St. Lawrence Testing
& Inspection Co. Ltd.

Totten Sims Hubicki & Assoc. Ltd.

Lancaster Water Intake

Environmental Investigation

18

St. Lawrence Testing & Inspection Co. Ltd.

P.O. Box 997, Cornwall, ON, Canada K6H 5V1
814 Second Street W., Phone (613) 938-2521
E-mail: slt@ontarioeast.net Fax (613) 938-7395

March 24, 2000

Mr. Michael Gundry
Totten Sims Hubicki & Assoc. Ltd.
300 Water St.
Whitby, ON
L1N 2C3

RE: Lancaster Water Intake
Environmental Investigation
Report No. 00C38

Dear Mr.Gundry:

In accordance with verbal instructions received from you, this report is submitted, outlining the results of an environmental investigation carried out off Faulkner's Point in South Lancaster, Ontario.

A) DESCRIPTION OF FIELD WORK

The field work was initially supposed to take place on March 16, 2000 but got postponed due to the tugboat getting damaged on a rock South West of the Lancaster dock. Work took place on Sunday, March 19, 2000.

The method of work was to use a tug work boat, barge and track shovel on a barge from West Front Construction Ltd. Supervision was by the undersigned environmental/geotechnical engineer.

From the plan faxed to us, we lined up the intake line parallel to the West side of Faulkner's Point. We then estimated distances of 300 m., 600 m., and 900 m. and dug test pits at each location. Essentially at each location, we

excavated to a depth of 0.90 m. and took samples at depths from 0 to 0.90 m. from the sample in the bucket. A large composite sample was placed and sealed in a plastic bag at each location. Thereafter, the excavation was done to the extent of reach or ability to dig of the track shovel, and the stratigraphy was recorded based on the river level.

On immediate return from the site to our laboratory, we filled and sealed 3, 375 ml. jars for each test pit and put the jars in the refrigerator. The remaining samples were tested for grain size analyses, the results of which are attached.

We then plotted the estimated locations on the depth chart plan given to us. We altered the final locations on the chart to correspond to the depth of water recorded on the boat. Test Pits 1 and 2 were close to the intended locations and Test Pit 3 was moved 50 m. North. The locations are shown on the depth chart sketch attached to this report.

The environmental samples were packaged in a refrigerated cooler and sent to Philip Analytical Services of Mississauga, Ontario for tests to note heavy metals, PAH's EPA Priority Pollutant Pesticides and PCB's. The requested turnover was super rush. All samples were received by Philip on March 21 and all results were faxed by late afternoon March 23, 2000. Copies of the results are attached. Also attached is MOEE Table A - Surface Soil in a Potable Groundwater Condition and Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario.

On a point of interest, Allan McDonald from West Front Construction indicated on March 23, 2000 that the sewer outfall pipe was installed this week by directional boring and this operation went well. This was slightly downstream from the proposed intake pipe.

B) DISCUSSION

The test results are attached as well as some appropriate guidelines. You may have more guidelines that you want to compare to.

All test results fall below the Table A Guidelines.

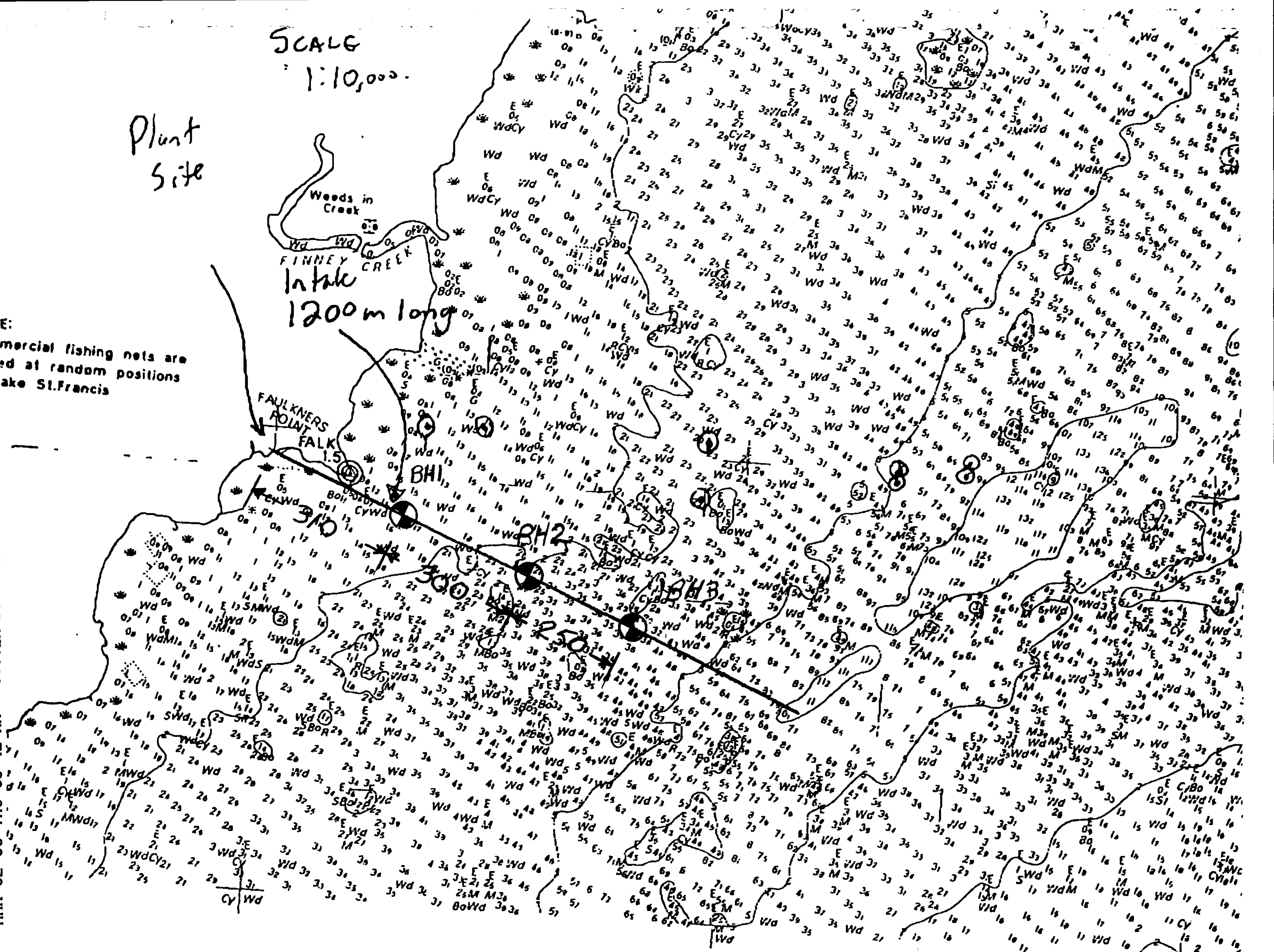
For the Aquatic Sediment Quality Guidelines, we noted that for Sample S1, the phosphorus content is slightly above the lowest effect level and for Sample S3, the DDE content is slightly above the lowest effect level.

Respectfully submitted
ST. LAWRENCE TESTING & INSPECTION CO. LTD.

REGISTERED PROFESSIONAL ENGINEER
G. G. McINTEE
PROVINCE OF ONTARIO

G.G. McIntee, P. Eng.
GGM:njw

Attachments


SCALE
1:10,000
Plant
Site
Weeds in
Creek
FINNEY CREEK
Intake
1200m long
E:
mercial fishing nets are
ed at random positions
ake St.Francis
FAULKNERS
POINT
FALK
1.5
BH1
BH2
BH3
310
300
250

St. Lawrence Testing & Inspection Co. Ltd.

