A SURVEY OF METALS AND TRACE ORGANIC COMPOUNDS IN SEDIMENTS FROM WABAMUN LAKE AND OTHER ALBERTA LAKES

Alberta Environment

A Survey Of Metals And Trace Organic Compounds In Sediments From Wabamun Lake And Other Alberta Lakes

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SUMMARY

Wabamun Lake is an important recreational lake west of Edmonton. Coal mining, coal-fired power generation plants, farming, summer villages and recreational activities influence the lake and its watershed. The impact on the lake of these intensive and sometimes conflicting uses is a cause of public concern.

In 2002 Alberta Environment (AENV) initiated several studies (including this one) in response to complaints about murky water in the lake near the TransAlta Utilities Corporation (TAU) ash lagoon outfall and in support of an investigation on fish mortality. The specific objectives of this study were to document surficial sediment quality of Wabamun Lake with respect to metals and trace organics and to compare results with those from other lakes.

From July 25 to September 5, 2002 Wabamun Lake sediments were sampled following a 1-km by 1-km grid pattern and at transects along the shoreline. A total of 69, 27, and 66 samples were collected for the determination of metals, trace organics, and sediment characteristics, respectively. The top 5 cm of sediments from at least five Ekman grabs were pooled to form individual samples. Eight reference lakes (Pigeon, Ste. Anne, Isle, Wizard, Gull, Sylvan, Bonnie and Amisk) were sampled in 2002 for the same sediment variables as Wabamun Lake. A total of 24 samples was taken from these lakes. Archived sediments from 28 lakes were analysed for a selection of metals. Twenty-nine 'total' metals were analysed by mass spectrometry (MS) after microwave digestion in nitric acid, hydrofluoric acid and hydrogen peroxide (i.e., harsh extraction). A subset of samples was analysed by MS after digestion in nitric acid (i.e., mild extraction) to yield 'near total' metal concentrations recommended for comparisons with sediment guidelines. Mercury was analysed by cold vapour-atomic adsorption spectrometry (CV-AAS). Trace organics were analysed by gas chromatography–mass spectrometry (GC-MS).

<u>Metals</u>

Metal concentrations in surficial sediments from Wabamun Lake tend to be highest in the deeper portion of the west basin where fine-grained sediment, rich in organic matter, prevails.

Shallow sediments near the ash lagoon outfall tend to have higher concentrations of some metals (e.g., As, Cd, Cr, Cu, Pb, Se and Zn) than similar sediments elsewhere in the lake. This is consistent with findings of AENV (2002), which identified the ash lagoon as a potential source of metals.

Compared to eight reference lakes, Wabamun Lake samples had higher average metal concentrations. Even when metal levels were standardized some Wabamun Lake samples had higher concentrations of Hg, and Cd, Cu, Zn, Sb than would be expected from the relationship of these metals to TOC and Al, respectively. However, levels of Cr, Pb, Tl, Sr and Ti fell within the expected range.

In archived sediment samples, Wabamun and Moonshine lakes had noticeably higher concentrations of Cu than other lakes.

A comparison with Interim Sediment Quality Guidelines (ISQG) shows that Hg and Pb were below the ISQG in all Wabamun Lake samples. However, 93% of As, 50% of Cr, 67% of Cu, and 6% of Zn measurements were above the ISQG and 25% of As were above the probable effects level (PEL). In other lakes there was also a high incidence of non-compliance for As and Cr and several lakes had concentrations above the ISQG for Cd, Cu, Pb, and Zn.

The subset of samples analysed after a mild extraction, which provides a more realistic indication of bio-available metal concentrations, generally had lower metal concentration than when analysed after the harsh extraction. Nevertheless non-compliance with ISQG and PEL persisted albeit at a lower frequency.

Results of this study combined with those of other studies on Wabamun and other lakes (Golder 2002, Donahue 2002) suggest that, quite independently from the history of anthropogenic effects on metal concentrations, elevated levels of As, Cd, Cr, Cu, Hg, and Zn may result from natural geochemical sources.

Trace Organics

PAHs were the primary trace organics detected in lake sediments. Of the 24 PAHs analysed in lake sediments, 22 occurred at measurable concentrations in at least one of the sediment samples from Wabamun Lake or the eight other lakes sampled in 2002. Generally, their variety and concentration were higher in Wabamun Lake. However, acenaphthylene was not found in Wabamun Lake and retene was found less frequently in Wabamun Lake than in other lakes.

Twelve of the 22 PAHs detected in lake sediments have sediment quality guidelines. ISQG were exceeded for naphthalene, pyrene, benzo(a)anthracene, chrysene, benzo(a)pyrene and dibenzo(a,h)anthracene in as many as four Wabamun Lake samples. Most of the sites where concentrations were above the guidelines are in the northeast portion of the lake. None of the PAHs found in Wabamun Lake exceeded the PEL. PAH levels in other lakes were below the ISQG. There is a good correspondence between PAH detected in this study and those reported by Donahue (2001) in Wabamun, Pigeon and Ste. Anne lakes.

There are several possible sources of PAH to Wabamun Lake. They include coal mining and coal burning, leaching from coal seams near or in the lake, fuel consumption and occasional spillage by motor boats and weed harvesters, creosote treated wood structures in or near the lake, and fuel consumption on a nearby major highway. Creosote treated wood and fuel consumption along the major railroad are other potential sources of PAHs. The relative contribution from these sources needs to be determined.

Implications for aquatic biota of metal and PAH concentrations in excess of ISQG and, in some cases PEL, need further investigation. Toxicological studies on Wabamun Lake sediments are ongoing and will provide some information on test organism responses under controlled laboratory exposure. A benthic invertebrate community study is also in progress – it will provide information on species composition and density at several locations in the lake.

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1.0 INTRODUCTION

Wabamun Lake is an important recreational lake in the Edmonton area. The lake and its watershed are influenced by coal mining, coal-fired power generation plants, farming, summer village development and recreational activities. Drier than average conditions have prevailed in the Wabamun Lake area since the early 1990's and have resulted in a gradual decline in lake level. Activities of TransAlta Utilities Corporation (TAU) in the watershed have also contributed to the decline in lake level. In 1997 the Wabamun Lake Water Treatment Plant (WL-WTP), which is operated by TAU, started treating water from the Sundance cooling pond. The treated water is discharged into the lake to pay back the water deficit created by TAU's operations. The cooling pond is replenished with water diverted from the North Saskatchewan River. Public hearings held in 2001 by the Energy and Utility Board (EUB) with respect to the expansion of the Wabamun, Keephills and Genesee Power Plants highlighted public concern about atmospheric deposition of contaminants released during the combustion of coal for power generation in the Wabamun Lake area. Public hearings held by the Environmental Appeal Board (EAB) in 2001 and 2002 regarding the expansion of the Wabamun Water Treatment Plant and the renewal of the licence of the Wabamun Power Plant further illustrated public concerns about the lake.

In early 2002, Alberta Environment (AENV) initiated an investigation in response to public concern regarding murky water in Lake Wabamun (AENV 2002) in the vicinity of the TAU ash lagoon outfall. In spring 2002, fish mortality was observed in the inlet canal and on the intake screens of the Wabamun Power Plant.

These events prompted an intensification of data collection and review programs on the lake, including an extensive review of the long-term water quality data base of Wabamun Lake (Casey 2003), a water quality study to document spatial patterns in the lake, an invertebrate impact assessment study on the ash lagoon effluent and Water Treatment Plant outfall, a sediment toxicity study, and the present sediment quality assessment.

Sediment quality sampling has been carried out in Wabamun Lake as part of a variety of research or monitoring initiatives (e.g., AENV 2002, Golder 2002, Donahue 2002). The sampling has been restricted to specific areas such as the vicinity of the TAU ash lagoon outfall, the cooling water inlet and outfall, and some sites in the deeper open, water portion of the lake. The intent has been to document the quality of recently deposited sediments in areas of interest (AENV 2002, Golder 2002), and to determine contaminant levels in sediments deposited over the last hundred years (Donahue 2002).

Although substantial water quality information exists for Alberta lakes, particularly as it relates to trophic status (AENV, data base), lake sediments have been sampled much less intensively. At the present time there is insufficient baseline information to depict levels of metals and trace organics in lake sediments, or to understand factors that influence these levels.

The objectives of the sediment study undertaken by AENV in the summer of 2002 were to assess spatial variability of recently deposited sediments in Wabamun Lake; to compare sediment quality of Wabamun Lake with that of other selected large lakes in Alberta; and to start developing a provincial lake sediment quality database.

2.0 METHODS

2.1 Sampling Program

2.1.1 Wabamun Lake Sediments (Summer 2002)

Spatially intensive sampling for water and sediments was carried out on Wabamun Lake in the summer of 2002. A grid with nodes 1 km apart was superimposed on a 1:50,000 topographic map (Figure 1). North south transects were numbered sequentially from west to east. Sampling sites or nodes within a transect were identified by the transect number and sequential numbers from south to north. Sampling sites covered the entire lake surface, including bays and littoral areas. While the grid pattern used to locate sampling points for water and sediments is the same, sediments were sampled at fewer nodes, but at additional transects along the shoreline (Figure 1). The latitude and longitude of sampling sites is documented in Table 1.

Sampling started on July 25, 2002 was completed on September 5, 2002. Sampling was initiated in the east basin, but strong winds and wave action precluded a systematic approach to the sediment sampling. Instead, sampling was opportunistic with a focus on the open water area during calm days and on sheltered areas along the shoreline on windy days. GPS readings were used to locate the sampling points.

All sediment samples were collected with a stainless steel Ekman grab. The top 5 cm of sediments from the centre part of the grab were scooped up with a plastic (samples for metal analysis) or metal (samples for trace organics analysis) spoon and transferred to appropriate sample containers (large plastic zip lock bags for metals and 50 ml glass vials for trace organics). The surficial sediments that were in contact with the inner wall of the grab were transferred to large zip lock plastic bags and reserved for total organic carbon (TOC) and particle size analysis. All samples are composites of at least five Ekman grabs from each site. However, samples for volatile priority pollutant analysis were derived from a single grab because there was a concern that repeated opening and closing of vials would result in the loss of volatile contaminants. Sampling depth and observations about sediment colour, odour, and presence or absence of macrophytes and benthic invertebrates were recorded at each sampling location. Figure 2 identifies which sediment variables were analyzed at each site.

2.1.2 Eight Additional Lakes (2002)

The following eight lakes were sampled in August and September 2002 to obtain lake sediment data that would be suitable for comparison to Wabamun Lake: Amisk, Bonnie, Gull, Isle, Ste. Anne, Pigeon, Sylvan and Wizard (Table 1, Figure 3). Bonnie, Gull, Ste. Anne, Isle, Pigeon, Sylvan and Wizard lakes are typical shallow lakes for central Alberta. Gull, Pigeon and Sylvan are most similar to Wabamun Lake because of their comparable watershed to lake area ratio, mean depth and trophic status. Furthermore, Pigeon and Sylvan lakes are located in the same ecoregion as Wabamun Lake (i.e., Boreal Mixed Wood, Table 2). Amisk is most dissimilar because of its greater depth.

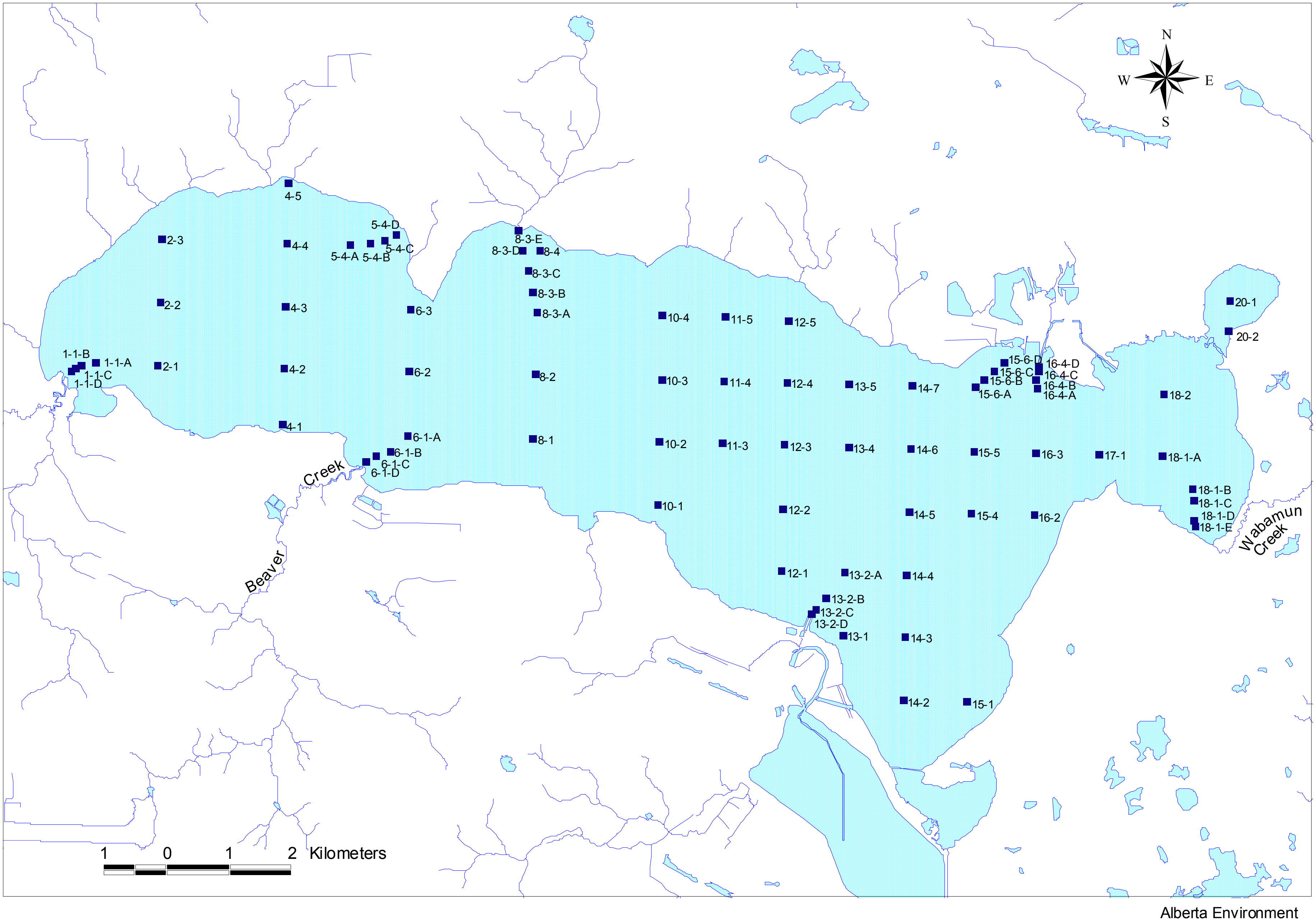

Figure 1 Sediment sites sampled during the Wabamun Lake survey, summer 2002

Table 1 Sediment sampling locations for Wabamun Lake and other lakes sampled in 2002 and in 1993-94

Site Name	Latitude in Decimal Degrees	Longitude in Decimal Degrees	Site Name	Latitude in Decimal Degrees	Longitude in Decimal Degrees
WABAMUN 2002					
Wabamun 1-1-A	53.553060	114.721670	Wabamun 12-3	53.540830	114.556390
Wabamun 1-1-B	53.552690	114.725030	Wabamun 12-4	53.549720	114.555830
Wabamun 1-1-C	53.552250	114.726440	Wabamun 12-5	53.558610	114.555280
Wabamun 1-1-D	53.551860	114.727310	Wabamun 13-1	53.513610	114.542780
Wabamun 2-1	53.552780	114.706670	Wabamun 13-2-A	53.522500	114.542220
Wabamun 2-2	53.561670	114.706110	Wabamun 13-2-B	53.518890	114.546670
Wabamun 2-3	53.570830	114.705560	Wabamun 13-2-C	53.517220	114.549170
Wabamun 4-1	53.544110	114.676940	Wabamun 13-2-D	53.516670	114.550000
Wabamun 4-2	53.552220	114.676390	Wabamun 13-4	53.540560	114.541110
Wabamun 4-3	53.561110	114.675830	Wabamun 13-5	53.549440	114.540830
Wabamun 4-4	53.570000	114.675560	Wabamun 14-2	53.504170	114.528330
Wabamun 4-5	53.578610	114.675000	Wabamun 14-3	53.513330	114.527780
Wabamun 5-4-A	53.569720	114.660280	Wabamun 14-4	53.522220	114.527220
Wabamun 5-4-B	53.570060	114.655470	Wabamun 14-5	53.531110	114.526670
Wabamun 5-4-C	53.570420	114.652000	Wabamun 14-6	53.540280	114.526110
Wabamun 5-4-D	53.571220	114.649390	Wabamun 14-7	53.549170	114.525560
Wabamun 6-1-A	53.542500	114.646670	Wabamun 15-1	53.503890	114.513060
Wabamun 6-1-B	53.540310	114.651080	Wabamun 15-4	53.530830	114.511670
Wabamun 6-1-C	53.539640	114.654420	Wabamun 15-5	53.539720	114.511110
Wabamun 6-1-D	53.538890	114.656670	Wabamun 15-6-A	53.548890	114.510560
Wabamun 6-2	53.551670	114.646390	Wabamun 15-6-B	53.550000	114.508245
Wabamun 6-3	53.560560	114.645830	Wabamun 15-6-C	53.551250	114.505930
Wabamun 8-1	53.541940	114.616640	Wabamun 15-6-D	53.552500	114.503615
Wabamun 8-2	53.551110	114.616110	Wabamun 16-2	53.530560	114.496670
Wabamun 8-3-A	53.560000	114.615560	Wabamun 16-3	53.539440	114.496110
Wabamun 8-3-B	53.562963	114.616640	Wabamun 16-4-A	53.548610	114.495560
Wabamun 8-3-C	53.565927	114.617720	Wabamun 16-4-B	53.550000	114.495940
Wabamun 8-3-D	53.568890	114.618800	Wabamun 16-4-C	53.551250	114.495420
Wabamun 8-3-E	53.571853	114.619880	Wabamun 16-4-D	53.551830	114.495110
Wabamun 8-4	53.568890	114.615000	Wabamun 17-1	53.539170	114.480830
Wabamun 10-1	53.532500	114.586940	Wabamun 18-1-A	53.538890	114.465830
Wabamun 10-2	53.541390	114.586390	Wabamun 18-1-B	53.534220	114.458560
Wabamun 10-3	53.550280	114.585830	Wabamun 18-1-C	53.532420	114.458390
Wabamun 10-4	53.559440	114.585560	Wabamun 18-1-D	53.529610	114.458170
Wabamun 11-3	53.541110	114.571390	Wabamun 18-1-E	53.528890	114.458060
Wabamun 11-4	53.550000	114.570830	Wabamun 18-2	53.547780	114.465280
Wabamun 11-5	53.559170	114.570280	Wabamun 20-1	53.561110	114.449170
Wabamun 12-1	53.522780	114.557220	Wabamun 20-2	53.556670	114.449720
Wabamun 12-2	53.531670	114.556940			
LAKES 2002					
Amisk	54.616110	112.623060	Lake Isle	53.633330	114.733330
Bonnie	54.150000	111.875000	Pigeon	53.000000	114.016670
Gull	52.533330	113.983330	Sylvan	52.350000	114.166670
Lac Ste. Anne	53.708330	114.400000	Wizard	53.116670	113.850000
LAKES 1993-94					
Battle	52.966670	114.183330	Lac Ste Anne	53.708330	114.400000
Bonnie	54.150000	111.875000	Sandy North	53.809440	114.048610
Buck	52.983330	114.766670	Pigeon	53.000000	114.016670
Buffalo	52.483330	112.866670	Pine	52.103330	113.454170
Crimson	52.461110	115.044400	Sandy South	53.772220	114.029720
Dillberry	52.575000	110.004170	Saskatoon	55.233330	119.083330
Elkwater	49.650000	110.300000	Smoke	54.366670	116.933330
Gull	52.533330	113.983330	Steele	54.650000	113.766670
Iosegun	54.466670	116.833330	Sturgeon	55.102780	117.537500
Long	54.583330	112.833330	Sylvan	52.350000	114.166670
McLeod	54.294440	115.658330	Tucker	54.536110	110.630560
Moonshine	55.883330	119.216670	Wabamun	53.540270	114.531390
Moose	54.250000	110.916670	Wizard	53.116670	113.850000
Muriel	54.066670	110.725000			

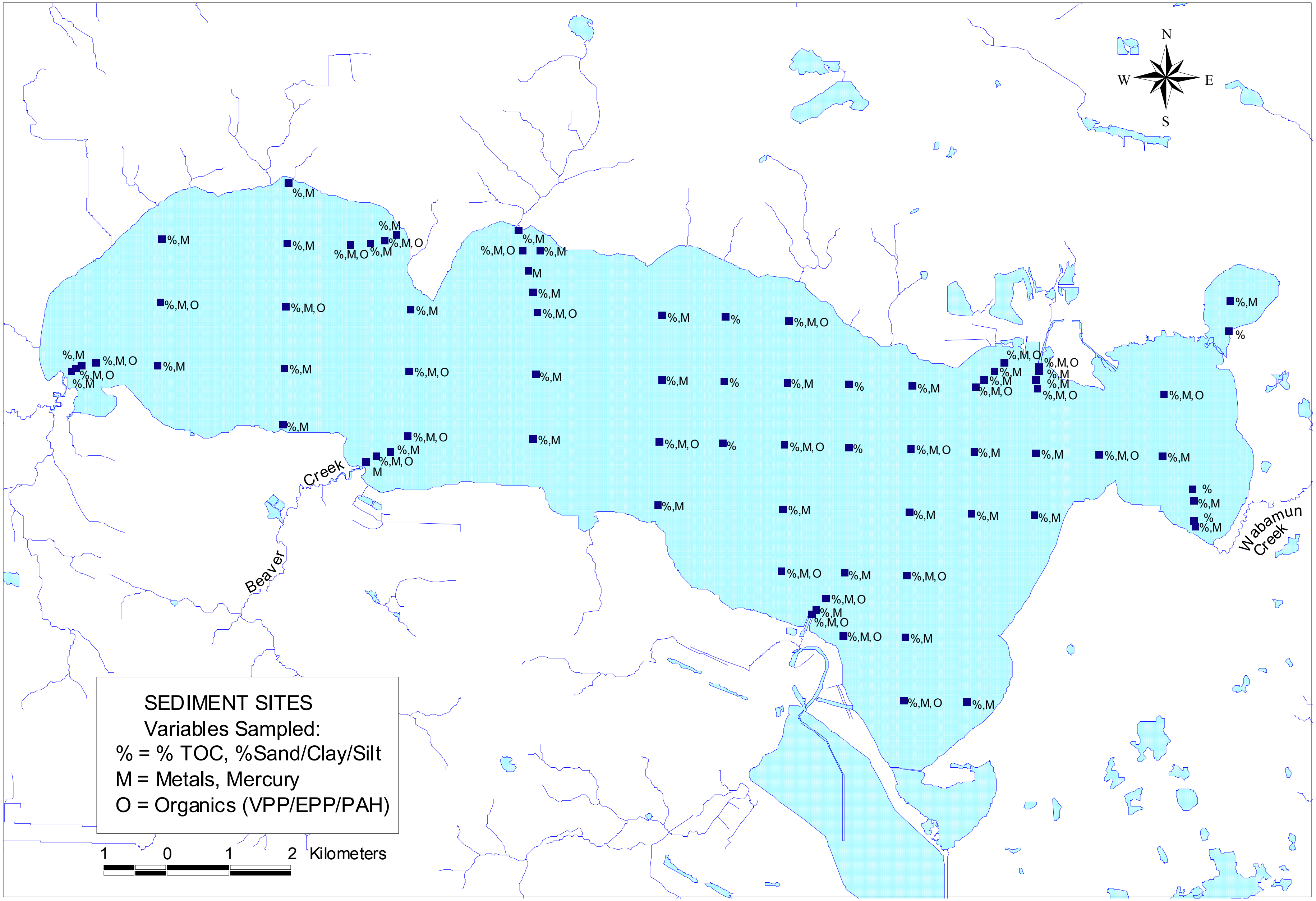

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Figure 2 Variables analysed in Wabamun Lake sediment samples, summer 2002

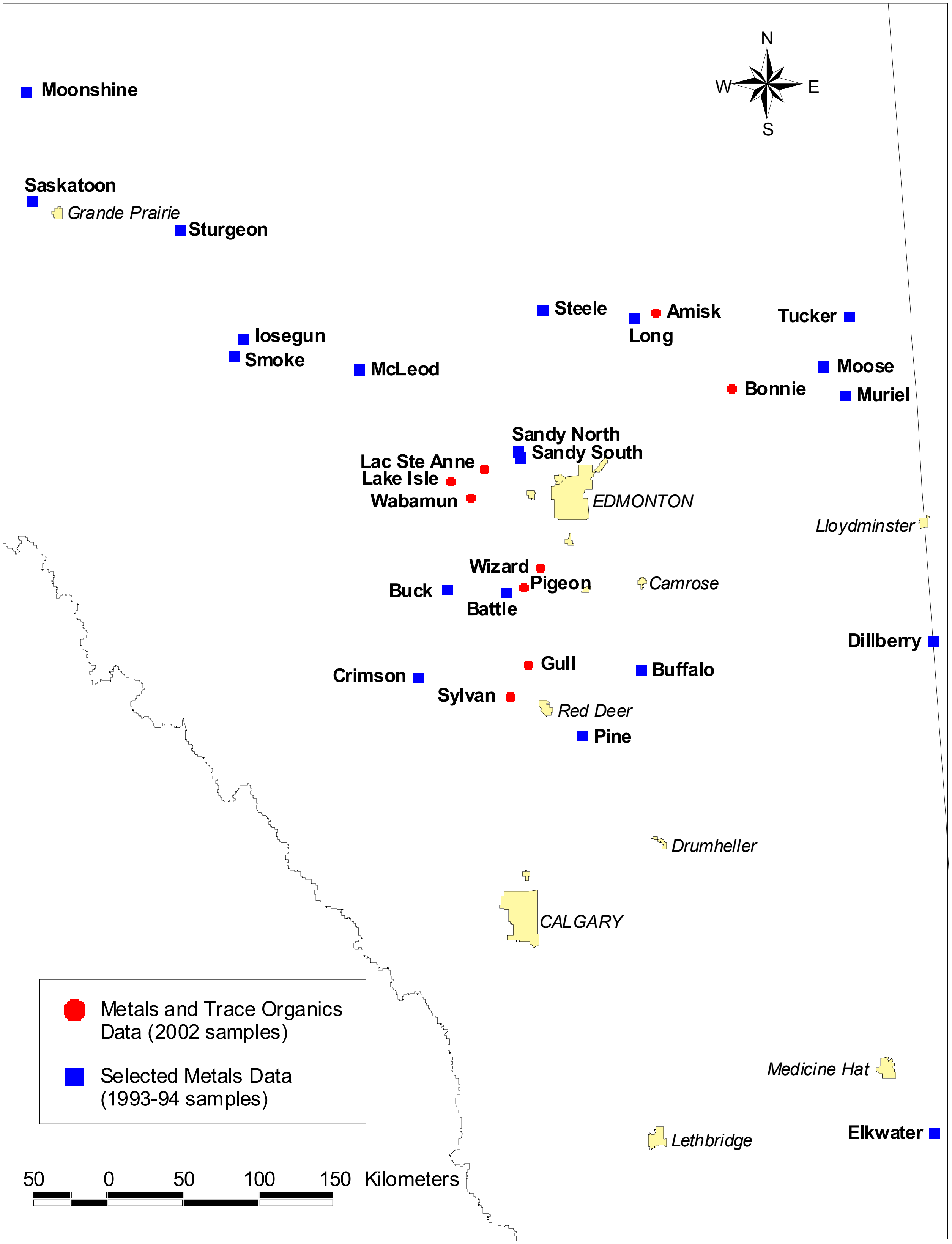

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Figure 3 Lakes with metals and trace organic data

Table 2 Characteristics of lakes sampled in summer 2002 and in 1993-94

Lake	Drainage Basin	Ecoregion	Lake Drainage Basin (km^2)	Lake Area (km^2)	Lake Basin/ Lake Area	Mean Depth (m)	Trophic Status
Amisk	Beaver	Boreal Mixedwood	234	5.15	0.02	15.5	H-E
Battle	Battle	Boreal Mixedwood	103	4.56	0.04	6.9	E
Bonnie	North Saskatchewan	Boreal Mixedwood-Aspen Parkland	49.6	3.77	0.08	3.1	H-E
Buck	North Saskatchewan	Boreal Mixedwood	233	25.4	0.11	6.2	E
Buffalo	Red Deer	Aspen Parkland	1440	93.5	0.06	2.8	M
Crimson	North Saskatchewan	Boreal Foothills	2.32	1.75	0.75	2.2	M
Dillberry	Sounding Creek	Aspen Parkland	11.8	0.8	0.07	2.8	O
Elkwater	South Saskatchewan	Boreal Foothills	25.7	2.31	0.09	3.5	M
Gull	Red Deer	Boreal Mixedwood-Aspen Parkland	206	80.6	0.39	5.4	M
Iosegun	Smoky	Boreal Mixedwood	248	13.4	0.05	4.1	E
Lac Ste Anne	North Saskatchewan	Boreal Mixedwood	619	54.5	0.09	4.8	E
Lake Isle	North Saskatchewan	Boreal Mixedwood	246	23	0.09	4.1	H-E
Long	Beaver	Boreal Mixedwod	82.4	5.84	0.07	4.3	E
McLeod	Athabasca	Boreal Foothills	45.9	3.73	0.08	5.1	M
Moonshine	Peace	Boreal Foothills	6.84	0.28	0.04	1.3	E
Moose	Beaver	Boreal Mixedwood	755	40.8	0.05	5.6	E
Muriel	Beaver	Boreal Mixedwood	384	64.1	0.17	6.6	E
Pigeon	Battle	Boreal Mixedwood	187	96.7	0.52	6.2	E
Pine	Red Deer	Aspen Parkland	150	3.89	0.03	5.3	E
Sandy South	North Saskatchewan	Boreal Mixedwood	48.4	11.4	0.24	2.6	E+H-E
Sandy North	North Saskatchewan	Boreal Mixedwood	48.4	11.4	0.24	2.6	E+H-E
Saskatoon	Smoky	Aspen Parkland	31.8	7.47	0.23	2.6	H-E
Smoke	Smoky	Boreal Foothills	127	9.59	0.08	5.1	E
Steele	Athabasca	Boreal Mixedwood	255	6.61	0.03	3.2	H-E
Sturgeon	Smoky	Boreal Mixedwood	571	49.1	0.09	5.4	H-E
Sylvan	Red Deer	Boreal Mixedwood	102	42.8	0.42	9.6	M
Tucker	Beaver	Boreal Mixedwood	312	6.65	0.02	2.9	H-E
Wabamun	North Saskatchewan	Boreal Mixedwood	259	81.8	0.32	6.3	E
Wizard	North Saskatchewan	Boreal Mixedwood	29.8	2.48	0.08	6.2	E

Notes:
Data and ecoregion classification listed are from Mitchell and Prepas (1990)
Shaded rows identify lakes sampled in 2002
All other lakes, except Amisk, sampled in 1993-1994
Trophic Status (lake productivity): O = Oligotrophic (low), M = Mesotrophic (moderate), E = Eutrophic (high), H-E = Hypereutrophic (very high)

Sediments from the deepest part of each lake were sampled at three locations (i.e., three samples). Each sample is a composite of surficial (top 5 cm) sediments from at least five Ekman grab hauls. Samples were analyzed for particle size, total organic carbon, metals and trace organic compounds.

2.1.3 Archived Sediment Samples (1993-1994)

AENV undertook sediment surveys in a range of shallow lakes in 1993 and 1994, as part of a study on internal phosphorus loading (AENV unpublished data). In 1993-94 sampling was stratified with respect to depth and representative samples were taken from different depth strata. Most lakes are represented by three or four samples, although only a single sample was available for Pine Lake. All available samples were analyzed.

Surficial sediment (top 5 cm) samples were collected with an Ekman grab. Sediment samples were freeze-dried and analyzed. Analyses included TOC for some samples, but particle size was not measured. Sample handling and storage history makes these samples unsuitable for the analysis of trace organics or the analysis of volatile metals (e.g., As, Hg, Se), but they were suitable for the analysis of selected metals.

Sample material was available for 28 lakes (Table 2 and Figure 3) and, despite the limitations of these samples, it was expected that they would provide a broader basis for comparing metal levels in lake sediments.

2.1.4 Quality Assurance

Three split samples were obtained from each of three Wabamun Lake sites (2-2, 12-1, 16-4-A) and analysed for TOC, particle size (2-2 and 12-1, only) and metals. Split samples were derived from one sample consisting of the surficial layers of several Ekman grabs; this sample was well mixed before apportioning the material to the three split samples.

Split samples for trace organic analysis were obtained at one location (site 2-2). In order to minimize air contact of sediment and possible loss of volatile organics, the split samples were obtained by allocating equal amounts from successive Ekman grabs to each split sample (i.e., samples were not drawn from a common, well mixed sample).

2.2 Laboratory Analyses

All metal and trace organic analyses were carried out at the Analytical Chemistry Laboratory of the Alberta Research Council (ARC), Vegreville. EnviroTest Laboratories, Saskatoon, performed particle size and TOC analyses.

2.2.1 Particle Size and TOC Analysis

Total organic carbon was measured by the combustion method (Nelson and Sommers 1996). Particle size was measured by the pipette method after removal of organic matter and carbonates and in some cases (e.g., Bonnie Lake) iron oxides (Kalra and Maynard 1991).

2.2.2 Metal Samples

- Aluminum (Al), antimony (Sb), arsenic (As) barium (Ba), beryllium (Be), bismuth (Bi), boron (B), cadmium (Cd), calcium (Ca), chloride (Cl), chromium (Cr), cobalt (Co), copper (Cu), iron (Fe), lead (Pb), lithium (Li), manganese (Mn), mercury (Hg) molybdenum (Mo), nickel (Ni), selenium (Se), silver (Ag), strontium (Sr) thallium (Tl), thorium (Th), tin (Sn), titanium (Ti), uranium (U), vanadium (V) and zinc (Zn) were analyzed as "total metals". Methods included closed vessel microwave digestion in nitric acid, hydrofluoric acid and hydrogen peroxide and analysis by inductively coupled plasma - mass spectrometry (ICP-MS). Results are expressed as microgram (µg) metal per gram dry weight sediment. Detection limits are listed in Table 3.

- Mercury was analysed using ultra-clean procedures, digestion in aqua regia (hydrochloric acid and nitric acid), and cold vapour atomic absorption spectrometry (CV-AAS). Detection limit is 0.006 µg/g and results are expressed as µg metal per g dry weight sediment.

- Archived sediments were analysed for selected trace metals (i.e., B, Be Cd, Co, Cr, Ni, Pb, Sr, Tl, V, and Zn).

- A sub-set of 20 samples from Wabamun Lake and the eight lakes sampled in 2002 was analyzed following closed level microwave digestion in nitric acid. CCME (2001) describes this as a milder extraction, which does not dissolve the silica matrix of the sediments and provides a closer approximation of the biologically available metal concentration.

2.2.3 Trace Organic Compounds

Trace organic analytes included extractable priority pollutants (EPP), volatile priority pollutants (VPP) and polycyclic aromatic hydrocarbons (PAH) (Table 4). The EPP 'scan' normally includes several PAHs, however, because the PAH scan is more accurate and sensitive, PAH also measured in the EPP scan are not reported here. The methodology used to analyse for VPP and EPP was patterned after routine VPP and EPP methods for water.

<u>EPP</u>

ARC used a modified method patterned after routine water methods for the EPP Method 2722. A portion of the sample was transferred to a vial and an in situ extraction was performed, after which the method developed for water was applied. Typically a 10-gram portion of sample is extracted in an ultrasonic bath into dichloromethane, first from a basic sample solution then from an acidic sample solution. The extract is dried with anhydrous sodium sulphate, concentrated to 500 µL, and analysed by GC/MS total ion monitoring. Deuterated internal and surrogated standards are added. Moisture content is determined and the results are reported as µg/g dry weight or ppb.

Table 3 List of trace metals analysed in lake sediments

Variable Code	Variable	Detection Limit (DL) (in ug/g = ppm, dry weight)
103471	Mercury, Total (Hg)	0.006
103474	Silver, Total (Ag)	0.1
103475	Aluminum, Total (Al)	16
103476	Arsenic, Total (As)	1
103477	Boron, Total (B)	100
103478	Barium, Total (Ba)	0.6
103479	Beryllium, Total (Be)	12
103480	Bismuth, Total (Bi)	0.2
103523	Cadmium, Total (Cd)	0.4
103481	Calcium, Total (Ca)	200
103483	Chlorine, Total (Cl)	4000
103485, 103514	Chromium, Total (Cr)	1
103516	Cobalt, Total (Co)	0.4
103486	Copper, Total (Cu)	2
103489	Lithium, Total (Li)	1
103491	Manganese, Total (Mn)	40
103492	Molybdenum, Total (Mo)	0.3
103517	Nickel, Total (Ni)	2
103499	Lead, Total (Pb)	0.3
103501	Antimony, Total (Sb)	0.08
103504	Tin, Total (Sn)	30
103521	Selenium, Total (Se)	0.8
103522, 103505	Strontium, Total (Sr)	1
103506	Thorium, Total (Th)	0.4
103507	Titanium, Total (Ti)	20
103508	Thallium, Total (Tl)	0.2
103509	Uranium, Total (U)	0.3
103510	Vanadium, Total (V)	2
103511	Zinc, Total (Zn)	6
103515	Iron, Total (Fe)	60

Table 4 List of trace organic contaminants analysed in lake sediments

VMV	Variable	Units	DL	VMV	Variable	Units	DL
	Volatile Priority Pollutants (VPP)				**Extractable Priority Pollutants (EPP)**		
99140	TRIHALOMETHANES	ug/g	0.1	99075	4-CHLORO-3-METHYLPHENOL	ug/g	2
99141	XYLENE	ug/g	0.1	99071	2-CHLOROPHENOL	ug/g	4
99142	BROMOBENZENE	ug/g	0.1	99065	2,4-DICHLOROPHENOL	ug/g	2
99143	SEC-BUTYLBENZENE	ug/g	0.1	99066	2,4-DIMETHYLPHENOL	ug/g	4
99144	TERT-BUTYLBENZENE	ug/g	0.1	99072	2-METHYL-4,6-DINITROPHENOL	ug/g	2
99145	N-BUTYLBENZENE	ug/g	0.1	99067	2,4-DINITROPHENOL	ug/g	2
99146	2-CHLOROTOLUENE	ug/g	0.1	99073	2-NITROPHENOL	ug/g	2
99147	4-CHLOROTOLUENE	ug/g	0.1	99077	4-NITROPHENOL	ug/g	2
99148	1,2-DIBROMO-3-CHLOROPROPANE	ug/g	0.3	99110	PENTACHLOROPHENOL	ug/g	2
99149	1,2-DIBROMOETHANE	ug/g	0.1	99112	PHENOL	ug/g	2
99150	CIS-1,2-DICHLOROETHENE	ug/g	0.1	99064	2,4,6-TRICHLOROPHENOL	ug/g	2
99151	2,2-DICHLOROPROPANE	ug/g	0.1	99084	BENZO(B)FLUORANTHENE	ug/g	2
99152	1,3-DICHLOROPROPANE	ug/g	0.1	99086	BENZO(K)FLUORANTHENE	ug/g	2
99153	1,1-DICHLOROPROPYLENE	ug/g	0.1	99070	2-CHLORONAPHTHALENE	ug/g	2
99154	HEXACHLOROBUTADIENE	ug/g	0.3	99100	HEXACHLOROBENZENE	ug/g	2
99155	ISOPROPYLBENZENE	ug/g	0.1	99101	HEXACHLOROBUTADIENE	ug/g	5
99156	P-ISOPROPYLTOLUENE	ug/g	0.1	99102	HEXACHLOROCYCLOPENTADIENE	ug/g	2
99157	NAPHTHALENE	ug/g	0.1	99103	HEXACHLOROETHANE	ug/g	5
99158	N-PROPYLBENZENE	ug/g	0.1	99061	1,2,4-TRICHLOROBENZENE	ug/g	2
99159	1,1,1,2-TETRACHLOROETHANE	ug/g	0.1	99081	BENZIDINE	ug/g	4
99160	1,2,3-TRICHLOROBENZENE	ug/g	0.1	99068	2,4-DINITROTOLUENE	ug/g	2
99161	1,2,4-TRICHLOROBENZENE	ug/g	0.1	99069	2,6-DINITROTOLUENE	ug/g	2
99162	TRICHLOROETHYLENE	ug/g	0.1	99062	1,2-DIPHENYLHYDRAZINE	ug/g	2
99163	1,2,3-TRICHLOROPROPANE	ug/g	0.1	99109	NITROBENZENE	ug/g	2
99164	1,2,4-TRIMETHYLBENZENE	ug/g	0.1	99107	N-NITROSODIPHENYLAMINE	ug/g	2
99165	1,3,5-TRIMETHYLBENZENE	ug/g	0.1	99106	N-NITROSODI-N-PROPYLAMINE	ug/g	4
99166	MTBE (METHYL TERTIARY BUTYL ETHER)	ug/g	0.1	99074	4-BROMOPHENYL PHENYL ETHER	ug/g	2
99167	BENZENE	ug/g	0.1	99087	BIS(2-CHLOROETHOXY) METHANE	ug/g	2
99168	DICHLOROBROMOMETHANE	ug/g	0.1	99088	BIS(2-CHLOROETHYL) ETHER	ug/g	2
99169	BROMOFORM	ug/g	0.5	99089	BIS(2-CHLOROISOPROPYL) ETHER	ug/g	2
99170	BROMOMETHANE	ug/g	0.1	99076	4-CHLOROPHENYL PHENYL ETHER	ug/g	2
99172	CARBON TETRACHLORIDE	ug/g	0.1	99091	BUTYLBENZYL PHTHALATE	ug/g	2
99173	CHLOROBENZENE	ug/g	0.1	99093	DI-N-BUTYL PHTHALATE	ug/g	2
99174	CHLOROETHANE	ug/g	0.1	99096	DIETHYL PHTHALATE	ug/g	2
99175	2-CHLOROETHYLVINYLETHER	ug/g	0.4	99097	DIMETHYL PHTHALATE	ug/g	2
99176	CHLOROFORM	ug/g	0.1	99094	DI-N-OCTYL PHTHALATE	ug/g	2
99177	DIBROMOCHLOROMETHANE	ug/g	0.1	99090	BIS(2-ETHYLHEXYL) PHTHALATE	ug/g	2
99178	DIBROMOMETHANE	ug/g	0.1	99105	ISOPHORONE	ug/g	2
99179	1,2-DICHLOROBENZENE	ug/g	0.1	99063	2,3,4,6-TETRACHLOROPHENOL	ug/g	2
99180	1,3-DICHLOROBENZENE	ug/g	0.1		**Polycyclic Aromatic Hydrocarbons (PAH)**		
99181	1,4-DICHLOROBENZENE	ug/g	0.1	10532	NAPHTHALENE	ng/g	1
99182	1,1-DICHLOROETHANE	ug/g	0.1	10535	ACENAPHTHYLENE	ng/g	1
99183	1,2-DICHLOROETHANE	ug/g	0.1	10536	ACENAPHTHENE	ng/g	1
99184	1,1-DICHLOROETHYLENE	ug/g	0.1	10537	FLUORENE	ng/g	1
99185	TRANS-1,2-DICHLOROETHENE	ug/g	0.1	10538	PHENANTHRENE	ng/g	1
99186	1,2-DICHLOROPROPANE	ug/g	0.1	10539	ANTHRACENE	ng/g	1
99187	CIS-1,3-DICHLOROPROPENE	ug/g	0.3	10540	ACRIDINE	ng/g	1
99188	TRANS-1,3-DICHLOROPROPENE	ug/g	0.3	10541	PYRENE	ng/g	1
99189	ETHYL BENZENE	ug/g	0.1	10542	FLUORANTHENE	ng/g	1
99190	METHYLENE CHLORIDE	ug/g	2	10543	METHYLPHENANTHRENE)	ng/g	1
99191	STYRENE	ug/g	0.1	10544	BENZO(C)PHENANTHRENE	ng/g	1
99192	1,1,2,2-TETRACHLOROETHANE	ug/g	0.1	10545	BENZO(A)ANTHRACENE	ng/g	1
99193	TETRACHLOROETHYLENE	ug/g	0.3	10546	CHRYSENE	ng/g	1
99194	TOLUENE	ug/g	0.1	10547	BENZO(B,J,K)FLUORANTHENE	ng/g	1
99195	1,1,1-TRICHLOROETHANE	ug/g	0.1	10548	7,12-DIMETHYLBENZ(A)ANTHRACENE	ng/g	1
99196	1,1,2-TRICHLOROETHANE	ug/g	0.1	10549	BENZO(E)PYRENE	ng/g	1
99197	TRICHLOROFLUOROMETHANE	ug/g	0.1	10550	BENZO(A)PYRENE	ng/g	1
99198	VINYL CHLORIDE	ug/g	0.5	10553	3-METHYLCHOLANTHRENE	ng/g	1
99199	O-XYLENE	ug/g	0.1	10554	INDENO(1,2,3-C,D)PYRENE	ng/g	1
99200	M- + P-XYLENE	ug/g	0.1	10555	DIBENZO(A,H)ANTHRACENE	ng/g	1
				10556	BENZO(G,H,I)PERYLENE	ng/g	1
				10557	DIBENZO(A,L)PYRENE	ng/g	1
				10558	DIBENZO(A,I)PYRENE	ng/g	1
				10559	DIBENZO(A,H)PYRENE	ng/g	1

Note: VMV = Valid Method Variable code

VPP

ARC used an automated GC/MS purge and trap system and a modified method patterned after the routine method 2321 for water. Methanol was added to assist in extracting volatile organic carbons from the sediments to the water/methanol mixture. The sample was spun and an aliquot of the extract was analysed following the procedures for VPP analysis on water. Typically a 10-gram portion of sample is extracted into methanol first by vortex mixing and then in an ultrasonic bath. After centrifuging a 500 µL aliquot is taken and diluted into organic free water. Sample is analyzed with an automated GC/MS purge and trap system. Deuterated internal and surrogated standards are added. Moisture content is determined and the results are reported as µg/g dry weight.

PAH

ARC used a modified method patterned after routine water method 2532. The same extract was used for extractable priority pollutants and PAH analysis. An acidic extraction was followed by a basic extraction which pulls out the neutral, basic and acidic compounds. The standard PAHsed GC/MS SIM was used for the analysis. Typically a 10-gram portion of sample is extracted into dichloromethane with an ultrasonic bath. The extract is dried with anhydrous sodium sulphate, concentrated to 500µL and analysed by GC/MS using selected ion monitoring. Deuterated internal and surrogate standards are added. Moisture content is determined and the results are expressed as ng/g dry weight or ppt.

2.3 Data Analysis

2.3.1 Comparisons with Sediment Quality Guidelines

Contaminant levels reported in sediments were compared with sediment quality guidelines derived by the Canadian Council of Ministers of the Environment (CCME 2001). Following is the CCME description on how sediment quality guidelines are derived.

CCME guidelines for sediments are derived from toxicological information, following a formal protocol which relies on both a modification of the National Status and Trends Program (modified NSTP) and the spiked-sediment toxicity test (SSTT) approach. The NSTP approach uses data from North American field-collected sediments that contain chemical mixtures. Synoptically collected chemical and biological data ("co-occurrence data") are evaluated from numerous individual studies to establish an association between the concentration of each chemical measured in the sediment and any adverse biological effect observed. This database is used to derive two assessment values: the lower value, referred to as the threshold effect level (TEL) represents the *concentration below which adverse biological effects are expected to occur rarely*. The upper value (probable effects level or PEL), defines the level above which *adverse effects are expected to occur frequently*. Minimum toxicological data requirements have been set for the SSTT approach; so far requirements are only met for cadmium in marine systems.

Full Canadian sediment guidelines are recommended if information exists to support both the NSTP and the SSTT approaches. If data only exist to support one approach, then interim sediment quality guidelines (ISQG) are recommended (note all sediment guidelines for freshwater aquatic life are qualified as interim, so far). One can assume that there is a low likelihood of negative effects on aquatic species when ISQG are met. The likelihood of effects increases as concentrations increase from the ISQG to the PEL and greater.

2.3.2 Assessment of Spatial Patterns

Metal concentrations in sediments can be influenced by factors such as organic content, particle size and mineralogy. Site-to-site or lake-to-lake comparisons could be biased by these characteristics. The Pearson correlation coefficient was used to evaluate the association between metals data and sediment characteristics (i.e., correlation to TOC, %silt and aluminum). A strong correlation was arbitrarily defined as $r \geq 0.5$.

Spatial trends in Wabamun Lake were assessed by plotting concentrations on the lake map and by visually assessing patterns. Metal concentrations in Wabamun Lake and the other lakes were depicted in bar graphs; the statistical significance of differences in mean concentrations between both groups of samples was tested with a two-sample t-test. Analyses were performed using SYSTAT.

Recognising that aluminum is the second most abundant metal in the earth's crust (e.g., Krauskopf 1979) and that the relative proportion of metals and aluminum is fairly constant, Schropp and Windom (1988) described an approach for interpreting metal data in sediments that provides a means of determining whether metals are enriched relative to expected natural concentrations. It requires that:

1. A strong correlation exists between metal and Al concentrations (i.e., Al explains much of the variation in the metal data set);

2. Data from reference sites are available;

3. Relationships between metals and Al are described with regressions and prediction limits are established; and

4. Metal/Al relationships from "test sites" are compared with those from "reference sites". If test data are well above the upper prediction limits for reference sites, sediments are considered to be enriched relative to the reference sites.

Although this approach was developed for estuarine sediments, other studies evaluating metal data in freshwater ecosystems have used Al to standardize metal data (e.g., Goldberg et al. 1979, Trefry et al. 1985 and Cooke and Drury 1998).

The approach described by Schropp and Windom (1988) was applied to metal data from 2002; data from the archived lake sediments were not included because the data set was incomplete (i.e., incomplete TOC and no Al data).

Linear regression analysis was performed on metal data from reference lakes (i.e., eight lakes sampled in 2002) and 95% prediction limits were defined for the regression lines. Metal and Al data from Wabamun Lake were then compared to reference lakes. If Wabamun Lake data were well above the upper 95% prediction limit, the metal was considered enriched relative to the reference lakes. If most of the Wabamun data fell within the prediction limits, no difference was assumed and if Wabamun data fell below the prediction limits then the reference lakes were considered enriched. Regression analysis and graphs were produced with Sigma Plot.

3.0 RESULTS

3.1 Metals

Results of metal analyses are presented in Appendices 1 A and B and 3; the results of the QA/QC sample analysis are presented in Appendix 1B and discussed in Appendix 2. Summary statistics are given in Table 5. All metals analysed, except Be occurred at measurable concentrations in most samples.

3.1.1 Comparison of Metal Concentrations with CCME Sediment Guidelines

CCME guidelines are available for seven of the metals analysed in lake sediment (i.e., Hg, As, Cd, Cr, Cu, Pb and Zn). A comparison of metal concentrations with ISQG and PEL is presented in Table 6.

Sediment concentrations of Hg and Pb in Wabamun Lake and the eight other lakes sampled in 2002 were well below the ISQG in all samples. However, Pb exceeded the ISQG in one archived sample from Sylvan Lake.

Arsenic was not measured in archived sediments, but in 2002 samples 93% and 63% of the samples collected from Wabamun Lake and the eight other lakes, respectively, had concentrations that exceeded the ISQG. About one quarter of the Wabamun samples and one sample from Bonnie Lake exceeded the PEL. Sylvan Lake was the only lake sampled in 2002 for which all As levels in sediments were less than the ISQG. Arsenic is the only metal which in our samples exceeded the PEL.

Chromium sediment concentrations also exceeded ISQG in a large portion of Wabamun (50%), 2002 lake samples (54%) and archived (29%) sediment samples. In 2002 all eight lakes except Bonnie and Amisk had Cr levels above the ISQG. Most lakes with archived sediment samples had at least one sample above the ISQG except for Pigeon, Bonnie, Tucker, Muriel, Steele, Moose, Dillberry, Crimson and Pine where all samples were below the ISQG.

Sediment concentrations for Cu, Cd, and Zn exceeded ISQG in 67, 54, and 6% of the 2002 Wabamun Lake samples, respectively. However, concentrations of these metals were below ISQG in all samples of the other eight lakes sampled in 2002. Nevertheless, some archived samples from Sylvan, Moonshine, Battle, Buck and also Wabamun lakes were above the ISQG for Cu; some archived samples from Sylvan and Smoke lakes were above the ISQG for Cd; and some archived samples from Sylvan, Iosegun, Sturgeon, Smoke, Saskatoon, Wabamun and Moonshine were above the ISQG for Zn.

Results for 20 samples that were extracted using nitric acid (mild extraction) and a mixture of nitric acid, hydrofluoric acid and hydrogen peroxide (harsh extraction) are shown in Appendix 3. A two-tailed paired t-test confirmed that the mild extraction resulted in statistically lower concentrations ($p<0.05$) for most metals tested (i.e., Al, B, Cd, Co, Cr, Fe, Pb, Sb, Se, Th, Tl, and Zn,) but not for As, Cu or Mn. Compared to the harsh extraction, a much lower percentage of samples that were subjected to the mild extraction exceeded the ISQG for Cd (40 % -harsh-

Table 5 Summary of metal data for Wabamun Lake, eight lakes sampled in 2002 and archived lake sediments
Values as µg/g (ppm) dry weight.

