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Sediment Quality in Lake Superior Tributaries: A Screening-Level Survey

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Executive Summary

A survey of sediment quality was undertaken in the summer and fall of 2005 in the mouths of tributaries draining to Lake Superior. A total of 117 samples were obtained, representing 108 tributaries. Six (6) samples were field duplicates and given fictitious names.

The sampling program was based on the Guidelines for Collecting and Processing Samples of Stream Bed Sediment for Analysis of Trace Elements and Organic Contaminants, developed by the United States Geological Survey (USGS) for the U.S. National Water-Quality Assessment Program (NAWQA; Shelton and Capel, 1994). A number of sub-samples are combined at each site so that one sample is obtained that is representative of the overall conditions in that tributary.

The samples were analyzed for 26 organochlorine compounds plus seven (7) PCB Aroclors and Total PCBs. Sixteen (16) PAH compounds and 27 metals were analyzed, and the inorganic and organic carbon content as well as loss on ignition was determined. For many of the tributaries, this study represents the first information related to organic compounds in sediments.

Twenty three (22) organochlorine compounds were not detected in any sample. DDT and metabolites DDE and DDD were the only detected organochlorines, with only 2 occurrences, both above the PEL. One or more PCB Aroclor was detected at nine sites. Total PCB concentrations were detected at only two (2) sites both below any guidelines.
Polycyclic aromatic hydrocarbons (PAHs) were found more often, with one or more of the 16 PAH compounds detected at 34 sites (i.e., detection frequency of 31%). Exceedences of one or more federal TEL guideline for PAHs occurred at 15% of the sites and PEL exceedences occurred at a further two (2) sites. In general, PAH concentrations were lower than found on the lower great lakes. This is probably do to the lower urbanization found along Lake Huron.

At most sites, the detections of metals are likely related to the natural occurrence of trace elements in stream sediments. For some metals, however, concentrations appear to be elevated to a degree that is considered to be toxic to aquatic biota. These metals include: chromium, zinc. Copper has a natural occurrence in Michigan which reflects levels of greater than ten times the provincial serious effect level. Other metals, including manganese and iron, appeared to be elevated at certain sites but these higher levels might be related to natural sources.

1.0 Introduction and Purpose

The Ecosystem Health Division (EHD) of Environment Canada (EC), Ontario Region, conducted a screening-level survey of sediment quality in both Canadian and American tributaries to Lake Superior in the fall of 2005. The sampling represents the final screening stage of a track-down program to identify potential sources of contamination to the upper Great Lakes that are not being addressed by other Great Lakes programs. The program constitutes a portion of Environment Canada's commitment towards the Great Lakes Water Quality Agreement (GLWQA).

The purpose of the sampling was to assess sediment quality in deposition zones in each tributary prior to discharge to Lake Superior. One sediment sample, consisting of many sub samples, was taken from each tributary in a manner that is representative of the overall sediment quality in that tributary.

The study was designed to maximize the probability of detecting persistent toxic substances entering the lake, if they exist. The intent of the program is to identify remaining sources of contamination for subsequent follow-up work. It is not the intent at this stage to quantify the loadings of contaminants entering Lake Superior. Instead, the results from this program will be combined with existing water quality, fish, benthic and sediment contaminant information, using a weight-of-evidence approach, to prioritize subsequent track-down efforts.

As with the Lake Erie, Lake Ontario and Lake Huron screening studies, this study also targeted parameters for the sediment screening identified in their respective Lakewide Management Plan (LaMP) as impairing lake-wide beneficial uses. In addition, a suite of contaminants targeted for virtual elimination in the Canada-U.S. Binational Toxics Strategy (BTS) were considered in order to assess Canada's commitments towards that Strategy. Additional parameters were included for contextual information (such as particle size and total organic carbon) and to improve our understanding of the contaminant status of Lake Superior tributaries (e.g., metals, pesticides, contaminants of emerging concern).

2.0 Methodology

To achieve the study objectives, the sampling program consisted of a survey-level, screening assessment of recently deposited sediment quality near the mouths of tributaries entering Lake Superior. The targeted substances are relatively insoluble in water (i.e., hydrophobic) and are therefore typically found at higher concentrations in sediments than in water. In addition, bed sediments in depositional environments provide a time-integrated sample of particulate matter transported by a stream. Analysis of bed sediments alleviated problems associated with detecting trace levels of substances in water samples. Bed sediment sampling can overcome problems detecting periodic or intermittent sources of contaminants in water from non-point pollution sources.

2.1 Field Program

Tributary Selection

A reconnaissance survey was conducted in May and June 2005 to identify tributaries and select sampling sites. Sediment deposition zones were sought near the mouths of the tributaries such that they were likely downstream from potential contaminant sources yet sufficiently far upstream not to be influenced by the water body into which it drains. In other words, sites were selected to be outside of the zone of lake influence.

During the reconnaissance survey, the method of access was also identified. Most sites were accessed by wading or were sampled from a bridge crossing. In certain, larger tributaries, sampling sites were accessed by boat. In the majority of cases, the sample site coincided with the most downstream road crossing of the tributary.

Number of Sites

Significantly less tributaries, containing sediment, draining the Lake Superior watersheds was sampled in this program as compared to previous tributary screening studies. Lake Superior represents the least urban developed Great Lake and therefore presented many challenges in accessing tributaries. Many sites were not sampled as access was prohibitable, 29 sites were attempted without success to sample and many other sites that were accessed (27 sites) did not have sediment. As well a further 4 sites were on First Nation Land and permission to sample was not given. As a result a total of 57 Canadian and 51 American sites were sampled. For many sites, this program has provided its first information about organic contaminants in sediments. The geographic extent of the program was restricted to Lake Superior from just east of the St. Marys River on the northern tip of the North Channel at Echo Bay. The tributaries sampled during the project are shown in Figure 1.

A total of 117 samples were obtained, representing 108 tributaries. As mentioned above, a single site sediment sample was generally taken from depositional zones upstream of the tributary mouth.

Of the 117 samples, 9 were blind duplicate samples; that is, they were split samples that were assigned a fictitious name in the field (usually a name of a common bird, unless a more appropriate name was conceived). The blind duplicates were obtained to assess variability due to sample handling and laboratory precision. A list of blind duplicates and the corresponding tributary is provided in Table 1, below.

Figure 1. Lake Superior tributaries sampled

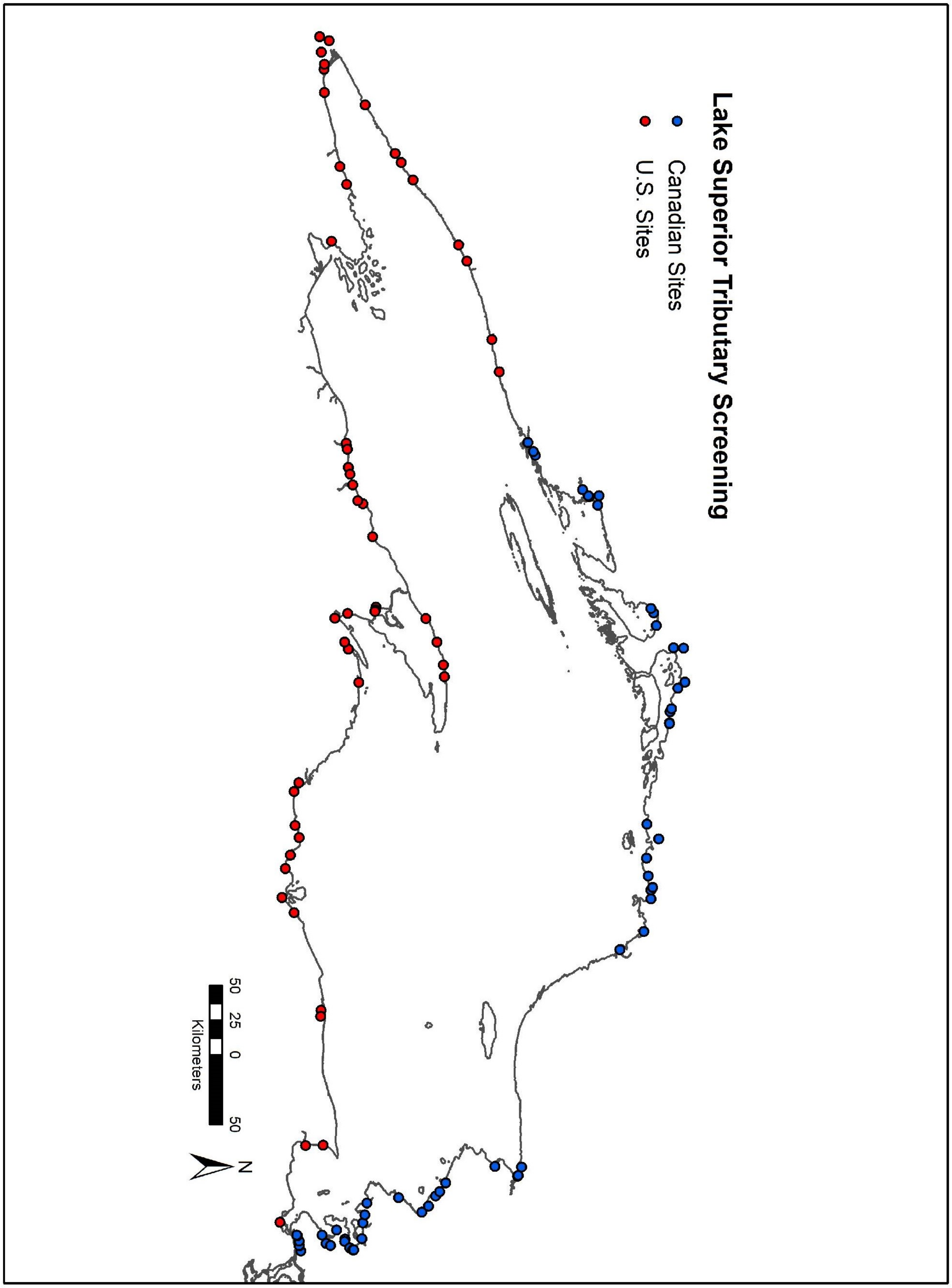

Table 1. Blind Duplicate Sample Listing

Tributary	Blind Duplicate Sample
Big Trout Creek	Goshawk Creek
Goulais River	Vulture Creek
Little Pic River	Kestrel Creek
Neebing River	Heron Creek
Prairie River	Redtail Creek
Sawmill Creek	Harrier Creek
Temperance River	Boa Creek
Grand Marais Creek	Rattler Creek
Sturgeon River	Copperhead Creek

Sampling Methodology

The sampling program was based on the Guidelines for Collecting and Processing Samples of Stream Bed Sediment for Analysis of Trace Elements and Organic Contaminants, developed by the United States Geological Survey (USGS) for the U.S. National Water-Quality Assessment Program (NAWQA; Shelton and Capel, 1994). In the NAWQA program, downstream locations in watersheds are selected to provide a coarse-scale network of sites. At these "integrator" sites, large-scale problems that may not be detected in smaller basins have a reasonable chance of being detected. A number of sub-samples are combined so that one sample is obtained that is representative of the overall conditions in that tributary.

Field Campaign

Sampling was conducted between August 15 – Sept 16 and October 3, 2005 for Canadian tributaries and from Sept 17 – Oct 26 for the American tributaries. One or more depositional reach was sampled upstream of the mouth in each tributary. Only the very fine-grained surface deposits, to a maximum depth of approximately 1 or 2 cm, depending on the site, were collected. These surface sediments better represent relatively recent rather than historic deposition. Sites were selected to be representative of the variety of locations (i.e., mid-channel, left bank, right bank) and habitat types (pools, different depths of water, and depositional zones behind obstacles such as boulders or sand bars) present at each site. Only wetted depositional zones were sampled.

Where water depths permitted wading and water velocities were slow enough to permit sample retrieval, samples were obtained using a stainless steel spoon and collected in a glass bowl. At sites where the water depth was too great for wading or water velocities were swift enough to wash the fine particles from the spoons during sample retrieval, an all-stainless steel Wildco Petite Ponar sampler was used.

Upon arrival at each site, the sampling equipment was thoroughly rinsed in the ambient river water. The surface sediments were collected (either by spoon or Ponar, as described above) and combined in a glass bowl. The sediments were sieved through a 2-mm stainless steel sieve to remove the larger size fractions and to assist with homogenization of the sample. The sample was further homogenized by mixing with a spoon for approximately two minutes.