OFFICE BOREHOLE RECORD

REPORT NO. 00C38

CLIENT Totten Sims Hubicki & Assoc. Ltd. BOREHOLE NO. 1

LOCATION Lancaster - River off Faulkner's Pt. CASING

DATE OF BORING March 19, 2000 DATE OF WL READING DATUM

DEPTH	ELEVATION / DEPTH	SOIL DESCRIPTION	STRAT. PLOT	WATER CONDITIONS	SAMPLES: CONDITION	TYPE	NUMBER	RECOVERY	N - VALUE	LABORATORY TESTS PERFORMED	LAB TEST RESULTS
0		River									WATER CONTENT & ATTERBERG LIMITS. WP W WL
1											DYNAMIC PENETRATION TEST BLOWS PER FOOT. . K . . . 0 20 40 60 80
2	1.9	Silty Fine Sand Grey, wet, loose									
3	3.1	Silty Clay Grey, wet, soft									
	3.7	Termination of test pit									
4											
5											

APPENDIX

St. Lawrence Testing & Inspection Co. Ltd.

OFFICE BOREHOLE RECORD

REPORT NO. 00C38

CLIENT Totten Sims Hubicki & Assoc. Ltd. BOREHOLE NO. 2

LOCATION Lancaster - River off Faulkner's Pt. CASING

DATE OF BORING March 19, 2000 DATE OF WL READING DATUM

DEPTH	ELEVATION DEPTH	SOIL DESCRIPTION	STRAT. PLOT	WATER CONDITIONS	SAMPLES: CONDITION	TYPE	NUMBER	RECOVERY	N - VALUE	LABORATORY TESTS PERFORMED
0		River								
1										
2										
	2.2	Silty Fine Sand Grey, wet, loose								
3										
	3.4	Silty Clay Grey, wet, soft								
4	4.0	Termination of test pit								
5										

LAB TEST RESULTS

WATER CONTENT & ATTERBERG LIMITS.
WP W WL

DYNAMIC PENETRATION TEST BLOWS PER FOOT. . .K . . .
0 20 40 60 80

APPENDIX

St. Lawrence Testing & Inspection Co. Ltd.

OFFICE BOREHOLE RECORD

REPORT NO. 00C38

CLIENT Totten Sims Hubicki & Assoc. Ltd. BOREHOLE NO. 3

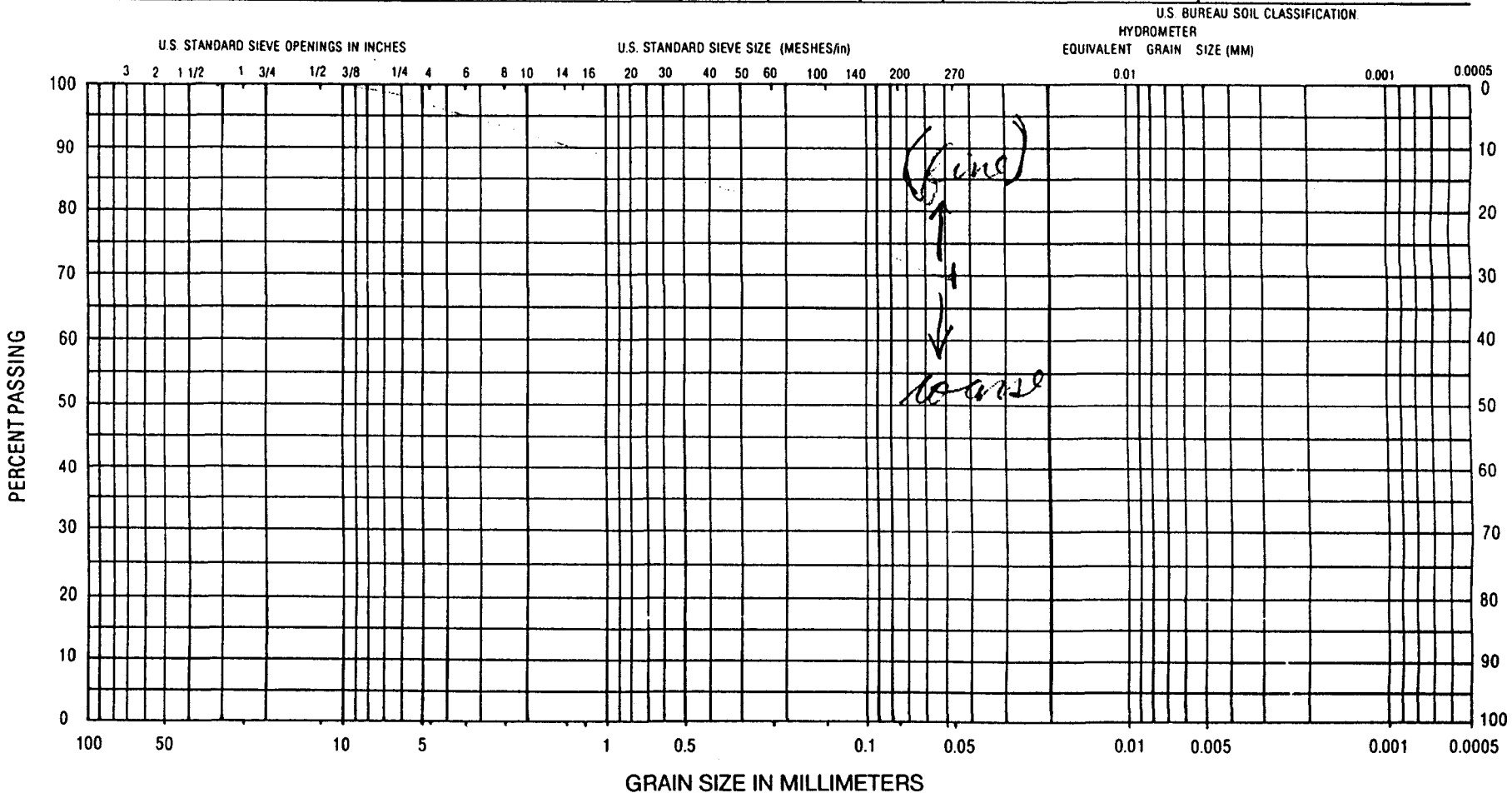
LOCATION Lancaster - River off Faulkner's Pt. CASING

DATE OF BORING March 19, 2000 DATE OF WL READING DATUM

SOIL PROFILE					SAMPLES					LABORATORY TESTS PERFORMED	LAB TEST RESULTS
DEPTH	ELEVATION DEPTH	SOIL DESCRIPTION	STRAT. PLOT	WATER CONDITIONS	CONDITION	TYPE	NUMBER	RECOVERY	N - VALUE		WATER CONTENT & ATTERBERG LIMITS. WP W WL
0		River									DYNAMIC PENETRATION TEST BLOWS PER FOOT. . K . . . 0 20 40 60 80
3	2.9	Silty Fine Sand Grey, wet loose									
4	4.1	Termination of test pit									
5											

APPENDIX

GRAVEL		FINE GRAVEL	SAND				SILT	CLAY
			Coarse	Medium	Fine	Very Fine		



GRAVEL		SAND			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		

UNIFIED CLASSIFICATION (ASTM D 2487)

BOREHOLE No. SAMPLE No. DEPTH DESCRIPTION

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REPORT NO.