		Hg	Al	As	B	Cd	Cr	Cu	Ni	Pb	Sb	Se	Tl	Zn
Wabamun Lake														
# of samples		69	69	69	69	69	69	69	69	69	69	69	69	69
# of samples with detections		67	69	69	66	69	69	69	69	69	69	67	69	69
Mean (all detections)		**0.067**	**41174.2**	**14.4**	**80**	**0.53**	**43.6**	**64.7**	**20.4**	**18.3**	**1.5**	**3.2**	**0.41**	**82**
Standard deviation		0.034	11909.6	9.6	29	0.14	16.9	41.8	9.6	6.9	0.9	1.5	0.10	35
Maximum		0.138	63150.0	81.9	132	0.76	66.3	154.0	47.3	32.4	3.4	5.9	0.62	139
Other Lakes Sampled in 2002														
# of samples		69	24	24	69	24	24	24	24	24	24	69	24	24
# of samples with detections		24	24	24	23	24	24	24	24	24	24	22	24	24
Mean (all detections)		**0.073**	**31774.5**	**8.3**	**61**	**0.35**	**34.7**	**18.9**	**23.6**	**18.3**	**0.7**	**1.6**	**0.34**	**67**
Standard deviation		0.019	10970.7	4.0	14	0.09	10.9	6.8	8.1	5.8	0.2	0.6	0.10	15
Maximum		0.101	46562.0	18.0	78	0.50	46.9	28.6	38.1	32.9	1.1	3.6	0.47	82
Amisk	Mean	0.080	18274.7	11.1	47	0.34	21.0	15.1	17.2	16.0	0.6	1.9	0.23	60
	Maximum	0.081	21614.0	11.3	49	0.37	24.9	15.7	18.0	18.6	0.7	2.3	0.26	65
Bonnie	Mean	0.090	13696.7	15.9	67	0.35	16.3	10.4	11.7	13.5	0.5	1.6	0.16	56
	Maximum	0.101	16021.0	18.0	68	0.37	18.2	12.1	13.0	19.1	0.5	1.7	0.19	62
Gull	Mean	0.050	35325.7	4.7	65	0.28	40.8	15.9	23.6	14.1	0.8	1.2	0.38	55
	Maximum	0.061	39113.0	5.7	77	0.38	46.1	19.1	27.1	15.4	0.9	2.0	0.40	65
Isle	Mean	0.090	27706.0	10.3	66	0.45	37.0	26.5	36.1	16.8	0.8	2.1	0.30	76
	Maximum	0.092	34232.0	11.9	70	0.47	40.0	28.6	38.1	17.3	0.8	3.6	0.34	81
Lac Ste. Anne	Mean	0.066	33817.7	5.7	75	0.29	36.3	19.5	21.0	17.4	0.6	1.6	0.37	68
	Maximum	0.072	34894.0	6.3	76	0.30	38.6	28.0	22.4	18.4	0.6	1.8	0.40	72
Pigeon	Mean	0.082	43562.3	6.1	73	0.38	44.0	22.6	29.5	21.3	0.9	1.2	0.45	80
	Maximum	0.085	43865.0	6.2	78	0.41	44.2	22.8	30.2	21.5	1.0	1.4	0.46	82
Sylvan	Mean	0.052	36851.7	4.0	62	0.35	37.4	16.9	22.1	18.1	0.8	1.6	0.39	60
	Maximum	0.074	42002.0	4.3	64	0.50	46.9	24.7	28.8	23.2	1.1	1.9	0.41	82
Wizard	Mean	0.072	44961.7	8.2	37	0.38	44.5	24.6	27.8	29.2	1.1	1.5	0.45	78
	Maximum	0.085	46562.0	8.3	40	0.42	45.1	25.4	28.4	32.9	1.1	1.7	0.47	79
Archived Samples														
# of samples					80	80	80	80	80	80			80	80
# of samples with detections					1	1	2	2	2	2			2	2
Mean (all detections)					**60**	**0.33**	**32.4**	**15.9**	**17.7**	**13.9**			**0.33**	**58**
Standard deviation					27	0.17	23.2	20.4	14.1	8.1			0.17	41
Maximum					163	0.92	95.0	114.0	76.0	48.2			0.97	187
Sturgeon	Mean				58	0.30	42.5	15.6	23.8	12.3			0.44	71
	Maximum				84	0.56	84.2	33.5	48.3	19.6			0.60	137
Buck	Mean				67	0.32	52.9	25.0	30.0	16.7			0.44	84
	Maximum				70	0.51	73.7	40.5	43.1	21.1			0.54	122
Smoke	Mean				42	0.33	39.2	12.7	20.1	10.9			0.39	64
	Maximum				63	0.92	78.4	30.3	44.1	19.7			0.64	146
Saskatoon	Mean				73	0.29	55.0	17.5	24.8	13.1			0.47	79
	Maximum				117	0.46	81.0	27.9	37.0	17.3			0.64	124
Sandy North	Mean				66	0.39	45.0	17.7	24.2	22.6			0.41	76
	Maximum				74	0.39	51.2	18.4	24.7	24.3			0.46	76

Table 5 Summary of metal data for Wabamun Lake, eight lakes sampled in 2002 and archived lake sediments
Values as µg/g (ppm) dry weight. (continued)

		Hg	Al	As	B	Cd	Cr	Cu	Ni	Pb	Sb	Se	Tl	Zn
Sandy South	Mean				46	0.25	37.7	13.3	20.8	16.7			0.45	60
	Maximum				57	0.30	41.0	15.4	21.9	16.7			0.49	67
Lac Ste. Anne	Mean				73	0.19	32.7	9.5	13.6	12.6			0.29	46
	Maximum				82	0.35	44.7	15.2	20.4	17.4			0.37	68
Lake Isle	Mean				65	0.15	21.6	8.0	13.2	8.2			0.21	31
	Maximum				65	0.38	42.6	20.8	31.2	16.1			0.33	73
Pine	Mean				65	0.38	34.7	17.8	16.3	33.5			0.36	96
	Maximum				65	0.38	34.7	17.8	16.3	33.5			0.36	96
Wabamun	Mean				86	0.35	65.3	70.0	26.7	24.7			0.39	108
	Maximum				104	0.44	79.6	110.0	30.5	30.0			0.46	133
Moonshine	Mean				85	0.41	65.3	80.7	32.2	15.7			0.55	121
	Maximum				109	0.53	79.0	114.0	40.2	17.7			0.68	151
Crimson	Mean				38	0.36	11.7	8.1	10.5	11.6			0.12	56
	Maximum				40	0.38	13.9	9.8	11.9	12.9			0.12	72
Dilberry	Mean				29	0.19	11.0	4.8	7.7	8.3			0.17	29
	Maximum				34	0.41	16.0	9.6	11.0	13.2			0.23	54
Battle	Mean				45	0.31	55.2	25.6	33.7	14.2			0.47	77
	Maximum				46	0.47	80.9	38.5	49.8	18.3			0.62	112
Gull	Mean				55	0.19	34.4	10.3	18.0	11.7			0.40	45
	Maximum				80	0.37	46.9	21.4	28.9	16.4			0.44	71
Sylvan	Mean				98	0.39	50.8	20.2	33.9	23.7			0.53	87
	Maximum				163	0.90	95.0	47.2	76.0	48.2			0.97	187
Pigeon	Mean				30	0.13	19.4	6.7	11.4	10.0			0.27	33
	Maximum				34	0.17	24.7	12.1	17.4	12.5			0.36	46
Tucker	Mean				60	0.18	8.9	5.1	5.4	5.8			0.13	21
	Maximum				62	0.34	14.9	9.6	9.9	7.5			0.17	39
Muriel	Mean				88	0.21	17.8	6.1	8.4	9.5			0.22	32
	Maximum				99	0.36	19.9	9.7	12.0	10.4			0.24	48
Steele	Mean				50	0.17	10.9	4.9	8.3	6.8			0.17	34
	Maximum				82	0.37	17.3	10.9	17.4	10.1			0.19	75
Buffalo	Mean				91	0.15	19.9	6.2	10.7	9.1			0.25	32
	Maximum				91	0.36	36.7	14.9	22.5	13.9			0.36	68
McLeod	Mean				44	0.22	24.3	9.8	13.9	11.0			0.32	43
	Maximum				44	0.42	38.6	21.9	27.5	18.3			0.39	82
Iosegun	Mean				66	0.44	48.2	16.6	25.3	13.4			0.46	95
	Maximum				70	0.77	70.5	28.7	41.7	18.7			0.64	151
Elkwater	Mean				42	0.15	42.6	13.8	21.0	19.3			0.54	66
	Maximum				56	0.29	53.1	22.4	27.2	25.3			0.59	86
Wizard	Mean				60	0.36	38.4	20.4	23.6	27.1			0.39	78
	Maximum				97	0.43	44.3	24.3	28.3	32.8			0.42	79
Bonnie	Mean				64	0.35	19.5	10.6	12.0	13.4			0.19	61
	Maximum				72	0.45	21.9	11.9	13.9	17.8			0.21	71
Moose	Mean				65	0.17	11.9	5.2	5.8	12.5			0.21	27
	Maximum				81	0.34	17.2	10.3	9.4	20.0			0.33	51
Long	Mean				63	0.24	30.4	14.6	18.4	14.8			0.32	60
	Maximum				77	0.33	40.1	18.7	22.8	21.4			0.37	71

Table 5 Summary of metal data for Wabamun Lake, eight lakes sampled in 2002 and archived lake sediments
Values as µg/g (ppm) dry weight. (continued)

		Bi	U	Ag	Li	Co	Mn	Mo	Sn	Sr	Th	Ti	V	Fe
Wabamun Lake														
# of samples		69	69	69	69	69	69	69	69	69	69	69	69	69
# of samples with detections		64	69	69	69	69	69	69	11	69	69	69	69	69
Mean (all detections)		**0.21**	**3.66**	**0.24**	**17.3**	**7.3**	**565**	**7.9**	**4.3**	**273**	**5.7**	**1937**	**69.5**	**15562**
Standard deviation		0.08	1.76	0.06	5.3	2.1	208	7.4	3.3	150	2.4	593	25.3	5786
Maximum		0.47	8.20	0.35	28.3	9.4	1222	37.5	14.2	808	8.8	2926	105.0	28568
Other Lakes Sampled in 2002														
# of samples		69	24	24	24	24	24	24	69	24	24	24	24	24
# of samples with detections		24	24	24	24	24	24	24	0	24	24	24	24	24
Mean (all detections)		**0.22**	**3.05**	**0.24**	**17.7**	**7.5**	**1240**	**2.7**	**<3.00**	**273**	**6.3**	**1709**	**56.9**	**22032**
Standard deviation		0.06	0.74	0.07	4.9	1.6	262	1.7	<3.00	234	2.1	509	17.2	5554
Maximum		0.42	4.36	0.33	25.4	9.7	14161	6.5	<3.00	899	9.0	2318	73.6	29533
Amisk	Mean	0.16	2.94	0.16	11.8	6.9	5580	6.3	<3.00	136	4.2	995	40.7	24012
	Maximum	0.18	3.37	0.18	13.8	7.5	14161	6.5	<3.00	145	4.8	1136	45.7	26296
Bonnie	Mean	0.16	2.26	0.12	10.2	4.8	510	4.5	<3.00	209	2.7	844	28.3	16322
	Maximum	0.18	2.51	0.13	12.1	5.3	576	5.2	<3.00	244	3.2	1012	32.9	18217
Gull	Mean	0.20	2.47	0.28	22.0	7.4	413	1.4	<3.00	678	5.8	2012	54.8	17686
	Maximum	0.23	3.07	0.33	25.4	8.6	467	2.1	<3.00	899	6.9	2172	62.4	20227
Isle	Mean	0.25	3.86	0.28	18.7	9.2	627	2.0	<3.00	101	6.9	1730	66.8	24322
	Maximum	0.27	4.36	0.30	19.8	9.7	697	2.3	<3.00	110	7.7	1850	71.0	24842
Lac Ste. Anne	Mean	0.20	3.12	0.26	21.1	7.1	779	1.7	<3.00	183	6.8	1891	67.4	18777
	Maximum	0.21	3.33	0.29	21.3	7.5	838	2.0	<3.00	192	7.1	2004	69.3	20111
Pigeon	Mean	0.33	2.91	0.30	20.8	8.6	810	1.3	<3.00	147	8.7	2288	72.9	28517
	Maximum	0.42	2.96	0.31	21.2	8.8	847	1.4	<3.00	155	9.0	2318	73.6	29533
Sylvan	Mean	0.26	3.05	0.27	19.2	8.0	460	1.3	<3.00	536	6.3	1839	54.7	17933
	Maximum	0.29	4.03	0.33	24.1	9.7	554	1.7	<3.00	777	7.7	2167	71.0	23902
Wizard	Mean	0.23	3.77	0.26	17.5	8.3	742	3.1	<3.00	193	8.8	2075	69.2	28684
	Maximum	0.25	3.93	0.30	17.7	8.7	789	3.4	<3.00	200	8.9	2127	70.1	28880
Archived Samples														
# of samples						80				80			80	
# of samples with detections						2				2			2	
Mean (all detections)						**6.6**				**227**			**52.9**	
Standard deviation						3.7				185			39.5	
Maximum						20.0				1316			164.0	
Sturgeon	Mean					8.6				105			74.6	
	Maximum					12.5				148			143.0	
Buck	Mean					8.3				125			84.1	
	Maximum					11.2				144			120.0	
Smoke	Mean					6.4				99			60.9	
	Maximum					12.0				116			123.0	
Saskatoon	Mean					8.1				124			97.6	
	Maximum					11.0				130			152.0	
Sandy North	Mean					8.6				222			62.5	
	Maximum					8.9				224			63.3	

Table 5 Summary of metal data for Wabamun Lake, eight lakes sampled in 2002 and archived lake sediments
Values as µg/g (ppm) dry weight. (continued)

		Bi	U	Ag	Li	Co	Mn	Mo	Sn	Sr	Th	Ti	V	Fe
Sandy South	Mean					7.9				255			55.2	
	Maximum					7.9				278			57.2	
Lac Ste. Anne	Mean					5.4				154			47.7	
	Maximum					7.3				211			64.7	
Lake Isle	Mean					3.9				96			29.2	
	Maximum					8.3				144			60.2	
Pine	Mean					7.4				333			56.6	
	Maximum					7.4				333			56.6	
Wabamun	Mean					9.4				286			89.5	
	Maximum					9.8				446			99.0	
Moonshine	Mean					9.9				113			125.8	
	Maximum					11.8				121			161.0	
Crimson	Mean					4.2				146			18.5	
	Maximum					4.2				164			20.2	
Dilberry	Mean					4.0				225			20.5	
	Maximum					6.2				339			28.6	
Battle	Mean					10.1				233			86.1	
	Maximum					14.2				292			124.0	
Gull	Mean					6.5				471			48.7	
	Maximum					9.1				790			66.0	
Sylvan	Mean					11.1				766			85.7	
	Maximum					20.0				1316			164.0	
Pigeon	Mean					4.9				241			32.5	
	Maximum					7.0				342			40.9	
Tucker	Mean					2.9				194			14.8	
	Maximum					4.7				261			26.9	
Muriel	Mean					4.4				386			25.5	
	Maximum					5.7				546			32.8	
Steele	Mean					3.1				89			19.4	
	Maximum					5.4				120			31.4	
Buffalo	Mean					4.8				303			33.7	
	Maximum					8.9				624			62.4	
McLeod	Mean					5.1				145			39.7	
	Maximum					7.7				199			64.2	
Iosegun	Mean					8.6				76			91.4	
	Maximum					12.6				91			136.0	
Elkwater	Mean					10.9				252			77.9	
	Maximum					11.4				276			95.3	
Wizard	Mean					8.3				236			59.2	
	Maximum					8.8				328			69.0	
Bonnie	Mean					5.7				206			33.1	
	Maximum					6.1				247			37.9	
Moose	Mean					3.1				205			18.4	
	Maximum					4.9				324			30.2	
Long	Mean					7.8				254			59.0	
	Maximum					8.6				277			72.2	

Table 6 Comparison of 'total' metals detected in lake sediments with CCME sediment quality guidelines

	Hg	As	Cd	Cr	Cu	Pb	Zn
Units (dry weight):	ug/g	ug/g	ug/g	ug/g	ug/g	ug/g	ug/g
Guideline (CCME ISQG) :	**0.170**	**5.9**	**0.60**	**37.3**	**35.7**	**35.0**	**123.0**
CCME PEL:	**0.486**	**17.0**	**3.50**	**90.0**	**197.0**	**91.3**	**315.0**
Wabamun Lake							
# of samples	69	69	69	69	69	69	69
mean of all detections	0.067	14.40	0.53	43.6	64.7	18.3	82
# of detect. > ISQG guideline	**0**	**64**	**28**	**50**	**46**	**0**	**4**
# of detect. > PEL guideline	**0**	**17**	**0**	**0**	**0**	**0**	**0**
% detect. (above DL) > ISQG guideline	0.00	92.75	53.85	72.46	66.67	0.00	5.80
% detect. (above DL) > PEL guideline	0.00	24.64	0.00	0.00	0.00	0.00	0.00
Other Lakes Sampled in 2002							
# of samples	24	24	24	24	24	24	24
mean of all detections	0.073	8.30	0.35	34.7	18.9	18.3	67
# of detect. > ISQG guideline	**0**	**15**	**0**	**13**	**0**	**0**	**0**
# of detect. > PEL guideline	**0**	**1**	**0**	**0**	**0**	**0**	**0**
% detect. (above DL) > ISQG guideline	0.00	62.50	0.00	54.17	0.00	0.00	0.00
% detect. (above DL) > PEL guideline	0.00	4.17	0.00	0.00	0.00	0.00	0.00
Archived Lake Sediments							
# of samples	0	0	80	80	80	80	80
mean of all detections			0.33	32.4	15.9	13.9	58
# of detect. > ISQG guideline			3	29	7	1	7
# of detect. > PEL guideline			0	1	0	0	0
% detect. (above DL) > ISQG guideline			3.75	36.25	8.75	1.25	8.75
% detect. (above DL) > PEL guideline			0.00	1.25	0.00	0.00	0.00

Note: Refer to Table 5 for further sample statistics compared to 0% -mild-), Cr (80% compared to 25%) and Zn (15% compared to 5%). This decline occurred for As and Cu also, but it was not as pronounced (As 90% to 80%; Cu (70% to 60%). Arsenic was the only metal that exceeded the PEL guideline; in this subset of samples 55% of the harsh extractions exceeded the PEL value compared to 25% of the mild extractions.

3.1.2 Assessment of Spatial Patterns

<u>Correlations with Sediment Characteristics</u>

Results of correlation analysis are shown in Table 7. Mercury showed a strong association with TOC, and several metals (Cd, Cr, Cu, Pb, Sb, Th, Ti, Tl, and Zn) were strongly associated with Al. Arsenic and Se were weakly correlated with these sediment characteristics, but they were fairly strongly correlated with Fe (As: $r = 0.67$; Se: $r = 0.47$).

In Wabamun Lake the %TOC is strongly correlated to sample depth (i.e., water depth).

Wabamun Lake

Spatial trends in Wabamun Lake are depicted in Figures 4 to 11. Overall there is quite a large degree of variability in the characteristics of Wabamun Lake sediments. Figures 4 and 5 show that the proportion of sand is highest in the eastern half of the lake (east of transect 10) and lowest in the western portion (west from transect 10). In contrast, the proportion of TOC is highest in the western, deeper part of the lake than in the eastern part. Metals have a tendency to occur at higher concentrations in the west portion of the lake. This is particularly noticeable for Hg (a situation which was expected because of the high correlation between Hg and TOC), but it is also apparent in the distribution of other metals (e.g., As).

The distribution of samples that exceed the ISQG is not confined to a particular area in the lake but appears to be diffusely distributed over the entire lake. Nevertheless, most samples which exceed PEL for As are located in the western portion of the lake.

Transect sites 15-6-B, -C, and D and 16-4-D on the northeast side of the lake and near the ash lagoon outfall, have metal concentrations that appear to be somewhat higher than metal levels recorded at other locations along the shoreline. These four sampling sites were sampled in 3 m of water or less, as were 18 other sites in this survey. In this group of 22 samples the four transect sites had the highest percentage of clay, a lower sand fraction, and somewhat higher carbon levels, but their Al levels were not among the highest. Yet these four samples ranked among the top five (Se), six (Cu, Pb, Zn, Sb), seven (Cd, Cr) and eight (As) for highest metal levels.

Comparison of Wabamun Lake and Other Lakes

Bar graphs depicting metal levels in Wabamun Lake and in other lakes sampled in 2002 are shown in Figure 12. Because some metals were strongly correlated to TOC or Al the ratio of these variables is also plotted as a means of normalising concentrations (eliminating the influence of TOC or Al on the concentrations). The results of the t-test analysis comparing the

Table 7 Pearson correlations (r; $p<0.05$) between sediment characteristics and contaminant levels

Wabamun Lake Data and Data from Eight Other Lakes				
Variables:		**%TOC**	**%Silt+Clay**	**Aluminum**
	Number of Samples:	92	92	92
Mercury	92	**0.80**	0.39	0.26
Arsenic	92	(ns)	(ns)	0.18
Cadmium	92	0.21	(ns)	**0.69**
Chromium	92	0.24	(ns)	**0.89**
Copper	92	0.30	(ns)	**0.56**
Lead	92	0.48	0.29	**0.68**
Selenium	92	0.31	(ns)	0.46
Zinc	92	(ns)	(ns)	**0.87**
Antimony	92	0.38	(ns)	**0.63**
Thallium	92	(ns)	(ns)	**0.87**
Strontium	92	(ns)	(ns)	-0.19
Thorium	92	0.33	0.35	**0.83**
Titanium	92	(ns)	0.21	**0.95**
	Number of Samples:	50	50	
sum PAH	50	-0.07	-0.04	not appl.

Variables:		**%TOC**	**%Silt +Clay**	**Aluminum**	**depth**
	Number of Samples:	66	66	66	66
%TOC	66	1	0.43	0.33	**0.77**
%Silt	66		1.00	0.22	0.34
Aluminum	66			1.00	0.25

Note: ns = not significant

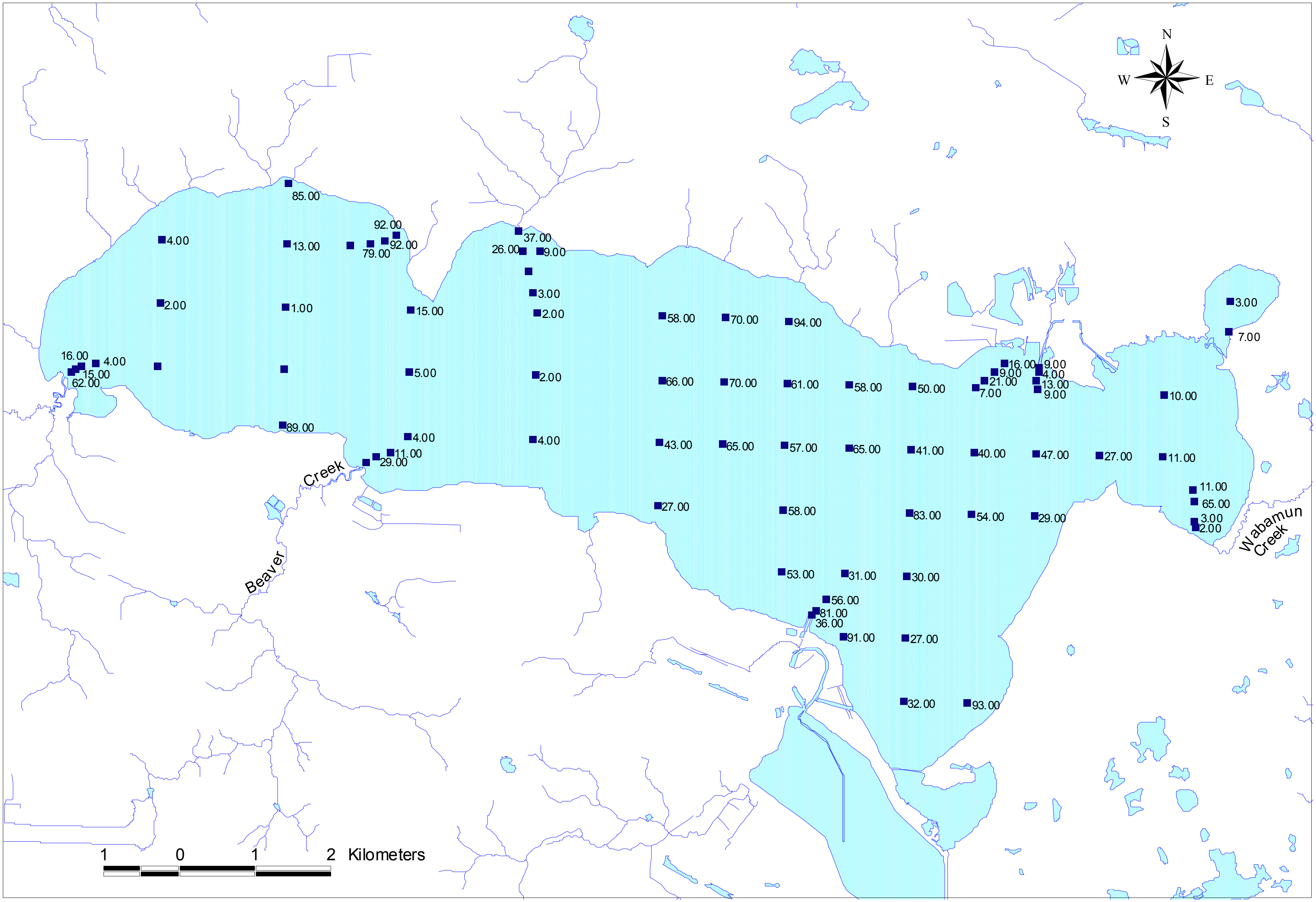

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Figure 4a Percent sand in Wabamun Lake sediment samples, summer 2002

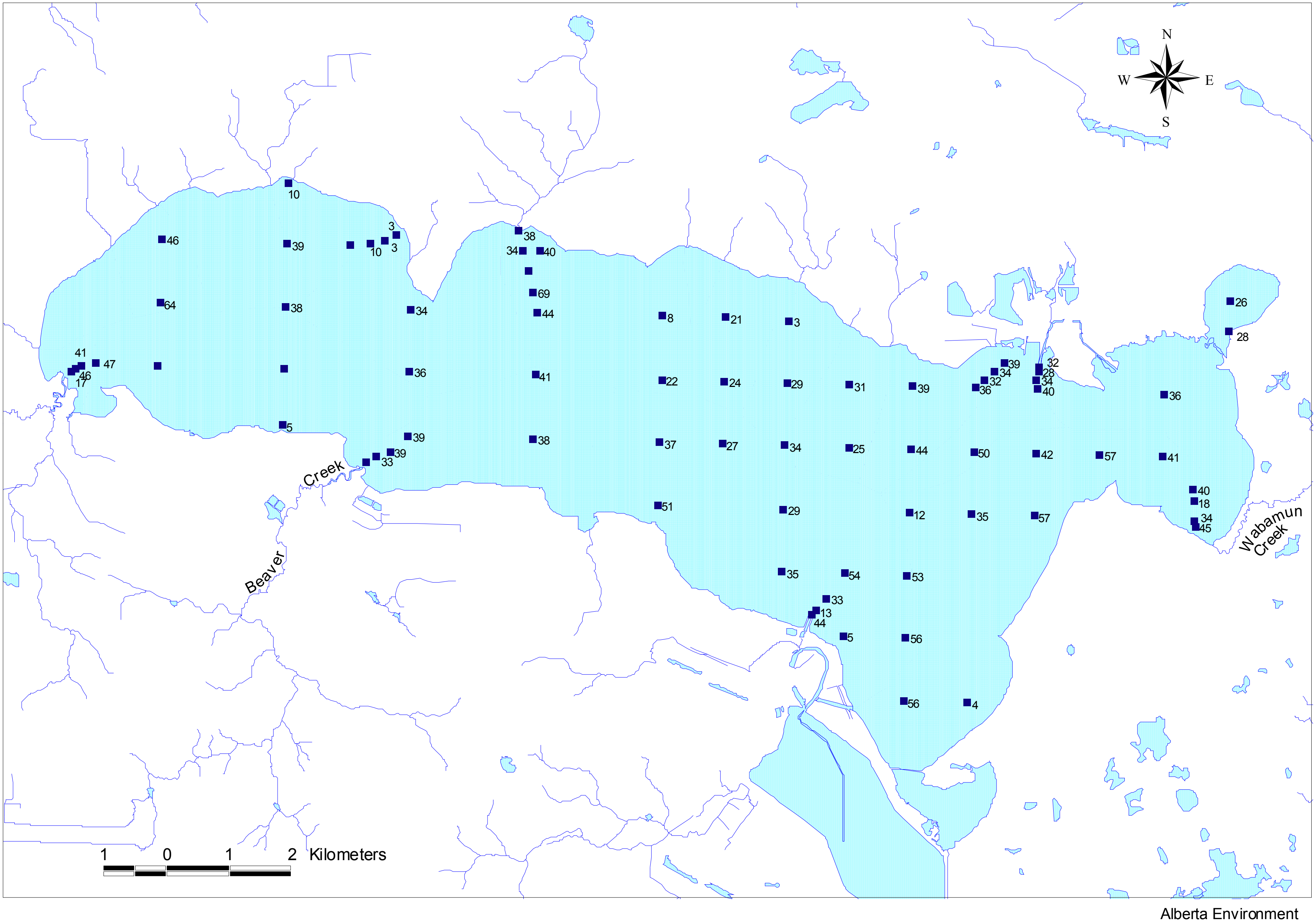

Figure 4b Percent silt in Wabamun Lake sediment samples, summer 2002

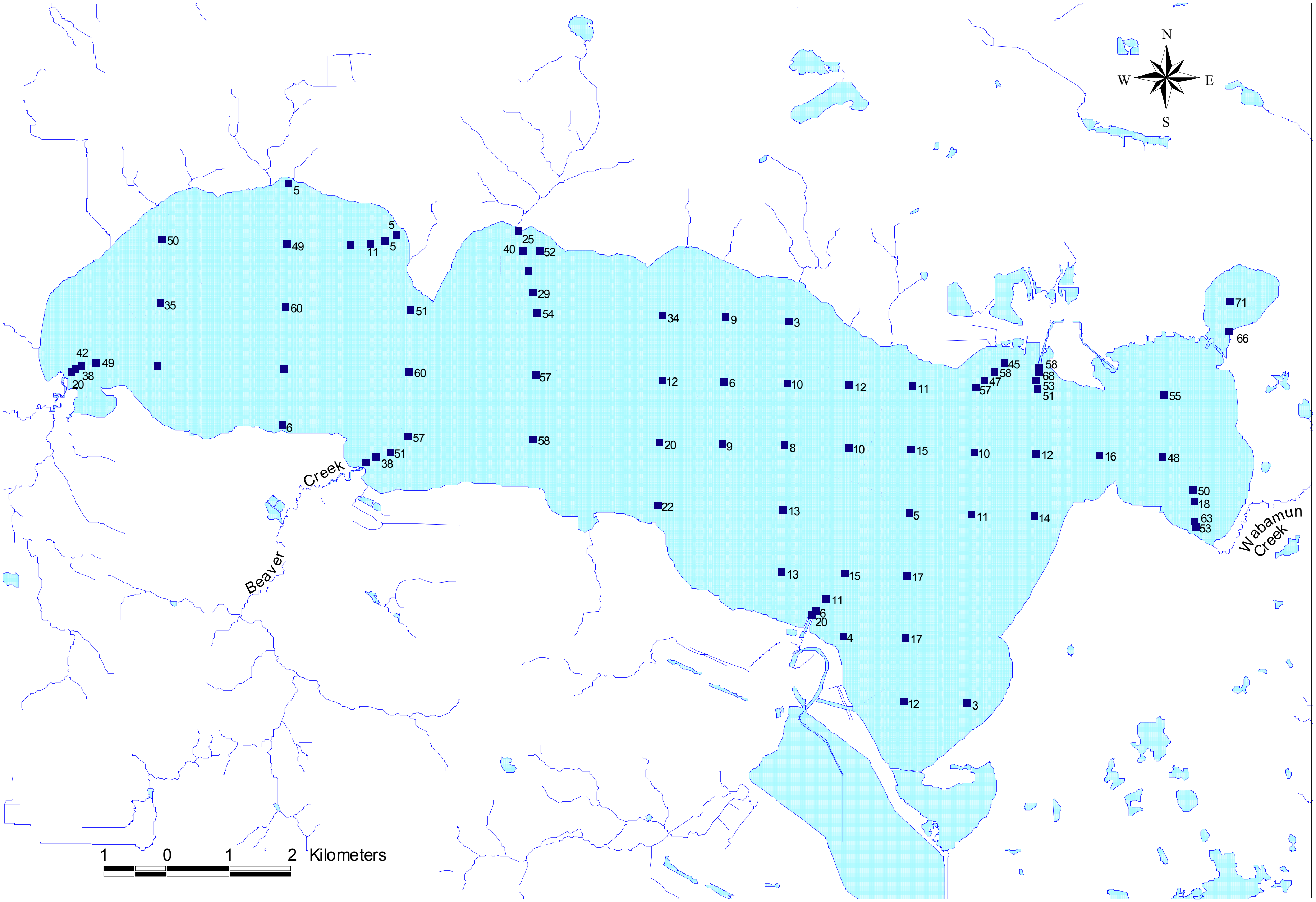

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Figure 4c Percent clay in Wabamun Lake sediment samples, summer 2002

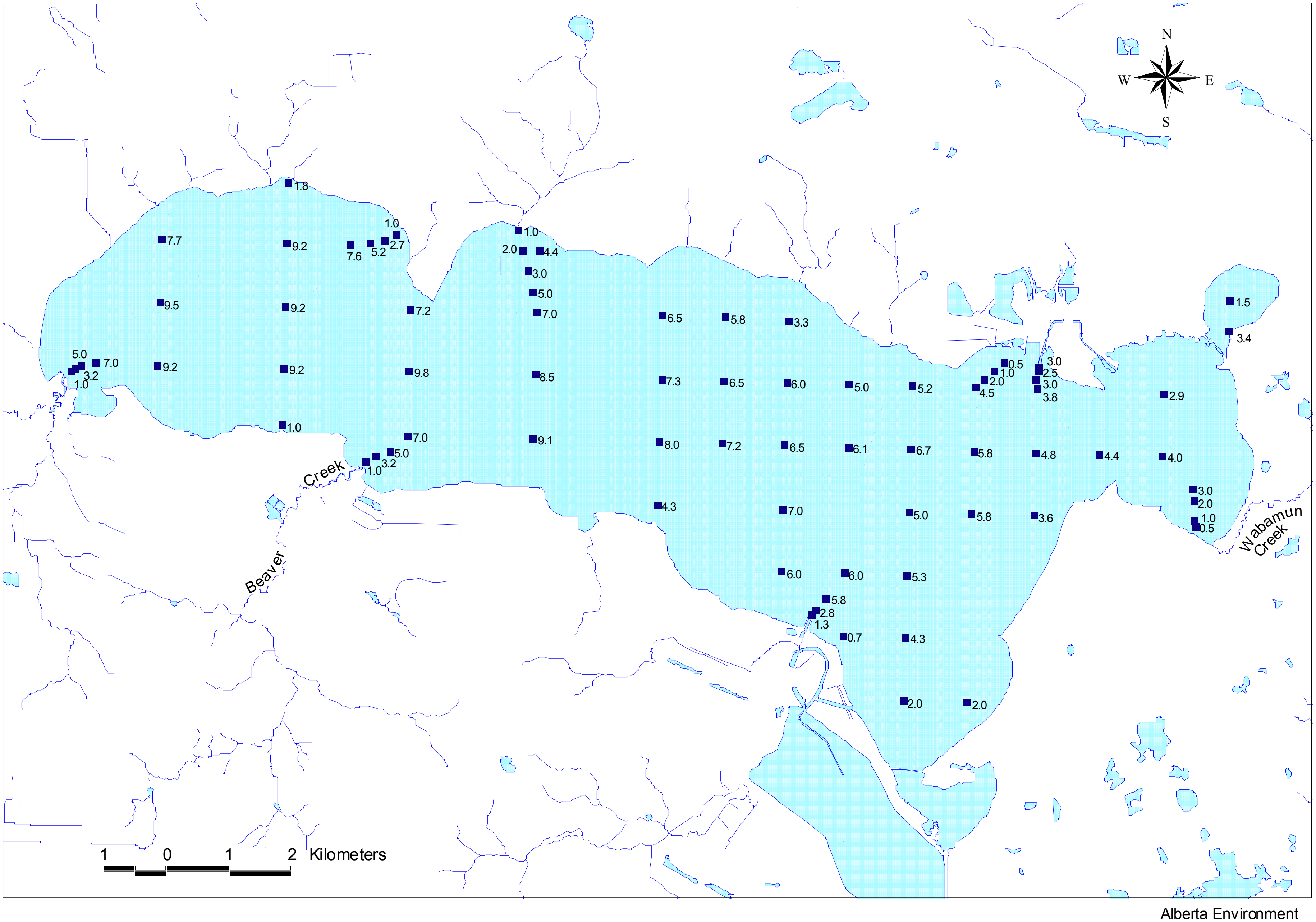

Figure 4d Sampling depth (m) for Wabamun Lake sediment samples, summer 2002

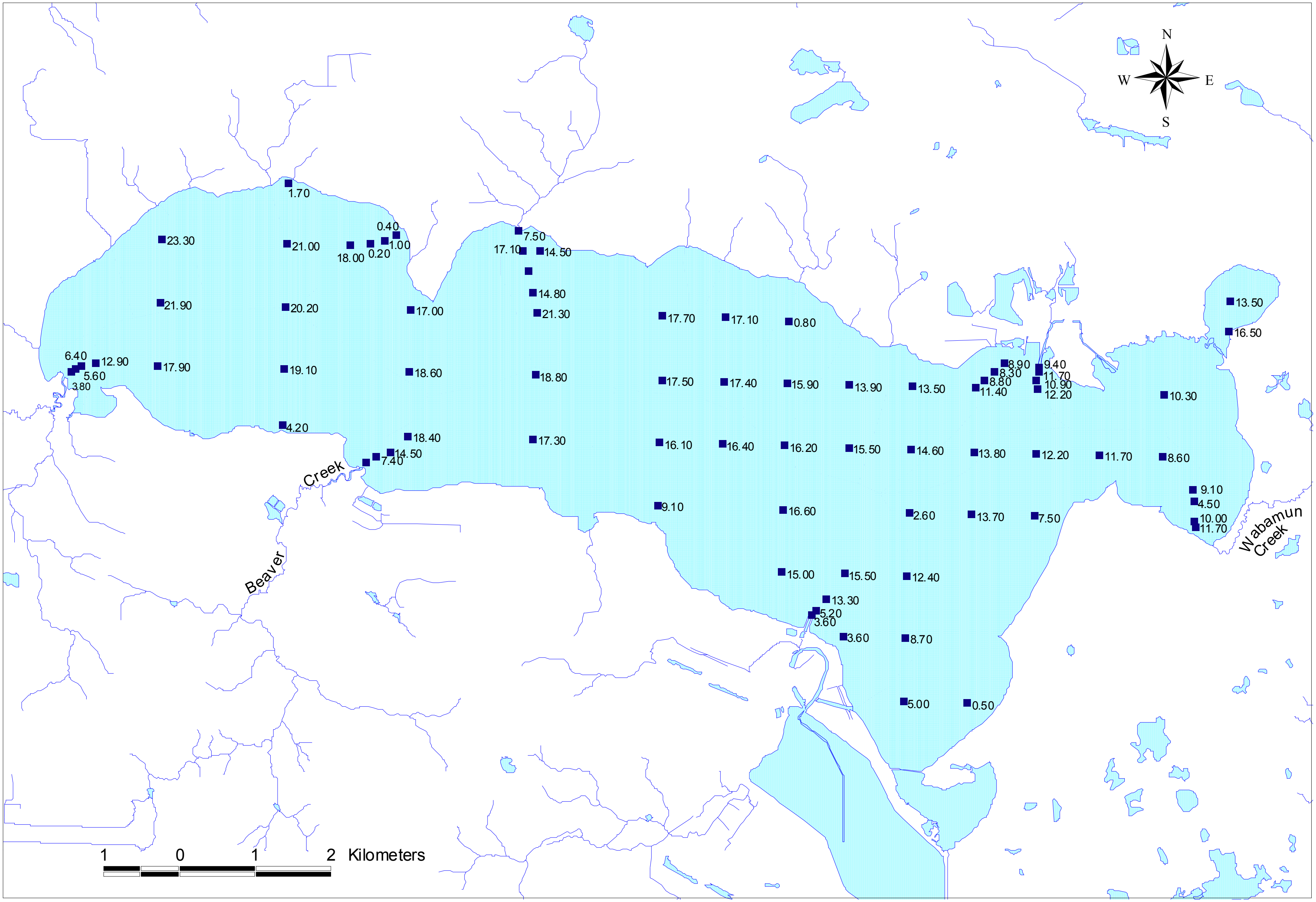

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Figure 5 Percent organic carbon in Wabamun Lake sediment samples, summer 2002

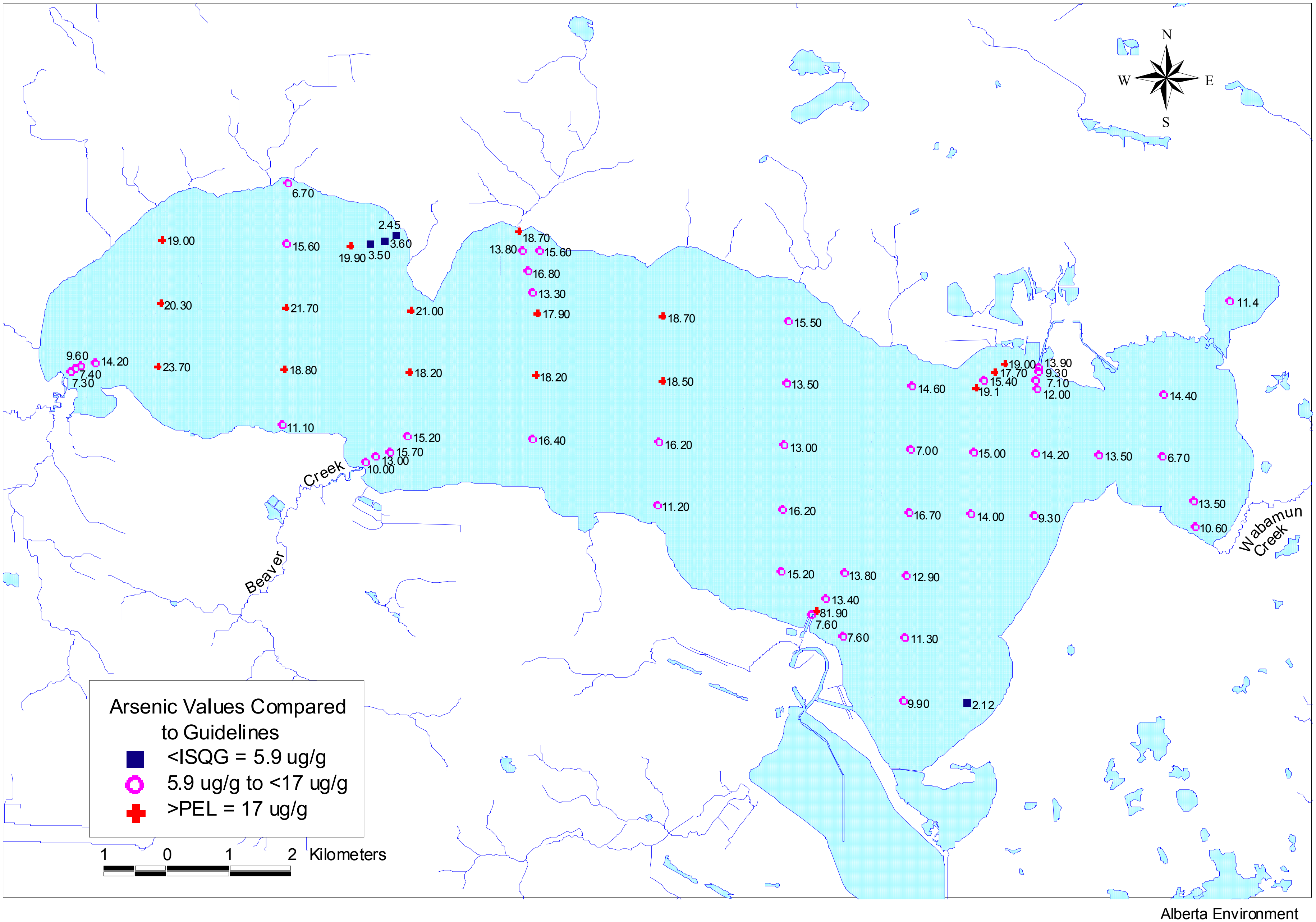

Figure 6 Concentration of total arsenic in Wabamun Lake sediment samples, summer 2002

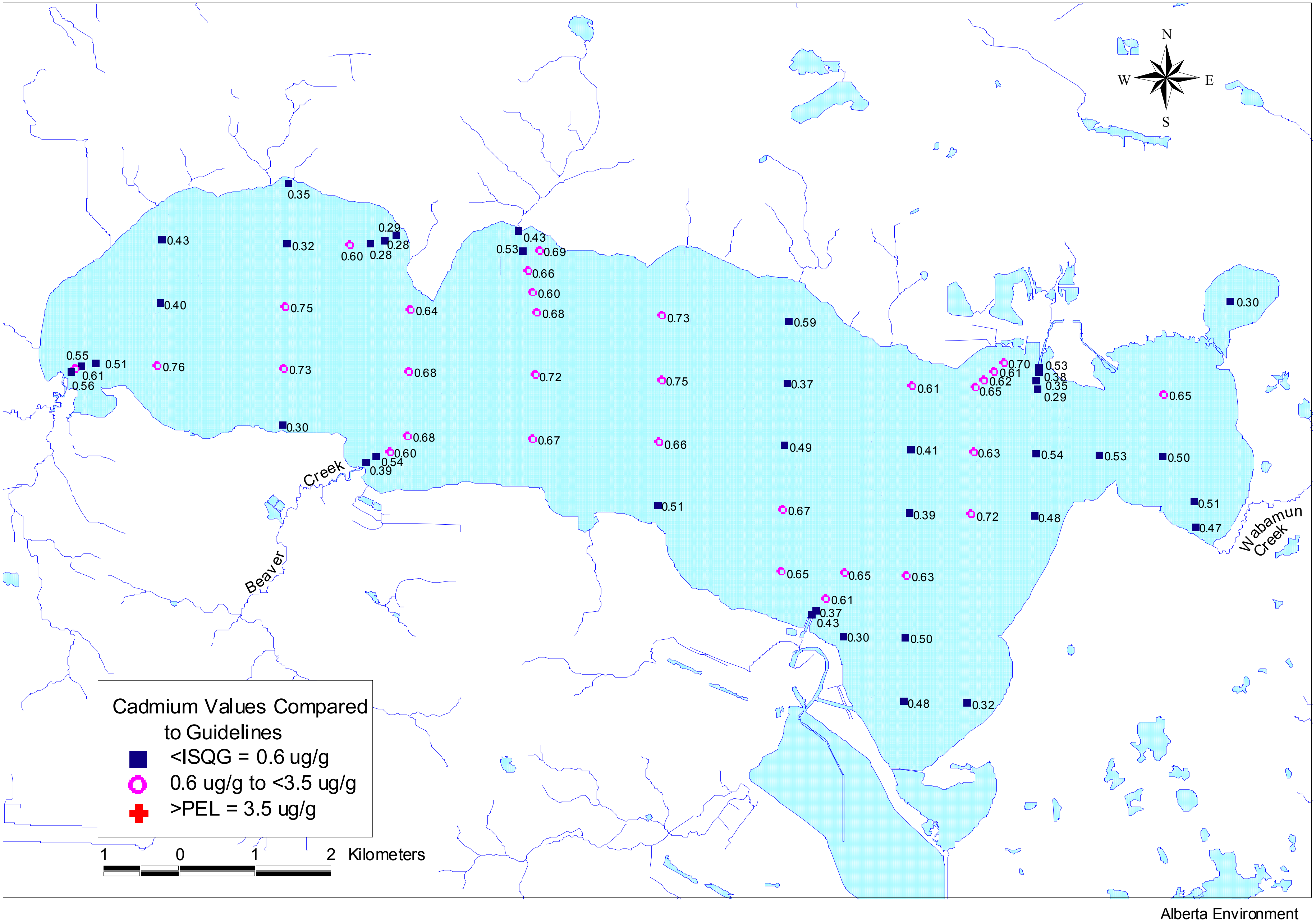

Figure 7 Concentration of total cadmium in Wabamun Lake sediment samples, summer 2002

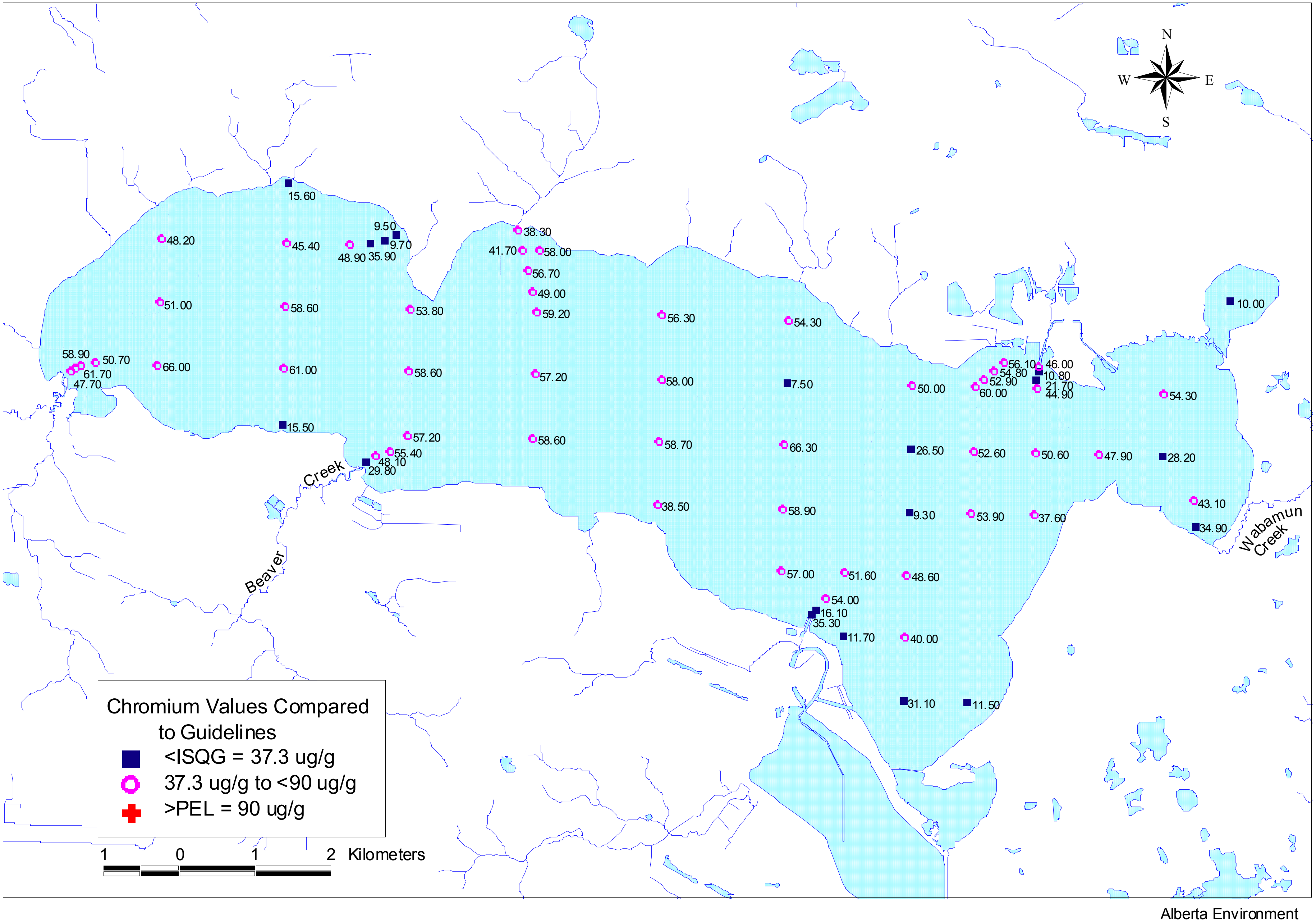

Figure 8 Concentrations of total chromium in Wabamun Lake sediment samples, summer 2002

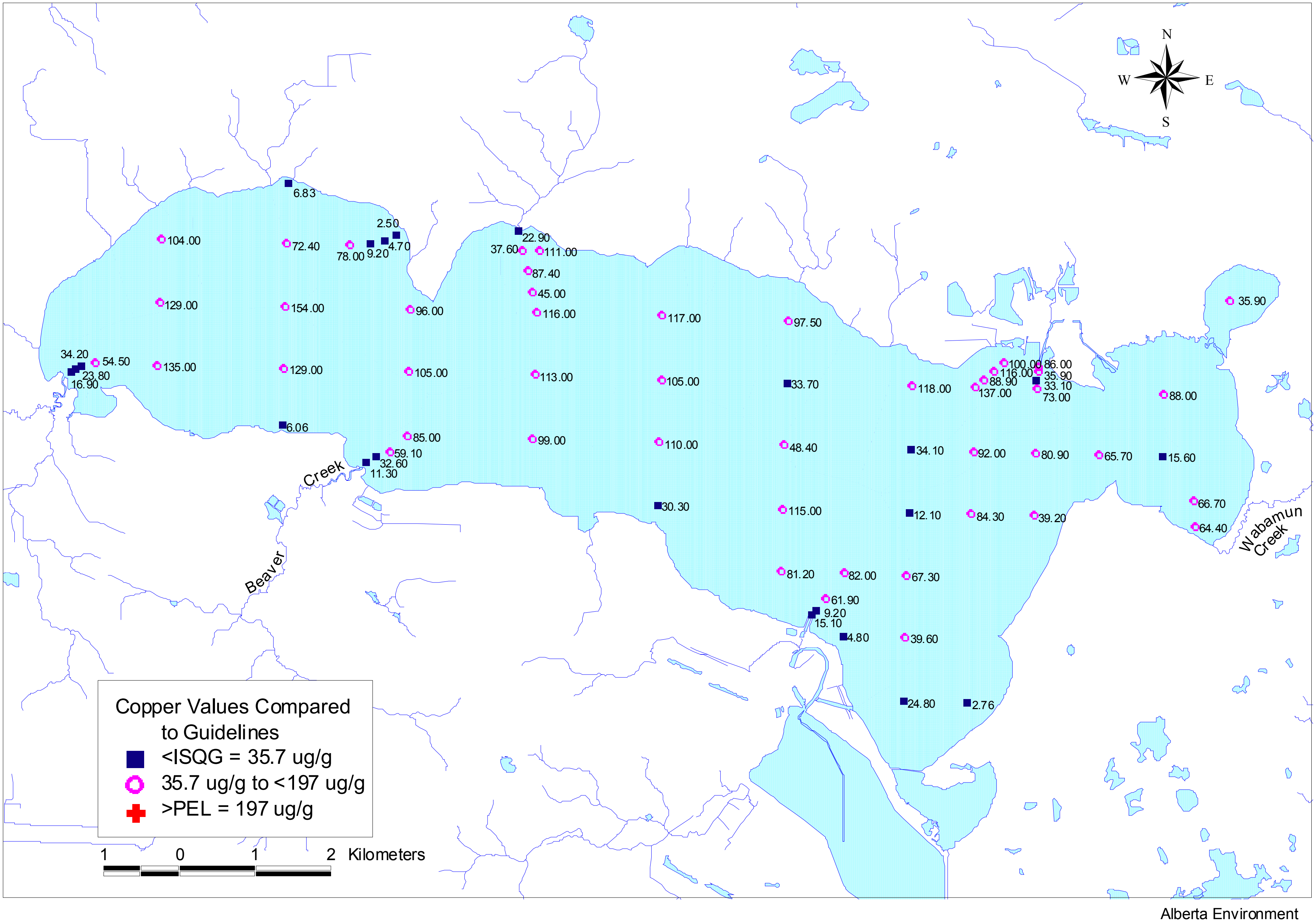

Figure 9 Concentration of total copper in Wabamun Lake sediment samples, summer 2002

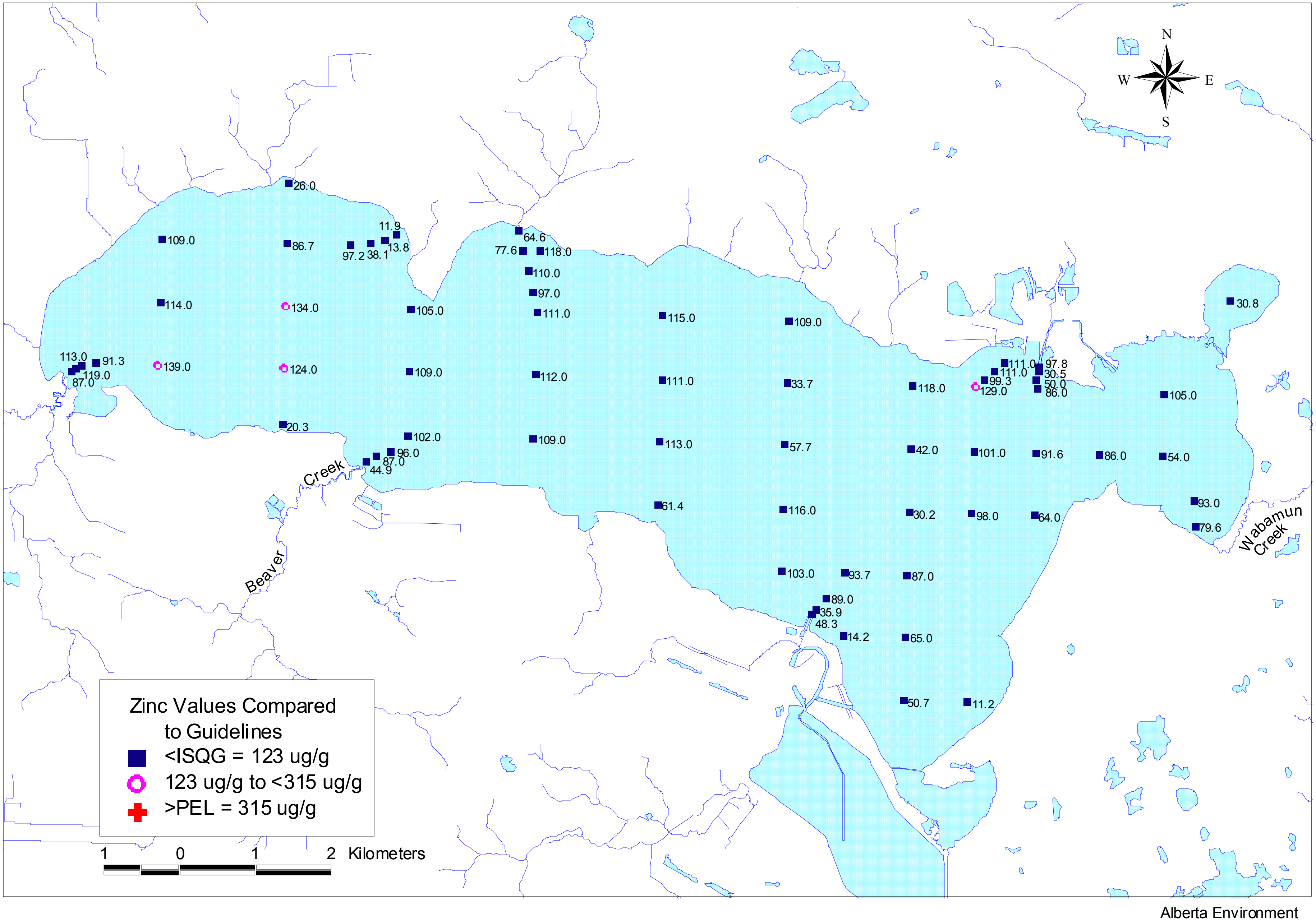

Figure 10 Concentrations of total zinc in Wabamun Lake sediment samples, summer 2002

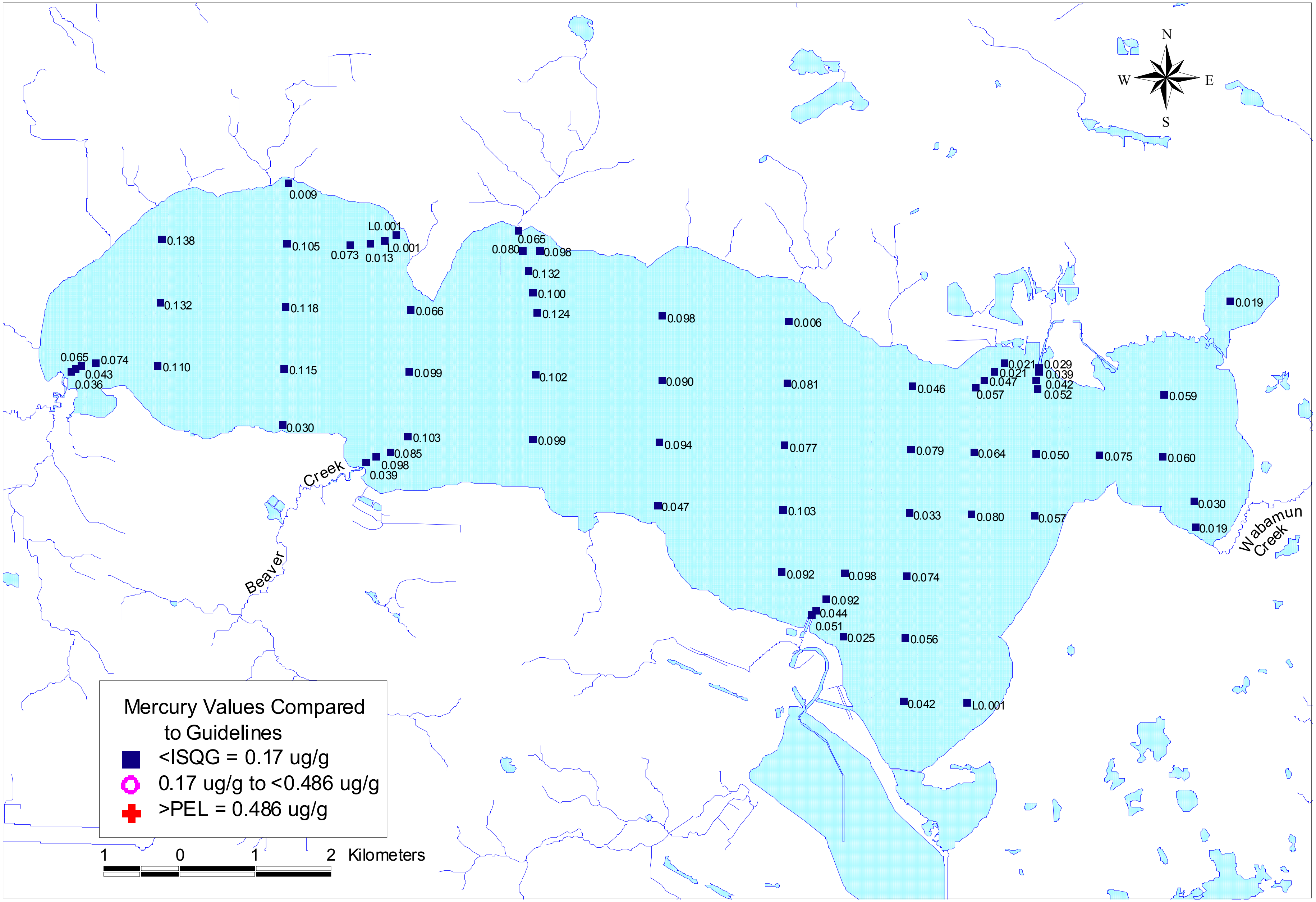

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Figure 11 Concentration of total mercury in Wabamun Lake sediment samples, summer 2002

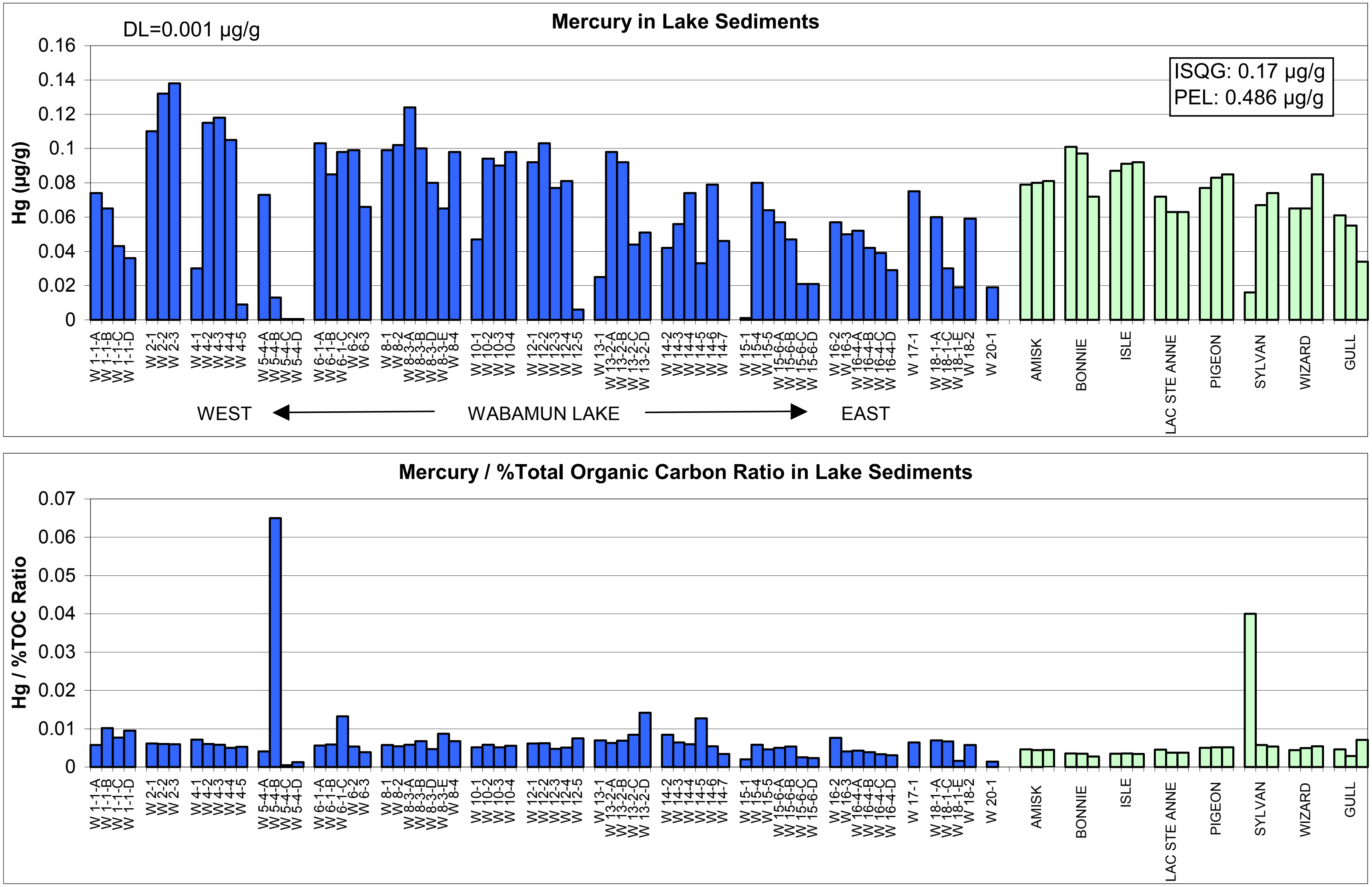


Figure 12 Comparison of total metal levels in Wabamun Lake sediments with those from other lakes sampled in 2002