Several sample jars were filled at each site. In general, four jars were used:

- one 125-mL polyethylene container filled with approximately 2 cm of sediment for metals analysis;
- one 125-mL polyethylene container filled approximately ½ full for total organic carbon and grain size analysis;
- one 250-mL glass container with Teflon-lined screw cap filled approximately ¾ full for organochlorine (OC) and polyaromatic hydrocarbon (PAH) analysis, and;
- one 250-mL Teflon or glass container filled approximately ¾ full for archiving purposes.

Blind duplicate samples were obtained at nine sites, including blind duplicate archive samples at each of these.

Sample jars were labeled with permanent marker on both the lids and on laboratory tape affixed to the side of the jars. The recorded information included the site name, date, organization (EHD/OR), and parameters for analysis (e.g. OCs and PAHs, metals, TOC and grain size, Archive). After the appropriate sample jars were filled, the sampling equipment was thoroughly rinsed in the ambient river water.

A field drawing was made and digital photos were taken at each site. A sketch of each tributary reach was made to include its major features, habitat types, approximate dimensions, surrounding land uses, major road crossings, etc. The locations and number of sampling sites were identified on each sketch, and the method of sediment retrieval was noted. A Lowrance Global Map 100 geographic positioning system (GPS) device was used to obtain each location using the position averaging function. The GPS location within the site was included on the sketch.

Samples were kept on ice in portable coolers while in the field. Upon return to the Canada Centre for Inland Waters in Burlington, the samples were decanted then frozen at –10ºC. Samples in glass bottles were frozen on their sides to prevent bottle breakage.

2.2 Laboratory Methods

The samples in polyethylene containers (i.e., those for metals, TOC and grain size analysis) were freeze-dried prior to analysis. Samples were sent to Natural Resources Canada in Ottawa, Ontario. All metals samples, TOC and grain size samples were freeze-dried at these facilities. Once freeze-dried, TOC was analyzed by Leco Cr-412 and grain size fractions were determined using a Lecotrac Particle Size Analyzer LT100.

Metal analysis was performed in their entirety by Caduceon Enterprises Inc. The laboratory performed the metals analysis (including mercury) on freeze-dried sediment samples using aqua regia digestion methods.

Analysis of organochlorines (OCs), including PCBs and polycyclic aromatic hydrocarbons (PAHs) was awarded to Maxxam Analytics Inc. in Mississauga as the result of a competitive bidding process. Frozen, wet sediment samples were sent to Maxxam in the winter of 2006.

Samples were thawed and OCs were analyzed by gas chromatography/dual column electron capture detector (GC/ECD) after accelerated solvent extraction following the EPA protocol SW846 EPA 3545. Samples for PAH analysis were extracted using a sonication method. The extracts were then concentrated and analyzed by mass spectrometry (GC/MS). Sample results were reported on a dry weight basis.

The archived sediments have proven useful for a variety of purposes to date. The National Laboratory for Environmental Testing (NLET) is analyzing selected samples for selected compounds of emerging concern (e.g., polybrominated diphenyl ethers, selected musk compounds). Dioxin, furans, dioxin-like PCBs and polychlorinated napthalene analysis was conducted on 13 samples by the Ontario Ministry of the Environment.

2.3 Data Analysis

The laboratory results were analyzed in a spreadsheet program. Results were compared with the Federal and Provincial sediment quality objectives and with other sites in the program. The frequency of detection and frequency of exceedances of the sediment quality objectives were computed.

3.0 Results

Throughout this report, references and comparisons are made to the federal and provincial sediment quality guidelines.

3.1 Quality Assurance/Quality Control

All laboratories used for the project were CAEAL accredited for their respective analytical parameters. As mentioned above in the methodology, Maxxam Analytical Inc. performed the organochlorine and polycyclic aromatic hydrocarbon analyses. The Maxxam laboratory QA/QC program consisted of blanks, spiked blanks and duplicate samples (i.e., laboratory replicate runs).

All method blanks were within acceptable limits (below method detection limit) and spikes were within acceptable limits (40-130%) for all parameters.

Paired student t-tests were also performed to assess differences between blind duplicate samples submitted to the laboratory. The majority of the inorganic parameters could be assessed this way, with the exception of parameters that were detected in fewer than three samples. Organic parameters could not be assessed do to there non-detects. There were no significant differences observed between the blind duplicate samples, for any of the parameter assessed, at the 95% confidence level.

3.2 Method Detection Limits

All of the analytical parameters used in the study are hydrophobic, i.e., they have a propensity for solid surfaces such as sediments as opposed to the dissolved phase. Sampling very fine, flocculent surface deposits, serves to maximize the probability of encountering these analytes, if they are present in the environment. Typical laboratory detection limits are therefore sufficient to detect these parameters at ambient concentrations. The laboratory method detection limits are provided in Table 2, below, for both laboratories used in this study. This Table also provides a useful reference of all parameters measured in the study.

Table 2. Analytical Parameters and Laboratory Method Detection Limits
a. Maxxam Analytics Inc. (Organics)

Polychlorinated Biphenyls (PCBs)		Polycyclic Aromatic Hydrocarbons (PAHs)		Organochlorine Pesticides (OCs)	
Parameter	**MDL**	**Parameter**	**MDL**	**Parameter**	**MDL**
Aroclor 1016	0.01 µg/g	Naphthalene	5 µg/kg	Hexachlorobenzene	0.002 µg/g
Aroclor 1221	0.03 µg/g	Acenaphthylene	5 µg/kg	o,p'-DDD	0.002 µg/g
Aroclor 1232	0.01 µg/g	Acenaphthene	10 µg/kg	Endrin aldehyde	0.002 µg/g
Aroclor 1242	0.02 µg/g	Fluorene	5 µg/kg	o,p'-DDT	0.002 µg/g
Aroclor 1248	0.01 µg/g	Phenanthrene	5 µg/kg	Toxaphene	0.08 µg/g
Aroclor 1254	0.01 µg/g	Anthracene	5 µg/kg	o,p'-DDE	0.002 µg/g
Aroclor 1260	0.01 µg/g	Fluoranthene	5 µg/kg	Aldrin	0.002 µg/g
Total PCB	0.01 µg/g	Pyrene	5 µg/kg	α-HCH	0.002 µg/g
		Benz(a)anthracene	10 µg/kg	β-HCH	0.002 µg/g
		Chrysene	10 µg/kg	δ-HCH	0.002 µg/g
		Benzo(b)fluoranthene	10 µg/kg	Lindane	0.002 µg/g
		Benzo(k)fluoranthene	10 µg/kg	α-Chlordane	0.002 µg/g
		Benzo(a)pyrene	5 µg/kg	γ-Chlordane	0.002 µg/g
		Indeno(1,2,3-cd)pyrene	20 µg/kg	p,p'-DDD	0.002 µg/g
		Dibenzo(a,h)anthracene	20 µg/kg	p,p'-DDE	0.002 µg/g
		Benzo(ghi)perylene	20 µg/kg	p,p'-DDT	0.002 µg/g
				Dieldrin	0.002 µg/g
				α-Endosulfan	0.002 µg/g
				β-Endosulfan	0.002 µg/g
				Endosulfan sulfate	0.002 µg/g
				Endrin	0.002 µg/g
				Heptachlor	0.002 µg/g
				Heptachlor epoxide	0.002 µg/g
				Methoxychlor	0.008 µg/g
				Mirex	0.002 µg/g
				Octachlorostyrene	0.002 µg/g

All laboratory method detection limits, for organic analytes are below the federal PEL except for Lindane (PEL sediment quality guideline 0.00138 µg/g). Most of the laboratory detection limits for the organic analytes are below the TEL with the exception of total DDT, total DDE, toxaphene, heptachlor epoxide and acenaphthene.

Table 2 cont. Analytical Parameters and Laboratory Method Detection Limits
b. Caduceon Enterprises (Metals)

Parameters	Units	MDL
Aluminum	%	0.01
Antimony	µg/g	5
Arsenic	µg/g	5
Barium	µg/g	1
Beryllium	µg/g	0.2
Bismuth	µg/g	5
Cadmium	µg/g	0.5
Calcium	%	0.01
Chromium	µg/g	1
Colbalt	µg/g	1
Copper	µg/g	1
Iron	%	0.01
Lead	µg/g	5
Lithium	µg/g	0.5
Magnesium	%	0.01
Manganese	µg/g	0.5
Molybdenum	µg/g	1
Nickel	µg/g	1
Phosphorus	µg/g	3
Potassium	%	0.05
Silver	µg/g	0.1
Sodium	%	0.01
Strontium	µg/g	1
Tin	µg/g	10
Titanium	µg/g	0.5
Vanadium	µg/g	1
Yttrium	µg/g	0.5
Zinc	µg/g	1
Zirconium	µg/g	0.1
Mercury	ng/g	5

All laboratory method detection limits for metals were below federal sediment quality guidelines.

3.3 Laboratory Results

A review of the detection frequency of analytical parameters and exceedences of sediment quality guidelines is provided here. A discussion of the highest observed levels is provided for selected parameters in Section 4. A full listing of the laboratory data for the 108 unique sites is provided in Appendix A. The laboratory data for the blind duplicate samples is not provided but can be obtained from Environment Canada.

3.3.1 Frequency of Detection

In general, organochlorine parameters were not detected, with only a few exceptions. Of the Canadian tributaries none of the 26 organochlorine compounds were detected and of the US tributaries a total of twenty two (22) organochlorine parameters were not detected in any sample. In addition, five (5) PCB Aroclors were not detected in Canadian tributary while no PCBs were detected in any U.S. tributary. Of the sixteen (16) PAHs, all were detected in at least one sample. Four (4) of the trace metals were not detected in any sample. The parameters that were not detected are listed below in Table 3.

Table 3. Parameters Not Detected

Organochlorines
• Hexachlorobenzene • o,p'-DDE • o,p'-DDD • Endrin aldehyde • Toxaphene • Aldrin • α-HCH • β-HCH • δ-HCH • Lindane • α-Chlordane • γ-Chlordane • Dieldrin • α-Endosulfan • β-Endosulfan • Endosulfan sulfate • Endrin • Heptachlor • Heptachlor epoxide • Methoxychlor • Mirex • Octachlorostyrene
PCB Aroclors
• Aroclor 1016 • Aroclor 1221 • Aroclor 1232 • Aroclor 1242 • Aroclor 1248
Metals
• Antimony • Bismuth • Molybdenum • Tin

3.3.2 Comparison of Results with Sediment Quality Guidelines

The sediment quality results were compared to the Canadian Environmental Quality Guidelines (Canadian Council of Ministers of the Environment, 2001). The CCME sediment quality guidelines provide scientific benchmarks, or reference points, for evaluating the potential for observing adverse biological effects in aquatic systems. The guidelines are derived from available toxicological information. A 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, referred to as the probable effect level (PEL), represents the level above which adverse effects are expected to occur frequently. Fewer than 25% of adverse effects (in the Biological Effects Database for Sediments) occur below the TEL, and more than 50% of adverse effects occur above the PEL.

Where no federal guidelines were available, the provincial guidelines were used for comparison (Persaud et al., 1992). Provincial Severe Effect Levels for organic compounds and polycyclic aromatic hydrocarbons were calculated individually for each site using the organic carbon concentration in the sediment. However, no SEL exceedences were determined for these compounds in this study.

A special mention should be made of toxaphene. At present the only guideline that is available is an interim sediment quality guideline which the federal government has adopted from the New York State Department of Environmental Conservation (NYSDEC 1994), 0.01µg/g TOC, which has been converted to dry weight. This value is the lowest available guideline from other jurisdictions; in fact it is lower than many laboratory detection limits. This guideline is considerably lower than the 80 µg/kg method detection limit reported for this program. While it is acknowledged that lower detection limits would be more beneficial for screening sediments it is pointed out that toxaphene is not a critical pollutant; and that sediment inventories of the Great Lakes support atmospheric transport as opposed to local sources (Muir et. al. 2005).

Table 5 provides a summary of the numbers of exceedences of the federal guidelines, and exceedences of the provincial guidelines for those parameters for which federal guidelines are not available. A complete list of the sediment quality guidelines relevant to this study is provided in Appendix B.