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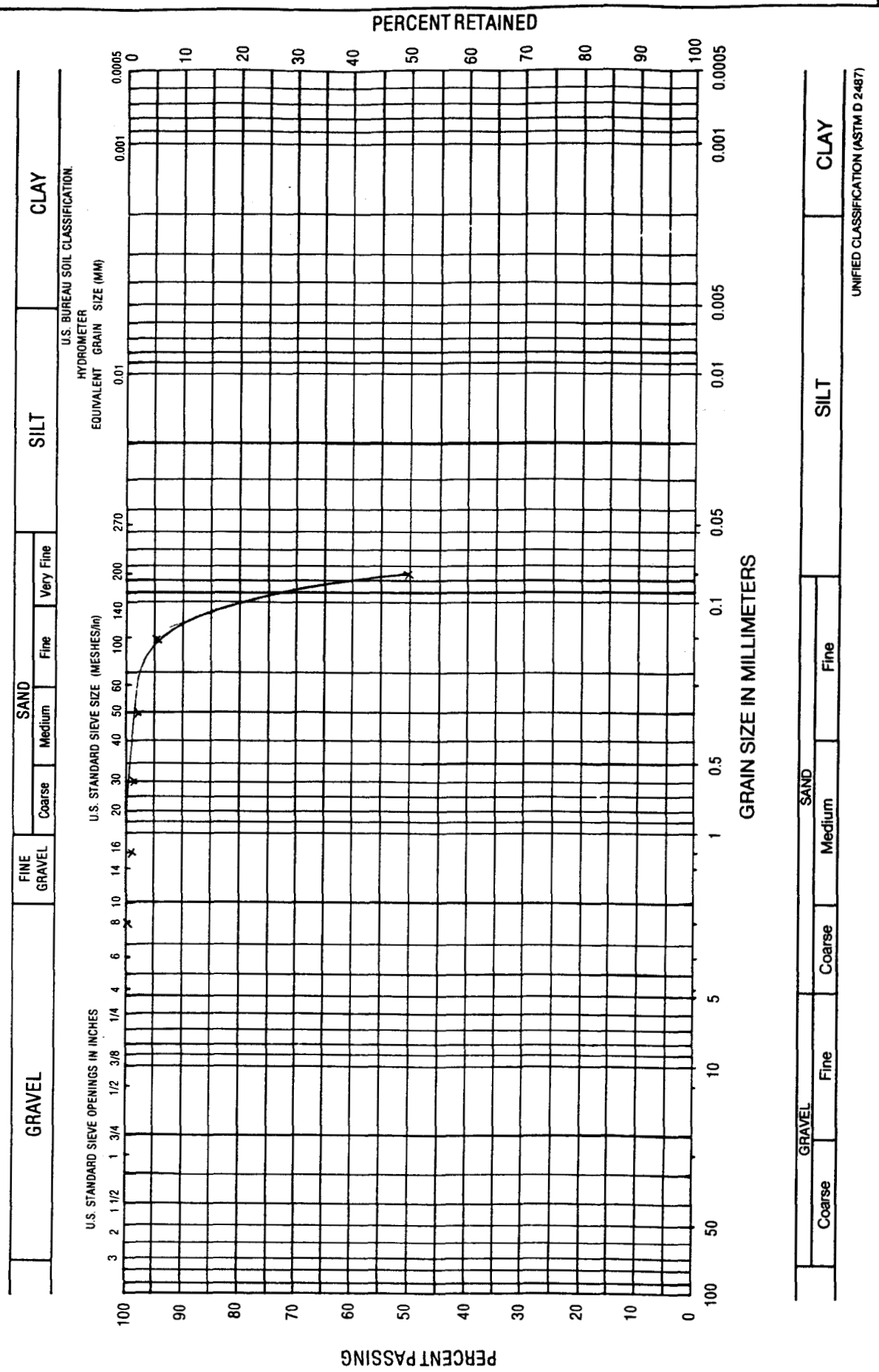
GRAIN SIZE DISTRIBUTION

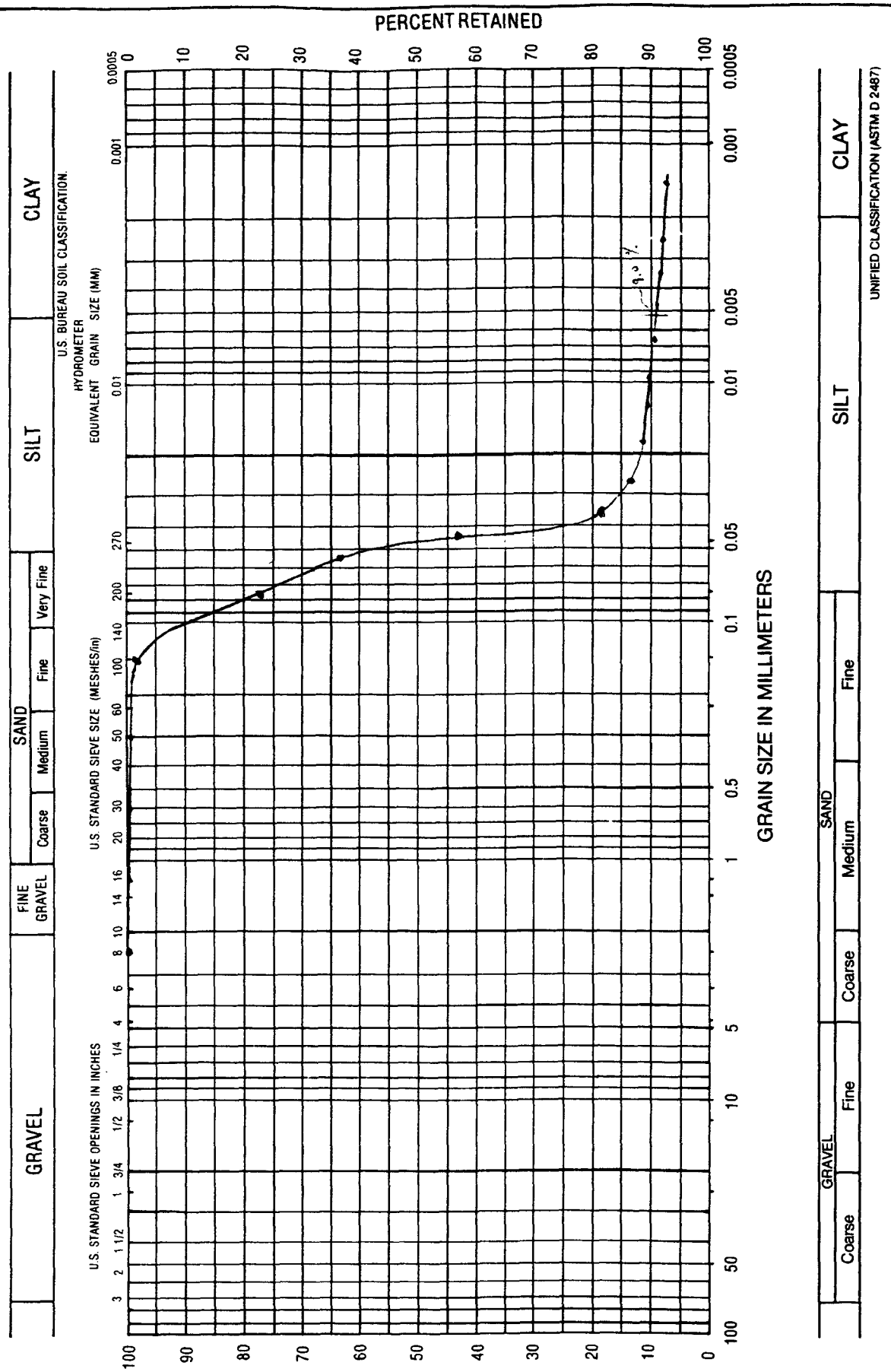
REPORT NO. 00C38



St. Lawrence Testing & Inspection Co. Ltd.

