

LAKEFILL QUALITY STUDY

LESLIE STREET SPIT

City of Toronto

August 1982



Environment
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Ministry
of the
Environment

READERS ARE ADVISED THAT THE RESULTS OF THE FOUR
DAYS OF SAMPLING CONTAINED IN THIS REPORT DO NOT
NECESSARILY REFLECT THE QUALITY OF ALL PAST AND
FUTURE LAKEFILL THAT HAS OR WILL BE DEPOSITED AT
THE LESLIE STREET SPIT.

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CITY OF TORONTO

August, 1982

by

Environment Canada

Environment Protection Service

and

Ontario Ministry of the Environment

Central Region

TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
1. INTRODUCTION	4
2. TRUCK FILL SAMPLING PROGRAM	6
2.1 Purpose	
2.2 Methodology	
2.3 Results of the Truck Fill Sampling Program	
3. EXCAVATION SITES SAMPLING PROGRAM	12
3.1 Purposes	
3.2 Methodology	
3.3 Results of Excavation Site Sampling Program	
4. CONCLUSIONS	17
5. RECOMMENDATIONS	19
6. APPENDICES	20

LIST OF TABLES

	<u>PAGE</u>
1. CATEGORIES OF TRUCK FILL MATERIALS	7
2. TRUCK FILL CONTAMINATION RATING	10
3. CONTAMINATION LEVELS - EXCAVATION SITES	14

LIST OF APPENDICES

A. THE MOE GUIDELINES FOR DREDGE SPOILS FOR OPEN-WATER DISPOSAL, 1974	20
B. THE MOE GUIDELINES FOR DREDGE SPOILS FOR OPEN-WATER DISPOSAL, 1978	21
C. THE MOE LAKEFILL QUALITY GUIDELINES	22
D. TERMS OF REFERENCE, TRUCK FILL SURVEY AND EXCAVATION SITE SAMPLE COLLECTION	23
E. TRUCK FILL QUALITY TEST RESULTS	26
F. SOIL TEST RESULTS FOR EIGHT ACTIVE EXCAVATION SITES	29
G. SOIL TEST RESULTS, CITY OF TORONTO, PUBLIC WORKS STOCK PILE SITE AT EASTERN AND BOOTH	36

MAPS

1. LOCATIONS OF MAJOR EXCAVATION SITES	8
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1. INTRODUCTION

Lakefilling to construct new lands is a long established and a most visible activity on the Toronto Waterfront. The largest and still growing lakefill is the five-kilometre long Leslie Street Spit. The construction was started by the Toronto Harbour Commission (THC) in the late 1950's. Lakefills are created to inexpensively dispose of materials mainly from the construction industry and to provide new lands. Originally the quality of the fill materials was not of concern and, at the earliest stages of the lakefilling, the materials were comprised mostly of excavated earth, construction rubble, dredge spoils, and miscellaneous solid waste.

In response to pressures from environmental agencies to control the use of contaminated materials for lakefilling, the THC in the mid-1970's decided not to accept undesirable waste materials such as incinerator residue, battery casings, and Hearn Generating Station fly ash at its lakefill sites. In addition, the THC began requiring haulers to separate rubble from earth fill in order to efficiently use the large aggregate materials on the exposed outer face of the advancing Spit. In 1979, the THC introduced a quality control system that allowed trucks to dump fill materials if they passed a visual and olfactory inspection.

The Ontario Ministry of the Environment (MOE) in 1974 established an initial set of guidelines for dredge spoils to be disposed of in open-waters, referred to as Open-Water Disposal Guidelines (Appendix A). These guidelines formed the basis upon which Environment Canada and the MOE controlled the quality of dredge spoils disposed of in the Great Lakes. The guidelines were expanded in 1978 (Appendix B). The MOE, in 1982, adopted the Open-water Disposal Guidelines as guidelines for determining the suitability of material as lakefill. These are referred to as the Lakefill Quality Guidelines (Appendix C).

In August, 1980 Environment Canada conducted two surveys on the quality of fill entering the Leslie Street Spit. The surveys revealed that the quality of many of the sampled loads failed to meet the MOE guidelines of 1978 (Appendix B). This was contrary to the previous assumption that most of the fill materials from deep excavations would be acceptable as lakefill when compared to the MOE guidelines. Subsequently, the MOE initiated a program to designate areas in the City of Toronto where the soils might be of an unacceptable quality because of the present or past land use practices.

Concurrent to the development of the MOE program, Environment Canada and the MOE developed the LAKEFILL QUALITY STUDY to further examine the quality of truck fill in a more rigorous and systematic manner, and to test assumptions underlying a proposed MOE program of soil sampling and site identification and classification. Fill from trucks dumping at the Leslie Street Spit was examined and soil samples at eight construction sites and one stockpile derived from miscellaneous activities were collected and analyzed. All samples were analyzed by the MOE.

2. TRUCK FILL SAMPLING PROGRAM

2.1 Purpose

The specific objective of this study was:

To characterize the quality of the fill material entering the Leslie Street Spit and to compare the quality of the fill material to the MOE Lakefill Quality Guidelines.

2.2 Methodology

The fill material from trucks was sampled during the winter of 1982 (February 10, 16, 19 and 23) in a systematic manner as described in the Terms of Reference for the W.D. Wilkins and Assoc. (Appendix D). The samples were collected immediately after the loads were dumped on the Leslie Street Spit and delivered to the MOE Central Laboratory. Samples were analyzed for total organic carbon (TOC), total phosphorus (TP), total Kjeldahl nitrogen (TKN), ammonia (NH₄⁺), cyanide (CN), mercury (Hg), lead (Pb), zinc (Zn), copper (Cu), chromium (Cr), nickel (Ni), arsenic (As), cadmium (Cd) and polychlorinated biphenyls (PCB).

2.3 Results of the Truck Fill Sampling Program

Three thousand, three hundred and seventy three truck loads of excavated material were hauled to the Leslie Street Spit during the four days of the survey (Table 1). The vast majority (3,131 trucks or 93%) contained sand and/or soil, the rest contained rubble. The loads containing non-rubble material were the focus of this study.