Table 5. Number of Sites Exceeding Sediment Quality Guidelines

	Federal Guidelines		Provincial Guidelines	
A. Metals	**Exceeds TEL[1] Below PEL**	**Exceeds PEL[2]**	**Exceeds LEL[3] Below SEL**	**Exceeds SEL[4]**
Chromium	12	0	28	0
Zinc	10	1	10	1
Lead	2	1	3	0
Nickel			40	0
Manganese			33	22
Iron			30	5
Copper	17	3	52	4
Cadmium	7	0	7	0
Arsenic	5	1	5	0

Mercury	1	0	0	0
B. Organochlorines				
pp DDD			1	
Total DDE	0	2		
Total DDD	0	1		
Total DDT	0	2	2	0
Total DDT metabolites			1	0
PCB Aroclor 1254	1		1	0
PCB Aroclor 1260			1	0
Total PCB	1	0	1	0

C. Polycyclic Aromatic Hydrocarbons	**Exceeds TEL[1] Below PEL**	**Exceeds PEL[2]**	**Exceeds LEL[3] Below SEL**	**Exceeds SEL[4]**
Naphthalene	1	0		
Acenaphthylene	8	0		
Acenaphthene	6	1		
Fluorene	5	2	2	
Phenanthrene	14	2	2	
Anthracene	7	0	0	
Fluoranthene	12	1	4	
Pyrene	14	1	4	
Benz(a)anthracene	11	2	3	
Chrysene	11	1		
Benzo k fluoranthene	1	0		
Benzo(a)pyrene	13	0	1	
Indeno(1,2,3-cd)pyrene			5	
Dibenzo(a,h)anthracene	5	0	0	

Notes: 1 Federal Threshold Effect Level
2 Federal Probable Effect Level
3 Provincial Lowest Effect Level
4 Provincial Severe Effect Level

4.0 Discussion

4.1 DDT and Metabolites

DDT (dichlorodiphenyltrichloroethane) is a chlorinated hydrocarbon that has broad-spectrum pesticide properties. It was used in large quantities in the 1950s and 1960s on crops. The U.S. banned the use of DDT in 1973. The use of DDT in Canada was severely restricted in the early 1970s and discontinued in 1985, with the sale and use of existing stocks permitted until the end of 1990 (CCME, 2001). DDT is still used as an insecticide in other countries.

DDT has two metabolites: DDE (dichlorodiphenyldichloroethylene) and DDD (dichlorodiphenyldichloroethane). Each DDT molecule has several isomeric forms, depending on the configurations of the chlorine atoms on the molecule. For comparison with sediment quality guidelines, the laboratory results were analyzed according to the following:

Total DDT = o-p'- plus p-p'DDT

Total DDE = o-p'- plus p-p'DDE
Total DDD = o-p'- plus p-p'DDD
Total DDT and metabolites = Total DDT + Total DDE + Total DDD

DDT, including its metabolites, was the only detected organochlorine compound in the current study with only 2 of the samples reaching detectable levels of one or more isomer of DDT or its metabolites.
Total DDD exceeded sediment quality guidelines (PEL; .00851 μg/g) in one (1) tributary while total DDE and total DDT exceeded the PEL (.00675μg/g and 0.00477 μg/g respectively) in two (2) tributaries.

Tributary	Total DDE (μg/g)	Total DDD (μg/g)	Total DDT (μg/g)
Eagle River (Am)	0.012	<0.002	0.02
Silver River (Am)	0.028	0.01	0.017

4.2 PCBs

Polychlorinated biphenyls, or PCBs, were commonly used in electrical equipment such as transformers and capacitors due to their chemical stability. The manufacture of PCBs was halted in 1977 in the United States. PCBs were not produced in Canada but approximately 40 000 t of PCBS were imported and used commercially prior to the 1980s. Like many other organochlorine compounds, PCBs are persistent, bioaccumulative and toxic. They are the cause of the majority of the fish consumption advisories in each of the Great Lakes and they are considered a priority pollutant by many authorities. The Great Lakes Water Quality Agreement calls for the virtual elimination of discharges of PCBs.

In the current study, PCBs were analyzed in the laboratory as Aroclors, the trade name that describes the complex mixture of PCB congeners under which some PCBs were manufactured. This method is much less expensive than the more elaborate congener analyses although it is also less precise and less accurate. The detection limit for Aroclor analysis was 10 ng/g, which is below the sediment quality guidelines and sufficient for the purposes of detecting PCBs in sediments.

Only two of the seven PCB Aroclors were detected in this study. Aroclor 1254 and Aroclor 1260 were both detected at two sites giving rise to only two sites with total PCB values. Only one site, the Fort Creek (Can) exceeded the TEL, 34.1 ng/g, with a value of 140 ng/g, well below the PEL of 277 ng/g.

4.3 PAHs

Polycyclic aromatic hydrocarbons are produced during the incomplete combustion of organic substances, most commonly the combustion of fossil fuels. As an indicator of human industrial activities, PAH contamination is relatively widespread.

PAHs were commonly detected in the current survey. One or more PAH compounds were found in 100% of the tributaries. Total PAHs exceeded the LEL of 4,000 µg/kg three (3) times. A listing is provided below of the ten (10) tributaries with concentrations of total PAH (i.e., the sum of the 16 PAH compounds investigated here) greater than 1,000 µg/kg.

Tributary	**Total PAH concentration (µg/kg)**
Eagle River (Am)	1,460
Kaministiquia River (Can)	1,572
McIntyre River (Can)	2,050
Davignon Creek (Can)	2,210
Knowlton Creek (Am)	2,620
Fort Creek (Can)	2,880
McVicar Creek (Can)	3,925
Bluff Creek (Am)	4,400
Firesteel River (Am)	4,864
Big Trout Creek (Can)	21,760

4.4 Metals

4.4.1 Arsenic

Arsenic (As) is a metalloid and a nonessential trace element. Its release from anthropogenic sources is mainly from gold and base metal production facilities, with smaller releases from the use of arsenical pesticides, wood preservatives, coal-fired power generation and disposal of domestic and industrial wastes (Environment Canada, 1993).

In the current study, arsenic was found to exceed sediment quality criteria infrequently. Of the 108 unique sites, concentrations were above the federal TEL at 5 sites, and above the PEL at one. (see Table 5). At some of these sites, the exceedences may be due to naturally elevated As levels. In the National Geochemical Reconnaissance (NGR) program of the Geological Survey of Canada, the mean concentration of As in stream sediments was determined to be 10.7 μg/g (P.W.B. Friske, 1996 in CCME 2001), which is greater than the federal TEL of 5.9 μg/g.

4.4.2 Cadmium

Cadmium (Cd) is a non-essential trace element that is produced commercially from base-metal smelters and refineries especially zinc refining. It is used in batteries, coatings, pigments, stabilizers and alloys (Hoskin, 1991 in Environment Canada, 1994a). Natural, background levels of Cd may be greater than the TEL, as the NGR program determined the mean concentration of Cd in stream sediments to be 0.63 μg/g (P.W.B. Friske, 1996 in CCME 2001) as compared with the federal TEL of 0.6 μg/g. In an assessment of the NGR data, Painter et al. (1994) found that 95% of the data were below 1.3 μg/g.

Cadmium concentrations in the current study were generally below the federal TEL (0.6 μg/g) with only 7 (seven) sites exceeding the TEL. All sites were below the federal PEL (3.5 μg/g)

4.4.3 Chromium

Chromium (Cr) is an essential trace element that can be toxic to organisms at elevated levels (CCME 2001). It is not mined in Canada, but its import contributes to the production of pigments, metal finishing, leather tanning and wood preservatives (Nriagu 1988 in Environment Canada 1994b).

Chromium was found at concentrations above sediment quality guidelines at more than 25 per cent of the sites. At twelve sites chromium levels exceeded the federal TEL (37.3 μg/g). No sites exceeded the federal PEL (90 μg/g).

4.4.4 Copper

Copper (Cu) is an essential trace element whose anthropogenic sources are mainly from mining and smelting operations. Naturally elevated Cu concentrations may contribute to the Cu content in streambed sediments. In an analysis of the NGR sediment database, Painter et al. (1994) found that 95% of Cu concentrations were below 76 μg/g. In the current study, 17 sites showed concentrations above the TEL of 35.7 μg/g while an additional 3 sites exceeded the PEL of 197 μg/g. Each of the Rivers with PEL exceedances are located in the state of Michigan where large copper deposits are found. Mining for copper in the area began in 1845 but declined after 1870. A listing of the tributaries with PEL exceedances are listed below.

Tributary	Cu (μg/g)
Little Cranberry River (Am)	320
Mineral River	464
Eagle River	1200

4.4.5 Mercury

Mercury (Hg) is a nonessential trace element that is toxic, persistent and bioaccumulative. Fish consumption advisories are in effect for mercury in much of the Great Lakes ecosystem. Current uses of mercury include some batteries, dental fillings, thermometers and switches, cathode tubes and household cleaners. Sources of mercury to the environment include mining and smelting, wastewater, fossil fuel combustion and waste incineration.

Sediment from most tributaries contained relatively low concentrations of mercury. Only one site exceeded any federal guidelines; the Current River in Thunder Bay, Ontario exceeding the LEL (170 ng/g). Local, natural mercury deposits can impact environmental concentrations. The 95^{th} percentile for mercury in the NGR database was determined to be 190 ng/g (Painter et al., 1994). Levels above this are therefore unlikely to be of natural origin.

4.4.6 Nickel

Nickel (Ni) is a trace element whose primary anthropogenic sources include primary base metal production and fossil fuel combustion (Environment Canada, 1994c). There is no federal sediment quality guideline for Ni, therefore sediment concentrations were compared with the provincial guidelines. The Lowest Effect Level (LEL) of 16 μg/g was exceeded at 40 sites. However, exceedences of the LEL can occur naturally. Analysis of the NGR database of stream and lake sediment metals concentrations showed that the 95^{th} percentile for Ni concentration was 60 μg/g (Painter et al., 1994). Levels greater than this are more likely to indicate anthropogenic impacts. In the current study, the Severe Effect Guideline (SEL) of 75 μg/g was not exceeded.

4.4.7 Lead

Lead (Pb) is a nonessential trace element. Its past use as an additive in gasoline has resulted in its widespread distribution in the environment above background levels. Currently, sources of lead to the environment include lead processing activities, batteries, and industrial and municipal effluents. Lead concentrations exceeded the federal TEL of 35 μg/g at 2 sites and the PEL of 91.3 μg/g at one site. The 95^{th} percentile of stream and lake sediment Pb concentration in the NGR database was 25 μg/g (Painter et al., 1994), therefore even TEL exceedences are likely to be due to anthropogenic influences. The guideline exceedences are listed below.

Tributary	Pb (µg/g)
McVicar Creek (Can)	36
Fort Creek (Can)	54
Little Cranberry River (Am)	137

4.4.8 Zinc

Zinc (Zn) is an essential trace element that is considered toxic to aquatic biota at elevated concentrations (CCME, 2001). Anthropogenic zinc sources are primarily related to metals processing, with smaller releases from fossil fuel burning and ancillary sources such as fertilizers, rubber goods and pharmaceuticals.

In the current study, the federal TEL of 124 µg/g was exceeded at 10 sites. There was one PEL (315 µg/g) exceedences . The 95th percentile zinc sediment concentration in the NGR database was 191 µg/g; therefore TEL exceedences may not be due to anthropogenic sources. The five highest concentrations of zinc for the Lake Superior Tributaries are listed below.

Tributary	Zn (µg/g)
Current River (Can)	167
Fort Creek (Can)	193
Blackbird Creek (Can)	201
Bennet Creek (Can)	247
Little Cranberry River (Am)	1790

4.4.9 Manganese and Iron

Concentrations of the essential metals manganese and iron were compared with provincial sediment quality guidelines as no federal guidelines are available. Manganese concentrations exceeded the LEL of 460 µg/g at 33 sites and the SEL of 1100 µg/g at a further 22 sites. The tributaries with concentrations greater than 2000 µg/g are listed below. The exceedences generally did not appear to be related to industrial impacts in the majority of cases. Mn exceedences also occurred in relatively "clean" tributaries that were expected to represent background or unimpacted conditions. The median Mn concentration in the Ontario Geological Survey stream sediment database (Fortescue, 1984) is calculated to be 850 µg/g, and the 95th percentile of concentrations was 2150 µg/g. It might therefore be interpreted that stream sediment concentrations in this range may be attributed to natural sources. Indeed, the application of the Ontario Sediment Quality Guidelines should take the background levels of metals into account prior to any management action (Persaud et al., 1992).