GRAIN SIZE DISTRIBUTION

REPORT NO.
00C38

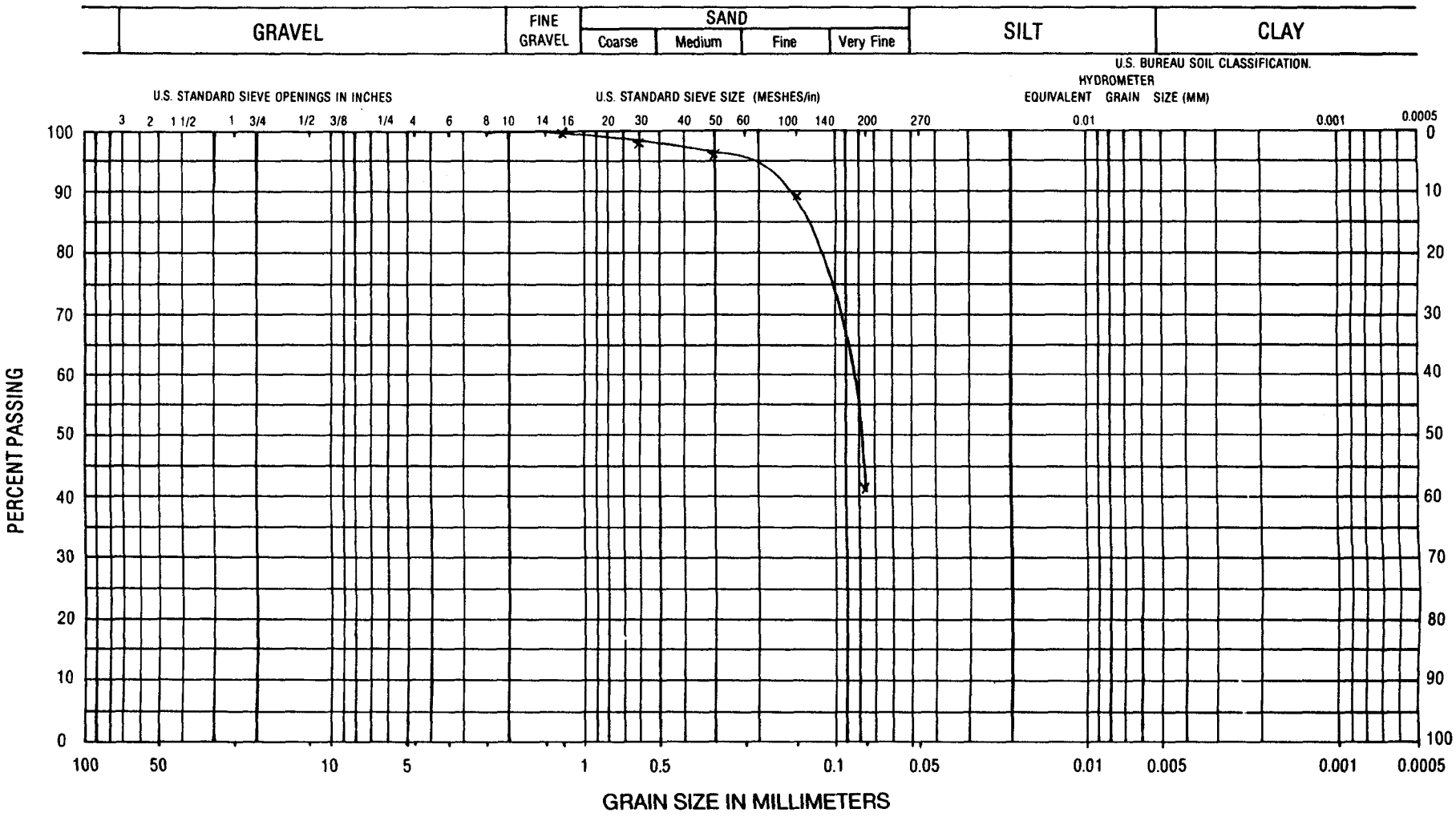


BOREHOLE No. 2

SAMPLE No.

DEPTH 0 - 0.9 m.

DESCRIPTION Fine sand & silt



GRAVEL		SAND			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		

UNIFIED CLASSIFICATION (ASTM D 2487)

BOREHOLE No.	SAMPLE No.	DEPTH	DESCRIPTION
3		0.90 m.	Silty fine sand

St. Lawrence Testing & Inspection Co. Ltd.

GRAIN SIZE DISTRIBUTION

REPORT NO. 00C38

Philip Analytical Services Corp

Report of Analysis

Client : St.Lawrence Testing&Inspection Co.Ltd.
Contact: G.G. McIntee

Report Date: March 22/2000
Lab Ref # : G201083
Lab Quote #: L8010011

Analysis of Soil, expressed on a dry weight basis

Client Ref#: TSH-LANCASTE

Parameter	EQL	Units	TSL S1	TSL S1 Replicate	TSL S2	TSL S3	
Mercury	0.01	mg/kg	nd	nd	nd	0.01	
Arsenic	0.5	mg/kg	nd	nd	nd	0.6	
Selenium	0.2	mg/kg	0.2	0.2	0.2	0.2	
Total Kjeldahl Nitrogen(as N)	30.0	mg/kg	392	392	224	392	
Aluminum	20.0	mg/kg	4440	4630	4280	3750	
Barium	5.0	mg/kg	27.9	28.2	27.2	22.8	
Beryllium	0.2	mg/kg	nd	nd	nd	nd	
Cadmium	0.3	mg/kg	nd	nd	nd	nd	
Chromium	1.0	mg/kg	14.7	15.5	14.0	10.5	
Cobalt	2.0	mg/kg	2.7	2.0	2.5	2.8	
Copper	1.0	mg/kg	5.4	6.0	5.2	4.2	
Iron	50.0	mg/kg	7400	7630	7110	5800	
Lead	5.0	mg/kg	nd	nd	nd	nd	
Manganese	1.0	mg/kg	94.2	99.0	90.0	78.5	
Molybdenum	2.0	mg/kg	nd	nd	nd	nd	
Nickel	2.0	mg/kg	8.1	8.9	7.4	5.4	
Phosphorus	20.0	mg/kg	632	583	534	545	
Silver	0.8	mg/kg	nd	nd	nd	nd	
Titanium	1.0	mg/kg	223	247	254	215	
Vanadium	1.0	mg/kg	14.3	15.4	13.4	10.4	
Zinc	5.0	mg/kg	18.9	19.8	18.6	17.1	
Total Organic Carbon	0.05	%	0.44	0.44	0.40	0.56	

EQL Estimated Quantitation Limit = lowest level of the parameter that can be quantified with confidence.
nd parameter not detected ! = EQL higher than listed due to dilution ( ) Adjusted EQL

PSC
PHILIP SERVICES

Client:	St.Lawrence Testing&Inspection Co.Ltd.	Date Received:	March 21/2000
	814 Second Street W.	Date Reported:	March 23/2000
	P.O.Box 997	Lab Ref#:	G201083
	Cornwall, ON, CANADA	Lab Quote#:	L8010011
	K6H 5V1		
Fax:	613-938-7395	Client Ref#:	TSH-LANCASTE

Attn: G.G. McIntee

Attached are your results for PAH's

If you have any questions, please call Nick Boulton,
your Service Manager at Philip Analytical Services Corp.

PHILIP SERVICES

Client: St. Lawrence Testing & Inspection Co. Ltd.
Project Reference: Lancaster River Bottom
Work Order Number: G201083B
Matrix: Soil

Polynuclear Aromatic Hydrocarbons (PAH's)

Units: Micrograms/gram (µg/g) dry weight

Date: 23-Mar-00

Compound	EQL µg/g	TSL-S1	TSL-S2	TSL-S3
Naphthalene	0.05	nd	nd	nd
2-Methylnaphthalene	0.05	nd	nd	nd
1-Methylnaphthalene	0.05	nd	nd	nd
enaphthylene	0.05	nd	nd	nd
cenaphthene	0.05	nd	nd	nd
Fluorene	0.05	nd	nd	nd
Phenanthrene	0.05	nd	nd	nd
Anthracene	0.05	nd	nd	nd
Fluoranthene	0.05	nd	nd	nd
Pyrene	0.05	nd	nd	nd
Benzo(a)anthracene	0.05	nd	nd	nd
Chrysene	0.05	nd	nd	nd
Benzo(b)fluoranthene	0.05	nd	nd	nd
Benzo(k)fluoranthene	0.05	nd	nd	nd
Benzo(a)pyrene	0.05	nd	nd	nd
Indeno(1,2,3-cd)pyrene	0.05	nd	nd	nd
Dibenzo(a,h)anthracene	0.05	nd	nd	nd
Benzo(ghi)perylene	0.05	nd	nd	nd
Surrogate Standard Recoveries (Control Limits)				
Acenaphthene-d10 (25-125%)		69%	70%	70%
Anthracene-d10 (30-120%)		64%	64%	64%
Benzo(a)pyrene-d12 (35-120%)		94%	91%	90%