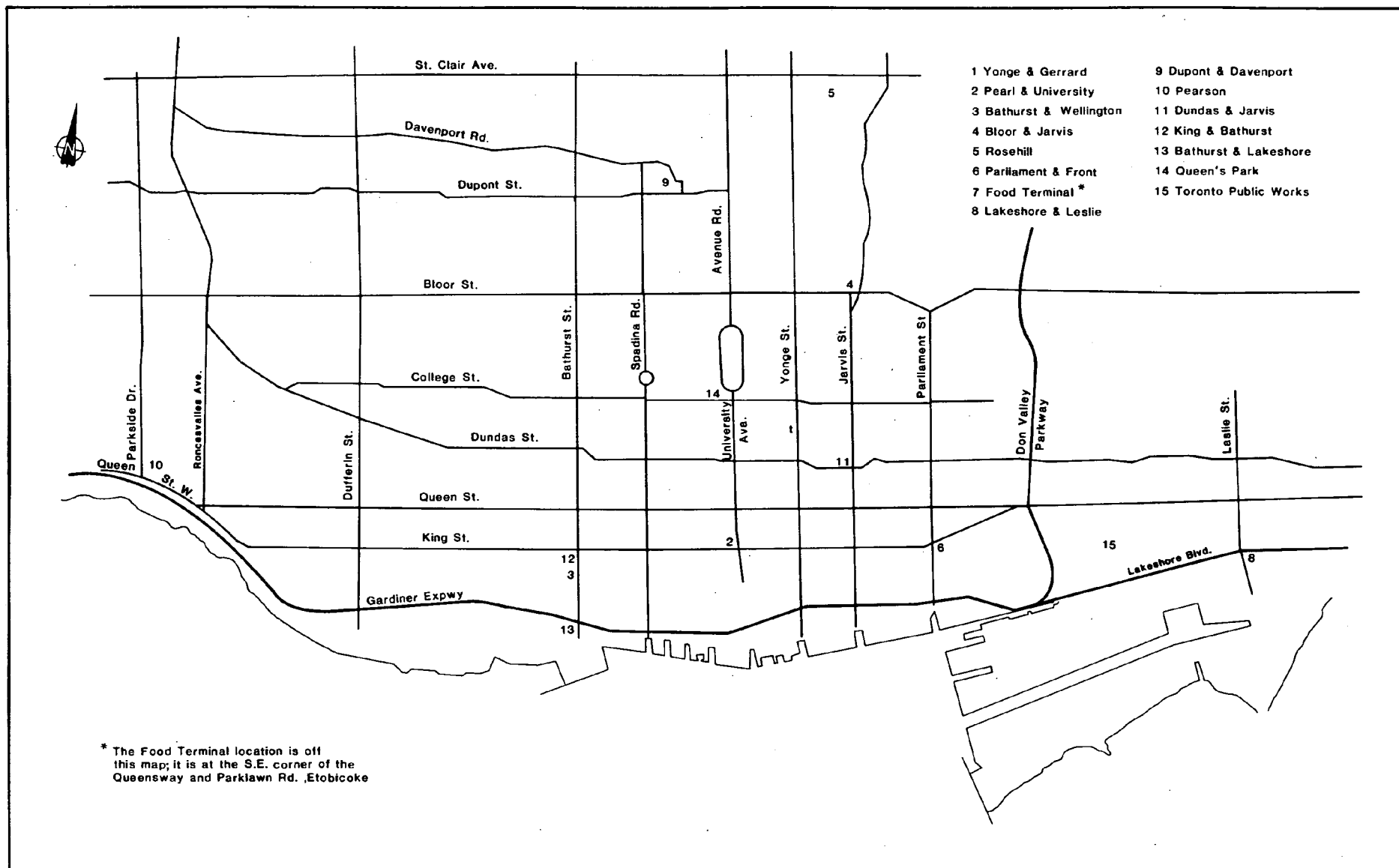
On any given day most of trucks came from only two or three sources rather than from the anticipated half dozen major sources. Trucks from 43 sources contributed fill to the Spit over the study period. The locations of the larger sources of material are shown on Map 1. The largest sources were commercial building sites, while many of the smaller ones involved municipal utility projects. It should be noted that winter construction has a bias towards large commercial sites, since shallow excavations are not appropriate under frozen ground conditions.

TABLE 1 - CATEGORIES OF TRUCK FILL MATERIALS

Number of Trucks with Type of Fill

<u>DATE</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Total</u>
February 10	904	66	9	979
February 16	815	45	4	864
February 19	660	53	3	716
February 23	752	46	16	814
	<hr/>	<hr/>	<hr/>	<hr/>
TOTAL	3131	210	32	3373

A - Sand and/or Soil
B - Rubble
C - Large Rubble



MAP 1: LOCATIONS OF MAJOR EXCAVATION SITES

Inspections by the W.D. Wilkins and Associates field staff of the trucked material dumped onto the Spit revealed that the visual and/or olfactory inspections of the THC were not effective in preventing contaminated materials from gaining access to the Leslie Street Spit and possibly Lake Ontario. This is substantiated later in the report. The consultant also observed that, during busy periods, the THC site crew was unable to check every truck since there were as many as six trucks entering the working site almost simultaneously. The situation deteriorated when two dump sites on the Spit were operated concurrently.

The analytical results of the truck fill samples are contained in Appendix E. To interpret the truck fill data, the quality of the fill was compared to and rated against the MOE Lakefill Quality Guidelines (Appendix C). For the purposes of this study and to facilitate comparison and analysis, four levels of contamination were arbitrarily chosen and were defined as follows:

Nil - No parameter of the MOE Lakefill Quality Guidelines tested for was exceeded.

Light - Only one parameter of the MOE Lakefill Quality Guidelines tested for was exceeded but by less than 3 times and the exceeded guideline was not one of the high priority parameters, namely mercury, lead, cadmium, and polychlorinated biphenyls.

Moderate - None of the high priority parameters was exceeded, but two or more guidelines for the other parameters were exceeded by less than 3 times.

High - Concentrations exceeded guidelines for any one high priority parameter, or concentrations exceeded any other guideline by greater than 3 times.

It was also decided that materials in the Moderate and High categories would be considered unacceptable as lakefill.

Using the foregoing rating system, it was determined that of the 80 trucks sampled, 41 loads (51%) exceeded one or more of the MOE Lakefill Quality Guidelines. Of these 80 loads, 22 (27%) were rated as Light, six (8%) Moderate and 13 (16%) High (Table 2). This would have meant that 19 (24%) of the 80 truck loads of fill would have been unacceptable as Lakefill. Eighteen of 22 truck loads were

TABLE 2 - TRUCK FILL CONTAMINATION RATING

<u>SOURCE</u>	<u>NO. OF TRUCKS</u>		<u>DEGREE OF CONTAMINATION</u>			
	<u>TOTAL</u>	<u>SAMPLED</u>	<u>NIL</u>	<u>LIGHT</u>	<u>MODERATE</u>	<u>HIGH</u>
Yonge and Gerrard	117	10	1	7	2	0
Pearl & University*	59	6	3	1	0	2
Bathurst & Wellington*	50	7	0	5	2	0
Bloor & Jarvis	40	4	0	2	1	1
Rosehill*	15	3	2	1	0	0
Parliament & Front	11	3	2	0	0	1
Food Terminal*	11	2	2	0	0	0
Lakeshore & Leslie*	10	2	0	0	0	2
Dupont & Davenport	10	1	1	0	0	0
Pearson	9	2	2	0	0	0
Dundas & Jarvis	6	3	1	2	0	0
King & Bathurst*	5	1	0	1	0	0
Bathurst & Lakeshore*	5	2	1	0	0	1
Queen's Park	4	3	1	1	0	1
Toronto Public Works	4	2	0	0	0	2
Christie & Dupont	2	1	0	1	0	0
Warden & Eglinton	2	1	0	0	0	1
Dundas & Spadina	1	1	0	0	0	1
Victoria & Dundas	1	1	0	0	0	1
CNE	1	1	0	0	1	0
Dundas & University	1	1	0	1	0	0
Others	36	23	23	0	0	0
TOTAL	400	80	39	22	6	13
Percent of Total Sampled			49	27	8	16

*These sites were observed to be located on industrial land or reclaimed land.

rated as Light solely on the basis of exceedance of the chromium concentration guidelines. Truck loads which contained excavated material rated as High came from several locations throughout Metro Toronto (Table 2).

