	$8.94	$8.83	$8.43

2000	2001	2002	2003	2004	2005	2006	2007	
$171,153	$171,153	$171,153	$171,153	$171,153	$171,153	$171,153	$171,153	
$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956	
$18,191	$65,970	$18,191	$18,191	$18,191	$18,191	$80,220	$18,191	
$814,450	$814,450	$814,450	$814,450	$814,450	$814,450	$814,450	$814,450	
$218,125	$218,125	$218,125	$218,125	$218,125	$218,125	$218,125	$218,125	
	$350,000						$1,000,000	
$273,403	$273,403	$273,403	$273,403	$273,403	$273,403	$273,403	$273,403	assume 8% of personal services, materials & services and capital outlay
$3,422,278	$3,820,057	$3,422,278	$3,422,278	$3,422,278	$3,422,278	$3,484,307	$4,422,278	
$9,694,593	$9,931,477	$9,464,035	$9,955,956	$9,455,956	$9,455,956	$9,580,014	$11,455,956	
1,022,000	1,037,000	1,051,000	1,066,000	1,081,000	1,096,000	1,111,000	1,125,000	waste flow based on capacity of Metro's facilities
$9.49	$9.58	$9.00	$9.34	$8.75	$8.63	$8.62	$10.18	$/TON--THREE FULL SIZE TRANSFER STETIONS

2000	2001	2002	2003	2004	2005	2006	2007	
$171,153	$171,153	$171,153	$171,153	$171,153	$171,153	$171,153	$171,153	
$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956	$1,926,956	
$18,191	$65,970	$18,191	$18,191	$18,191	$18,191	$80,220	$18,191	
$509,031	$509,031	$509,031	$509,031	$509,031	$509,031	$509,031	$509,031	
$218,125	$218,125	$218,125	$218,125	$218,125	$218,125	$218,125	$218,125	
	$350,000						$1,000,000	
$273,403	$273,403	$273,403	$273,403	$273,403	$273,403	$273,403	$273,403	assume 8% of personal services, materials & services and capital outlay
$3,116,859	$3,514,638	$3,116,859	$3,116,859	$3,116,859	$3,116,859	$3,178,888	$4,116,859	
$9,389,174	$9,626,058	$9,158,616	$9,650,537	$9,150,537	$9,150,537	$9,274,595	$11,150,537	
1,022,000	1,037,000	1,051,000	1,066,000	1,081,000	1,096,000	1,111,000	1,125,000	waste flow based on capacity of Metro's facilities
$9.19	$9.28	$8.71	$9.05	$8.46	$8.35	$8.35	$9.91	$/TON--TWO FULL AND ONE DOWN SIZE TRANSFER STATION

APPENDIX F

TRANSPORTATION COSTS (INCLUDING BARGE COSTS)

TRAVEL TIME MATRIX (in minutes to travel from facility to facility).

WASTE SHIPPED FROM	Bacona Rd.	Fluor	C-E	S/O-M	Riedel	Fluor
	WASTE SHIPPED TO					
CTRC 1990 OFF PEAK	64.7	61.9	36.6	35.6		25.4
WTRC 1990 OFF PEAK	39.1	54.0	30.2	29.1		21.4
ETRC 1990 OFF PEAK	56.4	46.8	17.7	17.0		13.4
Riedel 1990 OFF PEAK	56.4	46.8	17.7	17.0		13.4
Fluor 1990 OFF PEAK	54.9					
C-E 1990 OFF PEAK	61.1				17.7	
S/O-M 1990 OFF PEAK	60.0					

TRAVEL TIME MATRIX (in minutes per trip).(includes total travel time plus loading time)

WASTE SHIPPED FROM	Bacona Rd.	Fluor	C-E	S/O-M	Riedel	Fluor
	WASTE SHIPPED TO					
CTRC 1990 OFF PEAK	159.4	153.7	103.3	101.3		80.8
WTRC 1990 OFF PEAK	108.2	138.0	90.4	88.2		72.7
ETRC 1990 OFF PEAK	142.8	123.6	65.4	64.0		56.8
Riedel 1990 OFF PEAK	142.8	123.6	65.4	64.0		56.8
Fluor 1990 OFF PEAK	139.8					
C-E 1990 OFF PEAK	152.2				65.4	
S/O-M 1990 OFF PEAK	150.0					

$0.07 TRAVEL COST MATRIX (in 1990 dollars/ton assuming 20 tons/trip).

WASTE SHIPPED TO

	Bacona Rd	Fluor	C-E	S/O-M	Fluor Barging	Riedel
CTRC						
1990 OFF PEAK	$11.07	$10.68	$7.17	$7.03	$14.34	
WTRC						
1990 OFF PEAK	$7.52	$9.59	$6.28	$6.13	$13.78	
ETRC						
1990 OFF PEAK	$9.92	$8.58	$4.54	$4.45	$12.68	
Riedel						
1990 OFF PEAK	$9.92	$8.58	$4.54	$4.45	$12.68	
Fluor						
1990 OFF PEAK	$9.71					
C-E						
1990 OFF PEAK	$10.57					$4.54
S/O-M						
1990 OFF PEAK	$10.42					

Bacona Rd. is the proposed landfill site on Bacona Rd.

CTRC is the Clackamas Transfer and Recycling Center in Oregon City

WTRC is the proposed West Transfer and Recycling Center at 209th and TV hwy.

ETRC is the proposed East Transfer and Recycling Center in Multnomah County.

Riedel is the Columbia site and will replace ETRC if selected.

Fluor is the St. Helens site.

C-E is the Gilmore site.

S/O-M is the Rivergate site.

