DISPOSAL SITING ALTERNATIVES SUMMARY

SEPTEMBER 1978

REDUCE REUSE RECOVER

Metropolitan Service District

OBJECTIVES

In August, 1977, the Metropolitan Service District Board of Directors authorized staff to accomplish work which would:

1. Develop a list of potential landfill and transfer station sites and compile all readily available information;
2. Develop reliable waste generation estimates and forecasts;
3. Compare advantages and disadvantages of siting alternative systems;
4. Analyze the effect of alternatives on existing solid waste collection and disposal practices;
5. Consider feasibility of using gravel pits as sanitary landfills; and
6. Prepare a plan for the MSD Board and recommend priorities for site development.

FINDINGS AND RECOMMENDATIONS

Findings

1. The study provided no sites which had not been previously identified for their landfill feasibility.

2. A number of sites considered in earlier reports were eliminated from further consideration because of obstacles or problems in their implementation.

3. The cost of landfilling in new or expanded sites is projected to be double existing disposal related costs.

4. Citizen reaction, land use decision processes and attitudes about solid waste are the greatest obstacles to implementing new landfills.

5. No single site identified in the study meets all the requirements for implementation by local land use authorities and state and federal agencies.

6. The difficulty of siting new landfills is increased by the desire for providing dumping facilities for citizens hauling their own waste.

7. Solid waste weight measurements maintained since May, 1977 have increased the reliability of solid waste projections. Actual weighed quantities compare favorably with previous projections by COR-MET and subsequent refinements.

8. The Department of Environmental Quality offers little encouragement on the feasibility of the majority of sites considered in the report. DEO favors expansion of St. Johns Landfill outward more than upward expansion and offers some encouragement for both proposals.

9. Based on this report, the lowest cost disposal alternative for the future 20-year period results from filling close-in gravel pits, one at a time, constructing a transfer station after approximately ten years and utilizing a more remote site upon completion of the gravel pits.

a. Construction of a transfer station sooner increases disposal related costs, but reduces haul costs and provides greater flexibility in solid waste management.

b. Construction of a processing station slightly increases disposal related costs but reduces reliance on landfilling and extends the life of lower cost, close-in sites.

10. Preliminary information provided by Publishers Paper Company and Bechtel, engineering consultants for Publishers, indicates slight economic difference between systems employing solid waste processing with energy recovery and a system relying completely on landfills.

Recommendations

1. In that citizen impact is lower and implementation therefore more feasible for an existing site, MSD should support whatever expansion of St. Johns Landfill that can be made.

2. A request for proposals or bidding process should be used to determine the order of greatest economic advantage, benefits to MSD

citizens and likelihood of successful implementation for the sites deemed feasible in the report.

3. A search for a long term site(s) should commence as soon as possible.

4. MSD should implement a system of rate review as soon as possible, including coordination and/or agreement with the City of Portland on future operation of the St. Johns Landfill.

5. A transfer station should be identified as soon as possible and implemented to correspond with the Oregon City Processing Plant, if the project goes ahead, or a system of landfills.

6. Effforts should be initiated to phase out public dumping as currently handled at existing landfills through:

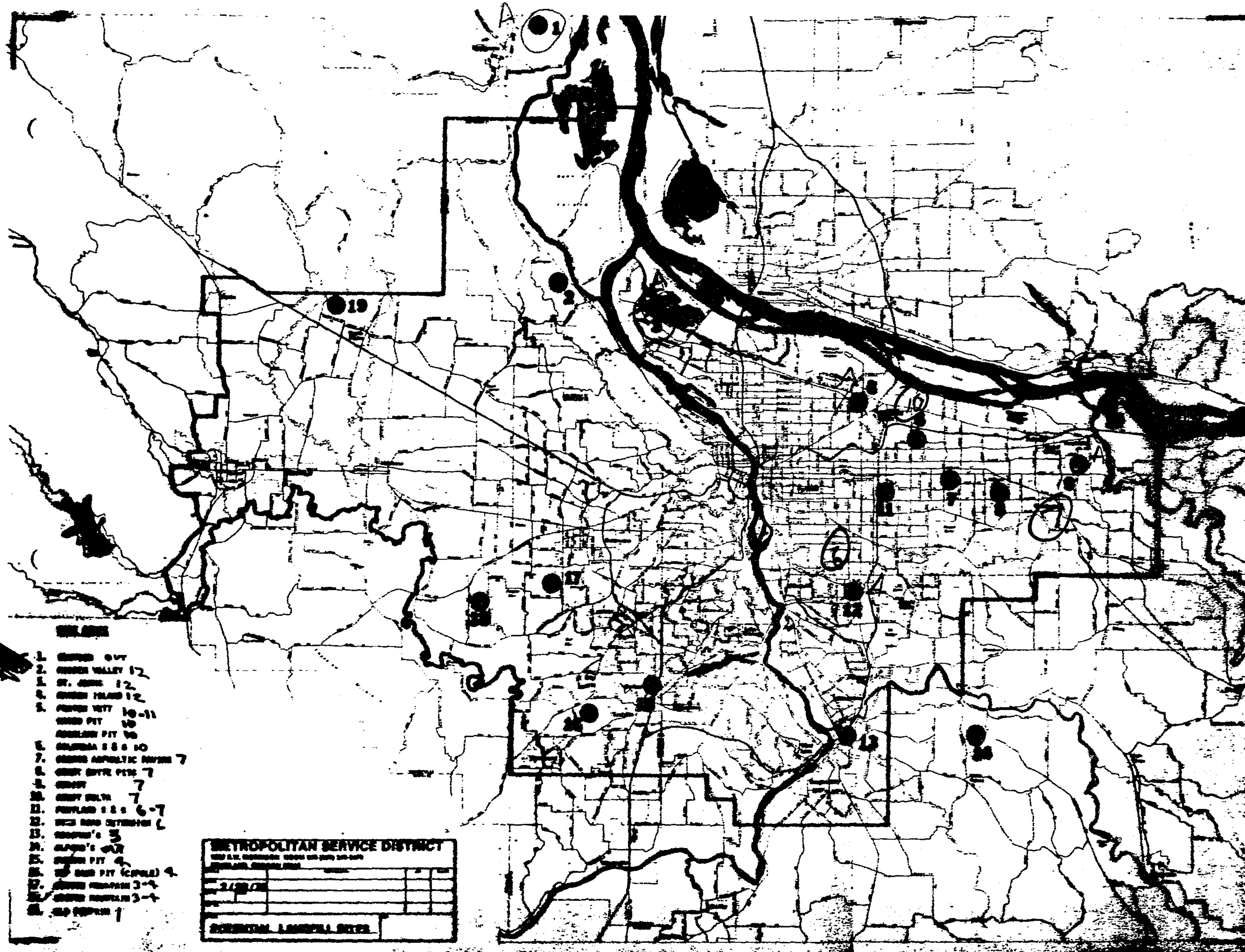
a. Review of cost allocation between citizen deliveries and commercial vehicle deliveries, and assessment of fair rates;

b. Construction of permanent unloading facilities at local landfills or through a system of citizen use transfer stations; and

c. Encouragement of programs such as brush chipping stations, building materials depots, appliance exchange or collection programs, equitable bulky waste collection services, and source separation and recycling.

SITE INVESTIGATIONS

During the study, MSD published a Request for Information and notified all known persons or groups directly affected by implementation of sanitary landfills of MSD's effort to identify potential sites. In addition, a detailed study of map resources available through other agencies was made and a careful review of all earlier reports and research dealing with sanitary landfills. These efforts resulted in identification of the sites shown on Figure S-1.



DIST- 2,8,9, (11?)

SITING CONSTRAINTS

Federal government, state government and local land use jurisdictions control the siting of sanitary landfills. Most notably, the State Department of Environmental Quality and the Environmental Protection Agency provide explicit direction on landfill siting.

Each potential site should be considered in light of the separation of the site from groundwater or surface water, the potential for gas migration from the site, the ability of access points to handle anticipated traffic loading, the proximity of the site to airports, relationship of the site to wetlands or flood plains, and the benefit of filling the site to the community. Assumptions were made that certain constraints could be overcome through expenditures for site development such as for separation of the site from groundwater or surface water. Based on these identified constraints, Table S-1 was compiled.

Table S-1
POTENTIAL SITES

NAME OF SITE	A	B	C
Alford's		X	
TRP Sand Pit (Cipole)		X	
Columbia Sand & Gravel		X	
Durham Pits		X	
Cooper Mountain		X	
Hidden Valley			X
Hayden Island			X
Nash Pit			X
King Road Extension	X		
Newberg		X	
Old Pumpkin		X	
Obrist	X		
Oregon Asphaltic			X
Portland Sand & Gravel		X	
Rossman's	X		
Roselawn			X
Sexton Mountain			X
St. Johns - Upward		X	
St. Johns - Outward	X		
Sandy Delta			X
Santosh	X		
Waybo Pit			X
Porter-Yett			X
Grant Butte Pit		X	

A: Needs environmental Acceptance
B: Needs environmental and land use acceptance
C: Needs environmental and land use acceptance and has major problems

DETAILED ECONOMIC ANALYSIS

Economic analysis required that certain explicit assumptions be made about various factors in the solid waste and disposal system. Significant work was expended to assure that these assumptions were as realistic as possible. A computer model was utilized to facilitate computational complexities.

Haul Costs

An analysis of 25 input parameters were reduced to a cost per ton-mile to move solid waste. Although costs per ton-mile differed for drop box collection vehicles and residential and commercial compaction vehicles, the higher rate was used for both collection methods. The effect of this assumption is to increase the importance of centrally located landfill sites.

Disposal Facility Costs

Specific estimates were made of landfill and transfer station design, construction and operational costs. These costs are intended to reflect the requirements of new federal legislation and strictly enforced state standards. The assumptions used in the report result in a disposal related cost increase of nearly two times the existing costs. The projected costs for landfill and transfer stations varied, depending on annual facility throughputs.

Oregon City Processing Plant

Cost comparisons used in this report were based on preliminary information supplied by Publishers Paper Company and their engineering consultants. The preliminary nature of this information makes drawing comparisons between systems alternatives with and without the processing plant difficult. Comparisons are further complicated by the uncertainty of implementing the landfills included in the analysis.

ECONOMIC ANALYSIS RESULTS

The relative economic advantages and disadvantages of each potential site is shown in Table S-2. The costs shown are based on operation of only one site at a time. Total system costs increased for operation of more than one site at a time. Table S-2 also provides the capacity of each site.

Table S-2
LANDFILL SUMMARY

Site	Haul Cost ($/Ton)	Disposal Cost* ($/Ton)**	Total Cost ($/Ton)	Capacity (Tons)
(1) Waybo-Roselawn	4.56	5.14	9.70	1,900,000
(2) Portland S & G	4.57	6.82	11.39	2,750,000
(3) Grant Butte Pits	5.74	5.88	11.62	950,000
(4) Oregon Asphaltic	4.80	7.35	12.15	1,400,000
(5) Columbia S & G	4.54	7.64	12.18	710,000
(6) Old Pumpkin	8.88	3.62	12.50	3,500,000
(7) St. Johns (Lateral)	6.18	6.67	12.86	1,700,000
(8) Durham	6.19	6.67	12.86	730,000
(9) Alford	9.68	3.29	12.97	8,800,000
(10) King Rd. Extension	5.90	7.55	13.45	1,900,000
(11) Hayden Island	6.46	7.92	14.38	10,700,000
(12) TR Sand Pit (Cipole)	6.75	8.17	14.92	950,000
(13) St. Johns (Up)	6.19	8.80	15.08	770,000
(14) Obrist	8.08	7.30	15.38	750,000
(15) Cooper Mountain	8.42	8.68	17.10	1,000,000

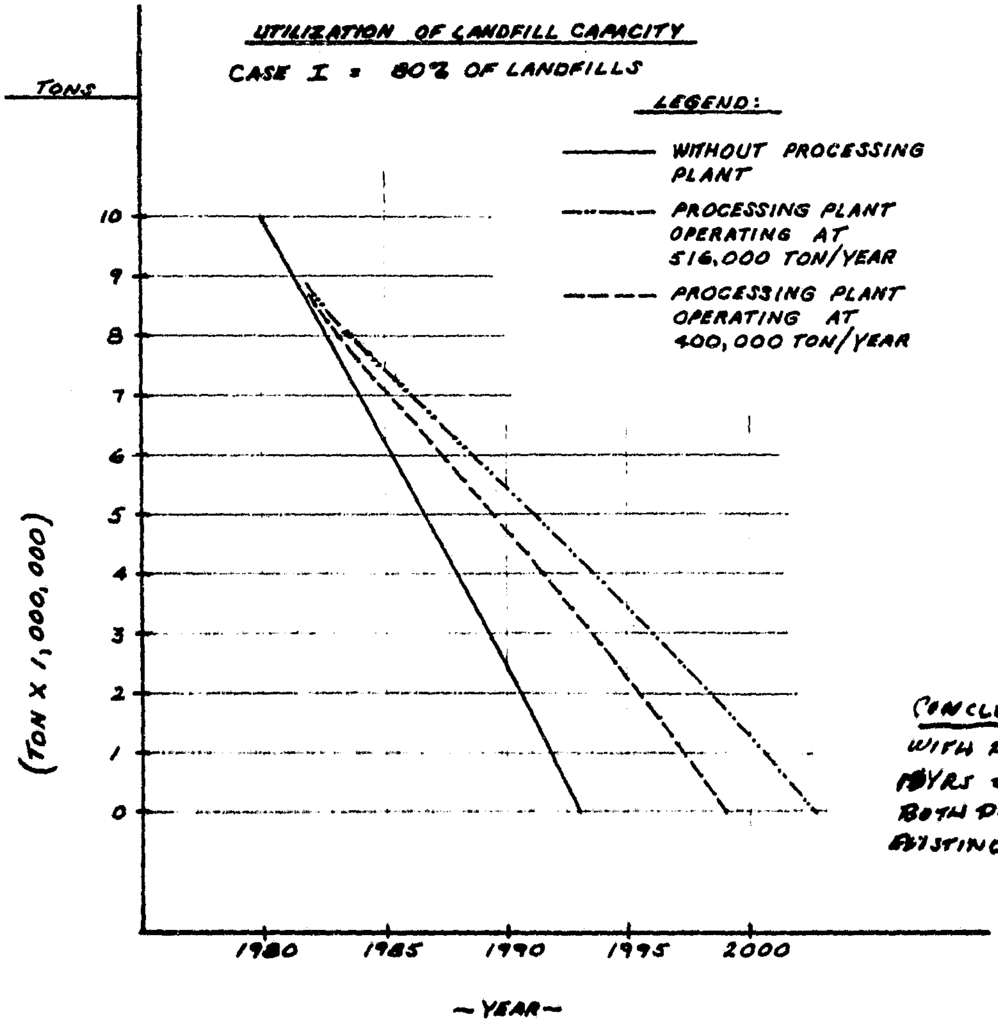
* Disposal Costs based on a volume of waste received of 730,000 tons per year (all of MSD's residential, and industrial and commercial waste plus 10% for public dumping).

** All costs 1977 dollars.

Considering all of the factors comprising implementation of any specific site, probabilities were derived by MSD staff to indicate the likelyhood of any site actually being used.

Figures S-2, S-3 and S-4 show the number of years of expected landfill life resulting from varying assumptions on the likelihood of implementation. The solid line in each of these figures represents a system relying 100 percent on landfills and the two dashed lines represent processing plant alternatives with varied annual throughput. Figure S-2 corresponds to an 80 percent probability of implementing all sites; Figure S-3, a 60 percent probability; and Figure S-4, a 40 percent probability.

Figure S-2



CONCLUSION
WITH PLANT ADDITIONAL YRS ON [redacted] LANDFILLS. BOTH POTENTIAL AND EXISTING.

Figure S-3

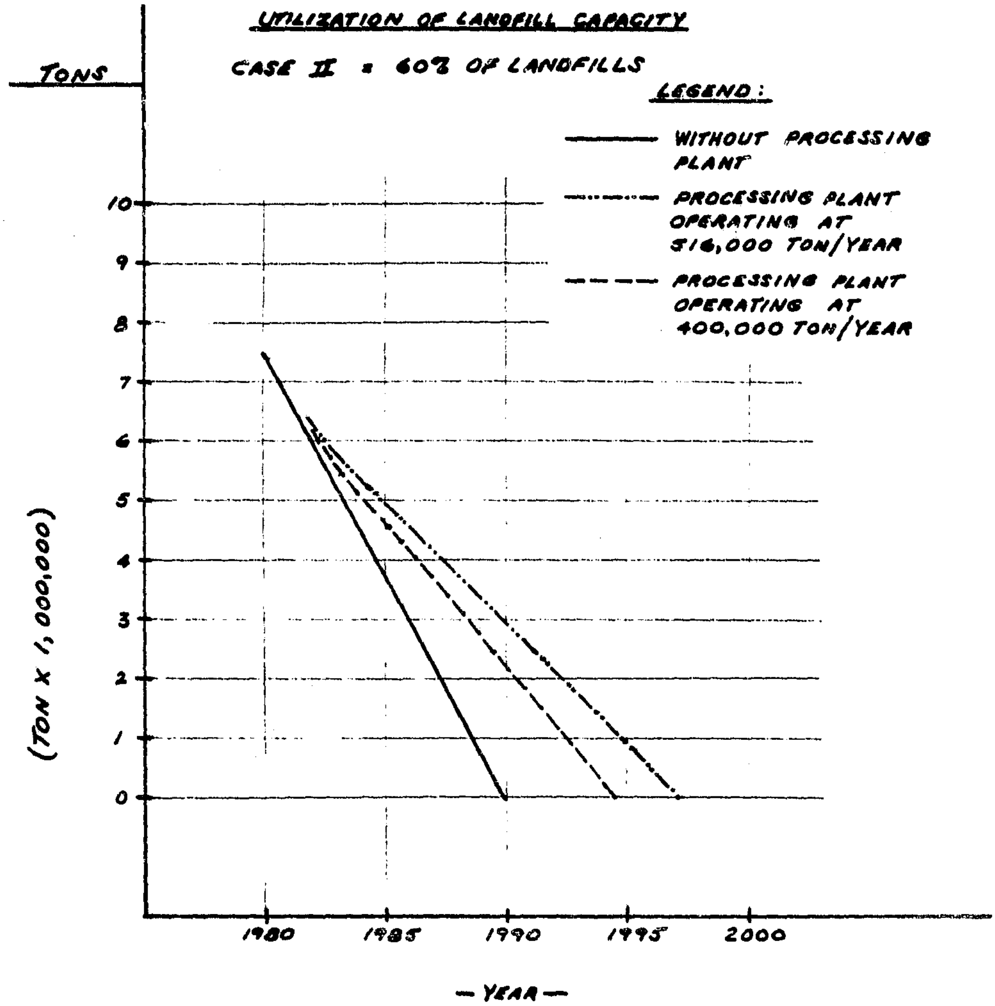
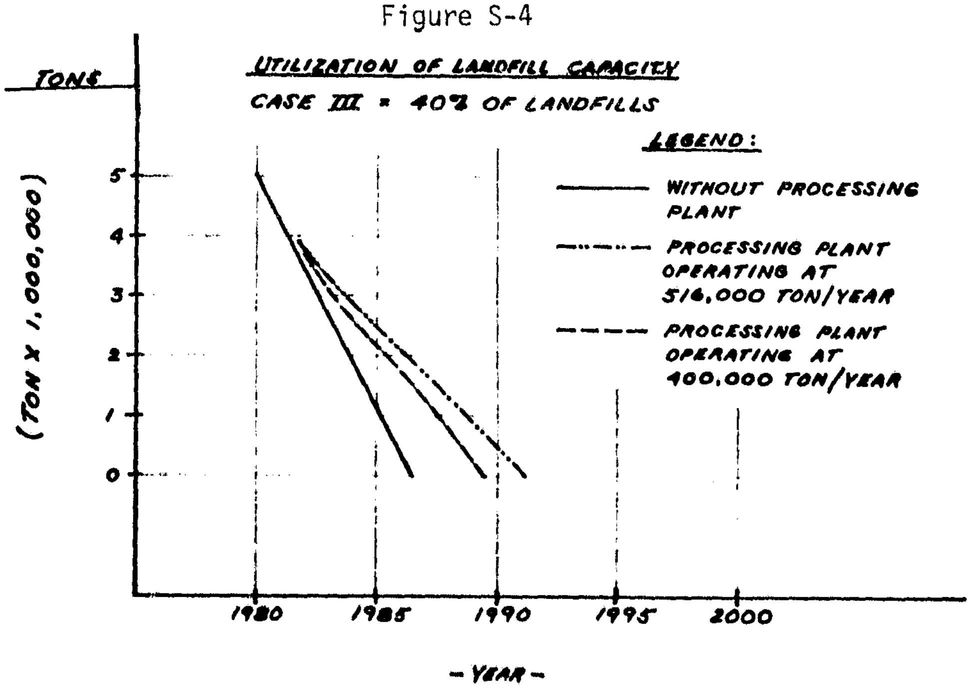


Figure S-4



Over a twenty year period, the total unit costs for each alternative is given by Figure S-5. The total unit costs include haul costs and disposal costs.

Figure S-5

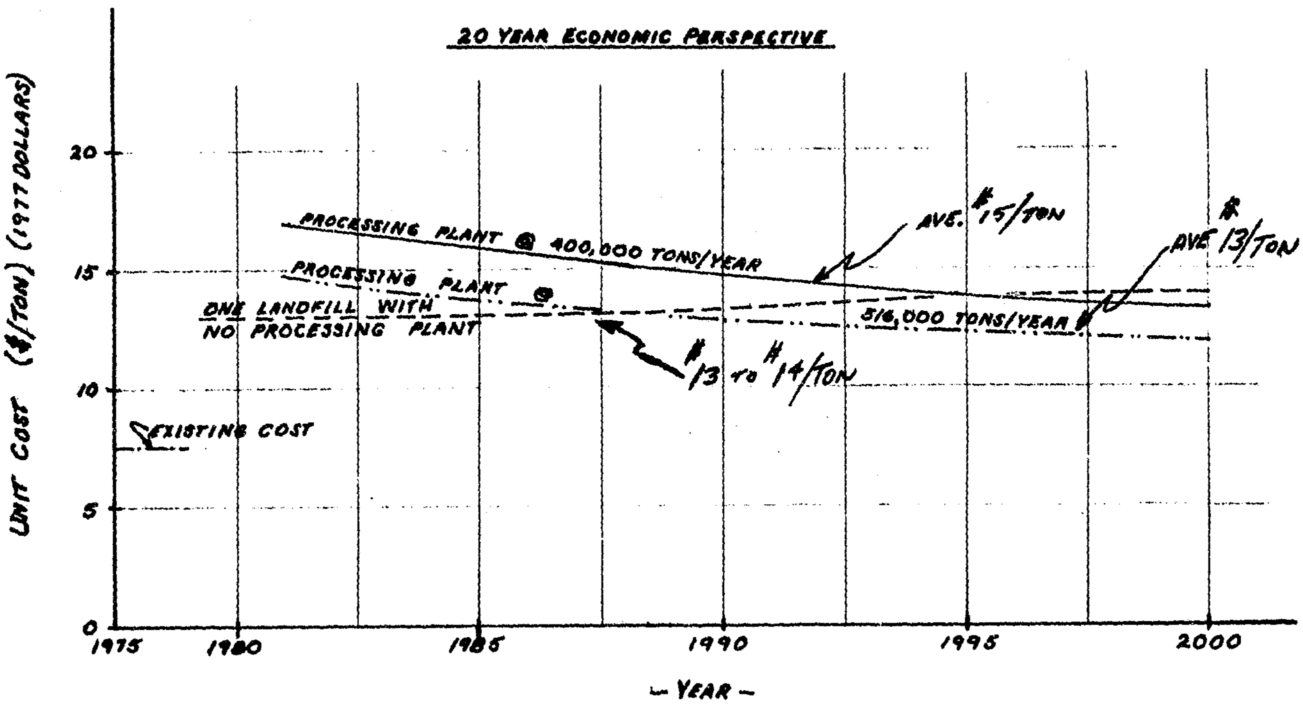
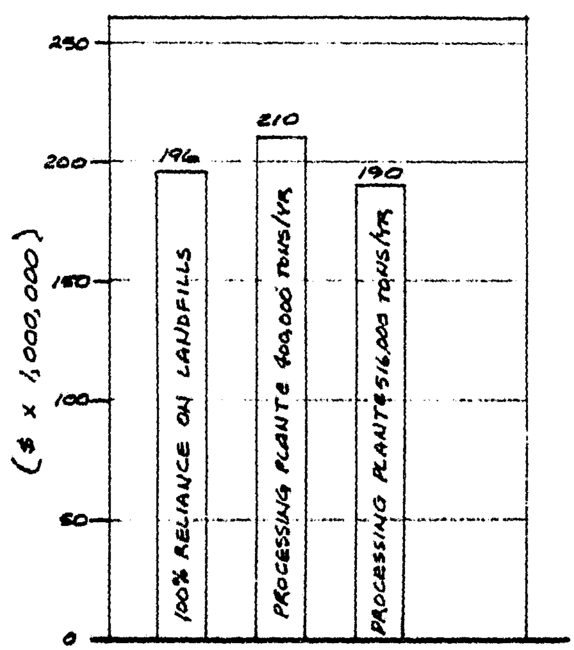


Figure S-6



Using the costs shown in Figure S-5, the total costs for each year over a twenty year period from 1980 to 2000, are accumulated in Figure S-6. Figure S-6 shows that, depending on the annual processing plant throughput, the cost of a system relying 100% on landfills versus a system incorporating the plant, are roughly similar.

IMPLEMENTATION

The MSD Board has indicated a preference for the private sector providing solid waste disposal services for which MSD establishes or confirms a need. It is unlikely that support can be confirmed for changing this reliance.

The study indicates a preference for supporting expansion of existing sites. It is anticipated that new sites will come from those sites deemed most feasible in the study. Site differences will be determined on the basis of the proposals prepared by site owners and landfill operators.

DISPOSAL SITING ALTERNATIVES

METROPOLITAN SERVICE DISTRICT

SEPTEMBER 1978

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Chapter 1

INTRODUCTION

Landfills are a necessary part of any solid waste disposal or processing plan. Residue from processing and resource recovery and unprocessable materials must be disposed in landfills.

On August 18, 1977, the Metropolitan Service District Board of Directors authorized staff to accomplish specific work tasks essential to developing future disposal sites. The work tasks included issuance of a "Request for Landfill Siting Information" informing the Department of Environmental Quality of MSD's proposed work plan, requesting staff aid from DEQ, and returning to the MSD Board with a specific plan.

The staff understood the objectives of the work plan to be the following:

1. Develop a list of potential landfill and transfer station sites and research readily available information on each site;

2. Develop reliable waste generation estimates and forecasts;

3. Formulate siting alternative systems and compare relative advantages and disadvantages of the alternatives;

4. Determine the effect of proposed alternatives on existing collection and disposal practices;

5. Explore the feasibility of gravel pit usage for sanitary landfills; and

6. Prepare an implementation plan and recommend the priorities for site development.

Chapters 3 through 17 of this report deal with specific objectives and sub-tasks. Chapter 2 is a presentation of staff findings and recommendations. A glossary of technical terms is provided in Appendix A.

Chapter 2

FINDINGS AND RECOMMENDATIONS

The results of this report can be summarized through presentation of findings. It is intended that the recommendations correspond to needs identified and addressed in the report.

Findings

1. An examination of earlier reports and research, a comprehensive map study and an extensively solicited published request for information provided no sites which had not been previously identified or discussed for their landfill feasability.

2. A number of sites which had been considered in earlier reports were eliminated from further consideration because of insurmountable obstacles or problems with their implementation.

3. The cost of landfilling in new or expanded sites is likely to increase the bill paid for disposal related costs by more than double. Disposal related costs are considered to be all costs incurred from the time a collection vehicle is full, until the waste is ultimately deposited in the ground.

4. Citizen reaction, land use decision processes, and attitudes about solid waste are likely to be the greatest obstacles to implementing new landfills.

5. Of all sites showing potential for landfill development or expansion, no single site meets all of the requirements for implementation by local land use authorities and state and federal agencies.

6. The environmental deficiencies of existing landfill operations and the problems of siting new landfills are increased by

the desire for providing dumping facilities for citizens hauling their own wastes.

7. Controversy over actual quantities of solid waste disposed in the MSD area has been significantly reduced by weight measurements maintained since May, 1977. Actual quantities correspond favorably to previous projections by COR-MET and subsequent refinements.

8. The Department of Environmental Quality (DEQ) offers little encouragement on the feasability of the majority of sites considered in the report. DEQ favors expansion of St. Johns Landfill outward, more than upward expansion, and offers some encouragement for both proposals.

9. Utilizing assumptions of this report, from an economic viewpoint only, the lowest cost disposal alternative for the future twenty year period for MSD results from filling close-in gravel pits one at a time, constructing a transfer station after approximately ten years, and utilizing a more remote site similar to Alford's or Old Pumpkin's, upon completion of the gravel pits.

(a) Construction of a transfer station sooner increases disposal related costs but reduces haul costs and provides significantly greater flexability in solid waste management.

(b) Construction of a processing station slightly increases disposal related costs but reduces reliance on landfilling and extends the life of lower cost, close-in sites.

10. MSD staff extrapolation of preliminary information provided by Publishers Paper Company and Bechtel Corporation for the Oregon City Processing Plant indicates little economic difference between a system employing solid waste processing and energy recovery with one relying completely on landfills. In making the comparison, there are a substantial number of other factors for which full consideration is beyond the scope of this report. These factors include projections of energy cost escalation, variations in plant operation and annual throughput, the risks of total landfill reliance, and the risk of processing plant technology.

Recommendations

1. That a decision regarding implementation of the proposed Oregon City Processing Plant be made as early as possible. That decision should consider information in this report, as well as substantial information yet to be supplied by Publishers Paper Company and the Bechtel Corporation, and a detailed analysis of the relative advantages and disadvantages of such a proposal.

2. That MSD support whatever expansions of St. Johns Landfill that can be made, on the basis that this landfill can provide short term landfill capacity for the region, and that citizen impact is substantially lower and implementation therefore more feasable for an existing site.

3. That MSD develop request for proposals on new sites identified in Chapter 15 and commence implementation as outlined in Chapter 17, in the order of greatest economic advantage, benefits to MSD citizens, and likelihood of successful implementation.

4. That with or without assurance of short term sites, MSD commence search for a longer term site. (It is assumed that finding a longer term site will require significantly more money and time than the sites which have been identified in this current study, which has been nearly one year in duration.)

5. That MSD implement a system of rate control as soon as possible, including coordination and/or agreements with the City of Portland on future operation of the St. Johns Landfill as required.

6. That a transfer station site be identified as soon as possible and implemented to correspond with the Oregon City Processing Plant, if implemented, or a system relying completely on landfills.

7. That efforts be initiated to phase out public dumping as currently handled at existing landfills through:

   a. Equitable assignment of costs between citizen deliveries and commercial vehicle deliveries;

   b. Construction of permanent unloading facilities at local landfills or through a system of "mini transfer stations"; and

   c. Encouragement of programs, such as brush chipping stations or portable units, building materials depots, appliance exchange programs, fair bulky waste collection services, and source separation and recycling.

Chapter 3

EARLIER REPORTS/RESEARCH

During the last twelve years, various jurisdictions and consultants have undertaken numerous independent analysis of alternative landfill sites. In spite of all this study, there has been only limited implementation of various report recommendations.

In late 1975, the MSD staff prepared a summary of earlier reports and findings and recommended policies for future landfill development. In January, 1977, the Metropolitan Service District Board of Directors adopted a Non-processable Solid Waste Disposal Program addressing mainly demolition landfills. The Non-processable Program created a moritorium on new landfills until a comprehensive analysis of landfill potential was developed.

Based on previous reports and attempted solid waste siting experiences, there are probably no sites which meet all of the requirements of 1) local land use; 2) environmental acceptability; and 3) economic reasonableness. At least one or more agencies having exclusive veto power and highly organized interest groups are the special guardians of one or more of these elements. Given the existing situation, siting of future landfills may be impossible.

A brief summary of each of the earlier reports or research is provided in Appendix A.

Chapter 4

LAND USE CONSTRAINTS

The Metropolitan Service District includes three counties and twenty-six cities having land use authority over their respective jurisdictions. Most jurisdictions' zoning ordinances or comprehensive plans do not specifically address solid waste disposal facilities. No future sites are reserved by any local jurisdiction for sanitary landfill, except St. Johns Landfill by the City of Portland. Federal and state agencies, plus local neighborhood organization, oppose this operation on a long range basis.

The Columbia Regional Association of Governments (CRAG) relies on MSD for designation of future landfill and transfer station sites. CRAG and the Land Conservation and Development Commission (LCDC) goals and guidelines provide consideration for solid waste management facilities.