Thirteen sources of trucked material contributed one or more sampled loads that were rated as Moderate or High. Four of these sources were on reclaimed or industrial land.* Six of the remaining nine sources not located on reclaimed or industrial land were minor (i.e. each source contributed fewer than five interviewed trucks).

In this Study, the truck fill from the Lakeshore and Leslie site had the greatest degree of contamination and this was substantiated by the results of the excavation site samples.

The fill from the City of Toronto Public Works yard was from a stock pile of materials obtained from excavations that occurred during the night time. The stock pile is periodically trucked to the Spit.

On two occasions, February 16 and February 19, loads left by unknown trucks were also sampled. Although not part of the Terms of Reference, this sampling took place because the materials were black in colour and contained substantial amounts of organic matter and debris. Based on the chemical analyses of these samples (see Samples X, Appendix E), they were rated as high. It was the opinion of the consultant's field crew that the loads probably originated from the Lakeshore and Leslie site. Material from that location was very similar in nature to the material dumped by the unknown trucks.

The foregoing substantiates the consultant's observation that the THC method of inspecting the fill material was not effective in preventing unacceptable materials from being dumped at the Spit.

*Selected types of industries were Food and Beverage, Rubber and Plastic Products, Leather, Textile, Paper and Allied, Printing, Publishing and Allied, Primary Metal, Metal Fabricating (except Machinery and Transportation Equipment), Machinery (except Electrical Machinery), Transportation Equipment, Electrical Products, Petroleum and Coal Products, Miscellaneous Manufacturing, Transportation as described in STANDARD INDUSTRIAL CLASSIFICATION MANUAL published by the Statistics Canada.

3. EXCAVATION SITES SAMPLING PROGRAM

3.1 Purposes

The purposes of this portion of the study were to:

1. characterize the quality of soil at the sources of material deposited at the Leslie Street Spit and to compare the quality of that material to the MOE Lakefill Quality Guidelines; and,
2. delineate, in an elementary manner, portions of the material at an excavation site considered unacceptable as lakefill.

3.2 Methodology

Soil samples were collected at eight active excavation sites and one stockpile. The sources were selected on the basis of the truck fill sampling program, which identified the sources of the fill and the frequency of arrival of trucks from them.

Six of the eight sources were classed as major sources of fill. Samples were collected at three representative locations at each of these sources. At the two minor sources and the one stockpile, only one location at each was sampled. At each location, composite samples were taken at the 0 to 25 centimetre interval, the 25 to 100 centimetre interval, and the 2 to 3 metre interval. The details of the sampling procedures are described in Appendix D. It should be noted that the depth of the excavations ranged from 1.5 to 10 metres. Consequently, the quality of up to 70 percent of the soil at some sites was not examined. In addition, the soil samples were collected at whatever excavation faces were available during the sampling program. The sampling locations were as representative as possible of the sources. However, the locations were not necessarily representative of the total soil volume that was excavated at a source. The results of the analyses are presented in Appendix F.

3.3 Results of Excavation Site Sampling Program

The following methods of categorizing soil quality were examined:

1. Utilizing the arithmetic mean calculated for each parameter based on the concentrations from all samples.
2. Utilizing the arithmetic mean calculated for each parameter from samples at a particular depth interval on a horizontal plane (i.e., the arithmetic mean of all samples from the same horizon).
3. Utilizing the arithmetic mean calculated for each parameter from all samples at a location on a vertical plane (i.e., the arithmetic mean of all samples from the same location).

Soil quality was assessed on the basis of the same parameters and categories used in Section 2, except total Kjeldahl nitrogen replaced total nitrogen.

Based on the foregoing, the following are assessments of the soil at each source. A comparison between source results and the truck fill results was attempted but, due to limitations of the sampling methodology and the resulting data, this comparison could not be accomplished. The contamination levels for the sites are presented in Table 3.

Yonge and Gerrard: This source was classified as High because of the mercury, lead, copper, and zinc concentrations. In the vertical plane, the soil at only Location 1 was rated as High (Table 4). In the horizontal plane, Horizons A and C were rated as High. The High ratings for Horizons A and C were caused primarily by the contamination at Location 1. The soils at Location 1 and Horizon C would be considered unacceptable as lakefill.

Pearl and University: This source was classified as High because of the mercury, lead, copper, zinc, chromium, and total phosphorus concentrations. In the horizontal plane, the soils in Horizons A and B (top one metre) were rated as High. In the vertical plane, the soils at all locations were rated as High due mainly to the contamination in Horizons A and B. Therefore, the soils in Horizon A and B would be considered unacceptable as lakefill.

Bathurst and Wellington: This source was classified as High because of the lead, arsenic, copper, zinc, and chromium concentrations. In the horizontal plane, Horizons A and B (top one metre) were rated as High. In the vertical plane the soil at Location 1 and 2 were rated

TABLE 3 - CONTAMINATION LEVELS - EXCAVATION SITES

<u>Site</u>	<u>Horizon</u>	<u>Location</u>			<u>Mean</u> <u>Classification²</u> <u>For Horizon</u>	<u>Mean</u> <u>Classification³</u> <u>for Site</u>
		1	2	3		
Yonge & Gerrard	A	H	N	L	H	
	B	H	N	N	N	H
	C	H	H	L	H	
	Mean for Location	H	N	N		
Pearl & University	A	H	H	H	H	
	B	H	M	H	H	H
	C	L	L	L	L	
	Mean for Location	H	H	H		
Bathurst & Wellington	A	H	H	H	H	
	B	H	H	N	H	H
	C	N	L	L	L	
	Mean for Location	H	H	N		
Rosehill	A	H	H	H	H	
	B	H	N	L	N	H
	C	M	N	N	N	
	Mean for Location	H	H	H		
Lakeshore* & Leslie	A	H	H	H	H	
	B	H	H	H	H	H
	C	H	H		H	
	Mean for Location	H	H	H		
Food Terminal	A	N	N	N	N	
	B	N	H	H	H	N
	C	N	N	N	N	
	Mean for Location	N	N	N		
Dundas and Jarvis	A	H			H	
	B	H			H	H
	C	L			L	
	Mean for Location	H				

TABLE 3 cont'd.