PSC
PHILIP SERVICES

Client: St. Lawrence Testing & Inspection Co. Ltd. **Polynuclear Aromatic Hydrocarbons (PAH's)**
Project Reference: Lancaster River Bottom
Work Order Number: G201083B Units: Micrograms/gram (µg/g) dry weight **Date:** 23-Mar-00
Matrix: Soil

		Method Blank			Spiked Method Blank			
Compound	**EQL µg/g**	**Result**	**Upper Limit**	**Accept**	**% Recovery**	**Lower Limit**	**Upper Limit**	**Accept**
Naphthalene	0.05	nd	0.05	yes	58	35	105	yes
2-Methylnaphthalene	0.05	nd	0.05	yes	56	30	100	yes
1-Methylnaphthalene	0.05	nd	0.05	yes	58	30	105	yes
Acenaphthylene	0.05	nd	0.05	yes	59	35	110	yes
Acenaphthene	0.05	nd	0.05	yes	69	35	105	yes
Fluorene	0.05	nd	0.05	yes	62	40	110	yes
Phenanthrene	0.05	nd	0.05	yes	73	50	110	yes
Anthracene	0.05	nd	0.05	yes	78	50	110	yes
Fluoranthene	0.05	nd	0.05	yes	87	50	120	yes
Pyrene	0.05	nd	0.05	yes	87	50	120	yes
Benzo(a)anthracene	0.05	nd	0.05	yes	92	55	120	yes
Chrysene	0.05	nd	0.05	yes	93	55	125	yes
Benzo(b)fluoranthene	0.05	nd	0.05	yes	89	50	125	yes
Benzo(k)fluoranthene	0.05	nd	0.05	yes	92	50	115	yes
Benzo(a)pyrene	0.05	nd	0.05	yes	86	50	120	yes
Indeno(1,2,3-cd)pyrene	0.05	nd	0.05	yes	95	50	125	yes
Dibenzo(a,h)anthracene	0.05	nd	0.05	yes	89	50	125	yes
Benzo(ghi)perylene	0.05	nd	0.05	yes	82	50	125	yes
Surrogate Standard Recoveries (Control Limits)								
Acenaphthene-d10		66%			59%	25	125	yes
Anthracene-d10		63%			61%	30	120	yes
Benzo(a)pyrene-d12		85%			86%	35	120	yes

PHILIP SERVICES

Client: St. Lawrence Testing & Inspection Co **Polynuclear Aromatic Hydrocarbons (PAH'S)**
Project Reference: Lancaster River Bottom **Date:** 23-Mar-00
Work Order Number: G201083B
Matrix: Soil

Legend: EQL = Estimated Quantitation Limit
nd = Not detected above LOQ

Date received: March 21, 2000
Date extracted: March 21, 2000
Date analysed: March 22, 2000

ANALYTICAL METHOD:

The soil samples (10 grams wet weight) were mixed with sodium sulfate and extracted with a 1:1 mixture of acetone:dichloromethane. The extracts were cleaned up using alumina column chromatography. Analysis was performed by gas chromatography/mass spectrometry using U.S. EPA Method 8270B (modified).

Note: Estimated quantitation limit is the lowest concentration that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions.

NOTE: All work recorded herein has been done in accordance with normal professional standards using accepted testing methodologies and QA/QC procedures. Philip Analytical is limited in liability to the actual cost of the pertinent analysis done. Your samples will be retained by PASC for a period of 30 days following reporting or as per specific contractual arrangement.

JOB APPROVED BY:

Tasha Sutherland-Hill
Chemist

PHILIP SERVICES

Client:	St.Lawrence Testing&Inspection Co.Ltd. 814 Second Street W. P.O.Box 997 Cornwall, ON, CANADA K6H 5V1	Date Received: Date Reported: Lab Ref#: Lab Quote#:	March 21/2000 March 23/2000 G201083 L8010011
Fax:	613-938-7395	Client Ref#:	TSH-LANCASTE
Attn:	G.G. McIntee		

Attached are your results for EPA 608 Pesticides

If you have any questions, please call Nick Boulton,
your Service Manager at Philip Analytical Services Corp.

PHILIP SERVICES

Client : St. Lawrence Testing&Inspection Co.Ltd.
814 Second Street W. P.O. Box 997
Cornwall ON K6H 5V1

Date : March 23, 2000

Contact : G.G. McIntee
Client project # : TSH-LANCASTE
PASC job # : G201083
Matrix : Soil

Certificate of Analysis

Analysis Performed:	EPA 608 Priority Pollutant Pesticides/PCB
Methodology:	Determination of EPA 608 pesticides by solvent extraction, dry over Na2SO4, Florisil cleanup, and analysis with dual capillary GC/ECD. U.S. EPA Method 8081/608
Instrumentation:	Varian 3400 with autosampler and STAR Workstation
Sample Description:	Soil
Results:	Refer to Report of Analysis attached.

All work recorded herein has been done in accordance with normal professional standards using accepted testing methodologies and QA/QC procedures. Philip Analytical is limited in liability to the actual cost of the pertinent analyses done unless otherwise agreed upon by contractual arrangement. Your samples will be retained by PASC for a period of 30 days following reporting or as per specific contractual arrangements.

M. Riskallah

Certified By
Medhat Riskallah ,Ph.D.,C.Chem.
Manager, Gas Chromatography Section

PHILIP SERVICES

Client : St. Lawrence Testing&Inspection Co.Ltd.
814 Second Street W. P.O. Box 997
Cornwall ON K6H 5V1

Date : March 23, 2000

Contact : G.G. McIntee
Client project # : TSH-LANCASTE
PASC job # : G201083
Matrix : Soil

Report Of Analysis

	Compound	L.O.Q ug/g	Reagent Blank	Spiked Reagent Blank	TSL S1	TSL S1 Repeat	TSL S2	TSL S3
1	Aldrin	0.002	ND	89%	ND	ND	ND	ND
2	Alpha-BHC	0.002	ND	118%	ND	ND	ND	ND
3	Beta-BHC	0.002	ND	118%	ND	ND	ND	ND
4	Delta-BHC	0.002	ND	78%	ND	ND	ND	ND
5	Gamma-BHC (Lindane)	0.002	ND	81%	ND	ND	ND	ND
6	Alpha-Chlordane	0.002	ND	97%	ND	ND	ND	ND
7	Gamma-Chlordane	0.002	ND	115%	ND	ND	ND	ND
8	4,4'-DDD	0.004	ND	86%	ND	ND	ND	ND
9	4,4-DDE	0.002	ND	91%	ND	ND	ND	0.007
10	4,4'-DDT	0.004	ND	82%	ND	ND	ND	ND
11	2,4'-DDT	0.004	ND	86%	ND	ND	ND	ND
12	Dieldrin	0.002	ND	82%	ND	ND	ND	ND
13	Endosulfan I	0.004	ND	79%	ND	ND	ND	ND
14	Endosulfan II	0.004	ND	82%	ND	ND	ND	ND
15	Endosulfan Sulphate	0.004	ND	78%	ND	ND	ND	ND
16	Endrin	0.004	ND	87%	ND	ND	ND	ND
17	Endrin Aldehyde	0.010	ND	85%	ND	ND	ND	ND
18	Heptachlor	0.002	ND	94%	ND	ND	ND	ND
19	Heptaclor Epoxide	0.002	ND	87%	ND	ND	ND	ND
20	Methoxychlor	0.040	ND	101%	ND	ND	ND	ND
21	Mirex	0.004	ND	106%	ND	ND	ND	ND
22	Endrin Ketone	0.004	ND	84%	ND	ND	ND	ND
23	Total PCB'S	0.05	ND	86%	ND	ND	ND	ND
24	Toxaphene	0.3	ND	------	ND	ND	ND	ND
25	Tetrachloro-m-Xylene (surrogate standard)	%Recovery	96%	105%	86%	87%	69%	79%

L.O.Q.= Limit of Quantitation
ND = Not Detected
ug/g = micrograms per grams

Table A

Surface soil and groundwater criteria for agricultural, residential/parkland, industrial/commercial land use for a potable groundwater condition

Table A: Surface soil and groundwater remediation criteria for three land uses (agricultural, residential/parkland and industrial/commercial) in a potable groundwater situation.