The economic size of landfill and transfer station operations discourages each jurisdiction from owning and operating a separate facility. Further, the unwillingness of one jurisdiction to accept another jurisdiction's waste vastly limits land use acceptability of any proposed sites.

In terms of land use, the ideal site would be located on vacant or industrial land. Industrial designated land is desirable because the "worst case" impact of a new landfill is lowest in an industrial area.

Five of the existing eight landfills in the MSD area abut residentially used properties. Only one existing landfill is located in a purely industrial area. The reclamation potential of a site, natural screening and/or other factors may allow location of a landfill site among agricultural, commercial or residential uses.

Other land use constraints to siting landfills may include proximity to airports, wetlands or flood plains and the ability of access points to handle anticipated traffic loading.

The Federal Aviation Administration has determined that sanitary landfills constitute a hazard to air traffic due to the landfill's attraction for birds.

Several local jurisdictions' zoning ordinances prohibit filling in flood plain areas. For certain waterways, the Army Corps of Engineers requires a permit for filling in flood plain or wetland areas. Except in rare situations, the Environmental Protection Agency prohibits filling in wetlands.

Disposal facility access constraints are defined by local traffic conditions and design standards.

In summary, not only are there explicit land use constraints to siting solid waste facilities, but local land use decision making processes and solid waste attitudes predict limited potential for siting future solid waste disposal facilities.

Chapter 5

TECHNICAL CONSTRAINTS

The Environmental Protection Agency (EPA), the State Department of Environmental Quality (DEQ), the State Water Resources Department, and the State Division of Lands establish technical constraints to siting solid waste disposal facilities. These constraints primarily affect landfills and relate to topography, hydrogeology and locations of potential sites.

The primary technical constraint for landfills is to prevent leachate from deposited solid waste contacting surface or ground waters. Within MSD there are certain areas dependent upon ground water resources for individual and community water systems.

Ideally, in locating a site, the seasonally high water table should be at least ten feet below the lowest proposed level of filling. The water table should be separated from the fill by a naturally impervious (restricting transmission of water) layer. Major surface drainage courses should not naturally flow through the fill. The topographical and geological features of the site and engineered design and operating plans should restrict the flow of leachate to the water table or into surface drainage courses.

Traffic generation by the landfill should have a minimal impact on the surrounding area.

The natural features of the site or other design provisions should restrict the migration of gases from in place decaying wastes during and after the fill period. Separation or isolation from buildings or other structures decreases the likelihood of gas generation problems.

Filling of the site should be beneficial to the community and consistent with natural formations. Filling in flood plains or canyons is usually an undersirable modification of nature's design and is likely to have the greatest impact on the environment. Although filling floodplains may reduce the potential for groundwater pollution, filling in flood plains and canyons increases the expense and potential effectiveness of leachate control.

Chapter 6

IDENTIFICATION OF POTENTIAL SITES/ PRELIMINARY SCREENING

The inventory of potential solid waste disposal sites was accumulated through research of earlier reports, through a published and directed solicitation of information, and by detailed studies of maps and aerial photographs.

The public solicitation for information consisted of explaining general sanitary landfilling constraints, background information about the Metropolitan Service District's Solid Waste Division, and a three-page information form for any sites the recipient felt should be considered in MSD's analysis. The information form requested only known information. Complete information on the site was not a requirement for consideration.

A notice, which read as follows, was published in the Daily Journal of Commerce on September 1, 2 and 5, 1977:

Request for Information

> "To develop new solid waste disposal facilities sites, the Metropolitan Service District is requesting that all persons or groups desiring to site landfills or transfer stations provide information regarding that site. Failure to provide information may preclude inclusion of the site in the original solid waste disposal program. Interested persons should contact MSD (222-3671). All information must be submitted by 5:00 p.m., November 4, 1977, at the office of MSD, Room 300, 1220 S.W. Morrison, Portland, Oregon 97205."

In addition, 92 copies of the Request For Information were distributed to 50 separate individuals or associations known to have an interest in siting landfills or transfer stations. These individuals and associations include the following: (See Appendix C)

1. Major contracting associations;
2. Large garbage collection service companies;
3. Garbage collection associations;
4. The Portland Board of Realtors;
5. Existing landfill owners and operators;
6. The 28 jurisdictions within MSD;
7. Owners of gravel pits in Clackamas, Multnomah and Washington counties;
8. Twelve sand and gravel companies listed in the Yellow Pages of the telephone book;
9. The Oregon Concrete & Agregate Producers' Association;
10. The Environmental Protection Agency; and
11. Several individuals having an interest in siting landfills in the MSD area.

The map study utilized U. S. Geological Survey (USGS) maps, Columbia Regional Association of Governments (CRAG) aerial photographs, Soil Conservation Service information and maps from the Department of Geology. The map study was started on the premise that all residential, commercial and industrially developed land could be blocked out on a base map of the MSD. In addition, areas could also be eliminated that were a prescribed distance from ground water, well systems, in flood plains, or had unsuitable soil. The remaining areas could then be closely analyzed for possible sanitary landfill disposal sites. While this process developed no new sites, valuable information was obtained about local ground water conditions, soil conditions and land use patterns in the metropolitan area.

The Request For Information, and map study failed to generate any sites not previously mentioned in earlier reports or research.

Utilizing information gained during the map study, the Request For Information process and earlier reports and research, information was generated for each potential site, such as:

1. Existing use;
2. Future use;
3. Zoning or current land use designation;
4. Owner;
5. Area;
6. Sanitary landfilling capacity estimates;
7. Physical features;
8. On-site soil conditions;
9. Potential surface water problems;
10. Ground water conditions with respect to the site;
11. Access conditions;
12. Cover material availability;
13. Any other known agencies' problems with potential site;
14. Unusual features or conditions;
15. Surrounding land use;
16. Utility locations; and
17. The assessed valuation.

The MSD staff then visited all but five of 24 potential sites. Five sites not visited were judged impractical because of technical and land use constraints listed in Chapters 4 and 5. All of the sites which had been submitted through the Request for Information process were visited.

The site visits and information collected on each site provided a basis for estimating the cost of developing each site for a sanitary landfill.

Table 6.1 summarizes a portion of the information generated through the inventory process. Column (10) of Table 6.1 indicates whether an economic evaluation was prepared for the site or the basis for eliminating the site from further consideration.

Table 6.1

SITES	(1) EXISTING USE	(2) SURROUNDING USES	(3) OWNER	(4) AREA	(5) PHYSICAL FEATURES	(6) ACCESS	(7) COVER MTL. AVAILAB'LTY	(8) OTHER AGENCY'S OUTLOOK	(9) UNUSUAL FEATURES	(10) INCL. IN FURTHER ANALYSIS
ALFORD'S CLACKAMAS COUNTY	VACANT LOGGING FARM	FARM VACANT RESIDENTIAL SCHOOL	BOB ALFORD	150 - 200A	HILLSIDES UNMINED GRAVEL SOURCES	CLACKAMAS RIVER DR., SPRING WATER RD.	ON-SITE	CLACK. CO. SOLID WASTE & DEQ PREL. O.K.	CITIZEN OPPOSITION	YES
CIPOLE WASHINGTON COUNTY	VACANT SAND AND GRAVEL PITS	FARMING	SEVERAL	20A SAND PITS, MORE ADJACENT	SAND PITS IN LOW LANDS	HIGHWAY 99-W	MOSTLY IMPORTED		LOW FLOOD PLAIN	YES
COLUMBIA SAND & GRAVEL MULTNOMAH COUNTY	SAND AND GRAVEL	COMMERCIAL RESIDENTIAL	R. GILBERT, WESTERN PACIFIC ENTERPRISES	10+A	GRAVEL PIT	N.E. 122ND OFF 80-N	MOSTLY IMPORTED	UNKNOWN	UNDER-CUTTING N.E. 122ND	YES
DURHAM PITS WASHINGTON COUNTY	GRAVEL PIT	RESIDENTIAL COMMERCIAL INDUSTRIAL	WASHINGTON COUNTY	67A	GRAVEL PIT	S.W. UPPER BOONES FRY. RD., S.W. 72 & BRIDGEPORT	MOSTLY IMPORTED	FILLING DESIRED BY WASHINGTON COUNTY	NUMEROUS WELLS NEAR SITE	YES
COOPER MOUNTAIN WASHINGTON COUNTY	GRAVEL PIT	VACANT RESIDENTIAL	UNKNOWN	200A TOTAL	GRAVEL PIT HILLSIDES	FARMINGTON ROAD	MOSTLY IMPORTED	UNKNOWN	CITIZEN OPPOSITION ANTICIPATED	YES
HIDDEN VALLEY MULTNOMAH COUNTY	VACANT, PREVIOUS LANDFILL	VACANT, ROCK CRUSHING PLANT	LAND RECLAMATION, INC.	73A	CANYONS RAVINES	OFF HIGHWAY 30	MOSTLY IMPORTED	PREVIOUS OPERATION CLOSED BY DEQ	CLOSED DOWN	NO-CANYON UNDESIRABLE FOR LANDFILL
HAYDEN ISLAND MULTNOMAH COUNTY	VACANT	COMMERCIAL INDUSTRIAL VACANT	SEVERAL	UNKNOWN	UNDEVELOPED LOWLANDS, WETLANDS	I-5 THRU JANTZEN BEACH CENTER	IMPORTED	UNKNOWN	SIGNIFICANT ACCESS PROBLEMS	NO

(continued)

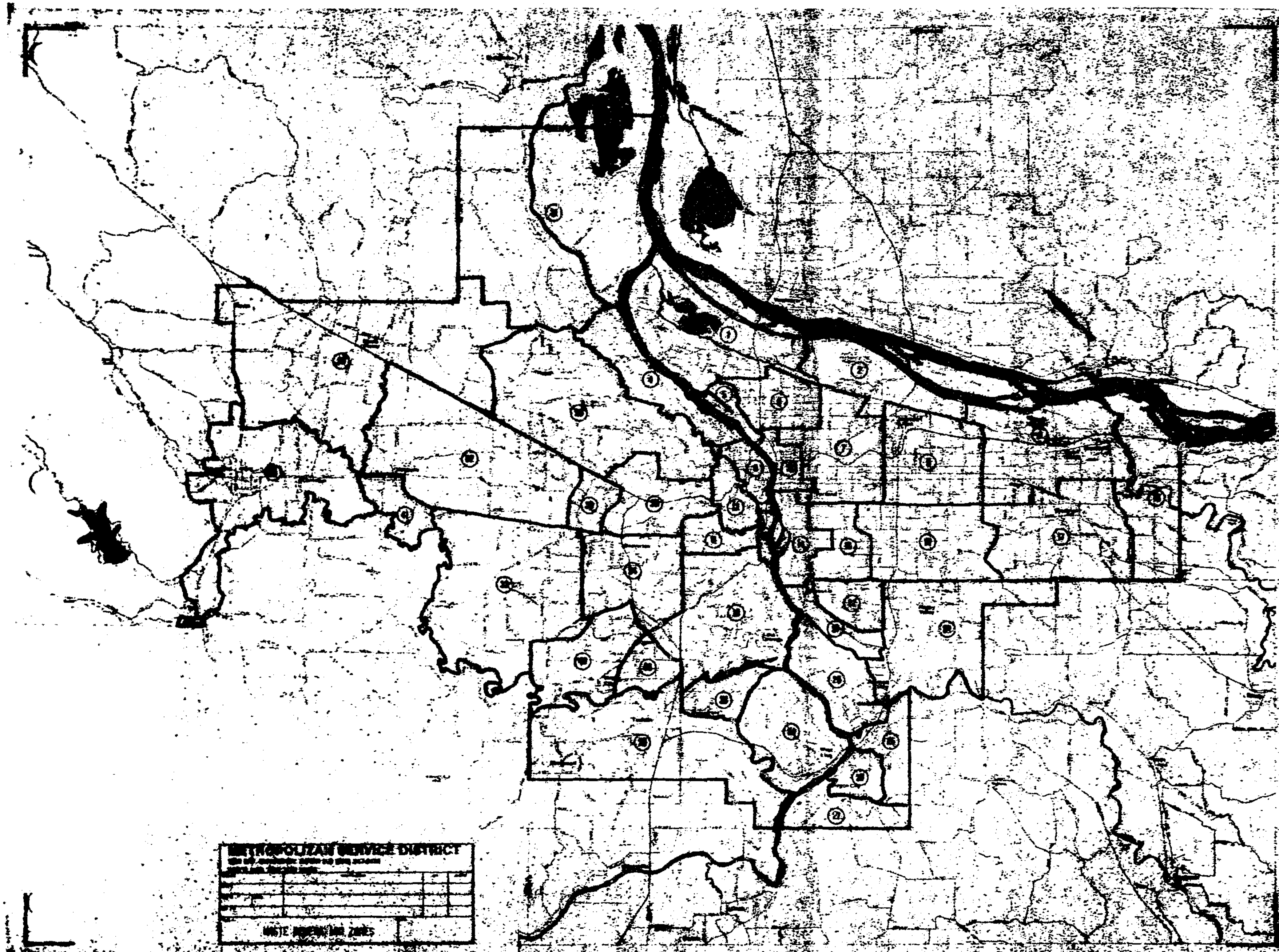
SITES	(1) EXISTING USE	(2) SURROUNDING USES	(3) OWNER	(4) AREA	(5) PHYSICAL FEATURES	(6) ACCESS	(7) COVER MTL. AVAILAB'LTY	(8) OTHER AGENCY'S OUTLOOK	(9) UNUSUAL FEATURES	(10) INCL. IN FURTHER ANALYSIS
NASH PIT MULTNOMAH	GRAVEL PIT	LIGHT AND HEAVY INDUSTRIAL, COMMERCIAL	FRANK NASH, MEL GOODIN	25A	GRAVEL PIT	N.E. 72ND, N.E. 75TH TO KILLINGSWORTH	MOSTLY IMPORTED	UNKNOWN	WITHIN 10,000 FT. PORTLAND AIRPORT	PARTIALLY NO. AIRPORT PROB. SIMILAR TO ROSELAWN
KING ROAD EXTENSION CLACKAMAS COUNTY	LANDFILL GRAVEL PIT	INDUSTRIAL, MOSTLY RESIDENTIAL	PORTLAND ROAD AND DRIVEWAY	30A	GRAVEL PIT	KING ROAD OFF 82ND	MOSTLY IMPORTED	CLACKAMAS CO. SOLID WASTE FAVORS	EXISTING LANDFILL SITE	YES
NEWBERG LANDFILL YAMHILL COUNTY	LANDFILL	VACANT AGRICULTURE RESIDENTIAL INDUSTRIAL	ANGUS McPHEE	80A	LOWLANDS, WETLANDS	RIVER ROAD	MOSTLY IMPORTED	UNKNOWN	WITHIN FLOODPLAIN WILLAMETTE	PARTIALLY
OLD PUMPKIN	AGRICULTURE RESIDENTAIL	AGRICULTURE RESIDENTIAL	UNKNOWN	340A	LOGGED OFF HILLSIDE	OLD PUMPKIN RIDGE ROAD	ON-SITE (TRENCH OPERATION)	UNKNOWN	EXPENSIVE HOMES ON OR NEAR SITE	YES
OBRIST MULTNOMAH COUNTY	GRAVEL PIT	**RESIDENTIAL**	DON OBRIST	12A	GRAVEL PIT HILLSIDE	TROUTDALE ROAD	MOSTLY IMPORTED	UNKNOWN	TROUTDALE WANTS SITE FILLED BY 1980	YES
OREGON ASPHALTIC MULTNOMAH COUNTY	GRAVEL PIT	RESIDENTIAL	OREGON ASPHALTIC PAVING COMPANY	20A	GRAVEL PIT	S.E. MAIN ST. THRU RESIDENTIAL	MOSTLY IMPORTED	UNKNOWN	TRAFFIC TO SITE PASSES SCHOOL	YES
PORTLAND SAND AND GRAVEL MULTNOMAH COUNTY	GRAVEL PIT	RESIDENTAIL COMMERCIAL PARK	BILL & ROSE CRASWELL	31.5A	GRAVEL PIT	DIVISION STREET	MOSTLY IMPORTED	UNKNOWN	LARGE GRAVEL PIT	YES

(continued)

SITE	(1) EXISTING USE	(2) SURROUNDING USES	(3) OWNER	(4) AREA	(5) PHYSICAL FEATURES	(6) ACCESS	(7) COVER MTL. AVAILAB'LTY	(8) OTHER AGENCY'S OUTLOOK	(9) UNUSUAL FEATURES	(10) INCL. IN FURTHER ANALYSIS
ROSSMAN'S EXPANSION CLACKAMAS COUNTY	EXISTING LANDFILL	INDUSTRIAL RESIDENTAIL	PARKER NORTHWEST CONSTRUCTION	40A	LOWLANDS	CASCADE HIGHWAY	IMPORTED	UNKNOWN	EXISTING LANDFILL SITE, 2ND LIFT	NO-BASIS FOR COST ESTIMATE
ROSELAWN MULTNOMAH COUNTY	GRAVEL PIT	RESIDENTIAL INDUSTRIAL COMMERCIAL	PORTLAND SAND AND GRAVEL	16A	GRAVEL PIT	74TH & 75TH OFF KILLINGSWORTH	SOME IMPT., MOSTLY ON-SITE*	UNKNOWN	NEAR AIRPORT	PARTIALLY. SEE ROSELAWN & WAYBO
SEXTON MOUNTAIN WASHINGTON COUNTY	GRAVEL PIT	LOW DENSITY RESIDENTIAL	UNKNOWN	40A	HILLSIDE, GRAVEL PIT	THRU RESIDENTIAL AREA	MOSTLY IMPORTED	UNKNOWN	PUBLIC WELL NEAR BY	NO-PUBLIC WELL LESS THAN 1 MILE AWAY
ST. JOHNS MULTNOMAH COUNTY	LANDFILL	COMMERCIAL INDUSTRIAL RESIDENTIAL	CITY OF PORTLAND	70A NEW, 180A EXISTING	LOWLANDS, WETLANDS	COLUMBIA BOULEVARD	IMPORTED	DEQ OPPOSES UPWARD EXP., EPA OPPOSES OUTWARD EXP.	EXISTING LANDFILL SITE	YES-UPWARD AND OUTWARD
SANDY DELTA MULTNOMAH COUNTY	VACANT AGRICULTURE	VACANT AGRICULTURE	REYNOLDS ALUMINUM	1400A	LOWLANDS, WETLANDS	I-80N, NO ADJACENT OFF-RAMP	MOSTLY IMPORTED	DEQ OPPOSES, AIRPORT PROBLEM	LARGE SITE IN AIRPORT APPROACH PATTERN	NO-AIRPORT PROBLEM
SANTOSH COLUMBIA COUNTY	LANDFILL	INDUSTRIAL UNDEVELOPED	SANTOSH PROPERTIES, INC.	240A	LOWLANDS, WETLANDS	WEST LANE ROAD OFF U.S. 30	IMPORTED	UNKNOWN	EXISTING LANDFILL SITE	PARTIALLY
WAYBO PIT MULTNOMAH COUNTY	GRAVEL PIT	INDUSTRIAL COMMERCIAL	WAYNE EASELY ROBT. KAUFMAN WAYBO, INC.	18A	GRAVEL PIT	N.E. KILLINGSWORTH	SOME IMPORTED, MOSTLY ON-SITE	APPROVAL BY MULTNOMAH COUNTY	NEAR AIRPORT	PARTIALLY-SEE ROSELAWN & WAYBO

(continued)

SITE	(1) EXISTING USE	(2) SURROUNDING USES	(3) OWNER	(4) AREA	(5) PHYSICAL FEATURES	(6) ACCESS	(7) COVER MTL. AVAILAB'LTY	(8) OTHER AGENCY'S OUTLOOK	(9) UNUSUAL FEATURES	(10) INCL. IN FURTHER ANALYSIS
PORTER-YETT MULTNOMAH COUNTY	GRAVEL PIT	COMMERCIAL INDUSTRIAL	PORTER AND DAVE YETT	28A LANDFILL	GRAVEL PIT	CULLY BOULEVARD	MOSTLY IMPORTED	UNKNOWN	NEAR AIRPORT	NO-AIRPORT PROBLEM SIMILAR TO ROSELAWN
GRANT BUTTE PIT WASHINGTON COUNTY	GRAVEL PIT	RESIDENTIAL	SEVERAL	86A	GRAVEL PIT	MAINLY S.E. 194TH & S.E. 190TH	MOSTLY IMPORTED	UNKNOWN	DEVELOPMENT BY MULT.CO. ANTICIPATED	YES


METROPOLITAN SERVICE DISTRICT
WASTE GENERATION ZONES

Chapter 7

SOLID WASTE QUANTITIES

Solid waste quantities in the Portland metropolitan area have been the subject of considerable controversy. Since 1972, the Department of Environmental Quality (DEQ) has required that landfills maintain records of the volume of material handled at respective landfills. Although these records provide considerable information, ommissions, inconsistencies, and the intracacies of the disposal system in this area complicate total quantity projections.

Throughout the five years since 1972, the density of solid waste delivered to the landfills has increased because new collection equipment provided greater compactive efficiency. Several consultants studying solid waste management for the area sampled solid waste quantities more accurately by using weight measurements.

In 1974, COR-MET projected the first solid waste quantities by weight for the Portland metropolitan area. These projected quantities were considered to be unreasonably high by the local solid waste collection industry.

In May of 1977, weight data became available from St. Johns Landfill when scales were installed. In September of 1977, weight data also became available from Rossman's Landfill in Oregon City. During the summer of 1977, the Metropolitan Service District conducted a sampling weight program at the area's demolition landfills. Continued weighing of refuse increases the reliability of solid waste quantity information and earlier data was found to be reasonable.

Maintaining more accurate volume records of solid waste quantities increased in June, 1977 when the Metropolitan Service District implemented a user fee at the area landfills.

Utilizing previously prepared records, the work of various consultants, the weight measurements taken at the major landfills, and the sample measurements taken at the demolition landfills, MSD has projected total solid waste quantities disposed in the metropolitan area in Table 7.1.

The improved figures on quantities of waste disposed, along with future per capita increases or decreases in solid waste generation rates, projected future commercial and industrial activity, the potential for waste reduction through new packaging laws, effects of source-separation and recycling and the development of alternative disposal strategies, were used for estimating disposal needs.

The first planning step was to divide the MSD into 41 different zones of solid waste generation (see Figure 7.1), corresponding to individual or several census tracts. For each of the 41 zones, an estimate of residential, commercial and industrial, and construction and demolition waste generation was made.

The commercial and industrial generation rates were related to standard industrial codes and number of employees for each code in each zone. Demolition and construction rates were based on estimates of construction activity and age of construction in individual zones. Using 1976 demographics, generation rates in the 41 zones were calibrated against records maintained at each of the disposal sites. The result is the staff's best estimate of existing solid waste generation in the MSD area, and is projected to the year 2000.

No increases in per capita residentially generated solid waste were estimated. Hopefully, the historical trend of increasing waste generation rates will be offset through source-separation, recycling and waste reduction.

A complete tabulation of projected solid waste quantities is provided in Appendix E.

Table 7-1

TABULATED RESULTS

ESTIMATED MSD SOLID WASTE TONNAGES

(January, 1978)

I. Computer Model Assumptions for 1980:

Category	Waste Disposed (tons)	Processible Fraction	Processible Tonnage
Industrial, Commercial	235,000	0.57	130,000
Residential	389,000	1.00	389,000
Demolition	108,000	0.00	-0-
Totals	732,000		519,000

II. Estimates Based on Reports to MSD, June 1977 through May 1978 and Densities from St. Johns, Rossman's and other sites:

Category	Waste Disposed (tons)	Processible Fraction	Processible Tonnage
Rossman's, St. Johns Newberg (Inside MSD only)	518,500	0.98	508,000
Grand Ave., LaVelle sites, Hillsboro	156,000	0.50	78,000
Obrist, Grabhorn	51,400	-0-	-0-
Public Deliveries	90,000	0.60	54,000
Total Excluding Public	725,900		586,000
Total Including Public	815,900		640,000

Chapter 8

PUBLIC USAGE OF LANDFILL SITES

The staff estimates that each year approximately 300,000 trips to area disposal sites by autos and pickups occur — mainly citizens hauling their own solid waste. The kinds of materials hauled can be classified as oversized, bulky waste, including, but not limited to, brush, yard trimmings, household debris or remodeling residue, as opposed to the everyday food and container waste generated by each household. In many parts of the country, no facilities are provided for citizens hauling their own waste.

This significant usage of landfill sites by citizens hauling waste in autos and pickups adds problems to siting landfills or other waste facilities. Hand unloading of vehicles substantially increases the size and complexity of disposal or transfer operations. The high volume of private vehicle traffic and the resultant litter may eliminate many otherwise acceptable disposal sites.

The practice of providing disposal facilities for individual citizens hauling their own waste increases the cost of operating the site per unit of solid waste disposed.

In many of the landfills, the environmental damage potential is increased by public dumping at landfill sites. Landfill operators use sawdust, in lieu of more acceptable cover material, to maintain drivable areas for public dumping during wet periods. The potential for accidents to individuals during hand unloading and the need for maintaining isolation between landfill equipment and the public also hampers daily cover operations. Often times it is necessary to postpone the covering of a large working face until the next day of operation or install lights to facilitate covering operations in the dark.

To better understand the various aspects of this practice, the MSD sought assistance through the League of Women Voters to conduct a citizen's survey. In addition, MSD discussed this practice with the Tri-County Policy Advisory Committee, a representation of garbage collection service companies in the metropolitan area.

Although the League of Women Voters was unable to conduct the survey, significant citizen input has been provided through discussions at the Washington County Advisory Committee level and the MSD Solid Waste Advisory Committee level.

The comments provided by the Tri-County Policy Advisory Committee generally reflect the viewpoint of the public and the collection industry for providing disposal services to individual citizens at landfill sites. These comments include the following:

1. For some, the trip to the local landfill may be a form of recreation. The trip provides a good opportunity for a father-son outing or "taking the harvest to market."

2. The individual citizen user of local landfills is a do-it-yourselfer type who's motivation is often more than an economic justification. Actions are not governed by monetary value assignments for time and the calculation of lowest cost methods for task accomplishment.

3. If, for no other reason, the trip to the local landfill may provide an opportunity for the newest member of the family to learn to drive.

4. Rates at local landfills tend to favor private hauling of garbage.

5. Citizens' delivery of solid waste requires significantly more space and time at the landfill site and is a much larger source of litter and nuisance than specifically designed collector vehicles.

6. Self hauling may provide a convenience in timely removal of waste not available through collection service companies.

Most of the collection service companies in the Portland area provide for collection of oversized, bulky waste directly or through other companies. Such services are usually at additional cost to the customer.

Citizens occasionally express reluctance to use collection services for bulky waste because there is no written description of the services and costs. Although some of the franchises in the area address hauling oversized, bulky wastes, it appears that the costs of such services, if addressed at all, are in terms of an hourly rate (see Table 8.1).

Collection service companies defend this lack of a written description of services and costs by noting the substantial variation between the amount of time in hauling and picking up various oversized wastes. A specific example given is brush. The cost of moving brush will be substantially different, depending on where the brush is located, how long ago it was cut and how easily the brush can be moved into the truck. The main problem in describing the cost of a service for oversized, bulky waste stems from accounting for the effort to get material from its location on the property into the truck.

According to the collection service companies, one of the over-rated solutions for providing collection service for oversized, bulky waste is usage of drop boxes. The average sized load appears to be three or four cubic yards, which is best handled in a packer truck. Provision of a three or four yard container on an irregular basis would cost a minimum of $25 for each separate service. Regular use of a small container encourages storage of waste by the homeowner.

A fear that a publically subsidized transfer station increases the number of citizen deliveries of solid waste and decreases the use of collection services was expressed by collection companies when the siting of a transfer station in Washington County was discussed.

There appear to be several solid waste management strategies available to reduce or eliminate disposal siting problems which relate to public usage of landfill sites. These include the following:

1. If the problems of traffic congestion can be absorbed by certain sites, then construction of a permanent public dumping area on the site or dumping into drop boxes eliminates the need to main-

tain drivable areas through use of sawdust. Loads received late in the day can be kept overnight in the drop box to avoid the use of extra lighting for loads which would have otherwise been placed in the landfill and covered after dark.

2. A larger number of sites handling fewer vehicles could eliminate concentration of traffic and litter problems which occur when fewer sites are available. Small transfer stations could augment or replace the need for public dumping facilities at landfills.

3. Increased emphasis on recycling by source-separation may reduce or minimize the need for public dumping facilities.

4. Greater use and availability of portable or stationary brush "chipper" machines, such as the ones used by the City of Hillsboro in past years for Christmas tree disposal, may help minimize the need for public dumping facilities.

5. A more equitable assessment of fees based on actual costs and problems of providing space for public dumping could increase illicit dumping but may promote better alternatives currently not economical.

Table 8-1

COLLECTION OF BULKY WASTES

Local Jurisdiction	No franchise agreement	No information in file	Not addressed in ordinance or agreement	Collector req'd. to provide all necessary service but rate not set	Misc. haul rate for 1 hr., truck plus 1 or 2 men
Clackamas County			X		*
Gladstone			X		
Happy Valley	X				
Johnson City					
Lake Oswego					18/25
Milwaukie				X	
Oregon City				X	
River Grove		X			
West Linn		X			
Multnomah County	X				
Fairview			X		
Gresham			X		
Maywood Park		X			
Portland	X				
Troutdale					20/30
Wood Village			X		
Washington County			X		
Banks		X			
Beaverton			X		
Cornelius					23/32
Durham		X			
Gaston		X			
Forest Grove					23/32
Hillsboro					20/30
King City			X		
North Plains				X	
Sherwood					20/30
Tigard			X		
Tualatin			X		

* Per Dave Phillips: for white goods and furniture - about $3 to $4 per item; customer must wait until collector can do a pickup or truck load.

Chapter 9

LANDFILL DEVELOPMENTAL COSTS

The startup of any landfill requires capital investment. For existing Portland area landfills, this initial cost may be considered minimal, as most present sites were established prior to land use and technical constraints referred to in Chapters 4 and 5.

To develop estimated costs for new landfills it was assumed that certain land use constraints and nearly all technical constraints could be met if developmental costs were increased. For instance, building improvement, screening for sites, on-site traffic handling, flood prevention measures and various pollution control equipment and facilities could make certain sites acceptable.

The developmental costs are intended to also reflect requirements of the Federal Solid Waste Act, as amended by the Resource Conservation and Recovery Act of 1976, and the latest published rules and regulations. The impact of this Act and amendments is further discussed in Chapter 16.

Information collected for each potential site was summarized, using the following sixteen qualitative or quantitative statements:

1. The perimeter of the site;
2. The land area of the bottom of the fill;
3. The land area of the top of the fill;
4. The depth from original ground to the top of the finished fill;
5. The percentage of the perimeter requiring new fencing;
6. The percentage of the perimeter requiring berming;
7. The percentage of the perimeter requiring diking;
8. The percentage of the perimeter requiring gas venting;
9. The length of new on-site roads;
10. The cost of new roads;

11. The need for a ground water seal for the site;
12. The need for a leachate collection and treatment system for the site;
13. Any other features of the site requiring the expenditure of capital;
14. The number of monitoring wells required for the finished site;
15. Any comparable cost contingency factors which could be used to weigh proposed site's viability; and
16. The need for off-site cover material.

Using these sixteen statements, and from estimates of unit costs for fencing, berming, diking, gas venting, roads, leachate containment, collection and treatment, the total cost of each site was calculated. Unit costs were developed from manufacturers' quotations and published sources, including Means Building Construction Cost Data (1978). The results of this calculation are shown in Appendix E for each landfill. A further description of each developmental cost item is as follows:

Site Building Improvement. Includes office space, collection booths, fully automatic weighing and billing system, on-site utilities development and paving. The costs estimated under this item were consistent for all sites considered.

Fence Costs. Fencing consists of six foot high chain link with slats and three barbed wires.

Berming Costs. Berming includes a ten foot high earth berm with three horizontal to one verticle side slope and an eight foot top.

Monitoring Wells. Wells consist of encased drillings to a depth approximately 30 percent greater than the depth of the site. The number of wells vary from site to site.

