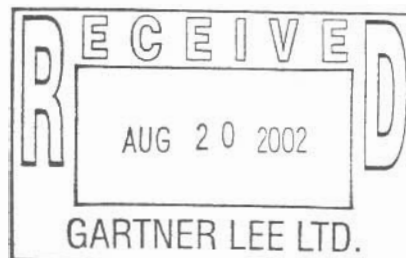




CHEMICAL ANALYSIS REPORT

Date: August 13, 2002
ALS File No. P7047
Report On: Polaris Soil Analysis
Report To: **Gartner Lee Ltd.**
Sperling Plaza
Suite 490, 6400 Roberts Street
Burnaby, BC
V5G 4C9
Attention: **Ms. Arlene Laudrum**
Received: July 17, 2002



ALS ENVIRONMENTAL

per:

Brent C. Mack, B.Sc. - Project Chemist
Natasha Markovic-Mirovic, B.Sc. - Project Chemist

File No. P7047
REMARKS



Please note the detection limits for certain Polycyclic Aromatic Hydrocarbons (PAHs) were increased for several of the samples reported in the following data tables due to sample matrix interferences.

RESULTS OF ANALYSIS - Sediment/Soil

Sample ID	TP02-04-01	TP02-05-01	TP02-06-01	TP02-07-01
Sample Date	02 07 10	02 07 10	02 07 10	02 07 10
ALS ID	1	2	3	5

Physical Tests

Moisture %	4.7	5.1	5.0	4.2
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Non-Halogenated Volatiles

Benzene	<0.04	-	-	-
CWS Fraction 1 (C6-10)	<30	-	-	-
CWS Fraction 1-BTEX	<30	-	-	-
Ethylbenzene	<0.05	-	-	-
Styrene	<0.05	-	-	-
Toluene	<0.05	-	-	-
meta- & para-Xylene	<0.05	-	-	-
ortho-Xylene	<0.05	-	-	-

Polycyclic Aromatic Hydrocarbons

Acenaphthene	<0.005	-	-	-
Acenaphthylene	<0.005	-	-	-
Anthracene	<0.01	-	-	-
Benz(a)anthracene	<0.01	-	-	-
Benzo(a)pyrene	<0.01	-	-	-
Benzo(b)fluoranthene	<0.01	-	-	-
Benzo(g,h,i)perylene	0.01	-	-	-
Benzo(k)fluoranthene	<0.01	-	-	-
Chrysene	<0.01	-	-	-
Dibenz(a,h)anthracene	<0.005	-	-	-
Fluoranthene	<0.01	-	-	-
Fluorene	<0.01	-	-	-
Indeno(1,2,3-c,d)pyrene	<0.01	-	-	-
Naphthalene	<0.01	-	-	-
Phenanthrene	<0.01	-	-	-
Pyrene	<0.01	-	-	-
2-Methylnaphthalene	0.02	-	-	-

Remarks regarding the analyses appear at the beginning of this report.

CWS = CCME - Canada Wide Standards.

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File No. P7047

RESULTS OF ANALYSIS - Sediment/Soil



Sample ID	TP02-04-01	TP02-05-01	TP02-06-01	TP02-07-01
Sample Date	02 07 10	02 07 10	02 07 10	02 07 10
ALS ID	1	2	3	5

Extractable Hydrocarbons

CWS Fraction 2 (C10-16)	<50	1960	4700	6350
CWS Fraction 2-Naph	<50	-	-	-
CWS Fraction 3 (C16-34)	137	909	1770	2380
CWS Fraction 3-PAH	137	-	-	-
CWS Fraction 4 (C34-50)	66	90	75	72

Surrogate Standards

1,2-Dichlorobenzene (SS)	%	105	-	-	-
3-Fluorotoluene (SS)	%	95	-	-	-
d8-Naphthalene (SS)	%	104	-	-	-
d10-Acenaphthene (SS)	%	109	-	-	-
d10-Phenanthrene (SS)	%	116	-	-	-
d12-Chrysene (SS)	%	112	-	-	-

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RESULTS OF ANALYSIS - Sediment/Soil

Sample ID	TP02-08-01	TP02-09-02	TP02-10-1
Sample Date	02 07 10	02 07 10	02 07 10
ALS ID	7	9	10