Tributary	Mn (µg/g)
Sand River	2070
Anglers Creek (Can)	2100
Beaver River (Am)	2310
Carp River (Am)	2900
Grand Marais Creek (Am)	3490
Little Goulais River (Can)	3580
Michipicoten River (Can)	3710
Brule River (Am)	4310
Magpie River (Can)	4450
Little Carp Creek (Can)	4960
Current River (Can)	32500

For iron (Fe), background levels may also be high due to natural sources. The Ontario Geological Survey stream sediment data (Fortescue, 1984) shows that the median Fe concentration is 3.1% and that the 95th percentile of Fe concentrations is 5.5%. These values are comparable to the LEL of 2% and the SEL of 4%. In the current study, 30 sites exceeded the LEL and 5 sites (listed below) exceeded the SEL. Several of these included sites at which contamination from anthropogenic sources would not be expected. Similar to Mn, the natural or background concentration of Fe would need to be determined in order to interpret sediment quality guideline exceedences.

Tributary	Fe (%)
Pigeon River (Can)	4.24
Brule River (Am)	4.31
McIntyre River (Can)	5.09
Current River (Can)	5.5
Little Goulais River (Can)	6.39

5.0 Next Steps

This sampling represents the first stage of a track-down program to identify potential sources of contamination to the upper Great Lakes that are not being addressed by other Great Lakes programs. The program constitutes a portion of Environment Canada's commitment towards the Great Lakes Water Quality Agreement (GLWQA).

By committing to the track-down program, the federal and provincial partners have agreed to conduct follow-up work at locations where ambient data indicate potentially significant sources of persistent, bioaccumulative and toxic substances (PBTs) may exist. The program has, to date, focused on potential PCB sources. Three pilot projects have been initiated/conducted in Lake Ontario tributaries and another two in Lake Erie tributaries where PCB contamination is suspected based on available ambient information. Based on the experiences in these projects, the project partners have developed a decision framework guide for potential future track-down projects; in particular, it provides guidelines for the initiation and termination of such projects and provides recommendations with respect to appropriate project design and sampling methodologies.

The parties have determined that potential projects must be prioritized based on the available information. The degree of contamination is determined for various media, and a prioritization is then made. These recommendations will require full disclosure and the sharing of ambient information between the project partners. To that end, steps have already been taken to ensure that information is freely shared in a manner that permits a broad prioritization based on the most current and reliable information.

By virtue of this document the information from the current study is being shared with other environmental authorities and partners in Ontario.

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Lake Superior Tributary Data:

Tributary	Latitude	Longitude	Sampling Date	HCB	Endrin aldehyde	OCS	Toxaphene	Aldrin	α HCH	β HCH	δ HCH	Lindane
Units				µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g
Agawa River	47.3575	-84.6318	31-Aug-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Aguasabon River	48.7728	-87.1164	19-Aug-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Alona Bay Creek	47.1637	-84.6913	31-Aug-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Anglers Creek	48.776	-86.4073	15-Sep-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Barrett River	47.4049	-84.7024	30-Aug-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Batchawan River	46.9351	-84.5274	14-Sep-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Bennett Creek	46.5234	-84.3863	13-Sep-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Big Carp River	46.516	-84.4652	13-Sep-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Big Trout Creek	48.9463	-88.2616	17-Aug-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Blackbird Creek	48.8508	-87.02	15-Sep-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Black Sturgeon River	48.9043	-88.3784	17-Aug-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Carp River	46.9517	-84.5755	14-Sep-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Chippewa River	46.9278	-84.4265	31-Aug-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Coldwater River	48.804	-88.5401	17-Aug-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Cold Water River East	47.4715	-84.7883	30-Aug-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Cranberry Creek	46.6961	-84.3955	13-Sep-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Current River	48.4545	-89.1876	15-Sep-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Cypress River	48.9334	-87.8645	18-Aug-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Davignon Creek	46.5372	-84.3619	15-Aug-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Dead Horse Creek	48.8173	-86.6866	20-Aug-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Diversion Channel	46.5219	-84.4091	13-Sep-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Fort Creek	46.5154	-84.3436	15-Aug-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Goulais River	46.7235	-84.3823	01-Sep-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Government Creek	46.869	-84.3539	01-Sep-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Gravel River	48.9202	-87.7689	18-Aug-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Harmony River	46.8461	-84.3706	01-Sep-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Havilland Creek	46.818	-84.4248	01-Sep-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Jackpine River	48.9718	-87.9997	18-Aug-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Kaministiquia River	48.3591	-89.2882	16-Sep-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Kelly Creek	46.6698	-84.4501	13-Sep-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Little Cypress River	48.9265	-87.8452	18-Aug-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002

Tributary	α Chlordane	γ Chlordane	Total Chlordane	op DDD	pp DDD	op DDE	pp DDE	op DDT	pp DDT	Total DDD	Total DDE	Total DDT
Units	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g
Agawa River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Aguasabon River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Alona Bay Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Anglers Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Barrett River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Batchawan River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Bennett Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Big Carp River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Big Trout Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Blackbird Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Black Sturgeon River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Carp River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Chippewa River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Coldwater River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Cold Water River East	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Cranberry Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Current River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Cypress River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Davignon Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Dead Horse Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Diversion Channel	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Fort Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Goulais River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Government Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Gravel River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Harmony River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Havilland Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Jackpine River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Kaministiquia River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Kelly Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Little Cypress River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002

Tributary	Total DDT Metabolites	Dieldrin	Endosulfan I	Endosulfan II	Endosulfan Sulfate	Endrin	Heptachlor	Heptachlor Epoxide	Methoxychlor	Mirex	Aroclor 1016
Units	µg/g	µg/g	µg/g	µg/g	µg/g		µg/g	µg/g	µg/g	µg/g	µg/g
Agawa River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Aguasabon River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Alona Bay Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Anglers Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Barrett River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Batchawan River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Bennett Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Big Carp River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Big Trout Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Blackbird Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Black Sturgeon River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Carp River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Chippewa River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Coldwater River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Cold Water River East	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Cranberry Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Current River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Cypress River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Davignon Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Dead Horse Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Diversion Channel	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Fort Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Goulais River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Government Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Gravel River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Harmony River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Havilland Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Jackpine River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Kaministiquia River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Kelly Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Little Cypress River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01

Tributary	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	Total PCB	Naphthalene	Acenaphthylene
Units	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/kg	µg/kg
Agawa River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Aguasabon River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Alona Bay Creek	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Anglers Creek	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Barrett River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Batchawan River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Bennett Creek	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Big Carp River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Big Trout Creek	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	37
Blackbird Creek	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Black Sturgeon River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Carp River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Chippewa River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Coldwater River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Cold Water River East	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Cranberry Creek	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Current River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Cypress River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Davignon Creek	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	10	10
Dead Horse Creek	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Diversion Channel	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Fort Creek	<0.03	<0.01	<0.02	<0.01	0.08	0.06	0.14	26	14
Goulais River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Government Creek	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Gravel River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Harmony River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Havilland Creek	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Jackpine River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Kaministiquia River	<0.03	<0.01	<0.02	<0.01	0.02	0.01	0.03	<5	19
Kelly Creek	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Little Cypress River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5

Tributary	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzoanthracene	Chrysene	Benzobfluoranthene
Units	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
Agawa River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Aguasabon River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Alona Bay Creek	<10	<5	<5	<5	<5	<5	<10	<10	<10
Anglers Creek	<10	<5	<5	<5	<5	<5	<10	<10	<10
Barrett River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Batchawan River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Bennett Creek	<10	<5	20	<5	40	40	<10	<10	30
Big Carp River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Big Trout Creek	110	206	3030	218	8030	8500	890	1040	1180
Blackbird Creek	<10	<5	<5	140	<5	<5	<10	<10	<10
Black Sturgeon River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Carp River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Chippewa River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Coldwater River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Cold Water River East	<10	<5	<5	<5	<5	<5	<10	<10	<10
Cranberry Creek	<10	<5	<5	<5	<5	<5	<10	<10	<10
Current River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Cypress River	<10	<5	9	<5	17	13	20	<10	12
Davignon Creek	30	<5	170	30	420	320	150	160	310
Dead Horse Creek	<10	<5	<5	<5	<5	<5	<10	<10	<10
Diversion Channel	<10	<5	<5	<5	<5	<5	<10	<10	<10
Fort Creek	10	17	199	40	512	418	210	210	363
Goulais River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Government Creek	<10	<5	<5	<5	<5	10	<10	<10	<10
Gravel River	<10	<5	<5	<5	<5	<5	<10	<10	5
Harmony River	<10	<5	<5	<5	20	20	<10	20	40
Havilland Creek	<10	<5	<5	<5	<5	<5	<10	<10	<10
Jackpine River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Kaministiquia River	<10	8	73	55	272	214	130	130	213
Kelly Creek	<10	<5	<5	<5	<5	<5	<10	<10	<10
Little Cypress River	<10	<5	<5	<5	<5	<5	<10	<10	<10

Tributary	Benzokfluoranthene	Benzoapyrene	Indeno123cdpyrene	Dibenzoahanthracene	Benzoghiperylene	Total PAH
Units	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
Agawa River	<10	<5	<20	<20	<20	<20
Aguasabon River	<10	<5	<20	<20	<20	<20
Alona Bay Creek	<10	<5	<20	<20	<20	<20
Anglers Creek	<10	<5	<20	<20	<20	<20
Barrett River	<10	<5	<20	<20	<20	<20
Batchawan River	<10	<5	<20	<20	<20	<20
Bennett Creek	<10	20	<20	<20	<20	150
Big Carp River	<10	<5	<20	<20	<20	<20
Big Trout Creek	380	386	220	50	180	21760
Blackbird Creek	<10	<5	<20	<20	<20	140
Black Sturgeon River	<10	<5	<20	<20	<20	<20
Carp River	<10	<5	<20	<20	<20	<20
Chippewa River	<10	<5	<20	<20	<20	<20
Coldwater River	<10	<5	<20	<20	<20	<20
Cold Water River East	<10	<5	<20	<20	<20	<20
Cranberry Creek	<10	<5	<20	<20	<20	<20
Current River	<10	<5	<20	<20	<20	<20
Cypress River	<10	<5	<20	<20	<20	<20
Davignon Creek	100	180	180	<20	170	2210
Dead Horse Creek	<10	<5	<20	<20	<20	<20
Diversion Channel	<10	<5	<20	<20	<20	<20
Fort Creek	140	245	220	40	200	2880
Goulais River	<10	<5	<20	<20	<20	<20
Government Creek	<10	<5	<20	<20	<20	10
Gravel River	<10	<5	<20	<20	<20	5
Harmony River	<10	10	<20	<20	<20	110
Havilland Creek	<10	<5	<20	<20	<20	<20
Jackpine River	<10	<5	<20	<20	<20	<20
Kaministiquia River	60	97	70	<20	60	1572
Kelly Creek	<10	<5	<20	<20	<20	<20
Little Cypress River	<10	<5	<20	<20	<20	<20