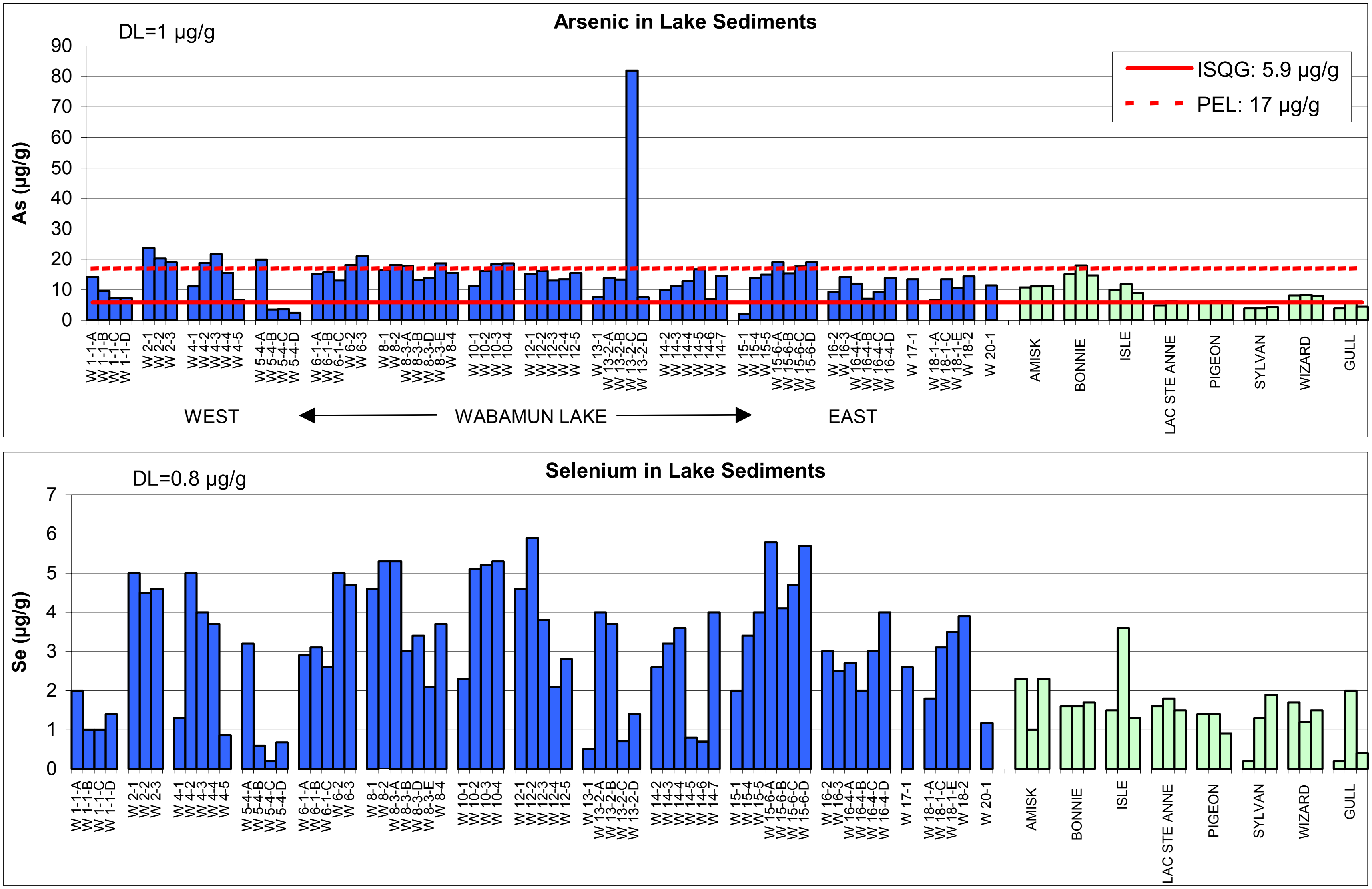


Figure 12 Comparison of total metal levels in Wabamun Lake sediments with those from other lakes sampled in 2002 (continued)

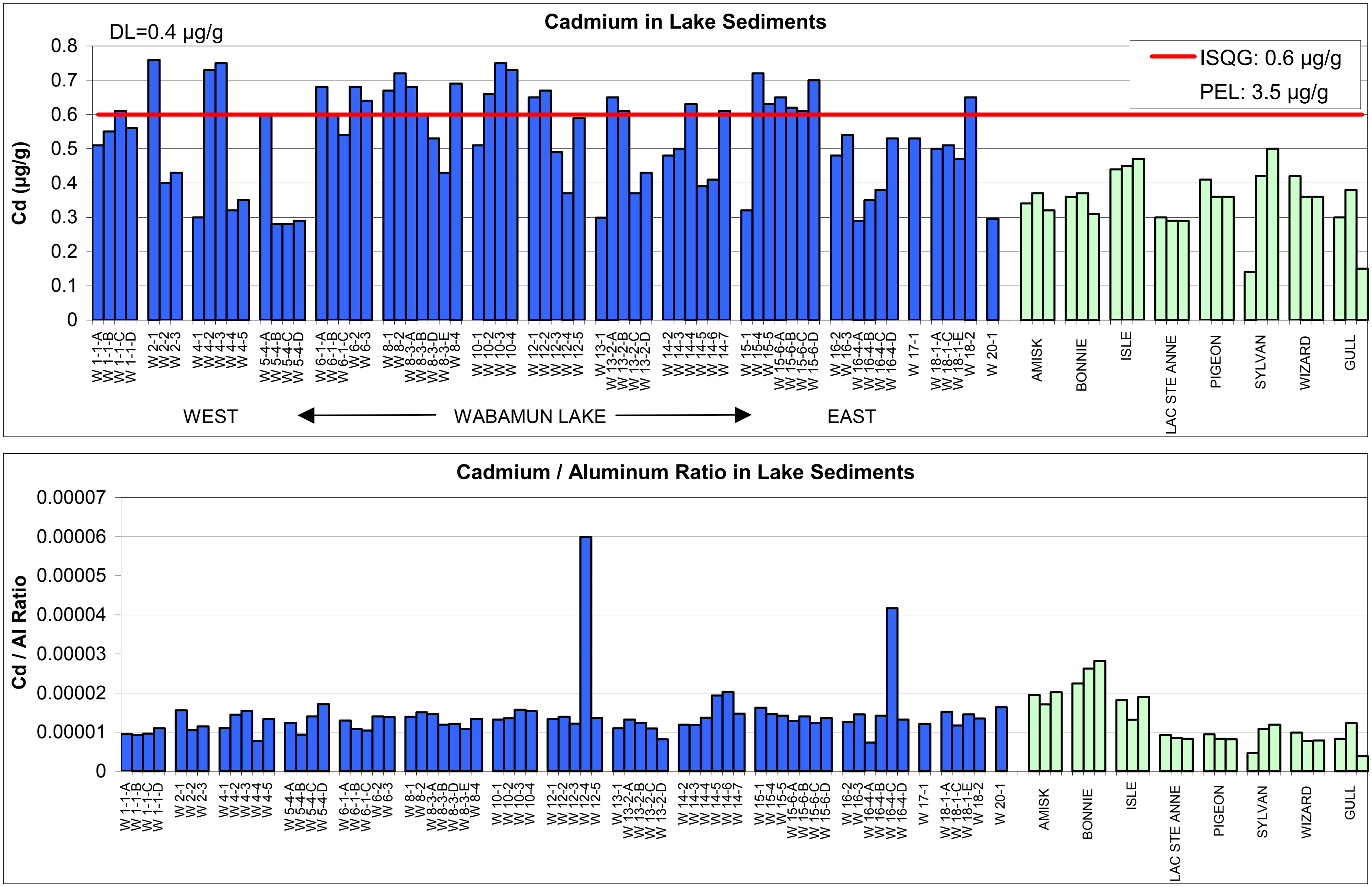
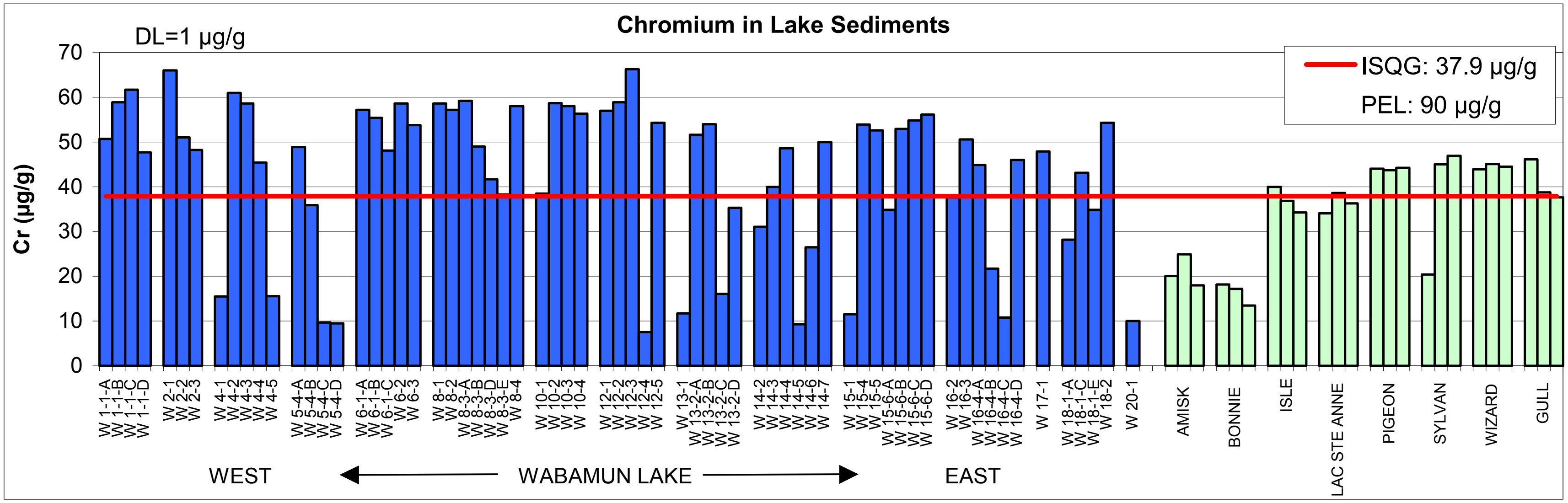


Figure 12 Comparison of total metal levels in Wabamun Lake sediments with those from other lakes sampled in 2002 (continued)



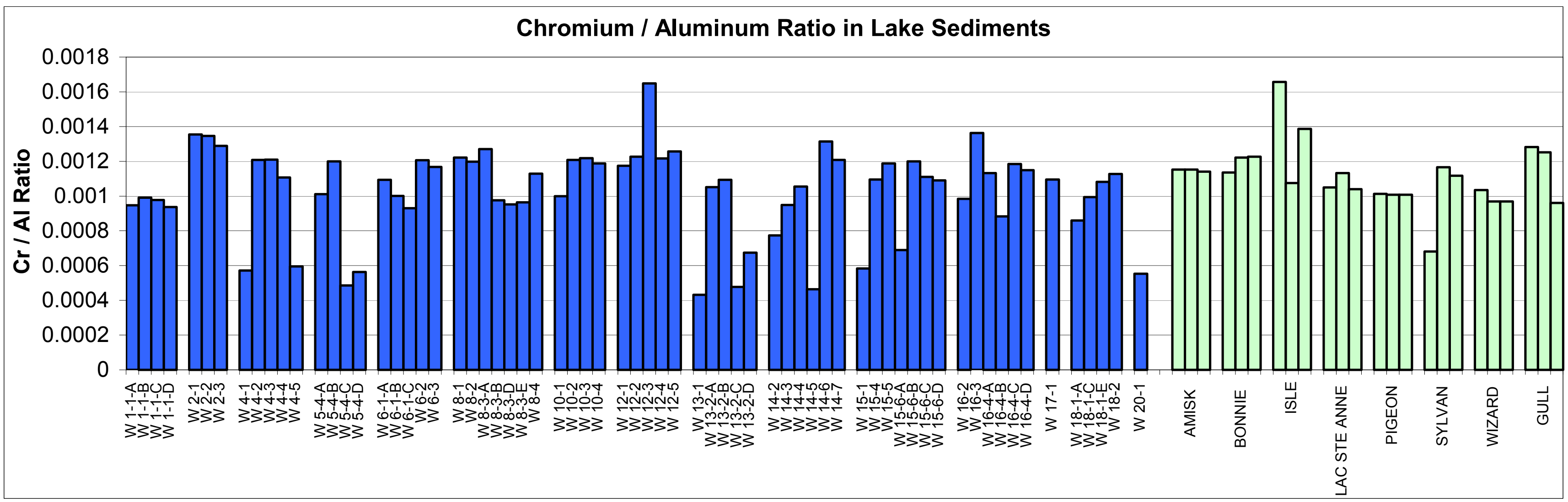


Figure 12 Comparison of total metal levels in Wabamun Lake sediments with those from other lakes sampled in 2002 (continued)

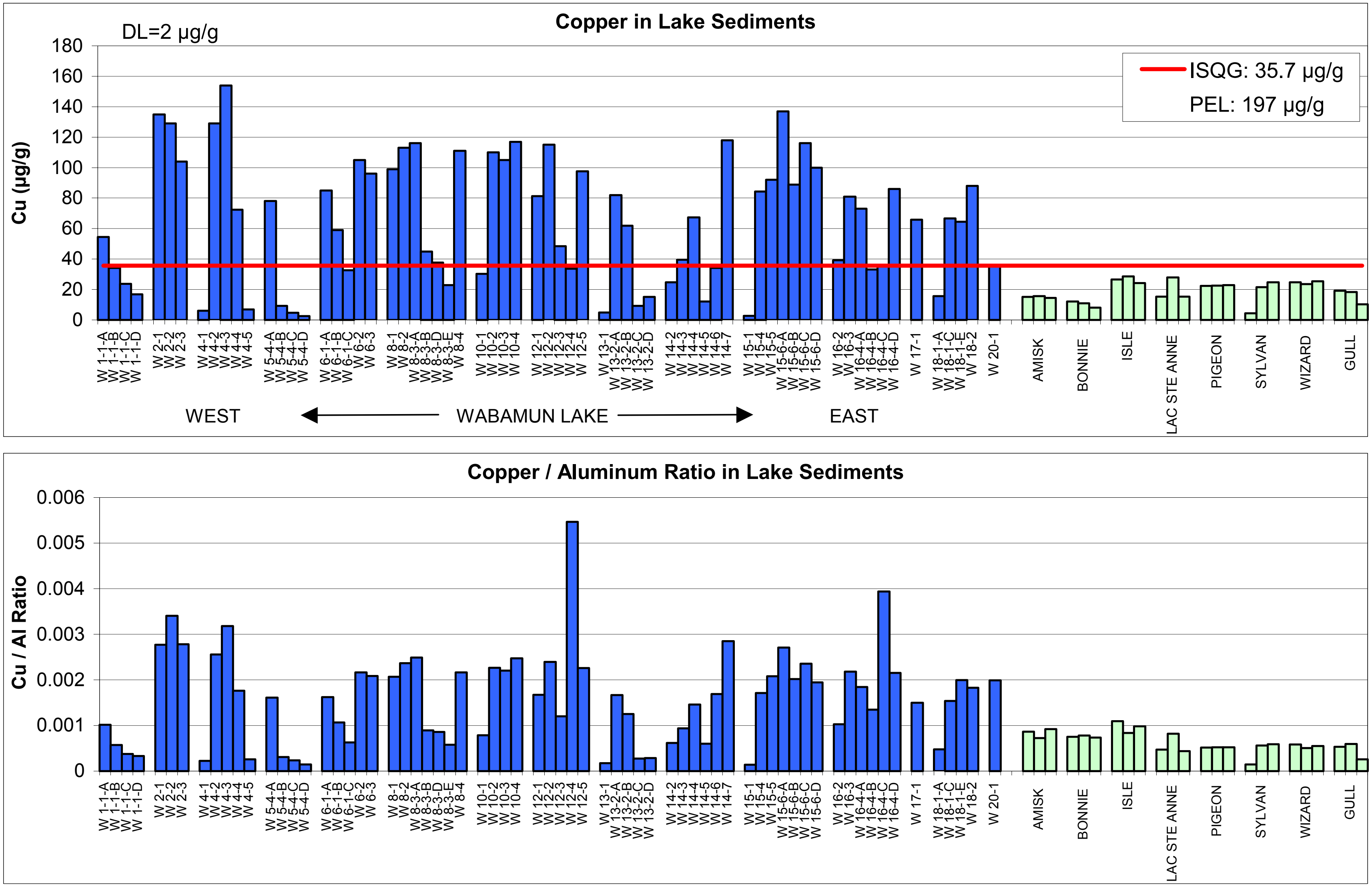
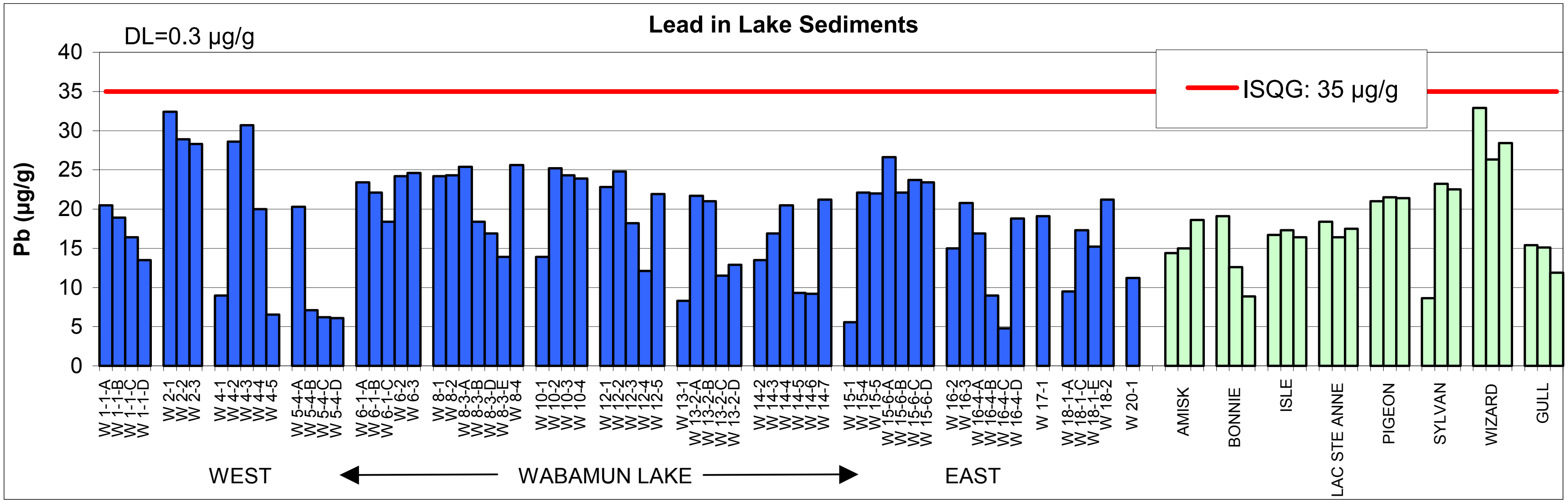


Figure 12 Comparison of total metal levels in Wabamun Lake sediments with those from other lakes sampled in 2002 (continued)



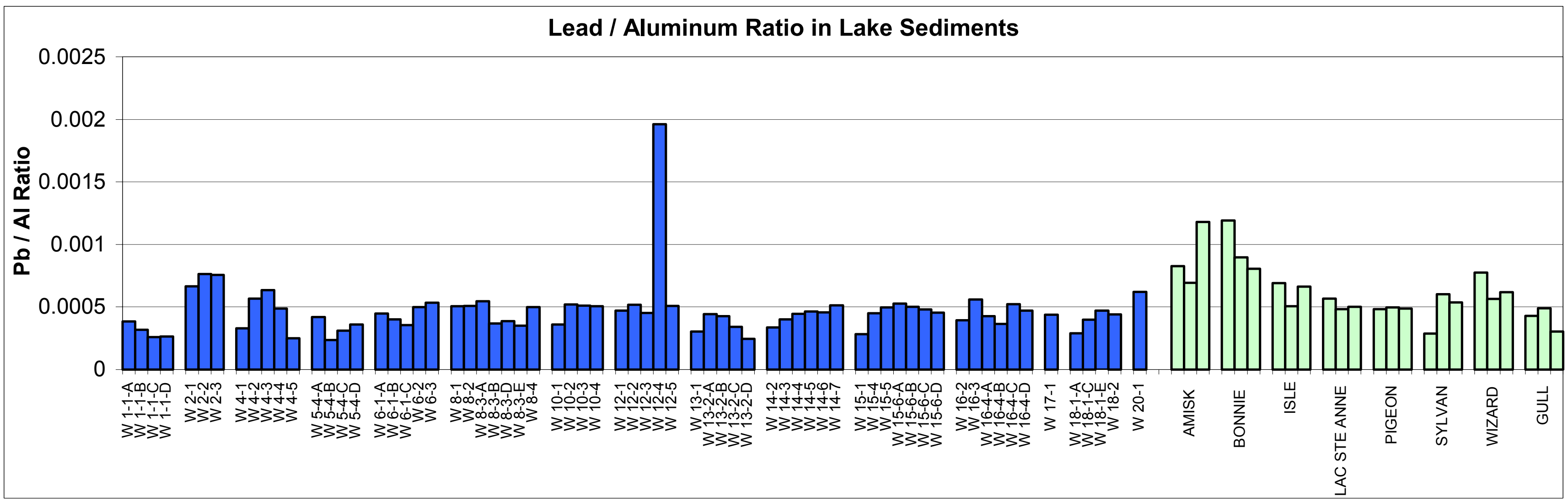
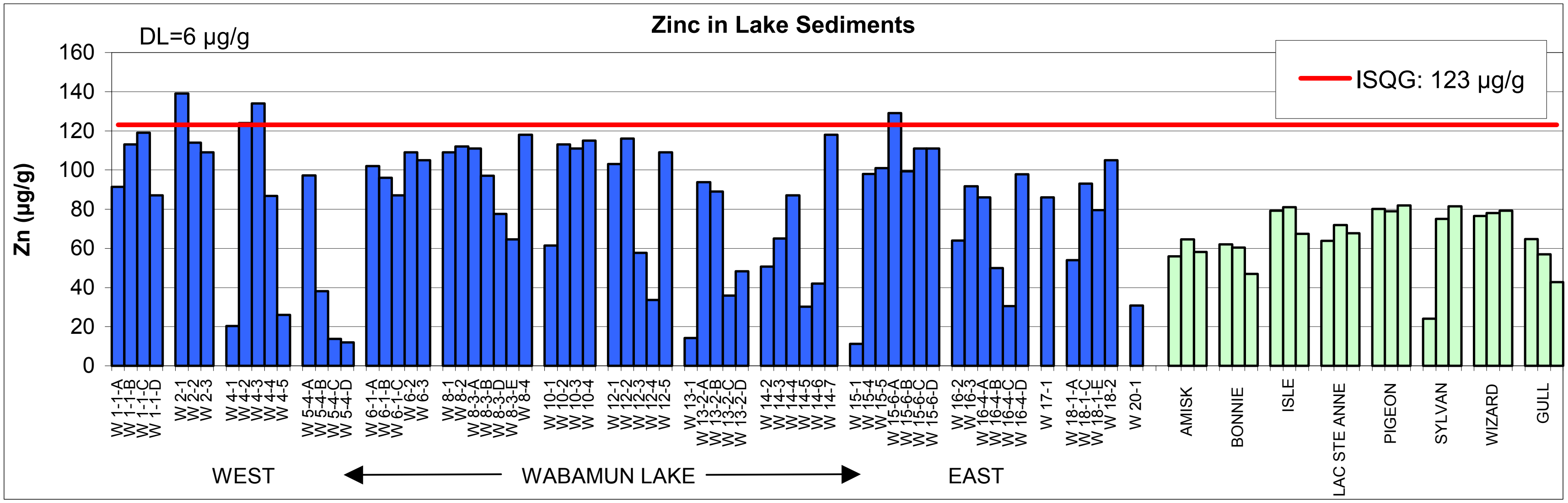


Figure 12 Comparison of total metal levels in Wabamun Lake sediments with those from other lakes sampled in 2002 (continued)



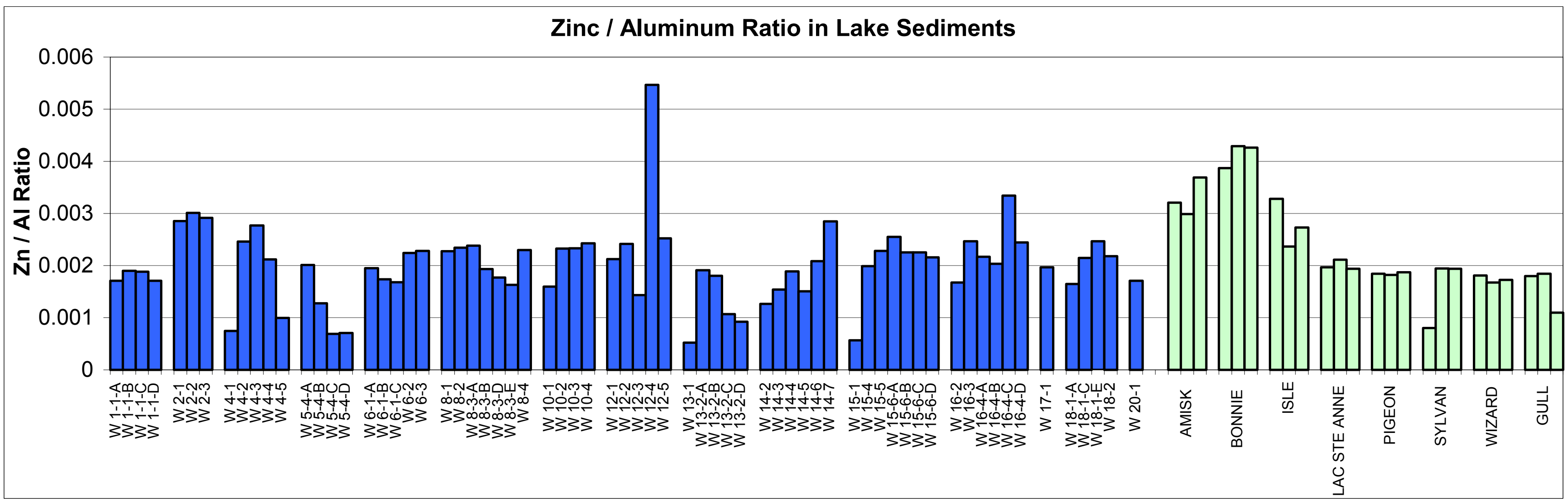
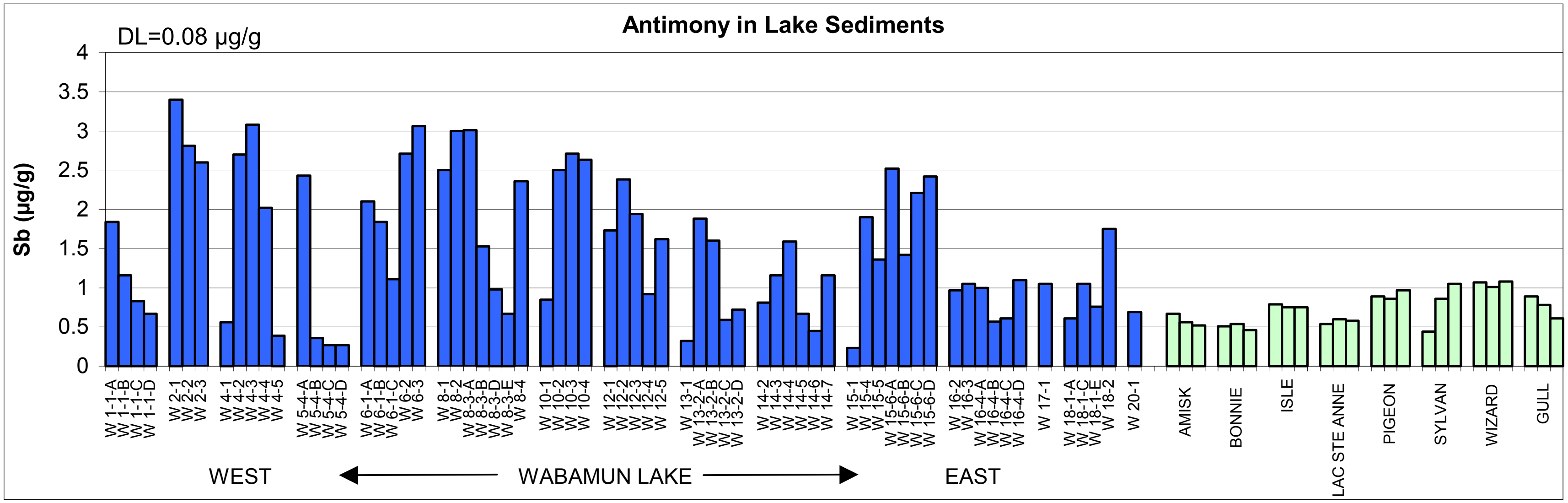


Figure 12 Comparison of total metal levels in Wabamun Lake sediments with those from other lakes sampled in 2002 (continued)



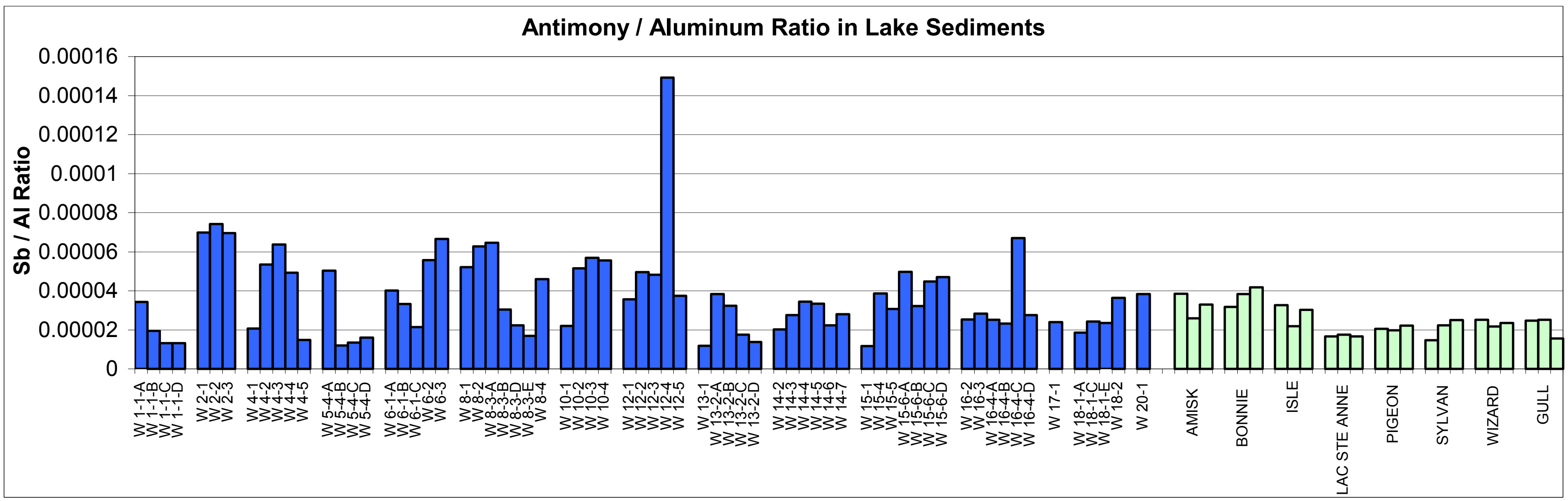
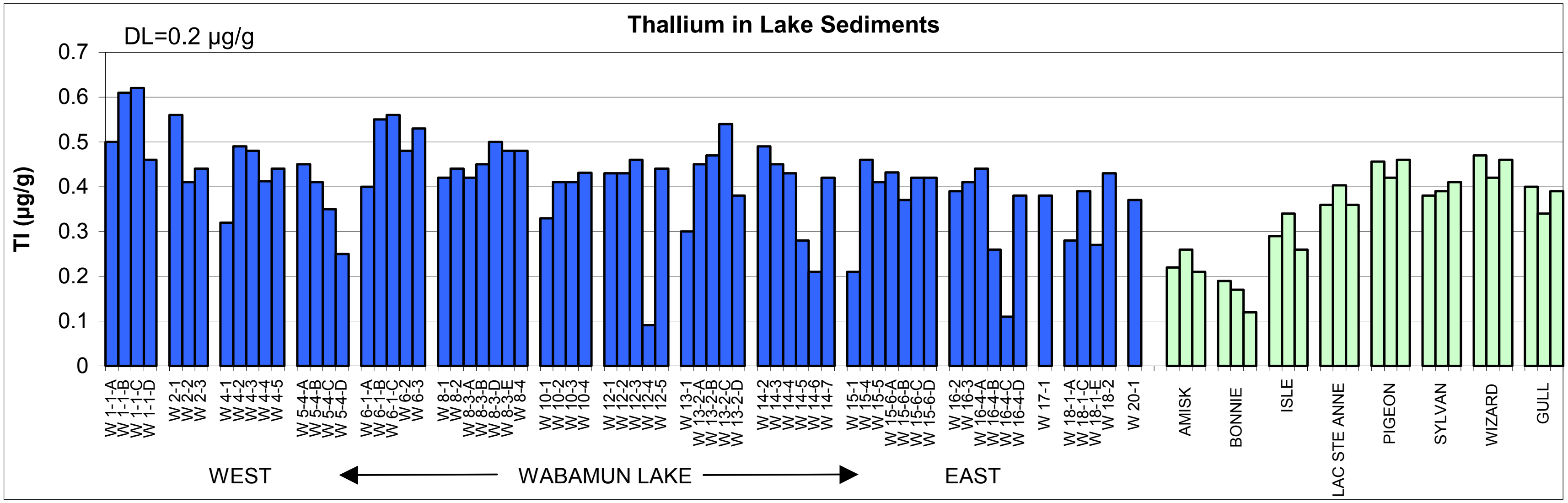


Figure 12 Comparison of total metal levels in Wabamun Lake sediments with those from other lakes sampled in 2002 (continued)



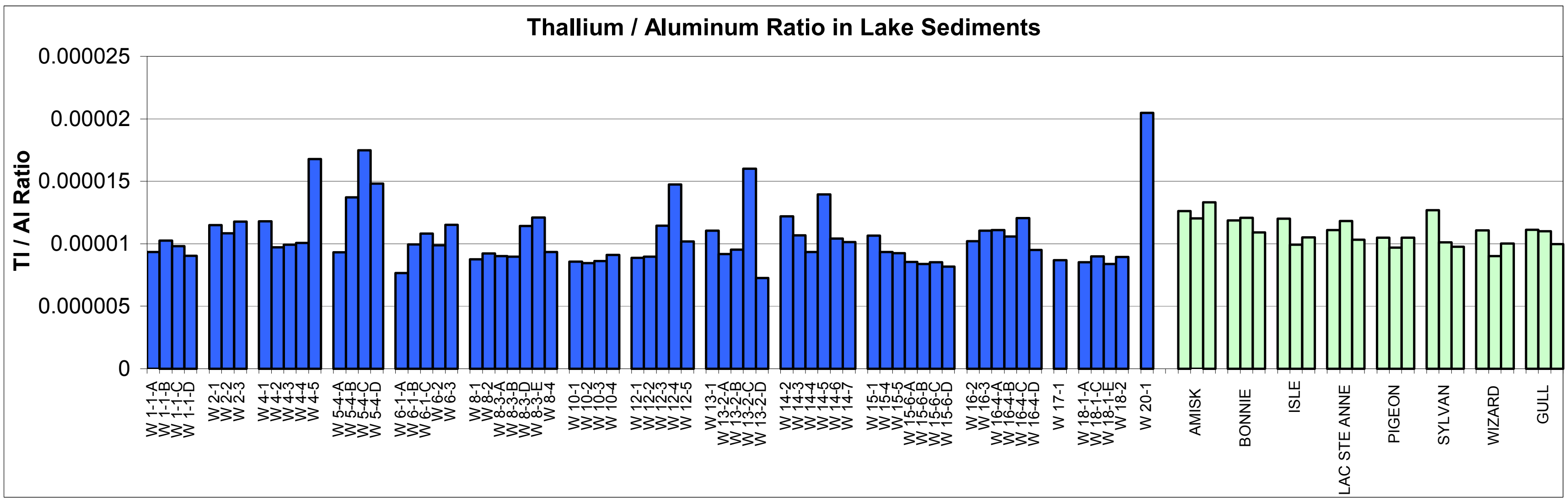


Figure 12 Comparison of total metal levels in Wabamun Lake sediments with those from other lakes sampled in 2002 (continued)

means of sediment characteristics and contaminant levels from Wabamun Lake samples with those from other lakes are shown in Table 8.

Wabamun Lake samples contained a higher fraction of sand, but less TOC, clay and silt than other lakes. The levels of Hg, Pb, Sr, Th and Ti were not different between the two sample groups, but Al, As, Se, Cd, Cr, Cu, Zn, Sb and Tl concentrations were higher in Wabamun Lake. Normalising of concentrations generally reduced the variability in the data set (implying that Al was indeed accounting for some of the variability in the data). Normalised levels of Sb and especially Cu remained higher in Wabamun; normalised Pb levels were higher in other lakes, but normalised levels of all other metals were not significantly different in the two sample groups.

Comparison of Metal Levels in Wabamun Lake with those from Reference Lakes

The result of linear regressions of metals and sediment characteristics from reference sites and the subsequent comparison to Wabamun sediment samples is shown in Figure 14.

- Although many of the Hg levels measured in Wabamun Lake sediments fall within or even below the prediction limits of the regression line, some points corresponding with higher TOC levels tend to have Hg levels which are higher than would be expected for comparable TOC values in reference lakes.

- Many of the Cd, Cu, Zn, Sb concentrations measured in Wabamun Lake tend to fall within the prediction limits for reference lakes, but metal concentrations in the higher range of Al concentrations tend to be above what would be expected from the regression on reference lakes.

Concentrations for Cr, Pb, Tl, Sr and Ti fall mostly within the expected prediction limits for reference lakes and in the case of Th, concentrations in Wabamun fall below that range.

Note that a similar analysis was not conducted with As or Se because they were not strongly correlated to TOC or Al.

Figure 13 provides a comparison of metal concentrations in archived sediments from 29 lakes. The graphs show that concentrations measured in Wabamun Lake fall, generally, within the concentration ranges of other lakes although in many instances towards the upper boundaries of the range. Copper is a notable exception. Sediment levels for Cu in Wabamun and Moonshine lakes were noticeably higher than in the other lakes.

3.2 Trace Organics

3.2.1 Extractable Priority Pollutants (EPP)

Of the 39 extractable priority pollutants that were analysed in the lake sediment samples, eight were detected (i.e., 4-chloro-3-methylphenol, phenol, benzidene, butylbenzyl phthalate, di-n-butyl phthalate, diethylphthalate, di-n-octylphthalate and bis (2-ethylhexyl)phthalate . Data for

Table 8 Comparison of contaminant levels between Wabamun Lake sediments and sediments from other lakes

Two-sample t-test, differences between means reported significant for $p<0.05$.

Sediment Characteristics and Metals			Wabamun			Other Lakes		
Variable	**Significance**	**Comparison of Means**	**n**	**mean**	**sd**	**n**	**mean**	**sd**
TOC	yes	Wabamun<others	67	11.6	6.1	24	17.4	6.8
%sand	yes	Wabamun>others	64	35.1	29.8	24	9.1	19.5
%clay	yes	Wabamun<others	64	30.6	21	24	47	14.9
%silt	yes	Wabamun<others	64	34.2	15.9	24	43.9	12.7
Hg	no		67	0.065	0.053	24	0.073	0.019
Al	yes	Wabamun>others	67	40990	12011	24	31775	11156
As	yes	Wabamun>others	67	14.4	9.7	24	8.3	3.9
Se	yes	Wabamun>others	67	3.1	1.6	24	1.5	0.7
Cd	yes	Wabamun>others	67	0.53	0.14	24	0.35	0.09
Cr	yes	Wabamun>others	67	43.6	17.0	24	34.7	11.1
Cu	yes	Wabamun>others	67	43.6	17.0	24	18.9	6.7
Pb	no		67	18.3	7.0	24	18.3	5.8
Zn	yes	Wabamun>others	67	82.4	34.9	24	66.6	14.4
Sb	yes	Wabamun>others	67	1.51	0.89	24	0.21	0.74
Tl	yes	Wabamun>others	67	0.41	0.10	24	0.34	0.10
Sr	no		67	275	151	24	272	233
Th	no		67	5.6	2.3	24	6.2	2.1
Ti	no		67	1929	599	24	1709	521
Normalized Data								
Hg/TOC	no							
Cd/Al	no							
Cr/Al	no							
Cu/Al	yes	Wabamun>others						
Pb/Al	yes	Wabamun<others						
Zn/Al	no							
Sb/Al	yes	Wabamun>others						
Tl/Al	no							

Trace Organics			Wabamun			Other Lakes		
Variable	**Significance**	**Comparison of Means**	**n**	**mean**	**sd**	**n**	**mean**	**sd**
total PAH	yes	Wabamun>others	27	180.5	227.4	24	24	36

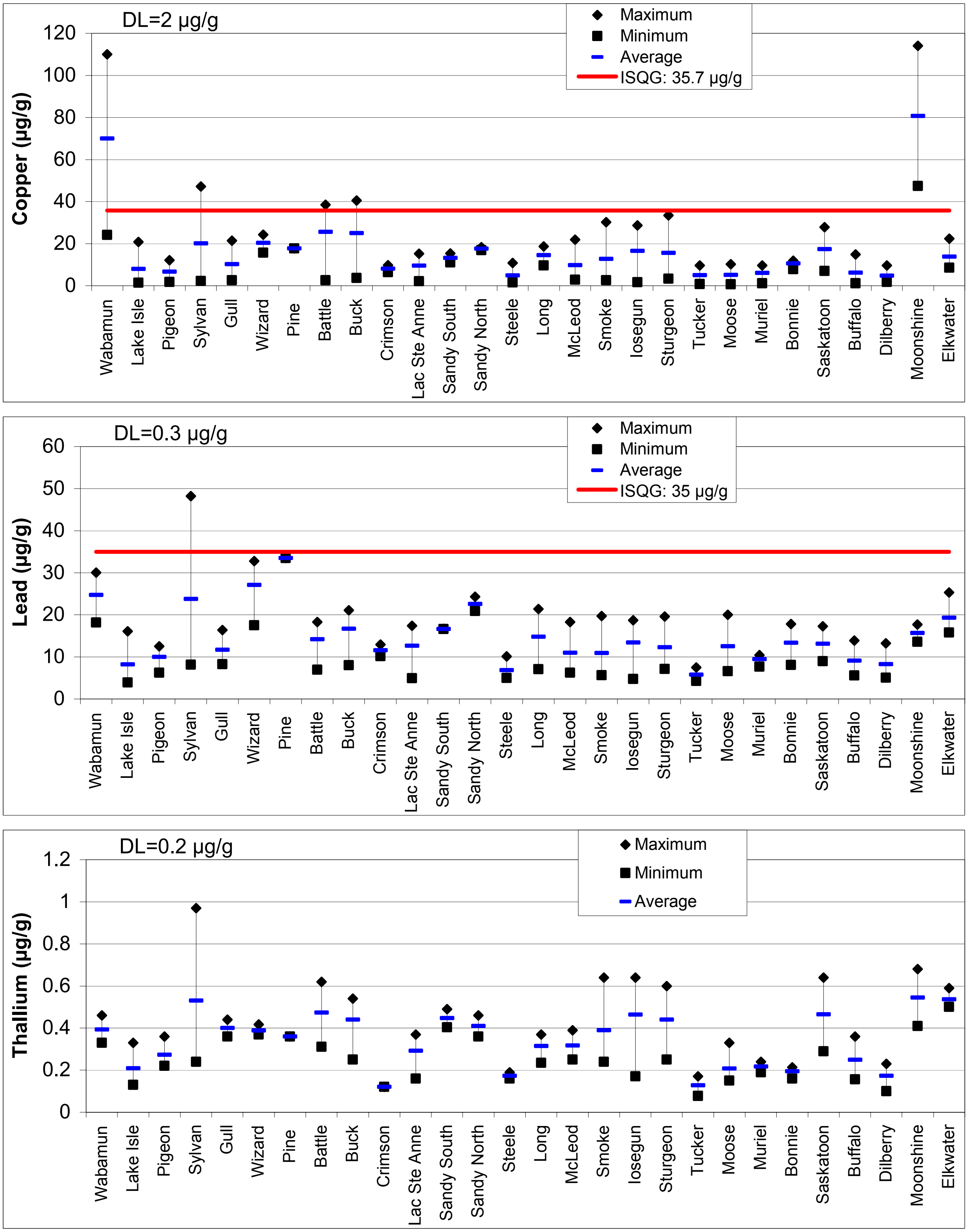


Figure 13 Comparison of total metal levels in Wabamun Lake sediments with those archived from other lakes sampled in 1993-94

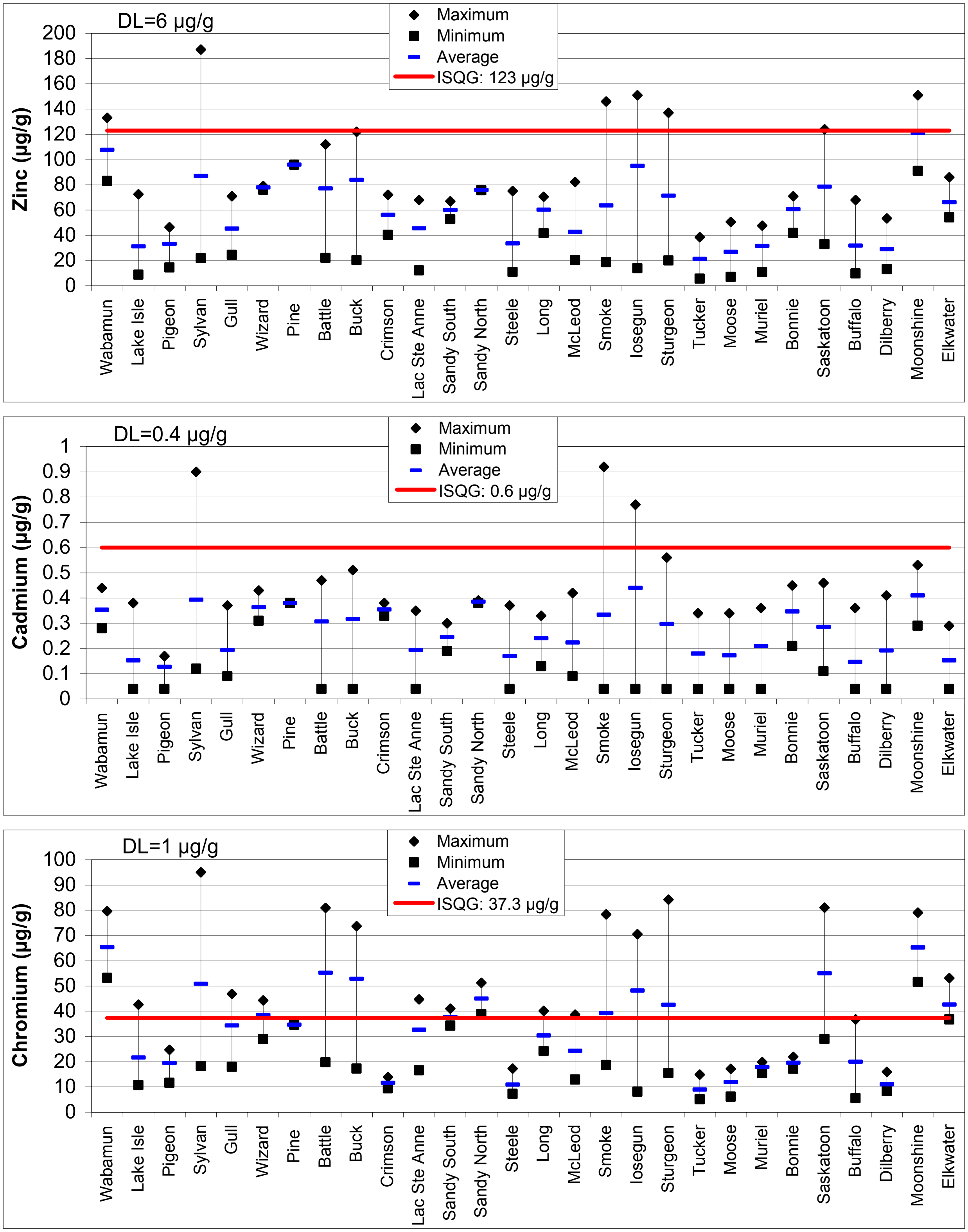
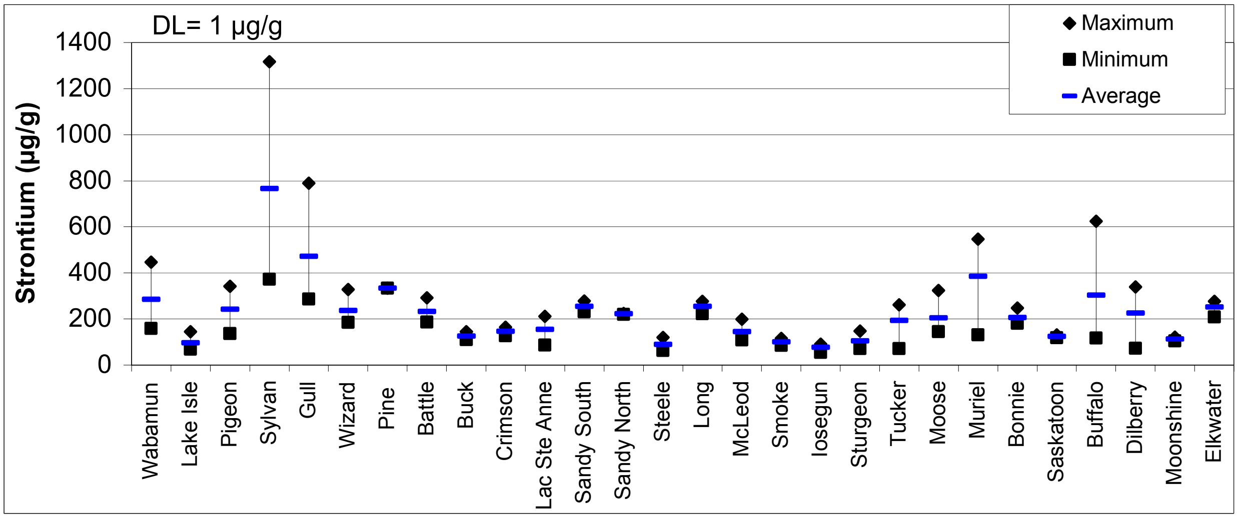
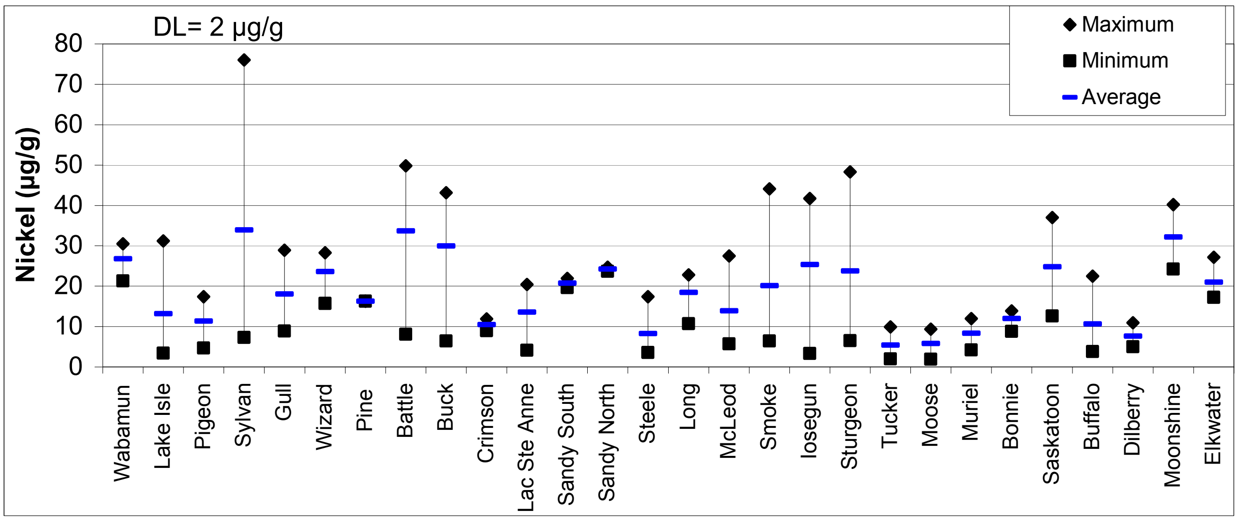


Figure 13 Comparison of total metal levels in Wabamun Lake sediments with those archived from other lakes sampled in 1993-94 (continued)





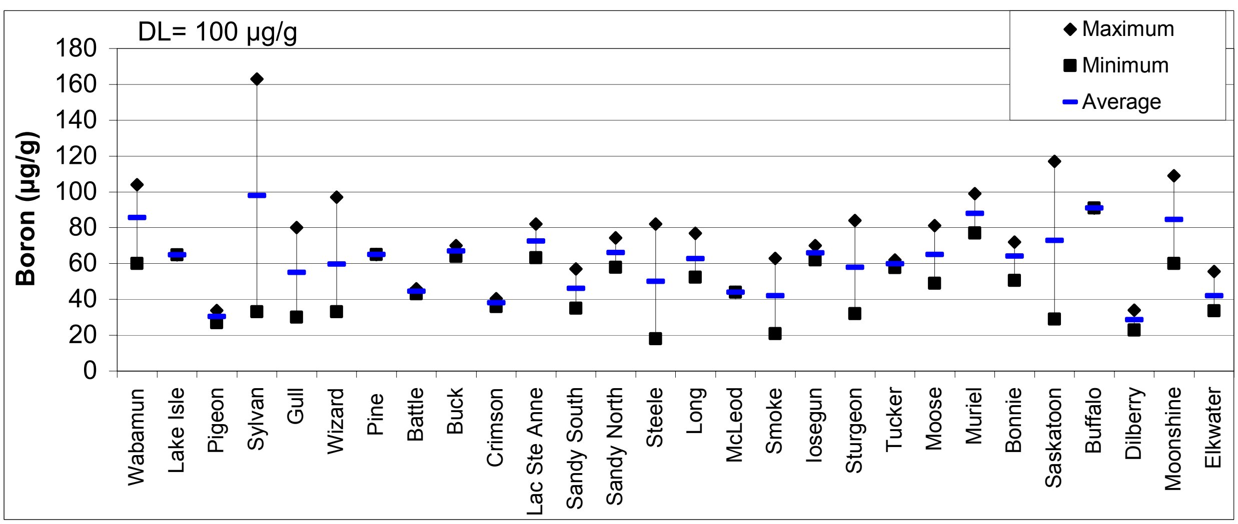


Figure 13 Comparison of total metal levels in Wabamun Lake sediments with those archived from other lakes sampled in 1993-94 (continued)

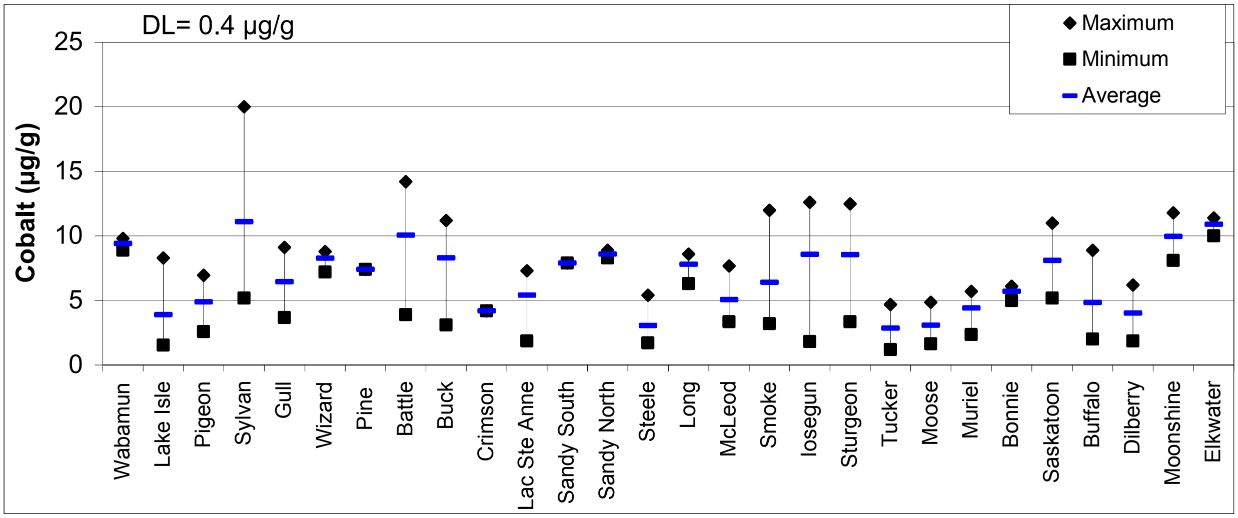


Figure 13 Comparison of total metal levels in Wabamun Lake sediments with those archived from other lakes sampled in 1993-94 (continued)

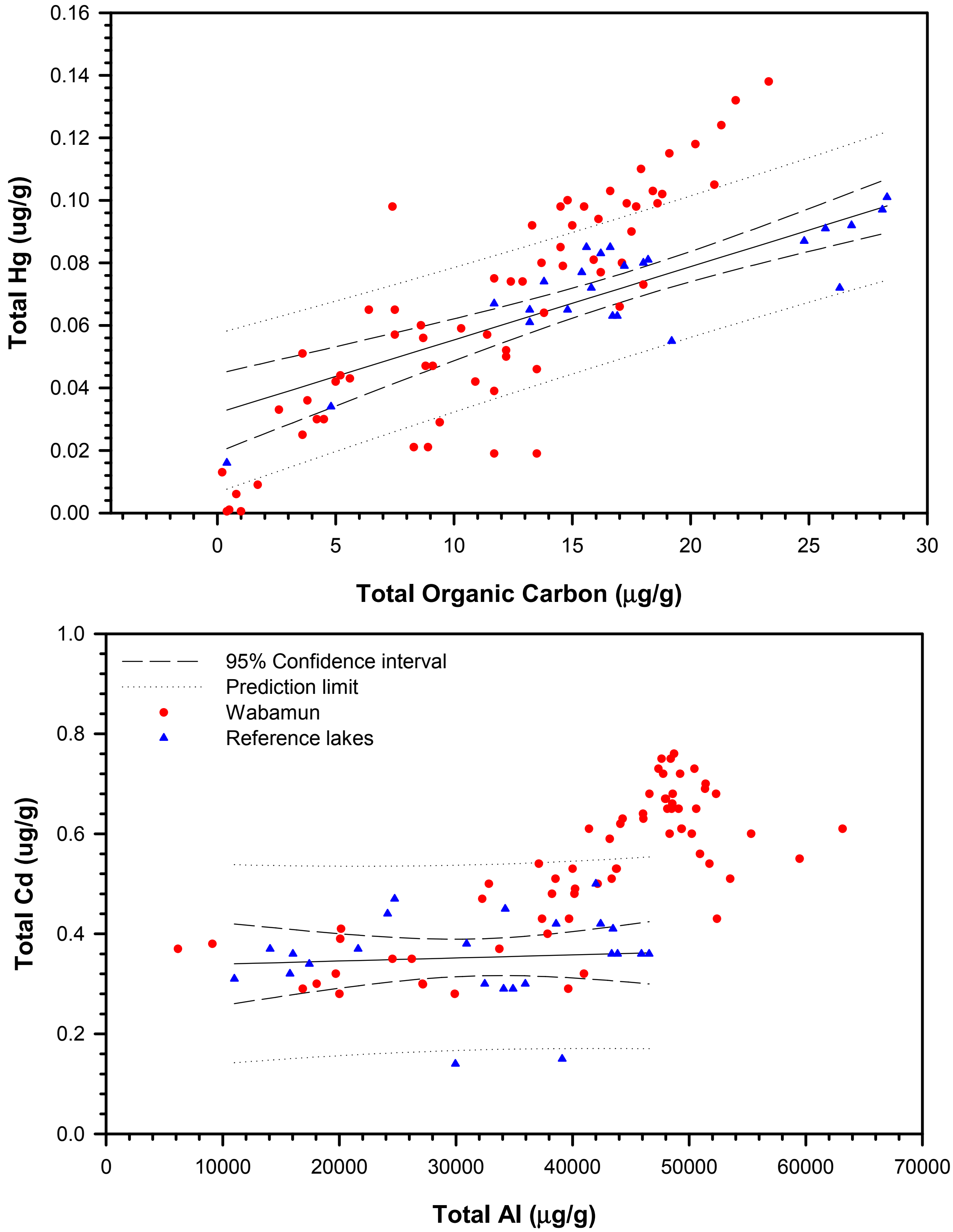
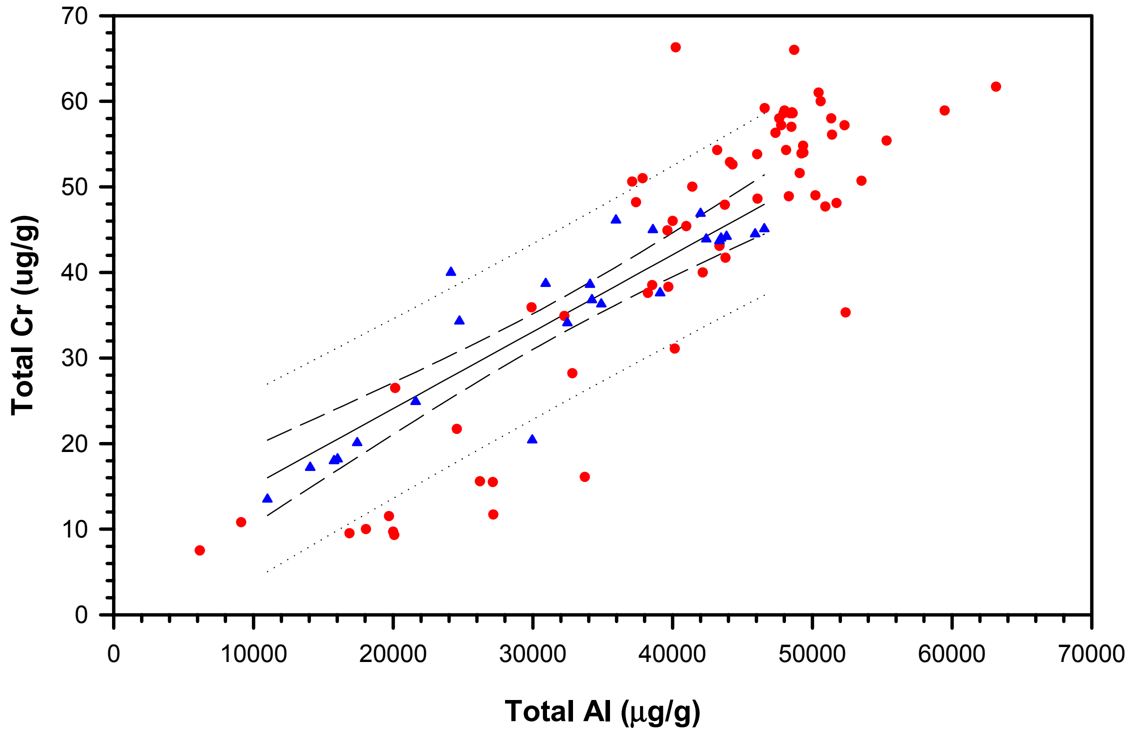