Physical Tests

Moisture %	5.2	6.6	18.2
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Non-Halogenated Volatiles

Benzene	-	<0.04	-
CWS Fraction 1 (C6-10)	-	<30	-
CWS Fraction 1-BTEX	-	<30	-
Ethylbenzene	-	<0.05	-
Styrene	-	<0.05	-
Toluene	-	<0.05	-
meta- & para-Xylene	-	<0.05	-
ortho-Xylene	-	<0.05	-

Polycyclic Aromatic Hydrocarbons

Acenaphthene	-	<0.005	-
Acenaphthylene	-	<0.005	-
Anthracene	-	<0.01	-
Benz(a)anthracene	-	<0.01	-
Benzo(a)pyrene	-	<0.01	-
Benzo(b)fluoranthene	-	<0.01	-
Benzo(g,h,i)perylene	-	0.01	-
Benzo(k)fluoranthene	-	<0.01	-
Chrysene	-	<0.01	-
Dibenz(a,h)anthracene	-	<0.005	-
Fluoranthene	-	<0.01	-
Fluorene	-	<0.01	-
Indeno(1,2,3-c,d)pyrene	-	<0.01	-
Naphthalene	-	0.01	-
Phenanthrene	-	<0.01	-
Pyrene	-	<0.01	-
2-Methylnaphthalene	-	0.02	-

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File No. P7047

RESULTS OF ANALYSIS - Sediment/Soil

Sample ID	TP02-08-01	TP02-09-02	TP02-10-1
Sample Date	02 07 10	02 07 10	02 07 10
ALS ID	7	9	10

Extractable Hydrocarbons

CWS Fraction 2 (C10-16)	338	<50	53
CWS Fraction 2-Naph	-	<50	-
CWS Fraction 3 (C16-34)	275	201	223
CWS Fraction 3-PAH	-	201	-
CWS Fraction 4 (C34-50)	72	93	84

Surrogate Standards

1,2-Dichlorobenzene (SS)	%	-	105	-
3-Fluorotoluene (SS)	%	-	94	-
d8-Naphthalene (SS)	%	-	111	-
d10-Acenaphthene (SS)	%	-	115	-
d10-Phenanthrene (SS)	%	-	111	-
d12-Chrysene (SS)	%	-	106	-

Particle Size

Gravel (>2.00mm)	(%)	-	-	65.6
Sand (2.00mm - 0.063mm)	(%)	-	-	33.4
Silt (0.063mm - 4um)	(%)	-	-	0.5
Clay (<4um)	(%)	-	-	0.5

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File No. P7047

RESULTS OF ANALYSIS - Sediment/Soil



Sample ID	TP02-11-1R	TP02-11-2R	TP02-12-1	TP02-13-1	TP02-13-2
Sample Date	02 07 10	02 07 10	02 07 11	02 07 11	02 07 11
ALS ID	11	12	13	14	15

Physical Tests						
Moisture	%	17.1	8.5	5.1	4.0	6.5

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File No. P7047

RESULTS OF ANALYSIS - Sediment/Soil



Sample ID	TP02-11-1R	TP02-11-2R	TP02-12-1	TP02-13-1	TP02-13-2
Sample Date	02 07 10	02 07 10	02 07 11	02 07 11	02 07 11
ALS ID	11	12	13	14	15

Extractable Hydrocarbons

CWS Fraction 2 (C10-16)	877	723	<50	410	<50
CWS Fraction 2-Naph	-	-	-	-	-
CWS Fraction 3 (C16-34)	423	434	136	371	136
CWS Fraction 3-PAH	-	-	-	-	-
CWS Fraction 4 (C34-50)	<50	84	50	60	54

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File No. P7047

RESULTS OF ANALYSIS - Sediment/Soil

Sample ID	TP02-14-1	TP02-15-1	TP02-16-1	TP02-17-1	TP02-17-2
Sample Date	02 07 11	02 07 11	02 07 11	02 07 11	02 07 11
ALS ID	16	17	18	19	20

Physical Tests

Moisture %	7.8	14.3	7.0	5.9	16.2
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Non-Halogenated Volatiles