Tributary	Ag	Al	As	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Fe	K	Mg	Mn	Mo	Na	Ni	Pb
Units	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	%	%	ppm	ppm	%	ppm	ppm
Agawa River	<0.1	0.53	<5	25	<0.2	<5	0.19	<0.5	9	33	18	1.07	0.04	0.53	666	<1	0.009	26	<5
Aguasabon River	<0.1	0.45	<5	87	<0.2	<5	2.43	<0.5	7	25	10	1.23	0.06	0.73	3400	<1	0.012	13	<5
Alona Bay Creek	<0.1	0.6	<5	70	<0.2	<5	0.65	<0.5	8	25	21	1.34	0.04	0.29	1130	<1	0.01	10	8
Anglers Creek	<0.1	0.77	<5	95	0.4	<5	4.01	<0.5	8	25	15	1.75	0.13	1.82	2100	<1	0.02	16	8
Barrett River	<0.1	0.42	<5	42	<0.2	<5	0.24	<0.5	7	10	9	2.35	0.04	0.24	175	<1	0.022	7	8
Batchawan River	<0.1	0.52	<5	25	<0.2	<5	0.29	<0.5	5	18	9	1.2	0.03	0.3	200	<1	0.014	10	5
Bennett Creek	<0.1	0.66	<5	49	0.3	<5	1.28	<0.5	6	25	18	1.72	0.08	0.39	452	<1	0.017	12	17
Big Carp River	<0.1	0.47	<5	53	<0.2	<5	0.21	<0.5	5	12	5	1.09	0.05	0.21	1020	<1	0.008	7	<5
Big Trout Creek	<0.1	0.93	<5	116	0.3	<5	3.48	<0.5	11	33	26	1.99	0.14	1.64	877	<1	0.07	22	8
Blackbird Creek	0.5	0.42	<5	77	<0.2	<5	4.26	1.3	4	27	19	0.86	0.06	1.33	357	<1	0.26	17	<5
Black Sturgeon River	<0.1	0.74	<5	71	<0.2	<5	1.05	<0.5	10	18	22	1.93	0.06	0.83	388	<1	0.076	20	<5
Carp River	<0.1	0.56	<5	35	<0.2	<5	0.29	<0.5	7	20	13	3.13	0.03	0.38	198	<1	0.011	14	5
Chippewa River	<0.1	0.59	<5	35	<0.2	<5	0.27	<0.5	8	18	17	1.49	0.04	0.39	655	<1	0.014	12	0
Coldwater River	<0.1	0.82	<5	184	0.3	<5	2.51	<0.5	12	21	30	2.4	0.14	1.5	586	<1	0.064	22	6
Cold Water River East	<0.1	0.54	<5	46	0.2	<5	0.35	<0.5	9	11	11	1.29	0.04	0.21	489	<1	0.013	7	8
Cranberry Creek	<0.1	1.01	<5	86	0.3	<5	0.39	<0.5	7	26	10	1.59	0.09	0.46	230	<1	0.021	15	12
Current River	<0.1	0.84	<5	1070	0.4	<5	1.05	0.7	31	34	36	5.5	0.09	0.39	32500	<1	0.042	32	23
Cypress River	<0.1	0.65	<5	70	0.3	<5	0.57	<0.5	13	25	14	1.47	0.06	0.58	1640	<1	0.01	15	11
Davignon Creek	<0.1	0.79	<5	138	0.4	<5	5.13	<0.5	14	37	37	1.99	0.1	0.77	1050	<1	0.033	16	25
Dead Horse Creek	<0.1	0.91	<5	87	0.5	<5	0.53	<0.5	14	49	14	1.71	0.08	0.57	1070	<1	0.015	32	11
Diversion Channel	<0.1	0.65	<5	63	0.3	<5	0.47	<0.5	6	23	13	1.56	0.07	0.37	714	<1	0.018	11	9
Fort Creek	<0.1	0.87	<5	99	0.6	<5	1.3	<0.5	10	54	57	2.5	0.12	0.72	1130	<1	0.033	26	54
Goulais River	<0.1	0.8	<5	54	0.2	<5	0.44	<0.5	8	22	17	2.1	0.07	0.45	337	<1	0.033	14	7
Government Creek	<0.1	0.68	<5	45	0.2	<5	0.32	<0.5	7	17	12	2.55	0.05	0.39	234	<1	0.058	11	8
Gravel River	<0.1	0.33	<5	20	<0.2	<5	5.3	<0.5	3	15	5	0.87	0.05	2.13	312	<1	0.009	7	0
Harmony River	<0.1	0.57	<5	62	<0.2	<5	0.3	<0.5	7	16	11	1.87	0.05	0.32	539	<1	0.012	11	7
Havilland Creek	<0.1	0.51	<5	41	<0.2	<5	0.23	<0.5	5	15	6	0.96	0.05	0.27	272	<1	0.007	9	<5
Jackpine River	<0.1	1.24	<5	126	0.4	<5	1.21	<0.5	19	33	56	2.33	0.1	1.17	1420	<1	0.079	29	10
Kaministiquia River	<0.1	1.16	<5	101	0.4	<5	1.03	<0.5	15	39	38	3.33	0.16	1.06	550	<1	0.088	33	31
Kelly Creek	<0.1	0.6	<5	125	0.3	<5	0.45	<0.5	6	16	9	1.32	0.06	0.26	140	<1	0.008	9	7
Little Cypress River	<0.1	1.34	<5	223	0.6	<5	1.9	<0.5	16	49	23	2.59	2.94	1.59	1020	<1	0.033	32	11

Tributary	Sb	Sn	Sr	Ti	V	Y	Zn	Mercury	Total C	Inorganic C	Organic C	LOI
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	%	%	%
Agawa River	<5	<10	7	NA	21	2.6	32	0.005	0.7	0	0.7	1.7
Aguasabon River	<5	<10	16	NA	23	4.3	28	0.015	2.2	0.8	1.4	3.4
Alona Bay Creek	<5	<10	17	NA	35	10.1	51	0.089	9.1	0	9.1	19
Anglers Creek	<5	<10	26	669	26	10.5	84	0.057	3.9	1.7	2.2	5.6
Barrett River	<5	<10	9	298	24	3.2	27	0.029	3.5	0	3.5	7.7
Batchawan River	<5	<10	9	432	23	3.8	36	0.021	1	0	1	2.6
Bennett Creek	<5	<10	34	535	27	6.7	247	0.051	3.8	0.7	3.1	6.5
Big Carp River	<5	<10	8	356	18	4.2	38	0.017	1.6	0	1.6	4
Big Trout Creek	<5	<10	28	938	55	7.7	83	0.032	3.7	1.3	2.4	6
Blackbird Creek	<5	<10	29	361	26	4.1	201	0.102	10.8	1.8	9	18.6
Black Sturgeon River	<5	<10	14	986	95	5.4	35	0.014	1.7	0.3	1.4	3.2
Carp River	<5	<10	9	546	33	4.1	42	0.015	NA	NA	NA	NA
Chippewa River	<5	<10	8	621	32	3.5	37	0.023	0.9	0	0.9	2.3
Coldwater River	<5	<10	20	1130	98	7.1	44	0.021	2.2	0.9	1.3	3.3
Cold Water River East	<5	<10	14	372	23	5	67	0.037	5.8	0	5.8	12.5
Cranberry Creek	<5	<10	20	494	29	5.6	52	0.057	5.2	0	5.2	11.4
Current River	<5	<10	26	249	89	14	167	0.181	16.2	0.2	16.1	36.6
Cypress River	<5	<10	8	387	23	4.9	55	0.026	1.9	0.1	1.8	4
Davignon Creek	<5	<10	86	552	34	7	136	0.023	3.8	1.6	2.2	5.5
Dead Horse Creek	<5	<10	18	683	33	6.7	96	0.054	4	0	4	8.9
Diversion Channel	<5	<10	15	419	27	6.4	80	0.042	2.8	0.4	2.5	5.5
Fort Creek	<5	<10	31	576	37	8.4	193	0.115	3.4	0.7	2.7	5.7
Goulais River	<5	<10	14	776	34	5.7	45	0.015	1.4	0.1	1.3	13.5
Government Creek	<5	<10	15	681	35	4.6	41	0.022	2.9	0	2.9	6.4
Gravel River	<5	<10	23	419	16	4.3	19	0.013	3.2	2.5	0.7	2.1
Harmony River	<5	<10	17	626	34	5.1	46	0.026	2.6	0	2.6	6
Havilland Creek	<5	<10	7	346	19	4.5	24	0.019	1.8	0	1.8	4.2
Jackpine River	<5	<10	27	607	50	8.4	79	0.044	4.3	0.2	4.2	10.2
Kaministiquia River	<5	<10	18	859	70	7.6	117	0.103	2.7	0.2	2.5	5.9
Kelly Creek	<5	<10	19	354	26	8.8	41	0.049	4.6	0	4.6	10.3
Little Cypress River	<5	<10	27	960	43	9.1	78	0.051	3.4	0.9	2.5	6.5

Tributary	Latitude	Longitude	Sampling Date	HCB	Endrin aldehyde	OCS	Toxaphene	Aldrin	α HCH	β HCH	δ HCH	Lindane
Units				µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g
Little Gravel River	48.9223	-87.7741	18-Aug-15	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Little Pine River	48.0393	-89.534	16-Aug-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Little Carp Creek	46.5097	-84.4442	13-Sep-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Little Goulais River	46.8214	-84.5006	01-Sep-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Little Pic River	48.8065	-86.6318	15-Sep-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Magpie River	47.9393	-84.8299	14-Sep-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
McIntyre River	48.3993	-89.2489	16-Sep-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
McKellar Creek	48.8154	-86.7107	19-Aug-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
McVicar Creek	48.4397	-89.2146	16-Sep-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Michipicoten River	47.9225	-84.8055	14-Sep-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Neebing River	48.3943	-89.2466	16-Sep-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Nipigon River	49.009	-88.2553	03-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Old Woman River	47.7909	-84.8941	30-Aug-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Ozone Creek	49.0218	-88.0377	17-Aug-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Pancake River	46.9603	-84.657	31-Aug-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Pic River	48.6071	-86.2908	15-Sep-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Pigeon River	48.0038	-89.5927	16-Sep-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Pine River	48.0677	-89.535	16-Aug-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Prairie River	48.8035	-86.776	19-Aug-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Sand River	47.433	-84.7304	30-Aug-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Sawmill Creek	46.8754	-84.3534	31-Aug-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Speckled Trout Creek	47.315	-84.5986	31-Aug-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Steel River	48.7717	-86.8905	19-Aug-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Stokely Creek	46.8147	-84.4078	01-Sep-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Tremblay Creek	47.9618	-84.8903	30-Aug-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Wolf River	48.8204	-88.5316	17-Aug-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Amnicon River	46.6855	-91.8639	24-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Anna River	46.4089	-86.6402	18-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Au Train River	46.4324	-86.8269	05-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Beaver River	47.2602	-91.2958	18-Sep-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Big Iron River	46.8301	-89.5705	22-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002

Tributary	α Chlordane	γ Chlordane	Total Chlordane	op DDD	pp DDD	op DDE	pp DDE	op DDT	pp DDT	Total DDD	Total DDE	Total DDT
Units	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g
Little Gravel River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Little Pine River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Little Carp Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Little Goulais River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Little Pic River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Magpie River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
McIntyre River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
McKellar Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
McVicar Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Michipicoten River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Neebing River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Nipigon River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Old Woman River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Ozone Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Pancake River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Pic River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Pigeon River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Pine River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Prairie River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Sand River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Sawmill Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Speckled Trout Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Steel River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Stokely Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Tremblay Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Wolf River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Amnicon River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Anna River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Au Train River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Beaver River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Big Iron River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002

Tributary	Total DDT Metabolites	Dieldrin	Endosulfan I	Endosulfan II	Endosulfan Sulfate	Endrin	Heptachlor	Heptachlor Epoxide	Methoxychlor	Mirex	Aroclor 1016
Units	µg/g	µg/g	µg/g	µg/g	µg/g		µg/g	µg/g	µg/g	µg/g	µg/g
Little Gravel River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Little Pine River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Little Carp Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Little Goulais River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Little Pic River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Magpie River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
McIntyre River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
McKellar Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
McVicar Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Michipicoten River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Neebing River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Nipigon River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Old Woman River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Ozone Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Pancake River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Pic River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Pigeon River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Pine River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Prairie River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Sand River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Sawmill Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Speckled Trout Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Steel River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Stokely Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Tremblay Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Wolf River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Amnicon River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Anna River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Au Train River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Beaver River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Big Iron River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01

Tributary	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	Total PCB	Naphthalene	Acenaphthylene
Units	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/kg	µg/kg
Little Gravel River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Little Pine River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Little Carp Creek	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Little Goulais River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Little Pic River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Magpie River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
McIntyre River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
McKellar Creek	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
McVicar Creek	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	23
Michipicoten River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Neebing River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Nipigon River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Old Woman River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Ozone Creek	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Pancake River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Pic River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Pigeon River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Pine River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Prairie River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Sand River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Sawmill Creek	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Speckled Trout Creek	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Steel River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Stokely Creek	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Tremblay Creek	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Wolf River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Amnicon River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Anna River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Au Train River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Beaver River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Big Iron River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5