Figure 14 Standardization of metal levels for aluminum or total organic carbon and comparison of Wabamun Lake samples to reference lakes



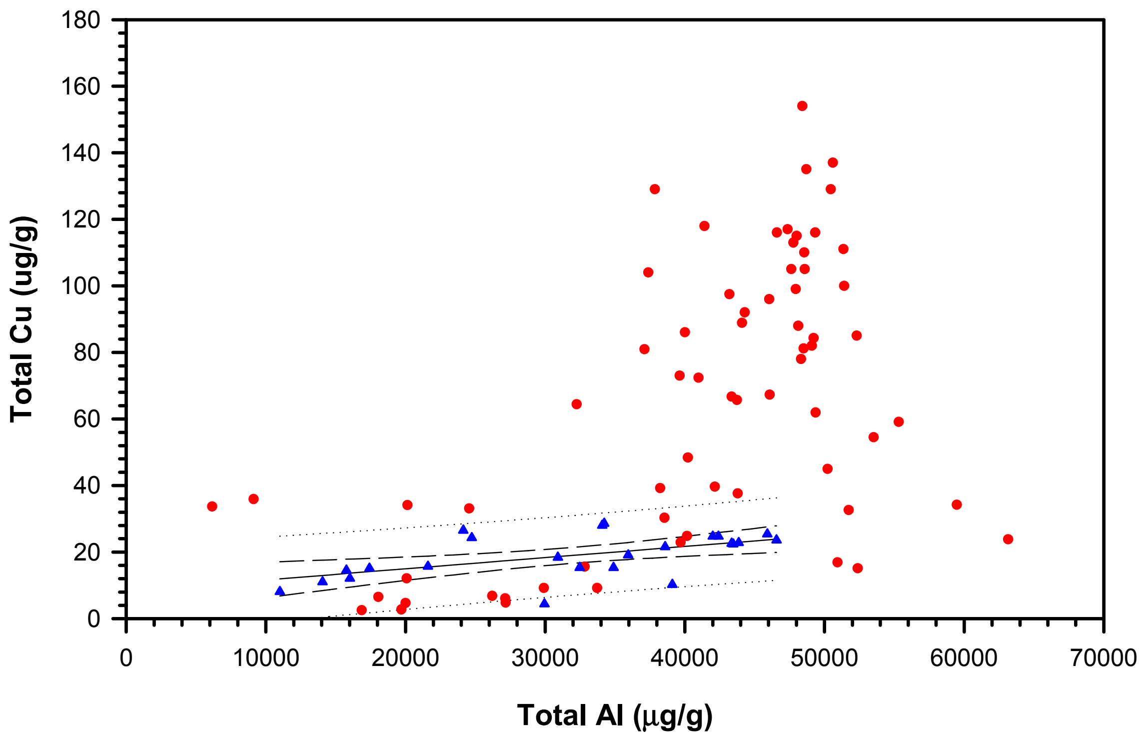


Figure 14 Standardization of metal levels for aluminum or total organic carbon and comparison of Wabamun Lake samples to reference lakes (continued)

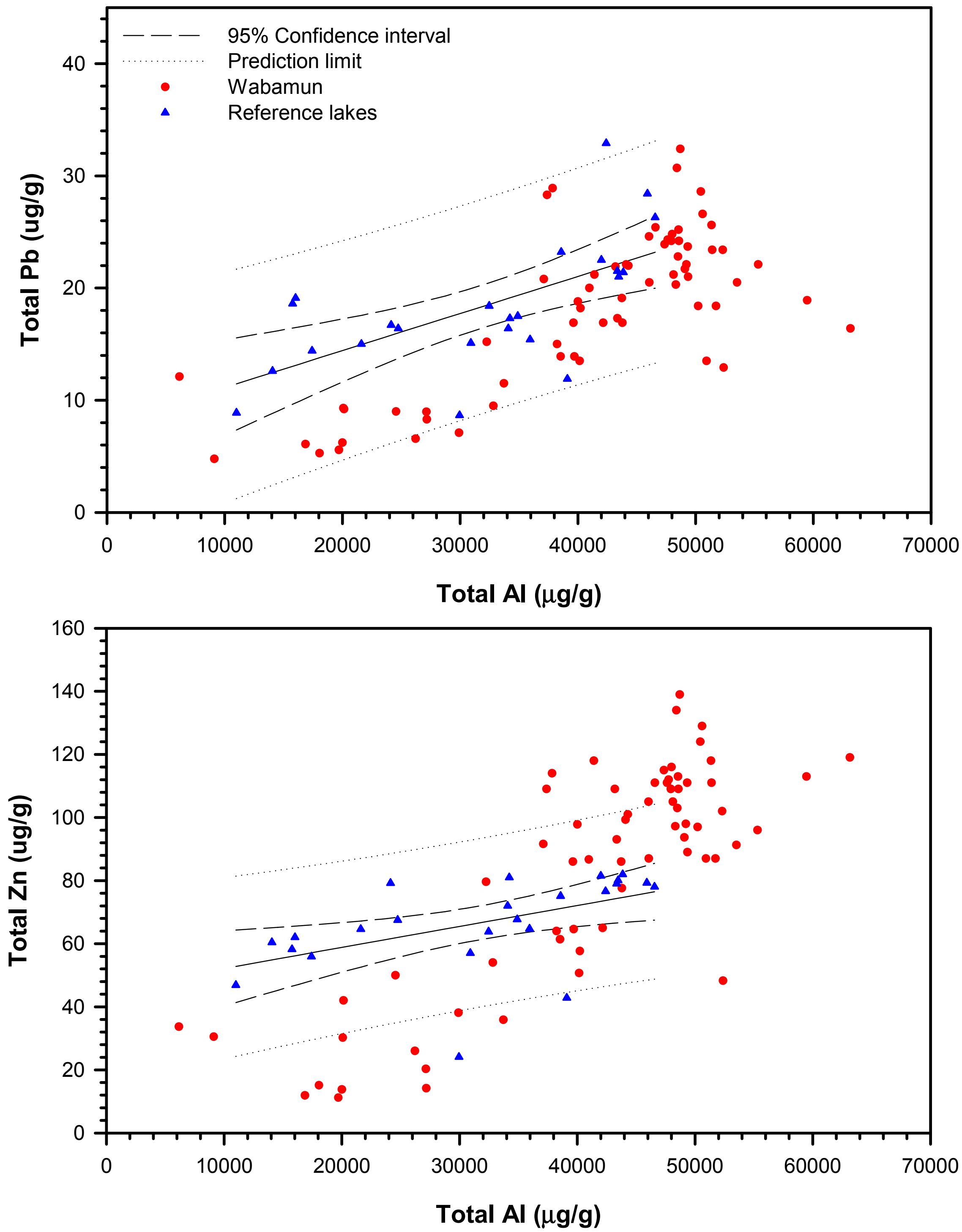
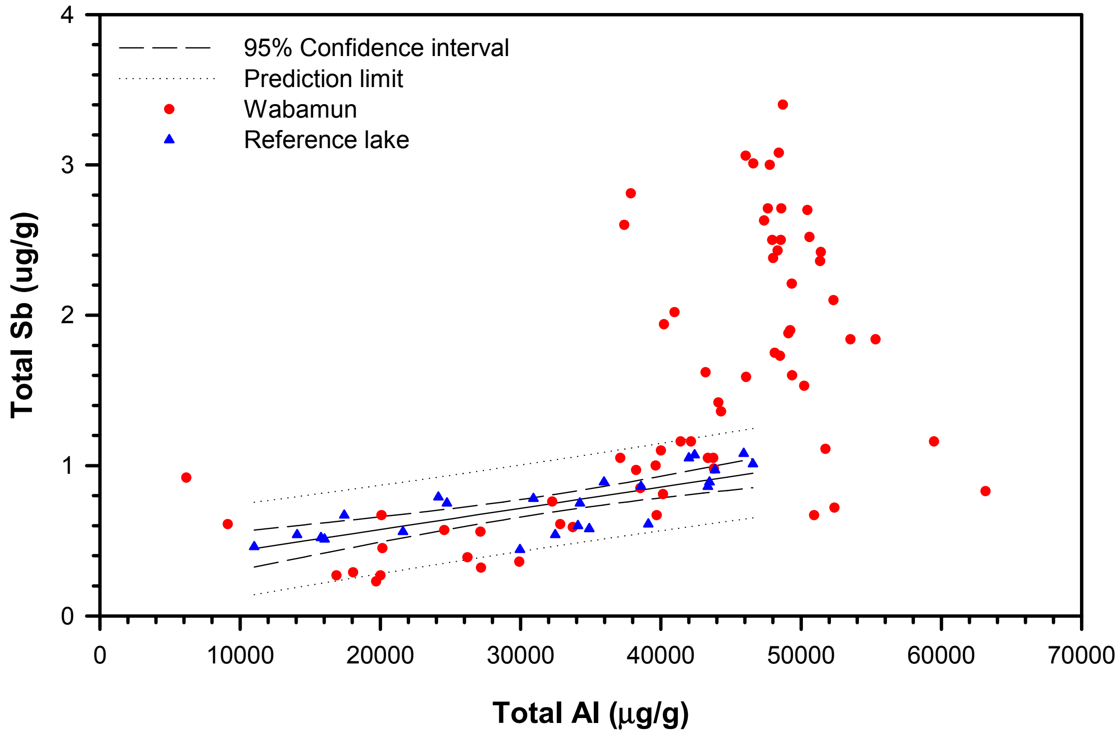


Figure 14 Standardization of metal levels for aluminum or total organic carbon and comparison of Wabamun Lake samples to reference lakes (continued)



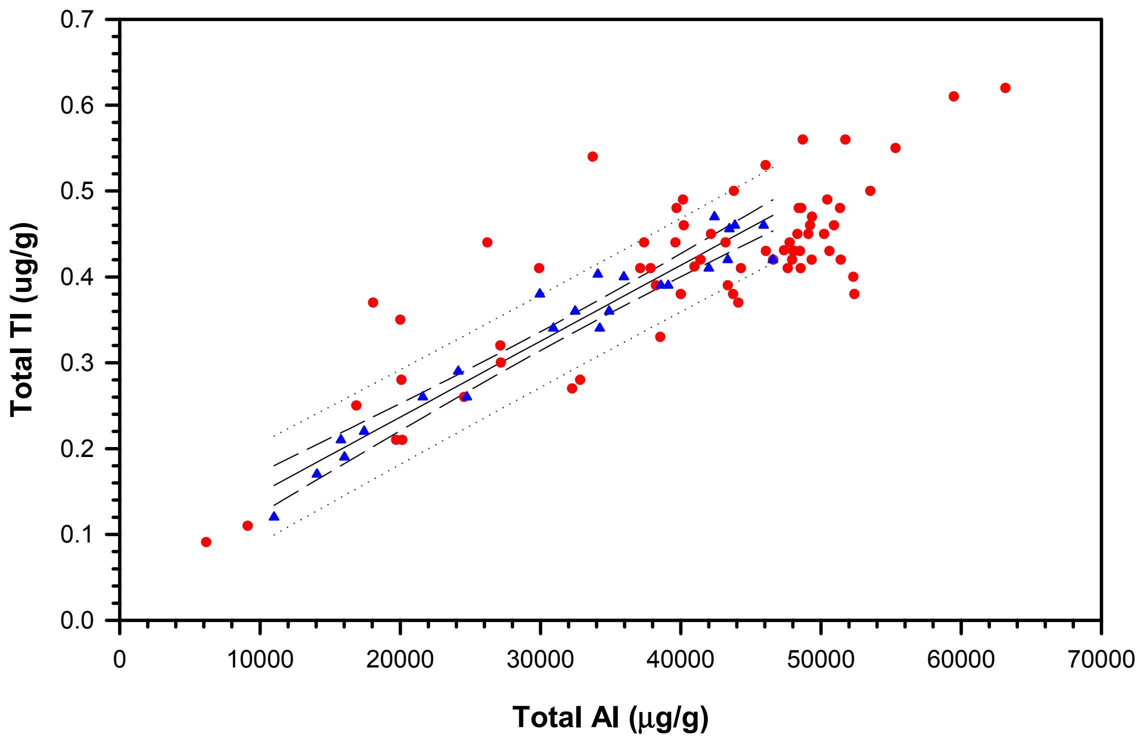


Figure 14 Standardization of metal levels for aluminum or total organic carbon and comparison of Wabamun Lake samples to reference lakes (continued)

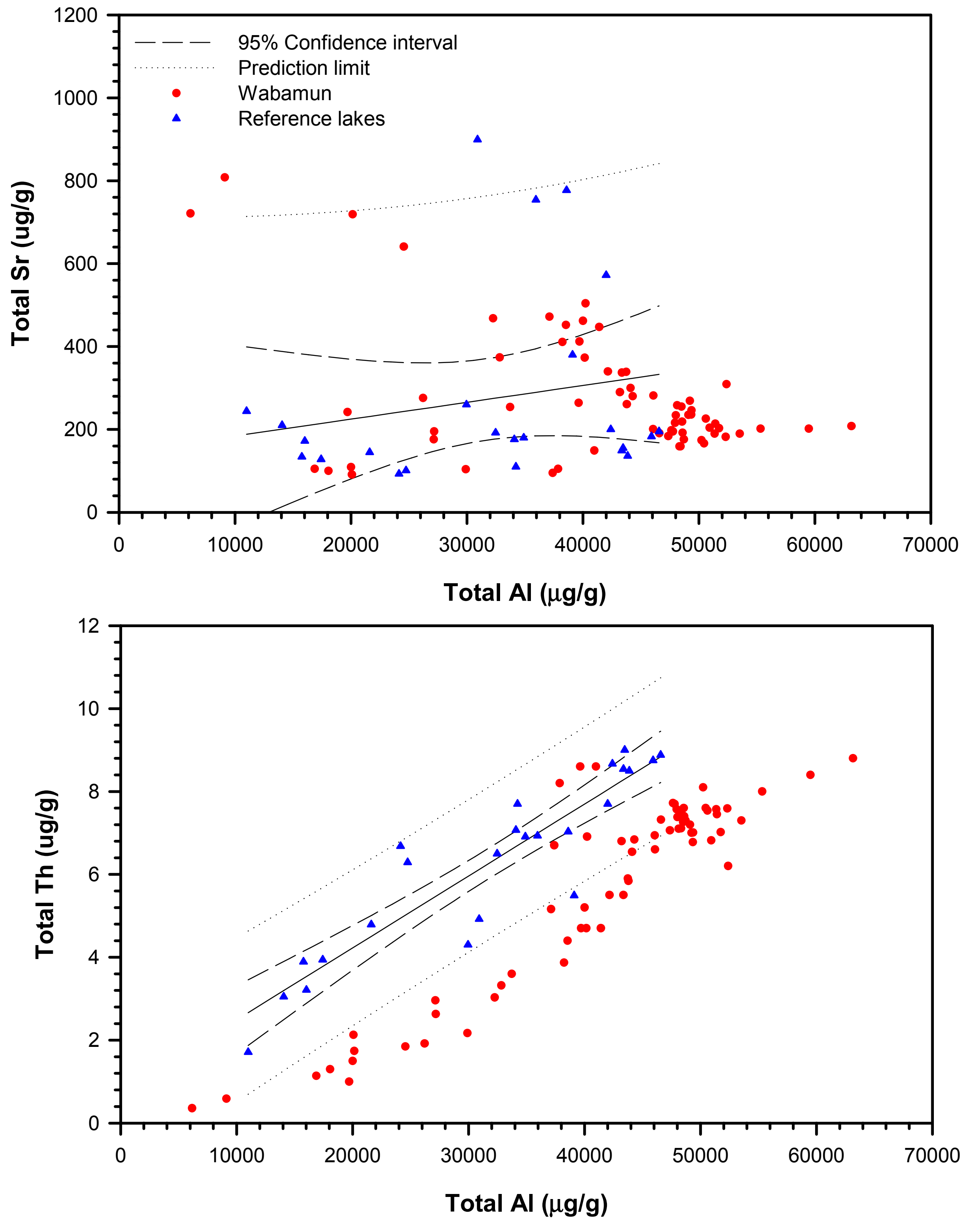


Figure 14 Standardization of metal levels for aluminum or total organic carbon and comparison of Wabamun Lake samples to reference lakes (continued)

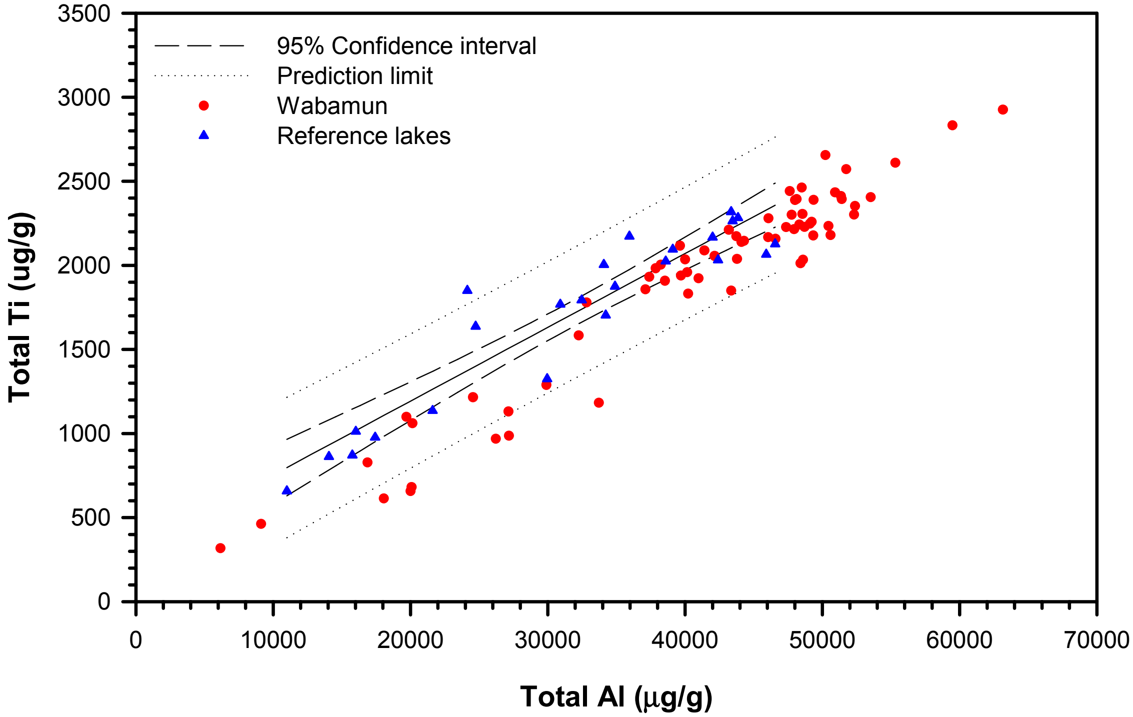


Figure 14 Standardization of metal levels for aluminum or total organic carbon and comparison of Wabamun Lake samples to reference lakes (continued)

4-chloro-3-methylphenol, phenol, benzidene are shown in Table 9. The occurrence of phthalates is discussed in further detail in Appendix 2.

4-chloro-3-methylphenol and phenol were detected in Wabamun Lake sediments. Benzidene was found in Ste. Anne and Amisk lakes.

None of the EPP detected in lake sediments have CCME guidelines and it is important to point out that they are reported at concentrations well below the method detection limit (i.e., reported as 'estimated' or 'trace').

3.2.2 Volatile Priority Pollutants (VPP)

None of the 60 volatile priority pollutants analyzed occurred at measurable concentrations in the lake sediments.

3.2.3 Polycyclic Aromatic Hydrocarbons (PAH)

Of the 24 PAH measured in lake sediments, 22 occurred at measurable concentrations in at least one of the lake sediments (naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, acridine, pyrene, fluoranthene, retene (7-isopropyl-1-methylphenanthrene), benzo(c)phenanthrene, benzo(a)anthracene, chrysene, benzo(b,j,k)fluoranthene, dimethylbenz(a)anthracene, benzo(e)pyrene, benzo(a)pyrene, 3-methylcholanthrene, indeno(1,2,3-c,d)pyrene, dibenzo(a,h)anthracene, benzo(g,h,i)perylene and dibenzo(a,l) pyrene) (Table 9). Figure 15 compares PAH concentrations detected in Wabamun Lake with concentrations detected in the eight other lakes sampled in 2002; the distribution of concentrations of selected PAH in Wabamun Lake is shown in Figures 16 to 21.

All of these compounds, except acenaphthylene, were encountered in Wabamun Lake sediments and all, except acenaphthene, anthracene, acridine, and 3-methylcholanthrene were encountered in the other eight lakes. In fact, one or more PAH were detected in the sediments of each of these eight lakes. Overall, PAH were detected more frequently and at significantly higher concentrations in Wabamun lake sediments than in the other eight lakes (Figure 15, Table 8). Some exceptions were acenaphthylene, which was not found in Wabamun Lake, and retene (7-isopropyl-1-methylphenanthrene), which was found less frequently (13 of the 27 samples) in Wabamun compared to the other eight lakes (21 of the 24 samples).

Again, it is important to indicate that several PAH detections in Wabamun Lake, and particularly in the other eight lakes, are reported at concentrations below the method detection limit (i.e., 'estimated' concentrations or 'trace levels').

Of the 22 PAH detected in lake sediments, 12 have CCME interim sediment guidelines (Table 10). Interim sediment quality guidelines were exceeded in Wabamun Lake sediments for naphthalene (one sample), pyrene (one sample), benzo(a)anthracene (two samples), chrysene (two samples) benzo(a)pyrene (three samples) and dibenzo(a,h)anthracene (four samples); levels in all samples were below the probable effects level specified by CCME. Sites where ISQG

Table 9 Summary of trace organic detections in sediments from Wabamun Lake and eight other lakes sampled in 2002

		Extractable Priority Pollutants (EPP)			Polycyclic Aromatic Hydrocarbons (PAH)									
		4-CHLORO-3-METHYL PHENOL	PHENOL	BENZI DINE	NAPH THA LENE	ACE NAPH THYL ENE	ACE NAPH THENE	FLUO RENE	PHEN ANTH RENE	ANTH RACENE	ACRI DINE	PYRENE	FLUOR ANTH ENE	RETENE (7-ISOPRO PYL-1-METHYL PHENAN THRENE)
Wabamun Lake														
# of samples		27	27	27	27	27	27	27	27	27	27	27	27	27
# of samples with detections		1	10	0	13	3	0	24	24	22	6	22	21	13
# of samples with conc. > DL		0	0	0	8	0	0	23	23	17	5	22	19	13
Mean (all detections)		**0.11**	**0.04**	ND	**19.88**	**0.44**	ND	**3.29**	**5.21**	**2.98**	**8.74**	**14.36**	**5.13**	**32.79**
Standard deviation		NA	0.03	ND	62.77	0.29	ND	2.53	4.58	2.56	8.25	15.60	3.76	55.36
Maximum		0.11 e	0.12	ND	228.70	0.76 e	ND	11.20	15.10	9.70	23.40	61.20	15.40	205.60
Other Lakes														
# of samples		24	24	24	24	24	24	24	24	24	24	24	24	24
# of samples with detections		0	9	1	4	0	1	22	21	0	0	22	21	21
# of samples with conc. > DL		0	0	0	1	0	0	10	18	0	0	18	17	16
Mean (all detections)		ND	0.23	ND	**0.73**	ND	ND	**1.37**	**1.86**	ND	ND	**2.33**	**2.18**	**3.03**
Standard deviation		ND	0.15	NA	0.38	ND	NA	1.43	0.95	ND	ND	1.73	1.12	3.06
Maximum		ND	0.50 e	0.02 t	1.10	ND	0.73 e	5.06	4.30	ND	ND	8.02	4.14	13.80
Amisk	Mean	ND	0.14	ND	0.70	ND	ND	1.37	1.48	ND	ND	2.40	2.77	5.30
	Maximum	ND	0.24 e	ND	1.00	ND	ND	1.60	1.71	ND	ND	3.30	4.00	6.50
Bonnie	Mean	ND	0.26	ND	ND	ND	ND	4.66	2.05	ND	ND	3.95	2.64	2.05
	Maximum	ND	0.32 e	ND	ND	ND	ND	5.06	2.30	ND	ND	8.02	2.74	2.70
Gull	Mean	ND	0.02	ND	ND	ND	ND	0.83	1.90	ND	ND	0.87	0.89	1.00
	Maximum	ND	0.02 e	ND	ND	ND	ND	1.10	2.40	ND	ND	1.20	1.20	1.20
Isle	Mean	ND	0.35	ND	1.10	ND	ND	1.10	2.11	ND	ND	2.60	2.30	2.10
	Maximum	ND	0.50 e	ND	1.10	ND	ND	1.10	2.11	ND	ND	2.60	2.30	2.10
Lac Ste Anne	Mean	ND	ND	0.02	ND	ND	ND	0.91	2.97	ND	ND	2.42	2.91	2.07
	Maximum	ND	ND	0.02 t	ND	ND	ND	1.36	4.30	ND	ND	3.22	4.14	3.10
Pigeon	Mean	ND	ND	ND	ND	ND	ND	0.42	2.33	ND	ND	1.59	1.84	2.93
	Maximum	ND	ND	ND	ND	ND	ND	0.56 e	2.80	ND	ND	1.72	2.04	5.80
Sylvan	Mean	ND	0.41	ND	ND	ND	ND	0.47	1.24	ND	ND	1.04	1.10	0.50
	Maximum	ND	0.41 e	ND	ND	ND	ND	0.69 e	2.00	ND	ND	2.10	2.20	0.77 e
Wizard	Mean	ND	ND	ND	0.40	ND	0.73	1.03	1.01	ND	ND	3.97	3.23	7.33
	Maximum	ND	ND	ND	0.40 e	ND	0.73 e	1.10	1.11	ND	ND	4.30	3.40	13.80

Notes: EPP Detection limit is 1µg/g, except for benzidene which is 4 µg/g. Concentrations in µg/g dry weight
PAH Detection limit is 1 ng/g. Concentrations in ng/g dry weight
Concentration <DL, but >0.1 x DL are reported as "estimated" (e)
Concentrations <0.01 x DL are reported as 'traces' (t)
ND: not detected NA: not applicable

Table 9 Summary of trace organic detections in sediments from Wabamun Lake and eight other lakes sampled in 2002 (continued)

		Polycyclic Aromatic Hydrocarbons (PAH)											
		BENZO (C)PHEN ANTH RENE	**BENZO (A)AN THRA CENE**	**CHRY SENE**	**BENZO (B,J,K) FLUOR ANTH ENE**	**7,12-DI METHYL BENZ(A) ANTHRA CENE**	**BENZO (E) PYRENE**	**BENZO (A) PYRENE**	**3-METHYL CHOL ANTH RENE**	**INDENO (1,2,3-C,D) PYRENE**	**DIBENZO (A,H)AN THRA CENE**	**BENZO (G,H,I) PERY LENE**	**DIBENZO (A,L)PY RENE**
Wabamun Lake													
# of samples		27	27	27	27	27	27	27	27	27	27	27	27
# of samples with detections		7	23	23	24	4	27	27	2	27	27	24	4
# of samples with conc. > DL		6	19	22	22	4	24	23	1	24	20	23	4
Mean (all detections)		**2.78**	**10.55**	**20.62**	**15.33**	**10.18**	**27.54**	**23.51**	**6.31**	**24.33**	**3.76**	**5.62**	**3.58**
Standard deviation		3.30	19.39	26.72	14.10	9.71	52.67	40.78	8.61	44.72	5.69	6.43	1.60
Maximum		10.00	88.80	124.00	62.10	24.70	257.00	196.00	12.40	225.00	28.40	31.20	4.60
Other Lakes													
# of samples		24	24	24	24	24	24	24	24	24	24	24	24
# of samples with detections		3	10	10	12	2	2	1	0	13	2	11	8
# of samples with conc. > DL		0	3	5	7	2	0	1	0	5	0	2	4
Mean (all detections)		**0.41**	**1.43**	**2.49**	**2.26**	**122.00**	**0.39**	3.10	ND	**0.73**	**0.23**	**0.61**	**1.17**
Standard deviation		0.21	3.10	3.23	2.19	25.46	0.05	NA	ND	0.49	0.04	0.44	0.42
Maximum		0.60 e	9.70	8.20	8.00	140.00	0.42 e	3.10	ND	1.70	0.26 e	1.50	2.00
Amisk	Mean	ND	0.92	2.30	2.37	ND	ND	ND	ND	ND	ND	ND	ND
	Maximum	ND	1.30	3.20	3.60	ND	ND	ND	ND	ND	ND	ND	ND
Bonnie	Mean	ND	ND	ND	ND	104.00	ND	ND	ND	0.49	ND	0.47	1.75
	Maximum	ND	ND	ND	ND	104.00	ND	ND	ND	0.52 e	ND	0.49	2.00
Gull	Mean	ND	0.21	0.65	0.85	ND	0.39	3.10	ND	0.28	ND	0.26	ND
	Maximum	ND	0.25 e	0.81 e	0.95 e	ND	0.42 e	3.10	ND	0.35 e	ND	0.32 e	ND
Isle	Mean	ND	ND	ND	2.80	ND	ND	ND	ND	ND	ND	ND	ND
	Maximum	ND	ND	ND	2.80	ND	ND	ND	ND	ND	ND	ND	ND
Lac Ste Anne	Mean	ND	ND	ND	ND	140.00	ND	ND	ND	1.16	ND	0.90	0.97
	Maximum	ND	ND	ND	ND	140.00	ND	ND	ND	1.16	ND	1.13	1.30
Pigeon	Mean	0.53	ND	ND	ND	ND	ND	ND	ND	0.86	ND	0.66	0.98
	Maximum	0.60 e	ND	ND	ND	ND	ND	ND	ND	1.26	ND	0.66	1.10
Sylvan	Mean	0.19	0.30	0.73	1.33	ND	ND	ND	ND	0.58	0.20	0.50	ND
	Maximum	0.19 e	0.66 e	1.40	2.80	ND	ND	ND	ND	1.10	0.20 e	0.95 e	ND
Wizard	Mean	ND	5.45	8.10	5.35	ND	ND	ND	ND	1.40	0.26	1.50	ND
	Maximum	ND	9.70	8.20	8.00	ND	ND	ND	ND	1.70	0.26 e	1.50	ND

Notes: EPP Detection limit is 1 µg/g, except for benzidene which is 4 µg/g. Concentrations in µg/g dry weight
PAH Detection limit is 1 ng/g. Concentrations in ng/g dry weight
Concentration <DL, but >0.1 x DL are reported as "estimated" (e)
Concentrations <0.01 x DL are reported as 'traces' (t)
ND: not detected NA: not applicable

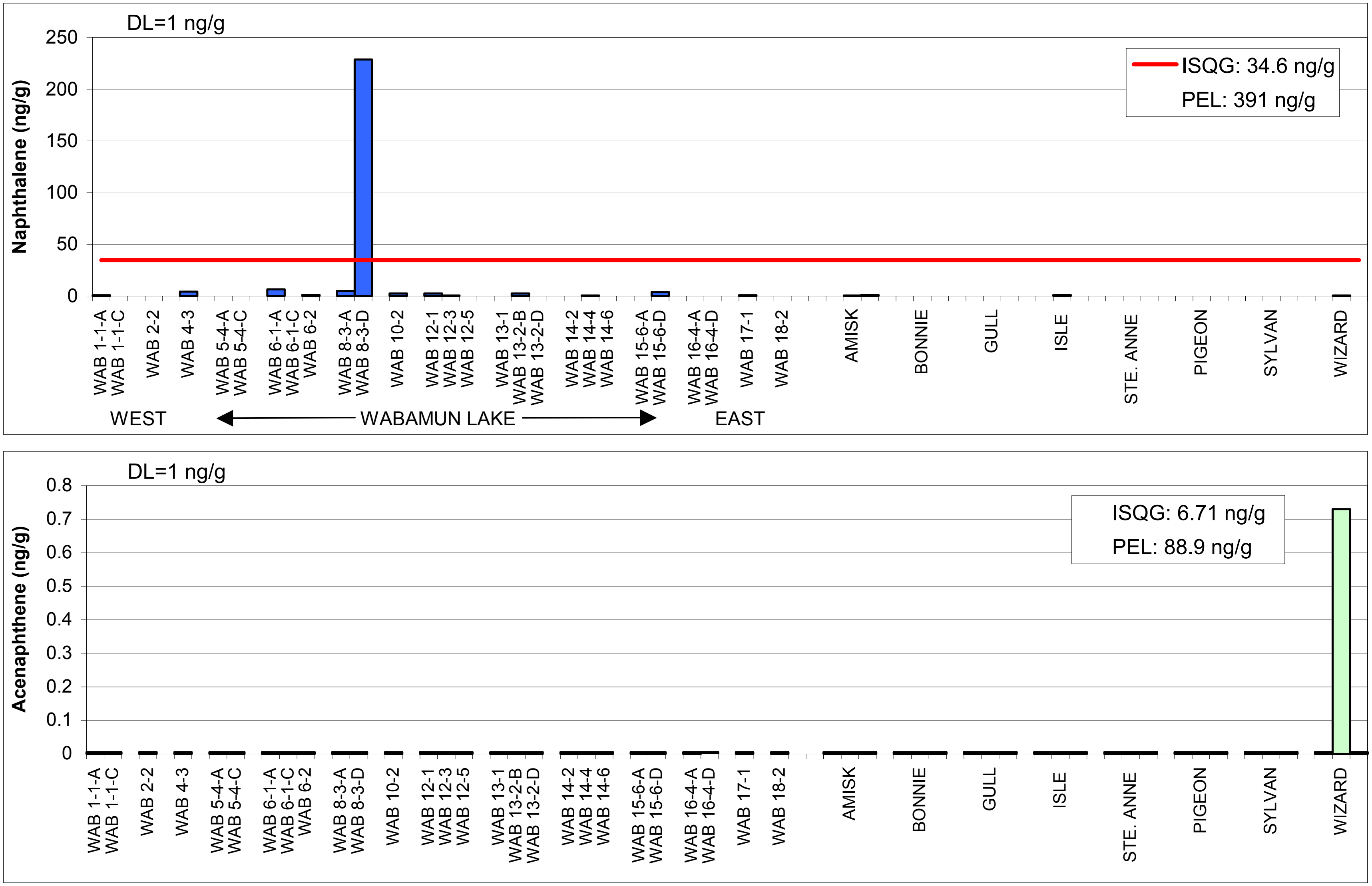
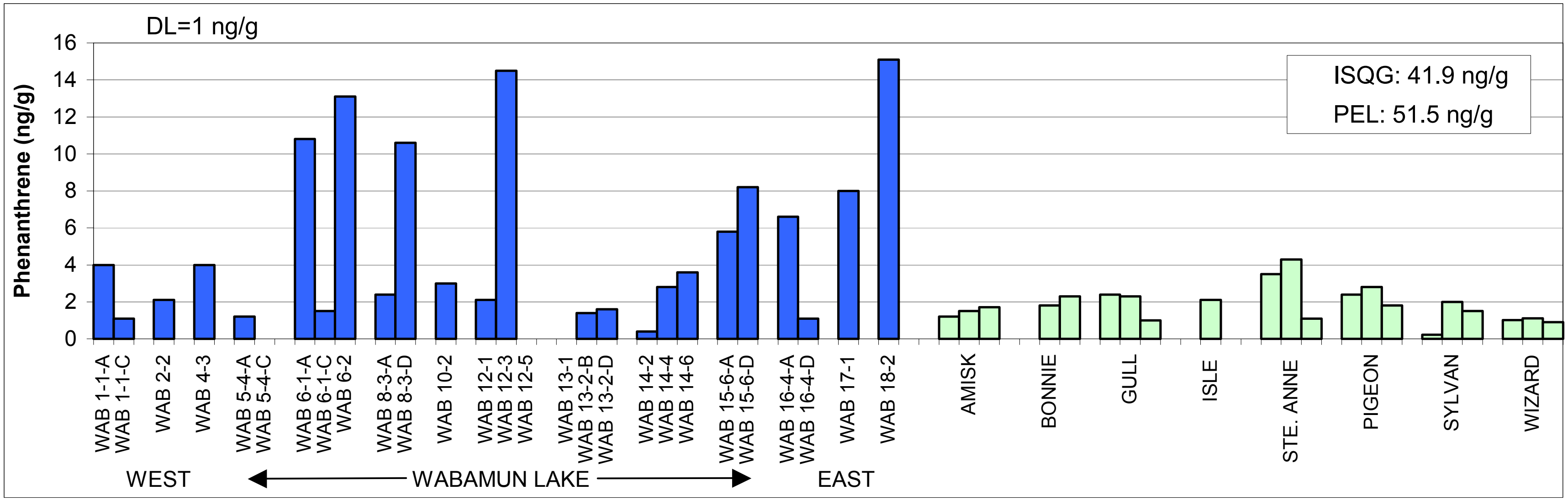


Figure 15 Comparison of PAH detected in Wabamun Lake sediments with those from other lakes sampled in 2002



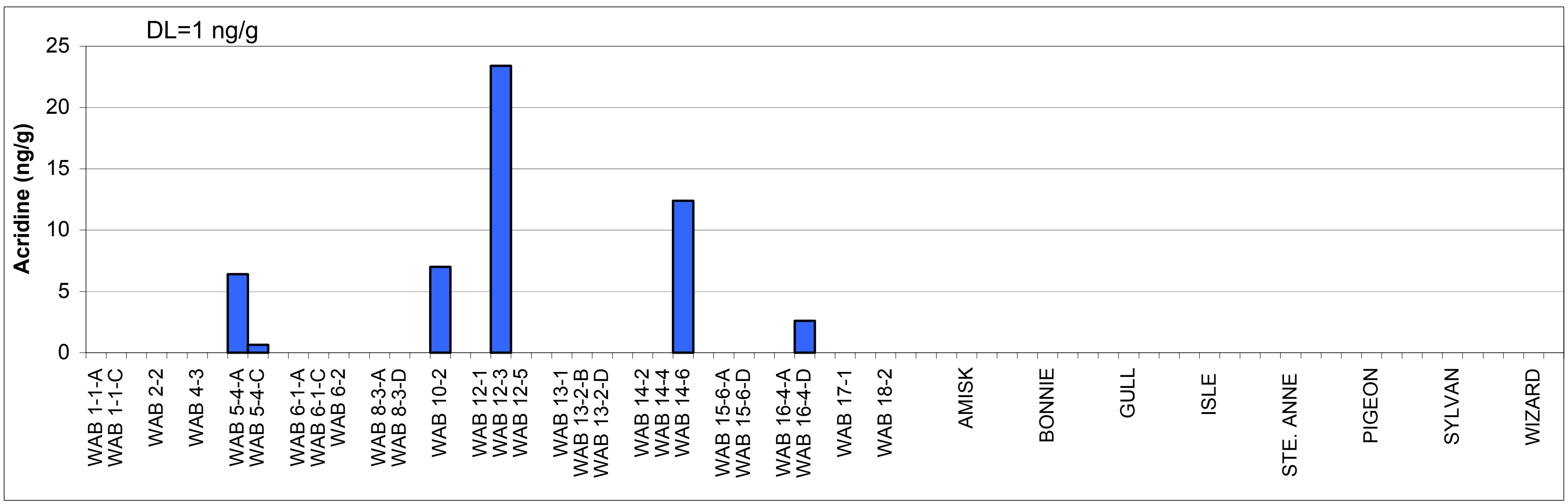


Figure 15 Comparison of PAH detected in Wabamun Lake sediments with those from other lakes sampled in 2002 (continued)

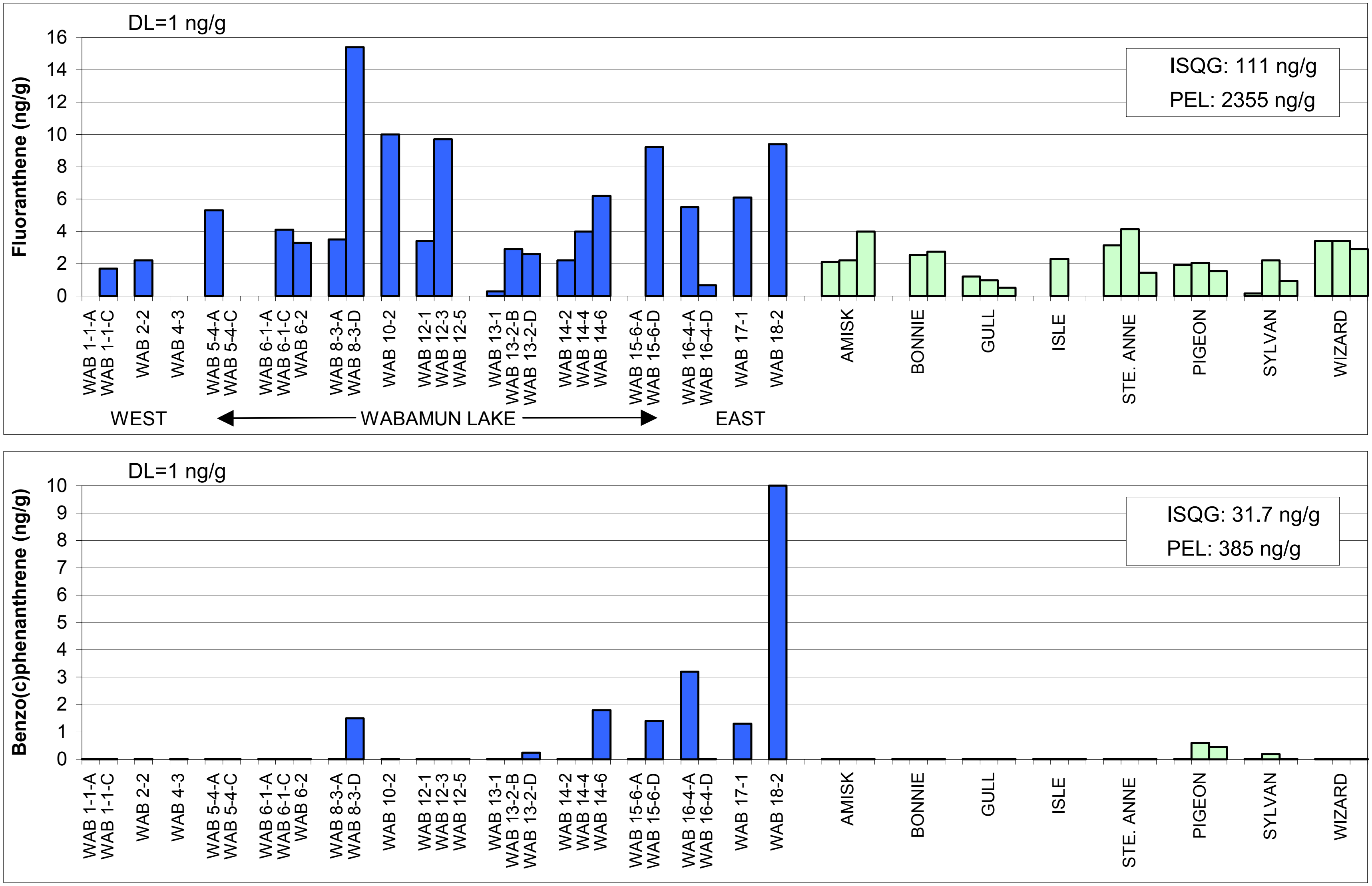
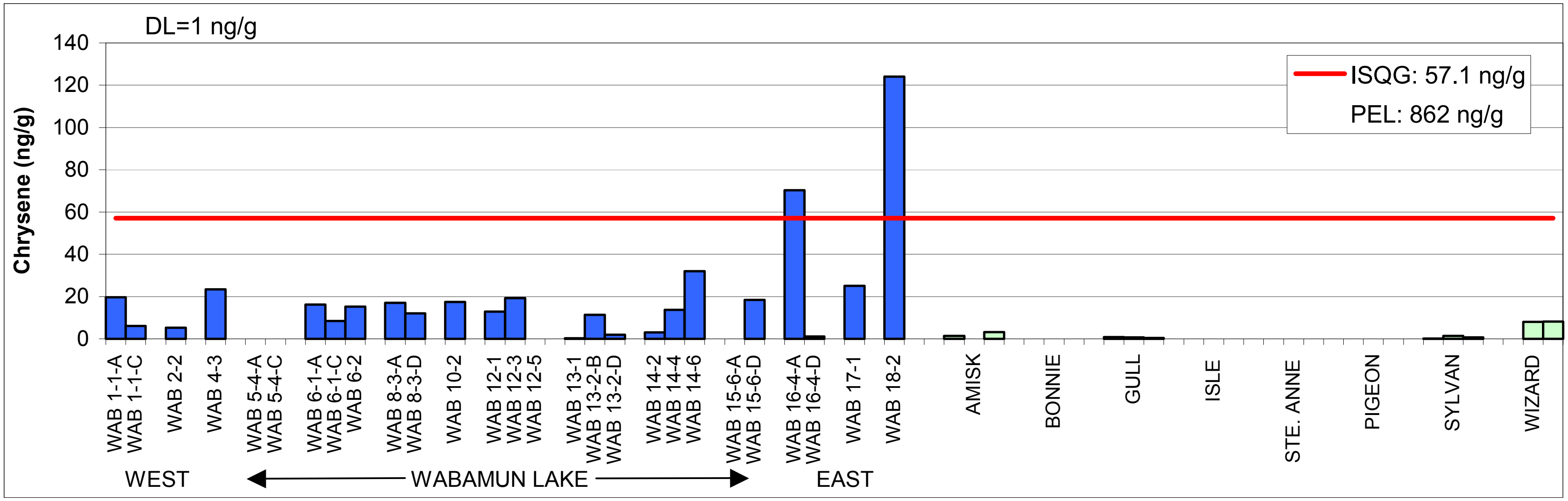


Figure 15 Comparison of PAH detected in Wabamun Lake sediments with those from other lakes sampled in 2002 (continued)



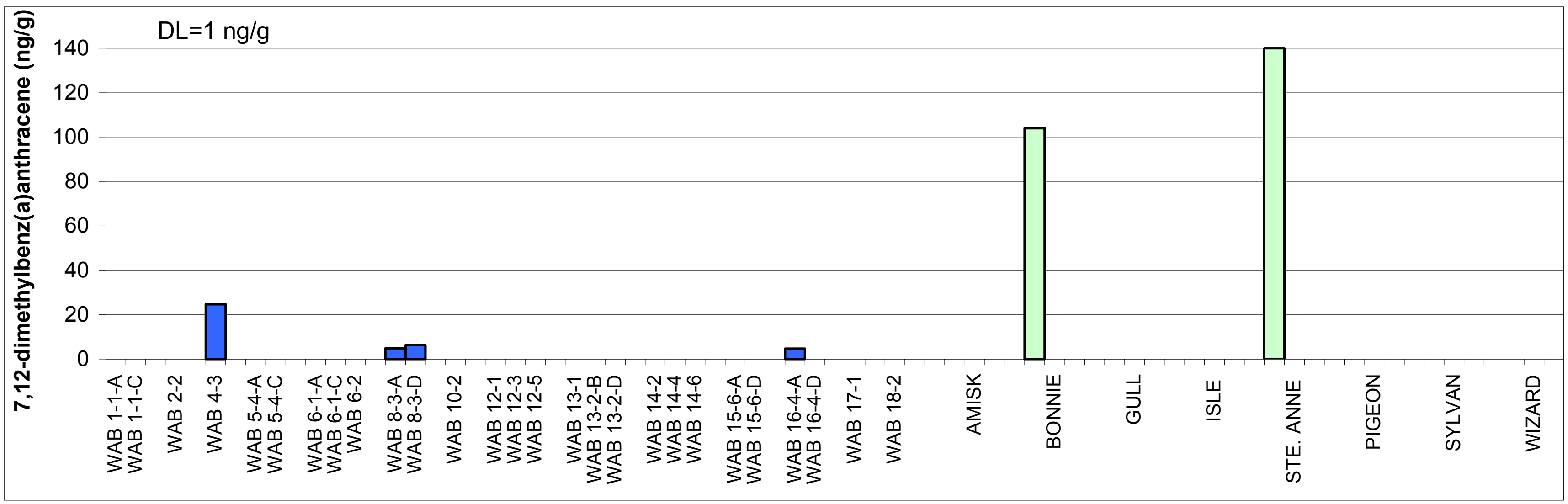
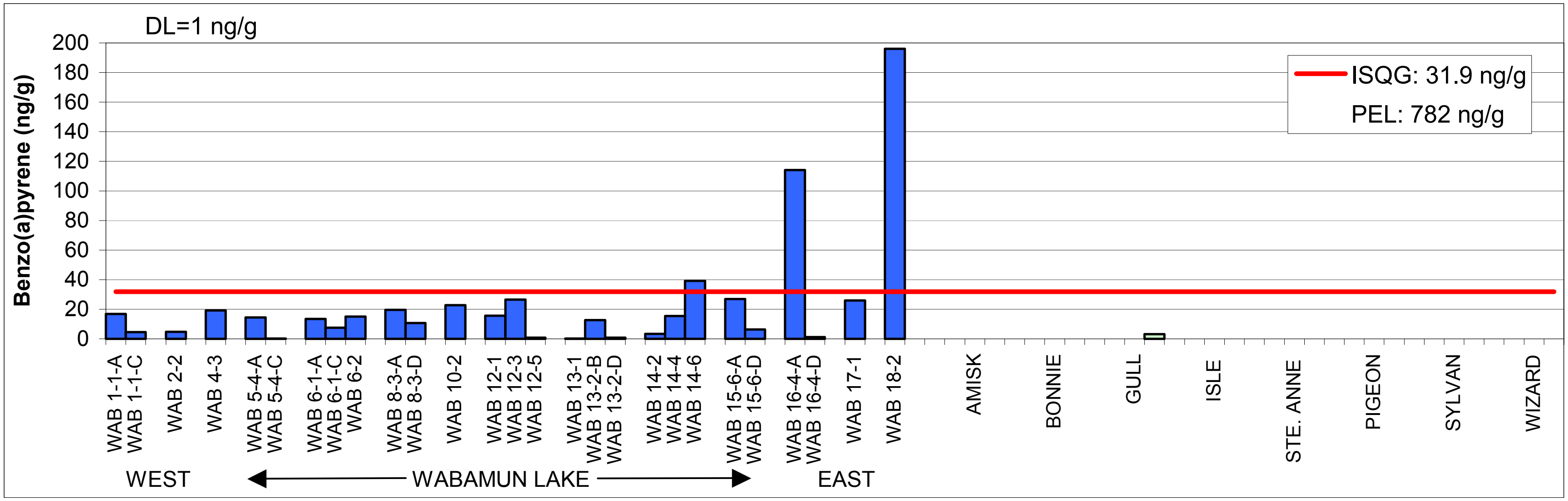


Figure 15 Comparison of PAH detected in Wabamun Lake sediments with those from other lakes sampled in 2002 (continued)



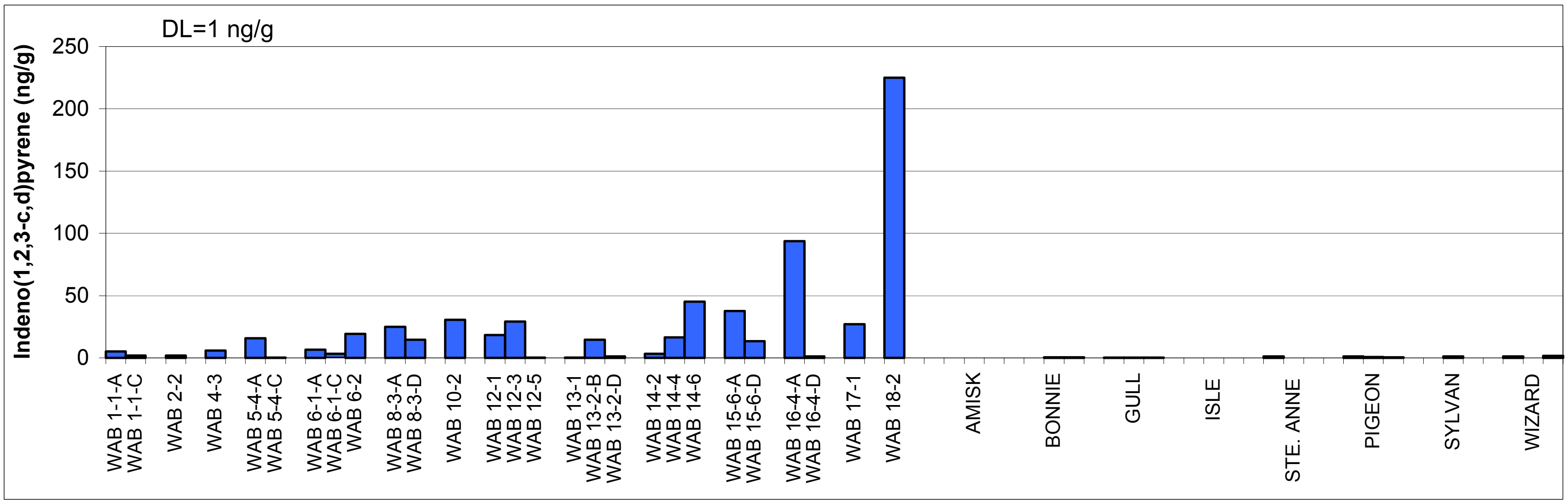
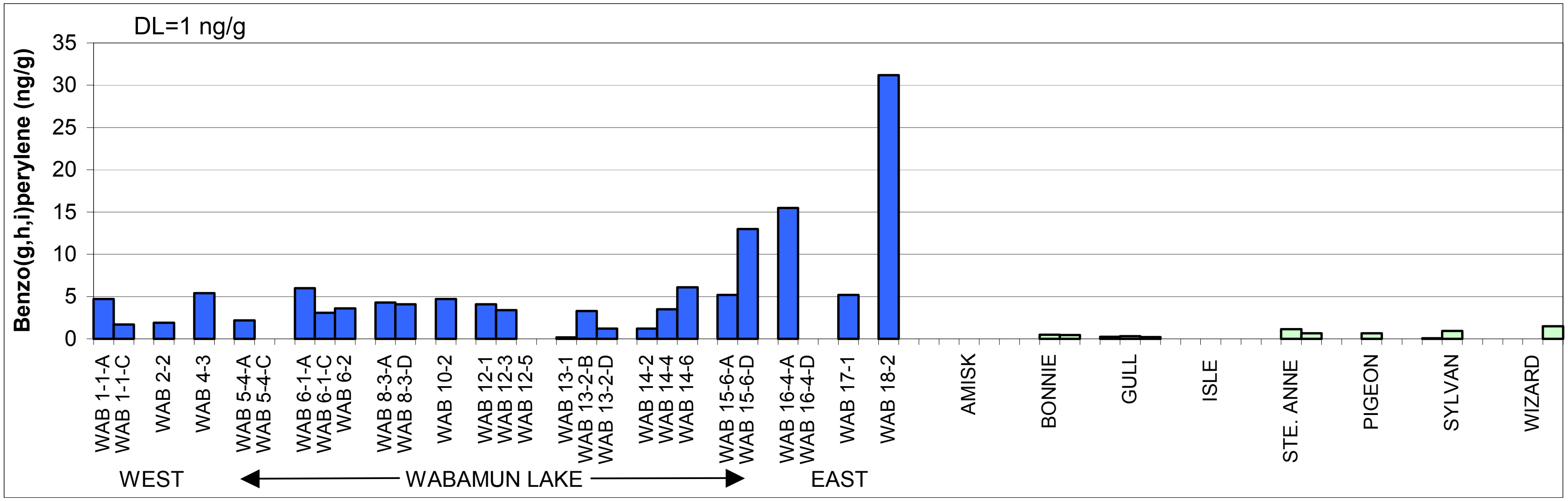


Figure 15 Comparison of PAH detected in Wabamun Lake sediments with those from other lakes sampled in 2002 (continued)



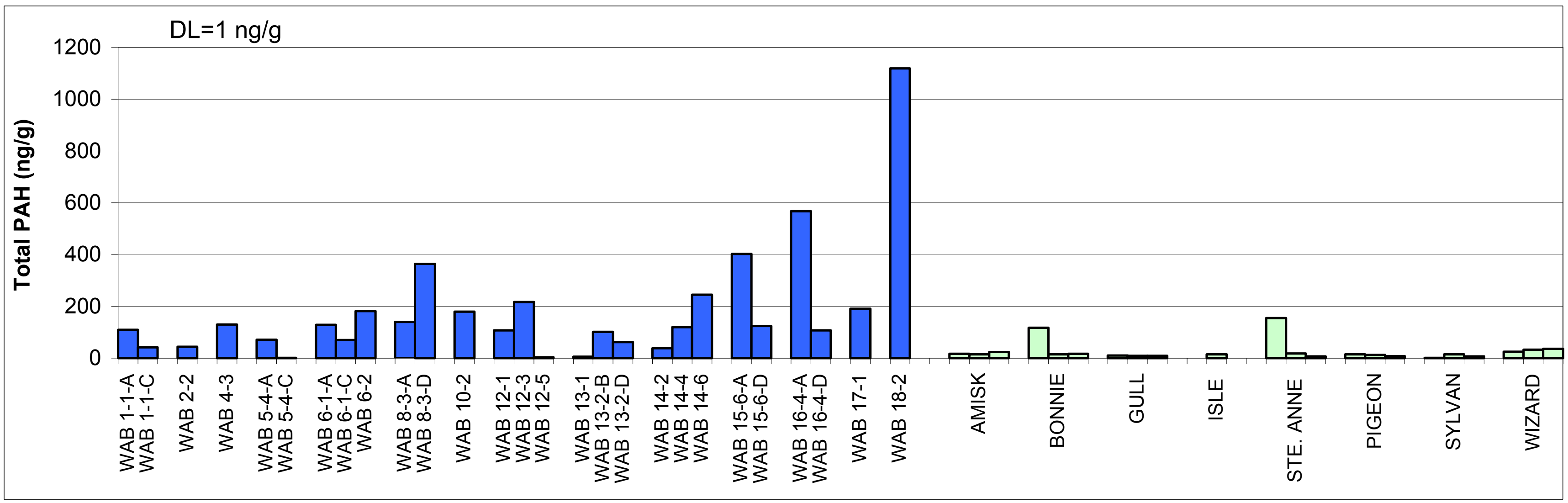
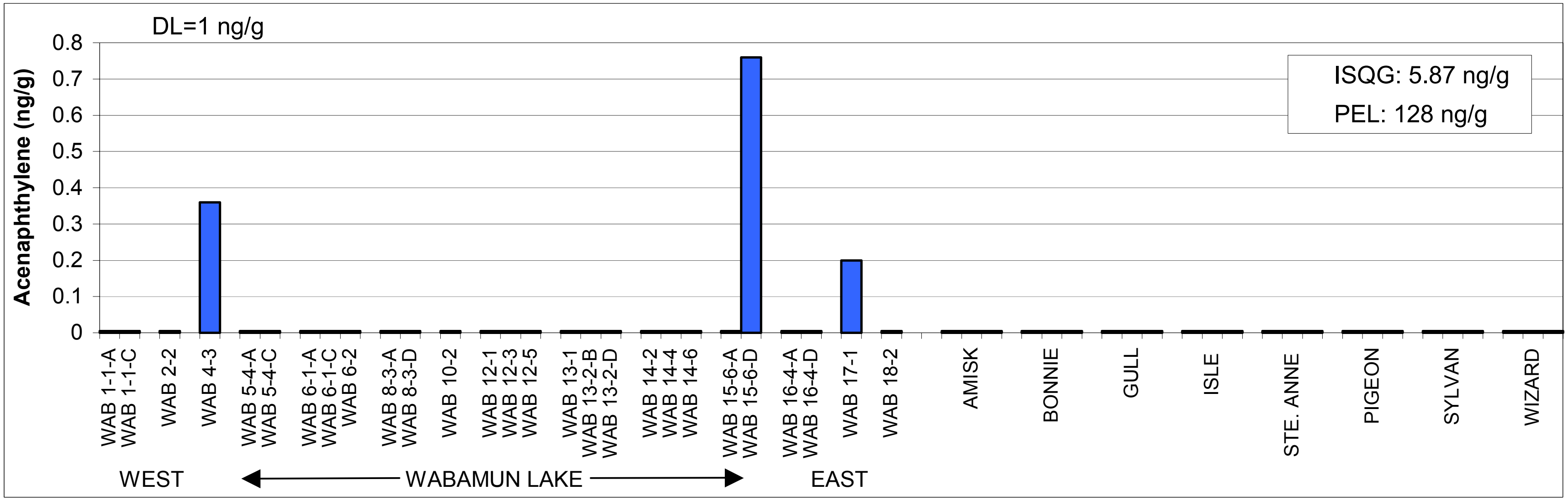