TRANSPORTATION COSTS FOR 874,000 TONS IN 1990 tons)

System A

		Dir. Haul	Bacona Rd.
CTRC	tons	131,100	131,100
	dollars		$1,451,063
WTRC	tons	262,200	262,200
	dollars		$1,971,174
ETRC	tons	480,700	480,700
	dollars		$4,767,838
landfil 874,000		transport.	$8,190,075

System C

		Dir. Haul	Bacona Rd.	Fluor
CTRC	tons	131,100	131,100	
	dollars		$1,451,063	
WTRC	tons	262,200	262,200	
	dollars		$1,971,174	
ETRC	tons	480,700	130,700	350,000
	dollars		$1,296,352	$3,004,731
Fluor	tons	0	89,600	
	dollars		$870,030	
landfil 613,600			transport.	$8,593,351

System E

		Dir. Haul	Bacona Rd.
CTRC	tons	131,100	131,100
	dollars		$1,451,063
WTRC	tons	262,200	262,200
	dollars		$1,971,174
Riedel	tons	480,700	341,000
	dollars		$3,382,219
landfil 734,300		transport.	$6,804,456

System G

		Dir. Haul	Bacona Rd.	Fluor
CTRC	tons	131,100	122,100	9,000
	dollars		$1,351,448	$96,098
WTRC	tons	262,200	262,200	
	dollars		$1,971,174	
Riedel	tons	480,700	0	341,000
	dollars		$0	$2,927,467
Fluor	tons	0	89,600	
	dollars		$870,030	
landfil 473,900			transport.	$7,216,217

System B

		Dir. Haul	Bacona Rd.
CTRC	tons	131,100	131,100
	dollars		$1,451,063
WTRC	tons	262,200	262,200
	dollars		$1,971,174
ETRC	tons	130,700	130,700
	dollars		$1,296,352
C-E	tons	350,000	116,100
	dollars		$1,227,343
landfil 640,100		transport.	$5,945,933

System D

		Dir. Haul	Bacona Rd.
CTRC	tons	131,100	131,100
	dollars		$1,451,063
WTRC	tons	262,200	262,200
	dollars		$1,971,174
ETRC	tons	130,700	130,700
	dollars		$1,296,352
S/O-M	tons	350,000	89,400
	dollars		$931,425
landfil 613,400		transport.	$5,650,014

System F

		Dir. Haul	Bacona Rd.	C-E
CTRC	tons	131,100	61,800	69,300
	dollars		$684,025	$497,137
WTRC	tons	262,200	262,200	
	dollars		$1,971,174	
Riedel	tons	200,000	60,300	
	dollars		$598,087	
C-E	tons	280,700	116,100	
	dollars		$1,227,343	
landfil 500,400			transport.	$4,977,767

System H

		Dir. Haul	Bacona Rd.	S/O-M
CTRC	tons	131,100	61,800	69,300
	dollars		$684,025	$487,510
WTRC	tons	262,200	262,200	
	dollars		$1,971,174	
Riedel	tons	200,000	60,300	
	dollars		$598,087	
S/O-M	tons	280,700	89,400	
	dollars		$931,425	
landfil 473,700			transport.	$4,672,222

		E	F	G	I	K	L	M
system	44	System B	System C	System D	System E	System F	System G	System H
rr	46	350000	350000	350000		350000	350000	350000
rrres	47	116100	89600	89400		116100	89600	89400
ret	48				200000	200000	200000	200000
retres	49				60300	60300	60300	60300

System CC

			Bacona Rd.	Fluor
CTRC	tons	131,100	131,100	
	dollars		$1,451,063	
WTRC	tons	262,200	262,200	
	dollars		$1,971,174	
ETRC	tons	480,700	130,700	350,000
	dollars		$1,296,352	$4,436,315
Fluor	tons	0	89,600	
	dollars		$870,030	
landfil 613,600			transport.	$10,024,935

System GG

			Bacona Rd.	Fluor
CTRC	tons	131,100	122,100	9,000
	dollars		$1,351,448	$129,074
WTRC	tons	262,200	262,200	
	dollars		$1,971,174	
Riedel	tons	480,700	0	341,000
	dollars		$0	$4,322,238
Fluor	tons	0	89,600	
	dollars		$870,030	
landfil 473,900			transport.	$8,643,965

TRANSPORTATION COSTS FOR 874,000 TONS IN 1990 tons)

System A

		Dir. Haul	Bacona Rd.
CTRC	tons	131,100	131,100
	dollars		$1,451,063
WTRC	tons	262,200	262,200
	dollars		$1,971,174
ETRC	tons	480,700	480,700
	dollars		$4,767,838
landfil 874,000	transport.		$8,190,075

System K

		Dir. Haul	Bacona Rd.	Fluor
CTRC	tons	131,100	131,100	
	dollars		$1,451,063	
WTRC	tons	262,200	262,200	
	dollars		$1,971,174	
ETRC	tons	480,700	30,700	450,000
	dollars		$304,499	$3,863,226
Fluor	tons	0	115,600	
	dollars		$1,122,494	
landfil 539,600			transport.	$8,712,457

System I

		Dir. Haul	Bacona Rd.
CTRC	tons	131,100	131,100
	dollars		$1,451,063
WTRC	tons	262,200	262,200
	dollars		$1,971,174
Riedel	tons	480,700	410,900
	dollars		$4,075,524
landfil 804,200	transport.		$7,497,762

System N

		Dir. Haul	Bacona Rd.	Fluor
CTRC	tons	131,100	131,100	0
	dollars		$1,451,063	$0
WTRC	tons	262,200	262,200	
	dollars		$1,971,174	
Riedel	tons	480,700	91,000	250,000
	dollars		$902,586	$2,146,237
Fluor	tons	0	63,700	
	dollars		$618,537	
landfil 548,000			transport.	$7,089,598

System J

		Dir. Haul	Bacona Rd.
CTRC	tons	131,100	131,100
	dollars		$1,451,063
WTRC	tons	262,200	262,200
	dollars		$1,971,174
ETRC	tons	30,700	30,700
	dollars		$304,499
C-E	tons	450,000	149,800
	dollars		$1,583,600
landfil 573,800	transport.		$5,310,337

System L

		Dir. Haul	Bacona Rd.
CTRC	tons	131,100	131,100
	dollars		$1,451,063
WTRC	tons	262,200	262,200
	dollars		$1,971,174
ETRC	tons	30,700	30,700
	dollars		$304,499
S/O-M	tons	450,000	115,300
	dollars		$1,201,267
landfil 539,300		transport.	$4,928,004