Benzene	-	-	-	-	<0.04
CWS Fraction 1 (C6-10)	-	-	-	-	<30
CWS Fraction 1-BTEX	-	-	-	-	<30
Ethylbenzene	-	-	-	-	<0.05
Styrene	-	-	-	-	<0.05
Toluene	-	-	-	-	<0.05
meta- & para-Xylene	-	-	-	-	<0.05
ortho-Xylene	-	-	-	-	<0.05

Polycyclic Aromatic Hydrocarbons

Acenaphthene	-	-	-	-	<0.007
Acenaphthylene	-	-	-	-	<0.005
Anthracene	-	-	-	-	<0.01
Benz(a)anthracene	-	-	-	-	<0.01
Benzo(a)pyrene	-	-	-	-	<0.01
Benzo(b)fluoranthene	-	-	-	-	<0.01
Benzo(g,h,i)perylene	-	-	-	-	<0.01
Benzo(k)fluoranthene	-	-	-	-	<0.01
Chrysene	-	-	-	-	<0.01
Dibenz(a,h)anthracene	-	-	-	-	<0.005
Fluoranthene	-	-	-	-	<0.01
Fluorene	-	-	-	-	0.01
Indeno(1,2,3-c,d)pyrene	-	-	-	-	<0.01
Naphthalene	-	-	-	-	0.04
Phenanthrene	-	-	-	-	0.01
Pyrene	-	-	-	-	<0.01
2-Methylnaphthalene	-	-	-	-	0.10

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RESULTS OF ANALYSIS - Sediment/Soil



Sample ID	TP02-14-1	TP02-15-1	TP02-16-1	TP02-17-1	TP02-17-2
Sample Date	02 07 11	02 07 11	02 07 11	02 07 11	02 07 11
ALS ID	16	17	18	19	20

Extractable Hydrocarbons

CWS Fraction 2 (C10-16)	65	3890	312	966	78
CWS Fraction 2-Naph	-	-	-	-	78
CWS Fraction 3 (C16-34)	138	1530	242	642	98
CWS Fraction 3-PAH	-	-	-	-	98
CWS Fraction 4 (C34-50)	<50	78	<50	80	<50

Surrogate Standards

1,2-Dichlorobenzene (SS)	%	-	-	-	108
3-Fluorotoluene (SS)	%	-	-	-	87
d8-Naphthalene (SS)	%	-	-	-	98
d10-Acenaphthene (SS)	%	-	-	-	102
d10-Phenanthrene (SS)	%	-	-	-	100
d12-Chrysene (SS)	%	-	-	-	100

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RESULTS OF ANALYSIS - Sediment/Soil

Sample ID	TP02-18-1	TP02-18-2	TP02-19-1	TP02-20-1	TP02-20-2
Sample Date	02 07 11	02 07 11	02 07 12	02 07 12	02 07 12
ALS ID	21	22	23	24	25
Physical Tests					
Moisture %	4.3	5.5	6.4	7.9	19.0
Non-Halogenated Volatiles					
Benzene	-	-	-	-	<0.04
CWS Fraction 1 (C6-10)	-	-	-	-	<30
CWS Fraction 1-BTEX	-	-	-	-	<30
Ethylbenzene	-	-	-	-	0.05
Styrene	-	-	-	-	<0.05
Toluene	-	-	-	-	<0.05
meta- & para-Xylene	-	-	-	-	<0.05
ortho-Xylene	-	-	-	-	<0.05
Polycyclic Aromatic Hydrocarbons					
Acenaphthene	-	-	<0.005	<0.2	<0.007
Acenaphthylene	-	-	<0.005	<0.03	<0.005
Anthracene	-	-	<0.01	<0.03	<0.01
Benz(a)anthracene	-	-	<0.01	<0.01	<0.01
Benzo(a)pyrene	-	-	<0.01	<0.01	<0.01
Benzo(b)fluoranthene	-	-	<0.01	<0.01	<0.01
Benzo(g,h,i)perylene	-	-	0.01	0.01	0.01
Benzo(k)fluoranthene	-	-	<0.01	<0.01	<0.01
Chrysene	-	-	<0.02	<0.01	<0.01
Dibenz(a,h)anthracene	-	-	<0.005	<0.005	<0.005
Fluoranthene	-	-	<0.01	<0.01	<0.01
Fluorene	-	-	<0.01	0.25	<0.01
Indeno(1,2,3-c,d)pyrene	-	-	<0.01	<0.01	<0.01
Naphthalene	-	-	0.02	<0.2	0.03
Phenanthrene	-	-	0.01	0.37	0.01
Pyrene	-	-	<0.01	0.02	<0.01
2-Methylnaphthalene	-	-	0.06	<0.3	0.08