Figure 15 Comparison of PAH detected in Wabamun Lake sediments with those from other lakes sampled in 2002 (continued)



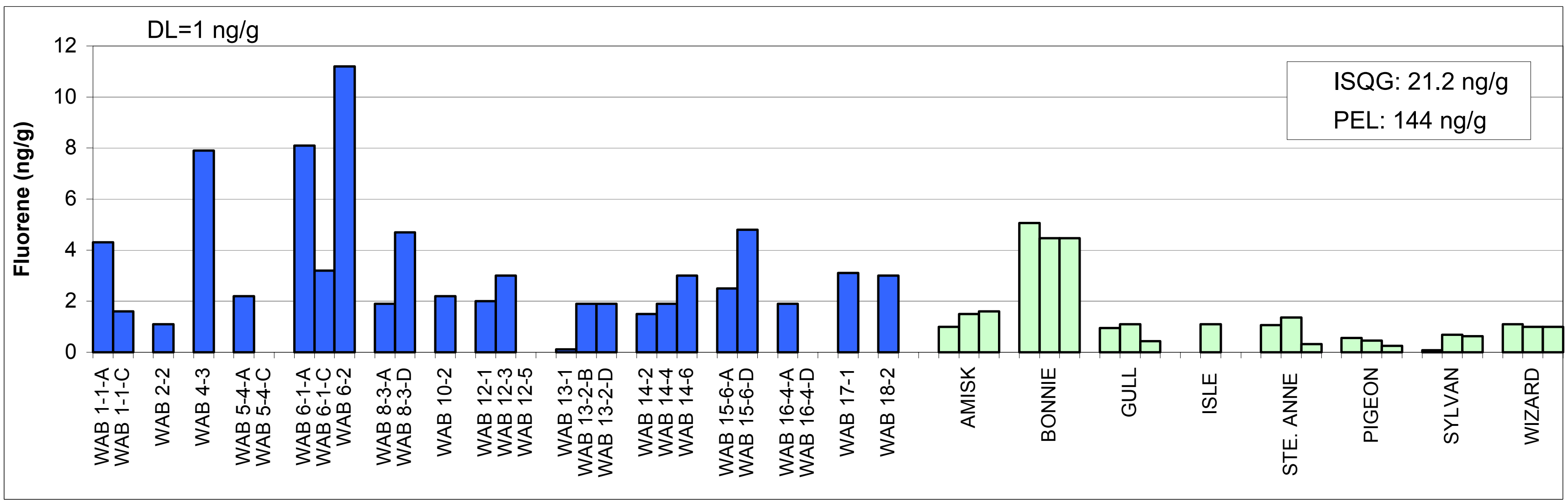


Figure 15 Comparison of PAH detected in Wabamun Lake sediments with those from other lakes sampled in 2002 (continued)

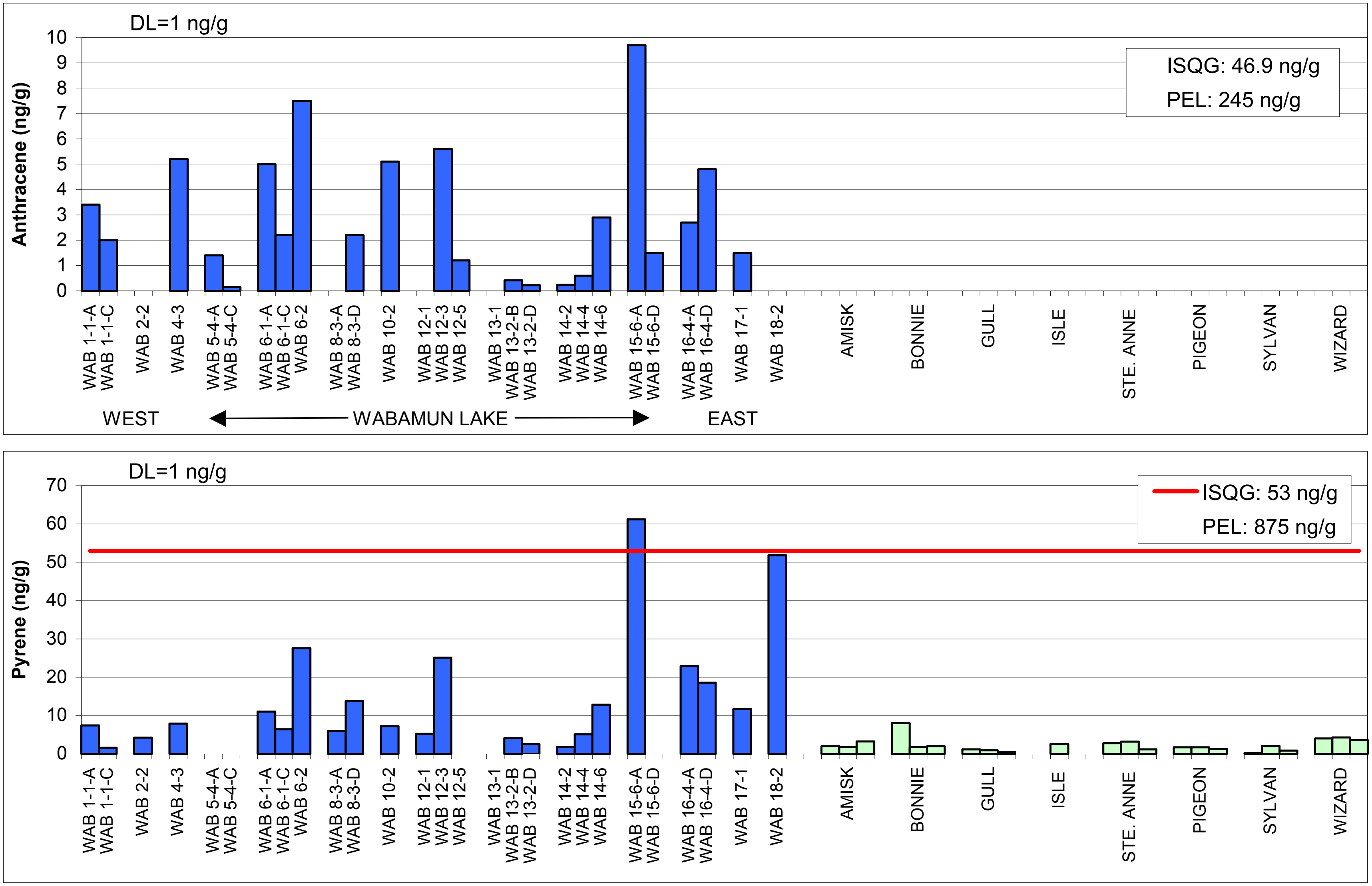


Figure 15 Comparison of PAH detected in Wabamun Lake sediments with those from other lakes sampled in 2002 (continued)

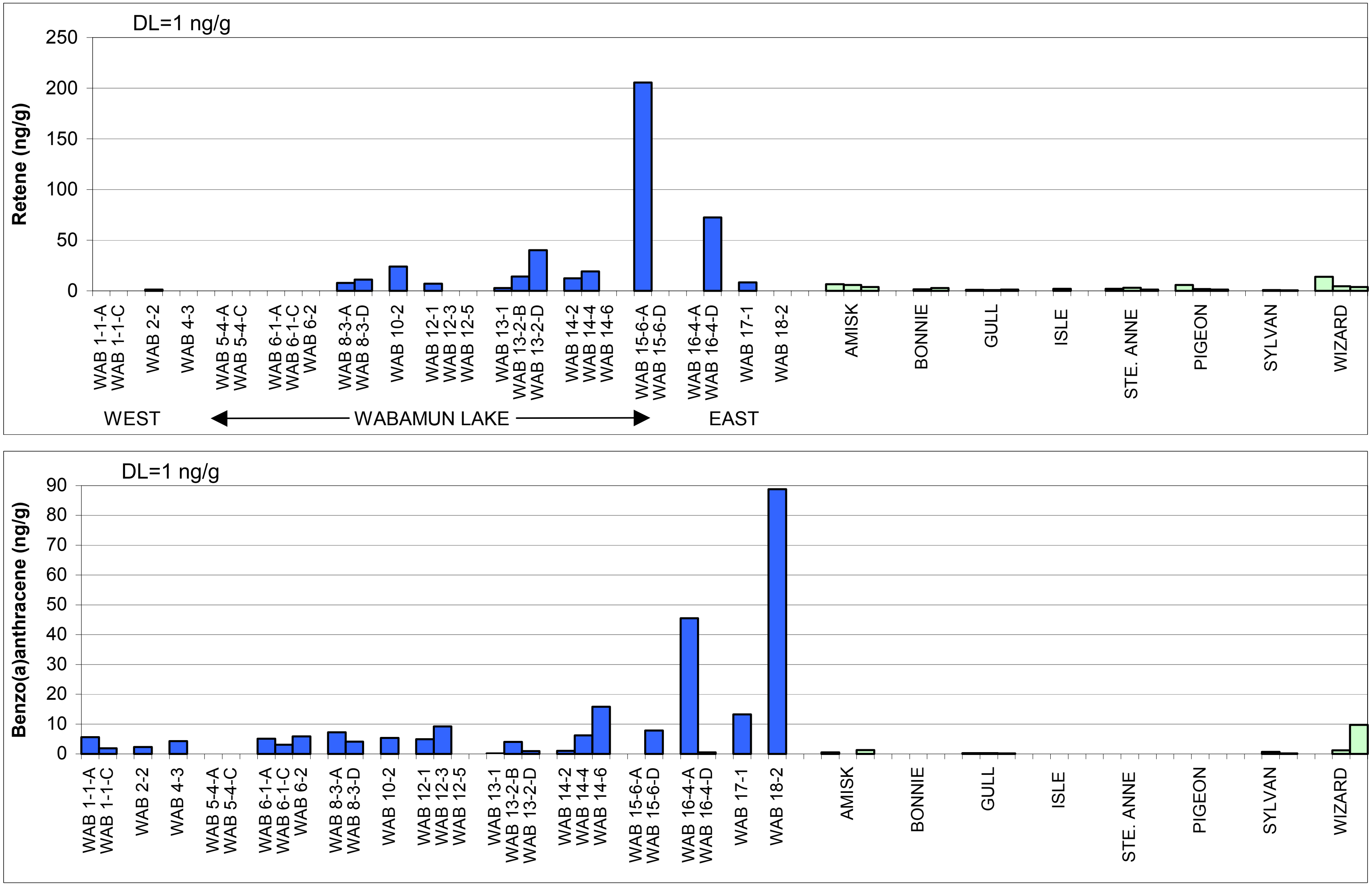
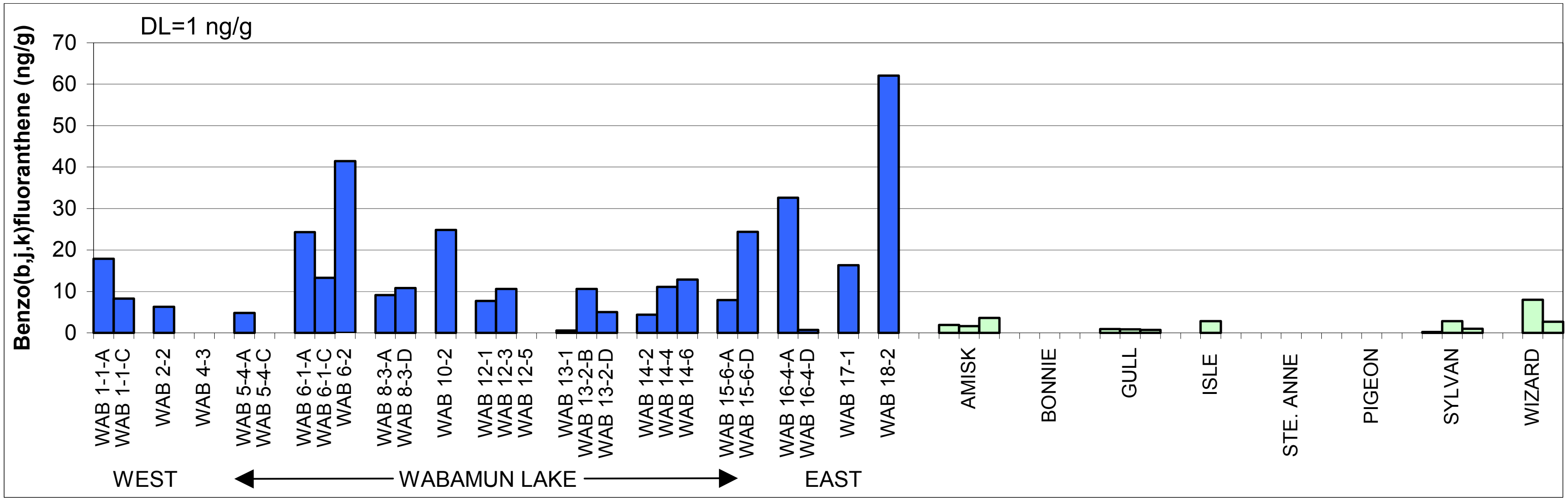


Figure 15 Comparison of PAH detected in Wabamun Lake sediments with those from other lakes sampled in 2002 (continued)



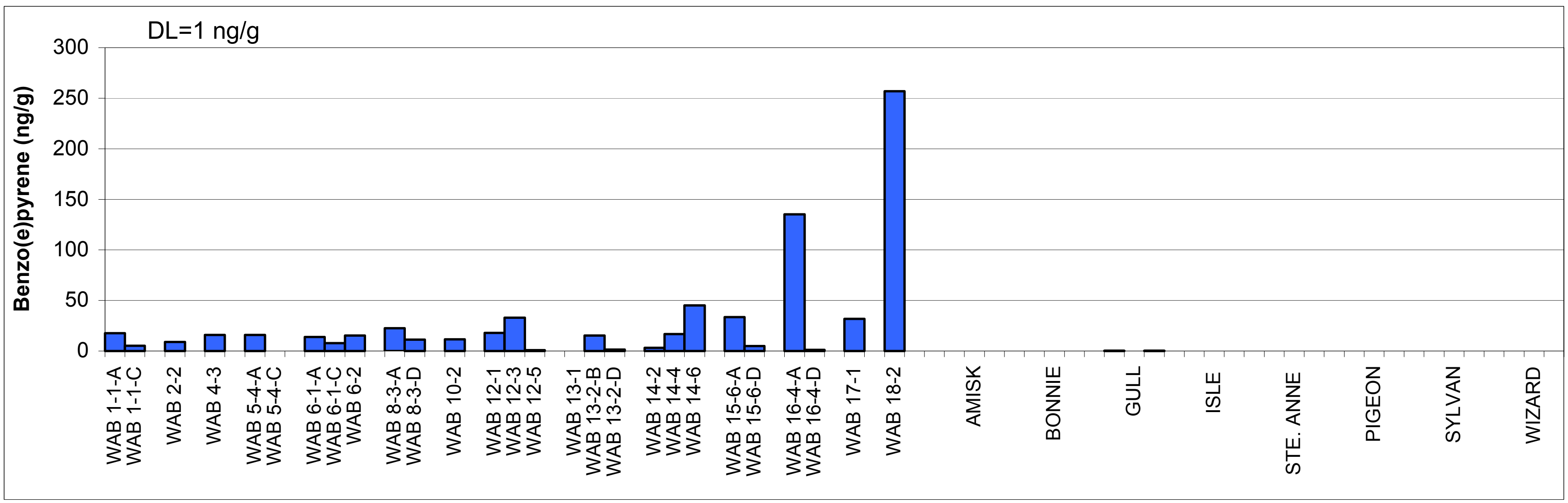
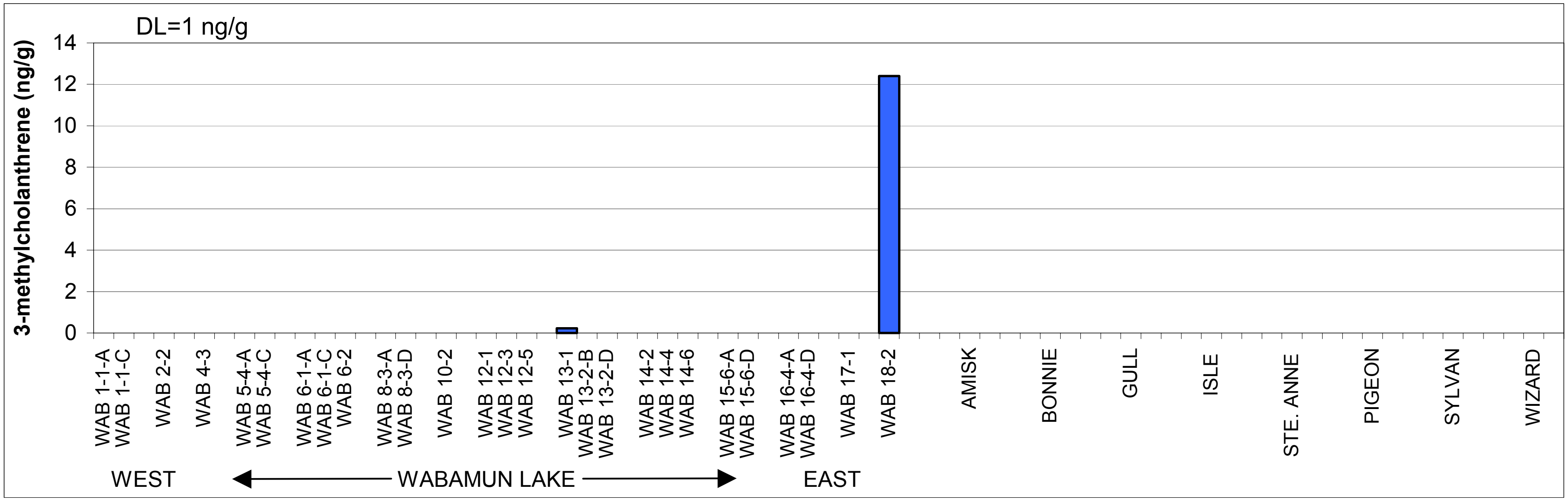


Figure 15 Comparison of PAH detected in Wabamun Lake sediments with those from other lakes sampled in 2002 (continued)



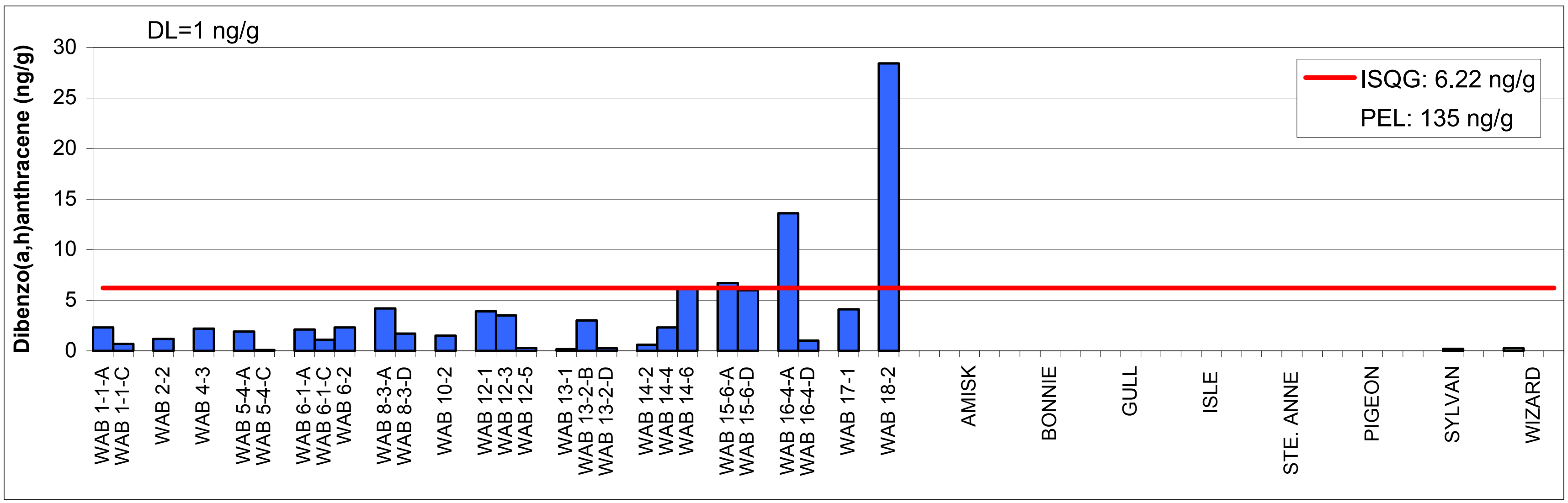


Figure 15 Comparison of PAH detected in Wabamun Lake sediments with those from other lakes sampled in 2002 (continued)

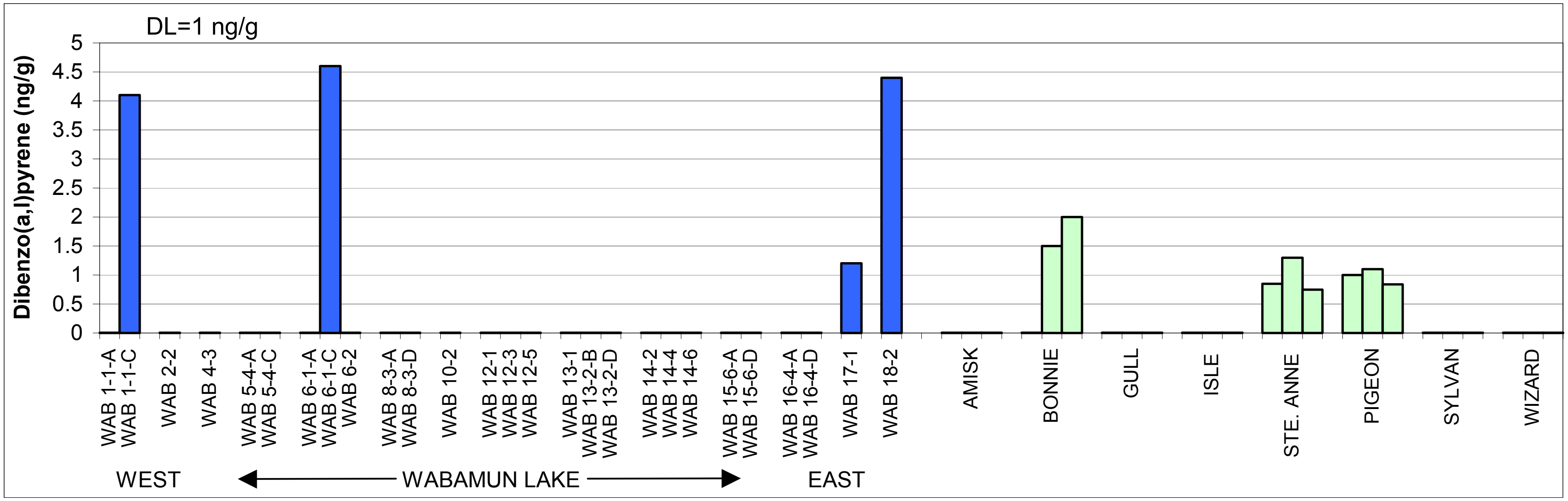


Figure 15 Comparison of PAH detected in Wabamun Lake sediments with those from other lakes sampled in 2002 (continued)

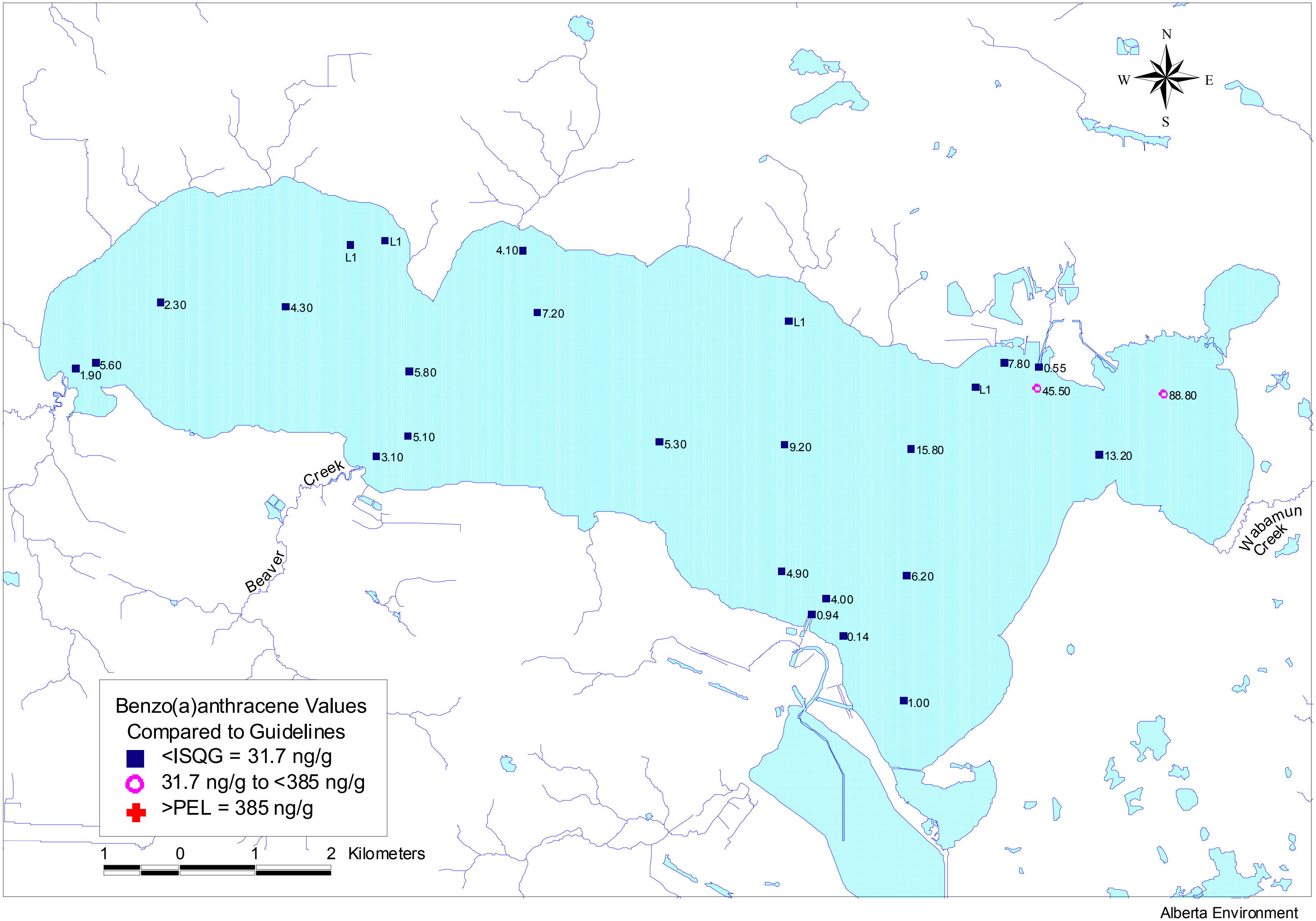


Figure 16 Concentration of benzo(a) anthracene in Wabamun Lake sediment samples, summer 2002

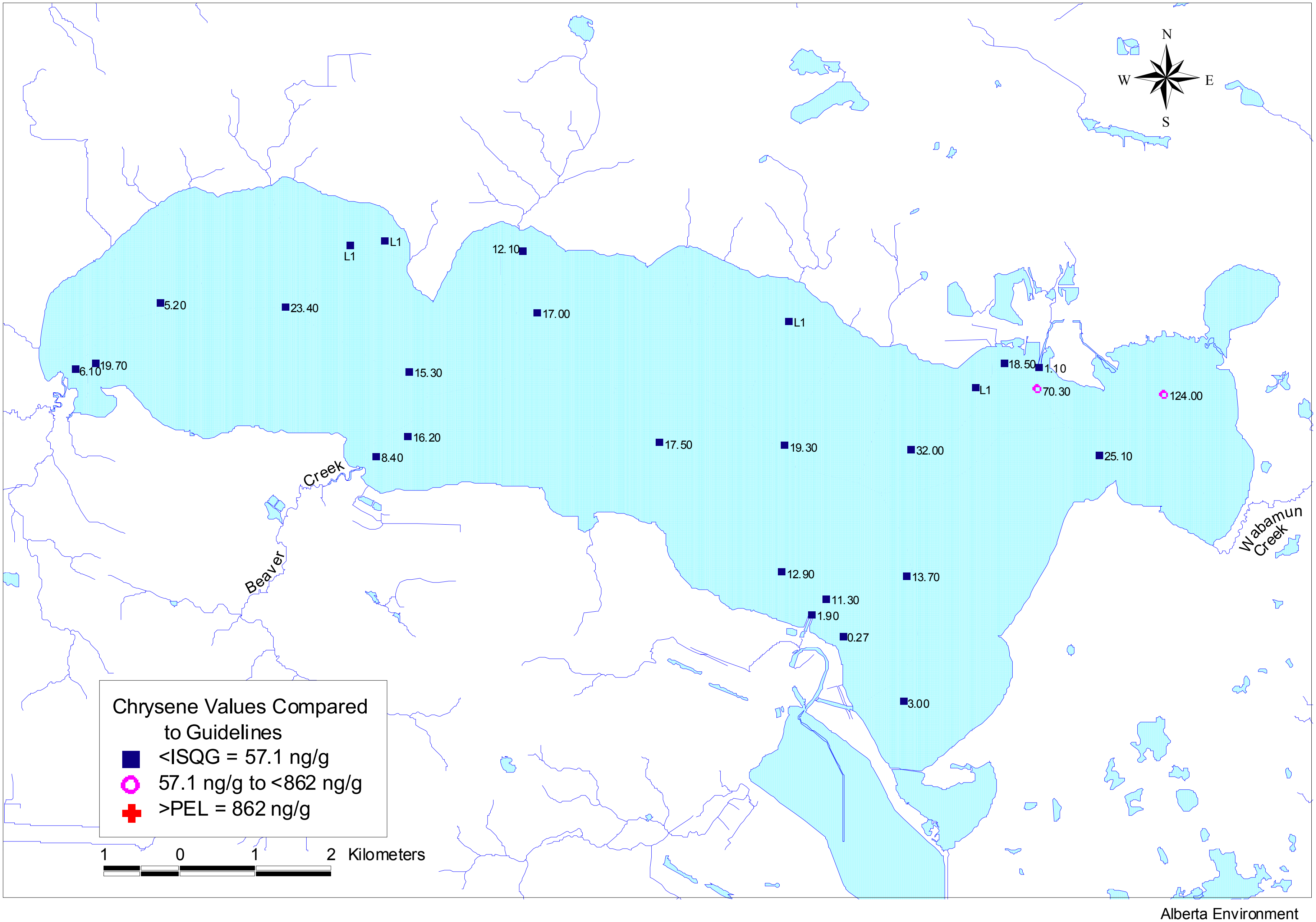


Figure 17 Concentration of chrysene in Wabamun Lake sediment samples, summer 2002

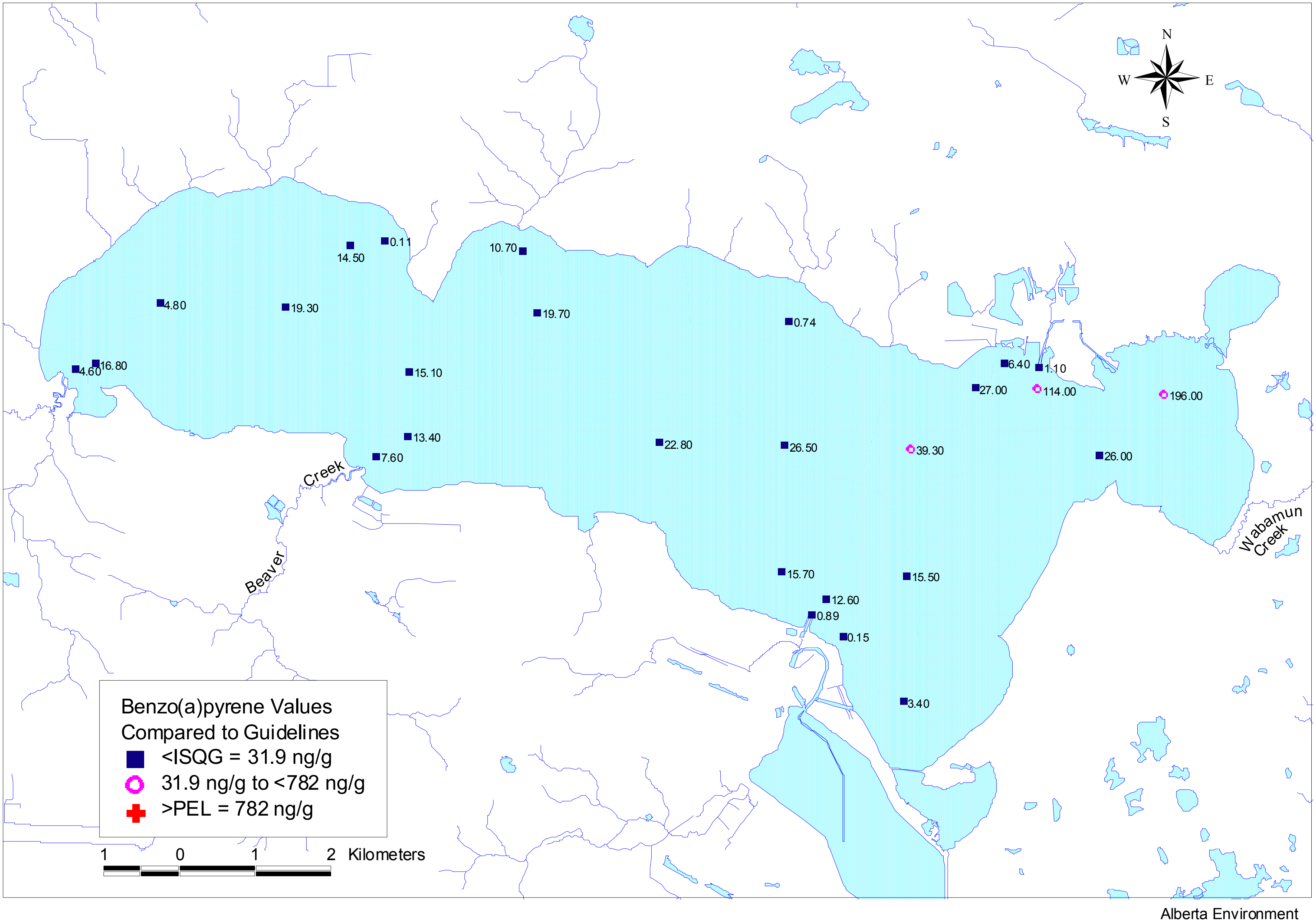


Figure 18 Concentration of benzo(a)pyrene in Wabamun Lake sediment samples, summer 2002

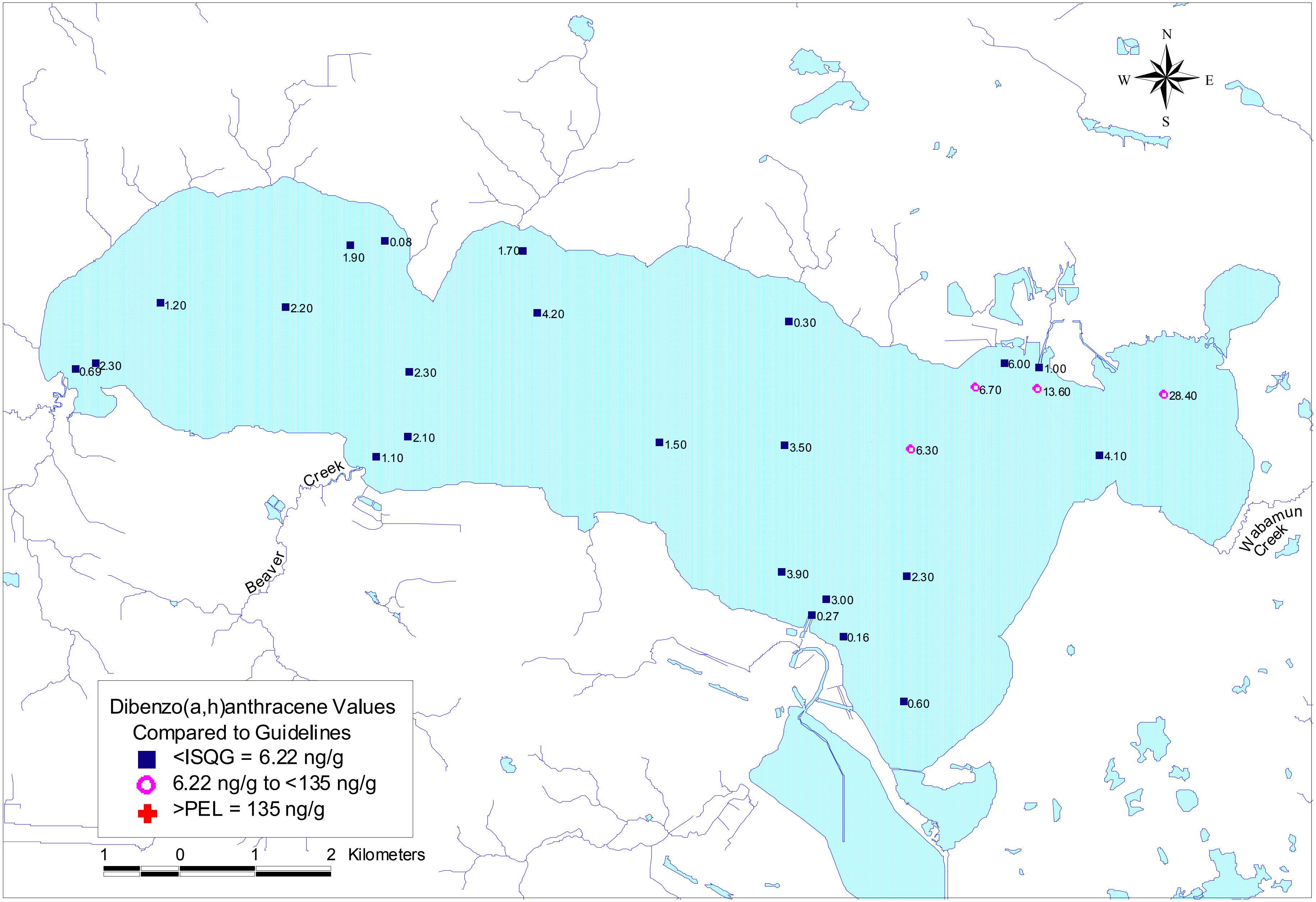


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Figure 19 Concentration of dibenzo(a,h)anthracene in Wabamun Lake sediment samples, summer 2002

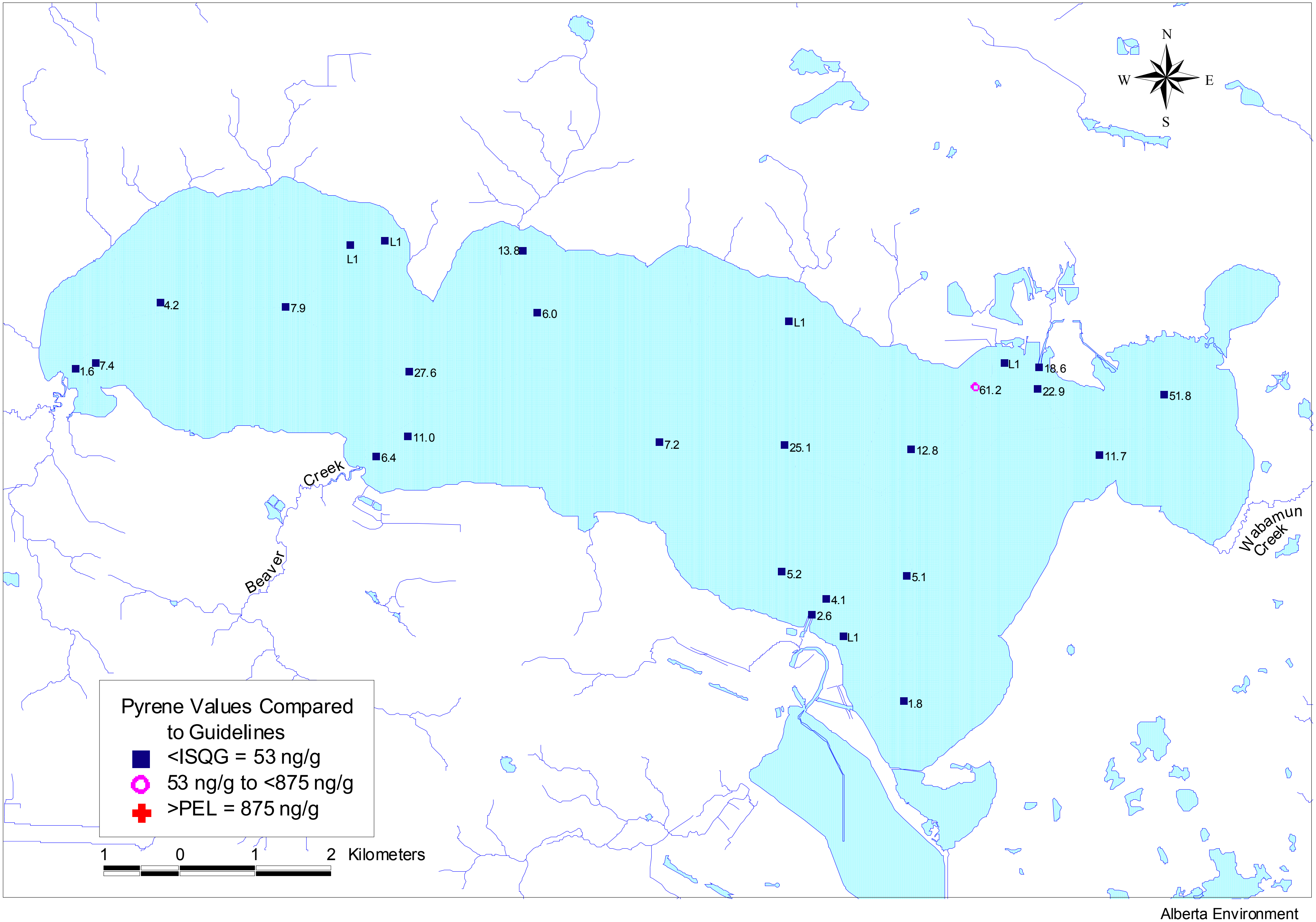

Figure 20 Concentration of pyrene in Wabamun Lake sediment samples, summer 2002

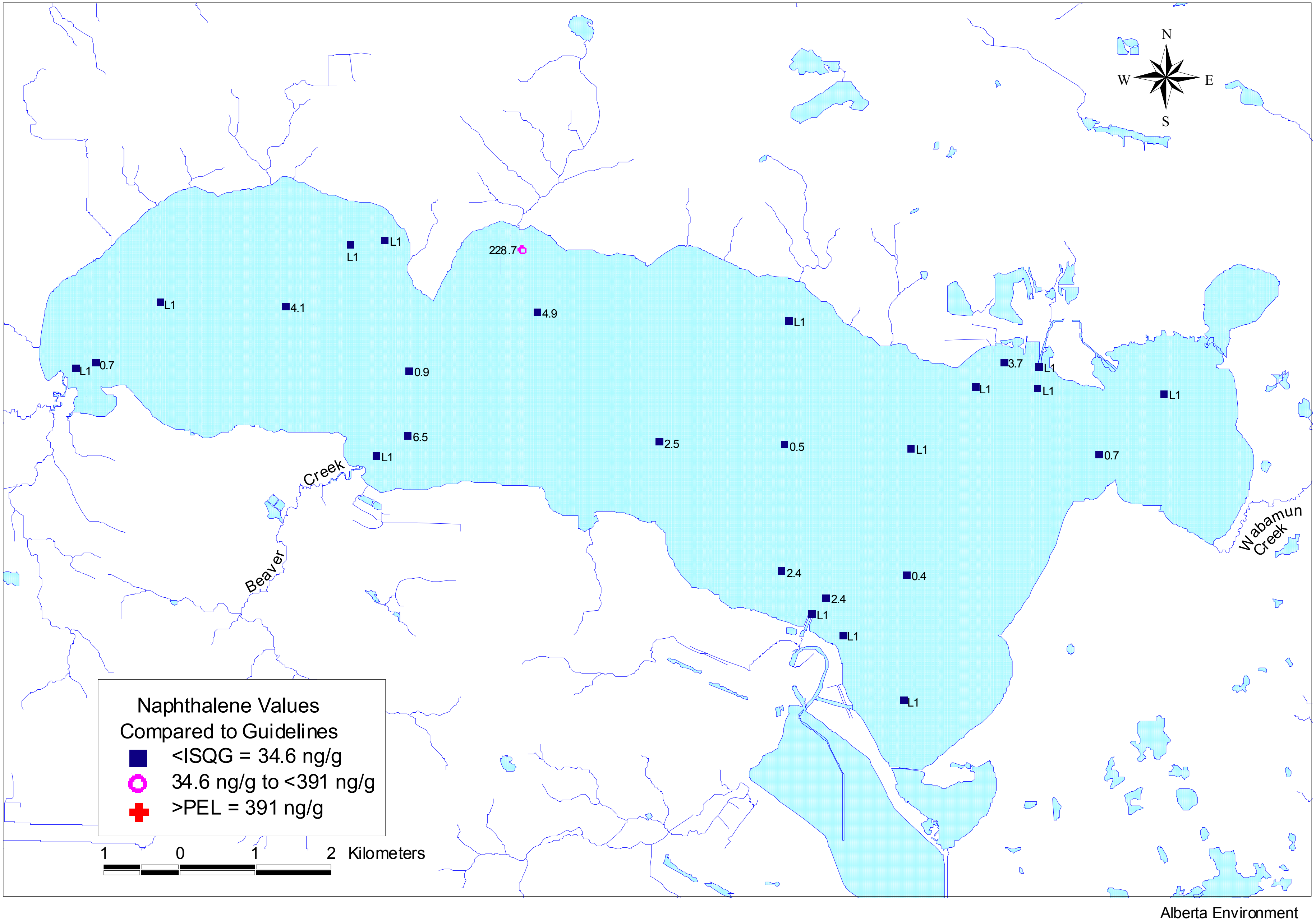

Figure 21 Concentration of naphthalene in Wabamun Lake sediment samples, summer 2002

Table 10 Comparison of trace organics detected in lake sediments with CCME sediment quality guidelines

	Naphth alene	Ace naphth ylene	Ace naph thene	Fluor ene	Phen anth rene	Anthra cene	Py rene	Fluor anth ene	Benzo(a) anthra cene	Chry sene	Benzo (a) pyrene	Dibenzo (a,h)anth racene
Units (dry weight):	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g
Guideline (CCME ISQG) :	**34.6**	**5.87**	**6.71**	**21.2**	**41.9**	**46.9**	**53**	**111**	**31.7**	**57.1**	**31.9**	**6.22**
CCME PEL:	**391**	**128**	**88.9**	**144**	**515**	**245**	**875**	**2355**	**385**	**862**	**782**	**135**
Wabamun Lake												
# of samples	27	27	27	27	27	27	27	27	27	27	27	27
mean of all detections	19.88	0.44	nd	3.29	5.21	2.98	14.36	5.13	32.79	20.62	23.51	3.76
# of detect. > ISQG guideline	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**2**	**2**	**3**	**4**
# of detect. > PEL guideline	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
% detect. (above DL) > ISQG guideline	12.50	0.00	0.00	0.00	0.00	0.00	4.55	0.00	10.53	9.09	13.04	20.00
% detect. (above DL) > PEL guideline	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Lakes Sampled in 2002												
# of samples	24	24	24	24	24	24	24	24	24	24	24	24
mean of all detections	0.73	nd	0.73	1.37	1.86	nd	2.33	2.18	1.43	2.49	3.10	0.23
# of detect. > ISQG guideline	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
# of detect. > PEL guideline	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
% detect. (above DL) > ISQG guideline	0.00	0.00	0.00	0.00	0.00	ND	0.00	0.00	0.00	0.00	0.00	ND
% detect. (above DL) > PEL guideline	0.00	0.00	0.00	0.00	0.00	ND	0.00	0.00	0.00	0.00	0.00	ND

were exceeded are shown in Figures 16 to 21. Naphthalene and pyrene guidelines were exceeded at site 8-3-D and 15-6-A, respectively. Most of the sites with concentrations above guidelines are on the northeast side of the lake.

In other lakes, PAH with sediment guidelines occurred at levels well below the ISQG.

4.0 DISCUSSION

4.1 Metals

Metals occur naturally in the earth's crust where their abundance ranges from trace to very high levels (e.g., ores). Moore and Ramamoorthy (1983) list many human activities that can contribute to increased metal levels in aquatic systems by direct release to surface waters, or indirectly, by releases to the atmosphere (e.g., mining, metal production, industrial applications, fossil fuel combustion, waste incineration, amendments to agricultural land). Enrichment by metals such as As, Se, Cd, Hg, Tl, Sb and Sn has been associated with the mining or burning of coal (Moore and Ramamoorthy 1983, Cheam et al. 2000, Pacyna and Pacyna 2001).

4.1.1 Variability

Lake sediment metal data presented in this report are highly variable. Some of the inter-lake variability is at least in part related to differences in study design (e.g., different basis for selecting sampling locations, and different sampling intensity). However, much of the variability is typically associated with sediment characteristics. The influence of particle size distribution and of total organic content on metal levels in sediments is illustrated in this data set as it has been in many others (e.g., Moore and Ramamoorthy 1983).

Some factors can influence the vertical profile of metal concentrations in sediments as well as their horizontal variability.

- Particulate matter and associated metals tend to settle to the bottom of the lakes and, over time, vertical profiles in sediment metal levels are formed. These profiles are influenced by natural as well as man-made atmospheric or watershed contributions and they have been used to retrace the history of anthropogenic influences (e.g., Jackson 1997, Lockhart et al. 1998, Bindler et al. 2001).

- Chemical reactions near the water sediment interface influence the distribution of many elements in sedimentary deposits; the process is termed 'diagenesis' (CCME 2001). Hydroxides and oxides of Fe and Mn are an important sink for trace metals (e.g., Co, Cu, Ni, and Zn) as they form insoluble complexes with metals. In reducing environments, Fe and Mn solid phases become soluble. This remobilization of Fe and Mn results in desorption of trace metals. In sediments, which are intermittently anoxic, sorption and desorption of metals between sediment and pore water can alter vertical profiles of element concentrations in sediments. Manganese and iron-bearing solid phases are typically remobilized in the upper few centimetres, but organic-rich sediments can become anoxic at much shallower depths (a few millimetres). As a result of these diagenetic processes and quite independently from anthropogenic influences, surficial sediments can have higher trace metal levels than deeper sediments and may influence bottom water concentrations. The activity of benthic organisms or 'bioturbation' is another factor that can alter metal profiles in surficial sediments (e.g. Petr 1977). The number, types and activity of benthic organisms influences the degree of bioturbation.

Redox reactions or bioturbation in sediments sampled in this study is a source of variability which was not documented or standardised. The influence of these factors on inter-site and inter-lake differences is unknown.

In light of the multiple sources and high degree of natural variability in sediment metal levels, identifying anthropogenic effects can be a challenging endeavour.

4.1.2 Comparison with Reference Sites

The application of the Schropp and Windom (1988) method for determining whether metals are enriched with respect to reference sites proved useful in this data set in the sense that it identified some notable differences among metals tested. Some metals (Cd, Cu, Hg, Sb and Zn) appear to be higher in Wabamun Lake than would be expected from linear regressions between metals and aluminum for reference lakes, while others (Cr, Pb, Sr, Ti and Tl) were not markedly different. The choice of reference lakes has a determining influence on the outcome of such analysis. Although most reference lakes are large shallow lakes in the mixed wood boreal ecoregion, the geology of the watersheds differs (Alberta Research Council n.d.) and could account for some differences in metal levels. Six of the nine lakes sampled in 2002 are located on the Paskapoo Formation, but lakes Isle and Wabamun are located on a member formation that is typified by grey feldspatic sandstone, dark grey bentonitic mud and thick coal beds. Lac Ste. Anne is located on the Wapiti Formation and Amisk and Bonnie lakes are on the Lac La Biche formation, the only one of the three mentioned that is of marine origin. In addition to the type of formation, the degree of contact between runoff water and formation material could also influence differences among lakes; presumably lakes in watersheds where surficial geology has been disturbed most extensively (e.g., Wabamun Lake watershed) would be most influenced by bedrock geology. The nature of till material, which is not necessarily of the same origin as the bedrock material (e.g., Bayrock 1962), is a further consideration.

While the Schropp and Windom approach was used here in a spatial context (comparison of recently deposited sediments in Wabamun Lake and reference lakes), valuable information regarding the metal enrichment of sediments could be obtained by examining metal Al relationships in a temporal context (i.e., compare recently deposited sediments with older sediments). Metal levels of historical sediments have been presented by Donahue (2002), unfortunately, Al was not determined.

4.1.3 Comparisons with Other Studies

AENV (2002) recorded elevated levels of several metals in the ash lagoon and in Wabamun Lake about 100 m away from the ash lagoon discharge; As, Cr and Zn exceeded ISQG in these samples. Our results show that lake sediments in a radius of approximately 500 m from the ash lagoon outfall tend to have higher metal levels than would be expected from the sediment characteristics. As, Cd, Cr, Cu, Pb, Se, and Zn are among the metals for which concentrations appear elevated, possibly as a result of the influence from the ash lagoon outfall.

In 2002 Golder (2002) sampled sediments from Wabamun Lake and six other lakes in the immediate vicinity of Wabamun Lake (i.e., Chip, Isle, Ste. Anne, Mink, Hasse, and Jackfish lakes). Considering the difference in sampling design between this study and the Golder study, results of both studies agree reasonably well. Compliance with CCME sediment guidelines can be used as a basis for comparing the two data sets. In both studies ISQG for Hg and Pb were met in all samples, but a relatively large proportion of the samples did not meet the ISQG for As, Cr, Cu and Zn and some As concentrations even exceeded the PEL. The results differ in the sense that Golder reports some exceedences of PEL for chromium in Wabamun Lake and Lake Isle, but does not report Cd levels above the ISQG in Wabamun Lake.

Donahue (2002) collected sediment cores from the deeper parts of Wabamun, Pigeon and Lac Ste. Anne in 2001-2002. Cores were sectioned and analyzed for trace metals; dating was completed on one core collected from Wabamun Lake in 2001. The report concludes that since the mid-1950's there has been an increase in sediment concentrations of Cu, Hg, Pb, Se and Zn and infers that atmospheric deposition from coal fired power plants is the main source contributing to these increases.

In addition to providing a temporal perspective of the sediment history in Wabamun Lake, Donahue's data allow some historical comparisons among the three lakes.

- As in this study, Hg levels in surficial sediments from the three lakes are below ISQG. However, some of the older sediment layers (17.25 cm) from the west basin of Wabamun Lake exceed the ISQG. A comparison of Hg data from Wabamun Lake sediments and sediments from Pigeon and Ste. Anne lakes suggest that Hg levels in Wabamun Lake have historically been higher than in the two other lakes.

- ISQG for Cu, Cr, and As are exceeded in most or all core sections from Wabamun and Pigeon lakes (i.e., recently deposited and older sediments). The PEL for As and Cr was exceeded in several sections of Wabamun Lake cores, and for Cu in two sections from the west basin sample (i.e., older sediment layer: 14.5 and 9.5 cm). Cr also exceeded the ISQG in most sections (up to a depth of 19.5 cm).

- The ISQG for Cd and Zn was exceeded in several or all layers from cores taken in Wabamun Lake in the west basin and near Beaver Creek as well as in Pigeon Lake.

The results of the three studies confirm that levels of several metals (As, Cr, Cu, Cd, Zn) are elevated above CCME guidelines in Wabamun Lake, but also in several other lakes such as Pigeon and to a more limited extend Lac Ste. Anne (Cr only), and have been so historically (going back to the early 1900's). Independently from the history of anthropogenic effects, these results suggest that, at least for some metals (e.g., As, Cd, Cr, Cu, Hg, Zn), elevated levels are related to natural geochemical sources.

4.1.4 Significance of Guidelines Exceedences

CCME (2001) specifies that the occurrence of adverse biological effects cannot be predicted precisely from concentration data alone, particularly in the concentration ranges between the ISQGs and PELs. The chemical form in which metals are present will influence their biological availability and toxicity; furthermore, different aquatic species and life stages may exhibit

varying levels of responses. Toxicological studies on Wabamun Lake sediments are ongoing and will provide some insights on responses of test organisms under controlled laboratory exposure. A benthic invertebrate community study is also in progress and it will provide information on species composition and density at several locations in the lake.
Of particular relevance with respect to the application of CCME sediment guidelines is the procedure used to extract metals from the sediments. In this respect CCME (2001 - Introduction) notes:

> *Because the ISQG are intended to be used for evaluating the potential for biological effects, "near total" trace metal extraction methods that remove the biologically available fraction of metals and not residual metals (i.e., those metals held within the lattice framework of the sediment) are recommended for determining sediment metal concentrations. A strong extraction method using hydrofluoric acid would remove both the bioavailable and residual fraction of metals in sediments. Therefore, (in the context of ISQG) the concentration of "total" metals refers to the concentration of metals recovered using a near-total (mild digestion; e.g., aqua regia, nitric acid or hydrochloric acid) method.*

All metal sediment determinations performed on Wabamun Lake and other lakes in this study, by Golder (2002) and by Donahue (2002) have involved the determination of total metals concentration by acid extractions which dissolve both residual and non-residual metals. Because the method used to extract metals from sediment influences the reported metal concentration, and hence the outcome of comparisons with guidelines, a subset of samples was analysed following a mild digestion in nitric acid as recommended by CCME. The comparison of "total" and "near total" metal concentrations indicates that "total" metals concentrations tend to be higher than "near total" metal concentrations, which implies that a variable portion of metals in the sediments is not readily biologically available. Consequently, the compliance level with guidelines for "near total" metals is higher than for "total" metals. Hence, possible negative effects on aquatic life are likely less than would be anticipated from samples extracted with harsh methods. However, in the subset of samples analysed for both forms of metals, Cd is the only metal for which non-compliance dropped to zero; all other metals still had some non-compliant samples. For As, non-compliance with PEL persisted in Wabamun Lake samples as well as in samples of Bonnie Lake.

Although metal analyses on Wabamun Lake are indicative of high concentrations compared to the ISQG, it is important to note that metal levels in water generally comply with guidelines (Casey 2003, AENV 2003 survey data). This is an indication that metals in Wabamun Lake sediments are mostly in insoluble form and that currently, sediments act as a sink rather than a source of metals.

4.2 PAH

The presence of PAHs in the environment is the result of both anthropogenic and natural processes. PAH are generally produced as a result of incomplete combustion of organic matter; however, complex mixtures of PAH also occur in fossil fuels such as coal and crude petroleum (Neff 1979). Natural sources include forest fires and volcanic eruptions. Man-made sources include fossil fuel (e.g., coal, oil, gas) burning for heat, power generation and transportation, solid waste incineration, and industrial activities. NRCC (1983) identifies the use of materials produced by pyrolysis (coal tar, creosote, anthracene oil, coal tar pitch and carbon black) as another man-made source of PAH. In aquatic ecosystems, PAH are not very volatile or soluble and they tend to become incorporated into bottom sediments primarily by removal from the water column through their association with particulate matter (CCME 2001).

4.2.1 Spatial Patterns in Wabamun Lake

Although PAH were detected at several locations in Wabamun Lake most of the samples with PAH above the CCME ISQG were from the northeast end. A number of activities are concentrated in this area. The Wabamun Power plant is the most visible; it has an ash lagoon that drains to the lake and also receives runoff from the Wildwood coal mine. The power plant also discharges cooling water in Wabamun Lake. A pier near the village of Wabamun provides access to the lake for motorboats and a marina offers shelter. In addition to pleasure boats, weed harvesters operate intensively on the northeast portion of the lake. Railroad tracks and Highway 16 cut through the northern part of the lake's watershed.

Goodarzi (1996) reported a variety of PAH in milled coal samples from the Wabamun and Keephill 'stations' including many which were detected in Wabamun Lake (i.e., naphthalene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benzo(a)anthracene, benzo(e)pyrene, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, dibenzo(a,h)anthracene and benzo(g,h,i)perylene. Goodarzi also detected phenanthrene, benzo(a)fluorene and benzo(a)anthracene in stack emission samples taken on three different days from the Wabamun and Keephills Power plants (Goodarzi 1996). Benzo(a)anthracene was detected in the lake, but the other two compounds were not. Recognizing that Goodarzi's data are generated from a small sample population that does not necessarily capture the diversity of PAHs in the coal that is mined near Wabamun Lake or in the stack emissions from the power plants, coal mining and stack emissions are probable sources of PAH to Wabamun Lake. However, their contribution relative to that from other sources needs to be determined. Other possible sources are: natural leaching from coal seams near or in the lake; fuel consumption and occasional spillage by motor boats and weed harvesters; creosote-treated wood from piers and bridge pilings (e.g., main pier and structures in warm water outlet canal from the Wabamun power plant, rail road trestles); and fuel consumption by vehicles and trains on the nearby major highway or railway, respectively. Several studies have associated these various sources with PAHs in sediments. Van Metre et al. (2002) identified differences in PAH signatures with increasing urbanization, which they attributed to the combustion of fossil fuel for transportation. NRCC (1983) cites studies on streams affected by coalmine runoff where PAH were detected in sediments as well as studies where PAH were measured in aquatic sediments in the vicinity of creosote treated wood.