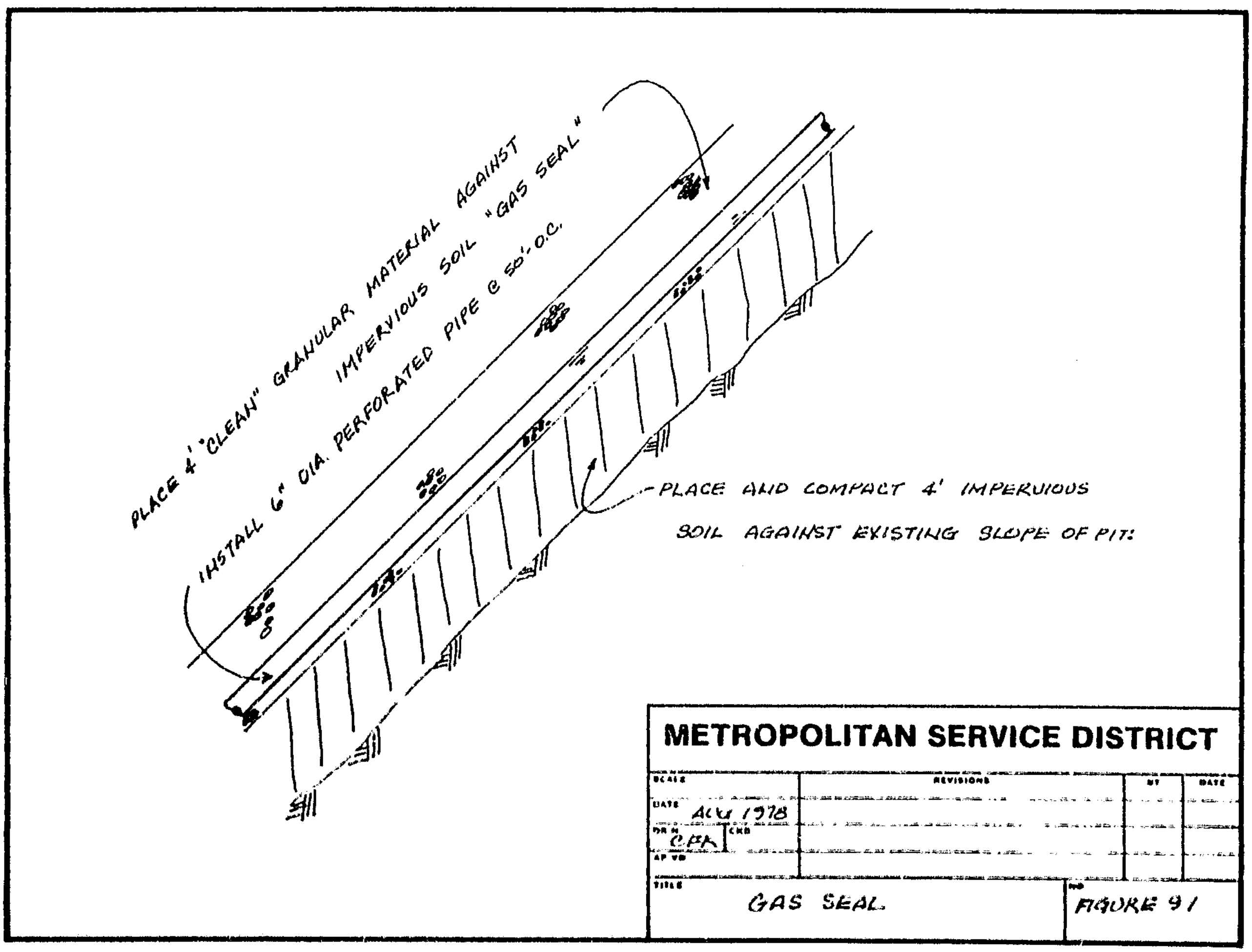
Gas Venting. Includes placing four feet of impermeable soil against the side slopes of the fill, placing six inch diameter perforated pipe against a pea gravel bedding and covering with four feet of gravel. The pipes are located at 50 feet on centers (see Figure 9.1).

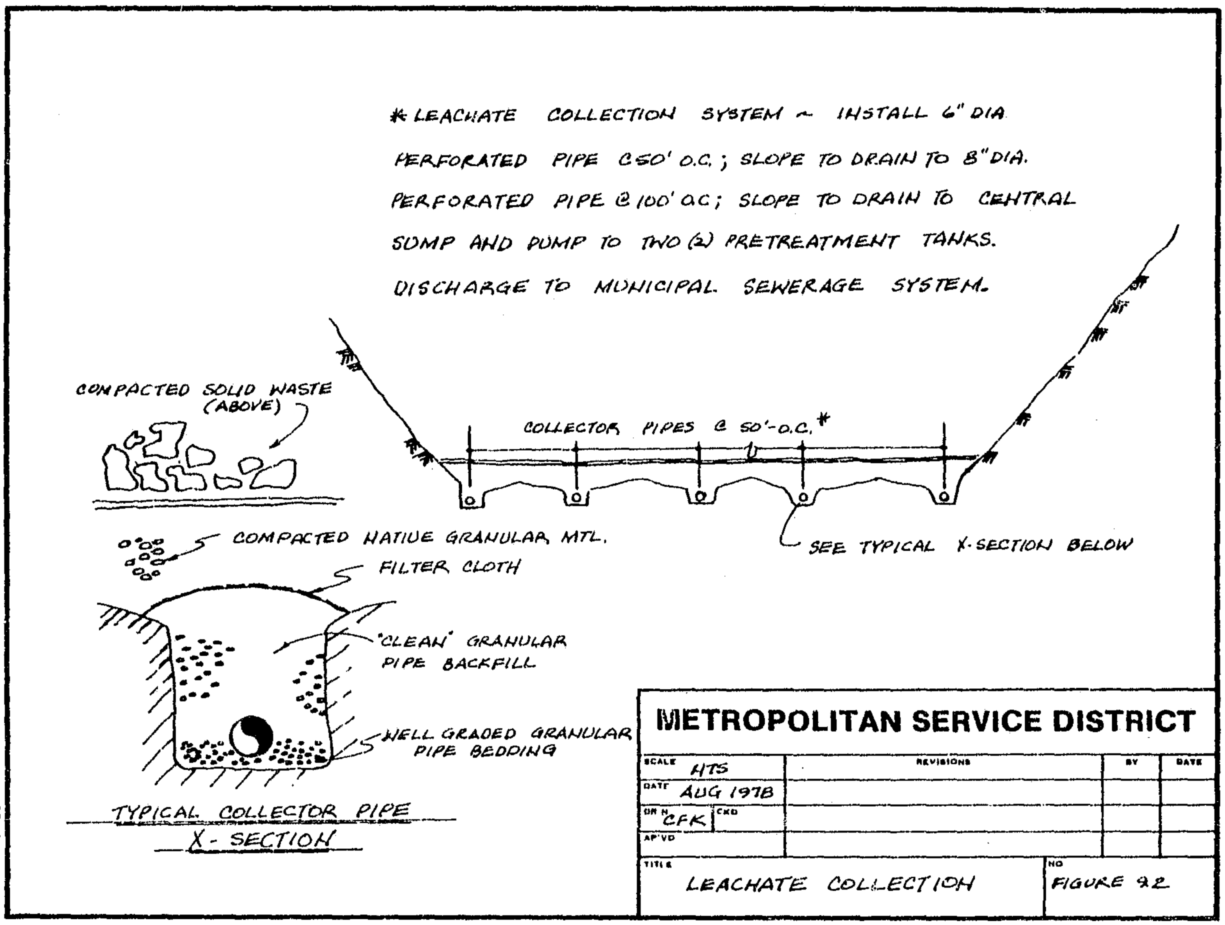
Road Construction. Consists of a 24 foot wide road section with shoulders.

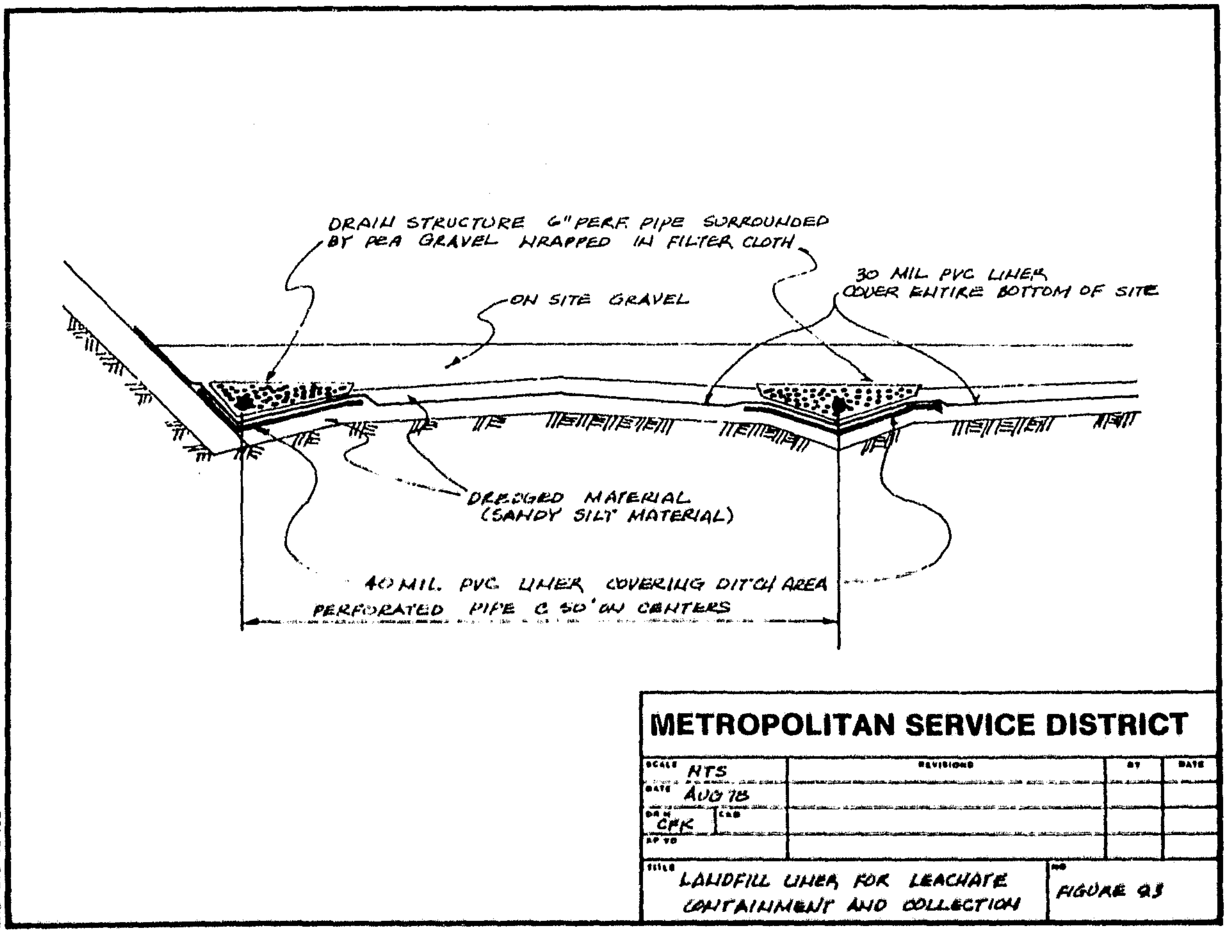
Dikes. Where required, have the same cross sectional dimensions as berms and, therefore, the same cost per lineal foot.

Leachate Containment. The leachate containment system consists of a seal of clay or other imported impermeable material placed on the bottom and sides of the landfill surface (see Figure 9.2). An alternate consists of utilizing imported soil materials and 30 mil. and 40 mil. PVC plastic membranes (see Figure 9.3).

Leachate Collection. The leachate collection system consists of six inch and eight inch diameter perforated pipe placed in well-drained gravel imported to the site (see Figures 9.3 and 9.4). The leachate flows by gravity to a central sump and is then pumped to a pretreatment system prior to discharge to a municipal sewer. Leachate treatment consists of Ph adjustment and an aeration process. Alternatives include on-site disposal through sprinkling over surface of the landfill or direct disposal in municipal sewage system without treatment.




* LEACHATE COLLECTION SYSTEM ~ INSTALL 6" DIA
PERFORATED PIPE C50' O.C.; SLOPE TO DRAIN TO 8" DIA.
PERFORATED PIPE @ 100' O.C; SLOPE TO DRAIN TO CENTRAL
SUMP AND PUMP TO TWO (2) PRETREATMENT TANKS.
DISCHARGE TO MUNICIPAL SEWERAGE SYSTEM.
COMPACTED SOLID WASTE (ABOVE)
COLLECTOR PIPES @ 50'-O.C.*
SEE TYPICAL X-SECTION BELOW
COMPACTED NATIVE GRANULAR MTL.
FILTER CLOTH
'CLEAN' GRANULAR PIPE BACKFILL
WELL GRADED GRANULAR PIPE BEDDING
TYPICAL COLLECTOR PIPE X-SECTION
METROPOLITAN SERVICE DISTRICT
SCALE NTS
DATE AUG 1978
DR N CFK
CKD
AP'VD
REVISIONS
BY
DATE
TITLE LEACHATE COLLECTION
NO FIGURE 92


DRAIN STRUCTURE 6" PERF. PIPE SURROUNDED BY PEA GRAVEL WRAPPED IN FILTER CLOTH
ON SITE GRAVEL
30 MIL PVC LINER COVER ENTIRE BOTTOM OF SITE
DREDGED MATERIAL (SANDY SILT MATERIAL)
40 MIL. PVC LINER COVERING DITCH AREA
PERFORATED PIPE C 50' ON CENTERS
METROPOLITAN SERVICE DISTRICT
SCALE NTS
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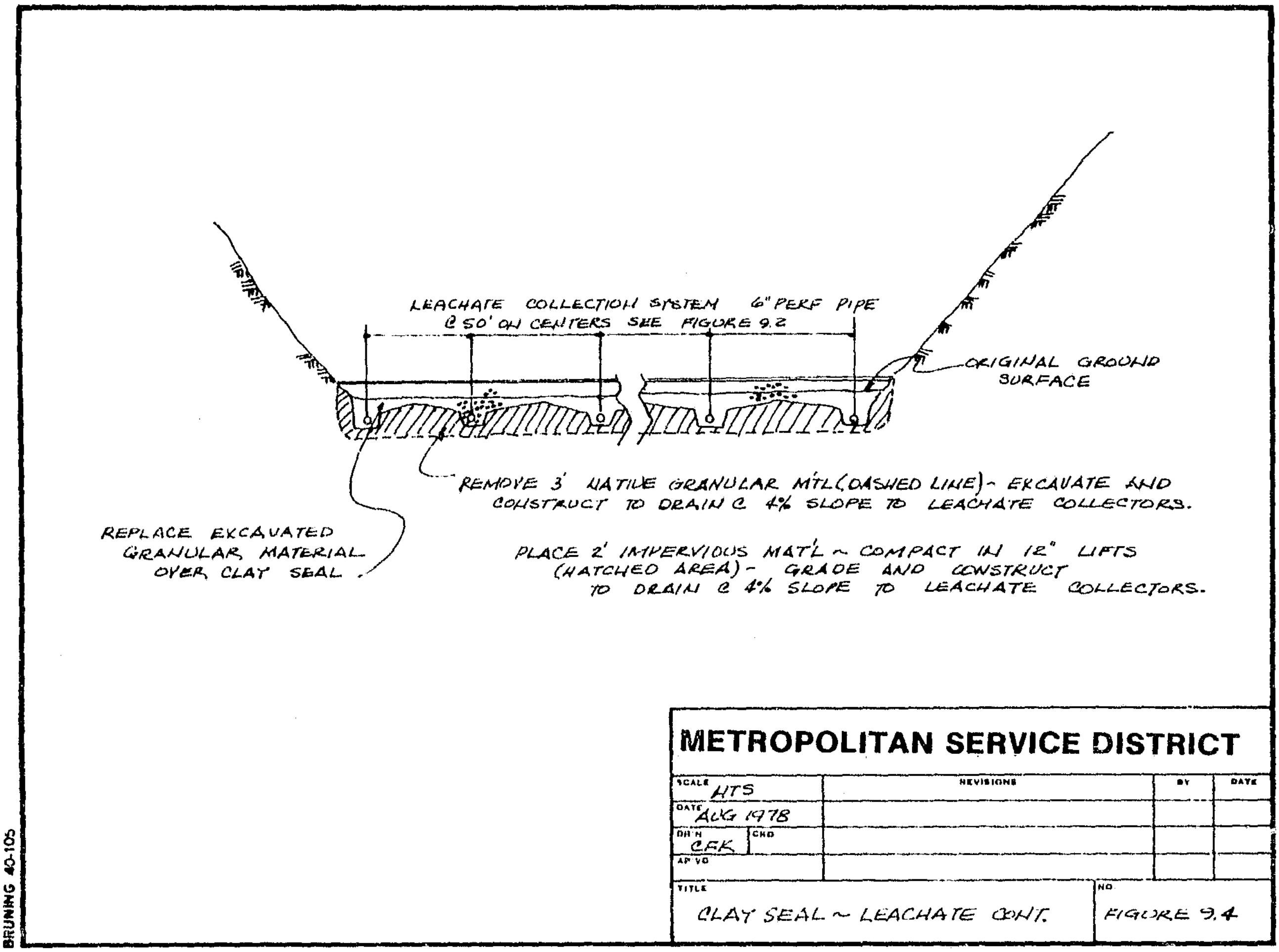
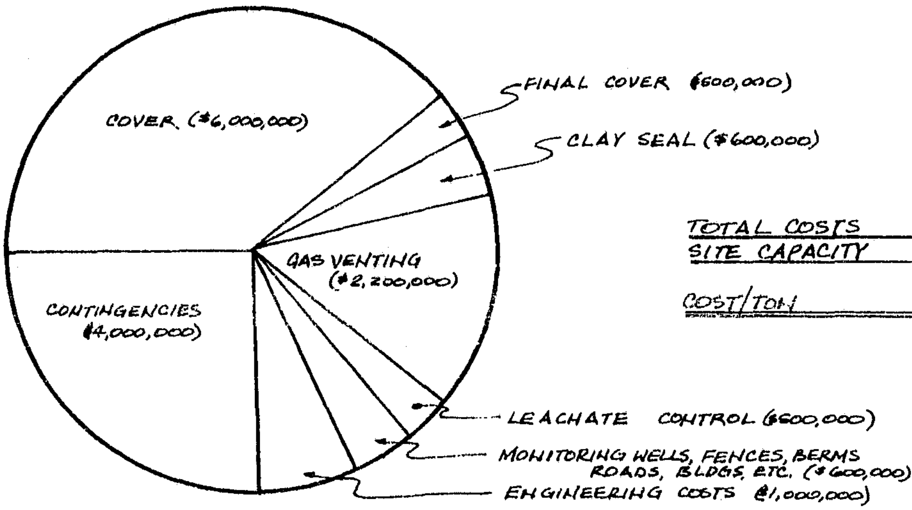
TITLE LANDFILL LINER FOR LEACHATE CONTAINMENT AND COLLECTION
NO FIGURE 93



Other developmental costs include daily, intermediate and final cover. Daily cover includes six inches of material placed on the working face of the landfill. Intermediate cover consists of one foot at the top of the finished cell. Final cover consists of two feet of soil over the completed landfill.

The initial development would include all the items previously listed except for cover and the gas venting system. The initial cost is sizable and is projected to be financed at a twelve percent interest rate. The amortization is based on the rate of fill. A summary of typical disposal site development costs is shown in Figure 9.5.

It should be noted that the site development costs shown in Figure 9.5 include all of the costs associated with designing, constructing and operating a landfill except labor and equipment costs (see Chap. 10). Site building improvements, fencing, berming, monitor wells, road construction, diking and a portion of the leachate collection and containment system are all expenses occurring prior to the site commencing operation.



TOTAL COSTS	$15,400,000
SITE CAPACITY	2,800,000 TONS
COST/TON	$5.50

NOTE: SITE DEVELOPMENT COSTS SHOWN IN FIGURE 9.6 INCLUDE ALL OF THE COSTS ASSOCIATED WITH DESIGNING, CONSTRUCTING, AND OPERATING A LANDFILL EXCEPT LABOR AND EQUIPMENT COSTS (SEE CHAPTER 10)

METROPOLITAN SERVICE DISTRICT

SCALE ~ | DATE AUG 1978 | DR'N CFK | CKD | AP'VD | REVISIONS | BY | DATE

TITLE: TYPICAL DISPOSAL SITE DEVELOPMENT COSTS

NO FIGURE 9.5

Chapter 10
LANDFILL OPERATIONAL COSTS

For purposes of preparing cost estimates, landfill operational costs are divided into labor and equipment operation and maintenance. A percentage of these costs were applied to administrative overhead and profit, which include insurance, property taxes, technical, legal and accounting fees, electricity, utilities and other overhead.

Labor for each of the landfills consists of seven persons: a supervisor, a bookkeeper, two laborers, a landfill spotter, equipment operator and an equipment maintenance person. Using the wage rates shown in Table 10.1, the total annual labor costs were estimated to be $250,000 per year. The extension of hourly rates is accomplished by multiplying the hourly rate by 66, or the equivalent of six 11-hour days at straight time.

Equipment costs include a bulldozer, a steel wheeled compactor, a water truck, miscellaneous vehicles such as a pickup, and miscellaneous equipment for each landfill. The cost of these items is estimated on an hourly basis, using standard rental and operation hourly cost rates. These rates are shown in Table 10.2. Using ten hour days and six day weeks, the hourly charge translates to $343,000 annually.

The total equipment costs and labor costs are rounded to $600,000 and increased by 40 percent to include administrative overhead and profit. The total annual operating costs for each landfill is assumed to be $850,000 per year. Note that the operating costs of the pollution control equipment (i.e. the leachate collection treatment system) is included in the developmental cost of the landfill.

Table 10.1

LABOR WAGE RATES	
Position	$/Hour
Supervisor	$14.42
Bookkeeper	8.65
Laborers (2)	17.30
Spotter	8.65
Operator	12.00
Oiler	12.00
Total	$73.02

Table 10.2

EQUIPMENT RENTAL RATES (Including O&M)	
Item	$/Hour
Dozer	$40.00
Compactor	50.00
Water Truck	10.00
Miscellaneous Vehicle	5.00
Miscellaneous Equipment	5.00
Total	$110.00

Chapter 11

TRANSFER STATIONS

The current MSD solid waste disposal management program calls for the design and construction of two processing facilities, a transfer station in East Washington County and a system of landfills.

A number of potential sites for transfer stations in East Washington County have previously been considered. After an initial proposal was rejected in 1974 by the City of Beaverton, MSD sought the assistance of Washington County planning staff. The Merlo Road site between 158th and 170th Avenues, south of Merlo Road, was selected from several alternatives by MSD staff and Washington County planners.

In 1975, MSD prepared an environmental impact assessment for the Merlo Road site as a transfer station.

During this same period of time, the courts rendered the "Baker Decision" requiring zoning of properties to conform to the comprehensive plan. The Merlo Road site was in an industrial zone, but was designated otherwise on Washington County's comprehensive plan. Prior to any attempt by MSD to gain ownership of the property, the owner of the property applied to Washington County for a comprehensive plan change to take care of "Baker Decision" concerns.

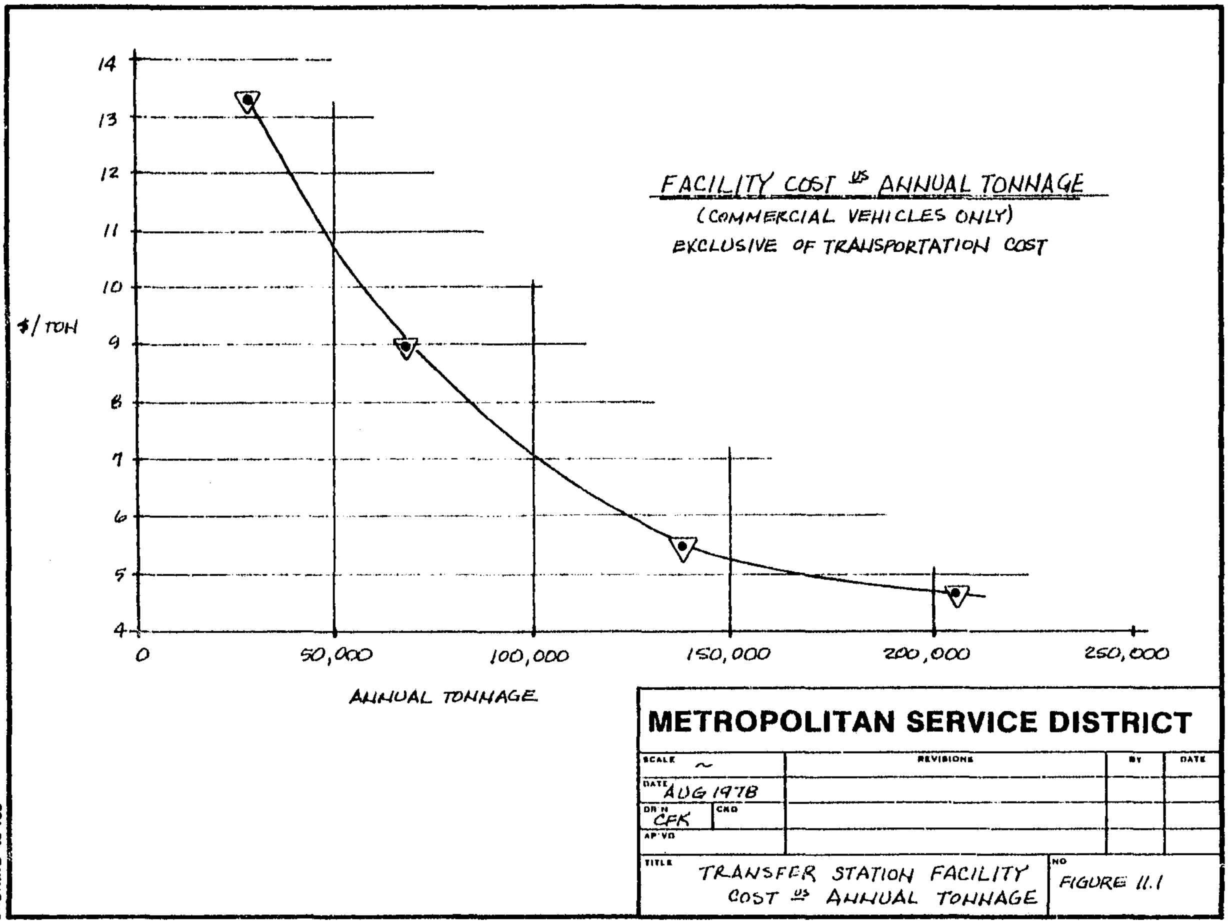
During the public hearings on the comprehensive plan amendment, significant opposition to MSD's utilization of the Merlo Road site for a transfer facility was voiced and became part of the public hearing record, even though MSD had made no committment to either purchase or use the site. This opposition provides insight into transfer station siting problems.

In August, 1975, Washington County haulers became concerned with the economic viability of the transfer station concept. Numerous meetings were held between MSD, Washington County's Advisory Committee members and various haulers. Several alternatives surfaced. These alternatives included various transfer station sizes for use by the public and commercial refuse haulers, by the public only, or by commercial refuse haulers only. Several locations were considered in addition to the Merlo Road site. These locations included Cipole and Forest Grove.

In early 1977, a proposal was made by MSD to design and construct a transfer station in East Multnomah County for usage by citizens only. This proposal consisted of several drop boxes located on a site and is similar to the transfer station in Sandy, Oregon. A decision on this proposal was deferred until completion of the present report.

As mentioned earlier in this report, opening a centrally located transfer or disposal point is a concern to commercial collectors because of potential loss of business. Other concerns should include the potential for illicit dumping or littering, satisfactory customer density for efficient, low cost collection service, the health and aesthetic aspects of publically used disposal facilities, comparable cost of collection services, and final disposal.

To bring the various facets of the problem into perspective, the MSD staff has prepared several cost estimates for different sized facilities under different operational constraints. The operational constraints consist of designing a facility to handle commercial vehicles only, designing a facility to handle private vehicles only, or designing a facility to handle a combination of both commercial and private vehicles. The staff estimated the cost of these facilities, based on various traffic or solid waste loadings. Figures 11.1 and 11.2 graphically display the variation in cost of facilities with changes in the volume of usage.


FACILITY COST VS ANNUAL TONNAGE
(COMMERCIAL VEHICLES ONLY)
EXCLUSIVE OF TRANSPORTATION COST
$/TON
14
13
12
11
10
9
8
7
6
5
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50,000
100,000
150,000
200,000
250,000
ANNUAL TONNAGE
METROPOLITAN SERVICE DISTRICT
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BY
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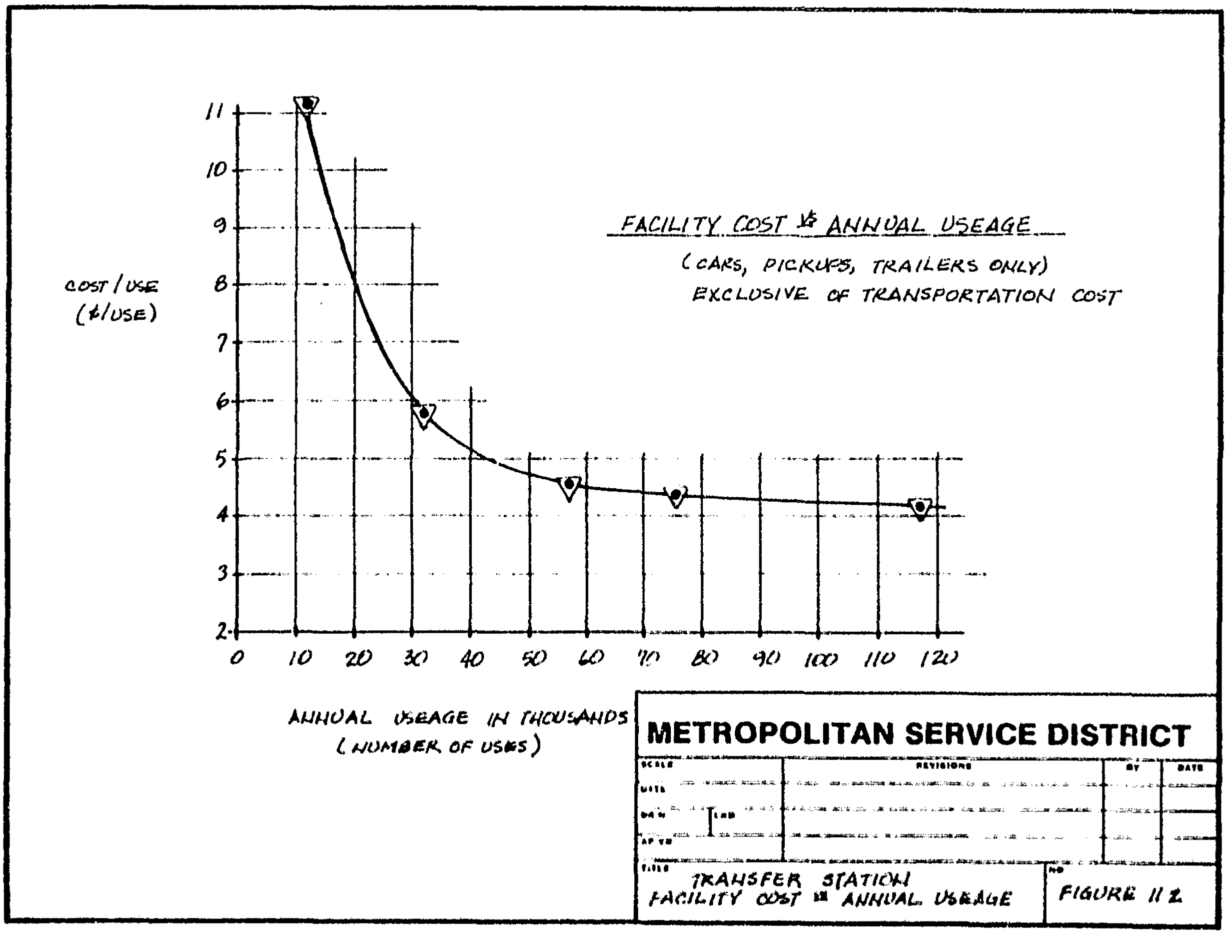
BRUNING 40-105


FACILITY COST VS ANNUAL USEAGE
(CARS, PICKUPS, TRAILERS ONLY)
EXCLUSIVE OF TRANSPORTATION COST
COST / USE
($/USE)
11
10
9
8
7
6
5
4
3
2
0
10
20
30
40
50
60
70
80
90
100
110
120
ANNUAL USEAGE IN THOUSANDS
(NUMBER OF USES)
METROPOLITAN SERVICE DISTRICT
SCALE
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TITLE TRANSFER STATION FACILITY COST VS ANNUAL USEAGE
NO FIGURE II.2
BRUNING 40-105

The basis of the cost estimates presented in the figures are as follows:

For Commercial Vehicles Only

1. Four annual usage rates are projected, including 30,000 tons per year, 70,000 tons per year, 140,000 tons per year and 210,000 tons per year.

2. For each of these annual solid waste loadings, estimates are prepared of the peak tonnage and vehicles using the facilities.

3. For the projected peak usage, unloading space and floor or storage area, volumes are estimated. Combining the estimated unloading space required, the solid waste storage volumes and maneuvering spaces for the unloading vehicles, a building space square footage for each annual tonnage is estimated.