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File No. P7047

RESULTS OF ANALYSIS - Sediment/Soil

Sample ID	TP02-18-1	TP02-18-2	TP02-19-1	TP02-20-1	TP02-20-2
Sample Date	02 07 11	02 07 11	02 07 12	02 07 12	02 07 12
ALS ID	21	22	23	24	25

Extractable Hydrocarbons

CWS Fraction 2 (C10-16)	2180	826	51	499	61
CWS Fraction 2-Naph	-	-	51	499	61
CWS Fraction 3 (C16-34)	1040	534	227	769	255
CWS Fraction 3-PAH	-	-	227	769	255
CWS Fraction 4 (C34-50)	69	81	99	115	73

Surrogate Standards

1,2-Dichlorobenzene (SS)	% -	-	-	-	111
3-Fluorotoluene (SS)	% -	-	-	-	90
d8-Naphthalene (SS)	% -	-	120	87	90
d10-Acenaphthene (SS)	% -	-	123	123	97
d10-Phenanthrene (SS)	% -	-	123	100	94
d12-Chrysene (SS)	% -	-	112	88	87

Particle Size

Gravel (>2.00mm)	(%) -	-	-	-	61.8
Sand (2.00mm - 0.063mm)	(%) -	-	-	-	36.0
Silt (0.063mm - 4um)	(%) -	-	-	-	1.5
Clay (<4um)	(%) -	-	-	-	0.7

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File No. P7047

RESULTS OF ANALYSIS - Sediment/Soil

Sample ID	TP02-21-1	TP02-22-1
Sample Date	02 07 12	02 07 12
ALS ID	26	27

Physical Tests

Moisture %	5.4	5.2
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Non-Halogenated Volatiles

Benzene	<0.04	-
CWS Fraction 1 (C6-10)	<30	-
CWS Fraction 1-BTEX	<30	-
Ethylbenzene	<0.05	-
Styrene	<0.05	-
Toluene	<0.05	-
meta- & para-Xylene	<0.05	-
ortho-Xylene	<0.05	-

Polycyclic Aromatic Hydrocarbons

Acenaphthene	<0.005	-
Acenaphthylene	<0.005	-
Anthracene	<0.01	-
Benz(a)anthracene	<0.01	-
Benzo(a)pyrene	<0.01	-
Benzo(b)fluoranthene	<0.01	-
Benzo(g,h,i)perylene	<0.01	-
Benzo(k)fluoranthene	<0.01	-
Chrysene	<0.01	-
Dibenz(a,h)anthracene	<0.005	-
Fluoranthene	<0.01	-
Fluorene	<0.01	-
Indeno(1,2,3-c,d)pyrene	<0.01	-
Naphthalene	<0.01	-
Phenanthrene	<0.01	-
Pyrene	<0.01	-
2-Methylnaphthalene	0.01	-

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File No. P7047

RESULTS OF ANALYSIS - Sediment/Soil



Sample ID	TP02- 21-1	TP02- 22-1
Sample Date	02 07 12	02 07 12
ALS ID	26	27

Extractable Hydrocarbons

CWS Fraction 2 (C10-16)	<50	<50
CWS Fraction 2-Naph	<50	-
CWS Fraction 3 (C16-34)	86	109
CWS Fraction 3-PAH	86	-
CWS Fraction 4 (C34-50)	<50	<50

Surrogate Standards

1,2-Dichlorobenzene (SS)	%	111	-
3-Fluorotoluene (SS)	%	95	-
d8-Naphthalene (SS)	%	120	-
d10-Acenaphthene (SS)	%	127	-
d10-Phenanthrene (SS)	%	129	-
d12-Chrysene (SS)	%	117	-

Particle Size

Gravel (>2.00mm)	(%)	80.6	-
Sand (2.00mm - 0.063mm)	(%)	19.1	-
Silt (0.063mm - 4um)	(%)	0.1	-
Clay (<4um)	(%)	0.1	-

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File No. P7047

Appendix 1 - QUALITY CONTROL - Replicates



Sediment/Soil	TP02- 07-01	TP02- 07-01	TP02- 13-2	TP02- 13-2
	02 07 10	QC # 295999	02 07 11	QC # 296000

Physical Tests

Moisture %	4.2	4.1	6.5	6.2
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Extractable Hydrocarbons

CWS Fraction 2 (C10-16)	6350	7100	<50	<50
CWS Fraction 3 (C16-34)	2380	2970	136	127
CWS Fraction 4 (C34-50)	72	78	54	<50

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< = Less than the detection limit indicated.