<u>Site</u>	<u>Horizon</u>	<u>Location</u>			<u>Mean</u> <u>Classification²</u> <u>For Horizon</u>	<u>Mean</u> <u>Classification³</u> <u>for Site</u>
		1	2	3		
Pearson	A	N			N	
	B	N			N	N
	C	N			N	
	Mean for Location	N				

- 1 Horizon A: 0-25 cm.
Horizon B: 25-100 cm.
Horizon C: 2-3 m.

- 2 Classification based on arithmetic mean concentrations of chemical parameters measured at three locations for major sites. The mean concentration for any of the other sites is the measurement at the one sampling location.

- 3 Classification based on arithmetic mean concentration of chemical parameters for all horizons and sampling locations.

Notes: H - High contamination level
M - Moderate contamination level
L - Light contamination level
N - Nil contamination level

*Lakeshore and Leslie Site: Horizon A: 0 - 25 cm.
B: 25-100 cm.
C: 1-1.5 m.

Because of shallow excavation depth, the sample for Horizon C at sampling Location 3 was omitted.

as High. These high ratings for Locations 1 and 2 was caused mainly by the contamination levels in Horizons A and B. Therefore, the soils in Horizons A and B would be considered unacceptable as lakefill.

Rosehill: This source was classified as High because of the lead, zinc, and total phosphorus concentrations. In the horizontal plane, only the soil in Horizon A (top 25 centimetres) was rated as High. In the vertical plane the soils at all three locations were rated as High. The High ratings were caused mainly by the contamination level in Horizon A. Soils at Location 1 and in Horizon A would be considered unacceptable as lakefill.

Lakeshore and Leslie: This source was classified as High because of the mercury, lead, cadmium, arsenic, copper, zinc, chromium, total phosphorus, and total Kjeldahl nitrogen concentrations. The High rating applied to all locations and at all horizons. Therefore, all the soil at this source would be considered unacceptable as lakefill.

Food Terminal: This source was classified as Nil. The soil in Horizon B was rated as High and thus would be considered unacceptable as lakefill.

Dundas and Jarvis: This source was classified as High because of the mercury, lead, PCB, cadmium, arsenic, copper, zinc, chromium, and total phosphorus concentrations. The soils in Horizons A and B (top one metre) were rated as High, and thus would be considered unacceptable for lakefill.

Pearson: This source was classified as Nil. Therefore it would be considered acceptable as lakefill.

Six of the eight sites had source classification of High. Four of these were on reclaimed or land currently classified as industrial.

4. CONCLUSION:

The following conclusions are derived from the assessment of the truck fill quality and the soils data for the excavation sources.

1. The THC visual and olfactory inspection of the truck fill brought onto the Leslie Street Spit was not effective in preventing highly contaminated materials from gaining access to the site.
2. The quality of the material from twenty four per cent of the truck loads sampled would be classified as Moderate or High.
3. The samples from the truck fill reflected the quality of the soils being excavated on those particular sampling days and did not necessarily reflect the overall quality of all soils at the excavation site. The truck fill data from this study did not allow an extrapolation to the quality of all materials deposited at the Spit.
4. In the truck fill data chromium was the parameter which most frequently exceeded the MOE Lakefill Quality Guidelines. Mercury, lead, nickel, copper, zinc and arsenic were the main parameters that contributed to the material ratings of Moderate or High.
5. Four of the thirteen sources contributing trucked material rated as Moderate or High were on reclaimed land or land currently classified as industrial. Six of the remaining nine sources not on such lands contributed minor amounts of fill to the Leslie Street Spit.
6. The excavated site samples do not represent the quality of all the material present at the site.
7. Of the eight excavation sites sampled, the source classification of six were High and two were Nil. The source classification system was deficient in that it did not accurately reflect site conditions. The horizontal and vertical classification systems provided a more accurate reflection of site conditions.
8. Four of the six sampled sources with a mean site classification of High were located on reclaimed land or land currently defined as industrial.

9. In general, a greater number of soil samples in the top one metre (Horizons A and B) were rated as High. Soils beneath the one metre depth were, with the exception of the Yonge and Gerrard source, the Rosehill source, and the Lakeshore and Leslie source, rated as Nil or Light.
10. The dominant parameters responsible for Moderate or High ratings at the excavation sites were mercury, lead, copper, and zinc.

5. RECOMMENDATIONS

To minimize the amount of unacceptable soils being used as lakefill, it is recommended that:

1. the present and past land use activities at potential lakefill sources should be established as the first step to locate lands where unacceptable soils could exist;
2. a soil sampling and testing program can be used to determine the acceptability as lakefill of the soils at those sources; and,
3. based on the sampling results, a source specific soil excavation plan can be developed.

APPENDIX A - THE MOE GUIDELINE FOR DREDGE SPOILS FOR
OPEN-WATER DISPOSAL, 1974

<u>Parameter</u>	<u>Levels</u>	
	<u>% Dry Wt.</u>	<u>mg/g</u>
Percent loss on ignition at 600°C (Organic Content)	6.0	
Chemical Oxygen Demand (COD)	5.0	50
Total Kjeldahl Nitrogen (as N)	0.2	2
Total Phosphorus (as P)	0.1	1
Oil and Grease (ether or chloroform solubles)	0.15	1.5
Total Mercury	0.00003	0.3 ug/g

*These guidelines are continually reviewed in the light of data being obtained from dredging projects on water quality and water use effects and in light of new information in the literature.

APPENDIX B - THE MOE GUIDELINES FOR DREDGE SPOILS FOR
OPEN-WATER DISPOSAL, 1978

VOLATILE SOLIDS	6%
(Loss on Ignition at 600°C)	
COD	5%
TOTAL KJELDAHL NITROGEN	0.2%
TOTAL PHOSPHORUS (As P)	0.1%
OIL AND GREASE	0. 15%
PCB's	0.05 ppm
MERCURY	0.3
LEAD	50 ppm
ZINC	100 ppm
IRON	10,000 ppm or 1%
CHROMIUM	25 ppm
COPPER	25 ppm
ARSENIC	8.0 ppm
CADMIUM	1.0 ppm
CYANIDE	0.1 ppm
AMMONIA	100 ppm
NICKEL	25 ppm
COBALT	50 ppm
SILVER	0.5 ppm

(Analyses must be on a dry weight basis (i.e. mg/g)).

APPENDIX C - THE MOE LAKEFILL QUALITY GUIDELINES

Materials to be used as fill at lakefill projects shall satisfy MOE's dredge spoils disposal guidelines for open-water disposal as outlined in MOE's Construction Handbook (1976).