Soil Criteria for Inorganics in this Table apply only where Surface Soil pH is 5.0 to 9.0 and for Full Depth Use, the Subsurface Soil pH is 5.0 to 11.0				
Table A:	**Soil remediation criteria (ug/g)**			**Potable groundwater criteria (ug/l)**
Chemical compound	**Agricultural land use**	**Residential/ parkland land use**	**Industrial/ commercial land use**	**All land use categories**
ACENAPHTHENE	15	15	15	20
ACENAPHTHYLENE	100	100	130	310
ACETONE	3.5	3.5	3.5	3000
ALDRIN	0.05	0.05	0.05	0.01
ANTHRACENE	28	28	28	12
ANTIMONY	13	13	(44) 40	6.0
ARSENIC	(25) 20	(25) 20	(50) 40	25
BARIUM	(1000) 750	(1000) 750	(2000) 1500	1000
BENZENE	0.24	0.24	0.24	5.0
BENZO(a)ANTHRACENE	6.6	6.6	6.6	0.2
BENZO(a)PYRENE	1.2	1.2	1.9	0.01
BENZO(b)FLUORANTHENE	12	12	18	0.2
BENZO(g,h,i)PERYLENE	40	40	40	0.2
BENZO(k)FLUORANTHENE	12	12	18	0.2
BERYLLIUM	1.2	1.2	1.2	4.0
BIPHENYL, 1,1-	0.89	0.89	0.89	350
BIS(2-CHLOROETHYL)ETHER	0.66	0.66	0.66	4.4
BIS(2-CHLOROISOPROPYL)ETHER	0.66	0.66	0.66	2.2
BIS(2-ETHYLHEXYL)PHTHALATE	100	100	100	6.0
BORON (AVAILABLE)	1.5*	1.5*	2.0*	5000
BROMODICHLOROMETHANE	0.12	0.12	0.12	5.0
BROMOFORM	0.11	0.11	0.11	5.0
BROMOMETHANE	(0.38) 0.061	(0.38) 0.061	(0.38) 0.061	(10) 3.7
CADMIUM	(4.0) 3.0	12	12	5.0
CARBON TETRACHLORIDE	(0.64) 0.10	(0.64) 0.10	(0.64) 0.10	5.0

Soil Criteria for Inorganics in this Table apply only where Surface Soil pH is 5.0 to 9.0 and for Full Depth Use, the Subsurface Soil pH is 5.0 to 11.0				
Table A:	**Soil remediation criteria (ug/g)**			**Potable groundwater criteria (ug/l)**
Chemical compound	**Agricultural land use**	**Residential/ parkland land use**	**Industrial/ commercial land use**	**All land use categories**
CHLORDANE	0.29	0.29	0.29	0.04
CHLOROANILINE, p-	1.3	1.3	1.3	28
CHLOROBENZENE	2.4	2.4	2.4	30
CHLOROFORM	0.13	0.13	0.13	5.0
CHLOROPHENOL, 2-	0.1	0.1	0.1	0.3
CHROMIUM (TOTAL)	(1000) 750	(1000) 750	(1000) 750	50
CHROMIUM (VI)	(10) 8.0	(10) 8.0	(10) 8.0	50
CHRYSENE	12	12	17	0.5
COBALT	(50) 40	(50) 40	(100) 80	100
COPPER	(200) 150	(300) 225	(300) 225	23
CYANIDE (FREE)	100	100	100	52
DIBENZO(a,h)ANTHRACENE	1.2	1.2	1.9	0.2
DIBROMOCHLOROMETHANE	0.09	0.09	0.09	5.0
DICHLOROBENZENE, 1,2- (o-DCB)	0.88	0.88	0.88	3.0
DICHLOROBENZENE, 1,3- (m-DCB)	30	30	30	630
DICHLOROBENZENE, 1,4- (p-DCB)	0.32	0.32	0.32	1.0
DICHLOROBENZIDINE, 3,3'-	1.3	1.3	1.3	83
DDD	2.2	2.2	3.5	6.0
DDE	1.6	1.6	2.4	20
DDT	1.6	1.6	2.0	0.05
DICHLOROETHANE, 1,1-	3.0	3.0	3.0	70
DICHLOROETHANE, 1,2-	(0.05) 0.022	(0.05) 0.022	(0.05) 0.022	5.0
DICHLOROETHYLENE, 1,1-	(0.015) 0.0024	(0.015) 0.0024	(0.015) 0.0024	(4.1) 0.66
DICHLOROETHYLENE, CIS-1,2-	2.3	2.3	2.3	70
DICHLOROETHYLENE, TRANS-1,2-	4.1	4.1	4.1	100
DICHLOROPHENOL, 2,4-	0.3	0.3	0.3	0.3
DICHLOROPROPANE, 1,2-	(0.12) 0.019	(0.12) 0.019	(0.12) 0.019	5.0

Soil Criteria for Inorganics in this Table apply only where Surface Soil pH is 5.0 to 9.0 and for Full Depth Use, the Subsurface Soil pH is 5.0 to 11.0				
Table A:	**Soil remediation criteria (ug/g)**			**Potable groundwater criteria (ug/l)**
Chemical compound	**Agricultural land use**	**Residential/ parkland land use**	**Industrial/ commercial land use**	**All land use categories**
DICHLOROPROPENE, 1,3-	(0.04) 0.0066	(0.04) 0.0066	(0.04) 0.0066	1.4
DIELDRIN	0.05	0.05	0.05	0.02
DIETHYL PHTHALATE	0.71	0.71	0.71	30
DIMETHYL PHTHALATE	0.7	0.7	0.7	30
DIMETHYLPHENOL, 2,4-	0.94	0.94	0.94	140
DINITROPHENOL, 2,4-	0.2	0.2	0.2	42
DINITROTOLUENE, 2,4-	0.66	0.66	0.66	0.5
DIOXIN/FURAN (ng TEQ/g soil)	0.01	1.0	1.0	0.000015
ENDOSULFAN	0.18	0.18	0.18	0.35
ENDRIN	0.05	0.05	0.05	0.05
ETHYLBENZENE	0.28	0.28	0.28	2.4
ETHYLENE DIBROMIDE	(0.01) 0.0056	(0.01) 0.0056	(0.012) 0.0056	1.0
FLUORANTHENE	40	40	40	130
FLUORENE	340	340	340	280
HEPTACHLOR	(0.12) 0.084	(0.12) 0.084	(0.15) 0.084	0.04
HEPTACHLOR EPOXIDE	0.06	0.06	0.09	3.0
HEXACHLOROBENZENE	0.46	0.46	0.76	(1.0) 0.62
HEXACHLOROBUTADIENE	(2.2) 0.38	(2.2) 0.38	(2.2) 0.38	0.45
HEXACHLOROCYCLOHEXANE, Gamma	0.41	0.41	0.49	0.8
HEXACHLOROETHANE	(6.3) 3.8	(6.3) 3.8	(8.5) 3.8	2.5
INDENO(1,2,3-cd)PYRENE	12	12	19	0.2
LEAD	200	200	1000	10
MERCURY	10	10	10	0.12
METHOXYCHLOR	4.0	4.0	4.0	0.3
METHYL ETHYL KETONE	0.27	0.27	0.27	350
METHYL ISOBUTYL KETONE	0.48	0.48	0.48	350