System M

		Dir. Haul	Bacona Rd.	C-E
CTRC	tons	131,100	131,100	0
	dollars		$1,451,063	$0
WTRC	tons	262,200	262,200	
	dollars		$1,971,174	
Riedel	tons	230,700	91,000	
	dollars		$902,586	
C-E	tons	250,000	82,500	
	dollars		$872,143	
landfil 566,800			transport.	$5,196,967

System O

		Dir. Haul	Bacona Rd.	S/O-M
CTRC	tons	131,100	131,100	0
	dollars		$1,451,063	$0
WTRC	tons	262,200	262,200	
	dollars		$1,971,174	
Riedel	tons	230,700	91,000	
	dollars		$902,586	
S/O-M	tons	250,000	63,500	
	dollars		$661,583	
landfil 547,800			transport.	$4,986,406

		E	F	G	I	K	L	M
system	104	System J	System K	System L	System I	System M	System N	System O
rr	106	450000	450000	450000		250000	250000	250000
rrres	107	149800	115600	115300		82500	63700	63500
ret	108				100000	200000	200000	200000
retres	109				30200	60300	60300	60300

System KK

			Bacona Rd.	Fluor
CTRC	tons	131,100	131,100	
	dollars		$1,451,063	
WTRC	tons	262,200	262,200	
	dollars		$1,971,174	
ETRC	tons	480,700	30,700	450,000
	dollars		$304,499	$5,703,834
Fluor	tons	0	115,600	
	dollars		$1,122,494	
landfil 539,600			transport.	$10,553,064

System NN

			Bacona Rd.	Fluor
CTRC	tons	131,100	131,100	0
	dollars		$1,451,063	$0
WTRC	tons	262,200	262,200	
	dollars		$1,971,174	
Riedel	tons	480,700	91,000	250,000
	dollars		$902,586	$3,168,797
Fluor	tons	0	63,700	
	dollars		$618,537	
landfil 548,000			transport.	$8,112,157

$8.96	$8.72	$8.59	$8.98	$8.44	$8.37	$8.36	$9.13
$8.35	$8.12	$7.99	$8.39	$7.86	$7.80	$7.80	$8.57
$8.96	$8.72	$8.59	$8.98	$8.44	$8.37	$8.36	$9.13
$8.35	$8.12	$7.99	$8.39	$7.86	$7.80	$7.80	$8.57
$8.96	$8.72	$8.59	$8.98	$8.44	$8.37	$8.36	$9.13
$8.35	$8.12	$7.99	$8.39	$7.86	$7.80	$7.80	$8.57
$8.96	$8.72	$8.59	$8.98	$8.44	$8.37	$8.36	$9.13

(E)-- RET DOWNSCALE	$10.26	$10.02	$9.76	$10.08	$9.56	$9.44	$9.35	$9.58	$9.46	$9.04
F -2 FULL SIZE TRANSFER STATIONS & RET TRANFER STATION	$9.54	$9.31	$9.07	$9.41	$8.89	$8.79	$8.70	$8.94	$8.83	$8.43
(F)--w/ RET DOWNSCALE	$10.26	$10.02	$9.76	$10.08	$9.56	$9.44	$9.35	$9.58	$9.46	$9.04
G -2 FULL SIZE TRANSFER STATIONS & RET TRANFER STATION	$9.54	$9.31	$9.07	$9.41	$8.89	$8.79	$8.70	$8.94	$8.83	$8.43
(G)--w/ RET DOWNSCALE	$10.26	$10.02	$9.76	$10.08	$9.56	$9.44	$9.35	$9.58	$9.46	$9.04
H -2 FULL SIZE TRANSFER STATIONS & RET TRANFER STATION	$9.54	$9.31	$9.07	$9.41	$8.89	$8.79	$8.70	$8.94	$8.83	$8.43
(H)--w/ RET DOWNSCALE	$10.26	$10.02	$9.76	$10.08	$9.56	$9.44	$9.35	$9.58	$9.46	$9.04

2000	2001	2002	2003	2004	2005	2006	2007	
$2,259,504	$2,310,984	$2,359,032	$2,410,512	$2,461,992	$2,513,472	$2,564,952	$2,613,000	based on operations contract that excludes waste transfer
1,022,000	1,037,000	1,051,000	1,066,000	1,081,000	1,096,000	1,111,000	1,125,000	BASED ON ONE TRANSFER STATION (MRF COMPONENT)
$2.21	$2.23	$2.24	$2.26	$2.28	$2.29	$2.31	$2.32	$/TON--ONE TRANSFER STATION

$2,883,504	$2,934,984	$2,983,032	$3,034,512	$3,085,992	$3,137,472	$3,188,952	$3,237,000
$2.82	$2.83	$2.84	$2.85	$2.85	$2.86	$2.87	$2.88

2000	2001	2002	2003	2004	2005	2006	2007
$9.49	$9.58	$9.00	$9.34	$8.75	$8.63	$8.62	$10.18
$9.19	$9.28	$8.71	$9.05	$8.46	$8.35	$8.35	$9.91
$9.49	$9.58	$9.00	$9.34	$8.75	$8.63	$8.62	$10.18
$9.19	$9.28	$8.71	$9.05	$8.46	$8.35	$8.35	$9.91
$8.35	$8.12	$7.99	$8.39	$7.86	$7.80	$7.80	$8.57

Technical Report- Barging Costs

Barging Systems:

The barging companies[1] indicate a long term committment is required to offset high initial capital costs. This would result in a small savings in transportation costs to the St. Helens site. (Long term is 20 years)

The cost of transporting waste by barge varies according to the system and geography of the route. There are three types of barging systems: 1) Bin Barge; 2) Container Barge; and 3) Roll-on Roll-off Barge. All the systems would require special interchange facilities, and loading and unloading equipments at the loading and unloading points.

The Bin Barge system would require a hopper and conveyor belt to feed the waste into the bin barge, and a "pico crane" to unload the waste at the St. Helens dock.

The Container Barge systems would require an adjustable pad and forklifts for loading and unloading. A compactor-loader may be needed to load waste into the containers so as to maximize load economies.

The Roll-on Roll-off system would need an adjustable ramp with transition lip at the loading and unloading docks. In addition 120 trailers and 4 tractors would be needed. A compactor-loader may also be needed to load waste into the containers so as to maximize load economies.