Tributary	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzoanthracene	Chrysene	Benzobfluoranthene
Units	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
Little Gravel River	<10	<5	18	<5	40	<5	20	20	23
Little Pine River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Little Carp Creek	<10	<5	<5	<5	<5	<5	<10	<10	<10
Little Goulais River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Little Pic River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Magpie River	<10	<5	60	<5	150	90	<10	60	60
McIntyre River	<10	30	200	40	640	460	130	170	170
McKellar Creek	<10	<5	<5	<5	<5	<5	<10	<10	<10
McVicar Creek	20	24	401	63	760	604	250	320	450
Michipicoten River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Neebing River	<10	<5	<5	<5	37	29	10	10	21
Nipigon River	<10	<5	20	<5	40	30	30	<10	20
Old Woman River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Ozone Creek	<10	<5	<5	<5	<5	<5	<10	<10	<10
Pancake River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Pic River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Pigeon River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Pine River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Prairie River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Sand River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Sawmill Creek	<10	<5	<5	<5	<5	<5	<10	<10	<10
Speckled Trout Creek	<10	<5	<5	<5	<5	<5	<10	<10	<10
Steel River	<10	<5	<5	<5	<5	<5	<10	<10	0
Stokely Creek	<10	<5	<5	<5	<5	<5	<10	<10	<10
Tremblay Creek	<10	<5	<5	<5	<5	<5	<10	<10	<10
Wolf River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Amnicon River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Anna River	<10	<5	50	<5	100	80	30	40	50
Au Train River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Beaver River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Big Iron River	<10	<5	<5	<5	<5	<5	<10	<10	<10

Tributary	Benzokfluoranthene	Benzoapyrene	Indeno123cdpyrene	Dibenzoahanthracene	Benzoghiperylene	Total PAH
Units	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
Little Gravel River	<10	16	<20	<20	<20	137
Little Pine River	<10	<5	<20	<20	<20	<20
Little Carp Creek	<10	<5	<20	<20	<20	<20
Little Goulais River	<10	<5	<20	<20	<20	<20
Little Pic River	<10	<5	<20	<20	<20	<20
Magpie River	<10	10	<20	<20	<20	430
McIntyre River	50	60	50	<20	50	2050
McKellar Creek	<10	<5	<20	<20	<20	<20
McVicar Creek	170	310	260	40	230	3925
Michipicoten River	<10	<5	<20	<20	<20	<20
Neebing River	<10	11	<20	<20	<20	118
Nipigon River	<10	20	<20	<20	<20	160
Old Woman River	<10	<5	<20	<20	<20	<20
Ozone Creek	<10	<5	<20	<20	<20	<20
Pancake River	<10	<5	<20	<20	<20	<20
Pic River	<10	<5	<20	<20	<20	<20
Pigeon River	<10	<5	<20	<20	<20	<20
Pine River	<10	<5	<20	<20	<20	<20
Prairie River	<10	<5	<20	<20	<20	<20
Sand River	<10	<5	<20	<20	<20	<20
Sawmill Creek	<10	<5	<20	<20	<20	<20
Speckled Trout Creek	<10	<5	<20	<20	<20	<20
Steel River	<10	<5	<20	<20	<20	<20
Stokely Creek	<10	<5	<20	<20	<20	<20
Tremblay Creek	<10	<5	<20	<20	<20	<20
Wolf River	<10	<5	<20	<20	<20	<20
Amnicon River	<10	<5	<20	<20	<20	<20
Anna River	<10	30	<20	<20	<20	380
Au Train River	<10	<5	<20	<20	<20	<20
Beaver River	<10	<5	<20	<20	<20	<20
Big Iron River	<10	<5	<20	<20	<20	<20

Tributary	Ag	Al	As	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Fe	K	Mg	Mn	Mo	Na	Ni	Pb
Units	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	%	%	ppm	ppm	%	ppm	ppm
Little Gravel River	<0.1	0.84	<5	104	0.4	<5	1.9	<0.5	10	31	16	2.19	0.12	1.24	285	<1	0.084	18	8
Little Pine River	<0.1	1.04	<5	80	0.3	<5	0.74	<0.5	14	30	24	2.35	0.18	0.84	855	<1	0.05	27	8
Little Carp Creek	0.2	0.76	<5	115	0.3	<5	0.39	<0.5	9	23	12	1.86	0.09	0.4	4960	<1	0.013	13	8
Little Goulais River	0.3	0.72	<5	131	0.3	<5	0.74	<0.5	22	23	9	6.39	0.11	0.39	3580	<1	0.017	12	15
Little Pic River	<0.1	0.5	<5	41	0.2	<5	9.03	<0.5	5	19	8	1.06	0.11	2.79	437	<1	0.014	10	1.1
Magpie River	0.3	0.55	27	128	<0.2	<5	2.05	<0.5	8	26	16	1.96	0.06	1.33	4450	<1	0.014	15	6
McIntyre River	<0.1	1.06	8	165	0.4	<5	0.96	<0.5	16	45	42	5.09	0.13	0.91	1480	<1	0.074	30	24
McKellar Creek	<0.1	1.18	<5	118	0.5	<5	1.54	0.6	17	47	25	2.49	0.15	0.98	603	<1	0.02	33	14
McVicar Creek	<0.1	0.68	<5	85	0.2	<5	0.55	<0.5	10	38	34	2.78	0.08	0.58	1100	<1	0.036	24	36
Michipicoten River	<0.1	0.36	<5	28	<0.2	<5	0.43	<0.5	5	18	11	1.01	0.05	0.37	3710	<1	0.009	11	<5
Neebing River	<0.1	0.72	<5	66	<0.2	<5	0.6	<0.5	10	26	20	2.89	0.06	0.52	417	<1	0.059	21	10
Nipigon River	<0.1	0.69	<5	32	<0.2	<5	3.54	<0.5	7	26	24	1.51	0.08	2.14	215	<1	0.048	17	6
Old Woman River	<0.1	0.41	<5	39	<0.2	<5	0.22	<0.5	10	12	16	1.58	0.06	0.26	484	<1	0.009	7	<5
Ozone Creek	<0.1	1.08	<5	157	0.6	<5	1.2	<0.5	13	38	17	1.99	0.18	0.98	590	<1	0.019	24	10
Pancake River	<0.1	0.72	<5	84	0.3	<5	0.4	<0.5	9	24	12	1.67	0.09	0.44	1710	<1	0.016	15	8
Pic River	<0.1	0.39	<5	27	<0.2	<5	9.9	<0.5	4	16	7	0.87	0.08	3.4	224	<1	0.013	8	<5
Pigeon River	<0.1	1.17	6	95	0.5	<5	0.54	<0.5	20	41	39	4.24	0.13	1.04	897	<1	0.049	41	11
Pine River	<0.1	1.12	<5	99	0.4	<5	1.07	<0.5	16	37	40	3.13	0.14	1.18	668	<1	0.065	34	9
Prairie River	<0.1	0.44	<5	45	<0.2	<5	2.81	<0.5	4	18	5	1	0.05	1.02	297	<1	0.007	9	<5
Sand River	<0.1	0.67	<5	110	0.3	<5	0.48	0.7	15	19	11	1.54	0.06	0.32	2070	<1	0.017	12	15
Sawmill Creek	<0.1	1.19	<5	134	0.6	<5	0.6	<0.5	15	33	20	3.55	0.15	0.62	1200	<1	0.02	20	14
Speckled Trout Creek	<0.1	0.61	<5	40	0.2	<5	0.27	<0.5	11	24	13	1.91	0.03	0.32	431	<1	0.013	15	8
Steel River	<0.1	0.58	<5	48	0.2	<5	2.63	<0.5	7	30	17	1.43	0.09	1.69	300	<1	0.012	17	7
Stokely Creek	<0.1	0.63	<5	37	<0.2	<5	0.32	<0.5	7	18	14	1.45	0.05	0.38	238	<1	0.013	12	5
Tremblay Creek	<0.1	0.62	9	40	<0.2	<5	0.81	<0.5	7	27	14	1.44	0.03	0.56	572	<1	0.008	16	<5
Wolf River	<0.1	0.73	<5	119	0.4	<5	2.66	<0.5	8	17	21	1.76	0.16	1.98	423	<1	0.044	16	6
Amnicon River	<0.1	1.41	<5	200	1.3	<5	1.36	<0.5	19	41	47	3.57	0.32	1.57	735	<1	0.035	38	13
Anna River	<0.1	0.31	5	70	0.3	<5	0.96	<0.5	3	13	15	1.09	0.04	0.26	437	<1	0.015	4	10
Au Train River	<0.1	0.1	<5	26	<0.2	<5	0.68	<0.5	1	6	8	0.44	0.02	0.25	196	<1	0.002	2	10
Beaver River	<0.1	1.21	<5	108	0.7	<5	0.95	<0.5	19	31	41	3.96	0.17	1.06	2310	<1	0.114	36	20
Big Iron River	<0.1	0.58	<5	57	0.4	<5	0.6	<0.5	7	19	26	1.86	0.08	0.4	277	<1	0.007	13	7

Tributary	Sb	Sn	Sr	Ti	V	Y	Zn	Mercury	Total C	Inorganic C	Organic C	LOI
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	%	%	%
Little Gravel River	<5	<10	17	705	33	7.4	60	0.031	3.7	0.8	2.8	7
Little Pine River	<5	<10	15	845	54	8	65	0.031	1.9	0.1	1.8	5.1
Little Carp Creek	<5	<10	16	387	30	6.7	79	0.029	2.1	0	2.1	4.9
Little Goulais River	<5	<10	29	393	47	6.7	71	0.063	8.4	0.1	8.3	19.7
Little Pic River	<5	<10	42	536	19	6	31	0.023	5	3.8	1.2	3.5
Magpie River	<5	<10	17	387	23	5.1	48	0.034	4.3	1.1	3.2	7.5
McIntyre River	<5	<10	23	810	85	8.3	175	0.118	3.4	0.2	3.2	7.8
McKellar Creek	<5	<10	22	765	39	10	150	0.076	6.9	0.5	6.4	15.2
McVicar Creek	<5	<10	12	645	68	4.7	150	0.031	1.7	0.1	1.6	3.3
Michipicoten River	<5	<10	10	458	22	3.3	38	0.005	1	0.1	0.9	2.1
Neebing River	<5	<10	12	891	88	5.1	83	0.036	1.3	0.1	1.3	2.8
Nipigon River	<5	<10	19	730	45	5.9	38	0.016	2.7	1.5	1.2	3
Old Woman River	<5	<10	7	438	23	3.6	38	0.021	2.1	0	2.1	4.7
Ozone Creek	<5	<10	17	814	34	7	81	0.032	2.9	0.4	2.5	6.2
Pancake River	<5	<10	15	521	32	6.5	68	0.026	3.2	0	3.2	7.4
Pic River	<5	<10	40	457	15	5.4	37	0.02	5.3	4.2	1.1	2.8
Pigeon River	<5	<10	16	700	65	9	6.7	0.047	1.7	0	1.7	4
Pine River	<5	<10	18	997	78	9.4	89	0.098	1.9	0.2	1.7	4.2
Prairie River	<5	<10	27	478	19	4.5	30	0.015	2.2	1.2	1	1.9
Sand River	<5	<10	18	530	29	6.4	138	0.029	4.8	0	4.8	9.9
Sawmill Creek	<5	<10	27	725	48	10.2	104	0.07	9	0	9	19.3
Speckled Trout Creek	<5	<10	10	392	27	4.9	58	0.03	5.9	0	5.8	12.3
Steel River	<5	<10	17	590	22	6.5	53	0.029	1.4	0.1	1.3	2.2
Stokely Creek	<5	<10	11	691	31	4.9	41	0.015	1.8	0	1.8	3.9
Tremblay Creek	<5	<10	11	466	20	4.3	57	0.025	2.3	0.2	2.1	4.9
Wolf River	<5	<10	15	556	43	7.4	41	0	1.8	1.1	0.7	2.2
Amnicon River	<5	<10	27	662	65	18.6	79	0.04	2.6	0.3	2.3	7.1
Anna River	<5	<10	26	163	18	5.4	45	0.128	7.9	0.3	7.6	16.2
Au Train River	<5	<10	6	53	8	4.1	25	0.035	5.4	0.2	5.2	10.1
Beaver River	<5	<10	42	1080	70	14.3	85	0.043	4.8	0	4.7	11.8
Big Iron River	<5	<10	17	1630	50	13.8	33	0.011	1	0.1	0.9	2.6