4.2.2 Comparison with Other Studies

A previous study conducted by AENV in 2002 (AENV 2002) had measured PAH in sediments near the Wabamun ash lagoon outfall, but analytical detection limits were much higher than in this study and no detections were reported.

Donahue (2001) analysed PAH in a sediment core from Wabamun, Lac Ste. Anne and Pigeon Lake and found the same 20 PAH in all three lakes. However, concentrations were higher in Wabamun Lake. Furthermore, and especially so in Wabamun Lake, many PAH occurred at substantially higher concentrations in the younger sediments (near the top of the core) than in the older sediments (near the bottom of the core). In our data set 20 PAHs were found in Wabamun Lake, but only eight were found in Lac Ste. Anne and nine in Pigeon Lake. Most of the PAH's reported in Donahue (2001) were also found in our study. Concentrations reported in this study are expressed as dry weight while Donahue (2001) reported concentrations as wet weight, which precludes a direct comparison of the data sets. However, the fact that the water content in our Wabamun Lake sediments averaged 85% accounts for the higher concentrations reported in this study. CCME guidelines apply to dry weight sediments and cannot be applied directly to the sediment core data.

PAH have been analysed extensively in the Athabasca River basin, in part to establish baseline information in areas with oils sand deposits. Total PAH concentrations reported by Headley et al. (2001) were as high as 34.7 µg/g (34700 ng/g) in Athabasca tributaries but equivalent to remote pristine areas (i.e., defined as <2 µg/g or 2000 ng/g) in the Athabasca River. By comparison, PAH in this study are much lower, ranging from 1.3 to 1118.6 ng/g in Wabamun Lake and from 0.1to 154.5 ng/g in other lakes. Evans et al. (2002) report concentrations of naphthalenes, fluorenes, dibenzothiophenes, phenanthrene/anthracene, fluoranthene/pyrene, benzo(a)anthracene/ chrysene and benzo(a)pyrene of 153,125,225, 681,253,205, 4 and 464, 71, 77,267, 137,237,6 ng/g dry weight in Richardson Lake and Lake Athabasca, respectively. In the same sequence, maximum concentrations of these PAH in Wabamun Lake were 228.7,11.2, not measured, 24.8, 76.6, 212.8 and 196 ng/g dry weight. The benzo(a)pyrene levels in Wabamun Lake are much higher than in Lake Athabasca or Richardson Lake, but the other compounds appear to be in the same concentration range.

PAH have also been detected in what could be qualified as pristine lakes. Indeed, traces of fluoranthene were found in Bow Lake, Alberta (Watt et al. 1984).

4.2.3 Significance of PAH

Because ISQG are exceeded by a number of PAH in the sediments, it is important to consider possible implications on aquatic life.

Sediment concentrations above the CCME interim sediment quality guidelines have been reported by Evans et al. (unpublished) in Lake Athabasca and the Athabasca ecosystem. In some instances concentrations were over 10 times the guideline. Sediment bioassays are ongoing in that area, but a clear response to the PAHs concentrations has not been observed.

Again, it is hoped that ongoing toxicological and benthic invertebrate community studies in Wabamun Lake will provide some insights on the significance of metal and PAH levels recorded in the lake's sediment.

5.0 CONCLUSIONS

Metals

- Consistent with results presented in AENV (2002), shallow sediments near the ash lagoon outfall tend to have higher concentrations of some metals (e.g., As, Cd, Cu, Cr, Pb, Sb, Se, and Zn) than comparable sediments elsewhere in the lake.

- Wabamun Lake samples tend to have higher concentrations of Cd, Cu, Hg, Sb and Zn than would be expected from Hg/TOC and 'metal'/Al relationships in reference lakes.

- Levels of Cr, Pb, Sr ,Ti and Tl, in Wabamun Lake sediments are within the range expected for reference lakes.

- CCME ISQG are exceeded in Wabamun Lake for As (93% of the samples), Cr (50%), Cu (67%), and Zn (6%) and PEL are exceeded for As in 25% of the samples. ISQG for As and Cr are commonly exceeded in reference lakes and archived sediments, and some exceedences were also encountered for Cu, Cd, Zn and Pb.

- A sub-set of samples that were analysed with a milder extraction, which provides a more realistic indication of bio-available metal concentration, had lower metal levels. However, non-compliance with ISQG (As, Cr, Cu, Zn) and PEL (As) persisted, albeit at a lower frequency.

- Results of this study combined with results from Golder (2002) and Donahue (2002) suggest that some metal concentrations (e.g., As Cd, Cr, Cu, Hg, and Zn) have been high historically in Wabamun, Pigeon and, to some extent, Ste. Anne lakes, suggesting that geochemistry has a strong influence on lake sediment quality. This conclusion is independent from any conclusions drawn about the history of anthropogenic effects on the lake. Anthropogenic effects and effects of geochemistry are cumulative.

PAH

- A variety of PAHs were detected in Wabamun Lake and eight other reference lakes sampled in 2002.

- Generally, the variety and concentrations of PAHs were highest in Wabamun Lake.

- Several of the 12 PAHs detected in lake sediments and for which CCME guidelines exist exceeded the ISQG in Wabamun Lake, but not in the other lakes.

- The scientific literature demonstrates that coal mining and coal burning are sources of PAHs. However, there are many other potential sources to Wabamun Lake (e.g., leaching from coal seams in or near the lake, fossil fuel burning by motor boats, highway traffic and rail traffic, and creosote-treated wood structures (piers, pilings and railway tracks). The relative importance of these sources needs to be evaluated.

Further work is required to understand the significance to the aquatic ecosystem of Wabamun Lake of metal and PAH concentrations above CCME guidelines.

6.0 LITERATURE CITED

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Appendix 1A Sediment analysis for Wabamun Lake and eight other lakes sampled in 2002. Metal concentrations apply to "total" metals.

Station No.	Station Name	Depth (m)	Station Description	Sample Date/Time	50303 Carbon Total Inorganic %	6075 Carbon Total %	6078 Carbon Organic %	97285 Sand %	97284 Clay %
a. Results of Wabamun Lake Sediment Analyses									
AB05DE2101	Wabamun Grid 1-1-A	7	1 Km East of Seba Beach (South Node) and Seba Transect Point A	12-Aug-02 12:15	1.03	14	12.9	4	49
AB05DE2102	Wabamun Grid 1-1-B	5	Seba Transect Point B	12-Aug-02 13:15	0.67	7	6.4	16	42
AB05DE2103	Wabamun Grid 1-1-C	3.2	Seba Transect Point C	12-Aug-02 12:50	0.28	5.9	5.6	15	38
AB05DE2104	Wabamun Grid 1-1-D	1	Seba Transect Point D, Near Jackpine Creek Mouth	12-Aug-02 12:35	0.5	4.3	3.8	62	20
AB05DE2106	Wabamun Grid 2-1	9.2	2 Km East of Seba Beach (South Node)	12-Aug-02 11:15	1	18.9	17.9		
AB05DE2107	Wabamun Grid 2-2	9.5	2 Km East of Seba Beach	21-Aug-02 16:30	0.79	22.7	21.9	2	35
AB05DE2108	Wabamun Grid 2-3	7.7	2 Km East of Seba Beach	21-Aug-02 16:05	0.62	24	23.3	4	50
AB05DE2113	Wabamun Grid 4-1	1	4 Km East of Seba Beach (South Node)	12-Aug-02 10:40	0.29	4.5	4.2	89	6
AB05DE2114	Wabamun Grid 4-2	9.2	4 Km East of Seba Beach	12-Aug-02 13:30	1.03	20.1	19.1		
AB05DE2115	Wabamun Grid 4-3	9.2	4 Km East of Seba Beach	12-Aug-02 13:45	0.89	21.1	20.2	1	60
AB05DE2116	Wabamun Grid 4-4	9.2	4 Km East of Seba Beach	21-Aug-02 15:45	0.82	21.8	21	13	49
AB05DE2117	Wabamun Grid 4-5	1.8	4 Km East of Seba Beach	30-Jul-02 14:00	1.1	2.8	1.7	85	5
AB05DE2121	Wabamun Grid 5-4-A	7.6	5 Km East of Seba Beach (North Node) and Fallis West Transect Point A	30-Jul-02 12:40	0.61	18.6	18		
AB05DE2122	Wabamun Grid 5-4-B	5.2	Fallis West Transect Point B	30-Jul-02 12:55	0.51	0.7	0.2	79	11
AB05DE2123	Wabamun Grid 5-4-C	2.7	Fallis West Transect Point C	30-Jul-02 13:20	0.41	1.4	1	92	5
AB05DE2124	Wabamun Grid 5-4-D	1	Fallis West Transect Point D, Near Shore	30-Jul-02 13:40	0.36	0.8	0.4	92	5
AB05DE2125	Wabamun Grid 6-1-A	7	6 Km East of Seba Beach (South Node) and Beaver Transect Point A	12-Aug-02 09:10	0.66	19.1	18.4	4	57
AB05DE2126	Wabamun Grid 6-1-B	5	Beaver Creek Transect Point B	12-Aug-02 10:10	0.62	15.1	14.5	11	51
AB05DE2127	Wabamun Grid 6-1-C	3.2	Beaver Creek Transect Point C	12-Aug-02 09:50	1.16	8.5	7.4	29	38
AB05DE2128	Wabamun Grid 6-1-D	1	Beaver Creek Transect Point D, Near Beaver Creek Mouth	12-Aug-02 09:30					
AB05DE2129	Wabamun Grid 6-2	9.8	6 Km East of Seba Beach	06-Aug-02 14:15	0.95	19.5	18.6	5	60
AB05DE2130	Wabamun Grid 6-3	7.2	6 Km East of Seba Beach	30-Jul-02 11:30	0.92	17.9	17	15	51
AB05DE2135	Wabamun Grid 8-1	9.1	1.5 Km East of Fallis Point (South Node)	06-Aug-02 10:30	0.98	18.2	17.3	4	58
AB05DE2136	Wabamun Grid 8-2	8.5	1.5 Km East of Fallis Point	06-Aug-02 11:00	0.96	19.8	18.8	2	57
AB05DE2137	Wabamun Grid 8-3-A	7	1.5 Km East of Fallis Point and Fallis East Transect Point A	06-Aug-02 11:30	0.65	22	21.3	2	54
AB05DE2138	Wabamun Grid 8-3-B	5	Fallis East Transect Point B	06-Aug-02 13:30	2.32	17.2	14.8	3	29
AB05DE2139	Wabamun Grid 8-3-C	3	Fallis East Transect Point C	06-Aug-02 13:00					
AB05DE2140	Wabamun Grid 8-3-D	2	Fallis East Transect Point D	06-Aug-02 12:45	1.16	18.2	17.1	26	40
AB05DE2141	Wabamun Grid 8-3-E	1	Fallis East Transect Point E, Near Shore	06-Aug-02 12:00	2.05	9.5	7.5	37	25
AB05DE2142	Wabamun Grid 8-4	4.4	1.5 Km East of Fallis Point	06-Aug-02 14:00	0.95	15.4	14.5	9	52
AB05DE2147	Wabamun Grid 10-1	4.3	3.5 Km East of Fallis Point (South Node)	02-Aug-02 10:00	2.44	11.5	9.1	27	22
AB05DE2148	Wabamun Grid 10-2	8	3.5 Km East of Fallis Point	02-Aug-02 10:20	0.89	17	16.1	43	20
AB05DE2149	Wabamun Grid 10-3	7.3	3.5 Km East of Fallis Point	02-Aug-02 10:35	0.85	18.3	17.5	66	12
AB05DE2150	Wabamun Grid 10-4	6.5	3.5 Km East of Fallis Point	02-Aug-02 10:45	0.74	18.4	17.7	58	34
AB05DE2153	Wabamun Grid 11-3	7.2	4.5 Km East of Fallis Point	26-Jul-02 11:45	0.79	17.1	16.4	65	9
AB05DE2154	Wabamun Grid 11-4	6.5	4.5 Km East of Fallis Point	26-Jul-02 11:30	0.77	18.2	17.4	70	6
AB05DE2155	Wabamun Grid 11-5	5.8	4.5 Km East of Fallis Point	26-Jul-02 11:10	0.66	17.8	17.1	70	9

Appendix 1A Sediment analysis for Wabamun Lake and eight other lakes sampled in 2002. (continued)

Station No.	Station Name	Depth (m)	Station Description	Sample Date/Time	50303 Carbon Total Inorganic %	6075 Carbon Total mg/kg	6078 Carbon Organic %	97285 Sand %	97284 Clay %
AB05DE2156	Wabamun Grid 12-1	6	North of Sundance Plant (South Node)	01-Aug-02 13:12	0.96	16	15	53	13
AB05DE2157	Wabamun Grid 12-2	7	North of Sundance Plant	01-Aug-02 14:07	0.88	17.5	16.6	58	13
AB05DE2158	Wabamun Grid 12-3	6.5	North of Sundance Plant	26-Jul-02 12:05	0.91	17.1	16.2	57	8
AB05DE2159	Wabamun Grid 12-4	6	North of Sundance Plant	26-Jul-02 10:30	0.93	16.8	15.9	61	10
AB05DE2160	Wabamun Grid 12-5	3.3	North of Sundance Plant	26-Jul-02 10:45	0.26	1.1	0.8	94	3
AB05DE2161	Wabamun Grid 13-1	0.7	1 Km East of Sundance Plant (South Node)	01-Aug-02 12:35	0.33	3.9	3.6	91	4
AB05DE2162	Wabamun Grid 13-2-A	6	1 Km East of Sundance Plant	01-Aug-02 11:25	1.09	16.6	15.5	31	15
AB05DE2206	Wabamun Grid 13-2-B	5.8	Sundance Plant Transect Point B	01-Aug-02 11:10	1.08	14.4	13.3	56	11
AB05DE2207	Wabamun Grid 13-2-C	2.8	Sundance Plant Transect Point C	01-Aug-02 11:54	1.01	6.2	5.2	81	6
AB05DE2208	Wabamun Grid 13-2-D	1.3	Sundance Plant Transect Point D	01-Aug-02 11:36	1.15	4.8	3.6	36	20
AB05DE2164	Wabamun Grid 13-4	6.1	1 Km East of Sundance Plant	26-Jul-02 12:45	0.97	16.4	15.5	65	10
AB05DE2165	Wabamun Grid 13-5	5	1 Km East of Sundance Plant	26-Jul-02 10:10	0.98	14.9	13.9	58	12
AB05DE2168	Wabamun Grid 14-2	2	2 Km East of Sundance Plant	01-Aug-02 10:15	1.41	6.4	5	32	12
AB05DE2170	Wabamun Grid 14-3	4.3	2 Km East of Sundance Plant	01-Aug-02 10:34	1.63	10.3	8.7	27	17
AB05DE2172	Wabamun Grid 14-4	5.3	2 Km East of Sundance Plant	01-Aug-02 10:50	1.29	13.7	12.4	30	17
AB05DE2173	Wabamun Grid 14-5	5	2 Km East of Sundance Plant	01-Aug-02 11:07	0.24	2.9	2.6	83	5
AB05DE2174	Wabamun Grid 14-6	6.7	2 Km East of Sundance Plant	26-Jul-02 13:10	1.13	15.8	14.6	41	15
AB05DE2175	Wabamun Grid 14-7	5.2	2 Km East of Sundance Plant	26-Jul-02 09:40	1.2	14.7	13.5	50	11
AB05DE2176	Wabamun Grid 15-1	2	3 Km East of Sundance Plant (South Node)	01-Aug-02 10:00	0.41	0.9	0.5	93	3
AB05DE2179	Wabamun Grid 15-4	5.8	3 Km East of Sundance Plant	01-Aug-02 08:50	1.27	14.9	13.7	54	11
AB05DE2180	Wabamun Grid 15-5	5.8	3 Km East of Sundance Plant	26-Jul-02 13:25	1.29	15.1	13.8	40	10
AB05DE2181	Wabamun Grid 15-6-A	4.5	3 Km East of Sundance Plant (North Node) and Alison Bay West Transect Point A	25-Jul-02 13:25	1.8	13.2	11.4	7	57
AB05DE2182	Wabamun Grid 15-6-B	2	Alison Bay West Transect Point B	25-Jul-02 14:45	2.55	11.3	8.8	21	47
AB05DE2183	Wabamun Grid 15-6-C	1	Alison Bay West Transect Point C	25-Jul-02 14:15	4.82	13.1	8.3	9	58
AB05DE2184	Wabamun Grid 15-6-D	0.5	Alison Bay West Transect Point D, Near Shore	25-Jul-02 13:50	2.02	11	8.9	16	45
AB05DE2186	Wabamun Grid 16-2	3.6	4 Km East of Sundance Plant	01-Aug-02 08:32	2.54	10	7.5	29	14
AB05DE2187	Wabamun Grid 16-3	4.8	4 Km East of Sundance Plant	26-Jul-02 13:40	1.52	13.7	12.2	47	12
AB05DE2188	Wabamun Grid 16-4-A	3.8	4 Km East of Sundance Plant (North Node) and Alison Bay East Transect Point A	30-Jul-02 10:20	2.14	14.3	12.2	9	51
AB05DE2189	Wabamun Grid 16-4-B	3	Alison Bay East Transect Point B	25-Jul-02 15:30	2.11	13	10.9	13	53
AB05DE2190	Wabamun Grid 16-4-C	2.5	Alison Bay East Transect Point C	25-Jul-02 15:20	2.88	14.6	11.7	4	68
AB05DE2191	Wabamun Grid 16-4-D	3	Alison Bay East Transect Point D, Near Lagoon Outfall	25-Jul-02 15:00	2.91	12.3	9.4	9	58
AB05DE2192	Wabamun Grid 17-1	4.4	Off Point Alison	01-Aug-02 07:51	1.8	13.5	11.7	27	16
AB05DE2193	Wabamun Grid 18-1-A	4	1 Km East of Point Alison (South Node) and Outlet Transect Point A	25-Jul-02 10:00	2.18	10.8	8.6	11	48
AB05DE2194	Wabamun Grid 18-1-B	3	Outlet Transect Point B	25-Jul-02 12:00	4.35	13.4	9.1	11	50
AB05DE2195	Wabamun Grid 18-1-C	2	Outlet Transect Point C	25-Jul-02 11:45	2.96	7.5	4.5	65	18
AB05DE2196	Wabamun Grid 18-1-D	1	Outlet Transect Point D	25-Jul-02 11:05	5	15	10	3	63
AB05DE2197	Wabamun Grid 18-1-E	0.5	Outlet Transect Point E	25-Jul-02 10:45	5.25	16.9	11.7	2	53
AB05DE2198	Wabamun Grid 18-2	2.9	1 Km East of Point Alison	25-Jul-02 12:20	2.42	12.7	10.3	10	55

Appendix 1A Sediment analysis for Wabamun Lake and eight other lakes sampled in 2002. (continued)

Station No.	Station Name	Depth (m)	Station Description	Sample Date/Time	50303 Carbon Total Inorganic %	6075 Carbon Total mg/kg	6078 Carbon Organic %	97285 Sand %	97284 Clay %
AB05DE2203	Wabamun Grid 20-1	1.5	Moonlight Bay (Park)	25-Jul-02 12:50	5.6	19.1	13.5	3	71
AB05DE2204	Wabamun Grid 20-2	3.4	Moonlight Bay	25-Jul-02 13:00	3.03	19.6	16.5	7	66
b. Results of Analyses of Eight Lakes Sampled in 2002									
AB06AA1010	Amisk Grid 1-1	54	No Description	27-Aug-02 12:09	1.13	18.3	17.2	3	46
AB06AA1020	Amisk Grid 1-2	40	No Description	27-Aug-02 12:58	1.15	19.1	18	2	54
AB06AA1030	Amisk Grid 1-3	30	No Description	27-Aug-02 13:30	1.8	20	18.2	5	40
AB05ED1470	Bonnie Grid 1-1	4	No Description	03-Sep-02 13:35	1.33	29.6	28.3	3	55
AB05ED1480	Bonnie Grid 1-2	3	No Description	03-Sep-02 13:50	2.08	30.2	28.1	3	51
AB05ED1490	Bonnie Grid 1-3	2	No Description	03-Sep-02 14:05	2.69	29	26.3	7	53
AB05CC1990	Gull Grid 1-1		No Description	21-Aug-02 12:00	1.83	15	13.2	2	19
AB05CC2000	Gull Grid 1-2		No Description	21-Aug-02 13:35	0.58	19.7	19.2	6	46
AB05CC2010	Gull Grid 1-3		No Description	21-Aug-02 14:30	1.05	5.9	4.8	29	14
AB05EA1720	Isle Grid 1-1	6.1	No Description	29-Aug-02 11:00	0.2	25	24.8	5	58
AB05EA1730	Isle Grid 1-2	5.2	No Description	29-Aug-02 12:30	0.21	25.9	25.7	2	64
AB05EA1740	Isle Grid 1-3	4.1	No Description	29-Aug-02 12:50	0.24	27.1	26.8	3	60
AB05EA1750	Lac. Ste. Anne Grid 1-1	9.5	No Description	05-Sep-02 11:30	1.5	17.3	15.8	8	55
AB05EA1760	Lac Ste. Anne Grid 1-2	8.9	No Description	05-Sep-02 12:00	1.2	18.1	16.9	7	55
AB05EA1770	Lac Ste. Anne Grid 1-3	7.5	No Description	05-Sep-02 12:30	1.03	17.7	16.7	10	48
AB05FA2000	Pigeon Grid 1-1	9.5	No Description	04-Sep-02 11:05	0.45	15.9	15.4	5	47
AB05FA2010	Pigeon Grid 1-2	8.5	No Description	04-Sep-02 12:00	0.32	16.6	16.2	4	46
AB05FA2020	Pigeon Grid 1-3	7.5	No Description	04-Sep-02 12:30	0.31	16.9	16.6	4	50
AB05CC1960	Sylvan Grid 1-1	15.2	No Description	22-Aug-02 12:30	0.63	1.1	0.4	97	1
AB05CC1970	Sylvan Grid 1-2	14	No Description	22-Aug-02 13:00	2.21	13.9	11.7	3	52
AB05CC1980	Sylvan Grid 1-3	13	No Description	22-Aug-02 13:45	1.82	15.6	13.8	2	55
AB05DF1160	Wizard Grid 1-1	11.2	No Description	28-Aug-02 12:30	1.08	15.9	14.8	2	56
AB05DF1170	Wizard Grid 1-2	10.4	No Description	28-Aug-02 13:40	1.03	14.2	13.2	3	50
AB05DF1180	Wizard Grid 1-3	9.1	No Description	28-Aug-02 14:00	0.92	16.6	15.6	3	53

Appendix 1A Sediment analysis for Wabamun Lake and eight other lakes sampled in 2002. (continued)

	97286	103471	103474	103475	103476	103477	103478	103479	103480	103523	103481	103483	103485 103514	103516	103486	103489	103491	103492
Station Name	Silt %	Mercury ug/g	Silver ug/g	Aluminum ug/g	Arsenic ug/g	Boron ug/g	Barium ug/g	Beryllium ug/g	Bismuth ug/g	Cadmium ug/g	Calcium ug/g	Chlorine ug/g	Chromium ug/g	Cobalt ug/g	Copper ug/g	Lithium ug/g	Mangan ese ug/g	Molybde num ug/g
Wabamun Grid 1-1-A	47	0.074	0.26	53526	14.2	82	604	L4	0.21	0.51	24073	1248	50.7	8.4	54.5	21	537	6.1
Wabamun Grid 1-1-B	41	0.065	0.3	59477	9.6	67	831	L4	0.20	0.55	14004	587	58.9	8.97	34.2	26	441	2.9
Wabamun Grid 1-1-C	46	0.043	0.31	63150	7.4	64	838	L4	0.18	0.61	13825	558	61.7	9.1	23.8	28.3	623	1.1
Wabamun Grid 1-1-D	17	0.036	0.26	50929	7.3	49	831	L4	0.13	0.56	11677	439	47.7	8.8	16.9	22.5	487	0.82
Wabamun Grid 2-1		0.11	0.3	48701	23.7	98	582	L4	0.26	0.76	29091	2285	66	8.8	135	23.7	392	37.5
Wabamun Grid 2-2	64	0.132	0.29	37863	20.3	81	342	L4	0.32	0.4	24253	367	51	7.1	129	16.1	340	31.4
Wabamun Grid 2-3	46	0.138	0.28	37385	19	86	347	L4	0.34	0.43	18402	238	48.2	7.5	104	15.9	305	21.2
Wabamun Grid 4-1	5	0.03	0.16	27133	11.1	28	787	L4	0.06	0.3	10601	557	15.5	5.17	6.06	12.7	425	0.71
Wabamun Grid 4-2		0.115	0.29	50446	18.8	102	520	L4	0.28	0.73	25443	1784	61	9.3	129	20.6	362	28.1
Wabamun Grid 4-3	38	0.118	0.27	48417	21.7	106	502	L4	0.29	0.75	23674	1565	58.6	8.6	154	20.4	371	29.3
Wabamun Grid 4-4	39	0.105	0.29	40979	15.6	95	442	L4	0.33	0.32	27409	191	45.4	7.7	72.4	17.4	531	9.3
Wabamun Grid 4-5	10	0.009	0.13	26215	6.7	26	799	L4	0.06	0.35	40600	530	15.6	4.4	6.83	10.3	510	1.67
Wabamun Grid 5-4-A		0.073	0.27	48326	19.9	87	497	L4.1	0.25	0.6	22459	3272	48.9	8.8	78	19.6	530	9.1
Wabamun Grid 5-4-B	10	0.013	0.16	29905	3.5	22	482	L3.9	0.06	0.28	3928	408	35.9	3.8	9.2	11.8	229	0.32
Wabamun Grid 5-4-C	3	L0.001	0.12	20006	3.6	26	483	L3.9	L0.04	0.28	6042	496	9.7	1.77	4.7	6.9	144	0.77
Wabamun Grid 5-4-D	3	L0.001	0.1	16875	2.45	L20	458	L4	L0.04	0.29	7854	205	9.5	1.82	2.5	6.1	123	0.38
Wabamun Grid 6-1-A	39	0.103	0.24	52302	15.2	107	542	L4	0.26	0.68	26921	1077	57.2	8.7	85	20.9	693	6.7
Wabamun Grid 6-1-B	39	0.085	0.25	55315	15.7	99	640	L4	0.23	0.6	25725	1289	55.4	8.9	59.1	22	513	7
Wabamun Grid 6-1-C	33	0.098	0.3	51744	13	66	690	L4	0.19	0.54	19338	744	48.1	9.26	32.6	20.6	522	3.5
Wabamun Grid 6-1-D		0.039	0.19	42616	10	33	854	L4	0.08	0.39	8571	695	29.8	8.5	11.3	15.4	346	0.92
Wabamun Grid 6-2	36	0.099	0.23	48585	18.2	112	534	L4	0.27	0.68	27539	2041	58.6	9	105	21	537	8.6
Wabamun Grid 6-3	34	0.066	0.27	46054	21	95	570	L4	0.25	0.64	30249	3336	53.8	8.5	96	19.3	529	6.7
Wabamun Grid 8-1	38	0.099	0.28	47946	16.4	113	573	L4	0.26	0.67	37120	2041	58.6	8.58	99	21.4	711	5.9
Wabamun Grid 8-2	41	0.102	0.28	47763	18.2	125	540	L3.9	0.27	0.72	29910	1669	57.2	9.2	113	21.4	655	6.7
Wabamun Grid 8-3-A	44	0.124	0.26	46599	17.9	132	526	L3.9	0.26	0.68	29577	2789	59.2	8.7	116	21.6	631	9
Wabamun Grid 8-3-B	69	0.1	0.26	50225	13.3	107	567	L4	0.24	0.6	26568	2376	49	9	45	21.3	397	7.11
Wabamun Grid 8-3-C		0.132	0.25	52101	16.8	94	615	L4	0.23	0.66	27127	1386	56.7	8.3	87.4	22.4	516	10.3
Wabamun Grid 8-3-D	34	0.08	0.21	43783	13.8	78	661	L4.1	0.18	0.53	36354	1281	41.7	7.4	37.6	18.9	503	6.8
Wabamun Grid 8-3-E	38	0.065	0.17	39699	18.7	48	873	L3.9	0.13	0.43	68023	1009	38.3	9.1	22.9	15.3	1222	2
Wabamun Grid 8-4	40	0.098	0.26	51355	15.6	93	608	L4.1	0.26	0.69	28777	2112	58	7.8	111	21.3	389	16.9
Wabamun Grid 10-1	51	0.047	0.26	38545	11.2	73	746	L4	0.12	0.51	100699	1248	38.5	7.3	30.3	15.8	956	6.2
Wabamun Grid 10-2	37	0.094	0.28	48553	16.2	117	592	L4	0.24	0.66	38418	1916	58.7	9.2	110	21.4	826	7.1
Wabamun Grid 10-3	22	0.09	0.28	47629	18.5	118	558	L4	0.23	0.75	32860	2490	58	9.4	105	22.5	613	8.1
Wabamun Grid 10-4	8	0.098	0.29	47358	18.7	125	522	L4	0.24	0.73	29745	3069	56.3	9	117	21.6	585	9.3
Wabamun Grid 11-3	27																	
Wabamun Grid 11-4	24																	
Wabamun Grid 11-5	21																	

Appendix 1A Sediment analysis for Wabamun Lake and eight other lakes sampled in 2002. (continued)

Station Name	97286 Silt %	103471 Mercury ug/g	103474 Silver ug/g	103475 Aluminum ug/g	103476 Arsenic ug/g	103477 Boron ug/g	103478 Barium ug/g	103479 Beryllium ug/g	103480 Bismuth ug/g	103523 Cadmium ug/g	103481 Calcium ug/g	103483 Chlorine ug/g	103485 103514 Chromium ug/g	103516 Cobalt ug/g	103486 Copper ug/g	103489 Lithium ug/g	103491 Manganese ug/g	103492 Molybdenum ug/g
Wabamun Grid 12-1	35	0.092	0.27	48503	15.2	109	617	L4	0.25	0.65	50107	2217	57	8.4	81.2	22.4	690	6.6
Wabamun Grid 12-2	29	0.103	0.32	48003	16.2	113	599	L4	0.26	0.67	42350	2636	58.9	9.2	115	22.6	696	7.8
Wabamun Grid 12-3	34	0.077	0.35	40226	13	76	1138	L4	0.28	0.49	79018	2233	66.3	6.7	48.4	21.2	295	12.3
Wabamun Grid 12-4	29	0.081	0.1	6167	13.5	57	644	L4	L0.04	0.37	102049	2736	7.5	3.9	33.7	4	390	19.4
Wabamun Grid 12-5	3	0.006	0.29	43197	15.5	83	622	L4	0.25	0.59	64787	1039	54.3	7.8	97.5	19.2	568	9
Wabamun Grid 13-1	5	0.025	0.12	27170	7.6	26	588	L4	0.07	0.299	21568	379	11.7	2.86	4.8	11.3	487	0.46
Wabamun Grid 13-2-A	54	0.098	0.24	49092	13.8	90	563	L4	0.23	0.65	42899	2198	51.6	8.43	82	19.3	804	4.64
Wabamun Grid 13-2-B	33	0.092	0.28	49358	13.4	86	596	L4	0.24	0.61	46525	1416	54	7.9	61.9	19.9	565	4.9
Wabamun Grid 13-2-C	13	0.044	0.16	33719	81.9	42	768	L4	0.16	0.37	36699	1640	16.1	7.6	9.2	10.5	852	1.16
Wabamun Grid 13-2-D	44	0.051	0.26	52379	7.6	41	731	L4	0.15	0.43	42489	901	35.3	7.4	15.1	17	485	1.85
Wabamun Grid 13-4	25																	
Wabamun Grid 13-5	31																	
Wabamun Grid 14-2	56	0.042	0.22	40161	9.9	55	801	L4	0.12	0.48	62259	815	31.1	5.4	24.8	13.6	498	4.8
Wabamun Grid 14-3	56	0.056	0.24	42157	11.3	68	689	L4	0.16	0.5	67418	945	40	7	39.6	16.3	630	5.2
Wabamun Grid 14-4	53	0.074	0.28	46078	12.9	94	631	L4	0.24	0.63	55072	1841	48.6	7.8	67.3	19.2	739	4.34
Wabamun Grid 14-5	12	0.033	0.12	20079	16.7	30	317	L4	0.12	0.39	8962	678	9.3	2.31	12.1	9	231	1.87
Wabamun Grid 14-6	44	0.079	0.15	20149	7	52	847	L4	0.08	0.41	126137	2555	26.5	4.3	34.1	9.5	980	7.2
Wabamun Grid 14-7	39	0.046	0.31	41404	14.6	83	762	L4	0.21	0.61	94194	3238	50	7.3	118	17.7	548	12.4
Wabamun Grid 15-1	4	0.001	0.12	19702	2.12	L20	568	L4	L0.04	0.32	35019	927	11.5	2.19	2.76	6.6	258	1.03
Wabamun Grid 15-4	35	0.08	0.28	49227	14	87	626	L4	0.24	0.72	53323	1990	53.9	8	84.3	20.9	614	7.7
Wabamun Grid 15-5	50	0.064	0.3	44289	15	87	609	L4	0.24	0.63	53874	4058	52.6	7.7	92	19	849	5.8
Wabamun Grid 15-6-A	36	0.057	0.14	18062	1.83	L20	531	L4	0.04	0.3	3723	756	10	1.73	6.5	6.6	93.5	0.61
Wabamun Grid 15-6-B	32	0.047	0.28	44103	15.4	97	641	L4	0.22	0.62	61149	2559	52.9	7.84	88.9	18.2	688	10.7
Wabamun Grid 15-6-C	34	0.021	0.28	49331	17.7	105	568	L4	0.25	0.61	45587	3771	54.8	8.6	116	19.7	636	6.66
Wabamun Grid 15-6-D	39	0.021	0.29	51407	19	115	584	L4	0.26	0.7	38813	3026	56.1	9.2	100	21.2	632	6.67
Wabamun Grid 16-2	57	0.057	0.2	38233	9.3	59	663	L4	0.15	0.48	96655	1125	37.6	7.6	39.2	14.8	751	6.6
Wabamun Grid 16-3	42	0.05	0.28	37116	14.2	68	793	L4	0.22	0.54	104514	2202	50.6	6.6	80.9	17	820	7.4
Wabamun Grid 16-4-A	40	0.052	0.29	39624	12	78	536	L4	0.47	0.29	74235	419	44.9	7.11	73	16	558	4.6
Wabamun Grid 16-4-B	34	0.042	0.18	24553	7.1	38	784	L4	0.07	0.35	132281	2371	21.7	5.3	33.1	9.6	740	4.67
Wabamun Grid 16-4-C	28	0.039	0.14	9118	9.3	51	772	L4	L0.04	0.38	129267	1857	10.8	5.11	35.9	4.5	515	13.8
Wabamun Grid 16-4-D	32	0.029	0.29	40012	13.9	81	743	L4	0.22	0.53	100733	2345	46	7.5	86	16.6	734	9.3
Wabamun Grid 17-1	57	0.075	0.28	43736	13.5	88	641	L4	0.21	0.53	73642	1621	47.9	7.8	65.7	18.3	716	9.4
Wabamun Grid 18-1-A	41	0.06	0.18	32821	6.7	67	480	L4	0.07	0.5	98660	2054	28.2	6.4	15.6	14.9	778	1.55
Wabamun Grid 18-1-B	40							L4										
Wabamun Grid 18-1-C	18	0.03	0.26	43360	13.5	80	626	L4	0.17	0.51	85894	2931	43.1	7.4	66.7	17.5	646	5.9
Wabamun Grid 18-1-D	34							L4										
Wabamun Grid 18-1-E	45	0.019	0.21	32253	10.6	80	637	L4	0.12	0.47	92250	3656	34.9	6.2	64.4	14.5	798	12.4
Wabamun Grid 18-2	36	0.059	0.31	48126	14.4	98	591	L4	0.24	0.65	53004	1067	54.3	8.9	88	20.2	501	8.3

Appendix 1A Sediment analysis for Wabamun Lake and eight other lakes sampled in 2002. (continued)

Station Name	97286 Silt %	103471 Mercury ug/g	103474 Silver ug/g	103475 Aluminum ug/g	103476 Arsenic ug/g	103477 Boron ug/g	103478 Barium ug/g	103479 Beryllium ug/g	103480 Bismuth ug/g	103523 Cadmium ug/g	103481 Calcium ug/g	103483 Chlorine ug/g	103485 103514 Chromium ug/g	103516 Cobalt ug/g	103486 Copper ug/g	103489 Lithium ug/g	103491 Manganese ug/g	103492 Molybdenum ug/g
Wabamun Grid 20-1	26	0.019	0.3	50599	19.1	121	599	L4.1	0.24	0.65	39274	3102	60	9.4	137	21.9	721	7.5
Wabamun Grid 20-2	28																	
Amisk Grid 1-1	51	0.079	0.18	17433	10.8	44	679	L4	0.13	0.34	44612	648	20.1	7.5	15.1	11.4	14161	6
Amisk Grid 1-2	44	0.08	0.14	21614	11.1	49	380	L4	0.18	0.37	53770	1629	24.9	7.4	15.7	13.8	1533	6.5
Amisk Grid 1-3	55	0.081	0.16	15777	11.3	48	297	L4	0.17	0.32	56231	614	18	5.9	14.5	10.3	1046	6.32
Bonnie Grid 1-1	42	0.101	0.115	16021	15.1	68	290	L4	0.18	0.36	60536	504	18.2	4.6	12.1	12.1	449	5.2
Bonnie Grid 1-2	46	0.097	0.13	14068	18	68	292	L4	0.15	0.37	85126	670	17.2	5.3	11	10.3	506	5.1
Bonnie Grid 1-3	41	0.072	0.12	11001	14.7	66	289	L4	0.16	0.31	103777	2321	13.5	4.4	8.1	8.3	576	3.16
Gull Grid 1-1	79	0.061	0.33	35953	3.9	77	792	L4	0.23	0.3	76082	1182	46.1	8.6	19.1	25.4	467	0.95
Gull Grid 1-2	48	0.055	0.28	30911	5.7	73	802	L4	0.23	0.38	88590	194	38.7	7.7	18.4	22.2	439	2.06
Gull Grid 1-3	57	0.034	0.23	39113	4.42	45	711	L4	0.14	0.15	41031	117	37.6	5.9	10.2	18.5	333	1.05
Isle Grid 1-1	37	0.087	0.27	24145	10	64	327	L4	0.26	0.44	15566	360	40	9.4	26.5	18.9	697	1.69
Isle Grid 1-2	34	0.091	0.3	34232	11.9	64	392	L4	0.27	0.45	16098	2567	36.8	9.7	28.6	19.8	499	2.1
ISLE Grid 1-3	36	0.092	0.27	24741	9	70	336	L4	0.21	0.47	17226	605	34.3	8.4	24.3	17.4	685	2.33
Lac. Ste. Anne Grid 1-1	37	0.072	0.26	32470	4.9	74	453	L4	0.20	0.3	63990	1035	34.1	6.8	15.3	20.6	838	1.32
Lac Ste. Anne Grid 1-2	38	0.063	0.29	34089	6.3	76	466	L4	0.21	0.29	51542	646	38.6	7.1	28	21.3	695	1.97
Lac Ste. Anne Grid 1-3	42	0.063	0.22	34894	5.9	76	451	L4	0.20	0.29	56208	1413	36.3	7.5	15.3	21.3	803	1.67
Pigeon Grid 1-1	48	0.077	0.3	43464	5.9	75	577	L4	0.42	0.41	19371	1721	44	8.8	22.4	20.2	741	1.15
Pigeon Grid 1-2	51	0.083	0.31	43358	6.2	78	603	L4	0.29	0.36	17140	1472	43.7	8.5	22.6	20.9	847	1.27
Pigeon Grid 1-3	45	0.085	0.29	43865	6.2	65	570	L4	0.28	0.36	13915	1285	44.2	8.6	22.8	21.2	843	1.37
Sylvan Grid 1-1	2	0.016	0.15	29961	3.9	L20	634	L4	0.22	0.14	24028	1194	20.4	5	4.4	10.1	294	0.52
Sylvan Grid 1-2	46	0.067	0.32	38592	3.9	60	714	L4	0.27	0.42	82105	996	45	9.2	21.6	23.3	531	1.74
Sylvan Grid 1-3	42	0.074	0.33	42002	4.3	64	677	L4	0.29	0.5	67334	780	46.9	9.7	24.7	24.1	554	1.51
Wizard Grid 1-1	42	0.065	0.24	42409	8.2	40	556	L4	0.25	0.42	52062	468	43.9	8	24.7	17.6	751	3.37
Wizard Grid 1-2	46	0.065	0.3	46562	8.3	34	574	L4	0.22	0.36	49744	563	45.1	8.1	23.6	17.2	789	2.9
Wizard Grid 1-3	44	0.085	0.25	45914	8.1	36	547	L4	0.23	0.36	42831	1282	44.5	8.71	25.4	17.7	685	3.06

Appendix 1A Sediment analysis for Wabamun Lake and eight other lakes sampled in 2002. (continued)

Station Name	103517 Nickel ug/g	103499 Lead ug/g	103501 Antimony ug/g	103504 Tin ug/g	103521 Selenium ug/g	103522 103505 Strontium ug/g	103506 Thorium ug/g	103507 Titanium ug/g	103508 Thallium ug/g	103509 Uranium ug/g	103510 Vanadium ug/g	103511 Zinc ug/g	103515 Iron ug/g	99140 Trihalomethanes ug/g	99141 Xylene ug/g	99142 Bromobenzene ug/g	99143 Sec-Butylbenzene ug/g	99144 Tert-Butylbenzene ug/g
Wabamun Grid 1-1-A	24.3	20.5	1.84	L3	2	190	7.3	2405	0.5	4.06	82.5	91.3	24464	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 1-1-B	27.1	18.9	1.16	L3	1	202	8.4	2833	0.61	2.92	95.2	113	25895					
Wabamun Grid 1-1-C	26.5	16.4	0.83	L3	1	208	8.8	2926	0.62	2.72	92.9	119	28568	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 1-1-D	22.9	13.5	0.67	L3	1.4	204	6.82	2433	0.46	2.3	73.6	87	19525					
Wabamun Grid 2-1	33.9	32.4	3.4	L3	5	176	7.3	2228	0.56	8.2	105	139	22967					
Wabamun Grid 2-2	47.3	28.9	2.81	L3	4.5	105	8.2	1982	0.41	6	84.1	114	20648	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 2-3	30	28.3	2.6	L3	4.6	95	6.7	1932	0.44	6.4	78	109	21233					
Wabamun Grid 4-1	10	8.96	0.56	L3	1.3	176	2.96	1131	0.32	1.17	34.1	20.3	9135					
Wabamun Grid 4-2	31.3	28.6	2.7	L3	5	166	7.6	2234	0.49	6.9	100	124	21446					
Wabamun Grid 4-3	31.8	30.7	3.08	L3	4	159	7.44	2012	0.48	7.6	103	134	21568	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 4-4	26.3	20	2.02	L3	3.7	149	8.6	1922	0.412	4.5	69.2	86.7	19600					
Wabamun Grid 4-5	6.7	6.56	0.39	L3	0.86	276	1.92	969	0.44	1.18	37.5	26	7136					
Wabamun Grid 5-4-A	30.8	20.3	2.43	L3	3.2	159	7.11	2242	0.45	6.67	80.1	97.2	21949	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 5-4-B	11.7	7.09	0.36	L3	0.6	104	2.17	1289	0.41	1.05	37.5	38.1	8790					
Wabamun Grid 5-4-C	4.6	6.22	0.27	L3	L0.4	109	1.5	657	0.35	0.8	19.2	13.8	4013	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 5-4-D	4.4	6.08	0.27	L3	0.68	105	1.14	827	0.25	0.68	21.9	11.9	3991					
Wabamun Grid 6-1-A	28.1	23.4	2.1	L3	2.9	182	7.59	2301	0.4	4.19	88.2	102	19754	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 6-1-B	27.4	22.1	1.84	L3	3.1	202	8	2610	0.55	4.47	88.6	96	20666					
Wabamun Grid 6-1-C	24.3	18.4	1.11	L3	2.6	203	7.02	2572	0.56	3.14	76.9	87	19273	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 6-1-D	18.3	12	0.71	L3	3.8	212	4.5	1976	0.4	1.78	46.2	44.9	13368					
Wabamun Grid 6-2	29.8	24.2	2.71	L3	5	192	7.4	2033	0.48	5.17	93.1	109	19063	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 6-3	27.2	24.6	3.06	L3	4.7	201	6.94	2167	0.53	6.26	89	105	18910					
Wabamun Grid 8-1	29.1	24.2	2.5	3.16	4.6	216	7.57	2214	0.42	4.91	96	109	18211					
Wabamun Grid 8-2	30.7	24.3	3	L3	5.3	195	7.7	2300	0.44	5.56	97.8	112	17236					
Wabamun Grid 8-3-A	29.8	25.4	3.01	3	5.3	191	7.32	2158	0.42	5.33	95.5	111	16540	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 8-3-B	32.5	18.4	1.53	L3	3	174	8.1	2655	0.45	4.8	82	97	19103					
Wabamun Grid 8-3-C	26.6	23.5	1.39	L3	3.6	198	7.71	2395	0.52	4.06	89.2	110	20825					
Wabamun Grid 8-3-D	19.1	16.9	0.98	L3	3.4	261	5.84	2038	0.5	2.93	65.7	77.6	17520	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 8-3-E	14.7	13.9	0.67	L3	2.1	412	4.7	1939	0.48	1.87	58.9	64.6	15397					
Wabamun Grid 8-4	27.4	25.6	2.36	3.43	3.7	190	7.57	2412	0.48	5.7	89	118	18769					
Wabamun Grid 10-1	15	13.9	0.85	L3	2.3	452	4.4	1908	0.33	2.54	64.5	61.4	14713					
Wabamun Grid 10-2	27.9	25.2	2.5	3.2	5.1	219	7.6	2305	0.41	4.83	94.2	113	17685	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 10-3	30.8	24.3	2.71	L3	5.2	198	7.72	2442	0.41	5.72	96.3	111	17223					
Wabamun Grid 10-4	28.8	23.9	2.63	3.07	5.3	184	7.06	2227	0.431	5.47	94	115	17092					
Wabamun Grid 11-3																		
Wabamun Grid 11-4																		
Wabamun Grid 11-5																		

Appendix 1A Sediment analysis for Wabamun Lake and eight other lakes sampled in 2002. (continued)

Station Name	103517 Nickel ug/g	103499 Lead ug/g	103501 Antimony ug/g	103504 Tin ug/g	103521 Selenium ug/g	103522 103505 Strontium ug/g	103506 Thorium ug/g	103507 Titanium ug/g	103508 Thallium ug/g	103509 Uranium ug/g	103510 Vanadium ug/g	103511 Zinc ug/g	103515 Iron ug/g	99140 Trihalomethanes ug/g	99141 Xylene ug/g	99142 Bromobenzene ug/g	99143 Sec-Butylbenzene ug/g	99144 Tert-Butylbenzene ug/g
Wabamun Grid 12-1	26.1	22.8	1.73	L3	4.6	255	7.26	2462	0.43	4.15	90	103	17716	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 12-2	28.7	24.8	2.38	3.37	5.9	234	7.38	2388	0.43	4.84	95.5	116	17273					
Wabamun Grid 12-3	14.3	18.2	1.94	L3	3.8	504	6.91	1832	0.46	3.16	84.1	57.7	14158	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 12-4	5.2	12.1	0.92	L3	2.1	721	0.358	317	0.091	3.57	21.3	33.7	1847					
Wabamun Grid 12-5	21.4	21.9	1.62	3.04	2.8	290	6.8	2211	0.44	4.42	78.7	109	15995	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 13-1	4.4	8.29	0.32	L3	0.52	195	2.63	986	0.3	0.99	18.5	14.2	6661	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 13-2-A	23.4	21.7	1.88	L3	4	235	7.2	2248	0.45	4.02	80.5	93.7	17579					
Wabamun Grid 13-2-B	24.2	21	1.6	L3	3.7	246	7.01	2389	0.47	4.12	81.9	89	17523	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 13-2-C	11.2	11.5	0.59	L3	0.71	254	3.6	1182	0.54	1.39	30.9	35.9	19995					
Wabamun Grid 13-2-D	18	12.9	0.72	L3	1.4	309	6.2	2353	0.38	2.26	55.7	48.3	13779	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 13-4																		
Wabamun Grid 13-5																		
Wabamun Grid 14-2	9.4	13.5	0.81	L3	2.6	373	4.7	1958	0.49	2.39	45.5	50.7	9967	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 14-3	14.4	16.9	1.16	L3	3.2	340	5.5	2055	0.45	3.14	63.9	65	13608					
Wabamun Grid 14-4	21.2	20.5	1.59	L3	3.6	282	6.6	2280	0.43	3.8	79	87	16856	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 14-5	6.2	9.29	0.67	L3	0.8	91	2.13	681	0.28	1.34	19.2	30.2	16428					
Wabamun Grid 14-6	5.7	9.2	0.45	L3	0.7	719	1.74	1061	0.21	1.68	36.7	42	6009	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 14-7	17.9	21.2	1.16	3.89	4	447	4.7	2089	0.42	3.87	75.8	118	15142					
Wabamun Grid 15-1	2.2	5.57	0.23	L3	2	242	1	1099	0.21	0.86	16.4	11.2	3824					
Wabamun Grid 15-4	22.4	22.1	1.9	L3	3.4	269	7	2259	0.46	4.44	82	98	17633					
Wabamun Grid 15-5	22.3	22	1.36	L3	4	280	6.84	2145	0.41	3.65	75.9	101	16575					
Wabamun Grid 15-6-A	4.2	5.28	0.29	L3	L0.4	100	1.3	614	0.37	0.75	25.5	15.1	3241	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 15-6-B	22.4	22.1	1.42	L3	4.1	300	6.54	2139	0.37	4.07	79.4	99.3	16540					
Wabamun Grid 15-6-C	24	23.7	2.21	3.36	4.7	236	6.78	2177	0.42	4.59	84.1	111	18553					
Wabamun Grid 15-6-D	29	23.4	2.42	L3	5.7	214	7.45	2394	0.42	5.36	91	111	18750	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 16-2	12.2	15	0.97	L3	3	411	3.87	2004	0.39	2.98	63.9	64	12507					
Wabamun Grid 16-3	13.7	20.8	1.05	L3	2.5	472	5.16	1857	0.41	2.9	66.2	91.6	12134					
Wabamun Grid 16-4-A	20.2	16.9	1	14.2	2.7	264	8.6	2116	0.44	3.18	63.4	86	15799	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 16-4-B	4.8	8.99	0.57	L3	2	641	1.85	1215	0.26	1.73	35.2	50	6847					
Wabamun Grid 16-4-C	2.8	4.77	0.61	L3	3	808	0.59	462	0.11	2.51	23.8	30.5	2158					
Wabamun Grid 16-4-D	16.2	18.8	1.1	L3	4	462	5.2	2035	0.38	3.3	70.3	97.8	13885	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 17-1	18.1	19.1	1.05	L3	2.6	339	5.9	2173	0.38	3.52	76.3	86	15916	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 18-1-A	15.3	9.5	0.61	L3	1.8	374	3.32	1779	0.28	2.5	54.4	54	12132					
Wabamun Grid 18-1-B																		
Wabamun Grid 18-1-C	18.6	17.3	1.05	L3	3.1	337	5.5	1849	0.39	3.25	70.7	93	16008					
Wabamun Grid 18-1-D																		
Wabamun Grid 18-1-E	15	15.2	0.76	L3	3.5	468	3.03	1583	0.27	2.8	60.4	79.6	11592					
Wabamun Grid 18-2	25.6	21.2	1.75	L3	3.9	258	7.1	2394	0.43	4.5	86	105	17330	L0.1	L0.1	L0.1	L0.1	L0.1

Appendix 1A Sediment analysis for Wabamun Lake and eight other lakes sampled in 2002. (continued)

Station Name	103517 Nickel ug/g	103499 Lead ug/g	103501 Antimony ug/g	103504 Tin ug/g	103521 Selenium ug/g	103522 103505 Strontium ug/g	103506 Thorium ug/g	103507 Titanium ug/g	103508 Thallium ug/g	103509 Uranium ug/g	103510 Vanadium ug/g	103511 Zinc ug/g	103515 Iron ug/g	99140 Trihalomethanes ug/g	99141 Xylene ug/g	99142 Bromobenzene ug/g	99143 Sec-Butylbenzene ug/g	99144 Tert-Butylbenzene ug/g
Wabamun Grid 20-1	29	26.6	2.52	3.85	5.8	226	7.54	2179	0.43	4.89	96.3	129	19524					
Wabamun Grid 20-2																		
Amisk Grid 1-1	16.2	14.4	0.67	L3	2.3	128	3.94	977	0.22	2.27	40.7	55.9	26296	L0.1	L0.1	L0.1	L0.1	L0.1
Amisk Grid 1-2	18	15	0.56	L3	1	145	4.79	1136	0.26	3.37	45.7	64.6	23691	L0.1	L0.1	L0.1	L0.1	L0.1
Amisk Grid 1-3	17.3	18.6	0.52	L3	2.3	134	3.89	871	0.21	3.18	35.8	58.2	22050	L0.1	L0.1	L0.1	L0.1	L0.1
Bonnie Grid 1-1	13	19.1	0.51	L3	1.6	172	3.21	1012	0.19	2.32	32.9	62	16573	L0.1	L0.1	L0.1	L0.1	L0.1
Bonnie Grid 1-2	12.1	12.6	0.54	L3	1.6	210	3.05	862	0.17	2.51	29.1	60.4	18217	L0.1	L0.1	L0.1	L0.1	L0.1
Bonnie Grid 1-3	9.9	8.87	0.46	L3	1.7	244	1.71	658	0.12	1.96	23	46.9	14175	L0.1	L0.1	L0.1	L0.1	L0.1
Gull Grid 1-1	27.1	15.4	0.89	L3	L0.4	754	6.93	2172	0.4	2.41	62.4	64.7	20227	L0.1	L0.1	L0.1	L0.1	L0.1
Gull Grid 1-2	26	15.1	0.78	L3	2	899	4.92	1768	0.34	3.07	56.7	57	17667					
Gull Grid 1-3	17.8	11.9	0.61	L3	0.41	380	5.49	2095	0.39	1.94	45.4	42.8	15164	L0.1	L0.1	L0.1	L0.1	L0.1
Isle Grid 1-1	36.4	16.7	0.79	L3	1.5	93	6.68	1850	0.29	3.57	71	79.2	24842	L0.1	L0.1	L0.1	L0.1	L0.1
Isle Grid 1-2	38.1	17.3	0.75	L3	3.6	110	7.7	1704	0.34	4.36	69.5	81	24211	L0.1	L0.1	L0.1	L0.1	L0.1
ISLE Grid 1-3	33.8	16.4	0.75	L3	1.3	101	6.29	1636	0.26	3.64	60	67.5	23912	L0.1	L0.1	L0.1	L0.1	L0.1
Lac. Ste. Anne Grid 1-1	19.7	18.4	0.54	L3	1.6	192	6.5	1793	0.36	2.78	63.7	63.8	17836	L0.1	L0.1	L0.1	L0.1	L0.1
Lac Ste. Anne Grid 1-2	20.8	16.4	0.6	L3	1.8	176	7.07	2004	0.403	3.25	69.3	72	18384	L0.1	L0.1	L0.1	L0.1	L0.1
Lac Ste. Anne Grid 1-3	22.4	17.5	0.58	L3	1.5	180	6.91	1875	0.36	3.33	69.2	67.7	20111	L0.1	L0.1	L0.1	L0.1	L0.1
Pigeon Grid 1-1	29	21	0.89	L3	1.4	155	9	2264	0.456	2.94	72.7	80.1	28010	L0.1	L0.1	L0.1	L0.1	L0.1
Pigeon Grid 1-2	29.4	21.5	0.86	L3	1.4	149	8.54	2318	0.42	2.83	72.3	79	29533	L0.1	L0.1	L0.1	L0.1	L0.1
Pigeon Grid 1-3	30.2	21.4	0.97	L3	0.9	136	8.5	2283	0.46	2.96	73.6	82	28007	L0.1	L0.1	L0.1	L0.1	L0.1
Sylvan Grid 1-1	9.9	8.64	0.44	L3	L0.4	260	4.3	1325	0.38	1.4	25.2	24.1	8390	L0.1	L0.1	L0.1	L0.1	L0.1
Sylvan Grid 1-2	27.5	23.2	0.86	L3	1.3	777	7.03	2025	0.39	4.03	68	75.1	21508	L0.1	L0.1	L0.1	L0.1	L0.1
Sylvan Grid 1-3	28.8	22.5	1.05	L3	1.9	572	7.7	2167	0.41	3.73	71	81.5	23902	L0.1	L0.1	L0.1	L0.1	L0.1
Wizard Grid 1-1	27.8	32.9	1.07	L3	1.7	200	8.67	2032	0.47	3.93	67.6	76.6	28762	L0.1	L0.1	L0.1	L0.1	L0.1
Wizard Grid 1-2	27.1	26.3	1.01	L3	1.2	195	8.88	2127	0.42	3.59	70.1	78	28880	L0.1	L0.1	L0.1	L0.1	L0.1
Wizard Grid 1-3	28.4	28.4	1.08	L3	1.5	183	8.75	2065	0.46	3.8	69.8	79.3	28410	L0.1	L0.1	L0.1	L0.1	L0.1

Appendix 1A Sediment analysis for Wabamun Lake and eight other lakes sampled in 2002. (continued)

Station Name	99145 N-Butylbenzene ug/g	99146 2-Chlorotoluene ug/g	99147 4-Chlorotoluene ug/g	99148 1,2-Dibromo-3-Chloropropane ug/g	99149 1,2-Dibromoethane ug/g	99150 Cis-1,2-Dichloroethene ug/g	99151 2,2-Dichloropropane ug/g	99152 1,3-Dichloropropane ug/g	99153 1,1-Dichloropropylene ug/g	99154 Hexachlorobutadiene ug/g	99155 Isopropylbenzene ug/g	99156 P-Isopropyltoluene ug/g	99157 Naphthalene ug/g	99158 N-Propylbenzene ug/g	99159 1,1,1,2-Tetrachloroethane ug/g	99160 1,2,3-Trichlorobenzene ug/g	99161 1,2,4-Trichlorobenzene ug/g	99162 Trichloroethylene ug/g	99163 1,2,3-Trichloropropane ug/g	99164 1,2,4-Trimethylbenzene ug/g
Wabamun Grid 1-1-A	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 1-1-B																				
Wabamun Grid 1-1-C	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 1-1-D																				
Wabamun Grid 2-1																				
Wabamun Grid 2-2	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 2-3																				
Wabamun Grid 4-1																				
Wabamun Grid 4-2																				
Wabamun Grid 4-3	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 4-4																				
Wabamun Grid 4-5																				
Wabamun Grid 5-4-A	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 5-4-B																				
Wabamun Grid 5-4-C	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 5-4-D																				
Wabamun Grid 6-1-A	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 6-1-B																				
Wabamun Grid 6-1-C	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 6-1-D																				
Wabamun Grid 6-2	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 6-3																				
Wabamun Grid 8-1																				
Wabamun Grid 8-2																				
Wabamun Grid 8-3-A	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 8-3-B																				
Wabamun Grid 8-3-C																				
Wabamun Grid 8-3-D	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 8-3-E																				
Wabamun Grid 8-4																				
Wabamun Grid 10-1																				
Wabamun Grid 10-2	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 10-3																				
Wabamun Grid 10-4																				
Wabamun Grid 11-3																				
Wabamun Grid 11-4																				
Wabamun Grid 11-5																				

Appendix 1A Sediment analysis for Wabamun Lake and eight other lakes sampled in 2002. (continued)

Station Name	99145 N-Butylbenzene ug/g	99146 2-Chlorotoluene ug/g	99147 4-Chlorotoluene ug/g	99148 1,2-Dibromo-3-Chloropropane ug/g	99149 1,2-Dibromoethane ug/g	99150 Cis-1,2-Dichloroethene ug/g	99151 2,2-Dichloropropane ug/g	99152 1,3-Dichloropropane ug/g	99153 1,1-Dichloropropylene ug/g	99154 Hexachlorobutadiene ug/g	99155 Isopropylbenzene ug/g	99156 P-Isopropyltoluene ug/g	99157 Naphthalene ug/g	99158 N-Propylbenzene ug/g	99159 1,1,1,2-Tetrachloroethane ug/g	99160 1,2,3-Trichlorobenzene ug/g	99161 1,2,4-Trichlorobenzene ug/g	99162 Trichloroethylene ug/g	99163 1,2,3-Trichloropropane ug/g	99164 1,2,4-Trimethylbenzene ug/g
Wabamun Grid 12-1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 12-2																				
Wabamun Grid 12-3	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 12-4																				
Wabamun Grid 12-5	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 13-1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 13-2-A																				
Wabamun Grid 13-2-B	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 13-2-C																				
Wabamun Grid 13-2-D	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 13-4																				
Wabamun Grid 13-5																				
Wabamun Grid 14-2	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 14-3																				
Wabamun Grid 14-4	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 14-5																				
Wabamun Grid 14-6	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 14-7																				
Wabamun Grid 15-1																				
Wabamun Grid 15-4																				
Wabamun Grid 15-5																				
Wabamun Grid 15-6-A	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 15-6-B																				
Wabamun Grid 15-6-C																				
Wabamun Grid 15-6-D	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 16-2																				
Wabamun Grid 16-3																				
Wabamun Grid 16-4-A	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 16-4-B																				
Wabamun Grid 16-4-C																				
Wabamun Grid 16-4-D	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 17-1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 18-1-A																				
Wabamun Grid 18-1-B																				
Wabamun Grid 18-1-C																				
Wabamun Grid 18-1-D																				
Wabamun Grid 18-1-E																				
Wabamun Grid 18-2	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1