The Bin Barge and Roll-on Roll-off systems would involve an estimated initial capital cost in the range of $7 to $12 million, and operation and maintainance costs of approximatelly $4 million annually. The Container Barge system would require an estimated initial capital cost of $3.1 million and an annual operating expence less than $1 million.

A detailed cost analysis of the Container Barge system is shown in the following pages. The analysis takes the following into account: 1) the hauling of empty containers between the proposed East Transfer and Recycling Center (ETRC) and Port of Portland's Terminal 1; 2) the hauling of containers between Port of St. Helens and the proposed site for Resource Recovery facility; 3) the towing of the container barge between Terminal 1 and Port of St. Helens; and 4) the loading and unloading of containers at both terminals.

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1. Barging cost estimates were based on figures submitted by Port of Portland, Port of St. Helens, Foss Launch & Tug, Co., & Sowsear-Knoppton Inc..

ANNUALIZED COSTS OF METRO'S PURCHASES & MGMT.:

To compute an annual cost (to be incured by Metro) for the container barging system the following amortization assumptions were employed:

-Containers	5 yrs. @ 9%
-Tractors	5 yrs. @ 9%
-Chasis	5 yrs. @ 9%
-Barges	40 yrs @ 9%

TABLE 3

ANNUALIZED COSTS

Items		Costs ($/YEAR)
Containers		$137,600
Tractors (see Appendix B)		$116,808
Chasis		$1,375
Barges		$51,570
Towing		$200,000
Labour Wages (see Appendix A)		$208,032
Fuel (for Tractor)		$5,076
Admin.		$100,000
	TOTAL	$820,461
WASTE HAULED		350,000 TPY
COST PER TON		$2.34

SYSTEM'S COSTS (PER TON)

METRO'S PURCHASES & MGMT.	$2.34/TON
MATERIAL HANDLING (PORT OF PORTLAND)	$2.60/TON
MATERIAL HANDLING (PORT OF ST. HELENS)	$2.60/TON
TOTAL BARGING COST	$7.54/TON
COST PER TON IN 1990 PRICES	$8.73/TON

CONTAINER BARGE SYSTEM COSTS

KEY ASSUMPTIONS

- The Port of Portland will provide land to barge interchange and load and unload containers into/from the barge.
- The Port of St. Helens will provide barge to land interchange and unload and load containers from/into the barge.
- Towing Services will be contracted out.
- Metro will manage the hauling of containers to and from the interchanges.

TABLE 1

MATERIAL HANDLING AT THE INTERCHANGE

Description:	Cost ($/TON)
1) @ Port of Portland Terminal 1, @ $57.40 per containers	$2.60
2) @ Port of St. Helens, @ $57.40/container	$2.60

TABLE 2

METRO'S PURCHASES AND MANAGEMENT

Description:			Cost (Full $ Annual)
Capital:	- Containers (160)		$800,000
	- Tractor (6)		$450,000
	- Chasis (12)		$96,000
	- Barges (4)		$1,800,000
		TOTAL	$3,146,000
Operating Expences:			
	- Labor (6 Tractor Drivers)		$208,032
	- Towing		$200,000
	- Fuel		$5,100
	- Admin.		$100,000
		TOTAL	$513,132

APPENDIX A

Labor Cost @ $12.00/ Hr. Wage

Description	Per Year
Wage	$24,960
Fringe:	
Overtime (five days/year)	$864
Vacation (two weeks/year)	$960
FICA Tax @ $7.15 of Payroll	$1,915
SAIF @ $11.20 per $100 of Payroll	$2,999
State Unemployment Tax @ 2.2% of $14,000	$308
Federal Unemployment @ .8% of $7,000	$56
Tri-Met Tax @ .006% of Payroll	$150
Health and Welfare Insurance	$2,460
TOTAL	$34,672

APPENDIX B

Tractor Operation Cost for Single Tractor
(Excluding Fuel)

Description	Per Year
Depreciation	$12,893
Insurance	$2,400
Licence	$100
Public Utilities Commission Plates	$475
Garage/Parking @ $50/month	$600
Tires and Repairs	$3,000
TOTAL	$19,468

FUEL COST PER YEAR

		COST
Milage (mpg)	5.0	
Miles (hauling)	3,630.0	
Miles (idle)	500.0	
Gallons Consumed (hauling)	726.0	$726.0
Gallons Consumed (idle)	120.0	$120.0
TOTAL COST		$846.0

APPENDIX G

DIVERSION PREMIUM COSTS

DIVERSION PREMIUM COSTS* (Dollars per ton)