4. For each building space requirement, specific land area requirements are also estimated.

5. Using building and land area estimates, site and building costs are estimated on a square footage or acreage basis. Site preparation, engineering and contingencies are all added to this cost. The sum of the building and land costs provides a total site and fixed capital costs requirement for each site under the various assumptions.

6. Given the incoming solid waste rates, operational crews and equipment requirements are established.

7. Capital, labor, operation and maintenance, profit taxes and other costs are estimated for each usage assumption. These calculations are shown in the technical appendix to this report.

For Private Vehicles Only

1. Assuming annual usage rates of approximately 120,000 per year, 72,000 per year, 57,000 per year, 31,000 per year and 11,000 per year, cost estimates are provided for transfer stations. Each usage volume compares respectively to the following: one transfer station per county; a transfer station sized to accomodate approximately what Rossman's currently receives; a transfer station to accomodate approximately what King Road currently receives; a transfer station which would handle approximately one-fifth of the current usage in the area; and a facility to handle what the current usage of the Hillsboro Landfill.

2. Starting with the basic usage assumptions, the process of estimating the costs of the facility is comparable to the commercial vehicle transfer station. These calculations are also shown in the appendix to this report (see Appendix F).

For the Combination of Commercial and Citizen Usage

1. Assuming a commercial sized station of 140,000 tons per year, cost savings for combined usage of the commercial station with private vehicles are estimated for each of the citizen usage volumes above.

2. Table 11.1 shows the calculated savings from the combination of a commercial vehicle station and citizen vehicle usage. Table 11.2 shows various schemes for allocating these savings among the commercial vehicles or the citizen users of the station.

Table 11.1

SUMMARY OF FACILITIES COST PROFILES

Commercial Vehicles Only:				
Size	30,000 TPY	70,000 TPY	140,000 TPY	210,000 TPY
Costs	$398,000	$632,000	$765,000	$971,000

Private Vehicles Only:					
Size	116,667 UPY	75,180 UPY	56,500 UPY	31,280 UPY	11,280 UPY
Costs	$482,000	$235,000	$254,000	$181,000	$126,000

Private Vehicles with 210,000 TPY station above, minor variation for 140,000 TPY STA, more substantial variation for other sized stations:					
Size	116,667 UPY	75,180 UPY	56,000 UPY	31,280 UPY	11,280 UPY
Costs	$281,000	$188,000	$148,000	$ 89,000	$ 57,000
Savings	**$201,000**	**$137,000**	**$106,000**	**$ 92,000**	**$ 69,000**

Table 11.2
SUMMARY OF ALTERNATIVES

	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Range	
Station Size	Public Cost $/Use	Comc'l. Cost $/Ton	Public Cost $/Use	Comc'l. Cost $/Ton	Public Cost $/Use	Comc'l. Cost $/Ton	Public Cost $/Use	Comc'l. Cost $/Ton	Public Cost $/Use	Comc'l. Cost $/Ton
210,000 TPY:										
116,667	3.99	3.75	3.57	3.98	4.13	3.67	2.41	4.62	2.41-3.99	3.67-4.62
75,180	4.17	3.98	3.87	4.13	4.32	3.97	2.50	4.62	2.50-4.32	3.97-4.62
56,500	4.34	4.12	3.89	4.22	4.50	4.12	2.62	4.62	2.68-4.50	4.12-4.62
31,280	5.54	4.23	5.08	4.26	5.79	4.19	2.85	4.62	2.85-5.79	4.19-4.62
11,280	10.64	4.33	10.46	4.33	11.17	4.30	5.05	4.62	5.05-11.17	4.30-4.62
140,000 TPY:										
116,667	3.99	4.15	3.47	4.58	4.13	4.03	2.41	5.46	2.41-4.13	4.03-5.46
75,180	4.17	4.65	.378	4.78	4.32	4.49	2.50	5.46	2.50-4.32	4.49-5.46
56,500	4.34	4.78	4.02	4.90	4.50	4.71	2.62	5.46	2.62-4.50	4.71-5.46
31,280	5.54	4.86	5.24	4.93	5.79	4.81	2.85	5.46	2.85-5.79	4.81-5.46
11,280	10.64	5.01	10.28	5.01	11.17	4.97	5.05	5.46	5.05-11.17	4.97-5.46

Alternative 1: Savings allocated on basis of tonnage per use (0.084 savings to citizen vehicles, 0.916 savings to commercial vehicles)

Alternative 2: Savings allocated on basis of ratios or annual cost for separate usage.

Alternative 3: 100% of savings allocated to commercial users.

Alternative 4: 100% of savings allocated to citizen users.

Although these cost estimates may become quickly outdated, they do provide a basis for establishing relationships of alternatives under various operating assumptions. In particular, they demonstrate the advantage of combining commercial vehicle stations with citizen usage.

In order to estimate the impact of a transfer station on commercial collection service, the following information is needed:

1. The sensitivity of citizen usage to disposal charges at the transfer station; and

2. The sensitivity of collection service usage to cost and availability of alternatives.

The staff has been unable to find any definitive information about these two areas of collection and disposal price elasticity. It is unlikely that such information will ever become available on a meaningful basis. In the absence of quantifiable data, any transfer station decision will rely on somewhat subjective and arbitrary decisions.

Chapter 12

HAUL COST ECONOMICS

MSD's legislative authority is limited to disposal aspects of solid waste management of which the siting of landfills is a necessary part and which may have a critical effect on collection of solid waste.

If disposal is considered separately from collection, it may be desirable to drive the disposal costs as low as possible. However, if, in order to minimize the disposal costs, a landfill or transfer point is remotely located from the source of waste generation, the cost of collection and delivery to the disposal or transfer point may be increased.

To provide a basis for minimizing the combination of collection and disposal costs, it is necessary to develop a cost model for collection activities. The cost model used consists of 25 input parameters whose relationships determine the cost per ton-mile to move solid waste from a point of generation to the point of disposal. The model provides an excellent basis for determining the sensitivity of the total collection costs for varying input parameters.

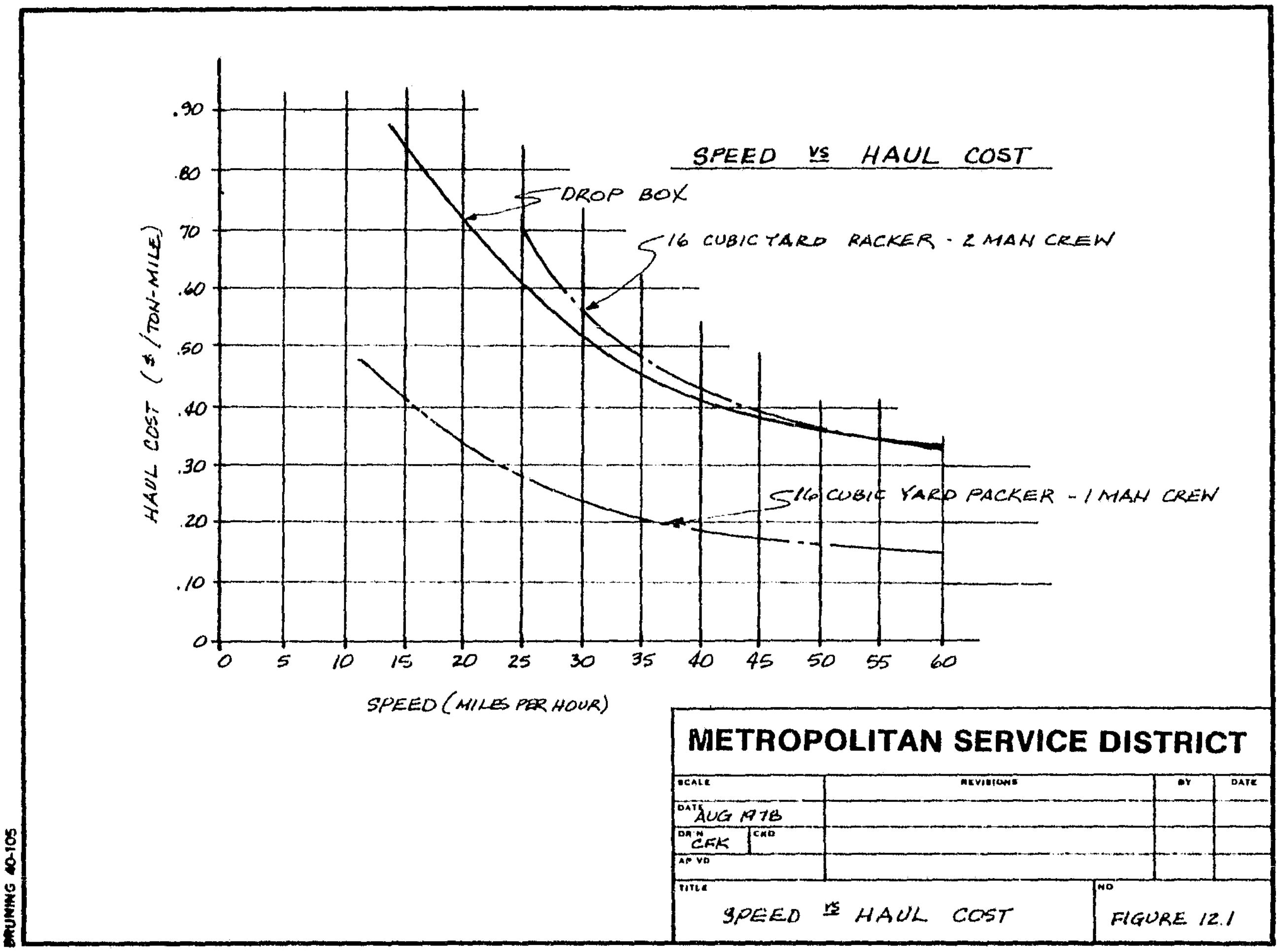
Numerous computer runs are made of the model and when acceptable values for individual parameters are established, the parameter describing distance from point of generation to disposal is varied. The difference between subsequent runs for various distances to the landfill provides a basis for determining the haul cost (haul cost, as used here, refers to the cost of moving waste the distance from the point at which the collection vehicle is loaded to the point of disposal). In this manner, haul costs for various distances are established for compaction vehicles and for drop boxes.

While residential collection vehicles may run to a landfill one or two times daily, certain drop box collection vehicles may use a landfill four to eight times daily. This difference in trips is somewhat offset by differences in labor and equipment costs. Even so, current residential haul costs are proprobably significantly lower than drop box home rates.

As the initial cost of vehicles and operation and maintenance costs increase, the cost of haul for residential collection vehicles will increase and approach the cost of haul for drop box vehicles. The high haul costs increase the desirability of locating landfills and transfer stations closer to the generation of solid waste. This report assumes that the higher haul costs were inevitable and thus, set haul costs for compaction vehicles at the higher level for drop box vehicles.

The effect of this assumption is to increase solid waste disposal costs somewhat at the expense of residential compaction vehicles and to the benefit of commercial drop boxes for the present situation. As residential haulers come under increasing pressure to develop more efficient collection methods, it is likely that their economic sensitivity to increased hauling distance will approach that of drop box haulers.

Figure 12.1 shows the variation of the haul cost per ton-mile with speed. Note that the drop box costs are higher than for the packer truck. Similar relationships were developed for transfer haul costs for large size tractor-trailer vehicles.


SPEED VS HAUL COST
DROP BOX
16 CUBIC YARD PACKER - 2 MAN CREW
16 CUBIC YARD PACKER - 1 MAN CREW
HAUL COST ($/TON-MILE)
.90
.80
.70
.60
.50
.40
.30
.20
.10
0
0
5
10
15
20
25
30
35
40
45
50
55
60
SPEED (MILES PER HOUR)
METROPOLITAN SERVICE DISTRICT
SCALE
REVISIONS
BY
DATE
DATE AUG 1978
DR N CFK
CKD
AP VD
TITLE SPEED VS HAUL COST
NO FIGURE 12.1
BRUNING 40-105

Chapter 13

DESCRIPTION OF ALTERNATIVES

The objectives of this report focus on implementing new landfill sites and articulating relative advantages of various approaches to solid waste disposal management. Alternative approaches to solid waste management include waste reduction, source separation or recycling, landfilling and capital intensive central processing of mixed solid waste for energy or resource recovery. Of the four approaches, the latter three also include the collection process and landfill siting.

Although all of these approaches have distinct advantages and disadvantages, it appears that no singular approach can, by itself, handle all of a community's solid waste management needs.

Solid waste management officials have determined that all four approaches need to be developed for an effective solid waste management system. Controversy stems from the relative emphasis placed on each solid waste management strategy. Emotional and political factors influence strategy choices.

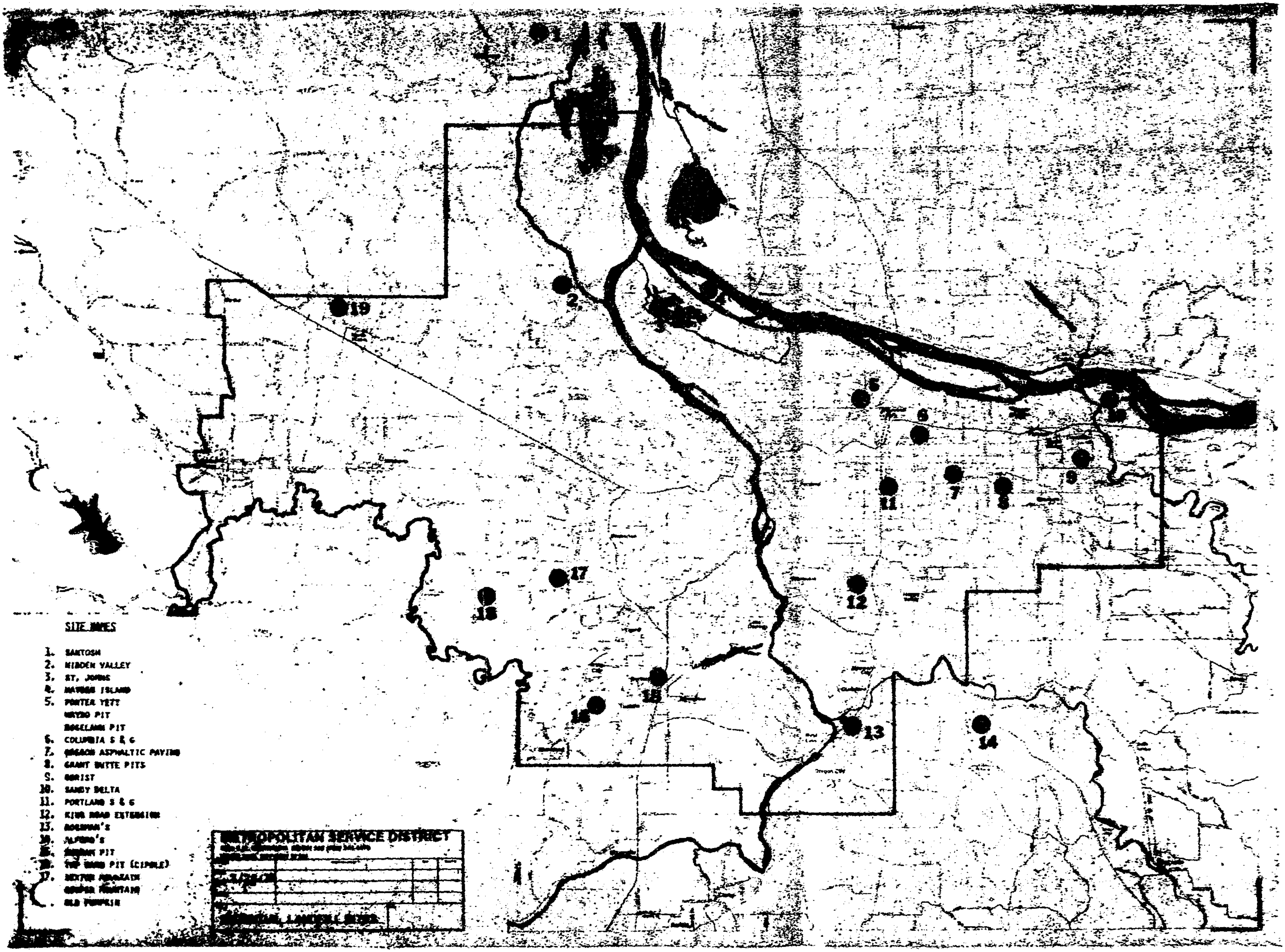
Capital intensive central processing of mixed solid waste should be analyzed in the context of allowing for the development of concurrent strategies, with landfilling being an integral part. Source separation encourages an awareness of waste generation which is often overlooked by over reliance on either landfilling or central processing.

For purposes of providing the MSD Board of Directors with the best possible information to cost effectively allocate resources, this report develops analytical information to allow:

1. Ranking alternative landfill sites in terms of their composite haul costs and disposal cost advantages;
2. Comparing alternative landfills in terms of environmental and land use acceptability; and

3. Projecting the cost of long term landfilling with and without incorporation of capital intensive processing of mixed solid waste.

Landfills considered in these alternatives are those shown in Figure 13.1 on the following page. An economic analysis was prepared for only a portion of these sites. (See Chapter 6.)


SITE NAMES
1. SANTOSH
2.
3. ST. JOHNS
4. HAYDEN ISLAND
5. PORTER YETT
6. COLUMBIA S & G
7. ASPHALTIC PAVING
8. GRANT BUTTE PITS
9.
10. SANDY DELTA
11. PORTLAND S & G
12. ROAD EXTENSION
13.
14.
15. PIT
16. PIT (CIPOLE)
17.
METROPOLITAN SERVICE DISTRICT
1
2
4
5
6
7
8
9
11
12
13
14
17
19

Chapter 14
A DESCRIPTION OF THE ANALYSIS MODEL

Minimization of haul and disposal costs means finding the most centrally located (closest to center of waste generation), lowest cost combination of landfills or landfill.

This is a mathematical problem best solved utilizing linear programming. Several solution methods are available. Utilizing software developed by CDC Computer Services, the local landfill disposal, transfer station, and haul cost situation model is developed.

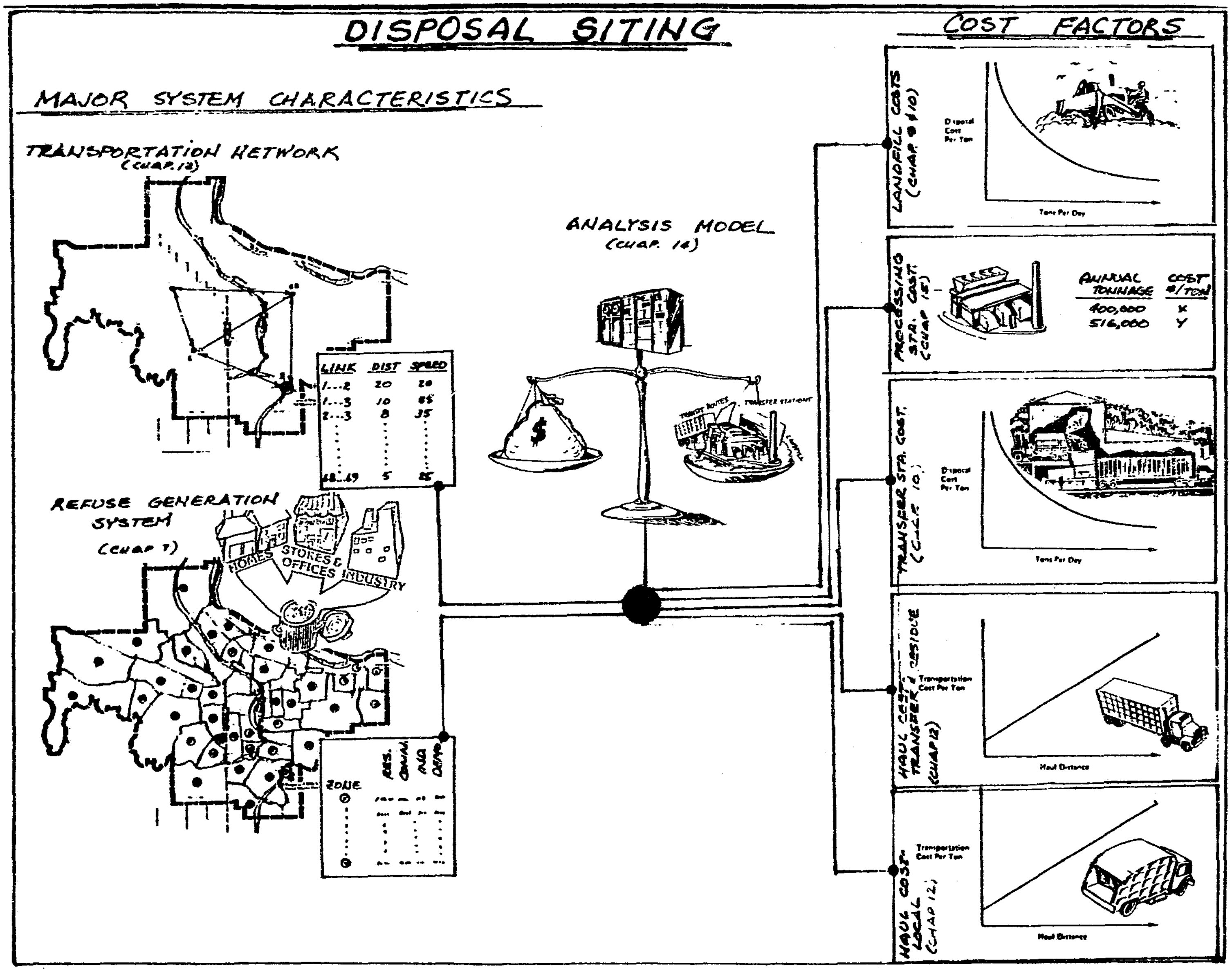
The basic features of the input consist of describing estimated costs to solid waste tonnage relationships for each potential landfill and developing a transportation network with associated haul costs for various links of the network.

The computer model calculates the sum of haul costs and disposal costs for the total of each waste generation zone to each potential site and minimizes the total of waste generation zone's haul costs and disposal costs.

The model has the ability to accept a variety of constraints, such as forcing all of the waste to one site or determining the lowest cost sites if haul costs are held at or below a specific level.

The real value of the model is best realized by studying the effects of varying constraints and input parameters on disposal and haul costs.

Figure 14.1 illustrates each of the input components utilized in the analysis model. The major system characteristics represent the specific transportation network and solid waste generation patterns for the MSD area. The cost factors applied to the system elements generate the alternative system costs. Note that for each component of the analysis model shown in Figure 14.1, the chapter or portion of this report further explaining the component is presented.


DISPOSAL SITING
MAJOR SYSTEM CHARACTERISTICS
TRANSPORTATION NETWORK
(CHAP. 12)
LINK DIST SPEED
1...2 20 20
1...3 10 25
2...3 8 35
68...69 5 25
REFUSE GENERATION SYSTEM
(CHAP. 7)
HOMES
STORES & OFFICES
INDUSTRY
ZONE
ANALYSIS MODEL
(CHAP. 14)
COST FACTORS
LANDFILL COSTS
(CHAP. 8 & 10)
Disposal Cost Per Ton
Tons Per Day
PROCESSING STA. COST
(CHAP. 15)
ANNUAL TONNAGE
COST $/TON
400,000 X
516,000 Y
TRANSFER STA. COST
(CHAP. 10)
Disposal Cost Per Ton
Tons Per Day
HAUL COST-TRANSFER & RESIDUE
(CHAP 12)
Transportation Cost Per Ton
Haul Distance
HAUL COST-LOCAL
(CHAP 12)
Transportation Cost Per Ton
Haul Distance

Chapter 15

EVALUATION OF ALTERNATIVES

The analytical information presented in this chapter is focused in three areas: 1) ranking alternative landfill sites in terms of their composite haul cost and disposal cost advantages; 2) comparing alternative landfills in terms of environmental and land use acceptability; and 3) projecting the cost of long term landfilling with and without incorporating capital intensive processing of mixed solid waste.

Haul Cost and Disposal Cost Advantages

The model developed for this report and for future MSD solid waste management efforts has the ability to quickly compute the cost of hauling waste from each of the 41 generation zones to any particular site, given specific haul cost assumptions. Generally the greater the distance the greater the cost.

The landfill operational and development costs described in Chapters 9 and 10, when combined with particular assumptions about annual rates of fill, provide a basis for determining the unit disposal cost for each landfill. Transfer station unit costs follow a similar pattern.

The model has the ability to optimize the sum of haul costs and disposal costs, and thus, select the optimum combination and most economic configuration of sites. An early surprise was that the lowest system cost was generated by operating one landfill at a time to take advantage of the lower unit disposal cost associated with higher annual filling rates.

After several computer runs comparing the various alternatives, it was concluded that the lowest combined unit cost for hauling and disposal results from operating one landfill at a time. This result is due to the lower unit cost associated with higher operational volumes. On this single landfill basis, Table 15.1 ranks the 14 sites for which cost estimates were prepared. Table 15.2 shows the most economic landfill in terms of system cost to be the Waybo-Roselawn pits.

Table 15.1
LANDFILL SUMMARY

Site	Haul Cost ($/Ton)	Disposal Cost* ($/Ton)**	Total Cost ($/Ton)	Capacity (Tons)
(1) Waybo-Roselawn	4.56	5.14	9.70	1,900,000
(2) Portland S & G	4.57	6.82	11.39	2,750,000
(3) Grant Butte Pits	5.74	5.88	11.62	950,000
(4) Oregon Asphaltic	4.80	7.35	12.15	1,400,000
(5) Columbia S & G	4.54	7.64	12.18	710,000
(6) Old Pumpkin	8.88	3.62	12.50	3,500,000
(7) St. Johns (Lateral)	6.18	6.67	12.86	1,700,000
(8) Durham	6.19	6.67	12.86	730,000
(9) Alford	9.68	3.29	12.97	8,800,000
(10) King Rd. Extension	5.90	7.55	13.45	1,900,000
(11) Hayden Island	6.46	7.92	14.38	10,700,000
(12) TR Sand Pit (Cipole)	6.75	8.17	14.92	950,000
(13) St. Johns (Up)	6.19	8.80	15.08	770,000
(14) Obrist	8.08	7.30	15.38	750,000
(15) Cooper Mountain	8.42	8.68	17.10	1,000,000

* Disposal Costs based on a volume of waste received of 730,000 tons per year (all of MSD's residential, and industrial and commercial waste plus 10% for public dumping).

** All costs 1977 dollars.

Because there are currently at least six different choices for commercial haulers to dispose of waste, one landfill would represent a significant change. The current average estimated haul cost is $3.80 per ton. The site showing the lowest unit haul cost of $4.56 per ton represents an increase of 20 percent. In addition to the 20 percent increase, the reader should realize that this is the average increase. Increases to individual haulers could be significantly higher.

To analyze the effect of operating more than one landfill at a time is complicated because of the need to choose sites which are optimally located with respect to each other. Of the potential sites considered, the majority are located in the north and east part of the District.

For the optimum solutions with two and with three landfills operating concurrently, Table 15.2 compares haul cost and disposal cost tradeoffs. At first glance, Table 15.3 is somewhat confusing. It appears that there are no haul cost savings from the two landfills operating versus one landfill. ($4.74/ ton for each.) Actually savings would be realized by certain individual haulers although the total hauling costs would be the same. In addition, the computer model also calculated more tonnage going to the Old Pumpkin site to take advantage of the lower unit disposal costs and thus offsetting some of the haul cost savings expected.

Actual conditions are likely to show more or less variations than represented by Table 15.2, depending on the distance relationships between landfills considered. Generally, it is felt that if two landfills whose distance relationship is compatable with each other operate concurrently, the total system cost will be similar, but haul costs will be reduced, and disposal costs increased. Three landfills further increase system costs and complicate disposal siting.

Table 15.2

HAUL COST - DISPOSAL COST TRADEOFFS

More Than 1 Landfill *

No. Landfills Operated Concurrently	Specific Sites	Unit Haul Cost ($ per Ton)	Unit Disposal Cost ($ per Ton)	Unit System Cost ($ per Ton)	Increase (Decrease) (%)
One	Portland Sand & Gravel	4.74	7.03	11.77	Base
Two	1) Portland Sand & Gravel 2) Old Pumpkin	4.74	7.34	12.08	2.6
Three	1) Portland Sand & Gravel 2) Durham Pits 3) St. Johns	3.76	10.00	13.76	16.9
Eight	Current Situation **	3.77(-) ***	3.25	7.02	(40.04)

* 1977 dollars: 1982 solid waste quantitites (not including public dumping deliveries)

** 2 landfills accept mainly construction and demolition;
4 landfills have specific limitations on acceptable solid waste;
2 landfills have few limitations on acceptable solid waste.

*** Based on somewhat limited weight and solid waste distribution estimates.

Environmental and Land Use Acceptability

Table 15.3 divides each of the 24 site alternatives considered into three categories, depending on their land use and/or environmental acceptability. With the exception of St. Johns outward expansion and Santosh, all of the other alternatives shown in Table 15.3 to have land use acceptance (Category A) may yet receive land use challenges, if used as suggested in this report. Category A is not universally accepted as true by all involved parties.

Dots indicate the sites for which economic analyses have been prepared in this report.

Table 15.3
POTENTIAL SITES

	NAME OF SITE	A	B	C
	Alford's		X	
●	TRP Sand Pit (Cipole)		X	
●	Columbia Sand & Gravel		X	
●	Durham Pits		X	
	Cooper Mountain		X	
	Hidden Valley			X
	Hayden Island			X
	Nash Pit			X
●	King Road Extension	X		
	Newberg		X	
	Old Pumpkin		X	
●	Obrist	X		
●	Oregon Asphaltic			X
●	Portland Sand & Gravel		X	
●	Rossman's	X		
●	Roselawn			X
	Sexton Mountain			X
●	St. Johns - Upward		X	
●	St. Johns - Outward	X		
	Sandy Delta			X
	Santosh	X		
●	Waybo Pit			X
	Porter-Yett			X
●	Grant Butte Pit		X	

A: Needs environmental Acceptance
B: Needs environmental and land use acceptance
C: Needs environmental and land use acceptance and has major problems

Projecting Costs With and Without a Solid Waste Processing Plant

There are a number of problems in projecting and making comparisons between landfill and transfer station data generated in this report and the combination of mixed central solid waste processing and landfilling. Considerably more effort and expense has been expended in defining costs for solid waste processing and energy recovery than for landfilling potential.

Nearly all of the processing data is based on the concept proposed for the Oregon City Processing Station. Although this concept has been defined through the preliminary engineering phase, there are still uncertainties about costs and/or the actual terms of contract between Publishers Paper Company and MSD which affect the cost if the project is to go ahead.

As more information becomes available about the processing station, the cost assumptions used in this report can be refined to better reflect the actual conditions. However, it is unlikely that the expenditure of considerably more money and time will increase the value or reduce the gross uncertainties of landfill siting.

The purpose of this section of the report is to not only present alternate comparisons, but also to discuss what is known about each alternative. Specific decision making procedures, in light of the significant uncertainties, are also presented.

Processing Plant Cost Assumptions

The cost or tipping fee assumptions shown in Table 15.4 are based on information contained in a preliminary draft of the final report on Phase I Engineering Resource Recovery Facilities by the Bechtel Corporation, and other information furnished by Publishers Paper Company. These assumptions may or may not be the actual tipping fees specified by contractual arrangements which will be made if the project goes ahead.

The assumptions also tend to reflect significant extrapolation of limited cost information available at the time the analysis was undertaken. These costs have been derived in the following way.

(1) The 1982 tipping fee is assumed to be $12.00/ton levied against 519,000 tons of solid waste, of which 400,000 tons are processed and 119,000 tons are landfilled at $6.00/ton. The $12/ton tipping fee includes residue disposal costs.

(2) The 1982 tipping fee of $12.00/ton is adjusted to determine the cost of the 400,000 tons; residue and ash disposal costs are extracted, and the $12.00/ton is discounted at 7% annually to determine the tipping fee in terms of 1977 dollars.

(3) The tipping fee for each of the subsequent years is determined by first inflating the tipping fee at 3% annually, then discounting the tipping fee at 7% annually to express it in terms of 1977 dollars. The tipping fee rate is assumed to inflate at 3% because of the offsetting value of energy revenues.

(4) For annual plant throughputs of 516,000 tons, the annual costs provided by Publishers and Bechtel during the "Phase I Engineering" have been reviwed by MSD staff to reflect the cost impact of additional plant throughput. The extra 116,000 tons of refuse to the plant are assumed to produce electrical energy valued at $25 per megawatt.

Table 15.4

Processing Plant Cost Assumptions

Operating Assumptions (Annual Throughput) (Tons/Year)	Year	Tipping Fee* (Not Including Residue Haul or Disposal Costs) 1977 $/Year
400,000	1982	$ 8.69
	1987	7.18
	1992	5.93
	1997	4.90
516,000	1982	$ 4.22
	1987	3.48
	1992	2.88
	1997	2.38

* The tipping fee reflects a 3% inflation rate as other costs inflate at 7%. Residue is 23% of annual throughput.