Appendix 1A Sediment analysis for Wabamun Lake and eight other lakes sampled in 2002. (continued)

Station Name	99145 N-Butylbenzene ug/g	99146 2-Chlorotoluene ug/g	99147 4-Chlorotoluene ug/g	99148 1,2-Dibromo-3-Chloropropane ug/g	99149 1,2-Dibromoethane ug/g	99150 Cis-1,2-Dichloroethene ug/g	99151 2,2-Dichloropropane ug/g	99152 1,3-Dichloropropane ug/g	99153 1,1-Dichloropropylene ug/g	99154 Hexachlorobutadiene ug/g	99155 Isopropylbenzene ug/g	99156 P-Isopropyltoluene ug/g	99157 Naphthalene ug/g	99158 N-Propylbenzene ug/g	99159 1,1,1,2-Tetrachloroethane ug/g	99160 1,2,3-Trichlorobenzene ug/g	99161 1,2,4-Trichlorobenzene ug/g	99162 Trichloroethylene ug/g	99163 1,2,3-Trichloropropane ug/g	99164 1,2,4-Trimethylbenzene ug/g
Wabamun Grid 20-1																				
Wabamun Grid 20-2																				
Amisk Grid 1-1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Amisk Grid 1-2	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Amisk Grid 1-3	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Bonnie Grid 1-1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Bonnie Grid 1-2	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Bonnie Grid 1-3	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Gull Grid 1-1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Gull Grid 1-2																				
Gull Grid 1-3	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Isle Grid 1-1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Isle Grid 1-2	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
ISLE Grid 1-3	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Lac. Ste. Anne Grid 1-1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Lac Ste. Anne Grid 1-2	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Lac Ste. Anne Grid 1-3	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Pigeon Grid 1-1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Pigeon Grid 1-2	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Pigeon Grid 1-3	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Sylvan Grid 1-1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Sylvan Grid 1-2	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Sylvan Grid 1-3	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wizard Grid 1-1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wizard Grid 1-2	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wizard Grid 1-3	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1

Appendix 1A Sediment analysis for Wabamun Lake and eight other lakes sampled in 2002. (continued)

Station Name	99165 1,3,5-Trimethylbenzene ug/g	99166 MTBE (Methyl Tertiary Butyl Ether) ug/g	99167 Benzene ug/g	99168 Dichlorobromomethane ug/g	99169 Bromoform ug/g	99170 Bromomethane ug/g	99172 Carbon Tetrachloride ug/g	99173 Chlorobenzene ug/g	99174 Chloroethane ug/g	99175 2-Chloroethylvinylether ug/g	99176 Chloroform ug/g	99177 Dibromochloromethane ug/g	99178 Dibromomethane ug/g	99179 1,2-Dichlorobenzene ug/g	99180 1,3-Dichlorobenzene ug/g	99181 1,4-Dichlorobenzene ug/g	99182 1,1-Dichloroethane ug/g	99183 1,2-Dichloroethane ug/g	99184 1,1-Dichloroethylene ug/g	99185 Trans-1,2-Dichloroethene ug/g	99186 1,2-Dichloropropane ug/g
Wabamun Grid 1-1-A	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 1-1-B																					
Wabamun Grid 1-1-C	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 1-1-D																					
Wabamun Grid 2-1																					
Wabamun Grid 2-2	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 2-3																					
Wabamun Grid 4-1																					
Wabamun Grid 4-2																					
Wabamun Grid 4-3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 4-4																					
Wabamun Grid 4-5																					
Wabamun Grid 5-4-A	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 5-4-B																					
Wabamun Grid 5-4-C	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 5-4-D																					
Wabamun Grid 6-1-A	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 6-1-B																					
Wabamun Grid 6-1-C	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 6-1-D																					
Wabamun Grid 6-2	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 6-3																					
Wabamun Grid 8-1																					
Wabamun Grid 8-2																					
Wabamun Grid 8-3-A	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 8-3-B																					
Wabamun Grid 8-3-C																					
Wabamun Grid 8-3-D	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 8-3-E																					
Wabamun Grid 8-4																					
Wabamun Grid 10-1																					
Wabamun Grid 10-2	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 10-3																					
Wabamun Grid 10-4																					
Wabamun Grid 11-3																					
Wabamun Grid 11-4																					
Wabamun Grid 11-5																					

Appendix 1A Sediment analysis for Wabamun Lake and eight other lakes sampled in 2002. (continued)

Station Name	99165 1,3,5-Trimethylbenzene ug/g	99166 MTBE (Methyl Tertiary Butyl Ether) ug/g	99167 Benzene ug/g	99168 Dichlorobromomethane ug/g	99169 Bromoform ug/g	99170 Bromomethane ug/g	99172 Carbon Tetrachloride ug/g	99173 Chlorobenzene ug/g	99174 Chloroethane ug/g	99175 2-Chloroethylvinylether ug/g	99176 Chloroform ug/g	99177 Dibromochloromethane ug/g	99178 Dibromomethane ug/g	99179 1,2-Dichlorobenzene ug/g	99180 1,3-Dichlorobenzene ug/g	99181 1,4-Dichlorobenzene ug/g	99182 1,1-Dichloroethane ug/g	99183 1,2-Dichloroethane ug/g	99184 1,1-Dichloroethylene ug/g	99185 Trans-1,2-Dichloroethene ug/g	99186 1,2-Dichloropropane ug/g
Wabamun Grid 12-1	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 12-2																					
Wabamun Grid 12-3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 12-4																					
Wabamun Grid 12-5	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 13-1	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 13-2-A																					
Wabamun Grid 13-2-B	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 13-2-C																					
Wabamun Grid 13-2-D	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 13-4																					
Wabamun Grid 13-5																					
Wabamun Grid 14-2	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 14-3																					
Wabamun Grid 14-4	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 14-5																					
Wabamun Grid 14-6	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 14-7																					
Wabamun Grid 15-1																					
Wabamun Grid 15-4																					
Wabamun Grid 15-5																					
Wabamun Grid 15-6-A	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 15-6-B																					
Wabamun Grid 15-6-C																					
Wabamun Grid 15-6-D	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 16-2																					
Wabamun Grid 16-3																					
Wabamun Grid 16-4-A	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 16-4-B																					
Wabamun Grid 16-4-C																					
Wabamun Grid 16-4-D	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 17-1	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wabamun Grid 18-1-A																					
Wabamun Grid 18-1-B																					
Wabamun Grid 18-1-C																					
Wabamun Grid 18-1-D																					
Wabamun Grid 18-1-E																					
Wabamun Grid 18-2	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1

Appendix 1A Sediment analysis for Wabamun Lake and eight other lakes sampled in 2002. (continued)

Station Name	99165 1,3,5-Trimethylbenzene ug/g	99166 MTBE (Methyl Tertiary Butyl Ether) ug/g	99167 Benzene ug/g	99168 Dichlorobromomethane ug/g	99169 Bromoform ug/g	99170 Bromomethane ug/g	99172 Carbon Tetrachloride ug/g	99173 Chlorobenzene ug/g	99174 Chloroethane ug/g	99175 2-Chloroethylvinylether ug/g	99176 Chloroform ug/g	99177 Dibromochloromethane ug/g	99178 Dibromomethane ug/g	99179 1,2-Dichlorobenzene ug/g	99180 1,3-Dichlorobenzene ug/g	99181 1,4-Dichlorobenzene ug/g	99182 1,1-Dichloroethane ug/g	99183 1,2-Dichloroethane ug/g	99184 1,1-Dichloroethylene ug/g	99185 Trans-1,2-Dichloroethene ug/g	99186 1,2-Dichloropropane ug/g
Wabamun Grid 20-1																					
Wabamun Grid 20-2																					
Amisk Grid 1-1	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Amisk Grid 1-2	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Amisk Grid 1-3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Bonnie Grid 1-1	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Bonnie Grid 1-2	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Bonnie Grid 1-3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Gull Grid 1-1	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Gull Grid 1-2																					
Gull Grid 1-3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Isle Grid 1-1	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Isle Grid 1-2	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
ISLE Grid 1-3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Lac. Ste. Anne Grid 1-1	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Lac Ste. Anne Grid 1-2	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Lac Ste. Anne Grid 1-3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Pigeon Grid 1-1	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Pigeon Grid 1-2	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Pigeon Grid 1-3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Sylvan Grid 1-1	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Sylvan Grid 1-2	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Sylvan Grid 1-3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wizard Grid 1-1	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wizard Grid 1-2	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1
Wizard Grid 1-3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L0.1	L0.1	L0.4	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1	L0.1

Appendix 1A Sediment analysis for Wabamun Lake and eight other lakes sampled in 2002. (continued)

Station Name	99187 Cis-1,3-Dichloropropene ug/g	99188 Trans-1,3-Dichloropropene ug/g	99189 Ethyl Benzene ug/g	99190 Methylene Chloride ug/g	99191 Styrene ug/g	99192 1,1,2,2-Tetrachloroethane ug/g	99193 Tetrachloroethylene ug/g	99194 Toluene ug/g	99195 1,1,1-Trichloroethane ug/g	99196 1,1,2-Trichloroethane ug/g	99197 Trichlorofluoromethane ug/g	99198 Vinyl Chloride ug/g	99199 O-Xylene ug/g	99200 M- + P-Xylene ug/g	99075 4-Chloro-3-Methylphenol ug/g	99071 2-Chlorophenol ug/g	99065 2,4-Dichlorophenol ug/g	99066 2,4-Dimethylphenol ug/g	99072 2-Methyl-4,6-Dinitrophenol ug/g	99067 2,4-Dinitrophenol ug/g
Wabamun Grid 1-1-A	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Wabamun Grid 1-1-B																				
Wabamun Grid 1-1-C	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Wabamun Grid 1-1-D																				
Wabamun Grid 2-1																				
Wabamun Grid 2-2	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Wabamun Grid 2-3																				
Wabamun Grid 4-1																				
Wabamun Grid 4-2																				
Wabamun Grid 4-3	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Wabamun Grid 4-4																				
Wabamun Grid 4-5																				
Wabamun Grid 5-4-A	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Wabamun Grid 5-4-B																				
Wabamun Grid 5-4-C	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Wabamun Grid 5-4-D																				
Wabamun Grid 6-1-A	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Wabamun Grid 6-1-B																				
Wabamun Grid 6-1-C	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	0.11	L4	L2	L4	L2	L2
Wabamun Grid 6-1-D																				
Wabamun Grid 6-2	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Wabamun Grid 6-3																				
Wabamun Grid 8-1																				
Wabamun Grid 8-2																				
Wabamun Grid 8-3-A	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Wabamun Grid 8-3-B																				
Wabamun Grid 8-3-C																				
Wabamun Grid 8-3-D	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Wabamun Grid 8-3-E																				
Wabamun Grid 8-4																				
Wabamun Grid 10-1																				
Wabamun Grid 10-2	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Wabamun Grid 10-3																				
Wabamun Grid 10-4																				
Wabamun Grid 11-3																				
Wabamun Grid 11-4																				
Wabamun Grid 11-5																				

Appendix 1A Sediment analysis for Wabamun Lake and eight other lakes sampled in 2002. (continued)

Station Name	99187 Cis-1,3-Dichloropropene ug/g	99188 Trans-1,3-Dichloropropene ug/g	99189 Ethyl Benzene ug/g	99190 Methylene Chloride ug/g	99191 Styrene ug/g	99192 1,1,2,2-Tetrachloroethane ug/g	99193 Tetrachloroethylene ug/g	99194 Toluene ug/g	99195 1,1,1-Trichloroethane ug/g	99196 1,1,2-Trichloroethane ug/g	99197 Trichlorofluoromethane ug/g	99198 Vinyl Chloride ug/g	99199 O-Xylene ug/g	99200 M- + P-Xylene ug/g	99075 4-Chloro-3-Methylphenol ug/g	99071 2-Chlorophenol ug/g	99065 2,4-Dichlorophenol ug/g	99066 2,4-Dimethylphenol ug/g	99072 2-Methyl-4,6-Dinitrophenol ug/g	99067 2,4-Dinitrophenol ug/g
Wabamun Grid 12-1	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Wabamun Grid 12-2																				
Wabamun Grid 12-3	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Wabamun Grid 12-4																				
Wabamun Grid 12-5	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Wabamun Grid 13-1	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Wabamun Grid 13-2-A																				
Wabamun Grid 13-2-B	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Wabamun Grid 13-2-C																				
Wabamun Grid 13-2-D	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Wabamun Grid 13-4																				
Wabamun Grid 13-5																				
Wabamun Grid 14-2	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Wabamun Grid 14-3																				
Wabamun Grid 14-4	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Wabamun Grid 14-5																				
Wabamun Grid 14-6	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Wabamun Grid 14-7																				
Wabamun Grid 15-1																				
Wabamun Grid 15-4																				
Wabamun Grid 15-5																				
Wabamun Grid 15-6-A	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Wabamun Grid 15-6-B																				
Wabamun Grid 15-6-C																				
Wabamun Grid 15-6-D	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Wabamun Grid 16-2																				
Wabamun Grid 16-3																				
Wabamun Grid 16-4-A	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Wabamun Grid 16-4-B																				
Wabamun Grid 16-4-C																				
Wabamun Grid 16-4-D	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Wabamun Grid 17-1	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Wabamun Grid 18-1-A																				
Wabamun Grid 18-1-B																				
Wabamun Grid 18-1-C																				
Wabamun Grid 18-1-D																				
Wabamun Grid 18-1-E																				
Wabamun Grid 18-2	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2

Appendix 1A Sediment analysis for Wabamun Lake and eight other lakes sampled in 2002. (continued)

Station Name	99187 Cis-1,3-Dichloropropene ug/g	99188 Trans-1,3-Dichloropropene ug/g	99189 Ethyl Benzene ug/g	99190 Methylene Chloride ug/g	99191 Styrene ug/g	99192 1,1,2,2-Tetrachloroethane ug/g	99193 Tetrachloroethylene ug/g	99194 Toluene ug/g	99195 1,1,1-Trichloroethane ug/g	99196 1,1,2-Trichloroethane ug/g	99197 Trichlorofluoromethane ug/g	99198 Vinyl Chloride ug/g	99199 O-Xylene ug/g	99200 M- + P-Xylene ug/g	99075 4-Chloro-3-Methylphenol ug/g	99071 2-Chlorophenol ug/g	99065 2,4-Dichlorophenol ug/g	99066 2,4-Dimethylphenol ug/g	99072 2-Methyl-4,6-Dinitrophenol ug/g	99067 2,4-Dinitrophenol ug/g
Wabamun Grid 20-1																				
Wabamun Grid 20-2																				
Amisk Grid 1-1	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Amisk Grid 1-2	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Amisk Grid 1-3	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Bonnie Grid 1-1	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Bonnie Grid 1-2	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Bonnie Grid 1-3	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Gull Grid 1-1	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Gull Grid 1-2															L2	L4	L2	L4	L2	L2
Gull Grid 1-3	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Isle Grid 1-1	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Isle Grid 1-2	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
ISLE Grid 1-3	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Lac. Ste. Anne Grid 1-1	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Lac Ste. Anne Grid 1-2	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Lac Ste. Anne Grid 1-3	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Pigeon Grid 1-1	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Pigeon Grid 1-2	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Pigeon Grid 1-3	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Sylvan Grid 1-1	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Sylvan Grid 1-2	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Sylvan Grid 1-3	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Wizard Grid 1-1	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Wizard Grid 1-2	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2
Wizard Grid 1-3	L0.3	L0.3	L0.1	L2	L0.1	L0.1	L0.3	L0.1	L0.1	L0.1	L0.1	L0.5	L0.1	L0.1	L2	L4	L2	L4	L2	L2

Appendix 1A Sediment analysis for Wabamun Lake and eight other lakes sampled in 2002. (continued)

Station Name	99073 2-Nitrophenol ug/g	99077 4-Nitrophenol ug/g	99110 Pentachlorophenol ug/g	99112 Phenol ug/g	99064 2,4,6-Trichlorophenol ug/g	99084 Benzo(B)Fluoranthene ug/g	99086 Benzo(K)Fluoranthene ug/g	99070 2-Chloronaphthalene ug/g	99100 Hexachlorobenzene ug/g	99101 Hexachlorobutadiene ug/g	99102 Hexachlorocyclopentadiene ug/g	99103 Hexachloroethane ug/g	99061 1,2,4-Trichlorobenzene ug/g	99081 Benzidene ug/g	99068 2,4-Dinitrotoluene ug/g	99069 2,6-Dinitrotoluene ug/g	99062 1,2-Diphenylhydrazine ug/g	99109 Nitrobenzene ug/g	99107 N-Nitrosodiphenylamine ug/g	99106 N-Nitrosodi-N-Propylamine ug/g
Wabamun Grid 1-1-A	L2	L2	L2	0.04	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Wabamun Grid 1-1-B																				
Wabamun Grid 1-1-C	L2	L2	L2	0.02	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Wabamun Grid 1-1-D																				
Wabamun Grid 2-1																				
Wabamun Grid 2-2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Wabamun Grid 2-3																				
Wabamun Grid 4-1																				
Wabamun Grid 4-2																				
Wabamun Grid 4-3	L2	L2	L2	0.12	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Wabamun Grid 4-4																				
Wabamun Grid 4-5																				
Wabamun Grid 5-4-A	L2	L2	L2	L2	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Wabamun Grid 5-4-B																				
Wabamun Grid 5-4-C	L2	L2	L2	L2	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Wabamun Grid 5-4-D																				
Wabamun Grid 6-1-A	L2	L2	L2	0.07	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Wabamun Grid 6-1-B																				
Wabamun Grid 6-1-C	L2	L2	L2	0.02	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Wabamun Grid 6-1-D																				
Wabamun Grid 6-2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Wabamun Grid 6-3																				
Wabamun Grid 8-1																				
Wabamun Grid 8-2																				
Wabamun Grid 8-3-A	L2	L2	L2	L2	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Wabamun Grid 8-3-B																				
Wabamun Grid 8-3-C																				
Wabamun Grid 8-3-D	L2	L2	L2	L2	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Wabamun Grid 8-3-E																				
Wabamun Grid 8-4																				
Wabamun Grid 10-1																				
Wabamun Grid 10-2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Wabamun Grid 10-3																				
Wabamun Grid 10-4																				
Wabamun Grid 11-3																				
Wabamun Grid 11-4																				
Wabamun Grid 11-5																				

Appendix 1A Sediment analysis for Wabamun Lake and eight other lakes sampled in 2002. (continued)

Station Name	99073 2-Nitrophenol ug/g	99077 4-Nitrophenol ug/g	99110 Pentachlorophenol ug/g	99112 Phenol ug/g	99064 2,4,6-Trichlorophenol ug/g	99084 Benzo (B)Fluoranthene ug/g	99086 Benzo (K)Fluoranthene ug/g	99070 2-Chloronaphthalene ug/g	99100 Hexachlorobenzene ug/g	99101 Hexachlorobutadiene ug/g	99102 Hexachlorocyclopentadiene ug/g	99103 Hexachloroethane ug/g	99061 1,2,4-Trichlorobenzene ug/g	99081 Benzidene ug/g	99068 2,4-Dinitrotoluene ug/g	99069 2,6-Dinitrotoluene ug/g	99062 1,2-Diphenylhydrazine ug/g	99109 Nitrobenzene ug/g	99107 N-Nitrosodiphenylamine ug/g	99106 N-Nitrosodi-N-Propylamine ug/g
Wabamun Grid 12-1	L2	L2	L2	L2	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Wabamun Grid 12-2																				
Wabamun Grid 12-3	L2	L2	L2	L2	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Wabamun Grid 12-4																				
Wabamun Grid 12-5	L2	L2	L2	0.01	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Wabamun Grid 13-1	L2	L2	L2	L2	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Wabamun Grid 13-2-A																				
Wabamun Grid 13-2-B	L2	L2	L2	L2	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Wabamun Grid 13-2-C																				
Wabamun Grid 13-2-D	L2	L2	L2	L2	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Wabamun Grid 13-4																				
Wabamun Grid 13-5																				
Wabamun Grid 14-2	L2	L2	L2	0.02	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Wabamun Grid 14-3																				
Wabamun Grid 14-4	L2	L2	L2	L2	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Wabamun Grid 14-5																				
Wabamun Grid 14-6	L2	L2	L2	L2	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Wabamun Grid 14-7																				
Wabamun Grid 15-1																				
Wabamun Grid 15-4																				
Wabamun Grid 15-5																				
Wabamun Grid 15-6-A	L2	L2	L2	0.03	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Wabamun Grid 15-6-B																				
Wabamun Grid 15-6-C																				
Wabamun Grid 15-6-D	L2	L2	L2	L2	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Wabamun Grid 16-2																				
Wabamun Grid 16-3																				
Wabamun Grid 16-4-A	L2	L2	L2	L2	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Wabamun Grid 16-4-B																				
Wabamun Grid 16-4-C																				
Wabamun Grid 16-4-D	L2	L2	L2	0.03	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Wabamun Grid 17-1	L2	L2	L2	0.01	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Wabamun Grid 18-1-A																				
Wabamun Grid 18-1-B																				
Wabamun Grid 18-1-C																				
Wabamun Grid 18-1-D																				
Wabamun Grid 18-1-E																				
Wabamun Grid 18-2	L2	L2	L2	L2	L2	0.077	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4

Appendix 1A Sediment analysis for Wabamun Lake and eight other lakes sampled in 2002. (continued)

Station Name	99073 2-Nitrophenol ug/g	99077 4-Nitrophenol ug/g	99110 Pentachlorophenol ug/g	99112 Phenol ug/g	99064 2,4,6-Trichlorophenol ug/g	99084 Benzo (B)Fluoranthene ug/g	99086 Benzo (K)Fluoranthene ug/g	99070 2-Chloronaphthalene ug/g	99100 Hexachlorobenzene ug/g	99101 Hexachlorobutadiene ug/g	99102 Hexachlorocyclopentadiene ug/g	99103 Hexachloroethane ug/g	99061 1,2,4-Trichlorobenzene ug/g	99081 Benzidene ug/g	99068 2,4-Dinitrotoluene ug/g	99069 2,6-Dinitrotoluene ug/g	99062 1,2-Diphenylhydrazine ug/g	99109 Nitrobenzene ug/g	99107 N-Nitrosodiphenylamine ug/g	99106 N-Nitrosodi-N-Propylamine ug/g
Wabamun Grid 20-1																				
Wabamun Grid 20-2																				
Amisk Grid 1-1	L2	L2	L2	0.04	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Amisk Grid 1-2	L2	L2	L2	0.14	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Amisk Grid 1-3	L2	L2	L2	0.24	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Bonnie Grid 1-1	L2	L2	L2	0.32	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Bonnie Grid 1-2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Bonnie Grid 1-3	L2	L2	L2	0.1997	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Gull Grid 1-1	L2	L2	L2	L2	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Gull Grid 1-2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Gull Grid 1-3	L2	L2	L2	0.02	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Isle Grid 1-1	L2	L2	L2	L2	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Isle Grid 1-2	L2	L2	L2	0.20	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
ISLE Grid 1-3	L2	L2	L2	0.50	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Lac. Ste. Anne Grid 1-1	L2	L2	L2	L2	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Lac Ste. Anne Grid 1-2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Lac Ste. Anne Grid 1-3	L2	L2	L2	L2	L2	L2	L2	L2	L2	L5	L2	L5	L2	0.02	L2	L2	L2	L2	L2	L4
Pigeon Grid 1-1	L2	L2	L2	L2	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Pigeon Grid 1-2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Pigeon Grid 1-3	L2	L2	L2	L2	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Sylvan Grid 1-1	L2	L2	L2	L2	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Sylvan Grid 1-2	L2	L2	L2	0.41	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Sylvan Grid 1-3	L2	L2	L2	L2	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Wizard Grid 1-1	L2	L2	L2	L2	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Wizard Grid 1-2	L2	L2	L2	L2	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4
Wizard Grid 1-3	L2	L2	L2	L2	L2	L2	L2	L2	L2	L5	L2	L5	L2	L4	L2	L2	L2	L2	L2	L4

Appendix 1A Sediment analysis for Wabamun Lake and eight other lakes sampled in 2002. (continued)

Station Name	99074 4-Bromophenyl Phenyl Ether ug/g	99087 Bis(2-Chloroethoxy) Methane ug/g	99088 Bis(2-Chloroethyl) Ether ug/g	99089 Bis(2-Chloroisopropyl) Ether ug/g	99076 4-Chlorophenyl Phenyl Ether ug/g	99105 Isophorone ug/g	99063 2,3,4,6-Tetrachlorophenol ug/g	10532 Naphthalene ng/g	10535 Acenaphthylene ng/g	10536 Acenaphthene ng/g	10537 Fluorene ng/g	10538 Phenanthrene ng/g	10539 Anthracene ng/g	10540 Acridine ng/g	10541 Pyrene ng/g	10542 Fluoranthene ng/g
Wabamun Grid 1-1-A	L2	L2	L2	L2	L2	L2	L2	0.7	L1	L1	4.3	4	3.4	L1	7.4	L1
Wabamun Grid 1-1-B																
Wabamun Grid 1-1-C	L2	L2	L2	L2	L2	L2	L2	L1	L1	L1	1.6	1.1	2	L1	1.6	1.7
Wabamun Grid 1-1-D																
Wabamun Grid 2-1																
Wabamun Grid 2-2	L2	L2	L2	L2	L2	L2	L2	L1	L1	L1	1.1	2.1	L1	L1	4.2	2.2
Wabamun Grid 2-3																
Wabamun Grid 4-1																
Wabamun Grid 4-2																
Wabamun Grid 4-3	L2	L2	L2	L2	L2	L2	L2	4.1	0.36	L1	7.9	4	5.2	L1	7.9	L1
Wabamun Grid 4-4																
Wabamun Grid 4-5																
Wabamun Grid 5-4-A	L2	L2	L2	L2	L2	L2	L2	L1	L1	L1	2.2	1.2	1.4	6.4	L1	5.3
Wabamun Grid 5-4-B																
Wabamun Grid 5-4-C	L2	L2	L2	L2	L2	L2	L2	L1	L1	L1	L1	L1	0.15	0.64	L1	L1
Wabamun Grid 5-4-D																
Wabamun Grid 6-1-A	L2	L2	L2	L2	L2	L2	L2	6.5	L1	L1	8.1	10.8	5	L1	11	L1
Wabamun Grid 6-1-B																
Wabamun Grid 6-1-C	L2	L2	L2	L2	L2	L2	L2	L1	L1	L1	3.2	1.5	2.2	L1	6.4	4.1
Wabamun Grid 6-1-D																
Wabamun Grid 6-2	L2	L2	L2	L2	L2	L2	L2	0.9	L1	L1	11.2	13.1	7.5	L1	27.6	3.3
Wabamun Grid 6-3																
Wabamun Grid 8-1																
Wabamun Grid 8-2																
Wabamun Grid 8-3-A	L2	L2	L2	L2	L2	L2	L2	4.9	L1	L1	1.9	2.4	L1	L1	6	3.5
Wabamun Grid 8-3-B																
Wabamun Grid 8-3-C																
Wabamun Grid 8-3-D	L2	L2	L2	L2	L2	L2	L2	228.7	L1	L1	4.7	10.6	2.2	L1	13.8	15.4
Wabamun Grid 8-3-E																
Wabamun Grid 8-4																
Wabamun Grid 10-1																
Wabamun Grid 10-2	L2	L2	L2	L2	L2	L2	L2	2.5	L1	L1	2.2	3	5.1	7	7.2	10
Wabamun Grid 10-3																
Wabamun Grid 10-4																
Wabamun Grid 11-3																
Wabamun Grid 11-4																
Wabamun Grid 11-5																

Appendix 1A Sediment analysis for Wabamun Lake and eight other lakes sampled in 2002. (continued)

Station Name	99074 4-Bromophenyl Phenyl Ether ug/g	99087 Bis(2-Chloroethoxy) Methane ug/g	99088 Bis(2-Chloroethyl) Ether ug/g	99089 Bis(2-Chloroisopropyl) Ether ug/g	99076 4-Chlorophenyl Phenyl Ether ug/g	99105 Isophorone ug/g	99063 2,3,4,6-Tetrachlorophenol ug/g	10532 Naphthalene ng/g	10535 Acenaphthylene ng/g	10536 Acenaphthene ng/g	10537 Fluorene ng/g	10538 Phenanthrene ng/g	10539 Anthracene ng/g	10540 Acridine ng/g	10541 Pyrene ng/g	10542 Fluoranthene ng/g
Wabamun Grid 12-1	L2	L2	L2	L2	L2	L2	L2	2.4	L1	L1	2	2.1	L1	L1	5.2	3.4
Wabamun Grid 12-2																
Wabamun Grid 12-3	L2	L2	L2	L2	L2	L2	L2	0.5	L1	L1	3	14.5	5.6	23.4	25.1	9.7
Wabamun Grid 12-4																
Wabamun Grid 12-5	L2	L2	L2	L2	L2	L2	L2	L1	L1	L1	L1	L1	1.2	L1	L1	L1
Wabamun Grid 13-1	L2	L2	L2	L2	L2	L2	L2	L1	L1	L1	0.12	L1	L1	L1	L1	0.28
Wabamun Grid 13-2-A																
Wabamun Grid 13-2-B	L2	L2	L2	L2	L2	L2	L2	2.4	L1	L1	1.9	1.4	0.41	L1	4.1	2.9
Wabamun Grid 13-2-C																
Wabamun Grid 13-2-D	L2	L2	L2	L2	L2	L2	L2	L1	L1	L1	1.9	1.6	0.22	L1	2.6	2.6
Wabamun Grid 13-4																
Wabamun Grid 13-5																
Wabamun Grid 14-2	L2	L2	L2	L2	L2	L2	L2	L1	L1	L1	1.5	0.4	0.24	L1	1.8	2.2
Wabamun Grid 14-3																
Wabamun Grid 14-4	L2	L2	L2	L2	L2	L2	L2	0.4	L1	L1	1.9	2.8	0.6	L1	5.1	4
Wabamun Grid 14-5																
Wabamun Grid 14-6	L2	L2	L2	L2	L2	L2	L2	L1	L1	L1	3	3.6	2.9	12.4	12.8	6.2
Wabamun Grid 14-7																
Wabamun Grid 15-1																
Wabamun Grid 15-4																
Wabamun Grid 15-5																
Wabamun Grid 15-6-A	L2	L2	L2	L2	L2	L2	L2	L1	L1	L1	2.5	5.8	9.7	L1	61.2	L1
Wabamun Grid 15-6-B																
Wabamun Grid 15-6-C																
Wabamun Grid 15-6-D	L2	L2	L2	L2	L2	L2	L2	3.7	0.76	L1	4.8	8.2	1.5	L1	L1	9.2
Wabamun Grid 16-2																
Wabamun Grid 16-3																
Wabamun Grid 16-4-A	L2	L2	L2	L2	L2	L2	L2	L1	L1	L1	1.9	6.6	2.7	L1	22.9	5.5
Wabamun Grid 16-4-B																
Wabamun Grid 16-4-C																
Wabamun Grid 16-4-D	L2	L2	L2	L2	L2	L2	L2	L1	L1	L1	L1	1.1	4.8	2.6	18.6	0.66
Wabamun Grid 17-1	L2	L2	L2	L2	L2	L2	L2	0.7	0.2	L1	3.1	8	1.5	L1	11.7	6.1
Wabamun Grid 18-1-A																
Wabamun Grid 18-1-B																
Wabamun Grid 18-1-C																
Wabamun Grid 18-1-D																
Wabamun Grid 18-1-E																
Wabamun Grid 18-2	L2	L2	L2	L2	L2	L2	L2	L1	L1	L1	3	15.1	L1	L1	51.8	9.4

Appendix 1A Sediment analysis for Wabamun Lake and eight other lakes sampled in 2002. (continued)

Station Name	99074 4-Bromophenyl Phenyl Ether ug/g	99087 Bis(2-Chloroethoxy) Methane ug/g	99088 Bis(2-Chloroethyl) Ether ug/g	99089 Bis(2-Chloroisopropyl) Ether ug/g	99076 4-Chlorophenyl Phenyl Ether ug/g	99105 Isophorone ug/g	99063 2,3,4,6-Tetrachlorophenol ug/g	10532 Naphthalene ng/g	10535 Acenaphthylene ng/g	10536 Acenaphthene ng/g	10537 Fluorene ng/g	10538 Phenanthrene ng/g	10539 Anthracene ng/g	10540 Acridine ng/g	10541 Pyrene ng/g	10542 Fluoranthene ng/g
Wabamun Grid 20-1																
Wabamun Grid 20-2																
Amisk Grid 1-1	L2	L2	L2	L2	L2	L2	L2	L1	L1	L1	1	1.21	L1	L1	2	2.1
Amisk Grid 1-2	L2	L2	L2	L2	L2	L2	L2	0.4	L1	L1	1.5	1.51	L1	L1	1.9	2.2
Amisk Grid 1-3	L2	L2	L2	L2	L2	L2	L2	1	L1	L1	1.6	1.71	L1	L1	3.3	4
Bonnie Grid 1-1	L2	L2	L2	L2	L2	L2	L2	L1	L1	L1	5.06	L1	L1	L1	8.02	L1
Bonnie Grid 1-2	L2	L2	L2	L2	L2	L2	L2	L1	L1	L1	4.46	1.8	L1	L1	1.82	2.54
Bonnie Grid 1-3	L2	L2	L2	L2	L2	L2	L2	L1	L1	L1	4.46	2.3	L1	L1	2.02	2.74
Gull Grid 1-1	L2	L2	L2	L2	L2	L2	L2	L1	L1	L1	0.95	2.4	L1	L1	1.2	1.2
Gull Grid 1-2	L2	L2	L2	L2	L2	L2	L2	L1	L1	L1	1.1	2.3	L1	L1	0.94	0.96
Gull Grid 1-3	L2	L2	L2	L2	L2	L2	L2	L1	L1	L1	0.44	1	L1	L1	0.46	0.51
Isle Grid 1-1	L2	L2	L2	L2	L2	L2	L2	L1	L1	L1	L1	L1	L1	L1	L1	L1
Isle Grid 1-2	L2	L2	L2	L2	L2	L2	L2	1.1	L1	L1	1.1	2.11	L1	L1	2.6	2.3
ISLE Grid 1-3	L2	L2	L2	L2	L2	L2	L2	L1	L1	L1	L1	L1	L1	L1	L1	L1
Lac. Ste. Anne Grid 1-1	L2	L2	L2	L2	L2	L2	L2	L1	L1	L1	1.06	3.5	L1	L1	2.82	3.14
Lac Ste. Anne Grid 1-2	L2	L2	L2	L2	L2	L2	L2	L1	L1	L1	1.36	4.3	L1	L1	3.22	4.14
Lac Ste. Anne Grid 1-3	L2	L2	L2	L2	L2	L2	L2	L1	L1	L1	0.32	1.1	L1	L1	1.22	1.44
Pigeon Grid 1-1	L2	L2	L2	L2	L2	L2	L2	L1	L1	L1	0.56	2.4	L1	L1	1.72	1.94
Pigeon Grid 1-2	L2	L2	L2	L2	L2	L2	L2	L1	L1	L1	0.46	2.8	L1	L1	1.72	2.04
Pigeon Grid 1-3	L2	L2	L2	L2	L2	L2	L2	L1	L1	L1	0.25	1.8	L1	L1	1.32	1.54
Sylvan Grid 1-1	L2	L2	L2	L2	L2	L2	L2	L1	L1	L1	0.084	0.22	L1	L1	0.17	0.16
Sylvan Grid 1-2	L2	L2	L2	L2	L2	L2	L2	L1	L1	L1	0.69	2	L1	L1	2.1	2.2
Sylvan Grid 1-3	L2	L2	L2	L2	L2	L2	L2	L1	L1	L1	0.63	1.5	L1	L1	0.85	0.94
Wizard Grid 1-1	L2	L2	L2	L2	L2	L2	L2	L1	L1	L1	1.1	1.01	L1	L1	4	3.4
Wizard Grid 1-2	L2	L2	L2	L2	L2	L2	L2	0.4	L1	0.73	1	1.11	L1	L1	4.3	3.4
Wizard Grid 1-3	L2	L2	L2	L2	L2	L2	L2	L1	L1	L1	1	0.91	L1	L1	3.6	2.9

Appendix 1A Sediment analysis for Wabamun Lake and eight other lakes sampled in 2002. (continued)

Station Name	10543 Retene (7-Isopropyl-1-Methylphenanthrene) ng/g	10544 Benzo(C)Phenanthrene ng/g	10545 Benzo(A)Anthracene ng/g	10546 Chrysene ng/g	10547 Benzo(B,J,K)Fluoranthene ng/g	10548 7,12-Dimethylbenz(A)Anthracene ng/g	10549 Benzo(E)Pyrene ng/g	10550 Benzo(A)Pyrene ng/g	10553 3-Methylcholanthrene ng/g	10554 Indeno(1,2,3-C,D)Pyrene ng/g	10555 Dibenzo(A,H)Anthracene ng/g	10556 Benzo(G,H,I)Perylene ng/g	10557 Dibenzo(A,L)Pyrene ng/g	10558 Dibenzo(A,I)Pyrene ng/g	10559 Dibenzo(A,H)Pyrene ng/g
Wabamun Grid 1-1-A	L1	L1	5.6	19.7	17.9	L1	17.7	16.8	L1	5.1	2.3	4.7	L1	L1	L1
Wabamun Grid 1-1-B															
Wabamun Grid 1-1-C	L1	L1	1.9	6.1	8.3	L1	5.1	4.6	L1	1.8	0.69	1.7	4.1	L1	L1
Wabamun Grid 1-1-D															
Wabamun Grid 2-1															
Wabamun Grid 2-2	1.3	L1	2.3	5.2	6.3	L1	9	4.8	L1	2	1.2	1.9	L1	L1	L1
Wabamun Grid 2-3															
Wabamun Grid 4-1															
Wabamun Grid 4-2															
Wabamun Grid 4-3	L1	L1	4.3	23.4	L1	24.7	15.9	19.3	L1	5.8	2.2	5.4	L1	L1	L1
Wabamun Grid 4-4															
Wabamun Grid 4-5															
Wabamun Grid 5-4-A	L1	L1	L1	L1	4.8	L1	16	14.5	L1	15.7	1.9	2.2	L1	L1	L1
Wabamun Grid 5-4-B															
Wabamun Grid 5-4-C	L1	L1	L1	L1	L1	L1	0.10	0.11	L1	0.12	0.08	L1	L1	L1	L1
Wabamun Grid 5-4-D															
Wabamun Grid 6-1-A	L1	L1	5.1	16.2	24.3	L1	14	13.4	L1	6.5	2.1	6	L1	L1	L1
Wabamun Grid 6-1-B															
Wabamun Grid 6-1-C	L1	L1	3.1	8.4	13.3	L1	7.9	7.6	L1	3.3	1.1	3.1	4.6	L1	L1
Wabamun Grid 6-1-D															
Wabamun Grid 6-2	L1	L1	5.8	15.3	41.4	L1	15.4	15.1	L1	19.3	2.3	3.6	L1	L1	L1
Wabamun Grid 6-3															
Wabamun Grid 8-1															
Wabamun Grid 8-2															
Wabamun Grid 8-3-A	7.8	L1	7.2	17	9.1	4.9	22.6	19.7	L1	24.9	4.2	4.3	L1	L1	L1
Wabamun Grid 8-3-B															
Wabamun Grid 8-3-C															
Wabamun Grid 8-3-D	11.2	1.5	4.1	12.1	10.8	6.3	11.4	10.7	L1	14.7	1.7	4.1	L1	L1	L1
Wabamun Grid 8-3-E															
Wabamun Grid 8-4															
Wabamun Grid 10-1															
Wabamun Grid 10-2	23.9	L1	5.3	17.5	24.8	L1	11.5	22.8	L1	30.7	1.5	4.7	L1	L1	L1
Wabamun Grid 10-3															
Wabamun Grid 10-4															
Wabamun Grid 11-3															
Wabamun Grid 11-4															
Wabamun Grid 11-5															

Appendix 1A Sediment analysis for Wabamun Lake and eight other lakes sampled in 2002. (continued)

Station Name	10543 Retene (7-Isopropyl-1-Methylphenanthrene) ng/g	10544 Benzo(C)Phenanthrene ng/g	10545 Benzo(A)Anthracene ng/g	10546 Chrysene ng/g	10547 Benzo(B,J,K)Fluoranthene ng/g	10548 7,12-Dimethylbenz(A)Anthracene ng/g	10549 Benzo(E)Pyrene ng/g	10550 Benzo(A)Pyrene ng/g	10553 3-Methylcholanthrene ng/g	10554 Indeno(1,2,3-C,D)Pyrene ng/g	10555 Dibenzo(A,H)Anthracene ng/g	10556 Benzo(G,H,I)Perylene ng/g	10557 Dibenzo(A,L)Pyrene ng/g	10558 Dibenzo(A,I)Pyrene ng/g	10559 Dibenzo(A,H)Pyrene ng/g
Wabamun Grid 12-1	7	L1	4.9	12.9	7.7	L1	18	15.7	L1	18.3	3.9	4.1	L1	L1	L1
Wabamun Grid 12-2															
Wabamun Grid 12-3	L1	L1	9.2	19.3	10.6	L1	32.9	26.5	L1	29.2	3.5	3.4	L1	L1	L1
Wabamun Grid 12-4															
Wabamun Grid 12-5	L1	L1	L1	L1	L1	L1	0.77	0.74	L1	0.34	0.3	L1	L1	L1	L1
Wabamun Grid 13-1	2.7	L1	0.14	0.27	0.58	L1	0.09	0.15	0.22	0.19	0.16	0.16	L1	L1	L1
Wabamun Grid 13-2-A															
Wabamun Grid 13-2-B	14.2	L1	4	11.3	10.6	L1	15.4	12.6	L1	14.7	3	3.3	L1	L1	L1
Wabamun Grid 13-2-C															
Wabamun Grid 13-2-D	40.2	0.24	0.94	1.9	5	L1	1.5	0.89	L1	1.2	0.27	1.2	L1	L1	L1
Wabamun Grid 13-4															
Wabamun Grid 13-5															
Wabamun Grid 14-2	12.4	L1	1	3	4.4	L1	3.1	3.4	L1	3.4	0.6	1.2	L1	L1	L1
Wabamun Grid 14-3															
Wabamun Grid 14-4	19.1	L1	6.2	13.7	11.1	L1	16.8	15.5	L1	16.5	2.3	3.5	L1	L1	L1
Wabamun Grid 14-5															
Wabamun Grid 14-6	L1	1.8	15.8	32	12.9	L1	45	39.3	L1	45.3	6.3	6.1	L1	L1	L1
Wabamun Grid 14-7															
Wabamun Grid 15-1															
Wabamun Grid 15-4															
Wabamun Grid 15-5															
Wabamun Grid 15-6-A	205.6	L1	L1	L1	7.9	L1	33.5	27	L1	37.6	6.7	5.2	L1	L1	L1
Wabamun Grid 15-6-B															
Wabamun Grid 15-6-C															
Wabamun Grid 15-6-D	L1	1.4	7.8	18.5	24.4	L1	4.9	6.4	L1	13.4	6	13	L1	L1	L1
Wabamun Grid 16-2															
Wabamun Grid 16-3															
Wabamun Grid 16-4-A	L1	3.2	45.5	70.3	32.6	4.8	135	114	L1	93.6	13.6	15.5	L1	L1	L1
Wabamun Grid 16-4-B															
Wabamun Grid 16-4-C															
Wabamun Grid 16-4-D	72.6	L1	0.55	1.1	0.73	L1	1.2	1.1	L1	1.2	1	L1	L1	L1	L1
Wabamun Grid 17-1	8.3	1.3	13.2	25.1	16.3	L1	31.8	26	L1	27.1	4.1	5.2	1.2	L1	L1
Wabamun Grid 18-1-A															
Wabamun Grid 18-1-B															
Wabamun Grid 18-1-C															
Wabamun Grid 18-1-D															
Wabamun Grid 18-1-E															
Wabamun Grid 18-2	L1	10	88.8	124	62.1	L1	257	196	12.4	225	28.4	31.2	4.4	L1	L1

Appendix 1A Sediment analysis for Wabamun Lake and eight other lakes sampled in 2002. (continued)

Station Name	10543 Retene (7-Isopropyl-1-Methylphenanthrene) ng/g	10544 Benzo(C)Phenanthrene ng/g	10545 Benzo(A)Anthracene ng/g	10546 Chrysene ng/g	10547 Benzo(B,J,K)Fluoranthene ng/g	10548 7,12-Dimethylbenz(A)Anthracene ng/g	10549 Benzo(E)Pyrene ng/g	10550 Benzo(A)Pyrene ng/g	10553 3-Methylcholanthrene ng/g	10554 Indeno(1,2,3-C,D)Pyrene ng/g	10555 Dibenzo(A,H)Anthracene ng/g	10556 Benzo(G,H,I)Perylene ng/g	10557 Dibenzo(A,L)Pyrene ng/g	10558 Dibenzo(A,I)Pyrene ng/g	10559 Dibenzo(A,H)Pyrene ng/g
Wabamun Grid 20-1															
Wabamun Grid 20-2															
Amisk Grid 1-1	6.5	L1	0.53	1.4	1.9	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
Amisk Grid 1-2	5.7	L1	L1	L1	1.6	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
Amisk Grid 1-3	3.7	L1	1.3	3.2	3.6	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
Bonnie Grid 1-1	L1	L1	L1	L1	L1	104	L1	L1	L1	L1	L1	L1	L1	L1	L1
Bonnie Grid 1-2	1.4	L1	L1	L1	L1	L1	L1	L1	L1	0.52	L1	0.49	1.5	L1	L1
Bonnie Grid 1-3	2.7	L1	L1	L1	L1	L1	L1	L1	L1	0.45	L1	0.45	2	L1	L1
Gull Grid 1-1	0.94	L1	0.25	0.81	0.95	L1	0.42	L1	L1	0.26	L1	0.25	L1	L1	L1
Gull Grid 1-2	0.86	L1	0.22	0.75	0.86	L1	L1	L1	L1	0.35	L1	0.32	L1	L1	L1
Gull Grid 1-3	1.2	L1	0.16	0.39	0.73	L1	0.35	3.1	L1	0.24	L1	0.22	L1	L1	L1
Isle Grid 1-1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
Isle Grid 1-2	2.1	L1	L1	L1	2.8	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
ISLE Grid 1-3	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
Lac. Ste. Anne Grid 1-1	1.9	L1	L1	L1	L1	140	L1	L1	L1	1.16	L1	L1	0.85	L1	L1
Lac Ste. Anne Grid 1-2	3.1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	1.13	1.3	L1	L1
Lac Ste. Anne Grid 1-3	1.2	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1	0.67	0.75	L1	L1
Pigeon Grid 1-1	5.8	L1	L1	L1	L1	L1	L1	L1	L1	1.26	L1	L1	1	L1	L1
Pigeon Grid 1-2	1.7	0.6	L1	L1	L1	L1	L1	L1	L1	0.76	L1	0.66	1.1	L1	L1
Pigeon Grid 1-3	1.3	0.45	L1	L1	L1	L1	L1	L1	L1	0.56	L1	L1	0.84	L1	L1
Sylvan Grid 1-1	0.11	L1	0.03	0.11	0.19	L1	L1	L1	L1	0.07	L1	0.05	L1	L1	L1
Sylvan Grid 1-2	0.77	0.19	0.66	1.4	2.8	L1	L1	L1	L1	1.1	0.2	0.95	L1	L1	L1
Sylvan Grid 1-3	0.62	L1	0.21	0.68	1	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
Wizard Grid 1-1	13.8	L1	L1	L1	L1	L1	L1	L1	L1	1.1	0.26	L1	L1	L1	L1
Wizard Grid 1-2	4.5	L1	1.2	8	8	L1	L1	L1	L1	L1	L1	L1	L1	L1	L1
Wizard Grid 1-3	3.7	L1	9.7	8.2	2.7	L1	L1	L1	L1	1.7	L1	1.5	L1	L1	L1

Appendix 1B Split sediment samples for Wabamun Lake, 2002

		Station No.:	AB05DE2107			AB05DE2156			AB05DE2188		
		Station Name:	Wabamun Grid 2-2			Wabamun Grid 12-1			Wabamun Grid 16-4-A		
		Depth:	9.5 m			6 m			3.8 m		
VMV		Units	Aug 21 4:30 PM	Aug 21 4:35 PM	Aug 21 4:40 PM	Aug 1 1:12 PM	Aug 1 1:27 PM	Aug 1 1:32 PM	Jul 30 10:20 AM	Jul 30 10:25 AM	Jul 30 10:30 AM
50303	Carbon Total Inorganic	%	0.79	0.63	0.57	0.96	1.05	1.08	2.14	1.97	2.03
6075	Carbon Total	mg/kg	22.7	22	21.7	16	16.5	16.1	14.3	14.1	14.3
6078	Carbon Organic	%	21.9	21.4	21.2	15	15.4	15.1	12.2	12.1	12.3
97285	Sand	%	2	L1	2	53	44	48			
97284	Clay	%	35	62	59	13	12	15			
97286	Silt	%	64	38	39	35	44	37			
103471	Mercury	ug/g	0.132	0.114	0.108	0.092	0.099	0.088	0.052	L0.001	0.065
103474	Silver	ug/g	0.29	0.31	0.25	0.27	0.25	0.28	0.29	0.24	0.27
103475	Aluminum	ug/g	37863	42138	36126	48503	49243	49645	39624	42834	43047
103476	Arsenic	ug/g	20.3	20.3	20.1	15.2	14.4	14.3	12	14.6	14.3
103477	Boron	ug/g	81	88	91	109	99	100	78	90	87
103478	Barium	ug/g	342	439	341	617	594	588	536	625	612
103479	Beryllium	ug/g	L3.8	L3.9	L3.6	L3.9	L4.3	L4	L3.8	L4	L4
103480	Bismuth	ug/g	0.32	0.33	0.29	0.25	0.23	0.21	0.47	0.23	0.246
103523	Cadmium	ug/g	0.4	0.48	0.48	0.65	0.67	0.67	0.29	0.67	0.62
103481	Calcium	ug/g	24253	25053	23278	50107	45985	46087	74235	71269	71694
103483	Chlorine	ug/g	367	390	301	2217	2470	2357	419	1767	2044
103485 103514	Chromium	ug/g	51	55	50	57	54.1	55.1	44.9	48.7	47.5
103516	Cobalt	ug/g	7.1	7.3	7.1	8.4	8.7	8.1	7.11	7.9	7.9
103486	Copper	ug/g	129	134	129	81.2	77.7	78	73	91	85
103489	Lithium	ug/g	16.1	17.8	16.6	22.4	21	20.5	16	19.9	19
103491	Manganese	ug/g	340	325	354	690	703	696	558	590	588
103492	Molybdenum	ug/g	31.4	32	30.1	6.6	6.1	6.4	4.6	6.6	6.1
103517	Nickel	ug/g	47.3	29.2	28	26.1	26	25.3	20.2	22.1	21.1
103499	Lead	ug/g	28.9	29.4	28.1	22.8	22.1	22.2	16.9	20.7	19.6
103501	Antimony	ug/g	2.81	2.8	2.84	1.73	1.78	1.87	1	1.29	1.34
103504	Tin	ug/g	L2.82	L2.91	L2.72	L2.96	L3.23	L2.98	14.2	L2.98	L3.02
103521	Selenium	ug/g	4.5	4.2	5	4.6	4.4	5.5	2.7	3.7	2.9
103522 103505	Strontium	ug/g	105	129	103	255	239	242	264	309	302
103506	Thorium	ug/g	8.2	9.1	8.16	7.26	6.72	6.96	8.6	6.03	5.7
103507	Titanium	ug/g	1982	1930	1917	2462	2324	2385	2116	2250	2219
103508	Thallium	ug/g	0.41	0.51	0.43	0.43	0.39	0.4	0.44	0.44	0.42
103509	Uranium	ug/g	6	6.9	6	4.15	3.88	3.9	3.18	4.06	3.83
103510	Vanadium	ug/g	84.1	87	83.9	90	86.6	85.5	63.4	75.3	73.6
103511	Zinc	ug/g	114	116	111	103	98	98	86	106	103
103515	Iron	ug/g	20648	20641	19748	17716	17961	17917	15799	16005	15912
99140	Trihalomethanes	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99141	Xylene	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99142	Bromobenzene	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99143	Sec-Butylbenzene	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99144	Tert-Butylbenzene	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99145	N-Butylbenzene	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99146	2-Chlorotoluene	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		

Appendix 1B Split sediment samples for Wabamun Lake, 2002 (continued)

		Station No.:	AB05DE2107			AB05DE2156			AB05DE2188		
		Station Name:	Wabamun Grid 2-2			Wabamun Grid 12-1			Wabamun Grid 16-4-A		
		Depth:	9.5 m			6 m			3.8 m		
VMV		Units	Aug 21 4:30 PM	Aug 21 4:35 PM	Aug 21 4:40 PM	Aug 1 1:12 PM	Aug 1 1:27 PM	Aug 1 1:32 PM	Jul 30 10:20 AM	Jul 30 10:25 AM	Jul 30 10:30 AM
99147	4-Chlorotoluene	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99148	1,2-Dibromo-3-Chloropropane	ug/g	L0.3	L0.3	L0.3	L0.3			L0.3		
99149	1,2-Dibromoethane	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99150	Cis-1,2-Dichloroethene	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99151	2,2-Dichloropropane	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99152	1,3-Dichloropropane	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99153	1,1-Dichloropropylene	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99154	Hexachlorobutadiene	ug/g	L0.3	L0.3	L0.3	L0.3			L0.3		
99155	Isopropylbenzene	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99156	P-Isopropyltoluene	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99157	Naphthalene	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99158	N-Propylbenzene	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99159	1,1,1,2-Tetrachloroethane	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99160	1,2,3-Trichlorobenzene	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99161	1,2,4-Trichlorobenzene	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99162	Trichloroethylene	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99163	1,2,3-Trichloropropane	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99164	1,2,4-Trimethylbenzene	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99165	1,3,5-Trimethylbenzene	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99166	MTBE (Methyl Tertiary Butyl Ether)	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99167	Benzene	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99168	Dichlorobromomethane	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99169	Bromoform	ug/g	L0.5	L0.5	L0.5	L0.5			L0.5		
99170	Bromomethane	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99172	Carbon Tetrachloride	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99173	Chlorobenzene	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99174	Chloroethane	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99175	2-Chloroethylvinylether	ug/g	L0.4	L0.4	L0.4	L0.4			L0.4		
99176	Chloroform	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99177	Dibromochloromethane	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99178	Dibromomethane	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99179	1,2-Dichlorobenzene	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99180	1,3-Dichlorobenzene	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99181	1,4-Dichlorobenzene	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99182	1,1-Dichloroethane	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99183	1,2-Dichloroethane	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99184	1,1-Dichloroethylene	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99185	Trans-1,2-Dichloroethene	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99186	1,2-Dichloropropane	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99187	Cis-1,3-Dichloropropene	ug/g	L0.3	L0.3	L0.3	L0.3			L0.3		
99188	Trans-1,3-Dichloropropene	ug/g	L0.3	L0.3	L0.3	L0.3			L0.3		
99189	Ethyl Benzene	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99190	Methylene Chloride	ug/g	L2	L2	L2	L2			L2		
99191	Styrene	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99192	1,1,2,2-Tetrachloroethane	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		

Appendix 1B Split sediment samples for Wabamun Lake, 2002 (continued)

		Station No.:	AB05DE2107			AB05DE2156			AB05DE2188		
		Station Name:	Wabamun Grid 2-2			Wabamun Grid 12-1			Wabamun Grid 16-4-A		
		Depth:	9.5 m			6 m			3.8 m		
VMV		Units	Aug 21 4:30 PM	Aug 21 4:35 PM	Aug 21 4:40 PM	Aug 1 1:12 PM	Aug 1 1:27 PM	Aug 1 1:32 PM	Jul 30 10:20 AM	Jul 30 10:25 AM	Jul 30 10:30 AM
99193	Tetrachloroethylene	ug/g	L0.3	L0.3	L0.3	L0.3			L0.3		
99194	Toluene	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99195	1,1,1-Trichloroethane	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99196	1,1,2-Trichloroethane	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99197	Trichlorofluoromethane	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99198	Vinyl Chloride	ug/g	L0.5	L0.5	L0.5	L0.5			L0.5		
99199	O-Xylene	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99200	M- + P-Xylene	ug/g	L0.1	L0.1	L0.1	L0.1			L0.1		
99075	4-Chloro-3-Methylphenol	ug/g	L2	L2	L2	L2			L2		
99071	2-Chlorophenol	ug/g	L4	L4	L4	L4			L4		
99065	2,4-Dichlorophenol	ug/g	L2	L2	L2	L2			L2		
99066	2,4-Dimethylphenol	ug/g	L4	L4	L4	L4			L4		
99072	2-Methyl-4,6-Dinitrophenol	ug/g	L2	L2	L2	L2			L2		
99067	2,4-Dinitrophenol	ug/g	L2	L2	L2	L2			L2		
99073	2-Nitrophenol	ug/g	L2	L2	L2	L2			L2		
99077	4-Nitrophenol	ug/g	L2	L2	L2	L2			L2		
99110	Pentachlorophenol	ug/g	L2	L2	L2	L2			L2		
99112	Phenol	ug/g	L2	L2	L2	L2			L2		
99064	2,4,6-Trichlorophenol	ug/g	L2	L2	L2	L2			L2		
99084	Benzo(B)Fluoranthene	ug/g	L2	L2	L2	L2			L2		
99086	Benzo(K)Fluoranthene	ug/g	L2	L2	L2	L2			L2		
99070	2-Chloronaphthalene	ug/g	L2	L2	L2	L2			L2		
99100	Hexachlorobenzene	ug/g	L2	L2	L2	L2			L2		
99101	Hexachlorobutadiene	ug/g	L5	L5	L5	L5			L5		
99102	Hexachlorocyclopenta diene	ug/g	L2	L2	L2	L2			L2		
99103	Hexachloroethane	ug/g	L5	L5	L5	L5			L5		
99061	1,2,4-Trichlorobenzene	ug/g	L2	L2	L2	L2			L2		
99081	Benzidene	ug/g	L4	L4	L4	L4			L4		
99068	2,4-Dinitrotoluene	ug/g	L2	L2	L2	L2			L2		
99069	2,6-Dinitrotoluene	ug/g	L2	L2	L2	L2			L2		
99062	1,2-Diphenylhydrazine	ug/g	L2	L2	L2	L2			L2		
99109	Nitrobenzene	ug/g	L2	L2	L2	L2			L2		
99107	N-Nitrosodiphenylamine	ug/g	L2	L2	L2	L2			L2		
99106	N-Nitrosodi-N-Propylamine	ug/g	L4	L4	L4	L4			L4		
99074	4-Bromophenyl Phenyl Ether	ug/g	L2	L2	L2	L2			L2		
99087	Bis(2-Chloroethoxy) Methane	ug/g	L2	L2	L2	L2			L2		
99088	Bis(2-Chloroethyl) Ether	ug/g	L2	L2	L2	L2			L2		
99089	Bis(2-Chloroisopropyl) Ether	ug/g	L2	L2	L2	L2			L2		
99076	4-Chlorophenyl Phenyl Ether	ug/g	L2	L2	L2	L2			L2		
99091	Butylbenzyl Phthalate	ug/g	L2	L2	L2	0.03			0.03		
99093	Di-N-Butyl Phthalate	ug/g	0.17	0.18	0.24	0.33			0.27		
99096	Diethyl Phthalate	ug/g	0.04	L2	0.04	L2			0.08		
99097	Dimethyl Phthalate	ug/g	L2	L2	L2	L2			L2		

Appendix 1B Split sediment samples for Wabamun Lake, 2002 (continued)