YEAR	1990	1991	1992	1993	1994	1995	1996	1997	1998
WASTE FLOW	874,000	898,000	903,000	918,000	932,000	948,000	962,000	977,000	992,000
COST FOR SYSTEM A	$47.07	$46.78	$46.38	$46.67	$44.89	$43.87	$44.25	$44.22	$44.22
PREMIUM COST	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
COST FOR SYSTEM B		$62.66	$61.18	$60.58	$58.99	$56.88	$56.56	$55.08	$54.03
PREMIUM COST		$60.30	$57.15	$54.59	$56.19	$52.73	$50.64	$45.36	$41.59
COST FOR SYSTEM C		$63.82	$62.88	$62.54	$61.30	$59.53	$59.50	$58.11	$57.09
PREMIUM COST		$58.12	$57.22	$55.96	$58.74	$57.01	$56.34	$52.10	$49.00
COST/SYSTEM CC w/ BARGING		$65.43	$64.47	$64.10	$62.83	$61.04	$60.99	$59.57	$58.53
PREMIUM COST		$63.62	$62.72	$61.46	$64.24	$62.51	$61.84	$57.59	$54.50
COST FOR SYSTEM D		$62.48	$61.22	$60.79	$59.44	$57.57	$57.37	$56.12	$55.18
PREMIUM COST		$53.51	$51.42	$49.74	$52.04	$49.83	$48.44	$44.63	$41.71
COST FOR SYSTEM E	$45.68	$48.29	$47.59	$47.46	$46.52	$44.25	$43.80	$43.69	$43.23
PREMIUM COST		$9.61	$7.78	$5.20	$10.92	$2.54	($3.06)	($3.74)	($7.02)
COST FOR SYSTEM F		$65.20	$63.75	$63.09	$61.45	$59.28	$58.57	$57.38	$57.28
PREMIUM COST		$43.80	$41.97	$40.34	$41.31	$39.11	$36.87	$34.42	$34.66
COST FOR SYSTEM G		$66.30	$65.44	$65.10	$63.86	$62.09	$61.68	$60.66	$60.06
PREMIUM COST		$43.34	$43.01	$42.29	$44.19	$43.16	$41.92	$40.13	$39.26
COST/SYSTEM GG w/ BARGING		$67.91	$67.03	$66.66	$65.39	$63.60	$63.17	$62.12	$61.50
PREMIUM COST		$46.91	$46.59	$45.87	$47.77	$46.74	$45.50	$43.71	$42.84
COST FOR SYSTEM H		$65.01	$63.78	$63.29	$61.89	$59.96	$59.37	$58.42	$57.86
PREMIUM COST		$40.45	$39.24	$38.12	$39.59	$38.11	$36.35	$34.67	$33.78
COST FOR SYSTEM I	$44.48	$47.32	$46.64	$46.54	$45.62	$43.37	$42.35	$42.85	$42.42
PREMIUM COST		$6.93	$3.38	($1.70)	$9.84	($6.81)	($17.92)	($19.14)	($25.60)
COST FOR SYSTEM J		$64.25	$62.59	$61.91	$60.27	$57.94	$57.73	$56.54	$55.37
PREMIUM COST		$51.70	$48.75	$46.60	$47.77	$44.42	$43.19	$40.09	$36.84
COST FOR SYSTEM K		$66.30	$65.09	$64.81	$63.61	$61.67	$61.80	$60.16	$59.04
PREMIUM COST		$51.85	$50.53	$49.79	$52.17	$50.46	$50.50	$46.56	$43.95
COST FOR SYSTEM KK		$68.34	$67.10	$66.78	$65.55	$63.58	$63.59	$62.01	$60.87
PREMIUM COST		$57.26	$55.94	$55.20	$57.60	$55.87	$55.92	$51.98	$49.37
COST FOR SYSTEM L		$62.36	$61.00	$60.57	$59.26	$57.00	$57.22	$55.78	$54.78
PREMIUM COST		$41.35	$39.44	$38.12	$40.01	$37.18	$37.28	$33.75	$31.30
COST FOR SYSTEM M		$64.08	$62.77	$62.24	$60.88	$58.80	$58.27	$57.89	$56.95
PREMIUM COST		$50.02	$48.16	$46.54	$48.51	$46.06	$43.91	$43.46	$41.11
COST FOR SYSTEM N		$62.74	$61.77	$61.55	$60.50	$58.73	$58.46	$58.18	$57.30
PREMIUM COST		$43.48	$42.62	$41.91	$44.64	$43.22	$41.92	$41.84	$39.80
COST FOR SYSTEM NN		$63.87	$62.88	$62.65	$61.58	$59.79	$59.50	$59.21	$58.32
PREMIUM COST		$46.56	$45.71	$44.99	$47.73	$46.30	$45.02	$44.93	$42.89
COST FOR SYSTEM O		$61.90	$60.78	$60.41	$59.24	$57.36	$56.94	$56.76	$55.93
PREMIUM COST		$41.17	$35.84	$38.67	$41.00	$35.20	$37.44	$37.55	$35.60