Solid Waste Management System Comparisons

Computer runs of the model were made for solid waste tonnages reflecting the midpoint of the period for 1980 to 1985, 1985 to 1990, 1990 to 1995 and 1995 to 2000. The costs used for landfill and transfer station are those developed in Chapters 10 and 11, combined with the haul costs from Chapter 12. The landfills were limited to the Alford's site and the Old Pumpkin site after the demand for landfill space reached 7.5 million tons. (The assumed probable capacity of close in sites, including gravel pits.)

For each of the four time periods analyzed, the model selected the optimum mix and location of sites for landfills and transfer station(s) with and without the processing plant. Unit haul cost and disposal costs for each of the respective time periods are shown in Table 15.6

The unit costs represented in Table 15.6 correspond to certain adjustments which have been made to the model analysis. These adjustments are made to maximize the realism of situations which the model creates. For example, the model is likely to select the same "lowest cost" landfill in each of the four periods it analyzes, even though the capacity of that landfill limits its useful life. Also, the unit haul costs and disposal costs for each alternative reflect the subjective probabilities of utilizing the landfill sites included in this report. This is further explained in the remaining part of this chapter.

Table 15.6

System Alternatives

	No Processing Plant, One Landfill		With Processing Plant One Landfill No Transfer Station		With Processing Plant One Landfill and Transfer Station	
Year	Without Transfer Stn.	With Transfer Stn.	400,000 tons per annum	516,000 tons per annum	400,000 tons per annum	516,000 tons per annum
1982						
- Unit Haul Cost ($/ton)	5.74	5.38	5.67	6.06	5.06	5.50
- Unit Disposal Cost ($/ton)	7.33	8.52	10.41	7.70	11.57	8.82
- Total Unit Cost ($/ton)	13.07	13.90	16.08	13.76	16.63	14.32
1987						
- Unit Haul Cost ($/ton)	5.74	5.38	5.56	6.01	4.87	5.22
- Unit Disposal Cost ($/ton)	7.33	8.52	9.28	7.02	10.38	8.17
- Total Unit Cost ($/ton)	13.07	13.90	14.84	13.03	15.25	13.39
1992						
- Unit Haul Cost ($/ton)	9.20	5.58	5.49	5.88	4.79	5.00
- Unit Disposal Cost ($/ton)	4.80	7.79	8.40	6.60	9.48	7.59
- Total Unit Cost ($/ton)	14.00	13.38	13.89	12.48	14.27	12.59
1997						
- Unit Haul Cost ($/ton)	9.20	5.58	5.43	5.80	5.08	5.08
- Unit Disposal Cost ($/ton)	4.80	7.79	7.70	6.20	8.77	7.27
- Total Unit Cost ($/ton)	14.00	13.38	13.13	12.00	13.85	12.35

Of the fifteen landfill sites for which cost estimates were prepared, subjective probabilities were assigned to the likelihood of these sites being implemented, considering their technical, land use, political feasability, and potential for citizen reaction. The assignment of subjective probabilities was based on the collective judgments of several staff members.

Any probabilities assigned in this manner are likely to vary widely, depending on the perspective of those making the assignment. The range of probabilities by individual staff members was considerable for each site. The subjective probabilities are a decision making tool and by themselves may have little significance. In other words, the analysis can be repeated for any probability assignments preferred by the decision maker.

The probabilities are used as shown in Table 15.7 to determine the probable capacity of landfills available to the District, the probable average haul cost, disposal cost and system cost for the one landfill alternative. Based on the relationships between the probable averages and the model determinations, corresponding adjustments for the transfer station and processing plant alternatives are made, i.e. a ten percent increase in haul costs calculated under model assumptions and the probable average costs have been applied to the processing plant.

Table 15.7

PROBABLE AVERAGES

(1) Landfill	(2) Assigned Probability	(3) Actual Assumed Landfill Capacity (Tons)	(4) Probable Capacity (4)=(2)x(3) (Tons)	(5) Unit Haul Cost ($/Tons)	(6) Total Haul Cost (6)=(4)x(5) ($/Tons)	(7) Unit System Cost ($/Tons)	(8) Total System Cost (8)=(4)x(7) ($/Tons)	(9) Franchised Portion Capital Cost ($)	(10) Weighted Capital Cost Factor (9)=(2)x(8) ($)
St. Johns	.79	770,000	608,000	6.19	3,760,000	15.08	9,170,000	602,000	476,000
Rossman's Up	.60	500,000	300,000	6.23	1,870,000	15.22	4,570,000	800,000	480,000
Obrist	.74	600,000	440,000	8.08	3,560,000	15.38	6,770,000	1,147,000	848,000
King Rd. Exp	.81	1,700,000	1,380,000	5.90	8,140,000	13.45	18,561,000	2,021,000	1,637,000
St. Johns Out	.71	1,700,000	1,210,000	6.19	7,500,000	12.86	15,561,000	1,326,000	941,460
Portland S&G	.61	2,750,000	1,680,000	4.57	7,680,000	11.39	19,140,000	1,542,000	941,000
Columbia S&G	.48	710,000	340,000	4.54	1,540,000	12.18	4,141,000	1,045,000	502,000
Durham Pits	.50	730,000	370,000	6.19	2,290,000	12.86	4,700,000	1,259,000	630,000
Grant Butte	.48	450,000	220,000	5.74	1,260,000	11.62	2,560,000	1,493,000	717,000
Oregon Asph.	.35	1,400,000	490,000	4.80	2,350,000	12.15	5,950,000	986,000	345,000
Cipole	.49	950,000	470,000	6.75	3,170,000	14.92	7,010,000	1,706,000	836,000

Weighted Probability (A) .61
Total Actual Landfill Space (B) → 12,260,000
Total Probable Landfill Space (C) → 7,510,000
Probable Haul Cost (D) → 5.74
Total "Factored" Haul Cost (E) → 43,120,000
Probable System Cost (F) → 13.07
Total "Factored" System Cost → 98,193,000
Probable Financed Cost/Site (H) → 1,270,000
Total Financed Cost (I) → 8,353,000

(A)=(C)/(B) (B)=Sum of (3) (C)=Sum of (4) (D)=(E)/(C) (E)=Sum of (6) (F)=(G)/(C) (G)=Sum of (8) (H)=(J)/Sum of (2).

The probable capacity (C) shown in Table 15.7 of 7,510,000 tons corresponds to eleven years of life if the processing plant is not built and sixteen years of life if the processing plant operates at 400,000 tons of annual throughput. Figures 15.1, 15.2 and 15.3 show the number of years of expected landfill life resulting from varying assumptions on the likelihood of implementation. The solid line in each of these figures represents a system relying 100 percent on landfills and the two dashed lines represent processing plant alternatives with varied annual throughput. Figure 15.1 corresponds to an 80 percent probability of implementing all sites, Figure 15.2, a 60 percent probability, and Figure 15.3, a 40 percent probability.

Figure 15.1

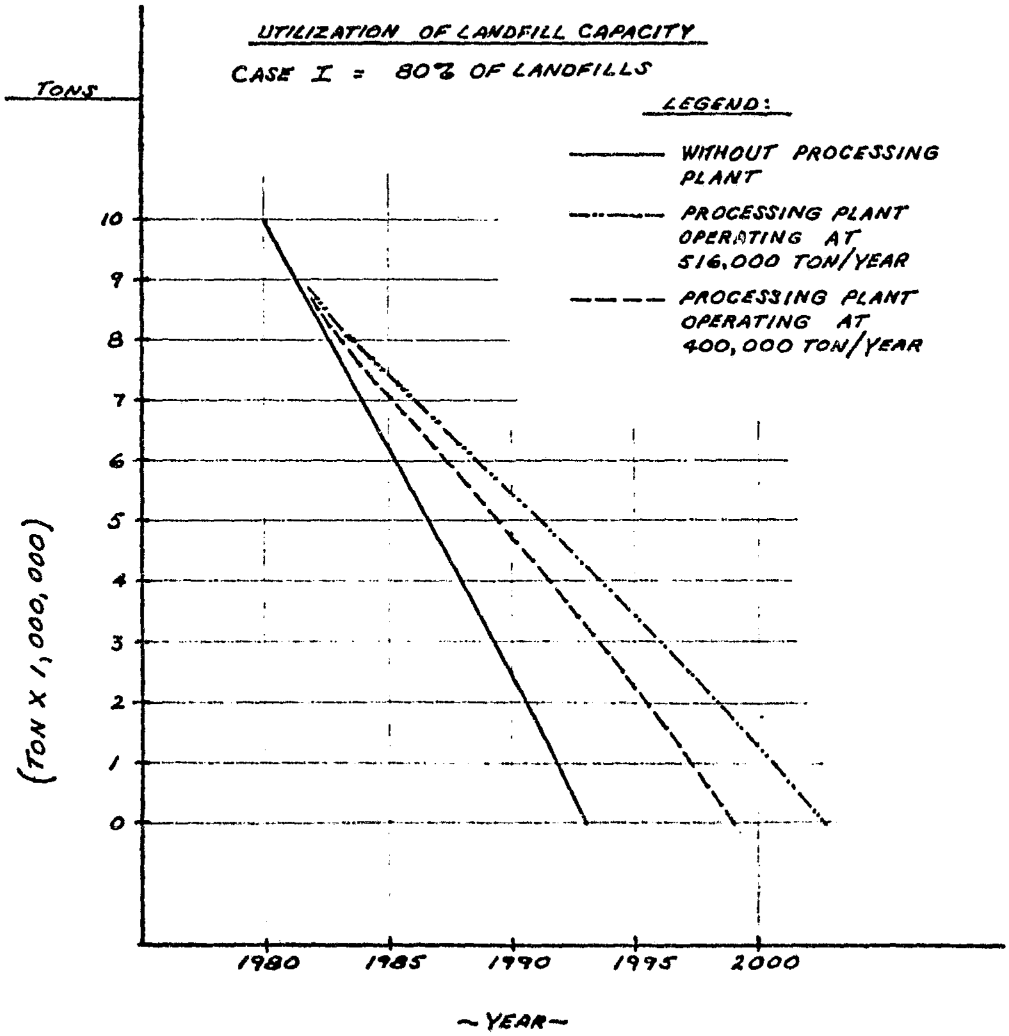

UTILIZATION OF LANDFILL CAPACITY
CASE I = 80% OF LANDFILLS
TONS
LEGEND:
WITHOUT PROCESSING PLANT
PROCESSING PLANT OPERATING AT 516,000 TON/YEAR
PROCESSING PLANT OPERATING AT 400,000 TON/YEAR
10
9
8
7
6
5
4
3
2
1
0
(TON X 1,000,000)
1980
1985
1990
1995
2000
~YEAR~

Figure 15.2

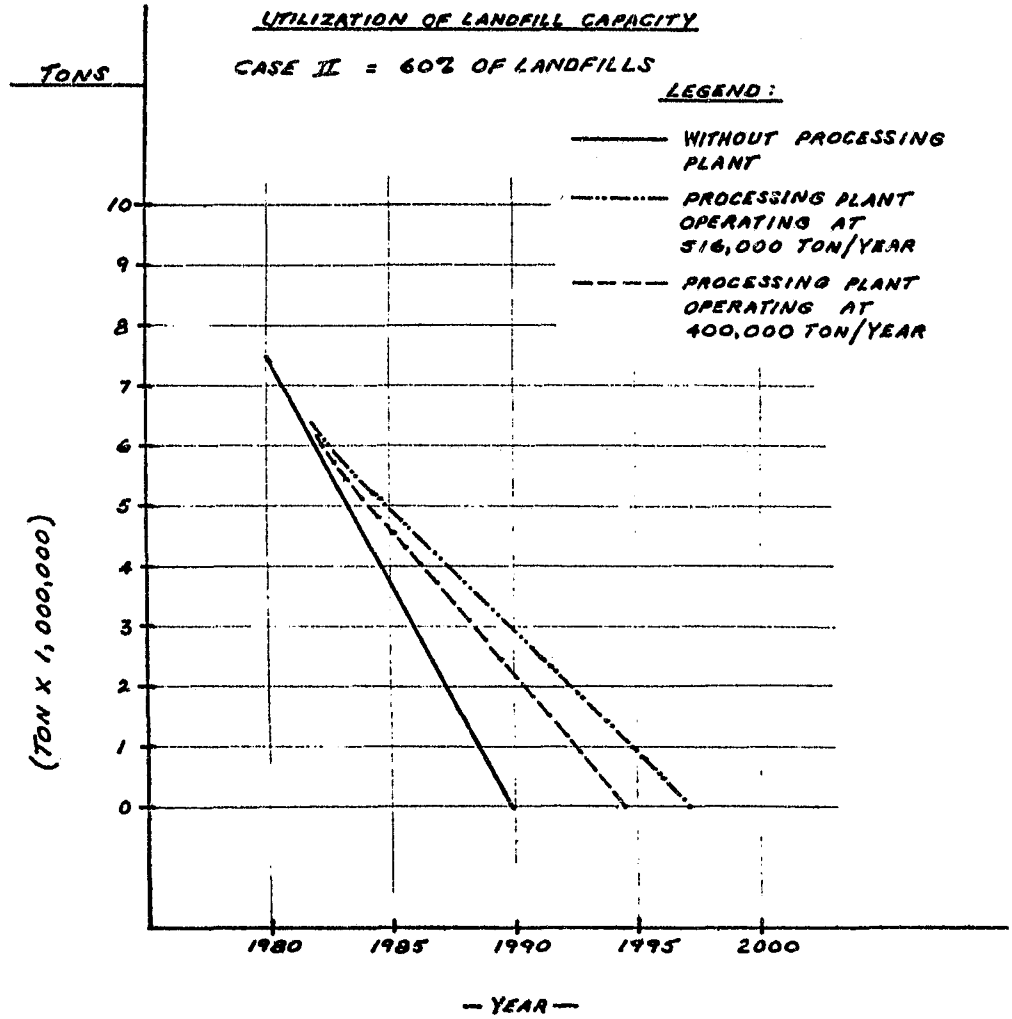


Figure 15.3

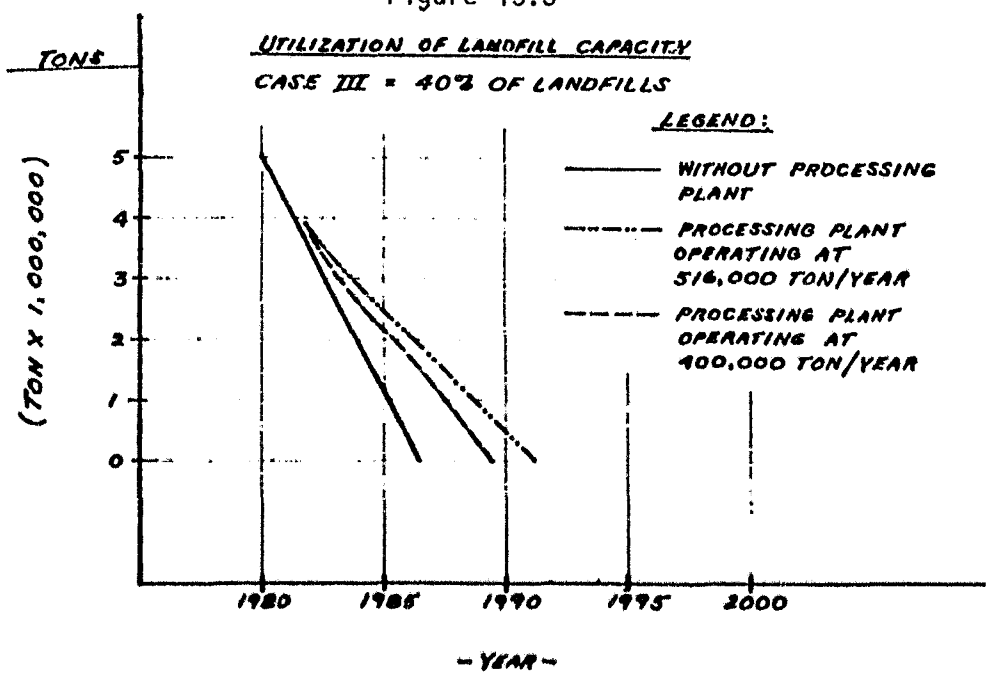


Figure 15.4

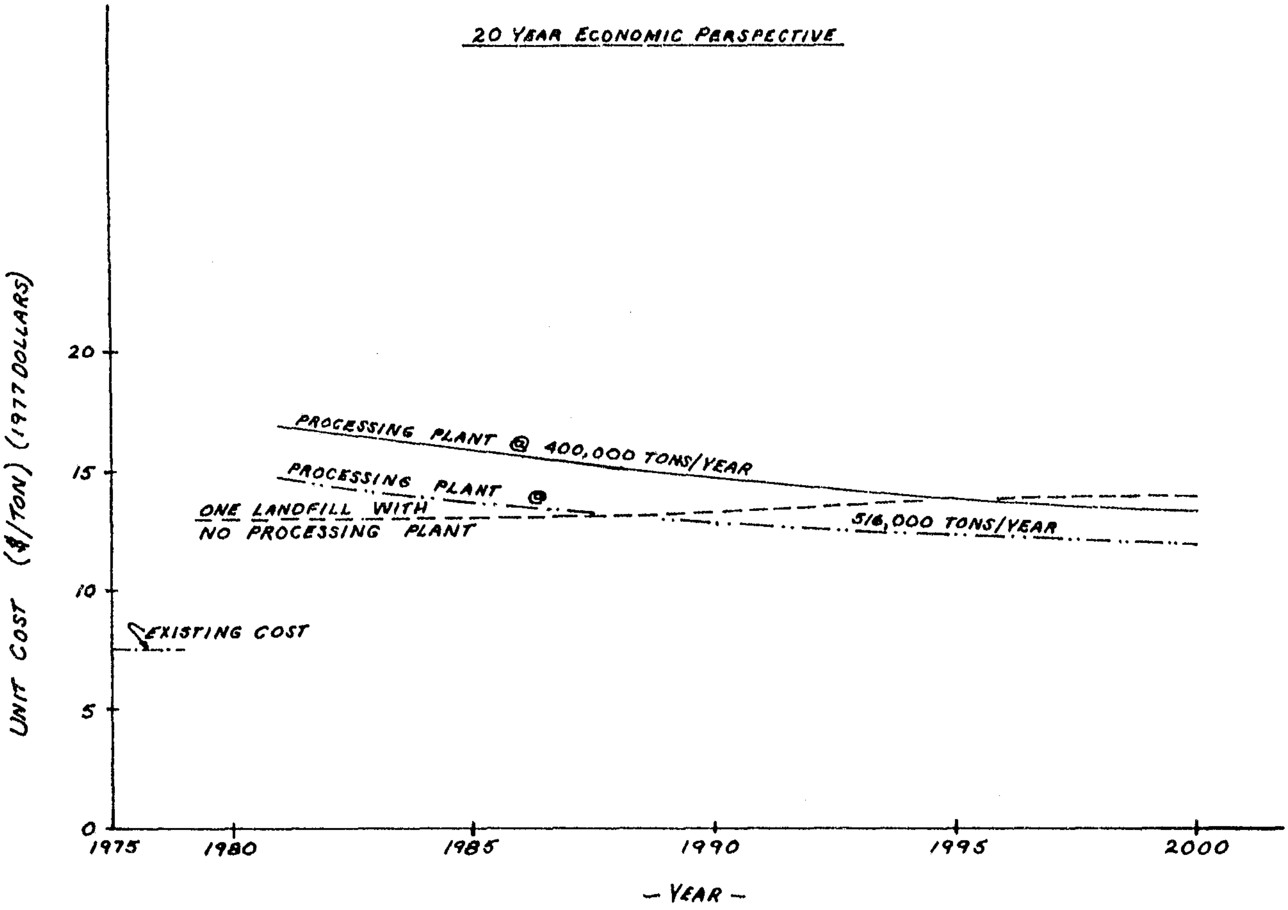
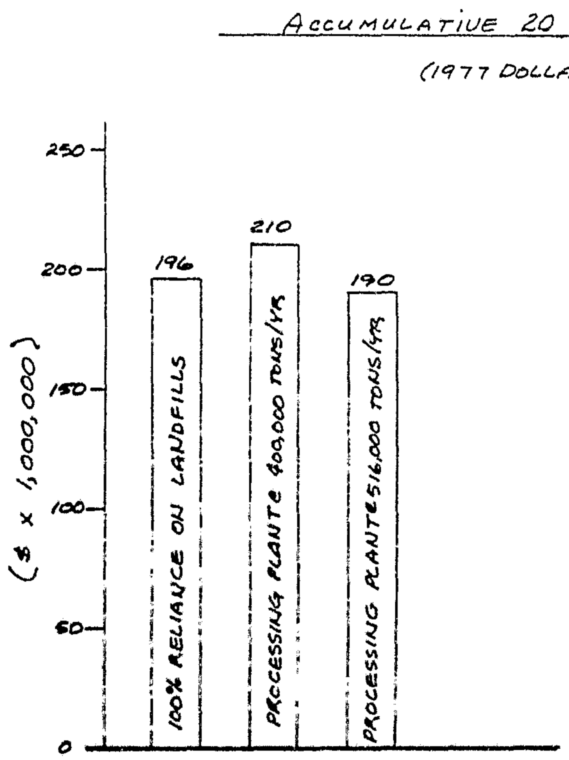


Figure 15.5



Using the costs shown in Figure 15.4, the total costs for each year over a twenty year period from 1980 to 2000, are accumulated in Figure 15.5. Figure 15.5 shows that, depending on the annual processing plant throughput, the cost of a system relying 100% on landfills versus a system incorporating the plant, are roughly similar.

If the processing plant is built, it is assumed that a transfer station is necessary to assure the required plant throughput. If the processing plant is not built, there is no economic advantage for a transfer system during the first ten year period of landfilling and some economic advantage thereafter. The respective economic advantages or disadvantages with and without a transfer station are slight.

Other Considerations

A complete analysis of the advantages and disadvantages of the processing plant is beyond the scope of this report. However, the transfer station should be further discussed.

Although one landfill operating singularly can be shown less costly than two or more, it is unlikely that either the present collection system or political situation will allow this to happen. Thus, the existing situation favors the construction of a transfer station. A transfer station and one landfill are nearly equal in system cost to two or more landfills operating concurrently.

Chapter 16
OTHER AGENCIES' OUTLOOK/ JURISDICTIONAL DIFFERENCES

Landfill proposals require approval from a multitude of jurisdictions and agencies. This list includes at least the following:

1. The local city or county planning commission;
2. The Department of Environmental Quality;
3. The Water Resources Department;
4. The Department of Geology & Mineral Institutes;
5. The State Division of Lands;
6. The Army Corps of Engineers; and
7. The Environmental Protection Agency.

Although previous chapters have discussed land use and technical constraints, the purpose of this chapter is to provide some of the background behind these constraints.

Local Land Use Agency. The only local jurisdictions in the Metropolitan Service District area which have previously dealt with solid waste related land use considerations are the three counties and the cities of Portland, Troutdale, Oregon City and Beaverton.

The Department of Environmental Quality (DEQ). The DEQ has historically been the leading agency in this state with regard to solid waste disposal. However, in most cases, this lead role does not include the responsibility for developing and siting new landfills. For this reason, the DEQ's stand on any particular landfill or transfer station proposal is one of examining available evidence, which is usually provided by the local jurisdictions. What has often been termed rejection of a particular site is often simply a request for more technical data to assure that degradation of the environment will not occur.

Sites which have previously gained acceptance tend to be located in areas of ground water discharge. Accordingly, many of these sites are located in flood plains or wet lands.

In conjunction with the preparation of this report, MSD requested DEQ's position on four elements of this report. These elements include: 1) expansion of St. Johns Landfill upward, 2) expansion of St. Johns Landfill outward, 3) use of gravel pits for sanitary landfills, and 4) use of dredge spoils for cover material. This request and DEQ's response is included in Appendix G.

DEQ's response was generally positive concerning expansion of St. Johns Landfill. From DEQ's vantage point, upward expansion presents more problems than outward expansion.

DEQ was unwilling to offer encouragement for use of the gravel pits as sanitary landfills. They point out some of the problems of the design scenario used by MSD to justify gravel pits as sanitary landfills. Their position is best expressed in their own words, "In summary, gravel pits could be used with appropriate design and engineering. We feel, however, their usage at this point could only be classed as 'maybe'."

DEQ offers that dredge spoils with low water content could be used as daily and intermediate cover, but lacks properties essential to final cover. Thus, there is optimism that landfilling costs can be offset through use of dredge spoils.

Some gravel pit locations have been approved by DEQ, based on favorable findings by the State Hydrogeologist.

Water Resources Department (WRD). Current Oregon law charges both the Department of Environmental Quality and the Water Resources Department with the responsibility of preventing any degradation of public waters of the state. Previously, efforts have centered around elimination of sewage sub-surface and surface water pollution. These programs have not been completely successful and, therefore, the Water Resources Department looks with increased caution on any new sources of pollution.

Once refuse is placed in the ground, the WRD feels that by the time any resulting ground water contamination can be detected, the only correction which can be done must be accomplished by nature. This involves continued decomposition of the refuse to the state at which no further leachate is generated, followed by a period of several years to flush the contaminates out of the system.

The WRD further feels that the specific geological conditions around gravel pits do not generally lend themselves to easy containment and treatment of leachate, or to prevention of ground water contamination. This is especially true in the East Portland area where gravels are very course, open and largely uncemented. However, the WRD will agree that there may be some sites in gravely deposits where sanitary landfills may be successfully operated. However, these sites would be rather rare exceptions and would probably require large expenditures of money to safeguard against ground water contamination.

The State Division of Lands. The Division of Lands has, from time to time, looked unfavorably to development or continuation of landfills in areas where wildlife or flooding potential might be adversely affected. For this Department, it is necessary to show that minimal degradation of the environment will occur.

The Corps of Engineers and the Environmental Protection Agency. These two federal agencies' concerns are focused in the siting of landfills in flood plain or wet land areas. Quoting from a memorandum of July 11, 1977 to the Enforcement Division Director from the Region X Deputy Assistant Administrator for Water Enforcement, the following statements are made:

"To summarize...the disposal of solid waste such as garbage, into wet lands or other waters of the United States is an unlawful discharge of pollutants, unless permitted under Section 402 of the Federal Water Pollution Control Act, by either the EPA or an NPEDS state. However, if the actual discharge of waste material has the primary purpose of altering the elevation of land beneath water or of impounding water, that activity may constitute a discharge of fill material and may be subject to Section 404. Where a permit for the discharge of waste material, such as garbage, is sought, there is a presumption that Section 402 will be applicable. Thus, a sanitary landfill will probably require a Section 404 permit for the discharge of garbage and a Section 404 permit for the preparation of the disposal site and the construction of dikes for the containment of garbage.

"Where a permit application for a sanitary landfill is submitted to EPA, that permit will most likely be denied in view of EPA's policy on the protection of wet lands (38 Federal Register, 10834, May 2, 1973), Section 404 Guidelines (40 C.F.R. 2:30) and concern for any contamination of surrounding waters by leachate."

The current proposed expansion of St. Johns Landfill has encountered resistance from the Environmental Protection Agency through the Army Corps of Engineers' 404 permit process, on the basis of the EPA's wet land policy.

Current Proposed Criteria for Classification of Sanitary Landfills, issued by the EPA under the Federal Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976 (RCRA), further limit landfill siting in flood plains or wet lands, the criteria indicate a "strong presumption against...the discharge of solid waste into wet land areas."

In addition, the proposed criteria address a number of other landfilling issues, including the need for leachate effluent collection, containment and treatment, and the practice of covering all "unshredded, unstabilized, purtrescible" wastes with dirt cover each day that the site is open.

The objective of the criteria is that sanitary landfilling is accomplished in a manner "posing no reasonable probability of adverse effects on health or the environment." MSD shares a similar objective and for that reason, the proposed criteria have been used in this report as a basis for establishing minimum design and operating standards for future landfilling and siting.

On a more favorable light, the Corps of Engineers' representatives have contacted MSD on the establishment of a program for use of dredge spoils as cover material for local landfills. From a preliminary viewpoint, both MSD and the Corps of Engineers have much to gain by the development of this proposal.

Chapter 17

IMPLEMENTATION STRATEGIES

Implementation of regional disposal sites requires that several tasks be performed. A portion of these tasks are accomplished by the acceptance of this report by the Board of the Metropolitan Service District. The following tasks are being accomplished prior to acceptance of the report by the MSD Board:

1. MSD continues to maintain records of landfill utilization and landfill capacity estimates;
2. MSD monitors research and collects data to analyze specific environmental impacts of handling and landfilling milled residue, shredded refuse and unprocessed refuse. Methods for leachate containment, recovery and treatment have also been researched and laboratory work will be undertaken as funding occurs; and
3. MSD has established and maintains a list of landfill users, operators and those interested in siting landfills and is periodically contacting these people, as developments occur, which affect the siting of future landfills or transfer stations.

Through the development and approval of this report, MSD intends to indicate to affected local jurisdictions, other agencies, various interest groups and corporations affected by the siting of landfills, a specific, long-term policy for implementing new landfill sites and corresponding priorities.

The many agency approvals required for landfill siting necessitate an orderly process of preparing information and coordinating the separate interests of all concerned. The purpose of this report is to indicate MSD Board policy and intent. With regard to implementation of new sites, there are many factors to be considered. Some of these factors include:

1. Public or private sector ownership/operation of site;

2. An enforcement or operational role for MSD;
3. Control of disposal rates; and
4. MSD's role in initiating new sites and financial responsibility for preliminary engineering, testing, and other pre-operational costs.

This chapter will discuss the various aspects of these factors.

Public or Private Sector Ownership/Operation of Sites

The existing solid waste system relies on a mixture of publicaly and privately owned sites and entirely private sector operation. The basis of this system is a mixture of county franchises and the structure of state statutes regulating solid waste disposal. Generally, state solid waste permits and franchises have been granted to anyone who could provide assurance that operations would be in accordance with certain standards.

Historical practices and the lack of enforcement money and/or alternatives have allowed for the development of a system with many sites who's economical viability is more related to shortcuts which can be taken in meeting the standards, rather than the volume of business which the sites are able to attract. Thus, what is often represented to be a free competition system is really something else.

Since there has been a poor understanding and little agreement on who is responsible if standards are not met, short term sites could be opened with little regard for long term consequences associated with landfilling. This practice has encouraged concentration on short term costs and profits with little regard for future costs or long term profits.

Neither the private sector nor the public sector can be held completely responsible for this present situation. These shortcomings of the existing system have only come to light with awareness of the difficulty of opening new sites for putrescible solid wastes. The shortcomings are of as much concern to the private operators working today's sites as any of the public agencies involved. There is no need to assign blame.

A clear definition of roles is desirable but probably difficult. In the past, the MSD Board has indicated a preference for reliance on the private sector for providing solid waste service, for which MSD establishes or confirms the need. This reliance can be implemented through leases of property, contracting and/or franchising, in accordance with public bidding laws. If public sector ownership and/or operation is deemed appropriate, public bidding laws, labor laws, and other rules and regulations will determine how this can be accomplished.

Enforcement or Operation Role for MSD

Historically, DEQ has assumed primary responsibility for enforcement of solid waste disposal sites. Currently, this role is being transferred to MSD, although DEQ's authority in this area continues. Some solid waste disposal industry officials fear that as MSD becomes involved in contracting for or providing solid waste disposal services, that a conflict of interests will be created. For instance, a site operating under contract to MSD or directly by MSD would not be "enforced" as strictly as another site not under contract to MSD, but which MSD enforces.

This may be a legitimate concern, but one which seems controllable if contracting or operating arrangements which MSD assumes are considered in light of their system impact. Rate regulation or review will also help minimize this concern.

Control of Rates

This report indicates landfilling costs can fluctuate considerably with changes in volume. Assuring an efficient, low cost system depends on incoming solid waste volume controls. Volume controls necessitate rate regulation.

Some volume controls have already been imposed on the system in the form of determining acceptable wastes for various sites and through limiting the implementation of new sites until the filling of existing sites is near completion. Although current disposal rates are generally low, it is likely that increases will be protested, especially where such rates are not now under regulation.

Initiation of New Sites and Expansion of Existing Sites

Processes to expand two existing sites are currently under way. This report addresses both of these expansion proposals and, assuming the shortage of landfill space explained in Chapter 15, MSD needs to participate in implementing these sites. The details of this support extend beyond the scope of this report, but should rely on the background information developed.

It is not likely that new sites for putrescible wastes will be forthcoming without initiation by MSD. A logical method of proceeding includes proposal requests for new sites. The requests can be directed at the sites deemed most feasable, as shown in Chapter 15. Depending on the response, monitoring of existing ground water and surface water for the best sites should commence as early as possible.

The necessary impact statements and land use clearances should be initiated early to determine if problems exist and to allow for development of alternatives in the event of setbacks. It is likely that MSD will have to incur a large part of these pre-development costs if no other alternatives exist.