The parameters to be analyzed for and the guideline for each are listed below:

Parameters Under Strict Control

1. Mercury*	0.3 ppm
2. Polychlorinated Biphenyls (PCBs)*	0.05 ppm
3. Lead*	50 ppm
4. Cadmium*	1.0 ppm
5. Oil and Grease*	1500 ppm
6. Volatile solids (loss on ignition at 600°C)	80,000 ppm
7. Total Phosphorus	1,000 ppm
8. Arsenic	8.0 ppm

Parameters to be Assessed on Case-by-Case Basis

9. Copper	25 ppm
10. Zinc	100 ppm
11. Total Kjeldahl Nitrogen	2,000 ppm
12. Chromium	25 ppm
13. Iron	40,000 ppm
14. Nickel	25 ppm
15. Cobalt	50 ppm
16. Silver	0.5 ppm
17. Cyanide	0.1 ppm
18. Ammonia	100 ppm

*High Priority Chemical Parameters; exceedance of any of these parameters would render materials unacceptable as lakefill.

APPENDIX D - TERM OF REFERENCE, TRUCK FILL SURVEY AND
EXCAVATION SITE SAMPLE COLLECTION

A. GENERAL

The work required involves the collection of field data and samples for chemical analysis. It is the field work component of a study to assess the quality of truck fill used in the construction of the East Headland of Toronto Harbour. Four major tasks are involved:

- conduct a truck fill source survey;
- collect samples of truck fill;
- collect samples of soil from active excavation sites;
- prepare a report on field activities.

B. TRUCK FILL SOURCE SURVEY

1. This survey will be conducted on four days during the month of February, 1982. Weather permitting, the survey days should be February 9, 16, 19 and 23.
2. Trucks will be stopped at a regular and predetermined interval. The sampling interval should be governed by the total number of fill-bearing trucks being received at the headland. Sampling interval should be adjusted by the contractor so as to:
 - a) achieve an even sampling during the sample day;
 - b) achieve the sampling of at least 100 trucks per day.
3. For each stopped truck, the contractor will conduct a survey to determine the source of the fill load.
4. It is expected that communication with truck drivers may be difficult. To help overcome this problem, the contractor should:
 - a) include a Portuguese and Italian speaking individual in the survey party;
 - b) have on hand a simple map of Metro Toronto.

C. TRUCK FILL SAMPLE COLLECTION

1. This sample collection will occur during the Truck Fill Source Survey outlined in B above.
2. Samples will be collected from stopped trucks when:
 - a) the identified fill source has not yet been sampled;
 - b) the identified fill source has been recorded ten times since the last fill samples was taken;
 - c) less than twenty samples have already been collected on that sample day.

3. Samples will be collected after the truck has dumped its load.
4. Samples should be collected into sample bottles which will be provided by the OMOE and in a manner which will optimize the representativeness of the sample.
5. Records of the fill source associated with each sample should be maintained.
6. Samples collected will be delivered to the Ontario Ministry of Environment Laboratory, on Resources Road in Rexdale.

D. EXCAVATION SITE FILL SAMPLE COLLECTION

1. Excavation sites will be selected for examination on the basis of the results of the first day of the truck fill source survey outlined in B above and will include the six largest fill sources and three smaller fill sources selected on a random basis.
2. For each large excavation site the contractor should collect at each of three locations:
 - a) a composite surface sample (0-25 cm);
 - b) a composite sample from the 2.5 cm-1.0 m depth;
 - c) a composite sample from the 2 m to 3 m depth.

These samples should be collected to ensure maximum representativeness of the material being excavated and transported to the east headland. If, because of operational constraints, the contractor is unable to collect samples at these depths, the contractor will collect samples as close as possible to these depths and record the sample collection depth.

3. For each smaller excavation site, the contractor will collect from one location:
 - a) one composite sample from the surface (0-25 cm) of the site;
 - b) one sample from 25 cm to 1 m depth;
 - c) one sample composite from 1 m segment the maximum depth of the excavation.
4. The contractor will collect additional samples from soil strata which, for reasons apparent in the field (and duly recorded and documented), he feels may be chemically contaminated.
5. The contractor will determine the areas, depth and volume of excavated material taken from each excavation site surveyed by inspection and/or discussion with the site engineer.

6. The contractor will photograph each excavation site sampled.
7. Samples collected will be delivered to the Ministry of Environment Laboratory on Resources Road in Rexdale.

E. REPORT PREPARATION

1. The contractor will produce one copy of a report which:
 - a) details the field procedures used in carrying out the activities outlined in A, B, C and D above;
 - b) summarizes the field data collected in A, B, C and D above;
 - c) includes the photographs taken at the excavation sites.

APPENDIX E: TRUCK FILL QUALITY TEST RESULTS

SOURCE	TRUCK	Hg	Pb	PCB	Cd	As	Cu	Zn	Cr (ppm)	Ni	TOC	TP	TKN	NH ₄ ⁺
Yonge & Gerrard	2	<0.01	4.8	<0.020	<0.3	7.3	21	49	44	23	6200	700	700	85
	38	<0.01	3.4	<0.020	<0.3	2.2	20	41	38	20	5700	710	590	89
	67	<0.01	3.8	<0.020	<0.3	2.5	23	50	43	24	4400	710	630	65
	2	<0.01	9.5	<0.020	<0.3	2.8	21	47	40	22	6900	710	590	72
	11	<0.01	3.5	<0.020	<0.3	2.8	21	48	32	20	5000	690	550	100
	31	<0.01	6.0	<0.020	<0.2	3.6	24	56	47	29	5200	810	740	71
	57	<0.01	5.5	<0.020	<0.2	2.8	24	57	46	28	5000	790	690	110
	16	<0.01	5.0	<0.020	<0.2	2.6	23	51	47	26	7800	650	730	86
	1	<0.01	3.0	<0.020	<0.2	0.95	7.2	13	10	5.3	2600	640	190	1.6
	38	<0.01	16.0	<0.020	<0.2	2.3	19	45	33	19	4700	700	540	22
Pearl & University	1	0.49	100	<0.020	<0.3	16	27	97	27	18	6300	1400	630	49
	17	<0.01	4.0	<0.020	<0.3	3.9	32	46	16	14	1300	680	390	9.2
	6	<0.01	7.8	<0.020	<0.2	4.1	24	49	26	20	3400	820	360	26
	47	<0.01	<3.0	<0.020	<0.2	3.4	22	42	15	12	N.D.*	650	290	4.8
	17	<0.01	4.5	<0.020	<0.2	4.8	25	51	22	18	1200	730	300	32
	48	0.19	84	<0.020	<0.2	7.1	27	70	20	14	9500	1100	570	6.3
Bathurst & Wellington	3	<0.01	6.0	<0.020	<0.3	12	20	52	38	20	3100	750	590	17
	9	<0.01	6.0	<0.020	<0.3	4.1	19	49	39	20	3200	730	490	17
	59	<0.01	<3.0	<0.020	<0.3	2.1	20	46	32	20	2900	770	490	18
	25	<0.01	5.0	<0.020	<0.2	2.6	20	47	31	22	4500	690	510	24
	60	<0.01	8.3	<0.020	<0.2	2.5	23	57	39	26	5900	770	580	73
	3	<0.01	3.8	<0.020	<0.2	3.0	22	45	28	20	6200	730	480	18
	10	<0.01	<3.0	<0.020	<0.3	2.8	24	57	57	29	4900	760	820	23
Bloor & Jarvis	64	0.15	28	<0.020	<0.3	6.8	26	82	31	21	5700	880	570	0.50
	27	<0.01	7.3	<0.020	<0.2	2.9	22	51	29	21	3400	830	490	19
	9	<0.01	5.5	<0.020	<0.2	2.4	22	50	29	19	4500	770	490	20
	7	1.3	68	<0.020	<0.3	10	27	76	28	18	1000	770	630	15
Rosehill	6	<0.01	4.0	<0.020	<0.3	1.5	7.1	19	13	6.4	1800	690	140	0.80
	1	<0.01	<3.0	<0.020	<0.3	0.97	8.7	18	10	5.8	1300	700	400	0.37
	1	<0.01	2.0	<0.020	<0.2	1.2	6.5	12	7	4	760	690	210	<0.30
Food Terminal	43	<0.01	5.5	<0.020	<0.2	2.2	15	30	13	11	4300	690	310	0.21
	2	<0.01	8.0	<0.020	<0.2	1.6	12	26	10	6.2	2500	800	350	0.25
Parliament & Front	5	0.04	60	<0.020	<0.2	2.8	20	200	16	9.2	19000	620	430	<0.10