Appendix 1 - QUALITY CONTROL - Reference Materials



Sediment/Soil

	Result	Target	Units	DL	ALSQC#	Method
<i>NRC Marine Harbour Sediment, HS-3B</i>						
<u>Polycyclic Aromatic Hydrocarbons</u>						
Acenaphthene	1.01	1.25	mg/kg	0.01	297110	a
Acenaphthylene	0.56	0.60	mg/kg	0.01	297110	a
Anthracene	1.94	2.76	mg/kg	0.01	297110	a
Benz(a)anthracene	6.39	7.91	mg/kg	0.01	297110	a
Benzo(a)pyrene	4.67	5.80	mg/kg	0.01	297110	a
Benzo(b)fluoranthene	8.99	9.45	mg/kg	0.01	297110	a
Benzo(g,h,i)perylene	4.26	3.88	mg/kg	0.01	297110	a
Benzo(k)fluoranthene	3.32	3.99	mg/kg	0.01	297110	a
Chrysene	7.25	8.77	mg/kg	0.01	297110	a
Dibenz(a,h)anthracene	1.13	0.89	mg/kg	0.01	297110	a
Fluoranthene	21.7	25.3	mg/kg	0.01	297110	a
Fluorene	1.41	2.38	mg/kg	0.01	297110	a
Indeno(1,2,3-c,d)pyrene	4.70	4.65	mg/kg	0.01	297110	a
Naphthalene	1.65	2.14	mg/kg	0.01	297110	a
Phenanthrene	16.9	18.8	mg/kg	0.01	297110	a
Pyrene	14.9	18.0	mg/kg	0.01	297110	a
<u>Extractable Hydrocarbons</u>						
CWS Fraction 2 (C10-16)	86	115	mg/kg	50	297737	b
CWS Fraction 3 (C16-34)	2790	3040	mg/kg	50	297737	b
CWS Fraction 4 (C34-50)	1250	1000	mg/kg	50	297737	b
<u>Surrogate Standards</u>						
d8-Naphthalene (SS)	% 92	100	%	0	297110	a
d10-Acenaphthene (SS)	% 99	100	%	0	297110	a
d10-Phenanthrene (SS)	% 94	100	%	0	297110	a
d12-Chrysene (SS)	% 89	100	%	0	297110	a

Methods:

a = ASE/GC-MS

b = ASE/GC-FID

Appendix 1 - QUALITY CONTROL - Spikes

Sediment/Soil

	Result	Target	Units	DL	ALSQC#	Method
<u>Non-Halogenated Volatiles</u>						
Benzene	51.0	50.0	mg/kg	0.04	296090	a
Ethylbenzene	53.7	50.0	mg/kg	0.05	296090	a
Styrene	50.9	50.0	mg/kg	0.05	296090	a
Toluene	53.1	50.0	mg/kg	0.05	296090	a
meta- & para-Xylene	53.9	50.0	mg/kg	0.05	296090	a
ortho-Xylene	53.0	50.0	mg/kg	0.05	296090	a
<u>Polycyclic Aromatic Hydrocarbons</u>						
Acenaphthene	0.191	0.200	mg/kg	0.005	297632	b
Acenaphthylene	0.174	0.200	mg/kg	0.005	297632	b
Anthracene	0.16	0.20	mg/kg	0.01	297632	b
Benz(a)anthracene	0.18	0.20	mg/kg	0.01	297632	b
Benzo(a)pyrene	0.18	0.20	mg/kg	0.01	297632	b
Benzo(b)fluoranthene	0.19	0.20	mg/kg	0.01	297632	b
Benzo(g,h,i)perylene	0.21	0.20	mg/kg	0.01	297632	b
Benzo(k)fluoranthene	0.18	0.20	mg/kg	0.01	297632	b
Chrysene	0.18	0.20	mg/kg	0.01	297632	b
Dibenz(a,h)anthracene	0.180	0.200	mg/kg	0.005	297632	b
Fluoranthene	0.18	0.20	mg/kg	0.01	297632	b
Fluorene	0.18	0.20	mg/kg	0.01	297632	b
Indeno(1,2,3-c,d)pyrene	0.18	0.20	mg/kg	0.01	297632	b
Naphthalene	0.19	0.20	mg/kg	0.01	297632	b
Phenanthrene	0.19	0.20	mg/kg	0.01	297632	b
Pyrene	0.18	0.20	mg/kg	0.01	297632	b
2-Methylnaphthalene	0.19	0.20	mg/kg	0.01	297632	b
<u>Surrogate Standards</u>						
d8-Naphthalene (SS)	% 94	100	%	0	297632	b
d10-Acenaphthene (SS)	% 96	100	%	0	297632	b
d10-Phenanthrene (SS)	% 92	100	%	0	297632	b
d12-Chrysene (SS)	% 90	100	%	0	297632	b