YEAR	1999	2000	2001	2002	2003	2004	2005	2006	2007	AVERAGE
WASTE FLOW	1,007,000	1,022,000	1,037,000	1,051,000	1,066,000	1,081,000	1,096,000	1,111,000	1,125,000	
COST FOR SYSTEM A	$44.99	$45.06	$45.38	$45.08	$45.69	$45.40	$45.59	$45.93	$47.88	
PREMIUM COST	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	
COST FOR SYSTEM B	$52.75	$51.41	$50.34	$49.59	$48.29	$45.75	$45.13	$44.12	$44.72	
PREMIUM COST	$33.40	$27.78	$21.98	$20.26	$11.84	$1.63	($2.18)	($8.61)	($15.20)	$29.97
COST FOR SYSTEM C	$55.80	$54.56	$53.57	$52.13	$51.02	$48.73	$48.10	$47.17	$47.86	
PREMIUM COST	$41.80	$37.30	$32.64	$28.46	$21.83	$13.84	$10.56	$5.30	($0.10)	$37.42
COST/SYSTEM CC w/ BARGING	$57.22	$55.96	$54.95	$53.50	$52.37	$50.05	$49.41	$48.46	$49.13	
PREMIUM COST	$47.30	$42.80	$38.13	$33.96	$27.33	$19.34	$16.06	$10.80	$5.40	$42.92
COST FOR SYSTEM D	$53.94	$52.82	$51.96	$50.61	$49.69	$47.62	$47.03	$46.21	$46.99	
PREMIUM COST	$34.59	$30.47	$26.19	$22.31	$16.35	$9.23	$6.04	$1.17	($3.05)	$31.40
COST FOR SYSTEM E	$42.34	$41.95	$43.30	$42.85	$42.93	$42.07	$40.63	$40.33	$40.84	
PREMIUM COST	($19.08)	($22.74)	($15.42)	($16.78)	($21.07)	($25.71)	($38.97)	($44.55)	($56.70)	($14.05)
COST FOR SYSTEM F	$55.95	$54.61	$53.13	$52.00	$50.70	$48.15	$47.53	$46.46	$46.22	
PREMIUM COST	$29.56	$26.12	$21.52	$19.47	$14.29	$7.97	$5.67	$1.56	($5.02)	$25.51
COST FOR SYSTEM G	$58.76	$57.51	$56.13	$55.06	$53.94	$51.63	$51.51	$50.51	$50.34	
PREMIUM COST	$34.66	$31.81	$27.87	$26.22	$21.98	$16.85	$16.21	$12.71	$6.91	$31.32
COST/SYSTEM GG w/ BARGING	$60.18	$58.91	$57.51	$56.43	$55.28	$52.96	$52.82	$51.80	$51.61	
PREMIUM COST	$38.24	$35.39	$31.45	$29.80	$25.56	$20.43	$19.79	$16.28	$10.48	$34.90
COST FOR SYSTEM H	$56.59	$55.46	$54.21	$53.24	$52.31	$50.23	$50.15	$49.25	$49.19	
PREMIUM COST	$29.18	$26.58	$22.88	$21.41	$17.61	$13.06	$12.47	$9.22	$3.67	$26.85
COST FOR SYSTEM I	$41.55	$43.11	$42.55	$42.12	$42.22	$40.29	$39.95	$39.68	$36.63	
PREMIUM COST	($49.60)	($28.50)	($42.03)	($44.61)	($53.07)	($79.14)	($88.57)	($99.57)	($181.38)	($42.20)
COST FOR SYSTEM J	$54.03	$52.49	$51.20	$49.61	$48.66	$45.70	$45.04	$43.85	$44.30	
PREMIUM COST	$30.33	$25.30	$20.12	$15.85	$10.53	$1.08	($2.03)	($7.70)	($13.42)	$25.85
COST FOR SYSTEM K	$57.70	$56.28	$55.12	$53.61	$52.16	$50.75	$50.07	$48.97	$49.51	
PREMIUM COST	$38.28	$34.31	$30.21	$26.80	$20.61	$17.31	$14.66	$10.09	$5.48	$34.91
COST FOR SYSTEM KK	$59.50	$58.06	$56.87	$55.34	$53.86	$52.43	$51.72	$50.60	$51.13	
PREMIUM COST	$43.70	$39.73	$35.63	$32.23	$26.03	$22.74	$20.08	$15.52	$10.92	$40.34
COST FOR SYSTEM L	$53.53	$52.29	$51.31	$49.93	$48.74	$47.65	$47.03	$46.09	$46.77	
PREMIUM COST	$25.70	$22.09	$18.37	$15.23	$9.71	$7.27	$4.11	$0.51	($3.72)	$23.43
COST FOR SYSTEM M	$55.73	$54.62	$53.38	$52.46	$51.47	$49.39	$48.80	$47.92	$47.89	
PREMIUM COST	$35.23	$31.82	$27.00	$25.25	$20.04	$14.04	$11.45	$7.18	$0.04	$31.75
COST FOR SYSTEM N	$56.11	$55.09	$53.94	$53.09	$52.25	$50.37	$49.80	$48.98	$49.04	
PREMIUM COST	$34.36	$31.46	$27.23	$25.83	$21.46	$16.48	$14.12	$10.40	$3.99	$30.87
COST FOR SYSTEM NN	$57.11	$56.08	$54.91	$54.05	$53.20	$51.30	$50.72	$49.89	$49.93	
PREMIUM COST	$37.45	$34.56	$30.33	$28.92	$24.55	$19.58	$17.22	$13.50	$7.09	$33.96
COST FOR SYSTEM O	$54.77	$53.83	$52.77	$51.98	$51.27	$49.54	$49.00	$48.26	$48.38	
PREMIUM COST	$30.19	$27.50	$23.48	$22.22	$18.23	$13.75	$11.43	$7.93	$1.72	$27.47

*Premium to divert waste from the landfill

MINUTES OF THE COUNCIL OF THE
METROPOLITAN SERVICE DISTRICT

June 30, 1987
Special Meeting

Councilors Present:	Mike Bonner, Tanya Collier, Tom DeJardin, Jim Gardner, Gary Hansen, Sharron Kelley, Corky Kirkpatrick, David Knowles, Mike Ragsdale, George Van Bergen and Richard Waker
Councilors Absent:	Larry Cooper
Also Present:	Rena Cusma, Executive Officer
Staff Present:	Dick Engstrom, Vickie Rocker, Don Carlson, Ray Barker, Bob Applegate, Debbie Allmeyer, Tor Lyshaug, Dave Luneke, Dennis Mulvihill, Richard McConaghy, Steve Rapp, Jon Allred, Becky Crockett

Presiding Officer Waker called the special meeting to order at 5:40 p.m. He explained that Resolution No. 87-780 would be the only item on the agenda and that the Council had conducted a public hearing on resource recovery project issues at their meeting of June 25, 1987.

1. Consideration of Resolution No. 87-780, for the Purpose of Authorizing Entry into Memorandum of Understanding Negotiations with System Contractors of Mass Composting and Mass Incineration Systems

Debbie Allmeyer, Resource Recovery Project Coordinator, summaried staff's recommendation: that staff be authorized to enter into preliminary negotiations, or Memorandum of Understanding negotitions, with the firms of 1) Riedel Environmental Technologies for a composting facility and transfer station; 2) Schnitzer/Ogden for mass incineration technology; and 3) Fluor/SEI for mass incineration technology. The composting facility's proposed location was at N.E. Columbia Boulevard in Portland and a St. Helens' site was recommended for mass incinceration technology.

Presiding Officer Waker noted he had received a letter from the Port of Portland, signed by Lloyd Anderson, indicated the Port supported the recommendations made by the Resource Recovery Review Committee and the Executive Officer.

He read an unsigned letter from the Tri-County Council, submitted by Executive Director Maureen Ernst, OSSI:

"The Tri-County Council has gone on record in support for continued negotiations with the Alternative Technology proposals. We encourage the Metro Council and staff to study all the proposals and render no decisions until the landfill/-disposal sites have been secured."

A letter from Councilor Larry Cooper read:

"Since I will be unable to attend the June 30 Special Meeting due to previous commitments, I would like to put several comments in writing to you. Personally, I feel we are committed to a balanced system, i.e., landfill, burner and composting. The composting is fairly simple since we had one responsive bidder.

Landfill siting by Metro is going to be a long, arduous process. We have several proposals including Arlington and Boardman plus others that may offer a temporary solution to Metro. I would dismiss the one from Art Raz as I believe his presentation and following correspondence were less than professional.

In the matter of the burners, since I would hate to spend the negotiating budget money, I think we should look into the Combustion Engineering as well as the other two vendors. There is plenty of opportunity to negotiate for better tipping fees and for a better equity position and the project would impact the costs.