* not detected

APPENDIX E: TRUCK FILL QUALITY TEST RESULTS (continued)

SOURCE	TRUCK	Hg	Pb	PCB	Cd	As	Cu	Zn (ppm)	Cr	Ni	TOC	TP	TKN	NH ₄ ⁺
Lakeshore & Leslie	9	0.39	320	<0.020	0.5	47	72	180	17	11	1400	790	580	<0.10
	7	0.09	480	<0.020	0.4	230	160	120	18	6.0	1800	800	430	<0.30
Pearson	3	<0.01	5.8	<0.020	<0.2	3.2	19	41	23	17	4300	720	720	0.31
	4	<0.01	<3.0	<0.020	<0.2	2.4	16	31	16	12	3600	630	330	2.0
Dupont & Davenport	61	<0.01	<3.0	<0.020	<0.3	1.3	10	20	12	7.4	2600	720	160	0.70
	4	<0.01	7.6	<0.020	<0.3	1.8	14	33	17	12	5600	740	300	<0.40
	6	<0.01	<3.0	<0.020	<0.2	0.96	7.8	19	9.5	5.0	6100	540	190	<0.30
	33	<0.01	3.5	<0.020	<0.2	1.5	12	30	18	8.1	5900	730	270	0.54
Dundas & Jarvis	12	<0.01	4.8	<0.020	<0.3	2.5	15	39	27	16	460	850	550	20
	24	<0.01	19	<0.020	<0.2	2.9	21	55	27	18	5100	720	560	2.2
	11	0.02	12	<0.020	<0.2	2.8	20	45	24	16	4000	750	410	0.27
King & Bathurst	15	<0.01	15	<0.020	<0.2	2.8	20	75	27	16	5500	790	540	3.2
Bathurst & Lakeshore	18	<0.01	<3.0	<0.020	<0.3	2.5	6.6	26	13	3.9	N.D.*	340	160	0.30
	75	<0.01	89	<0.020	<0.2	2.5	36	88	12	8.8	76000	490	590	<0.30
Queen's Park	23	0.10	82	<0.020	<0.3	5.1	18	70	18	10	2300	1200	2200	0.72
	76	0.19	4.3	<0.020	<0.2	1.3	10	26	15	9.3	1700	640	400	<0.30
	29	<0.01	4.5	<0.020	<0.2	2.1	19	42	30	17	49000	740	590	33
Toronto Public Works	88	0.41	1100	0.787	12	15	150	560	33	31	83000	890	180	8.6
Christie & Dupont	24	<0.01	5.8	<0.020	<0.2	2.5	23	49	29	20	2500	810	440	0.36
Warden & Eglinton	57	<0.01	<3.0	<0.020	<0.2	78	3.0	4.6	3.0	<2.0	N.D.*	70	120	<0.40
Victoria & Dundas	19	0.25	260	<0.020	0.25	4.9	29	120	18	9.2	35000	810	810	0.29
CNE	42	0.06	38	<0.020	<0.2	5.5	30	89	28	21	26000	810	720	0.65

* not detected

APPENDIX E: TRUCK FILL QUALITY TEST RESULTS (continued)

SOURCE	TRUCK	Hg	Pb	PCB	Cd	As	Cu	Zn	Cr	Ni	TOC	TP	TKN	NH ₄ ⁺
								(ppm)						
Dundas & University	62	0.04	6.4	<0.020	<0.2	2.8	19	56	30	17	1200	1000	710	1.4
Dundas & Spadina	32	0.14	50	0.053	<0.2	2.5	70	210	26	14	4100	800	570	0.54
Booth & Eastern	73	0.09	58	<0.020	<0.3	3.2	22	74	21	12	11000	1000	530	1.2
Addington & Vaughan	21	<0.01	<3.0	<0.020	<0.3	0.47	5.0	8.2	6.8	2.1	1100	550	130	0.61
	14	<0.01	<3.0	<0.020	<0.2	0.23	4.8	8.6	5.5	<2.0	1100	540	140	0.20
Jane & Annette	22	<0.01	3.3	<0.020	<0.2	1.0	8.8	13	4.0	3.5	3800	550	120	<0.20
Roncesvalles & Pearson	7	<0.01	7.9	0.023	<0.3	2.8	14	34	18	11	6100	760	410	<0.30
Laird Drive	70	<0.1	8.0	<0.020	<0.2	2.5	15	28	12	8.5	3500	530	250	<0.20
Comstock	13	<0.01	3.5	<0.020	<0.2	0.75	6.8	18	11	4.0	5400	400	230	<0.10
Dufferin & Peel	25	0.03	16	<0.020	<0.2	2.5	14	38	18	8.2	6600	800	480	<0.30
River & King	28	<0.01	6.4	<0.020	<0.2	2.3	19	44	21	16	6600	720	520	16
Danforth & Dupont	44	<0.01	6.6	<0.020	<0.2	1.5	5.0	17	9.5	4.6	6600	770	230	0.52
College & Brunswick	79	<0.01	47	<0.020	<0.2	2.2	20	53	18	12	3700	700	310	<0.40
College & Grace	7	<0.01	5.8	<0.020	<0.2	1.9	15	39	22	15	2500	850	300	0.52
Bay & Elm	8	<0.01	7.0	<0.020	<0.2	1.0	10	27	13	7.5	1000	510	310	1.6
St. Clair & Dufferin	14	<0.01	10	<0.020	<0.2	1.5	12	36	11	6.6	9700	580	450	0.30
Leslie & Finch	17	<0.01	4.5	<0.020	<0.2	1.7	13	30	15	9.4	4200	670	330	0.65
York & King	19	0.04	44	<0.020	<0.2	6.6	20	51	13	5.8	30000	460	420	1.5
Queen & Bay	51	0.08	8.5	<0.020	<0.2	2.3	16	40	20	11	4900	950	310	0.27
Glengrove & Dundas	56	<0.01	8.5	<0.020	<0.2	2.6	16	34	19	12	1500	750	320	0.35
St. Clair & Vaughan	27	<0.01	<3.0	<0.020	<0.3	1.4	7.6	19	12	6.8	570	810	320	<0.04
Western & St. Clair	40	<0.01	41	<0.020	<0.3	2.1	26	68	12	7.8	1100	780	360	1.8
Dufferin & Davenport	46	<0.01	<3.0	<0.020	<0.3	2.1	13	25	14	8.9	1500	660	270	5.8
Eglinton & Walmer	72	<0.01	5.3	<0.020	<0.3	2.1	11	34	14	8.8	4500	540	280	0.40
Woodbine & Mortimer	74	<0.01	3.2	<0.020	<0.3	1.0	4.0	12	8.2	4.3	1500	730	250	<0.30
X	Feb.16	3.4	2300	-	1.4	460	360	690	62	30	6800	1200	1300	1.2
	Feb.19	1.7	6100	0.022	1.9	7.3	340	990	39	24	160000	1500	4600	<0.10