		Station No.:	AB05DE2107			AB05DE2156			AB05DE2188		
		Station Name:	Wabamun Grid 2-2			Wabamun Grid 12-1			Wabamun Grid 16-4-A		
		Depth:	9.5 m			6 m			3.8 m		
VMV		Units	Aug 21 4:30 PM	Aug 21 4:35 PM	Aug 21 4:40 PM	Aug 1 1:12 PM	Aug 1 1:27 PM	Aug 1 1:32 PM	Jul 30 10:20 AM	Jul 30 10:25 AM	Jul 30 10:30 AM
99094	Di-N-Octyl Phthalate	ug/g	L2	0.10728	L2	L2			L2		
99090	Bis(2-Ethylhexyl) Phthalate	ug/g	0.12	0.19	0.41	0.30			0.85		
99105	Isophorone	ug/g	L2	L2	L2	L2			L2		
99063	2,3,4,6-Tetrachlorophenol	ug/g	L2	L2	L2	L2			L2		
10532	Naphthalene	ng/g	L1	L1	L1	2.4			L1		
10535	Acenaphthylene	ng/g	L1	L1	L1	L1			L1		
10536	Acenaphthene	ng/g	L1	L1	L1	L1			L1		
10537	Fluorene	ng/g	1.1	0.96	1.2	2			1.9		
10538	Phenanthrene	ng/g	2.1	1.7	2.1	2.1			6.6		
10539	Anthracene	ng/g	L1	L1	L1	L1			2.7		
10540	Acridine	ng/g	L1	L1	L1	L1			L1		
10541	Pyrene	ng/g	4.2	3.9	4.8	5.2			22.9		
10542	Fluoranthene	ng/g	2.2	1.9	2.6	3.4			5.5		
10543	Retene (7-Isopropyl-1-Methylphenanthrene)	ng/g	1.3	1.2	1.5	7			L1		
10544	Benzo(C)Phenanthrene	ng/g	L1	L1	L1	L1			3.2		
10545	Benzo(A)Anthracene	ng/g	2.3	1.9	2.4	4.9			45.5		
10546	Chrysene	ng/g	5.2	4.3	5.3	12.9			70.3		
10547	Benzo(B,J,K)Fluoran thene	ng/g	6.3	5.4	7	7.7			32.6		
10548	7,12-Dimethylbenz(A) Anthracene	ng/g	L1	L1	L1	L1			4.8		
10549	Benzo(E)Pyrene	ng/g	9	7.7	9	18			135		
10550	Benzo(A)Pyrene	ng/g	4.8	4.4	5.3	15.7			114		
10553	3-Methylcholanthrene	ng/g	L1	L1	L1	L1			L1		
10554	Indeno(1,2,3-C,D)Pyrene	ng/g	2	1.5	2.6	18.3			93.6		
10555	Dibenzo(A,H)Anthracene	ng/g	1.2	1.1	0.98	3.9			13.6		
10556	Benzo(G,H,I)Perylene	ng/g	1.9	1.4	2.4	4.1			15.5		
10557	Dibenzo(A,L)Pyrene	ng/g	L1	L1	L1	L1			L1		
10558	Dibenzo(A,I)Pyrene	ng/g	L1	L1	L1	L1			L1		
10559	Dibenzo(A,H)Pyrene	ng/g	L1	L1	L1	L1			L1		

Appendix 1C Total metal analyses of archived sediments for Wabamun Lake and other lakes (units in µg/g)

Sample No.	Station Name	VMV: Variable: Sample Date	103479 Beryllium	103512 Boron	103523 Cadmium	103514 Chromium	103516 Cobalt	103518 Copper	103499 Lead	103517 Nickel	103522+ 103505 Strontium	103508 Thallium	103510 Vanadium	103511 Zinc
02SWES0001	Sturgeon Lake Site 1, Sample 569	25-Aug-93	L4.	L20.	L0.08	15.5	3.35	3.31	7.17	6.5	148	0.25	26.3	20
02SWES0002	Sturgeon Lake Site 3, Sample 571	25-Aug-93	L4.	32	0.29	27.7	9.8	10	10.1	16.5	96.2	0.47	54.4	57.2
02SWES0003	Sturgeon Lake Site 5, Sample 575	25-Aug-93	L4.	84	0.56	84.2	12.5	33.5	19.6	48.3	70.5	0.6	143	137
02SWES0004	Buck Lake Site 1, Sample 598	15-Oct-93	L4.	L20.	L0.08	17.3	3.11	3.72	8.04	6.4	144	0.25	24.4	20.3
02SWES0005	Buck Lake Site 3, Sample 599	15-Oct-93	L4.	70	0.4	73.7	11.2	40.5	21.1	40.4	110	0.53	120	122
02SWES0006	Buck Lake Site 5, Sample 603	15-Oct-93	L4.	64	0.51	67.6	10.6	30.7	20.9	43.1	122	0.54	108	109
02SWES0007	Smoke Lake Site 1, Sample 582	24-Aug-93	L4.	21	L0.08	20.5	4	5.3	7.4	9.7	116	0.29	41.5	26.1
02SWES0008	Smoke Lake Site 3, Sample 583	24-Aug-93	L4.	L20.	L0.08	18.7	3.2	2.57	5.65	6.4	84.5	0.24	18.2	18.6
02SWES0009	Smoke Lake Site 5, Sample 587	24-Aug-93	L4.	63	0.92	78.4	12	30.3	19.7	44.1	97.9	0.64	123	146
02SWES0010	Saskatoon Lake Site 1, Sample 593	24-Aug-93	L4.	29	0.11	29	5.2	7	8.97	12.6	118	0.29	43.1	33
02SWES0011	Saskatoon Lake Site 5, Sample 594	24-Aug-93	L4.	117	0.46	81	11	27.9	17.3	37	130	0.64	152	124
02SWES0012	North Sandy Site 1, Sample 478	26-Oct-93	L4.	58	0.39	51.2	8.9	16.9	24.3	23.7	224	0.46	63.3	75.7
02SWES0013	North Sandy Site 5, Sample 479	26-Oct-93	L4.	74.4	0.38	38.8	8.3	18.4	20.9	24.7	220	0.36	61.6	75.9
02SWES0014	South Sandy Lake Site 1, Sample 540	26-Oct-93	L4.	35.1	0.19	34.3	7.9	11.1	16.6	19.6	278	0.49	53.2	52.8
02SWES0015	South Sandy Lake Site 5, Sample 541	26-Oct-93	L4.	57	0.3	41	7.9	15.4	16.7	21.9	231	0.404	57.2	67
02SWES0016	Lac Ste. Anne Site 1, Sample 545	27-Jul-93	L4.	L20.	L0.08	16.6	1.85	2.2	4.92	4.1	86.5	0.16	14.1	12.1
02SWES0017	Lac Ste. Anne Site 3, Sample 547	27-Jul-93	L4.	63.2	0.19	44.7	7.1	11.1	15.6	16.3	211	0.37	64.2	56.4
02SWES0018	Lac Ste. Anne Site 5, Sample 551	27-Jul-93	L4.	82	0.35	36.8	7.3	15.2	17.4	20.4	164	0.347	64.7	68
02SWES0019	Lake Isle Site 1, Sample 558	26-Sep-93	L4.	L20.	L0.07	10.7	1.55	1.45	3.91	3.45	68.1	0.13	12.9	8.8
02SWES0020	Lake Isle Site 3, Sample 559	28-Sep-93	L4.	L20.	L0.07	11.5	1.88	1.66	4.61	4.8	74.5	0.165	14.5	12
02SWES0021	Lake Isle Site 5, Sample 563	28-Sep-93	L4.	64.8	0.38	42.6	8.3	20.8	16.1	31.2	144	0.33	60.2	72.5
02SWES0022	Pine Lake Site 1, Sample 509	13-Oct-93	L4.	65	0.38	34.7	7.4	17.8	33.5	16.3	333	0.36	56.6	96
02SWES0025	Wabamun Lake Site 1, Sample 522	28-Oct-93	L4.	60	0.28	53.2	9.5	24.2	18.2	21.3	446	0.33	74.7	83
02SWES0026	Wabamun Lake Site 3, Sample 524	28-Oct-93	L4.	93	0.44	79.6	9.8	75.7	30	30.5	252	0.46	99	133
02SWES0027	Wabamun Lake Site 5, Sample 528	28-Oct-93	L4.	104	0.34	63.2	8.9	110	26	28.4	159	0.39	94.8	107
02SWES0028	Moonshine Lake Site 1, Sample 535	24-Aug-93	L4.	60	0.29	51.5	8.09	47.4	13.6	24.2	121	0.41	90.6	91
02SWES0029	Moonshine Lake Site 5, Sample 536	24-Aug-93	L4.	109	0.53	79	11.8	114	17.7	40.2	104	0.68	161	151
02SWES0030	Crimson Lake Site 1, Sample 448	03-Aug-93	L4.	35.9	0.33	13.9	4.2	6.4	12.9	9	164	0.12	20.2	40.4
02SWES0031	Crimson Lake Site 3, Sample 450	03-Aug-93	L4.	40.4	0.38	9.4	4.2	9.8	10.2	11.9	127	0.12	16.7	72
02SWES0033	Dillberry Lake Site 1, Sample 459	04-Aug-93	L4.	L20.	L0.07	11.3	1.87	2.09	5.4	5	72.2	0.19	18.7	13.2
02SWES0034	Dillberry Lake Site 3, Sample 460	04-Aug-93	L4.	29	0.29	8.5	4.1	5.6	13.2	6.9	339	0.1	14.6	33.5
02SWES0035	Dillberry Lake Site 1, Sample 846	17-Sep-94	L4.	L20.	L0.07	8.3	2.07	1.78	6.16	5.4	83.6	0.23	21.2	15.4
02SWES0036	Dillberry Lake Site 3, Sample 847	19-Sep-94	L4.	22.9	0.18	11.1	5.9	4.82	5.05	10	337	0.164	19.6	29.1
02SWES0037	Dillberry Lake Site 5, Sample 850	19-Sep-94	L4.	34	0.41	16	6.2	9.6	11.6	11	292	0.18	28.6	53.5
02SWES0038	Battle Lake Site 1, Sample 855	23-Sep-94	L4.	L20.	L0.07	19.8	3.9	2.64	7	8.1	220	0.311	37	22.1
02SWES0039	Battle Lake Site 3, Sample 857	23-Sep-94	L4.	43	0.47	64.9	12.1	38.5	17.3	43.2	292	0.49	97.2	97
02SWES0040	Battle Lake Site 5, Sample 860	23-Sep-94	L4.	46	0.41	80.9	14.2	35.6	18.3	49.8	186	0.62	124	112
02SWES0041	Gull Lake Site 1, Sample 461	15-Oct-93	L4.	L20.	0.09	18	3.68	2.65	8.3	8.9	286	0.36	30.3	24.4
02SWES0042	Gull Lake Site 3, Sample 462	04-Aug-93	L4.	30	0.12	38.3	6.6	6.74	10.3	16.2	336	0.44	49.9	40.5
02SWES0043	Gull Lake Site 5, Sample 466	15-Oct-93	L4.	80	0.37	46.9	9.1	21.4	16.4	28.9	790	0.4	66	71

Appendix 1C Total metal analyses of archived sediments for Wabamun Lake and other lakes (units in µg/g) (continued)

Sample No.	Station Name	VMV: Variable: Sample Date	103479 Beryllium	103512 Boron	103523 Cadmium	103514 Chromium	103516 Cobalt	103518 Copper	103499 Lead	103517 Nickel	103522+ 103505 Strontium	103508 Thallium	103510 Vanadium	103511 Zinc
02SWES0044	Sylvan Lake Site 1, Sample 483	01-Oct-93	L4.	L20.	0.12	18.3	5.2	2.29	8.14	7.3	610	0.24	35.5	21.8
02SWES0046	Sylvan Lake Site 3, Sample 485	01-Oct-93	L4.	33	0.16	39.2	8.1	11	14.9	18.5	1316	0.38	57.5	52
02SWES0048	Sylvan Lake Site 5, Sample 489	01-Oct-93	L4.	163	0.9	95	20	47.2	48.2	76	373	0.97	164	187
02SWES0049	Pigeon Lake Site 1, Sample 496	08-Oct-93	L4.	L20.	L0.07	11.6	2.59	1.74	6.28	4.7	136	0.22	19.3	14.5
02SWES0051	Pigeon Lake Site 3, Sample 498	08-Oct-93	L4.	27	0.17	24.7	6.96	6.15	11.2	12	246	0.36	40.9	38.9
02SWES0052	Pigeon Lake Site 5, Sample 502	08-Oct-93	L4.	33.7	0.17	22	5.1	12.1	12.5	17.4	342	0.24	37.3	46.4
02SWES0053	Tucker Lake Site 1, Sample 824	14-Sep-94	L4.	L20.	L0.07	6.7	1.19	0.85	5.57	2	71.3	0.135	7.64	5.6
02SWES0054	Tucker Lake Site 3, Sample 825	14-Sep-94	L4.	57.8	0.16	5.2	2.7	4.7	4.29	4.2	261	0.078	9.94	19.6
02SWES0055	Tucker Lake Site 5, Sample 829	14-Sep-94	L4.	62	0.34	14.9	4.7	9.6	7.48	9.9	249	0.17	26.9	38.6
02SWES0056	Muriel Lake Site 1, Sample 835	14-Sep-94	L4.	L20.	L0.07	15.5	2.37	1.16	7.7	4.2	131	0.19	16.1	10.9
02SWES0057	Muriel Lake Site 3, Sample 836	14-Sep-94	L4.	77	0.23	18.1	5.2	7.5	10.4	8.9	546	0.22	27.6	36
02SWES0058	Muriel Lake Site 5, Sample 840	14-Sep-94	L4.	99	0.36	19.9	5.7	9.7	10.3	12	480	0.24	32.8	47.6
02SWES0059	Steele Lake Site 1, Sample 777	01-Sep-94	L4.	L20.	L0.08	7.2	1.71	1.51	4.99	3.57	63.2	0.17	13.1	11
02SWES0060	Steele Lake Site 3, Sample 778	01-Sep-94	L4.	18	0.1	8.13	2.03	2.31	5.44	3.8	120	0.19	13.8	14.5
02SWES0061	Steele Lake Site 5, Sample 781	01-Sep-94	L4.	82	0.37	17.3	5.42	10.9	10.1	17.4	83.2	0.16	31.4	75
02SWES0062	Buffalo Lake Site 1, Sample 786	07-Sep-94	L4.	L20.	L0.08	5.6	2.02	1.2	5.63	3.8	117	0.156	11.9	9.7
02SWES0063	Buffalo Lake Site 3, Sample 787	07-Sep-94	L4.	L20.	L0.07	17.5	3.58	2.44	7.8	5.7	168	0.23	26.9	17.5
02SWES0064	Buffalo Lake Site 5, Sample 791	07-Sep-94	L4.	91	0.36	36.7	8.9	14.9	13.9	22.5	624	0.36	62.4	68
02SWES0065	McLeod Lake East Site 1, Sample 798	13-Sep-94	L4.	L20.	0.09	12.9	3.35	2.9	6.27	5.7	127	0.25	24.1	20.2
02SWES0066	McLeod Lake East Site 3, Sample 800	13-Sep-94	L4.	L20.	0.16	21.4	4.2	4.5	8.39	8.5	199	0.31	30.7	25.9
02SWES0067	McLeod Lake East Site 5, Sample 804	13-Sep-94	L4.	44	0.42	38.6	7.67	21.9	18.3	27.5	109	0.39	64.2	82.2
02SWES0068	Iosegun Lake Site 1, Sample 811	13-Sep-94	L4.	L20.	L0.07	8.1	1.8	1.67	4.74	3.3	54.4	0.17	15.2	14
02SWES0069	Iosegun Lake Site 3, Sample 813	13-Sep-94	L4.	62	0.51	65.9	11.3	19.5	16.8	31	90.6	0.58	123	120
02SWES0070	Iosegun Lake Site 5, Sample 817	13-Sep-94	L4.	70	0.77	70.5	12.6	28.7	18.7	41.7	83.9	0.64	136	151
02SWES0071	Elkwater Lake Site 1, Sample 662	26-Jul-94	L4.	33.6	L0.07	36.7	11.3	8.6	15.8	18.6	276	0.52	69.5	58
02SWES0072	Elkwater Lake Site 2, Sample 663	26-Jul-94	L4.	37	0.13	37.9	10	10.4	16.9	17.2	273	0.5	68.8	54.2
02SWES0073	Elkwater Lake Site 4, Sample 667	26-Jul-94	L4.	55.6	0.29	53.1	11.4	22.4	25.3	27.2	208	0.59	95.3	86
02SWES0074	Wizard Lake Site 1, Sample 617	22-Jun-94	L4.	97	0.31	29	7.2	15.7	17.5	15.7	328	0.38	43.3	76
02SWES0075	Wizard Lake Site 3, Sample 618	22-Jun-94	L4.	49	0.43	44.3	8.8	21.2	31.1	26.9	185	0.37	65.2	79
02SWES0076	Wizard Lake Site 5, Sample 620	22-Jun-94	L4.	33.1	0.35	42	8.8	24.3	32.8	28.3	196	0.417	69	78.8
02SWES0077	Bonnie Lake Site 1, Sample 623	04-Jul-94	L4.	50.5	0.21	17.2	5	7.9	8.09	8.8	247	0.16	27.8	42
02SWES0078	Bonnie Lake Site 3, Sample 624	04-Jul-94	L4.	72	0.38	21.9	6.1	11.9	17.8	13.9	181	0.21	37.9	69
02SWES0079	Bonnie Lake Site 5, Sample 627	04-Jul-94	L4.	70	0.45	19.5	6	11.9	14.2	13.4	191	0.213	33.5	70.9
02SWES0080	Moose Lake Site 1, Sample 632	05-Jul-94	L4.	L20.	L0.07	10	1.73	0.73	6.6	2.7	145	0.16	9.5	7.1
02SWES0081	Moose Lake Site 3, Sample 633	05-Jul-94	L4.	L20.	L0.07	6.17	1.63	0.99	10.4	1.9	175	0.33	7.43	7
02SWES0082	Moose Lake Site 5, Sample 637	05-Jul-94	L4.	81.2	0.34	14.1	4.86	8.7	13.1	9.1	324	0.15	26.4	42.3
02SWES0083	Moose Lake Site 6, Sample 643	05-Jul-94	L4.	49	0.27	17.2	4.1	10.3	20	9.4	176	0.19	30.2	50.7
02SWES0084	Long Lake Site 1, Sample 644	06-Jul-94	L4.	52.4	0.13	24.2	6.3	9.62	7.1	10.7	262	0.235	42.7	41.7
02SWES0085	Long Lake Site 3, Sample 646	06-Jul-94	L4.	76.9	0.26	40.1	8.5	15.4	21.4	22.8	223	0.37	72.2	70.6
02SWES0086	Long Lake Site 5, Sample 647	06-Jul-94	L4.	58.9	0.33	26.9	8.6	18.7	15.9	21.7	277	0.34	62.1	68

Appendix 2 Quality assurance and data evaluation

Comparisons Among Split Samples

The results of the analyses on split samples provide an indication of how precisely analytical results can be duplicated and the extent to which analytical variability may account for inter-site differences. The variability of the split samples was expressed as the coefficient of variation (CV).

The average CV in the three sets of triplicate splits was well below 25% for all variables, except Cl (CV=27%) (Table A2-1). However, the CV in individual sets was above 25% for some variables such as clay (28%), silt (31%), Bi (43%), Cd (39%), Cl (62%), and Ni (31%).

VPP were not detected in any of the three split samples, neither were they reported in any lake sample. Of the 39 EPP and 24 PAH analysed, 35 and 11 were not detected in any of the three spilt samples, respectively. Di-octyl phthalate is an exception; it was found at trace levels in one of the splits, but not in the other two. Of the compounds detected three had CV>25% [i.e., bis(2ethylhexyl)phthalate with a CV of 63% and indenol(1,2,3-CD)pyrene and benzol(g,h,i)perylene with a CV of 27 and 26, respectively]. All other compounds had CVs that were generally below 15%.

Comparatively speaking, the variability among Wabamun Lake samples was much larger than that among split samples (Table A2-1). Although analytical variability influences the data set, site-to-site variability in Wabamun Lake is generally more important.

Values Reported Below the Method Detection Limit

In several instances detections of trace organic compounds were reported at levels below the detection limit. While, the laboratory can assure the validity of the detections it cannot assure the accuracy of the measurements to the same extent as measurements above the method detection limit.

Phthalate Detections

Phthalates represent a large group of compounds widely used as plasticizers in polyvinyl chloride resins, adhesives and cellulose film coating. Other applications are found in cosmetics, rubbing alcohol, insect repellent, insecticides, tablet coating and solid rocket propellants (CCREM 1987).

Low levels of phthalates are often encountered in water in field samples and lab blanks and are believed to be the result of contamination in the field or in the laboratory. AENV's database for phthalates in sediments is limited, however, the similarity in the detection pattern (concentrations and frequency of detection, Table A2-2 and A2-3) in Wabamun Lake and other lakes contrasts with that for other contaminants measured in this study. That pattern suggests that phthalate detections in these samples may be influenced by a common factor such as field and or lab contamination. Because of this suspicion, phthalate results are not included in the sediment quality assessment.

It is suggested that a literature review on phthalates in the environment be undertaken to strengthen our understanding of contamination pathways, and to develop more appropriate sampling protocols and quality assurance procedures.

Appendix 2 - Table A2-1 Variability in split sediment samples and variability in Wabamun lake sediments

	%TOC	% Sand	% Clay	% Silt	Hg	Ag	Al	As	B	Ba	Be	Bi
Coefficient of variation in 3 split samples												
set Wab 2-2	1.68	0.00	**28.46**	**31.34**	10.58	10.78	7.99	0.57	5.92	15.05		6.64
set Wab 12-1	1.37	9.33	**11.46**	**12.22**	5.99	5.73	1.18	3.37	5.36	2.55		8.70
set Wab 16-4A	0.82				15.71	9.44	4.58	10.43	7.35	8.13		42.55
Mean CV	***1.29***	***4.66***	***19.96***	***21.78***	***10.76***	***8.65***	***4.59***	***4.79***	***6.21***	***8.58***	***ND***	***19.30***
N	***3***	***2***	***2***	***2***	***3***	***3***	***3***	***3***	***3***	***3***	***0***	***3***
N>25%	***0***	***0***	***1***	***1***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***1***
Variability in Wabamun Lake sediment samples												
mean	11.91	36.03	30.39	33.71	0.07	0.24	41174.19	14.38	79.68	629.87	**ND**	0.21
SD	5.91	29.88	21.46	15.18	0.03	0.06	11909.61	9.63	28.58	139.37		0.08
CV	**49.64**	**82.93**	**70.62**	**45.03**	**50.91**	**26.17**	**28.92**	**66.99**	**35.86**	**22.13**		**39.76**

	Li	Mn	Mo	Ni	Pb	Sb	Sn	Se	Sr	Th	Ti	Tl
Coefficient of variation in 3 split samples												
set Wab 2-2	5.19	4.27	3.12	**31.04**	2.28	0.74		8.85	12.88	6.26	1.77	11.76
set Wab 12-1	4.62	0.93	3.95	**1.69**	1.69	3.96		12.12	3.47	3.88	2.89	5.12
set Wab 16-4A	11.16	3.10	18.05	**4.50**	10.26	15.17		17.07	8.30	23.43	3.20	2.66
Mean CV	***6.99***	***2.77***	***8.37***	***12.41***	***4.74***	***6.62***	***ND***	***12.68***	***8.22***	***11.19***	***2.62***	***6.51***
N	***3***	***3***	***3***	***3***	***3***	***3***	***0***	***3***	***3***	***3***	***3***	***3***
N>25%	***0***	***0***	***0***	***1***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***
Variability in Wabamun Lake sediment samples												
mean	17.31	565.22	7.88	20.39	18.29	1.50	4.32	3.22	273.35	5.71	1936.80	0.41
SD	5.32	208.04	7.38	9.62	6.93	0.88	3.29	1.48	150.04	2.36	593.08	0.10
CV	**30.73**	**36.81**	**93.60**	**47.20**	**37.88**	**58.79**	**76.06**	**45.93**	**54.89**	**41.35**	**30.62**	**24.11**

	N-Butylbenzene	2-Chlorotoluene	4-Chlorotoluene	1,2-Dibromo-3-Chloropropane	1,2-Dibromoethane	Cis-1,2-Dichloroethene	2,2-Dichloropropane	1,3-Dichloropropane	1,1-Dichloropropylene	Hexachlorobutadiene	Isopropylbenzene	P-Isopropyltoluene
Coefficient of variation in 3 split samples												
set Wab 2-2												
set Wab 12-1												
set Wab 16-4A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mean CV												
N												
N>25%	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***
Variability in Wabamun Lake sediment samples												
mean	***1***	***1***	***1***	***1***	***1***	***1***	***1***	***1***	***1***	***1***	***1***	***1***
SD	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***
CV	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Appendix 2 - Table A2-1 Variability in split sediment samples and variability in Wabamun lake sediments (continued)

	MTBE (Methyl Tertiary Butyl Ether)	Benzene	Dichlorobromomethane	Bromoform	Bromomethane	Carbon Tetrachloride	Chlorobenzene	Chloroethane	2-Chloroethylvinylether	Chloroform	Dibromochloromethane	Dibromomethane
Coefficient of variation in 3 split samples												
set Wab 2-2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
set Wab 12-1												
set Wab 16-4A												
Mean CV	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***
N	***1***	***1***	***1***	***1***	***1***	***1***	***1***	***1***	***1***	***1***	***1***	***1***
N>25%	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***
Variability in Wabamun Lake sediment samples												
mean	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SD												
CV												

	Trans-1,3-Dichloropropene	Ethyl Benzene	Methylene Chloride	Styrene	1,1,2,2-Tetrachloroethane	Tetrachloroethylene	Toluene	1,1,1-Trichloroethane	1,1,2-Trichloroethane	Trichlorofluoromethane	Vinyl Chloride	O-Xylene
Coefficient of variation in 3 split samples												
set Wab 2-2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
set Wab 12-1												
set Wab 16-4A												
Mean CV	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***
N	***1***	***1***	***1***	***1***	***1***	***1***	***1***	***1***	***1***	***1***	***1***	***1***
N>25%	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***
Variability in Wabamun Lake sediment samples												
mean	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SD												
CV												

	Pentachlorophenol	Phenol	2,4,6-Trichlorophenol	Benzo(B)Fluoranthene	Benzo(K)Fluoranthene	2-Chloronaphthalene	Hexachlorobenzene	Hexachlorobutadiene	Hexachlorocyclopentadiene	Hexachloroethane	1,2,4-Trichlorobenzene	Benzidene
Coefficient of variation in 3 split samples												
set Wab 2-2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
set Wab 12-1												
set Wab 16-4A												
Mean CV	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***
N	***1***	***1***	***1***	***1***	***1***	***1***	***1***	***1***	***1***	***1***	***1***	***1***
N>25%	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***
Variability in Wabamun Lake sediment samples												
mean	ND	0.04	ND	0.08	ND	ND	ND	ND	ND	ND	ND	ND
SD		0.03										
CV		**90.92**										

Appendix 2 - Table A2-1 Variability in split sediment samples and variability in Wabamun lake sediments (continued)

	Bis(2-Chloroisopropyl) Ether	4-Chlorophenyl Phenyl Ether	Butylbenzyl Phthalate	Di-N-Butyl Phthalate	Diethyl Phthalate	Dimethyl Phthalate	Di-N-Octyl Phthalate	Bis(2-Ethylhexyl) Phthalate	Isophorone	2,3,4,6-Tetrachlorophenol	Naphthalene	Acenaphthylene
Coefficient of variation in 3 split samples												
set Wab 2-2	ND	ND	ND	19.61	9.84	ND	ND	62.96	ND	ND	ND	ND
set Wab 12-1												
set Wab 16-4A												
Mean CV	***ND***	***ND***	***ND***	***19.61***	***9.84***	***ND***	***not calculated***	***62.96***	***ND***	***ND***	***ND***	***ND***
N	***1***	***1***	***1***	***1***	***1***	***1***	***1***	***1***	***1***	***1***	***1***	***1***
N>25%	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***1***	***0***	***0***	***0***	***0***
Variability in Wabamun Lake sediment samples												
mean	ND	ND	0.04	1.13	0.07	ND	0.17	0.73	ND	ND	19.88	0.44
SD			0.05	2.80	0.05		0.15	1.24			62.77	0.29
CV			**119.65**	**247.55**	**70.46**		**91.70**	**169.08**			**315.80**	**65.56**

	Benzo(A)Anthracene	Chrysene	Benzo(B,J,K) Fluoranthene	7,12-Dimethylbenz(A)Anthracene	Benzo(E)Pyrene	Benzo(A)Pyrene	3-Methylcholanthrene	Indeno(1,2,3-C,D)Pyrene	Dibenzo(A,H) Anthracene	Benzo(G,H,I) Perylene	Dibenzo(A,L) Pyrene	Dibenzo(A,I) Pyrene
Coefficient of variation in 3 split samples												
set Wab 2-2	12.03	11.16	12.87	ND	8.76	9.33	ND	27.09	10.07	26.32	ND	ND
set Wab 12-1												
set Wab 16-4A												
Mean CV	***12.03***	***11.16***	***12.87***	***ND***	***8.76***	***9.33***	***ND***	***27.09***	***10.07***	***26.32***	***ND***	***ND***
N	***1***	***1***	***1***	***1***	***1***	***1***	***0***	***1***	***1***	***1***	***0***	***0***
N>25%	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***1***	***0***	***1***	***0***	***0***
Variability in Wabamun Lake sediment samples												
mean	10.55	20.62	15.33	10.18	27.54	23.51	6.31	24.33	3.76	5.62	3.58	ND
SD	19.39	26.72	14.10	9.71	52.67	40.78	8.61	44.72	5.69	6.43	1.60	
CV	**183.70**	**129.60**	**91.95**	**95.41**	**191.24**	**173.49**	**136.49**	**183.78**	**151.42**	**114.47**	**44.66**	

Appendix 2 - Table A2-1 Variability in split sediment samples and variability in Wabamun lake sediments (continued)

	Cd	Ca	Cl	Cr	Co	Cu
Coefficient of variation in 3 split samples						
set Wab 2-2	10.19	3.67	13.10	5.09	1.61	2.21
set Wab 12-1	1.74	4.96	5.40	2.66	3.57	2.46
set Wab 16-4A	39.20	2.22	61.65	4.13	5.97	11.04
Mean CV	***17.04***	***3.62***	***26.72***	***3.96***	***3.72***	***5.24***
N	***3***	***3***	***3***	***3***	***3***	***3***
N>25%	***1***	***0***	***1***	***0***	***0***	***0***
Variability in Wabamun Lake sediment samples						
mean	0.53	46975.16	1689.88	43.59	7.26	64.69
SD	0.14	32617.53	1000.98	16.91	2.11	41.84
CV	**26.69**	**69.44**	**59.23**	**38.79**	**29.12**	**64.68**

	U	V	Zn	Fe	Trihalomethanes	Xylene	Bromobenzene	Sec-Butylbenzene
Coefficient of variation in 3 split samples								
set Wab 2-2	8.25	2.04	2.21	2.54	ND	ND	ND	ND
set Wab 12-1	3.78	2.69	2.90	0.73				
set Wab 16-4A	12.37	9.09	10.97	0.65				
Mean CV	***8.13***	***4.61***	***5.36***	***1.31***	***ND***	***ND***	***ND***	***ND***
N	***3***	***3***	***3***	***3***	***1***	***1***	***1***	***1***
N>25%	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***
Variability in Wabamun Lake sediment samples								
mean	3.66	69.53	82.24	15561.74	ND	ND	ND	ND
SD	1.76	25.34	34.84	5785.53				
CV	**48.01**	**36.45**	**42.37**	**37.18**				

	Naphthalene	N-Propylbenzene	1,1,1,2-Tetrachloroethane	1,2,3-Trichlorobenzene	1,2,4-Trichlorobenzene	Trichloroethylene	1,2,3-Trichloropropane	1,2,4-Trimethylbenzene
Coefficient of variation in 3 split samples								
set Wab 2-2								
set Wab 12-1								
set Wab 16-4A	ND	ND	ND	ND	ND	ND	ND	ND
Mean CV								
N								
N>25%	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***
Variability in Wabamun Lake sediment samples								
mean	***1***	***1***	***1***	***1***	***1***	***1***	***1***	***1***
SD	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***
CV	ND	ND	ND	ND	ND	ND	ND	ND

Appendix 2 - Table A2-1 Variability in split sediment samples and variability in Wabamun lake sediments (continued)

	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	1,1-Dichloroethane	1,2-Dichloroethane	1,1-Dichloroethylene	Trans-1,2-Dichloroethene	1,2-Dichloropropane
Coefficient of variation in 3 split samples								
set Wab 2-2	ND	ND	ND	ND	ND	ND	ND	ND
set Wab 12-1								
set Wab 16-4A								
Mean CV	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***
N	***1***	***1***	***1***	***1***	***1***	***1***	***1***	***1***
N>25%	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***
Variability in Wabamun Lake sediment samples								
mean	ND	ND	ND	ND	ND	ND	ND	ND
SD								
CV								

	M- + P-Xylene	4-Chloro-3-Methylphenol	2-Chlorophenol	2,4-Dichlorophenol	2,4-Dimethylphenol	2-Methyl-4,6-Dinitrophenol	2,4-Dinitrophenol	2-Nitrophenol
Coefficient of variation in 3 split samples								
set Wab 2-2	ND	ND	ND	ND	ND	ND	ND	ND
set Wab 12-1								
set Wab 16-4A								
Mean CV	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***
N	***1***	***1***	***1***	***1***	***1***	***1***	***1***	***1***
N>25%	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***
Variability in Wabamun Lake sediment samples								
mean	ND	0.11	ND	ND	ND	ND	ND	ND
SD								
CV								

	2,4-Dinitrotoluene	2,6-Dinitrotoluene	1,2-Diphenylhydrazine	Nitrobenzene	N-Nitrosodiphenylamine	N-Nitrosodi-N-Propylamine	4-Bromophenyl Phenyl Ether	Bis(2-Chloroethoxy) Methane
Coefficient of variation in 3 split samples								
set Wab 2-2	ND	ND	ND	ND	ND	ND	ND	ND
set Wab 12-1								
set Wab 16-4A								
Mean CV	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***	***ND***
N	***1***	***1***	***1***	***1***	***1***	***1***	***1***	***1***
N>25%	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***
Variability in Wabamun Lake sediment samples								
mean	ND	ND	ND	ND	ND	ND	ND	ND
SD								
CV								

Appendix 2 - Table A2-1 Variability in split sediment samples and variability in Wabamun lake sediments (continued)

	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Acridine	Pyrene	Fluoranthene	Retene (7-Isopropyl-1-Methylphenanthrene)
Coefficient of variation in 3 split samples								
set Wab 2-2	ND	11.09	11.74	ND	ND	10.66	15.72	11.46
set Wab 12-1								
set Wab 16-4A								
Mean CV	***ND***	***11.09***	***11.74***	***ND***	***ND***	***10.66***	***15.72***	***11.46***
N	***1***	***1***	***1***	***1***	***1***	***1***	***1***	***1***
N>25%	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***
Variability in Wabamun Lake sediment samples								
mean	ND	3.29	5.21	2.98	8.74	14.36	5.13	32.79
SD		2.53	4.58	2.56	8.25	15.60	3.76	55.36
CV		**76.98**	**88.03**	**85.81**	**94.37**	**108.60**	**73.29**	**168.84**

	Dibenzo(A,H) Pyrene	
Coefficient of variation in 3 split samples		
set Wab 2-2	ND	
set Wab 12-1		
set Wab 16-4A		
Mean CV	***ND***	
N	***0***	
N>25%	***0***	
Variability in Wabamun Lake sediment samples		
mean	ND	
SD		
CV		

Appendix 2 - Table A2-2 Sediment trace organic phthalate analysis for Wabamun Lake and eight other lakes sampled in 2002

Station No.	Station Name	Depth (m)	Station Description	Sample Date/Time	99091 Butyl benzyl Phthalate ug/g	99093 Di-N-Butyl Phthalate ug/g	99096 Diethyl Phthalate ug/g	99097 Dimethyl Phthalate ug/g	99094 Di-N-Octyl Phthalate ug/g	99090 Bis(2-Ethylhexyl) Phthalate ug/g
a. Results of Wabamun Lake Sediment Analyses										
AB05DE2101	Wabamun Grid 1-1-A	7	1 Km East of Seba Beach (South Node) and Seba Transect Point A	12-Aug-02 12:15	0.04	0.52	0.06	L2	0.24	0.34
AB05DE2102	Wabamun Grid 1-1-B	5	Seba Transect Point B	12-Aug-02 13:15						
AB05DE2103	Wabamun Grid 1-1-C	3.2	Seba Transect Point C	12-Aug-02 12:50	0.07	0.45	0.06	L2	L2	0.36
AB05DE2104	Wabamun Grid 1-1-D	1	Seba Transect Point D, Near Jackpine Creek Mouth	12-Aug-02 12:35						
AB05DE2106	Wabamun Grid 2-1	9.2	2 Km East of Seba Beach (South Node)	12-Aug-02 11:15						
AB05DE2107	Wabamun Grid 2-2	9.5	2 Km East of Seba Beach	21-Aug-02 16:30	L2	0.17	0.04	L2	L2	0.12
AB05DE2108	Wabamun Grid 2-3	7.7	2 Km East of Seba Beach	21-Aug-02 16:05						
AB05DE2113	Wabamun Grid 4-1	1	4 Km East of Seba Beach (South Node)	12-Aug-02 10:40						
AB05DE2114	Wabamun Grid 4-2	9.2	4 Km East of Seba Beach	12-Aug-02 13:30						
AB05DE2115	Wabamun Grid 4-3	9.2	4 Km East of Seba Beach	12-Aug-02 13:45	L2	0.46	L2	L2	0.50	0.83
AB05DE2116	Wabamun Grid 4-4	9.2	4 Km East of Seba Beach	21-Aug-02 15:45						
AB05DE2117	Wabamun Grid 4-5	1.8	4 Km East of Seba Beach	30-Jul-02 14:00						
AB05DE2121	Wabamun Grid 5-4-A	7.6	5 Km East of Seba Beach (North Node) and Fallis West Transect Point A	30-Jul-02 12:40	L2	2.40	0.15	L2	L2	1.18
AB05DE2122	Wabamun Grid 5-4-B	5.2	Fallis West Transect Point B	30-Jul-02 12:55						
AB05DE2123	Wabamun Grid 5-4-C	2.7	Fallis West Transect Point C	30-Jul-02 13:20	0.01	0.15	0.00	L2	L2	0.04
AB05DE2124	Wabamun Grid 5-4-D	1	Fallis West Transect Point D, Near Shore	30-Jul-02 13:40						
AB05DE2125	Wabamun Grid 6-1-A	7	6 Km East of Seba Beach (South Node) and Beaver Transect Point A	12-Aug-02 09:10	0.03	0.63	L2	L2	L2	0.47
AB05DE2126	Wabamun Grid 6-1-B	5	Beaver Creek Transect Point B	12-Aug-02 10:10						
AB05DE2127	Wabamun Grid 6-1-C	3.2	Beaver Creek Transect Point C	12-Aug-02 09:50	0.05	0.30	L2	L2	0.08	0.35
AB05DE2128	Wabamun Grid 6-1-D	1	Beaver Creek Transect Point D, Near Beaver Creek Mouth	12-Aug-02 09:30						
AB05DE2129	Wabamun Grid 6-2	9.8	6 Km East of Seba Beach	06-Aug-02 14:15	0.02	0.37	0.03	L2	0.21	0.57
AB05DE2130	Wabamun Grid 6-3	7.2	6 Km East of Seba Beach	30-Jul-02 11:30						
AB05DE2135	Wabamun Grid 8-1	9.1	1.5 Km East of Fallis Point (South Node)	06-Aug-02 10:30						
AB05DE2136	Wabamun Grid 8-2	8.5	1.5 Km East of Fallis Point	06-Aug-02 11:00						
AB05DE2137	Wabamun Grid 8-3-A	7	1.5 Km East of Fallis Point and Fallis East Transect Point A	06-Aug-02 11:30	L2	0.48	L2	L2	L2	0.29
AB05DE2138	Wabamun Grid 8-3-B	5	Fallis East Transect Point B	06-Aug-02 13:30						
AB05DE2139	Wabamun Grid 8-3-C	3	Fallis East Transect Point C	06-Aug-02 13:00						
AB05DE2140	Wabamun Grid 8-3-D	2	Fallis East Transect Point D	06-Aug-02 12:45	0.01	0.24	L2	L2	0.09	0.17
AB05DE2141	Wabamun Grid 8-3-E	1	Fallis East Transect Point E, Near Shore	06-Aug-02 12:00						
AB05DE2142	Wabamun Grid 8-4	4.4	1.5 Km East of Fallis Point	06-Aug-02 14:00						
AB05DE2147	Wabamun Grid 10-1	4.3	3.5 Km East of Fallis Point (South Node)	02-Aug-02 10:00						
AB05DE2148	Wabamun Grid 10-2	8	3.5 Km East of Fallis Point	02-Aug-02 10:20	0.02	0.87	0.14	L2	0.11	0.24
AB05DE2149	Wabamun Grid 10-3	7.3	3.5 Km East of Fallis Point	02-Aug-02 10:35						
AB05DE2150	Wabamun Grid 10-4	6.5	3.5 Km East of Fallis Point	02-Aug-02 10:45						
AB05DE2153	Wabamun Grid 11-3	7.2	4.5 Km East of Fallis Point	26-Jul-02 11:45						
AB05DE2154	Wabamun Grid 11-4	6.5	4.5 Km East of Fallis Point	26-Jul-02 11:30						
AB05DE2155	Wabamun Grid 11-5	5.8	4.5 Km East of Fallis Point	26-Jul-02 11:10						

Appendix 2 - Table A2-2 Sediment trace organic phthalate analysis for Wabamun Lake and eight other lakes sampled in 2002 (cont'd)

Station No.	Station Name	Depth (m)	Station Description	Sample Date/Time	99091 Butylbenzyl Phthalate ug/g	99093 Di-N-Butyl Phthalate ug/g	99096 Diethyl Phthalate ug/g	99097 Dimethyl Phthalate ug/g	99094 Di-N-Octyl Phthalate ug/g	99090 Bis(2-Ethylhexyl) Phthalate ug/g
AB05DE2156	Wabamun Grid 12-1	6	North of Sundance Plant (South Node)	01-Aug-02 13:12	0.03	0.33	L2	L2	L2	0.30
AB05DE2157	Wabamun Grid 12-2	7	North of Sundance Plant	01-Aug-02 14:07						
AB05DE2158	Wabamun Grid 12-3	6.5	North of Sundance Plant	26-Jul-02 12:05	0.21	0.92	0.11	L2	0.10	3.76
AB05DE2159	Wabamun Grid 12-4	6	North of Sundance Plant	26-Jul-02 10:30						
AB05DE2160	Wabamun Grid 12-5	3.3	North of Sundance Plant	26-Jul-02 10:45	L2	1.76	0.01	L2	L2	0.30
AB05DE2161	Wabamun Grid 13-1	0.7	1 Km East of Sundance Plant (South Node)	01-Aug-02 12:35	L2	0.00	L2	L2	L2	0.02
AB05DE2162	Wabamun Grid 13-2-A	6	1 Km East of Sundance Plant	01-Aug-02 11:25						
AB05DE2206	Wabamun Grid 13-2-B	5.8	Sundance Plant Transect Point B	01-Aug-02 11:10	L2	0.22	L2	L2	L2	0.24
AB05DE2207	Wabamun Grid 13-2-C	2.8	Sundance Plant Transect Point C	01-Aug-02 11:54						
AB05DE2208	Wabamun Grid 13-2-D	1.3	Sundance Plant Transect Point D	01-Aug-02 11:36	0.01	0.15	L2	L2	0.01	1.23
AB05DE2164	Wabamun Grid 13-4	6.1	1 Km East of Sundance Plant	26-Jul-02 12:45						
AB05DE2165	Wabamun Grid 13-5	5	1 Km East of Sundance Plant	26-Jul-02 10:10						
AB05DE2168	Wabamun Grid 14-2	2	2 Km East of Sundance Plant	01-Aug-02 10:15	L2	0.12	L2	L2	L2	0.06
AB05DE2170	Wabamun Grid 14-3	4.3	2 Km East of Sundance Plant	01-Aug-02 10:34						
AB05DE2172	Wabamun Grid 14-4	5.3	2 Km East of Sundance Plant	01-Aug-02 10:50	L2	0.27	L2	L2	L2	0.17
AB05DE2173	Wabamun Grid 14-5	5	2 Km East of Sundance Plant	01-Aug-02 11:07						
AB05DE2174	Wabamun Grid 14-6	6.7	2 Km East of Sundance Plant	26-Jul-02 13:10	L2	3.40	0.11	L2	L2	5.75
AB05DE2175	Wabamun Grid 14-7	5.2	2 Km East of Sundance Plant	26-Jul-02 09:40						
AB05DE2176	Wabamun Grid 15-1	2	3 Km East of Sundance Plant (South Node)	01-Aug-02 10:00						
AB05DE2179	Wabamun Grid 15-4	5.8	3 Km East of Sundance Plant	01-Aug-02 08:50						
AB05DE2180	Wabamun Grid 15-5	5.8	3 Km East of Sundance Plant	26-Jul-02 13:25						
AB05DE2181	Wabamun Grid 15-6-A	4.5	3 Km East of Sundance Plant (North Node) and Alison Bay West Transect Point A	25-Jul-02 13:25	L2	14.61	0.09	L2	L2	0.74
AB05DE2182	Wabamun Grid 15-6-B	2	Alison Bay West Transect Point B	25-Jul-02 14:45						
AB05DE2183	Wabamun Grid 15-6-C	1	Alison Bay West Transect Point C	25-Jul-02 14:15						
AB05DE2184	Wabamun Grid 15-6-D	0.5	Alison Bay West Transect Point D, Near Shore	25-Jul-02 13:50	0.03	0.41	0.03	L2	L2	0.84
AB05DE2186	Wabamun Grid 16-2	3.6	4 Km East of Sundance Plant	01-Aug-02 08:32						
AB05DE2187	Wabamun Grid 16-3	4.8	4 Km East of Sundance Plant	26-Jul-02 13:40						
AB05DE2188	Wabamun Grid 16-4-A	3.8	4 Km East of Sundance Plant (North Node) and Alison Bay East Transect Point A	30-Jul-02 10:20	0.03	0.27	0.08	L2	L2	0.85
AB05DE2189	Wabamun Grid 16-4-B	3	Alison Bay East Transect Point B	25-Jul-02 15:30						
AB05DE2190	Wabamun Grid 16-4-C	2.5	Alison Bay East Transect Point C	25-Jul-02 15:20						
AB05DE2191	Wabamun Grid 16-4-D	3	Alison Bay East Transect Point D, Near Lagoon Outfall	25-Jul-02 15:00	0.04	0.06	0.05	L2	L2	0.13
AB05DE2192	Wabamun Grid 17-1	4.4	Off Point Alison	01-Aug-02 07:51	L2	0.17	L2	L2	L2	0.09
AB05DE2193	Wabamun Grid 18-1-A	4	1 Km East of Point Alison (South Node) and Outlet Transect Point A	25-Jul-02 10:00						
AB05DE2194	Wabamun Grid 18-1-B	3	Outlet Transect Point B	25-Jul-02 12:00						
AB05DE2195	Wabamun Grid 18-1-C	2	Outlet Transect Point C	25-Jul-02 11:45						
AB05DE2196	Wabamun Grid 18-1-D	1	Outlet Transect Point D	25-Jul-02 11:05						
AB05DE2197	Wabamun Grid 18-1-E	0.5	Outlet Transect Point E	25-Jul-02 10:45						
AB05DE2198	Wabamun Grid 18-2	2.9	1 Km East of Point Alison	25-Jul-02 12:20	L2	0.81	0.05	L2	L2	0.35

Appendix 2 - Table A2-2 Sediment trace organic phthalate analysis for Wabamun Lake and eight other lakes sampled in 2002 (cont'd)

Station No.	Station Name	Depth (m)	Station Description	Sample Date/Time	99091 Butylbenzyl Phthalate ug/g	99093 Di-N-Butyl Phthalate ug/g	99096 Diethyl Phthalate ug/g	99097 Dimethyl Phthalate ug/g	99094 Di-N-Octyl Phthalate ug/g	99090 Bis(2-Ethylhexyl) Phthalate ug/g
AB05DE2203	Wabamun Grid 20-1	1.5	Moonlight Bay (Park)	25-Jul-02 12:50						
AB05DE2204	Wabamun Grid 20-2	3.4	Moonlight Bay	25-Jul-02 13:00						
b. Results of Analyses of Eight Lakes Sampled in 2002										
AB06AA1010	Amisk Grid 1-1	54	No Description	27-Aug-02 12:09	0.02	0.18	L2	L2	L2	0.10
AB06AA1020	Amisk Grid 1-2	40	No Description	27-Aug-02 12:58	L2	0.27	L2	L2	L2	0.14
AB06AA1030	Amisk Grid 1-3	30	No Description	27-Aug-02 13:30	L2	0.33	L2	L2	L2	0.20
AB05ED1470	Bonnie Grid 1-1	4	No Description	03-Sep-02 13:35	0.11	0.96	L2	L2	0.19	1.29
AB05ED1480	Bonnie Grid 1-2	3	No Description	03-Sep-02 13:50	0.12	0.99	L2	L2	0.17	1.52
AB05ED1490	Bonnie Grid 1-3	2	No Description	03-Sep-02 14:05	0.13	1.03	0.06	L2	0.12	1.30
AB05CC1990	Gull Grid 1-1		No Description	21-Aug-02 12:00	L2	0.11	L2	L2	L2	0.10
AB05CC2000	Gull Grid 1-2		No Description	21-Aug-02 13:35	L2	0.14	L2	L2	L2	0.20
AB05CC2010	Gull Grid 1-3		No Description	21-Aug-02 14:30	L2	0.05	0.01	L2	L2	0.05
AB05EA1720	Isle Grid 1-1	6.1	No Description	29-Aug-02 11:00	0.04	0.42	0.02	L2	0.10	0.15
AB05EA1730	Isle Grid 1-2	5.2	No Description	29-Aug-02 12:30	0.03	0.45	0.05	L2	0.16	0.19
AB05EA1740	Isle Grid 1-3	4.1	No Description	29-Aug-02 12:50	0.07	0.49	0.04	L2	0.10	0.22
AB05EA1750	Lac. Ste. Anne Grid 1-1	9.5	No Description	05-Sep-02 11:30	0.09	0.94	L2	L2	0.32	0.90
AB05EA1760	Lac Ste. Anne Grid 1-2	8.9	No Description	05-Sep-02 12:00	0.12	1.11	L2	L2	0.35	0.36
AB05EA1770	Lac Ste. Anne Grid 1-3	7.5	No Description	05-Sep-02 12:30	0.04	0.88	L2	L2	0.03	0.44
AB05FA2000	Pigeon Grid 1-1	9.5	No Description	04-Sep-02 11:05	L2	0.56	L2	L2	0.04	0.82
AB05FA2010	Pigeon Grid 1-2	8.5	No Description	04-Sep-02 12:00	0.15	1.48	0.08	L2	0.29	2.22
AB05FA2020	Pigeon Grid 1-3	7.5	No Description	04-Sep-02 12:30	0.16	0.88	L2	L2	L2	1.45
AB05CC1960	Sylvan Grid 1-1	15.2	No Description	22-Aug-02 12:30	0.01	0.06	L2	L2	L2	0.05
AB05CC1970	Sylvan Grid 1-2	14	No Description	22-Aug-02 13:00	0.06	0.52	0.04	L2	L2	0.44
AB05CC1980	Sylvan Grid 1-3	13	No Description	22-Aug-02 13:45	0.07	0.41	0.07	L2	L2	0.30
AB05DF1160	Wizard Grid 1-1	11.2	No Description	28-Aug-02 12:30	0.01	0.23	0.03	L2	L2	0.15
AB05DF1170	Wizard Grid 1-2	10.4	No Description	28-Aug-02 13:40	0.01	0.25	L2	L2	L2	0.10
AB05DF1180	Wizard Grid 1-3	9.1	No Description	28-Aug-02 14:00	0.01	0.33	0.03	L2	L2	0.09

Appendix 2 - Table A2-3 Summary of trace organic phthalate detections in sediments from Wabamun Lake and eight other lakes sampled in 2002

		Extractable Priority Pollutants (EPP)									
		BUTYL BENZYL PHTHALATE		DI-N-BUTYL PHTHALATE		DIETHYL PHTHALATE		DI-N-OCTYL PHTHALATE		BIS(2-ETHYL HEXYL) PHTHALATE	
Wabamun Lake											
# of samples		27		27		27		27		27	
# of samples with detections		14		27		15		8		27	
# of samples with conc. > DL		0		3		0		0		2	
Mean (all detections)		**0.04**		**1.13**		**0.07**		**0.17**		**0.73**	
Standard deviation		0.05		2.80		0.05		0.15		1.24	
Maximum		0.21	e	14.61		0.15		0.50		5.75	
Other Lakes											
# of samples		24		24		24		24		24	
# of samples with detections		18		24		10		11		24	
# of samples with conc. > DL		0		0		0		0		1	
Mean (all detections)		**0.07**		**0.55**		**0.04**		**0.17**		**0.53**	
Standard deviation		0.05		0.39		0.02		0.11		0.61	
Maximum		0.16	e	1.48	e	0.08	t	0.35	e	2.22	
Amisk	Mean	0.02		0.26		ND		ND		0.15	
	Maximum	0.02	t	0.33	e	ND		ND		0.20	e
Bonnie	Mean	0.12		0.99		0.06		0.16		1.37	
	Maximum	0.13	e	1.03	e	0.06	t	0.19	e	1.52	
Gull	Mean	ND		0.10		0.01		ND		0.11	
	Maximum	ND		0.14	e	0.01	t	ND		0.20	e
Isle	Mean	0.05		0.46		0.04		0.12		0.18	
	Maximum	0.07	t	0.49	e	0.05	t	0.16	e	0.22	e
Lac Ste Anne	Mean	0.08		0.98		ND		0.23		0.57	
	Maximum	0.12	e	1.11	e	ND		0.35	e	0.90	e
Pigeon	Mean	0.16		0.98		0.08		0.17		1.50	
	Maximum	0.16	e	1.48	e	0.08	t	0.29	e	2.22	
Sylvan	Mean	0.04		0.33		0.05		ND		0.26	
	Maximum	0.07	t	0.52	e	0.07	t	ND		0.44	e
Wizard	Mean	0.01		0.27		0.03		ND		0.11	
	Maximum	0.01	t	0.33	e	0.03	t	ND		0.15	e

Notes: EPP Detection limit is 1µg/g, except for benzidene which is 4 µg/g. Concentrations in µg/g dry weight
PAH Detection limit is 1 ng/g. Concentrations in ng/g dry weight
Concentration <DL, but >0.1 x DL are reported as "estimated" (e)
Concentrations <0.01 x DL are reported as 'traces' (t)
ND: not detected NA: not applicable

Appendix 3 Comparison of 'total' (harsh extraction) and 'near total' (mild extraction) concentrations of selected metals for Wabamun and other lakes

	Aluminum		Arsenic		Cadmium		Chromium		Copper		Lead		Zinc		Boron	
Extraction:	***Mild***	***Harsh***	***Mild***	***Harsh***	***Mild***	***Harsh***	***Mild***	***Harsh***	***Mild***	***Harsh***	***Mild***	***Harsh***	***Mild***	***Harsh***	***Mild***	***Harsh***
Wabamun 15-6-A	19892	50599	14.1	19.1	0.326	0.3	34.8	60	95	137	16.8	26.6	90.5	129	56.1	121
Wabamun 15-6-B	13764	44103	11.1	15.4	0.256	0.62	33.6	52.9	68.2	88.9	13.4	22.1	68.8	99.3	31.7	97
Wabamun 15-6-C	8648	49331	6.14	17.7	0.147	0.61	20.3	54.8	32.0	116	6.97	23.7	35.7	111	28.9	105
Wabamun 15-6-D	15265	51407	12.0	19	0.253	0.7	55.3	56.1	43.1	100	9.78	23.4	44.4	111	46.5	115
Wabamun 2-1	30693	48701	19.1	23.7	0.484	0.76	47.1	66	126	135	27.0	32.4	114	139	70.6	98
Wabamun 2-2	25438	37863	20.7	20.3	0.536	0.4	44.2	51	157	129	29.8	28.9	123	114	60.6	81
Wabamun 2-3	24322	37385	19.7	19	0.558	0.43	37.2	48.2	123	104	28.7	28.3	119	109	67.4	86
Wabamun 4-3	29559	48417	21.1	21.7	0.437	**0.75**	45.7	58.6	152	154	26.9	30.7	119	134	76.0	106
Wabamun 5-4-C	1883	20006	1.08	3.6	0.0868	0.28	4.92	9.7	4.30	4.7	1.65	6.22	11.4	13.8	17.6	26
Wabamun 8-2	26909	47763	15.8	18.2	0.393	**0.72**	39.9	57.2	105	113	20.3	24.3	92.3	112	78.9	125
Wabamun 10-3	26206	47629	15.2	18.5	0.377	**0.75**	37.1	58	93.8	105	19.9	24.3	89.4	111	80.4	118
Wabamun 12-3	22406	40226	15.1	13	0.387	0.49	34.9	**66.3**	86.7	48.4	17.3	18.2	91.8	57.7	73.8	76
Wabamun 13-2-C	5276	33719	11.5	81.9	0.142	0.37	9.05	16.1	7.82	9.2	6.35	11.5	28.7	35.9	23.1	42
Wabamun 15-4	18347	49227	12.6	14	0.317	0.72	33.4	53.9	83.8	84.3	17.4	22.1	82.8	98	66.3	87
Wabamun 16-3	19683	37116	13.6	14.2	0.304	0.54	33.7	50.6	86.2	80.9	16.9	20.8	81.9	91.6	60.2	68
Wabamun 20-1	4489	50599	11.7	11.4	0.195	0.296	9.62	10	35.4	35.9	14.9	11.2	28.2	30.8	39.2	41.8
Gull Grid 1-2	17641	30911	5.78	5.7	0.393	0.38	27.4	38.7	19.8	18.4	14.3	15.1	56.3	57	61.1	73
Bonnie Grid 1-2	8770	14068	18.7	18	0.448	0.37	12.8	17.2	10.9	11	11.8	12.6	59.1	60.4	57.1	68
Pigeon Grid 1-3	20513	43865	5.59	6.2	0.454	0.36	28.9	44.2	22.7	22.8	19.4	21.4	82.7	82	42.5	65
Lac Ste. Anne Grid 1-2	15634	34089	5.66	6.3	0.342	0.29	22.3	38.6	13.7	28	13.9	16.4	67.2	72	44.8	76
Comparison of compliance frequency with CCME sediment guidelines																
number samples > ISQG			16	18	0	8	5	16	12	14	0	0	1	3		
number samples >PEL			5	11	0	0	0	0	0	0	0	0	0	0		
% >ISQG			80.0	90.0	0.0	40.0	25.0	80.0	60.0	70.0	0.0	0.0	5.0	15.0		
%>PEL			25.0	55.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		

Appendix 3 Comparison of 'total' (harsh extraction) and 'near total' (mild extraction) concentrations of selected metals for Wabamun and other lakes (continued)

	Cobalt		Iron		Manganese		Antimony		Selenium		Thorium		Thalium	
Extraction:	*Mild*	*Harsh*	*Mild*	*Harsh*	*Mild*	*Harsh*	*Mild*	*Harsh*	*Mild*	*Harsh*	*Mild*	*Harsh*	*Mild*	*Harsh*
Wabamun 15-6-A	6.01	9.38	13692	19524	552	721	0.053	2.52	1.73	5.79	5.97	7.54	0.206	0.432
Wabamun 15-6-B	4.37	7.84	9808	16540	741	688	0.0619	1.42	1.70	4.1	4.38	6.54	0.164	0.37
Wabamun 15-6-C	2.50	8.6	5773	18553	971	636	0.0390	2.21	< 0.4	4.7	2.40	6.78	0.100	0.42
Wabamun 15-6-D	4.64	9.2	10402	18750	263	632	0.127	2.42	0.664	5.7	5.59	7.45	0.245	0.42
Wabamun 2-1	7.72	8.8	20743	22967	370	392	0.159	3.4	4.06	5	7.26	7.3	0.336	0.56
Wabamun 2-2	8.03	7.1	18931	20648	346	340	0.183	2.81	4.53	4.5	7.28	8.2	0.372	0.41
Wabamun 2-3	8.32	7.5	19392	21233	346	305	0.192	2.6	2.78	4.6	7.07	6.7	0.326	0.44
Wabamun 4-3	8.38	8.6	18705	21568	347	371	0.227	3.08	4.02	4	7.30	7.44	0.352	0.48
Wabamun 5-4-C	1.34	1.77	2982	4013	90.1	144	0.0262	0.27	< 0.4	L0.39	2.15	1.5	0.116	0.35
Wabamun 8-2	7.67	9.2	15453	17236	667	655	0.188	3	0.887	5.3	7.17	7.7	0.244	0.44
Wabamun 10-3	7.76	9.4	15202	17223	588	613	0.146	2.71	2.46	5.2	7.50	7.72	0.283	0.41
Wabamun 12-3	7.62	6.7	14834	14158	594	295	0.014	1.94	0.61	3.8	6.03	6.91	0.233	0.46
Wabamun 13-2-C	4.83	7.6	8693	19995	559	852	0.0011	0.59	< 0.4	0.71	2.90	3.6	0.226	0.54
Wabamun 15-4	6.36	8	13544	17633	561	614	0.0466	1.9	1.55	3.4	5.89	7	0.225	0.46
Wabamun 16-3	5.87	6.6	13933	12134	685	820	0.0436	1.05	1.53	2.5	5.82	5.16	0.186	0.41
Wabamun 20-1	1.53	2.98	3467	3241	347	306	0.178	0.692	0.903	1.17	0.897	1.3	0.103	0.37
Gull Grid 1-2	7.04	7.7	16761	17667	464	439	0.0623	0.78	< 0.4	2	4.15	4.92	0.216	0.34
Bonnie Grid 1-2	3.87	5.3	18991	18217	537	506	0.0723	0.54	1.25	1.6	2.32	3.05	0.119	0.17
Pigeon Grid 1-3	9.05	8.6	27000	28007	894	843	0.0720	0.97	< 0.4	0.9	5.73	8.5	0.237	0.46
Lac Ste. Anne Grid 1-2	6.39	7.1	17767	18384	720	695	0.0425	0.6	0.778	1.8	4.71	7.07	0.232	0.403
Comparison of compliance frequency with CCME sediment guidelines														
number samples > ISQG														
number samples >PEL														
% >ISQG														
%>PEL														