Methods:

a = GC-FID-MS

b = ASE/GC-MS

Appendix 1 - QUALITY CONTROL - Blanks

Sediment/Soil

	Result	Target	Units	DL	ALSQC#	Method
<u>Non-Halogenated Volatiles</u>						
Benzene	<0.04	<0.04	mg/kg	0.04	296089	a
CWS Fraction 1 (C6-10)	<20	<20	mg/kg	20	296089	b
Ethylbenzene	<0.05	<0.05	mg/kg	0.05	296089	a
Styrene	<0.05	<0.05	mg/kg	0.05	296089	a
Toluene	<0.05	<0.05	mg/kg	0.05	296089	a
meta- & para-Xylene	<0.05	<0.05	mg/kg	0.05	296089	a
ortho-Xylene	<0.05	<0.05	mg/kg	0.05	296089	a
<u>Polycyclic Aromatic Hydrocarbons</u>						
Acenaphthene	<0.01	<0.01	mg/kg	0.01	297111	c
Acenaphthylene	<0.01	<0.01	mg/kg	0.01	297111	c
Anthracene	<0.01	<0.01	mg/kg	0.01	297111	c
Benz(a)anthracene	<0.01	<0.01	mg/kg	0.01	297111	c
Benzo(a)pyrene	<0.01	<0.01	mg/kg	0.01	297111	c
Benzo(b)fluoranthene	<0.01	<0.01	mg/kg	0.01	297111	c
Benzo(g,h,i)perylene	<0.01	<0.01	mg/kg	0.01	297111	c
Benzo(k)fluoranthene	<0.01	<0.01	mg/kg	0.01	297111	c
Chrysene	<0.01	<0.01	mg/kg	0.01	297111	c
Dibenz(a,h)anthracene	<0.01	<0.01	mg/kg	0.01	297111	c
Fluoranthene	<0.01	<0.01	mg/kg	0.01	297111	c
Fluorene	<0.01	<0.01	mg/kg	0.01	297111	c
Indeno(1,2,3-c,d)pyrene	<0.01	<0.01	mg/kg	0.01	297111	c
Naphthalene	<0.01	<0.01	mg/kg	0.01	297111	c
Phenanthrene	<0.01	<0.01	mg/kg	0.01	297111	c
Pyrene	<0.01	<0.01	mg/kg	0.01	297111	c
2-Methylnaphthalene	<0.01	<0.01	mg/L	0.01	297111	c
<u>Extractable Hydrocarbons</u>						
CWS Fraction 2 (C10-16)	<50	<50	mg/kg	50	297736	d
CWS Fraction 3 (C16-34)	<50	<50	mg/kg	50	297736	d
CWS Fraction 4 (C34-50)	<50	<50	mg/kg	50	297736	d

Methods:

a = GC-FID-MS

b = GC-FID

c = ASE/GC-MS

d = ASE/GC-FID

Appendix 2 - Methodology



Outlines of the methodologies utilized for the analysis of the samples submitted are as follows

Moisture in Sediment/Soil

This analysis is carried out gravimetrically by drying the sample at 103 C for a minimum of six hours.