Appendix F - - SOILS TESTS RESULTS FOR EIGHT ACTIVE EXCAVATION SITES

			Hg	Pb	PCB	Cd	As	Cu	Zn	Cr	Ni	CN	TOC	TP	TKN	NH ₄
			ppm													
MOE Guideline			0.3	50	0.05	1.0	8.0	25	100	25	25	0.1		1000	2000	100
Site	Location	Horizon														
Yonge & Gerrard	1	A	0.89	1000	0	2.5	11.4	120	370	22	10	0.05	29000	900	1100	2
		B	0.5	49	0	0.2	2.2	15	38	13	7	0.05	14000	800	500	1
		C	2.7	290	0	1.3	14.4	280	770	15	35	0.05	58000	900	800	3
	2	A	0.19	14	0	0.2	1.9	11	49	17	6	0.05	21000	1000	1500	4
		B	0.14	23	0	0.2	1.2	8	19	10	3	0.05	3800	900	500	1
		C	0.07	88	0	0.2	3.8	55	100	18	8	0.05	14000	600	800	6
	3	A	0.03	10	0	0.2	14.1	13	39	16	10	0.05	2300	700	400	3
		B	0.03	4	0	0.2	1.9	16	34	20	15	0.05	0	700	300	4
		C	0.01	3	0	0.2	2.4	23	49	42	24	0.05	6300	800	700	96
	Mean For Horizon	A	0.37	341	0	1.0	9.1	48	153	18	9	0.05	17400	900	1000	3
		B	0.22	25	0	0.2	1.8	13	30	140	8	0.05	5930	800	430	2
		C	0.93	127	0	0.6	6.9	119	306	25	22	0.05	26100	770	770	35
Mean for Site			0.51	164	0	0.6	5.9	60	163	19	13	0.05	16500	823	733	13
Rubble Mound			0.25	120	0.03	0.2	3.7	17	420	12	8	0.05	1100	400	300	1

Appendix F - - Cont'd.

Site	Location	Horizon	Hg	Pb	PCB	Cd	As	Cu	Zn	Cr	Ni	CN	TOC	TP	TKN	NH ₄
Pearl & University	1	A	3.2	340	0	0.2	17.0	280	300	25	20	0.02	110000	5000	2300	4
		B	10	370	0	0.3	13.3	100	290	34	22	0.02	96000	4700	2900	71
		C	0.01	6	0	0.2	2.8	24	52	26	19	0.02	5500	700	700	88
	2	A	0.99	35	0	0.2	2.9	20	69	23	14	0.02	15000	900	900	1
		B	0.11	19	0	0.2	2.9	26	60	28	20	-	8100	1000	700	1
		C	0.01	8	0	0.2	3.4	24	55	28	21	-	2700	700	700	0
	3	A	1.1	190	0	0.2	3.6	66	120	25	14	-	12000	1700	1100	0
		B	0.7	160	0	0.2	2.6	24	62	20	13	-	6700	1100	700	0
		C	0.1	6	0	0.2	3.7	24	58	29	23	-	3800	800	500	0
	Mean for Horizon	A	1.76	188	0	0.2	7.8	122	163	24	16	-	45700	2530	1430	2
		B	3.60	183	0	0.2	6.3	50	137	27	19	-	36900	2270	1430	0
		C	0.04	7	0	0.2	3.3	24	55	28	21	-	4000	730	630	0
	Mean for Site		1.80	126	0	0.2	5.8	65	118	26	19	-	28900	1840	1160	1

Appendix F - - Cont'd.

Site	Location	Horizon	Hg	Pb	PCB	Cd	As	Cu	Zn	Cr	Ni	CN	TOC	TP	TKN	NH+ 4
										ppm						
Bathurst & Wellington	1	A	0.38	710	0	3.4	13.3	300	1000	54	31	0.02	61000	300	1000	0
		B	1.0	1200	0	1.7	15.5	290	1200	77	31	0.02	88000	1000	1400	1
		C	0.01	11	0	0.2	3.0	20	58	25	16	0.02	1300	800	300	0
	2	A	0.37	330	0	0.8	25.6	61	490	30	16	0.02	41000	1400	1900	1
		B	0.3	190	0.028	0.3	6.6	43	200	30	15	0.02	25000	1200	1700	0
		C	0.01	8	0	0.2	3.6	23	56	31	22	0.02	4600	700	500	0
	3	A	0.1	100	0	0.3	3.9	40	100	16	9	0.02	11000	800	900	0
		B	0.01	26	0	0.2	1.6	10	37	12	6	0.02	17000	600	400	0
		C	0.01	6	0	0.2	2.8	22	51	27	20	0.02	5500	700	500	0
	Mean for Horizon	A	0.28	380	0	1.5	14.3	140	530	33	19	0.02	37700	830	1270	0
		B	0.44	472	0.009	0.7	7.9	114	496	40	17	0.02	43300	930	1170	0
		C	0.01	8	0	0.2	3.1	22	55	28	19	0.02	3800	730	430	0
Mean for Site			0.24	287	0.003	0.8	8.4	92	360	34	18	0.02	28300	830	957	0

Appendix F- - Cont'd.