A long term site should be located as soon as short term needs can be assured. The report indicates that it is highly unlikely that there is a long term site within MSD. Searches outside of MSD should be coordinated with county planners and take advantage of real estate listings for large parcels of property. Searches should begin along main transportation corridors.

DISPOSAL SITING ALTERNATIVES

APPENDIX

METROPOLITAN SERVICE DISTRICT

SEPTEMBER 1978

APPENDIX A

GLOSSARY OF SOLID WASTE TERMS

GLOSSARY OF SOLID WASTE TERMS

Processible Wastes: Processible wastes include, but are not limited to, items such as food waste, vegetable trimmings, paper and paper products, cardboard and corrugated boxes, garden waste including grass clippings, shrubbery clippings, small tree limbs and lawn trimmings, textiles, canvas, plastics, rubber, styrofoam, leather, ferrous metal in nonstructural sizes and nonferrous metal in nonstructural sizes, bottles and other glass products, and, in general, materials that can be mechanically reduced prior to reclamation.

Nonprocessible Wastes: Include but are not limited to, structural timbers, structural steel and ferrous metal and structural non-ferrous metals, cables, engine blocks, cast parts of large size, asphalt, dirt, rock, bricks, concrete, ceramics, ashes, sand and, in general, materials that cannot be mechanically reduced in size or any dense item for which there is no advantage in size reduction.

Milled Refuse: Processible wastes which have been processed or mechanically reduced in size so that generally the material or shape from which they were reduced is no longer recognizable. During the processing, the smaller shredded particles are generally mixed further limiting their original identity.

Commercial Haulers and Contractors: Person or classes of persons who, as a result of their normal operations, haul solid waste or whose specific objective is the hauling of solid wastes.

<u>Leachate Generation</u>: Water-borne suspended and dissolved solid waste matter and microbial waste products resulting from chemical and biological reductions in solid waste and the movement of ground or surface waters.

<u>Gas Generation</u>: Relative to solid waste, gases are produced from decaying solid waste.

<u>Water Table</u>: The local elevation at which the pressure in the water is zero with respect to the atmospheric pressure. This generally represents the elevation at which standing water would be observed if a hole were dug. The water table fluctuates with the seasons, rainfall, other factors.

<u>Surface Waters</u>: Water generated from precipitation and snow melt which moves at or near the surface of the ground. Also called rain water or storm runoff.

<u>Compacted Refuse</u>: Refuse which may be reduced in size or volume to facilitate hauling.

<u>Demolition Waste</u>: Material resulting from tearing down buildings, much of which is unsatisfactory for processing.

<u>Gravel Pits</u>: Large holes of excavations from which gravels and sands have been excavated.

<u>Processing Station</u>: As used by MSD, this means a building or site at which solid waste is received, reduced in size by shredding, mechanically separated by electromagnets and directed air streams into burnables, ferrous metals, and a heavy residual suitable for landfilling.

Sanitary Landfill: An engineered solid waste disposal site where wastes are disposed of by spreading in thin layers on land, compacting to the smallest practical volume, and controlling the generation of gas and leachate to minimize the impact on the environment.

Cover Material: One of the primary methods of controlling leachate generation in a landfill is by preventing surface waters from coming in contact with the refuse. This is done by placing soil over the daily deposit of refuse. This also helps control litter and minimizes aesthetic impact on the environment. The soil so placed is referred to as cover material.

Lowland Areas: Areas which by natural geological evolution are lower in elevation than their surroundings. Usually such areas tend to be periodically flooded if no flood control measures have been imposed.

Ravines: Naturally occuring areas which have been created by geological evolution and characterized by sudden and irregular elevation differences from their surroundings.

Drop Centers: Facilities which accept source separated materials such as paper, cans and glass from the public and other contractors, or businesses.

Source Separation: As used by MSD this means the separating or keeping separate of discarded materials by the person who last used them in their original form and selling or donating these source separated materials to one who reuses, recycles, or brokers these materials.

Screening: Site obscuring fencing or other natural features which hide a particular site from view by neighbors or passers-by.

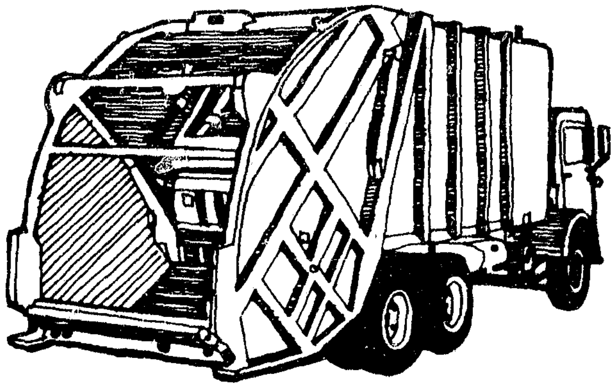
Shredded Residue: Material left over from a processing plant which has been reduced in size and not extracted from the waste stream for its value as a fuel fraction or ferrous metal.

Fuel Fraction (also refuse-derived fuel and light fuel fraction): Material separated by a processing plant consisting mainly of paper and plastics which has value as a fuel for producing energy.

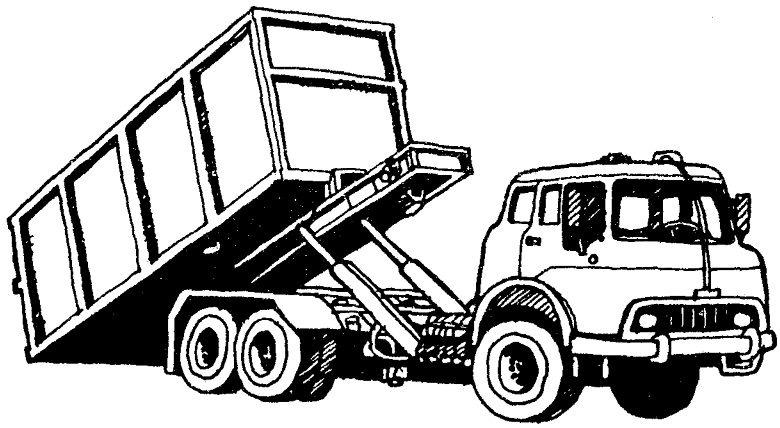
Solid Waste Related Equipment (see pictures on following pages):

Commercial haul vehicles:

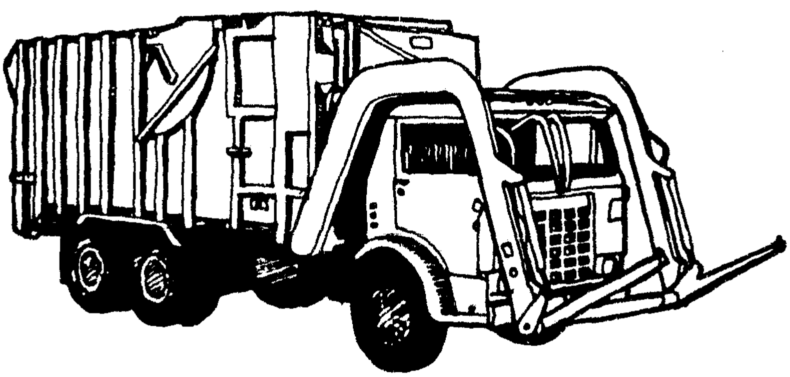
- Rear end loader truck
- Tilt-frame drop box truck
- Front end loader truck
- Semi trailer and tractor
- Commercial transfer station (sketches)
- Transfer station example



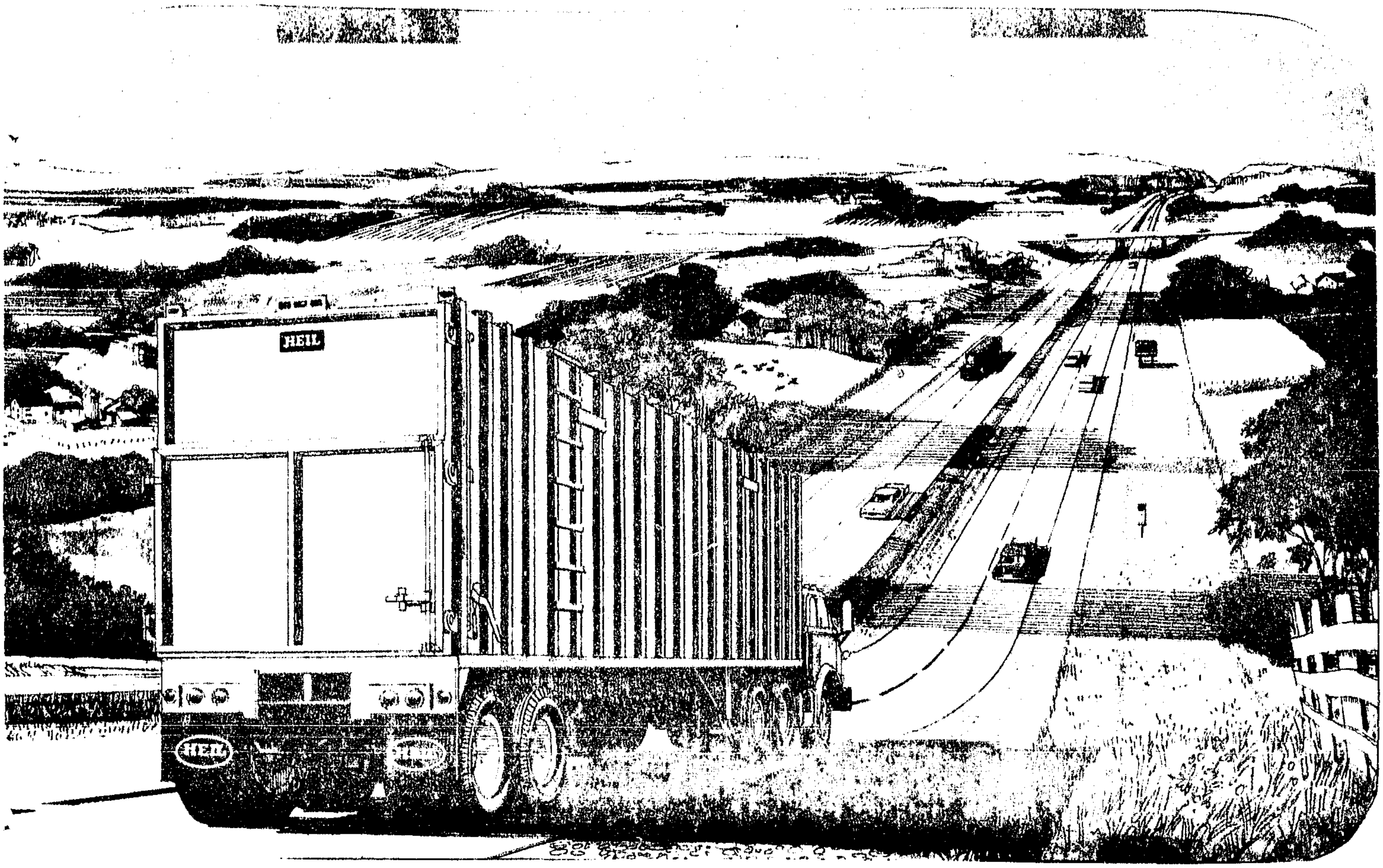
REAR END LOADER TRUCK



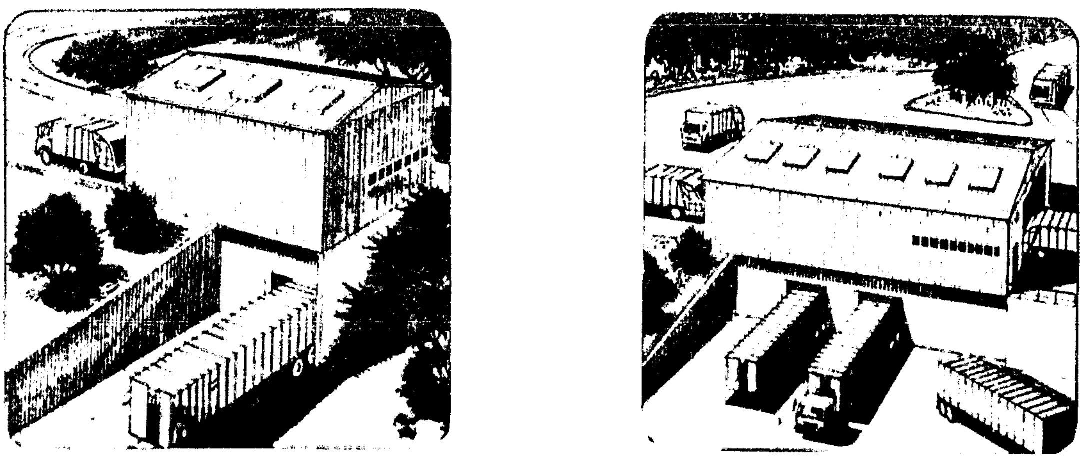
TILT FRAME DROP BOX TRUCK



FRONT END LOADER TRUCK

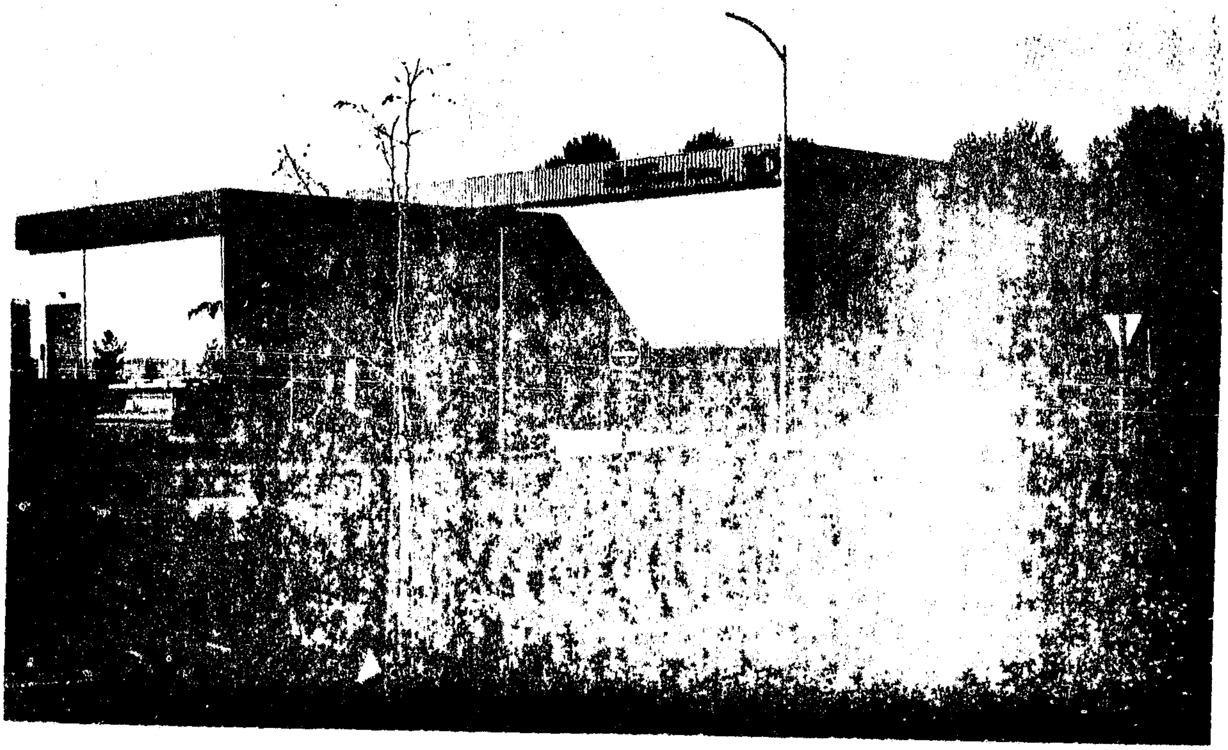


TRANSFER
SEMI TRAILER AND TRACTOR



COMMERCIAL TRANSFER STATION
(SKETCHES)

TRANSFER STATION EXAMPLE:



LANE COUNTY, OREGON, BEGAN operating its new Central Receiving Station on December 1, 1976. Commercial haulers and County residents deposit all solid wastes into a pit inside the building.

APPENDIX B

EARLIER REPORTS
DEALING WITH SANITARY LANDFILL SITES

EARLIER REPORTS DEALING WITH SANITARY LANDFILL SITES

A brief summary of early research and reports followed by generalized MSD staff findings:

Report on Refusal Disposal for Portland, Oregon, by Black and Veach Consulting Engineers, August, 1968.

The purpose of this report was to evaluate existing disposal facilities and disposal costs and determine alternate methods and sites for refuse disposal. The principal refuse disposal alternatives considered included filling surrounding gravel pits, developing disposal sites at Multnomah Channel, the Sandy River Delta, downstream lowlands, central incineration, and maintaining the present site (St. John's). The gravel pits have subsequently been developed into demolition sites. The downstream lowlands refered to areas downstream on the Columbia River as far as 70 miles from Portland.

The following recommendations from that report seem significant; the City should convert the existing dump to a sanitary landfill; the gravel pits should be used in conjunction with existing disposal methods, the "county, metropolitan, state, or other governmental agency acquire, as soon as possible, the excellent sanitary landfill sites in the Portland Metropolitan area and reserve them for future refuse disposal needs," and that scales be installed as soon as possible.

Study of Sanitary Landfill Sites for Washington County, Oregon, prepared by Clark and Groff Engineers, Inc., January, 1970.

The objective of this study was to develop a solution for the interim operation of a sanitary landfill or landfills until Portland Metropolitan waste disposal could be explored and implemented. Some 20 sites in Washington County were analyzed using available topographical, geological, and physical parameters. Each of the 20 sites were compared to a computer analysis optimizing collection haul costs. For the six sites considered most acceptable, development and operation costs were estimated. From a technical and economic point of view, a site adjacent to the north of the Tile Flat Road at the intersection of Clark Hill Road was recommended as the best location. Clark and Groff also suggested development of a subsidy to private collectors for unequal haul costs. Transfer stations were judged not feasible for distances less than 20 miles. Regional solutions had the disadvantage of transporting county wastes greater distances, although certain advantages were pointed out.

Report on Sanitary Landfill and Refuse Disposal Costs for Portland, Oregon, by Black and Veach, May, 1970.

This report is mentioned only because it provides reference to Portland's greater committment to the St. John's Landfill, and conversion of the open dump to an acceptable sanitary landfill.

The Final Report on the Portland Sanitary Landfill Hydrogeological Studies, by Stevens, Thompson and Runyan, Inc. October, 1972.

Addresses technical and environmental challenges imposed upon the City.

Metropolitan Service District Solid Waste Management Action Plan, by COR-MET, April, 1974.

Chapters 9 and 14 and appendices C, K, L, and P specifically deal with disposal sites in the MSD study area. In March, 1975, a summary report on potential landfill sites was prepared by COR-MET. The March analysis identifies six specific sites: Cipole, in Washington County; Alford, in Clackamas County; Santosh, in Columbia County; Sandy Delta, in Multnomah County; Hayden Island, in Multnomah County; and Burlington, in Multnomah County.

These specific sites are based on a composite of the site evaluations done by the COR-MET staff and the COR-MET Landfill Rating Group. These six sites represent the basis for this report.

Preliminary Engineering Design For Phased Expansion of the St. John's Sanitary Landfill, Volumes I and II, by Stevens, Thompson and Runyan, Inc., June, October, 1974.

Early in 1974, the City announced intentions of expanding the St. John's Landfill by distributing an Environmental Assessment for Blind Slough Filling and Drainage Improvements. The expansion plan calls for:

1) Phased expansion in 20-50 acre increments;
2) Construction of access roads to relieve traffic on Columbia Blvd;
3) Construction of dikes and other pollution control devices;
4) Protection of the environment including protection of tree stands and replanting certain areas;
5) Future development of park and recreational areas;
6) Development of a fixed shore line and general improvement to Smith Lake.

Report and Recommendation of the City Planning Commission Concerning St. John's Expansion, April, 1975.

The City of Portland Planning Commission recommends the following:

1) Granting a permit for continued operation of the St. John's Landfill for five years, based on a "Finger Bay Concept".
2) The landfill be permitted to reach a height of 80ft. MSL.
3) The landfill be turned over to recreational or open space uses at the completion of each phase.
4) That the existing landfill site and proposed expansion area be rezoned from M1 and F2 to a farm and forest zone.

Interoffice Memo to E.A. Schmidt, Department of Environmental Quality from H.R. Sweet, Hydrogeologist, August, 1973.

COR-MET proposed a number of sites to the State. A preliminary appraisal of these sites suggest certain reservations the Department of Environmental Quality maintains. Cipole, for instance, was given number one priority in the COR-MET analysis; however, DEQ feels that the potential for groundwater contamination at this site is reasonably high. A more acceptable site from a technical and environmental standpoint might be areas adjacent to Frank's in Washington County.

Durham Gravel Pit Study, by Washington County Department of Planning

This report recommends that the Durham Pit site be identified as Washington County's possible primary solid waste disposal site. The report further recommends that Washington County utilize solid waste to rehabilitate the site for an intensive urban use.

A Viewpoint of the Solid Waste Industry, sponsored by the Tri-County Solid Waste Management Council and prepared by Stevens, Thompson and Runyan, Inc., February, 1974.

This plan suggests various modifications to the alternative B concept of the MSD Action Plan. One of the stated primary concerns of the solid waste industry is the lack of a landfill site in Washington County. The Frank's site satisfies the short term needs of the Industry, and should be utilized as a processible site. In order to meet certain long term needs of the east Portland area, processed wastes could be used for land reclamation at one or more of the gravel pits in the general vicinity.

APPENDIX C

REQUEST FOR INFORMATION
MAILING LIST

City of Cornelius
PO Box 7
Cornelius, OR 97113

City of Beaverton
4950 S.W. Hall
Beaverton, OR 97005

City of Oregon City
PO Box 631
Oregon City, OR 97045

City of Milwaukie
926 Main Street
Milwaukie, OR 97222

City of West Linn
City Hall
West Linn, OR 97068

City of Lake Oswego
PO Box 369
Lake Oswego, OR 97034

City of Forest Grove
1924 Council Street
Forest Grove, OR 97116

City of Hillsboro
205 South 2nd Street
Hillsboro, OR 97123

City of Sherwood
PO Box 167
Sherwood, OR 97140

City of Tigard
PO Box 23557
Tigard, OR 97223

City of Troutdale
104 Kibling Street
Troutdale, OR 97060
ATTN: BOB JEAN

City of Tualatin
PO Box 426
Tualatin, OR 97062

City of Gladstone
City Hall
Gladstone, OR 97027

City of Wood Village
2055 N.E. 238 Drive
Troutdale, OR 97060

Mr. Cowles Mallory
City of Portland
400 S.W. 6th Avenue #313
Portland, OR 97204

City of Gresham
150 W. Powell Blvd.
Gresham, OR 97030

City of Fairview
City Hall
Fairview, OR 97024

City of Happy Valley
12900 S.E. King Road
Portland, OR 97236

Richard Howard *
Dept. of Public Works
2115 S.E. Morrison
Portland, OR 97214

Mike Sandberg *
Dept. of Public Health
150 N. First Street
Hillsboro, OR 97123

Jeanne McCormick *
City of Portland
400 S.W. 6th Avenue
Portland, OR 97204

David Phillips *
Dept. of Public Works
902 Abernethy Road
Oregon City, OR 97045

Bell Sand & Gravel Co.
9239 S.E. Bell
Portland, OR 97006

L.H. Cobb Crushed Rock
8275 S.W. Murray
Beaverton, OR 97005

Columbia Sand & Gravel Co.
12401 N.E. San Rafael
Portland, OR 97030

Gresham Sand & Gravel Co.
2039 S.E. 195th Avenue
Gresham, OR 907033

Hayden Island, Inc.
I-5 at Jantzen Beach
Portland, OR 97217

Northwest Sand & Gravel
7295 S.E. King Road
Milwaukie, OR 97222

Oregon Excavating, Inc.
6101 S.E. Johnson Creek Bd.
Portland, OR 97006

Portland Road & Driveway
7295 S.E. King Road
Milwaukie, OR 97222

Portland Sand & Gravel
10717 S.E. Division
Portland, OR 97066

Progress Quarries, Inc.
14515 S.W. Scholls Ferry Rd.
Beaverton, OR 97005

Wayne Easly
Waybo, Incorporated
7580 N. Killingsworth
Portland, OR 97018

Rossman's Landfill
1101 - 17th Street
Oregon City, OR 97045
ATTN: Jack Parker

St. Johns Landfill
9363 N. Columbia Blvd.
Portland, OR 97203
ATTN: GENE PLEW

Newberg Landfill
104 S. River Road
Newberg, OR 97132
ATTN: ANGUS McPHEE

Obrist Landfill
Route 2, Box 1156
Troutdale, OR 97060
ATTN: DON OBRIST

Hillsboro Landfill
Route 4, Box 143
Hillsboro, OR 97123
ATTN: DON LaVELLE

Lakeside Reclamation
Route 1, Box 849
Beaverton, OR 97005
ATTN: HOWARD GRABHORN

Land Reclamation, Inc.
10345 N.E. 13th Avenue
Portland, OR 97211
ATTN: WM. PLEW

LaVelle Landfill
7425 S.E. King Road
Milwaukie, OR 97222
ATTN: GLENN LaVELLE

H.G. LaVelle Landfill
3000 N.E. 82nd Avenue
Portland, OR 97220
ATTN: HAROLD LaVELLE

Assoc. Gen'l. Contractors
1008 N.E. Multnomah
Portland, OR 97232
ATTN: NORMANDY DENNEY

Assoc. Builders & Contr.
7525 S.E. Lake Road
Milwaukie, OR 97222

Metropolitan Disposal Corp.
P. O. Box 11457
Portland, OR 97211
ATTN: RICHARD KUHNAU

Wash. Co. Haulers Assn.
139 N.E. Lincoln
Hillsboro, OR 97123
ATTN: DEMAR BATCHELOR

Portland Dropbox Assn.
1508 Standard Plaza
Portland, OR 97204
ATTN: C. W. LEICHNER

Clackamas Co. Haulers Assn.
1108 Main Street
Milwaukie, OR 97222
ATTN: DALE WARLAN

O.S.S.I.
4645 18th Place South
Salem, OR 97302
ATTN: ROGER EMMONS

San Jose Steel Co.
PO Box 20025
Portland, OR 97220
ATTN: A.P. MESSINA

Environ. Protection Agcy.
Region X
1200 Sixth Avenue
Seattle, WA 98101
ATTN: DOUGLAS C. HANSEN

Oregon Concrete & Aggr.
1221 S.W. Main Street
Portland, OR 97205
ATTN: ART HEIZENRADER

Washington County
150 North Main Street
Hillsboro, OR 97123
ATTN: ART SCHLACK

Willard Deardort
12801 S. Liberal Way
Canby, OR 97013

Mr. William Right
4530 S.W. Kelley
Portland, OR 97201

SCA Services of Oregon
232 N.E. Middlefield Rd.
Portland, OR 97222

Irv Cooper
214 Willamette Bldg.
534 S.W. 3rd Avenue
Portland, OR 97204

APPENDIX D

LANDFILL SUMMARY
(COST ESTIMATE PARAMETERS)

METROPOLITAN SERVICE DISTRICT

LANDFILL SUMMARY

NAME OF SITE ALFORD

(1)	Perimeter	10.000 FT
(2)	Area Bottom	2.150.000 FT²
(3)	Area Top	3.870.000 FT²
(4)	Depth	140 FT
(5)	Percentage of Fence	100%
(6)	Percentage of Berming	0
(7)	Percentage of Diking	0
(8)	Percentage of Gas Venting	5%
(9)	Road Length	4.000 FT
(10)	Road Cost	$15/FT
(11)	Ground Water Seal:	[ ] Yes [X] No
(12)	Leachate Collection and Treatment:	[X] Yes [ ] No
(13)	Other Costs	0
(14)	Number of Monitoring Wells	10 EACH
(15)	Percentage of Contingency	50%*
(16)	On-site Cover:	[X] Yes [ ] No

* RISK RELATED TO ROADWORK ON COUNTY ROAD AND NO GROUND WATER SEAL.

DEVELOPMENT COSTS:

(1)	Site Building Improvements	$300.000
(2)	Fence Costs	$100.000
(3)	Berming Costs	0
(4)	Monitoring Well Costs	$23.000
(5)	Gas Venting Costs	$208.000
(6)	Road Costs	$60.000
(7)	Ground Water Seal	0
(8)	Leachate Collection and Treatment	$450.000
(9)	Diking Costs	0
(10)	Cover Costs	$7.032.000
(11)	Final Cover Costs	$1.935.000

METROPOLITAN SERVICE DISTRICT

LANDFILL SUMMARY

NAME OF SITE TR SAND PIT (CIPOLE)

(1) Perimeter 6000 FT
(2) Area Bottom 800,000 FT^2
(3) Area Top 860,000 FT^2
(4) Depth 50 FT
(5) Percentage of Fence 100 FT
(6) Percentage of Berming 0
(7) Percentage of Diking 0
(8) Percentage of Gas Venting 50%
(9) Road Length 500 FT
(10) Road Cost $15/FT
(11) Ground Water Seal: [X] Yes [ ] No
(12) Leachate Collection and Treatment: [X] Yes [ ] No
(13) Other Costs $200,000 *
(14) Number of Monitoring Wells 10 EACH
(15) Percentage of Contingency 30%
(16) On-site Cover: [ ] Yes [X] No

* COST FOR INTERSECTION IMPROVEMENT

DEVELOPMENT COSTS:

(1) Site Building Improvements $300,000
(2) Fence Costs $60,000
(3) Berming Costs 0
(4) Monitoring Well Costs $8000
(5) Gas Venting Costs $445,000
(6) Road Costs $8000
(7) Ground Water Seal $680,000
(8) Leachate Collection and Treatment $450,000
(9) Diking Costs 0
(10) Cover Costs $2080,000
(11) Final Cover Costs $430,000

METROPOLITAN SERVICE DISTRICT

LANDFILL SUMMARY

NAME OF SITE Columbia Sand & Gravel

(1) Perimeter 1.100 FT
(2) Area Bottom 300.000 FT^2
(3) Area Top 430.000 FT^2
(4) Depth 90 FT
(5) Percentage of Fence 20%
(6) Percentage of Berming 10%
(7) Percentage of Diking 0
(8) Percentage of Gas Venting 100%
(9) Road Length 900 FT
(10) Road Cost $15/FT
(11) Ground Water Seal: [X] Yes [ ] No
(12) Leachate Collection and Treatment: [X] Yes [ ] No
(13) Other Costs 0
(14) Number of Monitoring Wells 10 EACH
(15) Percentage of Contingency 30%
(16) On-site Cover: [ ] Yes [X] No

DEVELOPMENT COSTS:

(1) Site Building Improvements $300.000
(2) Fence Costs $2000 —
(3) Berming Costs $9000 —
(4) Monitoring Well Costs ~~$12000~~ $15.000
(5) Gas Venting Costs $294.000
(6) Road Costs $14.000
(7) Ground Water Seal $255.000
(8) Leachate Collection and Treatment $450.000
(9) Diking Costs 0
(10) Cover Costs $1.567.000
(11) Final Cover Costs $215.000

METROPOLITAN SERVICE DISTRICT

LANDFILL SUMMARY

NAME OF SITE: Cooper Mtn.