Soil Criteria for Inorganics in this Table apply only where Surface Soil pH is 5.0 to 9.0 and for Full Depth Use, the Subsurface Soil pH is 5.0 to 11.0				
Table A:	**Soil remediation criteria (ug/g)**			**Potable groundwater criteria (ug/l)**
Chemical compound	**Agricultural land use**	**Residential/ parkland land use**	**Industrial/ commercial land use**	**All land use categories**
METHYL MERCURY	6.8**	6.8**	10**	0.12
METHYL TERT BUTYL ETHER	5.7	5.7	5.7	700
METHYLENE CHLORIDE	1.1	1.1	1.1	50
METHYLNAPHTHALENE, 2-(*1-)	1.2	1.2	1.2	10
MOLYBDENUM	5.0	40	40	7300
NAPHTHALENE	4.6	4.6	4.6	21
NICKEL	(200) 150	(200) 150	(200) 150	100
PENTACHLOROPHENOL	5.0	5.0	5.0	30
PETROLEUM HYDROCARBONS (gas/diesel)	100	100	100	1000
PETROLEUM HYDROCARBONS (heavy oils)	1000	1000	1000	1000
PHENANTHRENE	40	40	40	63
PHENOL	40	40	40	4200
POLYCHLORINATED BIPHENYLS	0.5	5.0	25	0.2
PYRENE	250	250	250	40
SELENIUM	2.0	10	10	10
SILVER	(25) 20	(25) 20	(50) 40	1.2
STYRENE	(1.7) 1.2	(1.7) 1.2	(1.7) 1.2	100
TETRACHLOROETHANE, 1,1,1,2-	(0.12) 0.019	(0.12) 0.019	(0.12) 0.019	5.0
TETRACHLOROETHANE, 1,1,2,2-	0.01	0.01	0.01	1.0
TETRACHLOROETHYLENE	0.45	0.45	0.45	5.0
THALLIUM	4.1	4.1	32	2.0
TOLUENE	2.1	2.1	2.1	24
TRICHLOROBENZENE, 1,2,4-	30	30	30	70
TRICHLOROETHANE, 1,1,1-	(34) 26	(34) 26	(34) 26	200
TRICHLOROETHANE, 1,1,2-	0.28	0.28	0.28	5.0
TRICHLOROETHYLENE	(3.9) 1.1	(3.9) 1.1	(3.9) 1.1	50

Soil Criteria for Inorganics in this Table apply only where Surface Soil pH is 5.0 to 9.0 and for Full Depth Use, the Subsurface Soil pH is 5.0 to 11.0				
Table A:	**Soil remediation criteria (ug/g)**			**Potable groundwater criteria (ug/l)**
Chemical compound	**Agricultural land use**	**Residential/ parkland land use**	**Industrial/ commercial land use**	**All land use categories**
TRICHLOROPHENOL, 2,4,5-	3.2	3.2	3.2	200
TRICHLOROPHENOL 2,4,6-	0.66	0.66	0.66	2.0
VANADIUM	(250) 200	(250) 200	(250) 200	200
VINYL CHLORIDE	(0.0075) 0.003	(0.0075) 0.003	(0.0075) 0.003	(1.3) 0.5
XYLENES	25	25	25	300
ZINC	(800) 600	(800) 600	(800) 600	1100
ELECTRICAL CONDUCTIVITY (mS/cm)	0.70	0.70	1.4	N/A
CHLORIDE	N/V	N/V	N/V	250000
NITRATE	N/V	N/V	N/V	10000
NITRITE	N/V	N/V	N/V	1000
SODIUM ADSORPTION RATIO (SAR)	5.0	5.0	12	N/A
SODIUM	N/V	N/V	N/V	200000

( ) Criterion value in brackets applies to medium and fine textured soils.

\+ Boron soil criterion based on Hot Water Extract.

N/A = Not applicable. N/V = No Value.

++ Analysis for methyl mercury is only required when the total mercury criterion is exceeded.

(*1-) 2-methyl naphthalene soil criterion is applicable to 1-methyl naphthalene with the provision that if both are detected in the soil, the sum of the two concentrations cannot exceed the soil criterion.

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GUIDELINES FOR THE PROTECTION AND MANAGEMENT OF AQUATIC SEDIMENT QUALITY IN ONTARIO

New Sediment Guidelines - latest Revision - PAH limits different

AUGUST 1993

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log 92-2309-067
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Details on these levels, and the protocols used in developing the guidelines are provided in section 4 of this document.

The No Effect and Lowest Effect guidelines compare closely with the lowest or no effect levels determined through a review of sediment toxicity bioassays by National Oceanic and Atmospheric Administration (NOAA) (Long and Morgan, 1990)

As is discussed in Section 4.4, it is not currently possible to calculate a No Effect value for all parameters. Where this is the case for the metals, an interim value based on the lower of the background or Lowest Effect Levels will be used as a lower practical limit for management decisions. For the organics, the background values in Table 5 define the lower practical limit for management decisions.

Table 1: Provincial Sediment Quality Guidelines for Metals and Nutrients.
(values in ug/g (ppm) dry weight unless otherwise noted)

METALS	No Effect Level	Lowest Effect Level	Severe Effect Level
Arsenic	-	6	33
Cadmium	-	0.6	10
Chromium	-	26	110
Copper	-	16	110
Iron (%)	-	2	4
Lead	-	31	250
Manganese	-	460	1100
Mercury	-	0.2	2
Nickel	-	16	75
Zinc	-	120	820
NUTRIENTS			
TOC (%)	-	1	10
TKN	-	550	4800
TP	-	600	2000

'-' - values less than 10 have been rounded to 1 significant digit. Values greater than 10 have been rounded to two significant digits except for round numbers which remain unchanged (e.g., 400).

'-' - denotes insufficient data/no suitable method.

TOC - Total Organic Carbon TKN - Total Kjeldahl Nitrogen TP - Total Phosphorus

June 1992

Table 2a: Provincial Sediment Quality Guidelines for PCBs and Organochlorine Pesticides.
(values[a] in µg/g (ppm) dry weight unless otherwise noted)

Compound	No Effect Level	Lowest Effect Level	Severe Effect Level (µg/g organic carbon)[a]
Aldrin	-	0.002	8
BHC	-	0.003	12
α-BHC	-	0.006	10
β-BHC	-	0.005	21
γ-BHC	0.0002	(0.003)[b]	(1)[c]
Chlordane	0.005	0.007	6
DDT(total)	-	0.007	12
op+pp-DDT	-	0.008	71
pp-DDD	-	0.008	6
pp-DDE	-	0.005	19
Dieldrin	0.0006	0.002	91
Endrin	0.0005	0.003	130
HCB	0.01	0.02	24
Heptachlor	0.0003	-	-
H epoxide	-	0.005[a]	5[a]
Mirex	-	0.007	130
PCB(total)	0.01	0.07	530
PCB 1254[d]	-	(0.06)[b]	(34)[c]
PCB 1248[d]	-	(0.03)[b]	(150)[c]
PCB 1016[d]	-	(0.007)[b]	(53)[c]
PCB 1260[d]	-	(0.005)[b]	(24)[c]

Lowest Effect Levels and Severe Effect Levels are based on the 5th and 95th percentiles respectively of the Screening Level Concentration (SLC) (see Section 4.2.4) except where noted otherwise.

( ) Denotes tentative guidelines

[a] - Values less than 10 have been rounded to 1 significant digit. Values greater than 10 have been rounded to 2 significant digits except for round numbers which remain unchanged.

[b] - 10% SLC.

[c] - 90% SLC.

[d] - Analyses for PCB Arochlors are not mandatory unless specifically requested by MOE.

- Insufficient data to calculate guideline.

[a] Numbers in this column are to be converted to bulk sediment values by multiplying by the actual TOC concentration of the sediments (to a maximum of 10%), e.g. analysis of a sediment sample gave a PCB value of 30 ppm and a TOC of 5%. The value for PCB in the Severe Effects column is first converted to a bulk sediment value for a sediment with 5% TOC by multiplying 530 x 0.05 = 26.5 ppm as the Severe Effect Level guidelines for that sediment. The measured value of 30 ppm is then compared with this bulk sediment value and is found to exceed the guideline.