Site	Location	Horizon	Hg	Pb	PCB	Cd	As	Cu	Zn	Cr	Ni	CN	TOC	TP	TKN	NH ₄
ppm																
Rosehill	1	A	0.37	220	0.050	0.6	5.5	31	240	26	15	-	34000	1300	2800	2
		B	0.31	59	0	0.2	3.1	15	87	20	11	-	15000	1300	800	0
		C	0.14	36	0	0.2	7.8	30	66	22	18	-	13000	1400	1000	0
	2	A	0.66	260	0	0.4	6.8	25	200	23	14	-	28000	1100	1800	1
		B	0.28	47	0	0.2	-	17	84	25	16	-	-	-	-	-
		C	0.01	6	0	0.2	2	12	30	13	9	-	690	700	300	0
	3	A	0.24	150	0	0.5	7.2	24	160	24	15	-	22000	1200	2000	1
		B	0.02	14	0	0.2	3.8	23	51	28	20	-	4100	700	600	0
		C	0.01	3	0	0.2	1.6	11	21	10	8	-	4300	700	300	0
	Mean for Horizon	A	0.42	210	0.017	0.5	6.5	27	200	24	15	-	28000	1200	2200	1
		B	0.20	40	0	0.2	-	18	74	24	19	-	9550	-	-	0
		C	0.05	15	0	0.2	3.8	18	39	15	12	-	6000	930	530	0
	Mean for Site		0.22	88	0.006	0.3	5.2	21	104	21	15	-	14500	1065	1415	0

Appendix F - - Cont'd.

Site	Location	Horizon	Hg	Pb	PCB	Cd	As	Cu	Zn	Cr	Ni	CN	TOC	TP	TKN	NH+ 4
ppm																
Lakeshore & Leslie	1	A*	0.71	960	0	1.9	300.8	170	230	21	11	0.58	25000	900	1000	2
		B	0.15	230	0	0.2	30.2	71	150	16	10	0.03	8300	800	500	1
		C	1.5	750	0	2.9	52.9	240	1400	37	34	0.02	73000	1500	3400	70
	2	A	0.37	3300	0	3.2	87.0	260	11	32	27	0.06	97000	2100	4300	15
		B	9.0	1800	0	7.2	701.8	560	820	43	18	0.12	42000	1600	2100	30
		C	2.1	2500	0	4	178.2	380	1700	42	29	0.24	59000	1800	1800	4
	3	A	19	1000	0	1.6	1055	570	510	28	17	0.08	75000	1100	1300	1
		B	0.56	1100	0	1.7	1862	960	670	36	23	0.06	40000	1800	1300	1
	Mean for Horizon	A	6.69	1753	0	2.2	481	333	250	27	18	0.24	65700	1370	2200	6
		B	3.24	1043	0	3.0	865	527	547	32	17	0.07	30100	1400	1300	11
		C	1.8	1625	0	3.4	235	310	1550	40	32	0.13	66000	1650	2600	37
Mean for Site			3.91	1474	0	2.9	527	390	782	33	22	0.15	53900	1470	2030	18

* Horizon A: 0-25 cm; Horizon B: 25-100 cm; Horizon C: 100-150 cm; Shallow excavation; No Horizon C for Location 3

Appendix F - - Cont'd.

Site	Location	Horizon	Hg	Pb	PCB	Cd	As	Cu	Zn	Cr ppm	Ni	CN	TOC	TP	TKN	NH+ 4
Food Terminal (at Queensway & Parklawn)	1	A	0.01	29	0	0.2	4.6	16	59	20	13	0.02	20000	900	1700	1
		B	0.01	11	0	0.2	2.3	15	40	15	9	0.02	4800	900	600	0
		C	0.01	3	0.029	0.2	2.4	13	25	12	8	0.02	2000	800	300	4
	2	A	0.01	7	0.022	0.2	3.4	17	38	16	12	0.02	2300	800	400	1
		B	0.01	120	0	0.5	3.5	17	70	14	9	0.02	10000	800	700	1
		C	0.01	3	0	0.2	2.0	11	21	10	6	0.02	1700	900	300	1
	3	A	0.01	48	0	0.2	2.4	14	41	12	7	0.02	16000	900	700	1
		B	0.01	70	0	0.2	2.6	14	40	12	7	0.02	16000	800	700	12
		C	0.01	5	0	0.2	2.4	20	45	18	16	0.02	3600	800	300	6
	Mean for Horizon	A	0.01	28	0.007	0.2	3.6	16	46	16	11	0.02	12800	870	930	1
		B	0.01	67	0	0.3	2.8	15	50	14	8	0.02	10300	830	670	4
		C	0.01	4	0.010	0.2	2.3	15	30	13	10	0.02	2430	830	300	4
Mean for Site			0.01	33	0.006	0.2	2.9	15	42	14	10	0.02	8510	843	633	3

Appendix F - - Cont'd.

Site	Location	Horizon	Hg	Pb	PCB	Cd	As	Cu	Zn	Cr	Ni	CN	TOC	TP	TKN	NH ₄
											ppm					
Jarvis & Dundas	1	A	0.72	860	0.275	3	18.9	60	2100	30	17	0.05	35000	2300	1700	3
		B	0.32	160	0	0.2	2.2	20	160	21	10	0.05	21000	1600	900	2
		C	0.01	6	0	0.2	3.9	23	52	30	20	0.05	2100	800	600	73
	Mean for Site		0.35	342	0.0922	1.1	8.3	34	771	27	16	0.05	19400	1570	1070	26
Pearson (Sewer Trench)	1	A	0.01	3	0	0.2	1.1	6	9	5	3	0.03	1900	500	300	0
		B	0.01	3	0	0.2	1.9	16	28	21	12	0.02	1200	600	300	0
		C	0.01	5	0	0.2	2.6	18	37	18	16	0.02	4200	700	400	1
	Mean for Site		0.01	4	0	0.02	1.9	13	25	15	10	0.02	2430	600	330	0

APPENDIX G - - SOIL TEST RESULTS, CITY OF TORONTO, PUBLIC WORKS STOCK
PILE SITE AT EASTERN AND BOOTH

			Hg	Pb	PCB	Cd	As	Cu	Zn	Cr	Ni	CN	TOC	TP	TKN	NH ₄
			ppm													
MOE Guideline			0.3	50	0.05	1.0	8.0	25	100	25	25	0.1		1000	2000	100
Site	Location	Horizon														
Eastern & Booth	1	1	0.14	190	0	0.2	10.4	10	170	18		2.0+	21200	800	6000	420
		2	0.01	19	0	0.2	2.2	11	27	9	48	0.9	4700	700	500	1
		3	0.04	28	0	0.2	2.9	11	31	8	35	2.0	6470	800	700	12
Mean for Site			0.06	79	0	0.2	5.2	11	76	12	42	1.6	1080	770	2400	144