(1) Perimeter: 5000 FT
(2) Area Bottom: 1,500,000 FT^2
(3) Area Top: 1,500,000 FT^2
(4) Depth: 30 FT
(5) Percentage of Fence: 100%
(6) Percentage of Berming: 0
(7) Percentage of Diking: 0
(8) Percentage of Gas Venting: 20%
(9) Road Length: 6200 FT
(10) Road Cost: 1.0/FT
(11) Ground Water Seal: [X] Yes [ ] No
(12) Leachate Collection and Treatment: [X] Yes [ ] No
(13) Other Costs: 0
(14) Number of Monitoring Wells: 10 EACH
(15) Percentage of Contingency: 30%
(16) On-site Cover: [ ] Yes [X] No

DEVELOPMENT COSTS:

(1) Site Building Improvements: $300,000
(2) Fence Costs: $50,000
(3) Berming Costs: 0
(4) Monitoring Well Costs: $5,000
(5) Gas Venting Costs: $89,000
(6) Road Costs: $6,000
(7) Ground Water Seal: $1,275,000
(8) Leachate Collection and Treatment: $450,000
(9) Diking Costs: -0-
(10) Cover Costs: $2,282,000
(11) Final Cover Costs: $750,000

METROPOLITAN SERVICE DISTRICT

LANDFILL SUMMARY

NAME OF SITE Durham Pits

(1) Perimeter 4700 FT
(2) Area Bottom 500,000 FT^2
(3) Area Top 900,000 FT^2
(4) Depth 50 FT
(5) Percentage of Fence 50%
(6) Percentage of Berming 10%
(7) Percentage of Diking 0
(8) Percentage of Gas Venting 60%
(9) Road Length 800 FT
(10) Road Cost $15/FT
(11) Ground Water Seal: [X] Yes [ ] No
(12) Leachate Collection and Treatment: [X] Yes [ ] No
(13) Other Costs 0
(14) Number of Monitoring Wells 10 EACH
(15) Percentage of Contingency 30%
(16) On-site Cover: [X] Yes [ ] No

DEVELOPMENT COSTS:

(1) Site Building Improvements $300,000
(2) Fence Costs $24,000
(3) Berming Costs $40,000
(4) Monitoring Well Costs $68,000
(5) Gas Venting Costs $418,000
(6) Road Costs $12,000
(7) Ground Water Seal $425,000
(8) Leachate Collection and Treatment $450,000
(9) Diking Costs 0
(10) Cover Costs $584,000
(11) Final Cover Costs $450,000

METROPOLITAN SERVICE DISTRICT

LANDFILL SUMMARY

NAME OF SITE Grant Butte Pits

(1) Perimeter 3800 FT
(2) Area Bottom 840,000 FT^2
(3) Area Top 800,000 FT^2
(4) Depth 50 FT
(5) Percentage of Fence 50%
(6) Percentage of Berming 0
(7) Percentage of Diking 0
(8) Percentage of Gas Venting 20%
(9) Road Length 100 FT
(10) Road Cost $15/FT
(11) Ground Water Seal: [X] Yes [ ] No
(12) Leachate Collection and Treatment: [X] Yes [ ] No
(13) Other Costs 0
(14) Number of Monitoring Wells 10 EACH
(15) Percentage of Contingency 40*
(16) On-site Cover: [X] Yes [ ] No

*Risk of high water table

DEVELOPMENT COSTS:

(1) Site Building Improvements $300,000
(2) Fence Costs $19,000
(3) Berming Costs 0
(4) Monitoring Well Costs $8,000
(5) Gas Venting Costs $113,000
(6) Road Costs $2,000
(7) Ground Water Seal $714,000
(8) Leachate Collection and Treatment $450,000
(9) Diking Costs 0
(10) Cover Costs $763,000
(11) Final Cover Costs $400,000

METROPOLITAN SERVICE DISTRICT

LANDFILL SUMMARY

NAME OF SITE HAYDEN ISLAND

(1) Perimeter 24,000 FT
(2) Area Bottom 21,000,000 FT^2
(3) Area Top 31,000,000 FT^2
(4) Depth 15 FT
(5) Percentage of Fence 0
(6) Percentage of Berming 0
(7) Percentage of Diking 100% *
(8) Percentage of Gas Venting 5%
(9) Road Length 5,000 FT
(10) Road Cost $30/FT
(11) Ground Water Seal: [ ] Yes [X] No
(12) Leachate Collection and Treatment: [X] Yes [ ] No
(13) Other Costs $500,000
(14) Number of Monitoring Wells 10 EACH
(15) Percentage of Contingency 30%
(16) On-site Cover: [ ] Yes [X] No

*HIGHER THEN 10FT DIKE; ** ROAD WORK ON I-5

DEVELOPMENT COSTS:

(1) Site Building Improvements $300,000
(2) Fence Costs 0
(3) Berming Costs 0
(4) Monitoring Well Costs $2000
(5) Gas Venting Costs $53,000
(6) Road Costs $150,000
(7) Ground Water Seal 0
(8) Leachate Collection and Treatment $450,000
(9) Diking Costs $4,080,000
(10) Cover Costs $23,586,000
(11) Final Cover Costs $15,500,000

METROPOLITAN SERVICE DISTRICT

LANDFILL SUMMARY

NAME OF SITE King Rd EXTENSION

(1) Perimeter 7,500 FT
(2) Area Bottom 1,400,000 FT²
(3) Area Top 2,264,000 FT²
(4) Depth 50 FT
(5) Percentage of Fence 20%
(6) Percentage of Berming 0
(7) Percentage of Diking 0
(8) Percentage of Gas Venting 75%
(9) Road Length 500 FT
(10) Road Cost $15/FT
(11) Ground Water Seal: [X] Yes [ ] No
(12) Leachate Collection and Treatment: [X] Yes [ ] No
(13) Other Costs $50,000 *
(14) Number of Monitoring Wells 10 EACH
(15) Percentage of Contingency 30%
(16) On-site Cover: [ ] Yes [X] No

*MATERIAL TO FILL IN EXISTING PONDS

DEVELOPMENT COSTS:

(1) Site Building Improvements $300,000
(2) Fence Costs $15,000
(3) Berming Costs 0
(4) Monitoring Well Costs $8,000
(5) Gas Venting Costs $834,000
(6) Road Costs $8000.
(7) Ground Water Seal $1,190,000
(8) Leachate Collection and Treatment $450,000
(9) Diking Costs 0
(10) Cover Costs $4,281,000
(11) Final Cover Costs $1,132,000

METROPOLITAN SERVICE DISTRICT

LANDFILL SUMMARY

NAME OF SITE PORTLAND SAND & GRAVEL

(1) Perimeter 5300 FT
(2) Area Bottom 740,000 FT^2
(3) Area Top 1,078,000 FT^2
(4) Depth 140 FT
(5) Percentage of Fence 50%
(6) Percentage of Berming 15%
(7) Percentage of Diking 0
(8) Percentage of Gas Venting 100%
(9) Road Length 3000 FT
(10) Road Cost $15/FT
(11) Ground Water Seal: [X] Yes [ ] No
(12) Leachate Collection and Treatment: [X] Yes [ ] No
(13) Other Costs 0
(14) Number of Monitoring Wells 10 EACH
(15) Percentage of Contingency 30%
(16) On-site Cover: [ ] Yes [X] No

DEVELOPMENT COSTS:

(1) Site Building Improvements $300,000
(2) Fence Costs $27,000
(3) Berming Costs $68,000
(4) Monitoring Well Costs $23,000
(5) Gas Venting Costs $2,200,000
(6) Road Costs $45,000.00
(7) Ground Water Seal $629,000
(8) Leachate Collection and Treatment $450,000
(9) Diking Costs 0
(10) Cover Costs $6,055,000
(11) Final Cover Costs $539,000.

METROPOLITAN SERVICE DISTRICT

LANDFILL SUMMARY

NAME OF SITE OBRIST

(1) Perimeter 2800 FT
(2) Area Bottom 400.000 FT²
(3) Area Top 600.000 FT²
(4) Depth 70 FT
(5) Percentage of Fence 100%
(6) Percentage of Berming 0
(7) Percentage of Diking 0
(8) Percentage of Gas Venting 50%
(9) Road Length 1200 FT
(10) Road Cost $15/FT
(11) Ground Water Seal: [X] Yes [ ] No
(12) Leachate Collection and Treatment: [X] Yes [ ] No
(13) Other Costs 0
(14) Number of Monitoring Wells 10 EACH
(15) Percentage of Contingency 20%
(16) On-site Cover: [ ] Yes [X] No

DEVELOPMENT COSTS:

(1) Site Building Improvements $300.000
(2) Fence Costs $28.000
(3) Berming Costs 0
(4) Monitoring Well Costs $11.000
(5) Gas Venting Costs $290.000
(6) Road Costs $18.000
(7) Ground Water Seal $340.000
(8) Leachate Collection and Treatment $450.000
(9) Diking Costs 0
(10) Cover Costs $1,657.000
(11) Final Cover Costs $300.000

METROPOLITAN SERVICE DISTRICT

LANDFILL SUMMARY

NAME OF SITE OLD PUMPKIN

(1) Perimeter 6200 FT
(2) Area Bottom 3,800,000 FT^2
(3) Area Top 3,840,000 FT^2
(4) Depth 40 FT
(5) Percentage of Fence 100%
(6) Percentage of Berming 0
(7) Percentage of Diking 0
(8) Percentage of Gas Venting 10%
(9) Road Length 1500 FT
(10) Road Cost $30/FT
(11) Ground Water Seal: [ ] Yes [X] No
(12) Leachate Collection and Treatment: [X] Yes [ ] No
(13) Other Costs 0
(14) Number of Monitoring Wells 10 EACH
(15) Percentage of Contingency 36%
(16) On-site Cover: [X] Yes [ ] No

DEVELOPMENT COSTS:

(1) Site Building Improvements $300,000
(2) Fence Costs $62,000
(3) Berming Costs 0
(4) Monitoring Well Costs $7000
(5) Gas Venting Costs $74,000
(6) Road Costs $45,000
(7) Ground Water Seal 0
(8) Leachate Collection and Treatment $450,000
(9) Diking Costs 0
(10) Cover Costs $2,833,000
(11) Final Cover Costs $1,920,000

METROPOLITAN SERVICE DISTRICT

LANDFILL SUMMARY

NAME OF SITE OREGON ASPHALTIC

(1) Perimeter 3800 FT
(2) Area Bottom 550,000 FT^2
(3) Area Top 750,000 FT^2
(4) Depth 100 FT
(5) Percentage of Fence 20%
(6) Percentage of Berming 10%
(7) Percentage of Diking 0
(8) Percentage of Gas Venting 100%
(9) Road Length 1500 FT
(10) Road Cost $5/FT
(11) Ground Water Seal: [X] Yes [ ] No
(12) Leachate Collection and Treatment: [X] Yes [ ] No
(13) Other Costs 0
(14) Number of Monitoring Wells 10 EACH
(15) Percentage of Contingency 30%
(16) On-site Cover: [ ] Yes [X] No

DEVELOPMENT COSTS:

(1) Site Building Improvements $3800
(2) Fence Costs $8000
(3) Berming Costs $32,000
(4) Monitoring Well Costs $16,000
(5) Gas Venting Costs $1,128,000
(6) Road Costs $8,000
(7) Ground Water Seal $468,000
(8) Leachate Collection and Treatment $450,000
(9) Diking Costs 0
(10) Cover Costs $3,128,000
(11) Final Cover Costs $375,000

METROPOLITAN SERVICE DISTRICT

LANDFILL SUMMARY

NAME OF SITE ST. John LATERAL EXPANSION

(1) Perimeter 10,000 FT
(2) Area Bottom 1,700,000 FT^2
(3) Area Top 2,200,000 FT^2
(4) Depth 40 FT
(5) Percentage of Fence 0
(6) Percentage of Berming 0
(7) Percentage of Diking 60%
(8) Percentage of Gas Venting 10%
(9) Road Length 2000 FT
(10) Road Cost $30/FT
(11) Ground Water Seal: [ ] Yes [X] No
(12) Leachate Collection and Treatment: [X] Yes [ ] No
(13) Other Costs 0
(14) Number of Monitoring Wells 10 EACH
(15) Percentage of Contingency 30%
(16) On-site Cover: [ ] Yes [X] No

DEVELOPMENT COSTS:

(1) Site Building Improvements $300,000
(2) Fence Costs 0
(3) Berming Costs 0
(4) Monitoring Well Costs $6000
(5) Gas Venting Costs $119,000
(6) Road Costs $60,000
(7) Ground Water Seal 0
(8) Leachate Collection and Treatment $450,000
(9) Diking Costs $510,000
(10) Cover Costs $3,787,000
(11) Final Cover Costs $1,100,000

METROPOLITAN SERVICE DISTRICT

LANDFILL SUMMARY

NAME OF SITE ST. John's UPWARD EXTENSIUSION

(1) Perimeter 10,200 FT
(2) Area Bottom 3,400,000 FT^2
(3) Area Top 3,160,000 FT^2
(4) Depth 10 FT*
(5) Percentage of Fence 0
(6) Percentage of Berming 0
(7) Percentage of Diking 0
(8) Percentage of Gas Venting 10%
(9) Road Length 0
(10) Road Cost 0
(11) Ground Water Seal: [ ] Yes [X] No
(12) Leachate Collection and Treatment: [X] Yes [ ] No
(13) Other Costs 0
(14) Number of Monitoring Wells 10 EACH
(15) Percentage of Contingency 10%
(16) On-site Cover: [ ] Yes [X] No

DEVELOPMENT COSTS:

(1) Site Building Improvements $300,000
(2) Fence Costs 0
(3) Berming Costs 0
(4) Monitoring Well Costs $2,000
(5) Gas Venting Costs $30,000
(6) Road Costs 0
(7) Ground Water Seal 0
(8) Leachate Collection and Treatment $450,000
(9) Diking Costs 0
(10) Cover Costs $1,684,000
(11) Final Cover Costs $1,580,000

METROPOLITAN SERVICE DISTRICT

LANDFILL SUMMARY

NAME OF SITE WAYBO-ROSE LAWN

(1) Perimeter 5200 FT
(2) Area Bottom 900.000 FT²
(3) Area Top 1.400.000 FT²
(4) Depth 80 FT
(5) Percentage of Fence 20%
(6) Percentage of Berming 10%
(7) Percentage of Diking 0
(8) Percentage of Gas Venting 100%
(9) Road Length 1000 FT
(10) Road Cost $15/FT
(11) Ground Water Seal: [X] Yes [ ] No
(12) Leachate Collection and Treatment: [X] Yes [ ] No
(13) Other Costs 0
(14) Number of Monitoring Wells 10 EACH
(15) Percentage of Contingency 30%
(16) On-site Cover: [X] Yes [ ] No

DEVELOPMENT COSTS:

(1) Site Building Improvements $300.000
(2) Fence Costs $10.400
(3) Berming Costs $44.000
(4) Monitoring Well Costs $13.000
(5) Gas Venting Costs $1.234.000
(6) Road Costs $15.000
(7) Ground Water Seal $765.000
(8) Leachate Collection and Treatment $450.000
(9) Diking Costs 0
(10) Cover Costs $1.574.000
(11) Final Cover Costs $700.000

APPENDIX E

WASTE GENERATION DATA

INDUSTRIAL&COMMERCIAL WASTE GENERATION SUMMARY

SIC CODES	TONS OF WASTE/EMP
CONSTRUCTION	0.117
FOOD AND KINRED	0.800
TEXTILE PRODUCTS	0.560
APPAREL	0.480
LUMBER,WOOD	1.600
FURNITURE	1.570
PAPER,ALLIED PROD.	2.260
PRINTING,PUBLISHING	0.319
CHEMICALS,ALLIED PROD	2.170
PETROLEUM AND RELATED PROD.	2.640
RUBBER,MISC.PLASTICS	2.200
INSTRUMENTS	7.300
STONE,CLAY,GLASS,CONCRETE	1.600
PRIMARY METALS	3.000
FABRICATED MAETALS	0.812
MACHINERY	0.239
ELECTRICAL EQUIP.	0.400
TRANSPORTATION EQUIP.	1.160
INSTRUMENTS	0.318
OTHER MFG. INDUSTRIES	0.106
TRANS.-COMM.-UTIL.	0.250
WHOLESALE TRADES	0.250
RETAIL TRADES	0.250
FOOD STORES	1.460
EATING,DRINKING	1.460
OTHER RETAIL	0.250
FINANCE-INSURANCE-REALTY	0.260
SERVICES(HOTELS,BUSINEES,ECT.	0.350
GOVERNMENT	0.260

INDUSTRIAL&COMMERCIAL WASTE GENERATION SUMMARY

SIC CODES	TONS OF WASTE
CONSTRUCTION	1924.412
FOOD AND KINRED	6291.160
TEXTILE PRODUCTS	1271.199
APPAREL	1750.558
LUMBER,WOOD	9974.344
FURNITURE	3113.306
PAPER,ALLIED PROD.	9284.063
PRINTING,PUBLISHING	311.024
CHEMICALS,ALLIED PROD	3348.307
PETROLEUM AND RELATED PROD.	1320.000
RUBBER,MISC.PLASTICS	1806.198
INSTRUMENTS	1934.499
STONE,CLAY,GLASS,CONCRETE	2972.798
PRIMARY METALS	17937.000
FABRICATED MAETALS	5984.398
MACHINERY	1812.333
ELECTRICAL EQUIP.	856.397
TRANSPORTATION EQUIP.	9044.457
INSTRUMENTS	3768.297
OTHER MFG. INDUSTRIES	143.312
TRANS.-COMM.-UTIL.	7211.000
WHOLESALE TRADES	9285.750
RETAIL TRADES	16898.000
FOOD STORES	11071.121
EATING,DRINKING	24428.656
OTHER RETAIL	10637.500
FINANCE-INSURANCE-REALTY	5607.891
SERVICES(HOTELS,BUSINEES,ECT.	26958.348
GOVERNMENT	15853.164
TOTAL	212799.06

RESIDENTIAL WASTE IN MSD AREA TONS/YEAR

ZONE	1975	1980	1985	1990	1995	2000
1	13389.25	15581.26	16135.09	16539.96	17082.14	17568.14
2	2019.33	2319.76	2365.94	2397.57	2460.40	2518.24
3	12876.61	15450.61	17935.56	20552.41	22137.76	23770.95
4	429.00	580.46	645.79	711.53	743.15	770.62
5	30.38	25.80	22.05	21.64	17.89	17.06
6	21494.88	21625.12	21686.29	21561.45	21759.10	21788.24
7	42235.80	44275.93	43817.81	42867.44	42885.75	42750.52
8	30291.23	36355.05	37908.78	39126.70	40424.09	41761.86
9	10098.74	7716.57	6313.90	5183.36	4963.65	5014.42
10	5599.45	5621.93	5009.43	4455.59	4361.14	4386.52
11	5352.71	7640.01	8381.08	9132.97	9486.65	9856.98
12	4088.18	4985.29	5053.12	5036.05	5084.74	5140.91
13	1083.52	1124.30	1094.34	1048.99	1046.07	1052.32
14	9747.13	10045.48	10178.21	10219.82	10276.00	10309.70
15	17381.73	18674.13	18853.48	18776.49	18937.12	19015.75
16	21782.81	24903.99	26673.25	28174.95	29395.78	30434.79
17	11757.32	11743.17	13970.13	16342.73	17975.50	19720.62
18	735.25	1088.93	1250.38	1412.66	1500.46	1579.51
19	7021.27	7869.28	9010.64	10158.24	10928.86	11697.40
20	14102.03	15986.13	18523.93	21158.67	23359.42	25699.15
21	2806.59	3464.45	3760.29	4031.18	4322.03	4632.02
22	7934.61	8267.49	9483.74	10747.02	11756.48	12862.89
23	5097.22	6050.51	7516.43	9178.74	10725.80	12510.04
24	5212.90	6283.11	7245.96	8222.13	8891.21	9559.89
25	2308.94	2609.36	3280.11	4041.99	4590.83	5170.87
26	4328.69	4488.47	5045.63	5586.55	5888.64	6169.93
27	2186.60	1751.36	2041.39	2340.14	2642.65	2969.29
28	6385.88	7267.60	8249.18	9246.57	10360.05	11608.35
29	1945.68	2171.21	2453.74	2734.19	2903.54	3053.34
30	6642.62	8563.75	10162.41	11862.59	12946.11	14049.19
31	931.23	1180.89	1460.93	1782.99	2022.66	2280.23
32	11448.15	13232.80	16162.56	19385.26	21586.84	23899.11
33	5235.78	6310.15	7466.91	8682.75	9598.59	10566.44
34	15742.72	16896.14	25732.03	31104.71	35545.32	41117.73
35	10310.95	12926.97	15198.04	17655.94	19069.02	20117.58
36	2271.07	3114.51	4142.27	5424.28	6728.75	8355.29
37	8961.54	10369.62	11285.45	12096.02	12619.05	13081.34
38	3990.81	5016.50	5614.02	6199.47	6600.59	7032.92
39	5701.40	6594.35	7404.50	8226.29	8745.17	9329.38
40	4327.85	5946.07	7309.21	8809.66	10754.09	13058.87
TOTAL	345286.88	386117.44	425842.81	462236.63	493122.13	526277.31

WASTE PER CAPITA 2.28 LB./DAY

CONSTRUCTION AND DEMOLITION WASTE IN MSD TONS/YR

ZONE	CONSTRUCTION	DEMOLITION	TOTAL
1	398.94	3373.95	3772.90
2	103.19	411.11	514.30
3	625.19	2319.16	2944.35
4	79.87	1460.45	1540.32
5	137.34	0.00	137.34
6	324.35	5154.31	5478.66
7	636.59	4144.91	4781.50
8	998.97	4966.46	5965.43
9	817.94	7836.92	8654.86
10	510.04	1958.73	2468.77
11	379.42	146.82	526.24
12	136.19	471.77	607.96
13	142.01	4624.56	4766.57
14	197.05	1505.67	1702.72
15	282.07	1067.46	1349.52
16	622.65	2476.64	3099.30
17	1664.23	58.73	1722.96
18	374.42	0.00	374.42
19	422.97	530.50	953.47
20	1041.56	117.46	1159.02
21	621.33	0.00	621.33
22	856.33	264.28	1120.61
23	683.82	88.09	771.91
24	696.79	0.00	696.79
25	168.69	0.00	168.69
26	163.45	58.73	222.18
27	994.01	88.09	1082.10
28	625.00	0.00	625.00
29	80.23	58.73	138.96
30	445.36	474.03	919.40
31	176.67	29.36	206.03
32	1788.70	264.28	2052.98
33	1140.68	88.09	1228.77
34	1639.00	234.92	1873.92
35	470.62	0.00	470.62
36	389.09	29.36	418.45
37	467.43	530.50	997.93
38	427.47	0.00	427.47
39	78.21	0.00	78.21
40	600.85	0.00	600.85
41	213.08	234.92	448.00
TOTAL	22621.73	45068.98	67690.56

INDUSTRIAL & COMMERCIAL WASTE GENERATION

ZONE	1975	1980	1985	1990	1995	2000
1	15827.63	17830.93	19472.56	20962.51	22265.66	23643.29
2	4452.71	5011.97	5440.50	5829.61	6176.69	6544.04
3	7351.06	8387.38	9389.43	10361.58	11090.02	11860.28
4	9083.85	10229.81	11289.70	12267.89	13084.09	13954.29
5	6335.09	6910.98	7483.46	8076.73	8505.85	9035.51
6	4989.51	5417.93	5828.11	6192.88	6523.61	6865.23
7	11918.83	13039.67	13879.12	14597.80	15291.49	16018.76
8	8183.58	9537.33	10183.86	10745.99	11263.91	11810.61
9	38622.98	39796.95	41798.73	43792.57	46196.12	49044.38
10	17653.37	19101.48	19854.55	20556.80	21537.68	22717.51
11	972.87	1229.34	1352.23	1471.23	1548.06	1629.62
12	2506.00	2839.49	3095.49	3324.29	3523.91	3738.02
13	2636.36	2888.81	3084.18	3251.30	3418.37	3603.88
14	11691.96	12865.46	13960.98	14947.76	15791.29	16687.82
15	4906.10	5411.21	5789.34	6112.09	6409.59	6718.54
16	4053.02	4586.52	4983.98	5337.61	5632.77	5923.38
17	2980.73	3192.45	3625.40	4056.59	4383.92	4734.11
18	90.69	110.04	122.98	135.32	144.19	153.22
19	2109.42	2362.87	2658.20	2945.09	3156.91	3374.91
20	3085.53	3478.85	3947.99	4416.71	4810.23	5229.54
21	5670.16	6546.33	7184.30	7770.29	8305.46	8877.68
22	3766.44	4145.29	4615.36	5064.41	5438.47	5842.00
23	3609.61	4085.66	4617.10	5146.72	5614.16	6131.34
24	2274.44	2567.41	2847.49	3109.38	3324.23	3552.04
25	431.39	484.35	557.55	633.24	691.85	754.18
26	3290.36	3606.05	3998.78	4366.14	4644.09	4932.60
27	896.80	916.18	1024.56	1128.27	1222.51	1323.77
28	775.96	874.61	976.52	1074.98	1171.96	1278.61
29	316.85	354.56	392.46	427.77	456.25	486.06
30	2653.16	3137.79	3568.07	3997.97	4309.52	4634.63
31	249.93	281.27	312.03	341.00	365.25	391.23
32	2636.47	2982.74	3408.09	3838.91	4164.64	4510.07
33	786.25	901.99	1019.70	1135.33	1227.87	1326.34
34	8983.93	9833.32	13032.02	15126.08	16866.91	18982.71
35	6119.70	7346.33	8440.14	9578.27	10303.48	10913.77
36	1788.17	2084.99	2403.01	2744.44	3065.79	3443.31
37	2325.74	2629.54	2889.21	3125.59	3313.65	3507.53
38	613.12	709.34	785.93	857.87	914.95	976.20
39	3655.74	4120.31	4562.83	4979.88	5310.60	5668.52
40	882.52	1121.60	1328.36	1548.46	1816.72	2131.01
41	1621.74	1838.51	2087.73	2337.14	2592.33	2879.73
TOTAL	212798.50	234796.38	257290.81	277713.50	295873.81	315829.25

APPENDIX F

TRANSFER STATION
(FACILITY COSTS PROFILE)

Appendix F

FACILITY COSTS PROFILE

Transfer Station - Commercial Vehicles Only

(December 23, 1977)

Land and Buildings (Fixed Improvements):

1. Ratio $\frac{400,000}{1,400}$ ATD	30,000 TPY	70,000 TPY	140,000 TPY	210,000 TPY
$\frac{AVE}{TPY} \div 285$	105 TPD	245 TPD	490 TPD	740 TPD
2. Peak = 1.29 x AVE	135 TPD	320 TPD	635 TPD	960 TPD
3. Delivery Vehicles: Peak ÷ 4.5 tons/Veh.	30 Veh.	72 Veh.	141 Veh.	213 Veh.
4. Transfer Vehicles	2 Veh	2 Veh.	3 Veh.	3 Veh.
5. Peak Hourly: Peak ÷ 4	8	18	36	53
6. Unloading Space: Peak x 12 x 20	1,920 SF	4,320 SF	8,640 SF	12,720 SF
7. Floor or Pit Area Volume				
$2.00 \times 3207\ PD \times \frac{2000\ \#}{T} \times \frac{ICY}{500\ \#}$	29,160 CF	69,120 CF	137,160 CF	207,360 CF
Floor Area: 3 square feet	9,720 SF	23,040 SF	45,720 SF	69,120 SF
Pit Area: 8 square feet	3,645 SF	8,640 SF	17,145+ SF	25,910+ SF

(continued)

Appendix F

FACILITY COSTS PROFILE

(continued)

Land and Buildings (Fixed Improvements) (continued):

8.	Maneuver Space: 3 x Unloading	5,760 SF	12,960 SF	25,920 SF	38,160 SF
9.	Total Bldg. Space (7. + 8.)	15,480 SF 0.36 A	36,000 SF 0.83 A	43,065 SF 0.99 A	64,080 SF 1.47 A
10.	Land Area: 3. + 4. x Bldg. Space	1.07 A Say 1.5 A	3.32 A Say 3.75 A	3.47 A Say 4.5 A	4.41 A Say 4.5 A
11.	Building Cost: $30/Square Foot	$464,400	$1,080,000	$1,291,950	$1,922,400
12.	Site Preparation, Engineering: 25%	116,100	270,000	323,000	481,000
13.	Site Construction: 15%	69,660	162,000	194,000	288,360
14.	Land Costs @ $15,000/Acre	22,500	52,500	56,250	67,500
15.	Total Site & Bldg. Costs: 11.+12.+13.+14.	672,660	1,564,500	1,808,950	2,691,760
16.	Contingencies: 20%	134,600	312,900	361,790	538,350
17.	Total Capital Costs: Site + Fixed Improvements	850,000	1,900,000	2,200,000	3,250,000

(continued)

Appendix F

FACILITY COSTS PROFILE

(Continued)

Stationary Equipment:				
18. Stationary Compactors: Heil HTP 1000 Equivalent ($50,300 ea.)	$ 50,300	$100,600	$100,600	$150,90(
19. Scales: Billiab	150,000	200,000	200,000	200,000
Plant Rolling Equipment, Exclusive of Transfer Vehicles:				
20. Yard Tractor	30,000	40,000	40,000	40,000
21. Loaders: $65,000 new, $50,000 backup	65,000	65,000	115,000	115,000
22. Sweeper	5,000	5,000	7,500	10,000
Annualized Capital Costs:				
23. Site and Fixed Improvements:				
15 Years @ 9% (0.1241)	105,485	235,790	273,020	403,325
20 Years @ 9% (0.1095)	93,075	208,050	240,900	355,875
24. Stationary Equipment: 5 Years @ 16% (0.3054)	61,200	91,800	91,800	107,165

(continued)

Appendix F

FACILITY COSTS PROFILE

(continued)

Annualized Capital Costs (continued):

25. Plant Rolling Equipment, Exclusive of Transfer Vehicles: 4 years @ 15% (0.3503)	$ 35,030	$ 38,533	$ 56,924	$ 57,800
26. Summary of Annualized Capital Costs:	201,715	366,123	421,744	568,920
	205,000	375,000	425,000	575,000
	$6.85/Ton	$5.36/Ton	$3.04/Ton	$2.74/Ton
27. Labor Requirements:				
(1) Loader/Operator	(1.5)	(1.5)	(2)	(2)
(2) Laborer/Spotter		(1)	(1.5)	(2)
(3) Scaleman/Billing	(1)	(1)	(1.5)	(2)
Wages:				
Loader Operator - $25,000				
Laborer/Spotter - $18,000				
Scaleman/Billing - $18,000				
Fringes and Supervising/Administrative Costs (35%)				
(1)		50,625	67,500	67,500
(2)		24,300	36,450	48,600
(3)		24,300	36,450	48,600
Total Annualized Labor:	$ 74,925	$ 99,925	$140,400	$164,700
30% Contingency:	22,478	29,978	42,120	49,410
	$ 97,403	$129,903	$182,540	$214,110
	$100,000	$130,000	$185,000	$215,000
	$3.33/Ton	$1.86/Ton	$1.32/Ton	$1.02/Ton

(continued)

Appendix F

FACILITY COSTS PROFILE

(continued)

Annualized Capital Costs (continued):

28. Operating and Maintenance Costs:				
Stationary Equipment (0.10 x Capital Costs)	$ 20,300	$ 30,060	$ 30,060	$ 35,900
29. Rolling Equip. Exclusive of Transfer (0.25 x Capital Costs)	$ 25,000	$ 27,500	$ 40,625	$ 41,250
Facilities and Site Maintenance (0.01 x Capital Costs)	$ 8,500	$ 19,000	$ 22,000	$ 32,500
Utilities (0.01 x Stationary Equipment x 0.01 x Labor)	$ 1,000	$ 1,300	$ 1,850	$ 2,150
	2,000	3,000	3,000	3,500
	$ 3,000	$ 4,300	$ 4,150	$ 5,650
Administrative Expenses ($3,600 + 0.01 (Labor))	$ 3,600	$ 3,600	$ 3,600	$ 3,600
	1,000	1,300	1,850	2,150
	$ 4,600	$ 4,900	$ 5,550	$ 5,750
30. Total Annual Operating and Maint. Costs	$ 61,400	$ 85,760	$102,385	$121,050
20% Contingencies	12,280	17,150	20,480	24,210
	$ 75,000	$103,000	$123,000	$145,000
	$2.46/Ton	$1.47/Ton	$0.88/Ton	$0.69/Ton
31. Profit, Taxes and Other Expenses (10% of Labor + Operating and Maintenance Costs	$ 10,000	$ 13,000	$ 18,500	$ 21,500
	7,500	10,300	12,300	14,500
	$ 17,500	$ 23,300	$ 30,800	$ 36,000
	$ 18,000	$ 24,000	$ 52,000	$ 36,000

(continued)

Appendix F

FACILITY COSTS PROFILE

(continued)

Annualized Capital Costs (continued):

32. Summary of Total Costs:

Capital	$205,000	$375,000	$425,000	$575,000
Labor	100,000	130,000	185,000	215,000
Operation & Maintenance	75,000	103,000	123,000	145,000
Profit, Taxes, Other	18,000	24,000	32,000	36,000
	$398,000	$632,000	$765,000	$971,000
Per Ton	$13.27/Ton	$9.03/Ton	$5.46/Ton	$4.62/Ton

Appendix F

FACILITY COSTS PROFILE

(continued)

Transfer Stations - Private Vehicles Only

December 29, 1977

1.	Annual Volume (Uses)	116,667	75,180	56,500	31,280	11,280
2.	Peak Day Volume (Uses/Day)	940	600	450	240	90
3.	Peak Hour (Uses/Hour)	160	100	75	40	15
4.	Average Day (Uses/Day)	330	210	158	85	32
5.	Spaces Required @ 5/Hour	32	20	15	0	3
6.	Building Space (Square Feet)	28,050	20,350	17,600	7,800	4,200
7.	Land Area (Acres)	4.0	3.5	3.0	2.5	2.0
Fixed Costs:						
8.	Building Costs: Unit Cost/Sq. Ft.	$ 23	$ 21	$ 19	$ 19	$ 18
	Total Cost ($)	$645,150	$427,350	$334,400	$148,200	$ 75,600

(continued)

Appendix F

FACILITIY COSTS PROFILE

(continued)

Fixed Costs (continued):