(March 1993)

Pesticides

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Table 2b: Provincial Sediment Quality Guidelines for Polycyclic Aromatic Hydrocarbons.
(values in µg/g (ppm) dry weight unless otherwise noted)

Compound	No Effect Level	Lowest Effect Level	Severe Effect Level (µg/g organic carbon)*
Anthracene	-	0.220	370
Benz[a]anthracene	-	0.320	1,480
Benzo[k]fluoranthene	-	0.240	1,340
Benzo[a]pyrene	-	0.370	1,440
Benzo[g,h,i]perylene	-	0.170	320
Chrysene	-	0.340	460
Dibenzo[a,h]anthracene	-	0.060	130
Fluoranthene	-	0.750	1,020
Fluorene	-	0.190	160
Indeno[1,2,3-cd]pyrene	-	0.200	320
Phenanthrene	-	0.560	950
Pyrene	-	0.490	850
PAH (total)	-	4	10,000

(Guidelines could not be calculated for Acenaphthene, Acenaphthylene, Benzo[b]fluorene and Naphthalene due to insufficient data. These will be calculated when sufficient data is available.)

Lowest Effect Levels and Severe Effect Levels are based on the 5th and 95th percentiles respectively of the Screening Level Concentration (SLC) (see Section 4.2.4) except where noted otherwise.

- Insufficient data to calculate guideline.

* Numbers in this column are to be converted to bulk sediment values by multiplying by the actual TOC concentration of the sediments (to a maximum of 10%), e.g. analysis of a sediment sample gave a B[a]P value of 30 ppm and a TOC of 5%. The value for B[a]P in the Severe Effects column is first converted to a bulk sediment value for a sediment with 5% TOC by multiplying 1443 x 0.05 = 72 ppm as the Severe Effect Level guideline for that sediment. The measured value of 30 ppm is then compared with this bulk sediment value and is found to not exceed the guideline.

PAH (total) is the sum of 16 PAH compounds: Acenaphthene, Acenaphthylene, Anthracene, Benzo[k]fluoranthene, Benzo[b]fluorene, Benzo[a]anthracene, Benzo[a]pyrene, Benzo[g,h,i]perylene, Chrysene, Dibenzo[a,h]anthracene, Fluoranthene, Fluorene, Indeno[1,2,3-cd]pyrene, Naphthalene, Phenanthrene and Pyrene.

(March 1993)

Table 3: Additional Parameters.

Parameters carried over from the Open Water Disposal Guidelines.

Oil and Grease	0.15%
Cyanide	0.1 ppm
Ammonia	100 ppm
Cobalt	50 ppm
Silver	0.5 ppm

Routine testing for these parameters would not be required but may be requested on a case-specific basis.

(June 1992)

SECTION 3

APPLICATION OF THE SEDIMENT QUALITY GUIDELINES

The Provincial Sediment Quality Guidelines (PSQGs) shown in Tables 1 and 2 supersede the Open-Water Disposal Guidelines and will provide the basis for all sediment (or potential lakefill materials to be placed in water) evaluations in Ontario. The guidelines pertain mainly to activities within the aquatic environment and adherence to them is not to be construed as exemption from the requirements of other guidelines, policies, or regulations of this Ministry or other agencies (e.g., the placement of contaminated sediment at an upland site or facility will be subject to the requirements of the Ministry's Waste Management Regulations). The PSQGs will be used in making decisions on a number of sediment-related issues ranging from prevention of sediment contamination to remedial action for contaminated sediment. Issues to be addressed include, but are not limited to, the following:

- Determination of fill quality for lakefilling associated with shoreline development programs.
- Evaluation of sediment quality.
- Determination of appropriate action with regard to sediment clean-up in areas with historic sediment contamination such as LIC Areas of Concern as well as other areas of potential impact.
- Determination of the suitability of dredged material for open-water disposal.
- Establishing the chemical suitability of substrate material for the restoration of benthic habitat.
- Determination of the appropriate degree of sediment clean-up as a result of chemical spills or unauthorized discharge.

3.1 THE EVALUATION PROCESS

Initial evaluation of bottom sediment or fill material is conducted by comparing the chemical concentrations of the material to the appropriate parameter values listed in Tables 1 and 2a, and where required Tables 4 and 5, based on the conditions described in section 3.1.1. Chemical analysis for compounds listed in Table 2b will be performed where specifically requested by MOE or where there is reason to suspect contamination by PAH compounds. Provincial Sediment Quality Guidelines could not be calculated for the parameters in Table 3. Since these parameters can be of concern in protecting aquatic biological resources, the Open Water Disposal Guidelines will continue to be used though chemical analysis for these parameters will be performed only where specifically requested by MOE. The Open Water Disposal Guidelines are equivalent to the Lowest Effect Level in terms of management decisions.

3.1.1 General Conditions Governing Evaluation

(a) Material will be tested by bulk sediment analyses and results reported on a dry weight basis (*MOE Analytical Methods* (MOE 1983) or MOE approved equivalent analytical procedures to be used).

(b) For the purposes of sediment or fill quality evaluation, actual analytical results reported by the performing laboratory must be provided. However, in comparing the results with the parameter values in the guidelines the results will be rounded as follows: if the reported value is less than ten, it will be rounded to one significant digit. Values greater than 10 will be rounded to two significant digits. Round

numbers remain unchanged.

e.g.	Reported Value	Rounded Value
	<10 1.78	2
	0.0364	0.04
	0.0052	0.005
	>10 10.827	11
	129.4	130

(c) If all parameter values for a given material are at or below the No Effect Level Guidelines, that material passes the guideline and it is anticipated that the material will have no adverse chemical effects on aquatic life or water quality.

(d) If a single parameter value for a given material, based on a sampling program, exceeds the No Effect Level Guideline but is below the Lowest Effect Level Guideline, the material fails the No Effect Level Guidelines and would be considered as having a negligible potential to impair the aquatic environment.

(e) If a single parameter value for a given material, based on a sampling program, is at or above the Lowest Effect Level Guidelines, that material fails the guideline and it is anticipated that such material may have an adverse effect on some benthic biological resources. If all values are below the Lowest Effect Level Guidelines, no significant effects on benthic biological resources are anticipated.

(f) If any single parameter value for a given material, as determined by a sampling program, is at or above the Severe Effect Level Guideline, that material is considered highly contaminated and will likely have a significant effect on benthic biological resources.

(g) The Ministry recognizes that in an area as geologically diverse as Ontario, local natural sediment levels of the metals may vary considerably and in certain areas, such as wetlands, the organic matter content and nutrient levels may be naturally high.

METALS: In areas where local background levels are above the Lowest Effect Level, the local background level will form the practical lower limit for management decisions. In some waterbodies surficial

Table 4: Background Levels for the Metals

Metal	Background (μg/g)
Arsenic	4.2
Cadmium	1.1
Chromium	31
Copper	25
Iron (%)	3.12
Lead	23
Manganese	400
Mercury	0.10
Nickel	31
Zinc	65

Values are based on analyses of Great Lakes pre-colonial sediment horizon.

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Table 5: Background Sediment Concentrations* of Organic Compounds.

Compound	Background (μg/g dry wt.)
Aldrin	0.001
α-BHC	0.001
β-BHC	0.001
γ-BHC	0.001
Chlordane	0.001
DDT (total)	0.01
op+pp DDT	0.005
pp-DDD	0.002
pp-DDE	0.003
Dieldrin	0.001
Endrin	0.001
HCB	0.001
Heptachlor	0.001
Heptachlor eporide	0.001
Mirex	0.001
PCB (total)	0.02

* Values are based on the highest of the Lake Huron or Lake Superior mean surficial sediment concentrations.

(June 1992)