Recommended Holding Time:

Sample: 14 days

Reference: Puget

For more detail see ALS Environmental "Collection & Sampling Guide"

Volatile Organic Compounds and Volatile Hydrocarbons in Sediment/Soil

This analysis involves the extraction of a subsample of the sediment/soil with methanol. Aliquots of the methanol extract are then analyzed for Volatile Hydrocarbons (VH) by capillary column gas chromatography with flame-ionization detection (GC/FID) and for specific Volatile Organic Compounds (VOC) by capillary column gas chromatography with mass spectrometric detection (GC/MS). The methanol extraction and VH analysis are carried out in accordance with the British Columbia Ministry of Environment, Lands and Parks (BCMELP) Analytical Method for Contaminated Sites "Volatile Hydrocarbons in Solids by GC/FID" (Version 2.1 July 1999). The VOC analysis is carried out using procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846, Method 8260, published by the United States Environmental Protection Agency (EPA).

Recommended Holding Time:

Sample: 7 days Extract: 40 days

Reference: BCMELP

For more detail see ALS Environmental "Collection & Sampling Guide"

Petroleum Hydrocarbons in Sediment/Soil (Canada-Wide Standard)

This analysis is carried out in accordance with the "Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil - Tier 1 Method, Canadian Council of Ministers of the Environment, December 2000." The various extraction fractions are analysed as follows:

CWS Fractions 1 and 1-BTEX:

This procedure involves the extraction of a subsample of the sediment/soil with methanol. Aliquots of the methanol extract are then analysed by capillary column gas chromatography with flame-ionization detection (GC/FID) for CWS Fraction 1, and by capillary column gas chromatography

Appendix 2 - Methodology



with mass spectrometric detection (GC/MS) for the BTEX compounds.

CWS Fractions 2, 2-PAH, 3, 3-PAH, 4 and 4G-SG:

The procedure uses an automated system at high temperature and pressure (Accelerated Solvent Extractor - ASE) or a Soxhlet system to extract a subsample of the sediment/soil with a 1:1 mixture of hexane and acetone. The extract is concentrated and undergoes a silica-gel clean-up to remove polar material. The final extract is analysed by high temperature capillary column gas chromatography with flame ionization detection (GC/FID). CWS Fractions 4G and 4G-SG (Gravimetric Heavy Hydrocarbons) are analysed gravimetrically.

Reported results may include any or all of the following:

CWS Fraction 1 (C6-10):

sum of all petroleum hydrocarbon compounds that elute between nC6 and nC10 obtained by GC/FID analysis

CWS Fraction 1-BTEX:

CWS Fraction 1 (C6-10), minus BTEX compounds

CWS Fraction 2 (C10-16):

sum of all petroleum hydrocarbon compounds that elute between nC10 and nC16 obtained by GC/FID analysis

CWS Fraction 2-PAH:

CWS Fraction 2 (C10-16), minus selected PAH compounds (Naphthalene)

CWS Fraction 3 (C16-34):

sum of all petroleum hydrocarbon compounds that elute between nC16 and nC34 obtained by GC/FID analysis

CWS Fraction 3-PAH:

CWS Fraction 3 (C16-34), minus selected PAH compounds

CWS Fraction 4 (C34-50):

sum of all petroleum hydrocarbon compounds that elute between nC34 and nC50 obtained by GC/FID analysis

CWS Fraction 4G (GHH):

Results obtained by gravimetric analysis.

CWS Fraction 4G-SG (GHH + SG):

Results obtained by gravimetric analysis after silica gel clean-up

Recommended Holding Time:

Sample: 7 days for CWS Fraction 1

14 days for CWS Fractions 2, 3, 4, 4G & 4G-SG

Extract: 7 days for all CWS Fractions

Reference: CCME

For more detail see ALS Environmental "Collection & Sampling Guide"



Polycyclic Aromatic Hydrocarbons in Sediment/Soil

This analysis is carried out using procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846, Methods 3545, 3630 & 8270, published by the United States Environmental Protection Agency (EPA). The procedure uses an automated system (Accelerated Solvent Extractor - ASE) to extract a subsample of the sediment/soil with a 1:1 mixture of hexane and acetone. The extract is then solvent exchanged to toluene and undergoes a silica gel clean-up to remove sample components that could potentially interfere with the analysis. The final extract is analysed by capillary column gas chromatography with mass spectrometric detection (GC/MS).