9.	Land Cost: Unit Cost/Acre	$ 24,000	$ 22,000	$ 20,000	$ 16,000	$ 16,000
	Total Cost	96,000	77,000	60,000	40,000	32,000
10.	Site Preparation and Engineering (20% of 8.)	129,030	85,470	66,880	29,640	15,120
11.	Site Construction (15% of 8.)	96,770	64,100	50,160	22,230	11,340
12.	Total Site & Building Cost (8.+9.+10.+11.)	966,950	653,920	461,280	240,070	134,060
13.	Contingencies (20%)	193,390	130,780	92,260	48,010	26,810
14.	Total Capital Costs	$1,160,340	$784,700	$553,540	$288,080	$160,870
	$	$1,200,000	$800,000	$600,000	$300,000	$170,000

Equipment Costs:

15.	Yard Tractors	$ 40,000	--	--	--	--
16.	Cat Loaders	50,000	50,000	50,000	--	--
17.	Backhoe/Tractor Sweeper	5,000	5,000	5,000	10,000	8,000

(continued)

Appendix F

FACILITY COSTS PROFILE

(continued)

Equipment Costs (continued):

18. Pickup Truck	$ 8,000	$ 8,000	$ 8,000	$ 8,000	$ 8,000
19. Drop Boxes	14,000	14,000	14,000	49,000	28,000
20. Total Equipment Costs	$117,000	$ 77,000	$ 67,000	$ 67,000	$ 44,000
Annualized Capital Costs:					
21. Fixed Costs (15 years A 10% (0.13147))	$157,764 $160,000	$105,176 $106,000	$ 78,882 $ 79,000	$ 39,441 $ 40,000	$ 22,350 $ 23,000
22. Equipment Costs (5 years @ 16% (0.3054))	$ 35,732 $ 36,000	$ 23,516 $ 24,000	$ 20,462 $ 21,000	$ 20,462 $ 21,000	$ 13,438 $ 14,000
23. Total Capital Costs, Annualized	$196,000	$130,000	$100,000	$ 61,000	$ 37,000
$/Usage	$1.68	$1.73	$1.77	$1.95	$3.28
24. Labor Requirements:					
Loader/Operator @ $25,000	1.5 ($ 37,000)	1.0 ($ 25,000)	1.0 ($ 25,000)	1.0 ($ 25,000)	1.0 ($ 25,000)
Laborer/Spotter @ $18,000	3.0 (54,000)	2.0 (36,000)	1.0 (18,000)	1.0 (18,000)	1.0 (20,000)
Billing/Fees @ $18,000	2.0 (36,000)	1.5 (27,000	1.5 (27,000)	1.5 (18,000)	---

(continued)

Appendix F

FACILITY COSTS PROFILE

(continued)

Annualized Capital Costs (continued):

24. Labor Requirements (continued):					
Total Annualized Labor	$127,500	$ 88,000	$ 70,000	$ 61,000	$ 45,000
Contingencies @ 30%	38,250	26,400	21,000	18,300	13,500
Total Labor Costs	$165,750 $166,000	$114,400 $115,000	$ 91,000 $ 91,000	$ 78,300 $ 79,000	$ 58,500 $ 59,000
25. Operation and Maintenance Costs:					
Drop Boxes @ .01 x Capital Costs	$ 140	$ 140	$ 140	$ 490	$ 490
Moving Equip. @ .25 x Capital Costs	25,750	15,750	13,250	4,500	4,000
Facilities & Site Maint. @ .02 x Capital Costs	24,000	16,000	12,000	6,000	3,400
Utilities @ .01 Equipment + .01 Labor	1,170 1,160	770 1,150	670 910	670 790	670 590
Administrative @ .15 x Labor (Including Legal Costs)	24,900	17,250	13,650	11,850	8,850
26. Total Operation and Maintenance Costs:	$ 77,620	$ 51,060	$ 40,620	$ 24,300	$ 18,000
20% Contingencies	15,520	10,210	8,120	4,860	3,600
Total	$ 93,140 $ 94,000	$ 61,270 $ 62,000	$ 48,740 $ 49,000	$ 29,160 $ 30,000	$ 21,600 $ 22,000
27. Profit, Taxes, Other Expenses 10$ of Labor + Oper./Maint.	$ 26,000 $ 26,000	$ 17,700 $ 18,000	$ 14,000 $ 14,000	$ 10,900 $ 11,000	$ 8,100 $ 8,000

APPENDIX G

OREGON STATE
DEPARTMENT OF ENVIRONMENTAL QUALITY
ISSUES POSITION

MSD METROPOLITAN SERVICE DISTRICT
1220 S. W. MORRISON ROOM 300 PORTLAND, OREGON 97205
(503) 248-5470

March 7, 1978

Mr. William Young, Director
Department of Environmental Quality
P. O. Box 1760
Portland, Oregon 97207

ATTENTION: Ernie Schmidt and Bob Gilbert

Gentlemen:

We are completing a review of potential landfill disposal sites for the Metropolitan Service District area. Prior to presenting the review to the MSD Board of Directors, we would appreciate knowing DEQ's position regarding four specific issues. These issues include: 1) usage of Portland area gravel pits; 2) lateral expansion of St. Johns Landfill; 3) upward expansion of St. Johns Landfill; and 4) use of dredge materials for cover.

<u>Gravel Pit Usage</u>

We believe the environmental risks associated with using worked out gravel pits for sanitary landfills can be reduced to an acceptable level through sound engineering and proper landfill development and operational standards.

We propose that the following design standards will provide ample protection for existing and potential water supplies and the surrounding neighborhood:

1. A clay seal consisting of two feet of impervious compacted soil, three feet of existing soil material would be excavated prior to placement of the clay seal. The excavated material would then be placed over the constructed clay seal (see Attachment A) or an alternative, including a PCV liner;

2. A leachate collection system consisting of six inch diameter corrugated metal perforated pipe at fifty foot centers, with eight inch diameter collector pipes (see Attachment B);

3. A gas seal consisting of four feet of impermeable soil placed against the existing slope of the site with four feet of clean gravel material over the impervious soil and six inch diameter corrugated metal perforated pipe at fifty feet centers (see Attachment C);

4. A leachate treatment system consisting of two 32,000 gallon tanks for settling, Ph adjustment, and for aeration. The discharge from the pretreatment system would be to the municipal sewer.

Proper landfill development and operation would be provided through the following measures:

1. Initial reconnaissance consisting of a detail analysis of groundwater movements in the vicinity of the proposed site and a comprehensive monitoring program to insure effective leachate control.

2. Construction management, inspections and assignment of liability for construction, according to DEQ plans.

3. Operational inspections and records monitoring, consisting of off-site cover material receipts to assure a satisfactory cover to incoming solid waste ratio; total leachate generation quantity reports; operator performance bonds; and liability assignment for design, construction and operation of the sites.

Lateral Expansion of St. Johns Landfill

It is our understanding that DEQ has tentatively approved expansion of St. Johns Landfill laterally towards Smith and Bybee Lakes. We would like to be able to use Attachments E and F (referred to in your letter to Mr. Ron Perkins of November 30, 1976) and any other sketches which show the proposed details of the expansion for St. Johns Landfill. We have been unable to obtain these attachments from the City of Portland. The attachments are necessary for completion of our cost estimates for expansion of the landfill.

Upward Expansion of St. Johns Landfill

We believe that upward expansion of St. Johns Landfill can be made environmentally acceptable through specific engineering designs and operational guarantees. At this time, we are unsure of the exact nature of your objections to this upward expansion. Please provide a list of your specific concerns so we can consider whether the opportunity to mitigate environmental risks exists through investment of additional money. If you feel it is impossible to expand St. Johns Landfill upwards under any circumstances, please indicate.

Usage of Dredge Spoils

The Army Corp of Engineers has indicated there is a substantial supply of dredge spoils from the Willamette River which may be suitable for cover material. Please provide us an opinion or position on the usage of this material for area landfills.

Attachment D summarizes our thinking regarding some of the positions DEQ may take with regard to these issues and the consequences of DEQ positions to MSD's current planning effort, or future disposal alternatives. Although this list of positions is not intended to be exhaustive or exclusive, we hope that it will provide a framework for your consideration of these problems.

We intend to discuss the results of our analysis and these issues with participants in our program who have provided site information, with other interested persons, and with the Solid Waste Advisory Committee, beginning February 21, and hopefully with the MSD Board sometime in March. Your early response is therefore appreciated. If you anticipate a delay beyond March, please advise.

Very truly yours,

Charles Kemper, Director
SOLID WASTE DIVISION

CK:amn

File No. 1.20.B/4

ATTACHMENT "D"

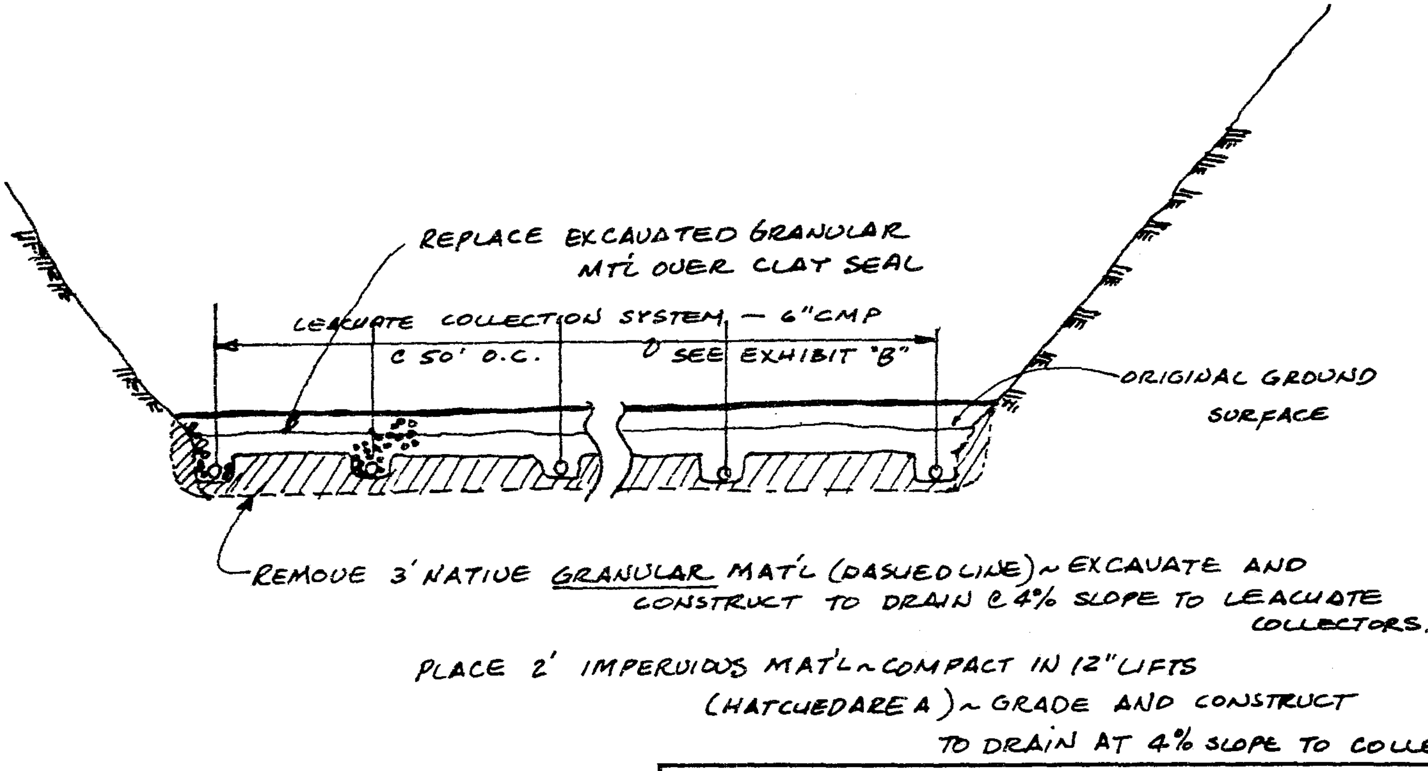
Alternative Positions Regarding MSD
Planning Issues

ISSUE	ALTERNATIVE DEQ POSITIONS	POSSIBLE CONSEQUENCES TO MSD
I. Use of Gravel Pits	1. O.K., if proposed construction standards and operational conditions are observed.	1. Provides basis for indicating to MSD Board and public possibility of using gravel pits. MSD will ask DEQ to assist in specific reconnaisance requirements, detailed specifications and standards of development. The specifications and standards will be used to obtain operator proposals or for selection of specific sites.
	2. Maybe, but depends on performing detailed reconnaisance and groundwater study of proposed site(s). No specific criteria provided.	2. Reduces potential of gravel pit usage and may necessitate expenditure of monies without assurance of return. Risk of favorable result may require looking for unnamed, undetermined sites. Significant future disposal costs.
	3. Maybe, but if after determination that groundwater, surface water, or wells could be adversely affected by landfill, then no.	3. Reduces potential of gravel pit usage and could result in necessity to close existing sites since all existing sites may have an adverse affect on groundwater, surface water, or wells...unless adverse means "a greater negative effect than presently created by existing fills." In this case, we could proceed as indicated by consequence #1.
	4. No, not under any circumstances.	4. Same consequence as #2.
	5. No, not at this time.	5. Same consequence as #2.
II. Outward Expansion of St. Johns Landfill	1. DEQ has approved.	1. MSD needs details of plan to incorporate into estimates. Without cost estimates, main basis of comparison is eliminated.

ATTACHMENT "D"

Page 2

ISSUE	ALTERNATIVE DEQ POSITIONS	POSSIBLE CONSEQUENCES TO MSD
III. Upward Expansion of St. Johns Landfill	1. Yes, under certain conditions which include...	1. MSD can take the conditions under consideration in estimate
	2. No, not under any conditions, including cost.	2. MSD will not include upward expansion as an alternative. If gravel pits not acceptable also, then MSD will look for unnamed, undetermined sites. If gravel pits acceptable, short term alternatives are available.
IV. Use of Dredge Spoil	1. No problem if reasonable moisture content.	1. Will reduce estimates for future disposal costs.
	2. Problems, not acceptable.	2. Significant future disposal costs.



9-p7

FIG 9.4

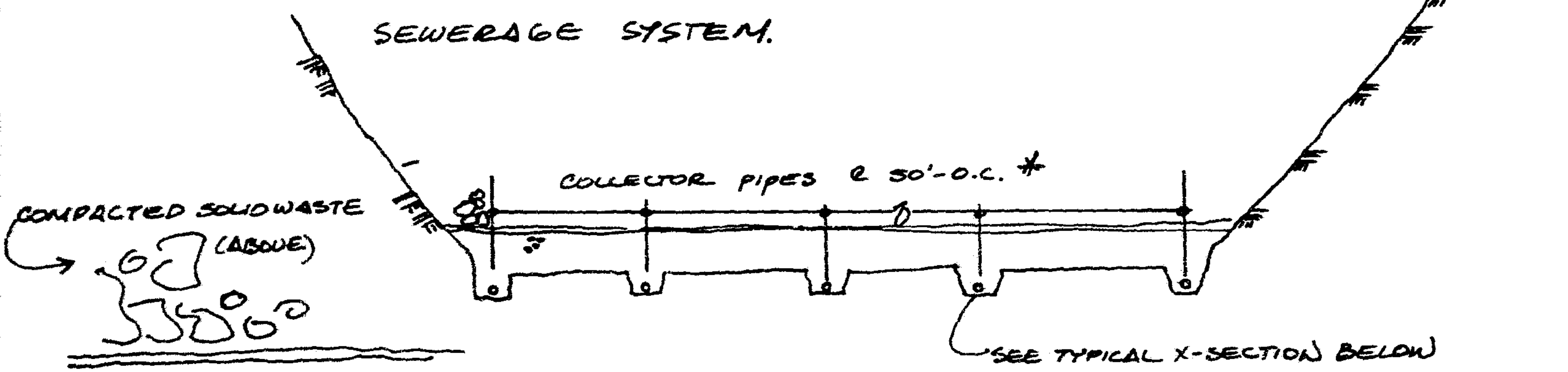
METROPOLITAN SERVICE DISTRICT

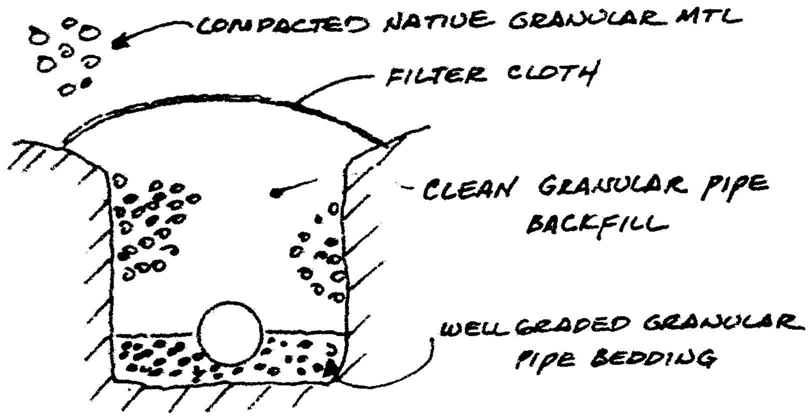
SCALE NTS	REVISIONS	BY	DATE
DATE JAN 1978			
DR'N. CFK / CKD.			
AP'VD.			
TITLE EXHIBIT "A" CLAY SEAL		NO. 1-A	

G-7

BRUNING 40 105

* LEACHATE COLLECTION SYSTEM ~ INSTALL 6" DIA CORRUGATED METAL PERF PIPE @ 50' O.C.; SLOPE TO DRAIN TO 8" DIA. CORRUGATED METAL PERF PIPE @ 100' O.C.; SLOPE TO DRAIN TO CENTRAL SUMP AND PUMP TO TWO(2) PRE-TREATMENT TANKS. DISCHARGE TO MUNICIPAL SEWERAGE SYSTEM.





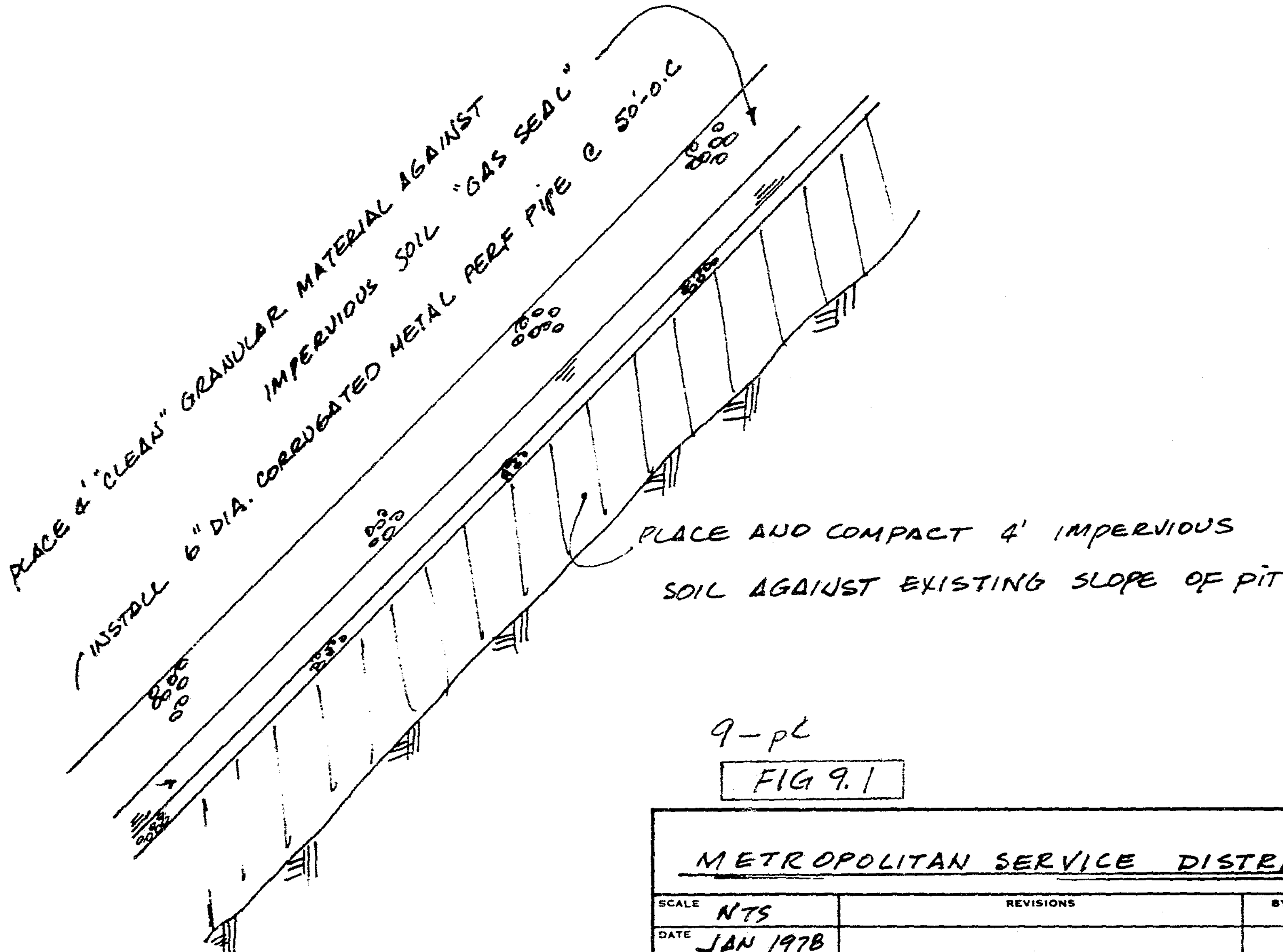
TYPICAL COLLECTOR PIPE
X SECTION

9-p5

FIG. 9.2

METROPOLITAN SERVICE DISTRICT

SCALE NTS	REVISIONS	BY	DATE
DATE JAN 1978			
DR'N. CFK / CKD.			
AP'VD.			
TITLE EXHIBIT "B" LEACHATE COLLECTION	NO. 1-B		



9-pt

FIG 9.1

METROPOLITAN SERVICE DISTRICT

SCALE NTS	REVISIONS	BY	DATE
DATE JAN 1978			
DR'N CFK / CKD.			
AP'VD.			

TITLE	NO
EXHIBIT "C" GAS SEAL	12C

G-9

BRUNING 40-105

MEMO

TO: Bob Gilbert, Region Engineer, DEQ
Portland Regional Office

FROM: Bob Keech, Solid Waste Engineer

RE: DOCUMENTATION OF LANDFILL LEACHATE CONTAINMENT

DATE: February 27, 1978

Bob, you requested more information on our references for our proposed standards for landfill development, specifically leachate containment.

Although containment of leachate from landfills using liners or clay seals has only limited use at this time, water containment and protection of groundwater using liners and clay seals are widely used.

We made a number of contacts in trying to determine the acceptability of the different types of liners. The following is a list of the contacts made:

1. Peter Kmet; Winconsin DNR; (608)266-7596; clay seals applications.
2. Ron Newton; N.W. Pollution Control Products; (206)747-1842; PVC liners application.
3. Guy Goethener, Sales Representative; (203)255-2542; PVC liners and application.
4. Stan Jorgenson, EPA; (206)442-1260; liners in general.

We also reviewed a number of publications, including "Liners for Land Disposal Sites and Assessment."

I would like to point out that even though all of the design details are not determined, the general feasibility within our estimated cost range looks very good.

We have looked at two possible containment systems, one with a clay seal, the other utilizing a PVC membrane. We favor the PVC membrane at this time (see attachment).

The reason why I am so optimistic at this time is because we have not just designed a thin plastic liner to contain the leachate, but have provided a reliable containment system.

The system has a 30 mil. PVC plastic membrane for its first level of protection, then under areas of high flow (ditch areas) there is a second level of protection with a 40 mil. PVC membrane. The third level of protection is provided by the impermeable nature of the sandy silt dredge material which would greatly reduce any leachate flow. This sandy silt would also provide first level protection to the liner by reducing the movement of leachate along its surface. The final insurance is positive leachate collection and removal which prevents the buildup of a hydraulic head near the liner.

Over the next six months, we plan to continue to study leachate containment systems and add further safety measures as they become known.

We are planning to conduct an extensive groundwater monitoring program at each new site, first drilling 5 to 10 wells approvimately 12 months before developing sites. This would allow for a record of existing groundwater quality and would also allow us to model the local groundwater flow and determine where 5 to 10 other wells would go to give us comprehensive monitoring of the groundwater flowing under the fill.

If you have further concerns that I might be able to help you with, please contact me.

BK:amn

PROPOSED LEACHATE CONTAINMENT SYSTEM FOR ENVIRONMENTALLY SENSITIVE AREAS

The following is a summary of the specifications and analysis for the design of the leachate containment system for those environmentally sensitive landfill sites in the Portland metropolitan area.

Leachate Quantity

For Portland Sand & Gravel, fully developed (one of MSD's largest proposed sites)

1. No surface water management: 200,000 gal/day during peak flow;

2. With surface water management: 135,000 gal/day during peak flow.

Estimates for runoff were as follows:

1. No surface water management: 10%/100% of area;

2. With surface water management: 5 acres 10%; remainder 40%.

Leachate Containment

Two options are as follows:

1. Clay seal with a thickness based on the permeability of available clay, with or without ditch liner of asphalt or a membrane;

2. Lined with a PVC 30 mil. membrane, reinforced with the addition of a 40 mil. membrane in the ditch areas (see figure 1).

Leachate Collection

Collection is provided by a system of perforated pipes (specific types of pipes will be studies and selected later). These pipes will drain into a sump and will be pumped to the surface.

Leachate Treatment

Three options exist:

1. On-site treatment and disposal;

2. On-site treatment and disposal in sewage system; and

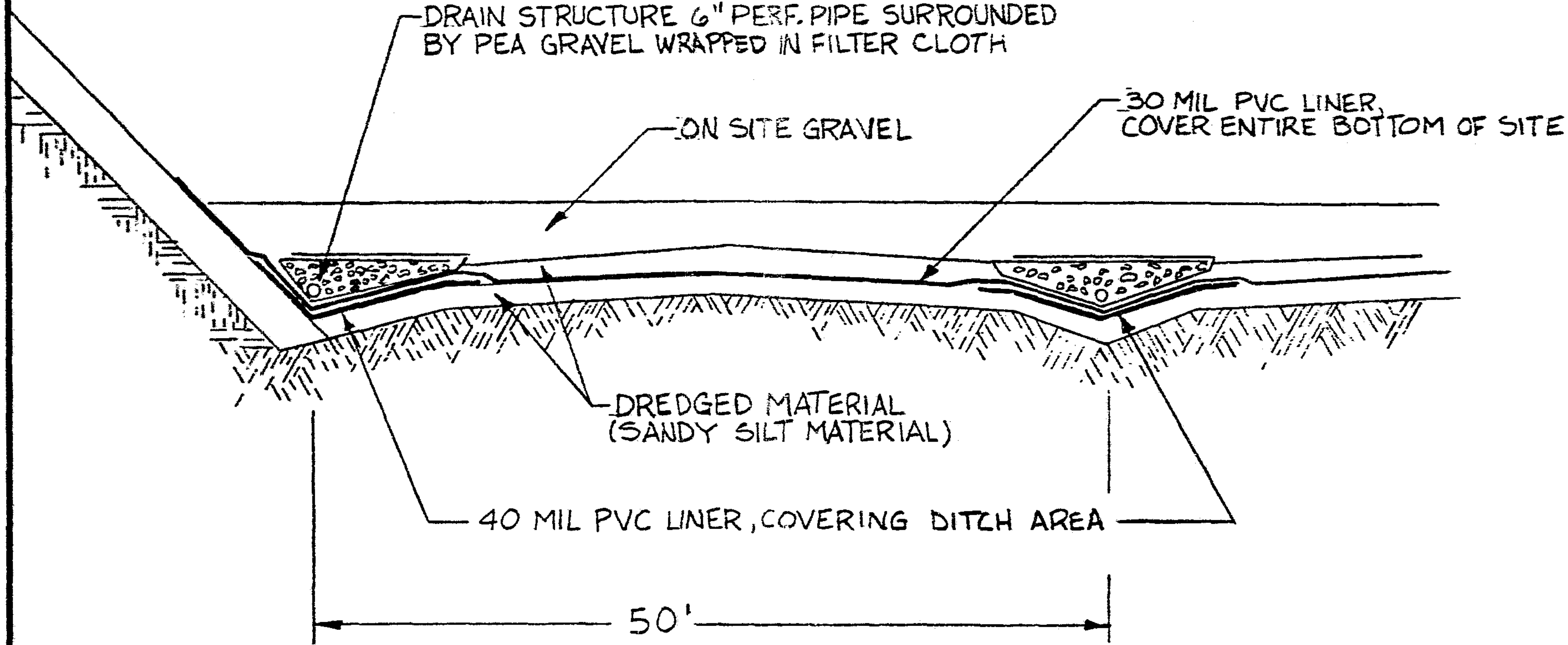
3. Disposal in sewage system.

Option No. 2 with facilities on-site for Ph adjustment and COD/BOD reduction is favored at this time.

BK:amn

G-14

TYPICAL SECTION LANDFILL LINER & LEACHATE COLLECTION



METROPOLITAN SERVICE DISTRICT
1220 S.W. MORRISON ROOM 300 (503) 248-5470
PORTLAND, OREGON 97205

SCALE 1" = 10'		REVISIONS	BY	DATE
DATE 2/28/78				
DR'N. LBB	CKD.			
AP'VD.				
TITLE			NO.	

BRUNING 40-105

ROBERT W STRAUB
GOVERNOR

Department of Environmental Quality

522 S.W. 5th AVENUE, P.O. BOX 1760, PORTLAND, OREGON 97207 PHONE (503) 229- 5292

April 14, 1978

Mr. Charles Kemper, Director
Metropolitan Service District
1220 S. W. Morrison Street
3rd Floor, Terminal Sales Bldg.
Portland, Oregon 97205

Re: SW-MSD

Dear Mr. Kemper:

We have reviewed the questions and issues which you raised in your letter of March 7, 1978 regarding landfill design standards in gravel pits, the expansion of the St John's Landfill and the use of dredge spoils for cover material.

The development of gravel pits into acceptable, environmentally sound landfill sites by incorporating the design scenario you have proposed has been reviewed. Our comments on the proposed design criteria are:

1. There are serious uncertainties involved in the usage of clay seals or PVC liners to adequately seal these pits.

2. Insuring that the proper clayey soil was used is critical as some clays break down in the presence of leachate. Also, tearing of the PVC liners has been an observed problem when used in waste treatment lagoons.

3. All leachate collection pipes would have to be polyvinyl or equivalent. Galvanized pipe does not last under acidic conditions.

4. Discharge of the collected leachate into a municipal sewerage system in some cases may not be possible because extensive areas are still unsewered.

5. The flow of groundwater from the landfill will be very critical. Allowing the filling of gravel pits in central Multnomah County may be in conflict with our Department's goal to phase out cesspools to prevent further nitrate buildup in the groundwater. It should be noted that this ground water aquifer is proposed to be utilized by the City of Portland as an alternate water supply to Bull Run.

6. Gas movement controls must be utilized in all new or expanded landfills. The use of proper soil is of particular importance. Collection and final disposal of the gases must be included in the landfill design.

Mr. Charles Kemper, Director
April 14, 1978
Page 2

In summary, gravel pits could be used with appropriate design and engineering. We feel, however, their usage at this point could only be classed as "maybe" at best.

Lateral Expansion of St. John's Landfill

We have enclosed copies of attachments E and F as requested. The Department still prefers lateral vs. upward expansion of this landfill. Nevertheless in order to fully evaluate each alternative, a thorough analysis must be done to obtain good estimates of the operational time inherent to each expansion alternative. Comparative costs and designs must be evaluated by your agency to clearly demonstrate which alternative is most cost-effective and environmentally compatible. Land-use must also be considered in determining your comparisons. Because of recent federal statutes and regulations EPA approval is necessary and it must be shown that there are no other suitable alternative sites at this time.

Upward Expansion of St. John's Landfill

With upward expansion increased leachate seeps would be expected due to an increased hydraulic head. Upward expansion would, therefore, require construction of a toe-dike to capture leachate with discharge to the city sewer. We would also expect increased problems controlling wind-blown litter which would need to be addressed in the operational plan. Consideration of this alternative must be tied to the ultimate land use of the property. We would not be opposed to some upward expansion with positive leachate control, gas movement control, and resolution of the land-use issue.

Usage of Dredge Spoils

Dredge spoils with low water content would provide an acceptable intermediate or daily cover material for controlling litter, vectors and fires. Dredge spoils, however, would not shed water and for this and other reasons could not be used for final cover.

We hope we have assisted you in analyzing the viable alternatives for future landfill sites. If we can be of any further assistance please contact us.

Sincerely,

Robt E. Gilbert

Robert E. Gilbert, Manager
Northwest Regional Office

CHG:mm
cc: Solid Waste Management Section