Tributary	Latitude	Longitude	Sampling Date	HCB	Endrin aldehyde	OCS	Toxaphene	Aldrin	α HCH	β HCH	δ HCH	Lindane
Units				µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g
Bluff Creek	46.6823	-92.0154	25-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Brule River	47.8179	-90.0514	17-Sep-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Carp River	46.5185	-87.384	18-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Chocolay River	46.489	-87.3285	18-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Cranberry Slough	46.8298	-91.2675	24-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Deviltrack River	47.7701	-90.2616	17-Sep-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Eagle River	47.4146	-88.2986	20-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Falls River	46.7531	-88.4537	19-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Firesteel River	46.9331	-89.1952	21-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Flag River	46.7844	-91.3841	24-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Flintsteel River	46.9006	-89.2147	21-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Gooseberry River	47.1436	-91.4685	18-Sep-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Gratiot River	47.3428	-88.4515	20-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Grand Marais Creek	46.6627	-85.9091	06-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Cedar Creek	47.4554	-88.1497	20-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Huron River	46.9088	-88.0364	26-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Knife River	46.9483	-91.7841	18-Sep-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Knowlton Creek	46.7162	-92.2002	25-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Laughing Whitefish River	46.5214	-87.0279	18-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Little Carp River	46.8356	-88.4837	19-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Little Cranberry River	46.8396	-89.4306	22-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Little Iron River	46.8259	-89.5881	22-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Mineral River	46.8342	-89.5495	22-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Miners River	46.4883	-86.5407	18-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Misery River	46.997	-88.9809	21-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Nemadji River	46.6857	-92.0482	25-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Onion River	47.6082	-90.7709	17-Sep-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Ontonagon River	46.8682	-89.3186	21-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Pike River	47.0193	-88.5252	19-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Pokegama River	46.666	-92.1263	25-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Potatoe River	46.8519	-89.387	22-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002

Tributary	α Chlordane	γ Chlordane	Total Chlordane	op DDD	pp DDD	op DDE	pp DDE	op DDT	pp DDT	Total DDD	Total DDE	Total DDT
Units	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g
Bluff Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Brule River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Carp River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Chocolay River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Cranberry Slough	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Deviltrack River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Eagle River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.012	<0.002	0.02	<0.002	0.012	0.02
Falls River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Firesteel River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Flag River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Flintsteel River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Gooseberry River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Gratiot River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Grand Marais Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Cedar Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Huron River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Knife River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Knowlton Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Laughing Whitefish River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Little Carp River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Little Cranberry River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Little Iron River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Mineral River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Miners River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Misery River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Nemadji River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Onion River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Ontonagon River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Pike River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Pokegama River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Potatoe River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002

Tributary	Total DDT Metabolites	Dieldrin	Endosulfan I	Endosulfan II	Endosulfan Sulfate	Endrin	Heptachlor	Heptachlor Epoxide	Methoxychlor	Mirex	Aroclor 1016
Units	µg/g	µg/g	µg/g	µg/g	µg/g		µg/g	µg/g	µg/g	µg/g	µg/g
Bluff Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Brule River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Carp River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Chocolay River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Cranberry Slough	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Deviltrack River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Eagle River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Falls River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Firesteel River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Flag River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Flintsteel River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Gooseberry River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Gratiot River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Grand Marais Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Cedar Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Huron River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Knife River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Knowlton Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Laughing Whitefish River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Little Carp River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Little Cranberry River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Little Iron River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Mineral River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Miners River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Misery River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Nemadji River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Onion River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Ontonagon River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Pike River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Pokegama River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Potatoe River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01

Tributary	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	Total PCB	Naphthalene	Acenaphthylene
Units	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/kg	µg/kg
Bluff Creek	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	20	40
Brule River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Carp River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Chocolay River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Cranberry Slough	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Deviltrack River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Eagle River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Falls River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Firesteel River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	9	9
Flag River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Flintsteel River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Gooseberry River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Gratiot River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Grand Marais Creek	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Cedar Creek	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Huron River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Knife River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Knowlton Creek	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	12	12
Laughing Whitefish River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Little Carp River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Little Cranberry River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Little Iron River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Mineral River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Miners River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Misery River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Nemadji River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Onion River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Ontonagon River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	110	<5
Pike River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Pokegama River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	8	<5
Potatoe River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5

Tributary	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzoanthracene	Chrysene	Benzobfluoranthene
Units	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
Bluff Creek	<10	50	300	130	820	780	360	320	590
Brule River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Carp River	<10	<5	20	<5	60	50	30	<10	40
Chocolay River	<10	<5	<5	<5	40	30	60	60	20
Cranberry Slough	<10	<5	<5	<5	<5	<5	<10	<10	<10
Deviltrack River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Eagle River	<10	<5	80	30	290	260	130	130	170
Falls River	<10	<5	71	9	140	110	50	50	81
Firesteel River	40	540	659	141	1070	832	400	290	423
Flag River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Flintsteel River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Gooseberry River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Gratiot River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Grand Marais Creek	<10	<5	<5	<5	<5	<5	<10	<10	<10
Cedar Creek	<10	<5	<5	<5	<5	<5	<10	<10	<10
Huron River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Knife River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Knowlton Creek	20	31	302	91	558	438	220	210	247
Laughing Whitefish River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Little Carp River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Little Cranberry River	<10	<5	49	15	127	113	80	60	116
Little Iron River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Mineral River	<10	<5	<5	<5	20	<5	<10	<10	<10
Miners River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Misery River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Nemadji River	<10	<5	<5	<5	13	10	<10	<10	<10
Onion River	<10	<5	20	0	60	40	<10	<10	20
Ontonagon River	40	29	66	12	54	47	20	20	32
Pike River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Pokegama River	<10	7	51	14	69	57	30	30	47
Potatoe River	<10	<5	25	7	53	44	30	30	41

Tributary	Benzokfluoranthene	Benzoapyrene	Indeno123cdpyrene	Dibenzoahanthracene	Benzoghiperylene	Total PAH	Ag	Al	As
Units	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	ppm	%	ppm
Bluff Creek	190	340	230	0	250	4400	<0.1	1.29	<5
Brule River	<10	<5	<20	<20	<20	<20	0.3	1.11	<5
Carp River	<10	20	<20	<20	<20	220	0.5	0.46	9
Chocolay River	<10	<5	<20	<20	<20	210	<0.1	0.94	<5
Cranberry Slough	<10	<5	<20	<20	<20	<20	<0.1	0.4	6
Deviltrack River	<10	<5	<20	<20	<20	<20	<0.1	0.39	<5
Eagle River	70	120	90	<20	90	1460	<0.1	0.9	<5
Falls River	30	49	50	<20	50	690	1.2	0.91	<5
Firesteel River	150	307	220	50	210	4864	<0.1	0.26	<5
Flag River	<10	<5	<20	<20	<20	<20	<0.1	0.61	<5
Flintsteel River	<10	<5	<20	<20	<20	<20	<0.1	0.56	<5
Gooseberry River	<10	<5	<20	<20	<20	<20	<0.1	1.28	<5
Gratiot River	<10	<5	<20	<20	<20	<20	<0.1	0.67	<5
Grand Marais Creek	<10	<5	<20	<20	<20	<20	<0.1	0.25	6
Cedar Creek	<10	<5	<20	<20	<20	<20	<0.1	NA	NA
Huron River	<10	<5	<20	<20	<20	<20	<0.1	0.33	<5
Knife River	<10	<5	<20	<20	<20	<20	<0.1	0.4	<5
Knowlton Creek	90	179	90	20	100	2620	<0.1	1.16	<5
Laughing Whitefish River	<10	<5	<20	<20	<20	<20	<0.1	0.92	<5
Little Carp River	<10	<5	<20	<20	<20	<20	<0.1	0.39	<5
Little Cranberry River	40	85	70	<20	60	815	<0.1	0.7	<5
Little Iron River	<10	<5	<20	<20	<20	<20	<0.1	0.4	<5
Mineral River	<10	<5	<20	<20	<20	30	0.5	0.75	<5
Miners River	<10	<5	<20	<20	<20	<20	<0.1	0.32	<5
Misery River	<10	<5	<20	<20	<20	<20	<0.1	0.35	<5
Nemadji River	<10	<5	<20	<20	<20	23	<0.1	0.53	<5
Onion River	<10	10	<20	<20	<20	150	<0.1	1.02	<5
Ontonagon River	10	18	<20	<20	<20	399	0.4	0.74	<5
Pike River	<10	<5	<20	<20	<20	<20	<0.1	0.34	<5
Pokegama River	20	27	20	<20	20	407	<0.1	0.74	<5
Potatoe River	20	36	20	<20	20	326	<0.1	0.54	<5

Tributary	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Fe	K	Mg	Mn	Mo	Na	Ni	Pb	Sb	Sn	Sr	Ti	V
Units	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	%	%	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Bluff Creek	145	0.9	<5	0.94	<0.5	16	39	43	3.13	0.24	1.15	472	<1	0.031	31	29	<5	<10	22	707	59
Brule River	151	1	<5	0.84	0.7	23	30	50	4.31	0.12	0.71	4310	<1	0.038	32	15	<5	<10	44	737	73
Carp River	104	0.4	<5	0.62	<0.5	6	18	24	2.46	0.05	0.29	2900	<1	0.015	11	14	<5	<10	43	304	39
Chocolay River	102	0.3	<5	1.03	<0.5	4	23	100	1.33	0.04	0.19	855	<1	0.012	5	17	<5	<10	21	203	39
Cranberry Slough	41	0.3	<5	0.26	<0.5	4	13	9	1.17	0.06	0.27	142	<1	0.01	8	<5	<5	<10	7	391	29
Deviltrack River	70	0.9	<5	0.7	<0.5	13	25	39	3.08	0.09	0.62	537	<1	0.042	23	12	<5	<10	25	946	71
Eagle River	49	0.2	<5	1.18	<0.5	15	26	1200	2.45	0.03	0.96	1550	<1	0.023	38	13	<5	<10	18	1450	60
Falls River	30	<0.2	<5	0.25	<0.5	3	9	14	0.84	0.03	0.17	458	<1	0.004	6	6	<5	<10	5	179	14
Firesteel River	61	0.4	<5	0.6	<0.5	7	18	15	1.71	0.09	0.41	359	<1	0.01	13	6	<5	<10	15	707	37
Flag River	63	0.4	<5	0.42	<0.5	6	19	16	1.43	0.09	0.4	275	<1	0.013	12	5	<5	<10	10	376	36
Flintsteel River	49	0.4	<5	0.39	<0.5	6	16	38	1.52	0.07	0.29	168	<1	0.008	11	6	<5	<10	13	642	31
Gooseberry River	144	0.8	<5	1.22	<0.5	20	39	49	3.88	0.2	1.26	1850	<1	0.065	42	13	<5	<10	36	1410	91
Gratiot River	47	0.2	<5	0.56	<0.5	9	21	29	2.31	0.03	0.49	441	<1	0.02	22	5	<5	<10	13	1160	67
Grand Marais Creek	198	<0.2	<5	1.21	<0.5	2	22	10	1.09	0.03	0.12	3490	<1	0.004	2	15	<5	<10	16	116	24
Cedar Creek	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Huron River	35	0.2	<5	0.18	<0.5	4	12	9	1.54	0.03	0.18	364	<1	0.003	8	6	<5	<10	5	218	25
Knife River	75	0.3	<5	0.64	<0.5	4	6	7	0.93	0.05	0.26	1000	<1	0.004	5	8	<5	<10	13	118	18
Knowlton Creek	112	0.6	<5	1.18	<0.5	17	33	51	3.21	0.18	1.09	1480	<1	0.068	36	10	<5	<10	31	1060	68
Laughing Whitefish River	93	0.6	<5	0.93	<0.5	12	29	43	2.71	0.12	0.74	659	<1	0.04	25	14	<5	<10	20	957	59
Little Carp River	67	0.3	<5	0.24	<0.5	4	10	15	1.58	0.07	0.18	151	<1	0.06	6	5	<5	<10	8	259	20
Little Cranberry River	233	0.4	<5	1.43	<0.5	12	17	320	3.89	0.1	0.54	694	<1	0.064	8	137	<5	<10	102	863	33
Little Iron River	37	0.2	<5	0.3	<0.5	5	13	31	1.45	0.04	0.28	266	<1	0.005	9	6	<5	<10	10	979	35
Mineral River	86	0.8	<5	0.86	<0.5	9	22	464	1.93	0.12	0.65	1010	<1	0.016	17	9	<5	<10	29	1120	45
Miners River	36	0.3	<5	1.31	0.6	6	12	26	0.83	0.04	0.3	458	<1	0.002	6	18	<5	<10	18	88	10
Misery River	43	0.2	<5	0.55	<0.5	3	12	8	1.02	0.04	0.26	356	<1	0.006	7	<5	<5	<10	10	442	24
Nemadji River	61	0.4	<5	1.16	<0.5	7	17	17	1.72	0.09	0.75	349	<1	0.015	13	7	<5	<10	12	481	37
Onion River	57	0.4	<5	0.95	<0.5	13	24	33	2.92	0.08	0.7	474	<1	0.064	26	8	<5	<10	44	1470	80
Ontonagon River	81	0.5	<5	1.05	<0.5	8	22	43	1.92	0.13	0.66	462	<1	0.017	17	14	<5	<10	18	952	44
Pike River	94	0.4	<5	0.22	<0.5	3	8	14	0.68	0.03	0.11	523	<1	0.004	5	5	<5	<10	10	165	14
Pokegama River	78	0.5	<5	0.7	<0.5	11	24	23	2.13	0.13	0.69	385	<1	0.021	19	40	<5	<10	13	640	51
Potatoe River	78	0.4	<5	0.51	<0.5	7	16	20	1.91	0.09	0.32	389	<1	0.014	12	20	<5	<10	16	755	40