Recommended Holding Time:

Sample: 14 days Extract: 40 days

Reference: EPA

For more detail see ALS Environmental "Collection & Sampling Guide"

Particle Size Distribution in Sediment/Soil

This analysis is carried out using a method adapted for Fisheries and Environment Canada, Ottawa, described in Walton, 1978. The procedure involves oven-drying and sample pre-treatment to remove organics, prior to using standard sieves for the sand and silt fractions and the pipette method for the clay fraction.

Note: Particle Size analysis is subcontracted.

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End of Report

ALS

B. Mack

	GRAVEL				SAND							SILT		CLAY	
	COARSE		FINE		VCS	CS	MEDIUM		FS	VERY FINE		#1	#2	#1	#2
	3 inches										#140 - 0.105 mm				
	3/4 inch										#200 - 0.074 mm				
				1/2 inch								#230 - 0.063 mm			
				#4 - 4.76 mm								#270 - 0.053 mm			
														4 microns	
														2 microns	
P7047 - 10				65.6		33.4						0.5		0.5	
-25				61.8		36.0						1.5		.7	
-26				80.7		19.1						0.1		.1	

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Environmental Chemistry



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laboratories ltd.

CLIENT: City of Vancouver
ADDRESS: 1000 Burrard Street
CONTACT: Mr. [unclear]
TELEPHONE: (604) 253-4188 FAX: (604) 253-6700
PROJECT NAME/NO.: TP02-15-1
QUOTE / PO NO.: 200/07/15
DATE SUBMITTED: 2007/07/15 ASL CONTACT: [unclear]

LAB USE ONLY

SAMPLE IDENTIFICATION

DATE / TIME COLLECTED
Y M D

MATRIX

NOTES

TP02-15-1	07/11	AM	Soil	
TP02-16-1		PM		
TP02-17-1		PM		
TP02-18-1		PM		
TP02-19-1		PM		
TP02-20-1		PM		
TP02-21-1		PM		
TP02-22-1		PM		
TP02-23-1		PM		
Drum 1		PM		
Drum 2		PM		

TURN AROUND REQUIRED:

- ☐ ROUTINE (7 - 10 WORKING DAYS)
☐ RUSH (SPECIFY DATE):

SPECIAL INSTRUCTIONS:

2007-07-15

SAMPLE CONDITION
UPON RECEIPT:

- ☐ FROZEN
☐ COLD
☐ AMBIENT

RELINQUISHED BY:

DATE
TIME

RECEIVED BY:

DATE
TIME

RELINQUISHED BY:

DATE
TIME

RECEIVED BY:

DATE
TIME

CLIENT: -11 - 1st
 ADDRESS: 410 - 6000 - 1st Avenue
 CONTACT: Alberta Environment
 TELEPHONE: 403-297-4444 FAX: 403-297-4444
 PROJECT NAME/NO: Blaris
 QUOTE / PO NO:
 DATE SUBMITTED: 2002.07.15 ASL CONTACT:

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F1 + BTEX
F2 - F4
F2 - F4 + PAHs
Grain Size

FOR LAB USE ONLY			DATE / TIME COLLECTED		MATRIX													NOTES
SAMPLE IDENTIFICATION			Y	D														
TP02-04-1			02	07	10	AM												
TP02-05-1						AM												
TP02-06-1						PM												
TP02-07-1						AM												
TP02-07-2						PM												
TP02-08-1						AM												
TP02-09-1						PM												
TP02-09-2						AM												
TP02-10-1						PM												
TP02-11-1						AM												
TP02-11-2						PM												
TP02-12-1						AM												
TP02-12-2						PM												
TP02-13-1						AM												
TP02-13-2						PM												
TP02-14-1						AM												

TURN AROUND REQUIRED:
☐ ROUTINE (7 - 10 WORKING DAYS)
☐ RUSH (SPECIFY DATE) _____
 SPECIAL INSTRUCTIONS: _____

SAMPLE CONDITION UPON RECEIPT:
☒ FROZEN
☐ COLD
☐ AMBIENT

RELINQUISHED BY: _____ DATE: _____ TIME: _____
 RECEIVED BY: _____ DATE: _____ TIME: _____