I also understand from last nights' meeting that the question of flow control has again come up. I feel comfortable with it but for everyone's peace of mind, we should get a firm opinion that we do have that right."

A letter was received from Wastech and written copies were distributed to all Councilors. The letter expressed concerns about designating the site proposed by Riedel for the regional transfer station.

<u>Main Motion</u>: Councilor Knowles moved, seconded by Councilor Hansen, to adopt Resolution No. 87-780.

Councilor Knowles then discussed two amendments to the Resolution he wished to propose. The first amendment would add Combustion Engineering (CE) and their proposal for a facility using resource derived fuel (RDF) technology to the list of burner technologies with which staff could negotiate. Staff would therefore be negotiating with three different firms. The second amendment would instruct staff to enter into limited negotiations with the three firms on business and financial issues, including risk and equity contribution matters.

First Motion to Amend: Councilor Knowles moved, seconded by Councilor Kirkpatrick, to add the RDF proposal submitted by Combustion Engineering to the list of firms with which staff would negotiate.

Councilor Knowles explained it would be appropriate to include RDF technology in Resolution No. 87-780 because Metro had, from the outset, identified RDF technology as acceptable. The Review Committee's recommendation was inconsistent with that determination. Councilor Knowles also thought CE's proposal was clearly better than at least one of the mass incineration proposals in terms of risk posture, better in terms of the amount of equity they would put into the project and the amount of money they would take out of the project, and potentially better in terms of addressing the state-mandated hierarchy of solid waste disposal. Finally, Councilor Knowles said that in order to place Metro in the best possible negotiating posture, it would be best to know as much as possible about all three technologies represented.

Councilor Hansen asked if Councilor Knowles intended staff to enter into negotiations with CE assuming they would use the St. Helens' site. Councilor Knowles said the Resolution was clear -- a precondition of the project was to use the St. Helens' site for a 350,000 ton per year facility. He would not propose changing those conditions for the CE proposal.

Councilor DeJardin agreed with Councilor Knowles' amendment. He was concerned, however, that additional negotiating costs could be incurred by adding one more vendor to the list.

Councilor Knowles said his second proposed amendment would help keep costs down by proposing more limited negotations at the onset of the process. Metro would not be committing its full resources to entering into memorandums of understanding (MOU's) with all the proposers until basic economic questions were answered to Metro's satisfaction.

Presiding Officer Waker asked Councilor Knowles to explain the exact intent of his second proposed amendment and how it would effect the MOU negotiation process.

Councilor Knowles said he did not propose chaning the full MOU negotiation with Riedel. The amendment would, however, revise the Resolution to instruct the staff to enter into limited negotiations regarding those issues listed in the "Economic Impact Criteria" of the Final Evaluation Report and to report back to the Council within 60 days. He suggested that procedure due to continuing questions raised about risk posture and equity of the proposals. For example, he said, there were still outstanding questions about Fluor's parent guarantee.

Councilor Kelley reminded Councilor Knowles the Review Committee had determined that although the CE proposal was more cost effective than the cost of mass burn, RDF technology was not "tried and true." Questions remained about emission levels. She suggested Councilor Knowles include CE's proposal and provisions for limited negotiations in his first amendment. She did not think it appropriate to recommend staff enter into a MOU with CE at this time.

Councilor Knowles said he did not want to limit the possibility of entering into MOU negotions with CE, especially since they had submitted an excellent financial proposal and since the Sierra Club and other parties had advocated that RDF was a cleaner technology than mass incineration.

Councilor Van Bergen thought the issue of the location of the next regional landfill should also be addressed in the Resolution. Councilor Gardner said he would, later in the meeting, propose an amendment that would request staff further refine system cost analysis to include two sets of assumptions for Eastern Oregon and the Bacona Road landfill sites.

Councilor Hansen requested the staff or Executive Officer respond to Councilor Knowles' two proposed amendments.

Executive Officer Cusma said she supported the Review Committee's recommendation because she believed the CE proposal was not responsive to Metro's Request for Proposals. She pointed out that Metro would eventually have to make a hard decision and narrow down the proposals. She thought it too expensive to continue negotiations with four firms and recommended going forward with the tried and true technology of mass incineration.

Ms. Allmeyer noted that although CE's proposal for RDF technology was responsive, the mass incinceration proposals were ranked superior and therefore recommended for MOU negotiations.

Councilor Knowles again pointed out that CE's proposal was superior in the areas of economic risk and equity and to cut off negotiations before all economic factors were known would be unwise.

Councilor Gardner asked CE's response to Councilor Knowles' proposals.

Paul Barbian of Combustion Engineering said CE would be pleased to negotiate for a project and would add something to Metro's process. He pointed out the proposal was responsive, CE was highly rated on economic issues, and the RDF technology had been rated acceptable by the Review Committee.

Vote on First Motion to Amend: A vote resulted in:

Ayes: Councilors Bonner, Collier, DeJardin, Gardner, Hansen, Kirkpatrick, Knowles, Ragsdale and Van Bergen

Nays: Councilors Kelley and Waker

Absent: Councilor Cooper

The motion carried.

Second Motion to Amend: Councilor Knowles moved, seconded by Councilor Kirkpatrick, that Paragraph 3 of the "Be it Resolved" section of Resolution No. 87-780 be eliminated and that Paragraph 2 be replaced with language (to be drafted later) that would instruct staff to enter into preliminary negotiations with each of the proposers solely on equity and risk postures and to report back to the Council within 60 days.

Councilor Hansen said he would oppose the amendment because it could delay the MOU process and would complicate staff's negotiation process. He pointed out the Council had originally expected to complete the entire MOU process in about 60 days.

Councilor Collier asked if staff could complete the initial financial negotiations within 30 days.

The Executive Officer advised that imposing time limits could seriously hinder negotiations. She said the Council would be fully briefed at regular invervals on the status of the negotiations.

Councilor Ragsdale was also concerned about any amendment that would limit staff's negotiation leverage.

Dean Gisvold, legal counsel for the project, agreed that too many Council limitations could hamper negotiations, but he also pointed out that certain financial issues needed to be resolved very early in the negotiation process including equity, cost of the St. Helens site, and risk.