Tributary	Y	Zn	Mercury	Total C	Inorganic C	Organic C	LOI
Units	ppm	ppm	ppm	%	%	%	%
Bluff Creek	13.7	91	0.051	6.2	0.4	5.7	12.2
Brule River	20.5	147	0.091	10.2	0	10.1	23
Carp River	7.9	56	0.069	5.5	0.1	5.4	11.3
Chocolay River	6.9	64	0.055	9.8	0.1	8.7	20.6
Cranberry Slough	6	20	0.009	1.4	0	1.4	3.3
Deviltrack River	25.3	84	0.05	6.3	0.1	6.2	13.5
Eagle River	8.8	64	0.096	5.6	0.1	5.4	11.9
Falls River	3.7	26	0.024	1.7	0.1	1.6	3.4
Firesteel River	11.3	33	0.024	2	0	2	4.4
Flag River	7.4	26	0.019	2.6	0.1	2.6	5.7
Flintsteel River	9.2	107	0.027	2.4	0.1	2.4	5.2
Gooseberry River	15.7	91	0.041	5.6	0.2	5.5	13.6
Gratiot River	7.4	40	0.033	4.6	0	4.6	9.8
Grand Marais Creek	5.1	43	0.115	20.8	0.5	20.3	42.6
Cedar Creek	NA	NA	0.082	8.6	0.1	5.4	11.3
Huron River	7.6	36	0.066	2.5	0	2.5	5.3
Knife River	7.4	41	0.034	5.5	0.2	5.3	12.9
Knowlton Creek	12.9	68	0.044	1.5	0.2	1.3	3.7
Laughing Whitefish River	11.7	58	0.025	5.4	0.2	5.3	11.1
Little Carp River	5	26	0.026	3.4	0.1	3.4	8
Little Cranberry River	8.3	1790	0.017	0.9	0	0.9	2.3
Little Iron River	7.1	25	0.008	0.6	0	0.6	1.9
Mineral River	14.2	80	0.045	2	0.2	1.7	4.2
Miners River	4.7	70	0.139	13.9	0.4	13.6	28.6
Misery River	6.6	19	0.012	1.8	0.1	1.7	3.7
Nemadji River	8.5	37	0.015	1.1	0.4	0.7	1.5
Onion River	10.6	60	0.027	3.2	0	3.2	7.3
Ontonagon River	13.2	70	0.122	2.2	0.2	1.9	4.3
Pike River	5	29	0.036	2.2	0	2.2	4.6
Pokegama River	8.9	61	0.019	0.9	0.2	0.7	1.8
Potatoe River	11.3	54	0.019	1.3	0	1.2	2.8

Tributary	Latitude	Longitude	Sampling Date	HCB	Endrin aldehyde	OCS	Toxaphene	Aldrin	α HCH	β HCH	δ HCH	Lindane
Units				µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g
Ravine River	46.8401	-88.2513	26-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Rock River	46.4637	-86.9161	05-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Sand River	46.4947	-87.1078	05-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Shelldrake River	46.6752	-85.0335	06-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Silver River	47.4629	-88.0725	20-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Silver River B	46.8162	-88.2981	26-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Sioux River	46.7301	-90.8992	23-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Splitrock Creek	47.1831	-91.4092	18-Sep-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
St Louis River	46.6534	-92.2263	25-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Sturgeon River	47.0175	-88.5066	19-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Sturgeon River Slough	47.0126	-88.4968	19-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Sucker River	46.6617	-85.869	06-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Tahquamenon River	46.562	-85.0311	06-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Temperance River	47.5545	-90.8746	17-Sep-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002
Waiskey River	46.3971	-84.5326	18-Oct-05	<0.002	<0.002	<0.002	<0.08	<0.002	<0.002	<0.002	<0.002	<0.002

Tributary	α Chlordane	γ Chlordane	Total Chlordane	op DDD	pp DDD	op DDE	pp DDE	op DDT	pp DDT	Total DDD	Total DDE	Total DDT
Units	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g
Ravine River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Rock River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Sand River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Shelldrake River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Silver River	<0.002	<0.002	<0.002	<0.002	0.01	<0.002	0.028	0.009	0.008	0.01	0.028	0.017
Silver River B	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Sioux River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Splitrock Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
St Louis River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Sturgeon River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Sturgeon River Slough	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Sucker River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Tahquamenon River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Temperance River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Waiskey River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002

Tributary	Total DDT Metabolites	Dieldrin	Endosulfan I	Endosulfan II	Endosulfan Sulfate	Endrin	Heptachlor	Heptachlor Epoxide	Methoxychlor	Mirex	Aroclor 1016
Units	µg/g	µg/g	µg/g	µg/g	µg/g		µg/g	µg/g	µg/g	µg/g	µg/g
Ravine River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Rock River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Sand River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Shelldrake River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Silver River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Silver River B	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Sioux River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Splitrock Creek	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
St Louis River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Sturgeon River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Sturgeon River Slough	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Sucker River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Tahquamenon River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Temperance River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01
Waiskey River	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01

Tributary	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	Total PCB	Naphthalene	Acenaphthylene
Units	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	µg/kg	µg/kg
Ravine River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Rock River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Sand River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Shelldrake River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Silver River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Silver River B	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Sioux River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Splitrock Creek	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
St Louis River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Sturgeon River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Sturgeon River Slough	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Sucker River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Tahquamenon River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Temperance River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5
Waiskey River	<0.03	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<5	<5

Tributary	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzoanthracene	Chrysene	Benzobfluoranthene
Units	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
Ravine River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Rock River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Sand River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Shelldrake River	<10	<5	<5	<5	40	30	20	<10	20
Silver River	<10	<5	20	<5	60	50	30	<10	40
Silver River B	<10	<5	<5	<5	<5	<5	<10	<10	<10
Sioux River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Splitrock Creek	<10	<5	30	<5	60	50	<10	<10	50
St Louis River	<10	<5	18	<5	38	32	20	20	27
Sturgeon River	<10	<5	32	6	65	52	30	20	29
Sturgeon River Slough	<10	<5	<5	<5	<5	<5	<10	<10	<10
Sucker River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Tahquamenon River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Temperance River	<10	<5	<5	<5	<5	<5	<10	<10	<10
Waiskey River	<10	<5	<5	<5	<5	<5	<10	<10	<10

Tributary	Benzokfluoranthene	Benzoapyrene	Indeno123cdpyrene	Dibenzoahanthracene	Benzoghiperylene	Total PAH	Ag	Al	As
Units	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	ppm	%	ppm
Ravine River	<10	<5	<20	<20	<20	<20	<0.1	0.18	<5
Rock River	<10	<5	<20	<20	<20	<20	<0.1	0.34	<5
Sand River	<10	<5	<20	<20	<20	<20	<0.1	0.41	<5
Shelldrake River	<10	<5	<20	<20	<20	110	<0.1	0.11	<5
Silver River	<10	30	<20	<20	<20	230	<0.1	0.92	<5
Silver River B	<10	<5	<20	<20	<20	<20	<0.1	0.39	<5
Sioux River	<10	<5	<20	<20	<20	<20	<0.1	0.59	<5
Splitrock Creek	<10	30	<20	<20	<20	220	<0.1	1.06	<5
St Louis River	<10	17	<20	<20	<20	172	<0.1	0.46	<5
Sturgeon River	10	21	<20	<20	<20	265	<0.1	0.49	<5
Sturgeon River Slough	<10	<5	<20	<20	<20	<20	<0.1	0.19	<5
Sucker River	<10	<5	<20	<20	<20	<20	<0.1	0.25	<5
Tahquamenon River	<10	<5	<20	<20	<20	<20	<0.1	0.26	<5
Temperance River	<10	<5	<20	<20	<20	<20	<0.1	1	<5
Waiskey River	<10	<5	<20	<20	<20	<20	<0.1	0.44	<5

Tributary	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Fe	K	Mg	Mn	Mo	Na	Ni	Pb	Sb	Sn	Sr	Ti	V	Y
Units	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	%	%	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Ravine River	35	<0.2	<5	0.15	<0.5	3	5	4	1.15	0.02	0.1	226	<1	<0.01	5	<5	<5	<10	4	151	12	4.1
Rock River	74	0.3	<5	0.68	<0.5	11	9	57	1.2	0.03	0.15	835	<1	0.003	8	9	<5	<10	21	97	15	9.9
Sand River	61	0.3	<5	0.26	0.5	4	6	7	1.14	0.02	0.06	225	<1	0.003	4	10	<5	<10	9	93	20	6.7
Shelldrake River	23	<0.2	<5	0.21	<0.5	1	5	2	1.07	0.01	0.07	108	<1	<0.01	1	9	<5	<10	3	104	11	2.2
Silver River	48	0.5	<5	1.25	<0.5	14	34	119	2.39	0.04	1.05	713	<1	0.032	36	17	<5	<10	21	1280	62	11
Silver River B	55	0.2	<5	0.29	<0.5	5	12	12	1.28	0.03	0.2	678	<1	0.002	9	7	<5	<10	7	191	20	6.2
Sioux River	92	0.5	<5	0.53	<0.5	7	22	17	1.89	0.1	0.41	342	<1	0.013	12	7	<5	<10	16	430	49	9.4
Splitrock Creek	87	0.5	<5	0.9	<0.5	16	30	34	3.09	0.08	0.85	363	<1	0.045	32	10	<5	<10	33	1220	70	12
St Louis River	76	0.3	<5	0.61	<0.5	7	18	28	1.98	0.05	0.44	1450	<1	0.019	15	12	<5	<10	14	476	38	6.7
Sturgeon River	83	0.4	<5	0.37	<0.5	5	16	14	1.55	0.08	0.32	837	<1	0.022	10	6	<5	<10	10	330	30	8.2
Sturgeon River Slough	31	<0.2	<5	0.15	<0.5	2	7	6	0.84	0.03	0.11	222	<1	<0.01	4	<5	<5	<10	4	172	16	4.1
Sucker River	74	<0.2	<5	4.17	<0.5	2	7	4	0.79	0.02	0.09	706	<1	<0.01	2	5	<5	<10	8	129	17	3.4
Tahquamenon River	41	<0.2	<5	0.29	<0.5	3	7	3	0.98	0.03	0.12		<1	0.003	3	<5	<5	<10	7	141	12	3
Temperance River	67	0.6	<5	0.77	<0.5	16	25	33	3.35	0.07	0.7	636	<1	0.062	29	9	<5	<10	36	1260	85	13
Waiskey River	60	0.2	<5	0.41	<0.5	4	13	6	0.89	0.07	0.3	284	<1	0.007	7	<5	<5	<10	9	270	15	4.5

Tributary	Zn	Mercury	Total C	Inorganic C	Organic C	LOI
Units	ppm	ppm	%	%	%	%
Ravine River	34	0.018	1	0	1	2.3
Rock River	73	0.086	9.9	0.2	9.7	19.3
Sand River	46	0.06	5	0	5	10
Shelldrake River	17	0.009	1.9	0.1	1.8	3.5
Silver River	56	0.049	5.2	0.1	5.1	11.2
Silver River B	45	0.033	3.3	0	3.3	6.8
Sioux River	36	0.024	3.4	0.1	3.3	7
Splitrock Creek	80	0.042	4.6	0	4.6	10.6
St Louis River	81	0.02	1.7	0.2	1.6	3.5
Sturgeon River	34	0.029	1.9	0	1.9	4.5
Sturgeon River Slough	15	0.011	1.1	0	1.1	2.6
Sucker River	28	0.028	6.2	0	6.2	
Tahquamenon River	34	0.025	3	0	3	6.2
Temperance River	79	0.039	3.9	0	3.9	9
Waiskey River	34	0.02	2.5	0.1	2.4	5.5