Ed Einowski, bond counsel for the project, agreed with Mr. Gisvold that certain financial issues needed to be dealth with before proceeding to the MOU phase. He said those financial issues would be very easy to identify and resolve.

Paul Atanasio of Salomon Brothers, questioned whether the "limited MOU negotiations" proposed by Councilor Knowles were really the same as formal MOU negotiations. He agreed with the opinions of Mssrs.

Gisvold and Einowski. He thought 60 days was enough time to resolve financial issues. Thirty days would not be enough time.

Councilor Van Bergen asked Councilor Knowles if the second amendment would include language about landfill sites. Councilor Knowles said he did not think enough was known about proposed sites at this time to address that issue in the amendment. Councilor Gardner added that at or near the end of the MOU phase, Metro would have received more difinitive information about Eastern Oregon sites and the Bacona Road site.

Ms. Allmeyer reminded the Council that the estimated fees paid to Metro's negotiating team were $500 per hour. Consultant costs would increase if limited negotiations were conducted with Combustion Engineering. Councilor Knowles explained that the total project would eventually cost between $300 and $400 million and the consultants' time was well-spent if the results were the best possible project.

Councilor Gardner said he would support the amendment because it would have the effect of shortening the time for MOU negotiations and net project costs could actually decrease due to a tighter financial arrangement.

Tor Lushaug, Acting Solid Waste Director, urged the Council not to vote for the amendment or take any action that would hamper staff's negotiation process. He recommended the negotiations be conducted in one continuous process.

Councilor Bonner supported the amendment because the Final Evaluation Report had not addressed his questions about project finances.

Councilor Hansen said he hoped Councilor Knowles would draft final wording for the amendment that would instruct staff to commence the MOU process at this time, focusing on financial issues at the start, to report back to the Council within 60 days regarding financial issues, and to continue on with other aspects of the MOU negotiations.

Councilor Ragsdale requested Councilor Knowles restate the motion to establish specific language for the amendment before a vote was taken. A discussion followed about the wording of the motion. Mr. Gisvold listed key financial issues to be resolved explaining the negotiating team understood precisely what issues had to be initially resolved. Councilor DeJardin suggested the Council was placing too much emphasis on defining tasks in the amendment and that more generic wording would be more beneficial to the negotiators. Councilor Van Bergen agreed with the generic approach.

Restatement of Second Motion to Amend: Councilor Knowles proposed the following wording, which was also agreeable to Councilor Kirkpatrick, for the amendment which would replace the second "Be it Resolved" paragraph of the Resolution and eliminate the third paragraph:

"That Metro will proceed with limited negotiations with Schnitzer/Ogden, Fluor/SEI and Combustion Engineering and staff shall report back to the Council within 60 days with a recommendation on whether to proceed with a Memorandum of Understanding."

Councilor Ragsdale said he could support the above language because no restrictions were being placed on the negotiating team.

Councilor Kelley again reminded the Council that the Review Committee had eliminated Combustion Engineering from further negotiations because RDF technology was not a proven entity. She cautioned the Council against making a decision to award the project based solely on economic factors.

Vote on the Second Motion to Amend: A vote resulted in:

Ayes: Councilors Bonner, Collier, DeJardin, Gardner, Kirkpatrick, Knowles, Ragsdale, Van Bergen and Waker

Nays: Councilors Hansen and Kelley

Absent: Councilor Cooper

The motion carried.

Third Motion to Amend: Councilor Gardner moved, seconded by Councilor DeJardin for discussion purposes, to add a new paragraph 3 to the "Be it Resolved" section to read as follows:

"That entering Memorandum of Understanding negotiations does not indicate Metro necessarily will complete procurement of a resource recovery facility or facilities. The Metro staff is requested to continue to define and refine the projected costs of regional solid waste disposal systems which both exclude and include resource recovery facilities. Staff is also requested to obtain the most reliable information possible on the costs of contracting for Eastern Oregon landfill disposal."

In response to Councilor DeJardin's question, Councilor Gardner said costs would be projected to reflect the life of the system.

<u>Revision of Third Motion to Amend</u>: After discussion on the motion, Councilors Gardner and DeJardin agreed to reword the amendment as follows:

"That entering Memorandum of Understanding negotiations indicates Metro's interest in proceeding with procurement of a resource recovery facility or facilities. At the same time, Metro staff is requested to continue to define and refine the projected costs of regional solid waste disposal systems which both exclude and include resource recovery facilities. Staff is also requested to obtain the most reliable information possible on the costs of contracting for Eastern Oregon landfill disposal. The ultimate decision to complete resource recovery procurement will depand on Metro negotiating the lowest cost possible."

Councilor Gardner envisioned staff would provide cost projections according to the MOU time frame. At the end of the MOU process, the Council would examine the best available system costs information to make its final decision.

The Executive Officer said she expected to have more difinitive landfill cost information in September or October when the Council made its final decision.

<u>Vote on Third Motion to Amend</u>: A vote on the motion resulted in all eleven Councilors present voting aye. Councilor Cooper was absent.

Councilor Kelley noted that after MOU negotiations were completed, she wanted staff to address the issue of ash separation and related costs and emmission levels. She suggested that emmission levels be lower than Marion County's. Ms. Allmeyer invited the Council to submit other concerns to staff.

<u>Vote on the Main Motion as Amended</u>: A vote on the motion to Adopt Resolution No. 87-780 as amended resulted in all eleven Councilors present voting aye. Councilor Cooper was absent.

The motion carried. (Note: The Clerk changed the title of Resolution No. 87-780 to be consistent with the adopted amendments. The title now reads: "For the Purpose of Authorizing Entro Into Memorandum of Understanding Negotiations with Contractor of Mass Composting and Limited Negotiations with Contractors of Mass Incineration and Refuse Derived Fuel.")

In response to Councilor Van Bergen's question, the Presiding Officer said the Council would address the flow control issue another time. Councilor Hansen pointed out the State Attorney General had recently issued an opinion on the matter which could be provided the Councilor. The Executive Officer said she would forward a copy of the opinion to Councilor Van Bergen.

There was no other business and the meeting adjourned at 7:10 p.m.

Respectfully submitted,

A. Marie Nelson

A. Marie Nelson
Clerk of the Council

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